WELDING CONSUMABLES
FOR THE CHEMICAL AND PETROCHEMICAL PROCESS INDUSTRY
BÖHLER WELDING is one of the premier suppliers of welding consumables for corrosion resistant alloys as well as high temperature and creep resistant steels, providing a full range of solutions for all joint welding applications and base metals. For this reason, key fabricators in a diverse range of process industries have preferred to use BÖHLER WELDING products and services worldwide since 1927.

The most demanding industries trust our experience and proven quality to reduce fabrication costs and to increase the service life of plant components. Our experienced welding engineers will assist you in matching the optimum and most economic welding solutions suitable to your individual requirements.

BÖHLER WELDING customers are able to choose from an extensive range of high quality electrodes and wires manufactured to the latest industry specifications. Specific customer and process requirements: i.e.: documentation, data sheets, certification, testing, packing and marking of products can be arranged upon request.

Contact us for more detailed information!

Our particular focus on high temperature and creep resisting products, as well as stainless steel and nickel base welding consumables, combined with our experience and solid history of almost 80 years has made BÖHLER WELDING a strong partner for the high quality demands of today’s process industries.

BÖHLER WELDING consumables are available in moisture resistant and hermetically sealed packs.
For high demanding industries

**Chemical and Petrochemical Plant Engineering**
In excess of 180 first class BÖHLER WELDING products supported by years of R&D including first hand production knowledge provide users with the confidence to be assured that BÖHLER WELDING products have the ability to perform to advanced product standards, consistent product quality and best operating characteristics for reliable corrosion / heat resistance to guarantee safe operating conditions and extend the life of today’s modern plant operations.

**Chemical Tankers**
Apart from 316L and 317L stainless steel, the application of Duplex stainless steel is being introduced more widely for the construction of tanks for bulk storage. BÖHLER WELDING products lead the way with a comprehensive range of flux cored wires, sub arc wires and flux and of course the full range of covered electrodes, GMAW solid wires and GTAW rods.

**Pharmaceutical Industry**
Particularly high demands of quality and purity of all medium exposed surfaces require top quality base and filler metals, including extremely smooth and even electro-polished stainless steel pipes and weld surfaces. BÖHLER WELDING recognises the importance of these specialist applications and as such has undertaken investigation of their filler metals and weld behaviour to ensure that optimum results are achieved when undertaking these specialist applications.

**Food and Beverage**
Whatever the application, storage tanks, pressure vessels, heat exchangers or process pipe work, you can be assured that BÖHLER WELDING filler metals are being referred to by thousands of welding engineers and used by welders throughout the world on a daily basis. There are many single product features available in the food and beverage industry.

**Pulp and Paper**
Mo alloyed stainless steel – Duplex and Super duplex stainless steel alternatively Nickel base alloys or even Titanium welding consumables are necessary to resist the severe effects of corrosive environments. The metallurgical concept of BÖHLER WELDING consumables guarantees the highest homogeneity and reliability of the chemical composition of weld metals and their corrosion resistance, crack resistance and mechanical properties.

**Seawater Desalination**
Adequate supplies of fresh water throughout the world are an essential part of everyday life, in several regions seawater desalination plants are needed to cover the demand. BÖHLER WELDING is aware of the extreme requirements demanded in this industry sector and a broad range of filler metals has been engineered without compromise to resist pitting, crevice and stress corrosion, and the cracking of weld metals.

**Flue Gas Desulphurisation**
Although allied to the power generation industry, FGD wet scrubbing systems are a perfect example to choose extremely corrosion resistant nickel base alloys. Alloy BÖHLER WELDING consumables offer maximum corrosion resistance e.g. in the absorber towers.
Ammonia synthesis

Flue gas desulphurization

Methanol plant

Site erection of a column
<table>
<thead>
<tr>
<th>Base metals</th>
<th>SMAW</th>
<th>FCAW</th>
<th>GTAW</th>
<th>GMAW</th>
<th>SAW</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>High temperature and creep resistant steels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5Mo</td>
<td>PT1</td>
<td>FOX DMO Ti, Kb</td>
<td>DMO-IG</td>
<td>DMO-IG</td>
<td>EMS 2Mo+BB 24</td>
<td>8</td>
</tr>
<tr>
<td>1Cr 0.5Mo</td>
<td>PT11</td>
<td>FOX DCM Si, Tb</td>
<td>DCM-IG</td>
<td>DCM-IG</td>
<td>EMS 2CrMo+BB 24</td>
<td>8, 9</td>
</tr>
<tr>
<td>0.5Cr 1Mo+V</td>
<td>–</td>
<td>FOX DMV 83Kb</td>
<td>DMOV 83-IG</td>
<td>DMOV 83-IG</td>
<td>EMS 3CrMo+BB 24</td>
<td>8, 9</td>
</tr>
<tr>
<td>2Cr 1Mo (mod.)</td>
<td>PT22</td>
<td>FOX CM 2Kb</td>
<td>CM 2-IG</td>
<td>CM 2-IG</td>
<td>CMS 2Cr+BB 24</td>
<td>10</td>
</tr>
<tr>
<td>3Cr 0.5Mo</td>
<td>PT23</td>
<td>FOX P 23</td>
<td>P 2-IG</td>
<td>P 2-IG</td>
<td>CMS 2Cr+BB 430</td>
<td>10</td>
</tr>
<tr>
<td>9Cr 1Mo</td>
<td>PT24</td>
<td>FOX P 24</td>
<td>P 24-IG</td>
<td>P 24-IG</td>
<td>CMS 2Cr+BB 430</td>
<td>10</td>
</tr>
<tr>
<td>9Cr 1Mo+V(W)</td>
<td>PT5</td>
<td>FOX CM 5 Kp</td>
<td>CM 5-IG</td>
<td>CM 5-IG</td>
<td>CMS 5Cr+BB 24</td>
<td>11</td>
</tr>
<tr>
<td>9Cr 3Mo</td>
<td>PT9</td>
<td>FOX CM 9 Kp</td>
<td>CM 9-IG</td>
<td>CM 9-IG</td>
<td>CMS 9Cr+BB 24</td>
<td>11</td>
</tr>
<tr>
<td>21/4Cr 1Mo</td>
<td>PT91</td>
<td>FOX C 9 MV</td>
<td>C 9 MV-IG</td>
<td>C 9 MV-IG</td>
<td>CMS 9Cr+BB 24</td>
<td>11</td>
</tr>
<tr>
<td>21/4Cr 1Mo (mod.)</td>
<td>PT92</td>
<td>FOX P 92</td>
<td>P 92-IG</td>
<td>P 92-IG</td>
<td>CMS 9Cr+BB 24</td>
<td>11</td>
</tr>
<tr>
<td>5Cr 0.5Mo</td>
<td>PT911</td>
<td>FOX C 9 MVW</td>
<td>C 9 MVW-IG</td>
<td>C 9 MVW-IG</td>
<td>CMS 9Cr+BB 24</td>
<td>11</td>
</tr>
<tr>
<td>9Cr 1Mo+V(W)</td>
<td>304H</td>
<td>FOX CN 18/11</td>
<td>CN 18/11-IG</td>
<td>CN 18/11-IG</td>
<td>CMS 18Cr+BB 202</td>
<td>14</td>
</tr>
<tr>
<td>10Cr 11Mo</td>
<td>321H</td>
<td>FOX E 308 H</td>
<td>E 308 H-IG</td>
<td>E 308 H-IG</td>
<td>CMS 18Cr+BB 202</td>
<td>15</td>
</tr>
<tr>
<td>18Cr 10Ni+4Nb</td>
<td>347H</td>
<td>FOX E 347 H</td>
<td>E 347 H-IG</td>
<td>E 347 H-IG</td>
<td>CMS 18Cr+BB 202</td>
<td>15</td>
</tr>
</tbody>
</table>

