

# Lastoevoegmaterialen Catalogus

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# Voorwoord

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Deze toevoegmaterialenbundel is een verzameling van productinformatiebladen die door verschillende leveranciers beschikbaar zijn gesteld. De inhoud van deze bundel dient alleen voor studiedoeleinde te worden gebruikt. In de bundel zijn gangbare informatiebladen opgenomen die betrekkingen hebben op de volgende lasprocessen:

Booglassen met beklede elektroden

MIG/MAG-lassen

TIG-lassen

Onderpoederdeklassen

Alleen deze bundel mag worden geraadpleegd tijdens het “case” onderdeel van het IWT examen dat behoort bij hoofdonderwerp 4. De examenkandidaat dient er zelf voor zorg te dragen dat hij/zij deze bundel bij zich heeft tijdens het examen. Tijdens het examen mag alleen gebruik worden gemaakt van een onbeschreven versie, er mogen dus geen aantekeningen in deze bundel staan.



| <b>Ongelegeerd staal</b> |              |                  |
|--------------------------|--------------|------------------|
|                          | AWS          | EN-ISO           |
| OK 39.50                 | E 7027       | E 42 2 RA 53     |
| OK 33.60                 | E 7024       | E 42 0 RR 53     |
| OK 33.80                 | E 7024       | E 42 0 RR 73     |
| OK 43.32                 | E 6013       | E 42 0 RR 12     |
| OK 46.00                 | E 6013       | E 38 0 RC 11     |
| OK 46.08                 | E 6013       | E 38 0 R 12      |
| OK 46.44                 | E 6013       | E 38 0 RC 11     |
| Filarc 48.00             | E 6013       | E 42 0 RC 11     |
| Filarc 36 S              | E 7016       | E 42 2 B 12 H10  |
| OK 53.16                 | E 7016       | E 38 2 B 32 H10  |
| Filarc 56 S              | E 7016 – 1   | E 42 5 B 12 H5   |
| OK 55.00                 | E 7018-1 H4R | E 46 5 B 32 H5   |
| OK 38.48                 | E 7028       | E 42 3 RB 53 H10 |
| Filarc 27 P              | E 8018 – G   | E 46 4 B 41 H5   |

| <b>Laaggelegeerd staal</b> |                  |                           |
|----------------------------|------------------|---------------------------|
| Fox DMO Kb                 | E 7018 – A1 H 4R | E Mo B 4 2 H5             |
| Fox DCMS Kb                | E 8018 – B2 H 4R | E CrMo 1 B 4 2 H5         |
| Fox CM 2 Kb                | E 9018 – B3 H 4R | E CrMo2 B 4 2 H5          |
| Phoenix SH V 1             | E 8018 – G       | E 50 6 Mn 1 Ni B 42 H5    |
| Phoenix SH Ni 2 K 100      | E 11018 – G      | E 69 5 Mn2 NiCrMo B 42 H5 |
| OK 73.68 VacPac            | E 8018 – C1      | E 46 56 2 Ni B 3 2 H5     |
| OK 75.75                   | E 11018 - G      | E 69 4 Mn2NiCrMo B 42 H5  |
| Phoenix SH Patinax Kb      | E 7015 – G       | E 38 3 Z 1 NiCu B 42      |
| Fox 2,5 Ni                 | E 8018 – C1 H 4R |                           |



| <b>Corrosievast staal</b> |                |                      |
|---------------------------|----------------|----------------------|
| Arosta 304L               | E 308 L - 16   | E 19 9 L R 12        |
| Limarosta 304 L           | E 308 L - 17   | E 19 9 L R 12        |
| Limarosta 304 L - 130     | E 308 L - 17   | E 19 9 L R 53        |
| Vertarosta 304L           | E 308 L - 15   | E 19 9 L R 21        |
| Arosta 304 H              | E 308H - 16    | E 19 9 H R 12        |
| Jungo 304 L               | E 308L - 15    | E 19 9 L B 22        |
| Arosta 347                | E 347 - 16     | E 19 9 Nb R 12       |
| Jungo 347                 | E 347 - 15     | E 19 9 Nb B 22       |
| Arosta 316 L              | E 316 L - 16   | E 19 12 3 L R 12     |
| Limarosta 316 L           | E 316 L - 17   | E 19 12 3 L R 12     |
| Limarosta 316 L - 130     | E 316 L - 17   | E 19 12 3 L R 53     |
| Vertarosta 316 L          | E 316 L - 15   | E 19 12 3 L R 21     |
| Jungo 316 L               | E 316 L - 15   | E 19 12 3 L B 22     |
| Arosta 318                | E 318 - 16     | E 19 12 3 Nb R 12    |
| Jungo 318                 | E 318 - 15     | E 19 12 3 Nb B 22    |
| Intherma 310              | E 310 - 16     | E 25 20 R 12         |
| Intherma 310 B            | E 310 - 15     | E 25 20 B 12         |
| Jungo 4500                | E 385 - 16     | E 20 25 5Cu N L R 12 |
| Arosta 309 s              | E 309 L - 16   | E 23 12 L R 32       |
| Arosta 309 Mo             | E 309L Mo - 16 | E 23 12 2 L R 32     |
| Nichroma 160              | E 309 Mo - 16  | E 23 12 2 L R 53     |
| Limarosta 309 S           | E 309 L - 17   | E 23 12 L R 32       |
| Jungo 309 L               | E 309 L - 15   | E 23 12 L B 22       |
| Arosta 309 H              | E 309 H - 16   | E 23 12 R 32         |

|                  |             |                   |
|------------------|-------------|-------------------|
| Limarosta 312    | E 312 - 17  | E 29 9 R 12       |
| Arosta 307       | E 307 - 16  | E 18 8 Mn R 12    |
| Arosta 307 - 160 | E 307 - 26  | E 18 8 Mn R 53    |
| Jungo 307        | E 307 - 15  | E 18 8 Mn B 22    |
| Arosta 329       | E 25 4 R 12 |                   |
| Arosta 4462      | E 2209 - 16 | E 22 9 3 N L R 32 |
| Jungo 4462       | E 2209 - 15 | E 22 9 3 N L B 22 |
| Jungo Zeron 100  | E 2595 - 15 | E 25 9 4 N L B 42 |

| <b>Nikkellegeringen</b> |                    |                         |
|-------------------------|--------------------|-------------------------|
| UTP 068 HH              | E NiCrFe - 3 (mod) |                         |
| UTP 6222 Mo             | E NiCrMo - 3       |                         |
| NiCro 70 / 15 Mn        | E NiCrFe - 3       | E Ni 6182 (NiCr15Fe6Mn) |
| Nyloid 2                | E NiCrMo - 6       | E Ni 6620 (NiCr14Mo7Fe) |

# OK 39.50

**Zure elektrode met verhoogd rendement voor lassen in platte posities**

## Omschrijving:

OK 39.50 is bijzonder geschikt voor het productief lassen van staande hoeklassen . Tevens voor het lassen onder de hand van hoeklassen en stompverbindingen. De elektrode kan slepend verlast worden en geeft een zeer glad lasuiterlijk. Uitstekende brokkelige slaklossing waardoor ook goed toepasbaar is smalle diepe voegen.

**Rendement:** ca. 165 %

**Stroomsoort:**

wissel: 65 V OCV  
gelijk: +/-

**Lasposities:**



## Classificaties:

SFA/AWS A5.1 : E7027  
EN ISO 2560-A: E 42 2 RA 53

## Mechanische eigenschappen:

ReL rekgrens > 420 MPa  
Treksterkte > 510 MPa  
Rek A5 (%) > 22  
Kerfslag: -40°C > 28 J

**Richtsamenstelling:** C = 0,09 ; Si = 0,25 % ; Mn = 0,7 % ; P en S < 0,03%

## Technische gegevens:

| Afmetingen Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |        |
|--------------------|--------|------------|-----|------------|--------------|------------|----------------|--------|
| Dia.               | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) | kg/uur |
| 3,2                | 450    | 130        | 170 | 69         | 22,6         | 279        | 6,6            | 2,3    |
| 4,0                | 450    | 150        | 230 | 71         | 15,6         | 195        | 9,2            | 3,2    |
| 5,0                | 450    | 200        | 350 | 65         | 10,1         | 120        | 14,2           | 5,5    |

# OK 33.60

## Rutielelektrode met verhoogd rendement voor lassen in platte posities

### Omschrijving:

OK 33.60 is bijzonder geschikt voor staande hoeklassen . Tevens voor het lassen onder de hand van hoeklassen en stompverbindingen. De elektrode kan slepend verlast worden, geeft een goede inbranding en een glad lasuiterlijk. Uitstekende slaklossing.

**Rendement:** ca. 160 %

**Stroomsoort:**

wissel: 50 V OCV  
gelijk: +/-

**Lasposities:**



### Classificaties:

SFA/AWS A5.1 : E7024  
EN ISO 2560-A: E 42 0 RR 53

### Mechanische eigenschappen:

ReL rekgrens > 420 MPa  
Treksterkte > 510 MPa  
Rek A5 (%) > 25  
Kerfslag: -20°C > 28 J

**Richtsamenstelling:** C < 0,12 % ; Si = 0,4 % ; Mn = 0,7 % ; P < 0,030 % ; S < 0,020 %

### Technische gegevens:

| Afmetingen Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |      |
|--------------------|--------|------------|-----|------------|--------------|------------|----------------|------|
| Dia.               | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |      |
| 3,2                | 450    | 130        | 170 | 71         | 23           | 294        | 6,4            | 2,20 |
| 4,0                | 450    | 150        | 230 | 77         | 15           | 195        | 9,1            | 3,10 |
| 5,0                | 450    | 200        | 350 | 78         | 9,5          | 114        | 15,5           | 4,90 |

# OK 33.80

## Rutielelektrode met verhoogd rendement voor lassen in platte posities

### Omschrijving:

OK 33.80 is bijzonder geschikt voor het productief lassen van staande hoeklassen . Tevens voor het lassen onder de hand van hoeklassen en stompverbindingen. De elektrode kan slepend verlast worden, geeft een goede inbranding en een glad lasuiterlijk. Uitstekende slaklossing.

**Rendement:** ca. 180 %

**Stroomsoort:**

wissel: 50 V OCV  
gelijk: +/-

**Lasposities:**



### Classificaties:

SFA/AWS A5.1 : E7024  
EN ISO 2560-A: E 42 0 RR 73

### Mechanische eigenschappen:

ReL rekgrens > 420 MPa  
Treksterkte > 510 MPa  
Rek A5 (%) > 22  
Kerfslag: 0°C > 47 J

**Richtsamenstelling:** C < 0,12 % ; Si = 0,45 % ; Mn = 0,70% ; S < 0,020 ;  
P < 0,030 %

### Technische gegevens:

| Afmetingen Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |        |
|--------------------|--------|------------|-----|------------|--------------|------------|----------------|--------|
| Dia.               | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) | kg/uur |
| 2,5                | 350    | 85         | 125 | 43         | 53           | 450        | 3,0            | 1,60   |
| 3,2                | 450    | 130        | 170 | 69         | 21           | 273        | 6,8            | 2,50   |
| 4,0                | 450    | 180        | 230 | 69         | 13,5         | 159        | 11,1           | 3,80   |
| 5,0                | 450    | 250        | 340 | 68         | 9,1          | 99         | 16,3           | 5,80   |
| 6,0                | 450    | 300        | 430 | 79         | 6,4          | 78         | 22,7           | 7,10   |

# OK 43.32

## Rutielelektrode voor hoeklassen in platte posities

### Omschrijving:

OK 43.32 is een dikbektelede rutielelektrode . Speciaal voor hoeklassen met fraai glad lasuiterlijk zonder randinkarteling. De elektrode is goed uitrekbaar, waardoor lassen van meerdere lasdiktes met zelfde diameter mogelijk is. De slak is gemakkelijk te verwijderen of zelflossend. De kleinere diameters zijn geschikt voor het vertikaal opgaand lassen. Door de lage ontsteekspanning kan OK 43.32 ook op hobbylastoestellen uitstekend worden verlast. Stabiele lasboog ook bij lage stromen, waardoor ideaal voor dunne platen.

**Rendement:** ca. 100 %

**Stroomsoort:**

wissel: 50 V OCV  
gelijk: +/-

**Lasposities:**



### Classificaties:

SFA/AWS A5.1 : E6013  
EN ISO 2560-A: E 42 0 RR 12

### Mechanische eigenschappen:

ReL rekgrens > 420 MPa  
Treksterkte > 510 MPa  
Rek A5 (%) > 25  
Kerfslag: 0°C > 47 J

**Richtsamenstelling:** C < 0,12 % ; Si = 0,55 % ; Mn = 0,5% ; S en P < 0,030 %

### Technische gegevens:

| Afmetingen Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |      |
|--------------------|--------|------------|-----|------------|--------------|------------|----------------|------|
| Dia.               | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |      |
| kg/uur             |        |            |     |            |              |            |                |      |
| 1,6                | 300    | 30         | 60  | 34         | 263          | 1434       | 0,8            | 0,4  |
| 2,0                | 300    | 50         | 60  | 36         | 167          | 1080       | 1,1            | 0,6  |
| 2,5                | 350    | 50         | 110 | 46         | 88           | 720        | 2,0            | 0,90 |
| 3,2                | 350    | 80         | 150 | 57         | 51           | 390        | 3,6            | 1,30 |
| 3,2                | 450    | 80         | 140 | 74         | 40,5         | 390        | 4,6            | 1,30 |
| 4,0                | 350    | 120        | 210 | 63         | 35           | 270        | 5,5            | 1,60 |
| 4,0                | 450    | 120        | 210 | 76         | 27           | 270        | 7,3            | 1,90 |
| 5,0                | 450    | 170        | 290 | 87         | 17           | 165        | 11             | 2,50 |



# OK 46.00

## Universele rutielelektrode voor het lassen in alle posities

### Omschrijving:

OK 46.00 is een gemakkelijk lassende rutielelektrode geschikt voor alle lasposities in dunne en middeldikke plaat.

De elektrode ontsteekt en herontsteekt gemakkelijk en is hierdoor bijzonder geschikt als hechtelektrode.

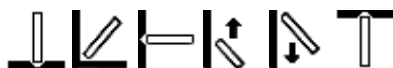
Door de goede overbruggingseigenschappen kan de OK 46.00 toegepast worden waar slecht passende naden voorkomen. Door de lage ontsteekspanning geschikt voor het lassen op hobby lastoestellen. Tevens geschikt voor het lassen van vervuilde plaat.

**Rendement:** ca. 100 %

**Stroomsoort:**

wissel: OCV 50 V  
gelijk: +/-

**Lasposities:**



### Classificaties:

SFA/AWS A5.1 : E6013  
EN ISO 2560-A: E 38 0 RC 11

### Mechanische eigenschappen:

ReL rekgrens > 380 MPa  
Treksterkte > 480 MPa  
Rek A5 (%) > 24  
Kerfslag: 0°C > 47 J  
-20°C > 28 J

**Richtsamenstelling:** C = 0,07 % ; Si = 0,3% ; Mn = 0,4 % ; S en P < 0,03%

### Technische gegevens:

| Afmetingen<br>Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |
|-----------------------|--------|------------|-----|------------|--------------|------------|----------------|
| Dia.                  | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |
| kg/uur                |        |            |     |            |              |            |                |
| 1,6<br>0,38           | 300    | 30         | 60  | 36         | 263          | 1908       | 0,6            |
| 2,0<br>0,55           | 300    | 50         | 70  | 38         | 172          | 1140       | 1,0            |
| 2,5<br>0,80           | 350    | 60         | 100 | 50         | 86           | 936        | 1,8            |
| 3,2<br>1,30           | 350    | 80         | 150 | 57         | 53           | 567        | 2,9            |
| 4,0<br>1,60           | 350    | 100        | 200 | 65         | 39           | 363        | 4,5            |
| 4,0<br>1,94           | 450    | 100        | 200 | 76         | 33           | 369        | 5,3            |

# OK 46.08

## Universele rutielelektrode voor het lassen in alle posities

### Omschrijving:

OK 46.08 is een zeer goed lassende rutielelektrode geschikt voor alle lasposities in dunne en middeldikke plaat.  
De elektrode ontsteekt en herontsteekt gemakkelijk en is hierdoor bijzonder geschikt als hechtelektrode.  
Door de goede overbruggingseigenschappen kan de OK 46.08 toegepast worden waar slecht passende naden voorkomen. Door de lage ontsteekspanning geschikt voor het lassen op hobby lastoestellen.

**Rendement:** ca. 95 %

**Stroomsoort:** wissel: OCV 50 V  
gelijk: +/-

**Lasposities:** 

### Classificaties:

SFA/AWS A5.1 : E6013  
EN ISO 2560-A: E 38 0 R 12

### Mechanische eigenschappen

ReL rekgrens > 380 MPa  
Treksterkte > 460 MPa  
Rek A5 (%) > 24  
Kerfslag: 0°C > 47 J

**Richtsamenstelling:** C < 0,12 % ; Si = 0,5% ; Mn = 0,5 % ; S en P < 0,03%

### Technische gegevens:

| Afmetingen Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per   |
|--------------------|--------|------------|-----|------------|--------------|------------|---------------|
| Dia.               | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks(kg) |
| kg/uur             |        |            |     |            |              |            |               |
| 2,5<br>0,70        | 350    | 70         | 100 | 58         | 93           | 810        | 1,8           |
| 3,2<br>1,10        | 350    | 100        | 140 | 60         | 57           | 540        | 2,9           |
| 4,0<br>1,30        | 350    | 120        | 170 | 73         | 37           | 360        | 4,3           |
| 5,0<br>2,00        | 450    | 160        | 250 | 105        | 27           | 210        | 8,8           |

# OK 46.44

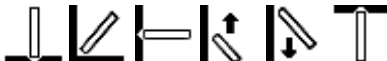
## Universele rutielelektrode voor het neergaand lassen

### Omschrijving:

OK 46.44 is een universele rutiel-cellulose elektrode geschikt voor het lassen in alle standen, maar vooral voor het vertikaal neergaand lassen. De slak loopt tijdens het lassen het smeltbad niet voor. Bij het vertikaal opgaand lassen is de elektrode uiterst geschikt voor het uitvoeren van de eerste laspas indien de lasvoeg een relatief grote vooropening heeft. Het ontsteken en herontsteken verloopt moeiteloos, wat deze elektrode tevens geschikt maakt voor hechtlassen.

**Rendement:** ca. 100 %

**Stroomsoort:** wissel: 42 V OCV  
gelijk: +/-

**Lasposities:** 

### Classificaties:

SFA/AWS A5.1 : E6013  
EN ISO 2560-A: E 38 0 RC 11

### Mechanische eigenschappen:

ReL rekgrens > 380 MPa  
Treksterkte > 510 MPa  
Rek A5 (%) > 22  
Kerfslag: -10°C > 47 J

**Richtsamenstelling:** C < 0,12 % ; Si = 0,4 % ; Mn = 0,6 % ; S en P < 0,030%

### Technische gegevens:

| Afmetingen Neersm. |               | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |      |
|--------------------|---------------|------------|-----|------------|--------------|------------|----------------|------|
| Dia.               | Lengte kg/uur | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |      |
| 2,5                | 350           | 70         | 100 | 58         | 80           | 900        | 2,1            | 0,78 |
| 3,2                | 350           | 90         | 150 | 52,3       | 68,2         | 570        | 2,9            | 1,00 |
| 4,0                | 350           | 110        | 200 | 62,4       | 36,6         | 360        | 4,4            | 1,58 |

# Filarc 48

Universele rutielelektrode voor het lassen in alle posities

## Omschrijving:

Filarc 48 is een gemakkelijk lassende rutielelektrode geschikt voor alle lasposities maar vooral voor hoeklassen in plafond positie.

Toepassingen in scheepsbouw en algemene constructie.

Tevens geschikt voor het lassen van geroeste en vervuilde plaat. Te lassen met korte boog.

**Rendement:** ca. 95 %

**Stroomsoort:**

wissel: OCV 50 V  
gelijk: -

**Lasposities:**



## Classificaties:

SFA/AWS A5.1 : E6013  
EN ISO 2560-A: E 42 0 RC 11

## Mechanische eigenschappen

Rp0.2 % rekgrens > 430 MPa  
Treksterkte > 510 MPa  
Rek A4 (%) > 24  
Kerfslag: 0°C > 47 J  
-20°C > 28 J

**Richtsamenstelling:** C = 0,08 % ; Si = 0,5% ; Mn = 0,6 % ; S en P < 0,03%

## Technische gegevens:

| Afmetingen<br>Neersm |                  | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |      |
|----------------------|------------------|------------|-----|------------|--------------|------------|----------------|------|
| Dia.                 | Lengte<br>kg/uur | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |      |
| 2,5                  | 350              | 60         | 90  | 49         | 91           | 840        | 1,8            | 0,80 |
| 3,2                  | 350              | 90         | 140 | 57         | 59           | 495        | 2,9            | 1,10 |
| 4,0                  | 350              | 110        | 185 | 64         | 40           | 345        | 4,4            | 1,40 |

# OK 48.00

## Universele basische elektrode met verhoogde treksterkte

### Omschrijving:

OK 48.00 is een universele basische elektrode die een goede lasbaarheid combineert met uitstekende mechanische eigenschappen. Dit type is bijzonder geschikt voor het lassen van fijnkorrelstalen en zwaar belaste constructies zoals stoomketels, e.d. Geschikt voor herstellingen aan staal en vrij ongevoelig voor samenstelling van het moedermateriaal met zeer grote scheurbestendigheid. Bijzonder geschikt voor het stapelen. Snelstollend lasmetaal met gemakkelijk te verwijderen slak. De bekleding is van het laagwaterstoftype. Lassen met korte boog. Is te bekomen in VacPac.

**Rendement:** ca. 120 %

**Stroomsoort:** gelijk: +(-)

**Lasposities:** 

**Waterstof:** < 5 ml/100 gr

### Classificaties:

SFA/AWS A5.1 : E7018  
EN ISO 2560-A: E 42 4 B 42 H5

### Mechanische eigenschappen:

ReL rekgrens > 420 MPa  
Treksterkte > 510 MPa  
Rek A5 (%) > 22  
Kerfslag: -40°C > 47 J

**Richtsamenstelling:** C < 0,1% ; Si = 0,5 % ; Mn = 1,1 % ; S < 0,02 % ; P < 0,015 %

### Technische gegevens:

| Afmetingen Neersm |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |     |
|-------------------|--------|------------|-----|------------|--------------|------------|----------------|-----|
| Dia.              | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |     |
| kg/uur            |        |            |     |            |              |            |                |     |
| 2,5               | 350    | 80         | 110 | 56         | 62,5         | 513        | 2,4            | 1,0 |
| 3,2               | 350    | 90         | 140 | 61         | 54           | 345        | 4,0            | 1,5 |
| 3,2               | 450    | 90         | 140 | 76         | 32,3         | 372        | 4,8            | 1,5 |
| 4,0               | 350    | 125        | 210 | 64         | 35           | 258        | 5,6            | 2,1 |
| 4,0               | 450    | 125        | 210 | 86         | 20,5         | 258        | 7,2            | 2,1 |
| 5,0               | 450    | 200        | 260 | 102        | 13,5         | 168        | 10,6           | 2,6 |

# Filarc 36 S

Universele basische elektrode met verhoogde treksterkte

## Omschrijving:

Filarc 36 S is een universele AC/DC basische elektrode voor het lassen van grond- en vullagen in alle posities.

Zeer goede lasbaarheid en uitstekende röntgendichtheid. Veel gebruikt in scheepsbouw, druk- en ketelbouw. Las met korte boog en een licht pendelende beweging.

Is te bekomen in VacPac.

**Rendement:** ca. 100 %

**Stroomsoort:** gelijk: +(-)  
wissel: OCV 70 V

**Lasposities:** 

**Waterstof:** < 10ml/100 gr

## Classificaties:

SFA/AWS A5.1 : E7016

EN ISO 2560-A: E 42 2 B 12 H10

## Mechanische eigenschappen:

ReL rekgrens > 420 MPa

Treksterkte > 510 MPa

Rek A5 (%) > 26

Kerfslag: -30°C > 28 J

**Richtsamenstelling:** C < 0,08% ; Si = 0,7 % ; Mn = 0,85 % ; S en P < 0,03 %

## Technische gegevens: (verpakking voor VacPac)

| Afmetingen<br>Neersm |                  | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |     |
|----------------------|------------------|------------|-----|------------|--------------|------------|----------------|-----|
| Dia.                 | Lengte<br>kg/uur | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |     |
| 2,5                  | 350              | 55         | 85  | 50         | 90           | 333        | 1,9            | 0,8 |
| 3,2                  | 350              | 85         | 140 | 65         | 47,6         | 294        | 3,5            | 1,1 |
| 4,0                  | 350              | 110        | 180 | 75         | 32,4         | 210        | 4,9            | 1,6 |
| 5,0                  | 450              | 180        | 240 | 95         | 15,9         | 132        | 10             | 2,4 |

# OK 53.16 Spezial

## Dubbelbektele elektrode voor het lassen in alle standen

### Omschrijving:

OK 53.16 is een dubbelbektele elektrode die de goede laseigenschappen van een rutielelektrode combineert met de goede mechanische eigenschappen van een basische.

De dubbele bekleding laat het lassen door middel van kleine transformatoren met lage openspanning toe. Geeft een makkelijk te volgen smeltbad en een mooi lasuiterlijk. Te bekomen in VacPac.

**Rendement:** ca. 105 %

**Stroomsoort:** wissel: 50 V OCV  
gelijk: +/-

**Lasposities:** 

**Waterstof:** < 10 ml/100 gr

### Classificaties:

SFA/AWS A5.1 : E7016  
EN ISO 2560-A: E 38 2 B 32 H10

### Mechanische eigenschappen

ReH rekgrens > 380 MPa  
Treksterkte > 510 MPa  
Rek A5 (%) > 22  
Kerfslag: -20°C > 47 J

**Richtsamenstelling:** C < 0,1 % ; Si = 0,5 % ; Mn = 0,9 % ; S en P < 0,03%

### Technische gegevens:

| Afmetingen<br>Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |      |
|-----------------------|--------|------------|-----|------------|--------------|------------|----------------|------|
| Dia.                  | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |      |
| kg/uur                |        |            |     |            |              |            |                |      |
| 2,5                   | 350    | 50         | 90  | 59         | 83,3         | 600        | 2,1            | 0,73 |
| 3,2                   | 350    | 90         | 150 | 56         | 53,6         | 375        | 3,4            | 1,2  |
| 3,2                   | 450    | 90         | 150 | 72         | 39,5         | 375        | 4,5            | 1,27 |
| 4,0                   | 450    | 120        | 190 | 90         | 24           | 240        | 6,9            | 1,65 |
| 5,0                   | 450    | 160        | 230 | 109        | 15,5         | 150        | 10,5           | 2,14 |

# Filarc 56S

## Laagtemperatuur basische elektrode voor alle posities

### Omschrijving:

Filarc 56S is een CTOD geteste basische laagwaterstofelektrode die een goede lasbaarheid combineert met uitstekende mechanische eigenschappen. Dit type is bijzonder geschikt voor het lassen van fijnkorrelstalen en zwaar belaste constructies in moeilijke omstandigheden. Bijzonder geschikt voor het lassen van doorlassingen in moeilijke posities bij pijplassen en stompverbindingen boven het hoofd. De bekleding is van het laagwaterstoftype en neemt langzaam terug vocht op. Lassen met korte boog. Is te bekomen in VacPac.

**Rendement:** ca. 100 %

**Stroomsoort:** gelijk: +(-)  
wissel: OCV 65V

**Lasposities:**



**Waterstof:**

< 5ml/100 gr

### Classificaties:

SFA/AWS A5.1 : E7016-1  
EN ISO 2560-A: E 42 5 B 12 H5

### Mechanische eigenschappen

ReL rekgrens > 420 MPa  
Treksterkte > 510 MPa  
Rek A5 (%) > 22  
Kerfslag: -50°C > 47 J

**Richtsamenstelling:** C = 0,07 % ; Si = 0,4 % ; Mn = 1,3 % ; P < 0,025 % ;  
S < 0,015 %

### Technische gegevens: (verpakking voor VacPac)

| Afmetingen Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |        |
|--------------------|--------|------------|-----|------------|--------------|------------|----------------|--------|
| Dia.               | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) | kg/uur |
| 2,5                | 350    | 55         | 85  | 50         | 90           | 324        | 1,9            | 0,80   |
| 3,2                | 350    | 80         | 140 | 53         | 52           | 348        | 3,1            | 1,30   |
| 3,2                | 450    | 80         | 130 | 73         | 41           | 330        | 4,0            | 1,20   |
| 4,0                | 350    | 110        | 180 | 62         | 34           | 234        | 4,6            | 1,70   |
| 4,0                | 450    | 110        | 170 | 83         | 26           | 228        | 5,9            | 1,70   |
| 5,0                | 450    | 180        | 230 | 90         | 17           | 138        | 8,9            | 2,40   |



# OK 55.00

## Universeel basische elektrode met verhoogd rendement

### Omschrijving:

OK 55.00 is een laagwaterstof elektrode voor het lassen van hogesterktestaal in alle posities. Goede weerstand tegen warscheuren.

De taaiheid van het lasmetaal bij lage temperatuur is uitstekend. Te lassen met korte boog. Is te bekomen in VacPac

**Rendement:** ca. 125 %

**Stroomsoort:** wissel: OCV 65 V  
gelijk: +

**Lasposities:**



**Waterstof:** < 4 ml/100 gr

### Classificaties:

SFA/AWS A5.1 : E7018-1H4 R  
EN ISO 2560-A: E 46 5 B 32 H5

### Mechanische eigenschappen

ReL rekgrens > 460 MPa  
Treksterkte > 560 MPa  
Rek A5 (%) > 22  
Kerfslag: -50°C > 47 J

**Richtsamenstelling:** C = 0,08 % ; Si = 0,5 % ; Mn = 1,3 % ; S en P < 0,03%

### Technische gegevens:

| Afmetingen Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |      |
|--------------------|--------|------------|-----|------------|--------------|------------|----------------|------|
| Dia.               | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |      |
| kg/uur             |        |            |     |            |              |            |                |      |
| 2,5                | 350    | 80         | 110 | 63,5       | 65,8         | 501        | 2,38           | 0,86 |
| 3,2                | 350    | 110        | 140 | 72         | 41,1         | 363        | 3,9            | 1,22 |
| 3,2                | 450    | 110        | 140 | 88         | 30           | 363        | 5,0            | 1,4  |
| 4,0                | 450    | 140        | 200 | 94         | 19           | 258        | 7,4            | 2,0  |
| 5,0                | 450    | 200        | 270 | 94         | 13           | 171        | 10,8           | 3,0  |

# OK 38.48

## Basische elektrode met verhoogd rendement voor platte positie

### Omschrijving:

OK 38.48 is bijzonder geschikt voor staande hoeklassen met goede aanvloeiing en glad lasuiterlijk.

Deze hoogrendementselektrode is gemakkelijk lasbaar en heeft een goede slaklossing.

Zeer goede hechtalselektrode. Is te bekomen in VacPac.

**Rendement:** ca. 150 %

**Stroomsoort:** gelijk: +(-)  
wissel: OCV 60 V

**Lasposities:**



**Waterstof:** < 8ml/100 gr

### Classificaties:

SFA/AWS A5.1 : E7028  
EN ISO 2560-A: E 42 3 RB 53 H10

### Mechanische eigenschappen:

ReL rekgrens > 420 MPa  
Treksterkte > 510 MPa  
Rek A5 (%) > 22  
Kerfslag: -30°C > 47 J

**Richtsamenstelling:** C < 0,065 % ; Si = 0,45 % ; Mn = 1,05 % ; S en P < 0,03 %

### Technische gegevens:

| Afmetingen<br>Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |        |
|-----------------------|--------|------------|-----|------------|--------------|------------|----------------|--------|
| Dia.                  | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) | kg/uur |
| 3,2                   | 350    | 100        | 160 | 66         | 34           | 270        | 4,9            | 1,6    |
| 4,0                   | 450    | 150        | 230 | 88         | 17,7         | 174        | 9,5            | 2,5    |
| 5,0                   | 450    | 200        | 320 | 84         | 11           | 120        | 14,2           | 4,2    |

# FILARC 27P

## Basische elektrode voor verticaal neergaand lassen

### Omschrijving:

Filarc 27P is een basische laagwaterstofelektrode die speciaal ontwikkeld werd voor het neergaand lassen van buizen.

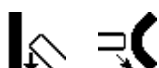
Dit type is bijzonder geschikt voor pijpleidingen en toepassingen op compressor stations en in olie-en gasinstallaties in staal API 5LX52 tot X70. De productiviteit is 25 tot 30 % hoger dan bij cellulose elektroden en 40 tot 50 % hoger dan bij opgaand lassen. Lassen met korte boog. Dia. 2,5 mm kan opgaand gelast worden. Bij voorkeur DC - polariteit. Is te bekomen in VacPac.

**Rendement:** ca. 120 %

**Stroomsoort:** gelijk: +(-)

**Lasposities:** 

**Waterstof:** < 5ml/100 gr



### Classificaties:

SFA/AWS A5.5 : E8018-G  
EN ISO 2560-A: E 46 4 B 41 H5

### Mechanische eigenschappen:

Rp0,2 rekgrens > 460 MPa  
Treksterkte > 550 MPa  
Rek A5 (%) > 25  
Kerfslag: -40°C > 80 J

**Richtsamenstelling:** C = 0,08 % ; Si = 0,5 % ; Mn = 1,2 % ; S en P < 0,015 %

### Technische gegevens: (verpakking voor VacPac)

| Afmetingen |        | Stroom (A)<br>Neersm. |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |     |
|------------|--------|-----------------------|-----|------------|--------------|------------|----------------|-----|
| Dia.       | Lengte | min                   | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |     |
| kg/uur     |        |                       |     |            |              |            |                |     |
| 2,5        | 350    | 80                    | 100 | 53         | 66,7         | 456        | 2,2            | 1,0 |
| 3,2        | 350    | 110                   | 150 | 53         | 43,7         | 360        | 3,4            | 1,6 |
| 4,0        | 350    | 180                   | 220 | 50         | 27           | 234        | 5,0            | 2,8 |
| 4,5        | 350    | 230                   | 270 | 50         | 22,2         | 180        | 6,4            | 3,4 |

EN ISO 3580-A: E Mo B 4 2 H5  
 EN ISO 3580-B: E4918-1M3 H5  
 EN ISO 2560-A:2010: E 46 5 Mo B 4 2 H5  
 EN ISO 2560-B:2010: E4918-1M3 A U H5  
 AWS A5.5: E7018-A1H4R  
 AWS A5.5M: E4918-A1H4R

## BÖHLER FOX DMO Kb

**SMAW basic electrode, low-alloyed,  
high temperature**

### Description

Basic low-hydrogen electrode for 0.5% Mo-alloyed boiler, plates, and tube steels. Approved in long-term condition up to +550°C service temperature. For high quality welds of long term stressed components with reliable mechanical properties under high and low temperature conditions. Crack resistant, tough and ageing resistant. Very low hydrogen content (acc. to AWS condition HD < 4 ml/100 g). Metal recovery approx. 115%.

### Typical Composition of All-weld Metal

|      | C           | Si          | Mn         | Mo          |
|------|-------------|-------------|------------|-------------|
| wt-% | <b>0.08</b> | <b>0.35</b> | <b>0.8</b> | <b>0.45</b> |

### Mechanical Properties of All-weld Metal

|                                                 | u                 | a                 |
|-------------------------------------------------|-------------------|-------------------|
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):   | <b>510</b> (≥480) | <b>520</b> (≥470) |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa): | <b>590</b> (≥560) | <b>600</b> (≥560) |
| elongation A ( $L_0=5d_0$ ) %:                  | <b>26</b> (≥22)   | <b>25</b> (≥22)   |
| impact work ISO-V KV J                          |                   |                   |
| +20°C:                                          | <b>170</b> (≥120) | <b>170</b> (≥120) |
| -50°C:                                          | <b>62</b> (≥47)   |                   |

u untreated, as-welded

a annealed 620°C/2h/furnace down to 300°C/air

### Operating Data



re-drying if necessary:

**300-350°C, min. 2 h**

electrode identification:

**FOX DMO Kb 7018-A1 E Mo B**

| ø mm | L mm    | amps A  |
|------|---------|---------|
| 2.5  | 250/350 | 80-110  |
| 3.2  | 350     | 100-140 |
| 4.0  | 350/450 | 130-180 |
| 5.0  | 450     | 190-230 |

**=+**

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

### Base Materials

high temperature steels and similar alloyed cast steels, steels resistant to caustic cracking and ageing resistant steels

16Mo3, S355J2G3, E295, E335, P255G1TH, L320 - L415NB, L320MB - L415MB, S255N, P295GH, P310GH, 15NiCuMoNb 5, 20MnMoNi4-5, 17MnMoV6-4, S255N - S500N, S255NH - S500NH, S255NL - S500NL, GE240-GE300, 22Mo4, GP240GH

ASTM A335 Gr. P1; A161-94 Gr. T1; A217 Gr. WC1; A182M Gr. F1; A204M Gr. A, B, C; A250M Gr. T1

### Approvals and Certificates

TÜV-D (0019.), KTA 1408.1 (8053.00), DB (10.014.14), ÖBB, TÜV-A (71), ABS (E 7018-A1), DNV (NV 0,3Mo), GL (15 Mo 3), RMR (-), Statoil, LTSS, VUZ, SEPROZ, CRS (3YH10), CE, NAKS

### Same Alloy Filler Metals

|                  |            |                  |                |
|------------------|------------|------------------|----------------|
| SMAW electrode:  | FOX DMO Ti | Flux cored wire: | DMO Ti-FD      |
| GTAW rod:        | DMO-IG     | SAW combination: | EMS 2 Mo/BB 24 |
| GMAW solid wire: | DMO-IG     |                  | EMS 2 Mo/BB 25 |
|                  |            | Gas welding rod: | DMO            |

EN ISO 3580-A: E CrMo1 B 4 2 H5  
 EN ISO 3580-B: E5518-1CM H5  
 AWS A5.5: E8018-B2H4R  
 AWS A5.5M: E5518-B2H4R

## BÖHLER FOX DCMS Kb

**SMAW basic electrode, low-alloyed,  
 high temperature**

### Description

Basic low hydrogen electrode for 1% Cr 0.5% Mo alloyed boiler, plate, and tube steels. Approved in long-term condition up to +570°C service temperature. Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant. High ductility and crack resistance. The weld metal deposit is heat treatable. Very low hydrogen content (acc. AWS condition HD < 4 ml/100 g). Metal recovery approx. 115%. Suitable for step-cooling application. Bruscato ≤15ppm. Post weld tempering at 660-700°C for at least ½ h followed by cooling in furnace down to 300°C and still air.

### Typical Composition of All-weld Metal

|      | C          | Si          | Mn         | Cr          | Mo         | P             | As            | Sb            | Sn            |
|------|------------|-------------|------------|-------------|------------|---------------|---------------|---------------|---------------|
| wt-% | <b>0.1</b> | <b>0.35</b> | <b>0.7</b> | <b>1.05</b> | <b>0.5</b> | <b>≤0.010</b> | <b>≤0.005</b> | <b>≤0.005</b> | <b>≤0.005</b> |

### Mechanical Properties of All-weld Metal

|                                                 | a                 | v                 |
|-------------------------------------------------|-------------------|-------------------|
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):   | <b>530</b> (≥490) | <b>380</b> (≥330) |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa): | <b>630</b> (≥590) | <b>520</b> (≥490) |
| elongation A ( $L_0=5d_0$ ) %:                  | <b>23</b> (≥22)   | <b>28</b> (≥24)   |
| impact work ISO-V KV J +20°C:                   | <b>160</b> (≥100) | <b>190</b> (≥100) |

a annealed 680°C/2h/furnace down to 300°C/air

v quenched/tempered 930°C/0.5 h/air + 680°C/10 h/furnace down to 300°C/air

### Operating Data



re-drying: if necessary:

**300-350°C, min. 2 h**

electrode identification:

**FOX DCMS Kb 8018-B2 E CrMo1 B**

| ø mm | L mm    | amps A  |
|------|---------|---------|
| 2.5  | 250/350 | 80-110  |
| 3.2  | 350     | 100-140 |
| 4.0  | 350/450 | 130-180 |
| 5.0  | 450     | 180-220 |



Preheat and interpass temperature for 13CrMo4-5 steels 200-250°C.

### Base Materials

high temperature steels and similar alloyed cast steels, case hardening and nitriding steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength up to 780 N/mm<sup>2</sup>, steels resistant to caustic cracking

1.7335 13CrMo4-5, 1.7262 15CrMo5, 1.7728 16CrMoV4, 1.7218 25CrMo4,

1.7258 24CrMo5, 1.7354 G22CrMo5-4, 1.7357 G17CrMo5-5

ASTM A193 Gr. B7, A335 Gr. P11 u. P12, A217 Gr. WC6

### Approvals and Certificates

TÜV-D (0728.), DB (10.014.32), ÖBB, TÜV-A (14), ABS (E 8018-B2), DNV (NV 1Cr 0,5Mo), GL (13 CrMo 44), LTSS, VUZ, SEPROZ, CE

### Same Alloy Filler Metals

|                       |             |                  |                     |
|-----------------------|-------------|------------------|---------------------|
| SMAW stick electrode: | FOX DCMS Ti | SAW combination: | EMS 2 CrMo/BB 24    |
| GTAW rod:             | DCMS-IG     |                  | EMS 2 CrMo/BB 24 SC |
| GMAW solid wire:      | DCMS-IG     |                  | EMS 2 CrMo/BB 25    |
| Gas welding rod:      | DCMS        | Flux cored wire: | DCMS Ti-FD          |

EN ISO 3580-A: E CrMo2 B 4 2 H5  
 EN ISO 3580-B: E6218-2C1M H5  
 AWS A5.5: E9018-B3H4R  
 AWS A5.5M: E6218-B3H4R

## BÖHLER FOX CM 2 Kb

**SMAW basic electrode**  
**low-alloyed, high temperature**

### Description

Basic electrode for 2,25 % Cr 1% Mo alloyed boiler, plate and tube steels. Approved in long-term condition up to +600°C service temperature. Core wire alloyed electrode which will provide reliable creep rupture properties for the whole service life of a boiler plant. Crack resistant and ductile deposit, high creep rupture strength, low hydrogen content (acc. AWS condition HD < 4 ml/100 g). Good weldability in all positions except vertical down. Deposit is nitridable and heat treatable. Metal recovery approx. 115%.  
 \*For step cooling applications we can offer a special product program.

### Typical Composition of All-weld Metal

|      | C           | Si         | Mn         | Cr         | Mo         | P             | As            | Sb            | Sn            |
|------|-------------|------------|------------|------------|------------|---------------|---------------|---------------|---------------|
| wt-% | <b>0.08</b> | <b>0.3</b> | <b>0.8</b> | <b>2.3</b> | <b>1.0</b> | <b>≤0.010</b> | <b>≤0.005</b> | <b>≤0.005</b> | <b>≤0.005</b> |

### Mechanical Properties of All-weld Metal

|                                                 | a                 | a1     | v          |        |
|-------------------------------------------------|-------------------|--------|------------|--------|
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):   | <b>510</b> (≥440) | (≥530) | <b>480</b> | (≥400) |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa): | <b>640</b> (≥570) | (≥620) | <b>620</b> | (≥570) |
| elongation A ( $L_0=5d_0$ ) %:                  | <b>22</b> (≥20)   | (≥17)  | <b>21</b>  | (≥18)  |
| impact work ISO-V KV J +20°C:                   | <b>180</b> (≥100) |        | <b>180</b> | (≥100) |

*a annealed, 720°C/2h/furnace down to 300°C/air*

*a1 annealed, 700°C/1h/furnace down to 200°C/air*

*v quenched/tempered 930°C/0.5 h/oil + 730°C/0.5 h/furnace down to 300°C/air*

### Operating Data



re-drying if necessary:

**300-350°C, min. 2 h**

electrode identification:

**FOX CM 2 Kb 9018-B3 E CrMo2 B**

| ø mm | L mm    | amps A  |
|------|---------|---------|
| 2.5  | 250     | 80-110  |
| 3.2  | 350     | 100-140 |
| 4.0  | 350/450 | 130-180 |
| 5.0  | 450     | 180-230 |

**=+**

Preheating and interpass temperatures 200-350°C. Post weld annealing at 700-750°C at least 1 hour followed by cooling in furnace down to 300°C and still air.

### Base Materials

high temperature steels and similar alloyed cast steels, QT-steels similar alloyed up to 980 N/mm<sup>2</sup> tensile strength, similar alloyed case hardening steels, nitriding steels

1.7380 10CrMo9-10, 1.8075 10CrSiMoV7, 1.7379 G17CrMo9-10

ASTM A335 Gr. P22, A217 Gr. WC 9

### Approvals and Certificates

TÜV-D (0722.), DB (10.014.30), ÖBB, TÜV-A (13), ABS (E 9018-B3), DNV (NV 2,25Cr 1Mo), GL (10 CrMo 9 10), VUZ, SEPROZ, CE

### Same Alloy Filler Metals

SMAW electrode: FOX CM 2 Kb SC\*  
 GTAW rod: CM 2-IG

GMAW solid wire: CM 2-IG  
 SAW combination: CM 2-UP/BB 24  
 CM 2SC-UP/BB24 SC\*

\*For step-cooling applications

Subject to change without notice

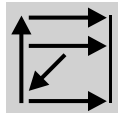
19.01.2009

# Phoenix SH V 1

Covered electrode

10.2009

Rev.: 1

|                                                                                         |                                                                                                                                                                                                                                                                                                                                                                    |                          |                                                 |                                                 |                               |
|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------|
| Classifications                                                                         | EN ISO 2560-A                                                                                                                                                                                                                                                                                                                                                      | EN ISO 2560-B            | AWS A5.5                                        | AWS A5.5M                                       |                               |
|                                                                                         | E 50 6 Mn 1 Ni B 42 H5                                                                                                                                                                                                                                                                                                                                             | E 5518-GA                | E8018-G<br>(E8018-C3 mod.)                      | E5518-G<br>(E5518-C3 mod.)                      |                               |
| Characteristics and field of use                                                        | Basic covered MnNi alloyed electrode. High toughness at temperatures as low as –60 °C (–76 °F). High radiographical soundness; H <sub>2</sub> -content ≤ 5 ml/100 g (HD). CTOD- and NDT tested.<br>Particularly suitable for welding fine grained structural steels, for steel construction and bridge building applications, gas storage spheres.                 |                          |                                                 |                                                 |                               |
| Materials                                                                               | fine grained structural steels S355N - S500Q;<br>low temperature fine grained structural steels P355NL1 - S500QL;<br>low temperature special grades P355NL2 - S500QL1;<br>general purpose structural steels;<br>pipe steels L360NB - L415NB, L360MB - L485MB, X 52 - X 70;<br>ASTM A516 Gr. 65; A572 Gr. 55, 60, 65; A633 Gr. E; A612;<br>A718 Gr. I; A537 Gr. 1-3 |                          |                                                 |                                                 |                               |
| Typical analysis in %                                                                   | C                                                                                                                                                                                                                                                                                                                                                                  | Si                       | Mn                                              | Ni                                              |                               |
|                                                                                         | 0.07                                                                                                                                                                                                                                                                                                                                                               | 0.25                     | 1.50                                            | 0.95                                            |                               |
| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment                                                                                                                                                                                                                                                                                                                                                     | Yield strength 0.2 % MPa | Tensile strength MPa                            | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN –60 °C |
|                                                                                         | AW                                                                                                                                                                                                                                                                                                                                                                 | 500                      | 580                                             | 23                                              | 140 50                        |
|                                                                                         | SR                                                                                                                                                                                                                                                                                                                                                                 | 470                      | 560                                             | 25                                              | 140 50                        |
|                                                                                         | N                                                                                                                                                                                                                                                                                                                                                                  | 295                      | 440                                             | 27                                              | 140                           |
| Welding position                                                                        |  <b>Stromart = +</b>                                                                                                                                                                                                                                                            |                          |                                                 |                                                 |                               |
| Approvals                                                                               | TÜV (Certificate No. 00531)<br>GL<br>DNV<br>ABS                                                                                                                                                                                                                                                                                                                    |                          | DB (Reg. form No. 10.132.37)<br>LR<br>Controlas |                                                 |                               |
| Packaging, weights and amperages (Tolerances acc. EN ISO 544)                           | Dimensions (mm)                                                                                                                                                                                                                                                                                                                                                    | pcs./pack                | kg/pack                                         | Amperage A                                      |                               |
|                                                                                         | 2.5 x 350                                                                                                                                                                                                                                                                                                                                                          | 200                      | 4.4                                             | 70-110                                          |                               |
|                                                                                         | 3.2 x 350                                                                                                                                                                                                                                                                                                                                                          | 120                      | 4.3                                             | 100-150                                         |                               |
|                                                                                         | 4.0 x 350                                                                                                                                                                                                                                                                                                                                                          | 90                       | 4.6                                             | 140-200                                         |                               |
|                                                                                         | 4.0 x 450                                                                                                                                                                                                                                                                                                                                                          | 80                       | 5.3                                             | 140-200                                         |                               |
|                                                                                         | 5.0 x 450                                                                                                                                                                                                                                                                                                                                                          | 60                       | 6.3                                             | 170-250                                         |                               |
|                                                                                         | 6.0 x 450                                                                                                                                                                                                                                                                                                                                                          | 40                       | 6.0                                             | 220-310                                         |                               |
|                                                                                         | Also available in “Extra dry” vacuum packaging.                                                                                                                                                                                                                                                                                                                    |                          |                                                 |                                                 |                               |

# Phoenix SH Ni 2 K 100

Covered electrode

08.2009

Rev.: 0

| Classifications | EN 757                     | AWS A5.5                    | AWS A5.5M                 |
|-----------------|----------------------------|-----------------------------|---------------------------|
|                 | E 69 5 Mn 2 NiCrMo B 42 H5 | E11018-G<br>(E11018-M mod.) | E7618-G<br>(E7618-M mod.) |

**Characteristics and field of use**

Basic covered NiCrMo alloyed electrode.  
Low H<sub>2</sub>-content ≤ 5 ml/100 g (HD) in the weld metal;  
very low moisture pickup during long term storage.  
For high strength fine grained structural steels, for cast steel qualities; weld metal insensitive to cold cracking.  
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

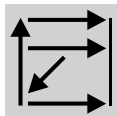
**Materials**

Quenched and tempered fine grained structural steels up to 720 MPa yield point.  
High strength fine grained structural steels S620QL - S690QL, S620QL1, S690QU, HY 100, Suprafort 700, N-AXTRA 56, 63, 70

| Typical analysis in % | C    | Si   | Mn   | Cr   | Mo   | Ni   |
|-----------------------|------|------|------|------|------|------|
|                       | 0.06 | 0.20 | 1.60 | 0.38 | 0.40 | 1.85 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2 % MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN -50 °C |
|-----------------------------------------------------------------------------------------|----------------|--------------------------|----------------------|-------------------------------------------------|-------------------------------|
|                                                                                         | AW             | 700                      | 750                  | 18                                              | 120 47                        |
|                                                                                         | SR             | 690                      | 740                  | 19                                              | 120 47                        |

**Welding position**



**Polarity** = +

**Approvals**

TÜV (Certificate No. 00548) DB (Reg. form No. 10.132.35)  
GL WIWEB (for HY100 + Suprafort700)  
BV

| Packaging, weights and amperages                | Dimensions (mm) | pcs./pack | kg/pack | Amperage A |
|-------------------------------------------------|-----------------|-----------|---------|------------|
| (Tolerances acc. EN ISO 544)                    | 2.5 x 350       | 225       | 4.7     | 70-100     |
|                                                 | 3.2 x 350       | 125       | 4.3     | 90-140     |
|                                                 | 4.0 x 450       | 90        | 6.0     | 140-190    |
|                                                 | 5.0 x 450       | 55        | 5.8     | 180-250    |
| Also available in "Extra dry" vacuum packaging. |                 |           |         |            |



# OK 73.68 VacPac

## Basische elektrode voor het lassen van lage temperatuurstaal

### Omschrijving:

OK 73.68 is gelegeerd met 2,5% Ni en geschikt voor het lassen van staal dat bij lage bedrijfstemperaturen tot -60°C wordt gebruikt.

