

OK Flux 10.93

OK Flux 10.93 is a basic non-alloying agglomerated flux for the submerged arc welding of stainless steels and high-alloyed CrNiMo steels including duplex stainless steels.

| | |
|------------------------|---|
| Classifications | EN ISO 14174 : S A AF 2 56 54 DC |
| Approvals | CE EN 13479 NAKS/HAKC RD 03-613-03 DB 51.039.10 |

Approvals are based on factory location. Please contact ESAB for more information.

| | |
|-----------------------|---|
| Slag Type | Fluoride basic CaF ₂ -Al ₂ O ₃ -SiO ₂ |
| Alloy Transfer | Non alloying |
| Density | nom 1.0 kg/dm ³ |
| Basicity Index | nom 1.9 |

Flux Consumption

| Volts | kg Flux / kg Wire DC+ | kg Flux / kg Wire AC |
|-------|-----------------------|----------------------|
| 26 V | 0.5 kg | - |
| 30 V | 0.6 kg | - |
| 34 V | 0.8 kg | - |
| 38 V | 1.0 kg | - |

| Dimensions | Amps | Travel Speed |
|------------|-------|--------------|
| 4.0 mm | 580 A | 33 m/h |

Classifications

| Wire | SFA/AWS - EN ISO | AWS - As Welded |
|--------------------|---|--|
| OK Autrod 16.10 | A5.9:ER308L | |
| OK Autrod 16.11 | A5.9:ER347 | |
| OK Autrod 16.30 | A5.9:ER316L | |
| OK Autrod 16.38 | 14343-A:S 20 16 3 Mn L | |
| OK Autrod 16.53 | A5.9:ER309L | |
| OK Autrod 16.97 | 14343-A:S 18 8 Mn | |
| OK Autrod 2209 | A5.9:ER2209/ 14343-A:S 22 9 3 N L | |
| OK Autrod 2307 | 14343-A:S 23 7 N L | |
| OK Autrod 2509 | A5.9:ER2594/ 14343-A:S 25 9 4 N L | A5.39: F120A8-ER2594/2594 |
| OK Autrod 2509 | A5.9:ER2594/ 14343-A:S 25 9 4 N L | A5.39: F120A8-ER2594/2594 |
| OK Autrod 308H | A5.9:ER308H/ 14343-A:S 19 9 H | |
| OK Autrod 308L | A5.9:ER308L/ 14343-A:S 19 9 L | A5.39: F80A32-ER308L/308L |
| OK Autrod 308L | A5.9:ER308L/ 14343-A:S 19 9 L | A5.39: F80A32-ER308L/308L |
| OK Autrod 309L | A5.9:ER309L/ 14343-A:S 23 12 L | |
| OK Autrod 309MoL | A5.9:ER309LMo (mod)/ 14343-A:S 23 12 2 L | A5.39: F85A4-ER309LMo (mod)/309LMo (mod) |
| OK Autrod 309MoL | A5.9:ER309LMo (mod)/ 14343-A:S 23 12 2 L | A5.39: F85A4-ER309LMo (mod)/309LMo (mod) |
| OK Autrod 310MoL | 14343-A:S 25 22 2 N L | |
| OK Autrod 312 | A5.9:ER312/ 14343-A:S 29 9 | |
| OK Autrod 316H | A5.9:ER316H/ 14343-A:S 19 12 3 H | |
| OK Autrod 316L | A5.9:ER316L/ 14343-A:S 19 12 3 L | |
| OK Autrod 316LMn | A5.9:ER316LMn/ 14343-A:S 20 16 3 Mn N L | |
| OK Autrod 317L | A5.9:ER317L/ 14343-A:S 18 15 3 L | |
| OK Autrod 318 | A5.9:ER318/ 14343-A:S 19 12 3 Nb | |
| OK Autrod 347 | A5.9:ER347/ 14343-A:S 19 9 Nb | A5.39: F90A15-ER347/347 |
| OK Autrod 347 | A5.9:ER347/ 14343-A:S 19 9 Nb | A5.39: F90A15-ER347/347 |
| OK Autrod 385 | A5.9:ER385/ 14343-A:S 20 25 5 Cu L | |
| OK Autrod 410NiMo | 14343-A:S 13 4 | |
| OK Autrod NiCrMo-3 | A5.14:ERNiCrMo-3/ 18274:S Ni 6625 (NiCr22Mo9Nb) | A5.39: F100A32-ERNiCrMo-3/NiCrMo-3 |
| OK Autrod NiCrMo-3 | A5.14:ERNiCrMo-3/ 18274:S Ni 6625 (NiCr22Mo9Nb) | A5.39: F100A32-ERNiCrMo-3/NiCrMo-3 |