**Stainless steels**

**Austenitic**

| 19Cr 9Ni L | 304L | FOX EAS 2 | EAS 2-IG | EAS 2-IG | EAS 2-IG (Si) | EAS 2-UP+BB 202 | 16 |
| 19Cr 13Ni 3Mo L | 316L | FOX EAS 2 A | EAS 2 PW-IG | EAS 2 PW-IG | EAS 2 PW-IG | 17 |
| 19Cr 13Ni 4Mo L | 316L | FOX EAS 4 | EAS 4 M-IG | EAS 4 M-IG | EAS 4 M-IG (Si) | EAS 4 M-UP+BB 202 | 17 |
| 19Cr 13Ni 4Mo L | 317L | FOX E 317L | E 317L-IG | E 317L-IG | SN 5 SY+UP+BB 202 | 18 |
| 18Cr 16Ni 5Mo NL | 317LN | FOX ASN 5 | ASN 5-IG | ASN 5-IG (Si) | ASN 5 UP+BB 202 | 19 |
| 22Cr 18Ni 4Mo L | – | FOX AM 400 | AM 400-IG | AM 400-IG | AM 400-IG | 20 |
| 19Cr 12Ni 3Mo Nb | 316Ti | FOX SAS 4 | SAS 4-IG | SAS 4-IG | SAS 4-UP+BB 202 | 21 |
| 19Cr 12Ni 3Mo Nb | 347 | FOX SAS 2 | SAS 2-IG | SAS 2-IG | SAS 2-IG | 22 |
| 20Cr 23Ni 5Mo CuNL | 904L | FOX CN 20/25 M | CN 20/25 M-IG | CN 20/25 M-IG (Si) | CN 20/25 M-IG (Si) | 23 |
| 18C 7Mo | 409 | FOX KW 10 | KW 5 Nb-IG | KW 10-IG | KW 10-IG | 24 |
| 17Cr | 410 | FOX SKWA | SKWA-IG | SKWA-IG | SKWA-IG | 25 |
| 15Cr | 431 | FOX SKWAM | SKWAM-IG | SKWAM-IG | SKWAM-IG | 26 |
| 13Cr | 430Cb | CAT 430 L Cr-IG | CAT 430 L Cr-IG | CAT 430 L Cr-IG | CAT 430 L Cr-IG | 27 |

**Ferritic / Martensitic**

| 13Cr | 304 | FOX CN 13/4 SUPRA | CN 13/4-IG | CN 13/4-IG | CN 13/4-UP+BB 203 | 28 |
| 16Cr 6Ni Mo | 316L | FOX CN 16/6 M-HD | CN 16/6 M-HD | CN 16/6 M-HD | CN 16/6 M-HD | 29 |

**Soft martensitic**

| 17Cr 4Ni Cu | – | FOX CN 17/4 PH | FOX CN 17/4 PH | FOX CN 17/4 PH | FOX CN 17/4 PH | 30 |

**Precipitation hardening**

| 22Cr | 531803 | FOX CN 22/9 N-8 | CN 22/9 N-8 | CN 22/9 N-8 | CN 22/9 N-8 | 31 |
| 25Cr | 532750 | FOX CN 25/9 CuTi | CN 25/9 CuTi | CN 25/9 CuTi | CN 25/9 CuTi | 32 |
### Welding processes

<table>
<thead>
<tr>
<th>Base metal</th>
<th>SMAW</th>
<th>FCAW</th>
<th>GTAW</th>
<th>GMAW</th>
<th>SAW</th>
<th>Page</th>
</tr>
</thead>
</table>

#### Special applications

<table>
<thead>
<tr>
<th>Base metal</th>
<th>SMAW</th>
<th>FCAW</th>
<th>GTAW</th>
<th>GMAW</th>
<th>SAW</th>
</tr>
</thead>
<tbody>
<tr>
<td>18Cr - 8Ni  Mn</td>
<td>A 7</td>
<td>A 7</td>
<td>A 7</td>
<td>A 7</td>
<td>28</td>
</tr>
<tr>
<td>Dissimilar joints</td>
<td>A 7-P</td>
<td>A 7-P</td>
<td>A 7-P</td>
<td>A 7-P</td>
<td>28</td>
</tr>
<tr>
<td>Corrosion resistant claddings</td>
<td>A 7-P</td>
<td>A 7-P</td>
<td>A 7-P</td>
<td>A 7-P</td>
<td>28</td>
</tr>
</tbody>
</table>