De elektrode is goed lasbaar in alle posities. De slaklossing is zeer goed .

Om een optimale kerftaaiheid te bekomen is het aangewezen om verkant te lassen waarbij de laagdikte per rups max. 4-4,5 mm bedraagt.

**Rendement:** ca. 120 %

**Stroomsoort:** gelijk: +  
wissel: OCV 65 V

**Lasposities:**



**Waterstof:**

< 5 ml/100 gr

### Classificaties:

SFA/AWS A5.5 : E8018-C1

EN ISO 2560-A: E 46 6 2Ni B 3 2 H5

### Mechanische eigenschappen :

Rp0,2% rekgrens > 470 MPa

Treksterkte > 560 MPa

Rek A5 (%) > 22

Kerfslag: -60°C > 47 J

**Richtsamenstelling:** C = 0,06 % ; Si = 0,35 % ; Mn = 0,9 % ; Ni = 2,4 % Cr < 0,1 % ;

S en P < 0,020 %

### Technische gegevens:

| Afmetingen Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |     |
|--------------------|--------|------------|-----|------------|--------------|------------|----------------|-----|
| Dia.               | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |     |
| kg/uur             |        |            |     |            |              |            |                |     |
| 2,5                | 350    | 70         | 110 | 55         | 70           | 243        | 2,3            | 0,9 |
| 3,2                | 450    | 105        | 150 | 81         | 32           | 264        | 4,8            | 1,4 |
| 4,0                | 450    | 140        | 190 | 88         | 21           | 168        | 7,3            | 2,0 |
| 5,0                | 450    | 190        | 270 | 104        | 13,5         | 108        | 11,5           | 2,5 |

# OK 75.75 VacPac

Basische elektrode voor het lassen van staal met verhoogde trekvastheid

## Omschrijving:

OK 75.75 is geschikt voor het lassen van staal met verhoogde trekvastheid, zoals T-1 staal, Naxtra 70 e.d. De elektrode is goed lasbaar in alle posities . Het lasmetaal heeft een goede taaiheid tot – 51°C.

**Rendement:** ca. 120 %

**Stroomsoort:** gelijk: +

**Lasposities:** 

**Waterstof:** < 5 ml/100g

## Classificaties:

SFA/AWS A5.5 : E11018-G  
EN 757: E 69 4 Mn2NiCrMo B42H5

## Mechanische eigenschappen

Rp0,2 rekgrens > 690 MPa  
Treksterkte > 760 MPa  
Rek A5 (%) = 20 (typisch)  
Kerfslag: -51°C > 27 J

**Richtsamenstelling :** C = 0,06 % ; Si = 0,35 % ; Mn = 1,8 % : Ni = 2,3 %  
Cr en Mo = 0,45 % ; S en P < 0,020 % ; V < 0,05 %

## Technische gegevens:

| Afmetingen<br>Neersm. |        | Stroom (A) |     | Opsmelt-   | Aantal el.   | Aantal per | Gewicht per    |     |
|-----------------------|--------|------------|-----|------------|--------------|------------|----------------|-----|
| Dia.                  | Lengte | min        | max | tijd (sec) | kg lasmetaal | doos       | 100 stuks( kg) |     |
| kg/uur                |        |            |     |            |              |            |                |     |
| 2,5                   | 350    | 70         | 110 | 54         | 66           | 243        | 2,3            | 1,0 |
| 3,2                   | 450    | 100        | 150 | 80         | 31,5         | 264        | 4,9            | 1,4 |
| 4,0                   | 450    | 135        | 200 | 92         | 21           | 186        | 7,4            | 1,9 |
| 5,0                   | 450    | 180        | 260 | 105        | 12           | 120        | 11,4           | 2,5 |

# Phoenix SH Patinax Kb

Covered electrode

08.2009

Rev.: 0

| Classifications | EN ISO 2560-A        | EN ISO 2560-B | AWS A5.5 | AWS A5.5M |
|-----------------|----------------------|---------------|----------|-----------|
|                 | E 38 3 Z 1 NiCu B 42 | E 4915-GA     | E7015-G  | E4915-G   |

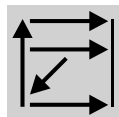
**Characteristics and field of use** Basic covered NiCu alloyed special electrode.  
For the welding of weathering and fine grained structural steels.  
Store dry. Redry for 2 h at 250 - 350 °C (482 - 662 °F).

**Materials** S235J0W, S235J2W, S355J2G1W, such as for example  
COR-TEN A, COR-TEN B, Patinax 37 etc.;  
ASTM A36, A283 Gr. B, C

| Typical analysis in % | C    | Si   | Mn   | Ni   | Cu   |
|-----------------------|------|------|------|------|------|
|                       | 0.05 | 0.30 | 0.65 | 0.60 | 0.40 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2 % MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|--------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 390                      | 480                  | 22                                              | 150                    |
|                                                                                         | SR             | 370                      | 450                  | 27                                              | 160                    |
|                                                                                         | N              | 300                      | 410                  | 30                                              | 190                    |

**Welding position**



**Polarity** = +

**Approvals** TÜV (Certificate No. 01600) DB (Reg. form No. 10.132.24)

| Packaging, weights and amperages | Dimensions (mm) | pcs./pack | kg/pack | Amperage A |
|----------------------------------|-----------------|-----------|---------|------------|
| (Tolerances acc. EN ISO 544)     | 3.2 x 350       | 125       | 4.4     | 90-140     |
|                                  | 3.2 x 450       | 125       | 5.7     | 90-140     |
|                                  | 4.0 x 450       | 80        | 5.6     | 140-190    |

EN ISO 2560-A: E 46 8 2Ni B 42 H5  
AWS A5.5: E8018-C1H4R  
AWS A5.5M: E5518-C1H4R

## BÖHLER FOX 2.5 Ni

SMAW basic electrode, low-alloyed,  
cryogenic application

### Description

Basic Ni-alloyed electrode for unalloyed and Ni-alloyed fine grained construction steels. Tough, crack resistant weld deposit. Low temperature toughness to  $-80^{\circ}\text{C}$ .

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

### Typical Composition of All-weld Metal

|      | C           | Si         | Mn         | Ni         |
|------|-------------|------------|------------|------------|
| wt-% | <b>0.04</b> | <b>0.3</b> | <b>0.8</b> | <b>2.4</b> |

### Mechanical Properties of All-weld Metal

|                                                       | u                 |                | s          |                |
|-------------------------------------------------------|-------------------|----------------|------------|----------------|
| yield strength $R_e \text{ N/mm}^2 \text{ (MPa)}$ :   | <b>490</b>        | ( $\geq 460$ ) | <b>470</b> | ( $\geq 420$ ) |
| tensile strength $R_m \text{ N/mm}^2 \text{ (MPa)}$ : | <b>570</b>        | (550-680)      | <b>550</b> | (540-640)      |
| elongation $A (L_0=5d_0) \%$ :                        | <b>30</b>         | ( $\geq 24$ )  | <b>30</b>  | ( $\geq 24$ )  |
| impact work ISO-V KV J                                | +20°C: <b>180</b> | ( $\geq 110$ ) | <b>200</b> | ( $\geq 110$ ) |
|                                                       | -80°C: <b>110</b> | ( $\geq 47$ )  |            |                |

u untreated, as-welded

s stress relieved  $580^{\circ}\text{C}/2\text{h}/\text{furnace down to } 300^{\circ}\text{C}/\text{air}$

### Operating Data



re-drying if necessary :

**300-350°C, min. 2 h**

electrode identification:

**FOX 2.5 Ni 8018-C1 E 46 8 2Ni B**

| ø mm | L mm | amps A  |
|------|------|---------|
| 2.5  | 350  | 70-100  |
| 3.2  | 350  | 110-140 |
| 4.0  | 450  | 140-180 |
| 5.0  | 450  | 190-230 |



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

### Base Materials

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

12Ni14, 14Ni6, 10 Ni 14, 13MnNi6-3, P355NL1-P460NL1, P355 NL2-P460NL2, S255N - S460N, S355NH - S460NH, S255NL - S460NL, S255NL1 - S380NL1

ASTM A633 Gr. E, A572 Gr. 65, A203 Gr. D, A333 and A334 Gr. 3, A 350 Gr. LF3

### Approvals and Certificates

TÜV-D (00147.), DB (10.014.16), ÖBB, ABS (Ni 2.1/2.6), BV (5Y40), WIWEB, DNV (5 YH10), GL (8Y46), LR (5Y40mH15), RINA (5YH5, 3H5), Statoil, SEPPOZ, CE

### Similar-alloy Filler Metals

|                  |               |
|------------------|---------------|
| GTAW rod:        | 2.5 Ni-IG     |
| GMAW solid wire: | 2.5 Ni-IG     |
| SAW combination: | Ni 2-UP/BB 24 |

## Stainless steel electrode

### Classification

AWS A5.4 : E308L-16  
EN 1600 : E 19 9 L R 12

### Temperature range

pressurized parts : -196...+350°C  
oxidation resistance : to 800°C

### General description

Rutile basic all position stainless steel electrode for 304L or equivalent steels  
Excellent corrosion resistance in oxidizing environments such as nitric acid  
High resistance to intergranular corrosion  
Smooth bead appearance  
Easy slag release  
Strong electrode coating  
Weldable on AC and DC  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

### Current type

AC / DC + / -

### Approvals

BV TÜV  
304L +

### Chemical composition (w%), typical, all weld metal

| C    | Mn   | Si   | Cr   | Ni  | FN (acc. WRC 192) |
|------|------|------|------|-----|-------------------|
| 0.02 | 0.80 | 0.80 | 19.5 | 9.7 | 04-10             |

### Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm²) | Tensile strength<br>(N/mm²) | Elongation<br>(%)  | Impact ISO-V(J)              |       |        |
|-------------------------------|-----------|--------------------------------|-----------------------------|--------------------|------------------------------|-------|--------|
|                               |           |                                |                             |                    | +20°C                        | -20°C | -196°C |
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 320       | min. 520<br>min. 510        | min. 35<br>min. 30 | not required<br>not required |       |        |
| Typical values                | AW        | 440                            | 580                         | 43                 | 70                           | 60    | 24     |

### Packaging and available sizes

|                 |                      |     |     |     |     |     |     |
|-----------------|----------------------|-----|-----|-----|-----|-----|-----|
|                 | Diameter (mm)        | 1.5 | 2.0 | 2.5 | 3.2 | 4.0 | 5.0 |
|                 | Length (mm)          | 250 | 300 | 350 | 350 | 350 | 350 |
| Unit: Box       | Pieces / unit        | 125 | 225 | 135 | 150 | 85  | 65  |
|                 | Net weight/unit (kg) | 0.7 | 2.3 | 2.6 | 4.8 | 4.9 | 4.8 |
| Unit: SRP       | Pieces / unit        | -   | -   | 69  | 56  | 29  | -   |
|                 | Net weight/unit (kg) | -   | -   | 1.4 | 1.9 | 1.5 | -   |
| Unit: Linc Can™ | Pieces / unit        | -   | -   | 222 | 141 | 84  | -   |
|                 | Net weight/unit (kg) | -   | -   | 4.6 | 4.5 | 4.3 | -   |

### Identification

Imprint: 308L-16 / AROSTA 304 L

Tip Color: light blue

Arosta® 304L: rev. EN 21

## Materials to be welded

| Steel grades                          | EN 10088-1/-2   | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------------------|-----------------|------------------|---------|----------------------------|------------------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                 |                  |         |                            |                  |
|                                       | X2 CrNi 19 11   |                  | 1.4306  | (TP)304L<br>CF-3           | S30403<br>J92500 |
|                                       | X2 CrNiN 18 10  |                  | 1.4311  | (TP)304LN<br>302,304       | S30453<br>S30400 |
| <b>Medium carbon (C &gt;0.03%)</b>    |                 |                  |         |                            |                  |
|                                       | X4 CrNi 18 10   |                  | 1.4301  | (TP)304                    | S30409           |
|                                       |                 | GX5 CrNi 19 10   | 1.4308  | CF 8                       | J92600           |
| <b>Ti-, Nb stabilized</b>             |                 |                  |         |                            |                  |
|                                       | X6 CrNiTi 18 10 |                  | 1.4541  | (TP)321<br>(TP)321H        | S32100<br>S32109 |
|                                       | X6 CrNiNb 18 10 |                  | 1.4550  | (TP)347<br>(TP)347H        | S34700<br>S34709 |
|                                       |                 | GX5 CrNiNb 19 10 | 1.4552  | CF-8C                      | J92710           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 1.5 x 250                       | 20 - 40                 | DC+             | 25                                                    | 19              | 0.44                | 5.5                          | 330                              | 1.82                                  |
| 2.0 x 300                       | 30 - 50                 | DC+             | 43                                                    | 45              | 0.55                | 10.4                         | 154                              | 1.59                                  |
| 2.5 x 350                       | 40 - 75                 | DC+             | 51                                                    | 88              | 0.86                | 19.2                         | 82                               | 1.59                                  |
| 3.2 x 350                       | 60 - 110                | DC+             | 57                                                    | 158             | 1.3                 | 32.2                         | 49                               | 1.59                                  |
| 4.0 x 350                       | 80 - 150                | DC+             | 65                                                    | 245             | 1.7                 | 47.3                         | 32                               | 1.52                                  |
| 5.0 x 350                       | 140 - 220               | DC+             | 66                                                    | 390             | 2.7                 | 76.7                         | 20                               | 1.56                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 1.5                                |       | 35A   | 35A   |          |       |          |
| 2.0                                |       | 45A   | 45A   | 40A      | 40A   | 40A      |
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |
| 5.0                                | 180A  | 180A  | 180A  |          |       |          |

For root passes DC- is recommended.

## Stainless steel electrode

## Classification

AWS A5.4 : E308L-17  
EN 1600 : E 19 9 L R 12

## Temperature range

pressurized parts : -196...+350°C  
oxidation resistance : to 800°C

## General description

A rutile-basic all position stainless steel electrode for 304L or equivalent steels

Mirror like bead appearance

Self releasing slag

Excellent side wall wetting, no undercut

High resistance to porosity

Weldable on AC and DC

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC + / -

## Approvals

| DNV     | GL   | LR   | RMRS | TÜV |
|---------|------|------|------|-----|
| 308LH10 | 4550 | 304L | 304L | +   |

## Chemical composition (w%), typical, all weld metal

| C     | Mn   | Si   | Cr   | Ni  | FN (acc. WRC 192) |
|-------|------|------|------|-----|-------------------|
| 0.025 | 0.75 | 0.95 | 19.0 | 9.7 | 04-10             |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C |
| Required: AWS A5.4 |           | not required                                | min. 520                                 | min. 35           | not required    |       |
| EN 1600            |           | min. 320                                    | min. 510                                 | min. 30           | not required    |       |
| Typical values     | AW        | 440                                         | 600                                      | 45                | 75              | 60    |

## Packaging and available sizes

|                 |                      | Diameter (mm) |     |     |     |     |
|-----------------|----------------------|---------------|-----|-----|-----|-----|
|                 |                      | 2.0           | 2.5 | 3.2 | 4.0 | 5.0 |
| Unit: Box       | Length (mm)          | 300           | 350 | 350 | 450 | 450 |
|                 | Pieces / unit        | 125           | 125 | 135 | 85  | 55  |
| Unit: SRP       | Net weight/unit (kg) | 2.3           | 2.7 | 4.7 | 5.8 | 5.8 |
|                 | Pieces / unit        | 60            | 65  | 52  | 28  | 22  |
| Unit: Linc Can™ | Net weight/unit (kg) | 0.6           | 1.4 | 1.8 | 2.0 | 2.4 |
|                 | Pieces / unit        | -             | 203 | 124 | 78  | -   |
|                 | Net weight/unit (kg) | -             | 4.4 | 4.3 | 5.3 | -   |

## Identification

Imprint: 308L-17 / LIMAROSTA 304 L

Tip Color: light blue

Limarosta® 304L: rev. EN 21

## Materials to be welded

| Steel grades                          | EN 10088-1/-2   | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS    |
|---------------------------------------|-----------------|------------------|---------|----------------------------|--------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                 |                  |         |                            |        |
|                                       | X2 CrNi 19 11   |                  | 1.4306  | (TP)304L                   | S30403 |
|                                       |                 |                  |         | CF-3                       | J92500 |
|                                       | X2 CrNiN 18 10  |                  | 1.4311  | (TP)304LN                  | S30453 |
|                                       |                 |                  |         | 302,304                    | S30400 |
| <b>Medium carbon (C &gt;0.03%)</b>    |                 |                  |         |                            |        |
|                                       | X4 CrNi 18 10   |                  | 1.4301  | (TP)304                    | S30409 |
|                                       |                 | GX5 CrNi 19 10   | 1.4308  | CF 8                       | J92600 |
| <b>Ti-, Nb stabilized</b>             |                 |                  |         |                            |        |
|                                       | X6 CrNiTi 18 10 |                  | 1.4541  | (TP)321                    | S32100 |
|                                       |                 |                  |         | (TP)321H                   | S32109 |
|                                       | X6 CrNiNb 18 10 |                  | 1.4550  | (TP)347                    | S34700 |
|                                       |                 |                  |         | (TP)347H                   | S34709 |
|                                       |                 | GX5 CrNiNb 19 10 | 1.4552  | CF-8C                      | J92710 |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.0 x 300                       | 35 - 50                 | DC+             | 40                                                    | 51              | 0.59                | 11.6                         | 151                              | 1.75                                  |
| 2.5 x 350                       | 45 - 80                 | DC+             | 51                                                    | 103             | 0.88                | 21.7                         | 81                               | 1.75                                  |
| 3.2 x 350                       | 80 - 115                | DC+             | 57                                                    | 177             | 1.3                 | 34.3                         | 48                               | 1.64                                  |
| 4.0 x 450                       | 100 - 155               | DC+             | 83                                                    | 373             | 1.8                 | 68.0                         | 24                               | 1.64                                  |
| 5.0 x 450                       | 150 - 220               | DC+             | 85                                                    | 577             | 2.7                 | 106.2                        | 16                               | 1.67                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.0                                |       | 45A   | 45A   | 40A      | 40A   | 40A      |
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  |          |       |          |
| 5.0                                | 180A  | 180A  |       |          |       |          |



**Stainless steel electrode****Classification**

AWS A5.4 : E308L-17  
EN 1600 : E 19 9 L R 53

**Temperature range**

pressurized parts : -120...+350°C  
oxidation resistance : to 800°C

**General description**

A rutile-basic all position stainless steel electrode for 304L or equivalent steels

High recovery (130%) providing high welding speed

Good side wall wetting, no undercut, self releasing slag

Only for down hand position

Excellent for fillet welds and filling V- and X-grooves

Weldable on AC and DC+ polarity

Only available in vacuum sealed Sahara ReadyPack® (SRP)

**Welding positions**

ISO/ASME PA/1G PB/2F

**Current type**

AC / DC +

**Chemical composition (w%), typical, all weld metal**

| C    | Mn  | Si  | Cr   | Ni   | FN (acc. WRC 192) |
|------|-----|-----|------|------|-------------------|
| 0.02 | 0.6 | 0.9 | 19.0 | 10.0 | 04-10             |

**Mechanical properties, typical, all weld metal**

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C |
| Required: AWS A5.4 |           | not required                                | min. 520                                 | min. 35           | not required    |       |
| EN 1600            |           | min. 320                                    | min. 510                                 | min. 30           | not required    |       |
| Typical values     | AW        | 440                                         | 600                                      | 40                | 70              | 50    |

**Packaging and available sizes**

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 450 | 450 | 450 |
| Unit: SRP | Pieces / unit        | 31  | 23  | 19  |
|           | Net weight/unit (kg) | 1.6 | 2.0 | 2.3 |

**Identification** Imprint: 308L-17 / LIMAROSTA 304 L-130 Tip Color: light blue

**Limarosta® 304L-130: rev. EN 21**

## Materials to be welded

| Steel grades                          | EN 10088-1/-2   | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240A312/A351 | UNS    |
|---------------------------------------|-----------------|------------------|---------|---------------------------|--------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                 |                  |         |                           |        |
|                                       | X2 CrNi 19 11   |                  | 1.4306  | (TP)304L                  | S30403 |
|                                       |                 |                  |         | CF-3                      | J92500 |
|                                       | X2 CrNiN 18 10  |                  | 1.4311  | (TP)304LN                 | S30453 |
|                                       |                 |                  |         | 302,304                   | S30400 |
| <b>Medium carbon (C &gt;0.03%)</b>    |                 |                  |         |                           |        |
|                                       | X4 CrNi 18 10   |                  | 1.4301  | (TP)304                   | S30409 |
|                                       |                 | GX5 CrNi 19 10   | 1.4308  | CF 8                      | J92600 |
| <b>Ti-, Nb stabilized</b>             |                 |                  |         |                           |        |
|                                       | X6 CrNiTi 18 10 |                  | 1.4541  | (TP)321                   | S32100 |
|                                       |                 |                  |         | (TP)321H                  | S32109 |
|                                       | X6 CrNiNb 18 10 |                  | 1.4550  | (TP)347                   | S34700 |
|                                       |                 |                  |         | (TP)347H                  | S34709 |
|                                       |                 | GX5 CrNiNb 19 10 | 1.4552  | CF-8C                     | J92710 |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 3.2 x 450                       | 90 - 120                | DC+             | 69                                                    | 241             | 1.8                 | 59.0                         | 28                               | 1.67                                  |
| 4.0 x 450                       | 120 - 160               | DC+             | 76                                                    | 378             | 2.5                 | 87.4                         | 19                               | 1.64                                  |
| 5.0 x 450                       | 160 - 230               | DC+             | 84                                                    | 616             | 3.6                 | 135.0                        | 12                               | 1.64                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions | PA/1G | PB/2F |
|-------------------|-------|-------|
| Diameter (mm)     |       |       |
| 3.2               | 110A  | 105A  |
| 4.0               | 155A  | 150A  |
| 5.0               | 175A  | 175A  |

## Stainless steel electrode

## Classification

AWS A5.4 : E308L-15  
EN 1600 : E 19 9 L R 21

## Temperature range

pressurized parts : -196...+350°C  
oxidation resistance : to 800°C

## General description

A rutile-basic all position stainless steel electrode for 304L or equivalent steels  
Specially developed for vertical down welding on DC  
Root passes in grooves with root opening  
High corrosion resistance in oxidizing environments

## Welding positions



ISO/ASME PG/3Gdown

## Current type

DC +

## Approvals

TÜV

+

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni  | FN (acc. WRC 192) |
|------|-----|-----|------|-----|-------------------|
| 0.02 | 0.8 | 0.7 | 20.0 | 9.8 | 04-10             |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C |
| Required: AWS A5.4 |           | not required                                | min. 520                                 | min. 35           | not required    |       |
| EN 1600            |           | min. 320                                    | min. 510                                 | min. 30           | not required    |       |
| Typical values     | AW        | 440                                         | 600                                      | 40                | 70              | 50    |

## Packaging and available sizes

|           |                      |     |     |
|-----------|----------------------|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 |
|           | Length (mm)          | 300 | 300 |
| Unit: Box | Pieces / unit        | 190 | 130 |
|           | Net weight/unit (kg) | 2.9 | 3.1 |

## Identification

Imprint: 308L-15 / VERTAROSTA 304 L Tip Color: grey

Vertarosta® 304L: rev. EN 21

## Materials to be welded

| Steel grades                          | EN 10088-1/-2   | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------------------|-----------------|------------------|---------|----------------------------|------------------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                 |                  |         |                            |                  |
|                                       | X2 CrNi 19 11   |                  | 1.4306  | (TP)304L<br>CF-3           | S30403<br>J92500 |
|                                       | X2 CrNiN 18 10  |                  | 1.4311  | (TP)304LN<br>302,304       | S30453<br>S30400 |
| <b>Medium carbon (C &gt;0.03%)</b>    |                 |                  |         |                            |                  |
|                                       | X4 CrNi 18 10   |                  | 1.4301  | (TP)304                    | S30409           |
|                                       |                 | GX5 CrNi 19 10   | 1.4308  | CF 8                       | J92600           |
| <b>Ti-, Nb stabilized</b>             |                 |                  |         |                            |                  |
|                                       | X6 CrNiTi 18 10 |                  | 1.4541  | (TP)321<br>(TP)321H        | S32100<br>S32109 |
|                                       | X6 CrNiNb 18 10 |                  | 1.4550  | (TP)347<br>(TP)347H        | S34700<br>S34709 |
|                                       |                 | GX5 CrNiNb 19 10 | 1.4552  | CF-8C                      | J92710           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 300                       | 60 - 70                 | DC+             | 44                                                    | 65              | 0.81                | 15.0                         | 101                              | 1.52                                  |
| 3.2 x 300                       | 80 - 110                | DC+             | 51                                                    | 117             | 1.2                 | 23.5                         | 59                               | 1.39                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

|                   |         |
|-------------------|---------|
| Welding positions | 3G down |
| Diameter (mm)     |         |
| 2.5               | 70A     |
| 3.2               | 100A    |

## Stainless steel electrode

### Classification

AWS A5.4 : E308H-16  
EN 1600 : E 19 9 H R 12

### Temperature range

pressurized parts : -20 ... +730°C  
scaling resistance : to 800°C

### General description

A rutile-basic all position stainless steel electrode

Specially developed for high temperature applications (up to 730°C) - e.g. AISI 304H or Mat. Nr 1.4948

Low sensitivity to precipitation of intermetallic phases

Weldable on AC and DC

Popular in petrochemical and nuclear industry

### Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

### Current type

AC / DC + / -

### Chemical composition (w%), typical, all weld metal

| C    | Mn   | Si   | Cr   | Ni  | FN (acc. WRC 192) |
|------|------|------|------|-----|-------------------|
| 0.05 | 0.75 | 0.85 | 18.5 | 9.5 | 03-7              |

### Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%)  | Impact ISO-V(J)<br>+20°C<br>-20°C |
|-------------------------------|-----------|---------------------------------------------|------------------------------------------|--------------------|-----------------------------------|
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 350                    | min. 550<br>min. 550                     | min. 35<br>min. 30 | not required<br>not required      |
| Typical values                | AW        | 450                                         | 600                                      | 44                 | 70<br>50                          |

### Packaging and available sizes

|           |                      |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 145 | 150 | 100 | 65  |
|           | Net weight/unit (kg) | 2.8 | 4.8 | 4.9 | 4.8 |

### Identification

Imprint: 308H-16 / AROSTA 304 H

Tip Color: green

Arosta® 304H: rev. EN 21

## Materials to be welded

| Steel grades                       | EN 10088-1/-2 | EN 10213-4     | Mat. Nr | ASTM/ACI | UNS    |
|------------------------------------|---------------|----------------|---------|----------|--------|
| <b>Medium carbon (C &gt;0.03%)</b> | X4 CrNi 18-10 | GX5 CrNi 19-10 | 1.4301  | (TP)304  | 302    |
|                                    |               |                |         | (TP)304H | S30400 |
|                                    | 1.4308        |                | CF8     | S30409   |        |
|                                    | 1.4948        |                |         | J92600   |        |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 40 - 75                 | DC+             | 51                                                    | 89              | 0.99                | 19.4                         | 79                               | 1.54                                  |
| 3.2 x 350                       | 60 - 110                | DC+             | 58                                                    | 121             | 1.3                 | 31.5                         | 48                               | 1.52                                  |
| 4.0 x 350                       | 80 - 150                | DC+             | 64                                                    | 258             | 1.8                 | 48.0                         | 32                               | 1.54                                  |
| 5.0 x 350                       | 140 - 220               | DC+             | 72                                                    | 493             | 2.3                 | 72.6                         | 22                               | 1.56                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |
| 5.0                                | 180A  | 180A  | 180A  |          |       |          |

For root passes DC- is recommended.

## Stainless steel electrode

### Classification

AWS A5.4 : E308L-15  
EN 1600 : E 19 9 L B 22

### Temperature range

pressurized parts : -196...+350°C  
oxidation resistance : to 800°C

### General description

Basic coated electrode for low temperature applications  
Low carbon content, good impact properties down to -196°C  
Good weldability and smooth bead appearance  
High resistance against oxidation up to 800°C  
Welding on DC electrode + is recommended

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

### Current type

DC +

### Approvals

TÜV  
+

### Chemical composition (w%), typical, all weld metal

| C     | Mn  | Si  | Cr   | Ni   | FN (acc. WRC 192) |
|-------|-----|-----|------|------|-------------------|
| 0.025 | 1.8 | 0.4 | 19.0 | 10.0 | 04-10             |

### Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |        |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|--------|
|                    |           |                                             |                                          |                   | +20°C           | -196°C |
| Required: AWS A5.4 |           | not required                                | min. 520                                 | min. 35           | not required    |        |
| EN 1600            |           | min. 320                                    | min. 510                                 | min. 30           | not required    |        |
| Typical values     | AW        | 450                                         | 600                                      | 40                | 80              | 40     |

### Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 |
|           | Length (mm)          | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 120 | 150 | 100 |
|           | Net weight/unit (kg) | 2.4 | 4.8 | 4.8 |

Identification Imprint: 308L-15 / JUNGO 304 L

Tip Color: dark blue

Jungo® 304L: rev. EN 21

## Materials to be welded

| Steel grades                          | EN 10088-1/-2   | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------------------|-----------------|------------------|---------|----------------------------|------------------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                 |                  |         |                            |                  |
|                                       | X2 CrNi 19 11   |                  | 1.4306  | (TP)304L<br>CF-3           | S30403<br>J92500 |
|                                       | X6 CrNiNb 18 10 |                  | 1.4311  | (TP)304LN<br>302,304       | S30453<br>S30400 |
| <b>Medium carbon (C &gt;0.03%)</b>    |                 |                  |         |                            |                  |
|                                       | X4 CrNi 18 10   |                  | 1.4301  | (TP)304                    | S30409           |
|                                       |                 | GX5 CrNi 19 10   | 1.4308  | CF 8                       | J92600           |
| <b>Ti-, Nb stabilized</b>             |                 |                  |         |                            |                  |
|                                       | X6 CrNiTi 18 10 |                  | 1.4541  | (TP)321<br>(TP)321H        | S32100<br>S32109 |
|                                       | X6 CrNiNb 18 10 |                  | 1.4550  | (TP)347<br>(TP)347H        | S34700<br>S34709 |
|                                       |                 | GX5 CrNiNb 19 10 | 1.4552  | CF-8C                      | J92710           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 55 - 65                 | DC+             | 50                                                    | 86              | 0.82                | 19.1                         | 88                               | 1.89                                  |
| 3.2 x 350                       | 70 - 90                 | DC+             | 51                                                    | 135             | 1.3                 | 31.6                         | 53                               | 1.72                                  |
| 4.0 x 350                       | 90 - 120                | DC+             | 66                                                    | 206             | 1.7                 | 47.0                         | 32                               | 1.56                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|-------------------|-------|-------|-------|----------|-------|----------|
| Diameter (mm)     |       |       |       |          |       |          |
| 2.5               | 60A   | 60A   | 60A   | 60A      | 60A   | 60A      |
| 3.2               | 95A   | 90A   | 90A   | 75A      | 75A   | 75A      |
| 4.0               | 125A  | 110A  | 125A  | 100A     | 100A  | 100A     |



## Stainless steel electrode

## Classification

AWS A5.4 : E347-16  
EN 1600 : E 19 9 Nb R 12

## Temperature range

pressurized parts : -120...+400°C  
oxidation resistance : to 800°C

## General description

Rutile-basic all position stainless steel electrode  
For Ti or Nb stabilized 304 or equivalent steels  
Excellent resistance in oxidizing environments such as nitric acid  
High resistance to intergranular corrosion  
Easy slag release and smooth bead appearance  
Strong electrode coating  
Weldable on AC and DC  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC + / -

## Approvals

TÜV

+

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni  | Nb   | FN (acc. WRC 192) |
|------|-----|-----|------|-----|------|-------------------|
| 0.03 | 0.8 | 0.8 | 19.5 | 9.8 | 0.35 | 06-12             |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C | -60°C |
| Required: AWS A5.4 |           | not required                                | min. 550                                 | min. 25           | not required    |       |       |
| EN 1600            |           | min. 350                                    | min. 550                                 | min. 25           | not required    |       |       |
| Typical values     | AW        | 500                                         | 630                                      | 35                | 70              | 50    | 35    |

## Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 |
|           | Length (mm)          | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 120 | 130 | 90  |
|           | Net weight/unit (kg) | 2.6 | 4.7 | 4.9 |
| Unit: SRP | Pieces / unit        | 69  | 52  | 28  |
|           | Net weight/unit (kg) | 1.4 | 1.8 | 1.4 |

## Identification

Imprint: 347-16 / AROSTA 347

Tip Color: gold

Arosta® 347: rev. EN 21

### Materials to be welded

| Steel grades              | EN 10088-1/-2  | EN 10213-4      | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------|----------------|-----------------|---------|----------------------------|------------------|
| <b>Ti-, Nb stabilized</b> |                |                 |         |                            |                  |
|                           | X6CrNiTi 18-10 |                 | 1.4541  | (TP)321<br>(TP)321H        | S32100<br>S32109 |
|                           | X6CrNiNb 18-10 |                 | 1.4550  | (TP)347<br>(TP)347H        | S34700<br>S34709 |
|                           |                | GX5CrNiNb 19-10 | 1.4552  | CF-8C<br>302               | J92710           |
| <b>Non stabilized</b>     |                |                 |         |                            |                  |
|                           | X4CrNi 18-10   |                 | 1.4301  | (TP)304                    | S30400           |
|                           | X2CrNi 19-11   |                 | 1.4306  | (TP)304L                   | S30403           |
|                           |                | GX5CrNi 19-10   | 1.4308  | CF-8                       | J92600           |
|                           |                |                 | 1.4312  | (TP)304H                   | S30409           |

### Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 40 - 75                 | DC+             | 52                                                    | 78              | 0.87                | 20.7                         | 80                               | 1.66                                  |
| 3.2 x 350                       | 60 - 110                | DC+             | 54                                                    | 119             | 1.4                 | 34.9                         | 48                               | 1.67                                  |
| 4.0 x 350                       | 80 - 150                | DC+             | 64                                                    | 210             | 1.7                 | 49.0                         | 33                               | 1.61                                  |

\* stub end 35 mm

### Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |

For root passes DC- is recommended.

## Stainless steel electrode

### Classification

AWS A5.4 : E347-15  
EN 1600 : E 19 9 Nb B 22

### Temperature range

pressurized parts : -120...+400°C  
oxidation resistance : to 800°C

### General description

Basic coated all position stainless steel electrode  
For Ti or Nb stabilized 304 or equivalent steels  
Excellent resistance in oxidizing environments such as nitric acid  
High resistance to intergranular corrosion  
Easy slag release and smooth bead appearance  
Strong electrode coating

### Welding positions



### Current type

DC +

### Approvals

TÜV  
+

### Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | Nb   | FN (acc. WRC 192) |
|------|-----|-----|------|------|------|-------------------|
| 0.02 | 1.6 | 0.5 | 20.0 | 10.0 | 0.40 | 06-12             |

### Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |        |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|--------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C | -120°C |
| Required: AWS A5.4 |           | not required                                | min. 520                                 | min. 30           | not required    |       |        |
| EN 1600            |           | min. 350                                    | min. 550                                 | min. 25           | not required    |       |        |
| Typical values     | AW        | 500                                         | 630                                      | 35                | 80              | 50    | 40     |

### Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 450 |
| Unit: Box | Pieces / unit        | 150 | 100 | 75  |
|           | Net weight/unit (kg) | 4.8 | 4.4 | 6.8 |

### Identification

Imprint: 347-15 / JUNGO 347

Tip Color: brown

Jungo® 347: rev. EN 21

## Materials to be welded

| Steel grades              | EN 10088-1/-2   | EN 10213-4     | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------|-----------------|----------------|---------|----------------------------|------------------|
| <b>Ti-, Nb stabilized</b> |                 |                |         |                            |                  |
|                           | X6 CrNiTi 18-10 |                | 1.4541  | (TP)321<br>(TP)321H        | S32100<br>S32109 |
|                           | X6 CrNiNb 18-10 |                | 1.4550  | (TP)347<br>(TP)347H        | S34700<br>S34709 |
|                           |                 | GX5CrNiNb19-10 | 1.4552  | CF-8C<br>302               | J92710           |
| <b>Non stabilized</b>     |                 |                |         |                            |                  |
|                           | X4 CrNi 18-10   |                | 1.4301  | (TP)304                    | S30400           |
|                           | X2 CrNi 19-11   |                | 1.4306  | (TP)304L                   | S30403           |
|                           |                 | GX5 CrNi 19-10 | 1.4308  | CF-8                       | J92600           |
|                           |                 |                | 1.4312  | (TP)304H                   | S30409           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 3.2 x 350                       | 80 - 100                | DC+             | 51                                                    | 135             | 1.3                 | 32.4                         | 53                               | 1.72                                  |
| 4.0 x 350                       | 100 - 130               | DC+             | 66                                                    | 206             | 1.7                 | 44.4                         | 32                               | 1.56                                  |
| 5.0 x 450                       | 130 - 160               | DC+             | 69                                                    | 378             | 2.3                 | 90.9                         | 23                               | 1.92                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 3.2                                | 95A   | 90A   | 90A   | 75A      | 75A   | 75A      |
| 4.0                                | 125A  | 110A  | 125A  | 100A     | 100A  | 100A     |
| 5.0                                | 150A  | 150A  |       |          |       |          |

## Stainless steel electrode

### Classification

AWS A5.4 : E316L-16  
EN 1600 : E 19 12 3 L R 12

### Temperature range

pressurized parts : -120....+350°C  
oxidation resistance : n.a.

### General description

Rutile-basic all position stainless steel electrode for 316L or equivalent steels

Molybdenum level min. 2.7 %

High resistance to general and intergranular corrosion

Smooth weld appearance

Easy slag release

Strong electrode coating

Weldable on AC and DC

Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

### Current type

AC / DC + / -

### Approvals

| ABS | BV   | DNV  | GL   | LR   | RINA | RMRS | TÜV |
|-----|------|------|------|------|------|------|-----|
| +   | 316L | 316L | 4571 | 316L | 316L | 316L | +   |

### Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | Mo   | FN (acc. WRC 192) |
|------|-----|-----|------|------|------|-------------------|
| 0.02 | 0.8 | 0.8 | 18.0 | 11.5 | 2.85 | 04-10             |

### Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm²) | Tensile strength<br>(N/mm²) | Elongation<br>(%)  | Impact ISO-V(J)              |        |
|-------------------------------|-----------|--------------------------------|-----------------------------|--------------------|------------------------------|--------|
|                               |           |                                |                             |                    | -20°C                        | -120°C |
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 320       | min. 490<br>min. 510        | min. 30<br>min. 25 | not required<br>not required |        |
| Typical values                | AW        | 450                            | 580                         | 39                 | 60                           | 40     |

### Packaging and available sizes

|                 |                      |     |     |     |     |     |     |
|-----------------|----------------------|-----|-----|-----|-----|-----|-----|
|                 | Diameter (mm)        | 1.5 | 2.0 | 2.5 | 3.2 | 4.0 | 5.0 |
|                 | Length (mm)          | 250 | 300 | 350 | 350 | 350 | 350 |
| Unit: Box       | Pieces / unit        | 160 | 225 | 135 | 150 | 90  | 65  |
|                 | Net weight/unit (kg) | 0.8 | 2.4 | 2.7 | 4.9 | 4.8 | 5.0 |
| Unit: SRP       | Pieces / unit        |     | 84  | 69  | 56  | 29  | -   |
|                 | Net weight/unit (kg) |     | 0.9 | 1.4 | 1.8 | 1.5 | -   |
| Unit: Linc Can™ | Pieces / unit        |     | -   | 217 | 134 | 80  | -   |
|                 | Net weight/unit (kg) |     | -   | 4.7 | 4.4 | 4.2 | -   |

### Identification

Imprint: 316L-16 / AROSTA 316 L

Tip Color: pink

Arosta® 316L: rev. EN 22

## Materials to be welded

| Steel grades                          | EN 10088-1/-2       | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------------------|---------------------|------------------|---------|----------------------------|------------------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                     |                  |         |                            |                  |
|                                       | X2 CrNiMo 17-12-2   |                  | 1.4404  | (TP)316L<br>CF-3M          | S31603<br>J92800 |
|                                       | X2 CrNiMo 18-14-3   |                  | 1.4435  | (TP)316L                   | S31603           |
|                                       | X2 CrNiMoN 17-11-2  |                  | 1.4406  | (TP)316LN                  | S31653           |
|                                       | X2 CrNiMoN 17-13-3  |                  | 1.4429  |                            |                  |
| <b>Medium carbon (C &gt;0.03%)</b>    |                     |                  |         |                            |                  |
|                                       | X4 CrNiMo 17-12-2   |                  | 1.4401  | (TP)316                    | S31600           |
|                                       | X4 CrNiMo 17-13-3   |                  | 1.4436  |                            |                  |
|                                       |                     | GX5 CrNiMo 19-11 | 1.4408  | CF 8M                      | J92900           |
| <b>Ti-, Nb stabilized</b>             |                     |                  |         |                            |                  |
|                                       | X6 CrNiMoTi 17-12-2 |                  | 1.4571  | 316Ti                      | S31635           |
|                                       | X6 CrNiMoNb 17-12-2 |                  | 1.4580  | 316Cb                      | S31640           |
|                                       | X6 CrNiNb 18-10     |                  | 1.4550  | (TP)347                    | S34700           |
|                                       |                     | GX5 CrNiNb 19-10 | 1.4552  | CF-8C                      | J92710           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 1.5 x 250                       | 20 - 40                 | DC+             | 25                                                    | 19              | 0.44                | 5.8                          | 330                              | 1.92                                  |
| 2.0 x 300                       | 30 - 50                 | DC+             | 42                                                    | 44              | 0.58                | 10.7                         | 150                              | 1.61                                  |
| 2.5 x 350                       | 40 - 75                 | DC+             | 50                                                    | 86              | 0.88                | 19.9                         | 82                               | 1.61                                  |
| 3.2 x 350                       | 60 - 110                | DC+             | 57                                                    | 157             | 1.3                 | 32.9                         | 49                               | 1.61                                  |
| 4.0 x 350                       | 80 - 150                | DC+             | 64                                                    | 240             | 1.7                 | 49.2                         | 32                               | 1.59                                  |
| 5.0 x 350                       | 140 - 220               | DC+             | 67                                                    | 396             | 2.6                 | 77.1                         | 20                               | 1.59                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 1.5                                |       | 35A   | 35A   |          |       |          |
| 2.0                                |       | 45A   | 45A   | 40A      | 40A   | 40A      |
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |
| 5.0                                | 180A  | 180A  | 180A  |          |       |          |

For root passes DC- is recommended.

## Stainless steel electrode

## Classification

AWS A5.4 : E316L-17  
EN 1600 : E 19 12 3 L R 12

## Temperature range

pressurized parts : -120...+350°C  
oxidation resistance : n.a.

## General description

A rutile-basic all position stainless steel electrode for 316L or equivalent steels

Molybdenum level min. 2.7 %

Mirror like bead appearance

Self releasing slag

Good side wall fusion, no undercut

High resistance to porosity

Weldable on AC and DC

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

## Current type

AC / DC + / -

## Approvals

| DNV     | LR   | RMRS | TÜV |
|---------|------|------|-----|
| 316LH10 | 316L | 316L | +   |

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | Mo  | FN (acc. WRC 192) |
|------|-----|-----|------|------|-----|-------------------|
| 0.02 | 0.8 | 1.0 | 18.0 | 11.5 | 2.8 | 04-10             |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm²) | Tensile strength<br>(N/mm²) | Elongation<br>(%) | Impact ISO-V(J) |       |        |
|--------------------|-----------|--------------------------------|-----------------------------|-------------------|-----------------|-------|--------|
|                    |           |                                |                             |                   | +20°C           | -20°C | -105°C |
| Required: AWS A5.4 |           | not required                   | min. 490                    | min. 30           | not required    |       |        |
| EN 1600            |           | min. 320                       | min. 510                    | min. 25           | not required    |       |        |
| Typical values     | AW        | 450                            | 580                         | 40                | 70              | 60    | 40     |

## Packaging and available sizes

|                 | Diameter (mm)        | 1.5 | 2.0 | 2.5 | 3.2 | 4.0 | 5.0 |
|-----------------|----------------------|-----|-----|-----|-----|-----|-----|
|                 | Length (mm)          | 250 | 300 | 350 | 350 | 450 | 450 |
| Unit: Box       | Pieces / unit        | 140 | 200 | 125 | 135 | 85  | 55  |
|                 | Net weight/unit (kg) | 0.7 | 2.3 | 2.7 | 4.8 | 5.9 | 5.9 |
| Unit: SRP       | Pieces / unit        |     | 57  | 65  | 52  | 28  | 22  |
|                 | Net weight/unit (kg) |     | 0.6 | 1.5 | 1.8 | 2.0 | 2.4 |
| Unit: Linc Pack | Pieces / unit        |     | -   | 47  | 28  | -   | -   |
|                 | Net weight/unit (kg) |     | -   | 1.0 | 1.0 | -   | -   |
| Unit: Linc Can™ | Pieces / unit        |     | -   | 202 | 124 | 79  | -   |
|                 | Net weight/unit (kg) |     | -   | 4.4 | 4.3 | 5.3 | -   |

## Identification

Imprint: 316L-17 / LIMAROSTA 316 L Tip Color: pink

Limarosta® 316L: rev. EN 21

## Materials to be welded

| Steel grades                          | EN 10088-1/-2       | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS    |
|---------------------------------------|---------------------|------------------|---------|----------------------------|--------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                     |                  |         |                            |        |
|                                       | X2 CrNiMo 17-12-2   |                  | 1.4404  | (TP)316L                   | S31603 |
|                                       |                     |                  |         | CF-3M                      | J92800 |
|                                       | X2 CrNiMo 18-14-3   |                  | 1.4435  | (TP)316L                   | S31603 |
|                                       | X2 CrNiMoN 17-11-2  |                  | 1.4406  | (TP)316LN                  | S31653 |
|                                       | X2 CrNiMoN 17-13-3  |                  | 1.4429  |                            |        |
| <b>Medium carbon (C &gt;0.03%)</b>    |                     |                  |         |                            |        |
|                                       | X4 CrNiMo 17-12-2   |                  | 1.4401  | (TP)316                    | S31600 |
|                                       | X4 CrNiMo 17-13-3   |                  | 1.4436  |                            |        |
|                                       |                     | GX5 CrNiMo 19-11 | 1.4408  | CF 8M                      | J92900 |
| <b>Ti-, Nb stabilized</b>             |                     |                  |         |                            |        |
|                                       | X6 CrNiMoTi 17-12-2 |                  | 1.4571  | 316Ti                      | S31635 |
|                                       | X6 CrNiMoNb 17-12-2 |                  | 1.4580  | 316Cb                      | S31640 |
|                                       | X6 CrNiNb 18-10     |                  | 1.4550  | (TP)347                    | S34700 |
|                                       |                     | GX5 CrNiNb 19-10 | 1.4552  | CF-8C                      | J92710 |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 1.5 x 250                       | 20 - 40                 |                 |                                                       |                 |                     |                              |                                  |                                       |
| 2.0 x 300                       | 35 - 50                 | DC+             | 39                                                    | 49              | 0.59                | 11.4                         | 155                              | 1.79                                  |
| 2.5 x 350                       | 45 - 80                 | DC+             | 46                                                    | 92              | 0.95                | 21.5                         | 83                               | 1.79                                  |
| 3.2 x 350                       | 80 - 115                | DC+             | 51                                                    | 157             | 1.5                 | 35.3                         | 48                               | 1.69                                  |
| 4.0 x 450                       | 100 - 155               | DC+             | 75                                                    | 339             | 1.9                 | 69.2                         | 24                               | 1.69                                  |
| 5.0 x 450                       | 150 - 220               | DC+             | 85                                                    | 577             | 2.7                 | 107.8                        | 16                               | 1.69                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.0                                |       | 45A   | 45A   | 40A      | 40A   | 40A      |
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  |          |       |          |
| 5.0                                | 180A  | 180A  |       |          |       |          |



## Stainless steel electrode

## Classification

AWS A5.4 : E316L-17  
EN 1600 : E 19 12 3 L R 53

## Temperature range

pressurized parts : -120...+350°C  
oxidation resistance : n.a.