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| Classifications | | |
|--------------------|--|-----------------|
| Wire | SFA/AWS - EN ISO | AWS - As Welded |
| OK Autrod NiCrMo-4 | A5.14:ERNiCrMo-4/ 18274:S Ni 6276 (NiCr15Mo16Fe6W4) | |

| Approvals | | | | | | | | | | | |
|--------------------|-----|----|-----|----|----|----|----|------|---------|-------|--------|
| Combined with Wire | ABS | BV | DNV | GL | LR | DB | CE | RINA | ClassNK | VdTÜV | DNV-GL |
| OK Autrod 16.97 | - | - | • | - | - | - | - | - | - | - | • |
| OK Autrod 2209 | • | • | • | • | • | - | • | • | • | • | • |
| OK Autrod 2509 | - | - | - | - | - | - | • | - | - | • | - |
| OK Autrod 308L | • | • | • | - | - | • | • | - | - | • | • |
| OK Autrod 308L LF | - | - | - | - | - | - | • | - | - | • | - |
| OK Autrod 309L | • | - | • | - | • | - | • | - | - | • | • |
| OK Autrod 316L | • | - | • | - | - | • | • | - | - | • | - |
| OK Autrod 318 | - | - | - | - | - | • | • | - | - | • | - |
| OK Autrod 347 | - | - | - | - | - | • | • | - | - | • | - |
| OK Autrod 385 | - | - | - | - | - | - | - | - | - | • | - |