#### Low temperature

<table>
<thead>
<tr>
<th>Base metal</th>
<th>SMAW</th>
<th>FCAW</th>
<th>GTAW</th>
<th>GMAW</th>
<th>SAW</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5Ni</td>
<td>A 632 Gr. E</td>
<td>EAS 2</td>
<td>EAS 2</td>
<td>EAS 2</td>
<td>31</td>
</tr>
<tr>
<td>19Cr - 9Ni</td>
<td>FOX NIBAS 60/15</td>
<td>NIBAS 625</td>
<td>NIBAS 625</td>
<td>NIBAS 625</td>
<td>34</td>
</tr>
<tr>
<td>9Ni</td>
<td>NIBAS 625-IG</td>
<td>NIBAS 625-IG</td>
<td>NIBAS 625-IG</td>
<td>NIBAS 625-IG</td>
<td>34</td>
</tr>
</tbody>
</table>

#### Heat resistant

<table>
<thead>
<tr>
<th>Base metal</th>
<th>SMAW</th>
<th>FCAW</th>
<th>GTAW</th>
<th>GMAW</th>
<th>SAW</th>
</tr>
</thead>
<tbody>
<tr>
<td>25Cr - 4Ni</td>
<td>FOX FA</td>
<td>FA-I</td>
<td>FA-I</td>
<td>FA-I</td>
<td>35</td>
</tr>
<tr>
<td>22Cr - 12Ni</td>
<td>FOX FF</td>
<td>FF-I</td>
<td>FF-I</td>
<td>FF-I</td>
<td>35</td>
</tr>
<tr>
<td>25Cr - 20Ni</td>
<td>FOX FF</td>
<td>FF-I</td>
<td>FF-I</td>
<td>FF-I</td>
<td>35</td>
</tr>
</tbody>
</table>

#### Nickel base alloys

<table>
<thead>
<tr>
<th>Base metal</th>
<th>SMAW</th>
<th>FCAW</th>
<th>GTAW</th>
<th>GMAW</th>
<th>SAW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alloy 600</td>
<td>FOX NIBAS 70/15</td>
<td>NIBAS 70/20</td>
<td>NIBAS 70/20</td>
<td>NIBAS 70/20</td>
<td>37</td>
</tr>
<tr>
<td>Alloy 650</td>
<td>FOX NIBAS 70/25</td>
<td>NIBAS 70/25</td>
<td>NIBAS 70/25</td>
<td>NIBAS 70/25</td>
<td>37</td>
</tr>
<tr>
<td>Alloy 625</td>
<td>FOX NIBAS 70/30</td>
<td>NIBAS 70/30</td>
<td>NIBAS 70/30</td>
<td>NIBAS 70/30</td>
<td>37</td>
</tr>
</tbody>
</table>

#### Non-ferrous alloys

<table>
<thead>
<tr>
<th>Base metal</th>
<th>SMAW</th>
<th>FCAW</th>
<th>GTAW</th>
<th>GMAW</th>
<th>SAW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu-Ni 90/10</td>
<td>FOX CuNi 30Fe</td>
<td>CuNi 30Fe</td>
<td>CuNi 30Fe</td>
<td>CuNi 30Fe</td>
<td>41</td>
</tr>
<tr>
<td>Cu-Ni 90/10</td>
<td>FOX CuNi 30Fe</td>
<td>CuNi 30Fe</td>
<td>CuNi 30Fe</td>
<td>CuNi 30Fe</td>
<td>41</td>
</tr>
<tr>
<td>Ti grade 2</td>
<td>FOX ER Ti 2</td>
<td>ER Ti 2</td>
<td>ER Ti 2</td>
<td>ER Ti 2</td>
<td>41</td>
</tr>
</tbody>
</table>
## High temperature and creep resistant steels

<table>
<thead>
<tr>
<th>BÖHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX DMO Ti</strong></td>
<td>E Mo R 12</td>
<td>SMAW</td>
<td>C 0.06</td>
<td>Si 0.3</td>
<td>Mo 0.5</td>
<td>Re 500 N/mm²</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>FOX DMO Kb</strong></td>
<td>E Mo B 42 H5</td>
<td>SMAW</td>
<td>C 0.08</td>
<td>Si 0.4</td>
<td>Mo 0.8</td>
<td>Re 550 N/mm²</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>DMSO-IG</strong></td>
<td>W Mo Si (GTAW) G Mo Si (GMAW)</td>
<td>GTAW</td>
<td>C 0.1</td>
<td>Si 0.6</td>
<td>Mn 0.5</td>
<td>Re 520 N/mm²</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Wire: EMS 2 Mo</strong></td>
<td>S2 Mo</td>
<td>SAW</td>
<td>C 0.08</td>
<td>Si 0.25</td>
<td>Mn 0.15</td>
<td>Re ≥470 N/mm²</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Welding Flux: BB 24</strong></td>
<td>SA FB 1 65 DC H5</td>
<td>SA</td>
<td>C 0.06</td>
<td>Si 0.25</td>
<td>Mn 0.6</td>
<td>Re ≥470 N/mm²</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>FOX DCMS Ti</strong></td>
<td>ECrMo 1 R 12</td>
<td>SMAW</td>
<td>C 0.06</td>
<td>Si 0.4</td>
<td>Mn 0.6</td>
<td>Re ≥470 N/mm²</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>FOX DCMS Kb</strong></td>
<td>E CrMo B 1 42 H5</td>
<td>SMAW</td>
<td>C 0.07</td>
<td>Si 0.4</td>
<td>Mn 0.8</td>
<td>Re ≥470 N/mm²</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>DCMS-IG</strong></td>
<td>W Cr Mo 1 Si (GTAW) G Cr Mo 1.5 Si (GMAW)</td>
<td>GTAW</td>
<td>C 0.11</td>
<td>Si 0.6</td>
<td>Mn 1.0</td>
<td>Re ≥470 N/mm²</td>
<td>1.6</td>
</tr>
</tbody>
</table>