## General description

A rutile-basic all position stainless steel electrode for 316L or equivalent steels

Molybdenum level min. 2.7 %

High recovery (130%) providing high welding speed

Excellent side wall fusion, no undercut

Only for down hand position

Excellent for fillet welds and filling V- and X-grooves

Weldable on AC and DC+ polarity

Only available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME

PA/1G

PB/2F

## Current type

AC / DC +

## Chemical composition (w%), typical, all weld metal

| C    | Mn   | Si  | Cr   | Ni   | Mo  | FN (acc. WRC 192) |
|------|------|-----|------|------|-----|-------------------|
| 0.02 | 0.65 | 1.0 | 18.0 | 11.5 | 2.8 | 04-10             |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |        |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|--------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C | -105°C |
| Required: AWS A5.4 |           | not required                                | min. 490                                 | min. 30           | not required    |       |        |
| EN 1600            |           | min. 320                                    | min. 510                                 | min. 25           | not required    |       |        |
| Typical values     | AW        | 450                                         | 580                                      | 40                | 70              | 60    | 40     |

## Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 450 | 450 | 450 |
| Unit: SRP | Pieces / unit        | 29  | 23  | 19  |
|           | Net weight/unit (kg) | 1.7 | 2.0 | 2.3 |

## Identification

Imprint: 316L-17 / LIMAROSTA 316 L-130 Tip Color: pink

Limarosta® 316L-130: rev. EN 21

## Materials to be welded

| Steel grades                          | EN 10088-1/-2       | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------------------|---------------------|------------------|---------|----------------------------|------------------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                     |                  |         |                            |                  |
|                                       | X2 CrNiMo 17-12-2   |                  | 1.4404  | (TP)316L<br>CF-3M          | S31603<br>J92800 |
|                                       | X2 CrNiMo 18-14-3   |                  | 1.4435  | (TP)316L                   | S31603           |
|                                       | X2 CrNiMoN 17-11-2  |                  | 1.4406  | (TP)316LN                  | S31653           |
|                                       | X2 CrNiMoN 17-13-3  |                  | 1.4429  |                            |                  |
| <b>Medium carbon (C &gt;0.03%)</b>    |                     |                  |         |                            |                  |
|                                       | X4 CrNiMo 17-12-2   |                  | 1.4401  | (TP)316                    | S31600           |
|                                       | X4 CrNiMo 17-13-3   |                  | 1.4436  |                            |                  |
|                                       |                     | GX5 CrNiMo 19-11 | 1.4408  | CF 8M                      | J92900           |
| <b>Ti-, Nb stabilized</b>             |                     |                  |         |                            |                  |
|                                       | X6 CrNiMoTi 17-12-2 |                  | 1.4571  | 316Ti                      | S31635           |
|                                       | X6 CrNiMoNb 17-12-2 |                  | 1.4580  | 316Cb                      | S31640           |
|                                       | X6 CrNiNb 18-10     |                  | 1.4550  | (TP)347                    | S34700           |
|                                       |                     | GX5 CrNiNb 19-10 | 1.4552  | CF-8C                      | J92710           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 3.2 x 450                       | 90 - 120                | DC+             | 68                                                    | 227             | 1.9                 | 60.4                         | 28                               | 1.67                                  |
| 4.0 x 450                       | 120 - 160               | DC+             | 78                                                    | 376             | 2.5                 | 91.0                         | 18                               | 1.67                                  |
| 5.0 x 450                       | 160 - 200               | DC+             | 81                                                    | 577             | 3.7                 | 143.7                        | 12                               | 1.72                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F |
|------------------------------------|-------|-------|
| 3.2                                | 110A  | 105A  |
| 4.0                                | 155A  | 150A  |
| 5.0                                | 175A  | 175A  |

## Stainless steel electrode

## Classification

AWS A5.4 : E316L-15  
EN 1600 : E 19 12 3 L R 21

## Temperature range

pressurized parts : -60...+400°C  
oxidation resistance : n.a.

## General description

A rutile-basic all position stainless steel electrode for 316L or equivalent steels  
Molybdenum level min. 2.7 %  
Specially developed for vertical down welding on DC  
Root passes in grooves with root opening  
High general corrosion resistance

## Welding positions



ISO/ASME PG/3Gdown

## Current type

AC / DC +

## Approvals

| ABS | BV   | DNV  | GL   | LR   | TÜV |
|-----|------|------|------|------|-----|
| +   | 316L | 316L | 4429 | 316L | +   |

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si   | Cr   | Ni   | Mo  | FN (acc. WRC 192) |
|------|-----|------|------|------|-----|-------------------|
| 0.02 | 0.7 | 0.85 | 18.0 | 11.5 | 2.8 | 04-10             |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C | -60°C |
| Required: AWS A5.4 |           | not required                                | min. 490                                 | min. 30           | not required    |       |       |
| EN 1600            |           | min. 320                                    | min. 510                                 | min. 25           | not required    |       |       |
| Typical values     | AW        | 500                                         | 620                                      | 35                | 50              | 45    | 35    |

## Packaging and available sizes

|           |                      |     |     |
|-----------|----------------------|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 |
|           | Length (mm)          | 300 | 300 |
| Unit: Box | Pieces / unit        | 190 | 130 |
|           | Net weight/unit (kg) | 2.9 | 3.1 |

## Identification

Imprint: 316L-15 / VERTAROSTA 316 L Tip Color: brown

Vertarosta® 316L: rev. EN 21

## Materials to be welded

| Steel grades                          | EN 10088-1/-2       | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------------------|---------------------|------------------|---------|----------------------------|------------------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                     |                  |         |                            |                  |
|                                       | X2 CrNiMo 17-12-2   |                  | 1.4404  | (TP)316L<br>CF-3M          | S31603<br>J92800 |
|                                       | X2 CrNiMo 18-14-3   |                  | 1.4435  | (TP)316L                   | S31603           |
|                                       | X2 CrNiMoN 17-11-2  |                  | 1.4406  | (TP)316LN                  | S31653           |
|                                       | X2 CrNiMoN 17-13-3  |                  | 1.4429  |                            |                  |
| <b>Medium carbon (C &gt;0.03%)</b>    |                     |                  |         |                            |                  |
|                                       | X4 CrNiMo 17-12-2   |                  | 1.4401  | (TP)316                    | S31600           |
|                                       | X4 CrNiMo 17-13-3   |                  | 1.4436  |                            |                  |
|                                       |                     | GX5 CrNiMo 19-11 | 1.4408  | CF 8M                      | J92900           |
| <b>Ti-, Nb stabilized</b>             |                     |                  |         |                            |                  |
|                                       | X6 CrNiMoTi 17-12-2 |                  | 1.4571  | 316Ti                      | S31635           |
|                                       | X6 CrNiMoNb 17-12-2 |                  | 1.4580  | 316Cb                      | S31640           |
|                                       | X6 CrNiNb 18-10     |                  | 1.4550  | (TP)347                    | S34700           |
|                                       |                     | GX5 CrNiNb 19-10 | 1.4552  | CF-8C                      | J92710           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 300                       | 60 - 70                 | DC+             | 44                                                    | 71              | 0.83                | 14.9                         | 98                               | 1.47                                  |
| 3.2 x 300                       | 80 - 110                | DC+             | 47                                                    | 118             | 1.3                 | 23.9                         | 59                               | 1.41                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

|                   |            |
|-------------------|------------|
| Welding positions | 3G ( down) |
| Diameter (mm)     |            |
| 2.5               | 70A        |
| 3.2               | 100A       |

## Stainless steel electrode

### Classification

AWS A5.4 : E316L-15  
EN 1600 : E 19 12 3 L B 22

### Temperature range

pressurized parts : -120...+350°C  
oxidation resistance : n.a.

### General description

Basic coated electrode for low temperature applications  
Good impact values down to -196°C  
Good weldability and smooth bead appearance  
Low carbon content  
Service temperature up to 400°C  
High resistance against general and intercrystalline corrosion

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

### Current type

DC +

### Approvals

BV  
316LBT

### Chemical composition (w%), typical, all weld metal

| C     | Mn  | Si  | Cr   | Ni   | Mo  | FN (acc. WRC 192) |
|-------|-----|-----|------|------|-----|-------------------|
| 0.025 | 1.6 | 0.4 | 18.5 | 11.0 | 2.7 | 04-10             |

### Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |        |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|--------|
|                    |           |                                             |                                          |                   | +20°C           | -196°C |
| Required: AWS A5.4 |           | not required                                | min. 490                                 | min. 30           | not required    |        |
| EN 1600            |           | min. 320                                    | min. 510                                 | min. 25           | not required    |        |
| Typical values     | AW        | 450                                         | 650                                      | 35                | 100             | 35     |

### Packaging and available sizes

|           |                      |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 350 | 450 |
| Unit: Box | Pieces / unit        | 135 | 150 | 100 | 65  |
|           | Net weight/unit (kg) | 2.7 | 4.8 | 4.8 | 6.6 |
| Unit: SRP | Pieces / unit        | 48  | 56  | 30  |     |
|           | Net weight/unit (kg) | 1,4 | 1,8 | 1,4 |     |

### Identification

Imprint: 316L-15 / JUNGO 316 L

Tip Color: red

Jungo® 316L: rev. EN 22

## Materials to be welded

| Steel grades                          | EN 10088-1/-2       | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------------------|---------------------|------------------|---------|----------------------------|------------------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                     |                  |         |                            |                  |
|                                       | X2 CrNiMo 17-12-2   |                  | 1.4404  | (TP)316L<br>CF-3M          | S31603<br>J92800 |
|                                       | X2 CrNiMo 18-14-3   |                  | 1.4435  | (TP)316L                   | S31603           |
|                                       | X2 CrNiMoN 17-11-2  |                  | 1.4406  | (TP)316LN                  | S31653           |
|                                       | X2 CrNiMoN 17-13-3  |                  | 1.4429  |                            |                  |
| <b>Medium carbon (C &gt;0.03%)</b>    |                     |                  |         |                            |                  |
|                                       | X4 CrNiMo 17-12-2   |                  | 1.4401  | (TP)316                    | S31600           |
|                                       | X4 CrNiMo 17-13-3   |                  | 1.4436  |                            |                  |
|                                       |                     | GX5 CrNiMo 19-11 | 1.4408  | CF 8M                      | J92900           |
| <b>Ti-, Nb stabilized</b>             |                     |                  |         |                            |                  |
|                                       | X6 CrNiMoTi 17-12-2 |                  | 1.4571  | 316Ti                      | S31635           |
|                                       | X6 CrNiMoNb 17-12-2 |                  | 1.4580  | 316Cb                      | S31640           |
|                                       | X6 CrNiNb 18-10     |                  | 1.4550  | (TP)347                    | S34700           |
|                                       |                     | GX5 CrNiNb 19-10 | 1.4552  | CF-8C                      | J92710           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 50 - 70                 | DC+             | 50                                                    | 86              | 0.82                | 19.2                         | 88                               | 1.89                                  |
| 3.2 x 350                       | 60 - 90                 | DC+             | 51                                                    | 135             | 1.3                 | 31.3                         | 53                               | 1.72                                  |
| 4.0 x 350                       | 80 - 120                | DC+             | 66                                                    | 206             | 1.7                 | 47.6                         | 32                               | 1.56                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 60A   | 60A   | 60A   | 60A      | 60A   | 60A      |
| 3.2                                | 95A   | 90A   | 90A   | 75A      | 75A   | 75A      |
| 4.0                                | 125A  | 110A  | 125A  | 100A     | 100A  | 100A     |

## Stainless steel electrode

### Classification

AWS A5.4 : E318-16  
EN 1600 : E 19 12 3 Nb R 12

### Temperature range

pressurized parts : -60...+400°C  
oxidation resistance : n.a.

### General description

Rutile basic all position stainless steel electrodes for welding Ti or Nb stabilized 316 or equivalent steels  
High resistance to general and intergranular corrosion  
Smooth bead appearance  
Easy slag release  
Strong electrode coating  
Weldable on AC and DC

### Welding positions



### Current type

AC / DC + / -

### Approvals

TÜV  
+

### Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si   | Cr   | Ni   | Mo  | Nb   | FN (acc. WRC 192) |
|------|-----|------|------|------|-----|------|-------------------|
| 0.03 | 0.8 | 0.85 | 18.0 | 11.5 | 2.7 | 0.35 | 06-12             |

### Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C | -60°C |
| Required: AWS A5.4 |           | not required                                | min. 550                                 | min. 25           | not required    |       |       |
| EN 1600            |           | min. 350                                    | min. 550                                 | min. 25           | not required    |       |       |
| Typical values     | AW        | 500                                         | 630                                      | 38                | 60              | 50    | 35    |

### Packaging and available sizes

|           |                      |     |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|-----|
|           | Diameter (mm)        | 2.0 | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 300 | 350 | 350 | 350 | 450 |
| Unit: Box | Pieces / unit        | 225 | 135 | 140 | 90  | 65  |
|           | Net weight/unit (kg) | 2.4 | 2.8 | 5.0 | 4.8 | 6.7 |

### Identification

Imprint: 318-16 / AROSTA 318

Tip Color: white

Arosta® 318: rev. EN 21

## Materials to be welded

| Steel grades                          | EN 10088-1/-2       | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------------------|---------------------|------------------|---------|----------------------------|------------------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                     |                  |         |                            |                  |
|                                       | X2 CrNiMo 17-12-2   |                  | 1.4404  | (TP)316L<br>CF-3M          | S31603<br>J92800 |
|                                       | X2 CrNiMo 18-14-3   |                  | 1.4435  | (TP)316L                   | S31603           |
|                                       | X2 CrNiMoN 17-11-2  |                  | 1.4406  | (TP)316LN                  | S31653           |
|                                       | X2 CrNiMoN 17-13-3  |                  | 1.4429  |                            |                  |
| <b>Medium carbon (C &gt;0.03%)</b>    |                     |                  |         |                            |                  |
|                                       | X4 CrNiMo 17-12-2   |                  | 1.4401  | (TP)316                    | S31600           |
|                                       | X4 CrNiMo 17-13-3   |                  | 1.4436  |                            |                  |
|                                       |                     | GX5 CrNiMo 19-11 | 1.4408  | CF 8M                      | J92900           |
| <b>Ti-, Nb stabilized</b>             |                     |                  |         |                            |                  |
|                                       | X6 CrNiMoTi 17-12-2 |                  | 1.4571  | 316Ti                      | S31635           |
|                                       | X6 CrNiMoNb 17-12-2 |                  | 1.4580  | 316Cb                      | S31640           |
|                                       | X6 CrNiNb 18-10     |                  | 1.4550  | (TP)347                    | S34700           |
|                                       |                     | GX5 CrNiNb 19-10 | 1.4552  | CF-8C                      | J92710           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.0 x 300                       | 30 - 60                 | DC+             | 36                                                    | 36              | 0.65                | 10.7                         | 152                              | 1.64                                  |
| 2.5 x 350                       | 40 - 90                 | DC+             | 46                                                    | 82              | 0.98                | 20.3                         | 80                               | 1.64                                  |
| 3.2 x 350                       | 70 - 110                | DC+             | 52                                                    | 137             | 1.4                 | 32.1                         | 48                               | 1.54                                  |
| 4.0 x 350                       | 90 - 140                | DC+             | 61                                                    | 212             | 1.9                 | 48.6                         | 31                               | 1.49                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.0                                |       | 45A   | 45A   | 40A      | 40A   | 40A      |
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |

For root passes DC- is recommended.



## Stainless steel electrode

### Classification

AWS A5.4 : E318-15\*  
EN 1600 : E 19 12 3 Nb B 22

\*: Deviation, see remarks

### General description

Basic coated electrode for stabilized CrNiMo-steels

Service temperature up to 400°C

Good bridging properties

Specially developed for highly restrained structures

### Welding positions



PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

ISO/ASME

### Current type

DC + / -

### Chemical composition (w%), typical, all weld metal

| C     | Mn  | Si  | Cr   | Ni   | Mo  | Nb  | FN (acc. WRC 192) |
|-------|-----|-----|------|------|-----|-----|-------------------|
| 0.025 | 1.5 | 0.4 | 18.0 | 11.0 | 2.7 | 0.5 | 06-12             |

### Mechanical properties, typical, all weld metal

| Condition          | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J)<br>+20°C |
|--------------------|---------------------------------------------|------------------------------------------|-------------------|--------------------------|
| Required: AWS A5.4 | not required                                | min. 550                                 | min. 25           | not required             |
| EN 1600            | min. 350                                    | min. 550                                 | min. 25           | not required             |
| Typical values     | AW 430                                      | 650                                      | 30                | 90                       |

### Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 |
|           | Length (mm)          | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 135 | 150 | 100 |
|           | Net weight/unit (kg) | 2.6 | 4.8 | 4.6 |

### Identification

Imprint: JUNGO 318

Tip Color: red

Jungo® 318: rev. EN 21

## Materials to be welded

| Steel grades                          | EN 10088-1/-2       | EN 10213-4       | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|---------------------------------------|---------------------|------------------|---------|----------------------------|------------------|
| <b>Extra low carbon (C &lt;0.03%)</b> |                     |                  |         |                            |                  |
|                                       | X2 CrNiMo 17-12-2   |                  | 1.4404  | (TP)316L<br>CF-3M          | S31603<br>J92800 |
|                                       | X2 CrNiMo 18-14-3   |                  | 1.4435  | (TP)316L                   | S31603           |
|                                       | X2 CrNiMoN 17-11-2  |                  | 1.4406  | (TP)316LN                  | S31653           |
|                                       | X2 CrNiMoN 17-13-3  |                  | 1.4429  |                            |                  |
| <b>Medium carbon (C &gt;0.03%)</b>    |                     |                  |         |                            |                  |
|                                       | X4 CrNiMo 17-12-2   |                  | 1.4401  | (TP)316                    | S31600           |
|                                       | X4 CrNiMo 17-13-3   |                  | 1.4436  |                            |                  |
|                                       |                     | GX5 CrNiMo 19-11 | 1.4408  | CF 8M                      | J92900           |
| <b>Ti-, Nb stabilized</b>             |                     |                  |         |                            |                  |
|                                       | X6 CrNiMoTi 17-12-2 |                  | 1.4571  | 316Ti                      | S31635           |
|                                       | X6 CrNiMoNb 17-12-2 |                  | 1.4580  | 316Cb                      | S31640           |
|                                       | X6 CrNiNb 18-10     |                  | 1.4550  | (TP)347                    | S34700           |
|                                       |                     | GX5 CrNiNb 19-10 | 1.4552  | CF-8C                      | J92710           |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 50 - 70                 | DC+             | 50                                                    | 86              | 0.82                | 17.6                         | 88                               | 1.89                                  |
| 3.2 x 350                       | 80 - 100                | DC+             | 51                                                    | 135             | 1.3                 | 28.5                         | 53                               | 1.72                                  |
| 4.0 x 350                       | 100 - 130               | DC+             | 66                                                    | 206             | 1.7                 | 43.8                         | 32                               | 1.56                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 60A   | 60A   | 60A   | 60A      | 60A   | 60A      |
| 3.2                                | 95A   | 90A   | 90A   | 75A      | 75A   | 75A      |
| 4.0                                | 125A  | 110A  | 125A  | 100A     | 100A  | 100A     |

## Remarks/ Application advice

Deviations: chemical composition:

Ni = 10.0 - 13.0%

AWS: Ni = 11.0 - 14.0%

## Stainless steel electrode

## Classification

AWS A5.4 : E310-16  
EN 1600 : E 25 20 R 12

## Temperature range

pressurized parts : -20 ... +400°C  
scaling resistance : 1100°C

## General description

Rutile basic electrode for all position welding except vertical down  
Fully austenitic weld metal with high Cr and Ni content for very high service temperature  
High resistance against oxidation and scaling up to 1100°C  
Avoid service temperatures between 650 - 850°C  
Weldable on AC and DC

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC +

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | FN (acc. WRC 192) |
|------|-----|-----|------|------|-------------------|
| 0.12 | 2.5 | 0.5 | 26.0 | 20.5 | 0                 |

## Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%)  | Impact ISO-V(J)<br>+20°C     |
|-------------------------------|-----------|---------------------------------------------|------------------------------------------|--------------------|------------------------------|
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 350                    | min. 550<br>min. 550                     | min. 30<br>min. 20 | not required<br>not required |
| Typical values                | AW        | 440                                         | 600                                      | 30                 | 80                           |

## Packaging and available sizes

|           |                      |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 145 | 150 | 100 | 62  |
|           | Net weight/unit (kg) | 3.0 | 5.1 | 5.1 | 5.0 |

## Identification

Imprint: 310-16 / INTHERMA 310

Tip Color: dark green

Intherma® 310: rev. EN 21

## Materials to be welded

| Steel grades          | EN 10088-1/-2     | EN 10213-4        | Mat. Nr | ASTM/ACI<br>A240/A351 | UNS              |
|-----------------------|-------------------|-------------------|---------|-----------------------|------------------|
| Heat resisting steels |                   |                   |         |                       |                  |
| X10 CrAl 24           |                   |                   | 1.4762  | 310S<br>CK20          | S31008<br>J94202 |
|                       |                   | GX25 CrNiSi 18-9  | 1.4825  |                       |                  |
|                       |                   | GX40 CrNiSi 22-9  | 1.4826  |                       |                  |
| X15 CrNiSi 20-12      | GX25 CrNiSi 20-14 |                   | 1.4828  |                       |                  |
|                       |                   |                   | 1.4832  |                       |                  |
| X15 CrNiSi 25-20      |                   |                   | 1.4841  |                       |                  |
| X12 CrNi 25-21        |                   |                   | 1.4845  |                       |                  |
|                       |                   | GX40 CrNiSi 25-20 | 1.4848  | HK40                  |                  |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 3.2 x 350                       | 90 - 140                | DC+             | 56                                                    | 155             | 1.31                | 31.8                         | 49                               | 1.56                                  |
| 4.0 x 350                       | 130 - 175               | DC+             | 72                                                    | 233             | 1.55                | 50.7                         | 32                               | 1.64                                  |
| 5.0 x 350                       | 165 - 200               |                 |                                                       |                 |                     |                              |                                  |                                       |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 3.2                                | 130A  | 120A  | 130A  | 110A     | 110A  | 110A     |
| 4.0                                | 160A  | 160A  | 160A  | 140A     |       |          |

## Remarks/ Application advice

Welding with Heat-Input max. 1.5 kJ/mm

Interpass temperature max. 100°C

## Stainless steel electrode

### Classification

AWS A5.4 : E310-15\*  
EN 1600 : E 25 20 B 12

\*: Deviation, see remarks

### Temperature range

pressurized parts : -20 ... +400°C  
scaling resistance : 1100°C

### General description

Basic coated electrode for all position welding except vertical down  
Fully austenitic weld metal with high Cr and Ni content for very high service temperature  
High resistance against oxidation and scaling up to 1100°C  
Avoid service temperatures between 650 - 850°C  
Weldable on DC only

### Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G

### Current type

DC +

### Chemical composition (w%), typical, all weld metal

| C   | Mn  | Si  | Cr   | Ni   | FN (acc. WRC 192) |
|-----|-----|-----|------|------|-------------------|
| 0.1 | 3.0 | 0.3 | 25.0 | 21.0 | 0                 |

### Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J)<br>+20°C |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|--------------------------|
| Required: AWS A5.4 |           | not required                                | min. 550                                 | min. 30           | not required             |
| EN 1600            |           | min. 350                                    | min. 550                                 | min. 20           | not required             |
| Typical values     | AW        | 440                                         | 600                                      | 30                | 100                      |

### Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 |
|           | Length (mm)          | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 135 | 150 | 100 |
|           | Net weight/unit (kg) | 2.4 | 4.3 | 4.3 |

### Identification

Imprint: INTHERMA 310 B

Tip Color: light green

Intherma® 310B: rev. EN 21

## Materials to be welded

| Steel grades                 | EN 10088-1/-2    | EN 10213-4        | Mat. Nr | ASTM/ACI | UNS    |
|------------------------------|------------------|-------------------|---------|----------|--------|
| <b>Heat resisting steels</b> |                  |                   |         |          |        |
|                              | X10 CrAl 24      |                   | 1.4762  |          |        |
|                              |                  | GX25 CrNiSi 18-9  | 1.4825  |          |        |
|                              |                  | GX40 CrNiSi 22-9  | 1.4826  |          |        |
|                              | X15 CrNiSi 20-12 |                   | 1.4828  |          |        |
|                              |                  | GX25 CrNiSi 20-14 | 1.4832  |          |        |
|                              | X15 CrNiSi 25-20 |                   | 1.4841  | 310S     | S31008 |
|                              |                  |                   |         | CK20     | J94202 |
|                              | X12 CrNi 25-21   |                   | 1.4845  |          |        |
|                              |                  | GX40 CrNiSi 25-20 | 1.4848  | HK40     |        |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>- per electrode at max. current -<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|------------------------------------------------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 60 - 70                 |                 |                                                       |                                                      |                     |                              |                                  |                                       |
| 3.2 x 350                       | 80 - 90                 |                 |                                                       |                                                      |                     |                              |                                  |                                       |
| 4.0 x 350                       | 110 - 130               |                 |                                                       |                                                      |                     |                              |                                  |                                       |

\* stub end 35 mm

## Remarks/ Application advice

Deviations: chemical composition

Mn = max. 5.0%

AWS: Mn = 1.0 - 2.5%

Welding with Heat-Input max. 1.5 kJ/mm

Interpass temperature max. 100°C

## Stainless steel electrode

### Classification

AWS A5.4 : E385-16\*  
EN 1600 : E 20 25 5 Cu N L R 12

\*: Deviation, see remarks

### Temperature range

pressurized parts : -60 ... +400°C  
oxidation resistance : n.a.

### General description

A rutile-basic fully austenitic all position electrode

Smooth bead appearance

Easy slag release

Especially developed for applications in phosphoric acid and sulphuric acid and paper mill equipment

Designed for welding alloy 904L

World wide reputation for reliability

Weldable on DC+ polarity

### Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

### Current type

DC +

### Approvals

TÜV

+

### Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | Mo  | Cu  | FN (acc. WRC 192) |
|------|-----|-----|------|------|-----|-----|-------------------|
| 0.02 | 1.2 | 0.9 | 20.0 | 25.0 | 5.0 | 1.5 | 0                 |

### Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%)  | Impact ISO-V(J)              |       |       |
|-------------------------------|-----------|---------------------------------------------|------------------------------------------|--------------------|------------------------------|-------|-------|
|                               |           |                                             |                                          |                    | +20°C                        | -10°C | -60°C |
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 320                    | min. 520<br>min. 510                     | min. 30<br>min. 25 | not required<br>not required |       |       |
| Typical values                | AW        | 410                                         | 620                                      | 40                 | 80                           | 100   | 50    |

### Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
| Unit: Box | Diameter (mm)        | 2.5 | 3.2 | 4.0 |
|           | Length (mm)          | 350 | 350 | 350 |
|           | Pieces / unit        | 145 | 185 | 125 |
|           | Net weight/unit (kg) | 2.9 | 5.7 | 5.9 |

### Identification

Imprint: JUNGO 4500

Tip Color: black

Jungo® 4500: rev. EN 22

## Materials to be welded

| Steel grades | EN 10088-1/-2 | EN 10213-4 | Mat. Nr |
|--------------|---------------|------------|---------|
|--------------|---------------|------------|---------|

### Fully austenitic NiCrMoCu and CrNiMoCu steels

|                     |                      |        |
|---------------------|----------------------|--------|
|                     | GX7 NiCrMoCuNb 25-20 | 1.4500 |
| X5 NiCrMoCuTi 20-18 |                      | 1.4506 |
|                     | GX2 NiCrMoCuN 20-18  | 1.4531 |
|                     | GX2 NiCrMoCuN 25-20  | 1.4536 |
| X1 NiCrMoCu 25-20-5 | (Alloy 904L)         | 1.4539 |
|                     | GX7 CrNiMoCuNb 18-18 | 1.4585 |
| X5 NiCrMoCuNb 22-18 |                      | 1.4586 |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 40 - 75                 | DC+             | 43                                                    | 72              | 0.96                | 19.9                         | 79                               | 1.59                                  |
| 3.2 x 350                       | 60 - 105                | DC+             | 53                                                    | 133             | 1.3                 | 32.1                         | 52                               | 1.69                                  |
| 4.0 x 350                       | 80 - 145                | DC+             | 61                                                    | 220             | 1.8                 | 48.0                         | 32                               | 1.56                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |

## Remarks/ Application advice

Deviations: chemical composition:

Si = max. 1.0%

AWS: Si = max. 0.9%

Welding with Heat-Input max. 1.5 kJ/mm

Interpass temperature max. 150°C



## Stainless steel electrode

### Classification

AWS A5.4 : E309L-16  
EN 1600 : E 23 12 L R 32

### Temperature range

pressurized parts : -120...+350°C  
scaling resistance : n.a.

### General description

A rutile-basic high CrNi alloyed buffer electrode  
For welding stainless steel to mild steel and root passes in clad steel  
Applicable for root passes in N alloyed AISI 304LN steels  
Excellent weldability and self releasing slag  
High resistance to embrittlement  
Weldable on AC and DC+ polarity  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

### Current type

AC / DC +

### Approvals

| ABS | BV   | RMRS   | TÜV |
|-----|------|--------|-----|
| +   | 309L | SS/CMn | +   |

### Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | FN (acc. WRC 192) |
|------|-----|-----|------|------|-------------------|
| 0.02 | 0.8 | 0.8 | 23.5 | 12.5 | 12-20             |

### Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm²) | Tensile strength<br>(N/mm²) | Elongation<br>(%)  | Impact ISO-V(J)              |       |        |
|-------------------------------|-----------|--------------------------------|-----------------------------|--------------------|------------------------------|-------|--------|
|                               |           |                                |                             |                    | +20°C                        | -20°C | -120°C |
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 320       | min. 520<br>min. 510        | min. 30<br>min. 25 | not required<br>not required |       |        |
| Typical values                | AW        | 480                            | 560                         | 40                 | 60                           | 50    | 40     |

### Packaging and available sizes

|           |                      |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 135 | 150 | 100 | 65  |
|           | Net weight/unit (kg) | 2.8 | 5.0 | 5.0 | 5.0 |
| Unit: SRP | Pieces / unit        | 69  | 56  | 31  | -   |
|           | Net weight/unit (kg) | 1.4 | 1.9 | 1.5 | -   |

**Identification** Imprint: 309L-16 / AROSTA 309 S Tip Color: sea green

**Arosta® 309S: rev. EN 21**

## Materials to be welded

| Steel grades | EN 10088-1/-2 | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS |
|--------------|---------------|---------|----------------------------|-----|
|--------------|---------------|---------|----------------------------|-----|

## Corrosion resistant cladsteels

|                |        |                  |                  |
|----------------|--------|------------------|------------------|
| X2 CrNiN 18-10 | 1.4311 | (TP)304LN        | S30453           |
| X2 CrNi 19-11  | 1.4306 | (TP)304L<br>CF-3 | S30403<br>J92500 |
| X4 CrNi 18-10  | 1.4301 | (TP)304          | S30400           |

Dissimilar metals (mild and low alloyed steel to CrNi or CrNiMo stainless steel)

Build-up welding on mild and low alloyed steel

Bufferlayer CrNi-cladsteel

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 40 - 75                 | DC+             | 50                                                    | 88              | 0.93                | 21.0                         | 77                               | 1.61                                  |
| 3.2 x 350                       | 60 - 110                | DC+             | 58                                                    | 160             | 1.3                 | 32.5                         | 46                               | 1.49                                  |
| 4.0 x 350                       | 80 - 150                | DC+             | 64                                                    | 241             | 1.8                 | 48.3                         | 31                               | 1.49                                  |
| 5.0 x 350                       | 140 - 220               | DC+             | 68                                                    | 372             | 2.8                 | 78.0                         | 19                               | 1.49                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |
| 5.0                                | 180A  | 180A  | 180A  |          |       |          |

## Stainless steel electrode

## Classification

AWS A5.4 : E309LMo-16  
EN 1600 : E 23 12 2 L R 32

## Temperature range

pressurized parts : -60 ... +400°C  
scaling resistance : n.a.

## General description

A high CrNiMo alloyed all position rutile-basic electrode

High corrosion resistance

Specially developed for welding stainless steel to mild steel and root runs in cladding

max. plate thickness in butt welds ~ 12mm

Suitable for repair welding in dissimilar joints and steels difficult to weld

Weldable on AC and DC+ polarity

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC +

## Approvals

| ABS | BV    | DNV   | GL   | LR     | RINA  | RMRS   | TÜV |
|-----|-------|-------|------|--------|-------|--------|-----|
| +   | 309Mo | 309Mo | 4459 | SS/CMn | 309Mo | SS/CMn | +   |

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | Mo  | FN (acc. WRC 192) |  |
|------|-----|-----|------|------|-----|-------------------|--|
| 0.02 | 0.8 | 0.8 | 23.0 | 12.5 | 2.7 | 15-25             |  |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C | -60°C |
| Required: AWS A5.4 |           | not required                                | min. 520                                 | min. 30           | not required    |       |       |
| EN 1600            |           | min. 350                                    | min. 550                                 | min. 25           | not required    |       |       |
| Typical values     | AW        | 580                                         | 700                                      | 30                | 57              | 50    | 45    |

## Packaging and available sizes

|           |                      |     |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|-----|
|           | Diameter (mm)        | 2.0 | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 300 | 350 | 350 | 350 | 450 |
| Unit: Box | Pieces / unit        | 180 | 110 | 120 | 85  | 55  |
|           | Net weight/unit (kg) | 2.4 | 2.6 | 4.7 | 4.8 | 5.4 |

## Identification

Imprint: 309LMo-16 / AROSTA 309 Mo

Tip Color: light blue

Arosta® 309Mo: rev. EN 21

## Materials to be welded

| Steel grades                           | EN 10088-1/-2       | EN 10213-4 | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS              |
|----------------------------------------|---------------------|------------|---------|----------------------------|------------------|
| <b>First layer in CrNiMo claddings</b> |                     |            |         |                            |                  |
|                                        | X2 CrNiMo 17-12-2   |            | 1.4404  | (TP)316L<br>CF-3M          | S31603<br>J92800 |
|                                        | X2 CrNiMo 18-14-3   |            | 1.4435  | (TP)316L                   | S31603           |
|                                        | X2 CrNiMoN 17-11-2  |            | 1.4406  | (TP)316LN                  | S31653           |
|                                        | X2 CrNiMoN 17-13-3  |            | 1.4429  |                            |                  |
|                                        | X4 CrNiMo 17-12-2   |            | 1.4401  | (TP)316                    | S31600           |
|                                        | X4 CrNiMo 17-13-3   |            | 1.4436  |                            |                  |
|                                        | X6 CrNiMoTi 17-12-2 |            | 1.4571  | 316Ti                      | S31635           |
|                                        | X10 CrNiMoTi 17-3   |            | 1.4573  | 316Ti                      | S31635           |
|                                        | X6 CrNiMoNb 17-12-2 |            | 1.4580  | 316Cb                      | S31640           |
|                                        | GX5 CrNiMo 19-11    |            | 1.4408  |                            |                  |

Welding dissimilar metals: mild steel or low alloyed steel to stainless CrNiMo-steel up to max. thickness of 12 mm.

Build-up welding on mild and low alloyed steel

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>- H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|-----------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.0 x 300                       | 30 - 60                 | DC+             | 44                                                    | 46              | 0.54                  | 10.8                         | 149                              | 1.61                                  |
| 2.5 x 350                       | 40 - 80                 | DC+             | 52                                                    | 90              | 0.91                  | 20.4                         | 76                               | 1.54                                  |
| 3.2 x 350                       | 60 - 80                 | DC+             | 58                                                    | 122             | 1.4                   | 33.2                         | 45                               | 1.49                                  |
| 4.0 x 350                       | 80 - 150                | DC+             | 64                                                    | 259             | 1.9                   | 51.6                         | 30                               | 1.54                                  |
| 5.0 x 450                       | 140 - 190               | DC+             | 99                                                    | 549             | 2.6                   | 98.7                         | 14                               | 1.38                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.0                                |       | 45A   | 45A   | 40A      | 40A   | 40A      |
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |
| 5.0                                | 180A  | 180A  | 180A  |          |       |          |

## Stainless steel electrode

## Classification

AWS A5.4 : E309Mo-26  
EN 1600 : E 23 12 2 LR 53\*

\*: Deviation, see remarks

## Temperature range

pressurized parts : -20 ... +350°C  
scaling resistance : n.a.

## General description

A rutile-basic synthetic high recovery (160%) electrode for shipbuilding  
For welding carbon steel to stainless steel in the down hand position  
Excellent for fillet welding  
High resistance to porosity on primed plate  
Higher welding current can be used  
High deposition rates  
Smooth bead appearance and easy slag release  
Weldable on AC and DC+ polarity

## Welding positions



ISO/ASME PA/1G PB/2F

## Current type

AC / DC +

## Approvals

| ABS | BV | DNV   | GL   | RINA  | RMRS   |
|-----|----|-------|------|-------|--------|
| +   | UP | 309Mo | 4431 | 309Mo | SS/CMn |

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | Mo  | FN (acc. WRC 192) |
|------|-----|-----|------|------|-----|-------------------|
| 0.05 | 0.7 | 1.0 | 23.7 | 12.8 | 2.4 | 15                |

## Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%)  | Impact ISO-V(J)              |       |
|-------------------------------|-----------|---------------------------------------------|------------------------------------------|--------------------|------------------------------|-------|
|                               |           |                                             |                                          |                    | +20°C                        | -20°C |
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 350                    | min. 550<br>min. 550                     | min. 30<br>min. 25 | not required<br>not required |       |
| Typical values                | AW        | 550                                         | 740                                      | 28                 | 50                           | 45    |

## Packaging and available sizes

|           |                      |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|
|           | Diameter (mm)        | 3.2 | 4.0 | 4.5 | 5.0 |
|           | Length (mm)          | 450 | 450 | 600 | 450 |
| Unit: Box | Pieces / unit        | 90  | 55  | 40  | 35  |
|           | Net weight/unit (kg) | 6.1 | 5.9 | 7.3 | 5.8 |

## Identification

Imprint: 309Mo-26 / NICHROMA 160

Tip Color: sea green

Nichroma 160: rev. EN 21

## Materials to be welded

| Steel grades | EN 10088-1/-2 | EN 10213-4 | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS |
|--------------|---------------|------------|---------|----------------------------|-----|
|--------------|---------------|------------|---------|----------------------------|-----|

## First layer in CrNiMo claddings

|                     |                  |  |        |          |        |
|---------------------|------------------|--|--------|----------|--------|
| X2 CrNiMo 17-12-2   |                  |  | 1.4404 | (TP)316L | S31603 |
| CF-3M               | J92800           |  |        |          |        |
| X2 CrNiMo 18-14-3   |                  |  | 1.4435 | (TP)316L | S31603 |
| X4 CrNiMo 17-12-2   |                  |  | 1.4401 | (TP)316  | S31600 |
| X4 CrNiMo 17-13-3   |                  |  | 1.4436 |          |        |
| X6 CrNiMoTi 17-12-2 |                  |  | 1.4571 | 316Ti    | S31635 |
| X10 CrNiMoTi 17-3   |                  |  | 1.4573 | 316Ti    | S31635 |
| X6 CrNiMoNb 17-12-2 |                  |  | 1.4580 | 316Cb    | S31640 |
|                     | GX5 CrNiMo 19-11 |  | 1.4408 |          |        |

Welding dissimilar metals: mild steel or low alloyed steel to stainless CrNiMo-steel up to max. thickness of 12 mm.

Build-up welding on mild and low alloyed steel

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 3.2 x 450                       | 140 - 170               | DC+             | 86                                                    | 409             | 1.9                 | 68.1                         | 22                               | 1.52                                  |
| 4.0 x 450                       | 180 - 230               | DC+             | 80                                                    | 644             | 3.0                 | 105.5                        | 15                               | 1.59                                  |
| 4.5 x 600                       | 200 - 250               | DC+             |                                                       |                 |                     |                              |                                  |                                       |
| 5.0 x 450                       | 230 - 300               | DC+             | 90                                                    | 1084            | 4.1                 | 162.0                        | 10                               | 1.59                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F |
|------------------------------------|-------|-------|
| 3.2                                | 175A  | 140A  |
| 4.0                                | 200A  | 180A  |
| 5.0                                | 230A  | 230A  |

## Remarks/ Application advice

Deviations: chemical composition

C = max. 0.05%

EN: C = max. 0.04%

## Stainless steel electrode

## Classification

AWS A5.4 : E309L-17  
EN 1600 : E 23 12 L R 32

## Temperature range

pressurized parts : -120 ... +350°C  
scaling resistance : n.a.

## General description

A rutile-basic all position CrNi over-alloyed buffer electrode  
Developed for welding stainless steel to mild steel and for clad steel  
Self releasing slag  
Excellent side wall wetting, no undercut, mirror like bead appearance  
High resistance to porosity  
Weldable on AC and DC+ polarity  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC +

## Approvals

| DNV  | GL   | LR     | RMRS   | TÜV |
|------|------|--------|--------|-----|
| 309L | 4432 | SS/CMn | SS/CMn | +   |

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | FN (acc. WRC 192) |
|------|-----|-----|------|------|-------------------|
| 0.02 | 0.8 | 1.0 | 23.0 | 12.5 | 10-20             |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -20°C |
| Required: AWS A5.4 |           | not required                                | min. 520                                 | min. 30           | not required    |       |
| EN 1600            |           | min. 320                                    | min. 510                                 | min. 25           | not required    |       |
| Typical values     | AW        | 480                                         | 560                                      | 40                | 55              | 50    |

## Packaging and available sizes

|                 |                      | Diameter (mm) |     |     |     |     |
|-----------------|----------------------|---------------|-----|-----|-----|-----|
|                 |                      | 2.0           | 2.5 | 3.2 | 4.0 | 5.0 |
| Unit: Box       | Length (mm)          | 300           | 350 | 350 | 450 | 450 |
|                 | Pieces / unit        | 200           | 125 | 135 | 85  | 55  |
| Unit: SRP       | Net weight/unit (kg) | 2.3           | 2.8 | 4.9 | 5.9 | 6.0 |
|                 | Pieces / unit        | 60            | 65  | 50  | 28  | -   |
| Unit: Linc Can™ | Net weight/unit (kg) | 0.6           | 1.5 | 1.8 | 2.0 | -   |
|                 | Pieces / unit        |               | 197 | 127 | 79  | -   |
|                 | Net weight/unit (kg) |               | 4.4 | 4.5 | 5.4 | -   |

## Identification

Imprint: 309L-17 / LIMAROSTA 309 S

Tip Color: sea green

Limarosta® 309S: rev. EN 21

**Materials to be welded**

| Steel grades | EN 10088-1/-2 | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS |
|--------------|---------------|---------|----------------------------|-----|
|--------------|---------------|---------|----------------------------|-----|

**Corrosion resistant cladsteels**

|                |        |                  |                  |
|----------------|--------|------------------|------------------|
| X2 CrNiN 18-10 | 1.4311 | (TP)304LN        | S30453           |
| X2 CrNi 19-11  | 1.4306 | (TP)304L<br>CF-3 | S30403<br>J92500 |
| X4 CrNi 18-10  | 1.4301 | (TP)304          | S30400           |

Dissimilar metals (mild and low alloyed steel to CrNi or CrNiMo stainless steel)

Build-up welding on mild and low alloyed steel

Bufferlayer CrNi-cladsteel

**Calculation data**

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.0 x 300                       | 35 - 55                 | DC+             | 38                                                    | 49              | 0.66                | 11.3                         | 142                              | 1.59                                  |
| 2.5 x 350                       | 45 - 80                 | DC+             | 48                                                    | 95              | 0.99                | 22.1                         | 77                               | 1.69                                  |
| 3.2 x 350                       | 80 - 115                | DC+             | 56                                                    | 160             | 1.4                 | 35.1                         | 46                               | 1.59                                  |
| 4.0 x 450                       | 100 - 155               | DC+             | 76                                                    | 317             | 2.0                 | 69.9                         | 23                               | 1.64                                  |
| 5.0 x 450                       | 150 - 220               | DC+             | 84                                                    | 575             | 2.9                 | 108.0                        | 15                               | 1.59                                  |

\* stub end 35 mm

**Welding parameters, optimum fill passes**

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.0                                |       | 45A   | 45A   | 40A      | 40A   | 40A      |
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  |          |       |          |
| 5.0                                | 180A  | 180A  |       |          |       |          |



## Stainless steel electrode

### Classification

AWS A5.4 : E309L-15  
EN 1600 : E 23 12 L B 22

### Temperature range

pressurized parts : -196...+350°C  
scaling resistance : n.a.

### General description

A basic high CrNi alloyed buffer electrode  
For welding stainless steel to mild steel and root passes in clad steel  
Applicable for root passes in N alloyed AISI 304LN steels  
Outstanding mechanical properties  
High resistance to embrittlement  
Weldable on AC and DC+ polarity

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

### Current type

AC / DC +

### Chemical composition (w%), typical, all weld metal

| C     | Mn  | Si  | Cr   | Ni   | FN (acc. WRC 192) |
|-------|-----|-----|------|------|-------------------|
| 0.025 | 1.5 | 0.4 | 23.0 | 13.0 | 8-20              |

### Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%)  | Impact ISO-V(J)<br>-196°C |
|-------------------------------|-----------|---------------------------------------------|------------------------------------------|--------------------|---------------------------|
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 320                    | min. 520<br>min. 510                     | min. 30<br>min. 25 |                           |
| Typical values                | AW        | 470                                         | 570                                      | 40                 | 40                        |

### Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 142 | 60  |     |
|           | Net weight/unit (kg) | 4.7 | 4.8 | 4.8 |

### Identification

Imprint: 309L-15 / JUNGO 309 L

Tip Color:

Jungo® 309L: rev. EN 02

## Materials to be welded

| Steel grades | EN 10088-1/-2 | Mat. Nr | ASTM/ACI<br>A240/A312/A351 | UNS |
|--------------|---------------|---------|----------------------------|-----|
|--------------|---------------|---------|----------------------------|-----|

### Corrosion resistant cladsteels

|                |        |           |        |
|----------------|--------|-----------|--------|
| X2 CrNiN 18-10 | 1.4311 | (TP)304LN | S30453 |
| X2 CrNi 19-11  | 1.4306 | (TP)304L  | S30403 |
|                |        | CF-3      | J92500 |
| X4 CrNi 18-10  | 1.4301 | (TP)304   | S30400 |

Dissimilar metals (mild and low alloyed steel to CrNi or CrNiMo stainless steel)

Build-up welding on mild and low alloyed steel

Bufferlayer CrNi-cladsteel

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 40 - 75                 | DC+             | 50                                                    | 88              | 0.93                | 21.0                         | 77                               | 1.61                                  |
| 3.2 x 350                       | 60 - 110                | DC+             | 58                                                    | 160             | 1.3                 | 32.5                         | 46                               | 1.49                                  |
| 4.0 x 350                       | 80 - 150                | DC+             | 64                                                    | 241             | 1.8                 | 48.3                         | 31                               | 1.49                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |

## Stainless steel electrode

## Classification

AWS A5.4 : E309H-16\*  
EN 1600 : E 23 12 R 32\*

\*: Deviation, see remarks

## Temperature range

pressurized parts : -10 ... +400°C  
scaling resistance : 1100°C

## General description

A rutile basic all position stainless steel electrode

Specially developed for high temperature applications like industrial furnaces (ovens)

High resistance to oxidation up to 1050°C

Weldable on AC and DC

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC + / -

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni   | FN (acc. WRC 192) |
|------|-----|-----|------|------|-------------------|
| 0.10 | 0.8 | 1.6 | 22.0 | 11.0 | 03-8              |

## Mechanical properties, typical, all weld metal

| Condition          | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J)<br>+20°C |
|--------------------|---------------------------------------------|------------------------------------------|-------------------|--------------------------|
| Required: AWS A5.4 | not required                                | min. 550                                 | min. 30           | not required             |
| EN 1600            | min. 350                                    | min. 550                                 | min. 25           | not required             |
| Typical values     | AW 500                                      | 700                                      | 30                | 50                       |

## Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 |
|           | Length (mm)          | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 120 | 130 | 90  |
|           | Net weight/unit (kg) | 2.6 | 4.8 | 4.9 |

## Identification

Imprint: AROSTA 309 H

Tip Color: yellow

Arosta® 309H: rev. EN 21

## Materials to be welded

| Steel grades | EN 10088-1/-2    | EN 10213-4        | Mat. Nr | ASTM/ACI           | UNS    |
|--------------|------------------|-------------------|---------|--------------------|--------|
|              |                  | GX30 CrSi 6       | 1.4710  |                    |        |
|              | X10 CrAl 7       |                   | 1.4713  | 502                |        |
|              | X10 CrAl 13      |                   | 1.4724  | 410/414-TP405-CA15 |        |
|              |                  | GX40 CrSi 13      | 1.4729  |                    |        |
|              |                  | GX40 CrSi 17      | 1.4740  |                    |        |
|              | X10 CrAl 18      |                   | 1.4742  | 430-TP430-CB30     |        |
|              | X10 CrAl 24      |                   | 1.4762  | TP443              |        |
|              |                  | GX25 CrNiSi 18-9  | 1.4825  |                    | J92502 |
|              |                  | GX40 CrNiSi 22-9  | 1.4826  |                    |        |
|              | X15 CrNiSi 20-12 |                   | 1.4828  | TP309              | S30900 |
|              |                  | GX25 CrNiSi 20-14 | 1.4832  |                    |        |
|              | X12 CrNiTi 18-9  |                   |         |                    |        |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 40 - 110                | DC+             | 47                                                    | 71              | 1.1                 | 19.7                         | 73                               | 1.44                                  |
| 3.2 x 350                       | 60 - 120                | DC+             | 58                                                    | 140             | 1.5                 | 31.9                         | 42                               | 1.33                                  |
| 4.0 x 350                       | 80 - 140                | DC+             | 58                                                    | 226             | 2.2                 | 53.7                         | 29                               | 1.55                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |

For root passes DC- is recommended.

