ESAB

Welding Handbook

Eighth edition

Consumables for manual and automatic welding

XA00003720

Consumables for mild steels

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Mild steels
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OK 43.32

Type Rutile

SMAW
E6013

Description

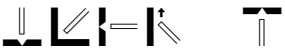
Easy-to-weld rutile type electrode for welding in the flat position. The good flowing properties of the weld metal give a good finish to the weld beads on both butt and fillet welds. Good slag detachability. The stable arc, even at low welding currents, makes the electrode very suitable for sheet metal welding.

Recovery

95%

Welding current

AC, DC(+ -) OCV 50 V



Classifications

SFA/AWS A5.1	E6013
EN 499	E 42 0 RR 12
ISO 2560	E 51 3 RR 31

Typical all weld metal composition, %

C	Si	Mn
<0.02	0.6	0.5

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	550
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	65
0	>47

Approvals

ABS	1
BV	1
DB	80.039.02
DNV	1
DS	EN 499
GL	2Y
LR	1
SS	EN 499
UDT	EN 499
Ü	10.039/1
VdTÜV	00621

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
1.6	300	30-60	27	0.50	263	0.4	34
2.0	300	40-80	23	0.54	167	0.6	36
2.5	350	50-110	25	0.54	88.0	0.9	46
3.2	350	80-150	26	0.57	50.0	1.3	57
3.2	450	80-140	26	0.54	40.5	1.3	74
4.0	450	120-210	27	0.54	26.8	1.9	76
5.0	450	170-290	26	0.56	17.2	2.5	87
6.0	450	230-370	-	-	-	-	-

OK 46.00

Type Rutile

SMAW
E6013

Description

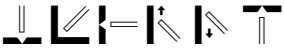
OK 46.00 is the best, all-round, rutile electrode and it is relatively insensitive to rust or other surface impurities. It deposits smooth weld beads in all positions, including vertical down, and the slag is easy to remove. OK 46.00 is very easy to strike and restrike, making it ideal for short welds, root runs and tacking.

Recovery

95%

Welding current

AC,DC+ - OCV 50 V



Classifications

SFA/AWS A5.1	E6013
EN 499	E 38 0 RC 11
ISO 2560	E 43 3 R 11
CSN 05 5010	E 46.17

Typical all weld metal composition, %

C	Si	Mn
0.08	0.3	0.4

Typical mech. properties all weld metal

Yield stress, MPa	400
Tensile strength, MPa	510
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
0	70
-20	35

Approvals

ABS	2
BV	2
DB	10.039.05
DNV	2
DS	EN 499 E 38 0 RC 11
GL	2
LR	2
PRS	2
RS	2
Sepros	UNA 485154
SS	EN 499 E 38 0 RC 11
UDT	EN 499
Ü	10.039/1
VdTÜV	00623

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
1.6	300	30-60	20	0.63	263	0.38	36
2.0	300	50-70	21	0.60	172	0.55	38
2.5	350	60-100	22	0.65	86.0	0.8	50
3.2	350	80-150	22	0.65	53.0	1.3	57
4.0	350	100-200	22	0.60	39.0	1.6	65
5.0	350	150-290	24	0.60	24.0	2.3	87
5.0	450	170-220	24	0.60	31.0	2.3	114

OK 48.00

Type Lime-basic

SMAW
E7018

Description

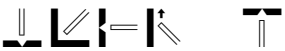
A reliable, general purpose, LMA electrode for mild and low-alloy steels. OK 48.00 deposits a tough, crack-resistant weld metal. High welding speed in the vertical-up position. OK 48.00 is insensitive to the composition of the base material within fairly wide limits. The electrode can be used for welding structures where difficult stress conditions cannot be avoided.

Recovery

125%

Welding current

DC+(-)



Classifications

SFA/AWS A5.1	E7018
CSA W48	E4918
EN 499	E 42 4 B 42 H5
ISO 2560	E51 5B 120 20H

Typical all weld metal composition, %

C	Si	Mn
0.06	0.5	1.2

Typical mech. properties all weld metal

Yield stress, MPa	445
Tensile strength, MPa	540
Elongation, %	29

Charpy V

Test temps, °C	Impact values, J
-20	140
-40	70

Approvals

ABS	3H5, 3Y	RINA	E 52 3 HH
BV	3, 3Y H5	RS	3YHH
CL		Sepros	
CWB	CSA W48	SFS	EN 499
DB	10.039.12	SS	EN 499
DNV	3Y H5	UDT	EN 499
DS	EN 499	Ü	10.039/12
GL	3Y H5	VdTÜV	
LR	3,3Y H5		
PRS	3YH10		

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
1.6	300	30-55	22				
2.0	300	50-80	24				
2.5	350	80-110	23	0.65	62.5	1.0	56
3.2	350	90-140	22	0.64	43	1.3	66
3.2	450	90-140	23	0.64	32.3	1.5	76
4.0	350	125-210	24	0.51	35.0	2.1	64
4.0	450	125-210	26	0.67	20.5	2.1	86
5.0	450	200-260	23	0.69	13.5	2.6	102
6.0	450	220-340	23	0.72	9.6	3.7	102
7.0	450	280-410	25	0.72	7.0	4.4	117

OK 48.04

Type Lime-basic

SMAW
E7018

Description

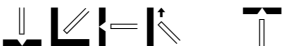
OK 48.04 is an AC/DC, general purpose, LMA electrode for welding mild and low-alloy steels. It has very good welding properties and deposits a high quality weld metal with very good mechanical properties. The electrode can be used for welding restrained structures where high welding stresses cannot be avoided.

Recovery

125%

Welding current

AC, DC+(-) OCV 65 V



Classifications

SFA/AWS A5.1	E7018
EN 499	E 42 4 B 32 H5
ISO 2560	E 51 5B 120 26H

Typical all weld metal composition, %

C	Si	Mn
0.06	0.5	1.1

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	560
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
-20	150
-40	100

Approvals

ABS	3H5, 3Y
BV	3YHH
DB	10.039.34
DNV	3 YH10
DS	EN 499
GL	3YH10
LR	3, 3YH15
PRS	3YH10
RS	3YHH
Sepros	UNA 409819
SS	EN 499
UDT	EN 499
Ü	10.039/1
VdTÜV	00050

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	50-80	23	0.61	125	0.67	44
2.5	350	70-110	23	0.64	67.0	1.0	59
3.2	350	110-150	22	0.63	42.3	1.37	62.4
3.2	450	110-150	25	0.67	30.0	1.5	92
4.0	450	150-200	26	0.68	20.0	2.0	101
5.0	450	190-260	26	0.72	13.0	2.8	106

OK 48.05

Type Lime-basic

SMAW
E7018

Description

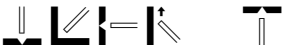
OK 48.05 is a general purpose, LMA electrode for welding mild and low-alloyed steels. It has very good running characheristics, especially on DC+. OK 48.05 welds very well even at very low currents, an advantage when welding thin-walled pipes.

Recovery

125%

Welding current

DC+



Classifications

SFA/AWS A5.1	E7018
EN 499	E 42 4 B 42 H5
ISO 2560	E51 5B 120 20H
NF A 81-309	E 51 5/4 B 120 20 BH

Typical all weld metal composition, %

C	Si	Mn
0.06	0.5	1.0

Typical mech. properties all weld metal

Yield stress, MPa	445
Tensile strength, MPa	540
Elongation, %	29

Charpy V

Test temps, °C	Impact values, J
-20	140
-40	70

Approvals

ABS	3H5, 3Y
DB	10.039.02
DNV	3 YH5
LR	3, 3YH15
Sepros	
UDT	EN 499
Ü	10.039/1
VdTÜV	06610

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	35-80	22	0.63	119.0	0.6	50
2.5	350	75-105	24	0.64	62.5	1.0	58
3.2	350	95-155	26	0.46	54.3	1.5	61
3.2	450	95-155	26	0.61	31.3	1.5	80
4.0	350	125-210	24	0.51	35.0	2.1	64
4.0	450	125-210	24	0.67	20.5	2.1	85
5.0	450	200-260	23	0.69	13.5	2.6	102

OK 48.15

Type Lime-basic

SMAW
E7018

Description

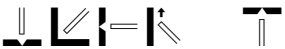
An LMA electrode for welding mild and low-alloy steels. Exceptional welding properties in the vertical-up position. OK 48.15 gives the same good weld metal quality as OK 48.00, which makes the electrode suitable for welding structures in which high stresses cannot be avoided. It is also suitable for welding galvanised plate.

Recovery

125%

Welding current

AC, DC+(-) OCV 65 V



Classifications

SFA/AWS A5.1	E7018
EN 499	E 42 3 B 32 H5
ISO 2560	E 51 5B 120 26 H

Typical all weld metal composition, %

C	Si	Mn
0.06	0.5	1.1

Typical mech. properties all weld metal

Yield stress, MPa	490
Tensile strength, MPa	575
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
-20	110
-30	60
-40	50

Approvals

ABS	3H10, 3Y
BV	3, 3YHH
DB	10.039.06
DNV	3YH10
DS	EN 499
GL	3YH10
LR	3, 3Y H15
PRS	3YH10
RS	3YHH
SS	EN 499
UDT	EN 499
Ü	10.039/1
VdTÜV	00625

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	55-80	22	0.61	125.0	0.7	43
2.5	350	65-110	22	0.60	67.0	1.0	60
3.2	350	100-140	22	0.63	41.0	1.4	63
3.2	450	100-140	23	0.66	31.0	1.4	84
4.0	350	140-200	24	0.63	29.0	1.9	68
4.0	450	140-200	24	0.66	21.0	2.0	89
4.5	450	180-240	24	0.67	18.0	2.6	86
5.0	450	190-260	26	0.72	13.0	2.8	106
6.0	450	220-360	26	0.73	9.0	3.8	113

OK 50.40

Type Rutile-basic

SMAW
E6013

Description

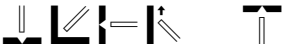
OK 50.40 is an all-round electrode for the positional welding of mild steel, also well suited for pipe welding. It is particularly good for welding in the vertical-up position and for welding root runs.

Recovery

94%

Welding current

DC-+, AC OCV 65 V



Classifications

SFA/AWS A5.1	E6013
EN 499	E 42 2 RB 12
CSN 05 5010	E 50.95

Typical all weld metal composition, %

C	Si	Mn
0.08	0.2	0.5

Typical mech. properties all weld metal

Yield stress, MPa	>440
Tensile strength, MPa	520-620
Elongation, %	27

Charpy V

Test temps, °C	Impact values, J
-20	>47
-30	>28

Approvals

DB	10.039.14
DNV	2
LR	2
UDT	EN 499
Ü	10.039/1
VdTÜV	00629

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	50-100	23	0.80	88.0	0.8	51
3.2	350	80-150	24	0.55	59.0	1.2	53
4.0	450	130-190	22	1.50	27.0	1.5	90
5.0	450	170-280	27	0.58	17.0	2.3	92

OK 53.05

Type Basic

SMAW
E7016

Description

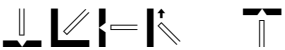
A low-hydrogen electrode with excellent running characteristics and very good mechanical properties. Because of its double coating, it creates a deep crater which stabilises the arc and gives good protection against air in inclined positions.

Recovery

105%

Welding current

DC+-



Classifications

SFA/AWS A5.1	E7016
EN 499	E 42 4 B 22 H10
ISO 2560	E 51 5 B 24 (H)

Typical all weld metal composition, %

C	Si	Mn
< 0.1	0.5	1.0

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	540
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	150
-40	80

Approvals

ABS	3H10, 3Y
BV	3, 3YHH
DB	10.039.32
DNV	3YH15
DS	EN 499
GL	3YH10
LR	3, 3YH10
RS	3YHH
UDT	EN 499
Ü	10.039/1
VdTÜV	03180

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	50-100	24	0.63	79	1.0	49
3.2	350	80-140	26	0.60	52	1.2	57
3.2	450	80-140	26	0.61	39	1.3	70
4.0	350	110-180	25	0.63	33	1.8	60
4.0	450	110-180	24	0.63	25	1.7	82
5.0	450	180-300	26	0.65	16	3.0	74

OK 53.16 SPEZIAL SMAW

Type Basic E7016

Description

OK 53.16 is a double-coated electrode combining the running characteristics of a rutile electrode with the mechanical properties of a basic electrode. OK 53.16 welds on both AC and DC and the spatter loss is minimal.

Recovery

105%

Welding current

DC+, AC OCV 50 V

Classifications

SFA/AWS A5.1	E7016
EN 499	E38 2 B 32 H10
ISO 2560	E 51 4 B 21(H)

Typical all weld metal composition, %

C	Si	Mn
0.07	0.6	0.9

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	530
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	120

Approvals

ABS	3, H10, 3Y
BV	3, 3YHH
CL	EN 499
DB	10.039.29
DNV	3YH10
DS-EN 499	E 38 2 B 32 H10
GL	3YH10
LR	3, 3YH10
UDT-EN 499	E 38 2 B 32 H10
VdTÜV	02762

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	50-90	26	0.63	77	0.86	54
3.2	350	90-150	25	0.65	46	1.4	57
4.0	450	120-190	26	0.64	24	1.9	79
5.0	450	160-230	26	0.63	15	2.4	99

OK 53.68

Type Lime-basic

SMAW
E7016-1

Description

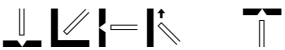
OK 53.68 is an extra-high quality LMA electrode, particularly suitable for on-site welding. OK 53.68 yields a homogeneous, high-quality weld metal with an extra low content of impurities. The electrode operates well on AC as well as DC positive and negative. DC negative is preferred, as it produces a small, easily controlled weld pool, minimising the risk of burn-through or undercutting. OK 53.68 is CTOD tested.

Recovery

100%

Welding current

AC, DC +(-) OCV 65 V



Classifications

SFA/AWS A5.1	E7016-1
EN 499	E 42 5 B 12 H5

Typical all weld metal composition, %

C	Si	Mn
0.06	0.4	1.3

Typical mech. properties all weld metal

Yield stress, MPa	>420
Tensile strength, MPa	510-640
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	>150
-40	>80
-50	>47

Approvals

ABS	3H5, 3Y
BV	3YH5
DNV	4 YH5
DS	EN 499
GL	4YH5
LR	4Y40 H15
PRS	4YH10
SFS	EN 499
SS	EN 499
UDT	EN 499
VdTÜV	06807

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	55-85	22	0.58	90	0.8	50
3.2	450	80-130	22	0.61	41	1.2	73
4.0	450	110-170	22	0.65	26	1.7	83
5.0	450	180-230	22	0.66	17	2.4	90

OK 53.70

Type Lime-basic

SMAW
E7016-1

Description

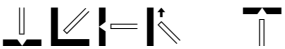
A low-hydrogen AC/DC electrode for the one-sided welding of pipes and general structures. The root penetration is good, leaving a flat bead with easily removable slag. The stable arc and the well-balanced slag system make the electrode easy to weld in all positions. Suitable for welding transmission pipelines made from pipe steels up to API 5LX56.
It is also suitable for welding the root in higher strength pipes, API 5LX60, 5LX65, 5LX70.

Recovery

100%

Welding current

AC, DC+(-) OCV 60 V



Classifications

SFA/AWS A5.1	E7016-1
DIN 1913	E 51 55 B10
EN 499	E 42 5 B 12 H5
GOST 9467-75	E50A
ISO 2560	E 51 5 B 24 H

Typical all weld metal composition, %

C	Si	Mn
0.06	0.5	1.2

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	530
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
-20	150
-40	120
-50	100

Approvals

ABS	3H5, 3Y
DNV	3 YH5
LR	3YH15
Sepros	UNA 485155
VNIIST	

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	60-85	26	0.63	87.7	0.7	57
3.2	350	80-130	28	0.60	53.6	1.1	60
3.2	450	80-130					
4.0	450	115-190	24	0.63	24.6	1.7	86

OK 55.00

Type Lime-basic

SMAW
E7018-1

Description

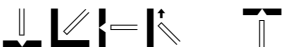
OK 55.00 is a reliable, high-quality, LMA electrode, particularly suitable for welding high strength low-alloy steels. The good, low-temperature impact strength of the weld metal should be noted. The weld metal is also very resistant to hot cracking. The electrode is also suitable for welding high strength ship's steel, grades A, D and E.

Recovery

125%

Welding current

AC, DC+ OCV 65 V



Classifications

SFA/AWS A5.1	E7018-1
CSA W48	E4918-1
CSN 05 5010	E 55.93
EN 499	E 46 5 B 32 H5
ISO 2560	E 51 5B 120 26H

Typical all weld metal composition, %

C	Si	Mn
0.07	0.5	1.4

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	590
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	115
-50	50

Approvals

ABS	3H5 , 3Y H5	Ü	10.039/1
BV	3Y H5	VdTÜV	00632
CL	EN 499		
CWB	CSA W48		
DB	10.039.03		
DNV	4YH5		
DS	EN 499		
GL	3YH5		
LR	3, 3Y H5		
RS	3YHH		
Sepros			
SFS	EN 499		
SS	EN 499		
UDT	EN 499		

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	80-110	23	0.64	65.8	0.86	64
3.2	350	110-140	23	0.62	41.1	1.22	72
3.2	450	110-140	24	0.69	30.0	1.4	88
4.0	350	140-200	23	0.62	28.0	1.77	72
4.0	450	140-200	24	0.70	19.0	2.0	94
5.0	450	200-270	24	0.72	13.0	3.0	94
6.0	450	215-360	25	0.72	9.0	4.0	98

OK Femax 33.30 SMAW

Type Rutile E7024

Description

High-recovery rutile electrode for the high productivity welding of fillets in the horizontal-vertical position. Particularly suitable for welding thick plates and for long run-out lengths. Good bead appearance. Easy slag removal.

Recovery

130%

Welding current

AC, DC+ - OCV 50 V

Classifications

SFA/AWS A5.1	E7024
EN 499	E 42 0 RR 53
ISO 2560	E 51 3 RR 140 34

Typical all weld metal composition, %

C	Si	Mn
< 0.12	0.4	0.7

Typical mech. properties all weld metal

Yield stress, MPa	>420
Tensile strength, MPa	510-610
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
0	>47
-20	>28

Approvals

CL	
DB	10.039.26
DNV	2
DS	EN 499
Ü	10.039/1
VdTÜV	00972

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	450	130-150	23	0.6	28	1.5	87
4.0	450	150-220	26	0.6	18	2.4	83
5.0	450	220-270	26	0.6	12	3.1	102

OK Femax 33.60 SMAW

Type Rutile E7024

Description

OK Femax 33.60 is a high-recovery, rutile, iron powder electrode giving a metal recovery of about 160%. OK Femax 33.60 is particularly recommended for welding horizontal-vertical fillets. The weld metal stays well on the vertical leg and gives a good transition to the base material without undercutting, even at high welding currents.

Recovery

160%

Welding current

AC, DC+(-) OCV 50 V

Classifications

SFA/AWS A5.1	E7024
CSN 05 5010	E 51.21
DIN 1913	E 51 32 RR 11 160
EN 499	E 42 0 RR 53
ISO 2560	E 51 2 RR 160 31
NF A 81-309	E 51 3/2 RR 160 31
UNE 14.003	E 51 32 RR 160 31

Typical all weld metal composition, %

C	Si	Mn
<0.12	0.4	0.7

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	550
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
0	55

Approvals

ABS	2
BV	2
DB	10.039.11
DNV	2
DS	EN 499
GL	2
LR	2
RINA	
SS	EN 499
UDT	EN 499
Ü	10.039/1
VdTÜV	01030
SZ 202	(**)

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	85-125	27	0.64	53.0	1.6	43
3.2	450	130-170	30	0.68	23.0	2.2	71
4.0	450	150-230	33	0.68	15.0	3.1	77
5.0	450	200-350	35	0.68	9.5	4.9	78
6.0	450	280-450	36	0.68	6.4	6.4	83

OK Femax 33.80 SMAW

Type Rutile E7024

Description

High-recovery rutile electrode for the high productivity welding of fillets in the horizontal-vertical position. Particularly suitable for welding thick plates and for long run-out lengths. Good bead appearance. Easy slag removal.

Recovery

180%

Welding current

AC, DC(+ -) OCV 50 V

Classifications

SFA/AWS A5.1	E7024
EN 499	E 42 0 RR 73
ISO 2560	E 51 2 RR 180 31
NF A 81-309	E 51 3/2 RR 190 31

Typical all weld metal composition, %

C	Si	Mn
<0.12	0.5	0.7

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	550
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
0	50

Approvals

ABS	2	RS	2
BV	2	Sepros	UNA 485154
CL	EN499	SFS	EN 499
DB	10.039.28	SS	EN 499
DNV	2	UDT	EN 499
DS	EN 499	Ü	10.039/1
DSRK	44.2 (FEMATIC too)	VdTUV	00634
GL	2Y		
LR	2, 2Y		
PRS	2		

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	85-125	27	0.64	53.0	1.6	43
3.2	450	130-170	28	0.68	21.0	2.5	69
4.0	450	180-230	30	0.68	13.5	3.8	69
4.5	700	180-230	30	0.69	6.8	3.7	141
5.0	450	250-340	30	0.67	9.1	5.8	68
5.0	700	210-260	31	0.69	5.6	4.4	146
5.6	700	250-300	35	0.69	4.7	4.5	171
6.0	450	300-430	35	0.68	6.4	7.1	79
6.0	700	280-400	34	0.72	4.0	6.9	131

OK Femax 38.48 SMAW

Type Rutile-basic E7028

Description

OK Femax 38.48 is a high-recovery, iron powder, LMA electrode, which gives extremely smooth fillets of equal leg length and very low emissions of fume and spatter. It is very easy to weld and is especially suitable for horizontal fillets with a leg length of 4-6.4 mm. OK Femax 38.48 is as easy to use as a rutile electrode, but the weld metal quality corresponds to that of basic electrodes. The slag is easy to remove. Also available in Fematic length.

Recovery

150%

Welding current

AC, DC+ - OCV 60 V

Classifications

SFA/AWS A5.1	E7028
EN 499	E 42 3 RB 53 H10
ISO 2560	E51 4B 150 36H

Typical all weld metal composition, %

C	Si	Mn
0.07	0.5	1.1

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	545
Elongation, %	27

Charpy V

Test temps, °C	Impact values, J
+20	140
0	120
-20	100
-30	80
-40	35

Approvals

ABS	3H5, 3Y
BV	3Y HH
CL	EN 499
DB	10.039.27
DNV	3 YH10
DS	EN 499
GL	3YH10
LR	3, 3YH15
RINA	3, 3YH10
RS	3YHH
SFS	EN 499
SS	EN 499
ÜDT	EN 499
Ü	10.039/1
VdTÜV	03004

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	350	100-160	24	0.60	34.0	1.6	66
4.0	450	150-230	28	0.58	17.7	2.5	88
5.0	450	200-320	32	0.60	11.0	4.2	84
5.6	450	250-330	34	0.62	8.7	4.4	96

OK Femax 38.65 SMAW

Type Zirconium-basic E7028

Description

High-recovery zircon-basic electrode, especially developed for performing butt welds and fillet welds in the downhand position in ordinary and high tensile steels. Good slag removal.

Recovery

165%

Welding current

AC, DC+ OCV 65 V

Classifications

SFA/AWS A5.1	E7028
EN 499	E 42 4 B 73 H5
ISO 2560	E51 5B 170 36H

Typical all weld metal composition, %

C	Si	Mn
0.08	0.5	1.1

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	540
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	110
-30	95
-40	65
-60	50

Approvals

ABS	3H5, 3Y
BV	3Y HH
CL	EN499
DB	10. 039.15
DNV	3 YH10
DS	EN 499
GL	3YH10
LR	3, 3YH15
RINA	3Y H10
Sepros	UNA 409819
SS	EN 499
UDT	EN 499
Ü	10.039/1
VdTÜV	00635

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	450	100-170	32	0.66	23.6	2.3	67
4.0	450	170-240	36	0.68	14.4	3.7	70
5.0	450	225-355	40	0.69	9.6	5.7	72
6.0	450	300-430	40	0.68	6.6	7.2	80
7.0	450	340-490	44	0.70	5.1	8.5	88

OK Femax 38.85 SMAW

Type Rutile-basic E7028

Description

Very fast rutile-basic, high-recovery electrode. The electrode is especially suitable for welding horizontal-vertical fillets, where a large throat thickness is required. It welds best on AC.

Recovery

215%

Welding current

AC, DC+ OCV 65 V

Classifications

SFA/AWS A5.1	E7028
ISO 2560	E 51 4B 220 36H
EN 499	E 42 3 RB 73 H10

Typical all weld metal composition, %

C	Si	Mn
< 0.10	0.6	1.1

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	560
Elongation, %	29

Charpy V

Test temps, °C	Impact values, J
-20	100
-30	80

Approvals

ABS	3H5, 3Y
BV	3YHH
DNV	3YH10
RS	3YHH
SS	EN 499

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
4.0	450	190-240	33	0.63	12.3	3.8	77
5.0	450	200-350	40	0.70	7.0	6.0	84
6.0	450	300-500	44	0.70	5.2	9.5	73

OK Femax 38.95 SMAW

Type Zirconium-basic E7028

Description

OK Femax 38.95 is a high-recovery, iron powder, AC/DC electrode giving about 240% recovery. OK Femax 38.95 gives a welding speed comparable with submerged arc welding: up to 240 g of weld metal a minute with a 6 mm diameter electrode. OK Femax 38.95 is primarily designed for welding prepared butt joints and fillets in the flat position where it gives a smooth transition to the base material.

Recovery

240%

Welding current

AC, DC+ OCV 70 V

Classifications

SFA/AWS A5.1	E7028
EN 499	E 38 4 B 73 H10
ISO 2560	E 51 5B 240 46H0

Typical all weld metal composition, %

C	Si	Mn
< 0.10	0.5	1.1

Typical mech. properties all weld metal

Yield stress, MPa	400
Tensile strength, MPa	500
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
-20	110
-40	90

Approvals

BV	3 3YHH
DNV	3 YHH
DS	E51 5B(H)
LR	3, 3YH
SS	EN 499

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
4.0	450	170-240	35	0.67	14.9	3.6	67
5.0	450	330-400	40	0.70	6.6	9.0	63
5.6	450	370-460	45	0.70	5.2	11.0	65
6.0	450	400-520	50	0.71	4.2	13.3	65

OK Femax 39.50 SMAW

Type Acid E7027

Description

OK Femax 39.50 is a very fast, high-recovery, acid electrode for horizontal-vertical fillets, lap and butt joints in mild steels. The electrode gives an attractive profile with a very good slag cover. The slag is porous and easy to remove. Tolerates a wide range of bead run-out lengths.

Recovery

160%

Welding current

AC, DC(+ -) OCV 65 V

Classifications

SFA/AWS A5.1	E7027
EN 499	E 42 2 RA 53
ISO 2560	E 51 5 AR 160 35

Typical all weld metal composition, %

C	Si	Mn
0.09	0.3	0.8

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	520
Elongation, %	27

Charpy V

Test temps, °C	Impact values, J
+20	85
-20	70

Approvals

ABS	3, 3Y
BV	3Y
CL	EN 499
DB	10.039.07
DNV	3
DS	EN 499
GL	3Y
LR	3, 3Y
PRS	3
RINA	3Y
SFS	EN 499
SS	EN 499
ÜDT	EN 499
Ü	10.039/1
VdTÜV	00636

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	450	130-170	31	0.68	22.6	2.3	69
4.0	450	150-230	32	0.70	15.6	3.2	71
4.5	700	160-210	27	0.73	7.6	2.9	165
5.0	450	220-350	37	0.70	10.0	5.5	65
5.6	700	220-270	30	0.74	5.0	3.9	189
6.0	450	280-400	35	0.71	6.6	6.4	86

FILARC 35

Type Basic

SMAW
E7018-1

Description

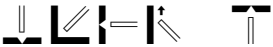
General-purpose, basic DC+ electrode for mild and low-alloy steels.
Very good running characteristics, producing high-quality welds with good impact values.

Recovery

60-65%

Welding current

DC+(-)



Classifications

SFA/AWS A5.1	E7018-1
EN 499	E 42 4 B 42 H10
ISO 2560	E 51 5B 120 20 (H)

Typical all weld metal composition, %

C	Si	Mn
0.06	0.6	0.975

Typical mech. properties all weld metal

Yield stress, MPa	420
Tensile strength, MPa	510-560
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	54
-40	47

Approvals

ABS	3H5, 3Y
BV	3, 3YHH
DNV	4YH10
DS	EN 499
GL	3YH10
LR	3, 3Y H10
RS	4Y42HH
SFS	EN 499
SS	EN 499
UDT	EN 499
VdTÜV	02556

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	45-75	26	0.56	125.0	0.6	46
2.5	350	70-105	25	0.63	65.8	0.9	57
3.2	450	100-135	21	0.67	30.9	1.3	87
4.0	450	140-185	22	0.69	20.5	1.9	90
5.0	450	180-250	24	0.68	13.2	2.6	106
6.0	450	220-360	26	0.73	9.0	3.8	113

FILARC 35S

SMAW

Type Basic E7018-1

Description

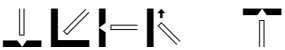
CTOD-tested, universal basic electrode for welding dynamically loaded structures, particularly in heavy plate, where the high deposition can be used to advantage. Satisfactory CTOD results are obtained in the stress-relieved condition.

Recovery

120%

Welding current

DC+(-), AC OCV 65 V



Classifications

SFA/AWS A5.1	E7018-1
EN 499	E 42 4 B 32 H5
ISO 2560	E 51 5B 120 26H

Typical all weld metal composition, %

C	Si	Mn
0.06	0.4	1.1

Typical mech. properties all weld metal

Yield stress, MPa	>420
Tensile strength, MPa	510-600
Elongation, %	>26

Charpy V

Test temps, °C	Impact values, J
-20	>100
-40	>50
-46	>27

Approvals

ABS	3H, 3Y
BV	3, 3YHH
DB	10.105.02
DNV	3YH5
GL	3YH5
ISPESL	
LR	3, 3Y H15
RS	3Y42HH
RINA	E 52 3HH
UDT-EN499	E 42 4 B 32 H5
VdTÜV	

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	70-100	22	0.58	59	1.0	57
3.2	350	90-150	23	0.63	43.5	1.29	60
3.2	450	90-140	23	0.63	30	1.4	80
4.0	450	110-170	23	0.66	24.0	1.67	95
5.0	450	160-260	23	0.68	14.2	2.62	100

FILARC 36D

Type Basic

SMAW
E7016

Description

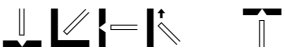
All-positional, basic electrode designed for the vertical-up welding of pipes. All diameters have a special double coating providing excellent properties for root pass welding. Deposition is about 10% higher than with conventional 100% recovery electrodes. Used for pipe welding and other stuctural work requiring low-hydrogen weld metal.

Recovery

100%

Welding current

DC+-



Classifications

SFA/AWS A5.1	E7016
EN 499	E 42 4 B 22 H10
ISO 2560	E 51 5B 24 (H)

Typical all weld metal composition, %

C	Si	Mn
<0.10	0.6	1.0

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	540
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	150
-40	80

Approvals

ABS	3H10, 3Y
BV	3, 3YHH
DB	10.105.12
DNV	3YH15
GL	3YH10
LR	3, 3YH10
RS	3YHH
UDT	EN 499
Ü	10.105/1
VdTÜV	01006

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	50-100	24	0.63	79	1.0	49
3.2	350	80-140	26	0.60	52	1.2	57
3.2	450	80-140	26	0.61	39	1.3	70
4.0	350	110-180	25	0.63	33	1.8	60
4.0	450	110-180	24	0.63	25	1.7	82
5.0	450	180-300	26	0.65	16	3.0	74

FILARC 36S

Type Lime-basic

SMAW
E7016

Description

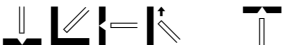
Basic-coated electrode for welding root passes and filling layers in all positions. Very good weldability and X-ray quality.
Filarc 36S finds its applications in the shipbuilding, boiler and pressure vessel industries, for example.

Recovery

100%

Welding current

DC+(-), AC OCV 70 V



Classifications

SFA/AWS A5.1	E7016
BS 639	E 51 43 B 24(H)
DIN 1913	E 51 43 B10
EN 499	E 42 2 B 12 H10
ISO 2560	E 51 4B 24 (H)
NBN F31-001	E 51.5B-1 LH
NF A 81-309	E 51 5/3 B 24 H

Typical all weld metal composition, %

C	Si	Mn
0.8	0.7	0.9

Typical mech. properties all weld metal

Yield stress, MPa	>420
Tensile strength, MPa	<590
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	>54
-30	>28

Approvals

ABS	3H5, 3Y
BV	3Y HH
CL	EN 499
DB	10.105.05
DNV	3 YH10
DS	EN 499
GL	3YH10
LR	3, 3Y H10
RS	3Y46HH
SFS	EN 499
SS	EN 499
UDT	DIN 1913
Ü	10.105/1
VdTÜV	01007

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	55-85	22	0.58	90.0	0.8	50
3.2	350	85-140	23	0.60	47.6	1.1	65
3.2	450	85-130	23	0.63	35.3	1.1	88
4.0	350	110-180	23	0.63	32.4	1.6	75
4.0	450	110-170	23	0.63	25.2	1.6	96
5.0	450	180-240	23	0.63	15.9	2.4	95

FILARC 56S

SMAW

Type Basic E7016-1

Description

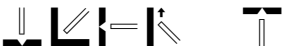
Basic, thin-coated AC/DC electrode providing excellent mechanical properties. The electrode ensures fully penetrated root passes, even under adverse conditions. Low moisture content coating and high resistance to moisture re-absorption.
The electrode is CTOD tested.

Recovery

100%

Welding current

DC+(-), AC OCV 70 V



Classifications

SFA/AWS A5.1	E7016-1
EN 499	E 42 5 B 12 H5

Typical all weld metal composition, %

C	Si	Mn
0.06	0.4	1.3

Typical mech. properties all weld metal

Yield stress, MPa	>420
Tensile strength, MPa	<640
Elongation, %	>22

Charpy V

Test temps, °C	Impact values, J
-20	>150
-40	>80
-50	>47

Approvals

ABS	3H5, 3Y
BV	3YHH
CL	EN 499
DB	10.105.15
DNV	4YH5
DS	EN 499
GL	4YH10
LR	4Y40H10
MOD	B + BX
RS	4Y42HH
SFS	EN 499
SS	EN 499
ÜDT	DIN 1913
Ü	10.105/1
VdTÜV	03012

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	35-60	22	-	-	-	43
2.5	350	55-85	22	0.58	90.0	0.8	50
3.2	350	80-140	22	0.61	52.0	1.3	53
3.2	450	80-130	22	0.61	41.0	1.2	73
4.0	350	110-180	22	0.64	34.0	1.7	62
4.0	450	110-170	22	0.65	26.0	1.7	83
5.0	450	180-230	22	0.66	17.0	2.4	90

Pipeweld 6010 Plus SMAW

Type Cellulosic E 38 2 C 21

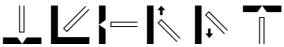
Description

Cellulosic-coated electrode designed for the welding of pipes and pipelines in all positions, using conventional and stovepipe techniques with AC or DC.

Recovery

Welding current

AC, DC+



Classifications

EN 499	E 38 2 C 21
SFA/AWS A5.1	E6010

Typical all weld metal composition, %

C	Si	Mn
0.08	0.05	0.4

Typical mech. properties all weld metal

Yield stress, MPa	410
Tensile strength, MPa	495
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	60
-29	40

Approvals

ABS	3
LR	3

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	50-70	31.5	0.69	91	0.71	55
3.2	350	65-120	29	0.71	54	0.9	76
4.0	350	90-180	28	0.72	36	1.3	78
5.0	350	150-240	29	0.71	23	1.58	98

OK Tubrod 14.11 FCAW

Type Metal-cored E70C-6M H4

Description

OK Tubrod 14.11 is a wire that has been specially designed for robotic applications, particularly in the area of thin plate welding. The welding characteristics of the wire permit the use of lower arc voltages in the spray transfer mode, which reduces arc power and thereby reduces the risk of blow-through in situations where the fit-up is variable. The wire also exhibits excellent feedability and deposits weld metal of the highest quality with Ar/20%CO_2 shielding gas.

Welding current

DC+

Classifications

SFA/AWS A5.18	E70C-6M H4
EN 758	T 42 4 M M 3 H5

Typical all weld metal composition, %

C	Si	Mn
0.06	0.6	1.4

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	560
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-40	70

Approvals

ABS	4Y400SA	Ar/20%CO_2
BV	SA 3Y M HH	Ar/20%CO_2
DB	42.039.28	Ar/20%CO_2
DNV	IIIY40 H5	Ar/20%CO_2
GL	4Y40 H5S	Ar/20%CO_2
LR	4Y40S H5	Ar/20%CO_2
VdTÜV	02133	Ar/20%CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.4	150-350	18-33
1.6	250-450	28-38

OK Tubrod 14.12 FCAW

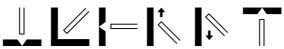
Type Metal-cored E70C-6M, E70C-6C

Description

OK Tubrod 14.12 is a tubular wire for use with both Ar/CO_2 mixtures or CO_2 shielding gases. Improved productivity and weld quality compared with solid wire under CO_2. It is especially suitable for fillet welding and has a high tolerance to primer.

Welding current

DC(+/-)



Classifications

SFA/AWS A5.18	E70C-6M, E70C-6C
EN 758	T 42 2 M M 1 H10, T 42 2 M C 1 H10

Typical all weld metal composition, %

C	Si	Mn
0.07	0.6	1.3

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	550
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	100

Approvals

ABS	3SA, 2YSA	Ar/CO_2 &CO_2
BV	SA3YM	Ar/CO_2 &CO_2
DB	42.039.24	Ar/CO_2 &CO_2
DNV	IIIYMS	Ar/CO_2 &CO_2
DS	T 42 2 M M 1 H10	Ar/CO_2 &CO_2
DS	T 42 2 M C 1 H10	CO_2
GL	3YS	Ar/CO_2 &CO_2
LR	3S, 3YS	Ar/CO_2 &CO_2
RINA	3Y S	Ar/CO_2 &CO_2
VdTÜV	06649	Ar/CO_2 &CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.0	80-250	14-30
1.2	100-320	16-32
1.4	120-380	16-34
1.6	140-450	18-36

OK Tubrod 14.13 FCAW

Type Metal-cored E70C-6M

Description

OK Tubrod 14.13 is a tubular wire particularly suited to the rapid welding of fillet and butt joints in the flat and horizontal positions. The arc action is stable at all current levels, which results in an excellent weld appearance with the absence of undercut and spatter.

Welding current

DC+

Classifications

SFA/AWS A5.18	E70C-6M
EN 758	T 42 2 M M 2 H5

Typical all weld metal composition, %

C	Si	Mn
0.06	0.5	1.4

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	580
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	90

Approvals

ABS	3SA 3YSA	Ar/20 CO_2
BV	SA3YM	Ar/20 CO_2
DB	42.039.03	Ar/20 CO_2
DNV	IIIYMS	Ar/20 CO_2
DS	T 42 2 M M 2 H10	Ar/20 CO_2
GL	3YS	Ar/20 CO_2
LR	3S 3YS	Ar/20 CO_2
VdTÜV	09086	Ar/20 CO_2
MoD(N)	MS<25mm, B&BX<12mm	Ar/20 CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	100-320	16-32
1.4	120-380	16-34
1.6	140-450	18-36

OK Tubrod 14.16 FCAW

Type Self-shielded E71T-GS

Description

OK Tubrod 14.16 is an all-positional, self-shielded, flux -cored wire designed for the welding of thin-gauge galvanised and mild steels in all positions. The smooth arc action on DC- polarity makes the wire particularly suited to the welding of thin-gauge material. Slag removal is easy with minimal spatter. Thicknesses down to 1.0 mm can be easily welded at currents as low as 40 amps without the risk of burn-through on lap and fillet joints.

Welding current

DC-

Classifications

SFA/AWS A5.20 E71T-GS

Typical all weld metal composition, %

C	Si	Mn	Al
0.2	0.3	0.8	2.2

Typical mech. properties all weld metal

Tensile strength, MPa 614

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
0.8	40-100	14-16

OK Tubrod 14.18 FCAW

Type Basic E70T-4

Description

OK Tubrod 14.18 is a self-shielded cored wire for the single- and multi-pass welding of mild and medium tensile strength steels in the flat and HV positions. Capable of high deposition rates, it is ideal for welding on site when no impact properties are required.

Welding current

DC+

Classifications

SFA/AWS A5.20	E70T-4

Typical all weld metal composition, %

C	Si	Mn
0.2	0.4	0.6

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	555
Elongation, %	26

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.6	200-400	25-32
2.4	350-500	27-32

OK Tubrod 15.00 FCAW

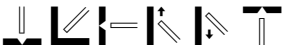
Type Basic E71T-5, E71T-5M

Description

OK Tubrod 15.00 is a flux-cored wire which deposits very low-hydrogen quality weld metal. Diameters 1.0 and 1.2 mm are available for positional welding. The slag cover is thin and easily remelted. Shielding gas CO_2 or Ar + 20% CO_2. OK Tubrod 15.00 is designed for general fabrication where the risk of hydrogen-induced cracking is to be avoided.

Welding current

DC-



Classifications

SFA/AWS A5.20	E71T-5, E71T-5M
EN 758	T 42 3 B M 2 H5, T 42 3 B C 2 H5

Typical all weld metal composition, %

C	Si	Mn
0.06	0.6	1.4

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	550
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
-20	135
-30	120

Approvals

CL	0485	Ar/20%CO_2
DB	42.039.12	Ar/20%CO_2 &CO_2
DNV	IIIYMS	Ar/20%CO_2
DS	T 42 2 B M 2 H5	Ar/20%CO_2
GL	3YH10S	Ar/20%CO_2
LR	3S 3YS H15	Ar/20%CO_2
RINA	3Y S H5	Ar/20%CO_2
RINA	3Y S	CO_2
VdTÜV	02181	Ar/20%CO_2 &CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.0	100-230	14-30
1.2	120-300	16-32
1.4	130-350	16-32
1.6	140-400	24-34
2.0	200-450	24-34
2.4	300-500	26-36

OK Tubrod 15.12 FCAW

Type Rutile E70T-1

Description

OK Tubrod 15.12 is a flux-cored, tubular wire designed for heavy deposition in the flat and horizontal positions on mild and medium tensile steels. Slag removal is easy and generally self-releasing. The weld appearance is exceptional and the spatter level is minimal. Shielding gas CO_2.
OK Tubrod 15.12 is designed for heavy deposition in steel thicknesses of 9 mm upwards.

Welding current

DC+

Classifications

SFA/AWS A5.20	E70T-1
EN 758	T 42 0 R C 3 H10

Typical all weld metal composition, %

C	Si	Mn
0.05	0.6	1.5

Typical mech. properties all weld metal

Yield stress, MPa	520
Tensile strength, MPa	580
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
0	>47

Approvals

DB	42.039.13	Ar/20%CO_2 &CO_2
DS	T 42 0 R C 3 H10	CO_2
VdTÜV	04211	CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-300	24-34
1.6	250-450	26-38
2.4	250-550	28-38

OK Tubrod 15.14 FCAW

Type Rutile E71T-1. E71T-1M

Description

OK Tubrod 15.14 is a flux-cored, tubular wire for all-positional welding using either Ar/CO_2 or CO_2. The wire is suitable for all mild and medium tensile structural steels. The running characteristics are exceptional, using the spray mode of transfer, and this applies equally to both shielding gases. OK Tubrod 15.14 is also universally approved to grade 3 by all major authorities.
Shielding gas
Ar/20%CO_2 or CO_2.

Welding current

DC+

Classifications

SFA/AWS A5.20	E71T-1, E71T-1M
EN 758:1997	T 46 2 P M 2 H10, T 46 2 P C 2 H10

Typical all weld metal composition, %

C	Si	Mn
0.05	0.5	1.3

Typical mech. properties all weld metal

Yield stress, MPa	530
Tensile strength, MPa	580
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	120

Approvals

ABS	3SA 3YSA	Ar/20%CO_2 &CO_2
BV	SA3YM	Ar/20%CO_2 &CO_2
DB	42.039.05	Ar/20%CO_2 &CO_2
DNV	IIIYMS	Ar/20%CO_2 &CO_2
DS	T 46 2 P M 2 H10	Ar/20%CO_2
DS	T 46 2 P C 2 H10	CO_2
GL	3YS	Ar/20%CO_2 &CO_2
LR	3S 3YS	Ar/20%CO_2 &CO_2
MoD (Navy)	MS<25mm, B&BX<12mm	Ar/20%CO_2 &CO_2
RINA	3Y S	Ar/20%CO_2
RINA	2Y S	CO_2
RS	3S 3YS	Ar/20%CO_2 &CO_2
VdTÜV	07651	Ar/20%CO_2 &CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	110-300	21-32
1.4	130-320	22-32
1.6	150-360	24-34

OK Tubrod 15.15 FCAW

Type Rutile E71T-1. E71T-1M

Description

OK Tubrod 15.15 is a flux-cored, tubular wire designed as a truly all-positional, general-purpose wire for welding mild and medium tensile steels up to 510 MPa tensile strength. Using either Ar/CO_2 or CO_2 as the shielding gas, the 1.2 and 1.4 mm sizes can be used in the vertical position on spray transfer providing for maximum deposition and time savings. Weld pool control is easy both vertically up and downwards and slag removal is rapid. OK Tubrod 15.15 is designed for a wide range of applications especially where manipulation of the work is impractical.

Welding current

DC+

Classifications

SFA/AWS A5.20	E71T-1, E71T-1M
EN 758:1997	T 46 2 P M 2 H5, T 46 2 P C 2 H5

Typical all weld metal composition, %

C	Si	Mn
0.05	0.3	1.3

Typical mech. properties all weld metal

Yield stress, MPa	520
Tensile strength, MPa	580
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	140

Approvals

ABS	3SA 3YSA	Ar/20CO_2 &CO_2
BV	SA3YM HH	Ar/20CO_2 &CO_2
CL	CDS 0390	Ar/20CO_2 &CO_2
DB	42.039.14	Ar/20CO_2 &CO_2
DNV	III YMS	Ar/20CO_2 &CO_2
DS	T 46 2 P M 2 H5	Ar/20CO_2
DS	T 46 2 P C 2 H5	CO_2
GL	3YH10S	Ar/20CO_2 &CO_2
LR	3S 3YS H15	Ar/20CO_2 &CO_2
MoD (Navy)	MS<25mm	Ar/20CO_2 &CO_2
MRS	3YMSHH	Ar/20CO_2 &CO_2
VdTÜV	04314	Ar/20CO_2 &CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	110-300	21-32
1.4	130-320	22-32
1.6	150-360	24-34

OK Tubrod 15.16 FCAW

Type Rutile E70T-1

Description

OK Tubrod 15.16 is a flux-cored wire intended for applications requiring very high deposition rates. It has a high recovery for its type at 87% and the 2.4 mm can produce > 8 kg of weld metal per hour at 450 A. It is designed for use with CO_2 shielding in the flat and HV positions on mild and medium tensile steels with a nominal tensile strength of 500 MPa.

Welding current

DC+

Classifications

SFA/AWS A5.20	E70T-1
EN 758	T 42 0 R C 3 H10

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.5	1.2	0.4

Typical mech. properties all weld metal

Yield stress, MPa	510
Tensile strength, MPa	580
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
0	50

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
2.4	250-550	28-38

OK Tubrod 15.18 FCAW

Type Rutile E70T-1

Description

OK Tubrod 15.18 is a rutile, flux-cored wire designed for high deposition welding in the flat and HV positions. It is characterised by an exeptional weld finish with minimal spatter and self-releasing slag using either argon-rich or CO_2 shielding gases. Suitable for all general fabrication of medium to heavy sections where weld appearance and high weld metal integrity are important.

Welding current

DC+

Classifications

SFA/AWS A5.20	E70T-1 E70T-1M
EN 758	T 42 2 R C 3 H10 T 42 2 R M 3 H10

Typical all weld metal composition, %

C	Si	Mn
0.06	0.5	1.1

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	560
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	70

Approvals

ABS	3SA, 2YSA	Ar/20%CO_2 &CO_2
BV	SA3YM	Ar/20%CO_2 &CO_2
DB	42.039.02	CO_2
DNV	III YMS	Ar/20%CO_2 &CO_2
DS	T 42 2 R M 3 H10	Ar/20%CO_2
DS	T 42 2 R C 3 H10	CO_2
LR	3S 3YS H15	Ar/20%CO_2 &CO_2
Ü	42.039/3	Ar/20%CO_2 & CO_2
VdTÜV	05197	Ar/20%CO_2 &CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	110-300	21-32
1.6	150-360	24-34

OK Tubrod 14.00S SAW

Type Metal-cored F7A2-EC1

Description

OK Tubrod 14.00S is a tubular wire designed for the submerged arc welding of mild and medium tensile steels and is suitable for fillet and multi-pass butt joints. When used in conjunction with OK Flux 10.71, exceptional productivity can be obtained at deposition rates up to 20% higher than with the same size of solid wire at the same current.

Welding current

DC+

Classifications

SFA/AWS A5.17	F7A2-EC1
EN 756	S 42 2 AB T 3

Typical all weld metal composition, %

C	Si	Mn
0.06	0.5	1.5

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	530
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
-20	120

Approvals

ABS	3M 3YM
BV	A3YM
DB	52.039.13
DNV	III YM
GL	3YM
LR	3M 3YM
VdTUV	9143
UDT	approved

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
2.4	250-450	28-38
3.0	400-700	28-40
4.0	500-850	28-40

OK Tubrod 15.00S SAW

Type Basic F7A4-EC1

Description

OK Tubrod 15.00S is a tubular wire for submerged arc welding in conjunction with OK Flux 10.71, when high integrity welded joints are required in mild and medium tensile steels. General fabrication, structural engineering and shipbuilding are the principal areas of application. The welding of primed plate at high speeds is a particular benefit.

Welding current

DC+

Classifications

SFA/AWS A5.17	F7A4-EC1
EN 756	S 42 4 AB T3

Typical all weld metal composition, %

C	Si	Mn
0.07	0.5	1.5

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	540
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
-40	130

Approvals

ABS	3M 3YM
BV	A3YM
CL	CDS 1339
DB	52.039.14
DNV	III YM
GL	3YM
LR	3M 3YM
VdTUV	09144
UDT	approved

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
2.4	250-500	28-38
3.0	400-900	28-36
4.0	500-1000	28-34

Coreshield 8

Type **SMAW** E71T-8

Description

Coreshield 8 has a fast-freezing slag that supports the molten metal during welding. It is an E71T-8 self-shielded cored wire, ideal for out-of-position welding in structural fabrication and other heavy -duty applications where good toughness is required.

Welding current

DC-

Classifications

SFA/AWS A5.20	E71T-8

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Cu	Al
0.18	0.14	0.6	<0.1	<0.5	<0.1	0.5

Typical mech. properties all weld metal

Yield stress, MPa	457
Tensile strength, MPa	552
Elongation, %	29

Charpy V

Test temps, °C	Impact values, J
-40	43

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.6	155-240	21-25

FILARC PZ6102 FCAW

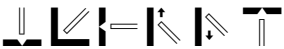
Type Metal-cored E70C-6M H4

Description

A metal-cored wire suitable for the welding of thin plate (>3mm) using M21 shielding gas. Diameters of less than 1.4mm are all positional, with the exception of vertical down.

Welding current

DC+



Classifications

SFA/AWS A5.18	E70C-6M H4
EN 758	T 46 4 M M 2 H5

Typical all weld metal composition, %

C	Si	Mn
0.07	0.85	1.36

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	560
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-40	75

Approvals

ABS	3SA,3YSA	Ar/20%CO_2
BV	S3 3YMHH	Ar/20%CO_2
DB	42.105.09	Ar/20%CO_2
DNV	IV YMS (H5)	Ar/20%CO_2
DS	T 46 4 M M 2 H10	Ar/20%CO_2
GL	4YH10S	Ar/20%CO_2
LR	3S,3YS H15	Ar/20%CO_2
VdTUV	04901	Ar/20%CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	21-37
1.4	150-350	18-33
1.6	150-450	17-36

FILARC PZ6103HS FCAW

Type E70C-GM H4

Description

FILARC PZ6103 is a high fill-ratio, metal-cored wire for high deposition welding in the flat and horizontal/vertical positions using M21 shielding gas.

Welding current

DC+

Classifications

SFA/AWS A5.18	E70C-GM H4
EN 758	T 42 3 M M 3 H5

Typical all weld metal composition, %

C	Si	Mn
0.05	0.9	1.4

Typical mech. properties all weld metal

Yield stress, MPa	477
Tensile strength, MPa	566
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-20	102

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.6	240-250	24-34

FILARC PZ6111

FCAW

Type E70T-1 H8 (nearest) E70T-1M H8 (nearest)

Description

A downhand rutile wire for use with Ar/CO_2 or CO_2 shielding gas in the flat and horizontal/vertical positions. The slag is often self lifting leaving a clean weld bead surface.

Welding current

DC+

Classifications

EN 758	T 42 2 1Ni R C 3 H10, T 46 2 1Ni R M 3 H10

Typical all weld metal composition, %

C	Si	Mn	Ni
0.055	0.45	0.9	0.75

Typical mech. properties all weld metal

Yield stress, MPa	495
Tensile strength, MPa	576
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	114

Approvals

ABS	3SA, 3YSA	Ar/20%CO_2 & CO_2
BV	SA3 3YMHH	Ar/20%CO_2 & CO_2
CL	0751	Ar/20%CO_2
CRS	3YH10S	Ar/20%CO_2 & CO_2
DB	42.105.06	Ar/20%CO_2 & CO_2
DNV	III YMS (H10)	Ar/20%CO_2 & CO_2
DS	T 42 2 1Ni R C 3 H10	CO_2
DS	T 46 2 1Ni R M 3 H10	Ar/20%CO_2
GL	3YH10S	Ar/20%CO_2 & CO_2
LR	3S 3YS	Ar/20%CO_2 & CO_2
PRS	3YH10S	Ar/20%CO_2 & CO_2
VdTÜV	03013	Ar/20%CO_2 & CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	27-38
1.4	150-350	26-36
1.6	150-450	24-40

FILARC PZ6111HS FCAW

Type Rutile E70T-1 (nearest)

Description

A high filling ratio, downhand, rutile cored wire that produces weld deposits at rates of up to 15 kg/h with conventional equipment. The finished weld is free from spatter and the self-releasing slag adds to the quality of the finished weld deposit.
Shielding gas Ar+15-25% CO_2 and CO_2.

Welding current

DC+

Classifications

EN 758	T 46 2 1Ni R M 3 H10, T 42 2 1Ni R C 3 H10

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.45	0.9	0.75

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	560
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	97

Approvals

ABS	3SA,3YSA H10	Ar/20%CO_2 & CO_2
BV	SA3 YMHH	Ar/20%CO_2 & CO_2
DB	42.105.18	Ar/20%CO_2 & CO_2
DNV	III Y40MS H10	Ar/20%CO_2 & CO_2
DS	T 46 2 1Ni R M 3 H10	Ar/20%CO_2
DS	T 42 2 1Ni R C 3 H10	CO_2
GL	3YH10S	Ar/20%CO_2 & CO_2
LR	3S 3YS H10	Ar/20%CO_2 & CO_2
VdTÜV	07668	Ar/20%CO_2 & CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.6	250-450	26-38

FILARC PZ6113 FCAW

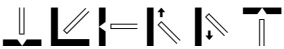
Type Rutile E71T-1 H4, E71T-1M H8

Description

Multi-purpose, all-positional, rutile cored wire for use with either Ar/CO_2 or CO_2. Exceptionally easy to use in all positions, the smooth, stable arc promotes spatter-free welds with smooth tie-ins. The wire is ideally suited for use with ceramic backing for root runs.

Welding current

DC+



Classifications

SFA/AWS A5.20	E71T-1 H4, E71T-1M H8
EN 758	T 42 2 P C 1 H5, T 46 2 P M 1 H10

Typical all weld metal composition, %

C	Si	Mn
0.06	0.5	1.25

Typical mech. properties all weld metal

Yield stress, MPa	535
Tensile strength, MPa	601
Elongation, %	25

Charpy V

Test temps, °C	Impact values, J
-20	128

Approvals

ABS	3SA, 3YSA	Ar/20%CO_2 & CO_2
BV	SA3 3YMHH	Ar/20%CO_2 & CO_2
CCS	3Y 40S H10	Ar/20%CO_2 & CO_2
CL	0452	Ar/20%CO_2 & CO_2
CL	1296	CO_2
CRS	3YH10S	Ar/20%CO_2 & CO_2
DB	42.105.07	Ar/20%CO_2 & CO_2
DNV	III YMS (H10)	Ar/20%CO_2 & CO_2
DS	T 46 2 P M 1 H10	Ar/20%CO_2 & CO_2
DS	T 42 2 P C 1 H10	Ar/20%CO_2 & CO_2
GL	3YH10S	Ar/20%CO_2 & CO_2
LR	3S 3YSH15	Ar/20%CO_2 & CO_2
PRS	3YH10S	Ar/20%CO_2 & CO_2
RINA	SG 52 3 / SG 52 2	Ar/20%CO_2 6 CO_2
RS	3YHHS	Ar/20%CO_2 & CO_2
UDT	EN 758	Ar/20%CO_2 & CO_2
VdTÜV	04902	Ar/20%CO_2 & CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	110-300	21-32
1.4	130-320	22-32
1.6	150-360	24-34

FILARC PZ6113S

Type Rutile

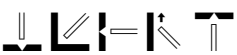
FCAW
E71T-9 H4

Description

Firmly established as the leading CO_2, all-positional, rutile cored wire, PZ6113S has a high degree of welder appeal. For example, the 1.2 mm diameter can weld in several positions at a single current/voltage setting, which explains why it is highly regarded in the shipbuilding segment.

Welding current

DC+



Classifications

SFA/AWS A5.20	E71T-9 H4
EN 758	T 46 3 P C 2 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.07	0.45	1.3	0.4

Typical mech. properties all weld metal

Yield stress, MPa	560
Tensile strength, MPa	628
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-30	109

Approvals

ABS	3SA 3YSA	CO_2
BV	SA3 3YMHH	CO_2
DNV	III YMS (H10)	CO_2
GL	4Y42H10S	CO_2
LR	3S 3YS	CO_2
PRS	3YH10S	CO_2
RINA	SG 52 3	CO_2
RS	3YHHS	CO_2
UDT	EN 758	CO_2
VdTÜV	07085	CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	110-300	21-32

FILARC PZ6114S SMAW

Type T 46 4 P C 1 H5

Description

An all-positional rutile cored wire with good toughness down to -40ºC for use with C1 shielding gas. Diameters less than 1.4 mm are all positional, with the exception of vertical down.

Welding current

DC+

Classifications

EN 758	T 46 4 P C 1 H5
SFA/AWS A5.20	E71T-1J H4

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.4	1.3	0.4

Typical mech. properties all weld metal

Yield stress, MPa	539
Tensile strength, MPa	605
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-40	108

Approvals

ABS	4YSA H5	CO_2
BV	SA 4YMHH	CO_2
CCS	4Y40SH10	CO_2
CRS	4YH5S	CO_2
DB	42.105.15	CO_2
DNV	IV Y40MS (H5)	CO_2
DS	T 46 4 P C 1 H5	CO_2
GL	4YH5S	CO_2
LR	3S 3YS	CO_2
PRS	4YH5S	CO_2
RS	4Y42HHS	CO_2
VdTÜV	07683	CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	27-35

Vertomax 2MG FCAW

Type Metal-cored EG70T-Ni1

Description

A flux-cored, tubular wire designed for automatic vertical-upwards welding using the electrogas process. The core formulation ensures good arc stability and excellent mechanical properties even on thin plate at heat inputs as high as 40 kJ/cm. It can also be used in conjunction with separate metal powder addition for a further improvement in mechanical properties, deposition rate and reduced heat loading to the plate. Shielding gas: CO_2.

Welding current

DC+

Classifications

SFA/AWS A5.20	EG70T-Ni1

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo
0.068	0.38	1.28	0.70	0.16

Typical mech. properties all weld metal

Yield stress, MPa	428
Tensile strength, MPa	568
Elongation, %	32

Charpy V

Test temps, °C	Impact values, J
0	88

Approvals

ABS	2A 2YA	CO_2
BV	AV, AV2Y	CO_2
DNV	IIY	CO_2
GL	2YV	CO_2
LR	2 2Y	CO_2
UDT		CO_2
VdTÜV	01770	CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.6	350-400	32-36
2.4	420-480	32-34
3.2	590-650	32-35

OK AristoRod 12.50

GMAW
ER70S-6

Description

OK AristoRod™ 12.50 is a bare Mn-Si-alloyed G3Si1/ER70S-6 solid wire for the GMAW of non-alloyed steels, as used in general construction, automotive components, pressure vessel fabrication and shipbuilding. OK AristoRod 12.50 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.18	ER70S-6
EN 440	G3Si1

Wire composition

C	Si	Mn
0.1	0.9	1.5

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	560
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	130
-20	90
-30	70

Approvals

ABS	3SA, 3YSA
BV	SA3YM
CWB	CSA W48
DB	42.039.29
DNV	III YMS
DS	EN 440
GL	3YS
LR	3S, 3YS
Ü	42.039/1
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.2-10	60-200	18-24	0.8-2.5
0.9	3.0-12	70-250	18-26	0.8-3.3
1.0	2.7-15	80-300	18-32	1.0-5.5
1.4	2.3-12	150-420	22-36	1.6-8.7
1.6	2.3-15	225-550	28-38	2.1-11.4

OK AristoRod 12.57

GMAW
ER70S-3

Description

OK AristoRod™ 12.57 is a bare Mn-Si-alloyed G2Si/ER70S-3 solid wire for the GMAW of non-alloyed steels, as used in general construction, automotive components, pressure vessel fabrication and shipbuilding. OK AristoRod 12.57 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.18	ER70S-3
EN 440	G2Si

Wire composition

C	Si	Mn
0.1	0.6	1.1

Typical mech. properties all weld metal

Yield stress, MPa	420
Tensile strength, MPa	515
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	140
-20	110
-30	90

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.2-13	60-200	18-24	0.8-3.0
1.0	2.7-15	80-300	18-32	1.0-5.6
1.2	2.5-15	120-380	18-34	1.3-8.0

OK AristoRod 12.62

GMAW
ER70S-2

Description

OK AristoRod™ 12.62 is a bare triple desoxidised G2Ti/ER70S-2 solid wire for the GMAW of non-alloyed steels, as used in general construction, pressure vessel fabrication and shipbuilding. It yields high-quality welds in semi-killed and rimmed steels, as well as with grades with various carbon contents. Added desoxidants, Al - Ti- Zr, make the wire also suitable for steels with a dirty or rusty surface, without sacrificing weld quality.

OK AristoRod 12.62 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.18	ER70S-2
EN 440	G2Ti

Wire composition

C	Si	Mn
0.06	0.6	1.2

Typical mech. properties all weld metal

Yield stress, MPa	>380
Tensile strength, MPa	470-600
Elongation, %	>20

Charpy V

Test temps, °C	Impact values, J
-30	>47

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.9	3.0-12.0	70-250	18-26	0.8-3.3
1.0	2.7-15.0	80-300	18-32	1.0-5.5
1.2	2.5-15.0	120-380	18-35	1.3-8.0

OK AristoRod 12.63

GMAW
ER70S-6

Description

OK AristoRod™ 12.63 is a bare Mn-Si-alloyed G4Si1/ER70S-6 solid wire for the GMAW of non-alloyed steels, as used in general construction, automotive components, pressure vessel fabrication and shipbuilding. It has a slightly higher manganese and silicon content than OK AristoRod 12.50 to increase the weld metal strength. This also promotes a low sensitivity to surface impurities and contributes to smooth, sound welds.

OK AristoRod 12.63 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.18	ER70S-6
EN 440	G4Si1

Wire composition

C	Si	Mn
0.1	1.0	1.7

Typical mech. properties all weld metal

Yield stress, MPa	525
Tensile strength, MPa	595
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	130
-20	90
-30	70

Approvals

ABS	3SA, 3YSA
BV	SA3YM
DB	42.039.30
DNV	III YMS
DS	EN 440
GL	3YS
LR	3S, 3YS
Ü	42.039/1
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.2-10	60-185	18-24	0.8-2.5
0.9	3.0-12	70-250	18-26	0.8-3.3
1.0	2.7-15	80-300	18-32	1.0-5.5
1.2	2.3-15	120-380	18-35	1.2-8.0
1.6	2.3-15	120-380	18-35	1.2-8.0

OK AristoRod 12.65

GMAW
ER70S-6

Description

OK AristoRod™ 12.65 is a Mn-Si-alloyed bare solid wire designed for the mechanised downhill GMAW of pipelines in materials such as API 5L grade 52 to 70. The main application areas are pipelines, compressor stations and associated work in the oil and gas industries. This is an EN 440 G4Si1 type with an improved impurity level to meet the special requirements of this industry. It is supplied on 1 and 5 kg wire spools for use on mechanised pipe welding systems.

OK AristoRod 12.65 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.18	ER70S-6
EN 440	G4Si1

Wire composition

C	Si	Mn
0.09	1.0	1.7

Typical mech. properties all weld metal

Yield stress, MPa	535
Tensile strength, MPa	600
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	140
-20	100
-30	80

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	2.7-15	80-300	18-32	1.0-5.6

OK Autrod 12.51 GMAW

ER70S-6

Description

OK Autrod 12.51 is a copper-coated, Mn-Si-alloyed G3Si1/ER70S-6 solid wire for the GMAW of non-alloyed steels, as used in general construction, pressure vessel fabrication and shipbuilding. The wire has a carefully controlled wire chemistry and a unique surface technology providing superior weld-metal quality at high wire feed speeds and at high welding currents. The wire can be used with both Ar/CO_2 mixed gas and pure CO_2 shielding gas.

Welding current

DC(+)

Classifications

SFA/AWS A5.18	ER70S-6
EN 440	G3Si1

Wire composition

C	Si	Mn
0.1	0.9	1.5

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	560
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	130
-20	90
-30	70

Approvals

ABS	3SA, 3YSA	UDT	DIN 8559
BV	SA3YM	Ü	42.039/1
CL		VdTÜV	
DB	42.039.06		
DNV	III YMS		
DS	EN 440		
GL	3YS		
LR	3 3YS		
PRS	3YS		
RINA	SG 52 3		
RS	3YMS		
Sepros	UNA 485178		
SFS	EN 440		
SS	EN 440		

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.6	5.5-13	30-100	15-20	0.7-1.7
0.8	3.2-13	60-200	18-24	0.8-3.0
0.9	3.0-12	70-250	18-26	0.9-3.6
1.0	2.7-15	80-300	18-32	1.0-5.6
1.2	2.5-15	120-380	18-34	1.3-8.0
1.4	2.3-12	150-420	22-36	1.6-8.7
1.6	2.3-12	225-550	28-38	2.1-11.4

OK Autrod 12.58 GMAW

ER70S-3

Description

OK Autrod 12.58 is a copper-coated, Mn-Si-alloyed G2Si/ER70S-3 solid wire for the GMAW of non-alloyed steels, as used in general construction, pressure vessel fabrication and shipbuilding. The wire has a carefully controlled wire chemistry and a unique surface technology providing superior weld -metal quality at high wire feed speeds and at high welding currents. The wire can be used with both Ar/CO_2 mixed gas and pure CO_2 shielding gas.

Welding current

DC+

Classifications

SFA/AWS A5.18	ER70S-3
EN 440	G2Si

Wire composition

C	Si	Mn
0.1	0.6	1.1

Typical mech. properties all weld metal

Yield stress, MPa	420
Tensile strength, MPa	515
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	140
-20	110
-30	90

Approvals

BV	SA3YM
DB	42.039.17
GL	3YS
LR	3 3YS
UDT	EN 440
Ü	42.039/1
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.6	5.5-13	30-100	15-20	0.7-1.7
0.8	3.2-10	60-200	18-24	0.8-3.0
0.9	3.0-12	70-250	18-26	0.9-3.6
1.0	2.7-15	80-300	18-32	1.0-5.6
1.2	2.5-15	120-380	18-34	1.3-8.0
1.4	2.3-12	150-420	22-36	1.6-8.7
1.6	2.3-12	225-550	28-38	2.1-11.4

OK Autrod 12.64 GMAW

ER70S-6

Description

OK Autrod 12.64 is a copper-coated, Mn-Si-alloyed G4Si1/ER70S-6 solid wire for the GMAW of non-alloyed steels, as used in general construction, automotive components, pressure vessel fabrication and shipbuilding. It has a slightly higher manganese and silicon content than OK Autrod 12.50 to increase the weld -metal strength. This also promotes low sensitivity to surface impurities and contributes to smooth, sound welds.

The wire can be used with both Ar/CO_2 mixed gas and pure CO_2 shielding gas

Welding current

DC+

Classifications

SFA/AWS A5.18	ER70S-6
EN 440	G4Si1

Wire composition

C	Si	Mn
0.1	1.0	1.7

Typical mech. properties all weld metal

Yield stress, MPa	525
Tensile strength, MPa	595
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	130
-30	70

Approvals

ABS	3SA, 3YSA	ŲDT	DIN 8559
BV	SA3YM	Ü	42.039/1
CL		VdTÜV	
DB	42.039.11		
DNV	III YMS		
DS	EN 440		
GL	3YS		
LR	3 3YS		
RINA	SG56A3; SG56A2		
RS	3YMS		
Sepros	UNA 485178		
SFS	EN 440		
SS	EN 440		

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.6	5.0-13	50-100	16-20	0.7-1.7
0.8	3.2-10	60-185	18-24	0.8-2.5
0.9	3.0-12	70-250	18-26	0.8-3.3
1.0	2.7-15	80-300	18-32	1.0-5.5
1.2	2.3-15	120-380	18-35	1.2-8.0
1.4	2.5-12	150-420	22-36	1.7-8.5
1.6	2.3-15	120-380	18-35	1.2-8.0

OK Autrod 12.66 GMAW

ER70S-6

Description

OK Autrod 12.66 is a copper-coated Mn-Si-alloyed solid wire designed for the mechanised downhill GMAW of pipelines in materials such as API 5L grade 52 to 70. The main application areas are pipelines, compressor stations and associated work in the oil and gas industries. This is an EN 440 G4Si1 type with an improved impurity level to meet the special requirements of this industry. It is supplied on 1 and 5 kg wire spools for use on mechanised pipe welding systems.

The wire can be used with both Ar/CO_2 mixed gas and pure CO_2 shielding gas.

Welding current

DC+

Classifications

SFA/AWS A5.18	ER70S-6
EN 440	G4Si1

Wire composition

C	Si	Mn
0.09	1.0	1.7

Typical mech. properties all weld metal

Yield stress, MPa	535
Tensile strength, MPa	600
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	140
-20	100
-30	80

Approvals

VdTÜV

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.2-13	60-200	18-24	0.8-3.0
0.9	3.0-12	70-250	18-26	0.9-3.6
1.0	2.7-15	80-300	18-32	1.0-5.6

OK Tigrod 12.60 GTAW

ER70S-3

Description

OK Tigrod 12.60 is a copper-coated Mn-Si-alloyed W2Si/ER70S-3 solid rod for the GTAW of non-alloyed steels, as used in general construction, pressure vessel fabrication and shipbuilding.

Welding current

DC(-)

Classifications

SFA/AWS A5.18	ER70S-3
EN 1668	W2Si

Wire composition

C	Si	Mn
0.1	0.6	1.1

Typical properties all weld metal

Yield stress, MPa	420
Tensile strength, MPa	515
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-30	90

Approvals

Sepros	UNA 485178

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 12.61 GTAW

ER70S-6

Description

OK Tigrod 12.61 is a copper-coated Mn-Si-alloyed W3Si1/ER70S-6 solid rod for the GTAW of non-alloyed steels, as used in general construction, pressure vessel fabrication and shipbuilding.