| Typical Mechanical Properties | | | | | |
|-------------------------------|--|------------------|-------------------|------------|--|
| Combined with Wire | Condition | Yield Strength | Tensile Strength | Elongation | Charpy V-Notch |
| OK Autrod 16.10 | As Welded DC+hr () | 410 MPa (59 ksi) | 570 MPa (83 ksi) | 38 % | 80 J @ -60°C (59 ft-lb @ -76°F) 60 J @ -110°C (44 ft-lb @ -166°F) 45 J @ -196°C (33 ft-lb @ -320.8°F) |
| OK Autrod 16.11 | As Welded DC+hr () | 420 MPa (61 ksi) | 590 MPa (86 ksi) | 36 % | 60 J @ -60°C (44 ft-lb @ -76°F) 45 J @ -110°C (33 ft-lb @ -166°F) 30 J @ -196°C (22 ft-lb @ -320.8°F) |
| OK Autrod 16.30 | As Welded DC+hr () | 400 MPa (58 ksi) | 530 MPa (77 ksi) | 35 % | 70 J @ -60°C (52 ft-lb @ -76°F) 65 J @ -110°C (48 ft-lb @ -166°F) 40 J @ -196°C (30 ft-lb @ -320.8°F) |
| OK Autrod 16.38 | As Welded DC+hr () | 410 MPa | 600 MPa | 44 % | 70 J @ -60°C 60 J @ -110°C 40 J @ -196°C |
| OK Autrod 16.53 | As Welded DC+hr () | 430 MPa (62 ksi) | 570 MPa (83 ksi) | 35 % | 65 J @ -60°C (48 ft-lb @ -76°F) 55 J @ -110°C (41 ft-lb @ -166°F) 35 J @ -196°C (26 ft-lb @ -320.8°F) |
| OK Autrod 16.97 | As Welded DC+hr () | 400 MPa (58 ksi) | 600 MPa (87 ksi) | 45 % | 60 J @ -20°C (44 ft-lb @ -4°F) |
| OK Autrod 2209 | As Welded hr () | 630 MPa (91 ksi) | 780 MPa (113 ksi) | 30 % | 140 J @ 20°C (104 ft-lb @ 68°F) 125 J @ -20°C (93 ft-lb @ -4°F) 110 J @ -40°C (81 ft-lb @ -40°F) 80 J @ -60°C (59 ft-lb @ -76°F) 28 J @ -110°C (21 ft-lb @ -166°F) |
| OK Autrod 2209 | As Welded DC+hr () | 630 MPa (91 ksi) | 780 MPa (113 ksi) | 30 % | 140 J @ 20°C (104 ft-lb @ 68°F) 125 J @ -20°C (93 ft-lb @ -4°F) 110 J @ -40°C (81 ft-lb @ -40°F) 80 J @ -60°C (59 ft-lb @ -76°F) |
| OK Autrod 2307 | As Welded DC+hr () | 560 MPa | 730 MPa | 32 % | 140 J @ 20°C 125 J @ -20°C 90 J @ -40°C 60 J @ -60°C |
| OK Autrod 2509 | As Welded DC+hr () | 640 MPa (93 ksi) | 840 MPa (122 ksi) | 28 % | 85 J @ 20°C (63 ft-lb @ 68°F) 60 J @ -40°C (44 ft-lb @ -40°F) |
| OK Autrod 2509 | As Welded DC+hr () | 670 MPa (97 ksi) | 870 MPa (126 ksi) | 24 % | 65 J @ 20°C (48 ft-lb @ 68°F) 40 J @ -60°C (30 ft-lb @ -76°F) |
| OK Autrod 308L | As Welded DC+hr () | 400 MPa | 560 MPa | 38 % | 100 J @ 20°C 75 J @ -40°C 65 J @ -60°C 55 J @ -110°C 40 J @ -196°C |
| OK Autrod 308L | As Welded dia 2.4mm, travel speed 56cm/min 400A DC+ 28V hr () | 400 MPa (58 ksi) | 570 MPa (83 ksi) | 40 % | 100 J @ 20°C (74 ft-lb @ 68°F) 75 J @ -40°C (56 ft-lb @ -40°F) 65 J @ -60°C (48 ft-lb @ -76°F) 55 J @ -110°C (41 ft-lb @ -166°F) 47 J @ -196°C (35 ft-lb @ -320.8°F) |
| OK Autrod 308L | As Welded dia 4.0 mm 500A DC+ 30V hr () | 400 MPa (58 ksi) | 560 MPa (81 ksi) | 38 % | 100 J @ 20°C (74 ft-lb @ 68°F) 75 J @ -40°C (56 ft-lb @ -40°F) 65 J @ -60°C (48 ft-lb @ -76°F) 55 J @ -110°C (41 ft-lb @ -166°F) 35 J @ -196°C (26 ft-lb @ -320.8°F) |

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Typical Mechanical Properties