## Remarks/ Application advice

Deviations: chemical composition

Si = max. 2.0%

Cr = 20.0 - 23.0%

Ni = 10.0 - 13.0%

AWS: Si = max. 1.0%

AWS: Cr = 22.0 - 25.0%

AWS: Ni = 12.0 - 14.0%

EN: Si = max. 1.2%

## Stainless steel electrode

## Classification

AWS A5.4 : E312-17  
EN 1600 : E 29 9 R 12

## Temperature range

pressurized parts : -10 ... +350°C  
scaling resistance : n.a.

## General description

A rutile-basic high CrNi-alloyed all position electrode

Excellent for repair welding

Especially developed for steels difficult to weld, such as armour plates, austenitic Mn-steels and high C-steels

Excellent weldability and self releasing slag

Weldable on AC and DC+ polarity

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC +

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni  |
|------|-----|-----|------|-----|
| 0.11 | 0.9 | 1.0 | 29.0 | 9.0 |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J)<br>+20°C |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|--------------------------|
| Required: AWS A5.4 |           | not required                                | min. 660                                 | min. 22           | not required             |
| EN 1600            |           | min. 450                                    | min. 650                                 | min. 15           | not required             |
| Typical values     | AW        | 700                                         | 800                                      | 20                | 50                       |

## Packaging and available sizes

|                 | Diameter (mm)        | 2.0 | 2.5 | 3.2 | 4.0 | 5.0 |
|-----------------|----------------------|-----|-----|-----|-----|-----|
|                 | Length (mm)          | 300 | 350 | 350 | 350 | 350 |
| Unit: Box       | Pieces / unit        | 175 | 125 | 150 | 100 | 72  |
|                 | Net weight/unit (kg) | 2.2 | 2.6 | 5.0 | 5.0 | 5.2 |
| Unit: SRP       | Pieces / unit        | 53  | 69  | 52  | 31  | 24  |
|                 | Net weight/unit (kg) | 0.6 | 1.5 | 1.8 | 1.5 | 1.7 |
| Unit: Linc Pack | Pieces / unit        | -   | 48  | 30  | -   | -   |
|                 | Net weight/unit (kg) | -   | 1.0 | 1.0 | -   | -   |

## Identification

Imprint: 312-17 / LIMAROSTA 312

Tip Color: black

Limarosta® 312: rev. EN 21

**Materials to be welded**

Various steel grades, such as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic austenitic steels
- Work hardening austenitic manganese steels
- Dissimilar steel grades (CMn-steels to stainless steel) up to max. thickness of 12 mm

**Calculation data**

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.0 x 300                       | 40 - 55                 | DC+             | 41                                                    | 45              | 0.59                | 12.0                         | 150                              | 1.80                                  |
| 2.5 x 350                       | 50 - 70                 | DC+             | 57                                                    | 91              | 0.73                | 20.7                         | 87                               | 1.79                                  |
| 3.2 x 350                       | 70 - 100                | DC+             | 60                                                    | 126             | 1.1                 | 33.0                         | 52                               | 1.72                                  |
| 4.0 x 350                       | 100 - 130               | DC+             | 72                                                    | 273             | 1.4                 | 49.7                         | 35                               | 1.72                                  |
| 5.0 x 350                       | 130 - 140               | DC+             | 79                                                    | 313             | 2.4                 | 71.5                         | 19                               | 1.36                                  |

\* stub end 35 mm

**Welding parameters, optimum fill passes**

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 90A   | 100A  | 65A      | 65A   | 65A      |
| 4.0                                | 130A  | 125A  | 130A  | 80A      |       |          |
| 5.0                                |       |       |       |          |       |          |

## Stainless steel electrode

## Classification

AWS A5.4 : E307-16\*  
EN 1600 : E 18 8 Mn R 12

\*: Deviation, see remarks

## Temperature range

pressurized parts : -60 ... +350°C  
scaling resistance : n.a.

## General description

A rutile- basic all position 5%Mn-alloyed stainless steel electrode

Especially developed for steels difficult to weld, such as armour plates and austenitic high Mn-steels

Often used as a buffer layer in hardfacing applications

Weldable on AC and DC+ polarity

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

## Current type

AC / DC +

## Approvals

TÜV

+

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni  | FN (acc. WRC 192) |
|------|-----|-----|------|-----|-------------------|
| 0.09 | 5.0 | 0.6 | 18.5 | 8.5 | 0                 |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -60°C |
| Required: AWS A5.4 |           | not required                                | min. 590                                 | min. 30           | not required    |       |
| EN 1600            |           | min. 350                                    | min. 500                                 | min. 25           | not required    |       |
| Typical values     | AW        | 450                                         | 650                                      | 35                | 110             | 75    |

## Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 |
|           | Length (mm)          | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 125 | 135 | 85  |
|           | Net weight/unit (kg) | 2.6 | 4.7 | 4.6 |

## Identification

Imprint: AROSTA 307

Tip Color: dark blue

Arosta® 307: rev. EN 21

**Materials to be welded**

Various steel grades, such as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic austenitic steels
- Work hardening austenitic manganese steels
- Dissimilar steel grades (CMn-steels to stainless steel) up to max. thickness of 12 mm
- Problem steels

**Calculation data**

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 70 - 80                 | DC+             | 52                                                    | 108             | 0.74                | 20.4                         | 94                               | 1.92                                  |
| 3.2 x 350                       | 90 - 120                | DC+             | 56                                                    | 148             | 1.2                 | 34.7                         | 54                               | 1.87                                  |
| 4.0 x 350                       | 110 - 140               | DC+             | 84                                                    | 251             | 1.3                 | 53.6                         | 33                               | 1.77                                  |

\* stub end 35 mm

**Welding parameters, optimum fill passes**

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 80A   | 80A   | 80A   | 80A      | 80A   | 80A      |
| 3.2                                | 100A  | 100A  | 100A  | 90A      |       |          |
| 4.0                                | 140A  | 115A  | 130A  | 110A     |       |          |

**Remarks/ Application advice**

Deviations: chemical composition

Mn = 4.5 - 6.0%

AWS: Mn = 3.30 - 4.75%



## Stainless steel electrode

### Classification

ASW A5.4 : E307-26\*  
EN 1600 : E 18 8 Mn R 53

\* Nearest classification, see remarks

### General description

A rutile 6%Mn-alloyed stainless steel electrode

Especially developed for steels difficult to weld, such as armour plates and austenitic high Mn-steels

Often used as a buffer layer in hardfacing applications

Weldable on DC+ polarity

### Welding positions



ISO/ASME PA/1G PB/2F

### Current type

AC / DC +

### Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni  |
|------|-----|-----|------|-----|
| 0.06 | 5.0 | 1.0 | 18.0 | 8.0 |

### Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|
|                    |           |                                             |                                          |                   | +20°C           | -10°C |
| Required: AWS A5.4 |           | not required                                | min. 590                                 | min. 30           | not required    |       |
| EN 1600            |           | min. 350                                    | min. 500                                 | min. 25           | not required    |       |
| Typical values     | AW        | 425                                         | 650                                      | 35                | 85              | 60    |

### Packaging and available sizes

|               |                      |     |     |     |     |
|---------------|----------------------|-----|-----|-----|-----|
|               | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|               | Length (mm)          | 350 | 350 | 450 | 450 |
| Unit: PE tube | Pieces / unit        | 116 | 94  | 62  | 49  |
|               | Net weight/unit (kg) | 2.5 | 4.7 | 6.0 | 6.0 |

Identification Imprint: AROSTA 307-160

Tip Color: red

Arosta® 307-160: rev. EN 01

## Materials to be welded

Various steel grades, such as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic austenitic steels
- Work hardening austenitic manganese steels
- Dissimilar steel grades (CMn-steels to stainless steel)

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 80 - 100                | DC+             | 44                                                    | 71              | 0.96                | 17.8                         | 85                               | 1.52                                  |
| 3.2 x 350                       | 110 - 150               | DC+             | 53                                                    | 132             | 1.4                 | 29.1                         | 48                               | 1.39                                  |
| 4.0 x 450                       | 140 - 200               | DC+             | 86                                                    | 264             | 1.7                 | 55.9                         | 25                               | 1.41                                  |
| 5.0 x 450                       | 210 - 260               | DC+             | 82                                                    | 388             | 2.7                 | 85.3                         | 16                               | 1.39                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G |
|------------------------------------|-------|-------|-------|
| 2.5                                | 90A   | 90A   | 90A   |
| 3.2                                | 150A  | 140A  | 140A  |
| 4.0                                | 200A  | 180A  | 160A  |
| 5.0                                | 230A  | 230A  |       |

## Remarks/ Application advice

Deviations: chemical composition

Mn = 4.5 - 7.5%

Cr = 17.0 - 20.0%

Ni = 7.0 - 10.0%

AWS: Mn = 3.30 - 4.75%

AWS: Cr = 18.0 - 21.5%

AWS: Ni = 9.0 - 10.7%

## Stainless steel electrode

## Classification

AWS A5.4 : E307-15\*  
EN 1600 : E 18 8 Mn B 22

\*: Deviation, see remarks

## Temperature range

pressurized parts : -120 ... +400°C  
scaling resistance : n.a.

## General description

A fully basic all position 5%Mn-alloyed stainless steel electrode

Especially developed for steels difficult to weld, such as armour plates and austenitic high Mn-steels

Often used as a buffer layer in hardfacing applications

Weldable on DC+ polarity

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC +

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni  |
|------|-----|-----|------|-----|
| 0.08 | 5.5 | 0.3 | 19.0 | 8.5 |

## Mechanical properties, typical, all weld metal

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |        |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|--------|
|                    |           |                                             |                                          |                   | +20°C           | -120°C |
| Required: AWS A5.4 |           | not required                                | min. 590                                 | min. 30           | not required    |        |
| EN 1600            |           | min. 350                                    | min. 500                                 | min. 25           | not required    |        |
| Typical values     | AW        | 500                                         | 650                                      | 35                | 100             | 35     |

## Packaging and available sizes

|           |                      |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|
| Unit: Box | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 450 | 450 |
| Unit: Box | Pieces / unit        | 160 | 170 | 110 | 70  |
|           | Net weight/unit (kg) | 2.8 | 5.0 | 6.5 | 6.5 |

## Identification

Imprint: JUNGO 307

Tip Color: silver

Jungo® 307: rev. EN 21

**Materials to be welded**

Various steel grades, such as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic austenitic steels
- Work hardening austenitic manganese steels
- Dissimilar steel grades (CMn-steels to stainless steel) up to max. thickness of 12 mm
- Problem steels

**Calculation data**

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>- H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|-----------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 50 - 70                 | DC+             | 44                                                    | 71              | 0.96                  | 17.8                         | 85                               | 1.52                                  |
| 3.2 x 350                       | 70 - 100                | DC+             | 53                                                    | 132             | 1.4                   | 29.1                         | 48                               | 1.39                                  |
| 4.0 x 450                       | 100 - 130               | DC+             | 86                                                    | 264             | 1.7                   | 55.9                         | 25                               | 1.41                                  |
| 5.0 x 450                       | 160 - 170               | DC+             | 82                                                    | 388             | 2.7                   | 85.3                         | 16                               | 1.39                                  |

\* stub end 35 mm

**Welding parameters, optimum fill passes**

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 60A   | 60A   | 60A   | 60A      | 60A   | 60A      |
| 3.2                                | 90A   | 90A   | 90A   | 70A      |       |          |
| 4.0                                | 140A  | 115A  | 130A  | 95A      |       |          |
| 5.0                                | 160A  | 165A  |       |          |       |          |

**Remarks/ Application advice**

Deviations: chemical composition

Mn = 4.5 - 6.5%

Ni = 5.7 - 9.5%

AWS: Mn = 3.30 - 4.75%

AWS: Ni = 9.0 - 10.7%

## Stainless steel electrode

## Classification

EN 1600 : E 25 4 R 12\*

\*: Deviation, see remarks

## Temperature range

pressurized parts : -10 ... +350°C  
scaling resistance : +1100°C

## General description

A rutile-basic all position stainless steel electrode

Typical applications:

- Buffer electrode, hardfacing on mild steels
- Welding Cr-steels
- High corrosion resistance
- high proof stress and Tensile strength

A ferritic/austenitic structure

Good weldability and easy slag release

Weldable on AC and DC+ polarity

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC +

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni  |
|------|-----|-----|------|-----|
| 0.08 | 0.7 | 1.2 | 25.0 | 4.5 |

## Mechanical properties, typical, all weld metal

|                   | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J)<br>+20°C |
|-------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|--------------------------|
| Required: EN 1600 |           | min. 400                                    | min. 600                                 | min. 15           | not required             |
| Typical values    | AW        | 500                                         | 700                                      | 15                | 30                       |

## Packaging and available sizes

|           |                      |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 350 | 450 |
| Unit: Box | Pieces / unit        | 135 | 150 | 100 | 65  |
|           | Net weight/unit (kg) | 2.7 | 4.8 | 4.8 | 6.1 |

## Identification

Imprint: AROSTA 329

Tip Color: orange

Arosta® 329: rev. EN 21

## Materials to be welded

| Steel grades                                         | EN 10088-1/-2 | EN 10213-4       | Mat. Nr | ASTM/ACI           |
|------------------------------------------------------|---------------|------------------|---------|--------------------|
| <b>Base metals for high temperature applications</b> |               |                  |         |                    |
|                                                      |               | GX30 CrSi 6      | 1.4710  |                    |
| X10 CrSi 6                                           |               |                  | 1.4712  | 502                |
| X10 CrAl 7                                           |               |                  | 1.4713  | 502                |
|                                                      |               |                  |         | 403/405-TP405-CA15 |
| X10 CrAl 13                                          |               |                  | 1.4724  | 410/414-TP405-CA15 |
|                                                      |               | GX40 CrSi 17     | 1.4740  |                    |
| X10 CrAl 18                                          |               |                  | 1.4742  | 430B-TP430-CB30    |
|                                                      |               | GX40 CrSi 23     | 1.4745  | TP433              |
| X10 CrAl 24                                          |               |                  | 1.4762  | TP443              |
| X20 CrNiSi 25-4                                      |               |                  | 1.4821  | TP329              |
|                                                      |               | GX40 CrNi 24-5   | 1.4822  | TP329              |
|                                                      |               | GX40 CrNiSi 27-4 | 1.4823  | TP329HC            |

Applications at high temperature when high Ni-content is unacceptable

Also very well suitable for hard surfacing in sea water corrosion resisting Application

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 40 - 70                 | DC+             | 59                                                    | 94              | 0.73                | 19.5                         | 85                               | 1.64                                  |
| 3.2 x 350                       | 60 - 110                | DC+             | 58                                                    | 122             | 1.2                 | 31.4                         | 50                               | 1.56                                  |
| 4.0 x 350                       | 80 - 140                | DC+             | 72                                                    | 273             | 1.5                 | 46.5                         | 34                               | 1.59                                  |
| 5.0 x 450                       | 140 - 190               | DC+             | 98                                                    | 542             | 2.2                 | 94.4                         | 17                               | 1.59                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |
| 5.0                                | 180A  | 180A  | 180A  |          |       |          |

## Remarks/ Application advice

Deviations: chemical composition

Si = max. 1.5%

EN: Si = max. 1.2%

## Stainless steel electrode

## Classification

AWS A5.4 : E2209-16  
EN 1600 : E 22 9 3 N L R 32

## Temperature range

pressurized parts : -40 ... +250°C  
oxidation resistance : n.a.

## General description

A rutile-basic all position electrode for duplex stainless steel welding  
Excellent weldability for filling as well as for root runs  
Applicable up to a service temperature of 250°C  
High resistance to general corrosion, pitting and stress corrosion (PREN ~35)  
High yield strength > 500 N/mm<sup>2</sup>  
Weldable on AC and DC  
EMR-Sahara product  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

## Current type

AC / DC + / -

## Approvals

| BV   | DNV | GL   | RINA | TÜV |
|------|-----|------|------|-----|
| 2209 | +   | 4462 | 2209 | +   |

## Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Cr   | Ni  | Mo  | N    | FN (acc. WRC 192) |
|------|-----|-----|------|-----|-----|------|-------------------|
| 0.02 | 0.8 | 1.0 | 22.5 | 9.5 | 3.2 | 0.16 | 30-55             |

## Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%)  | Impact ISO-V(J)              |       |       |
|-------------------------------|-----------|---------------------------------------------|------------------------------------------|--------------------|------------------------------|-------|-------|
|                               |           |                                             |                                          |                    | +20°C                        | -30°C | -40°C |
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 450                    | min. 690<br>min. 550                     | min. 20<br>min. 20 | not required<br>not required |       |       |
| Typical values                | AW        | 650                                         | 800                                      | 27                 | 60                           | 50    | 40    |

## Packaging and available sizes

|           |                      |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 350 | 350 |
| Unit: Box | Pieces / unit        | 120 | 152 | 95  | 55  |
|           | Net weight/unit (kg) | 2.6 | 5.0 | 4.8 | 4.6 |
| Unit: SRP | Pieces / unit        | 69  | 52  | 29  | 24  |
|           | Net weight/unit (kg) | 1.5 | 1.8 | 1.6 | 2.0 |

## Identification

Imprint: 2209-16 / AROSTA 4462

Tip Color: white

Arosta® 4462: rev. EN 22

## Materials to be welded

| Steel grades                   | EN 10088-1/-2/-4   | Mat. Nr | ASTM / ACI<br>A240 | UNS    |
|--------------------------------|--------------------|---------|--------------------|--------|
| <b>Duplex stainless steels</b> |                    |         |                    |        |
|                                | X2 CrNiMoN 22 -5-3 | 1.4462  |                    | S31803 |
|                                |                    | 1.4417  |                    | S31500 |
|                                | X3 CrNiMoN 27-5-2  | 1.4460  |                    | S31200 |
|                                | X2 CrNiN 23-4      | 1.4362  |                    | S32304 |
|                                | X2 CrMnNi21-5-1    | 1.4162  |                    | S32101 |

Dissimilar joints such as un- and low alloyed steel to duplex stainless steel

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 40 - 75                 | DC+             | 61                                                    | 127             | 0.73                | 20.6                         | 81                               | 1.67                                  |
| 3.2 x 350                       | 80 - 110                | DC+             | 56                                                    | 184             | 1.4                 | 34.3                         | 46                               | 1.59                                  |
| 4.0 x 350                       | 80 - 150                | DC+             | 59                                                    | 205             | 2.0                 | 51.5                         | 30                               | 1.52                                  |
| 5.0 x 350                       | 140 - 220               | DC+             | 65                                                    | 357             | 2.8                 | 77.4                         | 20                               | 1.61                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 70A   | 70A   | 70A   | 60A      | 60A   | 60A      |
| 3.2                                | 100A  | 100A  | 100A  | 70A      | 70A   | 70A      |
| 4.0                                | 140A  | 140A  | 140A  | 80A      |       |          |
| 5.0                                | 180A  | 180A  | 180A  |          |       |          |

For root passes DC- is recommended.

## Remarks/ Application advice

Welding with Heat-Input max. 2.5 kJ/mm  
Interpass temperature max. 150°C



## Stainless steel electrode

### Classification

AWS A5.4 : E2209-15  
EN 1600 : E 22 9 3 N L B 22

### Temperature range

pressurized parts : -40 ... +250°C  
oxidation resistance : n.a.

### General description

A basic electrode for 22% Cr duplex stainless steel welding  
Excellent weldability for filling as well as for root runs  
Applicable up to a service temperature of 250°C  
High resistance to general corrosion, pitting and stress corrosion (PREN ~35)  
High yield strength > 500 N/mm<sup>2</sup>  
Weldable on DC+ polarity  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

### Current type

DC +

### Approvals

DNV  
+

### Chemical composition (w%), typical, all weld metal

| C     | Mn  | Si  | Cr   | Ni  | Mo  | N    | FN (acc. WRC 192) |
|-------|-----|-----|------|-----|-----|------|-------------------|
| 0.025 | 1.6 | 0.5 | 23.5 | 9.0 | 3.0 | 0.15 | 30-60             |

### Mechanical properties, typical, all weld metal

|                               | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%)  | Impact ISO-V(J)              |       |       |       |
|-------------------------------|-----------|---------------------------------------------|------------------------------------------|--------------------|------------------------------|-------|-------|-------|
|                               |           |                                             |                                          |                    | +20°C                        | -20°C | -40°C | -50°C |
| Required: AWS A5.4<br>EN 1600 |           | not required<br>min. 450                    | min. 690<br>min. 550                     | min. 20<br>min. 20 | not required<br>not required |       |       |       |
| Typical values                | AW        | 650                                         | 800                                      | 28                 | 80                           | 75    | 70    | 45    |

### Packaging and available sizes

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 |
|           | Length (mm)          | 250 | 350 | 350 |
| Unit: SRP | Pieces / unit        | 69  | 55  | 30  |
|           | Net weight/unit (kg) | 1.4 | 1.8 | 1.5 |
| Unit: Box | Pieces / unit        | 112 | 152 | 103 |
|           | Net weight/unit (kg) | 2.3 | 5.0 | 5.0 |

### Identification

Imprint: 2209-15 / JUNGO 4462

Tip Color: red

Jungo® 4462: rev. EN 22

## Materials to be welded

| Steel grades                   | EN 10088-1/-2/-4   | Mat. Nr | ASTM / ACI<br>A240 | UNS    |
|--------------------------------|--------------------|---------|--------------------|--------|
| <b>Duplex stainless steels</b> |                    |         |                    |        |
|                                | X2 CrNiMoN 22 -5-3 | 1.4462  |                    | S31803 |
|                                |                    | 1.4417  |                    | S31500 |
|                                | X3 CrNiMoN 27-5-2  | 1.4460  |                    | S31200 |
|                                | X2 CrNiN 23-4      | 1.4362  |                    | S32304 |
|                                | X2 CrMnNiN21-5-1   | 1.4162  |                    | S32101 |

Dissimilar joints such as un- and low alloyed steel to duplex stainless steel

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>- per electrode at max. current -<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|------------------------------------------------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 50 - 80                 | DC+             | 74                                                    | 101                                                  | 0.62                | 21                           | 78                               | 1.64                                  |
| 3.2 x 350                       | 70 - 110                | DC+             | 84                                                    | 219                                                  | 0.88                | 33.8                         | 49                               | 1.64                                  |
| 4.0 x 350                       | 100 - 140               | DC+             | 80                                                    | 304                                                  | 1.4                 | 50.8                         | 32                               | 1.61                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|-------------------|-------|-------|-------|----------|-------|----------|
| Diameter (mm)     |       |       |       |          |       |          |
| 2.5               | 60A   | 60A   | 60A   | 60A      | 60A   | 60A      |
| 3.2               | 85A   | 80A   | 90A   | 80A      | 80A   | 80A      |
| 4.0               | 120A  |       |       |          |       |          |

## Remarks/ Application advice

Interpass temperature depends on construction (max. 150°C)

**Stainless steel electrode****Classification**

AWS A5.4 : E2595-15  
EN 1600 : E 25 9 4 N L B 42

**Temperature range**

pressurized parts : -50 ... +250°C  
oxidation resistance : n.a.

**General description**

A fully basic all position "super duplex" electrode  
For welding Zeron 100 and other "super duplex" stainless steel grades  
Fully cored wire alloyed electrode (including W+Cu)  
High resistance to pitting and crevice corrosion, e.g. in seawater; PREN > 40  
High strength and reliable impact toughness  
Good weldability on DC+ polarity  
Only available in vacuum sealed Sahara ReadyPack® (SRP)

**Welding positions**

ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

**Current type**

DC + / -

**Chemical composition (w%), typical, all weld metal**

| C    | Mn  | Si  | Cr   | Ni  | Mo  | Cu  | W   | N   | FN (acc. WRC 192) |
|------|-----|-----|------|-----|-----|-----|-----|-----|-------------------|
| 0.03 | 0.8 | 0.3 | 25.0 | 9.5 | 3.6 | 0.8 | 0.7 | 0.2 | 30-60             |

**Mechanical properties, typical, all weld metal**

|                    | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |       |
|--------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|-------|
|                    |           |                                             |                                          |                   | -20°C           | -46°C |
| Required: AWS A5.4 |           | not required                                | min. 760                                 | min. 15           | not required    |       |
| EN 1600            |           | min. 550                                    | min. 620                                 | min. 18           | not required    |       |
| Typical values     | AW        | 740                                         | 920                                      | 24                | 50              | 45    |

**Packaging and available sizes**

|           |                      |     |     |     |
|-----------|----------------------|-----|-----|-----|
|           | Diameter (mm)        | 2.5 | 3.2 | 4.0 |
|           | Length (mm)          | 350 | 350 | 350 |
| Unit: SRP | Pieces / unit        | 69  | 52  | 15  |
|           | Net weight/unit (kg) | 1.4 | 1.8 | 0.8 |

**Identification**

Imprint: 2595-15 / JUNG0 ZERON 100 X Tip Color: purple

Jungo® Zeron 100X: rev. EN 23

## Materials to be welded

| Steel grades                                     | EN 10088-1/-2     | EN 10213-4        | Mat. Nr | ASTM / ACI<br>A276/A351/A473 | UNS    |
|--------------------------------------------------|-------------------|-------------------|---------|------------------------------|--------|
| <b>Regular and super duplex stainless steels</b> |                   |                   |         |                              |        |
|                                                  | X2CrNiMoN 25-7-4  |                   | 1.4410  |                              |        |
|                                                  | X4 CrNiMoN 27-5-2 |                   | 1.4460  |                              |        |
|                                                  | X2 CrNiMoN 22-5-3 |                   | 1.4462  | 2205                         | S31803 |
|                                                  |                   | GX6 CrNiMo 24-8-2 | 1.4463  |                              |        |
|                                                  |                   |                   |         | CD-4MCu                      | S32550 |
|                                                  |                   |                   |         | Zeron 100                    | S32760 |

Super duplex stainless steel grades: chemical composition approximately:  
24-27% Cr, 6-9% Ni, 3-4% Mo, 0.10-0.25% N alloyed also with Cu and/or W

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 45 - 70                 | DC+             | 74                                                    | 101             | 0.62                | 21.0                         | 78                               | 1.64                                  |
| 3.2 x 350                       | 70 - 100                | DC+             | 84                                                    | 219             | 0.88                | 33.8                         | 49                               | 1.64                                  |
| 4.0 x 350                       | 100 - 130               | DC+             | 80                                                    | 304             | 1.4                 | 50.8                         | 32                               | 1.61                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|------------------------------------|-------|-------|-------|----------|-------|----------|
| 2.5                                | 60A   | 60A   | 60A   | 60A      | 60A   | 60A      |
| 3.2                                | 85A   | 80A   | 90A   | 80A      | 80A   | 80A      |
| 4.0                                | 120A  | 120A  | 120A  | 100A     | 100A  | 100A     |

## Remarks/ Application advice

Welding with Heat-Input max. 1.5 kJ/mm  
Interpass temperature max. 150°C

# UTP 068 HH

## Standards :

|              |                           |
|--------------|---------------------------|
| Material-No. | : 2.4648                  |
| EN ISO 14172 | : E Ni 6082 (NiCr20Mn3Nb) |
| AWS A5.11    | : E NiCrFe-3 (mod.)       |

**Basic coated NiCrFe stick electrode for high corrosion and high temperature resistant materials**

## Application field

**UTP 068 HH** is predominantly used for joining identical or similar heat resistant Ni-base alloys, heat resistant austenites, cold tough Ni-steel, and for joining heat resistant austenitic-ferritic materials, such as 2.4817 (LC NiCr15Fe), 1.4876 (X10 NiCrTiAl 32 20), 1.4941 (X8 CrNTi 18 10). Specially also used for joinings of high C content 25/35 CrNi cast steel to 1.4859 or 1.4876 for petrochemical installations with working temperatures up to 900° C. The welding deposit is hot cracking resistant and does not tend to embrittlement.

## Properties of the weld metal

The welding deposit of **UTP 068 HH** is hot cracking resistant, does not tend to embrittlement and is scale resistant at high temperatures.

## Mechanical properties of the weld metal

| Yield strength<br>R <sub>p0,2</sub><br>MPa | Tensile strength<br>R <sub>m</sub><br>MPa | Elongation<br>A<br>% | Impact strength<br>Kv Joule<br>+20° C -196° C | Heat treatment                 |
|--------------------------------------------|-------------------------------------------|----------------------|-----------------------------------------------|--------------------------------|
| 420                                        | 680                                       | 40                   | 120 80<br>120 70                              | As welded<br>15 h 650° C / air |

## Weld metal analysis in %

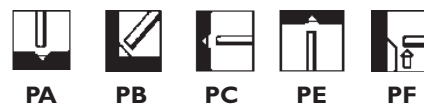
| C     | Si  | Mn  | Cr   | Mo  | Nb  | Ni      | Fe  |
|-------|-----|-----|------|-----|-----|---------|-----|
| 0,025 | 0,4 | 5,0 | 19,0 | 1,5 | 2,2 | balance | 3,0 |

## Welding instructions

Hold stick electrode as vertically as possible, only very little weaving. Fill end crater carefully. Interpass temperature max. 150° C. Re-dry electrode for 2 – 3 h / 250 – 300° C.

**Current type** DC (+)

**Welding positions**



## Availability / Current adjustment

| Stick electrodes | Ø mm x L | 2,0 x 250 | 2,5 x 300 | 3,2 x 300 | 4,0 x 350 | 5,0 x 400 |
|------------------|----------|-----------|-----------|-----------|-----------|-----------|
| Amperage         | A        | 40 - 60   | 50 - 70   | 70 - 95   | 90 - 120  | 120 - 160 |

## Approvals

TÜV (No. 00238), KTA, ABS, GL, BV, DNV

# UTP 6222 Mo

## Standards :

|              |                              |
|--------------|------------------------------|
| Material-No. | : 2.4621                     |
| EN ISO 14172 | : E Ni 6625<br>(NiCr22Mo9Nb) |
| AWS A5.11    | : E NiCrMo-3                 |

**Basic coated NiCrMo-stick electrode for corrosion and heat resistant materials**

## Application field

**UTP 6222 Mo** is particularly suited for joining and surfacing on nickel alloys, austenitic steels, low temperature nickel steels, austenitic-ferritic-joints and claddings of the same or similar nature, like 2.4856 (NiCr 22Mo 9 Nb), 1.4876 (X30 NiCrAlTi 32 20), 1.4529 (X2 NiCrMoCu 25 20 5).

## Properties of the weld metal

The weld metal is heat resistant and suitable for operating temperatures up to 1000° C. It must be noted that a slight decrease in ductility will occur if prolonged heat treatment is given within the temperature range 600 - 800° C. Scale-resisting in low-sulphur atmosphere up to 1100° C. High creep strength.

## Mechanical properties of the weld metal

| Yield strength<br>R <sub>p0.2</sub><br>MPa | Tensile strength<br>R <sub>m</sub><br>MPa | Elongation<br>A<br>% | Impact strength<br>Kv Joule<br>+20° C -196° C |
|--------------------------------------------|-------------------------------------------|----------------------|-----------------------------------------------|
| > 450                                      | > 760                                     | > 30                 | > 75 45                                       |

## Approximate weld metal analysis in %

| C    | Si  | Mn  | Cr   | Mo  | Ni      | Nb  | Fe  |
|------|-----|-----|------|-----|---------|-----|-----|
| 0,03 | 0,4 | 0,6 | 22,0 | 9,0 | balance | 3,3 | 1,5 |

## Welding instruction

Opening angle of the prepared seam approx. 70°, root gap approx. 2 mm. Weld stick electrode with slight tilt and short arc. String beads are welded. The interpass temperature of 150° C and a max. weaving width 2,5 x diameter of the stick electrode core wire should not be exceeded. Re-dry the stick electrodes 2 – 3 hours at 250 – 300° C before use and weld them out of a warm electrode carrier.

**Current type** DC (+)

**Welding positions**



## Availability / Current adjustment

| Stick electrodes | Ø mm x L | 2,5 x 250 | 3,2 x 300 | 4,0 x 350 | 5,0 x 400 |
|------------------|----------|-----------|-----------|-----------|-----------|
| Amperage         | A        | 50 – 70   | 70 – 95   | 90 – 120  | 120 – 160 |

## Approvals

TÜV (No. 03610), DNV, ABS, GL, BV

## Ni-base electrode

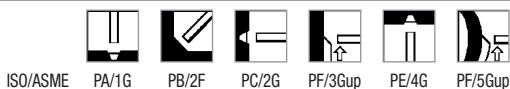
### Classification

AWS A5.11/A5.11M : ENiCrFe-3  
ISO 14172 : E Ni 6182 (NiCr15Fe6Mn)

### General description

Fully basic all position NiCr electrode  
For welding Ni-base alloys (as Alloy 600), claddings and dissimilar metals  
High creep resistance up to 815°C  
High resistance to embrittlement  
High toughness also at low temperature (-196°C)  
High resistance to carburization  
Extra alloyed with ~6% Mn to provide hot cracking resistance

### Welding positions



### Current type

DC +

### Chemical composition (w%), typical, all weld metal

| C     | Mn  | Si  | S     | Ni   | Cr | Nb  |
|-------|-----|-----|-------|------|----|-----|
| 0.025 | 5.5 | 0.4 | 0.010 | 76.1 | 16 | 2.0 |

### Mechanical properties, typical, all weld metal

|                     | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J)<br>-196°C |
|---------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|---------------------------|
| Required: AWS A5.11 |           | not required                                | min. 550                                 | min. 30           | not required              |
| ISO 14172           |           | min. 360                                    | min. 550                                 | min. 27           | not required              |
| Typical values      | AW        | 400                                         | 630                                      | 40                | 125                       |

### Packaging and available sizes

|               |                      |     |     |     |     |
|---------------|----------------------|-----|-----|-----|-----|
|               | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|               | Length (mm)          | 300 | 300 | 350 | 450 |
| Unit: PE tube | Pieces / unit        | 91  | 57  | 39  | 45  |
|               | Net weight/unit (kg) | 1.6 | 1.9 | 1.9 | 4.5 |

### Identification

Imprint: NiCrFe-3 / NICRO 70/15Mn

Tip Color: yellow

NiCro 70/15Mn: rev. EN 21

# NiCro 70/15Mn

SMAW

## Materials to be welded

| Steel grades                                                             | BS 3076 | DIN 17742<br>SEW 470/595 | Mat. Nr | ASTM / ACI<br>B366           | UNS           |
|--------------------------------------------------------------------------|---------|--------------------------|---------|------------------------------|---------------|
| <b>Ni base on Cr alloyed steels for high and low temperature service</b> |         |                          |         |                              |               |
| NA14                                                                     |         | LC-NiCr15Fe              | 2.4817  | Alloy600/B168<br>Alloy601(H) | N06600        |
|                                                                          |         | NiCr15Fe                 | 2.4816  |                              | N06600        |
|                                                                          |         | NiCr23Fe                 | 2.4851  |                              | N06601        |
|                                                                          |         | NiCr60 15                | 2.4867  |                              |               |
|                                                                          |         | NiCr80 20                | 2.4869  | Alloy75<br>Alloy80A          |               |
|                                                                          |         | NiCr20Ti                 | 2.4951  |                              | N06075        |
| NA17                                                                     |         | NiCr20TiAl               | 2.4952  |                              | N07080        |
|                                                                          |         | X12NiCrSi36 16           | 1.4864  | 330                          | N08330        |
|                                                                          |         | G-X10NiCrNb32 20         | 1.4859  |                              |               |
| NA15                                                                     |         | X10NiCrAlTi32 20         | 1.4876  | Alloy800/800H                | N08800/N08810 |

Suitable for welding dissimilar metals:

- Mild- and low-alloyed steel to stainless steel
- Mild- and low-alloyed steel to Ni base alloys
- Stainless steel to low-alloyed creep resisting steel

Not sensitive for embrittlement after heat treatment

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max.<br>(s)* | Energy<br>- at max. current -<br>E(kJ) | Dep.rate<br>- H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|---------------------------------------------|----------------------------------------|-----------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 300                       | 40 - 70                 | DC+             | 80                                          | 119                                    | 0.52                  | 17.4                         | 86                               | 1.49                                  |
| 3.2 x 300                       | 70 - 100                | DC+             | 77                                          | 193                                    | 0.84                  | 29.0                         | 56                               | 1.61                                  |
| 4.0 x 350                       | 90 - 140                | DC+             | 74                                          | 289                                    | 1.7                   | 50.9                         | 29                               | 1.47                                  |
| 5.0 x 450                       | 130 - 160               |                 |                                             |                                        |                       |                              |                                  |                                       |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions | PA/1G | PB/2F | PC/2G | PF/3G up | PE/4G | PF/5G up |
|-------------------|-------|-------|-------|----------|-------|----------|
| Diameter (mm)     |       |       |       |          |       |          |
| 2.5               | 60A   | 55A   | 60A   | 60A      | 60A   | 60A      |
| 3.2               | 90A   | 80A   | 90A   | 80A      | 80A   | 80A      |
| 4.0               | 120A  | 120A  |       |          |       |          |

## Remarks/ Application advice

Welding with Heat-Input max. 1.5 kJ/mm

Interpass temperature max. 150°C



## Ni-base electrode

### Classification

AWS A5.11/A5.11M : ENiCrMo-6  
ISO 14172 : E Ni 6620 (NiCr14Mo7Fe)

### General description

Basic high recovery all position electrode for welding low temperature steels  
Recovery of approximately 150%, providing high deposition rates  
Especially developed for welding 9% Ni steel  
Linear expansion coefficient equivalent to that of 9% Ni steel  
Excellent impact toughness at -196°C, reliable 0.2%-Yield strength  
Weldable on AC as well as DC+ polarity  
Only available in Sahara ReadyPack (vacuum sealed)

### Welding positions



### Current type

AC / DC +

### Approvals

GL TÜV  
5680 +

### Chemical composition (w%), typical, all weld metal

| C    | Mn  | Si  | Ni | Cr | Mo | Nb  | W   | Fe |
|------|-----|-----|----|----|----|-----|-----|----|
| 0.05 | 3.0 | 0.4 | 68 | 13 | 6  | 1.5 | 1.5 | 6  |

### Mechanical properties, typical, all weld metal

|                      | Condition | 0.2% Proof strength<br>(N/mm <sup>2</sup> ) | Tensile strength<br>(N/mm <sup>2</sup> ) | Elongation<br>(%) | Impact ISO-V(J) |        |
|----------------------|-----------|---------------------------------------------|------------------------------------------|-------------------|-----------------|--------|
|                      |           |                                             |                                          |                   | +20°C           | -196°C |
| Required: AWS A5.11M |           | not required                                | min. 620                                 | min. 35           | not required    |        |
| ISO 14172            |           | min. 350                                    | min. 620                                 | min. 32           | not required    |        |
| Typical values       | AW        | 475                                         | 725                                      | 40                | 100             | 90     |

### Packaging and available sizes

|           |                      |     |     |     |     |
|-----------|----------------------|-----|-----|-----|-----|
| Unit: SRP | Diameter (mm)        | 2.5 | 3.2 | 4.0 | 5.0 |
|           | Length (mm)          | 350 | 350 | 350 | 450 |
|           | Pieces / unit        | 62  | 52  | 27  | 10  |
|           | Net weight/unit (kg) | 1.7 | 2.2 | 1.8 | 1.5 |

### Identification

Imprint: NiCrMo-6 / NYLOID 2

Tip Color: white

Nyloid 2: rev. EN 22

## Materials to be welded

| Steel grades                                        | EN 10028-4       | Mat. Nr | ASTM                | UNS    |
|-----------------------------------------------------|------------------|---------|---------------------|--------|
| <b>9% Ni steel for LNG storage tanks</b>            |                  |         |                     |        |
|                                                     | X8Ni9            | 1.5662  | A353/A353M          |        |
|                                                     | X8Ni9 (9% Ni)    | 1.5662  | A553/A553M Type I   |        |
|                                                     | (8% Ni)          |         | A 553/A553M Type II | K71340 |
| <b>Low alloyed steel for cryogenic applications</b> |                  |         |                     |        |
|                                                     | X12Ni5 (12Ni19)  | 1.5680  |                     | K41583 |
|                                                     | 10Ni14 (3.5% Ni) | 1.5637  | A333 Grade 3        |        |
|                                                     | 12Ni14 (3.5% Ni) | 1.5637  | A202 Grade E        |        |

## Calculation data

| Sizes<br>Diam. x length<br>(mm) | Current<br>range<br>(A) | Current<br>type | Arc time<br>- per electrode at max. current -<br>(s)* | Energy<br>E(kJ) | Dep.rate<br>H(kg/h) | Weight/<br>1000 pcs.<br>(kg) | Electrodes/<br>kg weldmetal<br>B | kg Electrodes/<br>kg weldmetal<br>1/N |
|---------------------------------|-------------------------|-----------------|-------------------------------------------------------|-----------------|---------------------|------------------------------|----------------------------------|---------------------------------------|
| 2.5 x 350                       | 70 - 100                | AC              | 54                                                    | 128             | 1.3                 | 26.5                         | 53                               | 1.39                                  |
| 3.2 x 350                       | 85 - 145                | AC              | 63                                                    | 229             | 1.8                 | 43.6                         | 31                               | 1.37                                  |
| 4.0 x 350                       | 140 - 190               | AC              | 73                                                    | 355             | 2.4                 | 65.8                         | 21                               | 1.33                                  |
| 5.0 x 450                       | 180 - 280               | AC              | 94                                                    | 764             | 3.7                 | 133.5                        | 10                               | 1.35                                  |

\* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions<br>Diameter (mm) | PA/1G      | PB/2F      | PC/2G      | PF/3G up   | PE/4G      | PF/5G up   |
|------------------------------------|------------|------------|------------|------------|------------|------------|
| 2.5                                | 90 - 100A  | 90 - 100A  | 90 - 100A  | 90 - 100A  | 90 - 100A  | 80 - 100A  |
| 3.2                                | 135 - 145A | 135 - 145A | 135 - 145A | 125 - 135A | 125 - 135A | 120 - 135A |
| 4.0                                | 170 - 185A | 170 - 185A | 170 - 185A | 140 - 165A |            |            |
| 5.0                                | 220 - 270A | 220 - 280A |            |            |            |            |

## Remarks/ Application advice

Recommended Heat-Input for plate thickness:

≤ 15 mm: 1.4 kJ/mm

15 - 20 mm: 1.6 kJ/mm

< 20 mm: 2.0 kJ/mm



| <b>On- en laaggelegeerd staal</b> |               |                                 |
|-----------------------------------|---------------|---------------------------------|
| Union K 52                        | ER 70 – S6    | G 42 2 C G3Si1 / G 42 4 M G3Si1 |
| DMO – IG                          | ER 70S – A1   | G MoSi                          |
| DCMS – IG                         | ER 80S – G    | G CrMi 1 Si                     |
| CM 2 – IG                         | ER90S – G     | G CrMo2Si                       |
| Union Ni 2,5                      | ER80S – Ni2   | G 50 7 M ZG2Ni2                 |
| Union NiMoCr                      | ER 100S - G   | G 69 g M Mn4Ni1,5 CrMo          |
| Union Patinax                     | ER70S – G     | G 42 3 C G0 / G 46 4 M G0       |
| <b>Corrosievast staal</b>         |               |                                 |
| Thermanit JE-308 L Si             | ER 308 L Si   | G 19 9 L Si                     |
| Thermanit H Si                    | ER 347 Si     | G 19 9 Nb Si                    |
| Thermanit ATS 4                   | ER 19 – 10 H  | G 19 9 H                        |
| Thermanit GE 316 L Si             | ER 316 L Si   | G 19 12 3 L Si                  |
| Thermanit A Si                    | ER 318 (mod)  | G 19 12 3 Nb Si                 |
| Thermanit C Si                    | ER 310 (mod)  | G 25 20 Mn                      |
| Thermanit 25/14 E- 309 L Si       | ER 309 L Si   | G 23 12 L si                    |
| Avesta P5                         | ER 309L Mo    | L                               |
| Thermanit 30 /10                  | ER 312        | G 29 9                          |
| Thermanit X                       | ER 307 (mod)  | G 18 8 Mn                       |
| Thermanit 22/09                   | ER 2209       | G 22 9 3 N I                    |
| Thermanit 25/09 CuT               | ER 2594       | G 25 9 4 N L                    |
| <b>Nikkellegeringen</b>           |               |                                 |
| UTP A 068 HH                      | ER NiCr- 3    | S NiCr20Mn3Nb                   |
| UTP A 6222 Mo                     | ER NiCrMo – 3 | NiCr22Mo9Nb                     |
|                                   |               |                                 |

# Union K 52

GMAW solid wire

08.2009

Rev.: 0

## Classifications

**EN ISO 14341-A**
**EN ISO 14341-B**
**AWS A5.18**

G 42 2 C G3Si1/  
G 42 4 M G3Si1

G 49A 2 C G6  
G 49A 4 M G6

ER70S-6

## Characteristics and field of use

GMAW solid wire electrode for welding unalloyed and low alloy steels with shielding gas. All-purpose useable with gas mixture or CO<sub>2</sub>, low-spatter transfer in the short and spray arc range. Used in boiler and pipeline construction, shipbuilding, vehicle manufacturing and structural engineering.

## Materials

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

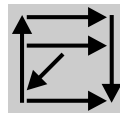
## Typical analysis in %

| C    | Si   | Mn   |
|------|------|------|
| 0.08 | 0.85 | 1.50 |

## Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT)

| Heat-treatment | Shielding gas   | Yield str. 0.2% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |        |        |
|----------------|-----------------|---------------------|----------------------|-------------------------------------------------|------------------------|--------|--------|
|                |                 |                     |                      |                                                 | +20 °C                 | -20 °C | -40 °C |
| AW             | CO <sub>2</sub> | 420                 | 540                  | 25                                              | 85                     | 47     | —      |
| AW             | M21             | 440                 | 560                  | 24                                              | 95                     | 60     | 47     |

## Welding position


**Polarity = +**
**Shielding gas (EN ISO 14175) M1 - M3 and C1**

## Approvals

TÜV (Certificate No. 106)  
ABS  
LR

DB (Reg. form No. 42.132.02)  
GL (3YHS)  
DNV

## Packaging and weights

(Tolerances acc. EN ISO 544)

**Diam. (mm)**
**Spool**
**kg/pack**

|     |      |    |
|-----|------|----|
| 0.8 | B300 | 15 |
| 0.9 | B300 | 18 |
| 1.0 | B300 | 18 |
| 1.2 | B300 | 18 |
| 1.6 | B300 | 18 |

Other spool types on request

EN ISO 21952-A: G MoSi  
 EN ISO 21952-B: G 52M 1M3  
 AWS A5.28: ER70S-A1 (ER80S-G)  
 AWS A5.28M: ER49S-A1 (ER55S-G)  
 W. No.: 1.5424

## BÖHLER DMO-IG

**GMAW solid wire, low-alloyed,  
high temperature**

### Description

GMAW wire for 0.5% Mo alloyed boiler, plate and tube steels as well as in pressure vessel and structural steel engineering. Highly-quality, very tough deposit of high cracking resistance, non-ageing. Approved in long- term condition up to +550°C service temperature. Low temperature toughness to -40°C. The wire shows very good feeding characteristics, resulting in smooth welding and wetting behaviour. Uniform copper bonding with low total copper content.