Welding current

DC(-)

Classifications

SFA/AWS A5.18	ER70S-6
EN 1668	W3Si1

Wire composition

C	Si	Mn
0.1	0.9	1.5

Typical properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	560
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-30	70

Approvals

DB	42.039.07
Ü	42.039/2
VdTÜV	09124

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 12.64 GTAW

ER70S-6

Description

OK Tigrod 12.64 is a copper-coated Mn-Si-alloyed W4Si1/ER70S-6 solid rod for the GTAW of non-alloyed steels, as used in general construction, pressure vessel fabrication and shipbuilding. It has a slightly higher manganese and silicon content than OK Tigrod 12.61 to increase the weld metal strength. This also promotes low sensitivity to surface impurities and contributes to smooth, sound welds.

Welding current

DC(-)

Classifications

SFA/AWS A5.18	ER70S-6
EN 1668	W4Si1

Wire composition

C	Si	Mn
0.09	1.0	1.7

Typical properties all weld metal

Yield stress, MPa	525
Tensile strength, MPa	595
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-30	70

Approvals

ABS	3, 3Y
CL	EN 1668
DNV	III YM(I1)
GL	3Y
LR	3 3Y
UDT	DIN 8559
VdTÜV	05260

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Autrod 12.10 SAW
EL12

Description
OK Autrod 12.10 is a copper-coated, mild steel wire for submerged arc welding.
It can be combined with the following fluxes:
OK Flux 10.40, OK Flux 10.45, OK Flux 10.61, OK Flux 10.70, OK Flux 10.71, OK Flux 10.76, OK Flux 10.80, OK Flux 10.81, OK Flux 10.83 and OK Flux 10.96.

Classifications

SFA/AWS A5.17	EL12
EN 756	S1

Wire composition

C	Si	Mn
0.09	<0.1	0.5

OK Autrod 12.20 SAW
EM12

Description
OK Autrod 12.20 is a copper-coated, semi-killed wire for the submerged arc and electroslag welding of medium and high strength structural steels.
It can be combined with the following fluxes:
OK Flux 10.40, OK Flux 10.45, OK Flux 10.50 (ESW), OK Flux 10.61, OK Flux 10.62, OK Flux 10.70, OK Flux 10.71, OK Flux 10.80, OK Flux 10.81 and OK Flux 10.83.

Classifications

SFA/AWS A5.17	EM12
EN 756	S2

Wire composition

C	Si	Mn
0.1	<0.1	1.0

OK Autrod 12.22 SAW
EM12K

Description
OK Autrod 12.22 is a killed, medium manganese-alloyed, copper-coated steel wire for submerged arc welding in medium and high strength structural steels.
It can be combined with the following fluxes:
OK Flux 10.45, OK Flux 10.61, OK Flux 10.62, OK Flux 10.71, OK Flux 10.81 and OK Flux 10.83.

Classifications

SFA/AWS A5.17	EM12K
EN 756	S2Si

Wire composition

C	Si	Mn
0.1	0.2	1.0

OK Autrod 12.30 SAW
S3

Description

OK Autrod 12.30 is a copper-coated, semi-killed, manganese-alloyed wire for the submerged arc welding of medium and high tensile strength structural steels.
It can be combined with the following fluxes: OK Flux 10.40, OK Flux 10.70, OK Flux 10.71, OK Flux 10.81 and OK Flux 10.83.

Classifications

EN 756	S3

Wire composition

C	Si	Mn
0.10	0.10	1.6

OK Autrod 12.32 SAW
EH12K

Description

OK Autrod 12.32 is a manganese-alloyed, copper-coated wire for the submerged arc welding of medium and high strength structural steels. OK Autrod 12.32 should preferably be used together with non-alloying or slightly alloying fluxes, such as OK Flux 10.62, when high weld metal quality requirements must be met.
It can also be combined with OK Flux 10.40, OK Flux 10.61.

Classifications

SFA/AWS A5.17	EH12K
EN 756	S3Si

Wire composition

C	Si	Mn
0.12	0.3	1.7

OK Autrod 12.40 SAW
EH14

Description

OK Autrod 12.40 is a copper-coated, manganese-alloyed, semi-killed wire for submerged arc and electroslag welding.
It can be combined with OK Flux 10.62 and OK Flux 10.50.

Classifications

SFA/AWS A5.17	EH14
EN 756	S4

Wire composition

C	Si	Mn
0.12	0.08	1.9

OK Flux 10.30 SAW

Type Basic EN 760: SA Z 1 65 AC

Description

Basic, high-recovery, agglomerated flux designed primarily for the one-sided welding of mild and high-strength steels, in combination with mild steel and low-alloyed steel wires.
The flux has a high current capacity and is therefore able to withstand very high amperages. The content of about 35% Fe powder contributes to very high productivity. Using the three-wire technique, the one-sided welding of plates with a thickness of up to 25 mm can be performed in one run.
Slightly Si- and micro-alloying.
Max. amperage for single wire: max. 1300 A is recommended. For the three-wire technique, max. 3,100 A is recommended.
An arc voltage of 34-48 V is recommended.
Note that the flux consumption is given as kg flux/kg wire.

Density

≈1.1 kg/dm^3

Basicity index

1.8

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
34	1.05	1.15
38	1.30	1.40
42	1.45	1.55

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.10	0.6	0.2	0.6	-	-	0.3

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.10	540	650	0	50

Approvals

Wire	ABS	LR	DNV
OK Autrod 12.10	2YT	2YT	II YT

Classifications

Wire	EN 756
OK Autrod 12.10	S 3T 0 Z S1

OK Flux 10.40 SAW

Type Acid EN 760: SF MS 1 88 AC

Description

OK Flux 10.40 is a fused, acid flux specially designed for welding in combination with mild steel electrodes OK Autrod 12.10 or OK Autrod 12.20. It is designed for use in the single- and multi-pass butt welding of mild and medium tensile steels with impact requirements down to a minimum of -20°C. OK Flux 10.40 is of the manganese-silicate type with high current-carrying capacity on both AC and DC.

Density

1.5 kg/dm^3

Basicity index

0.7

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.7	0.7
30	1.0	1.0
34	1.3	1.3
38	1.8	1.8

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.10	0.05	0.6	1.2	-	-	-
OK Autrod 12.20	0.05	0.6	1.5	-	-	-
OK Autrod 12.30	0.04	0.6	1.8	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.10	370	460	+20	80
			0	60
			-18	45
OK Autrod 12.20	395	500	+20	70
			0	65
			-18	45
			-20	40
OK Autrod 12.30	440	550	+20	80
			0	60

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.10							x	x	x
OK Autrod 12.20	3M, 3YM	3M 3YM	IIIYM	3YM	3YM		x	x	x
OK Autrod 12.30							x	x	x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.10	S 35 0 MS S1	F6A0-EL12/F6P0-EL12
OK Autrod 12.20	S 38 0 MS S2	F6A0-EM12/F6P0-EM12
OK Autrod 12.30	S 38 A MS S3	

OK Flux 10.45 SAW

Type Acid EN 760: SF MS 1 57 AC

Description

OK Flux 10.45 is a fused, acid, slightly Mn-alloying flux for submerged arc welding. It has a well-balanced silicate slag system. In combination with a specially-developed grain size, this slag system makes OK Flux 10.45 ideal for applications in which welding at high speed is of primary importance. Welding speeds of up to 5 m/minute can easily be achieved in thin sheet materials.

Density

≈1.75 kg/dm^3

Basicity index

0.85

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	1.4	1.6
30	1.8	1.9
34	2.4	2.4
38	3.1	3.1

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.10	0.07	0.2	1.1	-	-	-
OK Autrod 12.22	0.06	0.25	1.3	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.10	375	480	+20	110
			-20	70
			-29	35
OK Autrod 12.22	420	510	+20	110
			-20	70
			-29	60

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.10									x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.10	S 35 2 MS S1	F6A2-EL12/F6P2-EL12
OK Autrod 12.22	S 38 2 MS S2Si	F7A2-EM12K/F6P2-EM12K

OK Flux 10.47 SAW

Type Basic EN 760: SF AB 1 65 AC

Description

OK Flux 10.47 is a non-alloying, fused flux, specially designed for the single- and multi-pass butt welding of mild and medium tensile strength steels. It is not sensitive to moisture absorption and can be used without re-baking, while yielding low-hydrogen weld metal.
Typical applications are found in shipbuilding and pressure vessel manufacture with impact strength requirements down to –40°C. OK Flux 10.47 has a high current-carrying capacity on both AC and DC.

Density

approx. 1.1 kg/dm^3

Basicity index

1.3

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.7	0.7
30	1.0	1.0
34	1.3	1.3
38	1.8	1.8

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.20	0.04	0.3	0.9	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.20	365	455	-20	110
			-30	90
			-40	70

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.20							x	x	

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.20	S 35 3 AB S2	F6A4-EM12

OK Flux 10.50 ESW

Type Basic

Description

A fused, non-alloying flux, specially designed for electroslag welding. As no alloying takes place from the flux, the required mechanical properties can be obtained using a suitable alloyed wire.

Density

≈1.5 kg/dm^3

Basicity index

2.0

Flux consumption, kg flux/kg wire

Consumption fux: wire ≈1:20

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.20	0.10	0.15	1.2	-	-	-
OK Autrod 12.32	0.10	0.20	1.4	-	-	-
OK Autrod 12.40	0.10	0.20	1.6	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.20	340	480	+20	50
OK Autrod 12.32	360	500	+20	50
OK Autrod 12.40	390	540	+20	50

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.20									x
OK Autrod 12.32									x
OK Autrod 12.40									x

Other approvals may be applicable. Please contact ESAB.

OK Flux 10.61

SAW

Type High-basic EN 760: SA FB 1 65 DC

Description

OK Flux 10.61 is designed for the single-wire, multi-run butt welding of mild, medium and high tensile steels with impact strength requirements down to -40°C/-60°C.
Due to the non-alloying effect, OK Flux 10.61 is designed for use with a suitable alloying wire. OK Flux 10.61 can be used on DC±.

Density

1.1 kg/dm^3

Basicity index

2.8

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.6	
30	0.9	
34	1.2	
38	1.4	

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.10	0.07	0.15	0.5	-	-	-
OK Autrod 12.22	0.08	0.35	1.0	-	-	-
OK Autrod 12.32	0.09	0.3	1.4	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.10	355	445	+20	180
			-10	130
			-20	100
OK Autrod 12.22	440	520	-20	130
			-30	80
			-40	70
			-62	35
OK Autrod 12.32	440	550	-20	110
			-40	90
			-50	55
			-51	55
			-62	40

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.10							x	x	x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.22	S 38 4 FB S2Si	F7A8-EM12K/F6P8-EM12K
OK Autrod 12.32	S 42 5 FB S3Si	F7A6-EH12K/F7P8-EH12K

OK Flux 10.62 SAW

Type High-basic EN 760: SA FB 1 55 AC H5

Description

OK Flux 10.62 is an all-mineral, non-alloying, high-basic flux. The weld metal can be fully controlled through the suitable choice of wires, independently of the welding parameters. It is therefore very suitable for the multi-run welding of thick materials using the single-wire and multiple-wire technique. OK Flux 10.62 is designed for the multi-pass butt welding of mild, medium and high tensile steels, as well as low-alloyed steels, with an impact strength down to -40°/-60°C. As it is a flux of the high-basic type, OK Flux 10.62 has a high current-carrying capacity on both AC and DC. To increase productivity with no loss of mechanical properties, OK Flux 10.62 is best used together with iron powder addition. OK Flux 10.62 is especially suitable for narrow gap welding, due to the good slag detachability and smooth side-wall blending. Pressure vessels for nuclear applications and offshore constructions in which good CTOD values are required are two areas in which OK Flux 10.62 can be successfully used. It operates optimally at the lower end of the voltage range.
OK Flux 10.62 yields low-oxygen weld metal (approx. 300 ppm) and produces low-hydrogen weld metal (lower than 5 ml/100 g).

Density

approx. 1.1 kg/dm^3

Basicity index

3.4

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.7	0.6
30	0.9	0.75
34	1.2	1.0
38	1.5	1.25

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.22	0.07	0.30	1.0	-	-	-
OK Autrod 12.32	0.10	0.35	1.6	-	-	-
OK Autrod 12.32/ OK Grain 21.85	0.10	0.4	1.6	-	-	-
OK Autrod 12.40	0.08	0.12	1.9	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.22	410	500	0	170
			-20	160
			-40	90
			-50	70
			-62	35
OK Autrod 12.32	475	570	+20	175
			0	150
			-30	130
			-40	110
			-62	70
OK Autrod 12.32/ OK Grain 21.85	475	540	-40	110
			-60	75
OK Autrod 12.40	530	620	+20	140
			0	110
			-20	80
			-40	50
			-51	40

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.22	3M, 3YM	3M, 3YM	IIIYM	A3, 3YM	3YM		x	x	x
OK Autrod 12.32	4Y42M	4Y40M	IVY42M	A4Y42M	4Y42M	3YM	x	x	x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.22	S 38 5 FB S2Si	F7A8-EM12K/F6P8-EM12K
OK Autrod 12.32	S 46 6 FB S3Si	F7A8-EH12K/F7P8-EH12K
OK Autrod 12.40	S 50 4 FB S4	F7A6-EH14/F7P6-EH14

OK Flux 10.70 SAW

Type Basic EN 760: SA AB 1 79 AC

Description

OK Flux 10.70 is specially designed for welding with OK Autrod 12.10 and OK Autrod 12.20 in the butt and fillet welding of mild, medium and high tensile steels with impact requirements down to -20°C. OK Flux 10.70 is of the aluminate basic type and, for this slag system, it has a very high current-carrying capacity on both AC and DC. As it is an alloying flux with significant Si and Mn pick-up, it is most suitable for applications with high base material dilution – in other words, in fillet welding and butt welding with a small number of passes in single- or multi-wire systems.

Density

approx. 1.1 kg/dm^3

Basicity index

1.7

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.65	0.5
30	0.9	0.75
34	1.15	1.0
38	1.45	1.2

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.10	0.05	0.5	1.7	-	-	-
OK Autrod 12.20	0.06	0.6	1.9	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.10	430	520	+20	125
			0	100
			-20	70
			-30	55
			-40	40
OK Autrod 12.20	470	580	+20	100
			0	90
			-20	75
			-29	50

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.10	3TM, 3YM	3T, 3YM	IIIT (IIIYM)	A3, 3YM, 3T	3TM, 3YM		x	x	x
OK Autrod 12.20							x	x	x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.10	S 42 3 AB S1	F7A4-EL12/F7P4-EL12
OK Autrod 12.20	S 46 3 AB S2	F7A2-EM12/F7P2-EM12

OK Flux 10.71 SAW

Type Basic EN 760: SA AB 1 67 AC H5

Description

OK Flux 10.71 is a basic agglomerated, slightly Si- and Mn-alloying flux for submerged arc welding, specially designed for fillet welding and for the single- and multi-pass butt welding of mild, medium and high tensile steels. OK Flux 10.71 is of the aluminate basic type and, for this slag system, it has a very high current-carrying capacity on both AC and DC and very good operating characteristics. OK Flux 10.71 is ideally suited to narrow gap welding due to the excellent slag detachability and smooth side-wall blending.

Density

approx. 1.2 kg/dm^3

Basicity index

1.6

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.6	0.5
30	0.85	0.7
34	1.15	0.95
38	1.35	1.15

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.10	0.04	0.3	1.0	-	-	-
OK Autrod 12.20	0.05	0.3	1.35	-	-	-
OK Autrod 12.22	0.08	0.5	1.4	-	-	-
OK Autrod 12.30	0.09	0.4	1.65	-	-	-
OK Autrod 12.32	0.09	0.5	2.0	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.10	360	465	0 -20 -30 -40	125 95 75 65
OK Autrod 12.20	410	510	+20 0 -20 -40	135 125 80 55
OK Autrod 12.22	425	520	+20 0 -20 -40 -46	150 140 100 60 40
OK Autrod 12.30	480	580	+20 0 -20 -30	130 110 90 60
OK Autrod 12.32	480	580	+20 0 -20 -40 -46	150 130 95 65 40

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.10	3M	3M	IIIM	A3M	3M		x	x	x
OK Autrod 12.20	3M, 3YM	3M, 3YM	IIIYM	3YM	3YM		x	x	x
OK Autrod 12.22	4Y400M	4Y40M	IVY40M	A 4Y40M	4Y40M		x	x	x
OK Autrod 12.30							x	x	x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.10	S 35 4 AB S1	F6A4-EL12/F6P5-EL12
OK Autrod 12.20	S 38 4 AB S2	F7A4-EM12/F6P4-EM12
OK Autrod 12.22	S 38 4 AB S2Si	F7A5-EM12K/F6P5-EM12K
OK Autrod 12.30	S 46 3 AB S3	
OK Autrod 12.32	S 46 4 AB S3Si	F7A5-EH12K//F7P5-EH12K

OK Flux 10.72

SAW

Type Basic

EN 760: SA AB 1 57 AC

Description

Agglomerated aluminate-basic flux with an extremely high current-carrying capacity, for applications with toughness requirements down to -50ºC. Excellent slag removal, also in narrow V-joints. Ideal for structural steels, fine-grained steels and low-temperature steels. Specially designed for windmill tower fabrication. Suitable for single- and multi-wire procedures and for both DC and AC welding. Designed for the single-layer and multi-layer welding of unlimited plate thickness.

Density

1.1 kg/dm^3

Basicity index

1.9

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.7	0.6
30	1.0	0.9
34	1.3	1.2
38	1.5	1.4

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.20	0.05	0.2	1.5	-	-	-
OK Autrod 12.22	0.05	0.3	1.5	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.20	415	500	-30	125
			-40	100
			-50	70
			-62	50
OK Autrod 12.22	415	500	-30	120
			-40	100
			-50	70
			-62	50

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.20							x	x	x
OK Autrod 12.22							x	x	x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.20	S 38 5 AB S2	F7A8-EM12/F6P8-EM12
OK Autrod 12.22	S 38 5 AB S2Si	F7A8-EM12K/F6P8-EM12K

OK Flux 10.73

SAW

Type Basic EN 760: SA AB 1 66 AC H5

Description

Aluminate-basic agglomerated flux designed primarily for the multi-wire pipe welding of mild and high-strength pipe-steel grades. Due to its metallurgical design, the flux does not produce hard spots in pipe-welding applications.

Density

≈1.1 kg/dm^3

Basicity index

1.3

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.8	0.6
30	1.15	0.75
34	1.35	1.0
38	1.5	1.3

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.22	0.06	0.3	1.0	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.22	400	500	0	150
			-30	140
			-40	100

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.22	S 38 4 AB S2Si	

OK Flux 10.76 SAW

Type **Basic** EN 760: SA AB 1 79 AC

Description

OK Flux 10.76 is specially designed for welding with OK Autrod 12.10 in the butt and fillet welding of mild, medium and high tensile steels with impact requirements down to -20°C. OK Flux 10.76 is of the aluminate basic type and, for this slag system, it has a very high current-carrying capacity on both AC and DC. As it is an alloying flux with significant Si and Mn pick-up, it is most suitable for applications with high base material dilution – in other words, in fillet welding and butt welding with a small number of passes in single- or multi-wire systems.

Density

1.1.kg/dm^3

Basicity index

1.7

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.65	0.5
30	0.9	0.75
34	1.15	1.0
38	1.45	1.2

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.10	0.06	0.05	1.9	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.10	450	540	0	100
			-20	70
			-30	55
			-40	45

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.10	3TM, 3YTM	3YM, 3YT	III YTM	A3TM, A3YTM	3YTM				

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.10	S 42 3 AB S1	F7A4-EL12/F7P4-EL12

OK Flux 10.80 SAW

Type Neutral EN 760: SA CS 1 89 AC

Description

OK Flux 10.80 is designed for use in the single- and multi-pass butt welding of mild and medium tensile steels where moderate impact strength is required. OK Flux 10.80 is of the calcium-silicate type with a very high current-carrying capacity, even at low welding speeds with both AC and DC.
OK Flux 10.80 is excellent for the butt welding of materials from 10 to 30 mm thickness and is used in the shipbuilding industry, for example.
OK Flux 10.80 is specially designed for use in combination with OK Autrod 12.10 or OK Autrod 12.20 in single- or multi-wire systems.

Density

≈1.1 kg/dm^3

Basicity index

1.1

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.5	0.45
30	0.7	0.6
34	1.0	0.85
38	1.25	1.1

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.10	0.07	0.7	1.4	-	-	-
OK Autrod 12.20	0.09	0.6	1.7	-	-	-
OK Autrod 12.30	0.09	0.7	2.0	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.10	410	520	+20	110
			0	80
			-20	45
			-29	40
OK Autrod 12.20	460	560	+20	90
			0	70
			-20	50
OK Autrod 12.30	510	600	+20	90
			0	60

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.10							x	x	x
OK Autrod 12.20							x	x	x
OK Autrod 12.30							x	x	x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.10	S 38 0 CS S1	F7A2-EL12/F6P0-EL12
OK Autrod 12.20	S 42 0 CS S2	F7A2-EM12/F6P0-EM12
OK Autrod 12.30	S 46 0 CS S3	

OK Flux 10.81 SAW

Type Acid EN 760: SA AR 1 97 AC

Description

OK Flux 10.81 is an acid agglomerated Si- and Mn-alloying flux for submerged arc welding, most suitable for applications where the dilution of base metal is high, e.g. in fillet welding and butt welding of thin and medium thick plates with a small number of passes. The excellent welding properties associated with the acid slag system of OK Flux 10.81 permit high travel speeds in butt welding, i.e. the spiral welding of thin-walled pipes and fillet welding, where good bead shape, excellent slag removal and top-class surface finish are essential.

Density

approx. 1.25 kg/dm^3

Basicity index

0.6

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.6	0.5
30	0.8	0.65
34	1.05	0.9
38	1.35	1.25

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.10	0.06	0.8	1.2	-	-	-
OK Autrod 12.20	0.07	0.8	1.45	-	-	-
OK Autrod 12.22	0.07	0.9	1.5	-	-	-
OK Autrod 12.30	0.08	0.8	1.75	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.10	450	540	+20	50
			0	30
OK Autrod 12.20	510	610	+20	80
			0	60
			-18	40
OK Autrod 12.22	530	610	+20	60
OK Autrod 12.30	540	640	+20	75
			0	60

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.10							x	x	x
OK Autrod 12.20	2TM 2YTM	2TM 2YTM	IIYTM	A2 2YTM	2YTM		x	x	x
OK Autrod 12.30							x	x	x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.10	S 42 A AR S1	F7AZ-EL12/F7PZ-EL12
OK Autrod 12.20	S 46 0 AR S2	F7A0-EM12/F7PZ-EM12
OK Autrod 12.22	S 50 A AR S2Si	F7AZ-EM12K/F7PZ-EM12K
OK Autrod 12.30	S 50 0 AR S3	

OK Flux 10.83 SAW

Type Acid EN 760: SA AR 1 85 AC

Description

An acid, agglomerated flux for the high-speed, single-pass welding of butt, lap and fillets which are well washed and free from undercut, even at speeds in excess of 3 metres per minute. It is primarily used with DC single- and twin-arc wire systems at currents of up to 1300 A. It is recommended for the high-speed welding of heat exchanger tubes, storage tanks, building beams and rail car panels.

Density

≈1.4 kg/dm^3

Basicity index

0.3

Flux consumption, kg flux/kg wire

Voltage	DC+	AC
26	0.8	0.5
30	1.1	0.8
34	1.4	1.0
38	1.8	1.4

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.22	0.05	0.8	0.9	-	-	-
OK Autrod 12.51	0.04	1.3	1.3	-	-	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.22	470	560	+20	50
			0	30
OK Autrod 12.51	530	610	+20	25

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.22									x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 12.22	S42 Z AR S2Si	F7AZ-EM12K/F7PZ-EM12K
OK Autrod 12.51	S 46 Z AR SO	F7AZ-EH11K/F7PZ-EH11K

Consumables for low-alloyed steels

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Low-alloyed steels

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Low-alloyed steels

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Low-alloyed steels

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OK 48.08

Type Lime-basic

SMAW
E7018-G

Description

OK 48.08 is an LMA electrode with very good mechanical properties suitable for demanding applications, such as offshore. The weld metal contains approximately 1% Ni for high impact values down to -40°C. The coating is of the latest LMA type for optimum resistance to porosity and hydrogen cracking. OK 48.08 is CTOD tested.

Recovery

125%

Welding current

AC, DC+(-) OCV 65 V

Classifications

SFA/AWS A5.5	E7018-G
EN 499	E 46 5 1Ni B 32 H5
ISO 2560	E 51 5 B 120 24 H

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.4	1.2	0.8

Typical mech. properties all weld metal

Yield stress, MPa	540
Tensile strength, MPa	600
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	160
-40	130
-50	100
-60	60

Approvals

ABS	3H5 3Y
CL	EN 499
DB	10.039.31
DNV	4 Y40H5
DS	EN 499
GL	4YH5
LR	4Y40 H15
Sepros	UNA 409819
SS	EN 499
UDT	EN 499
Ü	10.039/1
VdTÜV	05778

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.0	300	55-80	22	0.57	135.1	0.6	42
2.5	350	75-110	27	0.57	88.2	1.0	41
3.2	350	110-150	22	0.62	42.3	1.3	66
3.2	450	110-150	22	0.66	30.0	1.4	85
4.0	350	150-200	22	0.66	26.5	2.0	68
4.0	450	150-200	22	0.69	20.3	2.0	90
5.0	450	190-275	23	0.69	14.0	3.0	85
6.0	450	220-360	26	0.66	10.0	3.8	95

OK 73.05

Type Basic

SMAW
E7018-G

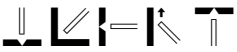
Description

Welds in offshore flowlines welded with standard 1% Ni consumables have demonstrated corrosion resistance that is considerably lower than that of the base material. OK 73.05 has been alloyed with Cr/Cu to provide increased corrosion resistance at the level of the base material. It is a basic electrode with very good welding characteristics, specially designed for pipe welding.

Recovery

Welding current

DC+ - AC OCV 65 V



Classifications

SFA/AWS A5.5	E7018-G

Typical all weld metal composition, %

C	Si	Mn	Cr	Cu
0.04	0.5	0.6	0.6	0.3

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	550
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	155
-40	60

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	75-105	22	0.69	61	0.94	63
3.2	450	90-130	22	0.62	33	1.1	101

OK 73.08

Type Lime-basic

SMAW
E8018-G

Description

OK 73.08 is a NiCu-alloyed LMA electrode, which deposits a weld metal with good corrosion resistance to sea-water and flue gases, for the welding of weatherproof steel and for ship's hull structural steel. The weld metal has excellent mechanical properties. It is particularly suitable for welding the shell plating of ice-breakers and other ships, which work under conditions where the protective paint coating wears off.

Recovery

125%

Welding current

AC, DC(+) OCV 65 V

Classifications

SFA/AWS A5.5	E8018-G
EN 499	E 46 5 Z B 32
ISO 2560	E 51 5 B 120 26 H

Typical all weld metal composition, %

C	Si	Mn	Ni	Cu
0.06	0.4	1.0	0.7	0.4

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	590
Elongation, %	27

Charpy V

Test temps, °C	Impact values, J
-20	160
-40	130
-50	70

Approvals

ABS	3H5, 3Y
BV	3Y HH
DB	10.039.20
DNV	3 YH10
DS	EN 499
GL	3YH15
LR	3, 3Y H15
RS	3YHH
Sepros	UNA 485154
SFS	EN 499
SS	EN 499
UDT	EN 499
Ü	10.039/1
VdTÜV	02115

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	60-90	20	0.62	113.0	0.7	42
2.5	350	80-115	21	0.62	66.0	0.9	59
3.2	350	100-150	23	0.62	43	1.2	68
3.2	450	100-150	22	0.66	30.5	1.3	90
4.0	450	130-200	23	0.68	20.0	1.8	100
5.0	450	190-280	27	0.70	13.5	2.6	106
6.0	450	240-370	28	0.68	9.5	3.3	115

OK 73.15

Type Basic

SMAW
E8018-G

Description

OK 73.15 is a basic electrode with very good welding characteristics. The electrode is of the AWS 8018-G type and yields a weld metal alloyed with about 0.9% Ni. It meets the impact requirements down to -50°C. The coating is of the low-moisture absorption type and the diffusible hydrogen content is below 5ml/100g weld metal.

Recovery

Welding current

DC+(-)

Classifications

SFA/AWS A5.5	E8018-G
EN 499	E 46 5 Mn1Ni B 42 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.4	1.4	0.9

Typical mech. properties all weld metal

Yield stress, MPa	>460
Tensile strength, MPa	550-680
Elongation, %	> 20

Charpy V

Test temps, °C	Impact values, J
-50	>47

Approvals

ABS	3H5, 3Y
DNV	4Y 46 H5
LR	3, 4Y

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	55-110	25	0.63	80.6	1.0	46
3.2	450	80-145	22	0.64	32.6	1.3	85
4.0	450	110-200	23	0.64	21.9	1.9	86
5.0	450	155-290	23	0.67	13.2	2.9	93

OK 73.68

Type Lime-basic

SMAW
E8018-C1

Description

OK 73.68 is a 2.5% nickel-alloyed LMA electrode suitable for the welding of low-alloy steels with impact requirements down to -60°C. The composition of the weld metal is such that good, low-temperature impact properties are obtained, even when welding vertically up. The weld metal of OK 73.68 is also noted for its good corrosion resistance to sea-water and sulphuric acid fumes.

Recovery

120%

Welding current

AC, DC+ OCV 65 V

Classifications

SFA/AWS A5.5	E8018-C1
EN 499	E 46 6 2Ni B 32 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.05	0.3	1.0	2.4

Typical mech. properties all weld metal

Yield stress, MPa	520
Tensile strength, MPa	610
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-55	110
-59	105
-60	105

Approvals

ABS	3H5, 3Y400
BV	UP
CL	EN 499
DNV	5 YH10
GL	6Y55H10
LR	5Y40H15
PRS	4YH10
RS	3YHH
Sepros	UNA 485154
SFS	EN 499
UDT	EN 499
VdTÜV	01529

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	55-75	21	0.62	130.0	0.6	46
2.5	350	70-110	23	0.62	70.0	0.9	55
3.2	450	105-150	23	0.62	32.0	1.4	81
4.0	450	140-190	23	0.65	21.0	2.0	88
5.0	450	190-270	27	0.65	13.5	2.5	104

OK 73.79

Type Lime-basic

SMAW
E8016-C2

Description

OK 73.79 is a nickel-alloyed, LMA electrode for welding 3.5 Ni steel with impact requirements down to -101°C. It is used, for example, for ethane tanks and chemical plants.

Recovery

100%

Welding current

AC, DC (+-) OCV 65 V

Classifications

SFA/AWS A5.5	E8016-C2
EN 499	E 46 6 3Ni B12 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.3	0.6	3.3

Typical mech. properties all weld metal

Yield stress, MPa	520
Tensile strength, MPa	610
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J	Test temps, °C	Impact values, J
-55	170	-95	40
-60	160	-101	35
-73	90		

Approvals

DNV	5 YH10
RS	5Y46HH

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	70-110	25	0.60	76	0.8	60
3.2	350	80-150	25	0.60	39	1.4	71
3.2	450	80-150	25	0.60	37	1.5	77
4.0	450	90-190	27	0.63	26	1.8	88
5.0	450	110-240	29	0.60	15	2.1	100

OK 74.46

Type Lime-basic

SMAW
E7018-A1

Description

OK 74.46 is an LMA electrode alloyed with 0.5% Mo for welding steels for pressure vessels. The running characteristics make it suitable for welding joints in inclined positions. The composition of the coating is adapted for welding with low currents, making OK 74.46 very suitable for the welding of pipes.

Recovery

115%

Welding current

DC+, AC OCV 65 V

Classifications

SFA/AWS A5.5	E7018-A1
EN 1599	E Mo B 42 H5
ISO 3580	E Mo B 20

Typical all weld metal composition, %

C	Si	Mn	Mo
0.06	0.5	0.7	0.5

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	560
Elongation, %	27

Charpy V

Test temps, °C	Impact values, J
+20	175
0	>31

Approvals

CL	EN 1599
SFS	EN 1599
UDT	DIN 8575
VdTÜV	01043

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	55-80	22	0.59	136.0	0.7	40
2.5	350	75-110	23	0.59	73.0	0.9	55
3.2	350	105-150	23	0.54	53.0	1.0	66
3.2	450	105-150	25	0.59	37.0	1.2	81
4.0	450	140-200	26	0.65	22.5	1.8	90
5.0	450	190-270	27	0.65	14.5	2.4	104
6.0	450	260-370	28	0.65	10.0	3.4	108

OK 74.70

Type Lime-basic

SMAW
E8018-G

Description

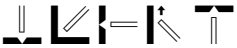
OK 74.70 is an LMA electrode used for welding high strength, low-alloyed steel. The electrode is designed for various applications, including pipelines.

Recovery

115%

Welding current

DC+(-)



Classifications

SFA/AWS A5.5	E8018-G
EN 499	E 50 4 MnMo B 42 H5

Typical all weld metal composition, %

C	Si	Mn	Mo
0.08	0.4	1.5	0.4

Typical mech. properties all weld metal

Yield stress, MPa	540
Tensile strength, MPa	630
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	110
-40	80
-60	50

Approvals

Sepros	UNA 485155
VNIIST	

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	350	80-140	23	0.58	50.0	1.14	63
4.0	350	90-190	23	0.61	31.6	1.60	71
4.0	450	90-190	24	0.63	23.4	1.66	93
5.0	450	150-250	23	0.65	15.0	2.30	102

OK 74.78

Type Lime basic

SMAW
E9018-D1

Description

OK 74.78 is an LMA electrode suitable for welding high tensile steels used in low-temperature applications. Good notch toughness down to -40°C. Very suitable for both the enclosed welding and cladding of rails, when a hardness of about 250 HV is required. The moisture content of the coating is very low, which makes OK 74.78 suitable when preheating cannot be applied.

Recovery

125%

Welding current

AC, DC+ OCV 70 V

Classifications

SFA/AWS A5.5	E9018-D1
EN 757	E 55 4 MnMo B 120 20BH

Typical all weld metal composition, %

C	Si	Mn	Mo
0.06	0.4	1.5	0.4

Typical mech. properties all weld metal

Yield stress, MPa	600
Tensile strength, MPa	650
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
0	100
-20	90
-51	60

Approvals

ABS	3H5, 3Y
BV	3Y HH
DB	10.039.17
DB	20.039.02
DNV	3 YH10
DS	EN 1599
LR	3, 3Y H15
Sepros	UNA 481555
SS	EN 1599
UDT	DIN 8529
Ü	10.039/3
VdTÜV	01027

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.0	300	55-80	22	0.62	136.0	0.7	38
2.5	350	75-100	22	0.62	73.0	0.9	55
3.2	450	105-140	23	0.65	32.0	1.3	86
4.0	450	140-190	23	0.65	20.5	1.8	97
5.0	450	190-260	24	0.68	14.0	2.6	100
6.0	450	240-340	24	0.69	10.0	3.6	103

OK 74.86 Tensitrode SMAW

Type Basic E10018-D2

Description

A basic coated electrode for steels and castings with U.T.S. of min. 690 MPa.

Recovery

120%

Welding current

DC+, AC OCV 70 V

Classifications

SFA/AWS A5.5	E10018-D2
BS 2493 (1985)	2Mn Mo BH

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo
0.07	0.6	1.8	0.7	0.4

Typical mech. properties all weld metal

Yield stress, MPa	>610
Tensile strength, MPa	>690
Elongation, %	>16

Charpy V

Test temps, °C	Impact values, J
-51	>30

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	75-100	22	0.61	69.4	0.86	60.1
3.2	450	110-140	22	0.62	33.0	1.3	84.0
4.0	450	150-190	23	0.62	22.4	1.72	93.4
5.0	450	190-260	23	0.68	14.3	2.72	92.6
6.0	450	240-340	23	0.69	9.7	3.9	94.8

OK 75.75

Type Lime-basic

SMAW
E11018-G

Description

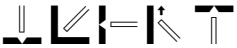
OK 75.75 is an LMA electrode dried to a very low moisture content and suitable for the welding of high-strength, low-alloyed steels, at room temperature or with moderate preheating.

Recovery

125%

Welding current

DC+



Classifications

SFA/AWS A5.5	E11018-G
EN 757	E 69 4 Mn2NiCrMoB 42 H5

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
0.06	0.3	1.7	0.4	2.2	0.4

Typical mech. properties all weld metal

Yield stress, MPa	755
Tensile strength, MPa	820
Elongation, %	20

Charpy V

Test temps, °C	Impact values, J
+20	115
-20	85
-40	70
-51	55
-60	45

Approvals

ABS	E11018-G
DB	10.039.19
RS	4Y62HH
Sepros	UNA 485155
UDT	DIN 8529
Ü	10.039/3
VdTÜV	01028

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	70-110	22	0.67	66.0	1.0	54
3.2	450	100-150	23	0.67	31.5	1.4	80
4.0	450	135-200	24	0.65	21.0	1.9	92
5.0	450	180-260	25	0.63	12.0	2.5	105

OK 75.78

SMAW

Type Basic E 89 6 Z B 42 H5

Description

This electrode is tailored for steels with extremely high tensile strength, giving tensile strength over 900 MPa and impact values over 47 J at -60°C.

Recovery

115%

Welding current

AC, DC+ OCV 70 V

Classifications

EN 757	E 89 6 Z B 42 H5

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
0.05	0.3	2.1	0.5	3.0	0.6

Typical mech. properties all weld metal

Yield stress, MPa	920
Tensile strength, MPa	965
Elongation, %	17

Charpy V

Test temps, °C	Impact values, J
-60	60

Approvals

UDT	DIN 8529

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	70-110	24	0.61	73.5	0.9	52
3.2	350	110-150	24	0.63	32.6	1.4	77
4.0	450	150-200	24	0.65	21.9	1.9	86

OK 76.16

Type Lime-basic

SMAW
E8018-B2-H4R

Description

Basic, low-hydrogen electrode for the DC welding of creep-resistant steels of the 1.25% Cr, 0.5% Mo type, such as SA-387 Grade 11/A 335 P11.The weld metal has an extra-low impurity level .

Recovery

115%

Welding current

DC+(-)

Classifications

SFA/AWS A5.5	E8018-B2-H4R
EN 1599	E Cr Mo 1 B 42 H5

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.07	0.4	0.6	1.4	0.6

Typical mech. properties all weld metal

Yield stress, MPa	550
Tensile strength, MPa	620
Elongation, %	22

Charpy V

Test temps, °C	Impact values, J
-20	70

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	70-110	23	0.6	74	0.65	75
3.2	350	95-150	23	0.59	48	1.07	71
4.0	350	130-190	22	0.89	30	1.55	78

OK 76.26

Type Lime basic

SMAW
E9018-B3

Description

Basic low-hydrogen electrode for the AC/DC welding of creep-resistant steels of the 2.3% Cr/1% Mo type, such as SA - 387 Grade 22/A 335 Grade P22 or similar. The weld metal has the extra-low impurity levels specified in step-cooling requirements.

Recovery

110 %

Welding current

AC, DC+ OCV 65 V

Classifications

SFA/AWS A5.5	E9018-B3
EN 1599	E CrMo2 B 42 H5

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.08	0.3	0.7	2.3	1.1

Typical mech. properties all weld metal

Yield stress, MPa	650
Tensile strength, MPa	740
Elongation, %	18

Charpy V

Test temps, °C	Impact values, J
-20	60

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	350	90-130	23	0.60	49	1.11	66
4.0	450	130-190	25	0.61	23	1.90	83
5.0	450	150-260	27	0.62	15	2.60	92

OK 76.35

Type Lime basic

SMAW
E8015-B6

Description

OK 76.35 is an LMA electrode containing 5Cr0.5Mo for welding creep-resistant steels. It is especially suitable for pipe welding. The electrode runs with a quiet, stable arc and gives a minimum amount of spatter loss. A preheating and interpass temperature of 150-260°C is normally required. The mechanical properties stated here are afterone hour of heat treatment at 740°C.

Recovery

115%

Welding current

DC(+ -)

Classifications

SFA/AWS A5.5	E8015-B6
EN 1599	E CrMo5 B 42 H5

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.08	0.4	0.8	5.0	0.6

Typical mech. properties all weld metal

	740°C/1h
Yield stress, MPa	>460
Tensile strength, MPa	>550
Elongation, %	>19

Charpy V

Test temps, °C	Impact values, J
+20	>47

Approvals

Sepros	UNA 485155

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.0	300	50-70	23	0.57	139.0	0.49	53
2.5	300	65-95	23	0.57	76.9	0.7	63
3.2	350	90-130	24	0.56	50.0	1.0	70
4.0	450	125-165	24	0.58	33.3	1.3	80
5.0	450	190-220	24	0.59	16.9	2.2	98

OK 76.96

Type Basic

SMAW
E8015-B8

Description

OK 76.96 is an LMA electrode containing 9Cr1Mo for the welding of creep-resistant steels. It is especially suitable for pipe welding. The electrode runs with a quiet, stable arc and gives a minimum amount of spatter. A preheating and interpass temperature of 150-260°C is normally required. The mechanical properties stated here are after one hour of heat treatment at 740°C.

Recovery

115%

Welding current

DC(+)

Classifications

SFA/AWS A5.5	E8015-B8
EN 1599	E CrMo9 B 42 H5

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.05	0.5	0.8	9.5	1.0

Typical mech. properties all weld metal

	740°C/1h
Yield stress, MPa	>460
Tensile strength, MPa	>550
Elongation, %	>20

Charpy V

Test temps, °C	Impact values, J
+20	>80

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.0	300	55-75	23	0.58	131.0	0.5	49
2.5	300	70-100	25	0.55	92.0	0.8	51
3.2	350	90-135	26	0.55	50.0	1.1	70
4.0	450	130-200	21	0.64	22.5	1.9	80
5.0	450	160-270	25	0.64	14.5	2.7	92

OK 76.98

Type Basic

SMAW

E9015-B9 (nearest)

Description

OK 76.98 is a low-hydrogen electrode for welding modified 9 Cr steels like T91/P91. The electrode is suitable for all-positional welding in pipes and plates. The mechanical properties stated here are after two hours of heat treatment at 750°C.

Recovery

115 %

Welding current

DC+

Classifications

SFA/AWS 5.5-96	E9015-B9 (nearest)
EN 1599	ECrMo 91 B 42 H5

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	N	V	Nb
0.1	0.4	0.7	9.0	0.7	1.0	0.05	0.2	0.06

Typical mech. properties all weld metal

Yield stress, MPa	650
Tensile strength, MPa	760
Elongation, %	18

Charpy V

Test temps, °C	Impact values, J
+20	70
0	50

Approvals

UDT	EN 1599
VdTÜV	07687

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	70-100	21	0.66	71.4	0.9	56
3.2	350	90-135	22	0.6	45.5	1.2	68
4.0	450	130-200	23	0.64	22.6	1.9	85

OK 78.16

Type Basic

SMAW
E9018-G

Description

OK 78.16 is a CrMo-alloyed electrode for the welding of 0.25C-1Cr-0.3Mo-alloyed quenched and tempered steel grades. The heat treatment requirements for the weld metal are the same as those for the parent plate. The weld metal of OK 78.16 is also suitable for flame hardening. The welding of high tensile strength steel with OK 78.16 should be carried out at a preheating temperature of minimum 200°C.

Recovery

120%

Welding current

DC(+)

Classifications

SFA/AWS A5.5	E9018-G

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.1	0.4	0.8	1.0	0.2

Typical mech. properties all weld metal

Yield stress, MPa	870
Tensile strength, MPa	900
Elongation, %	18

Charpy V

Test temps, °C	Impact values, J
+20	50

Approvals

DB	10.039.16
UDT	DIN 8555
Ů	10.039/1

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
1.6	300	50-65					
2.5	350	75-100	20	0.64	70.0	0.9	58
3.2	450	105-140	21	0.64	32.5	1.4	78
4.0	450	145-195	22	0.66	22.5	1.9	83
5.0	450	190-260	23	0.68	15.0	2.8	86
6.0	450	240-330	25	0.70	10.0	3.6	98

FILARC 75S

Type Basic

SMAW
E8018-C1

Description

CTOD-tested, all-positional basic 115% recovery electrode for 50D steels in offshore fabrication. Alloyed with 2.5% nickel. Good CVN toughness down to -60°C. CTOD tested in the AW and SR conditions.
DC+. Use DC- for root runs.

Recovery

115%

Welding current

DC+/-, OCV 70 V

Classifications

SFA/AWS A5.5	E8018-C1
EN 499	E 46 6 2NiB 32 H5

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo	Cu
0.05	0.3	0.8	2.4	<0.1	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	>460
Tensile strength, MPa	530-680
Elongation, %	> 22

Charpy V

Test temps, °C	Impact values, J
-60	>47

Approvals

ABS	3Y (-60ºC)
LR	5Y40H15

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	60-90	22	0.65	83	0.73	60
3.2	350	90-150	22	0.58	45	1.19	68
4.0	350	120-180	23	0.51	35	1.49	68
5.0	450	180-270	23	0.65	15	2.74	89
6.0	450	230-320	23	0.68	11	3.62	91

FILARC 76S

SMAW

Type Basic E7018-G

Description

CTOD-tested, all-positional, basic AC/DC electrode with 100% recovery for offshore fabrication (diameter 4.0 and 5.0 mm 115%). Alloyed with max 1%Ni. Good CVN toughness down to -60°C. CTOD tested in the AW and SR conditions. BS4360-50D steel and similar grades. Satisfactory CTOD results eliminate stress relieving for joints up to approx. 50 mm plate thickness. Many approved welding procedures available.
Use short arc. Weave slowly when permitted. DC+. Use DC- for root passes.

Recovery

100%

Welding current

DC+ -, AC OCV 65 V

Classifications

SFA/AWS A5.5	E7018-G
EN 499	E 42 6 Mn1Ni B 32 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.4	1.6	0.8

Typical mech. properties all weld metal

Yield stress, MPa	>460
Tensile strength, MPa	530-640
Elongation, %	> 22

Charpy V

Test temps, °C	Impact values, J
-20	150
-60	60

Approvals

ABS	3Y (-60°C)
BV	3YHH
CL	EN 499
DNV	3 YH5
GL	6YH10
LR	5Y40H15

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	55-85	24	0.65	87	0.7	59
3.0	350	100-125	21	0.63	55	1.05	63
3.2	350	80-140	23.8	0.57	54	1.12	60
3.2	450	80-130	23.6	0.62	39	1.13	83
3.5	350	125-175	21.6	0.61	41	1.4	63
4.0	350	120-180	22	0.63	31	1.51	78
4.0	450	120-170	22.2	0.61	24	1.4	109
5.0	450	180-270	24.3	0.62	15	2.22	106

FILARC 88S

Type Basic

SMAW
E8016-G

Description

CTOD-tested, all-positional, basic AC/DC electrode with 100% recovery for offshore fabrication. Alloyed with max 1% Ni. Good CVN toughness down to -60°C; CTOD tested in the AW and SR conditions. BS4360-55F steel and similar grades. Many approved welding procedures are available.
Use short arc. Weave slowly when permitted. DC+. Use DC- for root passes.

Recovery

100%

Welding current

DC+/-, AC OCV 65 V

Classifications

SFA/AWS A5.5	E8016-G
DIN 8529	ESY5077 Mn1Ni BH5 24
EN 499	E 50 6 Mn1Ni B 12 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.4	1.7	0.8

Typical mech. properties all weld metal

Yield stress, MPa	>500
Tensile strength, MPa	560-660
Elongation, %	> 22

Charpy V

Test temps, °C	Impact values, J
-20	150
-40	100
-60	60

Approvals

ABS	E8016-G (-60ºC)
CL	EN 499
DB	10.105.16
DNV	3 YH10
DS	EN 499
GL	6YH10
LR	5Y40H15
UDT	DIN 8529
Ü	10.105/1
VdTÜV	06107

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	55-85	21.2	0.65	87.1	0.7	59
3.2	350	80-140	21.4	0.59	54.5	0.96	69
4.0	350	110-170	21.0	0.58	36.6	1.2	82
4.0	450	110-170	21.5	0.62	26.8	1.27	106
5.0	450	180-230	22.6	0.63	16.9	1.95	109

FILARC 98S

Type Basic

SMAW
E9018-G

Description

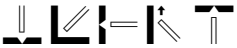
All-positional, low-hydrogen electrode for welding higher strength steels, depositing weld metal with a minimum yield strength of 550 N/mm^2 after stress relieving.

Recovery

110%

Welding current

DC+ -, AC OCV 70 V



Classifications

SFA/AWS A5.5	E9018-G
EN 757	E55 6 Mn1NiMo B T 32 H5

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo
0.06	0.4	1.8	0.8	0.5

Typical mech. properties all weld metal

Yield stress, MPa	>550
Tensile strength, MPa	>660
Elongation, %	>24

Charpy V

Test temps, °C	Impact values, J
-40	>80
-51	>60
-60	>40

Approvals

ABS	E9018-G
CL	EN 757

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	55-85	24.4	0.60	83.3	0.72	60
3.2	350	80-140	23.3	0.55	56.6	0.94	68
4.0	450	120-180	24.0	0.60	24.4	1.43	103

FILARC 108

SMAW

Type Basic E10018-M

Description

A basic coated alloy electrode for welding higher strength steels.

Recovery

120%

Welding current

DC+(-)

Classifications

SFA/AWS A5.5	E10018-M
EN 757	E 62 5 Mn2NiMo B 42

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo
0.06	0.3	1.3	1.7	0.4

Typical mech. properties all weld metal

Yield stress, MPa	610-690
Tensile strength, MPa	>690
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-51	55

Approvals

MOD	Q1N/HY80, QT28

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	350	90-140	22	0.6	43	1.3	64
4.0	450	110-180	22	0.64	22	1.8	91
5.0	450	170-240	23	0.65	15	2.3	108

FILARC 118

Type Basic

SMAW
E11018-M

Description

All-positional, basic AC/DC electrode with 120% recovery for welding steels with min. 680 N/mm^2 yield strength; e. g. NAXTRA 70, T1, 80 HLES, HY80 and HY100. Often applied in combination with FILARC 98, where the latter is used for tack welding, root-run welding and for welding standing fillet welds.
Use the shortest possible arc. Weave slowly when permitted. A slight weave can be used for standing fillet welds.
DC+. Use DC- for root runs.

Recovery

120%

Welding current

DC+/-, AC OCV 70 V

Classifications

SFA/AWS A5.5	E11018-M
EN 757	E 69 5 Mn2NiMo B 32 H5

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo
0.06	0.4	1.6	2.2	0.4

Typical mech. properties all weld metal

Yield stress, MPa	<760
Tensile strength, MPa	>760
Elongation, %	>20

Charpy V

Test temps, °C	Impact values, J
-51	>47

Approvals

ABS	E11018-M
BV	4Y62H5
DNV	4 Y62H10
MoD	(N) Q1N, HY80
LR	4Y62H5

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	55-105	25.3	0.61	83.3	0.93	46.6
3.2	350	90-140	22.8	0.56	46.2	1.21	64.3
4.0	450	110-180	22.8	0.61	23.1	1.72	90.0
5.0	450	190-280	24.6	0.63	13.5	2.75	90.3

OK 22.46P

Type Cellulosic

SMAW
E7010-G

Description

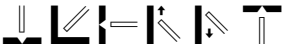
Cellulosic-coated electrode designed for the site welding of pipe and pipelines in API 5L X52 and X56 in all positions, using conventional stovepipe techniques. DC only.

Recovery

90%

Welding current

DC+



Classifications

SFA/AWS A5.5	E7010-G
EN 499	E 42 2 C 21
BS 639 (1986)	E 51 43 C (10)

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo
0.1	0.14	0.5	0.4	0.3

Typical mech. properties all weld metal

Yield stress, MPa	476
Tensile strength, MPa	544
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-20	60

Approvals

LR	3, 3Y
BV	3, 3Y

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of elec-trodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	350	65-120	31	0.58	65	0.62	90
4.0	350	90-180	30.5	0.59	42	0.93	93
5.0	350	150-240	28.6	0.67	24	1.47	100

OK 22.47P

SMAW

Type Cellulosic E 46 3 1Ni C 21

Description

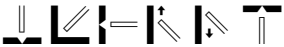
Cellulosic-coated electrode designed for the site welding of pipe and pipelines in API 5L X60 and X70 in all positions, using conventional stovepipe techniques. DC only.

Recovery

90%

Welding current

DC+



Classifications

EN 499	E 46 3 1Ni C 21
SFA/AWS A5.5	E8010-G
BS 639 (1986)	E 51 32 C (10)

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo
0.08	0.2	0.6	0.8	0.3

Typical mech. properties all weld metal

Yield stress, MPa	513
Tensile strength, MPa	600
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-20	80
-30	70

Approvals

LR	3, 3Y

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	350	65-120	30	0.62	61	0.68	86
4.0	350	90-180	29	0.68	37	1.15	84
5.0	350	150-240	29	0.68	24	1.55	97

OK 22.48P

SMAW

Type Cellulosic E 50 2 1NiMo C 21

Description

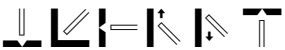
Cellulosic-coated electrode designed for the site welding of pipe and pipelines.

Recovery

90%

Welding current

DC+



Classifications

EN 499	E 50 2 1NiMo C 21
SFA/AWS A5.5	E9010-G

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo	Cu
0.1	0.2	1.0	0.8	0.5	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	560
Tensile strength, MPa	700
Elongation, %	22

Charpy V

Test temps, °C	Impact values, J
-20	60

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	350	65-120	32	0.67	56	0.82	79
4.0	350	90-180	34	0.63	39	1.17	78
5.0	350	150-240	32	0.67	24	1.67	90

OK 22.85P

Type Cellulosic

SMAW
E7010-A1

Description

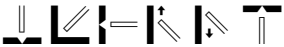
Cellulosic-coated electrode designed for the site welding of pipe and pipelines in API 5L X52 and X56 in all positions, using conventional stovepipe techniques. DC only.

Recovery

90%

Welding current

DC+



Classifications

SFA/AWS A5.5	E7010-A1
EN 499	E 42 2 Mo C 21
BS 639 (1986)	E 51 43 C (10)

Typical all weld metal composition, %

C	Si	Mn	Mo
0.07	0.1	0.3	0.5

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	540
Elongation, %	23

Charpy V

Test temps, °C	Impact values, J
-20	65

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	350	65-120	27.6	0.7	55	0.76	87
4.0	350	90-180	29	0.64	39	1	90
5.0	350	150-240	27.5	0.68	24	1.45	104

OK Tubrod 14.01 FCAW

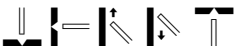
Type Metal-cored E70C-GM

Description

OK Tubrod 14.01 is a metal-cored wire containing copper, specially designed for the welding of Corten A & B and similar weathering steels or other high tensile structural steels with a tensile strength of up to 510 MPa. Shielding gas Ar + 20% CO_2. Slag levels are comparable with solid wire, often permitting multi-pass welding without inter-pass deslagging. OK Tubrod 14.01 is designed for bridge and general structural steelwork, ships and chimneys.

Welding current

DC+/-



Classifications

SFA/AWS A5.18	E70C-GM
EN 758	T 42 2 Z M M 2 H10

Typical all weld metal composition, %

C	Si	Mn	Cu
0.07	0.6	1.3	0.5

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	550
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
0	130
-20	47

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	100-320	16-32

OK Tubrod 14.02 FCAW

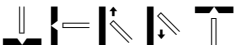
Type Metal-cored E80C-G

Description

OK Tubrod 14.02 is a metal-cored wire similar to OK Tubrod 14.12 with the addition of Mo for use on high tensile and quenched and tempered steels with tensile strengths of up to 550 MPa. Shielding gas Ar + 20% CO_2. Slag levels are comparable with solid wire, often permitting multi-pass welding without inter-pass deslagging. Suitable for marine structures, heavy machinery and high strength applications requiring good notch ductility. Steels include RQT 500, 600, Hyplus29, Ducol W30 and OK602.

Welding current

DC+/-



Classifications

SFA/AWS A5.28	E80C-G
EN 758	T 50 2 Z M M 2 H10

Typical all weld metal composition, %

C	Si	Mn	Mo
0.07	0.6	1.3	0.5

Typical mech. properties all weld metal

Yield stress, MPa	580
Tensile strength, MPa	650
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	65

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	100-320	16-32
1.6	140-450	18-36

OK Tubrod 14.02S

SAW

Type Metal-cored F7AZ-EC-A4 (with OK Flux 10.71)

Description

A metal-cored wire producing a 0.5% Mo weld metal for the submerged arc welding of high tensile steels. Designed for use with OK Flux 10.71, it can be used for high -speed fillet welding, as well as multi-pass butt joints. As an alternative to an S2Mo solid wire, it offers superior deposition rates and mechanical properties, especially notch toughness.

Applications

All general fabrication of high-tensile, fine-grained steels where submerged arc is appropriate. Boilers, pressure vessels in process plants are typical examples. A typical application within the power generation industry is the high-speed fillet welding of tubes to fins. Suitable for service up to 500°C.

Welding current

DC+

Classifications

SFA/AWS A5.23	F7AZ-EC-A4 (with OK Flux 10.71)

Typical all weld metal composition, %

C	Si	Mn	Mo
0.06	0.5	1.3	0.5

Typical mech. properties all weld metal

Yield stress, MPa	520
Tensile strength, MPa	570
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
2.4	250-450	28-38

OK Tubrod 14.03 FCAW

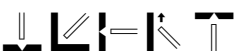
Type Metal-cored E110C-G

Description

OK Tubrod 14.03 is a metal-cored wire alloyed with nickel and molybdenum to provide extra high strength with good notch ductility down to -40°C. Shielding gas Ar + 20% CO_2. Typical applications for OK Tubrod 14.03 are offshore jack-up structures and the general fabrication of high-tensile steels.

Welding current

DC-



Classifications

SFA/AWS A5.28	E110C-G
EN 12535	T 69 4 Mn2NiMo M M 2 H10

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo
0.07	0.6	1.7	2.3	0.6

Typical mech. properties all weld metal

Yield stress, MPa	757
Tensile strength, MPa	842
Elongation, %	23

Charpy V

Test temps, °C	Impact values, J
-40	71

Approvals

DB	42.039.23
VdTÜV	
U	42.039/4

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	100-320	16-32
1.4	120-380	16-34
1.6	140-450	18-36

OK Tubrod 14.04 FCAW

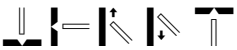
Type Metal-cored E70C-G

Description

OK Tubrod 14.04 contains nickel for applications that require -60°C impact properties, e.g. off-shore. Shielding gas Ar + 20% CO_2. The 1.2 mm and 1.4 mm diameter wires are suitable for all-positional welding using the dip transfer mode. OK Tubrod 14.04 is designed for all general fabrication and structural steelwork.

Welding current

DC-



Classifications

SFA/AWS A5.28	E70C-G
EN 758	T 42 6 2Ni M M 2 H10

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.4	1.0	2.3

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	580
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-60	>47

Approvals

ABS	3SA, 3YSA	Ar/20 CO_2
DNV	5YMS (H10) NV2-4, NV4-4	Ar/20 CO_2
DS	T 42 6 2Ni M M 2 H10	Ar/20 CO_2
LR	5Y40S H15	Ar/20 CO_2
RS	5YMSHH	Ar/20 CO_2
VdTÜV		Ar/20 CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	100-320	16-32
1.4	120-380	16-34

OK Tubrod 14.05 FCAW

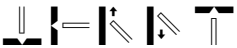
Type Metal-cored E70C-G

Description

OK Tubrod 14.05 is a metal-cored wire containing 1% nickel for toughness properties down to -40°C. Available in a wide range of sizes including 1.0 mm, which is ideal for root passes when used for one-sided welding. Shielding gas Ar + 20% CO_2. Slag levels are comparable with solid wire, often permitting multi-pass welding without inter-pass deslagging. OK Tubrod 14.05 is designed for all general fabrication and structural steel work, including offshore equipment where sub-zero impact properties are of prime importance.

Welding current

DC+/-



Classifications

SFA/AWS A5.28	E70C-G
EN 758	T 42 4 Z M M 2 H10

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.5	1.3	0.9

Typical mech. properties all weld metal

Yield stress, MPa	>460
Tensile strength, MPa	550
Elongation, %	>26

Charpy V

Test temps, °C	Impact values, J
-20	>54
-40	>47

Approvals

ABS	3SA 3YSA	Ar/20%CO_2
BV	SA3YM HH KV-40	Ar/20%CO_2
DNV	IIIYMS H10	Ar/20%CO_2
DS	T 42 4 Z M M 2 H10	Ar/20%CO_2
LR	4Y40S H15	Ar/20%CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	100-320	16-32

OK Tubrod 14.07S

SAW

Type Metal-cored F9AZ-EC-B2 (with OK Flux 10.71)

Description

A metal-cored wire for the submerged arc welding of the 1.25Cr 0.5Mo type of creep- resistant steels. Used with OK 10.63 fully basic flux , the weld metal is of the highest metallurgical integrity for service temperatures up to 500°C. The wire may also be used with OK Flux 10.71 for fillet welding applications.

Applications

Steels with a similar composition to those used in steam boilers, process plants and piping, together with pressure vessels in the power generation industry. This product has been successfully used in tube-to-fin applications with OK Flux 10.71.
Preheating dependent on thickness up to 300°C is essential, followed by post-weld heat treatment at 650-700°C.

Welding current

DC+, AC

Classifications

SFA/AWS A5.23	F9AZ-EC-B2 (with OK Flux 10.71)

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.06	0.5	0.9	1.2	0.5

Typical mech. properties all weld metal

Yield stress, MPa	620
Tensile strength, MPa	700
Elongation, %	26

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
2.4	250-450	28-38

OK Tubrod 15.09 FCAW

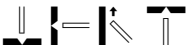
Type Rutile T 69 4 Z P M 2 H5

Description

An all-positional rutile cored wire for welding high strength steel with a minimum yield strength of 690 MPa for use with M21 shielding gas. Diameters of less than 1.4 mm are all positional, with the exception of vertical down.

Welding current

DC+



Classifications

EN 12535-00	T 69 4 Z P M 2 H5

Typical all weld metal composition, %

C	Si	Mn	Ni	Mo
0.07	0.4	1.2	2.8	0.2

Typical mech. properties all weld metal

Yield stress, MPa	780
Tensile strength, MPa	840
Elongation, %	19

Charpy V

Test temps, °C	Impact values, J
-40	70

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	27-35

OK Tubrod 15.11 FCAW

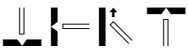
Type Rutile E81T1-Ni2M

Description

A rutile, all-positional, flux-cored, tubular wire containing 2.5 Ni for the welding of mild and medium tensile steels where good notch toughness down to -50°C is required. Extra productivity is available using the spray transfer mode when compared with the traditional basic types using short arc for vertical and overhead welding. All types of fabrication application involving mild and medium tensile steels with a min. yield strength of 510 MPa. This includes shipbuilding and offshore fabrication. Shielding gas: Ar + 20% CO_2.

Welding current

DC+



Classifications

SFA/AWS A5.29	E81T1-Ni2M
EN 758	T 50 6 2Ni P M 2 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.05	0.3	0.9	2.3

Typical mech. properties all weld metal

Yield stress, MPa	580
Tensile strength, MPa	620
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-50	95

Approvals

DNV IV Y46MS (H5) Ar/20%CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	110-300	21-32

OK Tubrod 15.17 FCAW

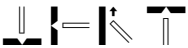
Type Rutile E81T1-Ni1M

Description

OK Tubrod 15.17 is an all-positional, rutile, flux-cored wire for good toughness down to -40°C. The wire contains 1% nickel and has exceptional operating characteristics in all positions with high deposition rates. Shielding gas Ar + 20% CO_2 or CO_2. OK Tubrod 15.17 is designed for the all-positional welding of carbon-manganese and low-alloy steels, e.g. offshore fabrications, vessels and structural steelwork.

Welding current

DC+



Classifications

SFA/AWS A5.29	E81T1-Ni1M
EN 758	T 46 3 1Ni P C 2 H5
	T 46 4 1Ni P M 2 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.3	1.1	0.9

Typical mech. properties all weld metal

Yield stress, MPa	560
Tensile strength, MPa	600
Elongation, %	25

Charpy V

Test temps, °C	Impact values, J
-40	130

Approvals

ABS	3SA, 3YSA	Ar/20%CO_2&CO_2
BV	SA3YM	Ar/20%CO_2
BV	SA3YM HH KV -40	CO_2
DB	42.039.26	Ar/20%CO_2&CO_2
DNV	IVY42MS H10	Ar/20%CO_2
DS	T 46 4 1Ni P M 2 H5	Ar/20%CO_2
LR	3S, 4Y40S, H15	Ar/20%CO_2
LR	3S, 3YS, H15	CO_2
MoD (Navy)	MS>25mm,B&BX >12mm	Ar/20%CO_2&CO_2
RS	4YMSH	Ar/20%CO_2
VdTÜV		Ar/20%CO_2&CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	110-300	21-32
1.6	150-360	24-34

OK Tubrod 15.19 FCAW

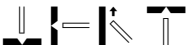
Type Rutile E81T1-Ni1M

Description

OK Tubrod 15.19 is an all-positional, rutile, flux-cored wire specially developed to produce high yield strength (min 550 MPa) and good toughness down to -50°C and high deposition spray transfer welding. Also suitable for open butt joints using non-fusible (e.g. ceramic) backing material. Shielding gas Ar + 20% CO_2. Ideal for welding quenched and tempered steels of the HY80 type.

Welding current

DC+



Classifications

SFA/AWS A5.29 E81T1-Ni1M

Typical all weld metal composition, %

C	Si	Mn	Ni
0.05	0.4	1.2	1.0

Typical mech. properties all weld metal

Yield stress, MPa	620
Tensile strength, MPa	650
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-50	95

Approvals

MoD Navy Q1(N) Ar/20%CO_2&Ar/5%

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	110-300	21-32

OK Tubrod 15.20 FCAW

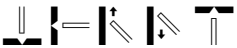
Type Basic E81T5-B2M

Description

OK Tubrod 15.20 is a fully basic, low-hydrogen, flux-cored wire containing 1.25Cr–0.5Mo, designed for welding creep-resistant steels of similar composition. Shielding gas CO_2 or Ar + 20% CO_2. Typical applications include fabrication and repair in the power industry.

Welding current

DC-



Classifications

SFA/AWS A5.29	E81T5-B2M

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.06	0.5	1.0	1.3	0.6

Typical mech. properties all weld metal

	SR 690°C/1h
Yield stress, MPa	570
Tensile strength, MPa	670
Elongation, %	22

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	120-300	16-32

OK Tubrod 15.22 FCAW

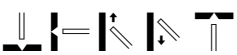
Type Basic E90T5-B3

Description

OK Tubrod 15.22 is a low-hydrogen, flux-cored wire containing 2.25Cr–1Mo for welding creep-resistant steels of similar compositon and intended for service at around 600°C. Shielding gas CO_2, Ar + 20% CO_2. Typical applications include fabrication and repair in the power generation sector.

Welding current

DC-



Classifications

SFA/AWS A5.29	E90T5-B3

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.06	0.5	0.9	2.2	1.0

Typical mech. properties all weld metal

	SR 690°C/1h
Yield stress, MPa	570
Tensile strength, MPa	680
Elongation, %	26

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	120-300	16-32

OK Tubrod 15.24 FCAW

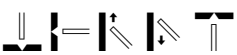
Type Basic E80T5-G

Description

OK Tubrod 15.24 is a fully basic, flux-cored wire depositing a 1Ni weld metal. It combines high strength with low-temperature toughness for service down to -50°C and has good CTOD performance. This applies to both the as-welded and stress-relieved condition. Good operability and slag release. Shielding gas Ar+20% CO_2 or CO_2.

Welding current

DC-



Classifications

SFA/AWS A5.29	E80T5-G
EN 758	T 46 5 Z B M 2 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.5	1.5	0.7

Typical mech. properties all weld metal

Yield stress, MPa	540
Tensile strength, MPa	600
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-50	120

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	120-300	16-32

OK Tubrod 15.25 FCAW

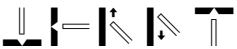
Type Basic E70T5-G

Description

OK Tubrod 15.25 is a 2.5Ni-alloyed , fully basic, flux-cored wire which deposits low-hydrogen weld metal, typically 2-3 ml/100g. It is all positional with a 1.2 mm diameter and is capable of producing toughness properties at temperatures down to -60°C. Shielding gas CO_2 or Ar + 20% CO_2. Applications for OK Tubrod 15.25 include the multipass welding of medium to heavy fabrications.

Welding current

DC-



Classifications

SFA/AWS A5.29	E70T5-G
EN 758	T 42 6 2Ni B M 2 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.05	0.5	0.8	2.2

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	570
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
-60	100

Approvals

CL		Ar/20%CO_2
DNV	YMS(H10) NV 2-4 NV 4-4	Ar/20%CO_2
LR	3S 5Y40 H15	Ar/20%CO_2
UDT VdTÜV	EN 758	Ar/20%CO_2&CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	120-300	16-32

OK Tubrod 15.27 FCAW

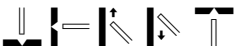
Type Basic E110T5-G

Description

OK Tubrod 15.27 is a fully basic, flux-cored, tubular wire for the welding of high tensile strength steels such as HY100. The weld metal contains 2.5Ni, producing the additional benefit of low-temperature toughness down to -50°C. This wire is capable of welding in all positions and uses the dip transfer mode for the vertical-up technique, which can be futher enhanced by the synergic pulsed process. Shielding gas Ar+20% CO_2.

Welding current

DC-



Classifications

SFA/AWS A5.28 E110T5-G

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.5	1.6	2.5

Typical mech. properties all weld metal

Yield stress, MPa	750
Tensile strength, MPa	820
Elongation, %	21

Charpy V

Test temps, °C	Impact values, J
-40	>50
-50	80

Approvals

MoD Q2N 95%Ar/5%CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	120-300	16-32

OK Tubrod 15.21TS SAW

Type Basic F7A2-EC-A4

Description

A basic, flux-cored wire used in conjunction with OK Flux 10.71 for the submerged arc welding of high tensile steels. The weld metal is alloyed with 0.5% Mo, which permits a very wide range of applications including elevated temperatures up to 500°C. The fully basic formulation ensures a very tough, high-quality weld deposit.

Applications

Typical examples include structural steelwork, pressure vessels and piping, cranes, contractors' plant and so on. It is also ideally suited to the rebuilding of marine engine piston crowns.

Welding current

DC+

Classifications

SFA/AWS A5.23 F7A2-EC-A4

Typical all weld metal composition, %

C	Si	Mn	P	S	Cr	Mo
0.07	0.5	1.3	0.012	0.09	0.5	0.5

Typical mech. properties all weld metal

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
2.4	250-500	28-38

OK Tubrod 15.24S SAW

Type Basic F7P8-EC-G (10.61)

Description

A fully basic, 1% Ni tubular wire for the submerged arc welding of medium strength steel with OK Flux 10.47. The weld metal has excellent toughness down to -50°C in the as-welded and stres- relieved condition.

Welding current

DC+

Classifications

SFA/AWS A5.23	F7P8-EC-G (OK Flux 10.61)
SFA/AWS A5.23	F8A4-EC-G (OK Flux10.47)
SFA/AWS A5.23	F8A6-EC-G (OK Flux10.62)
SFA/AWS A5.23	F8A6-EC-G (OK Flux10.71)

Typical all weld metal composition, %

C	Si	Mn	Ni
0.08	0.3	1.7	0.8

Typical mech. properties all weld metal

Yield stress, MPa	530
Tensile strength, MPa	620
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-50	120

Approvals

DNV	IV Y46M (H5)

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
2.4	250-500	28-38
3.0	400-800	28-40
4.0	500-900	28-40

OK Tubrod 15.25S SAW

Type Basic F7A8-EC-Ni2

Description

OK Tubrod 15.25S is a 2.5Ni tubular wire for submerged arc welding in conjunction with OK Flux 10.62 when charpy V values down to -60°C are required. It has also high tolerance to shop primer when welding high-speed fillets, as well as single-sided, single-pass butt joints.