| Combined with Wire | Condition | Yield Strength | Tensile Strength | Elongation | Charpy V-Notch |
|--------------------|--|-------------------|--------------------|------------|--|
| OK Autrod 308L LF | As Welded Dia 2.4 mm 45 cm/min 400A DC+ 28V hr () | 400 MPa (58 ksi) | 550 MPa (80 ksi) | 40 % | 40 J @ -196°C (30 ft-lb @ -320.8°F) |
| OK Autrod 309L | As Welded DC+hr () | 430 MPa (62 ksi) | 570 MPa (83 ksi) | 33 % | 90 J @ 20°C (67 ft-lb @ 68°F) 70 J @ -60°C (52 ft-lb @ -76°F) 60 J @ -110°C (44 ft-lb @ -166°F) 35 J @ -196°C (26 ft-lb @ -320.8°F) |
| OK Autrod 309MoL | As Welded DC+hr () | 400 MPa (58 ksi) | 600 MPa (87 ksi) | 38 % | 120 J @ 20°C (89 ft-lb @ 68°F) |
| OK Autrod 309MoL | As Welded DC+hr () | 430 MPa (62 ksi) | 610 MPa (88 ksi) | 31 % | 50 J @ 20°C (37 ft-lb @ 68°F) 35 J @ -40°C (26 ft-lb @ -40°F) |
| OK Autrod 310MoL | As Welded DC+hr () | 335 MPa (49 ksi) | 575 MPa (83 ksi) | 42 % | 120 J @ 20°C (89 ft-lb @ 68°F) |
| OK Autrod 316H | As Welded AWS 475A; 30V; H.I 2.0 kJ/mm DC+ hr () | 410 MPa (59 ksi) | 550 MPa (80 ksi) | 40 % | 85 J @ 20°C (63 ft-lb @ 68°F) 75 J @ 0°C (56 ft-lb @ 32°F) |
| OK Autrod 316L | As Welded DC+hr () | 390 MPa (57 ksi) | 565 MPa (82 ksi) | 42 % | 100 J @ 20°C (74 ft-lb @ 68°F) 95 J @ -40°C (70 ft-lb @ -40°F) 90 J @ -60°C (67 ft-lb @ -76°F) 75 J @ -110°C (56 ft-lb @ -166°F) 40 J @ -196°C (30 ft-lb @ -320.8°F) |
| OK Autrod 316LMn | As Welded 420A, 30V, 30m/h DC+ hr () | 410 MPa (59 ksi) | 600 MPa (87 ksi) | 30 % | 70 J @ -60°C (52 ft-lb @ -76°F) 60 J @ -110°C (44 ft-lb @ -166°F) 40 J @ -196°C (30 ft-lb @ -320.8°F) |
| OK Autrod 316LMn | As Welded 420A, 30V, 30m/h DC+ hr () | 410 MPa (59 ksi) | 600 MPa (87 ksi) | 44 % | 70 J @ -60°C (52 ft-lb @ -76°F) 60 J @ -110°C (44 ft-lb @ -166°F) 40 J @ -196°C (30 ft-lb @ -320.8°F) |
| OK Autrod 317L | As Welded DC+hr () | 440 MPa (64 ksi) | 615 MPa (89 ksi) | 28 % | 80 J @ 20°C (59 ft-lb @ 68°F) 50 J @ -60°C (37 ft-lb @ -76°F) |