### Typical Composition of Solid Wire

|      | C          | Si         | Mn         | Mo         |
|------|------------|------------|------------|------------|
| wt-% | <b>0.1</b> | <b>0.6</b> | <b>1.2</b> | <b>0.5</b> |

### Mechanical Properties of All-weld Metal

|                                                 | u                        | u2                | a                 |
|-------------------------------------------------|--------------------------|-------------------|-------------------|
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):   | <b>500</b> (≥470)        | <b>470</b> (≥450) | <b>450</b> (≥400) |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa): | <b>620</b> (≥550)        | <b>590</b> (≥520) | <b>570</b> (≥520) |
| elongation A ( $L_0=5d_0$ ) %:                  | <b>25</b> (≥22)          | <b>23</b> (≥20)   | <b>25</b> (≥19)   |
| impact work ISO-V KV J                          | +20°C: <b>150</b> (≥120) | <b>160</b> (≥120) | <b>150</b> (≥120) |
|                                                 | -40°C: (≥47)             | (≥47)             |                   |

u untreated, as-welded – shielding gas Ar + 18% CO<sub>2</sub>

u2 untreated, as-welded – shielding gas 100% CO<sub>2</sub>

a annealed, 620°C/1h/furnace down to 300°C/air – shielding gas Ar + 18% CO<sub>2</sub>

### Operating Data



shielding gases:

**Argon + 15- 25% CO<sub>2</sub>**  
**100% CO<sub>2</sub>**

ø mm

0.8  
1.0  
1.2

**=+**

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

### Base Materials

high temperature steels and similar alloyed cast steels, ageing resistant and steels resistant to caustic cracking

16Mo3, S355J2G3, L320 - L415NB, L320 MB - L415MB, P255G1TH, P235GH, P265GH P295GH, P310GH, P255NH, 17MnMoV6-4, 22NiMoCr4-7, 20MnMoNi5-5, 15NiCuMoNb5, 20MnMoNi4-5, GE240-GE300, 22Mo4, S255N - S460N, P255NH-P460NH

ASTM A335 Gr. P1, A161-94 Gr. T1 A A182M Gr. F1, A204M Gr. A, B, C, A250M Gr. T1, A217 Gr. WC1

### Approvals and Certificates

TÜV-D (0021.), DB (42.014.09), ÖBB, TÜV-A (76), SEPROZ, CE, NAKS

### Same Alloy Filler Metals

|                  |            |                  |                |
|------------------|------------|------------------|----------------|
| SMAW electrode:  | FOX DMO Kb | SAW combination: | EMS 2 Mo/BB 24 |
|                  | FOX DMO Ti |                  | EMS 2 Mo/BB 25 |
| GTAW rod:        | DMO-IG     | Gas welding rod: | DMO            |
| Flux cored wire: | DMO Ti-FD  |                  |                |

EN ISO 21952-A: G CrMo1Si  
 EN ISO 21952-B: G G1CM3  
 AWS A5.28: ER80S-G  
 ER80S-B2 (mod.)  
 AWS A5.28M: ER55S-G  
 ER55S-B2 (mod.)  
 W. No.: 1.7339

## BÖHLER DCMS-IG

**GMAW solid wire,  
 low-alloyed, high temperature**

### Description

GMAW wire for 1.25 % Cr 0.5% Mo alloyed boiler, plate and tube steels as well as for the welding of quenched and tempered and case hardening steels. Preferably used for the steels 13CrMo4-5 or ASTM A335 P11/P12. Approved in long-term condition up to +570°C service temperature.

The deposit is noted for its good mechanical properties and good toughness. Further, good resistance to cracking, when attacked by caustic soda, and the fact that it is suitable for nitriding, quenching and tempering are additional features. The values of the creep rupture strength lay within the scatter band of the material 13CrMo4-5.

The wire shows very good feeding characteristics, resulting in smooth welding and wetting behaviour. Uniform copper bonding with low total copper content.

### Typical Composition of Solid Wire

|      | C           | Si         | Mn         | Cr         | Mo         |
|------|-------------|------------|------------|------------|------------|
| wt-% | <b>0.11</b> | <b>0.6</b> | <b>1.0</b> | <b>1.2</b> | <b>0.5</b> |

### Mechanical Properties of All-weld Metal

|                                                                                               |            |        |
|-----------------------------------------------------------------------------------------------|------------|--------|
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):                                                 | <b>460</b> | (≥420) |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa):                                               | <b>570</b> | (≥510) |
| elongation A ( $L_0=5d_0$ ) %:                                                                | <b>23</b>  | (≥20)  |
| impact work ISO-V KV J                                                                        | <b>150</b> | (≥47)  |
| a      annealed, 680°C/2h/ furnace down to 300°C/air – shielding gas Ar + 18% CO <sub>2</sub> |            |        |

### Operating Data

|                                                                                     |                                                                        |      |                                                                                       |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------|
|  | shielding gases:                                                       | ø mm |  |
|                                                                                     | <b>Argon + 15- 25% CO<sub>2</sub></b>                                  | 0.8  |                                                                                       |
|                                                                                     | <b>100% CO<sub>2</sub></b>                                             | 1.0  |                                                                                       |
|                                                                                     | Using 100% CO <sub>2</sub> the mechanical properties can be different. | 1.2  |                                                                                       |
|                                                                                     |                                                                        | 1.6  |                                                                                       |

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

Preheating and interpass temperature for 13CrMo4-5 (P11/P12), 200-250°C. Tempering at 660-700°C at least ½ hr, followed by cooling in furnace down to 300°C and still air.

### Base Materials

high temperature steels and similar alloyed cast steels, case hardening and nitriding steels of similar chemical composition, similar alloyed heat treatable steels with tensile strength up to 780 N/mm<sup>2</sup>, steels resistant to caustic cracking

1.7335 13CrMo4-5, 1.7262 15CrMo5, 1.7728 16CrMoV4, 1.7218 25CrMo4, 1.7258 24CrMo5, 1.7354 G22CrMo5-4, 1.7357 G17CrMo5-5

ASTM A193 Gr. B7, A335 Gr. P11 u. P12, A217 Gr. WC6

### Approvals and Certificates

TÜV-D (1091.), DB (42.014.15), ÖBB, TÜV-A (92), SEPROZ, CE

### Same Alloy Filler Metals

|                 |             |                  |                  |
|-----------------|-------------|------------------|------------------|
| SMAW electrode: | FOX DCMS Kb | SAW combination: | EMS 2 CrMo/BB 24 |
|                 | FOX DCMS Ti |                  | EMS 2 CrMo/BB 25 |
| GTAW rod:       | DCMS-IG     | Gas welding rod: | DCMS             |
|                 | DCMS-IG B2  | Flux cored wire: | DCMS Ti-FD       |

EN ISO 21952-A: G CrMo2Si  
 EN ISO 21952-B: G G2C1M3  
 AWS A5.28: ER90S-G  
 ER90S-B3 (mod.)  
 AWS A5.28M: ER62S-G  
 ER62S-B3 (mod.)  
 W.No.: 1.7384

## BÖHLER CM 2-IG

**GMAW solid wire,  
 low-alloyed, high temperature**

### Description

GMAW for 2.25% Cr 1% Mo alloyed boiler, plate and tube steels as well as in oil refineries e.g. in crack plants. Preferably used for the base metal 10CrMo9-10 (ASTM A335 Gr. P22) Approved in long-term condition up to +600°C service temperature. Also for similar alloyed quenched and tempered steels and case hardening steels. The deposit is noted for its good mechanical properties and cracking resistance, but also for its creep rupture strength which is within the scatter band of 10CrMo9-10.

The wire shows very good feeding characteristics, resulting in smooth welding and wetting behaviour.

### Typical Composition of Solid Wire

|      | C           | Si         | Mn          | Cr         | Mo         |
|------|-------------|------------|-------------|------------|------------|
| wt-% | <b>0.08</b> | <b>0.6</b> | <b>0.95</b> | <b>2.6</b> | <b>1.0</b> |

### Mechanical Properties of All-weld Metal

|                                                 |            |        |
|-------------------------------------------------|------------|--------|
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):   | <b>440</b> | (≥400) |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa): | <b>580</b> | (≥500) |
| elongation A ( $L_0=5d_0$ ) %:                  | <b>23</b>  | (≥22)  |
| impact work ISO-V KV J                          | <b>170</b> | (≥47)  |

*a*      annealed, 720°C/ h / furnace down to 300°C/air – shielding gas Ar + 18% CO<sub>2</sub>

### Operating Data



|                                                                        |             |
|------------------------------------------------------------------------|-------------|
| shielding gases:                                                       | <b>ø mm</b> |
| <b>Argon + 15- 25% CO<sub>2</sub></b>                                  | 0.8         |
| <b>100% CO<sub>2</sub></b>                                             | 1.0         |
| Using 100% CO <sub>2</sub> the mechanical properties can be different. | 1.2         |

**=+**

Preheating and interpass temperature 200-350°C. Tempering at 700-750°C for at least 1 hr followed by cooling in furnace down to 300°C and still air.

### Base Materials

high temperature steels and similar alloyed cast steels, QT-steels similar alloyed up to 980 N/mm<sup>2</sup> tensile strength, similar alloyed case hardening steels, nitriding steels

1.7380 10CrMo9-10, 1.8075 10CrSiMoV7, 1.7379 G17CrMo9-10

ASTM A335 Gr. P22, A217 Gr. WC 9

### Approvals and Certificates

TÜV-D (1085.), TÜV-A (88), SEPROZ, CE, DB (42.014.39)

### Same Alloy Filler Metals

|                  |                                       |
|------------------|---------------------------------------|
| SMAW electrode:  | FOX CM 2 Kb<br>FOX CM 2 Kb SC*        |
| GTAW rod:        | CM 2-IG                               |
| SAW combination: | CM 2-UP/BB 24<br>CM 2 SC-UP/BB 24 SC* |

\*For step cooling application

Subject to change without notice

16.04.2008

# Union Ni 2,5

GMAW solid wire

12.2010

Rev.: 1

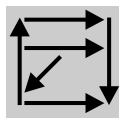
| Classifications | EN ISO 14341-A  | EN ISO 14341-B | AWS A5.28       |
|-----------------|-----------------|----------------|-----------------|
|                 | G 50 7 M ZG2Ni2 | G 57A 8 M GN5  | ER80S-Ni2(mod.) |

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

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

| Typical analysis in % | C    | Si   | Mn   | Ni   |
|-----------------------|------|------|------|------|
|                       | 0.08 | 0.60 | 1.00 | 2.35 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment              | Shielding gas | Yield strength 0.2% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN<br>+20 °C -70 °C -80 °C |    |    |
|-----------------------------------------------------------------------------------------|-----------------------------|---------------|-------------------------|----------------------|-------------------------------------------------|------------------------------------------------|----|----|
|                                                                                         | AW                          | M21           | 510                     | 620                  | 24                                              | 120                                            | 47 | —  |
|                                                                                         | SR                          | M21           | 450                     | 560                  | 24                                              | 140                                            | —  | 47 |
|                                                                                         | SR (560 °C (1040 °F) – 4 h) |               |                         |                      |                                                 |                                                |    |    |

**Welding position**


**Polarity = +**  
**Shielding gas (EN ISO 14175) M1, M2**

**Approvals**

TÜV (Certificate No. 1627)  
GL (7YS)  
BV

ABS  
LR  
DNV

**Packaging and weights**

(Tolerances acc. EN ISO 544)

| Diam. (mm)                   | Spool | kg/pack |
|------------------------------|-------|---------|
| 1.0                          | B300  | 18      |
| 1.2                          | B300  | 18      |
| Other spool types on request |       |         |



# Union NiMoCr

GMAW solid wire

10.2009

Rev.: 1

## Classifications

**EN ISO 16834-A**
**AWS A5.28**

G 69 6 M Mn4Ni1,5CrMo

ER100S-G  
[ER100S-1(mod.)]

## Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered and thermomechanically treated fine grained structural steels; for joint welding of wear resistant steels. For use with CO<sub>2</sub> and gas mixture. Outstanding toughness of the weld metal at low temperatures. For use in crane and vehicle manufacturing.

## Materials

S690QL1 (alform 700 M; aldur 700 QL1; Dillimax 690; N-A-XTRA 70; Weldom 700),  
S620QL1 (Dillimax 620; N-A-XTRA 63),  
S700MC (alform 700 M; Domex 700 MC; PAS 70)

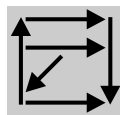
## Typical analysis in %

| C    | Si   | Mn   | Cr   | Mo   | Ni   |
|------|------|------|------|------|------|
| 0.08 | 0.60 | 1.70 | 0.20 | 0.50 | 1.50 |

## Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT)

|    | Shielding gas   | Yield strength 0.2% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |        |        |
|----|-----------------|-------------------------|----------------------|-------------------------------------------------|------------------------|--------|--------|
|    |                 |                         |                      |                                                 | +20 °C                 | -40 °C | -60 °C |
| AW | CO <sub>2</sub> | 680                     | 740                  | 18                                              | 80                     | 47     | —      |
| AW | M21             | 720                     | 780                  | 16                                              | 100                    | —      | 47     |

## Welding position



**Polarity = +**  
**Shielding gas (EN ISO 14175) M21 and C1**

## Approvals

TÜV (Certificate No. 2760)  
ABS  
BV  
LR

DB (Reg. form No. 42.132.08)  
DNV  
GL (6Y69S)

## Packaging and weights

(Tolerances acc. EN ISO 544)

| Diam. (mm)                   | Spool | kg/pack |
|------------------------------|-------|---------|
| 0.8                          | B300  | 15      |
| 1.0                          | B300  | 18      |
| 1.2                          | B300  | 18      |
| Other spool types on request |       |         |

# Union Patinax

GMAW solid wire

08.2009

Rev.: 0

| Classifications | EN ISO 14341-A              | EN ISO 14341-B               | AWS A5.18 |
|-----------------|-----------------------------|------------------------------|-----------|
|                 | G 42 3 C G0/<br>G 46 4 M G0 | G 55A 3 C G0<br>G 55A 4 M G0 | ER70S-G   |

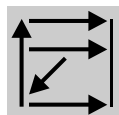
|                                         |                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Characteristics and field of use</b> | Medium alloy solid wire electrode for shielded arc welding of weatherproof structural steels. The weld metal has the same corrosion properties as matching weatherproof structural steels. For use with CO <sub>2</sub> and gas mixture. Outstanding toughness of the weld metal at low temperatures. For use in steel framed structures, in bridge building and rail vehicle manufacture. |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                  |                                                 |
|------------------|-------------------------------------------------|
| <b>Materials</b> | S235J2W - S355K2W; ASTM A36; A36; A283 Gr. B, C |
|------------------|-------------------------------------------------|

| Typical analysis in % | C    | Si   | Mn   | Ni   | Cu   |
|-----------------------|------|------|------|------|------|
|                       | 0.09 | 0.85 | 1.50 | 0.50 | 0.40 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Shielding gas   | Yield strength 0.2% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |        |        |
|-----------------------------------------------------------------------------------------|----------------|-----------------|-------------------------|----------------------|-------------------------------------------------|------------------------|--------|--------|
|                                                                                         |                |                 |                         |                      |                                                 | +20 °C                 | -30 °C | -40 °C |
|                                                                                         | AW             | CO <sub>2</sub> | 450                     | 570                  | 26                                              | 90                     | 47     | —      |
|                                                                                         | AW             | M21             | 480                     | 590                  | 24                                              | 100                    | —      | 47     |

Welding position


Polarity = +  
Shielding gas (EN ISO 14175) C1 and M21

|                  |                           |                              |
|------------------|---------------------------|------------------------------|
| <b>Approvals</b> | TÜV (Certificate No. 337) | DB (Reg. form No. 42.132.05) |
|------------------|---------------------------|------------------------------|

| Packaging and weights        | Diam. (mm)                   | Spool | kg/pack |
|------------------------------|------------------------------|-------|---------|
| (Tolerances acc. EN ISO 544) | 0.8                          | B300  | 15      |
|                              | 1.0                          | B300  | 18      |
|                              | 1.2                          | B300  | 18      |
|                              | Other spool types on request |       |         |

# Thermanit JE-308L Si

GMAW wire

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | G 19 9 L Si    | SS308LSi       | ER308LSi | 1.4316   |

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

**Materials** TÜV-certified parent metal  
1.4301 – X5CrNi18-10 1.4311 – X2CrNi18-10;  
1.4550 – X6CrNiNb18-10 AISI 304, 304L, 304LN, 302, 321, 347; ASTM A157 Gr. C9, A320 Gr. B8C or D.

| Typical analysis in % | C    | Si  | Mn  | Cr   | Ni   |
|-----------------------|------|-----|-----|------|------|
|                       | 0.02 | 0.9 | 1.7 | 20.0 | 10.0 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN -196 °C |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|--------------------------------|
|                                                                                         | AW             | 350                     | 370                     | 570                  | 35                                              | 75 35                          |

**Structure** Austenite with part ferrite

## Welding instruction

| Materials                                                                                      | Preheating | Postweld treatment                                                 |
|------------------------------------------------------------------------------------------------|------------|--------------------------------------------------------------------|
| Matching and similar non-stabilized and stabilized austenitic CrNi(N) steels/cast steel grades | None       | Mostly none. If necessary, solution annealing at 1000 °C (1832 °F) |
| Cryogenic austenitic steels/cast steel grades                                                  | None       | None                                                               |

**Polarity = +**

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

| Approvals | TÜV (Certificate No. 0555)<br>CWB (ER 308L-Si) | DB (Reg. form No. 43.132.08)<br>DNV |
|-----------|------------------------------------------------|-------------------------------------|
|-----------|------------------------------------------------|-------------------------------------|

| Packaging and weights (Tolerances acc. EN ISO 544) | Diam. (mm) | Spool | kg/pack |
|----------------------------------------------------|------------|-------|---------|
|                                                    | 0.8        | BS300 | 15      |
|                                                    | 1.0        | B300  | 15      |
|                                                    | 1.2        | B300  | 15      |
|                                                    | 1.6        | B300  | 15      |

# Thermanit H Si

GMAW wire

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | G 19 9 Nb Si   | SS347Si        | ER347Si  | 1.4551   |

## Characteristics and field of use

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

## Materials

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

## Typical analysis in %

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

## Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT)

| Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
| AW             | 400                     | 430                     | 570                  | 30                                              | 65                     |

## Structure

Austenite with part ferrite

08.2009

Rev.: 0

## Welding instruction

| Materials                                     | Preheating | Postweld treatment                                             |
|-----------------------------------------------|------------|----------------------------------------------------------------|
| Matching and similar steels/cast steel grades | None       | Mostly none. Otherwise solution annealing at 1020 °C (1868 °F) |

**Polarity = +**

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

## Approvals

TÜV (Certificate No. 0604)

DB (Reg. form No. 43.132.06)

## Packaging and weights

(Tolerances acc. EN ISO 544)

| Diam. (mm) | Spool | kg/pack |
|------------|-------|---------|
| 0.8        | BS300 | 15      |
| 1.0        | B300  | 15      |
| 1.2        | B300  | 15      |

# Thermanit ATS 4

GMAW wire

01.2011  
Rev.: 1

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9  | Mat. No. |
|-----------------|----------------|----------------|-----------|----------|
|                 | G 199 H        | SS19-10H       | ER19-10 H | 1.4948   |

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

|                  |                                                  |                                              |
|------------------|--------------------------------------------------|----------------------------------------------|
| <b>Materials</b> | 1.4550 – X6CrNiNb18-10<br>1.4878 – X12CrNiTi18-9 | 1.4948 – X6CrNi18-1<br>AISI 304H; 321H; 347H |
|------------------|--------------------------------------------------|----------------------------------------------|

| Typical analysis in % | C    | Si  | Mn  | Cr   | Ni  |
|-----------------------|------|-----|-----|------|-----|
|                       | 0.05 | 0.3 | 1.8 | 18.8 | 9.3 |

**Creep and stress rupture properties** In the range of matching high temperature resistant parent metals

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 350                     | 370                     | 550                  | 35                                              | 70                     |

**Structure** Austenite with approx. 5 % ferrite

## Welding instruction

| Materials                                            | Preheating                                                                                            | Postweld treatment                                                                                                            |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Matching/<br>similar steels/<br>cast steel<br>grades | Up to 25 mm wall thickness:<br>none. Over 25 mm wall-<br>thickness: max. 200 °C (392 °F)<br>advisable | Up to 25 mm wall thickness: none<br>Over 25 mm wall thickness: to<br>avoid stress corrosion<br>cracking 1050 °C (1922 °F)/air |

**Polarity = +**  
**Shielding gas (EN ISO 14175) M12**

**Approvals** TÜV (Certificate No. 6522)

| Packaging and weights<br>(Tolerances acc. EN ISO 544) | Diam. (mm) | Spool | kg/pack |
|-------------------------------------------------------|------------|-------|---------|
|                                                       | 1.0        | B300  | 15      |
|                                                       | 1.2        | B300  | 15      |

# Thermanit GE-316L Si

GMAW wire

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | G 19 12 3 L Si | SS316LSi       | ER316LSi | 1.4430   |

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

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

| Typical analysis in % | C    | Si  | Mn  | Cr   | Mo  | Ni   |
|-----------------------|------|-----|-----|------|-----|------|
|                       | 0.02 | 0.8 | 1.7 | 18.8 | 2.8 | 12.5 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 380                     | 420                     | 560                  | 35                                              | 70                     |

**Structure** Austenite with part ferrite

## Welding instruction

| Materials                                                                   | Preheating | Postweld treatment                                                                                              |
|-----------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------|
| Matching and similar non-stabilized and stabilized steels/cast steel grades | None       | Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to tendency to embrittlement |

**Polarity = +**  
**Shielding gas (EN ISO 14175) M12, M13**

| Approvals | TÜV (Certificate No. 0489)<br>LR (ftV3R-12)<br>GL (4429S) | DB (Reg. form No. 43.132.10)<br>CWB (ER 316L-Si)<br>DNV |
|-----------|-----------------------------------------------------------|---------------------------------------------------------|
|-----------|-----------------------------------------------------------|---------------------------------------------------------|

| Packaging and weights (Tolerances acc. EN ISO 544) | Diam. (mm) | Spool | kg/pack |
|----------------------------------------------------|------------|-------|---------|
|                                                    | 0.8        | BS300 | 15      |
|                                                    | 1.0        | B300  | 15      |
|                                                    | 1.2        | B300  | 15      |
|                                                    | 1.6        | B300  | 15      |

# Thermanit A Si

GMAW wire

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A  | AWS A5.9    | Mat. No. |
|-----------------|-----------------|-------------|----------|
|                 | G 19 12 3 Nb Si | ER318(mod.) | 1.4576   |

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

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

| Typical analysis in % | C    | Si  | Mn  | Cr   | Mo  | Ni   | Nb    |
|-----------------------|------|-----|-----|------|-----|------|-------|
|                       | 0.05 | 0.8 | 1.5 | 19.0 | 2.8 | 12.0 | ≥12xC |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 390                     | 410                     | 600                  | 30                                              | 70                     |

**Structure** Austenite with part ferrite

## Welding instruction

| Materials                                 | Preheating | Postweld treatment                                                                                              |
|-------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------|
| Matching/similar steels/cast steel grades | None       | Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to tendency to embrittlement |

**Polarity = +**  
**Shielding gas (EN ISO 14175) M12, M13**

**Approvals** TÜV (Certificate No. 0601) DB (Reg. form No. 43.132.02)

| Packaging and weights (Tolerances acc. EN ISO 544) | Diam. (mm) | Spool | kg/pack |
|----------------------------------------------------|------------|-------|---------|
|                                                    | 0.8        | BS300 | 15      |
|                                                    | 1.0        | B300  | 15      |
|                                                    | 1.2        | B300  | 15      |
|                                                    | 1.6        | B300  | 15      |



# Thermanit C Si

GMAW wire

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | AWS A5.9    | Mat. No. |
|-----------------|----------------|-------------|----------|
|                 | G 25 20 Mn     | ER310(mod.) | 1.4842   |

**Characteristics and field of use** Resistant to scaling up to 1150 °C (2102 °F). For surfacing and joining on matching/similar heat resistant steels/cast steel grades. For tough fill layers beneath cap passes made with Thermanit L when welding thicker cross-sections of Cr steels/cast steel grades to permit use of such steels in sulphurous atmospheres.

| Atmosphere                         | max. application temperature in °C (°F) |                            |
|------------------------------------|-----------------------------------------|----------------------------|
|                                    | sulphur-free                            | max. 2 g S/Nm <sup>3</sup> |
| Air and oxidizing combustion gases | 1150 (2102)                             | 1100 (2012)                |
| Reducing combustion gases          | 1080 (1976)                             | 1040 (1904)                |

**Materials** 1.4837 – GX40CrNiSi25-12 1.4840 – GX15CrNi25-20  
1.4841 – X15CrNiSi25-20  
AISI 305, 310, 314; ASTM A297 HF, A297HJ

| Typical analysis in % | C    | Si  | Mn  | Cr   | Ni   |
|-----------------------|------|-----|-----|------|------|
|                       | 0.13 | 1.0 | 3.2 | 25.0 | 20.5 |

**Creep and stress rupture properties** In the range of matching heat resistant parent metals

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 350                     | 380                     | 550                  | 25                                              | 80                     |

**Structure** Austenite

## Welding instruction

| Materials                                                | Preheating                | Postweld treatment        |
|----------------------------------------------------------|---------------------------|---------------------------|
| Heat resistant Cr steels/cast steel grades               | According to parent metal | According to parent metal |
| Heat resistant matching/similar steels/cast steel grades | None                      | None                      |

**Polarity = +**  
**Shielding gas (EN ISO 14175) M13**

| Packaging and weights (Tolerances acc. EN ISO 544) | Diam. (mm) | Spool | kg/pack |
|----------------------------------------------------|------------|-------|---------|
|                                                    | 0.8        | BS300 | 15      |
|                                                    | 1.0        | B300  | 15      |
|                                                    | 1.2        | B300  | 15      |

# Thermanit 25/14 E-309L Si

08.2009

Rev.: 0

GMAW wire

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | G 23 12 L Si   | SS309LSi       | ER309LSi | 1.4332   |

## Characteristics and field of use

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

## Materials

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

## Typical analysis in %

| C    | Si  | Mn  | Cr   | Ni   |
|------|-----|-----|------|------|
| 0.03 | 0.9 | 2.0 | 24.0 | 13.0 |

## Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT)

| Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
| AW             | 400                     | 430                     | 550                  | 30                                              | 55                     |

## Structure

Austenite with part ferrite

## Welding instruction

| Materials                                                                                      | Preheating                                               | Postweld treatment                                                                                                                                                 |
|------------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Joining: CrNi(MoN) austenitic steels with unalloyed/low-alloy steels/cast steel grades         | According to ferritic parent metal; mostly not necessary | No postweld heat treatment above 300 °C (572 °F); risk of carbide precipitation in weld fusion zone, loss of toughness, fracturing                                 |
| Joining: CrNi(MoN) austenitic steels with stainless heat resistant Cr steels/cast steel grades | According to ferritic parent metal                       | According to parent metals. Attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement |
| Cladded plates and cast materials with austenitic CrNi(MoN) overlay                            | According to ferritic parent metal                       | According to parent metals. Attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement |

**Polarity = +**  
**Shielding gas (EN ISO 14175) M12, M13**

## Approvals

GL (4332 S)

CBW (ER309LSi)

## Packaging and weights

(Tolerances acc. EN ISO 544)

| Diam. (mm) | Spool | kg/pack |
|------------|-------|---------|
| 0.8        | BS300 | 15      |
| 1.0        | B300  | 15      |
| 1.2        | B300  | 15      |

# P5

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

## Standard designations

EN ISO 14343 G 23 12 2 L

AWS A5.9 (ER309LMo)\*

\* Cr lower and Ni higher than standard.

## Characteristics and welding directions

AVESTA P5 is a molybdenum-alloyed wire of the 309MoL type, which is primarily designed for surfacing low-alloy steels and for dissimilar welding between stainless steels and low-alloy steels, ensuring a high resistance to cracking. It can also be used for welding high strength steels such as Hardox® and Armox®. When used for surfacing, the composition is more or less equal to that of ASTM 316 from the first run.

## Chemical composition, wire (typical values, %)

| C       | Si           | Mn               | Cr   | Ni   | Mo  |
|---------|--------------|------------------|------|------|-----|
| 0.02    | 0.35         | 1.5              | 21.5 | 15.0 | 2.7 |
| Ferrite | 9 FN<br>8 FN | DeLong<br>WRC-92 |      |      |     |

| Mechanical properties     | Typical values (IIW)  | Min. values EN ISO 14343 |
|---------------------------|-----------------------|--------------------------|
| Yield strength $R_{p0.2}$ | 390 N/mm <sup>2</sup> | 350 N/mm <sup>2</sup>    |
| Tensile strength $R_m$    | 610 N/mm <sup>2</sup> | 550 N/mm <sup>2</sup>    |
| Elongation $A_5$          | 31 %                  | 25 %                     |
| Impact strength KV        |                       |                          |
| +20°C                     | 75 J                  |                          |
| −40°C                     | 60 J                  |                          |
| Hardness                  | 210 Brinell           |                          |

## Welding data

|            | Diameter<br>mm | Current<br>A                                                              | Voltage<br>V |
|------------|----------------|---------------------------------------------------------------------------|--------------|
| Short arc  | 0.80           | 60 – 120                                                                  | 18 – 22      |
|            | 1.00           | 110 – 140                                                                 | 20 – 22      |
| Spray arc  | 1.00           | 160 – 220                                                                 | 25 – 29      |
|            | 1.20           | 200 – 260                                                                 | 26 – 30      |
|            | 1.60           | 250 – 320                                                                 | 29 – 32      |
| Pulsed arc | 1.20           | $I_{peak}$ = 350 – 450 A<br>$I_{bkg}$ = 50 – 150 A<br>Freq = 100 – 150 Hz |              |

## Shielding gas

Ar + 2% O<sub>2</sub> or 2 – 3% CO<sub>2</sub>.

Gas flow rate 12 – 16 l/min.

**Interpass temperature:** Max. 150°C.

**Heat input:** Max. 2.0 kJ/mm.

**Heat treatment:** Generally none.

For constructions that include low-alloy steels in mixed joints, a stress-relieving annealing stage may be advisable. However, this type of alloy may be susceptible to embrittlement-inducing precipitation in the temperature range 550 – 950°C.

**Structure:** Austenite with 5 – 10% ferrite.

**Scaling temperature:** Approx. 950°C (air).

**Corrosion resistance:** Superior to type 316L. The corrosion resistance obtained on the first layer when surfacing corresponds to that of ASTM 316.

## Approvals

• CE • DB • DNV • TÜV

# Thermanit 30/10

08.2009

Rev.: 0

GMAW wire

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | G 29 9         | SS312          | ER312    | 1.4337   |

**Characteristics and field of use**

Stainless; wet corrosion up to 300 °C (572 °F). High resistance to hot cracking: good toughness at high yield strength. For joining and surfacing applications with matching/similar steels/cast steel grades. For fabricating tough joints (one layer) on unalloyed/low-alloy structural steels of higher strength, on high manganese steel and CrNiMn steels.

**Materials**

1.3401 – X120Mn12, 1.4006 – X10Cr13 and joints between the forementioned steels, as well as 1.4583 – X10CrNiMoNb18-12 and ferritic structural steels as S235J, S355J

| Typical analysis in % | C    | Si  | Mn  | Cr   | Ni  |
|-----------------------|------|-----|-----|------|-----|
|                       | 0.15 | 0.5 | 1.6 | 30.0 | 9.0 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 500                     | 750                  | 20                                              | 27                     |

**Structure** Austenite/ferrite

## Welding instruction

| Materials                                                                                    | Preheating                | Postweld treatment   |
|----------------------------------------------------------------------------------------------|---------------------------|----------------------|
| Stainless and heat resistant, unalloyed and low-alloy steels/cast steel grades; combinations | According to parent metal | Mostly not necessary |

**Polarity = +**  
**Shielding gas (EN ISO 14175) M12, M13**

| Packaging and weights        | Diam. (mm) | Spool | kg/pack |
|------------------------------|------------|-------|---------|
| (Tolerances acc. EN ISO 544) | 1.0        | B300  | 15      |
|                              | 1.2        | B300  | 15      |

# Thermanit X

GMAW wire

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | AWS A5.9    | Mat. No. |
|-----------------|----------------|-------------|----------|
|                 | G 18 8 Mn      | ER307(mod.) | 1.4370   |

## Characteristics and field of use

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

## Materials

TÜV-certified parent metal  
1.4583 – X10CrNiMoNb18-12 and included parent metals combined with ferritic steels up to fine-grained structural steel P460NL2;  
on and between high-tensile, unalloyed and alloyed structural steels, quenched and tempered steels and armour steels; unalloyed as well as alloyed boiler or structural steels with high alloyed Cr and CrNi steels; heat resistant steels up to 850 °C (1562 °F), on austenitic high manganese steels and with other steels; cryogenic plate and pipe steels in combination with cryogenic austenitic materials.

## Typical analysis in %

| C    | Si  | Mn  | Cr   | Ni  |
|------|-----|-----|------|-----|
| 0.08 | 0.8 | 7.0 | 19.0 | 9.0 |

## Mechanical properties of the weld metal according to EN ISO 1592-1 (min. values at RT)

| Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
| AW             | 370                     | 400                     | 600                  | 35                                              | 100                    |

## Structure

Austenite with small amount of ferrite

## Welding instruction

| Materials                                                                                          | Preheating                                               | Postweld treatment                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heat resistant Cr steels/cast steel grades                                                         | According to wall thickness: 150 - 300 °C (302 - 572 °F) | Tempering at 750 °C (1382 °F) not necessary if service temperature the same or higher                                                                                     |
| Heat resistant CrNi steels/cast steel grades                                                       | None                                                     | None                                                                                                                                                                      |
| Joining of CrNi(MoN) austenitic steels to unalloyed/low-alloy steels/cast steel grades             | According to ferritic parent metal, mostly not necessary | No postweld heat treatment $\geq 300^{\circ}\text{C}$ (572 °F) – risk of carbide precipitation at grain boundaries in the weld fusion zone, loss of toughness, fracturing |
| Joining of CrNi(MoN) austenitic steels to stainless and heat-resistant Cr steels/cast steel grades | According to ferritic parent metal                       | According to parent metals. Attention must be paid to the inter-crystalline corrosion resistance and embrittlement susceptibility of the austenitic metal side            |

**Polarity = +**

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

## Approvals

TÜV (Certificate No. 5651)  
GL (4370 S)

DB (Reg. form No. 43.132.01)  
DNV

## Packaging and weights

(Tolerances acc. EN ISO 544)

| Diam. (mm) | Spool | kg/pack |
|------------|-------|---------|
| 0.8        | BS300 | 15      |
| 1.0        | B300  | 15      |
| 1.2        | B300  | 15      |
| 1.6        | B300  | 15      |

# Thermanit 22/09

GMAW wire

10.2009

Rev.: 1

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | G 22 9 3 N L   | SS2209         | ER2209   | ≈1.4462  |

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

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

| Typical analysis in % | C     | Si  | Mn  | Cr   | Mo  | Ni  | N    |
|-----------------------|-------|-----|-----|------|-----|-----|------|
|                       | 0.025 | 0.5 | 1.6 | 23.0 | 3.0 | 9.0 | 0.14 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 510                     | 550                     | 700                  | 25                                              | 70                     |

**Structure** Austenite/ferrite

## Welding instruction

| Materials                                 | Preheating | Postweld treatment                                                       |
|-------------------------------------------|------------|--------------------------------------------------------------------------|
| Matching/similar steels/cast steel grades | None       | Mostly none; if necessary solution annealing at 1050 °C (1922 °F)/ water |

**Polarity = +**  
**Shielding gas (EN ISO 14175) M12, M13**

| Approvals | TÜV (Certificate No. 3342)<br>DNV (W 11132) | GL (4462S) |
|-----------|---------------------------------------------|------------|
|-----------|---------------------------------------------|------------|

| Packaging and weights (Tolerances acc. EN ISO 544) | Diam. (mm) | Spool | kg/pack |
|----------------------------------------------------|------------|-------|---------|
|                                                    | 0.8        | BS300 | 15      |
|                                                    | 1.0        | B300  | 15      |
|                                                    | 1.2        | B300  | 15      |
|                                                    | 1.6        | B300  | 15      |



# Thermanit 25/09 CuT

GMAW wire

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------|----------|
|                 | G 25 9 4 N L   | ER2594   | ≈1.4501  |

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

**Materials** 1.4501 – X2CrNiMoCuN25-7-4 – UNS S32760  
1.4515 – GX3CrNiMoCuN26-6-3  
1.4517 – GX3CrNiMoCuN25-6-3-3  
25 % Cr-superduplex steels such as Zeron 100,  
SAF 25/07, FALC 100, NIROSTA® 4501

| Typical analysis in % | C    | Si  | Mn  | Cr   | Mo  | Ni  | N    | Cu  | W   |
|-----------------------|------|-----|-----|------|-----|-----|------|-----|-----|
|                       | 0.02 | 0.3 | 1.5 | 25.5 | 3.7 | 9.5 | 0.22 | 0.8 | 0.6 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN –46 °C |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-----------------------|----------------------|-------------------------------------------------|-------------------------------|
|                                                                                         | AW             | 650                     | 700                   | 750                  | 25                                              | 80 50                         |

**Structure** Austenite/ferrite

08.2009

Rev.: 0

## Welding instruction

| Materials                                 | Preheating  | Postweld treatment                                                         |
|-------------------------------------------|-------------|----------------------------------------------------------------------------|
| Matching/similar steels/cast steel grades | Mostly none | Mostly none; if necessary, solution annealing at 1120 °C (2048 °F)/ water. |

**Polarity = +**

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

| Packaging and weights        | Diam. (mm) | Spool | kg/pack |
|------------------------------|------------|-------|---------|
| (Tolerances acc. EN ISO 544) | 1.0        | B300  | 15      |
|                              | 1.2        | B300  | 15      |

# UTP A 068 HH

## Standards :

|              |                              |
|--------------|------------------------------|
| Material-No. | : 2.4806                     |
| EN ISO 18274 | : S Ni 6082<br>(NiCr20Mn3Nb) |
| AWS A5.14    | : ER NiCr-3                  |

**NiCrFe rods and wires for corrosion and high temperature materials**

## Application field

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

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

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

## Properties of the weld metal

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

## Mechanical properties of the weld metal

| Yield strength<br>R <sub>p0,2</sub><br>MPa | Tensile strength<br>R <sub>m</sub><br>MPa | Elongation<br>A<br>% | Impact strength<br>K <sub>v</sub><br>Joule |
|--------------------------------------------|-------------------------------------------|----------------------|--------------------------------------------|
| > 420                                      | 680                                       | 40                   | 20° C 160<br>-196° C 80                    |

## Weld metal analysis in %

| C      | Si    | Mn  | Cr   | Ni      | Nb  | Fe  |
|--------|-------|-----|------|---------|-----|-----|
| < 0,02 | < 0,2 | 3,0 | 20,0 | balance | 2,7 | 0,8 |

## Welding instruction

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

## Welding procedure and availability

| Ø<br>(mm) | Current type | Shielding gas<br>EN ISO 14175 |     |                    | Availability         |                    |
|-----------|--------------|-------------------------------|-----|--------------------|----------------------|--------------------|
|           |              | I I                           | R I | Z-ArHeHC-30/2/0,05 | Spools<br>EN ISO 544 | Rods<br>EN ISO 544 |
| 0,8       | DC (+)       |                               |     | x                  | x                    |                    |
| 1,0       | DC (+)       | s                             |     | x                  | x                    |                    |
| 1,2       | DC (+)       |                               |     | x                  | x                    |                    |
| 1,6       | DC (+)       |                               |     | x                  | x                    |                    |
| 1,6       | DC (-)       | x                             | x   |                    |                      | x                  |
| 2,0       | DC (-)       | x                             | x   |                    |                      | x                  |
| 2,4       | DC (-)       | x                             | x   |                    |                      | x                  |
| 3,2       | DC (-)       | x                             | x   |                    |                      | x                  |

## Approvals TÜV (No. 00882; 00883), KTA, ABS, GL, DNV

#### Standards :

|              |                              |
|--------------|------------------------------|
| Material-No. | : 2.4831                     |
| EN ISO 18274 | : S Ni 6625<br>(NiCr22Mo9Nb) |
| AWS A5.14    | : ER NiCrMo-3                |

## UTP A 6222 Mo

**Rods and wires for high corrosion resistant  
NiCrMo-alloys**

#### Application field

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

|                   |        |            |
|-------------------|--------|------------|
| XI NiCrMoCuN25206 | 1.4529 | UNS N08926 |
| XI NiCrMoCuN25205 | 1.4539 | UNS N08904 |
| NiCr21Mo          | 2.4858 | UNS N08825 |
| NiCr22Mo9Nb       | 2.4856 | UNS N06625 |

It can be used for joining ferritic steel to austenitic steel as well as for surfacing on steel. It is also possible to weld 9 % nickel steels using this wire due to its high yield strength.

Its wide range of uses is of particular significance in aviation, in chemical industry and in applications involving seawater.

#### Special properties of the weld metal

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

#### Mechanical properties of the weld metal

| Yield strength<br>$R_{p0,2}$<br>MPa | Tensile strength<br>$R_m$<br>MPa | Elongation<br>A<br>% | Impact strength<br>$K_v$<br>Joule |
|-------------------------------------|----------------------------------|----------------------|-----------------------------------|
| > 460                               | > 740                            | > 30                 | 20° C > 100<br>-196° C > 85       |

#### Weld metal analysis in %

| C      | Si    | Cr   | Mo  | Ni      | Nb  | Fe  |
|--------|-------|------|-----|---------|-----|-----|
| < 0,02 | < 0,2 | 22,0 | 9,0 | balance | 3,5 | 1,0 |

#### Welding instruction

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

#### Welding procedure and availability

| Ø<br>(mm) | Current type | Shielding gas<br>EN ISO 14175 |                    | Availability |            |
|-----------|--------------|-------------------------------|--------------------|--------------|------------|
|           |              |                               |                    | Spools       | Rods       |
|           |              | R I                           | Z-ArHeHC-30/2/0,05 | EN ISO 544   | EN ISO 544 |
| 0,8 *     | DC (+)       |                               | x                  | x            |            |
| 1,0       | DC (+)       |                               | x                  | x            |            |
| 1,2       | DC (+)       |                               | x                  | x            |            |
| 1,6       | DC (+)       |                               | x                  | x            |            |
| 1,6       | DC (-)       | x                             |                    |              | x          |
| 2,0       | DC (-)       | x                             |                    |              | x          |
| 2,4       | DC (-)       | x                             |                    |              | x          |
| 3,2 *     | DC (-)       | x                             |                    |              | x          |

\* available on request

**Approvals** TÜV (No. 03460; 03461), GL, DNV, ABS, LR (1,2mm MIG)



| <b>On- en laaggelegeerd staal</b> |                    |                           |
|-----------------------------------|--------------------|---------------------------|
| Fluxofil M 10                     | E 70C-6M H4        | T 46 4 M M 1 H5           |
| Fluxofil 11 HD                    | E 71T – 1C H4      | T 46 2 P C 1 H5           |
| Fluxofil 14                       | E71T – 1M – JH4    | T 46 4 P M 1 H5           |
| Fluxofil 20                       | E81T1 – Ni1M – JH4 | T 46 4 1Ni P M 1 H5       |
| Fluxofil 25                       | E81T 1 – A1M – H4  | T MoL P M 1 H5            |
| Fluxofil 31                       | E70T – 5C – JH4    | T 42 4 B C 2 H5           |
| Fluxofil 35                       | E80T5 – GC – H4    | T MoL B C 2 H5            |
| Fluxofil 36                       | E80T5 – B2C – H4   | T CtMo1 B C 2 H5          |
| Fluxofil 37                       | E80T5 – B3C – H4   | T CrMo2 B C 2 H5          |
| Fluxofil 40                       | E80T5 – GC – H4    | T 46 6 1Ni B C 2 H5       |
| Fluxofil 41                       | E90T5 – GC –H4     | T 55 4 1NiMo B M 1 H5     |
| Fluxofil 42                       | E110T5 – K4C – H4  | T69 6 Mn2NiCrMo B C 2 H5  |
| Fluxofil M 42                     | E70T5 – GM –JH4    | T 42 8 2Ni B M 2 H5       |
| Fluxofil 44                       | E110C – GM - H4    | T69 4 Mn2 NiCrMo M M 1 H5 |
| Fluxofil 48                       | E 81 T5 – GC – H4  | T 46 6 Z B C2 H5          |
| Citiflux R 82 SR                  | E81T1 – Ni1M – H4  | T 46 6 1Ni P M 1 H5       |
| <b>Corrosievast staal</b>         |                    |                           |
| Fluxinox 308 L                    | E308LT0 – 1        | T 19 9 L R C 3            |
| Fluxinox 347                      | E347LT0 - 1        | T 19 9 Nb R C 3           |
| Fluxinox 316 L                    | E316LT0 - 1        | T 19 12 3 L R C           |
| Fluxinox 318                      | E318L T0 - 1       | T 19 12 3 Nb R C 3        |
| Fluxinox 310                      | E 310T0 – G        | T 25 20 R C 3             |
| Fluxinox 309L                     | E309L T0 – 1       | T 23 12 L R C 3           |
| Fluxinox 307                      |                    | T 18 8 Mn R C 3           |
| Fluxinox 312                      | E 312T0 – 1        | T 29 9 R C 3              |
| Fluxinox 22 9 3 L                 | E 2209T0 – 1       | T 22 9 3 N L R C 3        |

## Cored Wires C-Mn and low-alloy steels

FLUXOFIL M10 is a seamless copper coated metal cored wire with outstanding welding properties in the short-arc and spray-arc ranges depositing slag free weld metal. Almost spatter-free when welding in the spray-arc range. Good restriking, even with a cold wire tip, thus being suitable for robotic applications. Characteristic features: good side wall fusion, smooth and finely rippled welds without undercut into the base metal. Little formation of silicates on top of weld, so that multi-pass welds can be made without inter-run cleaning. Due to an easily controllable weld pool in the short-arc range, FLUXOFIL M 10 is well-suited for root- and positional welding.

| Classification |                          | Approvals | Grade          |
|----------------|--------------------------|-----------|----------------|
| EN ISO         | 17632-A: T 46 4 M M 1 H5 | ABS       | 4YSA H5        |
| EN ISO         | 17632-B: T554T15-1MA-UH5 | BV        | SA3Y M H5 KV40 |
| AWS            | A5.18: E70C-6M H4        | DB        | ●              |
|                |                          | DNV       | IVY40MS H5     |
|                |                          | GL        | 4YH5S          |
|                |                          | LRS       | 4Y40S H5       |
|                |                          | TÜV       | ●              |

CE

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P     | S     |
|------|-----|-----|-------|-------|
| 0.08 | 1.5 | 0.4 | 0.010 | 0.010 |

### All-weld metal Mechanical Properties

| Heat Treatment      | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|---------------------|-------------------------|---------------------------|----------------------|---------------------------|
|                     |                         |                           |                      | -40 °C                    |
| 580°C x 2 h/furnace | ≥ 460                   | 550-680                   | ≥ 24                 | ≥ 80                      |
| As Welded           | ≥ 460                   | 550-680                   | ≥ 24                 | ≥ 60                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : M21

### Materials

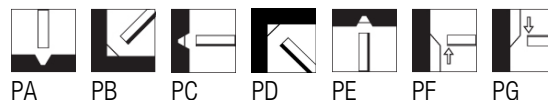
S(P)235-S(P)460, GP240-GP280

#### Storage

Keep dry and avoid condensation

#### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 | DRUM |
|-----------------------|------|------|
| Diam(mm) / weight(kg) | 16   | 200  |
| 1.0                   | ●    |      |
| 1.2                   | ●    | ●    |
| 1.6                   | ●    | ●    |

## Cored Wires C-Mn and low-alloy steels

FLUXOFIL 11 HD is a seamless copper coated rutile flux cored wire with excellent weldability in all position. The high filling degree of FLUXOFIL 11 HD results in a higher current carrying capacity and deposition rate. Welding speed is increased which leads to a saving of time and reduction of costs. It can be used in all positions with only one welding parameter setting (24 volts, wire feed = 9m/min, wire dia. 1,2 mm). FLUXOFIL 11 HD is used for manual welding, as well as in fully mechanized welding. To be used under CO<sub>2</sub> and it is characterized by low spatter loss, good slag removal and finely rippled, pore-free welds without undercut into the base metal.

| Classification |                          |
|----------------|--------------------------|
| EN ISO         | 17632-A: T 46 2 P C 1 H5 |
| EN ISO         | 17632-B: T552T1-1CA-UH5  |
| AWS            | A5.20: E71T-1C H4        |

| Approvals | Grade     |
|-----------|-----------|
| ABS       | 3Y40SA H5 |
| LRS       | 3Y40S H5  |
| RINA      | 3Y40S H5  |
| TÜV       | ●         |

CE

### Chemical analysis (Typical values in %)

| C    | Mn  | Si   |
|------|-----|------|
| 0.05 | 1.2 | 0.55 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | -20 °C                    |
| As Welded      | ≥ 460                   | 550-650                   | ≥ 22                 | ≥ 60                      |

Gas test: 100% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1

### Materials

Shipbuilding steels A,B,D,E,AH32 to EH36

S(P)235-S(P)460, GP240-GP280

| Storage                         |
|---------------------------------|
| Keep dry and avoid condensation |

| Current condition and welding position                                                |                                                                                       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| DC+                                                                                   |                                                                                       |
|    |   |
|  |  |
|  |  |
|  |                                                                                       |
| PA                                                                                    | PB                                                                                    |
| PC                                                                                    | PD                                                                                    |
| PE                                                                                    | PF                                                                                    |
| PG                                                                                    |                                                                                       |

### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |

## Cored Wires C-Mn and low-alloy steels

FLUXOFIL 14 is a seamless copper coated rutile flux cored wire with a fast-freezing slag. Due to an easily controllable weld pool, it shows outstanding welding characteristics in all positions. It is particularly suitable for partly and fully mechanized welding of girth seams in pipelines. In MAG-orbital welding in the 6 to 12 o'clock position, 1.2-1.4 mm electrodes, are preferred. Low spatter loss, easy slag removal, smooth finely rippled welds without undercut into the base metal are outstanding features.

| Classification |                          |
|----------------|--------------------------|
| EN ISO         | 17632-A: T 46 4 P M 1 H5 |
| EN ISO         | 17632-B: T554T1-1MA-UH5  |
| AWS            | A5.20: E71T-1M-JH4       |

| Approvals | Grade       |
|-----------|-------------|
| ABS       | 3YSA H5     |
| BV        | SA3YM H5    |
| DNV       | IIIY46MS H5 |
| GL        | 3YH5S       |
| LRS       | 3S-3YS H5   |
| RMRS      | 3YS H10     |
| TÜV       | ●           |