Welding current

AC, DC+

Classifications

SFA/AWS A5.23	F7A8-EC-Ni2

Typical all weld metal composition, %

C	Si	Mn	Ni
0.06	0.3	1.3	2.2

Typical mech. properties all weld metal

Yield stress, MPa	492
Tensile strength, MPa	581
Elongation, %	29

Charpy V

Test temps, °C	Impact values, J
-60	96

Approvals

ABS	4Y40 (-60)

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
4.0	500-900	28-40

FILARC PZ6116S FCAW

Type Rutile E81T1-K2 JH4

Description

An all-positional rutile cored wire with good toughness down to -60ºC for use with C1 shielding gas. Diameters of less than 1.4mm are all positional, with the exception of vertical down.

Welding current

DC+

Classifications

SFA/AWS A5.29	E81T1-K2 JH4
EN 758	T 46 6 1.5Ni P C 1 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.054	0.43	1.38	1.42

Typical mech. properties all weld metal

Yield stress, MPa	553
Tensile strength, MPa	624
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-50	69

Approvals

ABS	3SA(H),3YSA(HH)	CO_2
BV	SA 3YMHH	CO_2
DNV	V YMS (H10)	CO_2
GL	6YH5S H5	CO_2
LR	5Y40S H10	CO_2
RS	5Y42HHS	CO_2
PRS	3YH10S	CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	27-35
1.6	150-450	24-40

FILARC PZ6125 FCAW

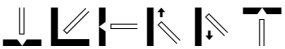
Type E71 T-5G

Description

All-positional, basic wire for demanding applications, such as offshore fabrication, with dependable CVN toughness down to -50°C and reliable CTOD properties, both AW and SR. Ar/CO_2 gas. Lack of fusion in vertical-up welding is largely avoided by semi-spray arc operation.

Welding current

DC-



Classifications

SFA/AWS A5.29	E71 T-5G
EN 758	T 42 6 1Ni B M 1H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.07	0.45	1.20	0.85

Typical mech. properties all weld metal

Yield stress, MPa	445
Tensile strength, MPa	556
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-40	139
-60	109

Approvals

ABS	3SA,3YSA	Ar/20%CO_2
BV	S4,5YMHH	Ar/20%CO_2
CL	956	Ar/20%CO_2
DNV	VY40MSH5	Ar/20%CO_2
DS	T 42 6 1Ni B N 1H5	Ar/20%CO_2
GL	6YH10S	Ar/20%CO_2
LR	5Y40S	Ar/20%CO_2
RS	5Y42HHS	Ar/20%CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.0	100-250	15
1.2	150-350	20
1.6	150-450	20

FILARC PZ6138 FCAW

Type Rutile E81T1-Ni1MJ H4

Description

Well established in the offshore sector, PZ6138 alloyed with 0.9% Ni produces reliable Charpy impact properties down to -60°C and CTOD performance to -10°C. The wire exhibits a smooth stable arc with virtually no spatter.

Welding current

DC+

Classifications

SFA/AWS A5.29	E81T1-Ni1MJ H4
EN 758	T 46 5 1 Ni P M 1 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.07	0.4	1.3	0.9

Typical mech. properties all weld metal

Yield stress, MPa	520
Tensile strength, MPa	610
Elongation, %	22

Charpy V

Test temps, °C	Impact values, J
-60	80

Approvals

ABS	3SA 3YSA	Ar/20%CO_2
BV	S3 3YMHH	Ar/20%CO_2
CL	925	Ar/20%CO_2
DNV	VY42MSH5	Ar/20%CO_2
DS	T 46 5 1NI P M 1 H10	Ar/20%CO_2
GL	6YH10S	Ar/20%CO_2
LR	3S 5Y42S	Ar/20%CO_2
RS	5Y42MSHH	Ar/20%CO_2
PRS	3YH10S	Ar/20%CO^2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	110-300	21-32

FILARC PZ6138SR FCAW

Type Rutile E81T1-Ni1M J

Description

An all-positional rutile cored wire for use with M21, providing very good toughness down to -60°C after stress relieving. Diameters of less than 1.4mm are all positional, with the exception of vertical down.

Welding current

DC+

Classifications

SFA/AWS A5.29	E81T1-Ni1M J
EN 758	T 46 6 1Ni P M 1 H5

Typical all weld metal composition, %

C	Si	Mn	Ni
0.048	0.37	1.24	0.84

Typical mech. properties all weld metal

	SR600°C/2h
Yield stress, MPa	456
Tensile strength, MPa	545
Elongation, %	27

Charpy V

Test temps, °C	Impact values, J
-60	81

Approvals

ABS	4YSAH5	Ar/20%CO_2
DNV	VY42MSH5	Ar/20%CO_2
LR	3S 5Y42SH5	Ar/20%CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	175-350	25-38

OK AristoRod 13.08 GMAW

ER80S-D2

Description

OK AristoRod™ 13.08 is a 0.4Mo-alloyed (ER80S-D2), bare, solid wire for the GMAW of creep-resistant steels of the same composition, like those used with a service temperature of up to 500°C. OK AristoRod 13.08 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.28	ER80S-D2
EN 440	G4Mo

Wire composition

C	Si	Mn	Mo
0.09	0.7	1.9	0.5

Typical mech. properties all weld metal

Yield stress, MPa	590
Tensile strength, MPa	685
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
+20	140
-29	80

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4-2.6
0.9	2.7-14.7	70-280	18-28	1.0-5.4
1.0	2.7-14.7	90-300	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.1-12.0	225-480	26-38	3.3-11.6

OK AristoRod 13.09 GMAW

ER80S-G

Description

OK AristoRod™ 13.09 is a 0.5Mo-alloyed, bare, solid wire for the GMAW of creep-resistant steels of the same composition, like those used for pipes in pressure vessels and boilers with a service temperature of up to 500°C. OK AristoRod 13.09 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.28	ER80S-G
EN 440	G2Mo
EN 12070	G MoSi

Wire composition

C	Si	Mn	Mo
0.1	0.5	1.1	0.5

Typical mech. properties all weld metal

Yield stress, MPa	540
Tensile strength, MPa	630
Elongation, %	25

Charpy V

Test temps, °C	Impact values, J
+20	117
-20	77
-40	57

Approvals

DB	42.039.31
DNV	III YMS (M21)
DS	EN 12070 (M21)
Ü	42.039/1
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4-2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.10-12.0	225-480	26-38	3.3-11.6

OK AristoRod 13.12 GMAW

ER80S-G

Description

OK AristoRod™ 13.12 is a 1.1Cr-0.5Mo-alloyed, bare, solid wire for the GMAW of creep-resistant steels of the same composition, like those used for pipes in pressure vessels and boilers with a service temperature of up to 450°C. OK AristoRod 13.12 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.28	ER80S-G
EN 12070	G CrMo1Si
GOST 2246	08X CM A

Wire composition

C	Si	Mn	Cr	Mo
0.1	0.7	1.0	1.2	0.5

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	580
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
+20	80
0	40
-20	30

Approvals

VdTÜV

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4 -2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.1-12.0	225-480	26-38	3.3-11.6

OK AristoRod 13.13 GMAW

ER100S-G

Description

OK AristoRod™ 13.13 is a 0.5Cr-0.5Ni-0.2Mo-alloyed, bare, solid wire for the GMAW of high strength steels. OK AristoRod 13.13 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.28	ER100S-G
EN 12534	G Mn3NiCrMo

Wire composition

C	Si	Mn	Cr	Ni	Mo
0.1	0.7	1.6	0.6	0.6	0.2

Typical mech. properties all weld metal

Yield stress, MPa	690
Tensile strength, MPa	770
Elongation, %	20

Charpy V

Test temps, °C	Impact values, J	Test temps, °C	Impact values, J
0	80	-40	60
-20	75		
-30	65		

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4-2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.5-12.0	225-480	26-38	3.3-11.6

OK Autrod 13.16 GMAW

ER80S-B2

Description

OK Autrod 13.16 is a 1.3Cr-0.5Mo-alloyed (ER80S-B2), copper-coated, solid wire for the GMAW of creep-resistant steels of the same composition, but it is also suitable for welding high strength steels. The wire has a high purity chemistry with a guaranteed Bruscato factor X < 15.

Welding current

DC+

Classifications

SFA/AWS A 5.28	ER80S-B2

Wire composition

C	Si	Mn	Cr	Mo
0.1	0.6	0.6	1.3	0.5

Typical mech. properties all weld metal

Yield stress, MPa	>470
Tensile strength, MPa	>550
Elongation, %	>19

Charpy V

Test temps, °C	Impact values, J

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4-2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.5-12.0	225-480	26-38	3.3-11.6

OK Autrod 13.17 GMAW

ER90S-B3

Description

OK Autrod 13.17 is a 2.5Cr-1.1Mo-alloyed (ER90S-B3), copper-coated, solid wire for the GMAW of creep-resistant steels like SA-387 Grade 22, A335 Grade P22 or similar materials. The wire has a high purity chemistry with a guaranteed Bruscato factor X < 15.

Welding current

DC+

Classifications

SFA/AWS A 5.28	ER90S-B3

Wire composition

C	Si	Mn	Cr	Mo
0.09	0.6	0.6	2.5	1.0

Typical mech. properties all weld metal

Yield stress, MPa	590
Tensile strength, MPa	720
Elongation, %	22

Charpy V

Test temps, °C	Impact values, J
-40	>47

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4-2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.5-12.0	225-480	26-38	3.3-11.6

OK AristoRod 13.22 GMAW

ER90S-G

Description

OK AristoRod 13.22 is a 2.5Cr-1.0Mo-alloyed, copper-coated, solid wire for the GMAW of creep-resistant steels of similar composition, with service temperatures of up to 600°C, but is also suitable for welding high strength steels.

OK AristoRod 13.22 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.28	ER90S-G
EN 12070	G CrMo2Si

Wire composition

C	Si	Mn	Cr	Mo
0.08	0.7	1.0	2.6	1.0

Typical mech. properties all weld metal

Yield stress, MPa	750
Tensile strength, MPa	890
Elongation, %	19

Charpy V

Test temps, °C	Impact values, J
+20	55
-40	30

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.1-8.1	225-480	26-38	3.3-11.6

OK Autrod 13.23 GMAW

ER80SNi1

Description

OK Autrod 13.23 is a 0.9Ni-alloyed (ER80S-Ni1), copper-coated, solid wire for the GMAW of low-temperature, fine-grained steels. The wire provides good impact toughness down to -50°C and is especially suitable for use in the offshore industry.

Welding current

DC(+)

Classifications

SFA/AWS A5.28	ER80SNi1

Wire composition

C	Si	Mn	Ni	Mo
0.1	0.6	1.0	0.9	0.3

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	560
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
+20	150
0	130
-46	70
-60	20

Approvals

BV	SA4Y40M

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4-2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.1-8.1	225-480	26-38	3.3-11.6

OK Autrod 13.25 GMAW

ER100S-G

Description

OK Autrod 13.25 is a 1.0Ni-0.3Mo-0.1Ti-alloyed, copper-coated, solid wire for the GMAW of low-alloyed, high tensile strength steels and fine-grained steels for use in constructions such as bridges, offshore and hoists with a minimum yield strength of up to 610 MPa. The alloy has good impact properties down to -60°C.

When used in mechanical pipe welding in narrow grooves, yield strengths in excess of 700 MPa may be obtained, permitting the overmatching of X80 pipeline steel.

Welding current

DC+

Classifications

SFA/AWS A5.28	ER100S-G

Wire composition

C	Si	Mn	Ni	Mo	Ti
0.08	0.6	1.8	1.0	0.4	0.15

Typical mech. properties all weld metal

Yield stress, MPa	620
Tensile strength, MPa	700
Elongation, %	20

Charpy V

Test temps, °C	Impact values, J
-20	130
-40	90
-60	70

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4-2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.1-8.1	225-480	26-38	3.3-11.6

OK AristoRod 13.26 GMAW

ER80S-G

Description

OK AristoRod TM 13.26 is a 0.8Ni-0.3Cu-alloyed, bare, solid wire for the GMAW of weathering steels such as COR-TEN, Patinax, Dillicor and so on. It is also suitable for high strength steels with a yield strength of up to 470MPa.

OK AristoRod 13.26 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

SFA/AWS A5.28	ER80S-G

Wire composition

C	Si	Mn	Ni	Cu
0.1	0.8	1.4	0.8	0.4

Typical mech. properties all weld metal

Yield stress, MPa	540
Tensile strength, MPa	625
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
+20	140
0	142
-20	110
-40	83
-60	50

Approvals

DB	42.039.32
DNV	III YMS (M21)
DNV	II YMS (C1)
DS	EN 440
Ü	42.039/1

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.7-14.7	80-280	18-28	0.4-2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6

OK Autrod 13.28 GMAW

ER80S-Ni2

Description

OK Autrod 13.28 is a 2.4Ni-alloyed (ER80S-Ni2), copper-coated, solid wire for the GMAW of low-alloyed and low-temperature steels in applications such as vessels, pipes and the offshore industry, with a minimum yield strength of up to 470 MPa. The wire provides good impact toughness down to -60°C.

Welding current

DC(+)

Classifications

SFA/AWS A5.28	ER80S-Ni2
EN 440	G2Ni2

Wire composition

C	Si	Mn	Ni
0.1	0.6	1.1	2.4

Typical mech. properties all weld metal

Yield stress, MPa	540
Tensile strength, MPa	630
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
0	130
-40	100
-60	60

Approvals

DNV	V YMS (M21)
UDT	EN 440
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4-2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.1-8.1	225-480	26-38	3.3-11.6

OK AristoRod 13.29 GMAW

ER100S-G

Description

OK AristoRod™13.29 is a 0.3Cr-1.4Ni-0.25Mo-alloyed, bare, solid wire for the GMAW of high strength steels with low-temperature impact toughness requirements. OK AristoRod 13.29 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

Classifications

SFA/AWS A5.28	ER100S-G
EN 12534	G Mn3Ni1CrMo

Wire composition

C	Si	Mn	Cr	Ni	Mo
<0.1	0.5	1.6	0.3	1.4	0.2

Typical mech. properties all weld metal

Yield stress, MPa	700
Tensile strength, MPa	800
Elongation, %	19

Charpy V

Test temps, °C	Impact values, J
+20	100
-20	70
-30	60

Approvals

DB	42.039.33
Ü	42.039/5
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6
1.6	3.1-8.1	225-480	26-38	3.3-11.6

OK AristoRod 13.31 GMAW

G Mn4Ni2CrMo

Description

OK AristoRod™ 13.31 is a 0.3Cr-1.9Ni-0.5Mo-alloyed, bare, solid wire for the GMAW of high strength steels, heat-treated steels and fine-grained structural steels with a yield strength of up to 850MPa, such as XABO90. OK AristoRod 13.31 is treated with ESAB's unique Advanced Surface Characteristics (ASC) technology, taking MAG welding operations to new levels of performance and all-round efficiency, especially in robotic and mechanised welding. Characteristic features include excellent start properties; trouble-free feeding at high wire speeds and lengthy feed distances; a very stable arc at high welding currents; extremely low levels of spatter; low fume emission; reduced contact tip wear and improved protection against corrosion of the wire.

Welding current

DC+

Classifications

EN 12534	G Mn4Ni2CrMo
SFA/AWS A5.28	ER110S-G

Wire composition

C	Si	Mn	Cr	Ni	Mo
0.1	0.8	1.9	0.4	2.1	0.6

Typical mech. properties all weld metal

Yield stress, MPa	850
Tensile strength, MPa	890
Elongation, %	17

Charpy V

Test temps, °C	Impact values, J
0	70
-20	60
-30	50

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	2.0-10.8	40-170	16-22	0.4-2.6
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6

OK Tigrod 13.08 GTAW

ER80S-D2

Description

OK Tigrod 13.08 is a 1.5Mn-0.4Mo-alloyed (ER80S-D2), copper-coated rod for the GTAW of creep-resistant steels of the same type, such as pipes in pressure vessels and boilers with a working temperature of up to about 500°C. The rod can also be used for welding low-alloyed, high tensile strength steels.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER80S-D2
BS 2901 part 1	A31
EN 1668	W 46 2 W4Mo

Wire composition

C	Si	Mn	Mo
0.9	0.6	1.9	0.5

Typical mech. properties all weld metal

Yield stress, MPa	520
Tensile strength, MPa	615
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
-29	200

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.09 GTAW

ER80S-G

Description

OK Tigrod 13.09 is a 0.5Mo-alloyed, copper-coated rod for the GTAW of creep-resistant steels of the same type, such as pipes in pressure vessels and boilers with a working temperature of up to about 500°C.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER80S-G
EN 1668	W2Mo
EN 12070	W MoSi

Wire composition

C	Si	Mn	Mo
0.1	0.5	1.1	0.5

Typical mech. properties all weld metal

Yield stress, MPa	540
Tensile strength, MPa	630
Elongation, %	25

Charpy V

Test temps, °C	Impact values, J
+20	180
-20	130
-40	90
-60	25

Approvals

DB	42.039.08
DNV	IIIYMS
UDT	DIN 8575
Ü	42.039/2
VdTÜV	04950

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.12 GTAW

ER80S-G

Description

OK Tigrod 13.12 is a 1.0Cr-0.5Mo-alloyed, copper-coated rod for the GTAW of creep-resistant steels of the same type, such as pipes in pressure vessels and boilers. The rod can also be used for welding low-alloyed, high strength steels with a minimum tensile strength of 550 MPa.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER80S-G
DIN 8575	W.nr. 1.7339
EN 12070	W CrMo1Si

Wire composition

C	Si	Mn	Cr	Mo
0.1	0.6	1.0	1.2	0.5

Typical mech. properties all weld metal

Yield stress, MPa	560
Tensile strength, MPa	720
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
+20	120
-20	50
-30	40
-40	20
-60	20

Approvals

UDT	DIN 8575
VdTÜV	04952

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.13 GTAW

ER100S-G

Description

OK Tigrod 13.13 is a 0.5Cr-0.5Ni-0.2Mo-alloyed, copper-coated rod for the GTAW of high strength steels with a minimum tensile strength of 690 MPa. The rod is also suitable for welding steels where good impact strength at low temperatures is required.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER100S-G
EN 12534	Mn3NiCrMo

Wire composition

C	Si	Mn	Cr	Ni	Mo
0.1	0.7	1.4	0.6	0.6	0.2

Typical mech. properties all weld metal

Yield stress, MPa	585
Tensile strength, MPa	750
Elongation, %	27

Charpy V

Test temps, °C	Impact values, J
0	150
-20	85
-40	69

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.16 GTAW

ER80S-B2

Description

OK Tigrod 13.16 is a 1.3Cr-0.5Mo-alloyed (ER80S-B2), copper-coated rod for the GTAW of creep-resistant steels like SA-387 Grade 11, A 335 Grade P11 or similar materials. The rod has a high purity chemistry with a guaranteed Bruscato factor X < 15.

Welding current

DC-

Classifications

SFA/AWS A5.28	ER80S-B2

Wire composition

C	Si	Mn	Cr	Mo
0.09	0.6	0.6	1.4	0.5

Typical mech. properties all weld metal

Yield stress, MPa	640
Tensile strength, MPa	730
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J
-40	>47

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.17 GTAW

ER90S-B3

Description

OK Tigrod 13.17 is a 2.5Cr-1.1Mo-alloyed (ER90S-B3), copper-coated rod for the GMAW of creep-resistant steels like SA-387 Grade 22, A335 Grade P22 or similar materials. The rod has a high purity chemistry with a guaranteed Bruscato factor X < 15.

Welding current

DC-

Classifications

SFA/AWS A5.28	ER90S-B3

Wire composition

C	Si	Mn	Cr	Mo
0.09	0.6	0.6	2.5	1.0

Typical mech. properties all weld metal

Yield stress, MPa	620
Tensile strength, MPa	730
Elongation, %	22

Charpy V

Test temps, °C	Impact values, J
-40	>47

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.22 GTAW

ER90S-G

Description

OK Tigrod 13.22 is a 2.5Cr-1.0Mo-alloyed, copper-coated rod for the GTAW of creep-resistant steels such as pipes in pressure vessels and boilers of similar composition, with service temperatures of up to 600°C, but it is also suitable for welding high strength steels.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER90S-G
DIN 8575	W.nr 1.7384
EN 12070	W CrMo2Si

Wire composition

C	Si	Mn	Cr	Mo
0.08	0.7	1.0	2.6	1.0

Typical mech. properties all weld metal

	SR 750°C/0.5h
Yield stress, MPa	>400
Tensile strength, MPa	>500
Elongation, %	>18

Charpy V

Test temps, °C	Impact values, J
+20	200

Approvals

Sepros	UNA 046731
UDT	EN 12070
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.23 GTAW

ER80S-Ni1

Description

OK Tigrod 13.23 is a 0.9Ni-alloyed (ER80S-Ni1), copper-coated rod for the GTAW of low-temperature, fine-grained steels. The wire provides good impact toughness down to -50°C and is especially suitable for use in the offshore industry.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER80S-Ni1

Wire composition

C	Si	Mn	Ni	Mo
0.08	0.6	1.0	0.9	0.3

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	600
Elongation, %	25

Charpy V

Test temps, °C	Impact values, J
0	230
-20	200
-46	140
-60	90

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.26 GTAW

ER80S-G

Description

OK Tigrod 13.26 is a 0.8Ni-0.3Cu-alloyed, copper-coated solid rod for the GTAW of weathering steels such as COR-TEN, Patinax, Dillicor and so on. It is also suitable for high strength steels with a yield strength of up to 470MPa.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER80S-G

Wire composition

C	Si	Mn	Ni	Cu
0.1	0.8	1.4	0.8	0.4

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	580
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
+20	110
-20	70
-40	60

Approvals

DNV	IV YM

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.28 GTAW

ER80S-Ni2

Description

OK Tigrod 13.28 is 2.4Ni-alloyed (ER80S-Ni2), copper-coated rod for the GTAW of low-temperature, fine-grained steels in applications such as pressure vessels, pipes and the offshore industry, with a minimum yield strength of up to 470 MPa. The wire provides good impact toughness down to -60°C.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER80S-Ni2
EN 1668	W2Ni2

Wire composition

C	Si	Mn	Ni
0.1	0.6	1.1	2.4

Typical mech. properties all weld metal

Yield stress, MPa	540
Tensile strength, MPa	630
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
-20	200
-40	180
-60	150

Approvals

UDT	EN 440
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 13.32 GTAW

ER80S-B6

Description

OK Tigrod 13.32 is a 5Cr-0.5Mo-alloyed (ER80S-B6), copper-coated rod for the GTAW of creep-resistant steels of similar composition. The rod is also suitable for welding high strength steels with a minimum yield strength of up to 730 MPa.

AWS has changed the classification for this product. The previous classification was A5.9 ER502.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER80S-B6
DIN 8575	W.nr. 1.7373
EN 12070	WCrMo5

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
0.07	0.4	0.6	5.8	<0.3	0.6	<0.4

Typical mech. properties all weld metal

Yield stress, MPa	730
Tensile strength, MPa	900
Elongation, %	22

Charpy V

Test temps, °C	Impact values, J
+20	100
-20	80
-29	50

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 13.37 GTAW

ER80S-B8

Description

OK Tigrod 13.37 is a 9Cr-1Mo-alloyed, copper-coated rod for the GTAW of high temperature steels and steels for hot hydrogen service, especially in oil refineries. The electrode is a plain ER505 type.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER80S-B8
EN 12070	W CrMo9

Wire composition

C	Si	Mn	Cr	Mo
0.08	0.4	0.6	9.0	1.0

Typical mech. properties all weld metal

Yield stress, MPa	540
Tensile strength, MPa	660
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-20	140
-40	120
-60	90

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 13.38 GTAW

ER90S-B9

Description

OK Tigrod 13.38 is a 9CrMoVN-alloyed rod for the GTAW of high-temperature steels and steels for hot hydrogen service, especially in oil refineries. It should preferably be used for 9% Cr steels, such as P 91/T 91 steels.

The alloy is modified in terms of the limits for impurity elements and is extremely "clean". This produces improved strength levels both at room temperature and at higher temperatures.

AWS has changed the classification for this product. The previous classification was A5.9 ER505.

Welding current

DC(-)

Classifications

SFA/AWS A5.28	ER90S-B9
EN 12070	W CrMo91

Wire composition

C	Si	Mn	Cr	Ni	Mo
0.1	0.2	0.5	8.9	0.7	1.0

Typical mech. properties all weld metal

Yield stress, MPa	690
Tensile strength, MPa	785
Elongation, %	20

Charpy V

Test temps, °C	Impact values, J
+20	200
0	180
-20	150
-40	90
-60	70

Approvals

UDT	DIN 8575
VdTÜV	07686

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Autrod 12.24 SAW
EA2

Description

OK Autrod 12.24 is a copper-coated, molybdenum-alloyed wire for the submerged arc welding of non-alloyed and low-alloyed steels.
It can be combined with OK Flux 10.47, OK Flux 10.61, OK Flux 10.62, OK Flux 10.71, OK Flux 10.72, OK Flux 10.73, OK Flux 10.81 and OK Flux 10.83.

Classifications

SFA/AWS A5.23	EA2
EN 756	S2Mo
EN 12070	S Mo

Wire composition

C	Si	Mn	Mo
0.1	0.1	1.1	0.5

OK Autrod 12.34 SAW
EA4

Description

OK Autrod 12.34 is a manganese-alloyed, copper-coated wire for the submerged arc welding of medium- and high-strength structural steels. OK Autrod 12.34 should preferably be used together with non-alloying or slightly alloying fluxes, such as OK Flux 10.62, when high weld metal quality requirements must be met.
Other combinations include OK Flux 10.40, OK Flux 10.61 or 10.71, 10.73 or 10.74 in high dilution welds, such as pipe mill applications..

Classifications

SFA/AWS A5.23	EA4
EN 756	S3Mo
EN 12070	S MnMo

Wire composition

C	Si	Mn	Mo
0.1	0.15	1.5	0.5

OK Autrod 12.44 SAW
EA3

Description

OK Autrod 12.44 is a Mn-Mo-alloyed, copper-coated wire for the submerged arc welding of high tensile steel and steel for low temperature work. It can be combined with OK Flux 10.62.

Classifications

SFA/AWS A5.23	EA3
EN 756	S4Mo

Wire composition

C	Si	Mn	Mo
0.11	0.15	2.0	0.5

OK Autrod 13.10 SC SAW
EB2R

Description
OK Autrod 13.10 SC is a low-alloyed, copper-coated wire designed for the submerged arc welding of creep-resistant steels of the 1.25Cr0.5Mo type, especially designed for step cooling applications. It can be combined with OK Flux 10.61, 10, 62 and 10.63.

Classifications

SFA/AWS A5.23	EB2R
EN 12070	S CrMo1

Wire composition

C	Si	Mn	Cr	Mo
0.10	0.15	0.7	1.2	0.5

OK Autrod 13.20 SC SAW
EB3R

Description
OK Autrod 13.20SC is a low-alloyed, copper-coated wire designed for the submerged arc welding of creep-resistant steels of the 2.25Cr1Mo type, especially designed for step cooling applications.
It can be combined with OK Flux 10.61, 10.62 and 10.63.

Classifications

SFA/AWS A5.23	EB3R
EN 12070	S CrMo2
DIN 8575	UP S1 CrMo2

Wire composition

C	Si	Mn	Cr	Mo
0.10	0.15	0.6	2.3	1.0

OK Autrod 13.21 SAW
ENi1

Description
OK Autrod 13.21 is a copper coated, nickel-alloyed (1Ni) wire designed for submerged arc welding. It can be combined with OK Flux 10.62.

Classifications

SFA/AWS A5.23	ENi1
EN 756	S2Ni1

Wire composition

C	Si	Mn	Ni
0.08	0.2	1.0	1.0

OK Autrod 13.24 SAW
EG

Description

OK Autrod 13.24 is a low-alloyed, copper-coated wire for submerged arc welding, to be used when the requirements imposed on the weld metal are rigorous - in the in offshore industry, for example. It can be used in combination with OK Flux 10.62 andOK Flux 10.71.

Classifications

SFA/AWS A5.23	EG
EN 756	S0

Wire composition

C	Si	Mn	Ni	Mo
0.11	0.2	1.4	1.0	0.2

OK Autrod 13.27 SAW
ENi2

Description

OK Autrod 13.27 is a copper-coated, low-alloyed, 2%Ni electrode for the submerged arc welding of low-alloyed and low-temperature steels for applications in the offshore industry, for example. It can be combined with OK Flux 10.62 and OK Flux 10.71.

Classifications

SFA/AWS A5.23	ENi2
EN 756	S2Ni2

Wire composition

C	Si	Mn	Ni
0.08	0.2	1.0	2.3

OK Autrod 13.36 SAW

Description

OK Autrod 13.36 is a CuNi-alloyed wire for the submerged arc welding of weathering steels of theUSS CORTEN A, B and C type. It can be combined with OK Flux 10.71, OK Flux 10.81, OK Flux 10.82 and OK Flux 10.83.

Classifications

SFA/AWS A5.23	EG
EN 756	S2Ni1Cu

Wire composition

C	Si	Mn	Cr	Ni	Cu
0.1	0.3	1.0	0.3	0.8	0.5

OK Autrod 13.40 SAW EG

Description

OK Autrod 13.40 is a nickel-molybdenum-alloyed, copper-coated wire designed for thesub-merged arc welding of higher tensile steel. It can be combined with OK Flux 10.62.

Classifications

SFA/AWS A5.23	EG
EN 14295	S3Ni1Mo

Wire composition

C	Si	Mn	Ni	Mo
0.10	0.2	1.5	0.9	0.5

OK Autrod 13.43 SAW EG

Description

OK Autrod 13.43 is a CrNiMo-alloyed, copper-coated wire for the submerged arc welding of extra high tensile steels.
It can be combined with OK Flux 10.62.

Classifications

SFA/AWS A5.23	EG
EN 14295	S3Ni2.5CrMo

Wire composition

C	Si	Mn	Cr	Ni	Mo
0.11	0.2	1.4	0.7	2.4	0.5

OK Autrod 13.44 SAW EG

Description

OK Autrod 13.44 is a CrNiMo-alloyed, copper-coated wire for the submerged arc welding of extra high tensile steel.

Classifications

SFA/AWS A5.23	EG
EN 14295	S3Ni1.5CrMo

Wire composition

C	Si	Mn	Cr	Ni	Mo
0.1	0.1	1.4	0.25	1.60	0.4

OK Autrod 13.49 SAW

ENi3

Description

OK Autrod 13.49 is a copper-coated, 3% Ni-alloyed wire designed for submerged arc welding for low-temperature applications. It can be used with OK Flux 10.63.

Classifications

SFA/AWS A5.23	ENi3
EN 756	S2Ni3

Wire composition

C	Si	Mn	Ni
0.10	0.20	1.0	3.3

OK Autrod 13.64 SAW

EG

Description

OK Autrod 13.64 is a low-alloyed and micro-alloyed Ti-B-containing, solid wire designed for submerged arc welding, especially in joints with a high dilution, such as the seam welding of line pipes, where low-temperature impact toughness properties are required.

Classifications

SFA/AWS A5.23	EG
EN 756	S0

Wire composition

C	Si	Mn	Mo	Ti	B
0.07	0.25	1.2	0.5	0.14	0.014

OK Flux 10.40 SAW

Type Acid EN 760: SF MS 1 88 AC

Description

OK Flux 10.40 is a fused, acid flux, specially designed for welding in combination with mild steel electrodes OK Autrod 12.10 or OK Autrod 12.20. It is designed for use in the single- and multi-pass butt welding of mild and medium tensile steels with impact requirements down to a minimum of -20°C. OK Flux 10.40 is of the manganese-silicate type with a high current-carrying capacity on both AC and DC.

Density

1.5 kg/dm^3

Basicity index

0.7

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.7	0.7
30	1.0	1.0
34	1.3	1.3
38	1.8	1.8

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.05	0.6	1.5	-	-	0.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.24	470	560	+20	50
			0	35

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.24									x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 42 A MS S2Mo	F7AZ-EA2-A4/F7PZ-EA2-A4

OK Flux 10.47 SAW

Type Basic EN 760: SF AB 1 65 AC H5

Description

OK Flux 10.47 is a non-alloying, fused base flux, specially designed for the single- and multi-pass butt welding of mild and medium tensile strength steels. Typical applications include structural steels for shipbuilding and pressure vessel manufacture with impact strength requirements down to -40°C. OK Flux 10.47 has a high current-carrying capacity on both AC and DC.

Density

approx. 1.1 kg/dm^3

Basicity index

1.3

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.7	0.7
30	1.0	1.0
34	1.3	1.3
38	1.8	1.8

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.04	0.4	0.9	-	-	0.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.24	430	520	0	90
			-20	70
			-29	40

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 42 2 AB S2Mo	F7A2-EA2-A2

OK Flux 10.50 ESW

Type Basic EN 760

Description

A fused, non-alloying flux, specially designed for electroslag welding. As no alloying takes place from the flux, the required mechanical properties can be obtained using a suitable alloyed wire.

Density

≈1.5 kg/dm^3

Basicity index

2.0

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.34	0.1	0.15	1.5	-	-	0.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.34	390	540	+ 20	50

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.34									x

OK Flux 10.61 SAW

Type High-basic EN 760:SA FB 1 65 DC

Description

OK Flux 10.61 is designed for the single-wire, multi-run butt welding of mild, medium and high tensile steels with impact strength requirements down to -40°C/-60°C.
Due to the non-alloying effect, OK Flux 10.61 is designed for use with a suitable alloying wire. OK Flux 10.61 can be used on DC±.

Density

≈1.1 kg/dm^3

Basicity index

2.8

Flux consumption kg flux/kg wire

Voltage	DC+
26	0.6
30	0.9
34	1.15
38	1.4

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.06	0.25	1.0	-	-	0.5
OK Autrod 13.10 SC	0.08	0.30	0.7	1.1	-	0.5
OK Autrod 13.20 SC	0.08	0.30	0.60	2.0	-	0.90

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.24	470	560	+20	130
			0	120
			-20	80
			-29	45
			-40	35
OK Autrod 13.10SC	510	600	-18	100
			-29	70
OK Autrod 13.20SC	540	630	-18	80
			-29	30

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.24									x
OK Autrod 13.10 SC								x	x
OK Autrod 13.20 SC									x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 42 2 FB S2Mo	F7A4-EA2-A2/F7P2-EA2-A2
OK Autrod 13.10 SC		F8P2-EB2R-B2
OK Autrod 13.20 SC		F8P0-EB3R-B3

OK Flux 10.62 SAW

Type Basic EN 760: SA FB 1 55 AC H5

Description

OK Flux 10.62 is an all-mineral, non-alloying, high-basic flux. The weld metal can be fully controlled through the suitable choice of wires, independently of the welding parameters. It is therefore very suitable for the multi-run welding of thick materials using the single-wire and multiple-wire technique. OK Flux 10.62 is designed for the multi-pass butt welding of mild, medium and high tensile steels, as well as low-alloyed steels, with an impact strength down to -40°/-60°C. As it is a flux of the high-basic type, OK Flux 10.62 has a high current-carrying capacity on both AC and DC. To increase productivity with no loss of mechanical properties, OK Flux 10.62 is best used together with iron powder addition. OK Flux 10.62 is especially suitable for narrow gap welding, due to its good slag detachability and smooth side-wall blending. Pressure vessels for nuclear applications and offshore constructions in which good CTOD values are required are two areas in which OK Flux 10.62 can be successfully used. It operates optimally at the lower end of the voltage range.
OK Flux 10.62 yields low-oxygen weld metal (approx. 300 ppm) and produces low-hydrogen weld metal (lower than 5 ml/100 g).

Density

approx. 1.1 kg/dm^3

Basicity index

3.4

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.7	0.6
30	0.9	0.75
34	1.2	1.0
38	1.5	1.25

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.07	0.22	1.0	-	-	0.5
OK Autrod 12.34	0.10	0.21	1.45	-	-	0.5
OK Autrod 12.44	0.08	0.21	1.9	-	-	0.5
OK Autrod 13.10SC	0.08	0.22	0.7	1.1	-	0.5
OK Autrod 13.20SC	0.08	0.20	0.60	2.0	-	0.85
OK Autrod 13.21	0.06	0.25	1.0	-	0.9	-
OK Autrod 13.24	0.08	0.30	1.4	-	0.9	0.2
OK Autrod 13.27	0.06	0.25	1.0	-	2.1	-
OK Autrod 13.40	0.07	0.26	1.50	-	0.9	0.5
OK Autrod 13.43	0.08	0.25	1.35	0.6	2.2	0.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	J
OK Autrod 12.24	500	580	+20	140
			0	115
			-20	80
			-40	60
			-51	45
OK Autrod 12.34	540	620	+20	170
			0	160
			-20	140
			-40	115
			-51	45
OK Autrod 12.44	600	700	-20	105
			-40	80
			-50	65
			-62	50
OK Autrod 13.10SC	500	610	-18	110
			-29	80
OK Autrod 13.20SC	525	620	-18	120
			-29	80
OK Autrod 13.21	470	560	+20	195
			0	185
			-20	160
			-40	70
			-51	60
OK Autrod 13.24	530	620	-40	120
			-50	110
			-60	70
			-73	50
OK Autrod 13.27	510	605	-20	150
			-40	120
			-60	80
			-70	60
OK Autrod 13.40	650	730	-40	70
			-50	60
			-62	50
OK Autrod 13.43	700	795	-20	100
			-40	75
			-50	65
			-60	55
			-62	50

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.24				A3, 3YM					
OK Autrod 12.34	4YQ500M	4Y50M	III YM	A4Y50M	4Y50M				
OK Autrod 12.44									
OK Autrod 13.10 SC								x	x
OK Autrod 13.20 SC									
OK Autrod 13.21									
OK Autrod 13.24									
OK Autrod 13.27	5YQ460M	5Y46M	5Y46M	5Y46M	5Y46M				x
OK Autrod 13.40									x
OK Autrod 13.43	4YQ690M	4Y69M	IV Y69M	4Y69M	4Y69M				

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 46 4 FB S2Mo	F8A6-EA2-A2/F7P6-EA2-A2
OK Autrod 12.34	S 50 4 FB S3Mo	F8A6-EA4-A4/F8P6-EA4-A4
OK Autrod 12.44	S 50 5 FB S4Mo	F9A8-EA3-A3/F9P8-EA3-A3
OK Autrod 13.10 SC		F8P2-EB2R-B2
OK Autrod 13.20 SC		F8P2-EB3R-B3
OK Autrod 13.21	S 42 4 FB S2Ni1	F7A6-ENi1-Ni1/F7P8-ENi1-Ni1
OK Autrod 13.24	S 50 6 FB S0	F8A10-EG-G/F8P8-EG-G
OK Autrod 13.27	S 46 7 FB S2Ni2	F8A10-ENi2-Ni2/F8P10-ENi2-Ni2
OK Autrod 13.40	S 62 6 FB S3Ni1Mo	F10A8-EG-F3/F9P6-EG-F3
OK Autrod 13.43	S 69 6 FB S3Ni2,5CrMo	F11A8-EG-G/F10P8-EG-G

OK Flux 10.63 SAW

Type High-basic EN 760: SA FB 1 55 AC H5

Description

OK Flux 10.63 is a high-basic, agglomerated, all-mineral, non-alloying flux, designed primarly for the multi-run welding of creep-resistant steels in combination with low-alloy Cr-Mo wires. The very low impurity level of the flux helps to produce an exceptionally clean weld metal, with high impact properties, even after step cooling treatment.

Density

≈1.1 kg/dm^3

Basicity index

3.2

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.7	0.6
30	0.9	0.75
34	1.2	1.0
38	1.5	1.25

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 13.10SC	0.08	0.2	0.8	1.2	-	0.5
OK Autrod 13.20SC	0.07	0.2	0.6	2.1	-	1.0

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 13.10 SC	480	590	-29	110
			-40	80
OK Autrod 13.20 SC	530	630	+20	180
			-20	150
			-40	110
			-62	50

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 13.10SC									
OK Autrod 13.20SC									

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 13.10SC		F8P4-EB2R-B2R
OK Autrod 13.20SC		F8P8-EB3R-B3R

OK Flux 10.70 SAW

Type Basic EN 760: SA AB 1 79 AC

Description

Basic, agglomerated flux for the single- and multi-run welding of ordinary and high strength steels using mild steel wires and low-alloyed wires. The flux is particularly well suited to butt and fillet welds with a high dilution from the base material. The flux has a very high current-carrying capacity

Density

1.7

Basicity index

1.1 kg/dm^3

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.65	0.5
30	0.9	0.75
34	1.15	1.0
38	1.45	1.2

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.06	0.6	2.0	-	-	0.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.24	580	670	+20	60
			0	50
			-18	40

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 50 0 AB S2Mo	F9A0-EA2-A3/F9PZ-EA2-A3

OK Flux 10.71 SAW

Type Basic EN 760: SA AB 1 67 AC H5

Description

OK Flux 10.71 is a basic, agglomerated, slightly Si- and Mn-alloying flux for submerged arc welding, specially designed for fillet welding and for the single- and multi-pass butt welding of mild, medium and high tensile steels. OK Flux 10.71 is of the aluminate-basic type and, for this slag system, it has a very high current-carrying capacity on both AC and DC and very good operating characteristics. OK Flux 10.71 is very suitable for narrow gap welding due to the excellent slag detachability and smooth side-wall blending.

Density

approx. 1.2 kg/dm^3

Basicity index

1.6

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.6	0.5
30	0.85	0.7
34	1.15	0.95
38	1.35	1.15

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.05	0.4	1.35			0.5
OK Autrod 12.34	0.09	0.4	1.5			0.5
OK Autrod 13.24	0.07	0.5	1.5		0.9	0.2
OK Autrod 13.27	0.05	0.4	1.4		2.2	-
OK Autrod 13.36	0.08	0.5	1.3	0.3	0.7	Cu: 0,5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.24	500	580	+20	125
			0	100
			-20	60
			-40	30
OK Autrod 12.34	535	620	+20	120
			0	105
			-20	70
			-30	60
			-40	45
OK Autrod 13.24	560	630	+20	120
			-20	85
			-30	70
			-40	60
			-46	40
OK Autrod 13.27	500	600	-20	100
			-40	60
			-51	50
OK Autrod 13.36	490	580	+20	120
			-20	70
			-29	55

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.24	3TM 3YTM	3T, 3YM, 3YT	IIIYTM	A3, A3YTM	3YTM			x	x
OK Autrod 12.34									
OK Autrod 13.24									
OK Autrod 13.27									x
OK Autrod 13.36									

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 46 2 AB S2Mo	F8A2-EA2-A4/F7P0-EA2-A4
OK Autrod 12.34	S 50 3 AB S3Mo	F8A4-EA4-A3/F8P2-EA4-A3
OK Autrod 13.24	S 50 4 AB S0	F8A5-EG-G/F8P4-EG-G
OK Autrod 13.27	S 46 5 AB S2Ni2	F8A6-ENi2-Ni2/F7P6-ENi2-Ni2
OK Autrod 13.36	S 46 3 AB S2Ni1Cu	F8A2-EG-G

OK Flux 10.72 SAW

Type Aluminate-basic EN 760: SA AB 1 57 AC

Description

Agglomerated, aluminate-basic flux with an extremely high current-carrying capacity, for applications with toughness requirements down to -50ºC. Excellent slag removal, also in narrow V-joints. For structural steels, fine-grained steels and low-temperature steels. Specially designed for windmill tower fabrication. Ideal for single and multi wire procedures. Suitable for both DC and AC welding and for the single- layer and multi-layer welding of unlimited plate thickness.

Density

1.1 kg/dm^3

Basicity index

1.9

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.7	0.6
30	1.0	0.9
34	1.3	1.2
38	1.5	1.4

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.05	0.2	1.6			0.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.24	500	590	-30	60
			-40	40
			-46	35

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.24								x	x

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 46 3 AB S2Mo	F8A5-EA2-A3/F8P5-EA2-A3

OK Flux 10.73 SAW

Type Basic EN 760: SA AB 1 66 AC H5

Description

Aluminate-basic, agglomerated flux, designed primarily for the multi-wire pipe welding of mild and high-strength pipe-steel qualities. Due to its metallurgical design, the flux does not produce hard spots in pipe welding applications.

Density

≈1.1 kg/dm^3

Basicity index

1.3

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.8	0.6
30	1.15	0.75
34	1.35	1.0
38	1.5	1.3

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.06	0.3	1.1			0.5
OK Autrod 12.34	0.06	0.4	1.3			0.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.24	500	580	0	70
			-20	50
			-29	40
OK Autrod 12.34	525	620	0	90
			-20	55
			-40	35

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 46 2 AB S2Mo	F8A2-EA2-A2/F7P0-EA2-A2
OK Autrod 12.34	S 50 2 AB S3Mo	F8A4-EA4-A4/F8P2-EA4-A4

OK Flux 10.74 SAW

Type EN 760: SA AB 1 67 AC H5

Description

Aluminate-basic, agglomerated flux designed for the multi-wire pipe welding of mild and high strength pipe-steel qualities. Especially designed for longitudinal seams at high welding speed. Produces a flat weld bead profile.

Density

~ 1,1 kg/dm^3

Basicity index

1.5

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.8	0.6
30	1.15	0.75
34	1.35	1.0
38	1.5	1.3

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.05	0.4	1.3			0.5
OK Autrod 12.34	0.08	0.4	1.5			0.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 12.24	520	590	0	100
			-20	65
			-29	50
			-40	30
OK Autrod 12.34	590	670	0	90
			-18	60
			-20	55
			-29	40

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 46 2 AB S2Mo	F8A2-EA2-A4/F7P0-EA2-A4
OK Autrod 12.34	S 50 2 AB S3Mo	F9A2-EA4-A3/F9P0-EA4-A3

OK Flux 10.81 SAW

Type Acid EN 760: SA AR 1 97 AC

Description

Acid, agglomerated flux for the single- and multi-wire welding of low- and medium-strength steels. Particularly suitable for high-productivity welding allowing very high travel speeds. Excellent fillet welding characteristics. Due to the alloying characteristic of the flux, the max. recommended plate thickness to be welded is 30 mm.

Density

1.25 kg/dm^3

Basicity index

0.6

Flux consumption kg flux/kg wire

Voltage	DC+	AC
26	0.6	0.5
30	0.8	0.65
34	1.05	0.9
38	1.35	1.25

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 12.24	0.07	0.8	1.5	-	-	0.5
						Cu:
OK Autrod 13.36	0.07	0.9	1.4	0.3	0.7	0.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	J
OK Autrod 12.24	565	660	+20	65
			0	45
OK Autrod 13.36	570	680	+20	55
			0	40
			-18	35

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	Ü	DB	VdTÜV
OK Autrod 12.24									x
OK Autrod 13.36									

Other approvals may be applicable. Please contact ESAB.

Classifications

Wire	EN 756	SFA/AWS A5.23
OK Autrod 12.24	S 50 A AR S2Mo	F9AZ-EA2-A4/F9PZ-EA2-A4
OK Autrod 13.36	S 50 A AR S2Ni1Cu	F9A0-EG-G

Consumables for stainless and high-alloyed steels

Contents

Stainless and high-alloyed steels

Contents

OK 61.20

Type Acid rutile

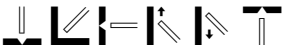
SMAW
E308L-16

Description

Rutile coated electrode for welding 19Cr10Ni-type steels. Also suitable for welding stabilised steels of similar composition, except when the full creep resistance of the base material is to be met. The electrode is specially designed for welding thin-walled pipes. Diameters 1.6-2.5 mm can be used in all positions including vertical down.

Welding current

DC+, AC OCV 50 V



Classifications

EN 1600	E 19 9 L R 1 2
SFA/AWS A5.4	E308L-16
Werkstoffnr	1.4316

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.7	0.9	19.5	10.0	<0.5	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	560
Elongation A5, %	45

Charpy V

Test temps, °C	Impact values, J
+20	70

Ferrite content FN 3-10

Approvals

Pending

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
1.6	300	23-40	23	0.66	227	0.3	53
2.0	300	25-60	22	0.66	143	0.7	38
2.5	300	28-85	22	0.63	93	0.9	44

OK 61.25

Type Basic

SMAW
E308H-15

Description

OK 61.25 is a basic coated, stainless-steel electrode of the 308H type. The electrode is designed for high-temperature applications in petrochemical and chemical process plants.

Welding current

DC+

Classifications

EN 1600	E 19 9 H B 2 2
SFA/AWS A5.4	E308H-15

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.07	0.5	1.5	19.0	10.0	<0.5	<0.5

Typical mech. properties all weld metal

		720°C/1000h:
Yield stress, MPa	430	300
Tensile strength, MPa	600	570
Elongation A4, %	45	45

Charpy V

Test temps, °C	Impact values, J	
+20	96	100

Ferrite content FN 2-5100

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	55-85	23	0.62	93	0.9	47
3.2	350	75-110	23	0.59	49	1.2	66
4.0	350	100-155	24	0.61	32	1.8	68

OK 61.30

Type Acid-rutile

SMAW
E308L-17

Description

OK 61.30 is an extra-low carbon, AC/DC, LMA electrode for welding steel of the 19Cr10Ni type It is also suitable for welding stabilised stainless steels of similar composition, except when the full creep resistance of the base material is to be met. OK 61.30 is very easy to strike and restrike and produces weld beads with an excellent appearance and self-relieving slag.

Welding current

DC+, AC OCV 50 V

Classifications

EN 1600	E 19 9 L R 1 2
SFA/AWS A5.4	E308L-17
Werkstoff Nr.	1.4316
CSA W48	E 308L-17

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.7	0.9	19.5	10.0	<0.5	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	560
Elongation A5, %	43

Charpy V

Test temps, °C	Impact values, J
+20	70

Ferrite content FN 3-10

Approvals

ABS	Stainless
CL	EN 1600
CWB	CSA W48
DB	30.039.02
DNV	308L
Sepros	UNA 409820
SS	EN 1600
UDT	EN 1600
VdTÜV	00792
Ü	30.039

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
1.6	300	35-50	27	0.55	240	0.6	24
2.0	300	45-65	29	0.55	160	0.8	29
2.5	300	60-90	31	0.55	99	1.1	36
3.2	350	80-120	31	0.60	49	1.4	54
4.0	350	120-170	32	0.60	33	2.0	60
5.0	350	150-240	33	0.60	20	3.0	60

OK 61.35

Type Basic

SMAW
E308L-15

Description

OK 61.35 is a basic, low-carbon, stainless electrode of the E308L type with very good welding properties in the vertical and overhead positions. The high impact toughness at cryogenic temperature (-196°C) makes OK 61.35 excellent in LNG applications.

Welding current

DC+

Classifications

EN 1600	E 19 9 L B 2 2
SFA/AWS A5.4	E308L-15
Werkstoff Nr.	1.4316

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.04	0.5	1.7	19.0	10.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	580
Elongation A4, %	60

Charpy V

Test temps, °C	Impact values, J
+20	100
-120	70
-196	>32
Ferrite content	FN 2-7

Approvals

Sepros	UNA 409820
UDT	EN 1600
VdTÜV	04811

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	55-85	22	0.61	92	0.9	37
3.2	350	75-110	25	0.61	50	1.3	54
4.0	350	110-155	27	0.61	33	1.9	58
5.0	350	160-210	26	0.51	25	2.2	66

OK 61.41

Type Acid-rutile

SMAW
E308L-26

Description

OK 61.41 is a high-recovery, extra-low carbon, LMA electrode for welding steels of the 19Cr10Ni type. It is particularly suitable for fillet welding in the downhand and HV positions and for butt welds in the flat position. The electrode could also be used for stabilised stainless steels of similar compositions, except when full creep resistance of the base material is to be met.

Welding current

DC+, AC OCV 55 V

Classifications

EN 1600	E 19 9 L R 5 3
SFA/AWS A5.4	E308L-26
Werkstoff Nr.	1.4316

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.7	0.9	19.5	10.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	420
Tensile strength, MPa	560
Elongation A5, %	45

Charpy V

Test temps, °C	Impact values, J
+20	65

Ferrite content FN 3-10

Approvals

SS	EN 1600
UDT	EN 1600
VdTÜV	01013

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	60-100	29	0.61	67.0	1.5	37
3.2	350	80-130	29	0.65	35.0	2.0	52
4.0	450	110-170	32	0.65	17.9	2.8	71
5.0	450	170-230	33	0.65	11.2	3.9	82

OK 61.50

Type Acid-rutile

SMAW
E308H-17

Description

OK 61.50 is a stainless-steel electrode for welding non-stabilised 18Cr 10Ni austenitic steels for elevated temperatures.

Welding current

DC+, AC OCV 55 V

Classifications

EN 1600	E 19 9 H R 1 2
SFA/AWS A5.4	E308H-17

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.06	0.7	0.9	20.0	10.0	<0.5	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	600
Elongation A4, %	45

Charpy V

Test temps, °C	Impact values, J
+20	60

Ferrite content FN 3-10

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	50-85	27	0.56	98	0.9	42
3.2	350	70-110	27	0.56	51	1.1	63
4.0	350	110-165	28	0.56	34	1.7	62

OK 61.80

Type Acid-rutile

SMAW
E347-17

Description

OK 61.80 is a niobium-stabilised, stainless-steel, LMA electrode with low carbon content for welding stainless types 321 and 347. It is resistant to intergranular corrosion up to 400°C.

Welding current

DC+, AC OCV 50 V

Classifications

EN 1600	E 19 9 Nb R 1 2
SFA/AWS A5.4	E347-17
Werkstoff Nr.	1.4551

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.03	0.7	0.9	20.0	10.0	<0.3	<0.6	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	620
Elongation A5, %	40

Charpy V

Test temps, °C	Impact values, J
+20	60
-80	40

Ferrite content FN 6-12

Approvals

GL	4550
UDT	EN 1600
VdTÜV	00638

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	45-65	24	0.56	150	0.7	35
2.5	300	60-90	26	0.56	97	1.0	38
3.2	350	80-120	28	0.56	50	1.4	53
4.0	350	120-170	30	0.56	33	2.0	55
5.0	350	150-240	31	0.56	21	2.9	60

OK 61.81

Type Rutile

SMAW
E347-16

Description

OK 61.81 is a niobium-stabilised, stainless welding electrode for titanium- and niobium-stabilised 18-8 steel. It is particularly suitable for high-temperature applications.

Welding current

DC+, AC OCV 60 V

Classifications

EN 1600	E 19 9 Nb R 3 2
SFA/AWS A5.4	E347-16
Werkstoff Nr.	1.4551

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
0.06	0.7	1.6	20.0	10.0	<0.3	<1.0	<0.3

Typical mech. properties all weld metal

		500°C/10,000h:
Yield stress, MPa	560	
Tensile strength, MPa	700	300
Elongation A4, %	31	

Charpy V

Test temps, °C	Impact values, J
+20	60

Ferrite content FN 6-12

Approvals

DNV	347
SS	EN 1600
UDT	EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	40-60	26.2	0.60	147	0.6	39
2.5	300	50-80	28.8	0.59	82	1.2	36
3.2	350	75-115	23	0.60	44	1.2	66
4.0	350	110-160	24	0.60	32	1.7	66
5.0	350	140-210	25	0.60	20	2.3	78

OK 61.85

Type Basic

SMAW
E347-15

Description

OK 61.85 is a basic coated, niobium stabilised electrode of the E347-type, specially designed for welding niobium- or titanium-stabilised steels. OK 61.85 has outstanding welding properties in the vertical and overhead positions, making it suitable for pipewelding, for example.

Welding current

DC+

Classifications

EN 1600	E 19 9 Nb B 2 2
SFA/AWS A5.4	E347-15
Werkstoff Nr.	1.4551

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.07	0.5	1.7	19.5	10.0	<0.3	<1.0	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	620
Elongation A5, %	40

Charpy V

Test temps, °C	Impact values, J
+20	100
-60	70
-120	>32
Ferrite content	FN 6-12

Approvals

Sepros	UNA 409820
UDT	EN 1600
VdTÜV	05663

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	55-85	25	0.60	98	0.9	42
3.2	350	75-110	23.3	0.62	49	1.1	64
4.0	350	110-150	23.5	0.61	33	1.6	70
5.0	350	150-200	23.1	0.61	21	2.3	76

OK 61.86

Type Acid-rutile

SMAW
E347-17

Description

Stainless-steel electrode for welding niobium- or titanium-stabilised steels of the 19Cr10Ni type. Controlled low ferrite content level.

Welding current

AC, DC+ OCV 50 V

Classifications

EN 1600	E 19 9 Nb R 1 2
SFA/AWS A5.4,	E347-17
Werkstoff Nr.	1.4551

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.03	0.7	0.9	19.0	10.0	<0.5	<0.6	<0.2

Typical mech. properties all weld metal

Yield stress, MPa	520
Tensile strength, MPa	660
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	55

Ferrite content FN 3-8

Approvals

Sepros UNA 409820

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	60-90	27	0.58	98	0.8	47
3.2	350	70-120	27	0.55	53	1.1	62
4.0	350	120-170	28	0.54	34	1.7	64

OK 62.53

Type Rutile

SMAW

Description

OK 62.53 is a rutile coated, stainless electrode, specially designed for high-temperature applications. The weld metal has a scaling temperature of about 1150°C. OK 62.53 is recommended for welding steels such as Avesta 253MA, W.nr. 1.4828, W.nr. 1.4835 and UNS S30815.

Welding current

AC, DC+ OCV 65 V

Classifications

No applicable classifications

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu	N
0.07	1.6	0.7	23.0	10.5	<0.5	<0.2	0.18

Typical mech. properties all weld metal

Yield stress, MPa	550
Tensile strength, MPa	730
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	60

Ferrite content FN 8-12

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	50-90	26	0.55	104	0.8	44
3.2	350	70-110	25	0.55	54	1.0	66
4.0	350	110-150	26	0.56	35	1.3	77

OK 62.73

Type Rutile

SMAW
E 20 10 3 R 1 2

Description

Rutile MMA electrode depositing an austenitic-ferritic weld metal, which is highly resistant to cracking. The electrode is suitable for welding crack-sensitive materials and stainless steel to mild steel. It is also used for welding 5%Cr 0.5%Mo steel, where no heat treatment after welding can be applied. In hardfacing, OK 62.73 is applied as a buffer layer to absorb stresses between the parent metal and the hard top layer.

Welding current

DC+, AC OCV 65 V

Classifications

EN 1600	E 20 10 3 R 1 2

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.08	<1.0	1.3	19.8	9.5	3.3	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	600
Tensile strength, MPa	750
Elongation A5, %	27

Charpy V

Test temps, °C	Impact values, J
+20	60

Ferrite content FN 25-40

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	40-75	24	0.60	96	0.9	42
3.2	350	60-100	23	0.60	50	1.2	57
4.0	350	90-140	24	0.60	33	1.7	68

OK 62.75

Type Rutile basic

SMAW

E 20 10 3 B 1 2

Description

Basic MMA electrode depositing an austenitic-ferritic weld metal, which is highly resistant to cracking. The electrode is preferred for the positional welding of crack-sensitive steels, armour steels and stainless steel to mild steel. It is also used for welding 5%Cr 0.5%Mo steel where no heat treatment after welding can be applied. In hardfacing, OK 62.75 is applied as a buffer layer to absorb stresses between the parent metal and the hard top layer.

Welding current

DC+, AC OCV 70 V

Classifications

EN 1600	E 20 10 3 B 1 2

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.08	<0.5	1.3	19.8	9.5	3.3	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	610
Tensile strength, MPa	750
Elongation A5, %	27

Charpy V

Test temps, °C	Impact values, J
+20	65

Ferrite content FN 25-40

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	40-75	22	0.60	99	0.8	80
3.2	350	65-100	21	0.60	51	1.3	66
4.0	350	100-140	23	0.60	33	1.6	70

OK 63.20

Type Acid-rutile

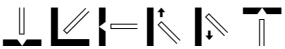
SMAW
E316L-16

Description

OK 63.20 is a rutile electrode with an extra-low carbon content for welding stainless steel of the 316L, 18Cr12Ni3Mo type. The electrode is specially designed for the positional welding of thin-walled pipes. OK 63.20 is very easy to strike and restrike.

Welding current

DC+, AC OCV 50 V



Classifications

EN 1600	E 19 12 3 L R 1 1
SFA/AWS A5.4	E316L-16
Werkstoff Nr	1.4430
CSA W48	E316L-16

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	<0.9	0.9	18.3	12.0	2.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	580
Elongation A5, %	37

Charpy V

Test temps, °C	Impact values, J
+20	56
-60	45

Ferrite content FN 3-10

Approvals

CWB	CSA W48
Sepros	UNA 409820
SS	EN 1600
UDT	EN 1600
VdTÜV	09716

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
1.6	265	15-40	23	0.55	294	0.4	30
1.6	300	15-40	23	0.63	227	0.3	53
2.0	265	18-60	22	0.65	167	0.6	44
2.0	300	18-60	25	0.62	152	0.5	49
2.5	300	25-80	22	0.63	96	0.8	54
3.2	350	55-110	26	0.60	52	1.2	65

OK 63.30

Type Acid-rutile

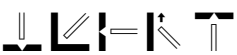
SMAW
E316L-17

Description

OK 63.30 is an extra-low carbon, LMA electrode of the 18Cr12Ni2.8Mo type. It is also suitable for welding stabilised steels of similar composition, except when the full creep resistance of the base material has to be met. OK 63.30 is very easy to strike and restrike and produces weld beads with an excellent appearance and self-relieving slag.

Welding current

DC+, AC OCV 50 V



Classifications

EN 1600	E 19 12 3 L R 1 2
SFA/AWS A5.4	E316L-17
Werkstoff Nr.	1.4430
CSA W48	E316L-17

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	<0.9	0.9	18.0	12.0	2.8	<0.2

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	570
Elongation A5, %	40

Charpy V

Test temps, °C	Impact values, J
+20	60
-20	55
-125	>32
Ferrite content	FN 3-10

Approvals

ABS	E316L-17	LR	316L
BV	U.P. for chemical applications	Sepros	UNA 409820
CL	EN 1600	SS	EN 1600
CWB	CSA W48	UDT	EN 1600
DB	30.039.06	VdTÜV	00262
DNV	316L	Ü	30.039
GL	4571		

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
1.6	300	35-50	29	0.56	250	0.4	37
2.0	300	45-65	29	0.60	147	0.6	39
2.5	300	60-90	29	0.55	96	0.9	45
2.5	350	60-90	30	0.56	83	1.1	41
3.2	350	80-125	30	0.55	52	1.4	57
4.0	350	120-170	32	0.56	34	2.0	57
5.0	350	150-240	32	0.56	21	3.0	63

OK 63.32

Type Rutile

SMAW
E308Mo-26

Description

OK 63.32 is a high-recovery, synthetic, stainless electrode for welding stainless or austenitic-manganese steel to mild or low-alloy steel. OK 63.32 can also be used for the stainless cladding and welding of armour plates.

Welding current

AC, DC+ OCV 55 V

Classifications

EN 1600	E 20 10 3 R 7 3
SFA/AWS A5.4	E308Mo-26
Werkstoff Nr	1.4431

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.08	0.6	0.9	19.3	11.3	2.8	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	560
Tensile strength, MPa	710
Elongation A5, %	34

Charpy V

Test temps, °C	Impact values, J
+20	65

Ferrite content FN 12-20

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	450	110-170	28	0.63	22	2.2	73
4.0	450	140-220	29	0.63	14	3.2	77

OK 63.34

Type Acid-rutile

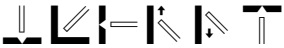
SMAW
E316L-16

Description

OK 63.34 is a stainless electrode of the 19Cr12Ni2.8Mo type, designed for the vertical-down welding of steels of similar composition. OK 63.34 produces beads with avery good finish and a smooth transition to the joint edges. The slag volume is fairly small and is easy to manipulate and easy to remove.

Welding current

DC+, AC OCV 60 V



Classifications

EN 1600	E 19 12 3 L R 1 1
SFA/AWS A5.4	E316L-16
Werkstoff Nr.	1.4430
CSA W48	E316L-16

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.7	0.9	18.0	12.0	2.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	600
Elongation A4, %	40

Charpy V

Test temps, °C	Impact values, J
+20	65
-120	38

Ferrite content FN 3-8

Approvals

CWB	CSA W48
UDT	EN 1600
VdTÜV	03816

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	70-90	22	0.7	94	1.0	39
3.2	300	110-130	25	0.7	59	1.6	39

OK 63.35

Type Basic

SMAW
E316L-15

Description

OK 63.35 is a low-carbon, basic, stainless electrode designed for welding steel of the 18Cr12Ni3Mo type. The high impact toughness at cryogenic temperatures (-196°C) makes OK 63.35 excellent in LNG applications. The weld metal is very resistant to cracking and porosity. OK 63.35 has outstanding welding properties in the vertical and overhead positions.

Welding current

DC+

Classifications

EN 1600	E 19 12 3 L B 2 2
SFA/AWS A5.4	E316L-15
Werkstoff Nr.	1.4430

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.04	0.5	1.7	18.5	12.0	2.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	560
Elongation A4, %	40

Charpy V

Test temps, °C	Impact values, J	Test temps, °C	Impact values, J
+20	95	-120	60
-60	75	-196	35

Ferrite content FN 3-8

Approvals

ABS	Stainless
DNV	316L
SS	EN 1600
UDT	EN 1600
VdTÜV	04815

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	55-85	24	0.63	91	0.9	42
3.2	350	75-110	24	0.63	47	1.3	58
4.0	350	110-150	24	0.62	32	1.8	63
5.0	350	150-200	24	0.62	20	2.6	68

OK 63.41

Type Acid-rutile

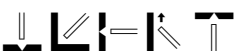
SMAW
E316L-26

Description

OK 63.41 is an extra-low carbon, acid-resistant, high-recovery LMA electrode of the 18Cr12.5Ni2.8Mo type. The electrode is intended for use in the flat position and produces smooth, shiny beads. The fillet weld has a slightly concave cross-section.

Welding current

AC, DC+ OCV 55 V



Classifications

EN 1600	E 19 12 3 L R 5 3
SFA/AWS 5.4	E316L-26
Werkstoff Nr.	1.4430

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.7	0.9	18.0	12.0	2.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	580
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	60
-20	50

Ferrite content FN 3-8

Approvals

DNV	316L
LR	316L, 316LN
SS	EN 1600
UDT	EN 1600
VdTÜV	01014

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	45-65	32	0.61	103	1.0	36
2.5	300	60-100	34	0.61	65	1.6	35
3.2	350	80-130	36	0.58	35	2.1	50
4.0	450	110-170	37	0.60	17	2.9	70
5.0	450	170-230	42	0.61	11	4.0	82

OK 63.80

Type Acid-rutile

SMAW
E318-17

Description

OK 63.80 is a stainless LMA electrode for welding Nb- or Ti-stabilised stainless steels of the 18Cr12Ni2-3Mo type. OK 63.80 is specially designed for welding Nb- and Ti-stabilised stainless steel corresponding to DIN Werkstoff Nr: 4573 and 4583.

Welding current

DC+, AC OCV 50 V

Classifications

EN 1600	E 19 12 3 Nb R 3 2
SFA/AWS A5.4	E318-17
Werkstoff Nr.	1.4576

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.03	0.7	0.9	18.0	12.0	2.8	<0.6	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	620
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	55

Ferrite content FN 6-12

Approvals

SS	EN 1600
UDT	EN 1600
VdTÜV	00639

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	45-65	29	0.56	155	0.8	29
2.5	300	60-90	30	0.56	97	1.1	35
3.2	350	80-120	32	0.61	48	1.4	54
4.0	350	120-170	33	0.61	32	2.1	55

OK 63.85

Type Lime-basic

SMAW
E 318-15

Description

OK 63.85 is a niobium-stabilised 18Cr12Ni2.8Mo electrode for welding steels of similar composition.

Welding current

DC+

Classifications

EN 1600	E 19 12 3 Nb B 4 2
SFA/AWS A5.4	E 318-15
Werkstoff Nr.	1.4576

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.06	0.5	1.7	18.5	12.0	2.8	<1.1	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	490
Tensile strength, MPa	640
Elongation A4, %	35

Charpy V

Test temps, °C	Impact values, J
+20	65
-120	45

Ferrite content FN 5-10

Approvals

Sepros	UNA 409820
UDT	EN 1600
VdTÜV	05662

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	50-80	22	0.66	81	1.0	45
3.2	350	80-120	23	0.64	43	1.5	58
4.0	350	110-160	24	0.64	28	2.0	64
5.0	350	145-210	26	0.61	19	2.7	72

OK 64.30

Type Acid-rutile

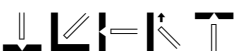
SMAW
E317L-17

Description

OK 64.30 is an acid-rutile electrode for welding 19Cr 13Ni 3.5Mo (317L) austenitic stainless steels. The high Mo content provides better resistance to acid and pitting corrosion compared with 316L types. OK 64.30 is easy to weld in all positions and yields smooth runs on both AC and DC.

Welding current

DC+, AC OCV 55 V



Classifications

EN 1600	E 19 13 4 N L R 3 2
SFA/AWS A5.4	E317L-17
Werkstoff Nr.	(1.4447)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.04	0.7	0.9	19.0	13.0	3.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	600
Elongation A5, %	30

Charpy V

Test temps, °C	Impact values, J
+20	45

Ferrite content FN 5-10

Approvals

UDT	EN 1600
VdTÜV	02311

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	50-80	29	0.56	94	0.8	52
3.2	350	70-120	30	0.56	51	1.4	52
4.0	350	100-170	32	0.56	33	2.1	58

OK 64.63

SMAW

Type Basic-rutile E 18 16 5 N L R 3 2

Description

OK 64.63 is a stainless electrode which deposits a fully austenitic (non-magnetic) weld metal of the CrNiMo type with very good corrosion resistance. It has excellent welding characteristics in all positions apart from vertical down.

Welding current

DC+, AC OCV 60 V

Classifications

EN 1600	E 18 16 5 N L R 3 2
Werkstoff Nr.	1.4440

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.04	0.5	2.7	18.0	17.0	4.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	640
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	75
-120	>32

Ferrite content FN 0

Approvals

UDT	EN 1600
VdTÜV	05199

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	350	80-110	22	0.60	45	1.3	62
4.0	350	110-150	22	0.60	30	1.8	69

OK 67.13

Type Basic-rutile

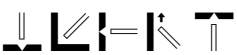
SMAW
E310-16

Description

OK 67.13 is an austenitic, stainless-steel electrode for welding 25Cr20Ni steels. The weld metal resists scaling up to 1100-1150°C and does not contain any measureable ferrite. OK 67.13 can also be used for welding certain air-hardening steels such as armour plate and for welding stainless to unalloyed steel.

Welding current

DC+, AC OCV 65 V



Classifications

EN 1600	E 25 20 R 1 2
SFA/AWS A5.4	E310-16
Werkstoff Nr.	1.4842

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Cu
0.12	0.5	2.0	26.0	21.0	<0.2

Typical mech. properties all weld metal

Yield stress, MPa	560
Tensile strength, MPa	600
Elongation A4, %	35

Charpy V

Test temps, °C	Impact values, J
+20	60

Ferrite content FN 0

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	60-85	21	0.51	101.0	0.8	42
3.2	350	80-120	24	0.51	53.0	1.2	58
4.0	350	105-160	28	0.51	34.0	1.7	61
5.0	350	150-220	31	0.54	20.5	2.6	67

OK 67.15

Type Lime-basic

SMAW
E310-15

Description

OK 67.15 is a stainless-steel electrode for welding 25Cr20Ni steels. It is also suitable for welding armour steel, austenitic-manganese steel and for joining dissimilar steels. OK 67.15 deposits a very crack-resistant weld metal.