| OK Autrod 318 | As Welded DC+hr () | 440 MPa (64 ksi) | 600 MPa (87 ksi) | 40 % | 100 J @ 20°C (74 ft-lb @ 68°F) 90 J @ -60°C (67 ft-lb @ -76°F) 40 J @ -110°C (30 ft-lb @ -166°F) |
| OK Autrod 318 | As Welded DC+hr () | 440 MPa (64 ksi) | 600 MPa (87 ksi) | 42 % | 100 J @ 20°C (74 ft-lb @ 68°F) 90 J @ -60°C (67 ft-lb @ -76°F) 40 J @ -110°C (30 ft-lb @ -166°F) |
| OK Autrod 347 | As Welded 420A DC+ Feed speed: 30m/h 27V hr () | 455 MPa (66 ksi) | 635 MPa (92 ksi) | 36 % | 105 J @ 20°C (78 ft-lb @ 68°F) 85 J @ -60°C (63 ft-lb @ -76°F) 60 J @ -110°C (44 ft-lb @ -166°F) 30 J @ -196°C (22 ft-lb @ -320.8°F) |
| OK Autrod 347 | As Welded DC+hr () | 455 MPa (66 ksi) | 635 MPa (92 ksi) | 36 % | 90 J @ 20°C (67 ft-lb @ 68°F) 85 J @ -60°C (63 ft-lb @ -76°F) 38 J @ -110°C (28 ft-lb @ -166°F) 25 J @ -196°C (19 ft-lb @ -320.8°F) |
| OK Autrod 385 | As Welded DC+hr () | 310 MPa (45 ksi) | 530 MPa (77 ksi) | 35 % | 80 J @ 20°C (59 ft-lb @ 68°F) |
| OK Autrod 410NiMo | As Welded DC+, 450A, 28Vhr () | 900 MPa (131 ksi) | 1000 MPa (145 ksi) | 15.5 % | 30 J @ 0°C (22 ft-lb @ 32°F) 30 J @ -20°C (22 ft-lb @ -4°F) |
| OK Autrod 410NiMo | Stress Relieved DC+, 450A, 28V Stress relieved 600°C, 2h hr () | 770 MPa (112 ksi) | 850 MPa (123 ksi) | 19 % | 55 J @ 0°C (41 ft-lb @ 32°F) 55 J @ -20°C (41 ft-lb @ -4°F) |
| OK Autrod 410NiMo | Stress Relieved DC+, 500A, 30V Stress relieved 580°C, 4h hr () | 785 MPa (114 ksi) | 860 MPa (125 ksi) | 18 % | 55 J @ 0°C (41 ft-lb @ 32°F) 50 J @ -20°C (37 ft-lb @ -4°F) |
| OK Autrod NiCrMo-3 | As Welded DC+hr () | 450 MPa (65 ksi) | 710 MPa (103 ksi) | 45 % | 90 J @ -60°C (67 ft-lb @ -76°F) 80 J @ -196°C (59 ft-lb @ -320.8°F) 80 J @ -196°C (59 ft-lb @ -320.8°F) |
| OK Autrod NiCrMo-4 | As Welded HI 1.6-1.8 kJ/mm DC+ () | 450 MPa (65 ksi) | 700 MPa (102 ksi) | 45 % | 100 J @ -60°C (74 ft-lb @ -76°F) 80 J @ -196°C (59 ft-lb @ -320.8°F) |