CE

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P       | S       |
|------|-----|-----|---------|---------|
| 0.05 | 1.2 | 0.5 | ≤ 0.010 | ≤ 0.010 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |        |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|--------|
|                |                         |                           |                      | -20 °C                    | -40 °C |
| As Welded      | ≥ 460                   | 550-650                   | ≥ 22                 | ≥ 80                      | ≥ 47   |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : M21

### Materials

Shipbuilding steels A,B,D,E,AH32 - EH36

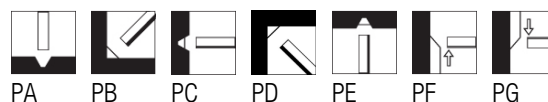
S(P)235-S(P)460, GP240-GP280

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |



## Cored Wires C-Mn and low-alloy steels

FLUXOFIL 20 is a seamless copper coated rutile flux cored wire with a fast-freezing slag, producing a weld metal with excellent mechanical-technological properties and a hydrogen content of < 5 ml per 100g deposited weld metal. Easily controllable weld pool and outstanding welding properties in all positions. Low spatter loss, easy slag removal producing finely rippled, pore-free welds without undercut.

| Classification |                              |
|----------------|------------------------------|
| EN ISO         | 17632-A: T 46 4 1Ni P M 1 H5 |
| EN ISO         | 17632-B: T554T1-1MA-N1-UH5   |
| AWS            | A5.29: E81T1-Ni1M-JH4        |

| Approvals | Grade      |
|-----------|------------|
| ABS       | 4Y46SA H5  |
| BV        | SA4Y46M H5 |
| DB        | ●          |
| GL        | 4Y46H5S    |
| LRS       | 4Y46S H5   |
| RMRS      | 4Y46S H5   |
| TÜV       | ●          |

CE

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P       | S       | Ni    |
|------|-----|-----|---------|---------|-------|
| 0.03 | 1.2 | 0.5 | ≤ 0.010 | ≤ 0.010 | ≤ 0.9 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | -40 °C                    |
| As Welded      | ≥ 480                   | 570-680                   | ≥ 23                 | ≥ 47                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : M21

### Materials

S(P)275-S(P)460

X42 - X70

| Storage                         |
|---------------------------------|
| Keep dry and avoid condensation |

| Current condition and welding position                                              |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| DC+                                                                                 |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |
|  |  |  |  |  |  |  |
| PA                                                                                  | PB                                                                                   | PC                                                                                    | PD                                                                                    | PE                                                                                    | PF                                                                                    | PG                                                                                    |

### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |

## Cored Wires Chromium-Molybdenum steels

FLUXOFIL 25 is a seamless copper coated rutile flux cored wire with a fast-freezing slag, suitable for the welding of creep resistant boiler and pipe steels, for operating temperatures up to 530 °C, as well as fine grain structural steels. Due to its easily controllable weld pool, it features outstanding welding properties in all positions. Low spatter loss, finely rippled welds without undercut.

| Classification |                          |
|----------------|--------------------------|
| EN ISO         | 17634-A: T MoL P M 1 H5  |
| EN ISO         | 17634-B: T55T1-1M-2M3-H5 |
| AWS            | A5.29: E81T1-A1M-H4      |

| Approvals | Grade |
|-----------|-------|
| TÜV       | ●     |
| CE        |       |

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P    | S    | Mo  |
|------|-----|-----|------|------|-----|
| 0.05 | 1.1 | 0.4 | 0.01 | 0.01 | 0.5 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | 20 °C                     |
| As Welded      | ≥ 490                   | 550-650                   | ≥ 22                 | ≥ 50                      |
| 580°C x 1h     | ≥ 470                   | 550-620                   | ≥ 23                 | ≥ 70                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : M21

### Materials

S(P)235-S(P)460, 16Mo3

| Storage                         |
|---------------------------------|
| Keep dry and avoid condensation |

| Current condition and welding position                                              |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| DC+                                                                                 |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |
|  |  |  |  |  |  |
| PA                                                                                  | PB                                                                                   | PC                                                                                    | PD                                                                                    | PE                                                                                    | PF                                                                                    |

### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |

## Cored Wires C-Mn and low-alloy steels

FLUXOFIL 31 is a seamless copper coated basic flux cored wire. The operating features produce very crack resistant and tough welded joints with very low hydrogen content, especially when welding steels with a higher carbon content. Pore-free welds with easy slag removal. A low-slag variant FLUXOFIL 31 S is available to order.

| Classification |                          |
|----------------|--------------------------|
| EN ISO         | 17632-A: T 42 4 B C 2 H5 |
| EN ISO         | 17632-A: T 42 4 B M 2 H5 |
| EN ISO         | 17632-B: T494T5-1CA-UH5  |
| EN ISO         | 17632-B: T494T5-1MA-UH5  |
| AWS            | A5.20: E70T-5C-JH4       |
| AWS            | A5.20: E70T-5M-JH4       |

| Approvals | Grade      |
|-----------|------------|
| ABS       | 3YSA H5    |
| BV        | SA3-3YM H5 |
| DB        | ●          |
| DNV       | IIY40MS H5 |
| GL        | 3YH5S      |
| LRS       | 3S-3YS-H5  |
| PRS       | 3S-3YS H5  |
| TÜV       | ●          |

CE

### Chemical analysis (Typical values in %)

|                     | C    | Mn  | Si  | P       | S       |
|---------------------|------|-----|-----|---------|---------|
| All weld metal (**) | 0.05 | 1.2 | 0.3 | ≤ 0.010 | ≤ 0.010 |

(\*\*) 100% CO<sub>2</sub>

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | -40 °C                    |
| As Welded      | ≥ 420                   | 500-640                   | ≥ 25                 | ≥ 80                      |

Gas test: 100% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : M21,C1

### Materials

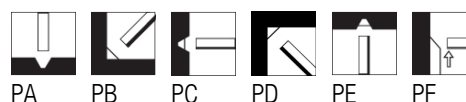
S(P)235-S(P)420, GP240-GP280

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |
| 1.4                   | ●    |
| 1.6                   | ●    |

## Cored Wires Chromium-Molybdenum steels

FLUXOFIL 35 is a seamless copper coated basic flux cored wire suitable for the welding of creep resistant boiler and pipe steels for operating temperatures up to 530 °C, as well as fine grain structural steels. Quiet and stable arc with low spatter loss and easy slag removal produce a uniform and smooth weld bead surface which is free from porosity.

| Classification |                          |
|----------------|--------------------------|
| EN ISO         | 17634-A: T MoL B C 2 H5  |
| EN ISO         | 17634-A: T MoL B M 2 H5  |
| EN ISO         | 17634-B: T55T5-1C-2M3-H5 |
| EN ISO         | 17634-B: T55T5-1M-2M3-H5 |
| AWS            | A5.29: E80T5-GC-H4       |
| AWS            | A5.29: E80T5-GM-H4       |

| Approvals | Grade |
|-----------|-------|
| TÜV       | ●     |
| CE        |       |

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P     | S     | Mo  |
|------|-----|-----|-------|-------|-----|
| 0.05 | 1.1 | 0.3 | 0.010 | 0.010 | 0.5 |

### All-weld metal Mechanical Properties

| Heat Treatment  | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|-----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                 |                         |                           |                      | -40 °C                    |
| As Welded (*)   | ≥ 490                   | 550-650                   | ≥ 23                 | ≥ 47                      |
| 620°C x 1h (**) | ≥ 470                   | 550-620                   | ≥ 25                 | ≥ 47                      |

Gas test: (\*) 100% CO<sub>2</sub>, (\*\*) 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : C1, M21

### Materials

S(P)235-S(P)460, 16Mo3

| Storage                         |
|---------------------------------|
| Keep dry and avoid condensation |

| Current condition and welding position |    |
|----------------------------------------|----|
| DC+                                    |    |
| PA                                     | PB |
| PC                                     | PD |
| PE                                     | PF |

### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |
| 1.6                   | ●    |

## Cored Wires Chromium-Molybdenum steels

FLUXOFIL 36 is a seamless copper coated basic flux cored wire suitable for the welding of Cr Mo-alloyed boiler and pipe steels for high creep rupture strength up to 570 °C. Quiet and smooth fusion and low spatter loss with easy slag removal produce uniform and smooth weld beads which are free from porosity.

| Classification |                           |
|----------------|---------------------------|
| EN ISO         | 17634-A: T CrMo1 B C 2 H5 |
| EN ISO         | 17634-A: T CrMo1 B M 2 H5 |
| EN ISO         | 17634-B: T55T5-1C-1CM-H5  |
| EN ISO         | 17634-B: T55T5-1M-1CM-H5  |
| AWS            | A5.29: E80T5-B2C-H4       |
| AWS            | A5.29: E80T5-B2M-H4       |

| Approvals | Grade |
|-----------|-------|
| TÜV       | ●     |
| CE        |       |

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P     | S     | Cr  | Mo  |
|------|-----|-----|-------|-------|-----|-----|
| 0.08 | 0.8 | 0.3 | 0.010 | 0.010 | 1.2 | 0.4 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | +20 °C                    |
| 690 °C x 1h    | ≥ 470                   | 550-660                   | ≥ 22                 | ≥ 120                     |

Gas test: 100% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1, M21

### Materials

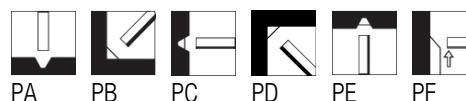
13CrMo4-5, 13CrMoSi5-5; G17CrMo5-5

#### Storage

Keep dry and avoid condensation

#### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |
| 1.6                   | ●    |

## Cored Wires Chromium-Molybdenum steels

FLUXOFIL 37 is a seamless copper coated basic flux cored wire, suitable for the welding of Cr Mo-alloyed boiler and pipe steels, for high creep rupture strength up to 600 °C. Quiet and smooth running and low spatter loss with easy slag removal produce uniform and smooth beads which are free from porosity.

| Classification |                           |
|----------------|---------------------------|
| EN ISO         | 17634-A: T CrMo2 B C 2 H5 |
| EN ISO         | 17634-A: T CrMo2 B M 2 H5 |
| EN ISO         | 17634-B: T55T5-1C-2C1M-H5 |
| EN ISO         | 17634-B: T55T5-1M-2C1M-H5 |
| AWS            | A5.29: E80T5-B3C-H4       |
| AWS            | A5.29: E80T5-B3M-H4       |

| Approvals | Grade |
|-----------|-------|
| TÜV       | ●     |
| CE        |       |

### Chemical analysis (Typical values in %)

| C   | Mn  | Si  | P     | S     | Cr  | Mo  |
|-----|-----|-----|-------|-------|-----|-----|
| 0.1 | 0.8 | 0.4 | 0.010 | 0.010 | 2.4 | 1.1 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) | Impact Energy ISO - V (J) |
|----------------|----------------------|------------------------|-------------------|---------------------------|
|                |                      |                        |                   | +20 °C                    |
| 700°C x 1h     | ≥ 470                | 570-670                | ≥ 20              | ≥ 100                     |

Gas test: 82% Ar+18% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1, M21

### Materials

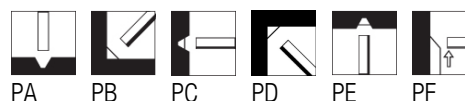
10CrMo9-10, 12CrMo9-10; A387 Gr.22, Cl 1and 2, A 182 Gr.F 22, A 336 Gr.F22

#### Storage

Keep dry and avoid condensation

#### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |
| 1.6                   | ●    |

## Cored Wires C-Mn and low-alloy steels

FLUXOFIL 40 is a seamless flux-cored wire electrode with basic slag for gas-shielded metal arc welding of unalloyed steels with yield strengths of up to 460 MPa. The weld metal is very crack resistant, good toughness down to -60°C and very low hydrogen content. Stable operating characteristics and low spatter formation with short, spray and pulsed arc applications alike. Safe side wall fusion and very good gap bridging characteristics. Preferably used under mixed gas. The use of CO<sub>2</sub> for short and spray arc processes is possible.

| Classification |                              |
|----------------|------------------------------|
| EN ISO         | 17632-A: T 46 6 1Ni B C 2 H5 |
| EN ISO         | 17632-A: T 46 6 1Ni B M 2 H5 |
| EN ISO         | 17632-B: T556T5-1CA-N2-UH5   |
| EN ISO         | 17632-B: T556T5-1MA-N2-UH5   |
| AWS            | A5.29: E80T5-GC-H4           |
| AWS            | A5.29: E80T5-GM-H4           |

| Approvals | Grade   |
|-----------|---------|
| DB        | ●       |
| DNV       | VYMS H5 |
| TÜV       | ●       |

CE

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P       | S       | Ni  |
|------|-----|-----|---------|---------|-----|
| 0.05 | 1.1 | 0.2 | ≤ 0.010 | ≤ 0.010 | 1.0 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | -60 °C                    |
| As Welded      | ≥ 470                   | 550-650                   | ≥ 24                 | ≥ 60                      |

Gas test: 100% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1, M21

### Materials

S(P)275-S(P)460

| Storage                         |
|---------------------------------|
| Keep dry and avoid condensation |

| Current condition and welding position                                                |                                                                                       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| DC+                                                                                   |                                                                                       |
|    |   |
|  |  |
|  |  |
| PA                                                                                    | PB                                                                                    |
| PC                                                                                    | PD                                                                                    |
| PE                                                                                    | PF                                                                                    |

### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |
| 1.4                   | ●    |
| 1.6                   | ●    |

## Cored Wires High-strength steels

FLUXOFIL 41 is a seamless copper coated basic cored wire for welding of high strength steels with minimum yield strength of 550 MPa. operating features include low spatter loss, easy slag removal and uniform bead appearance.

| Classification |                                |
|----------------|--------------------------------|
| EN ISO         | 18276-A: T 55 4 1NiMo B M 2 H5 |
| EN ISO         | 18276-A: T 55 6 1NiMo B C 2 H5 |
| EN ISO         | 18276-B: T624T5-1MA-N2M2-UH5   |
| EN ISO         | 18276-B: T626T5-1CA-N2M2-UH5   |
| AWS            | A5.29: E90T5-GC-H4             |
| AWS            | A5.29: E90T5-GM-H4             |

| Approvals | Grade   |
|-----------|---------|
| DB        | ●       |
| RMRS      | 5Y50 H5 |



### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P    | S    | Ni  | Mo  |
|------|-----|-----|------|------|-----|-----|
| 0.07 | 1.3 | 0.4 | 0.01 | 0.01 | 1.1 | 0.4 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | -40 °C                    |
| As Welded      | ≥ 550                   | 640-760                   | ≥ 23                 | ≥ 60                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1, M21

### Materials

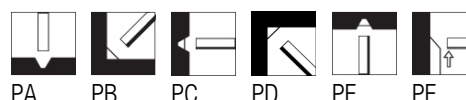
S(P)500, S550, HY 80

#### Storage

Keep dry and avoid condensation

#### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |
| 1.4                   | ●    |
| 1.6                   | ●    |



FLUXOFIL 42 is a seamless copper coated basic flux cored wire for the welding of high-strength fine grain structural steels with minimum yield strength of 690 MPa. Operating features include low spatter loss, easy slag removal and uniform bead appearance.

| Classification |                                    |
|----------------|------------------------------------|
| EN ISO         | 18276-A: T 69 6 Mn2NiCrMo B C 2 H5 |
| EN ISO         | 18276-A: T 69 6 Mn2NiCrMo B M 2 H5 |
| EN ISO         | 18276-B: T786T5-1 CA-N4C1M2-UH5    |
| EN ISO         | 18276-B: T786T5-1 MA-N4C1M2-UH5    |
| AWS            | A5.29: E110T5-K4C-H4               |
| AWS            | A5.29: E110T5-K4M-H4               |

| Approvals | Grade       |
|-----------|-------------|
| ABS       | 3YQ690SA    |
| ABS       | 4YQ690SA H5 |
| BV        | 3Y69 MS H5  |
| BV        | 4Y69 MS H5  |
| DB        | ●           |
| DNV       | IIY69MS H5  |
| DNV       | IVY69MS H5  |
| TÜV       | ●           |

CE

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P    | S    | Cr  | Ni  | Mo  |
|------|-----|-----|------|------|-----|-----|-----|
| 0.06 | 1.5 | 0.3 | 0.01 | 0.01 | 0.4 | 2.3 | 0.4 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |        |        |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|--------|--------|
|                |                         |                           |                      | -20 °C                    | -40 °C | -60 °C |
| As Welded      | ≥ 690                   | 780-890                   | ≥ 17                 |                           | ≥ 80   | ≥ 60   |
| 580 °C x 2 h   | ≥ 670                   | 760-840                   | ≥ 17                 | ≥ 60                      | ≥ 47   |        |

Gas test: 82% Ar+18% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1, M21

### Materials

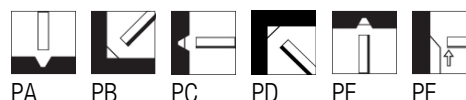
S620, S690, HY 100

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |
| 1.6                   | ●    |

## Cored Wires High-strength steels

FLUXOFIL M42 is a seamless copper coated metal cored wire for welding of high strength steels with minimum yield strength of 690 MPa with outstanding welding characteristics in the short-arc and spray-arc ranges. Almost spatter-free when welding in the spray-arc range. Good restriking, even with a cold wire tip, thus being suitable for robotic applications. Characteristic features: good side wall fusion, smooth and finely rippled welds without undercut into the base metal. Little formation of silicates on the weld surface, so that multi-pass welds can be made without inter-run cleaning. Due to the easily controllable weld pool in the short-arc range, FLUXOFIL M 42 is suitable for positional welding.

| Classification |                                    | Approvals | Grade        |
|----------------|------------------------------------|-----------|--------------|
| EN ISO         | 18276-A: T 69 4 Mn2NiCrMo M M 1 H5 | ABS       | 4Y 690 MS H5 |
| EN ISO         | 18276-B: T784T15-1MA-N4C1M2-UH5    | BV        | 4Y 69 MS H5  |
| AWS            | A5.28: E110C-GM H4                 | DB        | ●            |
|                |                                    | DNV       | IVY 69 MS H5 |
|                |                                    | LRS       | 4Y 690 MS H5 |
|                |                                    | TÜV       | ●            |

CE

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P    | S    | Cr  | Ni | Mo  |
|------|-----|-----|------|------|-----|----|-----|
| 0.05 | 1.5 | 0.5 | 0.01 | 0.01 | 0.4 | 2  | 0.4 |

### All-weld metal Mechanical Properties

| Heat Treatment          | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) | Impact Energy ISO - V (J) |
|-------------------------|----------------------|------------------------|-------------------|---------------------------|
|                         |                      |                        |                   | -40 °C                    |
| 580°C x 2 h/furnace (*) | ≥ 690                | 760-850                | ≥ 17              | ≥ 47                      |
| As Welded (**)          | ≥ 690                | 780-980                | ≥ 17              | ≥ 70                      |

Gas test: (\*) M21, (\*\*) 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : M21

### Materials

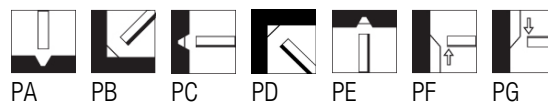
S620, S690, HY 100

#### Storage

Keep dry and avoid condensation

#### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |  | DRUM |     |
|-----------------------|------|--|------|-----|
| Diam(mm) / weight(kg) | 16   |  | 16   | 200 |
| 1.2                   | ●    |  |      | ●   |
| 1.6                   | ●    |  | ●    |     |

## Cored Wires C-Mn and low-alloy steels

FLUXOFIL 44 is a seamless copper coated basic flux cored wire for the welding of fine grain structural steels, and cryogenic steel grades. The weld metal meets high toughness mechanical property requirements in both the as-welded and stress relieved conditions. Quiet and smooth operation and low spatter loss with easy slag removal produces uniform and smooth weld beads which are free from porosity.

### Classification

|        |                              |
|--------|------------------------------|
| EN ISO | 17632-A: T 42 8 2Ni B M 2 H5 |
| EN ISO | 17632-B: T498T5-1MA-N5-UH5   |
| AWS    | A5.29: E70T5-GM-JH4          |

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P       | S       | Ni  |
|------|-----|-----|---------|---------|-----|
| 0.05 | 0.8 | 0.2 | ≤ 0.010 | ≤ 0.010 | 2.4 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |        |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|--------|
|                |                         |                           |                      | -60 °C                    | -80 °C |
| As Welded      | ≥ 420                   | 500-640                   | ≥ 26                 | ≥ 70                      | ≥ 47   |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : M21

### Materials

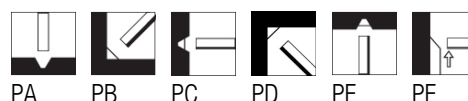
S(P)275-S(P)420

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16.0 |
| 1.2                   | ●    |

FLUXOFIL 48 is a seamless copper coated basic flux cored wire for gas-shielded metal arc welding of weathering and fine grain structural steels such as Patinax or Cor-ten. The weld metal is resistant to atmospheric corrosion. Low spatter loss, easy slag removal, smooth and uniform bead appearance. The weld metal is very crack-resistant, cold-tough down to 60°C with very low hydrogen content.

| Classification |                            |
|----------------|----------------------------|
| EN ISO         | 17632-A: T 46 6 Z B C 2 H5 |
| EN ISO         | 17632-A: T 46 6 Z B M 2 H5 |
| EN ISO         | 17632-B: T556T5-1CA-G-UH5  |
| EN ISO         | 17632-B: T556T5-1MA-G-UH5  |
| AWS            | A5.29: E81T5-GC-H4         |
| AWS            | A5.29: E81T5-GM-H4         |

| Approvals | Grade |
|-----------|-------|
| DB        | ●     |
| TÜV       | ●     |

CE

### Chemical analysis (Typical values in %)

| C    | Mn  | Si   | P     | S     | Ni  | Cu  |
|------|-----|------|-------|-------|-----|-----|
| 0.05 | 1.1 | 0.25 | 0.010 | 0.010 | 1.2 | 0.5 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | -60 °C                    |
| As Welded      | ≥ 470                   | 550-680                   | ≥ 24                 | ≥ 47                      |

Gas test: 100% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1, M21

### Materials

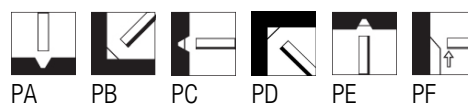
S235J0W; S235J2W; S355J0W; S355J2W; S355K2W

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |
| 1.6                   | ●    |

FLUXOFIL M 48 is a seamless copper coated metal flux cored wire for gas-shielded metal arc welding of weathering and fine grain structural steels such as Patinax or Cor-ten. The weld metal is resistant to atmospheric corrosion. The weld metal corrosion behaviour is adapted to these steel types. Stable operating characteristics in short, spray and pulsed arc applications alike. Safe side wall fusion and very good gap bridging characteristics. To be used with Ar/CO<sub>2</sub> gas shielding.

### Classification

|        |                               |
|--------|-------------------------------|
| EN ISO | 17632-A: T 46 3 Z M M 1 H5    |
| EN ISO | 17632-B: T553T15-1MA-NCC1-UH5 |
| AWS    | A5.29: E81TG-W2M              |

### Chemical analysis (Typical values in %)

| C    | Mn  | Si  | P       | S       | Cr  | Ni  | Cu  |
|------|-----|-----|---------|---------|-----|-----|-----|
| 0.04 | 1.0 | 0.4 | ≤ 0.010 | ≤ 0.010 | 0.5 | 0.5 | 0.5 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | -30 °C                    |
| As Welded      | ≥ 470                   | 560-680                   | ≥ 24                 | ≥ 47                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : M21

### Materials

S235J0W; S235J2W; S355J0W; S355J2W; S355K2W

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16.0 |
| 1.2                   | ●    |
| 1.4                   | ●    |

## Cored Wires C-Mn and low-alloy steels

CITOFLUX R82SR is a folded rutile flux cored wire for all-positional welding with good iMPact toughness at -60°C (as welded and after PWHT). Very easy to use for vertical up welding. Suitable for the welding of fine-grain structural steels for low temperature applications. Can be welded in all positions with one setting of parameters. To be use under mix gas. Ideal for offshore, naval shipbuilding, bridges and structures and pressure vessel applications. Good CTOD toughness.

| Classification |                              |
|----------------|------------------------------|
| EN ISO         | 17632-A: T 46 6 1Ni P M 1 H5 |
| EN ISO         | 17632-B: T556T1-1MA-N1-UH5   |
| AWS            | A5.29: E81T1-Ni1M-H4         |

| Approvals | Grade      |
|-----------|------------|
| ABS       | 4Y400SA H5 |
| DNV       | VY46MS H5  |
| LRS       | 4Y40S H5   |

CE

### Chemical analysis (Typical values in %)

| C    | Mn   | Si  | P       | S       | Ni  |
|------|------|-----|---------|---------|-----|
| 0.07 | 1.35 | 0.3 | ≤ 0.015 | ≤ 0.015 | 0.8 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | -60 °C                    |
| As Welded      | ≥ 460                   | 530-680                   | ≥ 22                 | ≥ 47                      |
| 580 °C /2h     | ≥ 460                   | 530-680                   | ≥ 22                 | ≥ 47                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : M21

### Materials

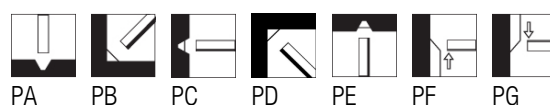
S(P)235-S(P)460, GP240-GP280

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | B300 |
|-----------------------|------|
| Diam(mm) / weight(kg) | 16   |
| 1.2                   | ●    |

## Cored Wires Stainless and Heat resistant steels

FLUXINOX 308L is an alloyed rutile flux cored wire for the welding of unstabilized and stabilized corrosion resistant Cr Ni-steels. Suitable for operating temperatures up to 350 °C, non-scaling up to approximately 800 °C. FLUXOFIL 308 L features outstanding, almost spatter-free, welding properties. Very easy slag removal from fillet welds. Flat and smooth weld beads without undercut.

| Classification |                         |
|----------------|-------------------------|
| EN ISO         | 17633-A: T 19 9 L R C 3 |
| EN ISO         | 17633-A: T 19 9 L R M 3 |
| EN ISO         | 17633-B: TS308L-FB0     |
| AWS            | A5.22: E308LT0-1        |
| AWS            | A5.22: E308LT0-4        |

| Approvals | Grade |
|-----------|-------|
| DB        | ●     |
| DNV       | 308L  |
| GL        | 4550S |
| LRS       | 304LS |
| TÜV       | ●     |

CE

### Chemical analysis (Typical values in %)

| C      | Mn  | Si  | Cr | Ni | Ferrite |
|--------|-----|-----|----|----|---------|
| ≤ 0.04 | 1.7 | 0.6 | 20 | 10 | 6-10    |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |         |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|---------|
|                |                         |                           |                      | -20 °C                    | -196 °C |
| As Welded      | ≥ 350                   | ≥ 520                     | ≥ 35                 | ≥ 40                      | ≥ 27    |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : C1, M21

### Materials

AISI 304 - 304L - 302

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4311 (X2CrNiN18-10)

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



PA

PB

### Packaging data

| Packaging Type        | BS300 |
|-----------------------|-------|
| Diam(mm) / weight(kg) | 15    |
| 1.0                   | ●     |
| 1.2                   | ●     |

## Cored Wires Stainless and Heat resistant steels

FLUXINOX 347 is an alloyed rutile flux cored wire for the welding of stabilized corrosion resistant Cr Ni-steels. The weld metal is used for operating temperatures up to 400 °C, non-scaling up to about 800 °C. FLUXINOX 347 exhibits excellent, almost spatter-free, welding properties with very easy slag removal from fillet welds. The weld beads produced are flat and smooth without undercut and with little discolouration of the weld, thus pickling costs can be minimised.

| Classification |                          |
|----------------|--------------------------|
| EN ISO         | 17633-A: T 19 9 Nb R C 3 |
| EN ISO         | 17633-A: T 19 9 Nb R M 3 |
| EN ISO         | 17633-B: TS347L-FB0      |
| AWS            | A5.22: E347T0-1          |
| AWS            | A5.22: E347T0-4          |

| Approvals | Grade |
|-----------|-------|
| TÜV       | ●     |
| CE        |       |

### Chemical analysis (Typical values in %)

| C      | Mn  | Si  | Cr | Ni | Nb  | Ferrite |
|--------|-----|-----|----|----|-----|---------|
| ≤ 0.04 | 1.8 | 0.4 | 20 | 10 | 0.4 | 5-10    |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | 20 °C                     |
| As Welded      | ≥ 350                   | ≥ 550                     | ≥ 30                 | ≥ 47                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1, M21

### Materials

1.4541 (X6CrNiTi18-10); 1.4301 (X4CrNi18-10); 1.4550 (X6CrNiNb18-10);

AISI 347 - 321

| Storage                         |
|---------------------------------|
| Keep dry and avoid condensation |

| Current condition and welding position                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DC+                                                                                                                                                                      |
|   |
| PA PB                                                                                                                                                                    |

### Packaging data

| Packaging Type        | BS300 |
|-----------------------|-------|
| Diam(mm) / weight(kg) | 15    |
| 1,2                   | ●     |
| 1.0                   | ●     |



## Cored Wires Stainless and Heat resistant steels

FLUXINOX 316L is an alloyed rutile flux cored wire for the welding of unstabilized and stabilized corrosion resistant Cr Ni Mo-steels. The weld metal is resistant to intergranular corrosion up to 400 °C and non-scaling up to 800 °C. FLUXINOX 316L exhibits outstanding, almost spatter-free, welding properties. Very easy slag removal from fillet welds, even in acute angles. The weld beads produced are finely rippled and without undercut. Due to only slight discolouration of the welds, pickling costs can be minimised.

| Classification |                            |
|----------------|----------------------------|
| EN ISO         | 17633-A: T 19 12 3 L R C 3 |
| EN ISO         | 17633-A: T 19 12 3 L R M 3 |
| EN ISO         | 17633-B: TS316L-FB0        |
| AWS            | A5.22: E316LT0-1           |
| AWS            | A5.22: E316LT0-4           |

| Approvals | Grade  |
|-----------|--------|
| DB        | ●      |
| DNV       | 316L   |
| GL        | 4571S  |
| LRS       | 316L S |
| TÜV       | ●      |

CE

### Chemical analysis (Typical values in %)

| C      | Mn  | Si  | Cr | Ni | Mo  | Ferrite |
|--------|-----|-----|----|----|-----|---------|
| ≤ 0.04 | 1.7 | 0.6 | 19 | 12 | 2.8 | 5-10    |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |         |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|---------|
|                |                         |                           |                      | 20 °C                     | -110 °C |
| As Welded      | ≥ 320                   | ≥ 510                     | ≥ 30                 | ≥ 47                      | ≥ 27    |

Gas test: 82% Ar+18% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1, M21

### Materials

AISI 316L

1.4401 (X4CrNiMo17-12-2), 1.4435 (X2CrNiMo18-14-3)

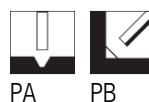
1.4571 (X6CrNiMoTi17-12-2), 1.4583 (X10CrNiMoNb18-12)

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | BS300 |
|-----------------------|-------|
| Diam(mm) / weight(kg) | 15    |
| 1.0                   | ●     |
| 1.2                   | ●     |

## Cored Wires Stainless and Heat resistant steels

FLUXINOX 318 is an alloyed rutile flux cored wire for the welding of unstabilized and stabilized corrosion resistant Cr Ni Mo-steels. The weld metal is resistant to intergranular corrosion up to 400 °C and non-scaling up to 800 °C. FLUXINOX 318 is characterized by excellent, almost spatter-free, welding properties with very easy slag removal from fillet welds, even in acute angles. The weld beads produced are finely rippled and free of undercut and the weld surface is shiny.

### Classification

|        |                             |
|--------|-----------------------------|
| EN ISO | 17633-A: T 19 12 3 Nb R C 3 |
| EN ISO | 17633-A: T 19 12 3 Nb R M 3 |
| EN ISO | 17633-B: TS318-FB0          |

### Chemical analysis (Typical values in %)

| C      | Mn  | Si  | Cr | Ni | Mo  | Nb  |
|--------|-----|-----|----|----|-----|-----|
| ≤ 0.04 | 1.5 | 0.8 | 19 | 12 | 2.8 | 0.4 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |        |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|--------|
|                |                         |                           |                      | 20 °C                     | -60 °C |
| As Welded      | ≥ 350                   | ≥ 550                     | ≥ 25                 | ≥ 40                      | ≥ 32   |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : C1, M21

### Materials

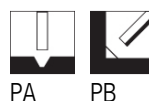
|                                                       |
|-------------------------------------------------------|
| 1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)  |
| 1.4580 (X6CrNiMoNb17-12-2) - 1.4408 (GX5CrNiMo19-11)  |
| 1.4571 (X6CrNiMoTi17-12-2) - 1.4401 (X4CrNiMo17-12-2) |
| 1.4583 (X10CrNiMoNb18-12)                             |

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | BS300 |
|-----------------------|-------|
| Diam(mm) / weight(kg) | 15    |
| 1.0                   | ●     |
| 1.2                   | ●     |

## Cored Wires Stainless and Heat resistant steels

FLUXINOX 310 is an alloyed rutile flux cored wire for the joining of heat resistant Cr and Cr-Ni steels and cast steel. The weld metal is fully austenitic and non-scaling up to 1200 °C. It is not resistant to sulphur-bearing gases. FLUXINOX 310 features outstanding, almost spatter-free, welding properties with very easy slag removal, finely rippled and shiny weld beads which are free of undercut into the base metal.

### Classification

EN ISO 17633-A: T 25 20 R C 3

EN ISO 17633-A: T 25 20 R M 3

AWS A5.22: E 310T0-G

### Chemical analysis (Typical values in %)

| C   | Mn  | Si   | Cr | Ni |
|-----|-----|------|----|----|
| 0.1 | 2.5 | 0.55 | 25 | 20 |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | 20 °C                     |
| As Welded      | ≥ 350                   | ≥ 550                     | ≥ 30                 | ≥ 40                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : C1, M21

### Materials

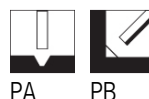
AISI 310; 1.4845 (X8CrNi25-21); 1.4841 (X15CrNiSi25-21); 1.4828 (X15CrNiSi20-12)

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | BS300 |
|-----------------------|-------|
| Diam(mm) / weight(kg) | 15    |
| 1,2                   | ●     |

## Cored Wires Stainless and Heat resistant steels

FLUXINOX 309L is an alloyed rutile flux cored wire for joining high-alloyed Cr and Cr-Ni-(Mo) steels with unalloyed steels, as well as for depositing austenitic stainless cladding. The highest operating temperature for dissimilar joints is 300°C. The weld metal is non-scaling up to 850°C. Preheating and interpass temperatures should be calculated according to the base metal used.

FLUXINOX 309 L exhibits outstanding, almost spatter-free, welding properties. It produces finely rippled flat and smooth welds, free of undercut into the base metal. Very easy slag removal.

| Classification |                          |
|----------------|--------------------------|
| EN ISO         | 17633-A: T 23 12 L R C 3 |
| EN ISO         | 17633-A: T 23 12 L R M 3 |
| EN ISO         | 17633-B: TS309L-FB0      |
| AWS            | A5.22: E309LT0-1         |
| AWS            | A5.22: E309LT0-4         |

| Approvals | Grade  |
|-----------|--------|
| DB        | ●      |
| DNV       | 309L   |
| GL        | 4332S  |
| LRS       | SS/CMn |
| TÜV       | ●      |

CE

### Chemical analysis (Typical values in %)

| C      | Mn  | Si  | P      | S      | Cr | Ni | Ferrite |
|--------|-----|-----|--------|--------|----|----|---------|
| ≤ 0.04 | 1.5 | 0.6 | ≤ 0.03 | ≤ 0.03 | 24 | 13 | 12-20   |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation | Impact Energy ISO - V (J) |        |
|----------------|----------------------|------------------------|------------|---------------------------|--------|
|                |                      |                        |            | -20 °C                    | -60 °C |
| As Welded      | ≥ 320                | ≥ 520                  | ≥ 30       | ≥ 40                      | ≥ 27   |

Gas test: 82% Ar+18% CO<sub>2</sub>

**Shielding Gas** - EN ISO 14175 : C1, M21

### Materials

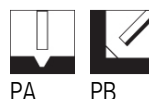
A312 TP309S; Ferrite-Austenite heterogeneous joints, Cladding

#### Storage

Keep dry and avoid condensation

#### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | BS300 |
|-----------------------|-------|
| Diam(mm) / weight(kg) | 15    |
| 1.0                   | ●     |
| 1.2                   | ●     |

FLUXINOX 307 is an alloyed rutile cored wire for crack-resistant joining and surfacing of heat treatable steels, armour plates, corrosion resisting steels and high manganese steels. It is also suitable for joining austenitic stainless steels to unalloyed steels. The weld metal is suitable for operating temperatures up to 300 °C, and is non-scaling up to 850°C. It is highly rust and corrosion resistant, and will harden by cold working.

## Classification

|        |                          |
|--------|--------------------------|
| EN ISO | 17633-A: T 18 8 Mn R C 3 |
| EN ISO | 17633-A: T 18 8 Mn R M 3 |

## Chemical analysis (Typical values in %)

| C    | Mn  | Si  | Cr | Ni |
|------|-----|-----|----|----|
| 0.04 | 6.5 | 0.7 | 19 | 9  |

## All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | 20 °C                     |
| As Welded      | ≥ 400                   | 600 - 700                 | ≥ 30                 | ≥ 30                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

## Shielding Gas - EN ISO 14175 : C1, M21

## Materials

Armour plate; Ferrite-Austenite heterogeneous joints

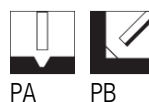
X120Mn12 (1.3401)

## Storage

Keep dry and avoid condensation

## Current condition and welding position

DC+



## Packaging data

| Packaging Type        | BS300 |
|-----------------------|-------|
| Diam(mm) / weight(kg) | 15.0  |
| 1.0                   | ●     |
| 1.2                   | ●     |

## Cored Wires Stainless and Heat resistant steels

FLUXINOX 312 is an alloyed rutile flux cored wire for the joining and surfacing of dissimilar steels. The ferritic-austenitic weld metal (Delta-ferrite approximately 50%) is non-scaling up to 1100 °C. Due to the high ferrite content, the weld metal is suited for difficult-to-weld steels and stress-relaxing buffer layers on crack-susceptible base plates.

FLUXINOX 312 is characterized by outstanding, almost spatter-free, welding properties. It produces finely rippled flat and smooth welds which are free of undercut into the base metal. Very easy slag removal. FLUXINOX 312 is mainly used for joining dissimilar steels and difficult-to-weld steels, e.g. heat treatable steels, tool steels, and high manganese steels, and for surfacing or repair welding.

### Classification

|        |                       |
|--------|-----------------------|
| EN ISO | 17633-A: T 29 9 R C 3 |
| EN ISO | 17633-A: T 29 9 R M 3 |
| EN ISO | 17633-B: TS312-FB0    |
| AWS    | A5.22: E312T0-1       |
| AWS    | A5.22: E312T0-4       |

### Chemical analysis (Typical values in %)

| C      | Mn  | Si  | Cr | Ni |
|--------|-----|-----|----|----|
| ≤ 0.15 | 1.3 | 0.9 | 29 | 9  |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|
|                |                         |                           |                      | 20 °C                     |
| As Welded      | ≥ 450                   | ≥ 660                     | ≥ 25                 | ≥ 32                      |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : C1, M21

### Materials

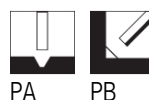
Ferrite-Austenite heterogeneous joints and difficult to weld steels

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



### Packaging data

| Packaging Type        | BS300 |
|-----------------------|-------|
| Diam(mm) / weight(kg) | 15    |
| 1.2                   | ●     |

## Cored Wires Stainless and Heat resistant steels

FLUXINOX 22 9 3 L is an alloyed rutile flux cored wire, suitable for the joining and cladding of corrosion resistant ferritic-austenitic duplex-steels. The weld metal consists of approximately 30% ferrite and 70% austenite and is particularly resistant to pitting, crevice corrosion and stress corrosion cracking in chloride and hydrogen sulphide bearing media. Principal applications include the construction of chemical plants and offshore installations, for operating temperatures up to 250 °C.

| Classification |                             |
|----------------|-----------------------------|
| EN ISO         | 17633-A: T 22 9 3 N L R C 3 |
| EN ISO         | 17633-A: T 22 9 3 N L R M 3 |
| AWS            | A5.22: E2209T0-1            |
| AWS            | A5.22: E2209T0-4            |

| Approvals | Grade   |
|-----------|---------|
| DNV       | DUPLEX  |
| GL        | 4462    |
| LRS       | S31803S |
| TÜV       | ●       |

CE

### Chemical analysis (Typical values in %)

| C      | Mn  | Si  | Cr | Ni | Mo | N   | Ferrite |
|--------|-----|-----|----|----|----|-----|---------|
| ≤ 0.04 | 1.1 | 0.5 | 22 | 9  | 3  | 0.1 | 38-60   |

### All-weld metal Mechanical Properties

| Heat Treatment | Yield Strength<br>(MPa) | Tensile Strength<br>(MPa) | Elongation<br>A5 (%) | Impact Energy ISO - V (J) |        |
|----------------|-------------------------|---------------------------|----------------------|---------------------------|--------|
|                |                         |                           |                      | -20 °C                    | -30 °C |
| As Welded      | ≥ 550                   | 750 - 900                 | ≥ 24                 | ≥ 40                      | ≥ 40   |

Gas test: 82% Ar+18% CO<sub>2</sub>

### Shielding Gas - EN ISO 14175 : C1, M21

### Materials

1.4462 (X2CrNiMoN22-5-3)

UNS S31803 - S31500 - S31200 - S32304

### Storage

Keep dry and avoid condensation

### Current condition and welding position

DC+



PA

PB

### Packaging data

| Packaging Type        | BS300 |
|-----------------------|-------|
| Diam(mm) / weight(kg) | 15    |
| 1.0                   | ●     |
| 1.2                   | ●     |



|                                  |                  |                 |
|----------------------------------|------------------|-----------------|
| <b>On en laaggelegeerd staal</b> |                  |                 |
| Union I 52                       | ER 70 – S6       | W 42 5 W 3Si1   |
| DMO – IG                         | ER 70S – A1      | W MoSi          |
| DCMS – IG                        | ER 80S – G       | W CrMo 1 Si     |
| CM 2 – IG                        | ER90S – G        | W CrMo2Si       |
| Böhler Ni 1 - IG                 | ER 80S-Ni1 (mod) | W3Ni1           |
| <b>Corrosievast staal</b>        |                  |                 |
| Thermanit JE-308 L               | ER 308 L         | W 19 9 L Si     |
| Thermanit H 347                  | ER 347           | w 19 9 Nb Si    |
| Thermanit ATS 4                  | ER 19 –10 H      | W19 9 H         |
| Thermanit GE 316 L               | ER 316 L         | W 19 12 3 L Si  |
| Thermanit A                      | ER 318 (mod)     | W 19 12 3 Nb Si |
| Thermanit C Si                   | ER 310 (mod)     | W 25 20 Mn      |
| Thermanit 25/14 E- 309 L Si      | ER 309 L         | W 23 12 L       |
| Avesta P5                        | ER 309L Mo       | W 23 12 2 L     |
| Thermanit X                      | ER 307 (mod)     | W 18 8 Mn       |
| Thermanit 22/09                  | ER 2209          | W 22 9 3 N I    |
| Thermanit 25/09 CuT              | ER 2594          | W 25 9 4 N L    |
| <b>Nikkellegeringen</b>          |                  |                 |
| UTP A 068 HH                     | ER NiCr- 3       | S NiCr20Mn3Nb   |
| UTP A 6222 Mo                    | ER NiCrMo – 3    | NiCr22Mo9Nb     |

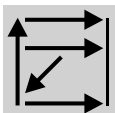


# Union I 52

GTAW rod / wire

08.2009

Rev.: 0

|                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                         |                      |                                                 |                               |
|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------|----------------------|-------------------------------------------------|-------------------------------|
| Classifications                                                                            | EN ISO 636-A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | EN ISO 636-B  | AWS A5.18               |                      |                                                 |                               |
|                                                                                            | W 42 5 W3Si1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | W 49A 5 W6    | ER70S-6                 |                      |                                                 |                               |
| Characteristics and field of use                                                           | GTAW solid rod and wire for the welding with argon.<br>Typical fields of use: boiler, tank and pipeline constructions and apparatus engineering.                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                         |                      |                                                 |                               |
| Marks<br>(Rods only)                                                                       |  W II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                         |                      |                                                 |                               |
| Materials                                                                                  | Unalloyed structural steels acc. to EN 10025: S185, S235JR, S235JRG1, S235JRG2, S275JR, S235J0, S275J0, S355J0.<br>Boiler steels P235GH, P265GH, P295GH, P355GH.<br>Fine grained structural steels up to S420N.<br>ASTM A27 and A36 Gr. all; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40, A841; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50; API 5 L Gr. B, X42-X56. |               |                         |                      |                                                 |                               |
| Typical analysis of rod and wire in %                                                      | C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Si            | Mn                      |                      |                                                 |                               |
|                                                                                            | 0.08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.85          | 1.50                    |                      |                                                 |                               |
| Mechanical properties of the weld metal according to EN ISO 15792-1<br>(min. values at RT) | Heat-treatment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Shielding gas | Yield strength 0.2% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN -50 °C |
|                                                                                            | AW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I1            | 440                     | 560                  | 25                                              | 130 50                        |
| Welding position                                                                           |  Polarity = –<br>Shielding gas (EN ISO 14175) I 1-3                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                         |                      |                                                 |                               |
| Approvals                                                                                  | TÜV (Certificate No. 1656)<br>DB (Reg. form No. 42.132.11)<br>DNV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                         |                      |                                                 |                               |
| Packaging and weights<br>(Tolerances acc. EN ISO 544)                                      | Rod Diam. x Length (mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                         |                      | kg/pack                                         |                               |
|                                                                                            | 1.6 x 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                         |                      | 20                                              |                               |
|                                                                                            | 2.0 x 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                         |                      | 20                                              |                               |
|                                                                                            | 2.4 x 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                         |                      | 20                                              |                               |
|                                                                                            | 3.0 x 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                         |                      | 20                                              |                               |
|                                                                                            | Other rod length on request.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                         |                      |                                                 |                               |

EN ISO 21952-A: W MoSi  
 EN ISO 21952-B: W 52 1M3  
 EN ISO 636-A: W2Mo (for rod)  
 EN ISO 636-A: W 46 3 W2Mo  
 EN ISO 636-B: W 55A 3U W1M3  
 AWS A5.28: ER70S-A1 (ER80S-G)  
 AWS A5.28M: ER49S-A1 (ER55S-G)  
 W. No.: 1.5424

## BÖHLER DMO-IG

**GTAW rod, low-alloyed, high temperature  
(high strength)**

### Description

Copper coated GTAW rod for welding in boiler, pressure vessel, pipeline, and crane constructions as well as in structural steel engineering. Very tough deposit of high crack resistant, non- ageing. Recommended for the temperature range from -30°C to +500 °C. Good copper bonding with low total copper content. Very good welding and flow characteristics.

### Typical Composition of Welding Rod

|      | C   | Si  | Mn  | Mo  |
|------|-----|-----|-----|-----|
| wt-% | 0.1 | 0.6 | 1.2 | 0.5 |

### Mechanical Properties of All-weld Metal

|                                                 | u                                        | a                 |
|-------------------------------------------------|------------------------------------------|-------------------|
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):   | <b>520</b> (≥480)                        | <b>480</b> (≥400) |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa): | <b>630</b> (≥570)                        | <b>570</b> (≥520) |
| elongation A ( $L_0=5d_0$ ) %:                  | <b>27</b> (≥23)                          | <b>26</b> (≥19)   |
| impact work ISO-V KV J                          | +20°C: <b>200</b> (≥180)<br>-30°C: (≥47) | <b>230</b> (≥200) |

u untreated, as-welded – shielding gas Argon

a annealed, 620°C/1h/furnace down to 300°C/air – shielding gas Argon

### Operating Data



shielding gas: **100% Argon**

rod marking:

front: **WMoSi**

back: **1.5424**

ø mm

1.6

2.0

2.4

3.0

3.2



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

### Base Materials

similar alloyed high temperature steels and cast steels, ageing resistant and steels resistant to caustic cracking

16Mo3, S355J2G3, L320 - L415NB, L320 MB - L415MB, P255G1TH, P235GH, P265GH, P295GH, P310GH, P255NH, 16Mo3, 17MnMoV6-4, 22NiMoCr4-7, 20MnMoNi5-5, 15NiCuMoNb5, 20MnMoNi4-5, GE240-GE300, 22Mo4, S255N - S460N, P255NH-P460NH

ASTM A335 Gr. P1, A161-94 Gr. T1, A182M Gr. F1, A204M Gr. A, B, C, A250M Gr. T1, A217 Gr. WC1

### Approvals and Certificates

TÜV-D (0020.), KTA 1408.1 (8066.07), DB (42.014.09), ÖBB, TÜV-A (75), BV (UP), DNV (I YMS), CRS (3), CE, NAKS

### Same Alloy Filler Metals

SMAW stick electrode: FOX DMO Kb  
 FOX DMO Ti

SAW combination: EMS 2 Mo/BB 24  
 EMS 2 Mo/BB 25

GMAW solid wire: DMO-IG  
 Flux cored wire: DMO Ti-FD

Gas welding rod: DMO

Subject to change without notice

16.06.2010

EN ISO 21952-A: W CrMo1Si  
 EN ISO 21952-B: W G1CM3  
 AWS A5.28: ER80S-G  
 ER80S-B2 (mod.)  
 AWS A5.28M: ER55S-G (ER55S-B2 mod.)  
 W. No.: 1.7339

## BÖHLER DCMS-IG

**GTAW rod, low-alloyed, high temperature**

### Description

GTAW rod for 1.25% Cr 0.5% Mo alloyed boiler, plate and tube steels as well as for the welding of quenched and tempered and case hardening steels. Preferably used for the steels 13CrMo4-5 or ASTM A335 P11/P12. Approved in long-term condition up to +570°C service temperature. Suitable for step- cooling applications. Bruscato ≤15 ppm. The deposit is noted for its good mechanical properties and good toughness. Further, good resistance to cracking, when attacked by caustic soda, and the fact that it is suitable for nitriding, quenching and tempering are additional features. The values of the creep rupture strength lay within the scatter band of the material 13CrMo4-5. Very good operating characteristics.