Welding current

DC+

Classifications

EN 1600	E 25 20 B 2 2
SFA/AWS A5.4	E310-15
Werkstoff Nr.	1.4842

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.12	0.5	2.2	26.0	21.0	<0.5	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	410
Tensile strength, MPa	590
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	100

Ferrite content FN 0

Approvals

DB	30.039.01
Sepros	UNA 409820
SS	EN 1600
UDT	EN 1600
VdTÜV	01025
Ü	30.039

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	35-55	24	0.62	162	0.6	36
2.5	300	55-85	25	0.61	96	0.9	40
3.2	350	70-110	25	0.59	50	1.2	60
4.0	350	110-150	26	0.59	28	1.8	62
5.0	350	150-200	26	0.60	22	2.5	65

OK 67.20

Type Acid-rutile

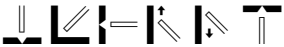
SMAW
(E309MoL-16)

Description

OK 67.20 is an over-alloyed, stainless electrode for welding stainless to mild steel or low-alloy steel. OK 67.20 is designed for positional welding in general (also vertical down).

Welding current

DC+, AC OCV 50 V



Classifications

EN 1600	E 23 12 2 L R 1 1
SFA/AWS A5.4	(E309MoL-16)
Werkstoff Nr.	1.4459

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	1.0	1.0	23.0	13.0	2.8	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	640
Elongation A4, %	35

Charpy V

Test temps, °C	Impact values, J
+20	60

Ferrite content FN 12-20

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.0	300	30-60	25	0.63	151	0.7	32
2.5	300	50-80	25	0.66	91	1.1	37
3.2	350	75-110	26	0.59	48	1.4	55

OK 67.43

Type Rutile-basic

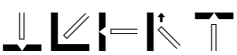
SMAW
(E307-16)

Description

OK 67.43 is an austentitic, stainless steel, AC/DC electrode, which deposits a weld metal with a small amount of uniformly distributed ferrite. The tough weld metal has excellent crack resistance, even when welding steels with very poor weldability. Suitable for welding 13Mn steels and steels of this kind to other steels.

Welding current

AC, DC+ OCV 65 V



Classifications

EN 1600	E 18 8 Mn B 1 2
SFA/AWS A5.4	(E307-16)
Werkstoff Nr.	1.4370

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.13	0.9	6.0	18.5	8.5	0.4	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	630
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	>47
-60	>32

Approvals

DB	30.039.07
UDT	EN 1600
VdTÜV	06797
Ü	30.039

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	60-80	22	0.51	106	0.8	46
3.2	350	90-115	23	0.54	57	1.3	54
4.0	350	100-150	23	0.56	35	1.7	61
5.0	450	130-210	24	0.60	17	2.8	86
6.0	450	210-270	22	0.66	12	3.3	95

OK 67.45

Type Lime-basic

SMAW
(E307-15)

Description

Austenitic stainless steel electrode producing a weld metal with less than 5% ferrite. The tough weld metal has excellent crack resistance, even when welding steels with very poor weldability. Suitable for joining 12 -14% manganese steel to itself or other steels.
It is also suitable for buffer layers before hardfacing.

Welding current

DC+

Classifications

EN 1600	E 18 8 Mn B 4 2
SFA/AWS A5.4	(E307-15)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.11	0.5	6.0	18.5	8.5	<0.5	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	605
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	85

Ferrite content FN <5

Approvals

ABS	Stainless
Sepros	UNA 409820
UDT	EN 1600
VdTÜV	01580

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	50-80	23	0.58	102	0.7	50
3.2	350	70-100	24	0.60	51	1.1	71
4.0	350	100-140	24	0.60	33	1.5	73
5.0	350	150-200	25	0.60	22	2.2	80

OK 67.50

Type Acid-rutile

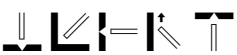
SMAW
E2209-17

Description

OK 67.50 is a rutile coated electrode for welding ferritic-austenitic stainless steels, e.g. UNS S31803. Special applications include the welding of pipes with high resistance to stress corrosion up to 300°C, the so-called Duplex steels. OK 67.50 is particularly suitable for welding duplex cargo tanks.

Welding current

DC+, AC OCV 60 V



Classifications

EN 1600	E 22 9 3 N L R 3 2
SFA/AWS A5.4	E2209-17
Werkstoff Nr.	1.4462
CSA W48	E2209-17

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu	N
<0.03	0.7	0.9	22.3	9.5	3.0	<0.3	0.16

Typical mech. properties all weld metal

Yield stress, MPa	660
Tensile strength, MPa	820
Elongation A5, %	25

Charpy V

Test temps, °C	Impact values, J
+20	50

Ferrite content FN 25-40

Approvals

ABS	For welding duplex steels
BV	2209
CWB	CSA W48
DNV	For duplex SS
GL	4462
LR	S 31803
RINA	2209
Sepros	UNA 409820
UDT	EN 1600
VdTÜV	04368

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.0	300	30-65	29	0.55	152	0.7	33
2.5	300	50-90	27	0.58	91	1.0	38
3.2	350	80-120	28	0.58	47	1.4	55
4.0	350	100-160	29	0.58	32	1.9	59
5.0	350	150-220	30	0.58	20	2.8	64

OK 67.51

Type Acid-rutile

SMAW
E2209-26

Description

High-recovery, stainless electrode for welding ferritic-austenitic (duplex) stainless steels, such as UNS S31803 or the equivalent.
Also excellent for joining duplex to CMn steels.

Welding current

AC, DC+ OCV 60 V

Classifications

EN 1600	E 22 9 3 N L R 53
SFA/AWS A5.4	E2209-26
Werkstoffnummer	1.4462

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu	N
<0.03	0.7	0.9	22.5	9.5	3.0	<0.2	0.16

Typical mech. properties all weld metal

Yield stress, MPa	645
Tensile strength, MPa	800
Elongation A4, %	25

Charpy V

Test temps, °C	Impact values, J
+20	50

Ferrite content FN 30-45

Approvals

DNV For Duplex SS

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	60-100	27	0.59	69	1.4	38
3.2	350	80-130	28	0.59	37	2.1	55
4.0	350	110-170	31	0.59	24	2.4	62

OK 67.52

Type Zirconium-basic

SMAW (E307-25)

Description

OK 67.52 is a synthetic, high-recovery electrode of the 18Cr8Ni6Mn type for welding dissimilar steels, 13Mn steels, steels with reduced weldability and for cladding carbon steels.

Welding current

DC+, AC OCV 70 V

Classifications

EN 1600	E 18 8 Mn B 8 3
SFA/AWS A5.4	(E307-25)
Werkstoff Nr.	1.4370

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Cu
<0.15	1.1	6.0	18.0	9.0	<0.2

Typical mech. properties all weld metal

Yield stress, MPa	420
Tensile strength, MPa	630
Elongation A4, %	45

Charpy V

Test temps, °C	Impact values, J
+20	70

Ferrite content FN <3

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	90-115	25	0.64	49.0	1.4	52
3.2	450	120-165	34	0.68	20.5	2.3	76
4.0	450	150-240	40	0.68	13.5	3.7	72
5.0	450	200-340	48	0.65	9.0	6.0	66

OK 67.53

Type Rutile

SMAW
(E2209-16)

Description

OK 67.53 is a rutile coated electrode designed for welding ferritic-austenitic duplex stainless steel pipes, e g UNS 31803 and 1.4462. The electrode has a thin coating which is ideal for root runs and positional welding.

Welding current

DC+, AC OCV 55 V

Classifications

EN 1600	E 22 9 3 N L R 1 2
SFA/AWS A5.4	(E2209-16)
Werkstoff Nr.	1.4462

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu	N
<0.03	0.9	0.9	23.0	9.5	3.3	<0.3	0.18

Typical mech. properties all weld metal

Yield stress, MPa	660
Tensile strength, MPa	840
Elongation A5, %	25

Charpy V

Test temps, °C	Impact values, J
+20	>40

Ferrite content FN 25-40

Approvals

DNV	For duplex SS
UDT	EN 1600
VdTÜV	05422

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	265	25-60	24	0.64	170	0.5	41
2.5	300	30-80	23	0.63	96	0.7	54
3.2	350	70-110	25	0.57	51	1.3	56

OK 67.55

Type Basic

SMAW
E2209-15

Description

OK 67.55 is a basic coated electrode specially designed for the welding of duplex stainless steel, e.g. UNS S31803. The deposited weld metal gives very high ductility down to -50°C/-60°C. Particularly suitable for welding duplex pipes in offshore applications.

Welding current

DC+

Classifications

EN 1600	E 22 9 3 N L B 2 2
SFA/AWS A5.4	E2209-15
Werkstoff Nr.	1.4462

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	N
<0.04	0.5	0.9	22.5	9.3	3.0	0.15

Typical mech. properties all weld metal

Yield stress, MPa	650
Tensile strength, MPa	800
Elongation A5, %	28

Charpy V

Test temps, °C	Impact values, J
+20	100
-20	85
-40	75
-60	65
Ferrite content	FN 35-50

Approvals

DNV	For duplex SS
Sepros	UNA 409820
UDT	EN 1600
VdTÜV	06774

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	50-80	21	0.58	98	0.8	46
3.2	350	60-100	21	0.58	50	1.0	71
4.0	350	100-140	21	0.58	32	1.5	74

OK 67.60

Type Acid-rutile

SMAW
E309L-17

Description

OK 67.60 is an over-alloyed, stainless electrode for welding stainless to mild steel and low-alloy steel, for surfacing mild steel and for welding the root runs in clad steel. The electrode has excellent weldability in all positions except vertical down, on both AC and DC.

Welding current

DC+, AC OCV 55 V

Classifications

EN 1600	E 23 12 L R 3 2
SFA/AWS A5.4	E309L-17
Werkstoff Nr.	1.4332
CSA W48	E309L-17

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.7	0.9	24.0	13.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	580
Elongation A5, %	32

Charpy V

Test temps, °C	Impact values, J
+20	50
-10	40

Ferrite content FN 12-22

Approvals

CL	EN 1600
CWB	CSA W48
Sepros	UNA 409820
UDT	DIN 1600
VdTÜV	00898

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	30-60	27	0.60	136	0.7	38
2.5	300	50-90	28	0.60	85	1.1	38
3.2	350	90-120	29	0.60	45	1.6	51
4.0	350	130-180	31	0.60	29	2.5	51
4.0	450	130-180	31	0.60	23	2.5	65
5.0	350	160-240	32	0.60	19	3.3	58

OK 67.62

Type Rutile

SMAW
E309-26

Description

OK 67.62 is a synthetic, stainless, high-recovery electrode of the 24Cr12Ni type for welding stainless steel to unalloyed steel. The composition is balanced to produce good crack resistance when welding stainless steel to mild steel. The bead appearance is outstanding in both butt welds and fillet welds.

Welding current

DC+, AC OCV 55 V

Classifications

EN 1600	E Z 23 12 R 7 3
SFA/AWS A5.4	E309-26
Werkstoff Nr.	1.4332

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Cu
<0.07	0.7	0.9	24.0	13.0	<0.2

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	560
Elongation A5, %	36

Charpy V

Test temps, °C	Impact values, J
+20	60
-60	42

Ferrite content FN 12-22

Approvals

BV	UP (min Kv -60 ºC)
DNV	309
GL	4332
LR	CMn/SS
UDT	EN 1600
VdTÜV	03729

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	70-120	25	0.64	49.0	1.2	60
3.2	450	110-165	30	0.64	21.0	2.0	82
4.0	450	150-230	35	0.67	14.5	3.1	82
5.0	450	200-310	38	0.66	9.5	4.5	86

OK 67.66

Type Basic-rutile

SMAW
E309L-16

Description

OK 67.66 is a stainless-steel electrode intended for transition layers when surfacing mild or low-alloyed steel with stainless steel weld metal. Controlled low ferrite level.

Welding current

AC, DC+ OCV 70 V

Classifications

SFA/AWS A5.4	E309L-16

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	0.1	23.0	13.0	<0.5	<0.2

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	580
Elongation A4, %	45

Charpy V

Test temps, °C	Impact values, J
+20	70

Ferrite content FN 4-10

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of elec-trodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
4.0	350	110-150	24	0.58	32	1.7	65

OK 67.70

Type Acid-rutile

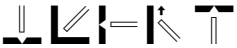
SMAW
E309MoL-17

Description

OK 67.70 is an over-alloyed, stainless-steel electrode for use as a buffer layer when welding acid-resistant clad steels and stainless steels to other types of steel. OK 67.70 has outstanding welding properties on both AC and DC. The electrode can be used in all positions apart from vertical down.

Welding current

DC+, AC OCV 55 V



Classifications

EN 1600	E 23 12 2 L R 3 2
SFA/AWS A5.4	E309MoL-17
Werkstoff Nr.	1.4459
CSA W48	E309LMo-17

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.7	0.9	23.0	13.0	2.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	510
Tensile strength, MPa	610
Elongation A5, %	32

Charpy V

Test temps, °C	Impact values, J
+20	50
-20	> 32

Ferrite content FN 12-22

Approvals

ABS	SS to C&C/Mn steels	RINA	E 309Mo
CL	EN 1600	Sepros	UNA 409820
CWB	CSA W48	SS	EN 1600
DB	30.039.05	UDT	EN 1600
DNV	309 Mo	VdTÜV	02424
LR	SS/CMn	Ü	30.039

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.0	300	30-60	26	0.58	147	0.6	48
2.5	300	50-90	29	0.57	94	0.9	45
3.2	350	90-120	27	0.59	47	1.4	61
4.0	350	130-180	31	0.61	32	2.0	56
5.0	350	160-240	30	0.59	20	2.7	64
5.0	450	160-240	30	0.57	15	2.7	85

OK 67.71

Type Acid-rutile

SMAW
E309MoL-17

Description

OK 67.71 is an over-alloyed, high-recovery electrode for welding transition layers when surfacing mild steel with stainless and joining stainless steel to other types of steel. The ferritic-austenitic weld metal is very crack resistant.

Welding current

DC+, AC OCV 70 V

Classifications

EN 1600	E 23 12 2 L R 5 3
SFA/AWS A5.4	E309MoL-17
Werkstoff Nr.	1.4459

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.04	0.7	0.9	23.0	13.0	2.8	<0.2

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	620
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	55
-60	30

Ferrite content FN 12-22

Approvals

DNV	309 Mo
SS	EN 1600
UDT	EN 1600
VdTÜV	02484

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	350	80-130	34	0.61	35.0	2.2	47
4.0	450	110-170	36	0.61	17.5	3.0	71
5.0	450	170-230	40	0.63	11.0	4.3	79

OK 67.75

Type Basic

SMAW
E309L-15

Description

OK 67.75 is a basic coated, stainless electrode for welding steels of the 24Cr13Ni type, for welding transition layers when surfacing mild steel with stainless, for joining dissimilar steels and welding root runs in the stainless side of clad steels.

Welding current

DC+

Classifications

EN 1600	E 23 12 L B 4 2
SFA/AWS A5.4	E309L-15
Werkstoff Nr.	1.4332

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.04	0.5	2.2	24.0	13.0	<0.5	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	600
Elongation A4, %	35

Charpy V

Test temps, °C	Impact values, J
+20	75
-80	55

Ferrite content FN 12-22

Approvals

ABS	Stainless
DNV	309
LR	SS to C/Mn Steels
Sepros	UNA 409820
UDT	EN 1600
VdTÜV	00633

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	50-80	22	0.73	78.0	1.1	42
3.2	350	80-110	24	0.73	39.0	1.5	60
4.0	350	100-150	26	0.73	25.0	2.3	62
5.0	350	160-220	27	0.73	16.5	3.4	65

OK 68.15

Type Lime-basic

SMAW
E410-15

Description

OK 68.15 is a stainless-steel electrode which deposits a ferritic 13Cr weld metal. OK 68.15 is designed for welding steels of similar composition, when CrNi-alloyed austenitic stainless steel electrodes cannot be used, e.g. when the structure is going to be exposed to aggressive sulphuric gases. Depending on the welding parameters, the structure and consequently the mechanical properties of untreated weld metal can vary within fairly large limits.

Welding current

DC+

Classifications

EN 1600	E 13 B 4 2
SFA/AWS A5.4	E410-15
Werkstoff Nr.	1.4009

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.06	<0.7	<1.0	12.5	<0.6	<0.5	<0.2

Typical mech. properties all weld metal

	PWHT 750 °C/ 1h
Yield stress, MPa	370
Tensile strength, MPa	520
Elongation A4, %	25

Charpy V

Test temps, °C	Impact values, J
+20	55
0	35
-20	20

Approvals

Sepros	UNA 409820
UDT	EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	65-115	25	0.62	73	1.0	48
3.2	450	90-160	25	0.63	33	1.5	71
4.0	450	120-220	30	0.57	24	2.0	73
5.0	450	170-270	30	0.60	15	2.5	85

OK 68.17

Type Rutile-basic

SMAW
E410NiMo-16

Description

OK 68.17 is a coated electrode designed for the welding of stainless-steel castings of the 13Cr4NiMo type, for example. OK 68.17 can be welded in all positions apart fromvertical down.

Welding current

DC+, AC OCV 55 V

Typical all weld metal hardness

As welded:	36 HRC
	After PWHT:
600 °C/ 1h	29 HRC
600 °C/ 8h	25 HRC

Classifications

EN 1600	E 13 4 R 3 2
SFA/AWS A5.4	E410NiMo-16
Werkstoff Nr.	1.4351

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	0.8	11.8	4.5	0.6	<0.3

Typical mech. properties all weld metal

	PWHT (600 °C/ 8h)
Yield stress, MPa	650
Tensile strength, MPa	870
Elongation A5, %	17

Charpy V

Test temps, °C	Impact values, J
+20	45
-10	45
-40	40

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	55-100	21	0.62	72.5	0.8	61
3.2	350	65-135	21	0.59	44.8	1.2	66
4.0	450	90-190	24	0.59	22.7	1.7	92

OK 68.25

Type Basic

SMAW
E410NiMo-15

Description

OK 68.25 is an electrode for welding corrosion-resistant, martensitic and martensitic-ferritic rolled, forged and cast steels, such as castings of 13Cr4NiMo type.

Welding current

DC+

Classifications

EN 1600	E 13 4 B 4 2
SFA/AWS A5.4	E410NiMo-15
ISO 3581	E 13.4 B
Werkstoff Nr.	1.4351

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
<0.04	0.5	0.8	12.0	4.5	0.6

Typical mech. properties all weld metal

	PWHT 600°C/8h
Yield stress, MPa	680
Tensile strength, MPa	880
Elongation A5, %	17

Charpy V

Test temps, °C	Impact values, J
+20	60
0	56
-20	53

Approvals

Sepros	UNA 409820
UDT	EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	450	90-150	28	0.64	34.5	1.6	63
4.0	450	110-190	28	0.66	21.6	2.2	73
5.0	450	140-250	27	0.67	13.7	3.1	86

OK 68.37

Type Basic

SMAW
E Z 17.4.1 B 20

Description

Basic coated electrode for joining and repairing corrosion-resistant, martensitic, rolled, forged and cast steels, such as hydro-turbine runners of the 17Cr4NiMo type.

Welding current

DC+

Classifications

NF A 81-343	E Z 17.4.1 B 20

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
<0.06	<0.3	1.2	16.0	5.5	0.5

Typical mech. properties all weld metal

	PWHT(600°C/3h)
Yield stress, MPa	710
Tensile strength, MPa	950
Elongation A5, %	14

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	55-80	26	0.71	70	1.0	51
3.2	450	90-120	29	0.74	33	1.5	73
4.0	450	135-170	29	0.71	22	2.0	82

OK 68.53

SMAW

Type Basic-rutile E 25 9 4 N L R 3 2

Description

OK 68.53 is a coated electrode for welding austenitic-ferritic steels of Super Duplex types, e.g. SAF 2507 and Zeron 100. OK 68.53 has good welding characteristics in all positions and the slag is easily detachable.

Welding current

DC+, AC OCV 60 V

Classifications

EN 1600	E 25 9 4 N L R 3 2
Werkstoff Nr.	(1.4410)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	N
<0.04	0.6	0.8	25.2	9.8	4.0	0.25

Typical mech. properties all weld metal

Yield stress, MPa	700
Tensile strength, MPa	850
Elongation A5, %	30

Charpy V

Test temps, °C	Impact values, J
+20	50
-40	40

Ferrite content	FN 35-50

Approvals

UDT	EN 1600
VdTÜV	07377

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	55-85	22	0.60	94	0.9	43
3.2	350	70-110	22	0.60	47	1.2	62
4.0	350	110-150	23	0.60	32	1.7	67

OK 68.55

Type Basic

SMAW

E 25 9 4 N L B 4 2

Description

OK 68.55 is a basic coated electrode for welding austenitc-ferritic steels of the Super Duplex type, e. g. SAF 2507 and Zeron 100. OK 68.55 deposits a weld metal with high ductility.

Welding current

DC+

Corrosion data

ASTM A-262

Practice B: 0.24mm/year

Practice C: 0.20mm/year

NACE TM 01-77:

Stress level: 770 MPa

Time to fracture (h): >720

ASTM G48-76: 60ºC

Classifications

EN 1600	E 25 9 4 N L B 4 2
Werkstoff Nr.	(1.4410)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	N
<0.04	0.5	0.8	25.3	9.8	4.0	0.25

Typical mech. properties all weld metal

Yield stress, MPa	700
Tensile strength, MPa	900
Elongation A5, %	28

Charpy V

Test temps, °C	Impact values, J
+20	90
-20	70
-40	55
-60	45
Ferrite content	FN 35-50

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	50-80	23	0.62	93	0.8	48
3.2	350	60-100	23	0.63	46	1.1	68
4.0	350	100-140	23	0.62	32	1.6	70

OK 68.81

Type Acid-rutile

SMAW
E312-17

Description

OK 68.81 is a high-alloyed electrode which deposits a ferritic-austenitic duplex weld metal with approx. 40% ferrite. It is resistant to stress corrosion and is highly insensitive to dilution. Good scaling resistance up to 1150°C. OK 68.81 is used for joining dissimilar steels, steels with reduced weldability and buffer layers prior to hardfacing. Applications: rolls, forging diies, hot-work tools, dies for plastics and so on.

Welding current

DC+, AC OCV 60 V

Classifications

EN 1600	E 29 9 R 3 2
SFA/AWS A5.4	E312-17
Werkstoff Nr.	1.4337

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.12	0.7	0.8	29.0	9.8	<0.5	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	610
Tensile strength, MPa	790
Elongation A5, %	22

Charpy V

Test temps, °C	Impact values, J
+20	30

Ferrite content FN 50-80

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	35-60	22	0.64	123.0	0.7	41
2.5	300	50-85	24	0.64	78.0	0.9	48
3.2	350	80-125	25	0.62	42.0	1.3	65
4.0	350	110-175	26	0.62	26.0	2.0	66
5.0	350	150-240	28	0.65	16.5	3.2	68

OK 68.82

Type Acid-rutile

SMAW
(E312-17)

Description

OK 68.82 is a high-alloyed electrode which deposits a ferritic-austenitic duplex weld metal with approx. 30-35% ferrite. It is resistant to stress corrosion and highly insensitive to dilution. Good scaling resistance up to 1150°C. OK 68.82 is used for joining steels with reduced weldability and buffer layers prior to hard surfacing, dissimilar steels, rolls, aluminium-forging diies, hot-work tools, dies for plastic and so on.

Welding current

DC+, AC OCV 55 V

Classifications

EN 1600	E 29 9 R 1 2
SFA/AWS A5.4	(E312-17)
Werkstoff Nr.	1.4337

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.12	1.0	0.9	29.0	10.0	<0.5	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	750
Elongation A5, %	25

Charpy V

Test temps, °C	Impact values, J
Ferrite content	FN 50-80

Approvals

UDT	EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	30-60	26	0.54	166	0.7	33
2.5	300	60-90	25	0.52	104	1.0	45
3.2	350	80-120	26	0.52	55	1.3	57
4.0	350	110-170	30	0.55	36	2.0	60
5.0	350	140-230	30	0.55	22	2.7	71

OK 69.25

SMAW

Type Basic E 20 16 3 Mn N L B 4 2

Description

Basic coated, stainless electrode for welding corrosion-resistant, non-magnetic and cryogenic stainless steels. The electrode produces a fully austenitic Cr-Ni-Mo weld metal with an increased Mn and N content.

Welding current

DC+

Classifications

EN 1600	E 20 16 3 Mn N L B 4 2
Werkstoffnummer	1.4455

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
<0.04	0.5	6.5	19.0	16.0	3.0

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	650
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	90
-196	50

Ferrite content FN <0.5

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	50-80	23	0.62	84	0.9	54
3.2	350	70-100	24	0.62	46	1.2	72
4.0	350	100-140	25	0.64	29	1.8	74

OK 69.33

Type Basic-rutile

SMAW
E385-16

Description

OK 69.33 is a stainless-steel electrode which deposits a fully austenitic weld metal with increased resistance to sulphuric acid. The weld metal of OK 69.33 also has good resistance to intergranular and pitting corrosion.

Welding current

AC, DC+ OCV 65 V

Classifications

EN 1600	E 20 25 5 Cu N L R 3 2
SFA/AWS A5.4	E385-16
Werkstoff Nr.	1.4519

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.3	20.5	25.5	4.8	1.6

Typical mech. properties all weld metal

Yield stress, MPa	400
Tensile strength, MPa	575
Elongation A4, %	35

Charpy V

Test temps, °C	Impact values, J
+20	80
-140	45

Ferrite content FN 0

Approvals

Sepros	UNA 409820
UDT	EN 1600
VdTÜV	02723

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	40-60	23	0.58	125	0.7	40
2.5	300	60-85	24	0.60	91	0.9	44
3.2	350	85-130	27	0.58	41	1.5	60
4.0	350	120-180	29	0.51	30	1.9	64
5.0	350	160-240	31	0.51	19	2.5	78

OK 69.63 SMAW

Type Rutile-basic E 20 25 5 Cu N L 3 2

Description

OK 69.63 is a rutile-basic coated electrode which deposits a fully austenitic (non-magnetic) weld metal of the CrNiMo type with very high corrosion resistance.

Welding current

DC+, AC OCV 60 V

Classifications

EN 1600	E 20 25 5 Cu N L 3 2

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu	N
<0.04	<0.6	2.8	20.0	25.0	6.5	1.2	0.16

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	680
Elongation A4, %	40

Charpy V

Test temps, °C	Impact values, J
+20	80
-140	50

Ferrite content FN 0

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	60-90	22	0.62	82	1.1	41
3.2	350	80-110	22	0.60	45	1.3	62
4.0	350	110-150	22	0.60	30	1.8	69

FILARC BM310Mo-L

SMAW

Type Basic-rutile (E310Mo-16)

Description

FILARC BM310Mo-L is a basic electrode for joining and cladding steel containing 25% Cr, 22% Ni and 2% Mo. The weld metal has excellent resistance to very aggressive corrosive media, such as those in urea plants. The fully austenitic weld metal is insensitive to hot cracking.
This electrode is approved for the construction and repair of urea plants using the stamicarbon process. It has been extensively tested for this purpose. BM310Mo-L is regularly substituted for AISI 316L electrodes for routine repair work on urea plants to obtain superior resistance to corrosive attack, without hot cracking.
Welding advice: use short arc, interpass temperature: 150°C.

Welding current

DC+

Classifications

EN 1600	E 25 22 2 N L R 1 2
SFA/AWS A5.4	(E310Mo-16)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu	N
<0.04	<0.5	4.3	25.0	22.0	2.2	<0.3	0.15

Typical mech. properties all weld metal

Yield stress, MPa	442
Tensile strength, MPa	623
Elongation A5, %	34

Charpy V

Test temps, °C	Impact values, J
+20	54

Ferrite content FN 0

Approvals

Stamicarbon Ureaplants

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	55-70	24	0.72	77	0.9	52
3.2	350	70-100	24	0.56	50	1.1	62
4.0	350	100-140	25	0.55	33	1.7	62

OK Tubrod 14.20 FCAW

Type Rutile E308LT1-4

Description

OK Tubrod 14.20 is a rutile, flux-cored wire, specifically designed to operate in the vertical and overhead positions when welding 304, 304L, 308 and 308L stainless steels. The stabilised 321 and 347 steels may also be welded. OK Tubrod 14.20 complements OK Tubrod 14.30 and the two are used in conjuction with each other to maximise productivity in multi-positional applications. Shielding gas Ar+20% CO_2.

Welding current

DC+

Classifications

EN 12073	T 19 9 L P M 2
SFA/AWS A5.22	E308LT1-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni
0.032	0.8	1.2	19.5	10.0

Typical mech. properties all weld metal

Yield stress, MPa	403
Tensile strength, MPa	593
Elongation, %	45

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	130-220	25-29

OK Tubrod 14.21

FCAW

Type Rutile E316LT1-4

Description

OK Tubrod 14.21 is a flux-cored wire for the out-of-position welding of 316 and 316L type stainless steels where increased resistance to pitting corrosion is required. This is particularly relevant when it comes to attack by chloride solutions and sulphuric acid. The weld metal composition is such that the stabilised 321 and 347 stainless steels may also be welded. This wire complements OK Tubrod 14.31. Shielding gas Ar+20% CO_2.

Welding current

DC+

Classifications

EN 12073	T 19 12 3 L P M 2
SFA/AWS A5.22	E316LT1-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
0.023	0.9	1.2	19.0	12.0	2.5

Typical mech. properties all weld metal

Yield stress, MPa	475
Tensile strength, MPa	615
Elongation, %	36

Approvals

VdTÜV 05730

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	130-220	25-29

OK Tubrod 14.22

FCAW

Type Rutile E309LT1-4

Description

OK Tubrod 14.22 is a flux-cored, tubular wire which produces weld metal of the 309 type. While suitable for25Cr12Ni type steels, the principal application is the vertical and overhead joining of dissimilar and difficult-to-weld steels. This includes the joining of clad steels to themselves and carbon-manganese steels. Shielding gas Ar+20% CO_2.

Welding current

DC+

Classifications

EN 12073	T 23 12 L P C 2, T 23 12 L P M 2
SFA/AWS A5.22	E309LT1-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni
0.034	0.9	1.3	22.6	12.6

Typical mech. properties all weld metal

Yield stress, MPa	459
Tensile strength, MPa	589
Elongation, %	37

Approvals

ABS	E309 LT1-4	80Ar/20CO_2
CL		80Ar/20CO_2
DNV	309L	80Ar/20CO_2
GL	4332S	80Ar/20CO_2
LR	SS/CMn	80Ar/20CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	130-220	25-29

OK Tubrod 14.27

FCAW

Type Rutile E2209T0-1

Description

An all-positional, duplex, stainless-steel, cored wire for use with M21 or C1 shielding gas. All positional apart fromvertical down.

Welding current

DC+

Classifications

EN 12073	T 22 9 3 N L P C 2, T 22 9 3 N L P M 2
SFA/AWS A5.22	E2209T0-1, E2209T0-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	N
0.028	0.8	1.0	22.6	8.9	3.0	0.15

Typical mech. properties all weld metal

Yield stress, MPa	637
Tensile strength, MPa	828
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J
-40	51

Approvals

ABS	E2209 T1-4
CL	(M21 only)
DNV	Duplex (M21 only)
GL	4462S
RINA	SG 2209
UDT	EN 12073
VdTÜV	07066

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-250	26-30

OK Tubrod 14.28 FCAW

Type Rutile

Description

A rutile, flux-cored, tubular wire for the all-positional welding of "super duplex" stainless steels. The rutile-based formulation ensures that the arc action is smooth and stable, leaving a weld deposit of consistent appearance with easy slag removal. The weld metal composition affords the highest resistance to pitting and crevice corrosion, as well as stress corrosion. Shielding gas Ar+20% CO_2.

Welding current

DC+

Classifications

no applicable classifications

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Ni
0.034	0.6	0.9	25.2	9.2	3.9	0.25

Typical mech. properties all weld metal

Yield stress, MPa	650
Tensile strength, MPa	820
Elongation, %	18

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-250	26-30

OK Tubrod 14.30

FCAW

Type Rutile E308LT0-1

Description

OK Tubrod 14.30 is a flux-cored, tubular wire designed for welding stainless steels containing 18-20Cr8-12Ni. In addition to the low-carbon 304 and 308 varieties, OK Tubrod 14.30 is also suitable for welding the stabilised 321 and 347 types. Slag detachability is effortless, leaving a bright finish to a weld deposit of exceptional appearance. Shielding gas CO_2 or Ar+20%CO_2.

Welding current

DC+

Classifications

EN 12073	T 19 9 L R M 3
SFA/AWS A5.22	E308LT0-1, E308LT0-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni
0.023	0.4	1.6	19.0	10.0

Typical mech. properties all weld metal

Yield stress, MPa	390
Tensile strength, MPa	560
Elongation, %	39

Approvals

DB	43.039.04	Ar/20%CO_2 &CO_2
LR	304L	Ar/20%CO_2 &CO_2
Ü	43.039/2	Ar/20%CO_2 &CO_2
VdTÜV	05145	Ar/20%CO_2 &CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-250	25-32
1.6	200-350	26-34

OK Tubrod 14.31 FCAW

Type Rutile E316LT0-1

Description

A flux-cored, tubular wire for joining the 316 low-carbon type 18-20Cr10-14Ni2-3Mo steels. The composition also ensures that the stabilised types can be welded with equal success. As it is capable of welding in the spray transfer mode, very high deposition rates are assured. The weld appearance is bright and fine, with an evenly rippled surface finish with minimal spatter. Shielding gas CO_2 or Ar+20%CO_2.

Welding current

DC+

Classifications

EN 12073	T 19 12 3 L R M 3
SFA/AWS A5.22	E316LT0-1, E316LT0-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
0.025	0.5	1.7	19.4	12.0	2.7

Typical mech. properties all weld metal

Yield stress, MPa	410
Tensile strength, MPa	570
Elongation, %	33

Charpy V

Test temps, °C	Impact values, J
+20	40
-196	32

Approvals

DB	43.039.08	Ar/20%CO_2 &CO_2
LR	316L	Ar/20%CO_2 &CO_2
Ü	43.039/2	Ar/20%CO_2 &CO_2
VdTÜV	05147	Ar/205CO_2 &CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-250	25-32
1.6	200-350	26-34

OK Tubrod 14.32

FCAW

Type Rutile E309LT0-1

Description

A flux-cored, tubular wire depositing weld metal of the 309 type. Apart from joining these steels, the weld metal ferrite content ensures that it is suitable for dissimilar applications, as well as joining difficult-to-weld steels. Shielding gas CO_2 or Ar+20%CO_2.

Welding current

DC+

Classifications

EN 12073	T 23 12 L R M 3
SFA/AWS A5.22	E309LT0-1, E309LT0-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni
0.030	0.4	1.6	24.0	13.0

Typical mech. properties all weld metal

Yield stress, MPa	449
Tensile strength, MPa	594
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
+20	42

Approvals

DB	43.039.09	Ar/20%CO_2 &CO_2
LR	SS-CMn (C)	Ar/20%CO_2 &CO_2
Ü	43.039/2	Ar/20%CO_2 &CO_2
VdTÜV	05149	Ar/20%CO_2 &CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-250	25-32
1.6	200-350	26-34

OK Tubrod 14.33 FCAW

Type Rutile E309LMoT0-1

Description

OK Tubrod 14.33 is a flux-cored, tubular wire producing weld metal of the 309+ MoL type composition. The austenitic-ferritic weld deposit has an exceptionally high resistance to hot cracking when welding dissimilar steels. Applications of this kind include the welding of buffer layers for acid-resistant clad steels and surfacing. It is also ideally suited to the welding of mild and low-alloy steels to a wide range of stainless steels. Shielding gas CO_2 or Ar+20% CO_2.

Welding current

DC+

Classifications

EN 12073	T 23 12 2 L R M 3
SFA/AWS A5.22	E309LMoT0-1, E309LMoT0-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
0.022	0.4	1.7	23.0	12.0	2.2

Typical mech. properties all weld metal

Yield stress, MPa	526
Tensile strength, MPa	672
Elongation, %	34

Charpy V

Test temps, °C	Impact values, J
+20	44

Approvals

LR	SS-CMn (C)	CO_2
RINA	SG 309Mo	Ar/20%CO_2
VdTÜV	05268	Ar/20%CO_2 &CO_2

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-250	25-32

OK Tubrod 14.34

FCAW

Type Rutile E347T0-1

Description

OK Tubrod 14.34 is a flux-cored wire for welding the 19Cr10Ni typ of niobium- and titanium-stabilised stainless steels. These steels are widely used in the chemical and process plant industries, where resistance to intergranular corrosion is required. These steels include the 302, 304, 321 types, as well as the standard 347 type. Shielding gas CO_2 or Ar+20% CO_2.

Welding current

DC+

Classifications

EN 12073	T 19 9 Nb R M 3
SFA/AWS A5.22	E347T0-1, E347T0-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb+Ta
0.038	0.5	1.6	19	12	2.2	0.8

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	610
Elongation, %	41

Charpy V

Test temps, °C	Impact values, J
0	56

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-250	25-32

OK Tubrod 14.37 FCAW

Type Rutile E2209T0-1

Description

OK Tubrod 14.37 is a flux-cored, tubular wire developed for welding duplex stainless steels corresponding to ASTM A240S31803 and DIN 1.4462. The weld metal is of the 22Cr9Ni3Mo type, which exhibits exeptional resistance to pitting and inter-granular corrosion, as well as stress corrosion cracking. Shielding gas CO_2 or Ar+20% CO_2.

Welding current

DC+

Classifications

EN 12073	T 22 9 3 N L R C 3, T 22 9 3 N L R M 3
SFA/AWS A5.22	E2209T0-1, E2209T0-4

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	N
0.03	0.7	0.9	22.6	8.9	3.1	0.13

Typical mech. properties all weld metal

Yield stress, MPa	633
Tensile strength, MPa	768
Elongation, %	31

Charpy V

Test temps, °C	Impact values, J
-100	49

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-250	25-30

OK Tubrod 15.30 FCAW

Type Metal-cored T 19 9 L M M 2

Description

AISI 304 type metal-cored wire developed for high deposition welding of (multilayer) standing fillet welds. No slag and low spatter, making it suitable for mechanised and robotic operation, as well as for cladding.
Shielding gas: M13 (Ar/2%O_2)

Welding current

DC+

Classifications

EN 12073	T 19 9 L M M 2

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni
0.023	0.7	1.3	19.0	10.0

Typical mech. properties all weld metal

Yield stress, MPa	333
Tensile strength, MPa	540
Elongation, %	45

Charpy V

Test temps, °C	Impact values, J
-196	44

Approvals

DB	43.039.02
Ü	43.039/2
VdTÜV	03014

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	18-34

OK Tubrod 15.31 FCAW

Type Metal-cored T 19 12 3 L M M 2

Description

AISI 316 type metal-cored wire developed for high deposition welding of (multilayer) standing fillet welds. No slag and low spatter, making it suitable for mechanised and robotic operation, as well as for cladding.
Shielding gas: M13 (Ar/2%O_2)

Welding current

DC+

Classifications

EN 12073	T 19 12 3 L M M 2

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
0.021	0.7	1.3	18.0	12.0	2.8

Typical mech. properties all weld metal

Yield stress, MPa	416
Tensile strength, MPa	575
Elongation, %	37

Charpy V

Test temps, °C	Impact values, J
-196	40

Approvals

DB	43.039.07
DNV	316L MS
LR	316L S 316LS
Ü	43.039/2
VdTÜV	03171

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	18-34
1.6	150-450	18-39

OK Tubrod 15.34 FCAW

Type Metal-cored T 18 8 Mn M M 2

Description

AISI 307 type metal-cored wire with a hot cracking-resistant austenitic weld metal, for welding armour steel, austenitic-manganese steel and dissimilar steels. Designed for the high deposition welding of (multi-layer) standing fillet welds. Shielding gas M13 (Ar/2%O_2)

Welding current

DC+

Classifications

EN 12073	T 18 8 Mn M M 2

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni
0.1	0.7	6.3	18.5	8.0

Typical mech. properties all weld metal

Yield stress, MPa	410
Tensile strength, MPa	635
Elongation, %	39

Charpy V

Test temps, °C	Impact values, J
-60	45

Approvals

DB	43.039.03
Ü	43.039/2
VdTÜV	04404

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	18-34

OK Tubrod 15.37

FCAW

Type Metal-cored EC2209

Description

Metal-cored wire for welding duplex stainless steels. Designed for the high deposition welding of (multi-layer) standind fillet welds. No slag and low spatter, making it suitable for mech.anised and robotic operation. Shielding gas Ar/2%CO_2 or Ar/2%O_2.

Welding current

DC+

Classifications

EN 12073	T 22 9 3 N L M M 2
SFA/AWS A5.9	EC2209

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	N
0.016	0.6	0.8	22.0	9.0	3.0	0.13

Typical mech. properties all weld metal

Yield stress, MPa	556
Tensile strength, MPa	735
Elongation, %	32

Charpy V

Test temps, °C	Impact values, J
-20	72
-50	56

Approvals

GL	4462 S
VdTÜV	09775

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	18-34

OK Autrod 308H

GMAW
ER308H

Description

A continuous, solid, corrosion-resistant, chromium-nickel wire for welding austenitic chromium-nickel alloys of the 18% Cr-8% Ni type. OK Autrod 308H has good general corrosion resistance. The alloy has a high carbon content, making it suitable for applications used at higher temperatures. The alloy is used in chemical and petrochemical plants for the welding of pipes, cyclones and boilers.

Welding current

DC (+)

Classifications

SFA/AWS A5.9	ER308H
EN 12072	G 19 9 H

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
0.06	0.5	1.8	20.3	10.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	>350
Tensile strength, MPa	>550
Elongation, %	>30

Charpy V

Test temps, °C	Impact values, J

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.9-8.4	80-190	16-24	1.0-3.1
1.2	4.9-8.5	180-280	20-28	2.6-4.6
1.6	3.2-5.5	230-350	24-28	3.0-5.2

OK Autrod 308LSi GMAW

ER308LSi

Description

A continuous, solid, corrosion-resistant, chromium-nickel wire for welding austenitic chromium-nickel alloys of the 18 Cr-8% Ni type. OK Autrod 308LSi has good general corrosion resistance. The alloy has a low carbon content, making it particularly recommended where there is a risk of intergranular corrosion. The higher silicon content improves the welding properties such as wetting. The alloy is widely used in the chemical and food processing industries, as well as for pipes, tubes and boilers.

Welding current

DC(+)

Classifications

SFA/AWS A5.9	ER308LSi
EN 12072	G 19 9 LSi
Werkstoffnummer	~1.4316

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.8	1.8	20.3	10.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	370
Tensile strength, MPa	620
Elongation, %	36

Charpy V

Test temps, °C	Impact values, J
+20	110
-60	90
-196	60

Approvals

DB	43.039.01
DNV	308L MS (-60ºC)
Sepros	UNA 485178
UDT	DIN 8556
VdTÜV Ü	43.039/1

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.6				
0.8	4.0-17.0	55-160	15-24	1.0-4.2
0.9	3.5-18.0	65-220	15-28	1.1-5.4
1.0	4.0-16.0	80-240	15-28	1.5-6.0
1.2	3.0-14.0	100-300	15-29	1.6-7.5
1.6	5.5-9.0	230-375	23-29	5.2-8.6

OK Autrod 309LSi

GMAW

ER309LSi

Description

A continuous, solid ,corrosion-resistant, chromium-nickel wire for welding steels with a similar composition, wrought and cast steels of the 23% Cr -12% Ni types. The alloy is also used for welding buffer layers on CMn steels and weldingdissimilar joints. When using the wire for buffer layers and dissimilar joints, it is necessary to control the dilution of the weld.
OK Autrod 309LSi has good general corrosion resistance. The higher silicon content improves the welding properties such as wetting.

Welding current

DC(+)

Classifications

SFA/AWS A5.9	ER309LSi
EN 12072	G 23 12 LSi
Werkstoffnummer	~1.4332

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.8	1.8	24.0	13.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	600
Elongation, %	41

Charpy V

Test temps, °C	Impact values, J
+20	160
-60	130
-110	90

Approvals

DB	43.039.16
UDT	DIN 8556
VdTÜV	
Ü	43.039/1

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	4.0-17.0	55-160	15-24	1.0-4.0
0.9	3.5-18.0	65-220	15-28	1.1-5.4
1.0	4.0-16.0	80-240	15-28	1.5-6.0
1.2	3.0-14.0	100-300	15-29	1.6-7.5
1.6	5.5-9.0	230-375	23-31	5.2-8.6

OK Autrod 309MoL GMAW

G 23 12 2 L

Description

A continuous, solid, corrosion-resistant wire of the 309LM type.
OK Autrod 309MoL is used for the overlay welding of unalloyed and low-alloyed steels and for welding dissimilar steels, such as 316L, to unalloyed and low-alloyed steels when Mo is essential.

Welding current

DC(+)

Classifications

EN 12072	G 23 12 2 L

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo
<0.03	<1.0	1.8	23.0	13.3	2.8

Typical mech. properties all weld metal

Yield stress, MPa	400
Tensile strength, MPa	600
Elongation, %	31

Charpy V

Test temps, °C	Impact values, J
+20	110

Approvals

RINA	Restricted availability
UDT	DIN 8556
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.9-8.4	80-190	16-24	1.0-3.2
1.2	4.9-8.5	180-280	20-28	2.7-4.6
1.6	3.2-5.5	230-350	24-28	3.0-5.2

OK Autrod 310

GMAW
ER310

Description

A continuous, solid ,corrosion-resistant, chromium-nickel wire for welding heat-resistant austenitic steels of the 25% Cr, 20% Ni types.
OK Autrod 310 has good general oxidation resistance, especially at high temperatures, due to its high Cr content. The alloy is fully austenitic and is therefore sensitive to hot cracking. Common applications include industrial furnaces and boiler parts, as well as heat exchangers.

Welding current

DC(+)

Classifications

SFA/AWS A5.9	ER310
EN 12072	G 25 20

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
0.1	0.5	1.8	26.0	21.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	390
Tensile strength, MPa	590
Elongation, %	43

Charpy V

Test temps, °C	Impact values, J
+20	175
-196	60

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.9-8.4	80-190	16-24	1.1-3.2
1.2	4.9-8.5	180-280	20-28	2.7-4.6
1.6	3.2-5.5	230-350	24-28	3.1-5.2

OK Autrod 312

GMAW
ER312

Description

A continuous, solid, corrosion-resistant, chromium-nickel wire for welding stainless steels of the 29% Cr, 9% Ni types.
OK Autrod 312 has good oxidation resistance at high temperatures due to its high content of Cr. The alloy is widely used for joining dissimilar steels, especially if one of the components is fully austenitic, and steels that are difficult to weld, i.e. machine components, tools and austenitic-manganese steels.

Welding current

DC(+)

Classifications

SFA/AWS A5.9	ER312
EN 12072	G 29 9

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.15	0.5	1.8	30.5	9.5	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	610
Tensile strength, MPa	770
Elongation, %	20

Charpy V

Test temps, °C	Impact values, J
+20	50

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.9-8.4	80-190	16-24	1.1-3.2
1.2	4.9-8.5	180-280	20-28	2.7-4.6
1.6	3.2-5.5	230-350	24-28	3.1-5.2

OK Autrod 316LSi GMAW

G 19 12 3 LSi

Description

A continuous, solid , corrosion-resistant, chromium-nickel-molybdenum wire for welding austenitic stainless alloys of the 18% Cr -8% Ni and 18% Cr -10% Ni -3% Mo types.
OK Autrod 316LSi has good general corrosion resistance; in particular, the alloy has very good resistance to corrosion in acid and chlorinated environments. The alloy has a low carbon content which makes it particularly recommended when there is a risk of intergranular corrosion. The higher silicon content improves the welding properties such as wetting. The alloy is widely used in the chemical and food processing industries, as well as in shipbuilding and various types of architectural structure.

Welding current

DC(+)

Classifications

EN 12072	G 19 12 3 LSi
SFA/AWS A5.9	ER316LSi
Werkstoffnummer	~1.4430

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.8	1.8	19.0	12.5	2.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	620
Elongation, %	37

Charpy V

Test temps, °C	Impact values, J
+20	120
-60	95
-196	55

Approvals

DB	43.039.05
DNV	316L MS (-120°c)
UDT	DIN 8556
VdTÜV	
Ü	43.039/1

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	4.0-17.0	55-160	12-24	1.0-4.2
0.9	3.5-18.0	65-220	15-28	1.1-5.4
1.0	4.0-16.0	80-240	15-28	1.5-6.0
1.2	3.0-14.0	100-300	15-29	1.6-7.5
1.6	5.5-9.0	230-375	23-31	5.2-8.6

OK Autrod 317L

GMAW
ER 317L

Description

A continuous, solid, corrosion-resistant, chromium-nickel-molybdenum wire for welding austenitic stainless alloys of the 19% Cr, 13% Ni, 3% Mo types.
OK Autrod 317L has good resistance to general corrosion and pitting due to its high content of molybdenum. The alloy has a low carbon content which makes it particularly recommended where there is a risk of intergranular corrosion. The alloy is used in severe corrosion conditions, such as in the petrochemical, pulp and paper industries.

Welding current

DC(+)

Classifications

SFA/AWS A5.9	ER 317L
EN 12072	G 18 15 3 L

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	19.3	14.0	3.5	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	390
Tensile strength, MPa	600
Elongation, %	45

Charpy V

Test temps, °C	Impact values, J
+20	80

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.6-7.1	80-190	16-24	0.9-2.6
1.2	4.9-8.5	180-280	20-28	2.7-4.6
1.6	3.2-5.5	230-350	24-28	3.0-5.2

OK Autrod 318Si GMAW

G 19 12 3 NbSi

Description

A continuous, solid, corrosion-resistant, stabilised, chromium-nickel-molybdenum wire for welding Cr-Ni-Mo and Cr-Ni stabailised or non-stabilised steels.
OK Autrod 318Si has good general corrosion resistance. The alloy is stabilised with niobium to improve resistance to the intergranular corrosion of the weld metal. The higher silicon content improves the welding properties such as wetting. Due to stabilisation by niobium, this alloy is recommended for service temperatures up to 400ºC.

Welding current

DC(+)

Classifications

EN 12072	G 19 12 3 NbSi
Werkstoffnummer	~1.4576

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.08	0.8	1.8	19.0	12.5	2.8	<1.0	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	615
Elongation, %	35

Charpy V

Test temps, °C	Impact values, J
+20	100
-60	70

Approvals

DB	43.039.14
UDT	DIN 8556
VdTÜV	
Ü	43.039/1

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	4.0-17.0	55-160	15-24	1.0-4.0
1.0	4.0-16.0	80-240	15-28	1.5-5.9
1.2	3.0-14.0	100-300	15-29	1.6-7.5
1.6	5.5-9.0	230-375	23-31	5.2-8.6

OK Autrod 347Si

GMAW
ER347Si

Description

A continuous, solid, corrosion-resistant, chromium-nickel wire for welding austenitic chromium-nickel alloys of the 18% Cr-8% Ni type. OK Autrod 347Si has good general corrosion resistance. The alloy is stabilised with niobium to improve resistance to the intergranular corrosion of the weld metal. The higher silicon content improves the welding properties such as wetting. Due to the niobium content, this alloy is recommended for use at higher temperatures.

Welding current

DC(+)

Classifications

SFA/AWS A5.9	ER347Si
EN 12072	G 19 9 NbSi
Werkstoffnummer	~1.4551

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.08	0.8	1.8	20.0	10.0	<0.3	<1.0	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	640
Elongation, %	37

Charpy V

Test temps, °C	Impact values, J
+20	110
-60	80

Approvals

DB	43.039.13
Sepros	UNA 046731
VdTÜV	
Ü	43.039/1

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	4.0-17.0	55-160	15-24	1.0-4.0
1.0	3.5-18.0	80-240	15-28	1.3-6.7
1.2	3.0-14.0	100-300	15-29	1.6-7.5
1.6	5.5-9.0	230-375	23-31	5.2-8.6

OK Autrod 385

GMAW
ER385

Description

A continuous, solid, corrosion-resistant, chromium-nickel-molybdenum-copper wire for welding austenitic stainless alloys of the 20% Cr, 25% Ni, 5% Mo, 1.5% Cu, low C types.
OK Autrod 385 weld metal has good resistance to stress corrosion and intergranular corrosion and shows very good resistance to attack in non-oxidising acids. The resistance to crevice corrosion is better than that of ordinary 18% Cr, 8% Ni, Mo steels. The alloy is widely used in many applications related to the process industry.

Welding current

DC(+)

Classifications

SFA/AWS A5.9	ER385
EN 12072	G 20 25 5 CuL

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	<0.5	1.8	20.5	25.0	4.7	1.6

Typical mech. properties all weld metal

Yield stress, MPa	340
Tensile strength, MPa	540
Elongation, %	37

Approvals

UDT
VdTÜV

DIN 8556

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.9-8.4	80-190	16-24	1.0-3.1
1.2	4.9-8.5	180-280	20-28	2.6-4.6
1.6	3.2-5.5	230-350	24-28	3.0-5.2

OK Autrod 410NiMo

GMAW
G 13 4

Description

A continuous, solid welding wire of the 12% Cr, 4.5% Ni, 0.5% Mo type.
OK Autrod 410NiMo is used for welding similar martentsitic and martensitic-ferritic steels in different applications, such as hydro turbines.

Welding current

DC(+)

Classifications

EN 12072	G 13 4

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.05	0.4	0.7	12.3	4.5	0.7	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	600
Tensile strength, MPa	840
Elongation, %	17

Charpy V

Test temps, °C	Impact values, J
-10	80

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	4.0-17.0	55-160	12-24	1.0-4.1
0.9	3.5-18.0	65-220	15-28	1.1-5.4
1.0	4.0-16.0	80-240	15-28	1.5-6.0
1.2	3.0-14.0	100-300	15-19	1.6-7.5
1.6	5.5-9.0	230-365	23-31	5.2-8.6

OK Autrod 430LNb GMAW

G Z 17 L Nb

Description

A ferritic, stainless, solid wire with a low carbon content, 18% Cr and stabilised with Nb, for welding similar and matching steels. OK Autrod 430 LNb has been developed and designed for the automotive industry and is used in the production of exhaust systems. The wire should be used when very good resistance to corrosion and thermal fatigue is required.

Welding current

DC(+)

Classifications

EN 12072	G Z 17 L Nb
Werkstoffnummer	~1.4511

Typical chemical composition, aw (%)

C	Si	Mn	Cr
<0.03	0.5	0.5	18.2

Typical mech. properties all weld metal

Yield stress, MPa	275
Tensile strength, MPa	420
Elongation, %	26

Charpy V

Test temps, °C	Impact values, J

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.9	3.5-18.0	65-220	15-28	1.1-5.4
1.0	4.0-16.0	80-240	15-28	1.5-6.0
1.2	3.0-14.0	100-300	15-19	1.6-7.5

OK Autrod 16.95

GMAW
G 18 8 Mn

Description

A continuous, solid, corrosion-resistant, chromium-nickel-manganese wire for welding austenitic stainless alloys of the 18% Cr, 8% Ni, 7% Mn types. OK Autrod 16.95 has general corrosion resistance similar to that of the corresponding parent metal. The higher silicon content improves the welding properties such as wetting. When used for joining dissimilar materials, the corrosion resistance is of secondary importance. The alloy is used in a wide range of applications across the industry, such as the joining of austenitic, manganese, work-hardenable steels, as well as armour plate and heat-resistant steels.

Welding current

DC(+)

Classifications

EN 12072	G 18 8 Mn
Werkstoffnummer	~1.4370

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni
<0.2	<1.2	6.5	18.5	8.5

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	640
Elongation, %	41

Charpy V

Test temps, °C	Impact values, J
+20	130

Approvals

DB	43.039.10
UDT	DIN 8556
Ü	43.039/1
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	4.0-17	55-160	15-24	1.0-4.1
0.9	3.5-18	65-220	15-28	1.1-5.4
1.0	4.0-16	80-240	15-28	1.5-6.0
1.2	3.0-14	100-300	15-29	1.6-7.5
1.6	5.5-9	230-375	23-31	5.2-8.6

OK Autrod 430Ti

GMAW
G Z 17 Ti

Description

A ferritic, stainless, solid wire with a content of 18% Cr and stabilised with 0.5% Ti for welding similar and matching steels. The alloy is also used for cladding on unalloyed and low-alloyed steels.
OK Autrod 430Ti is also widely used in the automotive industry for the welding of manifolds, catalytic converters and exhaust pipes.

Welding current

DC(+)

Classifications

EN 12072	G Z 17 Ti
Werkstoffnummer	1.4502

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ti
<0.12	<1.0	<1.0	17.5	0.5

Typical mech. properties all weld metal

Yield stress, MPa	390
Tensile strength, MPa	600
Elongation, %	24

Charpy V

Test temps, °C	Impact values, J

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	4.0-17.0	55-160	12-24	1.0-4.1
0.9	3.5-18.0	65-220	15-28	1.1-5.4
1.0	4.0-16.0	80-240	15-28	1.5-6.0
1.2	3.0-14.0	100-300	15-19	1.6-7.5
1.6	5.5-9.0	230-365	23-31	5.2-8.6

OK Autrod 2209

GMAW
ER2209

Description

A continuous, solid, corrosion-resistant, duplex wire for welding austenitic-ferritic stainless alloys of the 22% Cr, 5% Ni, 3% Mo types.
OK Autrod 2209 has high general corrosion resistance. In media containing chloride and hydrogen sulphide, the alloy has a high resistance to intergranularcorrosion, pitting and especially to stress corrosion. The alloy is used in a variety of applications across all industrial segments.

Welding current

DC(+)

Classifications

SFA/AWS A5.9	ER2209
EN 12072	G 22 9 3 NL

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.7	22.5	8.5	3.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	600
Tensile strength, MPa	765
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
+20	100
-20	85
-60	60

Approvals

DNV	For duplex stainless steels
GL	4462S
RINA	Restricted availability
Sepros	UNA 485179
UDT	DIN 8556
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.9-8.4	80-190	16-24	1.0-3.2
1.2	4.9-8.5	180-280	20-28	2.6-4.6
1.6	3.2-5.5	230-350	24-28	3.0-5.2

OK Autrod 2509

GMAW
G 25 9 4 NL

Description

A continuous, solid, corrosion-resistant, "Super Duplex" wire for welding austenitic-ferritic, stainless alloys of the 25% Cr, 7% Ni, 4% Mo, low C types.
OK Autrod 2509 has high intergranular-corrosion, pitting and stress-corrosion resistance. The alloy is widely used in applications in which corrosion resistance is of the utmost importance. The pulp & paper industry, offshore and gas industry are areas of interest.

Welding current

DC(+)

Classifications

EN 12072	G 25 9 4 NL

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	W	Cu
<0.02	0.4	0.4	25.0	9.8	4.0	<1.0	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	670
Tensile strength, MPa	850
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
+20	150
-40	115

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.9-8.4	80-190	16-24	1.0-3.2
1.2	4.9-8.5	180-280	20-28	2.6-4.6
1.6	3.2-5.5	230-350	24-28	3.0-5.2

OK Tigrod 308H

GTAW
ER308H

Description

Bare, corrosion-resistant, chromium-nickel rods for welding austenic chromium-nickel alloys of the18% Cr-8% Ni type.
OK Tigrod 308H has good general corrosion resistance. The alloy has a high carbon content, which makes it suitable for applications at higher temperatures. The alloy is used in the chemical and petrochemical industries for the welding of tubes, cyclones and boilers.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER308H
EN 12072	W 19 9 H

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
0.06	0.5	1.8	20.3	10.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	>350
Tensile strength, MPa	>550
Elongation, %	>30

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5
3.2	1000	5

OK Tigrod 308L

GTAW
ER308L

Description

Bare, corrosion-resistant, chromium-nickel TIG rod. OK Tigrod 308L has good general corrosion resistance. The alloy has a low carbon content which makes it particularly recommended when there is a risk of intergranular corrosion.
The alloy is widely used in the chemical and food-processing industries, as well as for pipes, tubes and boilers. Suitable forthe joining of stainless steels of the18% Cr-8% Ni type with a low carbon content and Nb-stabilised steels of the same type if the service temperaturedoes not exceed 350ºC. It can also be used for welding Cr steels, except in sulphur-rich environments.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER308L
EN 12072	W 19 9 L
Werkstoffnummer	~1.4316

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	20.3	10.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	645
Elongation, %	36

Charpy V

Test temps, °C	Impact values, J
+20	170
-80	135
-196	90

Approvals

DNV	308L (-60°C)
UDT	DIN 8556
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.2	1000	5
1.6	1000	5
2.0	1000	5
2.4	1000	5
3.2	1000	5

OK Tigrod 308LSi

GTAW

ER308LSi

Description

Bare, corrosion-resistant, chromium-nickel rods for welding austenitic chromium-nickel alloys of the18% Cr-8% Ni type.
OK Tigrod 308LSi has good general corrosion resistance. The alloy has a low carbon content which makes it particularly recommended when there is a risk of intergranular corrosion. The higher silicon content improves the welding properties such as wetting. The alloy is widely used in the chemical and food-processing industries, as well as for pipes, tubes and boilers.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER308LSi
EN 12072	W 19 9 LSi
Werkstoffnummer	~1.4316

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.8	1.8	20.3	10.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	510
Tensile strength, MPa	555
Elongation, %	36

Charpy V

Test temps, °C	Impact values, J
+20	170
-60	150
-110	140
-196	100

Approvals

DB	43.039.11
DNV	308L M
UDT	DIN 8556
VdTÜV	
Ü	43.039/1

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 309L

GTAW
ER309L

Description

Bare, corrosion-resistant, chromium-nickel welding rod for welding the 24%Cr, 13%Ni alloyed types of steel. The alloy is also used for welding buffer layers on CMn steels and for welding dissimilar joints. When using the wire for buffer layers and dissimilar joints, it is necessary to control the dilution of the weld.
OK Tigrod 309L has good general corrosion resistance. When used for joining dissimilar materials, the corrosion resistance is of secondary importance.

Welding current

DC (-)

Classifications

SFA/AWS A5.9	ER309L
EN 12072	W 23 12 L
Werkstoffnummer	~1.4332

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	24.0	13.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	590
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	160
-60	130
-110	90

Approvals

VdTÜV

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 309LSi

GTAW

ER309LSi

Description

Bare, corrosion-resistant, chromium-nickel welding rod for welding steels with similar composition, wrought and cast steels of the 23% Cr-12% Ni types. The alloy is also used for welding buffer layers on CMn steels and for welding dissimilar joints. When using the wire for buffer layers and dissimilar joints, it is necessary to control the dilution of the weld.
OK Tigrod 309LSi has good general corrosion resistance. The higher silicon content improves the welding properties such as wetting.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER309LSi
EN 12072	W 23 12 LSi
Werkstoffnummer	~1.4332

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.8	1.8	24.0	13.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	475
Tensile strength, MPa	635
Elongation, %	32

Charpy V

Test temps, °C	Impact values, J
+20	150
-60	130
-110	80

Approvals

UDT
VdTÜV

DIN 8556

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 309MoL GTAW

W 23 12 2 L

Description

Bare, corrosion-resistant rod of the "309LMo" type. OK Tigrod 309MoL is used for the overlay welding of unalloyed and low-alloyed steels and for welding dissimilar steels such as 316L to unalloyed and low-alloyed steels when Mo is essential.

Welding current

DC -

Classifications

EN 12072	W 23 12 2 L

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.6	22.0	14.8	2.7	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	400
Tensile strength, MPa	600
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	140

Approvals

DNV	For C- & C/Mn -steels to 316L

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 310

GTAW
ER310

Description

Bare, corrosion-resistant, chromium-nickel welding rod for welding heat-resistant austenitic steels of the 25Cr-20Ni type.
The wire has a high Cr content and provides good oxidation resistance at high temperatures. Common applications include industrial furnaces and boiler parts, as well as heat exchangers.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER310
EN 12072	W 25 20

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
0.1	0.5	1.8	26.0	21.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	390
Tensile strength, MPa	590
Elongation, %	43

Charpy V

Test temps, °C	Impact values, J
+20	175
-196	60

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 312

GTAW
ER312

Description

Bare, corrosion-resistant, chromium-nickel welding rods for welding materials of the 29% Cr, 9% Ni types. OK Tigrod 312 has good oxidation resistance at high temperatures due to its high content of Cr. The alloy is widely used for joining dissimilar steels, especially if one of the components is fully austenitc, and for steels that are difficult to weld, i.e. machine components, tools and austenitic-manganese steels.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER312
EN 12072	W 29 9

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.15	0.5	1.8	30.5	9.5	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	610
Tensile strength, MPa	770
Elongation, %	20

Charpy V

Test temps, °C	Impact values, J
+20	50

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 316L GTAW

ER316L

Description

Bare, corrosion-resistant, chromium-nickel-molybdenum rods for welding austenitic stainless alloys of the 18% Cr-8% Ni and 18% Cr-10% Ni-3% Mo types.
OK Tigrod 316L has good general corrosion resistance, particularly to corrosion in acid and chlorinated environments. The alloy has a low carbon content which makes it particularly recommended when there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as in shipbuilding and various types of architectual structure.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER316L
EN 12072	W 19 12 3 L
Werkstoffnummer	~1.4430

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	19.0	12.5	2.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	650
Elongation, %	32

Charpy V

Test temps, °C	Impact values, J
+20	140
-60	110
-196	70

Approvals

CL	
DNV	316L (-60°C)
Sepros	UNA 485179
UDT	DIN 8556
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 316LSi

GTAW
ER316LSi

Description

Bare, corrosion-resistant, chromium-nickel-molybdenum rods for welding austenitic stainless alloys of the 18% Cr-8% Ni and 18% Cr-10% Ni-3% Mo types.
OK Tigrod 316LSi has good general corrosion resistance, particularly to corrosion in acid and chlorinated environments. The alloy has a low carbon content which makes it particularly recommended when there is a risk of intergranular corrosion. The higher silicon content improves the welding properties such as wetting. The alloy is widely used in the chemical and food-processing industries, as well as in shipbuilding and various types of architectural structure.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER316LSi
EN 12072	W 19 12 3 LSi
Werkstoffnummer	~1.4430

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.8	1.8	19.0	12.5	2.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	480
Tensile strength, MPa	630
Elongation, %	33

Charpy V

Test temps, °C	Impact values, J
+20	140
-60	110
-196	70

Approvals

CL	
DB	43.039.06
DNV	316L
UDT	DIN 8556
VdTÜV	
Ü	43.039/1

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.0	1000	5.0
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 317L

GTAW
ER317L

Description

Bare, corrosion-resistant, chromium-nickel-molybdenum welding rods for welding austenitic stainless alloys of the 19% Cr, 9% Ni, 3% Mo types. OK Tigrod 317L has good resistance to general corrosion and pitting due to its high content of molybdenum. The alloy has a low carbon content which makes it particularly recommended when there is a risk of intergranular corrosion. The alloy is used in severe corrosion conditions such as in the petrochemical, pulp and paper industries.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER317L
EN 12072	W 18 15 3 L

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	19.3	14.0	3.5	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	390
Tensile strength, MPa	600
Elongation, %	45

Charpy V

Test temps, °C	Impact values, J
+20	80

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 318Si

GTAW

W 19 12 3 NbSi

Description

Bare, corrosion-resistant, stabilised, chromium-nickel-molybdenum wire for welding Cr-Ni-Mo and Cr-Ni stabilised or non-stabilised steels. OK Tigrod 318Si has good general corrosion resistance. The alloy is stabilised with niobium to improve resistance to the intergranular corrosion of the weld metal. The higher silicon content improves the welding properties such as wetting. Due to stabiliation by niobium, this alloy is recommended for service temperatures up to 400ºC.

Welding current

DC(-)

Classifications

EN 12072	W 19 12 3 NbSi
Werkstoffnummer	~1.4576

Wire composition

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.08	0.8	1.8	19.0	12.5	2.8	<1.0	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	460
Tensile strength, MPa	615
Elongation, %	35

Charpy V

Test temps, °C	Impact values, J
+20	40

Approvals

DB	43.039.15
UDT	DIN 8556
VdTÜV	
Ü	43.039/1

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 347

GTAW
W 19 9 Nb

Description

Bare, corrosion-resistant, chromium-nickel rods for welding stabilised austenitic chromium-nickel alloys of the 18% Cr-8% Ni type.
The rods are stabilised with niobium, which provides good resistance to the intergranular corrosion of the weld metal. Due to the niobium content, this alloy is recommended for use at higher temperatures.

Welding current

DC(-)

Classifications

EN 12072	W 19 9 Nb
SFA/AWS A5.9	ER347
Werkstoffnummer	~1.4551

Wire composition

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.08	0.5	1.4	20.0	10.0	<0.3	<1.0	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	>350
Tensile strength, MPa	>550
Elongation, %	>25

Charpy V

Test temps, °C	Impact values, J
-20	90

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 347Si

GTAW
ER347Si

Description

Bare, corrosion-resistant, chromium-nickel rods for welding austenitic chromium nickel alloys of the 18% Cr-8% Ni type.
OK Tigrod 347Si has good general corrosion resistance. The alloy is stabilised with niobium to improve resistance to the intergranular corrosion of the weld metal. The higher silicon content improves the welding properties such as wetting. Due to the niobium content, this alloy is recommended for use at higher temperatures.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER347Si
EN 12072	W 19 9 NbSi
Werkstoffnummer	~1.4551

Wire composition

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.08	0.8	1.8	20.0	10.0	<0.3	<1.0	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	640
Elongation, %	35

Charpy V

Test temps, °C	Impact values, J
+20	90

Approvals

Sepros	UNA 046731
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.0	1000	5.0
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 385

GTAW
W 20 25 5 CuL

Description

Bare, corrosion-resistant welding rods for welding austenitic stainless steels of the 20Cr-25Ni-4.5Mo-1.5Cu type. The weld metal has good resistance to stress corrosion and intergranular corrosion and shows very good resistance to attack in non-oxidising acids. The resistance to pitting and crevice corrosion is better than that of ordinary 18Cr-8Ni-Mo steels.

Welding current

DC(-)

Classifications

EN 12072	W 20 25 5 CuL
SFA/AWS A5.9	ER385

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	<0.5	1.8	20.5	25.0	4.7	1.6

Typical mech. properties all weld metal

Yield stress, MPa	340
Tensile strength, MPa	540
Elongation, %	37

Charpy V

Test temps, °C	Impact values, J
+20	120

Approvals

UDT
VdTÜV
DIN 8556

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 410NiMo GTAW
W 13 4

Description

Bare welding rods of the 420NiMo type alloyed with 13% Cr, 4.5% Ni and 0.5% Mo.
This alloy is used for welding similar composition martensitic and martensitic-ferritic steels in different applications, such as hydroturbines.

Welding current

DC(-)

Classifications

EN 12072	W 13 4

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.05	0.4	0.7	12.3	4.5	0.7	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	600
Tensile strength, MPa	800
Elongation, %	17

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 16.95

GTAW
W 18 8 Mn

Description

Bare, corrosion-resistant, chromium-nickel-manganese welding rods for welding austenitic stainless alloys of the 18% Cr, 8% Ni, 7% Mn types. OK Tigrod 16.95 has general corrosion resistance similar to that of the corresponding parent metal. The higher silicon content improves the welding properties such as wetting. When used for joining dissimilar materials, the corrosion resistance is of secondary importance. The alloy is used in a wide range of applications across the industry, such as the joining of austenitic, manganese, work-hardenable steels, as well as armour plate and heat-resistant steels.

Welding current

DC(-)

Classifications

EN 12072	W 18 8 Mn
Werkstoffnummer	appr. 1.4370

Wire composition

C	Si	Mn	Cr	Ni
<0.2	<1.2	6.5	18.5	8.5

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	640
Elongation, %	41

Charpy V

Test temps, °C	Impact values, J
+20	130

Approvals

DB	43.039.12
UDT	DIN 8556
Ü	43.039/1
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 2209

GTAW
ER2209

Description

Bare, corrosion-resistant, duplex welding rods for welding austenitic-ferritic stainless alloys of the 22% Cr, 5% Ni, 3% Mo types.
OK Tigrod 2209 has high general corrosion resistance. In media containing chloride and hydrogen sulphide, the alloy has high resistance to intergranular corrosion, pitting and especially to stress corrosion. The alloy is used in a variety of applications across all industrial segments.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER2209
EN 12072	W 22 9 3 NL

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.7	22.5	8.5	3.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	600
Tensile strength, MPa	765
Elongation, %	28

Charpy V

Test temps, °C	Impact values, J
+20	100
-20	85
-60	60

Approvals

Sepros	UNA 485179
UDT	DIN 8556
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 2509

GTAW
W 25 9 4 NL

Description

Bare, corrosion-resistant, "Super Duplex" rods for welding austenitic-ferritic stainless alloys of the 25% Cr, 7% Ni, 4% Mo, low C types.
OK Autrod 2509 has high intergranular-corrosion, pitting and stress-corrosion resistance. The alloy is widely used in applications where corrosion resistance is of the utmost importance. The pulp & paper industry, offshore and gas industry are areas of interest.