### Chemical composition (wt-%)

- **FOX DMO Ti**
  - C: 0.06
  - Si: 0.3
  - Mo: 0.5
  - Re: 500 N/mm²
  - Rm: 570 N/mm²
  - Av: 90 J

- **FOX DMO Kb**
  - C: 0.08
  - Si: 0.4
  - Mo: 0.8
  - Re: 550 N/mm²
  - Rm: 600 N/mm²
  - Av: 200 J

- **DMSO-IG**
  - C: 0.1
  - Si: 0.6
  - Mn: 0.5
  - Re: 520 N/mm²
  - Rm: 630 N/mm²

### Physical properties

- **FOX DMO Ti**
  - Re: 570 N/mm²
  - Rm: 570 N/mm²

- **FOX DMO Kb**
  - Re: 550 N/mm²
  - Rm: 600 N/mm²

### Service conditions

- **FOX DMO Ti**
  - For high quality welds, suitable for Step-Cooling treatments, fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant. LTSS, UDT, AVG, SEPROZ.

- **FOX DMO Kb**
  - Basic coated low hydrogen electrode for 0.5 % Mo alloyed boiler and tube steels up to +550 °C service temperature. For high quality welds of long term stressed components with reliable mechanical properties under high and low service temperature conditions. HD ≤ 4 ml/100 g acc. AWS condition. Low temperature toughness proven down to -50 °C.

### Approvals

- **FOX DMO Ti**
  - Basic coated low hydrogen electrode for 0.5 % Mo alloyed boiler and tube steels up to +550 °C service temperature. For high quality welds, suitable for Step-Cooling treatments, fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant. LTSS, UDT, AVG, SEPROZ.

- **FOX DMO Kb**
  - GTAW rod and GMAW wire for 0.5 % Mo alloyed boiler and tube steels as well as in pressure vessel and structural steel engineering. Recommended for service in the temperature range -30 °C (GTAW) or -40 °C (GMAW) up to +550 °C.
# High temperature and creep resistant steels

## BOHLER WELDING Consumables for the chemical and petrochemical process industry

### Wire: EMS 2 CrMo

<table>
<thead>
<tr>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Mo</th>
<th>Cr</th>
<th>P</th>
<th>As</th>
<th>Sb</th>
<th>Sn</th>
<th>Nb</th>
<th>Re / N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.08</td>
<td>0.25</td>
<td>1.0</td>
<td>0.45</td>
<td>0.45</td>
<td>0.0012</td>
<td>0.0005</td>
<td>0.0005</td>
<td>≤0.01</td>
<td>247</td>
<td>2600</td>
</tr>
</tbody>
</table>

#### Typical properties
- High hydrogen contents (HD < 2 ml/100 g)
- Good weldability in all positions except vertical down.
- Good service temperature.
- Suitable for Step-Cooling treatments.

#### Characteristics and applications
- Suitable for Step-Cooling treatments.
- Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant.

### Flux: BB 24

<table>
<thead>
<tr>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Mo</th>
<th>Cr</th>
<th>P</th>
<th>As</th>
<th>Sb</th>
<th>Sn</th>
<th>Nb</th>
<th>Re / N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.07</td>
<td>0.25</td>
<td>0.80</td>
<td>0.95</td>
<td>0.95</td>
<td>0.0012</td>
<td>0.0005</td>
<td>0.0005</td>
<td>≤0.01</td>
<td>247</td>
<td>2600</td>
</tr>
</tbody>
</table>

#### Typical properties
- High hydrogen contents (HD < 2 ml/100 g)
- Good weldability in all positions except vertical down.
- Good service temperature.

#### Characteristics and applications
- Suitable for Step-Cooling treatments.
- Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant.

## BOHLER WELDING Consumables for the chemical and petrochemical process industry

### Wire: EMS 2 CrMo

<table>
<thead>
<tr>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Mo</th>
<th>Cr</th>
<th>P</th>
<th>As</th>
<th>Sb</th>
<th>Sn</th>
<th>Nb</th>
<th>Re / N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.08</td>
<td>0.25</td>
<td>1.0</td>
<td>0.45</td>
<td>0.45</td>
<td>0.0012</td>
<td>0.0005</td>
<td>0.0005</td>
<td>≤0.01</td>
<td>247</td>
<td>2600</td>
</tr>
</tbody>
</table>

#### Typical properties
- High hydrogen contents (HD < 2 ml/100 g)
- Good weldability in all positions except vertical down.
- Good service temperature.

#### Characteristics and applications
- Suitable for Step-Cooling treatments.
- Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant.

### Flux: BB 24

<table>
<thead>
<tr>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Mo</th>
<th>Cr</th>
<th>P</th>
<th>As</th>
<th>Sb</th>
<th>Sn</th>
<th>Nb</th>
<th>Re / N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.07</td>
<td>0.25</td>
<td>0.80</td>
<td>0.95</td>
<td>0.95</td>
<td>0.0012</td>
<td>0.0005</td>
<td>0.0005</td>
<td>≤0.01</td>
<td>247</td>
<td>2600</td>
</tr>
</tbody>
</table>

#### Typical properties
- High hydrogen contents (HD < 2 ml/100 g)
- Good weldability in all positions except vertical down.
- Good service temperature.

#### Characteristics and applications
- Suitable for Step-Cooling treatments.
- Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant.

## BOHLER WELDING Consumables for the chemical and petrochemical process industry

### Wire: EMS 2 CrMo

<table>
<thead>
<tr>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Mo</th>
<th>Cr</th>
<th>P</th>
<th>As</th>
<th>Sb</th>
<th>Sn</th>
<th>Nb</th>
<th>Re / N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.08</td>
<td>0.25</td>
<td>1.0</td>
<td>0.45</td>
<td>0.45</td>
<td>0.0012</td>
<td>0.0005</td>
<td>0.0005</td>
<td>≤0.01</td>
<td>247</td>
<td>2600</td>
</tr>
</tbody>
</table>

#### Typical properties
- High hydrogen contents (HD < 2 ml/100 g)
- Good weldability in all positions except vertical down.
- Good service temperature.

#### Characteristics and applications
- Suitable for Step-Cooling treatments.
- Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant.

