# Rutile electrode



## Classification

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

## General description

**Rutile electrode, especially for down hand welding in structural steel**
**Smaller sizes most versatile for thin plate material**
**Very smooth appearance**
**Self releasing slag**

## Welding positions

ISO/ASME PA/1G PB/2F PC/2G PE/4G

## Current type

AC / DC -

## Approvals

| ABS | BV | DNV | FORCE | GL | LR | TÜV |
|---|---|---|---|---|---|---|
| 2 | 2 | 2 | + | 2 | 2 | + |

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

| C | Mn | Si |
|---|---|---|
| 0.1 | 0.6 | 0.4 |

## Mechanical properties, all weld metal

| | Condition | Yield strength (N/mm²) | Tensile strength (N/mm²) | Elongation (%) | Impact ISO-V(J) 0°C |
|---|---|---|---|---|---|
| Required: AWS A5.1 | | min. 331 | min. 414 | min. 17 | not required |
| ISO 2560-A | | min. 420 | 500-640 | min. 20 | min. 47 |
| Typical values | AW | 480 | 560 | 26 | 50 |

## Packaging and available sizes

| | | | | | | |
|---|---|---|---|---|---|---|
| | Diameter (mm) | 2.0 | 2.5 | 3.2 | 3.2 | 4.0 |
| | Length (mm) | 300 | 350 | 350 | 450 | 450 |
| Unit: box | Pieces / unit | 200 | 130 | 140 | 125 | 80 |
| | Net weight/unit (kg) | 2.4 | 2.8 | 4.8 | 5.8 | 5.9 |

**Identification** Imprint: 6013 / UNIVERSALIS Tip Color: none

**Universalis®: rev. EN 21**

## Materials to be welded

| Steel grades/Code | Type |
|---|---|
| **General structural steel** | |
| EN 10025 | S185, S235, S275, S355 |
| **Ship plates** | |
| ASTM A 131 | Grade A, B, D, AH32 to DH36 |
| **Cast steel** | |
| EN 10213-2 | G P 240R |
| **Pipe material** | |
| EN 10208-1 | L210, L240, L290, L360 |
| EN 10208-2 | L240, L290, L360. |
| API 5LX | X42, X46, X52, X60 |
| EN 10216-1/ | P235, P275 |
| EN 10217-1 | P355 |
| **Boiler & pressure vessel steel** | |
| EN 10028-2 | P235, P265, P295, P355 |
| **Fine grained steel** | |
| EN 10113-2 | S275, S355 |
| EN 10113-3 | S275, S355 |

## Calculation data

| Sizes Diam. x length (mm) | Current range (A) | Current type | Arc time - per electrode at max. current - (s)* | Energy E(kJ) | Dep.rate H(kg/h) | Weight/ 1000 pcs. (kg) | Electrodes/ kg weldmetal B | kg Electrodes/ kg weldmetal 1/N |
|---|---|---|---|---|---|---|---|---|
| 2.0 x 300 | 40 - 65 | AC | 41 | 58 | 0.5 | 11.4 | 178 | 2.00 |
| 2.5 x 350 | 70 - 100 | AC | 51 | 134 | 0.8 | 21.1 | 93 | 1.96 |
| 3.2 x 350 | 100 - 140 | AC | 57 | 281 | 1.3 | 39.3 | 47 | 1.85 |
| 3.2 x 450 | 100 - 140 | AC | 69 | 341 | 1.5 | 49.6 | 36 | 1.79 |
| 4.0 x 350 | 150 - 200 | AC | 55 | 399 | 2.0 | 56.3 | 33 | 1.85 |
| 4.0 x 450 | 150 - 200 | AC | 69 | 483 | 2.1 | 66.9 | 25 | 1.67 |
| 5.0 x 450 | 180 - 250 | AC | 83 | 882 | 2.9 | 112.0 | 15 | 1.69 |

* stub end 35 mm

## Welding parameters, optimum fill passes

| Welding positions Diameter (mm) | PA/1G | PB/2F | PC/2G | PE/4G |
|---|---|---|---|---|
| 2.0 | 50A | | | |
| 2.5 | 100A | 95A | 85A | 85A |
| 3.2 | 130A | 120A | 115A | 105A |
| 4.0 | 185A | 185A | 160A | 130A |
| 5.0 | 260A | 260A | | |

## Remarks/ Application advice

Best choice for welding thin plates.
High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1