Welding current

DC(-)

Classifications

EN 12072	W 25 9 4 NL

Wire composition

C	Si	Mn	Cr	Ni	Mo	W	Cu
<0.02	0.4	0.4	25.0	9.8	4.0	<1.0	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	670
Tensile strength, MPa	850
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
+20	150
-40	115

Approvals

UDT VdTÜV	DIN 8556

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Autrod 308H

SAW

ER308H

Description

A continuous, solid , corrosion-resistant, chromium-nickel wire for welding austenitic chromium-nickel alloys of the 18% Cr-8% Ni type. OK Autrod 308H has good general corrosion resistance. The alloy has a high carbon content, making it suitable for applications used at higher temperatures. The alloy is used in the chemical and food-processing industries, as well as for pipes, tubes and boilers. OK Autrod 308H can be used in combination with OK Flux 10.93 or OK Flux 10.92.

Classifications

SFA/AWS A5.9	ER308H
EN 12072	S 19 9 H

Wire composition (%)

C	Si	Mn	Cr	Ni
0.06	0.5	1.8	20.3	10.0

OK Autrod 308L

SAW

ER308L

Description

A continuous, solid, corrosion-resistant, chromium-nickel wire. OK Autrod 308L has good general corrosion resistance. The alloy has a low carbon content which makes it particularly recommended where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as for pipes, tubes and boilers. OK Autrod 308L can be used in combination with OK Flux 10.93 or OK Flux 10.92.

Classifications

SFA/AWS A5.9	ER308L
EN 12072	S 19 9 L

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	20.3	10.0	<0.3	<0.3

OK Autrod 347

SAW

ER347

Description

A continuous, solid , corrosion-resistant, chromium-nickel wire for welding austenitic chromium-nickel alloys of the 18% Cr-8% Ni type. OK Autrod 347 has good general corrosion resistance. The alloy is stabilised with niobium to improve resistance to the intergranular corrosion of the weld metal. Due to the niobium content, this alloy is recommended for use at higher temperatures.
OK Autrod 347 can be used in combination with OK Flux 10.93 or OK Flux 10.92.

Classifications

SFA/AWS A5.9	ER347
EN 12072	S 19 9 Nb

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.08	0.5	1.8	20.0	10.0	<0.3	<1.0	<0.3

OK Autrod 316L SAW

ER316L

Description

A continuous, solid , corrosion-resistant, chromium-nickel-molybdenum wire for welding austenitic stainless alloys of the 18% Cr-8% Ni and 18% Cr-8% Ni-3% Mo types. OK Autrod 316L has good general corrosion resistance. In particular, the alloy has very good resistance to corrosion in acid and chlorinated environments. The alloy has a low carbon content which makes it particularly recommended where there is a risk of intergranular corrosion. The alloy is widely used in the chemical and food-processing industries, as well as in shipbuilding and various types of architectural structure. OK Autrod 316L can be used in combination with OK Flux 10.93 or OK Flux 10.92.

Classifications

SFA/AWS A5.9	ER316L
EN 12072	S 19 12 3 L

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	19.0	12.5	2.8	<0.3

OK Autrod 318 SAW

ER318

Description

OK Autrod 318 is an extra-low carbon, stainless wire for the submerged arc welding of corrosion-resistant steels of the 18Cr12Ni3Mo type, such as AISi 316 and 316L, or somewhat lower alloyed types. OK Autrod 318 can be used in combination with OK Flux 10.93 or OK Flux 10.92.

Classifications

SFA/AWS A5.9	ER318
EN 12072	S 19 12 3 Nb

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.08	0.5	1.6	19.0	12.5	2.5	<1.0	<0.3

OK Autrod 309L SAW

Description

A continuous, solid , corrosion-resistant, chromium-nickel wire for joining stainless steels to non-alloy or low-alloy steels and for welding austenitic stainless alloys of the 24% Cr, 13% Ni types.
OK Autrod 309L has good general corrosion resistance. When used for joining dissimilar materials, the corrosion resistance is of secondary importance.
OK Autrod 309L can be used in combination with OK Flux 10.93 or OK Flux 10.92.

Classifications

SFA/AWS A5.9	ER309L
EN 12072	S 23 12 L

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	24.0	13.0	<0.3	<0.3

OK Autrod 309MoL SAW

S 23 12 2 L

Description

OK Autrod 309MoL is a stainless-steel, over-alloyed wire for submerged arc welding. It is suitable for joinng stainless Cr-Ni and Cr-Ni-Mo steels 304, 309 or 316 to ensure corrosion resistance in the pulp and paper industry, for example. It is also suitable for dissimilar steels when alloying with Mo is essential.
OK Autrod 309MoL can be used in combination with OK Flux 10.93 or OK Flux 10.92.

Classifications

EN 12072	S 23 12 2 L

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.6	22.0	14.8	2.7	<0.3

OK Autrod 310 SAW

ER310

Description

A continuous, solid , corrosion-resistant, chromium-nickel wire for welding heat-resistant austenitic steels of the 25% Cr, 20% Ni type.
OK Autrod 310 has good general oxidation resistance, especially at high temperatures, due to its high Cr content. The alloy is fully austenitic and is therefore sensitive to hot cracking. Common applications include industrial furnaces and boiler parts, as well as heat exchangers. OK Autrod 310 can be used in combination with OK Flux 10.92.

Classifications

SFA/AWS A5.9	ER310
EN 12072	S 25 20

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Cu
0.1	0.5	1.8	26.0	21.0	<0.3	<0.3

OK Autrod 312 SAW

ER312

Description

A continuous, solid , corrosion-resistant, chromium-nickel wire for welding stainless steels of the 29% Cr, 9% Ni type.
OK Autrod 312 has good oxidation resistance at high temperatures due to its high content of Cr. The alloy is widely used for joining dissimilar steels, especially if one of the components is fully austenitic, and for steels that are difficult to weld, .i e. machine components, tools and austenitic-manganese steels.
OK Autrod 312 can be used in combination with OK Flux 10.93 or OK Flux 10.92.

Classifications

SFA/AWS A5.9	ER312
EN 12072	S 29 9

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.15	0.5	1.8	30.5	9.5	<0.3	<0.3

OK Autrod 385

SAW

ER385

Description

A continuous, solid , corrosion-resistant, chromium-nickel-molybdenum-copper wire for welding austenitic stainless alloys of the 20% Cr, 25% Ni, 5% Mo, 1.5% Cu, low C types. OK Autrod 385 weld metal has good resistance to stress corrosion and intergranular corrosion and shows very good resistance to attack in non-oxidising acids. The resistance and crevice corrosion is better than that of ordinary 18% Cr, 8% Ni, Mo steels. The alloy is widely used in many applications related to the process industry. OK Autrod 385 can be used in combination with OK Flux 10.93.

Classifications

SFA/AWS A5.9	ER385
EN 12072	S 20 25 5 Cu L

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	<0.5	1.8	20.5	25.0	4.7	1.6

OK Autrod 16.97

SAW

S 18 8 Mn

Description

OK Autrod 16.97 is an 18% Cr, 8% Ni, 6% Mo type submerged arc wire, used in a wide range of applications throughout industry, such as joining austenitic-manganese, work-hardenable steels, as well as heat-resistant steels.
OK Autrod 16.97 is usully welded with OK Flux 10.93 or OK Flux 10.92.

Classifications

EN 12072	S 18 8 Mn

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	W	Cu
<0.2	0.5	6.5	18.5	8.5	<0.3	<1.0	<0.3

OK Autrod 2209

SAW

ER2209

Description

A continuous, solid , corrosion-resistant, duplex wire for welding austenitic-ferritic stainless alloys of the 22% Cr, 5% Ni, 3% Mo type.
OK Autrod 2209 has high general corrosion resistance. In media containing chloride and hydrogen sulphide, the alloy has high resistance to intergranular corrosion, pitting and especially to stress corrosion. The alloy is used in a variety of applications across all industrial segments.
OK Autrod 2209 can be used in combination with OK Flux 10.93.

Classifications

SFA/AWS A5.9	ER2209
EN 12072	S 22 9 3 N L

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.7	22.5	8.5	3.3	0.15

OK Autrod 2509 SAW

S 25 9 4 N L

Description

A continuous, solid , corrosion-resistant, "Super Duplex" wire for welding austenitic-ferritic stainless alloys of the 25% Cr, 10% Ni, 4% Mo, low C type.
OK Autrod 2509 has high resistance to intergranular corrosion and pitting. The alloy is widely used in applications where corrosion resistance is of the utmost importance. The pulp and paper industry, offshore and gas industry are areas of interest.
OK Autrod 2509 can be used in combination with OK Flux 10.94.

Classifications

EN 12072	S 25 9 4 N L

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	W	Cu
<0.02	0.4	0.4	25.0	9.8	4.0	<1.0	0.25

OK Flux 10.92 SAW

Type Calcium silicate SA CS 2 Cr DC

Description

OK Flux 10.92 is an agglomerated, Cr-alloying flux which is designed for the butt welding of stainless steels. It can also be used for strip cladding with austenitic stainless welding strips. The chromium alloying effect of OK Flux 10.92 compensates for Cr losses in the arc during welding.

Density

approx. 1.0 kg/dm^3

Basicity index

1.0

Flux consumption as kg flux/kg wire

Voltage	DC+
26	0.4
30	0.55
34	0.7
38	0.9

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 16.97	0.04	0.9	5.0	19.0	8.5	-
OK Autrod 308H	0.03	0.9	1.0	20.0	10.0	0.75
OK Autrod 308L	0.02	0.9	1.0	20.0	10.0	-
OK Autrod 309L	0.02	0.8	1.1	24.0	13.0	-
OK Autrod 309MoL	0.02	0.5	1.5	21.0	15.0	3.0
OK Autrod 310	0.1	0.8	1.1	26.0	21.0	-
OK Autrod 312	0.1	0.8	1.0	30.0	9.0	-
OK Autrod 316L	0.02	0.8	1.0	19.0	12.0	2.7
OK Autrod 318	0.03	0.5	1.2	18.5	12.0	2.6
OK Autrod 347	0.04	0.8	0.9	20.0	10.0	-
OK Band 308L	0.02	1.0	0.7	20.0	9.5	-
OK Band 309L	0.02	1.2	0.7	23.0	12.5	-
OK Band 316L	0.02	0.9	0.7	18.5	12.3	2.7
OK Band 347	0.03	1.3	0.7	20.0	9.5	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 16.97	450	630	+20	60
			-20	55
			-60	45
OK Autrod 308H	365	580	-60	60
OK Autrod 308L	365	580	-60	60
OK Autrod 309L	410	575	-20	50
OK Autrod 309MoL	400	600	+20	120
OK Autrod 316L	385	590	-70	55
OK Autrod 318	440	600	+20	100
			-60	90
			-110	40
OK Autrod 347	470	640	-60	55

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	CL	DB	VdTÜV
OK Autrod 308L							x		x
OK Autrod 347									x
OK Autrod 316L			316 L (tm)				x		x
OK Autrod 317L			316L (tm), NV 25	UP (KV -60°C)					
OK Autrod 318									x
OK Autrod 309L		SS/CMn	x						
OK Band 308L			x						x
OK Band 347									x
OK Band 316L			x		4462M				x

Classifications

Wire	EN 12072	SFA/AWS A5.9
OK Autrod 308L	ER308L	S 19 9 L
OK Autrod 308H	ER308H	S 19 9 H
OK Autrod 347	ER347	S 19 9 Nb
OK Autrod 316L	ER316L	S 19 12 3 L
OK Autrod 318	ER318	S 19 12 3 Nb
OK Autrod 309L	ER309L	S 23 12 L
OK Autrod 309MoL	(309MoL)	S 23 12
OK Autrod 310	ER310	S 25 20
OK Autrod 312	ER312	S 29 9
OK Autrod 16.97	(ER307)	S 18 8 Mn
OK Band 308L	EQ308L	S 19 9 L
OK Band 347	EQ347	S 19 9 Nb
OK Band 316L	EQ316L	S 19 12 3 L
OK Band 309L	EQ309L	S 23 12 L

OK Flux 10.93

SAW

Type Fluoride basic SA AF 2 DC

Description

OK Flux 10.93 is a basic non-alloying agglomerated flux for the submerged arc welding of stainless steels and high-alloyed CrNiMo steels such as duplex stainless steels.

Density

~1.0 kg/dm^3

Basicity index

1.7

Flux consumption as kg flux/kg wire

Voltage	DC+
26	0.5
30	0.6
34	0.8
38	1.0

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 308L	0.03	0.6	1.4	20.0	10.0	-
OK Autrod 309L	0.03	0.6	1.5	24.0	12.5	-
OK Autrod 312	0.1	0.5	1.5	29.0	9.5	-
OK Autrod 316L	0.03	0.6	1.4	18.5	11.5	2.7
OK Autrod 318	0.04	0.6	1.2	18.5	12.0	2.6
OK Autrod 347	0.03	0.5	1.1	19.2	9.6	-
OK Autrod 385	0.03	0.6	1.5	19.0	25.0	4.0
OK Autrod 16.97	0.06	1.2	6.3	18.0	8.0	-
OK Autrod 2209	0.02	0.8	1.3	22.0	9.0	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 308L	400	560	-40	75
			-60	65
			-110	55
			-196	40
OK Autrod 309L	430	570	-60	70
			-110	60
			-196	35
OK Autrod 316L	390	565	-40	95
			-60	90
			-110	75
			-196	40
OK Autrod 318	440	600	-60	90
			-110	40
OK Autrod 347	455	635	-60	85
			-110	60
			-196	30
OK Autrod 385	310	530	+20	80
OK Autrod 2209	630	780	-20	125
			-40	110
			-60	80

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	CL	DB	VdTÜV
OK Autrod 308L	Stainless		308L M						x
OK Autrod 347									x
OK Autrod 316L									x
OK Autrod 318									x
OK Autrod 309L			x						x
OK Autrod 16.97			x						x
OK Autrod 385									x
OK Autrod 2209			x		4462M		x		x

Classifications

Wire	EN 12072	SFA/AWS A5.9
OK Autrod 308L	ER308L	S 19 9 L
OK Autrod 347	ER347	S 19 9 Nb
OK Autrod 316L	ER316L	S 19 12 3 L
OK Autrod 318	ER318	S 19 12 3 Nb
OK Autrod 309L	ER309L	S 23 12 L
OK Autrod 16.97	(ER307)	S 18 8 Mn
OK Autrod 2209	ER 2209	S 22 9 3 N L
OK Autrod 312	ER312	S 29 9
OK Autrod 385	ER385	S 20 25 5 Cu L

OK Flux 10.94 SAW

Type Fluoride basic SA AF 2 Cr DC

Description

OK Flux 10.94 is a basic chromium-alloying flux for the butt welding of stainless steels. OK Flux 10.94 is a suitable flux for welding stainless, high-alloyed CrNiMo steels like super-duplex stainless steels.

Density

~ 1.0 kg/dm^3

Basicity index

1.7

Flux consumption as kg flux/kg wire

Voltage	DC+
26	0.5
30	0.6
34	0.8
38	1.0

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	N
OK Autrod 347	0.04	0.4	1.0	19.6	9.6	0.2
OK Autrod 2509	0.04	0.5	0.5	25.0	9.5	0.2

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 347	455	620	+20	100
			-60	70
			-110	50
			-196	30
OK Autrod 2509	630	780	+20	90
			-60	50

Classifications

Wire	EN 756	SFA/AWS A5.17
OK Autrod 347	S 19 9 Nb	ER 347
OK Autrod 2509	S 25 9 4 N L	-

OK Band 308L

SAW
EQ308L

Description

OK Band 308L is a stainless welding strip designed for surfacing using the submerged arc welding process. Together with OK Flux 10.05, it produces a 308L type of weld deposit.

Classifications

SFA/AWS A5.9	EQ308L
EN 12072	S 19 9 L

Typical strip composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	20.3	10.0	<0.3	<0.3

OK Band 347

SAW
EQ347

Description

OK Band 347 is a stainless welding strip designed for surfacing using the submerged arc welding process. Together with OK Flux 10.05, it produces a 347 type of weld deposit.

Classifications

SFA/AWS A5.9	EQ347
EN 12072	S 19 9 Nb

Typical strip composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.03	0.5	1.8	20.0	10.0	<0.3	<1.0	<0.3

OK Band 316L

SAW
EQ316L

Description

OK Band 316L is a stainless welding strip designed for surfacing using the submerged arc welding process. Together with OK Flux 10.05, it produces a 316L type of weld deposit.

Classifications

SFA/AWS A5.9	EQ316L
EN 12072	S 19 12 3 L

Typical strip composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	19.0	12.5	2.8	<0.3

OK Band 309L

SAW
EQ309L

Description

OK Band 309L is a stainless welding strip designed for surfacing using the submerged arc welding process. Together with OK Flux 10.05, it produces a 309L type of weld deposit.

Classifications

SFA/AWS A5.9	EQ309L
EN 12072	S 23 12 L

Typical strip composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	24.0	13.0	<0.3	<0.3

OK Band 309LNb

SAW
S Z 23 12 L Nb

Description

OK Band 309LNb is a stainless welding strip designed for the submerged arc or electroslag welding process. Together with OK Flux 10.05, it produces a 309LNb type of weld deposit using SAW. In combination with OK Flux 10.14, it produces a 347 type of weld deposit using single-layer electroslag strip cladding.

Classifications

EN 12072	S Z 23 12 L Nb

Typical strip composition, %

C	Si	Mn	Cr	Ni	Mo	Nb
<0.03	0.5	1.8	24.0	13.0	<0.3	<1.0

OK Band 430

SAW
S Z 17

Description

OK Band 430 is a 17Cr strip designed for submerged arc hard surfacing. Together with OK Flux 10.07, it produces a 15% Cr 4% Ni Mo weld overlay.

Classifications

EN 12072	S Z 17

Typical strip composition, %

C	Si	Mn	Cr	Ni
<0.06	<0.6	<1.0	17.0	<0.3

OK Band 309L ESW

ESW

Description

OK Band 309L ESW is a stainless strip for single-layer electroslag strip surfacing. Together with OK Flux 10.10, it produces a 308L type of weld deposit.

Typical strip composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	<0.4	1.8	21.0	11.0	<0.5	<0.5

OK Band 309LMo ESW

ESW

Description

OK Band 309LMo ESW is a stainless strip for single-layer electroslag strip surfacing. Together with OK Flux 10.10, it produces a 316 type of weld deposit.

Typical strip composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.02	<0.4	1.8	20.5	13.5	3.1	<0.5

OK Band 309LNb ESW

ESW

Description

OK Band 309LNb ESW is a stainless strip for single-layer electroslag strip surfacing. Together with OK Flux 10.10, it produces a 347 type of weld deposit.

Typical strip composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu
<0.02	<0.4	1.8	21.0	11.0	<0.5	0.6	<0.5

OK Flux 10.05 SAW

Type Basic EN 760: SA Z 2 DC

Description

OK Flux 10.05 is an agglomerated flux for submerged arc strip cladding. It is recommended for cladding with the Cr, CrNi and CrNiMo types of stainless strip. Slag removal and overlapping with this flux are excellent.

General

15 kg weld metal/h with the parameters: DC+, 750 A, 28 V, 7 m/h, using 60 mm wide strip

Density

≈0.7 kg/dm^3

Basicity index

1.1

Classifications

EN 760 SA Z 2 DC

Flux consumption as kg flux/kg wire

Voltage	DC+
25	0.4
28	0.5
32	0.6

Approvals

OK Flux 10.05/OK Band 316L	TÜV
OK Flux 10.05/OK Band 309L	TÜV

Typical all weld metal composition

Consumable	%C	%Si	%Mn	%Cr	%Ni	%Mo	Other	Ferrite
1. 308 L overlay combination on 2.25Cr 1Mo steel, typical parameters: DC+, 750 A, 28 V, 7 m/h								
OK Band 309L	0.020	0.4	1.9	23	13	-		
Weld composition 1st layer	0.027	0.7	1.1	19	11.3	-	-	FN 5
OK Band 308L	0.022	0.3	1.7	19.6	10.1	-	-	-
Weld composition 2nd layer	0.021	0.6	1.0	18.9	10.6	-	-	FN 8
2. 347 overlay combination on 2.25Cr 1Mo steel, typical parameters: DC+, 750 A, 28 V, 7 m/h								
OK Band 309L	0.020	0.4	1.9	23	13	-	-	-
Weld composition 1st layer	0.024	0.6	1.1	19	10.6	-	-	FN 4
OK Band 347	0.018	0.4	1.7	19.3	10	-	Nb=0.6	-
Weld composition 2nd layer	0.018	0.6	1.1	19.2	10.3	-	Nb=0.3	FN 7
3. 316 L overlay combination on 2.25Cr 1Mo steel, typical parameters: DC+, 750 A, 28 V, 7 m/h								
OK Band 309L	0.020	0.4	1.9	23	13	-	-	-
Weld composition 1st layer	0.028	0.7	1.1	19	11	-	-	FN 5
OK Band 316L	0.017	0.4	1.8	18.2	13.1	2.8	-	-
Weld composition 2nd layer	0.018	0.7	1.1	18	12.9	2.1	-	FN 7

OK Flux 10.07 SAW

Type Neutral EN 760: SA CS 2 NiMo DC

Description

Neutral, agglomerated nickel and molybdenum alloying flux, specially designed for the overlay welding of continuous cast rollers with OK Band 11.82 (EQ 430), producing a weld metal with 14 Cr-4 Ni-1 Mo and 370-420 HB. It can also be used for cladding with a 17 Cr wire, producing the same weld metal.

Density

≈1.0 kg/dm^3

Basicity index

1.0

Classifications

Not applicable classification.

Flux consumption as kg flux/kg wire

Voltage	DC+
28	0.5

Typical all weld metal composition

Consumable	%C	%Si	%Mn	%Cr	%Ni	%Mo
OK Band 430	0.04	0.4	0.2	13.5	4.0	0.9

OK Flux 10.10

ESW

Type Basic

Description

OK Flux 10.10 is an agglomerated flux, designed for electroslag strip surfacing. This flux is particular suitable for strip surfacing with stainless strips of the Cr, CrNi and CrNiMo types, with or without Nb stabilisation. The weldability, bead appearance and slag removal of OK Flux 10.10 are excellent.

General

20 kg weld metal/h with the parameters: DC+, 1250 A, 25 V, 9 m/h, using a 60 mm wide strip.

Density

≈1.0 kg/dm^3

Basicity index

4.0

Classifications

DIN 32522 BFB 6 63356 DC 17 B 1-16

Flux consumption as kg flux/kg wire

Voltage	DC+
25	0.5

Typical all weld metal composition

Consumable	%C	%Si	%Mn	%Cr	%Ni	%Mo	Other	Ferrite
1. “308L” overlay combination on 2.25Cr 1Mo steel, typical parameters: DC+, 1250 A, 25 V, 9 m/h								
OK Band 309L ESW	0.015	0.2	1.8	21	11.4	-	-	-
Weld composition 1st layer	0.023	0.45	1.2	18.5	10	-	-	FN 6
2. “347” overlay combination on 2.25Cr 1Mo steel, typical parameters: DC+, 1250 A, 25 V, 9 m/h								
OK Band 309LNb ESW	0.015	0.2	1.8	21	11	-	Nb=0.5	-
Weld composition 1st layer	0.023	0.47	1.2	19	10	-	Nb=0.4	FN 7
3. “316” overlay combination on 2.25Cr 1Mo steel, typical parameters: DC+, 1250 A, 25 V, 9 m/h								
OK Band 309LMo ESW	0.015	0.2	1.8	20	13.7	2.7	-	-
Weld composition 1st layer	0.024	0.4	1.2	18	12	2.7	-	FN 8

OK Flux 10.14 ESW

Type Fluoride basic

Description

OK Flux 10.14 is a high basic, agglomerated flux for electroslag strip cladding
The flux is suitable for cladding with austenitic Cr, CrNi and CrNiMo strips at high travel speeds.

Density

1.0 kg/dm^3

Basicity index

4.4

Flux consumption as kg flux/kg wire

Voltage	DC+
25	0,5

Typical all weld metal composition

Consumable	%C	%Si	%Mn	%Cr	%Ni	%Mo	Other	Ferrite
1. “347” overlay combination on CMn steel, typical parameters: DC+, 2300 A, 25 V, 24 m/h								
OK Band 309L ESW	0.01	0.2	1.8	24	12	-	Nb=0.7	-
Weld composition 1st layer	0.05	0.4	1.6	18.5	10	-	Nb=0.5	FN 5

Consumables for aluminium alloys

Contents

OK 96.10

Type Chloride and fluoride salt

SMAW
EL-Al99.5

Description

OK 96.10 is an electrode for welding pure aluminium and wrought aluminium alloys.

Welding current

DC+

Classifications

DIN 1732	EL-Al99.5

Typical all weld metal composition, %

Si	Al	Fe
<0.3	>99.5	<0.4

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V
2.5	350	50-90	22
3,2	350	70-110	22
4.0	350	90-130	22

OK 96.20

Type Chloride and fluoride salt

SMAW
EL-AlMn1

Description

OK 96.20 is an electrode for welding rolled, weldable aluminium alloys, such as aluminium-magnesium and aluminium-manganese alloys.

Welding current

DC+

Classifications

DIN 1732	EL-AlMn1

Typical all weld metal composition, %

Si	Mn	Al	Fe
<0.5	1.3	97.5	<0.7

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V
2.5	350	50-90	22
3.2	350	70-110	22
4.0	350	90-130	22

OK 96.40

Type Chloride and fluoride salt

SMAW
EL-AlSi5

Description

A coated electrode suitable for welding AlMnSi alloys such as EN - AW 6060/6063, 6005, 6201. Also suitable for welding AlSi5Cu and AlSi7 type castings.

Welding current

DC+

Classifications

DIN 1732	EL-AlSi5

Typical all weld metal composition, %

Si	Al	Fe
5.0	94.0	<0.4

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V
2.5	350	50-90	22
3.2	350	70-110	22
4.0	350	90-130	22

OK 96.50

Type Chloride and fluoride salt

SMAW

EL-AlSi12

Description

An electrode for welding cast aluminium alloys. Also suitable for welding rolled aluminium alloys or joining them to cast items.

Welding current

DC+

Classifications

DIN 1732	EL-AlSi12

Typical all weld metal composition, %

Si	Al	Fe
12.3	87.5	<0.5

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V
2.5	350	50-90	22
3.2	350	70-110	22
4.0	350	90-130	22

OK Autrod 1070 GMAW

S Al 1070 (Al99.7)

Description

OK Autrod 1070 is highly resistant to chemical attack and weathering. It is a relatively soft alloy that is very formable and it is used extensively in thin-gauge and foil products. It has good welding characteristics. One characteristic feature of the alloy is the bright finish obtained by anodising. Non-heat treatable.

Welding current

DC(+)

Classifications

EN ISO 18273	S Al 1070 (Al99.7)

Wire composition

Si	Mn	V	Cu	Al	Fe
<0.20	<0.03	<0.05	<0.04	>99.7	<0.25

Typical mech. properties all weld metal

Yield stress, MPa	35
Tensile strength, MPa	75
Elongation, %	45

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	7-14	90-210	15-26	0.9-1.8
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5
2.0		190-350	25-30	

OK Autrod 1100

GMAW
ER1100

Description

OK Autrod 1100 is highly resistant to chemical attack and weathering. It is a relatively soft alloy that is very formable and it is used extensively in thin-gauge and foil products. It has good welding characteristics. One characteristic feature of the alloy is the bright finish obtained by anodising. Non-heat treatable.

Welding current

DC +

Classifications

SFA/AWS A5.10	ER1100
EN ISO 18273	S Al 1100 (Al99.0Cu)

Wire composition

Mn	V	Cu	Al	Ti	Zn
<0.05	<0.05	0.13	>99.0	<0.03	<0.10

Typical mech. properties all weld metal

Yield stress, MPa	30
Tensile strength, MPa	75
Elongation, %	35

Approvals

CWB AWS A5.10 (Item no ending of A only)

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5

OK Autrod 1450 GMAW

S Al 1450 (Al99.5Ti)

Description

OK Autrod 1450 is highly resistant to chemical attack and weathering. The alloy has a small addition of titanium, which has a grain-refining effect, which reduces cracking susceptibility. It has good welding characteristics. One characteristic feature of the alloy is the bright finish obtained by anodising. Non-heat treatable.

Welding current

DC(+)

Classifications

EN ISO 18273	S Al 1450 (Al99.5Ti)

Wire composition

Si	Mn	Cu	Al	Ti	Zn	Fe
<0.25	<0.05	<0.05	>99.5	0.15	<0.07	<0.40

Typical mech. properties all weld metal

Yield stress, MPa	40
Tensile strength, MPa	90
Elongation, %	35

Approvals

VdTÜV

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5
2.4	3.5-5	280-400	26-31	2.5-3.7

OK Autrod 4043

GMAW
ER4043

Description

OK Autrod 4043 is one of the most widely used welding and brazing alloys and can be classified as a general-purpose filler alloy. The silicon addition results in improved fluidity (wetting action), making the alloy the preferred choice of welders. The alloy is not sensitive to weld cracking and produces bright, almost smut-free welds. Not recommended for anodising. Non-heat treatable.

Welding current

DC(+)

Classifications

SFA/AWS A5.10	ER4043
EN ISO 18273	S Al 4043 (AlSi5)
EN ISO 18273	S Al 4043A (AlSi5(A))

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe
5.0	<0.05	<0.05	<0.05	<0.15	0.10	<0.6

Typical mech. properties all weld metal

Yield stress, MPa	55
Tensile strength, MPa	165
Elongation, %	18

Approvals

CWB	AWS A5.10 (Item number ending with A)
DB	61.039.05
Ü	61.039

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	5-13	60-170	13-24	0.4-1.1
0.9	5-13	60-170	13-24	0.5-1.3
1.0	7-14	90-210	15-26	0.9-1.8
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5
2.4	3.5-5	280-400	26-31	2.5-3.7

OK Autrod 4047

GMAW
ER4047

Description

OK Autrod 4047 was originally developed as a brazing alloy to take advantage of its low melting point and narrow freezing range. In addition, it has a higher silicon content than OK Autrod 4043, which provides increased fluidity and reduced shrinkage. The alloy produces bright, almost smut-free welds. Hot cracking is significantly reduced when using OK Autrod 4047 as a filler alloy. The alloy can be used in applications with sustained elevated temperatures. Non-heat treatable.

Welding current

DC(+)

Classifications

SFA/AWS A5.10	ER4047
EN ISO 18273	S Al 4047 (AlSi12)
EN ISO 18273	S Al 4047A (AlSi12(A))

Wire composition

Si	Mn	Cu	Ti	Zn	Fe
12.0	<0.15	<0.05	<0.15	<0.20	<0.6

Typical mech. properties all weld metal

Yield stress, MPa	80
Tensile strength, MPa	170
Elongation, %	12

Approvals

CWB AWS A5.10
(Item number ending with A)

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5

OK Autrod 5087 GMAW

S Al 5087 (AlMg4.5MnZr)

Description

Continuous solid wire suitable for welding aluminium alloys with up to 5% Mg and alloys where a higher tensile strength is required. The alloying element Zr produces improved resistance to hot cracking during solidification.

Welding current

DC(+)

Classifications

EN ISO 18273	S Al 5087 (AlMg4.5MnZr)

Wire composition

Si	Mn	Cr	Cu	Ti	Zr	Zn	Fe	Mg
<0.25	0.9	0.15	<0.05	<0.15	0.15	<0.25	<0.40	4.9

Typical mech. properties all weld metal

Yield stress, MPa	130
Tensile strength, MPa	280
Elongation, %	30

Approvals

DB	61.039.07
Ü	61.039
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	7-14	90-210	15-26	0.9-1.8
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5

OK Autrod 5183

GMAW
ER5183

Description

OK Autrod 5183 is designed to provide the highest possible strength in the as-welded condition of alloy AA 5083 and similar high-magnesium alloys. The more common OK Autrod 5356 typically fails to meet the as-welded tensile requirements of AA 5083. The alloy is typically used in marine and structural applications where high strength, high fracture toughness for impact resistance and exposure to corrosive elements are important. The alloy is not recommended for elevated temperature applications due to its susceptibility to stress corrosion cracking. The alloy is non-heat treatable.

Welding current

DC(+)

Classifications

SFA/AWS A5.10	ER5183
EN ISO 18273	S Al 5183 (AlMg4.5Mn0.7(A)

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	0.8	0.15	<0.10	<0.15	<0.25	<0.40	4.8

Typical mech. properties all weld metal

Yield stress, MPa	140
Tensile strength, MPa	290
Elongation, %	25

Charpy V

Test temps, °C	Impact values, J
+20	30

Approvals

ABS	ER5183 for dim 1.2 and 1.6 mm
CWB	AWS A5.10 (Item number ending with A)
DB	61.039.03
DNV	5183 (WC)
GL	RAlMg4.5
LR	WC/I-1, RC/I-1
VdTÜV Ü	61.039

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	7-14	90-210	15-26	0.9-1.8
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5
2.4	3.5-5	280-400	26-31	2.5-3.7

OK Autrod 5356

GMAW
ER5356

Description

OK Autrod 5356 is the most widely used welding alloy and can be classified as a general-purpose type filler alloy. OK Autrod 5356 is typically chosen because of its relatively high shear strength. The 5XXX alloy base material, welded with OK Autrod 5356, with a weld pool chemistry greater than 3% Mg and service temperatures in excess of 65°C, is susceptible to stress corrosion cracking. The alloy is non-heat treatable.

Welding current

DC(+)

Classifications

SFA/AWS A5.10	ER5356
EN ISO 18273	S Al 5356 (AlMg5Cr(A))

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	0.15	0.13	<0.05	0.11	<0.10	<0.40	5.0

Typical mech. properties all weld metal

Yield stress, MPa	120
Tensile strength, MPa	265
Elongation, %	26

Approvals

ABS	ER 5356 for dim. 1.2 mm
CWB	AWS A5.10
	(Item number ending with A)
DB	61.039.01
DNV	5356 (WB)
GL	S-AlMg 5
LR	WB/I-1
VdTÜV	
Ü	61.039

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	5-13	60-170	13-24	0.4-1.1
0.9	5-13	60-170	13-24	0.5-1.3
1.0	7-14	90-210	15-26	0.9-1.8
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5
2.4	3.5-5	280-400	26-31	2.5-3.7

OK Autrod 5554

GMAW
ER5554

Description

OK Autrod 5554 is a solid aluminium wire with a content of 2.7% Mg. It is recommended for welding AlMg alloys like 5454. Typical applications include chemical storage tanks, automotive components like wheels and frame sections. The weld metal is not sensitive to stress corrosion cracking at elevated temperatures.

Welding current

DC +

Classifications

SFA/AWS A5.10	ER5554
EN ISO 18273	S Al 5554 (AlMg2.7Mn)

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	0.75	0.13	<0.10	0.13	<0.25	<0.40	2.7

Typical mech. properties all weld metal

Yield stress, MPa	110
Tensile strength, MPa	230
Elongation, %	17

Approvals

CWB	AWS A5.10 (Item no ending of A only)

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5

OK Autrod 5556

GMAW
ER5556

Description

Continuous solid wire suitable for welding aluminium alloys with up to approx. 5% Mg that are not age hardenable and alloys where a higher tensile strength is required.
The corrosion resistance in a marine atmosphere is high.

Welding current

DC(+)

Classifications

SFA/AWS A5.10	ER5556
EN ISO 18273	S Al 5556A (AlMg5Mn)

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	0.8	0.13	<0.10	0.13	<0.20	<0.40	5.3

Typical mech. properties all weld metal

Yield stress, MPa	145
Tensile strength, MPa	295
Elongation, %	25

Charpy V

Test temps, °C	Impact values, J
+20	25

Approvals

CWB	AWS A5.10 (Item number ending with A)
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	7-14	90-210	15-26	0.9-1.8
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5

OK Autrod 5754 GMAW

S Al 5754 (AlMg3)

Description

OK Autrod 5754 is a solid aluminium wire with a content of 3% Mg. It is recommended for welding Al-Mg alloys with less than 3% magnesium. The alloy has relatively high strength and corrosion resistance.

Welding current

DC(+)

Classifications

EN ISO 18273	S Al 5754 (AlMg3)

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	<0.50	<0.30	<0.05	<0.15	<0.20	<0.40	3.1

Typical mech. properties all weld metal

Yield stress, MPa	110
Tensile strength, MPa	230
Elongation, %	23

Approvals

VdTÜV

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	5-13	60-170	13-24	0.4-1.1
1.0	7-14	90-210	15-26	0.9-1.8
1.2	6-13	140-260	20-29	1.1-2.4
1.6	4.5-7.5	190-350	25-30	1.5-2.5

OK Tigrod 1070

GTAW

S Al 1070 (Al99,7)

Description

OK Tigrod 1070 is highly resistant to chemical attack and weathering. It is a relatively soft alloy that is very formable and it is used extensively in thin-gauge and foil products. It has good welding characteristics. One characteristic feature of the alloy is the bright finish obtained by anodising. Non-heat treatable.

Welding current

AC

Classifications

EN ISO 18273	S Al 1070 (Al99,7)

Wire composition

Si	Mn	V	Cu	Al	Ti	Zn	Fe
<0.20	<0.03	<0.05	<0.04	>99.7	<0.03	<0.04	<0.25

Typical mech. properties all weld metal

Yield stress, MPa	35
Tensile strength, MPa	75
Elongation, %	33

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	2.5
2.0	1000	2.5
2.4	1000	2.5
3.2	1000	2.5
4.0	1000	2.5

OK Tigrod 1100

GTAW
R1100

Description

OK Tigrod 1100 is highly resistant to chemical attack and weathering. It is a relatively soft alloy that is very formable and it is used extensively in thin-gauge and foil products. It has good welding characteristics. One desirable characteristic of the alloy is the bright finish obtained by anodising. Non-heat treatable.

Welding current

AC

Classifications

SFA/AWS A5.10	R1100
EN ISO 18273	S Al 1100 (Al99,0Cu)

Wire composition

Mn	V	Cu	Al	Ti	Zn
<0.05	<0.05	0.13	>99.0	<0.03	<0.10

Typical mech. properties all weld metal

Yield stress, MPa	30
Tensile strength, MPa	75
Elongation, %	35

Approvals

CWB AWS A5.10 (Item no ending of A only)

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.4	1000	5
3.2	1000	5

OK Tigrod 1450 GTAW

S Al 1450 (Al99,5Ti)

Description

OK Tigrod 1450 is highly resistant to chemical attack and weathering. The alloy has a small addition of titanium, which has a grain- refining effect, which reduces cracking susceptibility. It has good welding characteristics. One characteristic feature of the alloy is the bright finishes obtained by anodising. Non-heat treatable.

Welding current

AC

Classifications

EN ISO 18273	S Al 1450 (Al99,5Ti)

Wire composition

Si	Mn	Cu	Al	Ti	Zn	Fe
<0.25	<0.05	<0.05	>99.5	0.15	<0.07	<0.40

Typical mech. properties all weld metal

Yield stress, MPa	40
Tensile strength, MPa	90
Elongation, %	35

Approvals

VdTÜV

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	2.5
2.0	1000	2.5
2.4	1000	2.5
3.2	1000	2.5

OK Tigrod 4043

GTAW
R4043

Description

OK Tigrod 4043 is one of the most widely used welding alloys. It is used for welding AlMgSi types and AlSi alloys with up to 7% silicon. Not recommended for anodising. Non-heat treatable.

Welding current

AC

Classifications

SFA/AWS A5.10	R4043
EN ISO 18273	S Al 4043 (AlSi5)
EN ISO 18273	S Al 4043A (AlSi5(A))

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe
5.0	<0.05	<0.05	<0.05	<0.15	<0.10	<0.6

Typical mech. properties all weld metal

Yield stress, MPa	55
Tensile strength, MPa	165
Elongation, %	18

Approvals

CWB	AWS A5.10 (Item number ending with A)
DB	61.039.06
Ü	61.039

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	2.5/5
2.0	1000	2.5
2.4	1000	2.5/5
3.2	1000	2.5/5
4.0	1000	2.5/5

OK Tigrod 4047

GTAW
R4047

Description

OK Tigrod 4047 was originally developed as a brazing alloy to take advantage of its low melting point and narrow freezing range. In addition, it has a higher silicon content than OK Tigrod 4043, which provides increased fluidity and reduced shrinkage. Hot cracking is significantly reduced when using OK Autrod 4047 as a filler alloy. The alloy may be used in applications at sustained elevated temperatures. Non-heat treatable.

Welding current

AC

Classifications

SFA/AWS A5.10	R4047
EN ISO 18273	S Al 4047 (AlSi12(A))
EN ISO 18273	S Al 4047 (AlSi12)

Wire composition

Si	Mn	Cu	Ti	Zn	Fe
12.0	<0.15	<0.05	<0.15	<0.20	<0.6

Typical mech. properties all weld metal

Yield stress, MPa	80
Tensile strength, MPa	170
Elongation, %	12

Approvals

CWB AWS A5.10
(Item number ending with A)

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	2.5/5
2.0	1000	2.5
2.4	1000	2.5/5
3.2	1000	2.5/5

OK Tigrod 5087

GTAW

S Al 5087 (AlMg4,5MnZr)

Description

Bare welding rod suitable for welding aluminium alloys with up to 5% Mg and alloys where a higher tensile strength is required. The alloying element Zr produces improved resistance to hot cracking during solidification.

Welding current

AC

Classifications

EN ISO 18273 S Al 5087 (AlMg4,5MnZr)

Wire composition

Si	Mn	Cr	Cu	Ti	Zr	Zn	Fe	Mg
<0.25	0.9	0.15	<0.05	<0.15	0.15	<0.25	<0.40	4.9

Typical mech. properties all weld metal

Yield stress, MPa	130
Tensile strength, MPa	280
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
+20	35

Approvals

DB	61.039.08
Ü	61.039
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
2.0	1000	2.5
2.4	1000	2.5
3.2	1000	2.5

OK Tigrod 5183

GTAW
R5183

Description

OK Tigrod 5183 was developed to provide the highest possible strengtht in the as-welded condition of alloy AA 5083 and similar high magnesium alloys. The more common OK Tigrod 5356 will typically fail to meet the as-welded tensile requirements of AA 5083. The alloy is typically utilised in marine and structural applications where high strength, high impact fracture toughness and exposure to corrosive elements are important. The alloy is not recommended for elevated temperature applications due to its susceptibility to stress corrosion cracking. The alloy is non-heat treatable.

Welding current

AC

Classifications

SFA/AWS A5.10	R5183
EN ISO 18273	S Al 5183 (AlMg4,5Mn0,7(A))

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	0.8	0.15	<0.10	<0.15	<0.25	<0.40	4.8

Typical mech. properties all weld metal

Yield stress, MPa	140
Tensile strength, MPa	290
Elongation, %	25

Charpy V

Test temps, °C	Impact values, J
+20	30

Approvals

CWB	AWS A5.10 (Item number ending with A)
DB	61.039.04
VdTÜV Ü	61.039

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	2.5/5
2.0	1000	2.5
2.4	1000	2.5/5
3.2	1000	2.5/5
4.0	1000	2.5/5

OK Tigrod 5356

GTAW
R5356

Description

OK Tigrod 5356 is the most widely used welding alloy and can be classified as a general-purpose type filler alloy. OK Tigrod 5356 is typically chosen because of its relatively high shear strength. The 5XXX alloy base material, welded with OK Tigrod 5356, with a weld pool chemistry greater than 3% Mg and service temperatures in excess of 65°C, is susceptible to stress corrosion cracking. The alloy is non-heat treatable.

Welding current

AC

Classifications

SFA/AWS A5.10	R5356
EN ISO 18273	S Al 5356 (AlMg5Cr(A))

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	0.15	0.13	<0.05	0.11	<0.10	<0.40	5.0

Typical mech. properties all weld metal

Yield stress, MPa	120
Tensile strength, MPa	265
Elongation, %	26

Approvals

CWB	AWS A5.10 (Item number ending with A)
DB	61.039.02
VdTÜV Ü	61.039

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	2.5/5
2.0	1000	2.5/5
2.4	1000	2.5/5
3.2	1000	2.5/5
4.0	1000	2.5/5
5.0	1000	2.5/5

OK Tigrod 5554

GTAW
R5554

Description

OK Tigrod 5554 is a solid aluminium rod with a content of 2.7% Mg. It is recommended for the welding of AlMg alloys like 5454. Typical applications include chemical storage tanks, automotive components like wheels and frame sections. The weld metal is not sensitive to stress corrosion cracking at elevated temperatures.

Welding current

AC

Classifications

SFA/AWS A5.10	R5554
EN ISO 18273	S Al 5554 (AlMg2,7Mn)

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	0.75	0.13	<0.10	0.13	<0.25	<0.40	2.7

Typical mech. properties all weld metal

Yield stress, MPa	110
Tensile strength, MPa	230
Elongation, %	17

Approvals

CWB AWS A5.10 (Item no ending of A only)

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.4	1000	5
3.2	1000	5

OK Tigrod 5556

GTAW
R5556

Description

Bare welding rod suitable for welding aluminium alloys with up to approx. 5% Mg that are not age hardenable and alloys where a higher tensile strength is required.
The corrosion resistance in a marine atmosphere is very good.

Welding current

AC

Classifications

SFA/AWS A5.10	R5556
EN ISO 18273	S Al 5556A (AlMg5Mn)

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	0.8	1.3	<0.10	0.13	<0.20	<0.40	5.3

Typical mech. properties all weld metal

Yield stress, MPa	145
Tensile strength, MPa	295
Elongation, %	25

Charpy V

Test temps, °C	Impact values, J
+20	25

Approvals

CWB	AWS A5.10 (item number ending with A)
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	2.5
2.4	1000	2.5
3.2	1000	2.5
4.0	1000	2.5

OK Tigrod 5754

GTAW

S Al 5754 (AlMg3)

Description

OK Tigrod 5754 is a solid aluminium rod with a content of 3% Mg. It is recommended for welding Al-Mg alloys with less than 3% magnesium. The alloy has relatively high strength and corrosion resistance.

Welding current

AC

Classifications

EN ISO 18273	S Al 5754 (AlMg3)

Wire composition

Si	Mn	Cr	Cu	Ti	Zn	Fe	Mg
<0.25	<0.50	<0.30	<0.05	<0.15	<0.20	<0.40	3.1

Typical mech. properties all weld metal

Yield stress, MPa	110
Tensile strength, MPa	230
Elongation, %	23

Approvals

VdTÜV

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	2.5
2.0	1000	2.5
2.4	1000	2.5
3.2	1000	2.5
4.0	1000	2.5

Consumables for nickel-based alloys

Contents

Nickel-based alloys
Contents

OK 92.05

Type Lime-basic

SMAW
ENi-1

Description

OK 92.05 is a stick electrode for joining commercial pure nickel in wrought and cast forms. It can also be used to join dissimilar metals such as nickel to steel, nickel to copper and copper to steel. Moreover, this electrode can be used for surfacing steel.

Welding recommendations:

To avoid weld metal defects, it is important that the welding zone is thoroughly cleaned and free from oxides. Machining, grinding, grit blasting or pickling are ways of doing this. Brushing is not advisable.
The high nickel weld metal of OK 92.05 has reduced wettability compared with steel weld metal. However, this should not be compensated for by increasing the welding current so that it exceeds the recommended maximum limit for the electrode. This may lead to the loss of deoxidisers and the subsequent formation of pores.
The weaving technique is generally desirable.
The opening angle for joints should be between 80-90°C.
Machinability: good
Redrying the electrodes: 250°C, 2 h

Welding current

DC+

Classifications

SFA/AWS A5.11	ENi-1
EN ISO 14172	E Ni 2061 (NiTi3)

Typical all weld metal composition, %

C	Si	Mn	Ni	Cu	Al	Ti	Fe
0.04	0.7	0.4	>92.0	<0.2	<0.1	1.5	0.4

Typical mech. properties all weld metal

Yield stress, MPa	330
Tensile strength, MPa	470
Elongation A5, %	30

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	70-95	23	0.55	96	0.8	47
3.2	350	90-135	25	0.55	53	1.2	56
4.0	350	120-180	27	0.45	42	1.5	59

OK 92.15

Type Basic

SMAW
ENiCrFe-2

Description

OK 92.15 is a nickel-based electrode for welding Inconel 600 and similar alloys, cryogenic steels (e.g. 9Ni and 5Ni steels), martensitic to austenitic steels, dissimilar steels, heat-resistant steel castings with limited weldability and so on. The weldability is good in all positions, even in the overhead position.

Welding current

DC+

Classifications

SFA/AWS A5.11	ENiCrFe-2
EN ISO 14172	E Ni 6133 (NiCr16Fe12NbMo)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu	Fe
<0.1	<0.75	2.3	15.5	70	1.5	2.0	<0.5	9.0

Typical mech. properties all weld metal

Yield stress, MPa	420
Tensile strength, MPa	660
Elongation A4, %	45

Charpy V

Test temps, °C	Impact values, J
+20	110
-196	90

Approvals

ABS

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	50-80	22	0.63	91	0.9	45
3.2	350	70-105	23	0.62	57	1.3	57
4.0	350	95-140	24	0.65	31	2.1	58

OK 92.26

Type Basic

SMAW
ENiCrFe-3

Description

A nickel-based electrode for welding nickel alloys such as Inconel 600 and similar Inconel alloys, cryogenic steels, martensitic to austenitic steels, dissimilar steels, heat-resistant steels and castings with limited weldability.

Welding current

DC+

Classifications

SFA/AWS A5.11	ENiCrFe-3
EN ISO 14172	E Ni 6182 (NiCr15Fe6Mn)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Nb	Cu	Ti	Ta	Fe
0.03	0.5	6.6	15.8	67	1.7	<0.5	<0.5	<0.3	8.8

Typical mech. properties all weld metal

Yield stress, MPa	410
Tensile strength, MPa	640
Elongation A4, %	40

Charpy V

Test temps, °C	Impact values, J
+20	100
-196	80

Approvals

ABS	ENiCrFe-3
Sepros	UNA 409820
UDT	DIN 1736

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	45-70	22	0.63	88	0.9	50
3.2	350	70-105	23	0.62	57	1.2	60
4.0	350	90-130	24	0.64	31	2.0	60
5.0	350	120-170	25	0.64	20	2.7	68

OK 92.35

Type Rutile-basic

SMAW
(ENiCrMo-5)

Description

OK 92.35 is a nickel-based, super-alloy electrode of the NiCrMoW type. OK 92.35 deposits an extremely tough, work-hardening weld metal, which is resistant to attacks by the most commonly used acids. The weld metal is also resistant to high temperatures.

Welding current

DC+, AC OCV 70 V

Classifications

SFA/AWS A5.11	(ENiCrMo-5)
DIN 8555	E 23-250 CKT

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	W	Fe
0.05	0.5	0.8	15.5	58	16.4	3.5	5.5

Typical mech. properties all weld metal

Yield stress, MPa	515
Tensile strength, MPa	750
Elongation A5, %	17

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	65-110	18	0.61	56	1.1	62
3.2	350	110-150	18	0.63	28	1.6	86
4.0	350	160-200	20	0.64	19	2.3	89
5.0	350	190-250	20	0.65	11	3.1	106

OK 92.45

Type Basic

SMAW
ENiCrMo-3

Description

OK 92.45 is a NiCrMoNb-based electrode for welding nickel alloys of the same or similar type, like Inconel 625, and for welding 5Ni and 9Ni steel. OK 92.45 is also suitable for welding UNS S31254 steel.

Welding current

DC+

Classifications

SFA/AWS A5.11	ENiCrMo-3
EN ISO 14172	E Ni 6625 (NiCr22Mo9Nb)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu	Al	Fe
0.03	0.4	0.2	21.7	63	9.3	3.3	<0.3	<0.4	2.0

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	780
Elongation A5, %	

Charpy V

Test temps, °C	Impact values, J
+20	70
-196	50

Approvals

UDT	DIN 1736
VdTÜV	06833

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	50-80	23	0.6	100	0.9	40
3.2	350	70-110	25	0.6	49	1.4	52
4.0	350	100-140	27	0.6	33	1.9	57
5.0	350	120-170	24	0.6	21	2.1	72

OK 92.55

Type Basic

SMAW
ENiCrMo-6

Description

OK 92.55 is an all-positional, basic coated electrode which deposits a NiCr-based alloy with additions of Mo, W and Nb. The electrode is specifically designed for welding 9%Ni steels for cryogenic applications down to -196°C.

Welding current

AC, DC+ - OCV 55 V

Classifications

SFA/AWS A5.11	ENiCrMo-6
EN ISO 14172	E Ni 6620 (NiCr14Mo7Fe)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	W	Nb	Cu	Fe
0.05	0.3	3.0	13.0	69	6.2	1.6	1.3	<0.3	5.0

Typical mech. properties all weld metal

Yield stress, MPa	>430
Tensile strength, MPa	>690
Elongation A4, %	>35

Charpy V

Test temps, °C	Impact values, J
-196	>70

Approvals

ABS	ENiCrMo-6

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	65-115	22	0.66	34	1.5	68
3.2	350	70-150	22	0.66	34	1.5	68
4.0	350	120-200	22	0.67	23	1.9	82
5.0	350	150-240	23	0.68	14	2.8	91

OK 92.59

Type Basic

SMAW
ENiCrMo-13

Description

OK 92.59 is designed for welding alloy 59, C-276 and 625 Ni-based materials. It is also suitable for welding superaustenitic steels like AISI/ASTM S31254 and S32654.

Welding current

DC+

Classifications

SFA/AWS A5.11	ENiCrMo-13
EN ISO 14172	E Ni 6059 (NiCr23Mo16)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Fe
<0.02	<0.2	<0.2	23.0	62.0	15.8	<1.0

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	770
Elongation A5, %	40

Charpy V

Test temps, °C	Impact values, J
-60	70
-196	60

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V
2.5	300	50-70	20
3.2	350	60-90	21
4.0	350	80-120	22

OK 92.82

Type Basic

SMAW
2.4648

Description

A very versatile basic coated electrode with excellent corrosion resistance, heat resistance and low temperature toughness. For welding nickel alloys, heat-resistant austenitic steels, austenitic to ferritic steels; also when subjected to operating temperatures above 300 °C.

Welding current

DC+

Classifications

Werkstoff Nr.	2.4648
EN ISO 14172	E Ni 6082 (NiCr20Mn3Nb)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu	Ti	Fe
0.03	<0.4	4.8	19.4	>67	1.0	2.3	<0.5	<0.5	2.3

Typical mech. properties all weld metal

Yield stress, MPa	>390
Tensile strength, MPa	>620
Elongation A5, %	>35

Charpy V

Test temps, °C	Impact values, J
+20	>80
-196	>65

Approvals

VdTÜV	07290

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V
2.5	300	40-70	25
3.2	300	70-100	26
4.0	350	90-130	28

OK 92.86

Type Basic

SMAW
E NiCu-7

Description

A nickel-copper electrode for welding NiCu alloys to themselves and to steels and for corrosion-resistant surfacing. The weld metal of OK 92.86 is crack resistant and ductile and meets rigorous requirements relating to corrosion resistance in sea water and in reducing and oxidising acids. OK 92.86 is used for welding corrosion-resistant monel alloys within the petroleum and ammoniun sulphate industry and in power plants.

Welding current

DC+

Classifications

SFA/AWS A5.11	E NiCu-7
EN ISO 14172	E Ni 4060 (NiCu30Mn3Ti)

Typical all weld metal composition, %

C	Si	Mn	Ni	Nb	Cu	Al	Ti	Fe
0.01	0.3	2.1	66	<0.3	29	<0.5	0.2	1.6

Typical mech. properties all weld metal

Yield stress, MPa	410
Tensile strength, MPa	640
Elongation A4, %	40

Charpy V

Test temps, °C	Impact values, J
+20	100
-196	80

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	50-70	22	0.63	83	1.0	45
3.2	350	70-120	26	0.63	42	1.6	52
4.0	350	120-140	28	0.63	28	2.4	54

OK Autrod 19.81 GMAW

ERNiCrMo-13

Description

A continuous, solid, Ni-Cr-Mo electrode for welding high-alloyed materials of the 20Cr-25Ni type with 4-6% Mo and Ni-based alloys of a similar type. It can also be welded in combination with carbon steels. The weld metal has very good corrosion resistance over a wide range of applications in oxidising and reducing media.

Welding current

DC(+)

Classifications

SFA/AWS A5.14	ERNiCrMo-13
EN ISO 18274	S Ni 6059 (NiCr23Mo16)

Wire composition

C	Si	Mn	Cr	Ni	Mo
<0.01	<0.1	<0.5	23.0	>56.0	15.7

Typical mech. properties all weld metal

Yield stress, MPa	550
Tensile strength, MPa	750
Elongation, %	45

Charpy V

Test temps, °C	Impact values, J
-110	120

Approvals

VdTÜV

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	5-18	70-190	20-27	1.3-4.5
1.0	6-13	100-200	21-27	2.3-5.1
1.2	6-10	160-280	24-30	3.4-5.6
1.6	4-8	200-350	25-32	4.0-8.0

OK Autrod 19.82 GMAW

ERNiCrMo-3

Description

A continuous, solid, corrosion- and heat-resistant, Ni-Cr electrode for welding high-alloyed heat-resistant and corrosion-resistant materials, 9% Ni steels and similar steels with high notch toughness at low temperatures. It is also suitable for joining dissimilar metals of the types mentioned above. The weld metal has very good mechanical properties at high and low temperatures. Good resistance to pitting and stress corrosion.

Welding current

DC(+)

Classifications

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

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu	Al	Ti	Fe
<0.1	<0.5	<0.5	21.5	>60.0	9.0	<0.5	<0.4	<0.4	<2.0

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	780
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	130
-105	120
-196	110

Approvals

UDT
VdTÜV

DIN 1736

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	5-18	70-190	20-27	1.3-4.5
1.0	6-13	100-200	21-27	2.3-5.1
1.2	6-10	160-280	24-30	3.4-5.6
1.6	4-8	200-350	25-32	4.0-8.0

OK Autrod 19.85 GMAW

ERNiCr-3

Description

A nickel-based, corrosion- and heat-resistant, 20% Cr, 3% Mo, 2.5% Nb electrode for the GMAW of high-alloyed steel, heat-resistant steel, corrosion-resistant steel, 9% Ni and similar steels with high notch toughness at low temperatures. It is also suitable for joining dissimilar metals of the type mentioned above. OK Autrod 19.85 is usually welded with pure Ar as the shielding gas.

Welding current

DC(+)

Classifications

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

Wire composition

C	Si	Mn	Cr	Ni	Cu	Ti	Fe
<0.1	<0.5	3.0	20.0	>67.0	<0.5	<0.7	<3.0

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	670
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	150
-196	100

Approvals

UDT
VdTÜV
DIN 1736

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	5-18	70-190	20-27	1.3-4.5
1.0	6-13	100-200	21-27	2.3-5.1
1.2	6-10	160-280	24-30	3.4-5.6
1.6	4-8	200-350	25-32	4.0-8.0

OK Autrod 19.92 GMAW
ERNi-1

Description

A nickel-based electrode alloyed with 3% Ti for the GMAW of high-purity nickel (min. 99.6% Ni), ordinary wrought nickel and nickel with a reduced carbon content. OK Autrod 19.92 is usually welded with pure Ar as the shielding gas.

Welding current

DC(+)

Classifications

SFA/AWS A5.14	ERNi-1
DIN 1736	SG NiTi4
Werkstoff Nr.	2.4155

Wire composition

C	Si	Mn	Ti	Ni
0.02	0.3	0.4	3.0	bal.

Typical mech. properties all weld metal

Yield stress, MPa	300
Tensile strength, MPa	500
Elongation, %	27

Charpy V

Test temps, °C	Impact values, J
+20	190
-20	230

Approvals

UDT

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0,8	5-18	70-190	20-27	1.3-4.8
1.0	6-13	100-200	21-27	2.5-5.5
1.2	6-10	160-280	24-30	3.6-6.0
1.6	4-8	200-350	25-32	4.3-8.6

OK Autrod 19.93 GMAW

ERNiCu-7

Description

A nickel-based electrode alloyed with about 30% Cu, 2% Ti and 1% Fe for the GMAW of base materials of the same type. It can also be used for joining these alloys to steel. OK Autrod 19.93 is usually welded with pure Ar as the shielding gas.

Welding current

DC(+)

Classifications

SFA/AWS A5.14	ERNiCu-7
DIN 1736	SG NiCu30MnTi
Werkstoff Nr.	2.4377

Wire composition

C	Si	Mn	Cu	Ti	Fe	Ni
0.04	0.10	3.5	30.0	2.0	1.0	bal.

Typical mech. properties all weld metal

Yield stress, MPa	300
Tensile strength, MPa	530
Elongation, %	45

Charpy V

Test temps, °C	Impact values, J
+20	130
-20	150

Approvals

UDT

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	5-18	70-190	20-27	1.3-4.8
1.0	6-13	100-200	21-27	2.5-5.5
1.2	6-10	160-280	24-30	3.6-6.0
1.6	4-8	200-350	25-32	4.3-8.6

OK Tigrod 19.81 GTAW

ERNiCrMo-13

Description

Bare Ni-Cr-Mo rod for welding high-alloyed materials of the 20Cr-25Ni typewith 4-6% Mo and Ni-based alloys of a similar type. It can also be welded in combination with carbon steels. The weld metal has very good corrosion resistance over a wide range of applications in oxidising and reducing media.

Welding current

DC(-)

Classifications

SFA/AWS A5.14	ERNiCrMo-13
EN ISO 18274	S Ni 6059 (NiCr23Mo16)

Wire composition

C	Si	Mn	Cr	Ni	Mo
<0.01	<0.1	<0.5	23.0	>56.0	15.7

Typical mech. properties all weld metal

Yield stress, MPa	550
Tensile strength, MPa	750
Elongation, %	45

Charpy V

Test temps, °C	Impact values, J
-110	120

Approvals

VdTÜV

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5

OK Tigrod 19.82 GTAW

ERNiCrMo-3

Description

A nickel-based, corrosion- and heat-resistant, 22% Cr, 9% Mo, 3.5% Nb rod for the GTAW of high-alloyed steel, heat-resistant steel, corrosion-resistant steel, 9% Ni steels and similar steel with high notch toughness at low temperatures. It is also suitable for joining dissimilar metals of the types mentioned above. OK Tigrod 19.82 is normally welded with pure Ar as the shielding gas.

Welding current

DC(-)

Classifications

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

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu	Al	Ti	Fe
<0.1	<0.5	<0.5	21.5	>60.0	9.0	<0.5	<0.4	<0.4	<2.0

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	780
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	130
-105	120
-196	110

Approvals

UDT
VdTÜV

DIN 1736

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5
3.2	1000	5

OK Tigrod 19.85 GTAW

ERNiCr-3

Description

A nickel-based, corrosion- and heat-resistant, 20% Cr, 3% Mn, 2.5% Nb rod for the GTAW of high-alloyed steel, heat-resistant steel, corrosion-resistant steel, 9% Ni steels and similar steels with high notch toughness at low temperatures. It is also suitable for joining dissimilar metals of the types mentioned above. OK Tigrod 19.85 is usually welded with pure Ar as the shielding gas.

Welding current

DC(-)

Classifications

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

Wire composition

C	Si	Mn	Cr	Ni	Cu	Ti	Fe
<0.1	<0.5	3.0	20.0	>67.0	<0.5	<0.7	<3.0

Typical mech. properties all weld metal

Yield stress, MPa	440
Tensile strength, MPa	670
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	150
-196	100

Approvals

UDT
VdTÜV

DIN 1736

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5
3.2	1000	5

OK Tigrod 19.92 GTAW

ERNi-1

Description

A nickel-based rod alloyed with 3% Ti for the GTAW of high-purity nickel (min. 99.6% Ni), ordinary wrought nickel and nickel with a reduced carbon content. OK Tigrod 19.92 is normally welded with pure Ar as the shielding gas.

Welding current

DC(-)

Classifications

SFA/AWS A5.14	ERNi-1
DIN 1736	SG NiTi4
Werkstoff Nr.	2.4155

Wire composition

C	Si	Mn	Ti	Ni
0.02	0.3	0.4	3.0	bal.

Typical mech. properties all weld metal

Yield stress, MPa	300
Tensile strength, MPa	500
Elongation, %	27

Charpy V

Test temps, °C	Impact values, J
+20	190
-20	230

Approvals

UDT

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5

OK Tigrod 19.93 GTAW

ERNiCu-7

Description

A nickel-based rod alloyed with about 30% Cu, 2% Ti and 1% Fe for the GTAW of base materials of the same type. It can also be used for joining these alloys to steels. OK Tigrod 19.93 is normally welded with pure Ar as the shielding gas.

Welding current

DC(-)

Classifications

SFA/AWS A5.14	ERNiCu-7
DIN 1736	SG-NiCu30MnTi
Werkstoff Nr.	2.4377

Wire composition

C	Si	Mn	Ni	Nb	Cu	Ti	Fe
0.15	<1.0	3.0	65.5	<0.5	30.0	2.3	1.5

Typical mech. properties all weld metal

Yield stress, MPa	300
Tensile strength, MPa	530
Elongation, %	45

Charpy V

Test temps, °C	Impact values, J
+20	130
0	140
-20	150

Approvals

UDT
VdTÜV

DIN 1736

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5

OK Autrod 19.81 SAW

ERNiCrMo-13

Description

OK Autrod 19.81 is an Nb-free, Ni-Cr-Mo wire for welding high-alloyed steels of the 20Cr25Ni4-6Mo type and nickel-based alloys of a similar type. The wire can also be used for welding these steels to dissimilar steels. The weld metal has very good corrosion resistance in both oxidising and reducing media. OK Autrod 19.81 can be combined with OK Flux 10.90 or OK Flux 10.16.

Classifications

SFA/AWS A5.14	ERNiCrMo-13
EN ISO 18274	S Ni 6059 (NiCr23Mo16)

Wire composition

C	Si	Mn	Cr	Ni	Mo	Co	Al	Fe
<0.01	<0.1	<0.5	23.0	>56.0	15.8	<0.3	0.3	<1.5

OK Autrod 19.82 SAW

ERNiCrMo-3

Description

OK Autrod 19.82 is a corrosion- and heat-resistant, nickel-chromium wire for the submerged arc welding of high-alloyed steel, heat-resistant steel, corrosion-resistant steel, 9Ni steels and similar steel with high notch toughness at low temperatures.
OK Autrod 19.82 can be combined with OK Flux 10.90 or OK Flux 10.16.

Classifications

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

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu	Al	Ti	Fe
<0.1	<0.5	<0.5	21.5	>60.0	9.0	<0.5	<0.4	<0.4	<2.0

OK Autrod 19.85 SAW

ERNiCr-3

Description

OK Autrod 19.85 is a corrosion- and heat-resistant, nickel-chromium wire for the submerged arc welding of high-alloyed steel, heat-resistant steel, corrosion-resistant steel, 9Ni steels and similar steel with high notch toughness at low temperatures.
OK Autrod 19.85 can be combined with OK Flux 10.90 or OK Flux 10.16.

Classifications

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

Wire composition

C	Si	Mn	Cr	Ni	Cu	Ti	Fe
<0.1	<0.5	3.0	20.0	>67.0	<0.5	<0.7	<3.0

OK Band NiCr3 SAW

ERNiCr-3

Description

OK Band NiCr3 is a nickel-based strip for submerged arc strip cladding. Together with OK Flux 10.16, it produces a weld overlay with good resistance to stress-corrosion cracking at high temperatures.

Classifications

SFA/AWS A5.14	ERNiCr-3
EN ISO 18274	B Ni 6082 (NiCr20Mn3Nb)

Wire composition

C	Si	Mn	Cr	Mo	Cu	Ti	Ta	Fe
<0.05	<0.25	3.0	20.0	<2.0	<0.5	<0.75	<0.3	<3.0

OK Band NiCrMo3 SAW

ERNiCrMo-3

Description

OK Band NiCrMo3 is a nickel-based strip for submerged arc strip cladding. Together with OK Flux 10.16, it produces a weld overlay with good corrosion resistance and high-temperature properties.

Classifications

SFA/AWS A5.14	ERNiCrMo-3
EN ISO 18274	B Ni 6625 (NiCr22Mo9Nb)

Wire composition

C	Si	Mn	Cr	Mo	Co	Cu	Al	Ti
<0.03	<0.2	<0.5	21.5	9.0	<0.3	<0.5	<0.4	<0.4

Ta	Fe
<0.6	<2.0

OK Flux 10.11 SAW

Type Fluoride basic

Description

OK Flux 10.11 is very high basic agglomerated flux for electroslag strip cladding. The flux has low viscosity and is suitable for cladding with Ni-base, Co and fully-austenitic alloys due to its good wetting behaviour. It is also suitable for welding at higher travel speeds.

Density

1.0 kg/dm^3

Basicity index

5.4

Flux consumption as kg flux/kg wire

Voltage	DC
25	0.5

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Band NiCr3	<0.05	<0.25	3.0	20.0	>67	<2.0
OK Band NiCrMo3	0.02	0.1	0.3	22.0	bal.	9.0

Classifications

Wire	EN ISO 18274	SFA/AWS A5.14
OK Band NiCr3	B Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3
OK Band NiCrMo3	B Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3

OK Flux 10.16 SAW

Type Fluoride basic SA AF 2 DC

Description

OK Flux 10.16 is an agglomerated, non-alloying flux for submerged arc welding. OK Flux 10.16 is specially designed for butt welding with nickel-based alloyed wire and cladding with nickel-based alloy strips. The well-balanced flux composition minimises silicon transfer from the flux to the welding metal, thereby minimising the risk of hot cracking when welding with nickel-based alloys. OK Flux 10.16 can only be used on DC when butt welding with nickel-based alloy wires. Reverse polarity (DC-) should preferably be used in order to minimise the dilution from the base material and the risk of hot cracking in the weld metal.

Density

1.2 kg/dm^3

Basicity index

2.4

Flux consumption as kg flux/kg wire

Voltage	DC +
26	0.75
28	0.75
30	0.55
34	0.7
38	1.0

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 19.81	0.02	0.2	0.7	18.0	bal.	16.0
OK Autrod 19.82	0.01	0.35	0.3	21.0	bal.	9.0
OK Autrod 19.85		0.3	3.2	19.0	bal.	2.0
OK Band NiCr3	0.04	0.5	3.0	19.0	bal.	2.0
OK Band NiCrMo3	0.02	0.2	1.2	21.0	bal.	9.0

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 19.81	490	730	+20	80
			-60	75
			-196	60
OK Autrod 19.82	425	700	-140	100
			-196	80
OK Autrod 19.85	360	600	+20	140
			-196	100

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	CL	VdTÜV
OK Autrod 19.81								
OK Autrod 19.82								
OK Autrod 19.85								
OK Band NiCr3								x
OK Band NiCrMo3								

Classifications

Wire	EN ISO 18274	SFA/AWS A5.14
OK Autrod 19.81	S Ni 6059 (NiCr23Mo16)	ERNiCrMo-13
OK Autrod 19.82	S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3
OK Autrod 19.85	S Ni 6082 (NiCr20Mn3Nb)	
OK Band ERNiCr-3	B Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3
OK Band NiCrMo3	B Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3

OK Flux 10.90 SAW

Type Fluoride-basic SA AF 2 CrNi DC

Description

OK Flux 10.90 is an agglomerated fluoride basic flux for welding 9% Ni steels and other high-alloyed steels. The flux adds manganese , which reduces the risk of hot cracking. Good slag detachability and attractive bead appearance.