### Flux: BB 24

<table>
<thead>
<tr>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Mo</th>
<th>Cr</th>
<th>P</th>
<th>As</th>
<th>Sb</th>
<th>Sn</th>
<th>Nb</th>
<th>Re / N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.07</td>
<td>0.25</td>
<td>0.80</td>
<td>0.95</td>
<td>0.95</td>
<td>0.0012</td>
<td>0.0005</td>
<td>0.0005</td>
<td>≤0.01</td>
<td>247</td>
<td>2600</td>
</tr>
</tbody>
</table>

#### Typical properties
- High hydrogen contents (HD < 2 ml/100 g)
- Good weldability in all positions except vertical down.
- Good service temperature.

#### Characteristics and applications
- Suitable for Step-Cooling treatments.
- Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant.

## BOHLER WELDING Consumables for the chemical and petrochemical process industry

### Wire: EMS 2 CrMo

<table>
<thead>
<tr>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Mo</th>
<th>Cr</th>
<th>P</th>
<th>As</th>
<th>Sb</th>
<th>Sn</th>
<th>Nb</th>
<th>Re / N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.08</td>
<td>0.25</td>
<td>1.0</td>
<td>0.45</td>
<td>0.45</td>
<td>0.0012</td>
<td>0.0005</td>
<td>0.0005</td>
<td>≤0.01</td>
<td>247</td>
<td>2600</td>
</tr>
</tbody>
</table>

#### Typical properties
- High hydrogen contents (HD < 2 ml/100 g)
- Good weldability in all positions except vertical down.
- Good service temperature.

#### Characteristics and applications
- Suitable for Step-Cooling treatments.
- Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant.

### Flux: BB 24

<table>
<thead>
<tr>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Mo</th>
<th>Cr</th>
<th>P</th>
<th>As</th>
<th>Sb</th>
<th>Sn</th>
<th>Nb</th>
<th>Re / N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.07</td>
<td>0.25</td>
<td>0.80</td>
<td>0.95</td>
<td>0.95</td>
<td>0.0012</td>
<td>0.0005</td>
<td>0.0005</td>
<td>≤0.01</td>
<td>247</td>
<td>2600</td>
</tr>
</tbody>
</table>

#### Typical properties
- High hydrogen contents (HD < 2 ml/100 g)
- Good weldability in all positions except vertical down.
- Good service temperature.

#### Characteristics and applications
- Suitable for Step-Cooling treatments.
- Fully alloyed core wire which will provide reliable creep rupture properties for the whole service life of a boiler plant.
# High temperature and creep resistant steels

<table>
<thead>
<tr>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMAW</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Si</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fe</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cr</td>
<td>2.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>0.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nb</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PWHT a 740 °C/2h</td>
<td>Re</td>
<td>520 N/mm²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rm</td>
<td>620 N/mm²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS</td>
<td>19%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Av</td>
<td>150 J</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>mm</td>
<td>2.5</td>
<td>3.2</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TÜV</td>
<td>Basic coated core wire alloyed stick electrode for welding bainitic steels such as P23/T23 (ASTM A 213, code case 2199), pipe material. For high quality welds, which will provide reliable creep rupture properties for the whole service life of a boiler plant. Preheat and interpass temperature depends on wall thickness. PWHT at 740 °C for 2 hrs.</td>
<td>HCM25, P/T23 (ASTM A 213 code case 2199)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| GTAW | % | | | | | |
| C | 0.07 | | | | | |
| Si | 0.3 | | | | | |
| Mn | 0.5 | | | | | |
| Cr | 2.1 | | | | | |
| W | 1.7 | | | | | |
| V | 0.22 | | | | | |
| Nb | 0.05 | | | | | |
| PWHT a 740 °C/2h | Re | 450 N/mm² | | | | |
| | Rm | 585 N/mm² | | | | |
| | AS | 17% | | | | |
| | Av | 120 J | | | | |
| | mm | 1.0 | 1.2 | 1.6 | | |
| TÜV | For manual or automatic GTAW-welding of creep resistant steels such as HCM25 (P23/T23 acc. to ASTM A 213 code case 2199), pipe or tube material. Preheat and interpass temperature depends on wall thickness. PWHT at 740 °C for 2 hrs. | |

| SAW | % | | | | | |
| C | 0.05 | | | | | |
| Si | 0.27 | | | | | |
| Mn | 0.9 | | | | | |
| Cr | 2.05 | | | | | |
| W | 1.6 | | | | | |
| V | 0.20 | | | | | |
| Nb | 0.04 | | | | | |
| PWHT a 740 °C/2h | Re | 450 N/mm² | | | | |
| | Rm | 660 N/mm² | | | | |
| | AS | 21% | | | | |
| | Av | 100 J | | | | |
| | mm | 2.0 | 2.5 | 3.0 | | |
| TÜV | SAW wire/flux combination for welding high temperature and creep resistant steels such as HCM25 (P23/T23 acc. to ASTM A 213 code case 2199), pipe or tube material. Preheat and interpass temperature: 200-300 °C. Heat input ≤ 2.0 kJ/mm. BB 430 is an agglomerated welding flux of the fluoride-basic type with high basicity (2.9). | |

| SMAW | % | | | | | |
| C | 0.08 | | | | | |
| Si | 0.4 | | | | | |
| Mn | 0.9 | | | | | |
| Cr | 2.4 | | | | | |
| Mo | 1.0 | | | | | |
| V | 0.22 | | | | | |
| Ti | 0.04 | | | | | |
| B | 0.003 | | | | | |
| PWHT a 740 °C/2h | Re | 560 N/mm² | | | | |
| | Rm | 860 N/mm² | | | | |
| | AS | 18% | | | | |
| | Av | 100 J | | | | |
| | mm | 2.5 | 3.2 | 4.0 | | |
| TÜV | Basic coated core wire alloyed stick electrode for welding bainitic steels like 7CrMoVTiB10-10. For high quality welds, which will provide reliable creep rupture properties for the whole service life of a boiler plant. Preheat and interpass temperature depends on wall thickness. PWHT at 740 °C for 2 hrs. | 7CrMoVTiB10-10, P/T24 acc. to ASTM A213 Draft |