### Typical Composition of Welding Rod

|      | C           | Si         | Mn         | Cr         | Mo         | P      | As     | Sb     | Sn     |
|------|-------------|------------|------------|------------|------------|--------|--------|--------|--------|
| wt-% | <b>0.11</b> | <b>0.6</b> | <b>1.0</b> | <b>1.2</b> | <b>0.5</b> | ≤0.012 | ≤0.010 | ≤0.005 | ≤0.006 |

### Mechanical Properties of All-weld Metal

|                                                 | a1                | a2                |
|-------------------------------------------------|-------------------|-------------------|
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):   | <b>490</b> (≥440) | <b>510</b> (≥470) |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa): | <b>590</b> (≥520) | <b>620</b> (≥550) |
| elongation A ( $L_0=5d_0$ ) %:                  | <b>25</b> (≥22)   | <b>22</b> (≥19)   |
| impact work ISO-V KV J +20°C:                   | <b>250</b> (≥47)  | <b>200</b>        |

a1 annealed, 680°C/2 h/furnace down to 300°C/air – shielding gas Argon

a2 annealed, 620°C/1 h/furnace down to 320°C/air – shielding gas Argon

### Operating Data



shielding gas: **100% Argon**

rod marking:

front: **W CrMo1 Si**

back: **1.7339**

ø mm

1.6

2.0

2.4

3.0



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

Preheating and interpass temperature for 13CrMo4-5 (P11/P12), 200-250°C. Tempering at 660-700°C at least ½ hr followed by cooling in furnace down to 300°C and still air.

### Base Materials

similar alloyed high temperature steels and cast steels, case hardening and nitriding steels of similar chemical composition, steels resistant to caustic cracking

1.7335 13CrMo4-5, 1.7262 15CrMo5, 1.7728 16CrMoV4, 1.7218 25CrMo4,  
 1.7258 24CrMo5, 1.7354 G22CrMo5-4, 1.7357 G17CrMo5-5

ASTM A193 Gr. B7, A217 Gr. WC6, A335 Gr. P11 u. P 12

### Approvals and Certificates

TÜV-D (0727.), TÜV-A (91), SEPPOZ, CE

### Same Alloy Filler Metals

|                  |             |                  |                     |
|------------------|-------------|------------------|---------------------|
| SMAW electrode:  | FOX DCMS Kb | SAW combination: | EMS 2 CrMo/BB 24    |
|                  | FOX DCMS Ti |                  | EMS 2 CrMo/BB 24 SC |
| GMAW solid wire: | DCMS-IG     |                  | EMS 2 CrMo/BB 25    |
| gas welding rod: | DCMS        | GTAW rod:        | DCMS-IG B2          |
| Flux cored wire: | DCMS Ti-FD  |                  |                     |

Subject to change without notice

22.04.2008

EN ISO 21952-A: W CrMo2Si  
 EN ISO 21952-B: W G2C1M3  
 AWS A5.28: ER90S-G  
 ER90S-B3 (mod.)  
 AWS A5.28M: ER62S-G  
 ER62S-B3 (mod.)  
 W. No.: 1.7384

## BÖHLER CM 2-IG

**GTAW rod, low-alloyed,  
high temperature**

### Description

GTAW rod for 2.25% Cr 1% Mo alloyed boiler, plate and tube steels as well as in oil refineries. Preferably used for base metal 10CrMo9-10 (ASTM A335 P22). Approved in long-term condition up to +600°C service temperature. Also for similarly alloyed quenched and tempered steels as well as case hardening steels. The weld metal meets all prerequisites for reliable long term creep properties without embrittlement due to very low content of trace elements. Brucato ≤15 ppm. Very good operating characteristics. \*For step- cooling applications we can offer special products.

### Typical Composition of Welding Rod

|      | C           | Si         | Mn          | Cr         | Mo         | P             | As            | Sb            | Sn            |
|------|-------------|------------|-------------|------------|------------|---------------|---------------|---------------|---------------|
| wt-% | <b>0.08</b> | <b>0.6</b> | <b>0.95</b> | <b>2.6</b> | <b>1.0</b> | <b>≤0.010</b> | <b>≤0.010</b> | <b>≤0.005</b> | <b>≤0.006</b> |

### Mechanical Properties of All-weld Metal

|                                                 |            |        |
|-------------------------------------------------|------------|--------|
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):   | <b>470</b> | (≥420) |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa): | <b>600</b> | (≥520) |
| elongation A ( $L_0=5d_0$ ) %:                  | <b>23</b>  | (≥22)  |
| impact work ISO-V KV J +20°C:                   | <b>190</b> | (≥47)  |

*a annealed, 720°C/2 h/furnace down to 300°C/air – shielding gas Argon*

### Operating Data



shielding gas: **100% Argon**  
 rod marking:  
 front: **W CrMo2 Si**  
 back: **1.7384**

ø mm  
 1.6  
 2.0  
 2.4  
 3.0



Preheating and interpass temperature 200-350°C. Tempering at 700-750°C at least 1 hr followed by cooling in furnace down to 300°C and still air.

### Base Materials

high temperature steels and similar alloyed cast steels, similar alloyed case hardening steels, nitriding steels

1.7380 10CrMo9-10, 1.8075 10CrSiMoV7, 1.7379 G17CrMo9-10

ASTM A335 Gr. P22, A217 Gr. WC 9

### Approvals and Certificates

TÜV-D (1564.), TÜV-A (89), SEPROZ, CE

### Same Alloy Filler Metals

|                 |                 |                  |                     |
|-----------------|-----------------|------------------|---------------------|
| SMAW electrode: | FOX CM 2 Kb     | GMAW solid wire: | CM 2-IG             |
|                 | FOX CM 2 Kb SC* | SAW combination: | CM 2-UP/BB 24       |
|                 |                 |                  | CM 2 SC-UP/BB24 SC* |

\*For step- cooling application

EN ISO 636-A: W3Ni1 (for rod)  
 EN ISO 636-A: W 46 5 W3Ni1  
 EN ISO 636-B: W 55A 5U WN2  
 AWS A5.28: ER80S-Ni1(mod.)  
 AWS A5.28M: ER55S-Ni1(mod.)

## BÖHLER Ni 1-IG

**GTAW rod, low alloyed,  
cryogenic application**

### Description

Ni-alloyed GTAW rod for welding of offshore pipe work and similar high integrity applications. High impact properties down to -50°C.

### Typical Composition of Welding Rod

|      | C    | Si  | Mn   | Ni  |
|------|------|-----|------|-----|
| wt-% | 0.07 | 0.7 | 1.40 | 0.9 |

### Mechanical Properties of All-weld Metal

|                                                 |                         |  |
|-------------------------------------------------|-------------------------|--|
| (*)                                             | u                       |  |
| yield strength $R_e$ N/mm <sup>2</sup> (MPa):   | <b>500</b> (≥470)       |  |
| tensile strength $R_m$ N/mm <sup>2</sup> (MPa): | <b>600</b> (≥550)       |  |
| elongation A ( $L_0=5d_0$ ) %:                  | <b>25</b> (≥24)         |  |
| impact work ISO-V KV J                          | +20°C: <b>150</b> (≥47) |  |
|                                                 | -50°C: (≥47)            |  |

(\*) u untreated, as-welded – shielding gas Argon

### Operating Data



Shielding gas: **100% Argon**

rod marking:

front:  **W3Ni1**

back: **ER80S-Ni 1 (mod.)**

ø mm

1.6

2.0

2.4



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

### Base Materials

High strength steels up to S500N  
 Pipe steels: L290MB – L485MB,  
**API Spec. 5 L:** X52, X56, X60, X65,

### Approvals and Certificates

-

# Thermanit JE-308L

GTAW welding rod

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | W 19 9 L       | SS308L         | ER308L   | 1.4316   |

## Characteristics and field of use

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

## Marks

 W 19 9L / ER308L

## Materials

TÜV-certified parent metal  
1.4301 – X5CrNi18-10  
1.4311 – X2CrNi18-10  
1.4550 – X6CrNiNb18-10  
AISI 304, 304L, 304LN, 302, 321, 347;  
ASTM A157 Gr. C9, A320 Gr. B8G or D

## Typical analysis in %

| C    | Si  | Mn  | Cr   | Ni   |
|------|-----|-----|------|------|
| 0.02 | 0.5 | 1.7 | 20.0 | 10.0 |

## Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT)

| Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN -196 °C |
|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|--------------------------------|
| AW             | 400                     | 430                     | 570                  | 35                                              | 100 35                         |

## Structure

Austenite with part ferrite

08.2009

Rev.: 0

## Welding instruction

| Materials                                                                                      | Preheating | Postweld heat treatment                                            |
|------------------------------------------------------------------------------------------------|------------|--------------------------------------------------------------------|
| Matching and similar non-stabilized and stabilized austenitic CrNi(N) steels/cast steel grades | None       | Mostly none. If necessary, solution annealing at 1000 °C (1832 °F) |
| Cryogenic austenitic steels/cast steel grades                                                  | None       | None                                                               |

**Polarity = –**  
**Shielding gas (EN ISO 14175) I1, I3**

|                  |                                             |                                     |
|------------------|---------------------------------------------|-------------------------------------|
| <b>Approvals</b> | TÜV (Certificate No. 9451)<br>CWB (ER 308L) | DB (Reg. form No. 43.132.19)<br>DNV |
|------------------|---------------------------------------------|-------------------------------------|

| Packaging and weights        | Diam. x Length (mm) | kg/pack |
|------------------------------|---------------------|---------|
| (Tolerances acc. EN ISO 544) | 1.0 x 1000          | 20      |
|                              | 1.2 x 1000          | 20      |
|                              | 1.6 x 1000          | 20      |
|                              | 2.0 x 1000          | 20      |
|                              | 2.4 x 1000          | 20      |
|                              | 3.2 x 1000          | 20      |
|                              | 4.0 x 1000          | 20      |
|                              | 5.0 x 1000          | 20      |

# Thermanit H-347

GTAW welding rod

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | W 19 9 Nb      | SS347          | ER347    | 1.4551   |

**Characteristics and field of use**

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistant similar to matching stabilized austenitic CrNi steels/cast steel grades.

For joining and surfacing application with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) steels and cast steel grades.

**Marks**

 W 19 9 Nb / ER347

**Materials**

TÜV-certified parent metal  
1.4550 – X6CrNiNb18-10 and the parent metals also covered by VdTÜV-Merkblatt 1000.  
AISI 347, 321, 302, 304, 304L, 304LN  
ASTM A296 Gr. CF8, A157 Gr. C9; A320 Gr. B8C or D

| Typical analysis in % | C    | Si  | Mn  | Cr   | Ni  | Nb    |
|-----------------------|------|-----|-----|------|-----|-------|
|                       | 0.05 | 0.5 | 1.8 | 19.5 | 9.5 | ≥12xC |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 400                     | 430                     | 570                  | 30                                              | 65                     |

**Structure**

Austenite with part ferrite

## Welding instruction

| Materials                                     | Preheating | Postweld heat treatment                                        |
|-----------------------------------------------|------------|----------------------------------------------------------------|
| Matching and similar steels/cast steel grades | None       | Mostly none. Otherwise solution annealing at 1020 °C (1868 °F) |

**Polarity = –**  
**Shielding gas (EN ISO 14175) I1**

**Approvals**

TÜV (Certificate No. 9475) DB (Reg. form No. 43.132.21)

| Packaging and weights        | Diam. x Length (mm) | kg/pack |
|------------------------------|---------------------|---------|
| (Tolerances acc. EN ISO 544) | 1.0 x 1000          | 20      |
|                              | 1.6 x 1000          | 20      |
|                              | 2.0 x 1000          | 20      |
|                              | 2.4 x 1000          | 20      |
|                              | 3.2 x 1000          | 20      |



# Thermanit ATS 4

GTAW welding rod

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | W 19 9 H       | SS19-10H       | ER19-10H | 1.4948   |

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

**Marks**  W 19 9 H / ER19-10 H

**Materials** TÜV-certified parent metal  
 1.4948 – X6CrNi18-11 1.4878 – X12CrNiTi18-9  
 1.4850 – X6CrNiNb18-10 AISI 304H, 321H, 347H

| Typical analysis in % | C    | Si  | Mn  | Cr   | Ni  |
|-----------------------|------|-----|-----|------|-----|
|                       | 0.05 | 0.4 | 1.8 | 18.8 | 9.3 |

**Creep and stress rupture properties** In the range of matching high temperature resistant parent metals

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 400                     | 430                     | 600                  | 30                                              | 100                    |

**Structure** Austenite with part ferrite, 5 % max.

## Welding instruction

| Materials                                 | Preheating                                                                      | Postweld heat treatment                                   |
|-------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------|
| Matching/similar steels/cast steel grades | Up to 25 mm wall thickness: none.<br>Over 25 mm: max. 200 °C (392 °F) advisable | To avoid stress corrosion cracking: 1050 °C (1922 °F)/air |

**Polarity = –**  
**Shielding gas (EN ISO 14175) I1**

**Approvals** TÜV (Certificate No. 1616)

| Packaging and weights (Tolerances acc. EN ISO 544) | Diam. x Length (mm) | kg/pack |
|----------------------------------------------------|---------------------|---------|
|                                                    | 1.6 x 1000          | 20      |
|                                                    | 2.0 x 1000          | 20      |
|                                                    | 2.4 x 1000          | 20      |
|                                                    | 3.2 x 1000          | 20      |

# Thermanit GE-316L

GTAW welding rod

08.2009

Rev.: 0

|                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                  |                         |                         |                      |                                                 |                        |
|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
| Classifications                                                                         | EN ISO 14343-A                                                                                                                                                                                                                                                                                                                                                                   | EN ISO 14343-B          | AWS A5.9                | Mat. No.             |                                                 |                        |
|                                                                                         | W 19 12 3 L                                                                                                                                                                                                                                                                                                                                                                      | SS316L                  | ER316L                  | 1.4430               |                                                 |                        |
| Characteristics and field of use                                                        | Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistance similar to matching low-carbon and stabilized austenitic 18/8 CrNiMo steels/cast steel grades. For joining and surfacing application with matching and similar – non-stabilized and stabilized – austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades. |                         |                         |                      |                                                 |                        |
| Marks                                                                                   |  W 19 12 3L / ER316L                                                                                                                                                                                                                                                                            |                         |                         |                      |                                                 |                        |
| Materials                                                                               | TÜV-certified parent metal<br>1.4583 – X10CrNiMoNb18-12; S31653, AISI 316L, 316Ti, 316Cb                                                                                                                                                                                                                                                                                         |                         |                         |                      |                                                 |                        |
| Typical analysis in %                                                                   | C                                                                                                                                                                                                                                                                                                                                                                                | Si                      | Mn                      | Cr                   | Mo                                              | Ni                     |
|                                                                                         | 0.02                                                                                                                                                                                                                                                                                                                                                                             | 0.5                     | 1.7                     | 18.5                 | 2.6                                             | 12.3                   |
| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment                                                                                                                                                                                                                                                                                                                                                                   | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|                                                                                         | AW                                                                                                                                                                                                                                                                                                                                                                               | 450                     | 480                     | 580                  | 35                                              | 100                    |

**Structure** Austenite with part ferrite

## Welding instruction

| Materials                                                                   | Preheating | Postweld heat treatment                                                                                         |
|-----------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------|
| Matching and similar non-stabilized and stabilized steels/cast steel grades | None       | Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to tendency to embrittlement |

**Polarity = –**  
**Shielding gas (EN ISO 14175) I1**

|                  |                                                          |                                     |
|------------------|----------------------------------------------------------|-------------------------------------|
| <b>Approvals</b> | TÜV (Certificate No. 9500)<br>CWB (ER 316L)<br>GL (4429) | DNV<br>DB (Reg. form No. 43.132.31) |
|------------------|----------------------------------------------------------|-------------------------------------|

| Packaging and weights<br>(Tolerances acc. EN ISO 544) | Diam. x Length (mm) | kg/pack |
|-------------------------------------------------------|---------------------|---------|
|                                                       | 1.0 x 1000          | 20      |
|                                                       | 1.2 x 1000          | 20      |
|                                                       | 1.6 x 1000          | 20      |
|                                                       | 2.0 x 1000          | 20      |
|                                                       | 2.4 x 1000          | 20      |
|                                                       | 3.2 x 1000          | 20      |
|                                                       | 4.0 x 1000          | 20      |

# Thermanit A

GTAW welding rod

08.2009

Rev.: 0

|                                                                                         |                                                                                                                                                                                                                                                                                                                                |                         |                         |                      |                                                 |                        |       |
|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|-------|
| Classifications                                                                         | EN ISO 14343-A                                                                                                                                                                                                                                                                                                                 | EN ISO 14343-B          | AWS A5.9                | Mat. No.             |                                                 |                        |       |
|                                                                                         | W 19 12 3 Nb                                                                                                                                                                                                                                                                                                                   | SS318                   | ER318                   | 1.4576               |                                                 |                        |       |
| Characteristics and field of use                                                        | Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistant similar to matching stabilized CrNiMo steels. For joining and surfacing application with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades. |                         |                         |                      |                                                 |                        |       |
| Marks                                                                                   |  W 19 12 3 Nb / ER318                                                                                                                                                                                                                         |                         |                         |                      |                                                 |                        |       |
| Materials                                                                               | TÜV-certified parent metal<br>1.4583 – X10CrNiMoNb18-12, AISI 316L, 316Ti, 316Cb                                                                                                                                                                                                                                               |                         |                         |                      |                                                 |                        |       |
| Typical analysis in %                                                                   | C                                                                                                                                                                                                                                                                                                                              | Si                      | Mn                      | Cr                   | Mo                                              | Ni                     | Nb    |
|                                                                                         | 0.04                                                                                                                                                                                                                                                                                                                           | 0.4                     | 1.7                     | 19.5                 | 2.7                                             | 11.5                   | ≥12xC |
| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment                                                                                                                                                                                                                                                                                                                 | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |       |
|                                                                                         | AW                                                                                                                                                                                                                                                                                                                             | 400                     | 430                     | 600                  | 30                                              | 100                    |       |

**Structure** Austenite with part ferrite

## Welding instruction

| Materials                                 | Preheating | Postweld heat treatment                                                                                         |
|-------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------|
| Matching/similar steels/cast steel grades | None       | Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to tendency to embrittlement |

**Polarity = –**  
**Shielding gas (EN ISO 14175) I1**

**Approvals** TÜV (Certificate No. 9474) DB (Reg. form No. 43.132.27)

| Packaging and weights<br>(Tolerances acc. EN ISO 544) | Diam. x Length (mm)       | kg/pack |
|-------------------------------------------------------|---------------------------|---------|
|                                                       | 1.0 x 1000                | 20      |
|                                                       | 1.6 x 1000                | 20      |
|                                                       | 2.0 x 1000                | 20      |
|                                                       | 2.4 x 1000                | 20      |
|                                                       | 3.2 x 1000                | 20      |
|                                                       | 4.0 x 1000                | 20      |
|                                                       | 5.0 x 1000                | 20      |
|                                                       | Other length upon request |         |

# Thermanit C Si

GTAW welding rod

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9    | Mat. No. |
|-----------------|----------------|----------------|-------------|----------|
|                 | W 25 20 Mn     | SSZ310         | ER310(mod.) | 1.4842   |

## Characteristics and field of use

Resistant to scaling up to 1050 °C (1922 °F). For tough joints with heat resistant Cr and CrNi steels/cast steel grades. For surfacing and joining on matching/similar heat resistant steels/cast steel grades. For tough fill layers beneath final weld passes made with Thermanit L and Thermanit 30 when welding thicker cross-sections of Cr-steels/cast steel grades to permit use of such steels in sulphurous atmospheres.

| Atmosphere                         | max. application temperature in °C (°F) |                            |
|------------------------------------|-----------------------------------------|----------------------------|
|                                    | sulphur-free                            | max. 2 g S/Nm <sup>3</sup> |
| Air and oxidizing combustion gases | 1150 (2102)                             | 1100 (2012)                |
| Reducing combustion gases          | 1080 (1976)                             | 1040 (1904)                |

**Marks**  W 25 20 Mn / 1.4842

**Materials**

|                          |                        |
|--------------------------|------------------------|
| 1.4837 – GX40CrNiSi25-12 | 1.4840 – GX15CrNi25-20 |
| 1.4841 – X15CrNiSi25-20  | AISI 305, 310, 314     |
| ASTM A297 HF, A297 HJ    |                        |

| Typical analysis in % | C    | Si  | Mn  | Cr   | Ni   |
|-----------------------|------|-----|-----|------|------|
|                       | 0.13 | 0.9 | 3.2 | 25.0 | 20.5 |

**Creep and stress rupture properties** In the range of matching heat resistant parent metals

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 380                     | 410                     | 580                  | 25                                              | 80                     |

**Structure** Austenite

08.2009

Rev.: 0

## Welding instruction

| Materials                                                    | Preheating                   | Postweld heat treatment      |
|--------------------------------------------------------------|------------------------------|------------------------------|
| Heat resistant Cr-steels/<br>cast steel grades               | According to parent<br>metal | According to parent<br>metal |
| Heat resistant matching/<br>similar steels/cast steel grades | None                         | None                         |

**Polarity = –**  
**Shielding gas (EN ISO 14175) I1**

## Packaging and weights

(Tolerances acc. EN ISO 544)

### Diam. x Length (mm)

### kg/pack

|            |    |
|------------|----|
| 1.6 x 1000 | 20 |
| 2.0 x 1000 | 20 |
| 2.4 x 1000 | 20 |
| 3.2 x 1000 | 20 |
| 4.0 x 1000 | 20 |

# Thermanit 25/14 E-309L

GTAW welding rod

08.2009

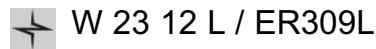
Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | W 23 12 L      | SS309L         | ER309L   | 1.4332   |

## Characteristics and field of use

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

## Marks



## Materials

TÜV-certified parent metal.

Combinations between 1.4583 – X10CrNiMoNb18-12 and ferritic steels up to S355N.

Joints of and between high-tensile, unalloyed and alloyed quenched and tempered steels, stainless, ferritic Cr and austenitic Cr-Ni steels, high manganese steels as well as claddings: for the first layer of chemical resistant weld claddings on ferritic-pearlitic steels up to fine grained structural steels S500N, in steam boiler and pressure boiler construction, as well as creep resistant fine grained structural steels 11NiMoCr4-7 acc. to leaflet "SEW-Werkstoffblatt" No. 365, 366, 20MnMoNi5-5 and G18NiMoCr3-7.

## Typical analysis in %

| C    | Si  | Mn  | Cr   | Ni   |
|------|-----|-----|------|------|
| 0.02 | 0.5 | 1.7 | 24.0 | 13.0 |

## Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT)

| Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
| AW             | 430                     | 460                     | 580                  | 30                                              | 80                     |

## Structure

Austenite with part ferrite

## Welding instruction

| Materials                                                                                                  | Preheating                                                        | Postweld heat treatment                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Joining: CrNi(MoN)<br>austenitic steels with<br>unalloyed/low-alloy steels/<br>cast steel grades           | According<br>to ferritic parent<br>metal; mostly<br>not necessary | No Postweld heat treatment above<br>300 °C (572 °F); risk of carbide<br>precipitation in weld fusion zone,<br>loss of toughness, fracturing                                        |
| Joining: CrNi(MoN)<br>austenitic steels with stain-<br>less heat resistant Cr-<br>steels/cast steel grades | According<br>to ferritic<br>parent metal                          | According to the parent metals.<br>Attention must be paid to resistance<br>to intercrystalline corrosion and to<br>susceptibility of the austenitic metal<br>side to embrittlement |
| Cladded plates and cast<br>materials with austenitic<br>CrNi(MoN) overlay                                  | According<br>to ferritic<br>parent metal                          | According to the parent metals.<br>Attention must be paid to resistance<br>to intercrystalline corrosion and to<br>susceptibility of the austenitic metal<br>side to embrittlement |

**Polarity = –**

**Shielding gas (EN ISO 14175) I1**

## Approvals

TÜV (Certificate No. 2661)  
GL (4332)

CWB (ER 309L-Si)

## Packaging and weights

(Tolerances acc. EN ISO 544)

### Diam. x Length (mm)

### kg/pack

|            |    |
|------------|----|
| 1.6 x 1000 | 20 |
| 2.0 x 1000 | 20 |
| 2.4 x 1000 | 20 |
| 3.2 x 1000 | 20 |

# P5

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

## Standard designations

EN ISO 14343 W 23 12 2 L

AWS A5.9 (ER309LMo)\*

\* Cr lower and Ni higher than standard.

## Characteristics and welding directions

AVESTA P5 is a molybdenum-alloyed wire of the 309MoL type, which is primarily designed for surfacing low-alloy steels and in dissimilar welding between stainless steels and low-alloy steels ensuring a high resistance against cracking. It can also be used for welding high-strength steels such as Hardox® and Armox®. When used for surfacing, the composition is more or less equal to that of ASTM 316 from the first run.

## Welding data

| Diameter, mm | Current, A | Voltage, V |
|--------------|------------|------------|
| 1.20         | 60 – 80    | 9 – 11     |
| 1.60         | 80 – 110   | 10 – 12    |
| 2.00         | 100 – 130  | 14 – 16    |
| 2.40         | 130 – 160  | 16 – 18    |
| 3.20         | 160 – 200  | 17 – 19    |

## Shielding gas

Ar (99.95%) or Ar with an addition of 20 – 30% helium (He) or 1 – 5% hydrogen (H<sub>2</sub>).

Gas flow rate 4 – 8 l/min.

## Chemical composition, wire (typical values, %)

| C       | Si           | Mn               | Cr   | Ni   | Mo  |
|---------|--------------|------------------|------|------|-----|
| 0.02    | 0.35         | 1.5              | 21.5 | 15.0 | 2.7 |
| Ferrite | 9 FN<br>8 FN | DeLong<br>WRC-92 |      |      |     |

| Mechanical properties            | Typical values (IIW)  | Min. values EN ISO 14343 |
|----------------------------------|-----------------------|--------------------------|
| Yield strength R <sub>p0.2</sub> | 470 N/mm <sup>2</sup> | 350 N/mm <sup>2</sup>    |
| Tensile strength R <sub>m</sub>  | 640 N/mm <sup>2</sup> | 550 N/mm <sup>2</sup>    |
| Elongation A <sub>5</sub>        | 30 %                  | 25 %                     |
| Impact strength KV               |                       |                          |
| +20°C                            | 140 J                 |                          |
| –40°C                            | 90 J                  |                          |
| Hardness                         | 210 Brinell           |                          |

**Interpass temperature:** Max. 150°C.

**Heat input:** Max. 2.0 kJ/mm.

**Heat treatment:** Generally none.

For constructions that include low-alloy steels in mixed joints, a stress-relieving annealing stage may be advisable. However, this type of alloy may be susceptible to embrittlement-inducing precipitation in the temperature range 550 – 950°C. Always consult the supplier of the parent metal or seek other expert advice to ensure that the correct heat treatment process is carried out.

**Structure:** Austenite with 5 – 10% ferrite.

**Scaling temperature:** Approx. 950°C (air).

**Corrosion resistance:** Superior to 316L.

The corrosion resistance obtained on the first layer when surfacing corresponds to that of ASTM 316.

## Approvals

• CE • DB • DNV • TÜV



# Thermanit X

GTAW welding rod

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9    | Mat. No. |
|-----------------|----------------|----------------|-------------|----------|
|                 | W 18 8 Mn      | SSZ307         | ER307(mod.) | 1.4370   |

**Characteristics and field of use**

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

**Marks**  W 18 8 Mn / 1.4370

**Materials**

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

| Typical analysis in % | C    | Si  | Mn  | Cr   | Ni  |
|-----------------------|------|-----|-----|------|-----|
|                       | 0.08 | 0.8 | 7.0 | 19.0 | 9.0 |

| Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT) | Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|-----------------------------------------------------------------------------------------|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
|                                                                                         | AW             | 450                     | 500                     | 620                  | 35                                              | 100                    |

**Structure** Austenite with small amount of ferrite

## Welding instruction

| Materials                                                                                          | Preheating                                               | Postweld heat treatment                                                                                                                                        |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heat resistant Cr-steels/cast steel grades                                                         | According to wall thickness: 150 - 300 °C (302 - 572 °F) | Tempering at 750 °C (1382 °F) not necessary if service temperature is the same or higher                                                                       |
| Heat resistant CrNi steels                                                                         | None                                                     | None                                                                                                                                                           |
| Joining of CrNi(MoN) austenitic steels to unalloyed/low-alloy steels/cast steel grades             | According to ferritic parent metal, mostly not necessary | No Postweld heat treatment >300 °C (572 °F) – risk of carbide precipitation at grain boundaries in the weld fusion zone, loss of toughness, fracturing         |
| Joining of CrNi(MoN) austenitic steels to stainless and heat-resistant Cr-steels/cast steel grades | According to ferritic parent metal                       | According to parent metals. Attention must be paid to the inter-crystalline corrosion resistance and embrittlement susceptibility of the austenitic metal side |

**Polarity = –**

**Shielding gas (EN ISO 14175) I1**

## Approvals

TÜV (Certificate No. 1234)  
DNV

DB (Reg. form No. 43.132.26)

## Packaging and weights

(Tolerances acc. EN ISO 544)

### Diam. x Length (mm)

### kg/pack

|            |    |
|------------|----|
| 1.0 x 1000 | 20 |
| 1.6 x 1000 | 20 |
| 2.0 x 1000 | 20 |
| 2.4 x 1000 | 20 |
| 3.2 x 1000 | 20 |
| 5.0 x 1000 | 20 |

# Thermanit 22/09

GTAW welding rod

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | EN ISO 14343-B | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------------|----------|----------|
|                 | W 22 9 3 N L   | SS2209         | ER2209   | ≈1.4462  |

## Characteristics and field of use

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

## Marks

 W 22 9 3 NL / ER2209

## Materials

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

| Typical analysis in % | C    | Si  | Mn  | Cr   | Mo  | Ni  | N    |
|-----------------------|------|-----|-----|------|-----|-----|------|
|                       | 0.02 | 0.4 | 1.7 | 22.5 | 3.2 | 8.8 | 0.15 |

## Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT)

| Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation (L <sub>0</sub> =5d <sub>0</sub> ) % | Impact values in J CVN |
|----------------|-------------------------|-------------------------|----------------------|-------------------------------------------------|------------------------|
| AW             | 600                     | 650                     | 720                  | 25                                              | 100                    |

## Structure

Austenite/ferrite

08.2009

Rev.: 0

## Welding instruction

| Materials                                 | Preheating | Postweld heat treatment                                                  |
|-------------------------------------------|------------|--------------------------------------------------------------------------|
| Matching/similar steels/cast steel grades | None       | Mostly none; if necessary solution annealing at 1050 °C (1922 °F)/ water |

**Polarity = –**  
**Shielding gas (EN ISO 14175) I1**

## Approvals

TÜV (Certificate No. 3343)  
 ABS  
 LR

GL (4462)  
 DNV

## Packaging and weights

(Tolerances acc. EN ISO 544)

### Diam. x Length (mm)

1.6 x 1000  
 2.0 x 1000  
 2.4 x 1000  
 3.2 x 1000

### kg/pack

20  
 20  
 20  
 20

# Thermanit 25/09 CuT

GTAW welding rod / solid wire

08.2009

Rev.: 0

| Classifications | EN ISO 14343-A | AWS A5.9 | Mat. No. |
|-----------------|----------------|----------|----------|
|                 | W 25 9 4 N L   | ER2594   | ≈1.4501  |

## Characteristics and field of use

Super duplex stainless steel; resistant to intercrystalline corrosion (Service temperature:  $-50^{\circ}\text{C}$  up to  $+220^{\circ}\text{C}$ ).

Very good resistance to pitting corrosion and stress corrosion cracking due to the high CrMo(N) content (pitting index  $\geq 40$ ).

Well suited for conditions in offshore application, particularly for welding of supermartensitic stainless steels (13 % Cr); extra low hydrogen in the filler material available on request.

## Marks



W 25 9 4 NL

## Materials

1.4515 – GX3CrNiMoCuN26-6-3

1.4517 – GX3CrNiMoCuN25-6-3-3

25 % Cr-superduplex steels such as Zeron 100, SAF 25/07, FALC 100

## Typical analysis in %

| C    | Si  | Mn  | Cr   | Mo  | Ni  | N    | Cu  | W   |
|------|-----|-----|------|-----|-----|------|-----|-----|
| 0.02 | 0.3 | 0.8 | 25.3 | 3.7 | 9.5 | 0.22 | 0.6 | 0.6 |

## Mechanical properties of the weld metal according to EN ISO 15792-1 (min. values at RT)

| Heat-treatment | Yield strength 0.2% MPa | Yield strength 1.0% MPa | Tensile strength MPa | Elongation ( $L_0=5d_0$ ) % | Impact values in J CVN $-40^{\circ}\text{C}$ |
|----------------|-------------------------|-------------------------|----------------------|-----------------------------|----------------------------------------------|
| AW             | 600                     | 650                     | 750                  | 25                          | 80 50                                        |

## Structure

Austenite/ferrite

## Welding instruction

| Materials                                 | Preheating  | Postweld heat treatment                                                                                                                             |
|-------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Matching/similar steels/cast steel grades | Mostly none | Mostly none; if necessary, solution annealing at 1120 °C (2048 °F)/ water.                                                                          |
|                                           |             | Welding of root pass with "thick layer".<br>Next two passes with thin layers and low heat input to avoid precipitation and too high ferrite content |

**Polarity = –**  
**Shielding gas (EN ISO 14175) I1**

## Packaging and weights

(Tolerances acc. EN ISO 544)

### Diam. x Length (mm)

1.6 x 1000  
2.0 x 1000  
2.4 x 1000  
3.2 x 1000  
Spools on request

### kg/pack

20  
20  
20  
20

# UTP A 068 HH

## Standards :

|              |                              |
|--------------|------------------------------|
| Material-No. | : 2.4806                     |
| EN ISO 18274 | : S Ni 6082<br>(NiCr20Mn3Nb) |
| AWS A5.14    | : ER NiCr-3                  |

**NiCrFe rods and wires for corrosion and high temperature materials**

## Application field

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

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

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

## Properties of the weld metal

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

## Mechanical properties of the weld metal

| Yield strength<br>R <sub>p0,2</sub><br>MPa | Tensile strength<br>R <sub>m</sub><br>MPa | Elongation<br>A<br>% | Impact strength<br>K <sub>v</sub><br>Joule |
|--------------------------------------------|-------------------------------------------|----------------------|--------------------------------------------|
| > 420                                      | 680                                       | 40                   | 20° C 160<br>-196° C 80                    |

## Weld metal analysis in %

| C      | Si    | Mn  | Cr   | Ni      | Nb  | Fe  |
|--------|-------|-----|------|---------|-----|-----|
| < 0,02 | < 0,2 | 3,0 | 20,0 | balance | 2,7 | 0,8 |

## Welding instruction

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

## Welding procedure and availability

| Ø<br>(mm) | Current type | Shielding gas<br>EN ISO 14175 |     |                    | Availability         |                    |
|-----------|--------------|-------------------------------|-----|--------------------|----------------------|--------------------|
|           |              | I I                           | R I | Z-ArHeHC-30/2/0,05 | Spools<br>EN ISO 544 | Rods<br>EN ISO 544 |
| 0,8       | DC (+)       |                               |     | x                  | x                    |                    |
| 1,0       | DC (+)       | s                             |     | x                  | x                    |                    |
| 1,2       | DC (+)       |                               |     | x                  | x                    |                    |
| 1,6       | DC (+)       |                               |     | x                  | x                    |                    |
| 1,6       | DC (-)       | x                             | x   |                    |                      | x                  |
| 2,0       | DC (-)       | x                             | x   |                    |                      | x                  |
| 2,4       | DC (-)       | x                             | x   |                    |                      | x                  |
| 3,2       | DC (-)       | x                             | x   |                    |                      | x                  |

## Approvals TÜV (No. 00882; 00883), KTA, ABS, GL, DNV

#### Standards :

|              |                              |
|--------------|------------------------------|
| Material-No. | : 2.4831                     |
| EN ISO 18274 | : S Ni 6625<br>(NiCr22Mo9Nb) |
| AWS A5.14    | : ER NiCrMo-3                |

## UTP A 6222 Mo

**Rods and wires for high corrosion resistant  
NiCrMo-alloys**

#### Application field

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

|                   |        |            |
|-------------------|--------|------------|
| XI NiCrMoCuN25206 | 1.4529 | UNS N08926 |
| XI NiCrMoCuN25205 | 1.4539 | UNS N08904 |
| NiCr21Mo          | 2.4858 | UNS N08825 |
| NiCr22Mo9Nb       | 2.4856 | UNS N06625 |

It can be used for joining ferritic steel to austenitic steel as well as for surfacing on steel. It is also possible to weld 9 % nickel steels using this wire due to its high yield strength.

Its wide range of uses is of particular significance in aviation, in chemical industry and in applications involving seawater.

#### Special properties of the weld metal

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

#### Mechanical properties of the weld metal

| Yield strength<br>$R_{p0,2}$<br>MPa | Tensile strength<br>$R_m$<br>MPa | Elongation<br>A<br>% | Impact strength<br>$K_v$<br>Joule |
|-------------------------------------|----------------------------------|----------------------|-----------------------------------|
| > 460                               | > 740                            | > 30                 | 20° C > 100<br>-196° C > 85       |

#### Weld metal analysis in %

| C      | Si    | Cr   | Mo  | Ni      | Nb  | Fe  |
|--------|-------|------|-----|---------|-----|-----|
| < 0,02 | < 0,2 | 22,0 | 9,0 | balance | 3,5 | 1,0 |

#### Welding instruction

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

#### Welding procedure and availability

| Ø<br>(mm) | Current type | Shielding gas<br>EN ISO 14175 |                    | Availability |            |
|-----------|--------------|-------------------------------|--------------------|--------------|------------|
|           |              |                               |                    | Spools       | Rods       |
|           |              | R I                           | Z-ArHeHC-30/2/0,05 | EN ISO 544   | EN ISO 544 |
| 0,8 *     | DC (+)       |                               | x                  | x            |            |
| 1,0       | DC (+)       |                               | x                  | x            |            |
| 1,2       | DC (+)       |                               | x                  | x            |            |
| 1,6       | DC (+)       |                               | x                  | x            |            |
| 1,6       | DC (-)       | x                             |                    |              | x          |
| 2,0       | DC (-)       | x                             |                    |              | x          |
| 2,4       | DC (-)       | x                             |                    |              | x          |
| 3,2 *     | DC (-)       | x                             |                    |              | x          |

\* available on request

**Approvals** TÜV (No. 03460; 03461), GL, DNV, ABS, LR (1,2mm MIG)



## Onderpoederdek lassen, IWT-opleiding



|           |                               |                            |
|-----------|-------------------------------|----------------------------|
| OP 119    | EN 760: SA CS 1 77 AC         | AWS A5.17: F7A2-EM12K      |
| OP 120 TT | EN 760: SA FB 1 66 AC H5      | AWS A5.17: F7A6-EM12K      |
| OP 121 TT | EN 760: SA FB 1 55 AC         | AWS A5.17: F6P8-EM12K      |
| OP 125 W  | EN 760: SA FB 1 55 AC         | AWS A5.23: F8P0-EB6-B6     |
| OP 181    | EN 760: SA AR 1 88 AC         | AWS A5.17: F7A0-F7PZ-EM12K |
| OP 41 TT  | EN 760: SA FB 1 53 DC H5      | AWS A5.17: F7A8-F6P8-EH12K |
| OP 176    | EN 760: SA MS 1 88 AC H5      | AWS A5.17: F7A2-EM12K      |
| OP F72    | EN ISO 14171-A-S 46 0 CS S2Mo | AWS A5.17: F7A2-EM12K      |

OP 119 is an agglomerated calcium-silicate type flux for the welding of general structural steels, boiler and pipe steels, as well as fine grain structural steels. OP 119 is particularly suited for the multi-wire welding process at high speed. Slag removal is easy in all cases. The slag freezes quickly which means that girth seams of small-diameter work pieces can be welded without the slag running off. Damp flux should be re-dried at 300-350°C. Grain size according to EN 760: 2-20.

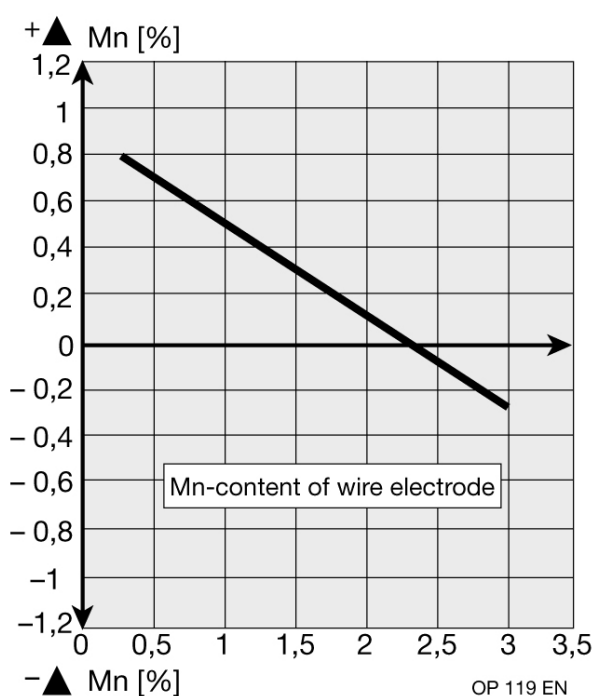
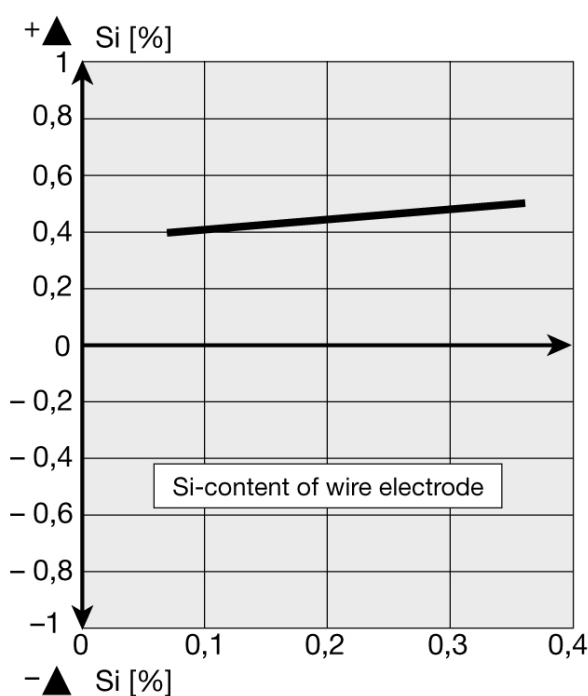
| Classification |     |                    |
|----------------|-----|--------------------|
|                | EN  | 760: SA CS 1 77 AC |
| OE-S2 Mo       | AWS | A5.23: F8A0-EA2-A2 |
| OE-S1          | AWS | A5.17: F7A0-EL12   |
| OE-S2          | AWS | A5.17: F7A2-EM12K  |

| Approvals      |     | Grade |
|----------------|-----|-------|
| OE-S2 Mo       | DB  | ●     |
| OE-S1 CrMo2    | TÜV | ●     |
| OE-S2 CrMo1    | TÜV | ●     |
| OE-S2 Mo       | TÜV | ●     |
| OE-S1          | DB  | ●     |
| OE-S1          | TÜV | ●     |
| OE-S2          | DB  | ●     |
| OE-S2          | TÜV | ●     |
| OE-S3          | TÜV | ●     |
| OE-SD3 1Ni ½Mo | TÜV | ●     |

| Flux Main Components                 |      |
|--------------------------------------|------|
| SiO <sub>2</sub> + TiO <sub>2</sub>  | 40 % |
| Al <sub>2</sub> O <sub>3</sub> + MnO | 25 % |
| CaO + MgO                            | 20 % |
| CaF <sub>2</sub>                     | 10 % |

## METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)  
DVS-Merkblatt 0907 Part 1



## SAW Fluxes SAW Rutile-Acid Fluxes

### Chemical analysis (Typical values in %)

|                |          | C    | Mn  | Si  | Mo  |
|----------------|----------|------|-----|-----|-----|
| All weld metal | OE-S2 Mo | 0.05 | 1.3 | 0.5 | 0.5 |
| All weld metal | OE-S1    | 0.05 | 1.1 | 0.5 | -   |
| All weld metal | OE-S2    | 0.05 | 1.4 | 0.5 | -   |

### All-weld metal Mechanical Properties

|          | Heat Treatment | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) |
|----------|----------------|----------------------|------------------------|-------------------|
| OE-S2 Mo | As Welded      | ≥ 480                | 600-700                | ≥ 20              |
| OE-S1    | As Welded      | ≥ 360                | 420-520                | ≥ 24              |
| OE-S2    | As Welded      | ≥ 400                | 520-620                | ≥ 24              |

### All-weld metal Mechanical Properties - CV

|          | Heat Treatment | Impact Energy (J) |      |        |
|----------|----------------|-------------------|------|--------|
|          |                | +20 °C            | 0 °C | -20 °C |
| OE-S2 Mo | As Welded      | ≥ 90              | ≥ 50 | ≥ 35   |
| OE-S1    | As Welded      | ≥ 100             | ≥ 60 | ≥ 30   |
| OE-S2    | As Welded      | ≥ 100             | ≥ 80 | ≥ 50   |

### Typical applications

|          | Materials                                                                                                                                                          |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OE-S2 Mo | ASME: X60, X65,<br>EN: 16Mo3, S(P)355-S(P)460, L245-L450                                                                                                           |
| OE-S1    | ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50<br>EN: S(P)235-S(P)355; L245-L360 |
| OE-S2    | ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50<br>EN: S(P)235-S(P)355; L245-L360 |

#### Redrying

300-350°Cx2-4h

#### Current Conditions

AC; DC+

### Packaging data

| Packaging Type | PE |
|----------------|----|
| Weight (kg)    | 25 |
| -              | ●  |

## SAW Fluxes SAW Basic and Semi-basic Fluxes

OP 120TT is an agglomerated fluoride-basic type welding flux that is used for the welding of fine-grain structural steels, especially when high levels of weld metal toughness are required. The manganese pick-up results in excellent toughness values when used in combination with wire electrode OE-S2 containing lower level of manganese. OP 120TT has a very low diffusible hydrogen content and is highly resistant to moisture pick up during use. Self-releasing slag even in narrow joint configurations. The welding flux is suitable for welding with DC+ and AC up to about 1000A. Damp flux should be re-dried at 300-350°C. Grain size according to EN 760: 2-20.

| Classification |     |                       |
|----------------|-----|-----------------------|
|                | EN  | 760: SA FB 1 66 AC H5 |
| OE-S2 Mo       | AWS | 5:23: F8A4-EA2-A2     |
| OE-S2          | AWS | 5:17: F7A6-EM12K      |
| OE-SD2 1NiCrMo | AWS | 5:23: F10P4-EG-G      |

|             | Approvals | Grade |
|-------------|-----------|-------|
| OE-S2 Mo    | DB        | ●     |
| OE-S2 CrMo1 | TÜV       | ●     |
| OE-S2 Mo    | TÜV       | ●     |
| OE-S2 Ni1   | TÜV       | ●     |
| OE-S1       | DB        | ●     |
| OE-S1       | TÜV       | ●     |
| OE-S2       | ABS       | 3YM   |
| OE-S2       | BV        | 3YM   |