Density

1.0 kg/dm^3

Basicity index

1.7

Flux consumption as kg flux/kg wire

Voltage	DC
26	0.5
30	0.6
34	0.8
38	1.0

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 19.81	0.001	0.2	3.0	22.0	bal.	14.0
OK Autrod 19.82	0.01	0.2	1.5	21.0	bal.	8.5

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 19.81	470	675	-196	70
OK Autrod 19.82	440	720	-196	90

Classifications

Wire	EN ISO 18274	SFA/AWS A5.14
OK Autrod 19.81	S Ni 6059 (NiCr23Mo16)	ERNiCrMo-13
OK Autrod 19.82	S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3

Consumables for copper-based alloys

Contents

Copper-based alloys
Contents

OK 94.25

Type Basic

SMAW
EL-CuSn7

Description

Electrode for welding copper and bronzes, especially tin bronzes. It is also suitable for cladding steels and for small-scale repair work in weldable cast irons.

Applications:

For the repair and construction of parts in casting such as:

- valves
- pumps
- housings
- bearing surfaces

Welding current

DC+

Classifications

DIN 1733	EL-CuSn7

Typical all weld metal composition, %

Mn	P	Cu	Sn	Fe
<0.5	<0.1	92.5	7.0	<0.2

Typical mech. properties all weld metal

Yield stress, MPa	235
Tensile strength, MPa	330-390
Elongation A5, %	25
Hardness(HB):	95

(Preheat and interpass temp. 300°C)

Charpy V

Test temps, °C	Impact values, J
+20	25
0	20

Approvals

Sepros	UNA 409820

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	60-90	22	0.71	77.,0	1.2	39
3.2	350	90-125	24	0.72	46.0	1.9	40
4.0	350	125-170	25	0.74	30.5	2.9	41

OK 94.35

Type Basic

SMAW
ECuNi

Description

Copper-nickel electrode used for chemical process equipment, desalination plants and offshore applications. It is suitable for the joining and cladding of matching and dissimilar alloys.

Welding current

DC+

Classifications

SFA/AWS A5.6	ECuNi
DIN 1733	EL-CuNi30Mn

Typical all weld metal composition, %

C	Si	Mn	Ni	Ti	Fe	Cu
<0.05	<0.5	1.5	30.5	<0.5	0.6	bal.

Typical mech. properties all weld metal

Tensile strength, MPa	400
Elongation, A4 (%)	30

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V
2.5	300	55-70	23
3.2	350	70-120	25

OK 94.55

Type Basic

SMAW

Description

OK 94.55 is an electrode for welding silicon bronzes and certain special types of brass. It is also suitable for overlaying bearing surfaces and corrosion-resistant surfacing on steel.

Welding current

DC+

Classifications

DIN 1733	EL-CuSi3
Werkstoff	Nr.2.1461

Typical all weld metal composition, %

Si	Mn	Cu
3.0	<1.5	95.5

Typical mech. properties all weld metal

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	55-95	25	0.67	77	1.1	42
3.2	350	85-130	28	0.67	47	1.7	45
4.0	350	110-165	28	0.67	32	2.3	50

OK Autrod 19.12 GMAW

ERCu

Description

A continuous, solid, copper wire for the GMA joining of oxygen-free, pure copper and low-alloyed copper. OK Autrod 19.12 is alloyed with tin and has good flow properties. OK Autrod 19.12 is normally welded with pure Ar as the shielding gas.

Welding current

DC(+)

Classifications

SFA/AWS A5.7	ERCu
EN 14640	S Cu 1898 (CuSn1)

Wire composition

Si	Mn	Cu	Sn
0.3	0.3	>98.0	0.8

Typical mech. properties all weld metal

Yield stress, MPa	75
Tensile strength, MPa	220
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
+20	75
-20	40

OK Autrod 19.20 GMAW

S Cu 5180 (CuSn6P)

Description

A continuous, solid, copper wire for the GMA joining of copper-tin bronzes.
OK Autrod 19.20 is alloyed with tin and has good flow properties. The alloy is widely used for joining copper-zinc alloys to steel, as well as for the repair welding of cast bronzes. Pulsed GMA is recommended. OK Autrod 19.20 is normally welded with pure Ar as the shielding gas.

Welding current

DC(+)

Classifications

EN 14640	S Cu 5180 (CuSn6P)

Wire composition

P	Cu	Sn	Zn	Fe
0.3	>92.0	6.3	<0.1	<0.1

Typical mech. properties all weld metal

Yield stress, MPa	150
Tensile strength, MPa	300
Elongation, %	20

OK Autrod 19.21 GMAW

Description

A continuous, solid, copper wire for the GMA joining of copper-zinc alloys and low-alloyed copper and for the GMA brazing of zinc-coated steel sheets.
OK Autrod 19.21 is alloyed with silicon and manganese and has good flow properties. The alloy is also used for overlay welding on low- and non-alloyed steels and cast iron. Pulsed GMA is recommended. OK Autrod 19.21 is normally welded with pure Ar as the shielding gas.

Welding current

DC(+)

Classifications

Wire composition

Si	Mn	Sn	Cu
1.8	1.0	0.2	bal.

Typical mech. properties all weld metal

Yield stress, MPa	90
Tensile strength, MPa	280
Elongation, %	40

OK Autrod 19.30 GMAW

ERCuSi-A

Description

A continuous, solid, copper wire for the GMA joining of copper-zinc alloys and low-alloyed copper and for the GMA brazing of zinc-coated steel sheets.
OK Autrod 19.30 is alloyed with silicon and manganese and has good flow properties and wear resistance. The alloy is widely used in the joining of zinc-coated steel sheets in car body production, as well as for overlay welding on low- and non-alloyed steels and cast iron. Pulsed GMA is recommended. OK Autrod 19.30 is normally welded with pure Ar as the shielding gas; however, for GMA brazing, the addition of 1% O_2 improves the brazing properties.

Welding current

DC(+)

Classifications

SFA/AWS A5.7	ERCuSi-A
EN 14640	S Cu 6560 (CuSi3Mn1)

Wire composition

Si	Mn	Cu	Sn	Zn	Fe
3.4	1.1	>94.0	<0.2	<0.2	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	130
Tensile strength, MPa	350
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	25

Approvals

TÜV

OK Autrod 19.40 GMAW

ERCuAl-A1

Description

A continuous, solid, copper wire for the GMA joining of aluminium bronzes.
OK Autrod 19.40 is alloyed with aluminium and is recognised for its high strength, good wear resistance and very good corrosion resistance, particularly in salt water. The alloy is widely used for joining corrosion-resistant pipes made of aluminium bronze or other special brass alloys. Other common applications include the overlay welding of bearings, ship's propellers and rails. OK Autrod 19.40 is normally welded with pure Ar as the shielding gas.

Welding current

DC(+)

Classifications

SFA/AWS A5.7	ERCuAl-A1
EN 14640	S Cu 6100 (CuAl8)

Wire composition

Si	Mn	Al	Fe	Cu
<0.1	<0.5	7.8	<0.5	bal.

Typical mech. properties all weld metal

Yield stress, MPa	175
Tensile strength, MPa	420
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	70

OK Autrod 19.49 GMAW

ERCuNi

Description

A continuous, solid, Cu-Ni wire for welding similar alloys like 90Cu10Ni, 80Cu20Ni and 70Cu30Ni alloys. The addition of nickel strengthens the weld metal and improves the corrosion resistance, particularlyin the case of salt water. The alloy is used for the overlay welding of steels and is widely used for welding Cu-Ni components for desalination plants.

Welding current

DC(+)

Classifications

SFA/AWS A5.7	ERCuNi
EN 14640	S Cu 7158 (CuNi30)

Wire composition

C	Si	Mn	Fe	Ni	Ti	Cu
<0.05	<0.1	0.8	0.6	31.0	0.3	bal.

Typical mech. properties all weld metal

Yield stress, MPa	180
Tensile strength, MPa	350
Elongation, %	40

Charpy V

Test temps, °C	Impact values, +20 J

OK Tigrod 19.12

GTAW
ERCu

Description

Bare copper wire for the GTA joining of oxygen-free, pure copper and low-alloyed copper.
OK Tigrod 19.12 is alloyed with tin and has good flow properties. Preheating is recommended when welding large pieces. OK Tigrod 19.12 is normally welded with pure Ar as the shielding gas.

Welding current

DC(-)

Classifications

SFA/AWS A5.7	ERCu
EN 14640	S Cu 1898 (CuSn1)

Wire composition

Si	Mn	Cu	Sn
0.3	0.3	>98.0	0.8

Typical mech. properties all weld metal

Yield stress, MPa	75
Tensile strength, MPa	220
Elongation, %	30

Charpy V

Test temps, °C	Impact values, J
+20	75
-20	40

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5

OK Tigrod 19.30 GTAW

ERCuSi-A

Description

Bare copper wire for the GTA joining of copper-zinc alloys and low-alloyed copper alloys.
OK Tigrod 19.30 is alloyed with silicon and manganese and has good flow properties and wear resistance. The alloy is widely used in the joining of zinc-coated steel sheets andfor joining low- and non-alloyed steels and cast iron.
OK Tigrod 19.30 is normally welded with pure Ar as the shielding gas.

Welding current

DC(-)

Classifications

SFA/AWS A5.7	ERCuSi-A
EN 14640	S Cu 6560 (CuSi3Mn1)

Wire composition

Si	Mn	Cu	Sn	Zn	Fe
3.4	1.1	>94.0	<0.2	<0.2	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	150
Tensile strength, MPa	350
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	30

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5

OK Tigrod 19.40 GTAW

ERCuAl-A1

Description

An aluminium-bronze (CuAl8) rod for the GTAW of rolled and cast aluminium-bronze alloys. The alloy is noted for its high strength, good wear resistance and very good corrosion resistance, particularly in salt water. OK Tigrod 19.40 is normally welded with pure Ar as the shielding gas.

Welding current

DC(-)

Classifications

SFA/AWS A5.7	ERCuAl-A1
EN 14640	S Cu 1600 (CuAl8)

Wire composition

Si	Mn	Al	Fe	Cu
<0.1	<0.5	8.3	<0.5	bal.

Typical mech. properties all weld metal

Yield stress, MPa	175
Tensile strength, MPa	420
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	70

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.4	1000	5

OK Tigrod 19.49 GTAW

ERCuNi

Description

Bare Cu-Ni rods for welding similar alloys, such as 90Cu10Ni, 80Cu20Ni and 70Cu30Ni alloys. The addition of nickel strengthens the weld metal and improves corrosion resistance, particularly to salt water. The alloy is used for the overlay welding of steels and is widely used for welding Cu-Ni components for desalination plants.

Welding current

DC(-)

Classifications

SFA/AWS A5.7	ERCuNi
EN 14640	S Cu 7158 (CuNi30)

Wire composition

C	Si	Mn	Fe	Cu
<0.05	<0.1	0.8	0.6	bal.

Typical mech. properties all weld metal

Yield stress, MPa	180
Tensile strength, MPa	350
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	90

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5

Consumables for cast iron

Contents

OK 92.18

Type Basic special, high graphite

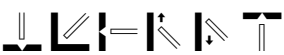
SMAW
ENi-CI

Description

A nickel-cored electrode for welding normal grades of cast iron. The weld metal is soft and easily machinable. Deposition is performed on cold or slightly preheated material.
The electrode is suitable for joining cast iron for the rectification of casting and the repair of broken parts.

Welding current

AC, DC+ OCV 50 V



Classifications

SFA/AWS A5.15	ENi-CI
EN ISO 1071	E C Ni-CI 3

Typical all weld metal composition, %

C	Si	Mn	Ni	Fe
0.9	0.7	0.6	>92.0	3.5

Typical mech. properties all weld metal

Tensile strength, MPa	300
Hardness:	150 HB

Approvals

Sepros	UNA 409820

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	55-110	20	0.71	83.3	0.9	46
3.2	350	80-140	20	0.68	44.8	1.2	66
4.0	350	100-190	20	0.70	29.4	1.7	71

OK 92.58

Type Basic Special high graphite

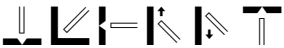
SMAW ENiFe-CI-A

Description

A nickel-iron-cored electrode for joining normal grades of cast iron, such as grey, ductile and malleable irons. It is also suitable for the rectification and repair of these grades and for joining them to steel. Deposition is performed on cold or slightly preheated cast iron. The weld metal is stronger and more resistant to impurities than the nickel-cored type.

Welding current

AC, DC+ - OCV 50 V



Classifications

SFA/AWS A5.15	ENiFe-CI-A
EN ISO 1071	E C NiFe-CI-A 1

Typical all weld metal composition, %

C	Si	Mn	Ni	Al	Fe
1.5	0.7	0.8	51	1.4	46

Typical mech. properties all weld metal

Tensile strength, MPa	375
Hardness (HB):	180

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	55-75	21	0.70	90	0.6	70
3.2	350	75-100	23	0.70	45	0.9	90
4.0	350	85-160	24	0.70	30	1.8	70

OK 92.60

SMAW

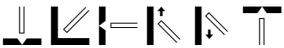
Type Basic special, high graphite ENiFe-CI

Description

An electrode of the nickel-iron type for welding normal grades of cast iron and for joining them to steel.
The electrode has very good current-carrying capacity. The electrode produces a weld metal that is stronger and more resistant to solidification cracking than that of the nickel electrode type.

Welding current

AC, DC+ OCV 45 V



Classifications

SFA/AWS A5.15	ENiFe-CI
EN ISO 1071	E C NiFe-1 3

Typical all weld metal composition, %

C	Si	Mn	Ni	Nb	Cu	Al	Fe
0.9	<0.8	0.7	52	0.2	1.0	0.3	44

Typical mech. properties all weld metal

Yield stress, MPa	380
Tensile strength, MPa	560
Elongation A5, %	>15%
Hardness (HB):	200

Approvals

Sepros	UNA 409820

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	60-100	22	0.70	85	0.8	45
3.2	350	80-150	23	0.70	44	1.2	56
4.0	350	100-200	23	0.70	30	1.6	59
5.0	350	150-250	23	0.70	19	2.4	66

OK 92.78

Type Basic-special

SMAW
E C NiCu 1

Description

OK 92.78 is a nickel-copper electrode of the monel-alloy type for welding all types of cast iron with or without low preheat. The weld metal is easily machinable and produces a colour very similar to that of cast iron.

Welding current

AC, DC+ - OCV 45 V

Classifications

EN ISO 1071	E C NiCu 1

Typical all weld metal composition, %

C	Si	Mn	Ni	Cu	Fe
0.7	<0.2	0.9	64	32	3

Typical mech. properties all weld metal

Tensile strength, MPa	300-350
Elongation A5, %	15
Hardness (HB):	150

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	50-100	18	0.60	96	0.6	66
3.2	350	60-125	18	0.65	49	0.8	97
4.0	350	90-140	18	0.65	32	0.9	130

OK Tubrodur 15.66 FCAW

Type Rutile

Description

OK Tubrodur 15.66 is a flux-cored, tubular wire for the welding of cast iron. The weld metal is of a nickel-iron composition to maximise flexibility for welding cast iron not only to itself but also to steel and a wide range of other ferrous and non-ferrous materials. Shielding gas: 95Ar/2CO_2.

Welding current

DC+

Typical all weld metal composition, %

C	Si	Mn	Ni	Fe
1.04	0.71	0.23	45.3	bal.

Typical mech. properties all weld metal

Yield stress, MPa	
Tensile strength, MPa	500
Elongation, %	12

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.2	220-250	28-30

Consumables for dissimilar materials

Contents

Dissimilar materials

Contents

OK 67.45

Type Lime-basic

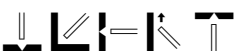
SMAW
(E307-15)

Description

Austenitic stainless-steel electrode producing a weld metal with less than 5% ferrite. The tough weld metal has excellent crack resistance, even when welding steels with very poor weldability. Suitable for joining 12-14% manganese steel to itself or other steels.
Also suitable for buffer layers before hardfacing.

Welding current

DC+



Classifications

EN 1600	E 18 8 Mn B 4 2
SFA/AWS A5.4	(E307-15)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.11	0.5	6.0	18.5	8.5	<0.5	<0.5

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	605
Elongation A5, %	35

Charpy V

Test temps, °C	Impact values, J
+20	85

Ferrite content FN <5

Approvals

ABS	Stainless
Sepros	UNA 409820
UDT	EN 1600
VdTÜV	01580

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	50-80	23	0.58	102	0.7	50
3.2	350	70-100	24	0.60	51	1.1	71
4.0	350	100-140	24	0.60	33	1.5	73
5.0	350	150-200	25	0.60	22	2.2	80

OK 67.52

Type Zirconium-basic

SMAW (E307-25)

Description

OK 67.52 is a synthetic, high-recovery electrode of the 18Cr8Ni6Mn type for welding dissimilar steels, 13Mn steels andsteels with reduced weldability and for cladding carbon steels.

Welding current

DC+, AC OCV 70 V

Classifications

EN 1600	E 18 8 Mn B 8 3
SFA/AWS A5.4	(E307-25)
Werkstoff Nr.	1.4370

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Cu
<0.15	1.1	6.0	18.0	9.0	<0.2

Typical mech. properties all weld metal

Yield stress, MPa	420
Tensile strength, MPa	630
Elongation A4, %	45

Charpy V

Test temps, °C	Impact values, J
+20	70

Ferrite content FN <3

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	90-115	25	0.64	49.0	1.4	52
3.2	450	120-165	34	0.68	20.5	2.3	76
4.0	450	150-240	40	0.68	13.5	3.7	72
5.0	450	200-340	48	0.65	9.0	6.0	66

OK 67.60

Type Acid-rutile

SMAW
E309L-17

Description

OK 67.60 is an over-alloyed stainless electrode for welding stainless to mild steel and low-alloy steel, for surfacing mild steel and for welding the root runs in clad steel. The electrode has excellent weldability in all positions except vertical down, on both AC and DC.

Welding current

DC+, AC OCV 55 V

Classifications

EN 1600	E 23 12 L R 3 2
SFA/AWS A5.4	E309L-17
Werkstoff Nr.	1.4332
CSA W48	E309L-17

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.7	0.9	24.0	13.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	470
Tensile strength, MPa	580
Elongation A5, %	32

Charpy V

Test temps, °C	Impact values, J
+20	50
-10	40

Ferrite content	FN 12-22

Approvals

CL	EN 1600
CWB	CSA W48
Sepros	UNA 409820
UDT	DIN 1600
VdTÜV	00898

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	30-60	27	0.60	136	0.7	38
2.5	300	50-90	28	0.60	85	1.1	38
3.2	350	90-120	29	0.60	45	1.6	51
4.0	350	130-180	31	0.60	29	2.5	51
4.0	450	130-180	31	0.60	23	2.5	65
5.0	350	160-240	32	0.60	19	3.3	58

OK 67.70

Type Acid-rutile

SMAW
E309MoL-17

Description

OK 67.70 is an over-alloyed, stainless-steel electrode for use as a buffer layer in welding acid-resistant clad steels and stainless steels to other types of steel. OK 67.70 has outstanding welding properties on both AC and DC. The electrode can be used in all positions except vertical down.

Welding current

DC+, AC OCV 55 V

Classifications

EN 1600	E 23 12 2 L R 3 2
SFA/AWS A5.4	E309MoL-17
Werkstoff Nr.	1.4459
CSA W48	E309LMo-17

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.7	0.9	23.0	13.0	2.8	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	510
Tensile strength, MPa	610
Elongation A5, %	32

Charpy V

Test temps, °C	Impact values, J
+20	50
-20	> 32

Ferrite content FN 12-22

Approvals

ABS	SS to C&C/Mn steels	RINA	E 309Mo
CL	EN 1600	Sepros	UNA 409820
CWB	CSA W48	SS	EN 1600
DB	30.039.05	UDT	EN 1600
DNV	309 Mo	VdTÜV	02424
LR	SS/CMn	Ü	30.039

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.0	300	30-60	26	0.58	147	0.6	48
2.5	300	50-90	29	0.57	94	0.9	45
3.2	350	90-120	27	0.59	47	1.4	61
4.0	350	130-180	31	0.61	32	2.0	56
5.0	350	160-240	30	0.59	20	2.7	64
5.0	450	160-240	30	0.57	15	2.7	85

OK 68.81

Type Acid-rutile

SMAW
E312-17

Description

OK 68.81 is a high-alloyed electrode which deposits a ferritic-austenitic duplex weld metal with approx. 40% ferrite. It is resistant to stress corrosion and is highly insensitive to dilution. Good scaling resistance up to 1150°C. OK 68.81 is used for joining dissimilar steels, steels with reduced weldability and buffer layers prior to hardfacing. Applications: rolls, forging dies, hot-work tools, dies for plastics and so on.

Welding current

DC+, AC OCV 60 V

Classifications

EN 1600	E 29 9 R 3 2
SFA/AWS A5.4	E312-17
Werkstoff Nr.	1.4337

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.12	0.7	0.8	29.0	9.8	<0.5	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	610
Tensile strength, MPa	790
Elongation A5, %	22

Charpy V

Test temps, °C	Impact values, J
+20	30

Ferrite content FN 50-80

Approvals

UDT EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.0	300	35-60	22	0.64	123.0	0.7	41
2.5	300	50-85	24	0.64	78.0	0.9	48
3.2	350	80-125	25	0.62	42.0	1.3	65
4.0	350	110-175	26	0.62	26.0	2.0	66
5.0	350	150-240	28	0.65	16.5	3.2	68

OK 68.82

Type Acid-rutile

SMAW
(E312-17)

Description

OK 68.82 is a high-alloyed electrode which deposits a ferritic-austenitic duplex weld metal with approx. 30-35% ferrite. It is resistant to stress corrosion and is highly insensitive to dilution. Good scaling resistance up to 1150°C. OK 68.82 is used for joining steels with reduced weldability and buffer layers prior to hard surfacing, dissimilar steels, rolls, aluminium-forging dies, hot-work tools, dies for plastic and so on.

Welding current

DC+, AC OCV 55 V

Classifications

EN 1600	E 29 9 R 1 2
SFA/AWS A5.4	(E312-17)
Werkstoff Nr.	1.4337

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Cu
0.12	1.0	0.9	29.0	10.0	<0.5	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	500
Tensile strength, MPa	750
Elongation A5, %	25

Charpy V

Test temps, °C	Impact values, J
Ferrite content	FN 50-80

Approvals

UDT	EN 1600

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.0	300	30-60	26	0.54	166	0.7	33
2.5	300	60-90	25	0.52	104	1.0	45
3.2	350	80-120	26	0.52	55	1.3	57
4.0	350	110-170	30	0.55	36	2.0	60
5.0	350	140-230	30	0.55	22	2.7	71

OK 92.05

Type Lime-basic

SMAW
ENi-1

Description

OK 92.05 is a stick electrode for joining commercial pure nickel in wrought and cast forms. It can also be used to join dissimilar metals such as nickel to steel, nickel to copper and copper to steel. Moreover, this electrode can be used for surfacing steel.

Welding recommendations:

To avoid weld metal defects, it is important that the welding zone is thoroughly cleaned and free from oxides. Machining, grinding, grit blasting or pickling are ways of doing this. Brushing is not advisable.
The high nickel weld metal of OK 92.05 has reduced wettability compared with steel weld metal. However, this should not be compensated for by increasing the welding current so that it exceeds the recommended maximum limit for the electrode. This may lead to the loss of deoxidisers and the subsequent formation of pores.
The weaving technique is generally desirable.
The opening angle for joints should be between 80-90°C.
Machinability: good
Redrying the electrodes: 250°C, 2 h

Welding current

DC+

Classifications

SFA/AWS A5.11	ENi-1
EN ISO 14172	E Ni 2061 (NiTi3)

Typical all weld metal composition, %

C	Si	Mn	Ni	Cu	Al	Ti	Fe
0.04	0.7	0.4	>92.0	<0.2	<0.1	1.5	0.4

Typical mech. properties all weld metal

Yield stress, MPa	330
Tensile strength, MPa	470
Elongation A5, %	30

Approvals

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	70-95	23	0.55	96	0.8	47
3.2	350	90-135	25	0.55	53	1.2	56
4.0	350	120-180	27	0.45	42	1.5	59

OK 92.15

Type Basic

SMAW
ENiCrFe-2

Description

OK 92.15 is a nickel-based electrode for welding Inconel 600 and similar alloys, cryogenic steels (e.g. 9Ni and 5Ni steels), martensitic to austenitic steels, dissimilar steels, heat-resistant steel castings of limited weldability and so on. The weldability is good in all positions, even in the overhead position.

Welding current

DC+

Classifications

SFA/AWS A5.11	ENiCrFe-2
EN ISO 14172	E Ni 6133 (NiCr16Fe12NbMo)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Nb	Cu	Fe
<0.1	<0.75	2.3	15.5	70	1.5	2.0	<0.5	9.0

Typical mech. properties all weld metal

Yield stress, MPa	420
Tensile strength, MPa	660
Elongation A4, %	45

Charpy V

Test temps, °C	Impact values, J
+20	110
-196	90

Approvals

ABS

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	300	50-80	22	0.63	91	0.9	45
3.2	350	70-105	23	0.62	57	1.3	57
4.0	350	95-140	24	0.65	31	2.1	58

OK 92.26

Type Basic

SMAW
ENiCrFe-3

Description

A nickel-based electrode for welding nickel alloys such as Inconel 600 and similar Inconel alloys, cryogenic steels, martensitic to austenitic steels, dissimilar steels, heat-resistant steels and castings with limited weldability.

Welding current

DC+

Classifications

SFA/AWS A5.11	ENiCrFe-3
EN ISO 14172	E Ni 6182 (NiCr15Fe6Mn)

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Nb	Cu	Ti	Ta	Fe
0.03	0.5	6.6	15.8	67	1.7	<0.5	<0.5	<0.3	8.8

Typical mech. properties all weld metal

Yield stress, MPa	410
Tensile strength, MPa	640
Elongation A4, %	40

Charpy V

Test temps, °C	Impact values, J
+20	100
-196	80

Approvals

ABS	ENiCrFe-3
Sepros	UNA 409820
UDT	DIN 1736

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	45-70	22	0.63	88	0.9	50
3.2	350	70-105	23	0.62	57	1.2	60
4.0	350	90-130	24	0.64	31	2.0	60
5.0	350	120-170	25	0.64	20	2.7	68

OK Tubrodur 14.71 FCAW

Type Rutile

Description

A stainless, 18.8.6Mn, self-shielded, tubular wire for cladding and joining 13% Mn steels and steels with limitied weldability. It is also useful for buffer layers prior to hardfacing.

Welding current

DC+

Classifications

No applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni
0.026	0.48	5.12	19.1	8.7

Typical mech. properties all weld metal

Yield stress, MPa	400
Tensile strength, MPa	640
Elongation, %	35

Charpy V

Test temps, °C	Impact values, J
+20	70
-20	60
-60	40

Approvals

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.6	250-350	28-34
2.4	350-450	29

OK Autrod 309MoL GMAW

G 23 12 2 L

Description

A continuous, solid, corrosion-resistant wire of the "309LMo" type.
OK Autrod 309MoL is used for the overlay welding of unalloyed and low-alloyed steels and for welding dissimilar steels, such as 316L, to unalloyed and low-alloyed steels when Mo is essential.

Welding current

DC(+)

Classifications

EN 12072	G 23 12 2 L

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo
<0.03	<1.0	1.8	23.0	13.3	2.8

Typical mech. properties all weld metal

Yield stress, MPa	400
Tensile strength, MPa	600
Elongation, %	31

Charpy V

Test temps, °C	Impact values, J
+20	110

Approvals

RINA	Restricted availability
UDT	DIN 8556
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.9-8.4	80-190	16-24	1.0-3.2
1.2	4.9-8.5	180-280	20-28	2.7-4.6
1.6	3.2-5.5	230-350	24-28	3.0-5.2

OK Autrod 312

GMAW
ER312

Description

A continuous, solid, corrosion-resistant, chromium-nickel wire for welding stainless steels of the 29% Cr, 9% Ni types.
OK Autrod 312 has good oxidation resistance at high temperatures due to its high content of Cr. The alloy is widely used for joining dissimilar steels, especially if one of the components is fully austenitic, and steels that are difficult to weld, i.e. machine components, tools and austenitic-manganese steels.

Welding current

DC(+)

Classifications

SFA/AWS A5.9	ER312
EN 12072	G 29 9

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.15	0.5	1.8	30.5	9.5	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	610
Tensile strength, MPa	770
Elongation, %	20

Charpy V

Test temps, °C	Impact values, J
+20	50

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	3.4-11.0	50-140	16-22	0.8-2.6
1.0	2.9-8.4	80-190	16-24	1.1-3.2
1.2	4.9-8.5	180-280	20-28	2.7-4.6
1.6	3.2-5.5	230-350	24-28	3.1-5.2

OK Autrod 16.95

GMAW

G 18 8 Mn

Description

A continuous, solid, corrosion-resistant, chromium-nickel-manganese wire for welding austenitic stainless alloys of the 18% Cr, 8% Ni, 7% Mn types. OK Autrod 16.95 has general corrosion resistance similar to that of the corresponding parent metal. The higher silicon content improves the welding properties such as wetting. When used for joining dissimilar materials, the corrosion resistance is of secondary importance. The alloy is used in a wide range of applications across the industry, such as the joining of austenitic, manganese, work-hardenable steels, as well as armour plate and heat-resistant steels.

Welding current

DC(+)

Classifications

EN 12072	G 18 8 Mn
Werkstoffnummer	~1.4370

Typical chemical composition, aw (%)

C	Si	Mn	Cr	Ni
<0.2	<1.2	6.5	18.5	8.5

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	640
Elongation, %	41

Charpy V

Test temps, °C	Impact values, J
+20	130

Approvals

DB	43.039.10
UDT	DIN 8556
Ü	43.039/1
VdTÜV	

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
0.8	4.0-17	55-160	15-24	1.0-4.1
0.9	3.5-18	65-220	15-28	1.1-5.4
1.0	4.0-16	80-240	15-28	1.5-6.0
1.2	3.0-14	100-300	15-29	1.6-7.5
1.6	5.5-9	230-375	23-31	5.2-8.6

OK Tigrod 309L

GTAW
ER309L

Description

Bare, corrosion-resistant, chromium-nickel welding rod for welding the 24%Cr, 13%Ni-alloyed types of steel. The alloy is also used for welding buffer layers on CMn steels and welding dissimilar joints. When using the wire for buffer layers and dissimilar joints, it is necessary to control the dilution of the weld.
OK Tigrod 309L has good general corrosion resistance. When used for joining dissimilar materials, the corrosion resistance is of secondary importance.

Welding current

DC (-)

Classifications

SFA/AWS A5.9	ER309L
EN 12072	W 23 12 L
Werkstoffnummer	~1.4332

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	24.0	13.0	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	430
Tensile strength, MPa	590
Elongation, %	40

Charpy V

Test temps, °C	Impact values, J
+20	160
-60	130
-110	90

Approvals

VdTÜV

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0
4.0	1000	5.0

OK Tigrod 312

GTAW
ER312

Description

Bar, corrosion-resistant, chromium-nickel welding rods for welding materials of the 29% Cr, 9% Ni types. OK Tigrod 312 has good oxidation resistance at high temperatures due to its high content of Cr. The alloy is widely used for joining dissimilar steels, especially if one of the components is fully austenitc, and for steels that are difficult to weld, i.e. machine components, tools and austenitic-manganese steels.

Welding current

DC(-)

Classifications

SFA/AWS A5.9	ER312
EN 12072	W 29 9

Wire composition

C	Si	Mn	Cr	Ni	Mo	Cu
<0.15	0.5	1.8	30.5	9.5	<0.3	<0.3

Typical mech. properties all weld metal

Yield stress, MPa	610
Tensile strength, MPa	770
Elongation, %	20

Charpy V

Test temps, °C	Impact values, J
+20	50

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Tigrod 16.95

GTAW
W 18 8 Mn

Description

Bare, corrosion-resistant, chromium-nickel-manganese welding rods for welding austenitic stainless alloys of the 18% Cr, 8% Ni, 7% Mn types. OK Tigrod 16.95 has general corrosion resistance similar to that of the corresponding parent metal. The higher silicon content improves the welding properties such as wetting. When used for joining dissimilar materials, the corrosion resistance is of secondary importance. The alloy is used in a wide range of applications across the industry, such as the joining of austenitic, manganese, work-hardenable steels, as well as armour plate and heat-resistant steels.

Welding current

DC(-)

Classifications

EN 12072	W 18 8 Mn
Werkstoffnummer	appr. 1.4370

Wire composition

C	Si	Mn	Cr	Ni
<0.2	<1.2	6.5	18.5	8.5

Typical mech. properties all weld metal

Yield stress, MPa	450
Tensile strength, MPa	640
Elongation, %	41

Charpy V

Test temps, °C	Impact values, J
+20	130

Approvals

DB	43.039.12
UDT	DIN 8556
Ü	43.039/1
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/ box, kg
1.2	1000	5.0
1.6	1000	5.0
2.0	1000	5.0
2.4	1000	5.0
3.2	1000	5.0

OK Autrod 309L SAW

S 23 12 L

Description

A continuous, solid, corrosion-resistant, chromium-nickel wire for joining stainless steels to non-alloy or low-alloy steels and for welding austenitic stainless alloys of the 24% Cr, 13% Ni types.
OK Autrod 309L has good general corrosion resistance. When used for joining dissimilar materials, the corrosion resistance is of secondary importance.
OK Autrod 309L can be used in combination with OK Flux 10.93 or OK Flux 10.92.

Classifications

SFA/AWS A5.9	ER309L
EN 12072	S 23 12 L

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	Cu
<0.03	0.5	1.8	24.0	13.0	<0.3	<0.3

OK Autrod 16.97 SAW

S 18 8 Mn

Description

OK Autrod 16.97 is an 18% Cr, 8% Ni, 6% Mo type of submerged arc wire, used in a wide range of applications throughout industry, such as joining austenitic-manganese, work-hardenable steels and heat-resistant steels.
OK Autrod 16.97 is usully welded with OK Flux 10.93 or OK Flux 10.92.

Classifications

EN 12072	S 18 8 Mn

Wire composition (%)

C	Si	Mn	Cr	Ni	Mo	W	Cu
<0.2	0.5	6.5	18.5	8.5	<0.3	<1.0	<0.3

OK Flux 10.93

SAW

Type Fluoride basic SA AF 2 DC

Description

OK Flux 10.93 is a basic, non-alloying, agglomerated flux for the submerged arc welding of stainless steels and high-alloyed CrNiMo steels, such as duplex stainless steels.

Density

~1.0 kg/dm^3

Basicity index

1.7

Flux consumption as kg flux/kg wire

Voltage	DC+
26	0.5
30	0.6
34	0.8
38	1.0

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo
OK Autrod 308L	0.03	0.6	1.4	20.0	10.0	-
OK Autrod 309L	0.03	0.6	1.5	24.0	12.5	-
OK Autrod 312	0.1	0.5	1.5	29.0	9.5	-
OK Autrod 316L	0.03	0.6	1.4	18.5	11.5	2.7
OK Autrod 318	0.04	0.6	1.2	18.5	12.0	2.6
OK Autrod 347	0.03	0.5	1.1	19.2	9.6	-
OK Autrod 385	0.03	0.6	1.5	19.0	25.0	4.0
OK Autrod 16.97	0.06	1.2	6.3	18.0	8.0	-
OK Autrod 2209	0.02	0.8	1.3	22.0	9.0	-

Typical mech. properties all weld metal

Wire	Yield stress MPa	Tensile strength MPa	Charpy V °C	Charpy V J
OK Autrod 308L	400	560	-40	75
			-60	65
			-110	55
			-196	40
OK Autrod 309L	430	570	-60	70
			-110	60
			-196	35
OK Autrod 316L	390	565	-40	95
			-60	90
			-110	75
			-196	40
OK Autrod 318	440	600	-60	90
			-110	40
OK Autrod 347	455	635	-60	85
			-110	60
			-196	30
OK Autrod 385	310	530	+20	80
OK Autrod 2209	630	780	-20	125
			-40	110
			-60	80

Approvals

Wire	ABS	LR	DNV	BV	GL	RS	CL	DB	VdTÜV
OK Autrod 308L	Stainless		308L M						x
OK Autrod 347									x
OK Autrod 316L									x
OK Autrod 318									x
OK Autrod 309L			x						x
OK Autrod 16.97			x						x
OK Autrod 385									x
OK Autrod 2209			x		4462M		x		x

Classifications

Wire	EN 12072	SFA/AWS A5.9
OK Autrod 308L	ER308L	S 19 9 L
OK Autrod 347	ER347	S 19 9 Nb
OK Autrod 316L	ER316L	S 19 12 3 L
OK Autrod 318	ER318	S 19 12 3 Nb
OK Autrod 309L	ER309L	S 23 12 L
OK Autrod 16.97	(ER307)	S 18 8 Mn
OK Autrod 2209	ER 2209	S 22 9 3 N L
OK Autrod 312	ER312	S 29 9
OK Autrod 385	ER385	S 20 25 5 Cu L

Consumables for hardfacing

Contents

OK 83.27

Type Lime-basic

SMAW
E1-UM-350

Description

OK 83.27 is an electrode depositing a low-alloy steel for the protection of parts exposed to metallic wear. Typical applications include rail and rail-crossing sections, cog wheels of cast steel and components in rolling mills, such as grooved rollers and clutches.

Welding current

AC, DC+ OCV 70 V

Classifications

DIN 8555	E1-UM-350

Typical all weld metal composition, %

C	Si	Mn	Cr
0.15	<0.7	0.7	3.2

Typical mech. properties all weld metal

Weld metal hardness, a w (no preheat, interpass temperature <90°C)	≈35 HRC
Machinability	Good
Impact resistance	Very good
Metal-to-metal wear resistance	Very good

Approvals

DB	20.039.06

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
4.0	450	140-190	23	0.66	23	1.7	92
5.0	450	190-260	23	0.68	15	2.4	99

OK 83.28

Type Lime-basic

SMAW
E1-UM-300

Description

OK 83.28 is a chromium-alloyed electrode for hardfacing and cladding tracks, shafts, rolls, rails and rail-crossing sections, as well as components in rolling mills, such as grooved rollers and clutches and large cog wheels made of cast steel.

The joining of hardenable steels is another application.

Welding current

AC, DC+ OCV 70 V

Classifications

DIN 8555 E1-UM-300

Typical all weld metal composition, %

C	Si	Mn	Cr
0.1	<0.7	0.7	3.2

Typical mech. properties all weld metal

Weld metal hardness, a w (no preheat, interpass temperature <90°C)	≈30 HRC
Machinability	Good
Impact resistance	Very good
Metal-to-metal wear resistance	Very good

Tempering resistance

Temp°C	HRC(1h)	HRC(24h)
100	33	33
300	33	33
400	34	34
500	35	28
600	27	17
700	18	

Approvals

DB	20.039.01
Sepros	UNA 485155
UDT	DIN 8555

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	60-90	20	0.64	69.0	0.7	75
3.2	450	100-140	21	0.66	34.0	1.2	88
4.0	450	140-190	22	0.66	23.0	1.7	92
5.0	450	190-260	23	0.68	15.0	2.8	86
6.0	450	230-320	23	0.68	10.5	3.7	92

OK 83.29

Type Zirconium-basic **SMAW** E1-UM-300

Description

OK 83.29 is a high-recovery electrode for cladding and hardfacing rolls, points, crossings, wheel conveyors and so on, i.e. the same applications as OK 83.28.

Welding current

DC+ AC OCV 70 V

Classifications

DIN 8555 E1-UM-300

Typical all weld metal composition, %

C	Si	Mn	Cr
0.1	0.5	0.7	3.2

Typical mech. properties all weld metal

Weld metal hardness, a w (no preheat, interpass temperature <90°C)	~ 30 HRC
Machinability	Good
Impact resistance	Very good
Metal-to-metal wear resistance	Very good

Tempering resistance

Temp°C/1h	HRC
100	34
300	34
500	33
600	20
700	17

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	450	110-180	26	0.67	23	2.4	66
4.0	450	160-240	30	0.67	15	3.4	69
4.5	450	200-290	36	0.68	12	4.1	71
5.0	450	230-330	42	0.68	10	5.0	73
5.6	450	270-380	46	0.68	8	5.9	77

OK 83.50

Type Acid-Rutile

SMAW
E6-UM-55

Description

OK 83.50 is a hardfacing electrode for the repair welding of worn parts on agricultural equipment, forestry tools, loading machines and so on. Transformers with low open-circuit voltage can be used (> 45 volt).

Welding current

AC, DC+ OCV 45 V

Classifications

DIN 8555	E6-UM-55

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.4	<0.6	<1.0	6.0	0.6

Typical mech. properties all weld metal

Weld metal hardness, a w (preheat and interpass temperature approx. 250°C)	50-60 HRC
Machinability	Grinding only
Abrasion resistance	Very good

Tempering resistance

Temp°C/1h	HRC
200	56
300	54
400	53
500	52
550	51
600	44
650	41
700	34

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
2.5	350	60-120	28	0.46	88.0	0.8	49
3.2	350	90-160	30	0.46	52.0	1.2	59
4.0	450	125-210	33	0.48	25.5	1.7	82
5.0	450	160-260	37	0.48	16.0	2.6	86

OK 83.53

Type Basic

SMAW
E 6-UM-60

Description

OK 83.53 is a basic hardfacing electrode designed for applications in which heavy abrasive wear or a combination of abrasive and impact wear are present. Typical applications include rock-crushing machinery parts and drilling equipment.

Welding current

DC+, AC OCV 65 V

Classifications

DIN 8555 E 6-UM-60

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo	Nb
0.5	0.8	1.3	7.4	1.3	0.6

Typical mech. properties all weld metal

Weld metal hardness, a w (first layer on mild steel, no preheat)	58 HRC
Machinability	Grinding only
Impact resistance	Excellent
Abrasion resistance	Excellent

Tempering resistance

Temp°C/1h	HRC
200	54
300	51
400	51
500	53
550	52
600	49
650	42
700	37
750	32

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	450	90-140	21	0.66	35.7	1.2	83
4.0	450	115-170	21	0.65	23.8	1.5	99

OK 83.65

Type Basic

SMAW
E2-UM-60

Description

OK 83.65 deposits a hard, wear-resistant weld metal. Good resistance to oxidation up to about 875°C. Suitable for hardfacing machine parts exposed to wear from stone, coal, sand and soil. Typical applications are dredging machines, feeder screws, crusher and tractor parts.

Welding current

AC, DC+ OCV 70 V

Classifications

DIN 8555	E2-UM-60

Typical all weld metal composition, %

C	Si	Mn	Cr
0.8	4.0	<0.6	2.0

Typical mech. properties all weld metal

Weld metal hardness, a w	
No preheat, interpass temperature 60°C:	58-63 HRC
Preheat and interpass temperature 300°C:	56-60 HRC
Machinability	Grinding only
Abrasion resistance	Very good

Tempering resistance

Temp°C/1h	HRC
100	61
200	60
300	59
400	56
500	58
600	55
700	41

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	450	100-140	23	0.68	34	1.2	87
4.0	450	140-190	25	0.68	22	1.8	90

OK 84.42

Type Rutile-basic

SMAW
E5-UM-45-R

Description

OK 84.42 is a hardfacing electrode depositing a corrosion-resistant, martensitic-ferritic stainless steel. Suitable for hardfacing shafts, wheel conveyors, racks and pinions, links and pins and valve seats of cast steel.

Recommendation:

Generally, a preheat and interpass temperature of about 200°C is recommended for most applications. Temperatures above 250°C could lead to reduced hardness levels and should be avoided.

Welding current

AC, DC+ OCV 70 V

Classifications

DIN 8555 E5-UM-45-R

Typical all weld metal composition, %

C	Si	Mn	Cr
0.12	0.5	<0.5	13.0

Typical mech. properties all weld metal

Weld metal hardness, a w (no preheat, interpass temperature 250°C):	39-45 HRC
1st layer:	35-41 HRC
2nd layer:	37-43 HRC
3rd layer:	39-45 HRC
Machinability	By cemented carbide tools
Metal-to-metal wear resistance	Very good
Abrasion resistance	Good
High temp. wear resistance	Very good
Corrosion resistance	Very good

Tempering resistance

Temp°C/1h	HRC
100	45
200	44
300	44
400	45
500	46
600	41
700	34

Annealing and hardening of weld metal:

Soft annealing:	780-800C
Rehardening procedure:	
Hardening temperature, °C:	950- 1000
Quenching medium:	compressed air or oil

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	70-110	22	0.57	77.0	1.0	46
3.2	450	100-160	24	0.60	34.0	1.5	69
4.0	450	140-220	25	0.60	22.5	2.1	78
5.0	450	220-310	31	0.62	14.0	3.2	80

OK 84.52

Type Rutile-basic

SMAW
E6-UM-55-GR

Description

A general-purpose, hardfacing electrode depositing a corrosion-resistant fully martensitic steel. The electrode is suitable for hardfacing shafts, racks and pinions, links and pins, valve seats of cast steel, mixer arms, feed gear, knives, loading buckets and track rollers.

Generally, a preheat and interpass temperature of about 200°C is recommended for most applications.

Welding current

AC, DC+ OCV 70 V

Classifications

DIN 8555	E6-UM-55-GR

Typical all weld metal composition, %

C	Si	Mn	Cr
0.25	0.5	<0.5	13.0

Typical mech. properties all weld metal

Weld metal hardness, a w (deposited on mild steel, no preheat, interpass temperature 250°C)	49-55 HRC
1st layer	43- 49 HRC
2nd layer	46-52 HRC
3rd layer	49-55 HRC
Machinability	Grinding only
Abrasion resistance	Very good
High temp. wear resistance	Very good
Corrosion resistance	Very good

Tempering resistance

Temp°C/1h	HRC
100	52
200	50
300	50
400	52
500	55
600	47
700	35

Annealing and hardening of weld metal:

Soft annealing:	780-800°C
Rehardening procedure:	
Hardening temperature, C:	950- 1000
Quenching medium:	compressed air or oil

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	70-110	22	0.55	80.0	0.9	48
3.2	450	100-160	24	0.58	35.0	1.4	70
4.0	450	140-220	25	0.58	23.0	2.0	80
5.0	450	220-310	31	0.60	14.5	3.0	80

OK 84.58

Type Lime-basic

SMAW
E6-UM-55-G

Description

OK 84.58 is a hardfacing electrode depositing a semi-corrosion-resistant martensitic steel. Full hardness is obtained even in the first bead, irrespective of the cooling rate. Suitable for hardfacing parts exposed to abrasive and impact wear, such as farm equipment, forestry tools, loading machines and mixers.

Welding current

AC, DC+ OCV 65 V

Classifications

DIN 8555 E6-UM-55-G

Typical all weld metal composition, %

C	Si	Mn	Cr
0.7	0.6	0.7	10.0

Typical mech. properties all weld metal

Weld metal hardness, a w deposited on mild steel, no preheat, interpass temperature 250°C)	53-59 HRC
1st layer	52-59 HRC
2nd layer	52-59 HRC
3rd layer	53-59 HRC
Machinability	Grinding only
Abrasion resistance	Very good
High temp. wear resistance	Good
Corrosion resistance	Good

Tempering resistance

Temp°C/1h	HRC
100	55
200	55
300	52
400	50
500	54
600	46
700	31

Annealing and hardening of weld metal:
Soft annealing: 840-860°C
Rehardening procedure:
Hardening temperature, °C: 950- 1000
Quenching medium: compressed air or oil

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	75-110	23	0.67	58.0	1.0	62
3.2	450	110-150	23	0.67	27.0	1.4	95
4.0	450	145-200	24	0.67	17.5	1.9	107
5.0	450	190-270	26	0.66	11.5	2.8	110
6.0	450	250-370	28	0.65	8.5	4.0	110

OK 84.78

Type Rutile-basic **SMAW** E10-UM-60-CZ

Description

Electrode producing a weld metal with coarse chromium carbides in an austenitic matrix. Suitable for surfacing worn parts exposed to abrasion and wear by coal, ore or other minerals. Typical applications include earth-moving machines, mixers, feeder screws, dust exhausters and crushers. It can also be used on components operating in corrosive environments and/or at elevated temperatures.

Welding current

AC, DC+ OCV 50 V

Classifications

DIN 8555 E10-UM-60-CZ

Typical all weld metal composition, %

C	Si	Mn	Cr
4.5	0.8	<1.6	33

Typical mech. properties all weld metal

Weld metal hardness, a w	59-63 HRC
No preheat and interpass temperature 100°C:	
3rd layer:	59-63 HRC
Preheat and interpass temperature 500°C:	
3rd layer:	55-61 HRC
Machinability	Grinding only
Abrasion resistance	Excellent
High temp. wear resistance	Good
Corrosion resistance	Excellent

Tempering resistance

Temp°C/1h	HRC
100	58
300	59
400	57
490	59
600	57
700	58

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	90-120	24	0.62	48.0	1.2	60
3.2	350	115-170	24	0.62	26.0	1.6	85
4.0	450	130-210	26	0.64	13.5	2.0	135
5.0	450	150-300	26	0.64	9.0	2.9	140

OK 84.80

Type Special

SMAW
E10-UM-65-GZ

Description

OK 84.80 is a high-recovery electrode which deposits a high density of wear-resistant carbides in an austenitic matrix, resistant to extreme abrasion up to 700°C. Typical applications include exhaust fans, ash ploughs, conveyor screws and sinter plant components.

Welding current

DC+

Classifications

DIN 8555	E10-UM-65-GZ

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo	Nb
5.0	2.0	0.7	23.0	7.0	7.0

Typical mech. properties all weld metal

Weld metal hardness, a w	62-66 HRC
(deposited on mild steel) No preheat, interpass temperature 100°C:	
1st layer:	57- 61 HRC
2nd layer:	61-65 HRC
3rd layer:	62-66 HRC
Preheat and interpass temperature 600°C:	
3rd layer:	50-54 HRC
Machinability	Grinding only
Abrasion resistance	Excellent
High temp. wear resistance	Very good
Corrosion resistance	Excellent

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	350	150-170	22	0.72	21.6	1.2	132
4.0	350	220-250	23	0.71	14.9	2.0	123

OK 84.84

Type Basic

SMAW
E10-UM-60-GP

Description

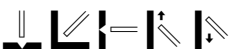
OK 84.84 is a hardfacing electrode depositing a weld metal with a high volume fraction of fine carbides in a martensitic matrix. It is designed for theprotection of components subjected to severe abrasive wear. Typical applications: earth-drilling equipment, hammers, scrapers and knives, shovel buckets and shovel teeth.

Recommendation:

Preheating is normally not required, except for heavier sections where preheating to 200°C may be beneficial. Stringer beads are recommended. Optimum hardness is obtained in the first layer due to low dilution with the parent material.

Welding current

AC, DC+ - OCV 45 V



Classifications

DIN 8555	E10-UM-60-GP

Typical all weld metal composition, %

C	Si	Cr	V	Ti
3.0	2.0	6.3	5.0	4.8

Typical mech. properties all weld metal

Weld metal hardness, a w (deposited on mild steel, no preheat):	60-62 HRC
1st layer:	62 HRC
Machinability	Grinding only
Impact resistance	Very good
Abrasion resistance	Excellent

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	70-100	17	0.63	71	0.5	105
3.2	350	100-150	17	0.60	44	0.7	110
4.0	350	115-200	17	0.64	27	1.0	120

OK 85.58

Type Lime-basic

SMAW
E3-UM-50-ST

Description

OK 85.58 is a hardfacing electrode for the repair welding of hot-working tools, hot trimming tools, punches and so on. The weld metal hardness can be increased by hardening and tempering, or by tempering alone. The weld metal can be step hardened. To avoid cracking, the preheat and interpass temperature should be at least 300°C and preferably 500°C.

Welding current

AC, DC+ OCV 70 V

Classifications

DIN 8555	E3-UM-50-ST

Typical all weld metal composition, %

C	Si	Mn	Cr	W	Co	Nb
0.32	1.1	1.0	1.8	8.0	2.0	0.8

Typical mech. properties all weld metal

Weld metal hardness, a w (deposited on mild steel)	42-50 HRC
Preheat and interpass temperature 350°C:	
1st layer:	47- 52 HRC
2nd layer:	47- 52 HRC
3rd layer:	47- 52 HRC
Machinability	Grinding only
Abrasion resistance	Good
High temp. wear resistance	Very good

Tempering resistance

Temp°C	HRC(1h)
100	51
200	51
300	52
400	53
500	53
550	55
600	53
650	45
700	35

Annealing and hardening:

Soft annealing °C:	850
Cooling:	
10C/h down to 650°C, then cooling in air	
Hardening Temperature, °C:	1100-1150
Quenching:	In air or oil

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of elec-trodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	70-110	22	0.65	72.0	0.9	53
3.2	350	100-150	23	0.63	45.0	1.3	62
4.0	350	130-190	23	0.63	29.5	1.7	75
5.0	350	180-250	25	0.66	18.0	2.2	88

OK 85.65

Type Lime-basic

SMAW
E4-UM-60-S

Description

OK 85.65 deposits a molybdenum-alloyed, high-speed steel. Suitable for metal cutting tools, punching tools, drills and stamping machines. Welded cutting edges can be put into use without tempering. For shaping machine tools and large cutting tools, untempered weld metal is recommended.
To avoid cracking, the working temperature should be at least 300°C and preferably 400-500°C.

Welding current

AC, DC+ OCV 70 V

Heat treatment data

Hardening. Temperature, °C:	1230-1250
Cooling:	In air
Tempering. Temperature, °C:	525
Holding time, h:	2 x 1h
Cooling:	In air
Soft annealing. Temperature, °C:	750-775
Holding time, h:	2- 3
Cooling:	In air

Classifications

DIN 8555 E4-UM-60-S

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo	W	V
0.9	1.5	1.3	4.5	7.5	1.8	1.5

Typical mech. properties all weld metal

Weld metal hardness	59-61 HRC
(top of a three-layer deposit on mild steel, preheat and interpass temperature 450C)	
As welded:	59-61 HRC
Tempered:	65-67 HRC
Soft annealed:	37-40 HRC
Machinability	Grinding only
Abrasion resistance	Very good
High temp. wear resistance	Very good

Tempering resistance

Temp°C	HRC(1h)	HRC(2x1h)
20	60	60
100	60	60
300	60	60
400	58	58
550	62	66
700	40	40

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	80-110	23	0.55	67.0	0.8	67
3.2	350	100-150	23	0.57	40.0	1.1	82
4.0	350	120-190	25	0.58	26.5	1.4	97

OK 86.08

Type Lime-basic

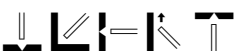
SMAW
E7-UM-200-K

Description

OK 86.08 deposits an austenitic-manganese steel alloy which work-hardens under impact and compressive stresses. The electrode is primarily used for surfacing and building up manganese steel components such as crusher jaws and hammers. The interpass temperature should be kept as low as possible.

Welding current

AC, DC+ OCV 70 V



Classifications

DIN 8555	E7-UM-200-K

Typical all weld metal composition, %

C	Si	Mn
1.1	0.8	13.0

Typical mech. properties all weld metal

Weld metal hardness, a w (No preheat, interpass temperature 100-150°C)	180-200 HB
Weld metal hardness, w h (approx. 25% reduction)	44-48 HRC
Machinability	Grinding
Impact resistance	Excellent
Metal-to-metal wear resistance	Very good

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
3.2	450	95-135	23	0.60	35.5	1.1	95
4.0	450	130-180	23	0.60	24.0	1.4	109
5.0	450	170-230	25	0.60	15.0	1.8	132

OK 86.28

Type Zirconium-basic

SMAW EFeMn-A

Description

OK 86.28 is a high-recovery, austenitic-manganese steel electrode containing nickel. It produces a crack-resistant weld metal, which work-hardens under compressive stresses.

It is intended for surfacing and building up Mn-steel components exposed to severe impact and moderate abrasion. Typical applications include crusher plates and rolls, bulldozer teeth, cones and mantels of rotary crushers, dredger buckets, rail crossings and so on.

The interpass temperature should be kept as low as possible.

Welding current

AC, DC+ OCV 70 V

Classifications

SFA/AWS A5.13	EFeMn-A

Typical all weld metal composition, %

C	Si	Mn	Ni
0.8	<0.3	14.0	3.5

Typical mech. properties all weld metal

Weld metal hardness, a w (no preheat, interpass temperature 100- 150°C)	160-180 HB
Weld metal hardness, w h (approx. 25% reduction)	42-46 HRC
Machinability (overheating must be avoided)	Grinding
Impact resistance	Excellent

Approvals

DB	20.039.05
Sepros	UNA 409820

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	450	100-160	30	0.54	26.5	1.5	90
4.0	450	130-210	30	0.54	17.5	2.0	105
5.0	450	170-300	31	0.56	11.0	2.9	114

OK 86.30

SMAW

Type Rutile-basic E7-UM-200-KR

Description

OK 86.30 deposits an austenitic, chromium-manganese steel with excellent work-hardening properties and initial resistance to abrasion. The high chromium content also produces good resistance to heat and corrosion.
The electrode is used for surfacing and building up manganese steels on crusher hammers, dredger buckets and so on.

Application:

It is recommended to limit the heat input and utilise an interpass temperature below 200°C.

Welding current

DC+ -, AC OCV 60 V

Classifications

DIN 8555 E7-UM-200-KR

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	V
0.3	0.5	14.0	18.0	1.5	< 0.1

Typical mech. properties all weld metal

Values valid for welding on mild steel and on austenitic manganese steel.

Weld metal hardness, a w (1-3 layers)	190-210 HB
Weld metal hardness, w h (1- 3 layers)	40-44 HRC
Machinability	Grinding
Impact resistance	Excellent

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	450	105-155	23	0.61	23	1.6	97
4.0	450	120-200	25	0.61	15	2.4	99

OK 92.35

Type Rutile-basic

SMAW
(ENiCrMo-5)

Description

OK 92.35 is a nickel-based, super-alloy electrode of the NiCrMoW type. OK 92.35 deposits an extremely tough work-hardening weld metal, resistant to attacks by the most commonly used acids. The weld metal has good high-temperature properties in terms of tensile strength, hardness, thermal shock and scaling. The lowest possible heat input should be applied.

Typical applications

Hardfacing: hot forging dies, hot working tools, hot shear blades

Joining: Nimonic and Inconel alloys, these alloys to carbon and alloy steels

Cladding: Corrosion- and wear-resistant layers on valves and pump components

Welding current

DC+, AC OCV 70 V

Classifications

SFA/AWS A5.11	(ENiCrMo-5)
DIN 8555	E 23-250 CKT

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	W	Fe
0.06	0.7	0.7	15.5	57	16.5	3.8	5.5

Typical mech. properties all weld metal

Weld metal hardness, a w	240-260 HV
Weld metal hardness, w h	40-45 HRC

As-welded condition:	
Yield strength, MPa	515
Tensile strength, MPa	750
Elongation, A5 (%)	17
Machinability	Fair
High temp. wear resistance	Excellent
Corrosion resistance	Very good

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	300	65-110	18	0.61	56	1.1	62
3.2	350	110-150	18	0.63	28	1.6	86
4.0	350	160-200	20	0.64	19	2.3	89
5.0	350	190-250	20	0.65	11	3.1	106

OK 93.01

Type Acid-rutile

SMAW
ECoCr-C

Description

A high-recovery, surfacing electrode depositing a Co-Cr-W alloy high in carbon. The deposit is the hardest of the standard Co-base range.
Typical applications:
- hot rolls, hot rolling guides, drawing blocks
- kneadling rolls, screw presses
- hot shear blades, glass cutters, hot scrapers, pump and press casings, burner nozzles

Welding current

AC, DC+ OCV 65 V

Classifications

SFA/AWS A5.13	ECoCr-C
DIN 8555	E 20-UM 55 CTZ

Typical all weld metal composition, %

C	Si	Mn	Cr	W	Co	Fe
2.2	1.2	1.0	30	12.5	48	3

Typical mech. properties all weld metal

Weld metal hardness, a w		≈55 HRC
Hot hardness	600°C ≈44 HRC	800°C ≈34 HRC
Machinability		Grinding only
Abrasion resistance		Excellent
High temp. wear resistance		Excellent
Corrosion resistance		Excellent

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
3.2	350	90-130	30	0.60	30	1.4	88
4.0	350	120-170	30	0.60	20	2.0	95
5.0	350	150-200	28	0.55	14	2.0	124

OK 93.06

Type Acid-rutile

SMAW
ECoCr-A

Description

A high-recovery, surfacing electrode depositing a Co-Cr-w alloy with a medium-high carbon content.
Typical applications:
• hot shear blades, guide rolls
• kneading equipment, steam nozzles, mech. sealings, bushings
• blanking dies, press mandrels, trimming dies, exhaust valves

Application:

Preheat and interpass (up to 300°C for heavy sections) should be applied to prevent the deposit cracking. After welding, very slow cooling is recommended to below 100°C.

Welding current

AC, DC+ OCV 65 V

Classifications

SFA/AWS A5.13	ECoCr-A
DIN 8555	E20-UM-40-CTZ

Typical all weld metal composition, %

C	Si	Mn	Cr	W	Co	Fe
1.0	0.9	1.0	28	4.5	60	3

Typical mech. properties all weld metal

Weld metal hardness, a w		≈42 HRC
Hot hardness	300°C	600°C
	≈35 HRC	≈29 HRC
Machinability		By cemented carbide tools
Abrasion resistance		Very good
High temp. wear resistance		Excellent
Corrosion resistance		Excellent

Deposition data at max current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/ electrode
2.5	350	65-80	25	0.60	77	0.8	60
3.2	350	90-130	30	0.60	28	1.8	71
4.0	350	120-170	30	0.60	20	2.3	78
5.0	350	150-200	30	0.60	13	2.4	114

OK 93.07

Type Acid-rutile

SMAW
E20-UM-300-CTZ

Description

A high-recovery, surfacing electrode depositing a Co-Cr-Mo-Ni alloy with a low carbon content. The weld metal provides good resistance to heat and corrosion and combinations of these. It can be work hardened.

Typical applications:

- Water hot shear blades, mandrels, ingot gripper teeth
- Valves for hot steam and combustion engines, slipping and sealing surfaces
- Buffer layers when using OK 93.01, OK 93.06 andOK 93.12

Welding current

DC+, AC OCV 65 V

Classifications

DIN 8555	E20-UM-300-CTZ

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Co	Fe
0.3	0.9	1.0	28	3	5.5	58	2

Typical mech. properties all weld metal

Weld metal hardness, a w	≈30 HRC
Weld metal hardness, w h	≈45 HRC
Hot hardness	300°C ≈280 HB
Machinability	By cemented carbide tools
Impact resistance	Good
Abrasion resistance	Very good
Corrosion resistance	Excellent

Deposition data at max. current

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V
3.2	350	90-130	30
4.0	350	120-170	30
5.0	350	150-200	31

OK Tubrodur 15.40 FCAW

Type Rutile

Description

OK Tubrodur 15.40 is a CO_2-shielded, flux-cored wire for the hardfacing deposit of a manganese-chromium-molybdenum-alloyed weld metal. It is used for the surfacing of wheel runners, wheels and rollers for conveyor belts, wheels for mine trucks, rolls and shafts.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr
0.2	1.0	1.4	1.4

Typical mech. properties all weld metal

Weld metal hardness, a w	32-40 HRC
Machinability	Good
Impact resistance	Good
Metal-to-metal wear resistance	Very good

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
1.6	250-350	28-34

OK Tubrodur 15.40S SAW

Type Metal cored

Description

OK Tubrodur 15.40S is a flux-cored wire for SAW hardfacing in conjunction with OK Flux 10.71, depositing a manganese-chromium-molybdenum-alloyed weld metal with a hardness of 32-36 Rockwell C. Suitable for surfacing wheel runners, track links, wheels and rollers for conveyor belts, wheels for mine trucks, rolls and shafts, where a hardness within the range of 32-40 Rockwell C is desired. With negative polarity, less heat input to the base material, less dilution of the weld metal and a higher deposition rate are obtained. In most cases, surfacing with OK Tubrodur 15.40S can be performed without preheat. The need for preheat and increased interpass temperature is determined by the weldability of the parent material in question and the form and dimensions of the workpiece. Whenever possible, surfaced axles and similar objects, which are exposed to a bending stress during rotation, should always be stress relieved at 500-600°C.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr
0.11	0.7	1.4	2.9

Typical mech. properties all weld metal

Weld metal hardness, a w	32-40 HRC
Machinability	Good
Impact resistance	Good
Metal-to-metal wear resistance	Very good

Welding parameters

Diameter, mm	Welding current, A	Arc voltage, V
2.4	250-450	28-38
3.0	400-700	28-36
4.0	500-900	28-34

OK Tubrodur 15.41 FCAW

Type Basic

Description

OK Tubrodur 15.41 is a self-shielded, flux-cored wire for semi-automatic hardfacing, producing a chromium-manganese-alloyed weld metal with a hardness of 28-36 HRC. It is ideal for the on-site rebuilding of rollers, shafts, wheels and worn parts of CMn railway tracks, point frogs and so on.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Al
0.10	0.4	1.4	3.4	1.4

Typical mech. properties all weld metal

Weld metal hardness, a w	28-36 HRC
Machinability	Good
Impact resistance	Good
Metal-to-metal wear resistance	Very good

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
1.6	150-300	25-36
2.4	250-550	26-40

OK Tubrodur 15.42 FCAW

Type Basic

Description

OK Tubrodur 15.42 is a self- or CO_2-shielded, flux-cored wire for GMAW hardfacing. It is designed for surfacing wheel runners, track links, billet rolls, wheels and rollers for conveyor belts, wheels for mine trucks, rolls and shafts, where a hardness of 35-45 HRC is desired.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Al
0.14	0.6	1.6	0.5	0.6	3.4	1.5

Typical mech. properties all weld metal

Weld metal hardness, a w	35-45 HRC
Machinability	Fair
Impact resistance	Good
Metal-to-metal wear resistance	Good
Abrasion resistance	Good

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
1.6	150-300	25-36

OK Tubrodur 15.43 FCAW

Type Basic

Description

OK Tubrodur 15.43 is a self-shielded, flux-cored, tubular wire, primarily developed for the on-site rebuilding of worn CMn railway and tram tracks. The weld deposit is of the CrNiMo type and has excellent compressive strength with a hardness of 30-40 HRC.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	Al
0.14	0.3	1.1	1.0	2.2	0.5	1.5

Typical mech. properties all weld metal

Weld metal hardness, a w	30-40 HRC
Machinability	Good
Impact resistance	Good
Metal-to-metal wear resistance	Very good

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-250	28-37
1.6	150-300	25-36

OK Tubrodur 15.50 FCAW

Type Metal-cored MF6-55GP

Description

OK Tubrodur 15.50 deposits a weld metal with a structure consisting of evenly divided, hard chromium carbides in a martensitic matrix, with a hardness of HV 600-700.
It is suitable for hardfacing parts subjected to extremely severe service conditions involving a combination of impact and abrasion. The weld deposit can only be machined by grinding.
It is advisable to apply no more than three layers of weld metal. When badly worn surfaces have to be rebuilt, it is recommended to begin by using a tougher weld metal.

Applications

- Mill hammers
- Parts of agricultural equipment
- Earth-moving equipment
- Grinders for animal carcasses

Welding current

DC+

Classifications

DIN 8555 MF6-55GP

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.7	0.8	0.8	5.5	1.0

Typical mech. properties all weld metal

Weld metal hardness, a w 55-62 HRC

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
1.2	150-350	18-34
1.6	150-450	21-40
2.4	250-550	26-40

OK Tubrodur 15.52 FCAW

Type Rutile

Description

OK Tubrodur 15.52 is a self- or CO_2-shielded, flux-cored wire for hardfacing with a hardness of 55-60 HRC. It is designed for hardfacing feed screws, mixer blades and vessels and ring grooves on diesel-engine pistons.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo	Al
0.4	0.3	1.2	5.0	1.2	0.6

Typical mech. properties all weld metal

Weld metal hardness, a w	55-60 HRC
Machinability	Grinding only
Impact resistance	Fair
Abrasion resistance	Very good

OK Tubrodur 15.52S SAW

Type Metal cored

Description

OK Tubrodur 15.52S is a flux cored wire for SAW hardfacing in conjuction with OK Flux 10.71. OK Tubrodur 15.52S is designed for hardfacing of feed screws, mixer blades and vessels, ring grooves on diesel motor pistons.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo
0.4	0.6	1.5	5.0	1.2

Typical mech. properties all weld metal

Weld metal hardness, a w	55-65 HRC
Machinability	Grinding only
Impact resistance	Fair
Abrasion resistance	Very good

Deposition data at max current

Diameter, mm	Welding current, A	Arc voltage, V
3.0	400-700	28-36

OK Tubrodur 15.60 FCAW

Type Rutile

Description

OK Tubrodur 15.60 is a self-shielded, flux-cored wire of the austentic-manganese type. The work-hardening characteristics and extremely tough crack-resistant weld metal ensure that OK Tubrodur 15.60 is the ideal solution for rebuilding 13Mn steels, normally found in crusher jaws, swing hammers and numerous parts of earth-moving, mining and quarrying equipment.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Ni	Al
0.8	0.6	11.7	3.0	0.6

Typical mech. properties all weld metal

Weld metal hardness, a w	200-250 HV
Weld metal hardness, w h	400-500 HV
Machinability	Grinding
Impact resistance	Excellent

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
1.6	150-260	24-30
2.4	250-380	28-34

OK Tubrodur 15.65 FCAW

Type Rutile

Description

OK Tubrodur 15.65 is a flux-cored wire for self- or CO_2 shielding, depositing a martensitic-austenitic, work-hardening deposit. OK Tubrodur 15.65 can be used for the rebuilding of mild, low-alloy and 13Mn steels. The weld metal combines excellent abrasion and impact resistance and is suitable for applications such as crusher jaws and hammers, railway point frogs, ripper teeth and wear plates.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo
0.3	0.6	13.5	15.5	1.8	0.8

Typical mech. properties all weld metal

Weld metal hardness, a w	200-250 HV
Weld metal hardness, w h	400-500 HV
Machinability	Grinding
Impact resistance	Excellent
Metal-to-metal wear resistance	Good

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
1.6	200-260	24-28
2.4	250-450	28-38

OK Tubrodur 15.72S SAW

Type Metal cored

Description

A cored wire which produces a martensitic 12%-chromium alloy steel deposit with nitrogen addition. It is used under flux in the submerged arc process.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Mo	Ni	V	Nb
0.06	0.5	0.9	12.0	1.0	4.0	0.11	0.12

Typical mech. properties all weld metal

Weld metal hardness, a w	45-51 HRC
Machinability	By cemented tools
Abrasion resistance	Good
High temp. wear resistance	Very good
Corrosion resistance	Very good

TDeposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
3.0	400-700	28-36

OK Tubrodur 15.73 FCAW

Type metal-cored

Description

OK Tubrodur 15.73 is a versatile, metal-cored, hardfacing wire which deposits a martensitic 13Cr alloy steel deposit, especially suitable for applications involving wear at elevated temperatures. They include shafts, valve seats, rolls and other parts subjected to wear and/or corrosion at high temperatures. An 80% Ar+20% CO_2 gas mix is recommended.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	V	Nb
0.19	0.4	1.2	13.0	2.5	1.5	0.23	0.23

Typical mech. properties all weld metal

Weld metal hardness, a w	45-51 HRC
Machinability	By cemented carbide tools
Abrasion resistance	Good
High temp. wear resistance	Very good
Corrosion resistance	Very good

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
1.6	200-260	28-30

OK Tubrodur 15.73S SAW

Type Metal-cored

Description

OK Tubrodur 15.73S is a metal-cored, hardfacing wire which deposits a martensitic 13Cr alloy steel for use with OK Flux 10.37. It is designed for applications involving wear at elevated temperatures.
Typical applications: steel mill concast rolls, valve seats and components subject to wear, fatigue and corrosion at high temperatures.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	Mo	V	Nb
0.12	0.5	1.1	12.7	2.5	1.5	0.23	0.23

Typical mech. properties all weld metal

Weld metal hardness, a w	45-51 HRC
Machinability	By cemented carbide tools
Abrasion resistance	Good
High temp. wear resistance	Very good
Corrosion resistance	Very good

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
2.4	250-450	28-38
3.0	400-700	28-36
4.0	500-900	28-34

OK Tubrodur 15.86 FCAW

Type Metal-cored

Description

OK Tubrodur 15.86 is a tubular wire designed to deposit a cobalt-based alloy for a wide range of surfacing applications. They include erosion, abrasion, heat and corrosion resistance. It is suitable for exhaust valves, chemical valves, forging dies and a host of components in the power generation, plastics, paper and rubber industries.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	Cr	Ni	W	Fe	Co
0.11	1.0	1.0	28.0	1.8	4.5	3.0	bal.