| GTAW | % | | | | | |
| C | 0.05 | | | | | |
| Si | 0.3 | | | | | |
| Mn | 0.5 | | | | | |
| Cr | 2.2 | | | | | |
| Mo | 1.0 | | | | | |
| V | 0.22 | | | | | |
| Ti | 0.05 | | | | | |
| B | 0.003 | | | | | |
| PWHT a 740 °C/2h | Re | 540 N/mm² | | | | |
| | Rm | 620 N/mm² | | | | |
| | AS | 15% | | | | |
| | Av | 120 J | | | | |
| | mm | 1.0 | 1.2 | 1.6 | | |
| TÜV | For manual or automatic GTAW-welding of creep resistant steels such as 7CrMoVTiB10-10 (P24/T24 acc. to ASTM A 213 Draft), pipe or tube material. Preheat and interpass temperature depends on wall thickness. PWHT at 740 °C for 2 hrs. | 7CrMoVTiB10-10, P/T24 acc. to ASTM A213 Draft |

| SAW | % | | | | | |
| C | 0.06 | | | | | |
| Si | 0.2 | | | | | |
| Mn | 0.7 | | | | | |
| Cr | 2.1 | | | | | |
| Mo | 1.0 | | | | | |
| V | 0.22 | | | | | |
| Ti | 0.027 | | | | | |
| B | 0.003 | | | | | |
| PWHT a 740 °C/2h | Re | 500 N/mm² | | | | |
| | Rm | 620 N/mm² | | | | |
| | AS | 15% | | | | |
| | Av | 100 J | | | | |
| | mm | 2.0 | 2.5 | 3.0 | | |
| TÜV | SAW wire/flux combination for welding high temperature and creep resistant steels such as 7CrMoVTiB (P24/T24 acc. to ASTM A213). Böhler B 430 is an agglomerated welding flux of the fluoride-basic type with high basicity. Grain size: EN 760: 3-16 (0.3-1.6 mm). Preheating and interpass temperature: 200-300 °C. Heat input ≤ 2.0 kJ/mm. | |
### Characteristics and applications

- **BOHLMER WELDING Consumables for the chemical and petrochemical process industry**

<table>
<thead>
<tr>
<th>Wire: <strong>CM 9</strong></th>
<th>SMAW</th>
<th><strong>Sizes</strong></th>
<th><strong>Approvals</strong></th>
<th><strong>Base metals</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CM 5 Kb</strong></td>
<td></td>
<td></td>
<td></td>
<td>High temperature steels and similar alloyed cast steels</td>
</tr>
<tr>
<td>E CrMo 9 5 B 42 H5</td>
<td></td>
<td></td>
<td></td>
<td>17362 X12CrMo5, 17363 GX12CrMo6</td>
</tr>
<tr>
<td>EB018-B6H4R</td>
<td></td>
<td></td>
<td></td>
<td>ASTM e. g. A123 Gr.15, A217 Gr.C5, A335 Gr.P5</td>
</tr>
<tr>
<td><strong>CM 5-IG</strong></td>
<td>GTAW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Cr Mo 5 Si (GTAW)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G Cr Mo 5 Si (GMAW)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER805-B6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CM 9-IG</strong></td>
<td>GTAW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W CrMo9 Si</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER805-B8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CM 5-UP</strong></td>
<td>SAW</td>
<td></td>
<td></td>
<td>Similar alloyed creep resistant steels</td>
</tr>
<tr>
<td>S CrMo5</td>
<td></td>
<td></td>
<td></td>
<td>17386 X12CrMo9-1, 17388 X7CrMo9-3, 17389 GX12CrMo10</td>
</tr>
<tr>
<td>EB6</td>
<td></td>
<td></td>
<td></td>
<td>ASTM A217 Gr.C12, A234 Gr.WP9, A335 Gr.P9</td>
</tr>
<tr>
<td>**FOX C 9 **</td>
<td>SMAW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E CrMo 9 1 B 42 H5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E9015-B9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Typical analysis

<table>
<thead>
<tr>
<th><strong>CM 5 Kb</strong></th>
<th><strong>CM 5-IG</strong></th>
<th><strong>CM 5-UP</strong></th>
<th><strong>FOX C 9</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>C 0.07</td>
<td>C 0.08</td>
<td>C 0.05</td>
<td>C 0.07</td>
</tr>
<tr>
<td>Si 0.4</td>
<td>Si 0.4</td>
<td>Si 0.5</td>
<td>Si 0.3</td>
</tr>
<tr>
<td>Mn 0.8</td>
<td>Mn 0.5</td>
<td>Mn 0.7</td>
<td>Mn 0.5</td>
</tr>
<tr>
<td>Cr 5.0</td>
<td>Cr 5.8</td>
<td>Cr 9.0</td>
<td>Cr 9.0</td>
</tr>
<tr>
<td>Mo 0.5</td>
<td>Mo 0.6</td>
<td>Mo 0.5</td>
<td>Ni 0.9</td>
</tr>
<tr>
<td>Av 90 J</td>
<td>Av 200 J</td>
<td>Av 70 J</td>
<td>V 0.2</td>
</tr>
<tr>
<td>Av 21%</td>
<td>Av 20%</td>
<td>Av 19 %</td>
<td>Nb 0.05</td>
</tr>
</tbody>
</table>

### Typical mechanical properties

- **FOX CM 5 Kb**
  - PWHT at 730 °C / 2h
  - Re 520 N/mm²
  - Rm 620 N/mm²
  - As 21%
  - Av 90 J

- **CM 5-IG**
  - PWHT at 730 °C / 2h
  - Re 520 N/mm²
  - Rm 620 N/mm²
  - As 20%
  - Av 200 J

- **CM 5-UP**
  - PWHT at 740 °C / 2h
  - Re 450 N/mm²
  - Rm 500 N/mm²
  - As 28%
  - Av 24%

- **FOX C 9**
  - PWHT at 760 °C / 2h
  - Re 500 N/mm²
  - Rm 600 N/mm²
  - As 19%
  - Av 60 J