Typical Weld Metal Analysis %

| C | Mn | Si | S | P | Ni | Cr | Mo | V | Cu |
|---------------------------------------|------|------|-------|-------|-------|-------|------|---|------|
| OK Autrod 16.10 | | | | | | | | | |
| 0.02 | 1.40 | 0.60 | - | - | 8.60 | 18.80 | - | - | - |
| OK Autrod 16.11 DC+, As welded | | | | | | | | | |
| 0.05 | 1.20 | 0.55 | 0.015 | 0.025 | 8.50 | 18.30 | 0.10 | - | 0.15 |
| OK Autrod 16.30 DC+, As welded | | | | | | | | | |
| 0.02 | 1.40 | 0.50 | 0.015 | 0.025 | 10.60 | 17.50 | 2.00 | - | 0.10 |
| OK Autrod 16.53 DC+, As welded | | | | | | | | | |

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Typical Weld Metal Analysis %

| C | Mn | Si | S | P | Ni | Cr | Mo | V | Cu |
|--|------|------|-------|-------|-------|-------|------|-----|------|
| 0.02 | 1.40 | 0.50 | 0.015 | 0.025 | 11.60 | 22.10 | 0.10 | - | 0.10 |
| OK Autrod 16.97 | | | | | | | | | |
| 0.06 | 6.3 | 1.2 | 0.01 | 0.02 | 8.0 | 18.0 | 0.1 | - | 0.1 |
| OK Autrod 2209 Current: DC+, 420A, 27V | | | | | | | | | |
| 0.02 | 1.3 | 0.5 | 0.01 | 0.02 | 9.0 | 22.5 | 3.1 | - | 0.1 |
| OK Autrod 2509 Current: DC+, 350A, 28V, 48cm/min | | | | | | | | | |
| 0.02 | 0.4 | 0.5 | 0.01 | 0.02 | 9.5 | 24.6 | 3.5 | - | 0.2 |
| OK Autrod 308H DC+ | | | | | | | | | |
| 0.05 | 1.5 | 0.6 | 0.01 | 0.02 | 9.9 | 19.9 | 0.1 | - | 0.1 |
| OK Autrod 308L DC+, As welded | | | | | | | | | |
| 0.02 | 1.6 | 0.5 | 0.01 | 0.02 | 10.0 | 19.5 | 0.2 | - | 0.1 |
| OK Autrod 309L Current: DC+, 420 A, 27 V | | | | | | | | | |
| 0.02 | 1.3 | 0.5 | 0.01 | 0.02 | 12.5 | 23.0 | 0.2 | - | 0.2 |
| OK Autrod 309MoL DC+, 380 A, 28 V, 50cm/min | | | | | | | | | |
| 0.02 | 1.2 | 0.5 | 0.02 | 0.02 | 14.5 | 20.8 | 2.8 | - | 0.1 |
| OK Autrod 312 Current: DC+, 420A, 27V | | | | | | | | | |
| 0.1 | 1.5 | 0.5 | - | - | 9.5 | 29.0 | 0.1 | - | 0.1 |
| OK Autrod 316H DC+ | | | | | | | | | |
| 0.04 | 1.5 | 0.6 | 0.01 | 0.02 | 11.2 | 18.4 | 2.1 | - | 0.1 |
| OK Autrod 316L | | | | | | | | | |
| 0.02 | 1.4 | 0.5 | 0.01 | 0.02 | 12.5 | 18.0 | 2.6 | - | 0.1 |
| OK Autrod 316LMn | | | | | | | | | |
| 0.02 | 5.4 | 0.7 | 0.01 | 0.01 | 15.5 | 20.0 | 2.5 | - | 0.2 |
| OK Autrod 317L Current: DC+, 420 A, 27 V | | | | | | | | | |
| 0.02 | 1.5 | 0.5 | 0.01 | 0.02 | 13.5 | 18.5 | 3.2 | - | 0.1 |
| OK Autrod 318 Current: DC+, 440A, 30V | | | | | | | | | |
| 0.035 | 1.2 | 0.5 | 0.01 | 0.02 | 12.0 | 18.5 | 2.6 | - | 0.2 |
| OK Autrod 347 Current: DC+, 420A, 27V, welding speed 48cm/min | | | | | | | | | |
| 0.035 | 1.1 | 0.5 | 0.01 | 0.02 | 9.6 | 19.2 | 0.1 | - | 0.2 |
| OK Autrod 385 Current: DC+, 420A, 27V | | | | | | | | | |
| 0.02 | 1.5 | 0.5 | 0.01 | 0.01 | 25.0 | 19.0 | 4.0 | - | 1.5 |
| OK Autrod 410NiMo DC+, 450A, 28V | | | | | | | | | |
| 0.02 | 0.4 | 0.5 | 0.01 | 0.02 | 4.1 | 11.7 | 0.51 | - | 0.10 |
| OK Autrod NiCrMo-3 Current: DC+, 400A, 28V, travel speed: 25 m/h. | | | | | | | | | |
| 0.02 | 0.2 | 0.4 | 0.005 | 0.015 | - | 22 | 9 | - | 0.1 |
| OK Autrod NiCrMo-4 DC+ | | | | | | | | | |
| 0.01 | 0.4 | 0.20 | - | - | Bal | 15.1 | 15.6 | 0.1 | - |

| N | Nb | Co | Fe | Nb+Ta | W | FN WRC-92 |
|---|------|----|----|-------|--------|-----------|
| OK Autrod 16.10 | | | | | | |
| - | - | - | - | - | - | - |
| OK Autrod 16.11 DC+, As welded | | | | | | |
| - | 0.50 | - | - | - | - | - |
| OK Autrod 16.30 DC+, As welded | | | | | | |
| - | - | - | - | - | - | - |
| OK Autrod 16.53 DC+, As welded | | | | | | |
| - | - | - | - | - | - | - |
| OK Autrod 16.97 | | | | | | |
| - | - | - | - | - | - | - |
| OK Autrod 2209 Current: DC+, 420A, 27V | | | | | | |
| 0.17 | - | - | - | - | - | 45 |
| OK Autrod 2509 Current: DC+, 350A, 28V, 48cm/min | | | | | | |
| 0.20 | - | - | - | - | <0.002 | 58 |
| OK Autrod 308H DC+ | | | | | | |