Typical mech. properties all weld metal

Weld metal hardness, a w	40-43 HRC
Machinability	Fair
Impact resistance	Fair
Metal-to-metal wear resistance	Good
Abrasion resistance	Excellent
High temp. wear resistance	Good
Corrosion resistance	Excellent

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
1.2	280-320	28-32
1.6	340-360	25-29

OK Tubrodur 15.91S SAW

Type Metal-cored

Description

A tubular electrode for submerged arc welding with OK Flux 10.92. This electrode produces a weld metal with the following composition: 22% chromium, 4% nickel and 1% molybdenum. The weld metal is oxidation and heat resistant.

Applications

This electrode is suitable for a wide range of components subjected to corrosive media or high-temperature conditions. Examples include shafts, axles, wheels, rollers and so on which are subject to wear by corrosion-oxidation processes. It can be used as a buffer layer on high carbon-base material, prior to hardfacing with high carbon deposits.

Welding current

DC+

Classifications

no applicable classification

Typical all weld metal composition, %

C	Si	Mn	P	S	Cr	Ni	Mo
0.04	0.8	0.23	<0.04	<0.04	23.4	4.0	1.3

Typical mech. properties all weld metal

Deposition data at max. current

Diameter, mm	Welding current, A	Arc voltage, V
3.0	400-700	28-36

OK Autrod 13.89 GMAW

MSG-2-GZ-C-350

Description

OK Autrod 13.89 is a copper-coated, low-alloyed, solid GMAW wire used for hardfacing and building up, producing a wear-resistant weld metal with a hardness of between 35-40 HRC. It is used for the repair and maintenance of tracks, rails, wheels, rolls, rail crossings, shafts, shovel teeth and other parts on digging machines, tools like dies and so on.

Welding current

DC(+)

Classifications

DIN 8555	MSG-2-GZ-C-350

Wire composition

C	Si	Mn	Cr	Ti
0.7	0.4	2.0	1.0	0.2

Typical mech. properties all weld metal

Weld metal hardness, a w	30-40 HRC
Machinability	Fair
Abrasion resistance	Good
Metal to metal	Good
Impact	Good

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6

OK Autrod 13.90 GMAW

MSG-2-GZ-C-50G

Description

OK Autrod 13.90 is a copper-coated, low-alloyed, solid GMAW wire used for hardfacing and building up highly wear-resistant layers on machinery parts like shafts, feed screws, driving rollers, cutting tools, dies and other parts subjected to heavy wear. The hardness of the weld metal becomes 50-60 HRC.

Welding current

DC(+)

Classifications

DIN 8555	MSG-2-GZ-C-50G

Wire composition

C	Si	Mn	Cr	Ti
1.1	0.4	2.0	1.8	0.2

Typical mech. properties all weld metal

Weld metal hardness, a w	50-60 HRC
Machinability	Grinding
Abrasion resistance	Very good
Impact	Good

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6

OK Autrod 13.91 GMAW

MSG-6-GZ-C-60G

Description

OK Autrod 13.91 is a copper coated, low-alloyed solid GMAW wire used for hardfacing and building up highly wear-resistant layers on tools and machinery parts, driving rollers, digging tools and so on.

The hardness of the weld metal becomes 50-60 HRC.

Applications:

Hardfacing

- mixers
- shovel blades and teeth
- earth-moving and mining equipment

Welding current

DC(+)

Classifications

DIN 8555	MSG-6-GZ-C-60G

Wire composition

C	Si	Mn	Cr
0.45	3.0	<0.8	9.0

Typical mech. properties all weld metal

Weld metal hardness, a w	50-60 HRC
Machinability	Grinding only
Abrasion resistance	Very good
High temp. wear resistance	Very good

Welding parameters

Diameter, mm	Wire feed, m/min	Welding current, A	Arc voltage, V	Deposition rate kg weld metal/hour
1.0	2.7-14.7	80-280	18-28	1.0-5.4
1.2	2.7-12.4	120-350	20-33	1.5-6.6

OK Autrod 12.10

SAW
EL12

Description

OK Autrod 12.10 is a copper-coated mild steel wire for submerged arc welding.
It can be combined with the following fluxes: OK Flux 10.40, OK Flux 10.45, OK Flux 10.61, OK Flux 10.70, OK Flux 10.71, OK Flux 10.80, OK Flux 10.81, OK Flux 10.82, OK Flux 10.83 and OK Flux 10.96.

Classifications

SFA/AWS A5.17	EL12
EN 756	S1

Wire composition

C	Si	Mn
0,09	<0,1	0,5

OK Flux 10.37

SAW

Type Fluoride basic SA FB 2 DC

Description

Agglomerated, fluoride-basic flux, designed primarily for surfacing continuous casting rollers, using cored wires with the single- or twin-arc technique. The flux has excellent slag removal and tolerates high interpass temperatures.

Density

1.0 kg/dm^3

Basicity index

2.6

Flux consumption as kg flux/kg wire

Voltage	DC+	AC
26	0.7	
29	0.9	
32	1.0	
34	1.1	

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr	Ni	Mo	V	Nb
OK Tubrodur 15.40S	0.14	<1.0	1.5	3.5	-	-	-	-
OK Tubrodur 15.72S	0.05	0.55	1.0	9.5	3.5	0.6	0.09	0.15
OK Tubrodur 15.73S	0.10	0.5	1.5	11.3	2.2	1.2	-	-

OK Flux 10.96 SAW

Type Neutral SA CS 3 Cr DC

Description

OK Flux 10.96 is a Cr-alloying agglomerated flux intended for hardfacing with a hardness of up to 40 HRC in combination with mild steel electrodes. OK Flux 10.96 is specifically designed for hardfacing in combination with OK Autrod 12.10, which gives a weld metal hardness of 35-40 HRC.

The flux consumption and the chromium content of the deposit in the weld metal increase with increasing arc voltage. As a result, the hardness and the hardenability of the weld metal also increase as the arc voltage increases. Wheel beds for cranes loading wagons, shafts, caterpillar tracks and links are typical areas of application. Hardfacing with OK Flux 10.96 can be performed on AC or DC. DC positive polarity produces higher heat input to the base material and somewhat higher flux consumption and a lower deposition rate than negative polarity. As the flux contains chromium and the chromium content of the deposit varies with the arc voltage, the latter should be kept as constant as possible.

Density

≈1.1 kg/dm^3

Basicity index

0.7

Flux consumption as kg flux/kg wire

Voltage	DC+	AC
30	0.7	0.6
34	0.9	0.8
38	1.2	1.0

Typical all weld metal composition, %

Wire	C	Si	Mn	Cr
OK Autrod 12.10	0.6	1.2	0.85	3.5

Special products

Contents

Special products
Contents

OK 21.03

Type

SMAW

Description

OK 21.03 is designed for gouging, cutting and piercing mild and alloyed steel, cast iron and non-ferrous metals, with the exception of pure copper, using standard welding equipment. The electrode can be used in a wide variety of applications, such as bevelling, the preparation of cracked areas before welding and the back-gouging of root runs.

Welding current

AC, DC- OCV 70 V

Procedure

The arc is struck with the electrode perpendicular to the workpiece, after which the electrode is pointed in the direction of travel at an angle of about 15-20°C and pushed forward.
Gouging speed 100-150 cm/minute depending on the depth of the groove. Deep grooves can be made by repeated gouging. Welding can follow without further preparation, but, when gouging in stainless steel, a thin layer with increased carbon content is obtained and it should be removed by grinding.
When using OK 21.03 indoors, it is necessary to have very good ventilation or fume extraction.

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V
2.5	350	100-120	43
3,2	350	130-180	43
4.0	350	170-230	48
5.0	450	230-300	48

OK 91.00

Type Acid

SMAW

Description

OK 91.00 is an electrode which has been specially developed for the repair welding of heavy cast-iron equipment when cast-iron weld metal is needed, e.g. steelwork ingot modules, bottom plates, slag pots and so on.

Welding current

AC, DC+ - OCV 60 V

Wire composition

C	Si	Mn
2.2	2.3	0.4

Hardness:

Weld deposited on nodular cast iron. No preheat.

1st bead:	HV 640
2nd bead: (Interpass temp. 150°C)	HV 260
3rd bead: (Interpass temp. 150°C)	HV 340

Welding parameters

Diameter, mm	Length, mm	Welding current, A	Arc voltage, V	N. Kg weld metal/kg electrodes	B. No. of electrodes/kg weld metal	H. Kg weld metal/hour arc time	T. Burn-off time, s/electrode
8.0	450	380-600	28	0.75	6.2	5.0	120

OK Gasrod 98.70

OFW
R60

Description

OK Gasrod 98.70 is a 1.0Mn-alloyed, copper-coated welding rod for the gas welding of un-alloyed steels in applications such as tanks and piping.

Classifications

SFA/AWS A5.2	R60
EN 12536	OII

Wire composition

C	Si	Mn
0.1	0.2	1.0

Typical mech. properties all weld metal

Yield stress, MPa	300
Tensile strength, MPa	390
Elongation, %	20

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.2	1000	5
1.6	1000	5
2.0	1000	5
2.5	1000	5
3.0	1000	5
4.0	1000	5
5.0	1000	5

OK Gasrod 98.73 OFW
O II

Description

OK Gasrod 98.73 is a 0.5Mn-alloyed, copper-coated welding rod for the gas welding of un-alloyed steels in applications such as piping and in plates where the requirements imposed on the mechanical properties are of less importance.

Classifications

EN 12536	OII

Wire composition

C	Si	Mn
0.07	0.1	0.5

Typical mech. properties all weld metal

Yield stress, MPa	>260
Tensile strength, MPa	>300
Elongation, %	>20

Charpy V

Test temps, °C	Impact values, J
+20	30

Approvals

DB	70.039.01
Ü	70.039

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.5	1000	5
3.0	1000	5
4.0	1000	5
5.0	1000	5

OK Gasrod 98.75 OFW
OIII

Description

OK Gasrod 98.75 is a 0.5Ni-alloyed, copper-coated welding rod for gas-welding applications when good impact properties are required. Welding should be performed with a neutral flame. The rod produces a viscous melt.

Classifications

EN 12536	OIII

Wire composition

C	Si	Mn	Ni
0.1	0.2	1.1	0.6

Typical mech. properties all weld metal

Yield stress, MPa	>320
Tensile strength, MPa	>440
Elongation, %	>29

Charpy V

Test temps, °C	Impact values, J
+20	70

Approvals

DB	70.039.02
UDT	DIN 8554
Ü	70.039
VdTÜV	

Packing data

Diameter, mm	Length, mm	Weight of rods/box, kg
1.6	1000	5
2.0	1000	5
2.4	1000	5
3.0	1000	5
4.0	1000	5
5.0	1000	5

OK Grain 21.85 SAW

Description

OK Grain 21.85 is a metal powder specially designed for the submerged arc welding of C-Mn steels. It is added to an appropriate flux-wire combination in order to increase the deposition rate.

Composition of grain

C	Si	Mn
0.14	0.4	1.8

OK Flux 10.69 SAW

Type Basic

Description

OK Flux 10.69 is a basic, agglomerated flux, specially designed as a backing flux for one-sided submerged arc welding. A copper bar is normally used to support the flux.

Density

≈1.4 kg/dm^3

Basicity index

1.5

Kit for joining rails

	ESAB rail set 2121 7478 00
Backing	OK Backing 21.21
Pieces/set	2
Dimensions	60 x 200 x 13 mm
Stick electrodes for joint welding	OK 74.78
Pieces/set	30
Diameter/length	5.0 x 450 mm
Stick electrodes for wear-resistant top layers	OK 83.28
Pieces/set	6
Diameter/length	5.0 x 450 mm
Packaging	1 kit = in an electrode package 3 kits = in a cardboard box

Procedure:

Firstly, OK Backing 21.21 is placed and fixed under the joint opening and the foot is then welded using stringer beads. Secondly, copper moulds are placed on both sides of the rail and the web and head are welded continuously using the same type of electrode as for the foot.

OK 83.28 is used to weld the top layer of the rail head. In this way, the otherwise softer weld deposit will become wear resistant and the “deflection” of the welded rail joint will be prevented.

Suitable for applications on tram lines, site railway tracks, dock railway tracks, train tracks and crane railway tracks.

All set components mentioned here are also available individually.

FILARC ceramic weld metal supports

Since their introduction for shipbuilding, the use of ceramic weld metal supports for fast root pass deposition has spread to bridge building, pressure vessels, general steel component construction and other areas of fabrication. This has been accompanied by an increase in the use of flux- and metal-cored wires to obtain optimum productivity.

The process advantages can be summarised as follows,

- Higher welding currents are possible, thereby substantially increasing the root pass deposition rate.
- High-quality root runs with dependable penetration and smooth profile.
- Applicable in the 1G, 2G, 3G up positions.
- Gouging, grinding and sealing of the back side are avoided.
- Welder qualification easier to obtain.

FILARC ceramic weld metal supports have no adverse effect on weld metal composition and mechanical properties. They are dry and insensitive to moisture absorption, leaving the low-hydrogen performance of consumables unaffected.

The FILARC range presented here comprises the most commonly used types, covering the majority of applications in any type of industry. The range comprises grey and brown ceramic blocks/strips.

The grey types are of a harder ceramic, with a higher melting point and lower slag production than the brown types. The grey types are more prone to cracking by thermal expansion and therefore always require a carrier in the form of a rail or adhesive strip.

The brown types can be applied without a carrier and they can also be cut.

Types with a concave groove are used for processes producing no or relatively small amounts of slag, such as GMAW with solid wire and FCAW with basic flux-cored or metal-cored wires.

Rectangular grooves are required to accommodate the higher slag production from special basic stick electrodes, such as FILARC 35B, rutile flux-cored wires and SAW fluxes.

Both types are supplied in the form of loose ceramic blocks, blocks mounted in rigid metal rails for straight joints, or blocks on self-adhesive aluminium tape or fitted on wire. Blocks on tape are available in semi-rigid form for straight joints and in flexible form for curved joints, like those used in ship's hulls, tanks, vessels and pipes.

Centreline cracking on ceramic backing

When welding root runs on ceramic backing strips, centreline cracking may occur at high heat inputs. This is a characteristic aspect of all rutile cored wires.

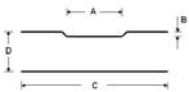
The concave bead shape promotes unfavourable solidification, making the weld prone to hot cracking, especially when shrinkage forces are high. For crack-free welding, the following guidelines should be observed.

- Use a joint angle of 45-60°C and a root opening of approx. 5 mm.
- Use ceramic strips with a rectangular groove to accommodate the slag. The groove width must be around 15 mm.
- Use welding currents below 180A (Ø1.2 mm). This produces a more or less oval weld pool, instead of the unfavourable arrow shape.
- Minimise weaving to avoid excessive bead thickness, while keeping the arc in front of the weld pool to obtain sufficient penetration.

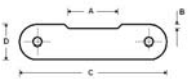
FILARC ceramic weld metal supports

Selection table

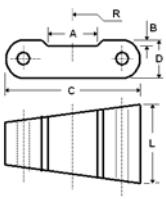
Rectangular groove type for all-postitional welding suitable for flux-cored wires, submerged arc welding and stick electrodes



	Dimensions, mm					Assembly	Colour
Type	**A**	**B**	**C**	**D**	**Length**		
PZ1500/33	16.0	0.9	35	9.0	100	Loose block	Grey
PZ1500/03	16.0	0.9	35	9.0	1000	Rail	Brown
PZ1500/71	11.5	1.1	25	7.0	500	Tape	Grey
PZ1500/81	13.0	1.5	30	7.0	600	Tape/block 25 mm	Grey
PZ1500/54	16.0	0.9	35	9.0	600	Tape	Grey
OK Backing Rectangular 13	13.0	1.5	26.5	7.3	600	Tape/block 25 mm	Brown

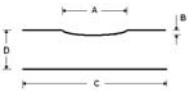


PZ1500/42	13.2	0.9	30	7.0	1000	Wire/block 20 mm	Brown

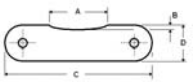


PZ1500/22	13.5	0.9	30	7.0	19.5	Loose block	Brown

Concave groove type for all-positional welding. Suitable for metal-cored wires, low-slag, flux-cored wires and solid wires



	Dimensions, mm					Assembly	Colour
Type	**A**	**B**	**C**	**D**	**Length**		
PZ1500/30	11.5	0.7	25	7.0	150	Loose block	Brown
PZ1500/32	13.5	1.3	25	7.0	150	Loose block	Grey
PZ1500/44	19.0	1.4	35	9.0	500	Rail	Brown
PZ1500/48	13.2	1.3	25	7.0	500	Rail	Grey
PZ1500/70	13.2	1.3	25	7.0	500	Tape	Grey
PZ1500/87	5.6	0.9	28	6.5	500	Tape/block 25 mm	Grey
PZ1500/72	9.5	1.5	25	7.0	500	Tape/block 25 mm	Grey
PS1500/73	12.5	1.0	25	7.0	500	Tape/block 25 mm	Brown
PZ1500/80	16.0	1.5	30	7.0	600	Tape/block 25 mm	Grey
OK Backing Concave 13	13.0	1.5	26.5	7.3	600	Tape/block 25 mm	Brown



PZ1500/02	13.2	0.8	30	7.0	1000	Wire/block 20 mm	Brown

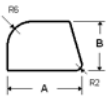
FILARC ceramic weld metal supports

Selection table

Round type for all-positional welding, flexible for straight or curved plates. Suitable for cored wires, solid wires and stick electrodes for T, K and X joints.

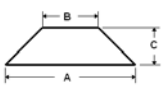
FILARC type	Dimensions, mm					Assembly	Colour
	A	B	C	D	Length		
PZ1500/01	12.0	-	-	-	150	Loose block	Brown
PZ1500/08	7.0	-	-	-	100	Loose block	Brown
PZ1500/17	9.5	-	-	-	100	Loose block	Brown
PZ1500/50	7.0	-	-	-	500	Tape/block 20 mm	Brown
PZ1500/56	9.0	-	-	-	500	Tape/block 25 mm	Grey
PZ1500/51	9.5	-	-	-	500	Tape/block 25 mm	Brown
PZ1500/57	11.3	-	-	-	500	Tape/block 25 mm	Grey
PZ1500/52	12.0	-	-	-	500	Tape/block 25 mm	Brown
OK Backing Pipe 9	9.0	-	-	-	600	Tape	Brown
OK Backing Pipe 12	12.0	-	-	-	600	Tape	Brown

Special types for all-positional welding straight or curved plates. Suitable for cored wires, solid wires and electrodes



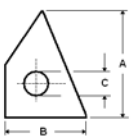
For T joints with large root gap

PZ1500/29	14.2	9.5	-	-	500	Tape/block 25 mm	Grey



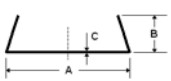
For one-side welded V joints, where minimum penetration to ceramics is required. Welded on side A

PZ1500/24	18.5	8.0	6.0	-	500	Tape/block 25 mm	Grey



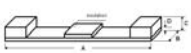
For one-side welded V joints, where plates are not in the same plane

PZ1500/25	15.0	12.0	4.0	-	100	Loose block	Brown



Rail suitable for ceramic backing (loose block) with a total width of 25 or 35 mm

PZ1501/01	26	6.0	1.0	-	1000	-	-
PS1501/02	35	7.5	0.5	-	1000	-	-



Magnetic clamp for fixing rails or wire-held ceramic block

PZ1504/01	250	50	7.0	1.0	-	-	-

FILARC ceramic weld metal supports

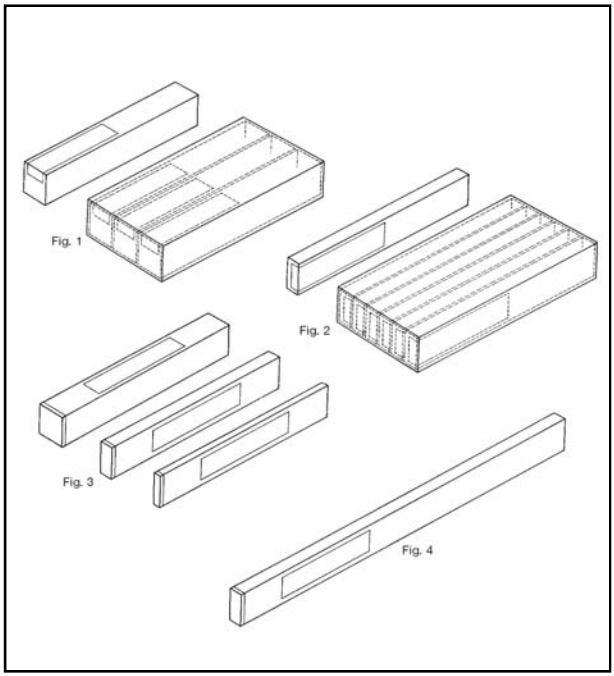
Packing data

FILARC type no	No/box	Gross weight, kg/box	Box/pallet
Loose blocks			
PZ1500/01	200	7.0	48
PZ1500/08	900	7.5	48
PZ1500/17	520	7.5	48
PZ1500/32	175	10.0	48
PZ1500/33	160	12.0	48
PZ1500/22	1000	7.5	48
PZ1500/25	450	10.0	48
PZ1500/30	175	9.0	48
Rigid in rail			
PZ1500/03	21	15.0	30
PZ1500/44	35	13.5	42
PZ1500/48	63	17.0	42
Semi-rigid on adhesive tape			
PZ1500/70	56	11.0	42
PZ1500/71	56	11.0	42
Flexible on adhesive tape or wire			
PZ1500/02	24	11.0	36
PZ1500/24	70	8.5	42
PZ1500/29	48	9.0	42
PZ1500/42	24	11.0	36
PZ1500/50	100	5.0	42
PZ1500/51	72	6.5	42
PZ1500/52	60	8.5	42
PZ1500/54	30	13.5	35
PZ1500/56	72	7.0	42
PZ1500/57	60	9.0	42
PZ1500/72	56	13.0	42
PZ1500/73	56	10.0	42
PZ1500/80	48	12.2	42
PZ1500/81	48	12.2	42
PZ1500/87	54	12.5	42
OK Backing Rectangular 13	56	13.5	35
OK Backing Concave 13	56	13.4	35
OK Backing Pipe 9	72	8.0	35
OK Backing Pipe 12	56	10.0	35
Metal rails			
PZ1501/01	48	15.0	30
PZ1501/02	38	7.5	30
Magnetic clamps			
PZ1504/01	66	10.0	48

Packaging and spool types

Contents

Packaging



Stick electrodes

Rutile and low-hydrogen electrodes are packed in cardboard packs with polyethylene shrink wrapping. They are supplied in units of three or six in outer boxes made of corrugated board (Figures 1 & 2).

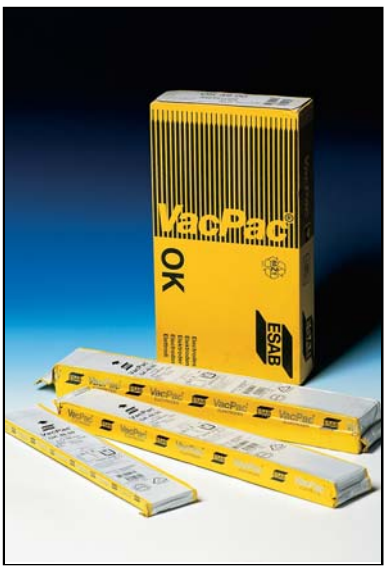
Stainless electrodes are packed in polyethylene boxes with a re-sealable lid (Figure 3).

Tig rods

Tig rods are packed in strong, air-tight fibre cylinders with a re-sealable plastic lid (Figure 4).

Strip electrodes

OK Band welding strip is normally supplied in 30 kg coils and a frequent dimension is 60 x 0.5 mm. However, other widths such as 30 or 90 mm or larger coil weights are available on request



VacPac™

No re-baking - no quivers - no holding ovens

VacPac vacuum packaging eliminates the costly re-baking and handling routines normally associated with the storage of electrodes, by preventing airborne moisture absorption. VacPac is simple and convenient to use, ensuring that the electrodes keep their ”factory fresh”, low-moisture condition until the sealed vacuum is released and the electrodes are used. When stored under conditions in which the sealed VacPac electrodes are not damaged, their shelf life is virtually unlimited.

Quality control is simple. The date and time of issue from the warehouse are written on the foil to monitor safe usage within the time limits prescribed for the various electrode types after opening the VacPac. The foil, showing all the necessary product information, is left in place after opening.

The VacPac sizing options make it possible to match the number of electrodes to the expected production rate and are the electrodes are available as full, half and quarter packs, containing approximately 4, 2.5 and 1 kg of electrodes.

Packaging

Flux

ESAB fluxes are normally supplied in paper bags of 20 or 25 kg each. An inner bag of polythene provides extra protection from moisture pick-up from the surrounding atmosphere.

ESAB fluxes for submerged arc welding can also be supplied in steel buckets of 25 kg. This packaging type is very strong and is used for demanding handling conditions. The re-sealable metal lid has a rubber seal to prevent the flux from absorbing moisture.

Big Barrel is a bulk packaging alternative for SAW fluxes. The steel barrel contains about 250 kg, depending on the volume weight of the flux. This large packaging for flux offers more rational handling. The Big Barrel is environmentally compatible and reduces waste.

Big Bag is intended for bulk usage. Fluxes, including OK Flux 10.71, are now available in 500-1,000 kg content. Big Bag offers six-fold security in terms of weight and has base dimensions of 85 x 85 cm. The height of a one-tonne Big Bag is 88 cm, enabling two bags to be stacked in a truck or container for transport.

Big Bag is made of layers of fabric, coated on the inside for moisture protection. There is a discharge spout with a diameter of 150 mm. It can easily be re-closed with a rope so that only part of the flux is taken out at any time. Big Bag has four strong straps allowing it to be lifted by a fork-lift truck or overhead crane and emptied directly into a flux container.

MARATHON PAC™ — endless feedability

For many customers, Marathon Pac bulk drums for MIG/MAG and FCAW are key in maximising production efficiency and quality; in manual welding and especially in mechanised and robotic welding. Marathon Pac can cut the time taken by spool changes and maintenance by almost 95%. Marathon Pac comes in three sizes – the standard version, the jumbo version and the mini version – and is available for non- and low-alloyed MAG wires, stainless MIG wires, aluminium MIG wires, MAG-brazing wires and cored wires. In addition, there is an "endless version", which makes it possible to combine the content of a series of Marathon Pacs to form a continuous in-line supply source, thereby necessitating no stops whatsoever for wire exchange. This is ideal for multi-robot stations. A special wire resistance welder is available from ESAB for this purpose. Availability and content weight are given in the table below.

Marathon Pac version	Wire types	Filling content
Standard version	Non-/low-alloyed	250 kg (ø 0.8 mm: 200 kg)
(w x h: 513 x 830 mm)	Stainless	250 kg (ø 0.8 mm: 200 kg)
	MAG-brazing	200 kg
	Cored wires	depending on wire type
Jumbo version	Non-/low-alloyed	475 kg (min. ø 1.0 mm)
(w x h: 595 x 935 mm)	Stainless	475 kg (min. ø 1.0 mm)
	Aluminium	141 kg
	Cored wires	depending on wire type
Mini version	Stainless	100 kg
(w x h: 513 x 500 mm)		
Endless version	Non-/low-alloyed wires	2 x 250 kg
(2 x standard or jumbo version)		2 x 475 kg
	Stainless	2 x 250 kg
		2 x 475 kg

Packaging

Marathon Pac (left) and Jumbo Marathon Pac.

Perfect delivery to the welding head

The special coiling technique that is used when packing the drum ensures that the wire is never twisted or warped, which would otherwise cause arc wander. Welds are well positioned and perfectly straight. The unwinding process from the drum is automatic, so no separate de-coiling equipment is needed and no additional forces are required, like those that are needed when pulling a traditional revolving spool. This translates into a lower wear rate for the wire feeder.

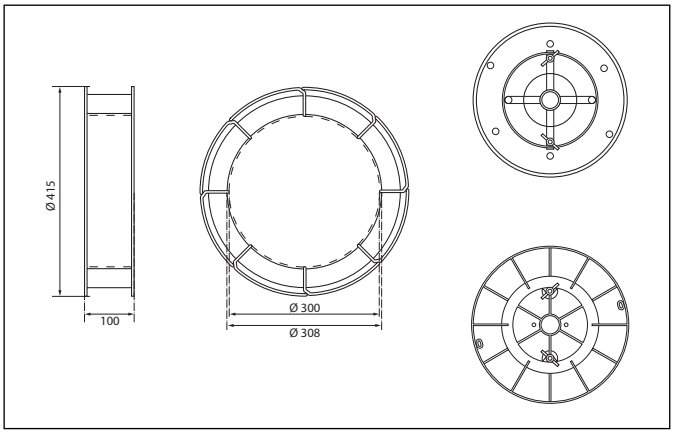
Easy recycling

Marathon Pac comes in octagonal cardboard drums that are fully recyclable. They can be folded flat after use to save on storage space.

Mini Marathon Pac

Endless Marathon Pac

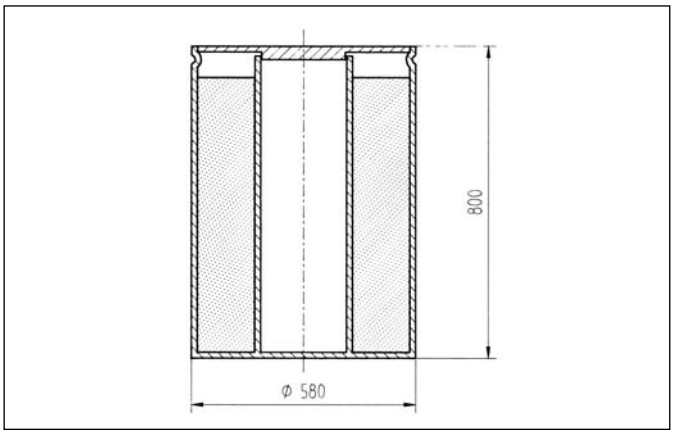
Spool types



Spool 03

03-0	25 kg
03-2	30 kg
03-3	15 kg

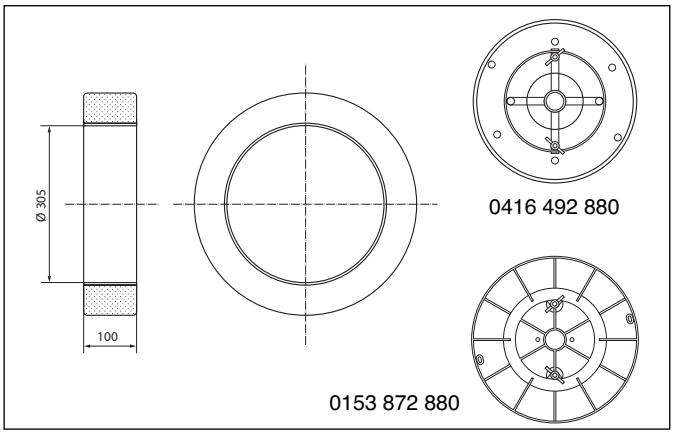
Random-wound wire basket. Can be fitted to ESAB's 0416 492 880 or 0153 872 880 coil holder. This spool is also suitable for coil holders with crossed arms. The empty basket is non-returnable.



Spool 04

04-0	280 kg

Random-wound pay-off drum. The empty spool is non-returnable.

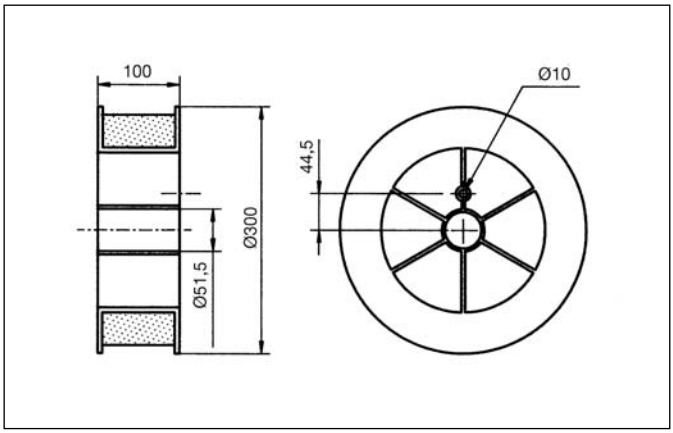


Spool 08

08-0	30 kg

Random-wound spool without cardboard former. Can be fitted to ESAB's 0416 492 880 or 0153 872 880 coil holders.
This spool is not suitable for coil holders with crossed arms.

Spool types



Spool 24

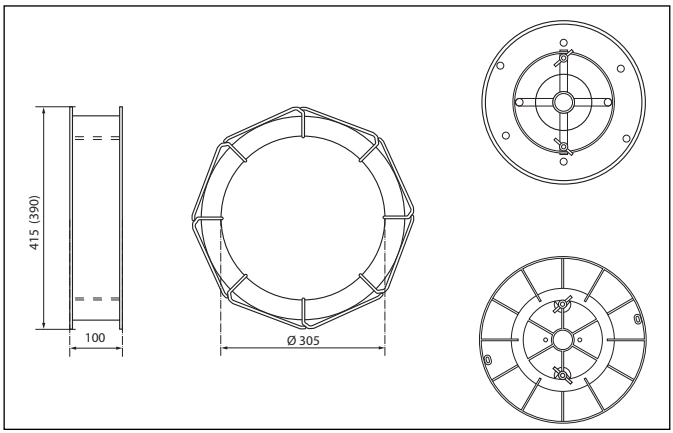
Plastic spool. Layer wound.
EN 759: S 300

24-7	15 kg

Spool 25

Plastic spool. Random wound.
EN 759: S 300

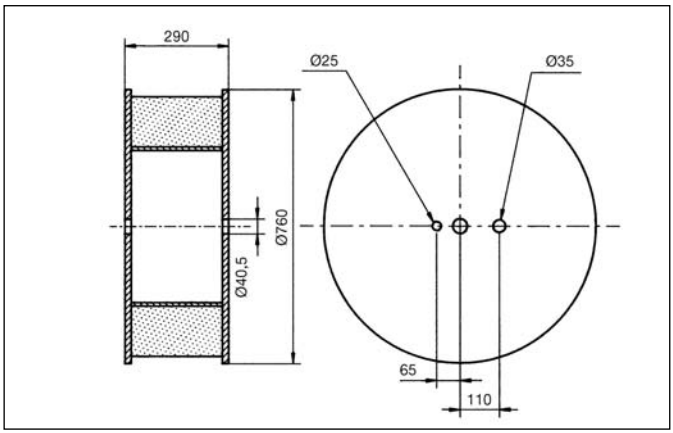
25-0	15 kg
25-2	10 kg



Spool 28/31 Eurospool

28-0	30 kg
28-1	25 kg
28-2	15 kg

Precision-wound octagonal wire basket. Can be fitted to ESAB's 0416 492 880 or 0153 872 880 coil holder. This spool is also suitable for coil holders with crossed arms. The empty basket is non-returnable.

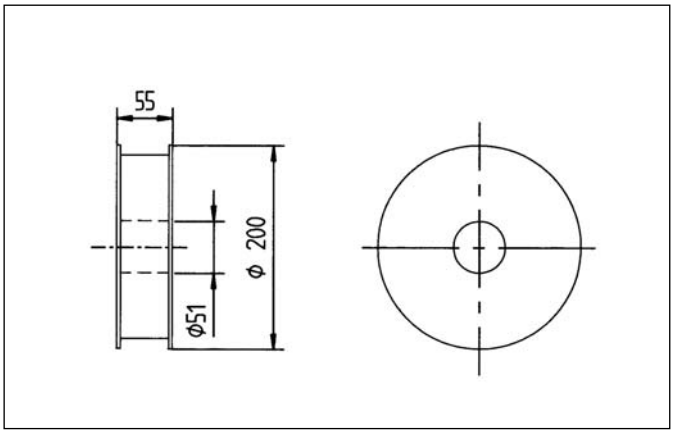


Spool 34

34-0	300 kg

Random-wound wooden bobbin. Decoiling stand required. The empty bobbin is non-returnable.

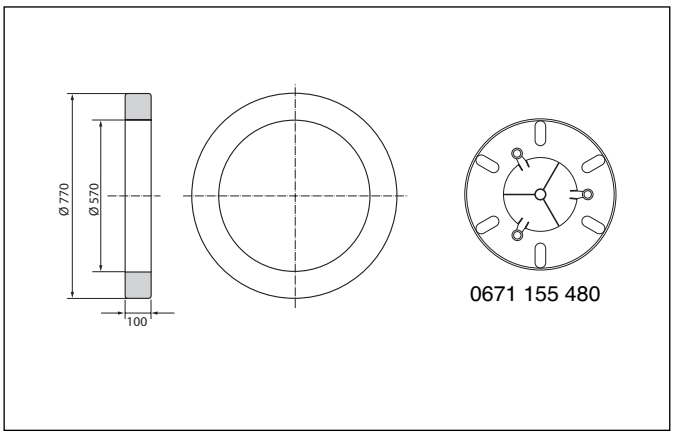
Spool types



Spool 46

Plastic spool. Random wound
EN 759: S 200

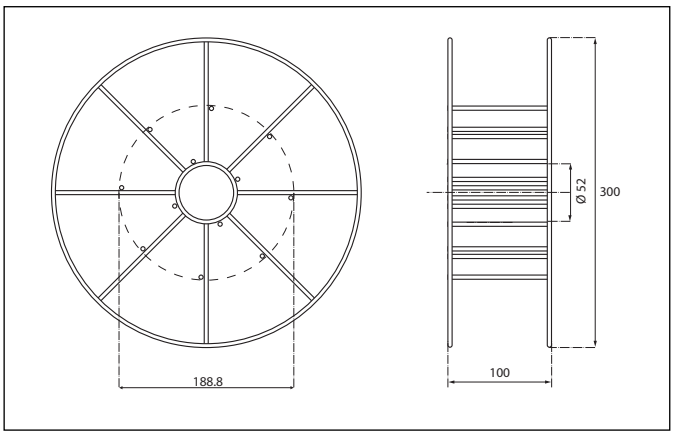
46-0	5 kg
46-2	2 kg



Spool 48

48-0	100 kg
48-1	75 kg

Random-wound coil sheet metal former. Can be fitted to ESAB's 0671 155 480 coil holder. Decoiling stand required.



Spool 66/68

Wire basket. Random wound.
EN 759: BS 300
66-copper-coated, 68-bare

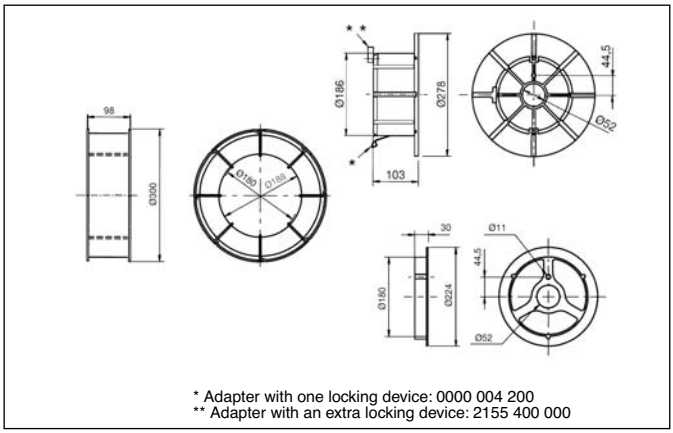
66-0	15 kg
66-1	18 kg
66-2	10 kg
66-3	16 kg

Spool 67/69

Wire basket. Layer wound.
EN 759: BS 300
67-copper-coated, 69-bare

67-0	15 kg
67-1	18 kg
67-3	16 kg

Spool types



* Adapter with one locking device: 0000 004 200
** Adapter with an extra locking device: 2155 400 000

Spool 76

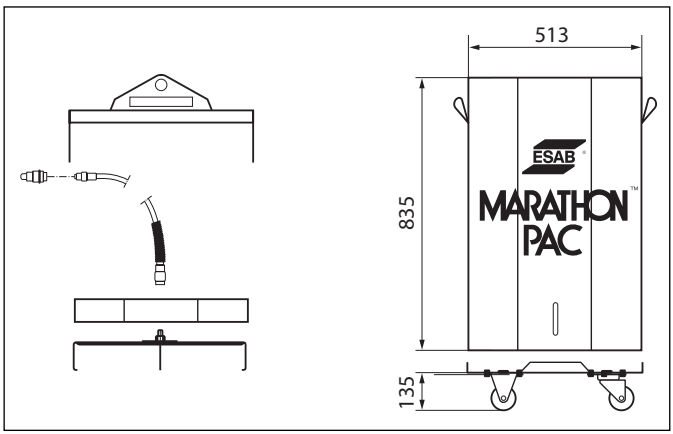
Wire basket. Random wound.
EN 759: B 300

76-0	15 kg
76-1	18 kg
76-3	16 kg

Spool 77

Wire basket. Layer wound.
EN 759: B 300

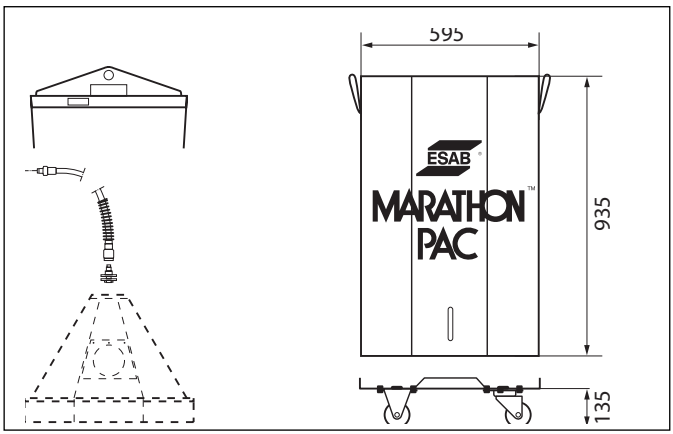
77-0	15 kg
77-1	18 kg
77-3	16 kg



Spool 93 MARATHON PAC™

93-0-200 kg, 93-2-250 kg
93-X-catch weight

Accessories:
1. Wire conduit attachment
2. Wire conduits
3. Connector wire feed unit
4. Lifting yoke
5. Trolley

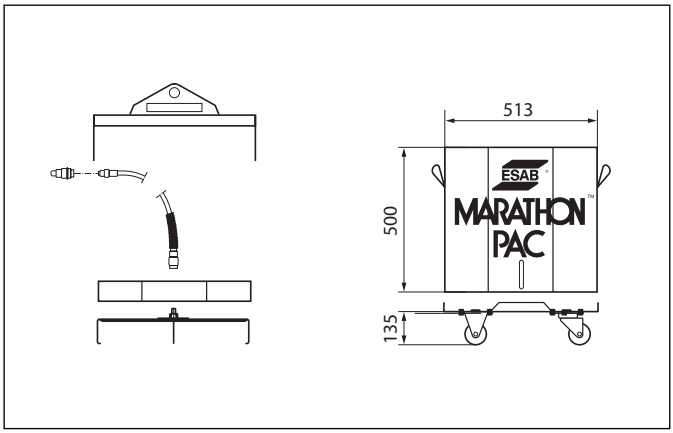


Spool 94 MARATHON PAC™

94-0	475 kg

Accessories:
1. Plastic hood
2. Quick connector
3. Wire conduits
4. Connector wire feed unit
5. Lifting yoke
6. Trolley

Spool types

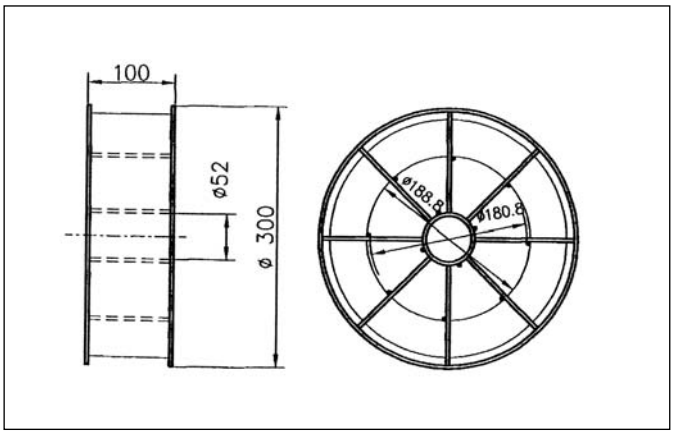


Spool 95

MARATHON PAC™

95-0	100 kg

Accessories:
1. Quick connector
2. Wire conduits
3. Connector wire feed unit
4. Lifting yoke
5. Trolley



Spool 98

EN 759: BS 300
Layer-wound wire basket, plastic coated, which is used without adapter. Fitting to hub with diam. = 51 mm. Empty spool is recyclable.

98-2	15 kg
98-3	18 kg
98-4	16 kg
98-6	6 kg
98-7	7 kg

Storage and handling

Contents

Recommendations for the storage, re-drying and handling of ESAB covered electrodes

General information

All covered electrodes are sensitive to moisture re-absorption to a greater or lesser degree. Care must be taken during storage and handling to prevent moisture being re-absorbed.

Storage

Covered electrodes of any type will pick up moisture only very slowly if they are stored in the following climatic conditions.

Temperature	Relative humidity
5-15°C	< 60%
15-25°C	< 50%
above 25°C	< 40%

During the winter, it is possible to have low relative humidity by keeping the temperature in the storeroom at least 10°C above the outdoor temperature. During certain periods in the summer and in a tropical climate, sufficiently low relative humidity can be maintained by air de-humidification.

If the electrodes have been stored in a cold place, allow them to reach ambient temperature before breaking the package.

Re-drying

Low-hydrogen basic electrodes should be re-dried before use whenever there are application requirements relating to weld metal hydrogen content and/or radiographic soundness (not needed for VacPac™).

Acid rutile stainless electrodes and all types of basic electrode may produce pores in the weld if they have not been stored in sufficiently dry conditions. Re-drying the electrodes will restore their usability.

Mild steel rutile and acid electrodes normally require no re-drying.

Cellulose electrodes must not be re-dried.

Electrodes which are seriously damaged by moisture can normally not be re-dried with first-class results. These electrodes should be scrapped.

Re-drying conditions

Re-drying temperatures and holding times are specified on the label and in the product specification.

The re-drying temperature is the temperature in the bulk of the electrodes.

The re-drying time is measured from the point at which the re-drying temperature has been reached.

Do not stack more than four layers of electrodes in the re-drying oven.

It is recommended not to re-dry covered electrodes more than three times.

Holding oven

The holding oven is used for intermediate storage to avoid moisture pick-up in the coating of low-hydrogen electrodes and acid rutile stainless electrodes. The electrodes which should be

stored in the holding oven are:

1. Electrodes that have been re-dried.
2. Electrodes that have been removed from their hermetically-sealed container.
3. Electrodes that are considered to be in good condition and are transferred directly from the storeroom after unpacking.

Holding oven temperature: 120-150°C.

Precautions on site

Keep the electrodes in electrically-heated quivers at a minimum temperature of 70°C.

After work, return the remaining electrodes to the holding oven.

Discoloration in the coating

If the colour of the electrodes changes during storage, they should be scrapped or the electrode manufacturer should be contacted.

Damaged coating

Mechanically damaged electrodes on which parts of the coating are missing will not perform correctly and should be scrapped.

VacPac™

Electrodes in VacPac will not pick up any moisture during storage. They require no re-drying before use, provided the package is undamaged. This is indicated by the vacuum in the package.

Handling VacPac™ electrodes

Protect VacPac from damage at all times.

The outer board packaging offers extra protection from mechanical damage to the metal foil. Handle the single inner, metal foil, VacPac with special care.

Do not use a knife or any other sharp object to open the outer board packaging.

Before using VacPac™ electrodes

Check if the protective foil still contains a vacuum. If the vacuum has been lost, re-dry the electrodes before use.

Cut open the protective foil at one end.

Do not take out more than one electrode at a time, thereby ensuring that the remaining electrodes are still protected inside the package. Put the top back on the plastic capsule.

Discard or re-dry electrodes that have been exposed to the atmosphere in an opened VacPac™ for more than 12 hours.

Storage and handling recommendations for OK Tubrod cored wires

Cored wire should be stored in conditions which prevent the accelerated deterioration of products or packaging. All cored wires should avoid direct contact with water or moisture. This could take the form of rain or the condensation of moisture on a cold wire.

Cored wires must be stored in dry conditions. The relative humidity and temperature should be monitored and the temperature should not fall below the dew point.

To avoid condensation, the wire should be kept in the original packaging and, if necessary, left to warm up to at least the ambient temperature before opening the package.

Other hydrogen-containing substances, such as oil, grease and corrosion, or substances that could absorb moisture must also be avoided on the wire surface.

Products must be stored in such a way as to avoid damage during storage.

Storage and handling recommendations for OK Flux

ESAB fluxes, agglomerated as well as fused, have a guaranteed as-manufactured moisture content from the factories. This moisture content is well- controlled by internal ESAB specifications. Before transport, each pallet is shrink wrapped in plastic foil. This precaution action is done in order to maintain the as-manufactured moisture content as long as possible. Flux should never be exposed to direct wetness such as rain or snow.

Storage

- Unopened flux bags must be kept under properly maintained storage condition as follows:

  Temperature: 20 +/- 10°C

  Relative humidity: As low as possible - not exceeding 60 %.
- The content of unprotected flux hoppers should after an 8 hours shift be placed in a drying cabinet or heated flux hopper at a temperature of 150 +/- 25°C.
- Remaining flux from opened bags should be placed at a temperature of 150 +/- 25°C

Recycling

- Moisture and oil must in a suitable way be removed from the pressure air used in the recycling system.
- Addition of new flux must be done with the proportion of at least one part new flux to three parts recycled flux.
- Foreign material such as millscale, dross etc. should be removed by a suitable system such as sieving.

Redrying

- When handled and stored as above, the ESAB fluxes can normally be used as they are.
- If, however, a severe application is considered, as given by the applicable material specification, redrying of the flux is recommended.
- Furthermore, if the flux, due to unfavourable handling or storage, has picked up moisture, redrying can return the flux to its original state regarding moisture.
- Redrying shall be performed as follows:

  Agglomerated fluxes: 300 +/- 25°C for about 2-4 hours.

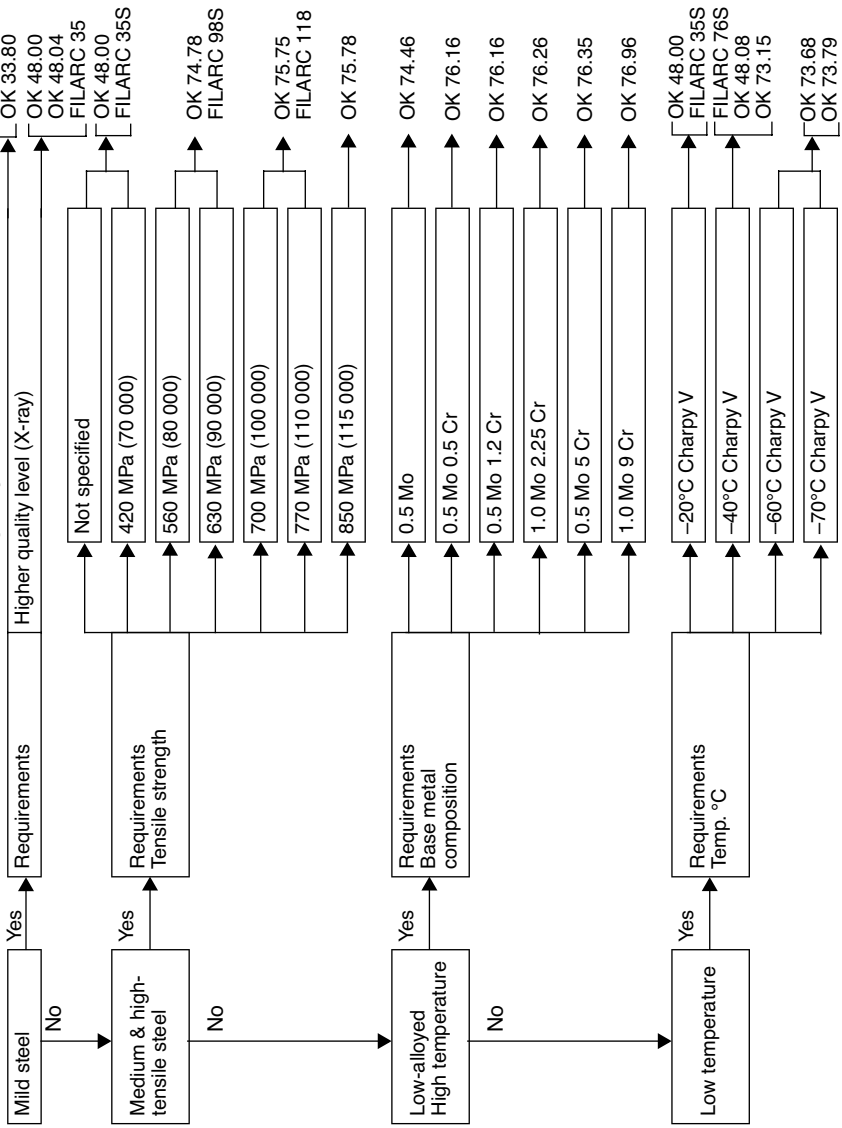
  Fused fluxes: 200 +/- 50°C for about 2-4 hours.

Redrying must be done on shallow plates with a flux height not exceeding 50 mm. Redried flux, not immediately used, must be kept at 150 +/- 25°C before use.

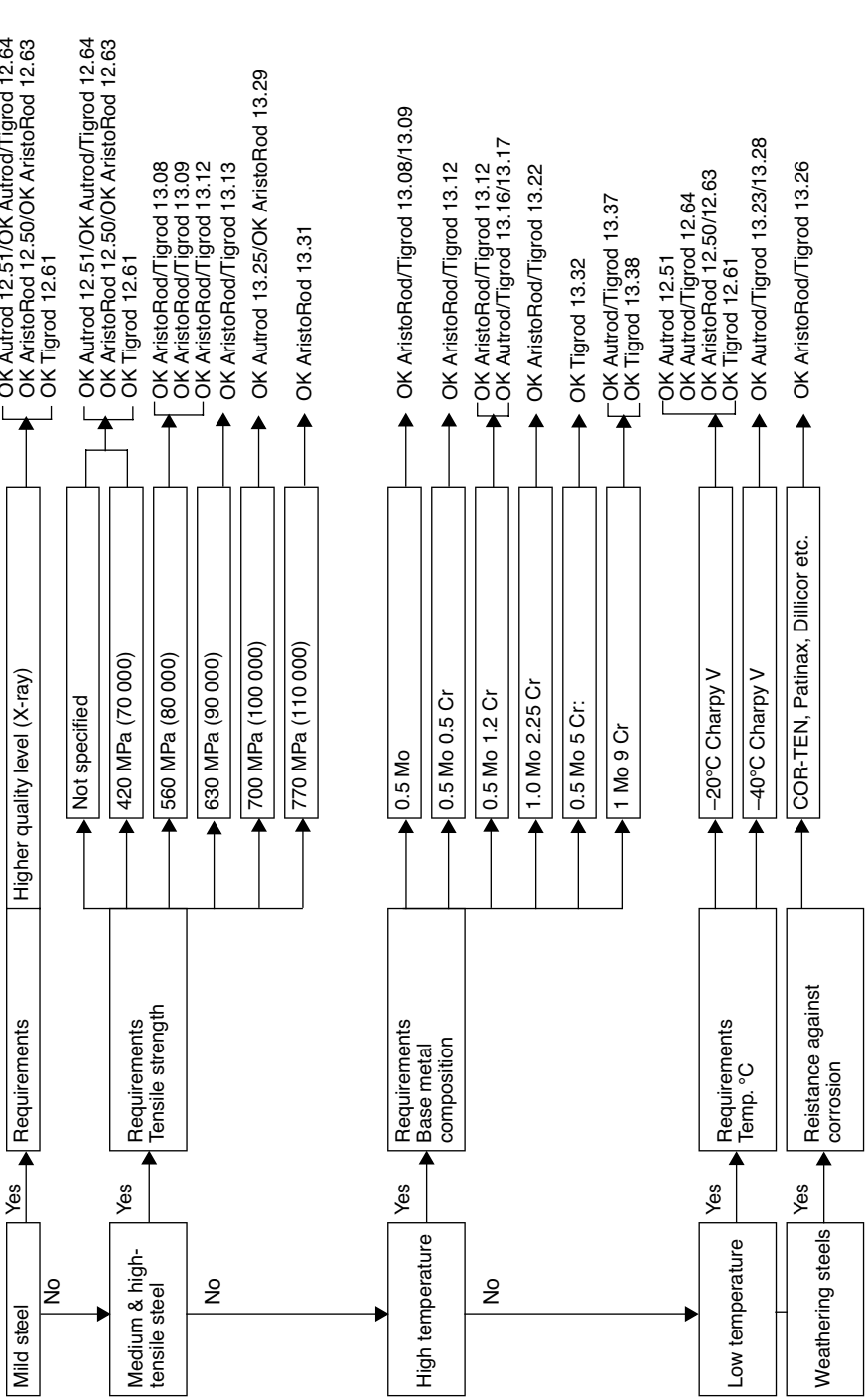
Quick guide for the selection of welding consumables

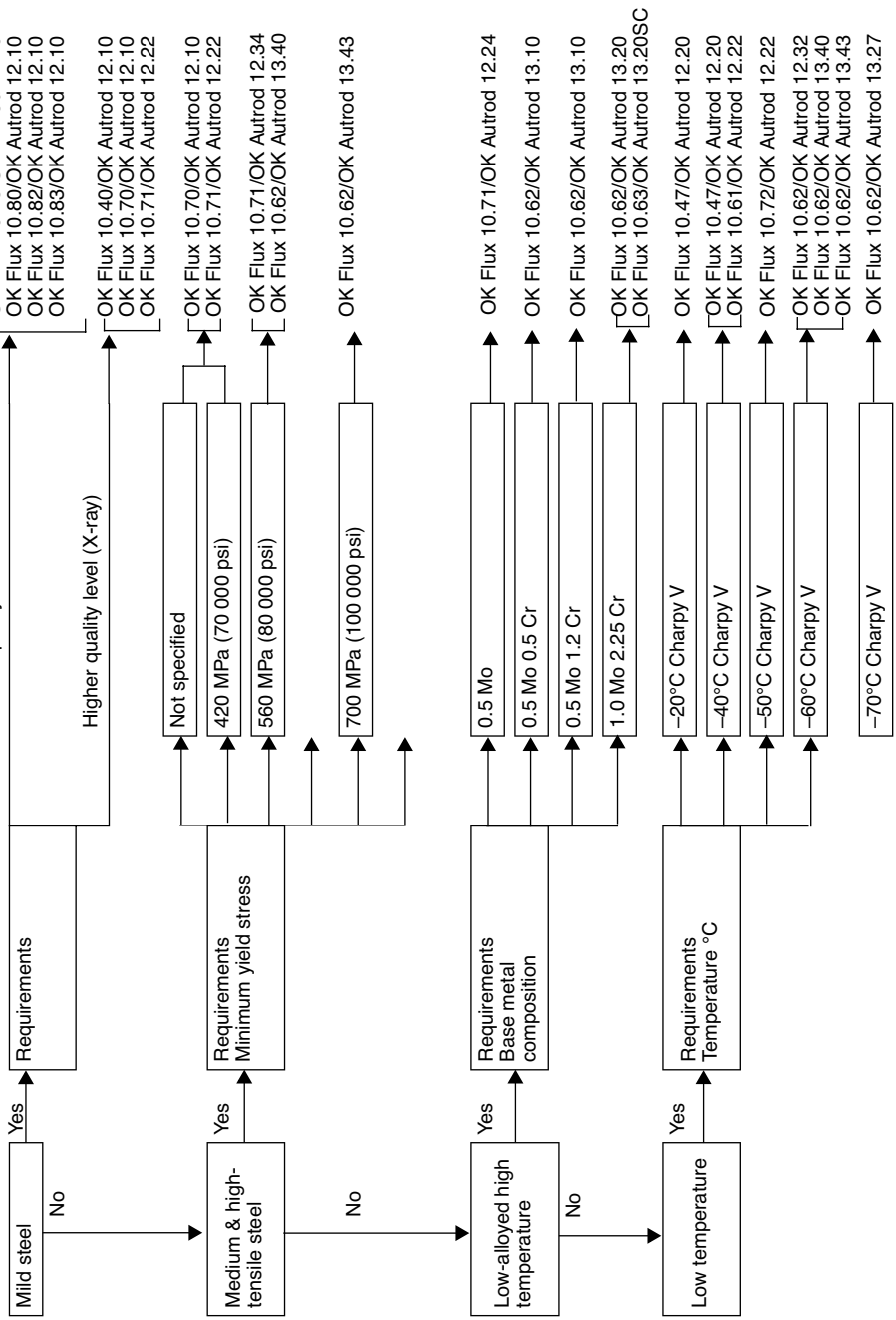
Contents

1. MMA electrodes for mild and low-alloyed steels

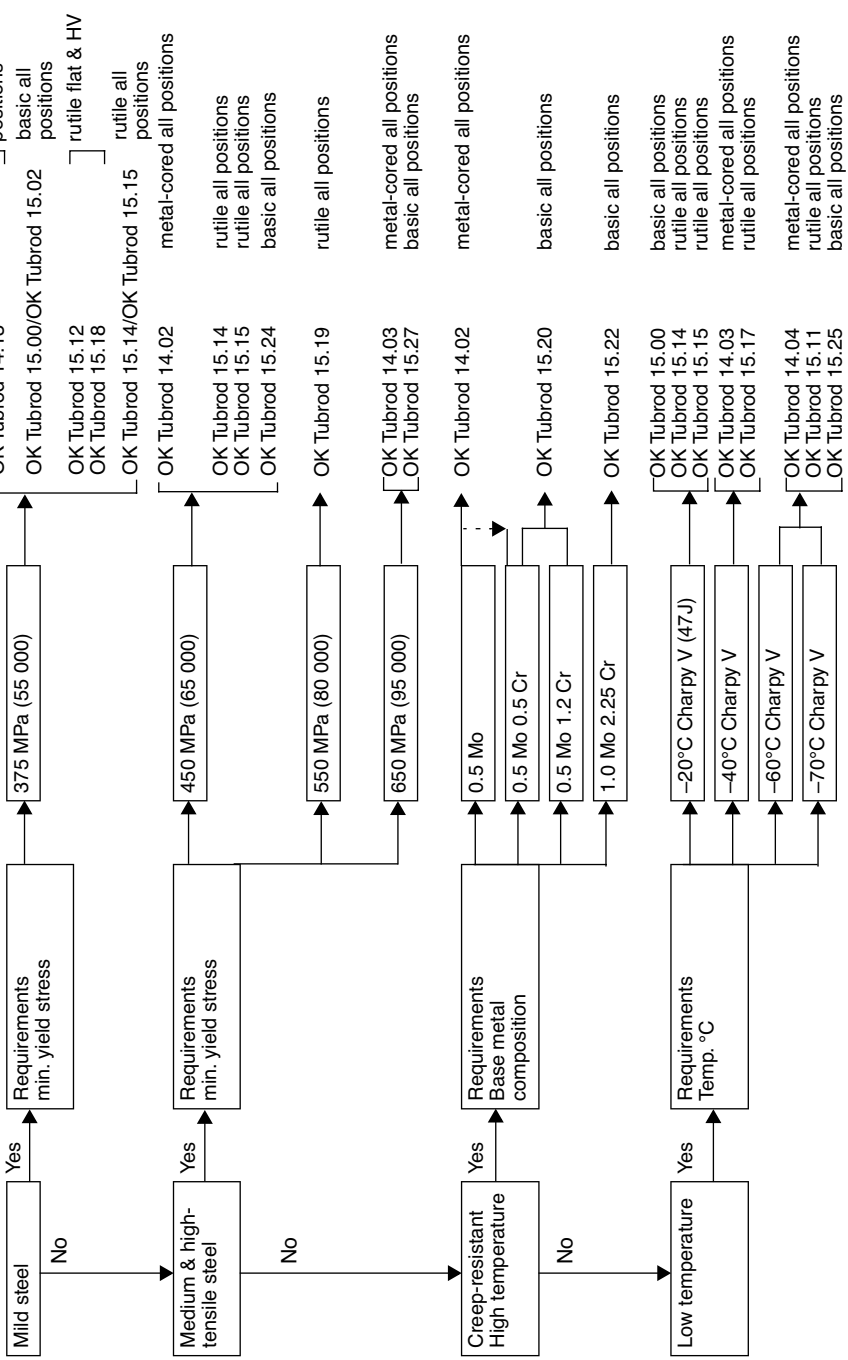


2. Solid wires

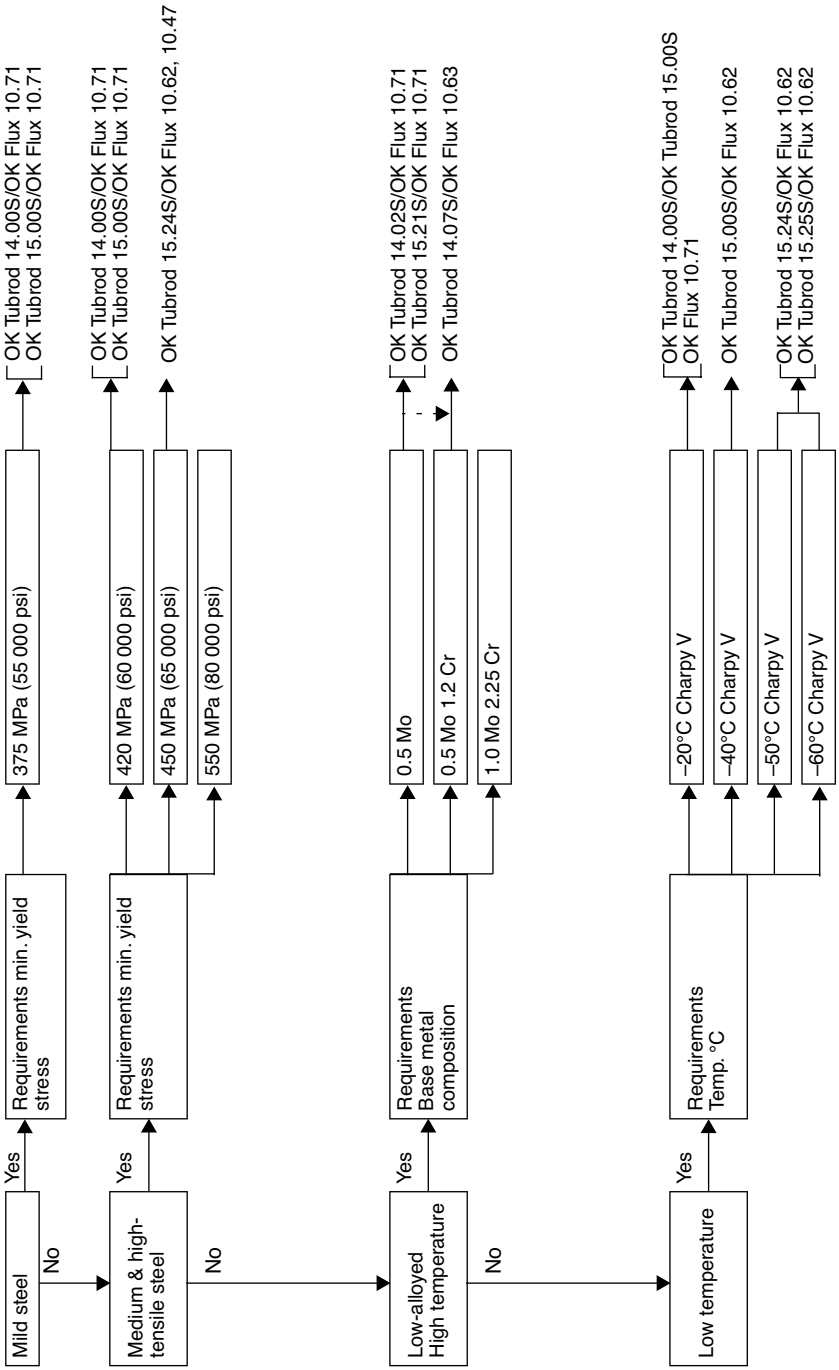




4. Cored wires



5. Submerged arc cored wires and fluxes



6. Wires for stainless steels. Selection by wire classification

EN 10088-1 Designation	Werkstoff. No	AISI	C	Cr	Ni	Mo	Other elements	MIG OK Autrod	TIG OK Tigrod
Austenitic									
X10CrNi18-8	1.4310	302	< 0.12	18	8			308LSi	308L, 308LSi
X5CrNi18-10	1.4301	304	< 0.07	18	10			308LSi	308L, 308LSi
X6CrNiTi18-10	1.4541	321	< 0.08	18	11		Ti 0.7	347Si, (308LSi)	347, 347Si, (308LSi)
X6CrNiNb18-10	1.4550	347	< 0.08	18	11		Nb 0.7	347Si, (308LSi)	347, 347Si, (308LSi)
X8CrNiS18-9	1.4305	303	< 0.12	18	9		S 0.2	308LSi, 309LSi	308L, 308LSi, 309L
X2CrNi18-9	1.4307	304L	< 0.03	18	10			308LSi	308L, 308LSi
X2CrNiN18-10	1.4311	304LN	< 0.03	18	10		N 0.15	308LSi	308L, 308LSi
		304N	< 0.08	18	9		N 0.15	308LSi	308L, 308LSi
X3CrNiMo17-13-3	1.4436	316	< 0.05	18	12	2.5		316LSi	316L, 316LSi
X5CrNiMo17-12-2	1.4401	316	< 0.05	18	12	2.5			
X2CrNiMo17-12-2	1.4404	316L	< 0.03	18	12	2.5			
X2CrNiMo18-14-3	1.4435	316L	< 0.03	18	13	2.5		16.38	16.38
X6CrNiMoTi17-13-2	1.4571	316Ti	< 0.08	18	12	2.5	Ti 0.7	318Si, (316LSi)	318Si, (316L)
X2CrNiMoN17-13-3	1.4429	316LN	< 0.03	18	12	2.5	N 0.5	316LSi	316L, 316LSi
X12CrMnNiN	1.4372	202	< 0.15	18	5		Mn 8	16.95	16.95
X2CrNiMo18-15-4	1.4438	S31703	< 0.03	18	16	3.5		317L	317L
X1NiCrMoCuN25-20-5	1.4539	N08904	< 0.03	20	25	4.5	Cu 1.5	385	385
X1CrNiMoCuN20-18-7	1.4547	S31254	< 0.02	20	18	6.2	Cu 0.8, N 0.2	19.81, 19.82	19.81, 19.82
X1NiCrMoCu31-27-4	1.4563	N08028	< 0.02	27	31	3.5	Cu 1.5	19.81, 19.82	19.81, 19.82
-	1.4652	S32654	< 0.02	24	22	7.3	Cu 0.5, N 0.5	19.81	19.81
X9CrNiSiNCe21-11-2	1.4835	S30815	< 0.10	21	11		N 0.17 + Ce	310	310
Austenitic-ferritic (Duplex)									
	1.4162	S32101	0.03	21.5	1.5		Mn 5	2209	2209
X2CrNiN23-4	1.4362	S32304	< 0.03	23	4		N 0.10	2209	2209
X2CrNiMoN22-5-3	1.4462	S31803	< 0.03	22	5	3	N 0.10	2209	2209
X2rNiMoN25-7-4	1.4410	S32750	< 0.03	25	7	4	N 0.25	2509	2509
X2CrNiMoCuWN25-7-4	1.4501	S32760	< 0.03	25	6	3	N 0.25 W 0.7	2509	2509