### Sizes

- **CM 5 Kb**
  - 2.5 mm

- **CM 5-IG**
  - 3.2 mm

- **CM 5-UP**
  - 2.4 mm

- **FOX C 9**
  - 3.2 mm

### Approvals

- **FOX CM 5 Kb**
  - TUV-D, TUV-A, CL, UDT, LTSS, VUZ, SEPROZ

- **CM 5-IG**
  - TUV-D, TUV-A, CL, UDT, LTSS, VUZ, SEPROZ

- **CM 5-UP**
  - TUV-D, TUV-A, CL, UDT, LTSS, VUZ, SEPROZ

- **FOX C 9**
  - TUV-D, CL, UDT, SEPROZ

### Characteristics

- **FOX CM 5 Kb**
  - Basic coated core wire alloyed electrode, preferably for X12CrMo5 (5 Cr 1 Mo) steels. Approved in long-term condition up to +650 °C service temperature. High creep resistance, very low hydrogen content (acc. AWS condition HD < 4 ml/100 g). Good weldability in all positions except vertical down. The deposit is heat treatable. Metal recovery approx. 115%. Preheat and interpass temperatures 300-350 °C. PWHT at 730-760 °C for at least 1 hour followed by cooling in furnace down to 300 °C and still air.

- **CM 5-IG**
  - GTAW rod and GMAW wire for 5 % Cr 12 % Mo steels and steels for hot hydrogen service, particularly for application in oil refineries and the base metals X12CrMo5 / P5. Approved in long-term condition up to +660 °C service temperature. The GTAW wire shows very good feeding characteristics, resulting in smooth welding and flow behaviour. Uniform copper bonding with low total copper content. Preheating and interpass temperatures 300-350 °C. Tempering at 730-760 °C at least 1 hr followed by cooling in furnace down to 300 °C and still air.

- **CM 5-UP**
  - SAW wire /flux combination suited for 5 % Cr 0.5 % Mo alloyed steels, particularly for hot hydrogen service. High temperature strength at service temperatures up to +600 °C. The weld deposit exhibits good mechanical properties. Easy slag detachability and smooth bead surface are additional quality features. Preheating, interpass temperature and PWHT are determined by the base metal.

- **FOX C 9**
  - Basic coated core wire alloyed electrode for high temperature steels and steels for hot hydrogen service, particularly in the petrochemical industry. Preferably used for 9 % Cr 1 % Mo steels (e.g. X12CrMo9-1 Approved in long-term condition up to +650 °C service temperature. The weld metal is heat treatable. Metal recovery approx. 115%. Preheating and interpass temperatures 250-350 °C. PWHT at 710-760 °C for at least 1 hr followed by cooling in furnace down to 300 °C and still air.

### Base metals

- **FOX CM 5 Kb**
  - A199 Gr.T91
  - A213 Gr.T91
  - A335 Gr.P91
  - ASTM e. g. 1.7389 GX12CrMo10

- **CM 5-IG**
  - A213 Gr.WP9
  - A335 Gr.P9

- **CM 5-UP**
  - A213 Gr.T91
  - A234 Gr.WP9
  - A199 Gr.T91

- **FOX C 9**
  - X10CrMoVNb9-1 (W.-Nr. 1.4903)

- **Base metals**
  - High temperature steels and similar alloyed cast steels
  - 17362 X12CrMo5, 17363 GX12CrMo6
  - ASTM e. g. A123 Gr.T5, A217 Gr.C5, A335 Gr.P5
### High temperature and creep resistant steels

<table>
<thead>
<tr>
<th>BÖHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 9 MV-IG</td>
<td>GTAW</td>
<td>C 0.09</td>
<td>PWH 760 °C/2h</td>
<td>2.0 2.4 3.0</td>
<td>TÜV-D, CL, UDT</td>
<td>GTAW rod and GMAW wire for high temperature, creep resistant martensitic 9% chromium steels. Especially designed for the ASTM steels T/P91. Approved in long-term condition up to +650 °C service temperature. Preheating and interpass temperature 200-300 °C. After welding, the weld joint should cool down below 80 °C to finish the martensite transformation. In case of greater wall thickness or complex components the possibility of residual stresses must be considered. The following post weld heat treatment is recommended: annealing 760 °C/min. 2 hrs, max. 10 hrs, heating and cooling rates below 550 °C max. 150 °C/hr, above 550 °C max. 80 °C/hr. For optimised toughness values a welding technology should be applied which produces thin welding layers (approx. 2 mm).</td>
<td></td>
</tr>
</tbody>
</table>
| G CrMo 91 | GMAW | E90S-B9 | Mo 0.9 | Nb 0.05 | SEPROZ | \n
**Wire: C 9 MV-UP**

| S CrMo91 | SAW | C 0.11 | PWH 760 °C/2h | 2.5 3.0 | TÜV-D, UDT, SEPROZ | SAW wire/flux combination suited for creep resistant 9% Cr steels, especially for T/P91 acc. ASTM A335. Approved in long-term condition up to +650 °C service temperature. The wire and flux are precisely balanced to consistently meet the highest technical requirements. Preheating and interpass temperature 200-300 °C. After welding the joint should cool down below 80 °C in order to finish the martensitic transformation. Pipe welds with wall thickness up to 45 mm can be cooled down to room temperature for heavier wall thicknesses or stressed components, unfavourable possible stress condition must be considered. The recommended post weld heat treatment is annealing after welding at 760 °C/min. 2 hrs, max. 10 hrs, heating/cooling-rates below 550 °C max. 150 °C/hr, above 550 °C max. 80 °C/hr. For optimised toughness properties a welding technology which ensures thin welding layers is recommended. |
| Eb9 | | Mo 0.8 | W 1.0 | V 0.2 | Nb 0.05 | | |
| Flux: BB 910 | | | | | | |
| SA FB 2.55 DC H5 | | | | | | |