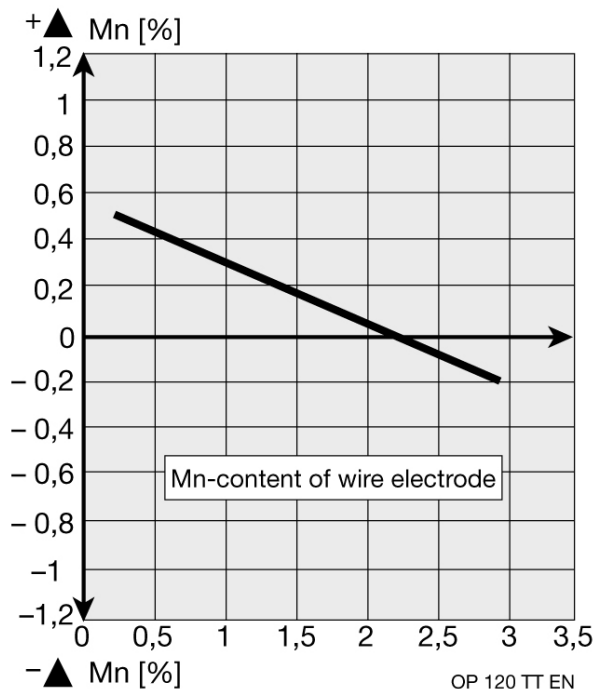
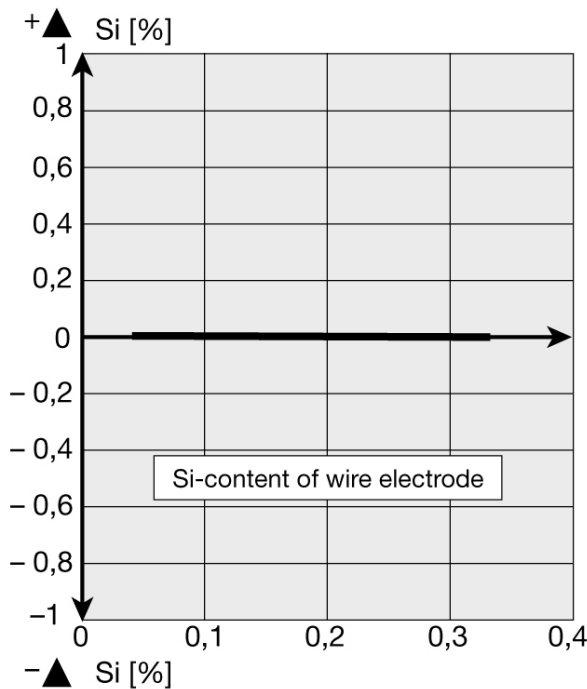
| Flux Main Components                 |      |
|--------------------------------------|------|
| CaF <sub>2</sub>                     | 30 % |
| CaO + MgO                            | 30 % |
| Al <sub>2</sub> O <sub>3</sub> + MnO | 20 % |
| SiO <sub>2</sub> + TiO <sub>2</sub>  | 15 % |

|       | Approvals | Grade |
|-------|-----------|-------|
| OE-S2 | DB        | ●     |
| OE-S2 | DNV       | IIIYM |
| OE-S2 | GL        | 3YM   |
| OE-S2 | LRS       | 3YM   |
| OE-S2 | TÜV       | ●     |
| OE-S3 | DB        | ●     |
| OE-S3 | TÜV       | ●     |

**Boniszewski Basicity** 3.1

### METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)  
DVS-Merkblatt 0907 Part 1



OP 120 TT EN

### Chemical analysis (Typical values in %)

|                |                   | C    | Mn  | Si  | Cr | Ni  | Mo  |
|----------------|-------------------|------|-----|-----|----|-----|-----|
| All weld metal | OE-S2 CrMo1       | 0.07 | 1.2 | 0.3 | 1  | -   | 0.5 |
| All weld metal | OE-S2 Mo          | 0.06 | 1.2 | 0.4 | -  | -   | 0.5 |
| All weld metal | OE-S1             | 0.05 | 0.8 | 0.2 | -  | -   | -   |
| All weld metal | OE-S2             | 0.06 | 1.2 | 0.4 | -  | -   | -   |
| All weld metal | OE-SD3 1Ni<br>½Mo | 0.05 | 1.6 | 0.4 | -  | 0.9 | 0.5 |
| All weld metal | OE-SD2<br>1NiCrMo | 0.06 | 1.4 | 0.5 | 1  | 0.9 | 0.6 |

### All-weld metal Mechanical Properties

|                | Heat Treatment  | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) |
|----------------|-----------------|----------------------|------------------------|-------------------|
| OE-S2 CrMo1    | 680°Cx2h        | ≥ 380                | 570-670                | ≥ 22              |
| OE-S2 CrMo1    | 920°C/air+720°C | ≥ 310                | 430-530                | ≥ 28              |
| OE-S2 Mo       | As Welded       | ≥ 450                | 600-700                | ≥ 24              |
| OE-S1          | As Welded       | ≥ 360                | 440-540                | ≥ 25              |
| OE-S2          | As Welded       | ≥ 420                | 500-600                | ≥ 24              |
| OE-SD3 1Ni ½Mo | 620°Cx2h        | ≥ 580                | 680-720                | ≥ 30              |
| OE-SD2 1NiCrMo | As Welded       | ≥ 760                | 840-870                | ≥ 24              |
| OE-SD2 1NiCrMo | 660°Cx3h        | ≥ 590                | 690-720                | ≥ 26              |

## SAW Fluxes SAW Basic and Semi-basic Fluxes

### All-weld metal Mechanical Properties - CV

|                | Heat Treatment  | Impact Energy (J) |       |        |        |        |
|----------------|-----------------|-------------------|-------|--------|--------|--------|
|                |                 | +20 °C            | 0 °C  | -20 °C | -40 °C | -60 °C |
| OE-S2 CrMo1    | 680°Cx2h        | ≥ 200             | ≥ 150 |        |        |        |
| OE-S2 CrMo1    | 920°C/air+720°C |                   | ≥ 200 |        |        |        |
| OE-S2 Mo       | As Welded       | ≥ 130             | ≥ 90  | ≥ 70   | ≥ 40   |        |
| OE-S1          | As Welded       | ≥ 150             | ≥ 90  |        |        |        |
| OE-S2          | As Welded       | ≥ 160             | ≥ 130 | ≥ 100  | ≥ 70   | ≥ 40   |
| OE-SD3 1Ni ½Mo | 620°Cx2h        |                   |       |        | ≥ 40   |        |
| OE-SD2 1NiCrMo | As Welded       |                   |       |        | ≥ 40   |        |
| OE-SD2 1NiCrMo | 660°Cx3h        |                   |       |        | ≥ 27   |        |

### Typical applications

|                | Materials                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OE-S2 CrMo1    | ASME: A199 and A200 Grade T11, A213 Grades T11, T12<br>EN: 13CrMo4-5, 13CrMoSi5-5                                                                                            |
| OE-S2 Mo       | ASME: X60, X65, ASTM A355 Gr. P1; A182M Gr. F1<br>EN: 16Mo3, S(P)420-S(P)500; L245-L485                                                                                      |
| OE-S1          | ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50<br>EN: S(P)235-S(P)355; L245-L360           |
| OE-S2          | ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50<br>EN: S(P)235-S(P)420                      |
| OE-SD3         | ASME: A131 Grades E, EH32, EH46; A 572 Grades 42, 50; A633 Grades A, C, D; A285 Grades A, B,C; A537 Class 1; A662 Grades A, B, C; A737 Grades B; A841<br>EN: S(P)235-S(P)460 |
| OE-SD3 1Ni ½Mo | ASME: X70, X80, N-A-XTRA 55, HY80, QIN<br>EN: S(P)420-S(P)500; L245-L485; 20MnMoNi5-5, 15NiCuMoNb5                                                                           |
| OE-SD2 1NiCrMo | ASME: ASTM A302 Grade B, ASTM A336 Grade F30, ASTM A487 Class 1N, 1Q 2N, 2Q, AISI 4130<br>EN: S(P)460-S(P)555                                                                |

#### Redrying

300-350°Cx2-4h

#### Current Conditions

AC; DC+

### Packaging data

| Packaging Type | PE |
|----------------|----|
| Weight (kg)    | 25 |
| -              | ●  |

## SAW Fluxes SAW Basic and Semi-basic Fluxes

OP 121TT is a fully basic agglomerated submerged-arc welding flux that is widely used for the welding of structural and fine grained low alloy steels requiring high integrity welds with low temperature impact and CTOD fracture toughness properties. OP 121TT flux, in combination with a range of Oerlikon submerged-arc wires, in particular with OE-SD3, is established for the welding of offshore structures such as oil platform jackets, piles, decks and modules giving a high level of consistency and mechanical property performance. The flux is widely used for the welding of thick section components in the offshore, nuclear and pressure vessel industries. The flux exhibits a low hydrogen content in the as manufactured condition and gives a high resistance to moisture pick up during exposure under workshop conditions. The flux promotes a very stable arc characteristic during use with excellent slag detachment. The weld is of a uniform even profile with regular fine ripple formation and smooth toe blending. OP 121TT flux is suitable for use with DC+ or AC and is ideal for single wire, twin wire, tandem arc [DC+/AC] and other multi-arc systems using up to 1000A with single wire welding. Grain size according to EN 760: 2-20.

| Classification |     |                       |
|----------------|-----|-----------------------|
|                | EN  | 760: SA FB 1 55 AC H5 |
| OE-S1 CrMo2    | AWS | A5.23: F8P2-EB3-B3    |
| OE-S2 CrMo1    | AWS | A5.23: F8P4-EB2-B2    |
| OE-S2 Mo       | AWS | A5.23: F8A4-EA2-A2    |
| OE-S2 Mo       | AWS | A5.23: F8P4-EA2-A2    |
| OE-S2 Ni2      | AWS | A5.23: F7A10-ENi2-Ni2 |
| OE-S2 Ni2      | AWS | A5.23: F7P10-ENi2-Ni2 |
| OE-SD3 Mo      | AWS | A5.23: F8P6-EA4-A4    |
| OE-S2          | AWS | A5.17: F6P8-EM12K     |
| OE-S2          | AWS | A5.17: F7A6-EM12K     |
| OE-SD3         | AWS | A5.17: F7A8-EH12K     |
| OE-SD3         | AWS | A5.17: F7P8-EH12K     |
| OE-SD3 1Ni ¼Mo | AWS | A5.23: F8A10-EG-G     |
| OE-SD3 1Ni ¼Mo | AWS | A5.23: F8P10-EG-G     |
| OE-SD3 1Ni ½Mo | AWS | A5.23: F9A8-EF3/EG-F3 |
| OE-SD3 1Ni ½Mo | AWS | A5.23: F9P8-EF3/EG-F3 |
| OE-SD3 2NiCrMo | AWS | A5.23: F11A8-EG-G     |
| OE-SD3 2NiCrMo | AWS | A5.23: F11P5-EG-G     |

|                | Approvals | Grade           |
|----------------|-----------|-----------------|
| OE-S2 Mo       | ABS       | 3YM-3YT         |
| FLUXOCORD 31   | DB        | ●               |
| FLUXOCORD 31HD | DB        | ●               |
| FLUXOCORD 42   | DB        | ●               |
| OE-S2 Mo       | DB        | ●               |
| OE-S2 Ni2      | DNV       | 5YM H5, 3YT H5  |
| OE-S2 Ni2      | GL        | in Progress     |
| OE-S2 Mo       | LRS       | 3Y40T, 4Y40M H5 |
| FLUXOCORD 31HD | LRS       | 4Y              |
| FLUXOCORD 41   | TÜV       | ●               |
| OE-S1 CrMo2    | TÜV       | ●               |
| OE-S2 CrMo1    | TÜV       | ●               |
| OE-S2 Mo       | TÜV       | ●               |
| OE-S2 Ni1      | TÜV       | ●               |
| OE-S2 Ni2      | TÜV       | ●               |
| OE-S2 Ni3      | TÜV       | ●               |
| OE-SD3 Mo      | TÜV       | ●               |
| OE-S2          | LRS       | 3M, 3YM         |
| OE-S2          | TÜV       | ●               |
| OE-S3          | DB        | ●               |
| OE-S3          | TÜV       | ●               |
| OE-SD3         | ABS       | 3YM (-40 °C)    |
| OE-SD3         | BV        | A3YM            |
| OE-SD3         | DB        | ●               |
| OE-SD3         | DNV       | 4Y42M H5        |
| OE-SD3         | GL        | 5Y40M           |
| OE-SD3         | LRS       | 4Y40M           |
| OE-SD3         | RMRS      | 5Y40M HHH       |
| OE-SD3         | TÜV       | ●               |
| OE-SD3 1Ni ¼Mo | ABS       | 4Y Q460M        |
| OE-SD3 1Ni ¼Mo | TÜV       | ●               |
| OE-SD3 1Ni ½Mo | ABS       | 5Y Q550M        |
| OE-SD3 1Ni ½Mo | LRS       | 3Y50M H5        |
| OE-SD3 1Ni ½Mo | TÜV       | ●               |
| OE-SD3 2NiCrMo | ABS       | 5Y Q690M        |
| OE-SD3 2NiCrMo | DB        | ●               |
| OE-SD3 2NiCrMo | DNV       | 5Y69M H5        |
| OE-SD3 2NiCrMo | LRS       | 5Y69M H5        |
| OE-SD3 2NiCrMo | TÜV       | ●               |

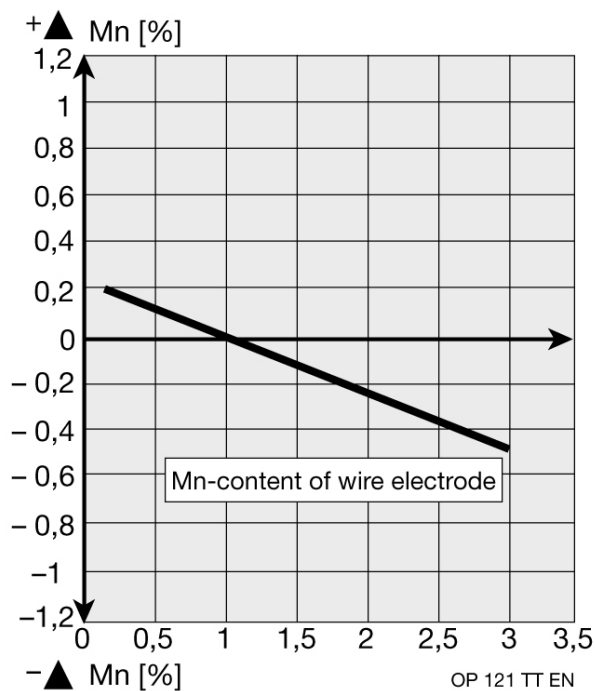
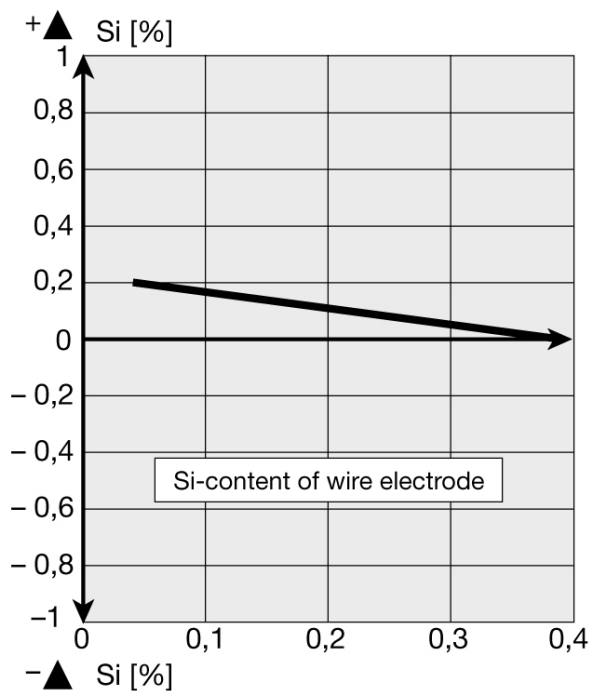
### Flux Main Components

|             |      |
|-------------|------|
| CaO + MgO   | 35 % |
| CaF2        | 25 % |
| Al2O3 + MnO | 20 % |
| SiO2 + TiO2 | 15 % |

**Boniszewski Basicity** 3.1

### METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)  
DVS-Merkblatt 0907 Part 1



### Chemical analysis (Typical values in %)

|                |                   | C    | Mn  | Si  | Cr  | Ni   | Mo  |
|----------------|-------------------|------|-----|-----|-----|------|-----|
| All weld metal | OE-S1 CrMo2       | 0.08 | 0.6 | 0.3 | 2.2 | -    | 1   |
| All weld metal | OE-S2 CrMo1       | 0.07 | 0.9 | 0.3 | 1.1 | -    | 0.5 |
| All weld metal | OE-S2 Mo          | 0.07 | 0.9 | 0.2 | -   | -    | 0.5 |
| All weld metal | OE-S2 Ni2         | 0.07 | 0.9 | 0.3 | -   | 2.3  | -   |
| All weld metal | OE-S2 Ni3         | 0.06 | 0.9 | 0.2 | -   | 3.3  | -   |
| All weld metal | OE-S2             | 0.07 | 0.9 | 0.2 | -   | -    | -   |
| All weld metal | OE-SD3            | 0.07 | 1.6 | 0.3 | -   | -    | -   |
| All weld metal | OE-SD3 1Ni<br>¼Mo | 0.07 | 1.3 | 0.3 | -   | 0.9  | 0.2 |
| All weld metal | OE-SD3 1Ni<br>½Mo | 0.07 | 1.5 | 0.3 | -   | 0.95 | 0.5 |
| All weld metal | OE-SD3<br>2NiCrMo | 0.07 | 1.4 | 0.4 | 0.6 | 2.2  | 0.5 |



## SAW Fluxes SAW Basic and Semi-basic Fluxes

### All-weld metal Mechanical Properties

|                | Heat Treatment  | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) |
|----------------|-----------------|----------------------|------------------------|-------------------|
| OE-S1 CrMo2    | 720°Cx8h        | ≥ 450                | 550-650                | ≥ 22              |
| OE-S1 CrMo2    | 940°C/air+740°C | ≥ 400                | 520-620                | ≥ 22              |
| OE-S2 CrMo1    | 680°Cx2h        | ≥ 380                | 530-630                | ≥ 24              |
| OE-S2 CrMo1    | 920°C/air+710°C | ≥ 310                | 430-530                | ≥ 30              |
| OE-S2 Mo       | As Welded       | ≥ 470                | 550-680                | ≥ 24              |
| OE-S2 Ni2      | As Welded       | ≥ 450                | 550-600                | ≥ 24              |
| OE-S2 Ni2      | 600°Cx2h        | ≥ 430                | 500-600                | ≥ 26              |
| OE-S2 Ni3      | As Welded       | ≥ 480                | 560-660                | ≥ 25              |
| OE-SD3 Mo      | As Welded       | ≥ 550                | 610-670                | ≥ 29              |
| OE-SD3 Mo      | 620°Cx1h        | ≥ 520                | 600-660                | ≥ 27              |
| OE-S2          | As Welded       | ≥ 360                | 450-550                | ≥ 28              |
| OE-SD3         | As Welded       | ≥ 450                | 530-630                | ≥ 25              |
| OE-SD3         | 600°Cx2h        | ≥ 400                | 490-590                | ≥ 27              |
| OE-SD3 1Ni ¼Mo | As Welded       | ≥ 500                | 560-680                | ≥ 22              |
| OE-SD3 1Ni ¼Mo | 600°Cx2h        | ≥ 470                | 550-660                | ≥ 24              |
| OE-SD3 1Ni ½Mo | As Welded       | ≥ 550                | 650-750                | ≥ 20              |
| OE-SD3 1Ni ½Mo | 600°Cx2h        | ≥ 540                | 630-730                | ≥ 22              |
| OE-SD3 2NiCrMo | As Welded       | ≥ 720                | 760-900                | ≥ 18              |
| OE-SD3 2NiCrMo | 580°Cx2h        | ≥ 600                | 700-850                | ≥ 19              |

### All-weld metal Mechanical Properties - CV

|                | Heat Treatment  | Impact Energy (J) |        |        |        |        |
|----------------|-----------------|-------------------|--------|--------|--------|--------|
|                |                 | 0 °C              | -20 °C | -40 °C | -60 °C | -80 °C |
| OE-S1 CrMo2    | 720°Cx8h        | ≥ 100             |        |        |        |        |
| OE-S1 CrMo2    | 940°C/air+740°C | ≥ 90              |        |        |        |        |
| OE-S2 CrMo1    | 680°Cx2h        | ≥ 180             |        |        |        |        |
| OE-S2 CrMo1    | 920°C/air+710°C | ≥ 200             |        |        |        |        |
| OE-S2 Mo       | As Welded       | ≥ 120             | ≥ 100  | ≥ 50   |        |        |
| OE-S2 Ni2      | As Welded       | ≥ 140             | ≥ 120  | ≥ 100  | ≥ 70   | ≥ 50   |
| OE-S2 Ni2      | 600°Cx2h        | ≥ 160             | ≥ 140  | ≥ 130  | ≥ 100  | ≥ 80   |
| OE-S2 Ni3      | As Welded       | ≥ 160             | ≥ 140  | ≥ 130  | ≥ 100  | ≥ 80   |
| OE-SD3 Mo      | As Welded       |                   |        | ≥ 110  | ≥ 80   |        |
| OE-SD3 Mo      | 620°Cx1h        |                   |        | ≥ 130  | ≥ 60   |        |
| OE-S2          | As Welded       | ≥ 160             | ≥ 100  | ≥ 50   |        |        |
| OE-SD3         | As Welded       | ≥ 180             |        | ≥ 100  | ≥ 70   |        |
| OE-SD3         | 600°Cx2h        | ≥ 200             |        | ≥ 120  | ≥ 90   |        |
| OE-SD3 1Ni ¼Mo | As Welded       |                   |        | ≥ 145  | ≥ 70   |        |
| OE-SD3 1Ni ¼Mo | 600°Cx2h        |                   |        | ≥ 160  | ≥ 70   |        |
| OE-SD3 1Ni ½Mo | As Welded       | ≥ 120             | ≥ 90   | ≥ 70   | ≥ 47   |        |
| OE-SD3 1Ni ½Mo | 600°Cx2h        | ≥ 140             | ≥ 120  | ≥ 90   | ≥ 70   |        |
| OE-SD3 2NiCrMo | As Welded       |                   |        |        | ≥ 69   |        |
| OE-SD3 2NiCrMo | 580°Cx2h        |                   |        | ≥ 47   |        |        |

### Typical applications

|                | Materials                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OE-S2 Mo       | ASME: X60, X65, ASTM A355 Gr. P1; A182M Gr. F1<br>EN: 16Mo3, S(P)355-S(P)460, L245-L450                                                                            |
| OE-S2 CrMo1    | ASME: A199 and A200 grade T11, A213 Grades T11, T12<br>EN: 13CrMo4-5, 13CrMoSi5-5                                                                                  |
| OE-S2 Ni2      | EN: 11MnNi5-3, 15NiMn5-3                                                                                                                                           |
| OE-S2 Ni3      | ASME: ASTM A333 Grade 3, ASTM A334 Grade 3; A352LC3; ASTM A203 D, E<br>EN: 12Ni14, S(P)275-S(P)460                                                                 |
| OE-S2          | ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50<br>EN: S(P)235-S(P)355; L245-L360 |
| OE-SD3         | ASME: A516 all Grades<br>EN: S(P)235-S(P)420                                                                                                                       |
| OE-SD3 1Ni ¼Mo | ASME: ASTM A131 AH40, DH40, EH40, X65, X70<br>EN: S(P)275-S(P)460                                                                                                  |
| OE-SD3 1Ni ½Mo | ASME: X70, X80, N-A-XTRA 55, HY80, QIN<br>EN: S(P)420-S(P)500; L245-L485; 20MnMoNi5-5, 15NiCuMoNb5                                                                 |

### Redrying

300-350°Cx2-4h

### Current Conditions

AC; DC+

### Packaging data

| Packaging Type | PE | DRY |
|----------------|----|-----|
| Weight (kg)    | 25 | 25  |
| -              | ●  | ●   |

OP 125 W is an agglomerated special welding flux of the fluoride-basic type, suitable for the welding of creep resistant steels. The metallurgical behaviour is characterised by an extremely low pick-up of silicon, and a neutral behaviour for the pick-up of manganese. OP 125 W is used for twin wire or multi-wire welding with two or more wire electrodes. It has a low bulk density and the flux consumption is correspondingly low. Even in the case of high interpass temperatures, slag removal is good. OP 125 W is suitable for use on either DC or AC up to 800 A. Grain size according to DIN EN 760: 2-20

| Classification |     |                       |
|----------------|-----|-----------------------|
|                | EN  | 760: SA FB 1 55 AC H5 |
| OE-S1 CrMo2    | AWS | A5.23: F8P0-EB3-B3    |
| OE-S1 CrMo5    | AWS | A5.23: F8P0-EB6-B6    |

| Approvals    |     | Grade |
|--------------|-----|-------|
| FLUXOCORD 31 | DB  | ●     |
| OE-S1 CrMo2  | DB  | ●     |
| OE-S1 CrMo5  | DB  | ●     |
| OE-S2 CrMo1  | DB  | ●     |
| OE-S1 CrMo2  | TÜV | ●     |
| OE-S1 CrMo5  | TÜV | ●     |
| OE-S2 CrMo1  | TÜV | ●     |

| Flux Main Components                 |      |
|--------------------------------------|------|
| CaO + MgO                            | 40 % |
| CaF <sub>2</sub>                     | 25 % |
| Al <sub>2</sub> O <sub>3</sub> + MnO | 20 % |
| SiO <sub>2</sub> + TiO <sub>2</sub>  | 15 % |

### Chemical analysis (Typical values in %)

|                |             | C    | Mn  | Si  | Cr  | Mo  |
|----------------|-------------|------|-----|-----|-----|-----|
| All weld metal | OE-S1 CrMo2 | 0.06 | 0.6 | 0.2 | 2.2 | 1.0 |
| All weld metal | OE-S1 CrMo5 | 0.06 | 0.6 | 0.2 | 5.0 | 0.6 |
| All weld metal | OE-S2 CrMo1 | 0.06 | 0.8 | 0.2 | 1.0 | 0.5 |
| All weld metal | OE-S2 Mo    | 0.06 | 0.8 | 0.2 | -   | 0.5 |

### All-weld metal Mechanical Properties

|             | Heat Treatment  | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) |
|-------------|-----------------|----------------------|------------------------|-------------------|
| OE-S1 CrMo2 | 740°C           | ≥ 420                | 520-620                | ≥ 25              |
| OE-S1 CrMo2 | 940°C/air+740°C | ≥ 400                | 500-600                | ≥ 25              |
| OE-S1 CrMo5 | 740°C           | ≥ 450                | 520-620                | ≥ 22              |
| OE-S1 CrMo5 | 950°C/air+740°C | ≥ 400                | 500-600                | ≥ 22              |
| OE-S2 CrMo1 | 710°C           | ≥ 380                | 510-610                | ≥ 22              |
| OE-S2 CrMo1 | 920°C/air+710°C | ≥ 310                | 430-530                | ≥ 30              |
| OE-S2 Mo    | As Welded       | ≥ 470                | 550-650                | ≥ 22              |

### All-weld metal Mechanical Properties - CV

|             | Heat Treatment  | Impact Energy (J) |       |        |
|-------------|-----------------|-------------------|-------|--------|
|             |                 | +20 °C            | 0 °C  | -20 °C |
| OE-S1 CrMo2 | 740°C           | ≥ 180             | ≥ 140 |        |
| OE-S1 CrMo2 | 940°C/air+740°C | ≥ 150             | ≥ 100 |        |
| OE-S1 CrMo5 | 740°C           | ≥ 150             | ≥ 120 |        |
| OE-S1 CrMo5 | 950°C/air+740°C | ≥ 130             | ≥ 100 |        |
| OE-S2 CrMo1 | 710°C           | ≥ 200             | ≥ 180 |        |
| OE-S2 CrMo1 | 920°C/air+710°C | ≥ 200             | ≥ 200 |        |
| OE-S2 Mo    | As Welded       | ≥ 160             | ≥ 130 | ≥ 110  |

### Typical applications

|             | Materials                                                                                                                            |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------|
| OE-S1 CrMo2 | ASME: A387 Gr.22, Cl 1 and 2, A 182 Gr.F 22, A336 Gr.F22<br>EN: 10CrMo9-10, 12CrMo9-10                                               |
| OE-S1 CrMo5 | ASME: A182 Gr. F5, A199 Gr. T5, A213 Gr.T5, A335 Gr.P5; A336 Cl. F5, A369 Gr. FP5, A387 Gr.5, Cl 1 and 2<br>EN: 12CrMo19-5, X12CrMo5 |

### Redrying

300-350°Cx2-4h

### Packaging data

| Packaging Type | PE |
|----------------|----|
| Weight (kg)    | 25 |
| -              | ●  |

OP 181 is an agglomerated rutile-aluminate type flux for welding unalloyed structural steels as well as fine-grain structural steels with a yield strength of up to 355 MPa. High silicon and manganese pick-up is obtained with this flux. It is therefore particularly suited for applications in combination with wire electrodes OE-S1 and OE-S2. OP 181 is used for high-speed welding with the SA twin-wire process, as well as for tandem and multi-wire welding of large pipes or spiral pipes in thin materials. The good slag detachability makes OP 181 particularly suitable for fillet welding applications and pipe-web-pipe joints (e.g. finned tubes). OP 181 can be welded with DC or AC at up to 1000 A. When using DC the wire electrode should be connected to the +pole.

Damp flux should be re-dried at 300-350°C. Grain size in accordance with EN 760: 2-16.

| Classification |     |                        |
|----------------|-----|------------------------|
|                | EN  | 760: SA AR 1 88 AC     |
| OE-S1          | AWS | A5.17: F7A0-F7PZ-EL12  |
| OE-S2          | AWS | A5.17: F7A0-F7PZ-EM12K |

|                | Approvals | Grade   |
|----------------|-----------|---------|
| FLUXOCORD 31HD | DB        | ●       |
| OE-S2 Mo       | DB        | ●       |
| FLUXOCORD 31HD | TÜV       | ●       |
| OE-S2 CrMo1    | TÜV       | ●       |
| OE-S2 Mo       | TÜV       | ●       |
| OE-S1          | DB        | ●       |
| OE-S1          | TÜV       | ●       |
| OE-S2          | ABS       | 3YT-3YM |

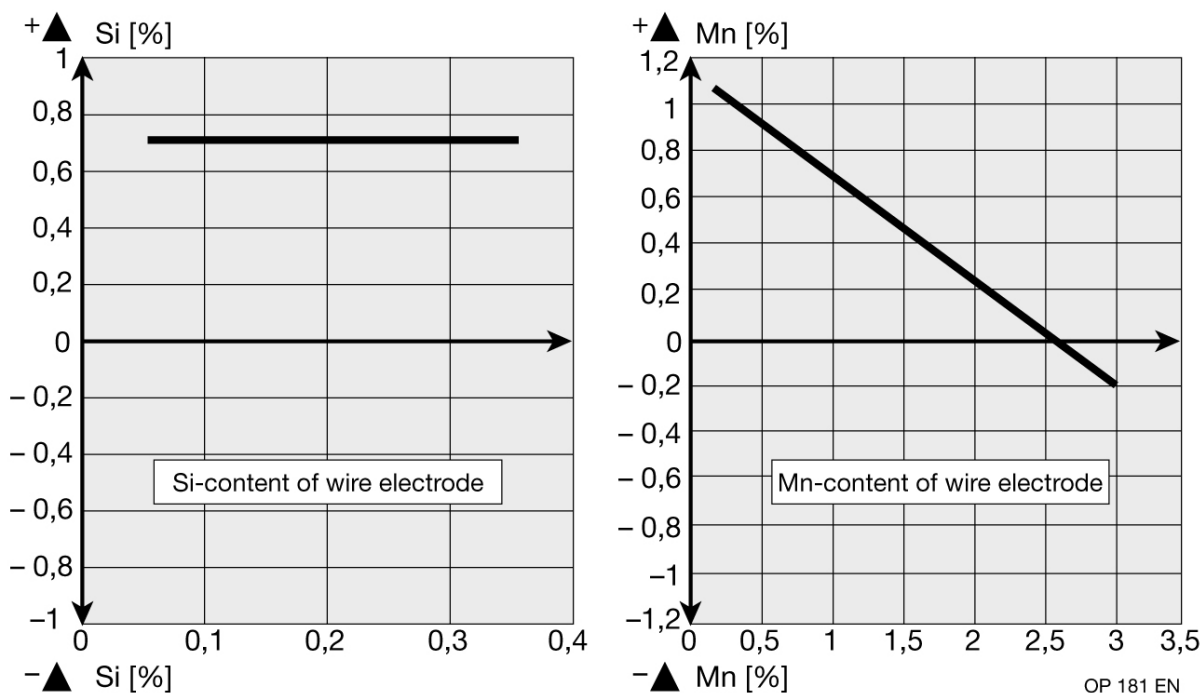
| Flux Main Components                 |      |
|--------------------------------------|------|
| Al <sub>2</sub> O <sub>3</sub> + MnO | 50 % |
| SiO <sub>2</sub> + TiO <sub>2</sub>  | 30 % |
| CaF <sub>2</sub>                     | 10 % |

|       | Approvals | Grade    |
|-------|-----------|----------|
| OE-S2 | BV        | 3YTM     |
| OE-S2 | DB        | ●        |
| OE-S2 | DNV       | IIIYTM   |
| OE-S2 | GL        | 3YTM     |
| OE-S2 | LRS       | 3YT, 3YM |
| OE-S2 | RMRS      | 3YTM     |
| OE-S2 | TÜV       | ●        |

**Boniszewski Basicity** 0.4

### METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)  
DVS-Merkblatt 0907 Part 1



### Chemical analysis (Typical values in %)

|                |          | C    | Mn  | Si  | Mo  |
|----------------|----------|------|-----|-----|-----|
| All weld metal | OE-S2 Mo | 0.04 | 1.3 | 0.6 | 0.5 |
| All weld metal | OE-S1    | 0.03 | 1.1 | 0.6 | -   |
| All weld metal | OE-S2    | 0.04 | 1.3 | 0.6 | -   |

### All-weld metal Mechanical Properties

|          | Heat Treatment | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) |
|----------|----------------|----------------------|------------------------|-------------------|
| OE-S2 Mo | As Welded      | ≥ 490                | 610-710                | ≥ 18              |
| OE-S1    | As Welded      | ≥ 420                | 520-620                | ≥ 22              |
| OE-S2    | As Welded      | ≥ 450                | 560-660                | ≥ 22              |

### All-weld metal Mechanical Properties - CV

|          | Heat Treatment | Impact Energy (J)<br>+20 °C |
|----------|----------------|-----------------------------|
| OE-S2 Mo | As Welded      | ≥ 50                        |
| OE-S1    | As Welded      | ≥ 50                        |
| OE-S2    | As Welded      | ≥ 50                        |

### Typical applications

|          | Materials                                                                                                                                                          |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OE-S2 Mo | ASME: API 5L Grades A, B, X42, X46, X52, X56<br>EN: 16Mo3, S(P)355-S(P)420, L245-L450                                                                              |
| OE-S1    | ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50<br>EN: S(P)235-S(P)355; L245-L360 |
| OE-S2    | ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50<br>EN: S(P)235-S(P)355; L245-L360 |

### Redrying

300-350°Cx2-4h

### Packaging data

| Packaging Type | PE |
|----------------|----|
| Weight (kg)    | 25 |
| -              | ●  |

OP 41TT is an agglomerated fluoride-basic type flux for welding high-tensile fine-grain structural steels as well as heat-resistant structural steels. In the nuclear sector it is used for many applications in combination with different wire electrodes, such as reactor pressure vessels, steam generators, pressurizers, reactor safety tanks and pipes in the primary and secondary circuits as well as the auxiliary units. OP 41TT is used with wire electrodes containing a higher level of manganese and silicon, such as e.g. OE-SD3. Due to the special manufacturing process of the flux the moisture pick up of the flux and the weld metal hydrogen content are very low. OP 41TT should be welded on DC+ at up to approximately 800 A.

Grain size according to EN 760: 2-20.

| Classification |     |                        |
|----------------|-----|------------------------|
|                | EN  | 760: SA FB 1 53 DC H5  |
| OE-S2 Mo       | AWS | A5.23: F8A8-F6P5-EA2   |
| OE-S2 Ni1      | AWS | A5.23: F7A8-F7P10-ENi1 |
| OE-SD3         | AWS | A5.17: F7A8-F6P8-EH12K |

|             | Approvals | Grade |
|-------------|-----------|-------|
| OE-S2 CrMo1 | TÜV       | ●     |
| OE-S2 Mo    | TÜV       | ●     |
| OE-S2 Ni2   | TÜV       | ●     |
| OE-SD3 Mo   | TÜV       | ●     |
| OE-SD3      | ABS       | 3YM   |
| OE-SD3      | BV        | 3YM   |
| OE-SD3      | DB        | ●     |

| Flux Main Components                 |      |
|--------------------------------------|------|
| CaO + MgO                            | 35 % |
| CaF <sub>2</sub>                     | 30 % |
| Al <sub>2</sub> O <sub>3</sub> + MnO | 20 % |
| SiO <sub>2</sub> + TiO <sub>2</sub>  | 10 % |

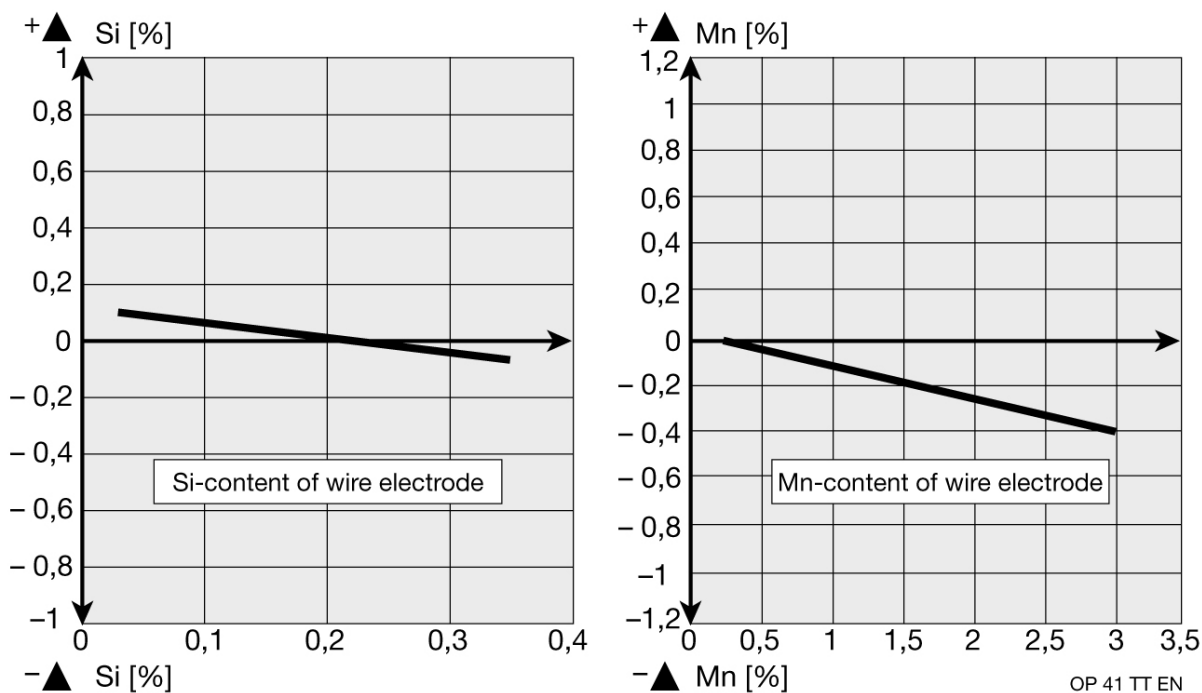
|                | Approvals | Grade   |
|----------------|-----------|---------|
| OE-SD3         | DNV       | IIIYM   |
| OE-SD3         | GL        | 3YM     |
| OE-SD3         | LRS       | 3M, 3YM |
| OE-SD3         | RMRS      | 3YM     |
| OE-SD3         | TÜV       | ●       |
| OE-SD3 1Ni ½Mo | TÜV       | ●       |

**Boniszewski Basicity** 3.1



### METALLURGICAL BEHAVIOUR

Pick-up and burn-out of the alloying elements Si and Mn = f (alloy content of wire electrode)  
DVS-Merkblatt 0907 Part 1



### Chemical analysis (Typical values in %)

|                |             | C    | Mn  | Si  | Cr   | Ni   | Mo  |
|----------------|-------------|------|-----|-----|------|------|-----|
| All weld metal | OE-S1 CrMo2 | 0.08 | 0.5 | 0.2 | 2.2  | -    | 1   |
| All weld metal | OE-S2 CrMo1 | 0.07 | 0.8 | 0.2 | 1    | -    | 0.5 |
| All weld metal | OE-S2 Mo    | 0.07 | 0.8 | 0.2 | -    | -    | 0.5 |
| All weld metal | OE-S2 Ni1   | 0.07 | 1.1 | 0.3 | 0.15 | 1.15 | 0.3 |
| All weld metal | OE-SD3      | 0.07 | 1.2 | 0.3 | -    | -    | -   |

### All-weld metal Mechanical Properties

|             | Heat Treatment | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) |
|-------------|----------------|----------------------|------------------------|-------------------|
| OE-S1 CrMo2 | 740°C          | ≥ 450                | 550-650                | ≥ 22              |
| OE-S2 CrMo1 | 710°C          | ≥ 380                | 530-630                | ≥ 24              |
| OE-S2 Mo    | As Welded      | ≥ 490                | 570-670                | ≥ 20              |
| OE-S2 Ni1   | As Welded      | ≥ 420                | 500-600                | ≥ 24              |
| OE-S2 Ni1   | 600°Cx2h       | ≥ 380                | 480-500                | ≥ 26              |
| OE-SD3      | As Welded      | ≥ 420                | 530-630                | ≥ 24              |

## SAW Fluxes SAW Basic and Semi-basic Fluxes

### All-weld metal Mechanical Properties - CV

|             | Heat Treatment | Impact Energy (J) |       |        |        |        |
|-------------|----------------|-------------------|-------|--------|--------|--------|
|             |                | +20 °C            | 0 °C  | -20 °C | -40 °C | -60 °C |
| OE-S1 CrMo2 | 740°C          | ≥ 140             | ≥ 100 |        |        |        |
| OE-S2 CrMo1 | 710°C          | ≥ 200             | ≥ 150 |        |        |        |
| OE-S2 Mo    | As Welded      | ≥ 140             | ≥ 120 | ≥ 100  | ≥ 70   | ≥ 50   |
| OE-S2 Ni1   | As Welded      | ≥ 150             | ≥ 130 | ≥ 100  | ≥ 70   | ≥ 50   |
| OE-S2 Ni1   | 600°Cx2h       | ≥ 170             | ≥ 140 | ≥ 110  | ≥ 90   | ≥ 70   |
| OE-SD3      | As Welded      | ≥ 170             | ≥ 150 | ≥ 120  | ≥ 70   | ≥ 40   |

### Typical applications

|             | Materials                                                                                                                                                          |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OE-S1 CrMo2 | ASME: A387 Gr.22, Cl 1 and 2, A182 Gr.F 22, A 36 Gr.F22<br>EN: 10CrMo9-10, 12CrMo9-10                                                                              |
| OE-S2 Mo    | ASME: X60, X65, ASTM A355 Gr. P1; A182M Gr. F1<br>EN: 16Mo3, S(P)355-S(P)460, L245-L450                                                                            |
| OE-S2 CrMo1 | ASME: A199 and A200 Grade T11, A213 Grades T11, T12<br>EN: 13CrMo4-5, 13CrMoSi5-5                                                                                  |
| OE-S2       | ASME: ASTM A131 Grades A, B, D, DS; A253 all Grades; A529 Grades 42, 50; A570 all Grades; A572 Grades 42, 50; A709 Grades 36, 50<br>EN: S(P)235-S(P)355; L245-L360 |
| OE-SD3      | ASME: A516 all Grades<br>EN S(P)235-S(P)420                                                                                                                        |

#### Redrying

300-350°Cx2-4h

#### Current Conditions

DC+

### Packaging data

| Packaging Type | DRYBAG |
|----------------|--------|
| Weight (kg)    | 25     |
| -              | ●      |

OP 176 is an agglomerated manganese-silicate type flux for welding of general structural steels, pipe steels, as well as fine grain structural steel. OP 176 is well-suited for single wire, tandem and multi-wire welding. It is suitable for one-side, DSAW or multi-pass-welding. It can be used on either DC or AC up to about 1000 A. OP 176 has an extremely low flux consumption. The slag is very thin and can easily be removed. Damp flux should be re-dried at 300-350 °C. Grain size according to DIN EN 760: 2-20

| Classification |     |                       |
|----------------|-----|-----------------------|
|                | EN  | 760: SA MS 1 88 AC H5 |
| OE-S2 Mo       | AWS | A5.23: F8A0-EA2-G     |
| OE-S1          | AWS | A5.17: F7A2-EL12      |
| OE-S2          | AWS | A5.17: F7A2-EM12K     |

| Flux Main Components                 |      |
|--------------------------------------|------|
| SiO <sub>2</sub> + TiO <sub>2</sub>  | 44 % |
| Al <sub>2</sub> O <sub>3</sub> + MnO | 24 % |
| CaO + MgO                            | 23 % |
| CaF <sub>2</sub>                     | 7 %  |

|                             |     |
|-----------------------------|-----|
| <b>Boniszewski Basicity</b> | 0.8 |
|-----------------------------|-----|

### Chemical analysis (Typical values in %)

|                |          | C    | Mn  | Si   | Mo   |
|----------------|----------|------|-----|------|------|
| All weld metal | OE-S2 Mo | 0.05 | 1.4 | 0.7  | 0.45 |
| All weld metal | OE-S1    | 0.06 | 0.8 | 0.15 | -    |
| All weld metal | OE-S2    | 0.05 | 1.5 | 0.7  | -    |

### All-weld metal Mechanical Properties

|          | Heat Treatment | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) |
|----------|----------------|----------------------|------------------------|-------------------|
| OE-S2 Mo | As Welded      | ≥ 500                | ≥ 600                  | ≥ 22              |
| OE-S1    | As Welded      | ≥ 405                | ≥ 510                  | ≥ 27              |
| OE-S2    | As Welded      | ≥ 410                | ≥ 530                  | ≥ 28              |

### All-weld metal Mechanical Properties - CV

|          | Heat Treatment | Impact Energy (J) |        |        |
|----------|----------------|-------------------|--------|--------|
|          |                | 0 °C              | -20 °C | -30 °C |
| OE-S2 Mo | As Welded      |                   | 50     | 40     |
| OE-S1    | As Welded      |                   | 60     | 50     |
| OE-S2    | As Welded      | 100               | 65     | 60     |

### Typical applications

|          | Materials                                                                                                                                                                             |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OE-S2 Mo | ASTM A36, ASTM A121 Grades A, B, D, DS, ASTM A253 all Grades, ASTM A529 Grades 42, 50, ASTM A570 all Grades, ASTM A572 Grades 42, 50, ASTM A709 Grades 36, 50<br>API 5L X60, X65, X70 |
| OE-S2    | EN S235, S235JRG1, S355; L360<br>ASTM A36, ASTM A131 Grades A, B, D, DS, ASTM A529 Grade 42, ASTM A570 Grade 45, ASTM A572 Grade 42, ASTM A709 Grade 36                               |

## SAW Fluxes SAW Rutile-Acid Fluxes

### Redrying

300-350°Cx2h

### Current Conditions

AC; DC+

### Packaging data

| Packaging Type | PE   |
|----------------|------|
| Weight (kg)    | 25.0 |
| -              | ●    |

OP F72 is a fused flux which donates manganese and silicon to the weld deposit. Suitable for longitudinal and spiral welding of pipes using single wire, tandem or multi-wires. It can be used for both single pass and multi pass welding. Good slag removal. Damp flux should be re-dried at 100°C. OP F72 is not hygroscopic and does not absorb moisture. Grain size according to EN 760: 2-20.

| Classification |        |                         |
|----------------|--------|-------------------------|
| OE-S2 Mo       | EN ISO | 14171-A- S 46 0 CS S2Mo |
| OE-S1          | EN ISO | 14171-A- S 35 0 CS S1   |
| OE-S2          | EN ISO | 14171-A- S 42 2 CS S2   |
|                | EN     | 760: S F CS 1 66 AC     |
| OE-S2 Mo       | AWS    | A5.23: F8A0-EA2-A2      |
| OE-S1          | AWS    | A5.17: F6A0-EL12        |
| OE-S2          | AWS    | A5.17: F7A2-EM12K       |

| Flux Main Components |      |
|----------------------|------|
| SiO <sub>2</sub>     | 40 % |
| MnO                  | 20 % |
| CaO                  | 19 % |
| CaF <sub>2</sub>     | 12 % |
| MgO                  | 4 %  |

**Boniszewski Basicity** 1.1

### Chemical analysis (Typical values in %)

|                |          | C    | Mn  | Si   | Mo  |
|----------------|----------|------|-----|------|-----|
| All weld metal | OE-S2 Mo | 0.03 | 1   | 0.35 | 0.5 |
| All weld metal | OE-S1    | 0.04 | 0.8 | 0.35 | -   |
| All weld metal | OE-S2    | 0.03 | 1   | 0.35 | -   |

### All-weld metal Mechanical Properties

|          | Heat Treatment | Yield Strength (MPa) | Tensile Strength (MPa) | Elongation A5 (%) |
|----------|----------------|----------------------|------------------------|-------------------|
| OE-S2 Mo | As Welded      | ≥ 480                | 570-640                | ≥ 22              |
| OE-S1    | As Welded      | ≥ 350                | 440-490                | ≥ 22              |
| OE-S2    | As Welded      | ≥ 400                | 490-550                | ≥ 22              |

### All-weld metal Mechanical Properties - CV

|          | Heat Treatment | Impact Energy (J) |
|----------|----------------|-------------------|
|          |                | -20 °C            |
| OE-S2 Mo | As Welded      | ≥ 35              |
| OE-S1    | As Welded      | ≥ 35              |
| OE-S2    | As Welded      | ≥ 35              |

## Typical applications

|          | Materials                               |
|----------|-----------------------------------------|
| OE-S2 Mo | ASME:<br>EN: 16Mo3                      |
| OE-S1    | ASME:<br>EN: S(P)235-S(P)355; L245-L360 |
| OE-S2    | ASME:<br>EN: S(P)235-S(P)355; L245-L360 |

### Redrying

100°Cx1h

### Current Conditions

AC; DC+

## Packaging data

| Packaging Type | PE |
|----------------|----|
| Weight (kg)    | 25 |
| -              | ●  |