EN 10088-1 Designation	Werkstoff. No	AISI	C	Cr	Ni	Mo	Other elements	MIG OK Autrod	TIG OK Tigrod
Ferritic-martensitic									
X6Cr13	1.4000	403	< 0.08	13				308LSi	308L, 308LSi
X2CrNi12	1.4003	S41050	< 0.03	12	0.7			308LSi	308L, 308LSi
X12Cr13	1.4006	410	0.1	13				309LSi	309L, 309LSi
Ferritic									
X6Cr17	1.4016	430	< 0.08	16.5				430Ti, 430LNb, 308LSi	430Ti, 308L, 308LSi
X6CrTiNb18	1.4509	441	< 0.03	18			Ti, Nb	430Ti, 430LNb	430Ti
X6CrTi17	1.4510	439	< 0.8	17			Ti	430Ti	430Ti
X2CrMoTi18-2	1.4521	S44400	< 0.03	18		2		316LSi	316L,316LSi
-	-	446	< 0.20	26				310	310

7. The most common fluxes and wires for SAW of stainless steels

European standard EN 10082-1		German DIN 17440		England	France AFNOR	SS steel	USA AISI	Recommended SAW consumables
Designation steel	No	Designation steel	Werkst. Nr.	BS 970; 1=Part 1 BS 1449; 2=Part 2	NFA 35-572 to NFA 35-578	No		OK Flux + OK Autrod
X 6 Cr 13	1.4000	X 7 Cr 13	1.4000	403 S 17	Z 6 C 13	2301	403	10.93+308L or 308H/10.92+308L
X 12 Cr 13	1.4006	X 10 Cr 13	1.4006	410 S 21	Z 12 C 13	2302	410	10.93+308L or 308H/10.92+308L
X 20 Cr 13	1.4021	X 20 Cr 13	1.4021	420 S 37	Z 20 C 13	2303	420	10.93+308L or 308H/10.92+308L
X 30 Cr 13	1.4028	X 30 Gr 13	1.4028	420 S 45	Z 30 C 13	2304	–	10.93+308L or 308H/10.92+308L
X 6 Cr 17	1.4016	X 6 Cr 17	1.4016	430 S 17	Z 8 C 17	2320	430	10.93+308L or 308H/10.92+308L
X 17 Cr Ni 16-2	1.4057	X 20 Cr Ni 17 2	1.4057	431 S 29	Z 15 CN 16.02	2321	431	10.93+347 or 10.92+347
		–	1.4749[1)]	–	Z 10 C 24	2322	446	10.92+310
		X 8 Cr Ni Mo 27 5 2[1)]	1.4460[1)]	–	–	2324	329	10.93+2209 or 2509/10.94+2509
X 2 Cr Ni N 23-4	1.4362			–	–	2327	S32304	10.93+2209 or 2509/10.94+2509
X 2 Cr Ni Mo N 22-5-3	1.4462			–	–	2377	S31803	10.93+2209 or 2509/10.94+2509
X 2 Cr Ni Mo N 25-7-4	1.4410			–	–	2328	S32750	10.94+2509
X 2 Cr Ni Mo Ca WN 25-7-4	1.4501			–	–	–	S32760	10.94+2509
X 10 Cr Ni 18-8	1.4310	–	–	302 S 31	Z 10 CN 18.09	2331	302	10.93+308L /10.92+308L
X 5 Cr Ni 18-10	1.4301	X 5 Cr Ni 18 10	1.4301	304 S 31	Z 6 CN 18.09	2332	304	10.93+308L /10.92+308L
X 5 Cr Ni 18-10	(1.4301)	(X 5 Cr Ni 18 10)	(1.4301)	(304 S 15)	(Z 6 CN 18.09)	2333	(304)	10.93+308L /10.92+308L
X 6 Cr Ni Ti 18-10	1.4541	X 6 Cr Ni Ti 18 10	1.4541	321 S 31	Z 6 CNT 18.10	2337	321	10.93+347 or 10.92+347
X 6 Cr Ni Nb 18-10	1.4550	X 10 Cr Ni Nb 18 10	1.4550	347 S 31	Z 6 CNNb 18.10	2338	347	10.93+347 or 10.92+347
X 3 Cr Ni Mo 17-13-3	1.4436	(X 5 Cr Ni Mo 17 13 3)	1.4436)	(316 S 33)	(Z 6 CND 17.12)	2343	(316)	10.93+316L or 10.92+316L
X 5 Cr Ni Mo 17-12-2	(1.4401)	(X 5 Cr Ni Mo 17 12 2	(1.4401)	(316 S 31)	(Z 6 CND 17.11)	2347	(316)	10.93+316L or 10.92+316L
X 2 Cr Ni Mo 17-12-2	1.4404	X 2 Cr Ni Mo 17 13 2	1.4404	316 S 11	Z 2 CND 17.12	2348	316 L	10.93+316L or 10.92+316L
X 6 Cr Ni Mo Ti 17-12-2	1.4571	X 6 Cr Ni Mo Ti 17 12 2	1.4571	320 S 31	Z 6 CNDT 17.12	2350	316 Ti	(10.93+316L) or (10.92+316L)
X 2 Cr Ni 18-9	1.4307	X 2 Cr Ni 18 10	1.4306	304 S 11	Z 2 CN 18.10	2352	304 L	10.93+308L or 308H/10.92+308L
X 2 Cr Ni Mo 18-14-3	1.4435	X 2 Cr Ni Mo 18 14 3	1.4435	316 S 3	Z 2 CND 17.13	2353	316 L	10.93+316L or 10.92+316L
(EN 10095) X 8 Cr Ni 25-21	1.4845	X 12 Cr Ni 25 21[1)]	1.4845[1)]	(310 S 24)	(Z 12 CN 25-20)	2361	310 S	10.92+310
X 2 Cr Ni Mo 18-15-4	1.4438	X 2 Cr Ni Mo 18 16 4	1.4438	–	Z 2 CND 19.15	2367	317 L	10.93+317L or 10.92+317L
X 2 Cr Ni N 18-10	1.4311	X 2 Cr Ni N 18 10	1.4311	–	Z 2 CN 18.10 Az	2371	304 LN	(10.93+308L) or (10.92+308L)
X 2 Cr Ni Mo N 17-13-3	1.4429	X 2 Cr Ni Mo N 17 13 3	1.4429	–	Z 2 CND 18.10 Az	2375	316 LN	(10.93+316L) or (10.92+316L)

1) not standard

8. Comparison table for stainless steels and MMA electrodes

European standard EN 10088-1/EN 10095 Designation	Werkst.nr.	SS steel No	England BS 970; 1=Part 1 BS 1449; 2=Part 2
X 6 Cr 13	1.4000	2301	403 S 17
X 12 Cr 13	1.4006	2302	410 S 21
X 20 Cr 13	1.4021	2303	420 S 37
X 30 Cr 13	1.4028	2304	420 S 45
X 6 Cr 17	1.4016	2320	430 S 17
X 17 Cr Ni 16-2	1.4057	2321	431 S 29
X 18 Cr N 28	1.4749	2322	–
X 4 Cr Ni Mo N 27-5-2	1.4460	2324	–
X 10 Cr Ni 18-8	1.4310	2331	302 S 31
X 5 Cr Ni 18-10	1.4301	2332	304 S 31
X 5 Cr Ni 18-10	1.4301	2333	(304 S 15)
X 6 Cr Ni Ti 18-10	1.4541	2337	321 S 31
X 6 Cr Ni Nb 18-10	1.4550	2338	347 S 31
X 3 Cr Ni Mo 17-13-3	1.4436	2343	(316 S 33)
X 8 Cr Ni S 18-9	1.4305	2346	303 S 31
X 5 Cr Ni Mo 17-12-2	(1.4401)	2347	(316 S 31)
X 2 Cr Ni Mo 17-12-2	1.4404	2348	316 S 11
X 6 Cr Ni Mo Ti 17-12-2	1.4571	2350	320 S 31
X 2 Cr Ni 18-9	1.4307	2352	304 S 11
X 2 Cr Ni Mo 18-14-3	1.4435	2353	316 S 3
X 8 Cr Ni 25-21	1.4845	2361	(310 S 24)
X 2 Cr Ni Mo 18-15-4	1.4438	2367	–
X 2 Cr Ni N 18-10	1.4311	2371	–
X 2 Cr Ni Mo N 17-13-3	1.4429	2375	–
X 12 Cr S 13	1.4005	2380	416 S 21
X 14 Cr Mo S 17	1.4104	2383	–
X 2 Cr Ni N 23-4	1.4362	2327	–
X 2 Cr Ni Mo N 22-5-3	1.4462	2377	–
X 2 Cr Ni Mo N 25-7-4	1.4410	2328	–
X 2 Cr Ni Mo Cu WN 25-7-4	1.4501	–	–

France AFNOR NFA 35-572 to NFA 35-578	USA AISI	Japan JIS G4303 -4318 SUS	Italy UNI 6900-71	MMA electrode OK
Z 6 C 13	403	403	X 6 Cr 13	61.30, 61.35, 68.15
Z 12 C 13	410	410	X 10 Cr 13	61.30, 61.35, 68.15
Z 20 C 13	420	420 J1	X 20 Cr 13	61.30, 61.35, 68.15
Z 30 C 13	–	420 J2	X 38 Cr 13	61.30, 61.35, 68.15
Z 8 C 17	430	430	X 8 Cr 17	61.30, 61.35, 61.80
Z 15 CN 16.02	431	431	X 16 Cr Nr 16	61.30, 61.35, 61.80
Z 10 C 24	446	–	X 16 Cr 26	67.15
–	329	329 J1	–	67.50, 68.60
Z 10 CN 18.09	302	302	–	61.30, 61.35, 61.41
Z 6 CN 18.09	304	304	X 5 Cr Ni 18 10	61.30, 61.35, 61.41
(Z 6 CN 18.09)	(304)	(304)	(X 5 Cr Ni 18 10)	61.30, 61.35, 61.41
Z 6 CNT 18.10	321	321	X 6 Cr Ni Ti-18 11	(63.34), 61.80, 61.85
Z 6 CNNb 18.10	347	347	X 8 Cr Ni Nb 1811	(63.34), 61.80, 61.85
(Z 6 CND 17.12)	(316)	(316)	(X 5 Cr Ni Mo 17 13)	63.30, 63.34, 63.41
Z 10 CNF 18.09	303	303	X 10 Cr Ni 18 09	68.81
(Z 6 CND 17.11)	(316)	(316)	X 5 Cr Ni Mo 17 12	63.30, 63.34, 63.41
Z 2 CND 17.12	316 L	316 L	X 2 Cr Ni Mo 17 2	63.30, 63.34, 63.41
Z 6 CNDT 17.12	316 Ti	–	X 6 Cr Ni Mo Ti 17 12	63.80
Z 2 CN 18.10	304 L	304 L	X 2 Cr Ni 18 11	61.30, 61.35, 61.41
Z 2 CND 17.13	316 L	316 L	X 2 Cr Ni Mo 17 13	63.30, 63.34, 63.41
(Z 12 CN 25-20)	310 S	310 S	X 6 Cr Ni 2520	67.15
Z 2 CND 19.15	317 L	317 L	X 2 Cr Ni Mo 18 16	64.30
Z 2 CN 18.10 Az	304 LN	304 LN	X 2 Cr Ni N 18 11	61.30, 61.35, 61.41
Z 2CND 18.10 Az	316 LN	316 LN	X 2 Cr Ni Mo N 17 13	63.30, 63.41, 69.25
Z 12 CF 13.4 M	416	416	X 12 Cr S 13	61.30, 61.35, 68.15
Z 10 CF 17	430 F	430 F	X 10 Cr S 17	61.30, 61.35
–	S32304	–	–	67.50, 67.55
–	S31803	–	–	67.50, 67.55
–	S32750	–	–	68.53, 68.55
–	S32760	–	–	68.53, 68.55

9. MIG and TIG wires for aluminium

Base material

EN 573 Alloy designation Numerical	Chemical symbols	The Aluminum Association	ESAB filler metal OK Autrod/Tigrod
EN AW-1050A	EN AW-Al 99,5	AA 1050A	1070,1100, 1450
EN AW-1070A	EN AW-Al 99,7	AA 1070A	1070,1100, 1450
EN AW-1100	EN AW-Al 99,0Cu	AA 1100	1070,1100
EN AW-1200	EN AW-Al 99.0	AA 1200	1070,1100
EN AW-3003	EN AW-Al Mn1Cu	AA 3003	4043, 4047
EN AW-3103	EN AW-Al Mn1	AA 3103	4043, 5356
EN AW-3004	EN AW-Al Mn1Mg1	AA 3004	4043, 5356
EN AW-4045	EN AW-Al Si10	AA 4045	4043,4047
EN AW-5005	EN AW-Al Mg1(B)	AA 5005	5356
EN AW-5019	EN AW-Al Mg5	AA 5019	5356
EN AW-5050	EN AW-Al Mg1,5(C)	AA 5050	5356
EN AW-5052	EN AW-Al Mg2,5	AA 5052	5356
EN AW-5083	EN AW-Al Mg4,5Mn0,7	AA 5083	5183
EN AW-5086	EN AW-Al Mg4	AA 5086	5356
EN AW-5454	EN AW-Al Mg3Mn	AA 5454	5554
EN AW-6013	EN AW-Al Mg1Si0,8CuMn	AA 6013	4043, 5356
EN AW-6060	EN AW-Al MgSi	AA 6060	4043, 5356
EN AW-6061	EN AW-Al Mg1SiCu	AA 6061	5356
EN AW-6063	EN AW-Al Mg0,7Si	AA 6063	5356
EN AW-6082	EN AW-Al Si1MgMn	AA 6082	4043, 5356
EN AW-7005	EN AW-Al Zn4,5Mg1,5Mn	AA 7005	5356
EN AW-7021	EN AW-Al Zn5,5Mg1,5	AA 7021	5356
EN AW-7029	EN AW-Al Zn4,5Mg1,5Cu	AA 7029	5356
EN AW-7039	EN AW-Al Zn4Mg3	AA 7039	5356
EN AW-7050	EN AW-Al Zn6CuMgZr	AA 7050	5356

General information and tables

Contents

Handwelding electrodes

Official approval

In addition to the official approval given in this catalogue, many OK electrodes are approved by foreign authorities, railway boards, private companies and so on. Information about the different types of approval is available on request.

Tensile properties

Unless otherwise stated, tensile properties refer to all weld metal test pieces prepared according to the rules of the classification societies using 4 and 6 mm diameter electrodes.

Welding current

Maximum and minimum values are given. The most suitable welding current depends largely on the size of the workpiece, the welding position and the type of joint.

Small workpieces require a lower current, larger workpieces a higher current, depending on the dissipation of heat from the joint.

Cold cracking

Cold cracking will only occur if the following three factors are present at the same time:

1. Hard phases in the weld, preferably martensite
2. Sufficient stress
3. Hydrogen dissolved in the weld metal

Hard phases form when the weld is cooled rapidly from melting temperature to room temperature. Alloying elements, mostly carbon, are forced to dissolve in the weld metal and make it brittle. The following formula describes this process in the case of standard carbon-manganese steel.

$$E_C = \%C + \frac{\%Mn}{6} + \frac{\%(Cr+Mo+V)}{5} + \frac{\%(Ni+Cu)}{15}$$

Steels with E_C=0.35 and below are usually weldable without any problems at normal steel sizes. For the more highly alloyed steels and steels with thicker dimensions, an elevated working temperature is necessary in order to reduce the cooling rate.

The elevated temperature also allows the hydrogen to diffuse.

To determine elevated working temperatures, please consult BS 5135: 1984 or SS 064025. If the E_C dimension of the plates and heat input are known, these standards will state whether heating is necessary and the level at which it should take place.

Tension cannot be avoided when welding, as steel expands when heated, although correct planning and heat treatment can reduce tension considerably.

Hydrogen forms from water in the surroundings and from the electrode coating. The water is divided into oxygen and hydrogen in the arc and the hydrogen in particular has a strong tendency to dissolve in the weld metal and initiate cold cracking.

Conclusion: Dry basic electrodes when there is risk of cold cracking.

Labelling

The electrode type is clearly marked on the coating of each electrode near the grip end, e.g. OK 48.00.

Choice of suitable electrode

The OK electrodes in this catalogue are placed into groups according to the type of alloy deposited. Within each group of electrodes for welding mild, low-alloy and stainless steels, there are several cases in which many different electrodes are designed for welding the same type of steel. So, for each steel grade, there are often a large number of electrode types to choose from, all of which produce similar weld metal compositions but have different coatings, welding properties, welding speeds and weld metal quality. This large choice makes it possible to choose the electrode which produces the right weld metal quality at the lowest cost.

When selecting an electrode, the first rule is to select one which produces a weld metal quality equal to or better than that of the base material and, when necessary, is approved for the material in question. Welding position and type of joint are other factors which influence the choice of electrode, as different electrodes have different properties in different welding positions and types of joint.

General information about the influence of coating type on welding properties, welding speed and weld metal quality

Rutile electrodes giving about 100% weld metal recovery are easy to strike and use and are particularly suitable for short welds in mild steel, for fillet welds, for welding sheet steels and for bridging large joint gaps. The welds have a fine finish and spatter losses are negligible. The welding speed is moderate.

Unalloyed electrodes

Unalloyed rutile electrodes are not normally recommended for welding steel with a nominal tensile strength exceeding 440 MPa (45 kp/mm^2). Rutile electrodes are relatively insensitive to moisture.

High-efficiency rutile electrodes

High-efficiency rutile electrodes generally produce a higher welding speed, which increases as the weld metal recovery increases, up to a maximum of about 140 g/minute for 6 mm diameter OK Femax 33.80.

They are all easy to use, produce excellent slag detachability, fine bead appearance and are particularly suitable for welding horizontal/vertical fillets. The weld metal has tensile properties which are as high as, or somewhat higher than, those of the weld metal from unalloyed basic electrodes but have lower elongation and impact strength.

The evenness of the weld and the smooth transition of the base material make joints produced with rutile electrodes at least as good in terms of fatigue strength as unmachined joints produced using basic electrodes. Unalloyed rutile electrodes, irrespective of their efficiency, can be recommended for welding mild steel with a nominal tensile strength of 440 MPa (45 kp/mm^2). When it comes to the tensile strength of the deposit, rutile electrodes can also be used for welding steels with a nominal tensile strength of more than 440 MPa (45 kp/mm^2), but, as a general rule, only electrodes producing a weld metal with a low hydrogen content, e.g. basic, rutile-basic or zircon-basic electrodes, should be used to weld these steels.

Acid electrodes

Acid electrodes without iron powder in the covering are easier to strike than basic electrodes but more difficult to strike and re-strike than rutile electrodes. The welding speed is moderate. The weld beads are smooth and shiny. The slag is inflated and easy to remove. The weld metal has a lower yield stress and tensile strength compared with that produced by rutile electrodes, but it has higher elongation and impact strength.

This type of electrode, which completely dominated the market a few decades ago, has gradually been replaced by rutile electrodes for welding in the flat position and basic electrodes for positional welding. Unalloyed acid electrodes are suitable for welding steels with a nominal tensile strength of up to 440 MPa (45 kp/mm^2).

High-efficiency acid electrodes

High-efficiency acid electrodes have a considerably higher welding speed than normal electrodes, up to a maximum of about 120 g/min for 6 mm diameter OK Femax 39.50. The beads are smooth and shiny. The slag is inflated and easy to remove. High-efficiency acid electrodes are particularly suitable for making butt joints and fillet welds in the flat position. OK Femax 39.50 in long lengths is suitable for gravity welding with short-neck equipment.

The weld metal has the same strength as that produced by normal acid electrodes and the range of applications is therefore similar, i.e. they are suitable for welding mild steels with a nominal tensile strength of no more than 440 MPa (45 kg/mm^2).

Unalloyed basic electrodes

Unalloyed basic electrodes give moderate welding speed in the flat position but are faster than other types when welding vertically upwards. The reason for this is that basic electrodes can be deposited at a higher current in the vertical position than other types of electrode. In addition, the amount of weld metal deposited per electrode is greater than that of other electrodes which can be used in this position. This results in a smaller number of electrode changes. The normal result is therefore a higher fusion rate and higher arc-time factor when welding vertically upwards with basic electrodes compared with other types.

The slag is normally not quite as easy to remove as the slag from acid or rutile electrodes, but, in spite of this, it can be classed as easily detachable. The slag from basic electrodes has a lower melting point than that from rutile or acid electrodes. The risk of slag inclusions during normal production welding is therefore unusually small when basic electrodes are used, even if the slag is not completely removed between beads during multi-run welding.

The weld metal from basic electrodes has a low hydrogen content and usually has good toughness even at low temperatures. Basic electrodes are less likely to produce either hot cracks or cold cracks compared with other types of electrode. The superiority of basic electrodes from this point of view appears when welding manganese-alloyed structural steels, pressure-vessel steels and ship's plate with a nominal tensile strength of 490-530 MPa (50-54 kp/mm^2). The higher the hardenability of the steel to be welded, the greater the necessity to use basic electrodes and the greater the need for low moisture content in the coating.

Zircon-basic, high-efficiency electrodes

Zircon-basic, high-efficiency electrodes are the fastest of all and are preferably deposited in the flat position. OK Femax 38.95 deposits a maximum of 250 g/min. with 6 mm diameter electrodes. Zircon-basic, high-efficiency electrodes can be used for welding the same steels as unalloyed basic electrodes. OK Femax 38.65 is suitable for welding butt joints and fillet joints in the horizontal, vertical and flat positions.

OK Femax 38.95 is recommended for welding butt joints and fillet joints.

Rutile-basic, high-efficiency electrodes

Rutile-basic, high-efficiency electrodes combine the good welding properties of rutile electrodes with the high weld metal quality of basic electrodes. They are therefore the best electrodes for performing horizontal-vertical fillet welds in high strength steels, where ordinary rutile, high-efficiency electrodes are not permitted. They can be used for welding the same steels as standard unalloyed basic electrodes or unalloyed zircon-basic, high-efficiency electrodes.

OK Femax 38.85 is the fastest low-hydrogen electrode for horizontal fillet welds.

Cellulose electrodes

Cellulose electrodes are easy to use in all welding positions and are particularly good for vertical and overhead welding. Cellulose electrodes are recommended for all-positional welding where the mechanical properties of the deposit are of the greatest importance and radiographic requirements must be met. Vertical and overhead welding often require an electrode one size larger in comparison to electrodes with other types of coating. Cellulose electrodes are extremely good for vertical-down welding.

Higher tensile steel requires preheating and higher interpass temperatures than when the welding is done with low-hydrogen electrodes.

Choose the correct OK electrodes, wires and fluxes for hardfacing and maintenance.

Recommendations for the right choice of electrodes for joining dissimilar materials can be found in Figs 1 and 2 on the next page.

The conditions to be considered when choosing the correct electrode, wire and flux for hardfacing and maintenance are summarised in the following outline.

A classification of weld metal resistance to different kinds of working condition can be found in Table 1.

The working conditions for an object that is going to be repaired are often known. The table provides information about suitable electrodes and the different kinds of attack which must be taken into account.

The recommended OK electrodes, wires and fluxes for some of the most common objects for hardfacing and maintenance by welding can be found in Table 2.

Short rules for choosing the correct type of weld metal alloy for hardfacing and cladding

With regard to:

1. Type of wear
2. Working conditions
3. Machinability requirements

Useful information when choosing the correct type of alloy

1. The composition of the material to be welded when deciding
   a) which types of welding alloy are usable and suitable
   b) if preheating is favourable
   c) if welding a buffer layer is necessary

2. Conditions for welding
   a) Is preheating possible or not?

If it is not possible, hardenable welding alloys can only be used to a very limited extent.

For steel and cast iron weldments:
austenitic or non-ferrous alloys are preferable:
OK 67.45, OK 67.75 – austenitic
OK 68.81 and OK 68.82 – austenitic-ferritic
OK 92.18, OK 92.58, OK 92.35 – non-ferrous.

   b) The welding position
   c) Can submerged arc welding or gas metal arc welding be applied?
   d) For which of the applicable welding processes is suitable filler material available?

3. Working conditions for the repaired workpiece
   a) Type of wear: abrasive, erosive or cavitation
   To *resist abrasive wear* by sharp-edged blast stone and ore, a hard surface or a work-hardening surface is required or desirable.
   Recommended:
   OK 84.78, OK 84.80
   OK 84.58, OK 83.65
   OK 86.28, OK 86.08

   To resist erosive wear, a hard surface and a fine-grained microstructure in the weld metal is required.
   Recommended:
   OK 84.80
   OK 84.78
   OK 85.65, OK 84.58
   OK 83.65
   OK 84.52

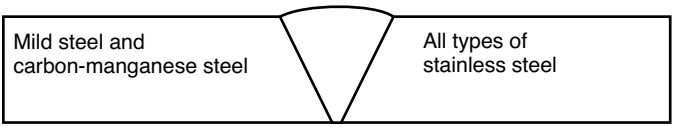
   Cavitation attacks in water turbines can usually be prevented by cladding with austenitic electrodes.
   OK 63.35 is the most frequently-used electrode for this purpose, but the following are also suitable:
   OK 67.70
   OK 67.71

4. Environment
   a) Corrosive or non-corrosive?
   b) The temperature, high or low?
   c) To resist wear in a corrosive environment, the weld metal must be resistant to both corrosion and wear. So, depending on the severity of the corrosion attacks, an alloy with some degree of corrosion resistance is required.

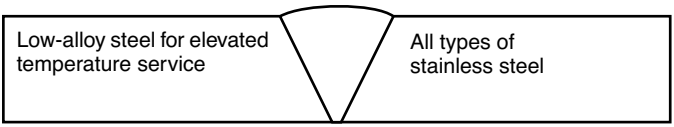
Choose the right OK Electrodes for joining dissimilar materials

1. OK 67.70, OK 67.75
2. OK 67.45, OK 68.81, OK 68.82

Fig. 1



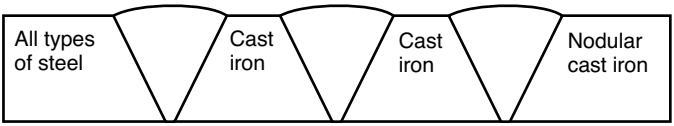
1. OK 92.26
2. OK 67.70, OK 67.75, OK 67.45
3. OK 63.30, OK 63.35



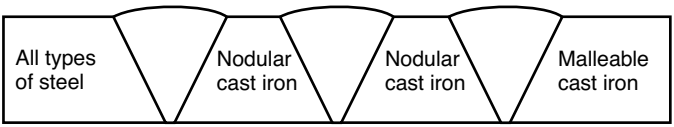
Never use unalloyed electrodes for these joints

1. OK 92.18
2. OK 92.60, OK 92.58

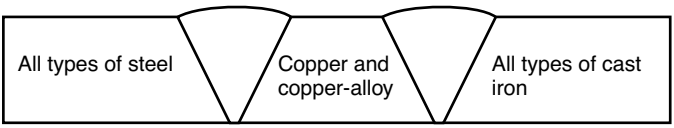
Fig. 2



1. OK 92.60, OK 92.58
2. OK 92.18



OK 94.25



1. First hand choice
2. Second hand choice
3. Third hand choice

Table 1. Hardfacing and cladding.

Choose the right OK electrode for different working conditions

ENVIRONMENT	Resistance-Suitability 5. Superior, 3. Good, 1. Limited usability
CORROSIVE ENVIRONMENT Requirements: Corrosion resistance	**5.** OK 92.26, OK 92.35, OK 92.86, OK 94.25, OK 94.55, OK 93.01, OK 93.12 **4.** OK 68.81, OK 68.82, OK 67.45, OK 67.52 **3.** OK 84.80, OK 84.78, OK 84.42, OK 84.52 **2.** OK 84.58, OK 83.50 **1.** OK 83.28, OK 83.65, OK 85.58, OK 85.65, OK 86.08
HIGH TEMPERATURE **Oxidizing** Requirements: Scaling resistance	**5.** OK 92.26, OK 92.35, OK 93.01 **4.** OK 68.81, OK 68.82, OK 84.78, OK 67.45, OK 83.65, OK 84.80 **3.** OK 84.42, OK 84.52, OK 84.58, OK 85.58, OK 85.65 **2.** OK 83.50, OK 92.86 **1.** OK 83.28, OK 86.08, OK 86.28
Annealing, Softening Requirements: Hardness at high temperature, annealing resistance	**5.** OK 92.35, OK 93.01, OK 93.12 **4.** OK 84.78, OK 85.58, OK 85.65 **3.** OK 84.42, OK 84.52, OK 84.58, OK 83.50, OK 83.65 **2.** OK 83.28, OK 86.08, OK 86.28, OK 68.81, OK 68.82 **1.** OK 67.45, OK 67.52
LOW TEMPERATURE Requirements: Cold toughness	**5.** OK 92.26, OK 92.35, OK 92.86, OK 67.45, OK 94.25, OK 94.55 **4.** OK 67.52, OK 86.28, OK 86.08 **3.** OK 83.28, OK 68.81, OK 68.82 **2.** OK 83.50, OK 84.42, OK 84.52 **1.** OK 83.65, OK 84.58, OK 84.78, OK 85.65, OK 93.01
TYPE OF WEAR **Impact, high surface pressure** Requirements: Impact-resistance and resistance to crushing	**5.** OK 92.35, OK 86.08, OK 86.28, OK 68.81, OK 68.82, OK 93.07 **4.** OK 67.45, OK 67.52, OK 83.28 **3.** OK 92.25, OK 93.06 **2.** OK 84.42, OK 84.52, OK 85.65, OK 93.12 **1.** OK 83.50, OK 83.65, OK 84.58, OK 84.78, OK 94.25, OK 94.55, OK 93.01
Wear by blast stone and ore Requirements: High surface-hardness or cold-work hardening weld metal	**5.** OK 84.78, OK 84.84, OK 84.80, OK 93.01 **4.** OK 86.08, OK 86.28, OK 83.65, OK 85.65, OK 93.12 **3.** OK 83.50, OK 84.58, OK 84.42, OK 84.52, OK 93.06 **2.** OK 85.58, OK 68.81, OK 68.82, OK 67.45, OK 67.52, OK 93.07 **1.** OK 83.28
Wear by fine grained materials Sand and clay Requirements: High surface hardness	**5.** OK 84.84, OK 84.78, OK 84.80, OK 93.01 **4.** OK 83.65, OK 85.65, OK 93.12 **3.** OK 84.58, OK 83.50, OK 93.06 **2.** OK 84.42, OK 84.52, OK 68.81, OK 68.82, OK 85.38 **1.** OK 67.45, OK 67.52, OK 83.28, OK 86.08, OK 86.28, OK 93.07
Cavitation	**5.** OK 63.35, OK 67.71, OK 93.06, OK 93.07 **4.** OK 67.45, OK 67.52, OK 94.55, OK 94.25 **3.** OK 84.42 **2.** OK 84.52, OK 84.58, OK 93.01, OK 93.12 **1.** OK 83.28

Table 2. Application range electrodes, wires and fluxes for hardfacing and maintenance

Object	Required weld hardness	Consumables for MMA	Consumables for MAG, MIG, FCAW, SAW	Recommended post weld treatment
Shafts NB! Stress relief is recommended for shafts subject to fatigue	<250HV 200-300 HV 30-35 HRC 35-40 HRC 44-49 HRC 50-56 HRC	OK 48.xx, OK 55.00 OK 74.78, OK 74.79 OK 83.28, OK 83.29 OK 84.42 OK 84.52	OK Flux 10.40, 10.70, 10.71/ OK Autrod 12.40 OK Flux 10.96/OK Autrod 12.10 OK Flux 10.40, 10.71/OK Tubrodur 15.40/OK Flux 10.40, OK Flux 10.71 OK Flux 10.96/OK Autrod 12.40 OK Flux 10.61/OK Tubrodur 15.73	Stress relief Stress relief Stress relief Stress relief Stress relief
Caterpillar tracks Links	30-35 HRC 35-40 HRC	OK 83.28, OK 83.29	OK Flux 10.96/OK Autrod 12.10 OK Flux 10.96/OK Autrod 12.40 OK Flux 10.71/OK Tubrodur 15.40	
Plates and rollers	31-35 HRC 45-50 HRC	OK 83.28, OK 83.29 OK 86.28 Work hardening	 OK Tubrodur 15.65 OK Tubrodur 15.60	
Brake shoes	30-35 HRC 45-50 HRC	OK 83.28, OK 83.29 OK 86.28 Workhardening		
Mixer arms etc	50-56 HRC 55-63 HRC >62 HRC >62 HRC	OK 84.52 OK 84.58 OK 84.78* OK 84.80 OK 84.84	 OK Tubrodur 15.73 OK Tubrodur 14.70* OK Tubrodur 15.80	
Impellers for mills and crushers	55-58 HRC 58-63 HRC > 63 HRC	OK 84.58 OK 83.65, OK 84.78, OK 84.80 OK 84.84	OK Tubrodur 15.52 OK Tubrodur 14.70* OK Tubrodur 15.80	
Excavator teeth, forged: Joining Hardfacing 58-63 HRC	 55-58 HRC	 OK 48.xx, OK 55.00 OK Femax 38.65 OK 48.xx + OK 84.58 OK 48.xx + OK 83.65 OK 84.78, OK 84.80	 OK Autrod 12.51 OK Tubrodur 15.41 + OK Tubrodur 15.52 OK Tubrodur 14.70*	
Excavator teeth, 13 % Mn steel Joining		OK 63.35, OK 67.45 OK 67.52	OK Tubrodur 14.71	
Hardfacing	≈ 50 HRC 55-58 HRC > 62 HRC	OK 48.xx OK 48.xx + OK 84.58 OK 84.84	OK Tubrodur 15.41 OK Tubrodur 15.52 OK Tubrodur 15.80	

Table 2. cont.

Object	Required weld hardness	Consumables for MMA	Consumables for MAG, MIG, FCAW, SAW	Recommended post weld treatment
Excavator buckets, 13 % Manganese steel: Joining		OK 63.35, OK 67.45 OK 67.52, OK 67.75	OK Tubrodur 14.71	
Hardfacing	55-58 HRC 58-63 HRC	OK 48.xx + OK 84.58 OK 84.78 + OK 84.80	OK Tubrodur 15.52 OK Tubrodur 14.70*	
Wheel beds for cranes, lorries and loading wagons	<250 HV	OK 48.xx	OK Flux 10.40, 10.71/ OK Autrod 12.40	Stress relief
	200-300 HV 30-35 HRC	OK 74.78 OK 83.28, OK 83.29	OK Flux 10.96/OK Autrod 12.10 OK Flux 10.71/OK Tubrod 15.40	Stress relief
	40-45 HRC	OK 86.28 OK 86.30	OK Tubrodur 15.60 OK Tubrodur 15.65	
Guillotine blades	50-56 HRC	OK 84.52	OK Tubrodur 15.73	
Cold die and cutting tools	60-65 HRC	OK 85.65		
Cog wheels and bars	<250 HV 200-300 HV 30-35 HRC 44-49 HRC 51-56 HRC 55-58 HRC	OK 48.xx OK 74.78 OK 83.28, OK 83.29 OK 84.42 OK 84.52 OK 84.58	OK Autrod 12.51 OK Autrod 13.12 OK Flux 10.71/OK Tubrodur 15.40 OK Tubrodur 15.73 + Ok Autrod 13.91 OK Flux 10.71/OK Tubrodur 15.52	
Feed gears	50-56 HRC 55-63 30-40 HRC	OK 84.52 OK 84.58, OK 84.78, OK 84.80 OK 63.32	OK Tubrodur 15.52 OK Tubrodur 14.70* OK Tubrodur 14.71	 Hammering
Dredger Buckets 13% Mn steel	200-230 HV* 30-50 HRC* 50 HRC 55-58 HRC > 62 HRC	OK 86.28 OK 67.45 OK 48.xx OK 48.xx + OK 84.58 OK 84.78, OK 84.80, OK 84.84	OK Tubrodur 15.65 OK Tubrodur 14.71 OK Tubrodur 15.52, OK Autrod 13.91 OK Tubrodur 14.70* OK Tubrodur 15.80	
Links and pins 13 % Mn steel		See buckets, Mn steel		
Buckets, links and pins of carbon steel or low-alloyed steel	< 250 HV 200-300 HV 200-230 HV 31-35 HRC 44-50 HRC	OK 48.xx OK 74.78 OK 67.45 OK 83.28, OK 83.29 OK 84.42, OK 86.28	OK Autrod 12.51 OK Autrod 13.12 OK Tubrodur 14.71 OK Tubrodur 15.41 OK Tubrodur 15.42, OK Tubrodur 15.65	

* Chromium-carbide ≈ 1500 HV

OK 48.xx = all electrodes of the OK 48-series

Table 2. cont.

Object	Required weld hardness	Consumables for MMA	Consumables for MAG, MIG, FCAW, SAW	Recommended post weld treatment
Chequer-net wearing plates	50-58 HRC 58-63 HRC > 62 HRC	OK 84.58 OK 83.65, OK 84.78*, OK 84.79 OK 84.80, OK 84.84	OK Tubrodur 15.52 OK Tubrodur 14.70* OK Tubrodur 15.80	
Unalloyed and low-alloyed C steel	< 250 HV 250-300 HV 31-35 HRC 45-50 HRC** 50-58 HRC	OK 48.xx OK 74.78, OK 74.79 OK 83.28, OK 83.29 OK 86.28 OK 84.58	OK Flux 10.40, 10.71/OK Autrod 12.40 OK Flux 10.96/OK Autrod 12.10 OK Tubrodur 15.65 OK Flux 10.71/OK Tubrodur 15.52, OK Autrod 13.91	
13 % Mn steel	200-230 HV 400 HV**	OK 86.28, OK 63.32 OK 67.45, OK 67.52	OK Tubrodur 14.71 OK Tubrodur 15.65	
Forging tools	31-35 HRC ≈ 40 HRC** ≈ 45 HRC 40-52 HRC	OK 83.28, OK 93.07 OK 92.35 OK 84.42 OK 93.01, OK 93.06, OK 93.12	OK Tubrodur 15.41 OK Tubrodur 15.73 OK Tubrodur 15.86	Tempering 550°C
Stone and ore crushers Plates 13 % Mn steel Cones 13 % Mn steel Spindles 13 % steel Casings 13 % Mn steel Rollers etc.	200-230 HV 45-50 HRC 55-58 HRC 58-63 HRC	OK 86.28 OK 86.28 OK 48.xx + OK 84.58 OK 48.xx + OK 83.65 OK 84.78, OK 84.79	OK Tubrodur 15.65 OK Tubrodur 15.52 OK Tubrodur 14.70	
High speed tools	60-65 HRC	OK 85.65	–	Tempering 625°C
Hot bar shears steel	≈ 45 HRC** 50-56 HRC	OK 93.07 OK 85.58	OK Tubrodur 15.87	 Tempering 625°C
Hot rollers, C steel and low-alloyed steel	250-300 HV 30-35 HRC 40-50 HRC 44-50 HRC 40-52 HRC	OK 74.78, OK 74.79 OK 83.28, OK 83.29 OK 93.07, OK 92.35 OK 84.42 OK 93.01, OK 93.06, OK 93.12	OK Tubrodur 15.41 OK Flux 10.71/OK Tubrodur 15.42 OK Flux 10.96/OK Autrod 12.40 OK Flux 10.61/OK Tubrodur 15.73	Stress relief, 500°C Stress relief, 500°C Stress relief, 500°C

* Chromium-carbide ≈ 1500 HV

** Work-hardened

OK 48.xx = all electrodes of the OK 48-series

General recommendations GMAW

GMAW – Gas Metal Arc Welding

The electrodes and joint faces should be clean. This is particularly important when welding aluminium and aluminium alloys. The shielding gases which are used must be of a purity suitable for welding. Moisture in the gas can produce porous welds.

Shielding gas for mild and low-alloy steels

Carbon dioxide, CO_2, is the cheapest and most commonly used gas and, in most cases, it produces satisfactory welds in both mild and low-alloy steel.

Mixed gas, of which the most commonly used consists of 80% Ar + 20% CO_2, is clearer than pure CO_2 but produces a softer arc, quieter welding, better bead appearance and less spatter. It is therefore often used, in spite of its higher price, for welding sheet steel 0.8-1.5 mm thick, which is more difficult to weld with pure CO_2. A further advantage of mixed gas is the higher quality, in particular notch toughness, compared with CO_2. For this reason, mixed gas is often recommended for welding low-alloy steels, such as creep-resistant steels, even in thicknesses greater than 1.5 mm. Mixed gas of the 80/20 type, in which the argon is of a lower purity, is also available. These gases are less expensive than those based on pure argon and can often be used with equally good results.

One drawback of argon/CO_2 mixtures is that they lead to increased ozone formation, compared with pure CO_2, when used as shielding gas in arc welding.

Another drawback when using the mixture is that the current load capacity of the welding gun is reduced by about 30% compared with welding with CO_2.

Shielding gas for stainless and heat-resistant steels

Argon containing 1% oxygen is normally used for welding stainless and heat-resistant steels, but argon containing 2% O_2 or 5% O_2 is also available. The latter produces a more fluid weld pool. A shielding gas which consists of 98% argon + 2% CO_2 has gained favour for MIG welding stainless steels. It can often replace argon/helium mixtures, which are used to help fusion when welding thick stainless steel, and can very often replace argon/oxygen mixtures.

Choice of welding process:

Short arc or spray arc

The electrodes for gas metal arc welding listed in these pages are suitable for short arc welding in the smallest diameters and for spray arc welding in diameters 1.2-2.4 mm. Short arc welding (welding with short circuiting droplet transfer) can be carried out in all positions and is the best process for welding sheet material approximately 0.8-3 mm thick and for making the root run in prepared butt joints.

Spray arc welding (welding with finely divided free flight drop transfer) is carried out at higher currents and voltages than short arc welding and is therefore generally faster and more economical than short arc welding for plate thicknesses exceeding 2-3 mm. It is only used for welding in the horizontal or horizontal/vertical positions. The gas consumption is 6-10 litres/min for short arc welding and 12-20 litres/min for spray arc welding. The higher the welding current, the higher the gas flow required.

Welding technique

The welding gun is normally held in the right hand, which means that the weld is made from right to left with the gun directed away from the deposited weld at an angle of 75-80° between the electrode and the workpiece, thereby giving the operator a good view of the weld pool and the joint. This produces a smoother weld bead than if the gun is directed towards the finished weld.

Abbreviations

MIG welding = metal inert gas welding = metal arc welding in an atmosphere consisting mainly of an inert gas such as argon.

MAG welding = metal active gas welding = metal arc welding in an atmosphere consisting of an active gas, usually carbon dioxide. Gas mixtures containing 20% or more CO_2 are usually classified as active.

General recommendations for Submerged Arc Welding

1. **The flux must be dry**. Agglomerated fluxes must be protected from moisture pick-up.

   In tropical, humid areas, re-drying agglomerated fluxes at 250-350°C before use is recommended. The remaining flux in the welding machine container should be removed and stored in a dry cabinet and should therefore not be left in the open container during the night.

   During the transport of fluxes, a maximum of two pallets should be stacked to prevent the grains being crushed.

2. The fusion faces and the plate in the vicinity of the joint should be clean and dry. The cleaner the joint, the better the chances of obtaining a satisfactory weld. Rust, mill scale, paint, oil and residue from arc-air gouging or grinding can adversely affect the quality of the weld metal. The more impurities on the fusion faces, the greater the risk of weld metal defects.

3. The arc voltage must be kept constant. Increased arc voltage results in higher flux consumption. If the flux contains alloying elements, the amount transferred to the weld metal will increase as the arc voltage increases.

4. As a general rule, multi-run deposits made at moderate welding currents have better mechanical properties than one- or two-layer deposits made at high currents in similar plate thicknesses.

N.B. The chemical analyses given in this catalogue are for all weld metal deposited with DC+, 580 A, 29 V, 33 m/h, except for OK Flux 10.92, where DC+, 420 A, 27 V and 30 m/h has been used (wire Ø 4 mm) and for OK Flux 10.90, where DC+, 300A, 30V, 24 m/h has been used (wire Ø 2.4 mm).

The mechanical properties are obtained according to the weldding conditions given in EN 756 (i.e. the same welding data as in EN 760.

Other welding conditions may produce weld metal analyses and mechanical properties which differ from those given in the handbook.

Approval in accordance with classification society rules

Welding materials are normally classified by ESAB in accordance with a standard, e.g. AWS and EN. To verify mechanical properties they are also approved in accordance with the rules of the classification societies.

Classification

The classification of welding products refers to standards and, when a welding product is classified, its type, properties and field of application are given. The manufacturer verifies the correct classification of a product by internal testing and/or by witness of an outside organisation.

Approval

Shipowners and partners in offshore enterprises require welding consumables to be approved in accordance with the rules of the classification societies. Approval is also required by clients in accordance with national or international standards for boiler and pressure vessels as well as other standards to be verified by an authorized approval institutute.

Approved welding products are entered on the "List of Approved Welding Consumables" distributed annually by the societies and other institutes.

The ESAB Welding Handbook provides information about the welding position, current/polarity, low hydrogen and grading.

Non-alloyed and low-alloyed steels

Consumables are divided into three categories based on their tensile strength level:

Normal strength steel: indicated by the numbers 1, 2 or 3 (e.g. 3 3M) that the electrode is to be used in steel with a minimum yield strength (ReH) of 305 and a tensile strength of 400-560 MPa.

High strength steel: indicated by 2Y, 3Y, 4Y, 5Y (ReH min 375 and Rm 490-660 MPa) and 2Y40, 3Y40, 4Y40 (ReH min 400 and Rm 510-690 MPa)

Extra high strength steel: indicated by 3Y42, 4Y42, 5Y42 up to 5Y69 and so on for the different strength steel categories, where the numbers 42...69 symbolize a yield strength in MPa indicating that the electrodes can be used for extra high tensile steels.

Toughness level

Each steel category is divided into three to five toughness levels represented by the first digit in the grade (1, 2, 3, 4 or 5)

-1 suitable for grade A steel (impact tested at 20°C)

-2 suitable for grade A, B and C steels (impact tested at 0°C)

-3 suitable for grade A, B, D and E steels (impact tested at -20°C)

-4 suitable for grade A, B, D, E and F steels (impact tested at -40°C)

-5 suitable for grades A, B, D, E and F steels (impact tested at -60°C)

Other frequently used abbreviations

T	two-run welding (submerged arc welded with one run from each side)
M	multi-run welding (submerged arc or automatic gas-shielded arc welding)
S	semi-automatic, gas-shielded and flux-cored arc welding
H5, H10, H15	low-hydrogen welding consumables
DP	deep penetration

Stainless steel and other high-content alloyed steels

Grades of stainless steel for which the welding consumable is approved are indicated with respect to one or more of the types of stainless steels: 304L, 304LN, 316LN and so on.

The abbreviation SS/CMn indicates approval for joining any of the austenitic types of stainless steel to any of the normal strength or higher tensile ship steels. Dup/CMn indicates approval for joining any of the duplex types of stainless steel to any of the normal strength or higher tensile ship steels.

The system described for grading the consumables in accordance with the rules of the classification societies changes as new steels appear on the market and sometimes there are changes to the approval ratings which might mean that the handbook may not be currently up-to-date. To ensure that valid information is used, please request the latest issued Product Data Sheet for the consumables and/or the latest edition of the "List of Approved Consumables" and approval certificates from the most recent annual repeat test.

Guide to the ISO coding, ISO 2560

Mechanical properties

Electrode designation	Tensile strength[1]	Minimum elongation on L=5d	Temperature for minimum impact value of 28 J[2]
	MPa	%	C
E 43 0	430-510	-	-
E 43 1	430-510	20	+20
E 43 2	430-510	22	0
E 43 3	430-510	24	-20
E 43 4	430-510	24	-30
E 43 5	430-510	24	-40
E 51 0	510-610	-	-
E 51 1	510-610	18	+20
E 51 2	510-610	18	0
E 51 3	510-610	20	-20
E 51 4	510-610	20	-30
E 51 5	510-610	20	-40

Type of coating

A = Acid (iron oxide

AR = Acid (rutile)

B = Basic

C = Cellulosic

O = Oxidizing

R = Rutile (medium coated)

RR = Rutile (heavy coated

S = Other types

COMPULSORY

1) Upper limit tolerance:+40 MPa
2) 1J = 0.102 kgf.m

Example: E 51 3 B 160 20 H

% Metal recovery for not less than 110 % recovery

Low-hydrogen electrode

Welding positions

Current conditions

Welding positions	Symbol	Direct current Recommended polarity	Alternating current Minimum open circuit voltage V
1. all positions	0 [1]	+	
2. all positions, except vertical downward	1	+ or –	50
	2	–	50
	3	+	50
3. flat butt weld, flat fillet weld, horizontal/vertical fillet weld	4	+ or –	70
	5	–	70
	6	+	70
4. flat butt weld, flat fillet weld	7	+ or –	90
	8	–	90
5. as 3 and recommended for vertical downward	9	+	90

OPTIONAL

1) Symbol reserved for electrodes used exclusively on direct current

NB! In the example above, it will be seen that E 51 3 B is compulsory, the remainder optional

Guide to the EN coding, EN 499. For covered electrodes for manual arc welding of non-alloyed and fine grain steels

E 46 3 1Ni B 5 4 H5

Symbol for strength and elongation

Symbol	min. yield strength[1] (MPa)	Tensile strength (MPa)	min. elongation[2] (%)
35	355	440-570	22
38	380	470-600	20
42	420	500-640	20
46	460	530-680	20
50	500	560-720	18

1) For the yield strength the lower yield (R_{el}) shall be used when yielding occurs, otherwise the 0.2% proof stress ($R_{p0.2}$) shall be used
2) $L_0 = 5d$

Symbol for impact properties

Symbol	Minimum av. impact energy 47J °C
Z	no requirements
A	+20
0	0
2	-20
3	-30
4	-40
5	-50
6	-60

Symbol for chemical composition of all weld metal

Alloy symbol	Chemical composition[1)2)3)] %		
	Mn	Mo	Ni
no symbol	2.0	–	–
Mo	1.4	0.3 - 0.6	–
MnMo	>1.4 - 2.0	0.3 - 0.6	–
1Ni	1.4	–	0.6 - 1.2
2Ni	1.4	–	1.8 - 2.6
3Ni	1.4	–	>2.6 - 3.8
Mn1Ni	>1.4-2.0	–	0.6 - 1.2
1NiMo	1.4	0.3 - 0.6	0.6 - 1.2
Z	Any other agreed composition		

1) If not specified: Mo <0.2, Ni <0.3, Cr <0.2, V <0.05, Nb <0.05, Cu <0.3 (electrodes without gas shield only)
2) Single values shown in the table mean maximum values
3) The results shall be rounded to the same number of significant figures as in the specified value using the rules according to ISO 31-0, annex B Rule A.

Symbol for diffusible hydrogen (optional)

Symbol	Max. hydrogen content, ml/100g deposited weld metal
H 5	5
H 10	10
H 15	15

Symbol for the welding position

The welding positions are symbolised by a digit designating the positions for which the electrode is tested according to prEN-3 (00121205)
1: all positions 2: all positions,except vertical down 3: flat butt weld, flat fillet weld, horizontal/vertical weld 4: flat butt weld, flat fillet weld 5: as 3 and recommended vertical down welding

Symbol for recovery and type of current

Symbol	Weld metal recovery %		Type of current[1)2)]
1	≤105		ac + dc
2	≤105		dc
3	>105	≤125	ac + dc
4	>105	≤125	dc
5	>125	≤160	ac + dc
6	>125	≤160	dc
7	>160		ac + dc
8	>160		dc

1) In order to demonstrate operability on ac, tests shall be carried out with no load voltage not higher than 65V.
2) ac = alernation current
dc = direct current

Symbol for the type of electrode covering

A	Acid
C	Cellulosic
R	Rutile
RC	Rutile-cellulosic
RA	Rutile-acid
RB	Rutile-basic
B	Basic

Guide to the EN coding, EN 756 for flux/wire combinations

S 35 4 AB S1

S	Submerged Arc welding

Symbol for tensile properties

Grade Designation	Yield Strength MPa (min)	Tensile Strength MPa	Elongation % (min)
35	355	440-570	22
38	380	470-600	20
42	420	500-640	20
46	460	530-680	20
50	500	560-720	18

Symbol	Minimum parent material yield strength MPa	Minimum tensile strength of the welded joint MPa
2T	275	370
3T	355	470
4T	420	520
5T	500	600

Chemical composition of flux

Symbol	Type of flux
MS	Manganese-silicate
CS	Calcium-silicate
ZS	Zirconium-silicate
RS	Rutile-silicate
AR	Aluminate-rutile
AB	Aluminate-basic
AS	Aluminate-silicate
AF	Aluminate-fluoride-basic
FB	Fluoride-basic
Z	Any other composition

Symbol for impact properties

Grade Designation	Charpy-V Impact J (min)	Temp °C
Z	No requirements	
A	47	20
0	47	0
2	47	-20
3	47	-30
4	47	-40
5	47	-50
6	47	-60
7	47	-70
8	47	-80

Type of wire according to EN 760 and chemical composition of wire electrode

Grade Designation	C	Si	Mn	Ni	Mo	Cr	
SZ	Any other agreed analysis						
S1	0.05-0.15	-0.15	0.35-0.60	-0.15	-0.15	-0.15	*)
S2	0.07-0.15	-0.15	0.80-1.30	-0.15	-0.15	-0.15	*)
S3	0.07-0.15	-0.15	1.30-1.75	-0.15	-0.15	-0.15	*)
S4	0.07-0.15	-0.15	1.75-2.25	-0.15	-0.15	-0.15	*)
S1Si	0.07-0.15	0.15-0.40	0.35-0.60	-0.15	-0.15	-0.15	*)
S2Si	0.07-0.15	0.15-0.40	0.80-1.30	-0.15	-0.15	-0.15	*)
S2Si2	0.07-0.15	0.40-0.60	0.80-1.20	-0.15	-0.15	-0.15	*)
S3Si	0.07-0.15	0.15-0.40	1.30-1.85	-0.15	-0.15	-0.15	*)
S4Si	0.07-0.15	0.15-0.40	1.85-2.25	-0.15	-0.15	-0.15	*)
S1Mo	0.05-0.15	0.05-0.25	0.35-0.60	-0.15	0.45-0.65	-0.15	*)
S2Mo	0.07-0.15	0.05-0.25	0.80-1.30	-0.15	0.45-0.65	-0.15	*)
S3Mo	0.07-0.15	0.05-0.25	1.30-1.75	-0.15	0.45-0.65	-0.15	*)
S4Mo	0.07-0.15	0.05-0.25	1.75-2.25	-0.15	0.45-0.65	-0.15	*)
S2Ni1	0.07-0.15	0.05-0.25	0.80-1.30	0.80-1.20	-0.15	-0.15	*)
S2Ni1.5	0.07-0.15	0.05-0.25	0.80-1.30	1.20-1.80	-0.15	-0.15	*)
S2Ni2	0.07-0.15	0.05-0.25	0.80-1.30	1.80-2.40	-0.15	-0.15	*)
S2Ni3	0.07-0.15	0.05-0.25	0.80-1.30	2.80-3.70	-0.15	-0.15	*)
S2Ni1Mo	0.07-0.15	0.05-0.25	0.80-1.30	0.80-1.20	0.45-0.65	-0.20	*)
S3Ni1.5	0.07-0.15	0.05-0.25	1.30-1.70	1.20-1.80	-0.15	-0.20	*)
S3Ni1Mo	0.07-0.15	0.05-0.25	1.30-1.80	0.80-1.20	0.45-0.65	-0.20	*)
S3Ni1.5Mo	0.07-0.15	0.05-0.25	1.20-1.80	1.20-1.80	0.30-0.50	-0.20	*)
S2Ni1Cu	0.06-0.12	0.15-0.35	0.70-1.20	0.65-0.90	0.15	-0.40	*)
S3Ni1Cu	0.05-0.15	0.15-0.40	1.20-1.70	0.60-1.20	0.15	-0.15	*)
*) Other elements:		Cu -0.30 Al -0.030					

Guide to the EN coding, EN 758, for flux cored wires.

T 46 3 1Ni B M 4 H5

Symbol for strength and elongation

Symbol	min. yield strength[1] (MPa)	Tensile strength (MPa)	min. elongation[2] (%)
35	355	440-570	22
38	380	470-600	20
42	420	500-640	20
46	460	530-680	20
50	500	560-720	18

1) For the yield strength the lower yield (R_{el}) shall be used when yielding occurs, otherwise the 0.2% proof stress ($R_{p0.2}$) shall be used
2) $L_0 = 5d$

Symbol for impact properties

Symbol	Minimum av. impact energy 47J °C
Z	no requirements
A	+20
0	0
2	-20
3	-30
4	-40
5	-50
6	-60

Symbol for chemical composition of all weld metal

Alloy symbol	Chemical composition[1)2)3)] %		
	Mn	Mo	Ni
no symbol	2.0	–	–
Mo	1.4	0.3 - 0.6	–
MnMo	>1.4 - 2.0	0.3 - 0.6	–
1Ni	1.4	–	0.6 - 1.2
1.5Ni	<1.6	–	1.2 - 1.8>
2Ni	1.4	–	1.8 - 2.6
3Ni	1.4	–	>2.6 - 3.8
Mn1Ni	>1.4-2.0	–	0.6 - 1.2
1NiMo	1.4	0.3 - 0.6	0.6 - 1.2
Z	Any other agreed composition		

1) If not specified: Mo <0.2, Ni <0.3, Cr <0.2, V <0.05, Nb <0.05, Cu <0.3 (electrodes without gas shield only)
2) Single values shown in the table mean maximum values
3) The results shall be rounded to the same number of significant figures as in the specified value using the rules according to ISO 31-0, annex B Rule A.

Symbol for diffusible hydrogen (optional)

Symbol	Max. hydrogen content, ml/100g deposited weld metal
H 5	5
H 10	10
H 15	15

Symbol for the welding position

The welding positions are symbolised by a digit designating the positions for which the electrode is tested according to prEN-3 (00121205)
1: all positions 2: all positions except vertical down 3: flat butt weld, flat fillet weld, horizontal/vertical weld 4: flat butt weld, flat fillet weld 5: as 3 and recommended vertical down welding

Shielding gas

EN 758 symbol	
M	Argon mixture
C	CO_2
N	No shielding gas

Description of core

Symbol	EN 758
gas-shielded R	 Rutile base, slow freezing slag
P B	Rutile base, fast freezing slag Basic slag
M	Metal powder core
self-shielded U V W X Y Z S	 Rutile of basic/fluoride Basic/fluoride, slow freezing slag Basic/fluoride, fast freezing slag Other types

Guide to the EN coding, EN 760 for fluxes

SA AB 1 67 AC H5

S	Submerged Arc welding

Method of manufacture

Symbol	
F	Fused flux
A	Agglomerated flux
M	Mixed flux

Hydrogen content of deposited metal

Symbol	Hydrogen content ml/100 g deposited metal (max)
H5	5
H10	10
H15	15

Chemical composition of flux

Symbol	Type of flux
MS	Manganese-silicate
CS	Calcium-silicate
ZS	Zirconium-silicate
RS	Rutile-silicate
AR	Aluminate-rutile
AB	Aluminate-basic
AS	Aluminate-silicate
AF	Aluminate-fluoride-basic
FB	Fluoride-basic
Z	Any other composition

Type of current

Symbol	
DC	Direct current only
AC	Alternating and direct current

Metallurgical behaviour

Symbol	Metallurgical behaviour	Contribution from flux
1	Burn-out	0.7 -
2	Burn-out	0.5 - 0.7
3	Burn-out	0.3 - 0.5
4	Burn-out	0.1 - 0.3
5		0 - 0.1
6	Pick-up	0.1 - 0.3
7	Pick-up	0.3 - 0.5
8	Pick-up	0.5 - 0.7
9	Pick-up	0.7 -

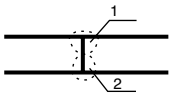
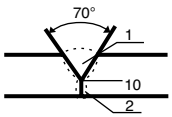
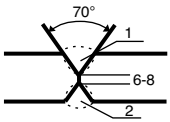
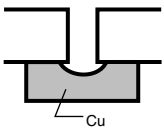
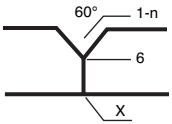
Application

Class	
1	SA welding of non alloy and low alloy steels
2	SA welding and surfacing of stainless and heat resisting Cr and Cr-Ni steels and/or Ni and Ni-based alloys
3	Surfacing purposes yielding a wear resisting weld metal by alloying C, Cr or Mo from flux

Class 1	Si and Mn as above
Class 2	Stating corresponding chemical symbols
Class 3	Stating corresponding chemical symbols

Welding data and joint preparation

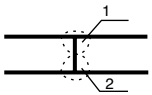
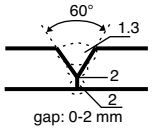
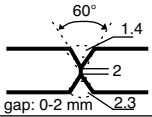
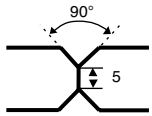
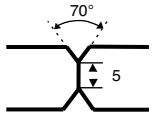
Typical welding data and recommended joint preparation for submerged arc welding mild steel and carbon-manganese structural steels with OK Flux 10.40, OK Flux 10.47, OK Flux 10.70, OK Flux 10.71, OK Flux 10.72, OK Flux 10.76 and OK Flux 10.81.

Type of joint	Plate thickness mm	Wire diameter mm	Run No	Arc voltage V	Welding current A	Welding speed cm/min.
	6	3	1	33	400	80
			2	33	430	
	8	4	1	34	480	60
			2	34	550	
	10	4	1	34	550	55
			2	35	650	
	12	4	1	35	650	50
			2	35	700	
	14	4	1	35	700	40
			2	35	750	
	16	4	1	32	600	50
			2	35	650	
	18	4	1	34	700	50
			2	35	650	
	20	4	1	36	750	40
			2	35	650	
	18	6	1	36	700	30
			2	36	850	
	20	6	1	36	800	25
			2	36	850	
	25	6	1	36	850	20
			2	36	950	
	30	6	1	36	900	15
			2	36	1000	
	2	2	1	28	325	125
	4	2.5	1	30	450	70
	6	3	1	31	510	50
	8	3	1	32	525	45
	10	3	1	33	600	35
	20	4	1	29	650	50
			2	32	750	50
			3	34	750	40
			X	30	550	50
	25	4	1	29	650	50
			2	30	700	50
			3, 4	32	750	40
			5	36	750	40
			X	30	550	50
	30	4	1	29	650	50
			2	30	700	50
			3-5	32	750	50
			6	34	750	40
			7-8	36	750	40
			X	30		

Typical welding data for submerged arc fillet welding mild steel and carbon-manganese structural steels withOK Flux 10.47, OK Flux 10.71 and OK Flux 10.81

Type of joint	Plate thickness mm	Wire diameter mm	Throat thickness mm	Arc voltage V	Welding current A	Welding speed cm/min.
	Single welding head					
	≥ 6 ≥ 8 ≥10	3 4 4	3 4 5	30–32 30–32 30–32	500 450 650	100 60 50
	≥ 8 ≥12 ≥15	4 4 4	4 4 7	32–34 32–34 36	700 800 800	115 140 45
	≥15 ≥20	4 4	– –	36 36	750 750	45 40
	Twin wire					
	– –	2x1.6 2x2.0	4 5	32 34	800 300	120 110
	Two welding heads + ~					
	– –	4 4	4 4	+32 ~38 +32 ~38	800 700 800 700	140 140
	– –	4 4	4 5	+32 ~38 +32 ~35	800 700 800 700	140 90

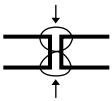
Submerged arc welding “18/8” stainless steel. Joint preparation and typical welding data for filler materials OK Autrod 16.10 + OK Flux 10.92, 10.93 and similar OK-combinations.

Type of joint	Plate thickness mm	Wire diameter mm	Run No	Arc voltage V	Welding current A	Welding speed m/h
	6	3	1 2	34	400 500	80 60
	8	4	1 2	34	500 600	80 60
	Manual welded root bead					
	10	4	1 2	34	600 600	40 60
	12	4	1 2	34	600 600	35 50
	20	4	1 2 3	34	600 600 600	35 30 40
	25	4	1 2 3 4	34 34	600 600 600 600	40 35 35 40
	8	4	1 2	34 34	450 550	55 50
	10	4	1 2	34 34	500 600	40 50
	12	4	1 2	34 34	500 600	35 40
	14	4	1 2	34 34	550 600	35 35

Calculation of electrode consumption

In the tables, joint cross section, theoretical joint volume and kg weld metal per metre length of welded joint are given. The electrode consumption per metre of welded joint is obtained by dividing the number of kg of weld metal by N, where N is the kg of weld metal per kg of electrode and is given for each electrode on their respective pages.

Square butt joints: Joint volumes and weld metal weights

Position	Plate thickness mm	Gap mm	Volume/length cm^3/m	Weight/length weld metal kg/m
 Flat	1	0	2	0.02
	1.5	0.5	3	0.02
	2	1	4	0.03
	3	1.5	7	0.05
 Flat	4	2	17	0.13
	5	2	21	0.16
	6	2.5	27	0.21
	7	3	36	0.28
 Horizontal-Vertical	1	0	2.5	0.02
	1.5	0.5	4	0.03
	2	1	5	0.04
	3	1.5	9.5	0.07
 Horizontal-Vertical	4	2	22	0.17
	5	2.5	25	0.20
	6	3	32	0.25
	7	3	42	0.33
 Overhead	4	2	9	0.07
	5	2	10.5	0.08
	6	2.5	13	0.10
	7	3	16	0.13
	4	2	10.5	0.08
	5	2	16	0.13
	6	2.5	18	0.14
	7	3	21	0.16

Calculation of electrode consumption

Single V-joints: volumes and weld metal weights

Plate thick-ness mm	Gap mm	50° Flat			60° Flat			70° Vertical			80° Overhead			60° Horizontal-Vertical		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
4	1	11.5	11	0.09	13	12.5	0.10	15	16.5	0.13	17.5	18	0.14	13	14.5	0.11
5	1	16.5	16	0.13	19.5	19	0.15	22.5	24.5	0.19	26	28	0.22	19.5	21	0.16
6	1	23	21.5	0.17	27	25.5	0.20	31	37	0.29	36	38.5	0.30	27	30	0.24
7	1.5	33.5	32.5	0.26	39	38	0.30	45	49	0.38	51.5	56	0.44	39	42	0.33
8	1.5	42	40	0.31	49	46.5	0.37	57	59.5	0.47	65.5	70	0.55	49	56	0.44
9	1.5	51	48	0.38	60.5	56	0.44	70	75.5	0.59	81.5	87.5	0.69	60.5	65	0.51
10	2	66.5	62	0.49	77.5	72	0.57	90	96.5	0.76	104	109	0.86	77.5	81	0.64
11	2	78.5	71.5	0.56	92	83.5	0.66	107	113	0.89	124	130	1.02	92	96.5	0.76
12	2	91	83	0.65	107	97.5	0.77	125	134	1.05	145	157	1.23	107	113	0.89
14	2	120	110	0.86	141	130	1.02	165	171	1.34	193	204	1.60	141	159	1.17
15	2	135	123	0.97	160	146	1.15	188	197	1.55	219	231	1.81	160	171	1.34
16	2	151	132	1.04	180	157	1.23	211	223	1.75	247	257	2.02	180	186	1.46
18	2	189	170	1.33	223	204	1.60	263	276	2.17	308	320	2.51	223	233	1.83
20	2	227	208	1.63	271	247	1.94	320	334	2.62	376	396	3.11	271	281	2.21
25	2	341	313	2.46	411	375	2.94	488	510	4.00	577	606	4.76	411	425	3.34

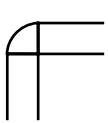
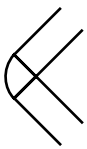
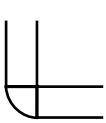
1 Theoretical volume cm^3/m
2 Actual joint volume cm^3/m (taking account of transverse shrinkage)
3 Deposited weld metal kg/m

The first run and backing run V-joints: Weld metal weights

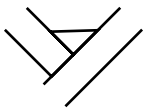
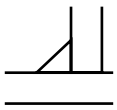
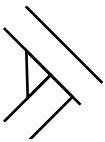
Position	Plate thickness mm	Weight/length kg/m	Electrode diam mm
Flat	6–12	0.10	3.25
Flat	> 12	0.15	4
Vertical	> 8	0.15	3.25
Horizontal-Vertical	> 8	0.15	3.25
Overhead	> 10	0.10	3.25

Calculation of electrode consumption

Corner welds: Actual joint volumes and weld metal weights

Plate thickness	Section size								
mm	mm^2	cm^3/m	kg/m	cm^3/m	kg/m	cm^3/m	kg/m	cm^3/m	kg/m
2	2	3.5	0.03	3	0.02	3.5	0.03	3.5	0.03
3	4.5	7	0.05	7	0.05	7	0.05	7.5	0.06
4	8	9	0.07	9	0.07	9.5	0.07	10.5	0.08
5	12.5	13	0.10	13.5	0.11	14.5	0.11	16	0.13
6	18	18.5	0.15	19.5	0.15	21	0.16	22	0.17
7	24.5	25.5	0.20	26.5	0.21	27.5	0.22	31.5	0.25
8	32	33	0.26	34.5	0.27	36	0.28	40.5	0.32
9	40.5	41.5	0.33	43	0.34	45.5	0.36	51	0.40
10	50	51.5	0.40	53.5	0.42	56	0.44	64	0.50
11	60.5	63	0.49	67	0.53	72	0.57	78.5	0.62
12	72	74.5	0.58	79	0.62	84.5	0.66	93	0.73
15	113	116	0.91	123	0.97	132	1.04	141	1.11
18	162	167	0.31	174	1.37	190	1.49	204	1.60
20	200	206	1.62	206	1.62	227	1.78	252	1.98
22	242	248	1.95	255	2.00	275	2.16	204	2.39
25	323	329	2.58	331	2.60	370	2.90	405	3.18

Fillet welds: Actual joint volumes and weld metal weights

Throat thickness	Section size								
mm	mm^2	cm^3/m	kg/m	cm^3/m	kg/m	cm^3/m	kg/m	cm^3/m	kg/m
2	4	5	0.04	6	0.05	5.5	0.04	5.5	0.04
2.5	6.5	7.5	0.06	8.5	0.07	8	0.06	8.5	0.07
3	9	10.5	0.08	12.5	0.10	11	0.09	12	0.09
3.5	12.5	14	0.11	16	0.13	15	0.12	16.5	0.13
4	16	18	0.14	21	0.16	19.5	0.15	22	0.17
4.5	20.5	22.5	0.18	26	0.20	24.5	0.19	26.5	0.21
5	25	27.5	0.22	31.5	0.25	30.5	0.24	33	0.26
5.5	30.5	33.5	0.26	37	0.29	36	0.28	40.5	0.32
6	36	40	0.31	42	0.33	43	0.34	47.5	0.37
6.5	42.5	46.5	0.37	49.5	0.39	51	0.40	56	0.44
7	49	54.5	0.43	57	0.45	56	0.44	65	0.51
7.5	56.5	60.5	0.47	65	0.51	64	0.50	73.5	0.58
8	64	70	0.55	73.5	0.58	76.5	0.60	82.5	0.65
9	81	88	0.69	94	0.74	95	0.75	109	0.86
10	100	108	0.85	114	0.89	116	0.91	130	1.02
11	121	131	1.03	138	1.08	143	1.12	157	1.23
12	144	155	1.22	162	1.27	169	1.33	188	1.48
13	169	179	1.41	190	1.49	195	1.53	220	1.73
14	196	207	1.62	224	1.76	227	1.78	257	2.02
15	225	237	1.86	248	1.95	264	2.07	294	2.31

P

Q

S

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