**FOX C 9 MVW**

| E Z CrMoWVNb 911 B 42 H5 | SMAW | C 0.1 | PWH 760 °C/2h | 3.2 4.0 5.0 | TÜV-D, UDT, SEPROZ | Basic coated core wire alloyed Cr-Mo-Ni-V-W-Nb-electrode for the welding of high temperature martensitic steels like e.g. X11CrMoWVNb9-1-1 (W.-Nr. 1.4903). Approved in long-term condition up to +650 °C service temperature. Good welding properties in all positions except vertical down. Preheating and interpass temperature 200-300 °C. After welding the joint should be cooled down below 80 °C to finish the martensitic transformation. In case of greater wall thickness or complex components the possibility of residual stresses must be considered. The following post weld heat treatment is recommended: annealing 760 °C/min. 2 hrs, max. 10 hrs, heating and cooling rates up to 550 °C max. 150 °C/hr, above 550 °C max. 80 °C/hr. For optimised toughness values a welding technology should be applied which produces thin welding layers. |
| E901S-B9(mod.) | | Ni 0.7 | W 1.0 | V 0.2 | Nb 0.05 | | |

**C 9 MVW-JG**

| W Z CrMoVNb 911 | GTAW | C 0.11 | PWH 760 °C/2h | 2.0 2.4 | TÜV-D, UDT | GTAW-rod for high temperature, creep resistant martensitic 9% chromium steels, especially designed for the steel T/P91 according to ASTM A335. Approved in long-term condition up to +650 °C service temperature. Preheating and interpass temperature 200-300 °C. After welding the joint should be cooled down below 80 °C to finish the martensite transformation. In case of greater wall thickness or complex components the possibility of residual stresses must be considered. The following post weld heat treatment is recommended: annealing 760 °C/min. 2 hrs, max. 10 hrs, heating and cooling rates below 550 °C max. 150 °C/hr, above 550 °C max. 80 °C/hr. For optimised toughness values a welding technology should be applied which produces thin welding layers. |
| ER90S-B9(mod.) | | Mn 0.45 | W 1.05 | V 0.2 | Nb 0.07 | | |

**Base metals**

X10CrMoVNb9-1 (W.-Nr. 1.4903)  
ASTM e.g. A335 Gr. P91  
A199 Gr. T91  
A213 Gr. T91

---

Similar alloyed creep resistant steels  
1.4905 X11CrMoWVNb9-1-1  
ASTM A335 Gr. P91  
A213 Gr. T91
### BÖHLER WELDING Consumables for the chemical and petrochemical process industry

<table>
<thead>
<tr>
<th>BÖHLER</th>
<th>Standard</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX P 92</strong></td>
<td>E Z CrMoWV Nb 9 0.5 2 B 42 HS</td>
<td>SAW</td>
<td>C 0.30</td>
<td>Si 0.3</td>
<td>3.2</td>
<td>TÜV-D, UDT, SEPKOZ</td>
<td>Basic coated Cr-Mo-Ni-W-V-Nb-alloyed electrode</td>
<td>Similar alloyed creep resistant steels</td>
</tr>
<tr>
<td></td>
<td>E901S-9H(mod.)</td>
<td></td>
<td>Mn 0.77</td>
<td>Cr 9.1</td>
<td></td>
<td></td>
<td>suited for welding of high temperature steel</td>
<td>NF 616</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ni 0.55</td>
<td>Mo 0.17</td>
<td></td>
<td></td>
<td>9 % Cr - 1.5 W Mo-Nb-N / T/P92</td>
<td>ASTM A335 Gr.P 92(T92)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>W 0.2</td>
<td>V 0.2</td>
<td></td>
<td></td>
<td>Approved in long-term condition up to +650 °C service</td>
<td>A213/213M Gr.T92</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N 0.045</td>
<td>Nb 0.05</td>
<td></td>
<td></td>
<td>temperature. The stick electrode features a stable arc,</td>
<td></td>
</tr>
<tr>
<td><strong>P 92-IG</strong></td>
<td>W Z CrMoWV Nb 9 0.5 2 ER90S-9H(mod.)</td>
<td>GTAW</td>
<td>C 0.30</td>
<td>Si 0.4</td>
<td>2.0</td>
<td>TÜV-D, UDT</td>
<td>GTAW rod especially designed for the welding of</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mn 0.4</td>
<td>Cr 8.6</td>
<td></td>
<td></td>
<td>a 9 % Cr 1.5 W Mo-Nb-N / T/P92</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mo 0.4</td>
<td>Ni 0.6</td>
<td></td>
<td></td>
<td>Approved in long-term condition up to +650 °C service</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>W 1.5</td>
<td>CrMoWVNb 9 0.5 W 0.2 Nb 0.05</td>
<td></td>
<td></td>
<td>temperature. Preheating and interpass</td>
<td></td>
</tr>
<tr>
<td><strong>Wire: P 92-UP</strong></td>
<td>S Z CrMoWV Nb 9 0.5 15 ER9H(mod.)</td>
<td>SAW</td>
<td>C 0.09</td>
<td>Si 0.45</td>
<td></td>
<td></td>
<td>temperature 200-300 °C. After welding the joint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flux: BB 910</td>
<td></td>
<td>Mn 0.4</td>
<td>Cr 8.6</td>
<td>3.0</td>
<td>TÜV-D, UDT</td>
<td>should cool down below 80 °C to finish the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SA FB 2 55 DC HS</td>
<td></td>
<td>Ni 0.35</td>
<td>Mn 0.6</td>
<td></td>
<td></td>
<td>martensite transformation. In case of greater wall</td>
<td></td>
</tr>
<tr>
<td><strong>FOX 20 MVW</strong></td>
<td>E CrMoWV12 B 42 HS</td>
<td>SAW</td>
<td>C 0.18</td>
<td>Si 0.3</td>
<td></td>
<td></td>
<td>thickness or complex components the possibility of</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mn 0.6</td>
<td>Cr 11.0</td>
<td></td>
<td></td>
<td>residual stresses must be considered. The following</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cr 11.0</td>
<td>Mn 1.0</td>
<td></td>
<td></td>
<td>post weld heat treatment is recommended:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ni 0.6</td>
<td>W 0.5</td>
<td></td>
<td></td>
<td>Annealing 760 °C/min. 2 hours, max. 10 hours, heating/</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V 0.3</td>
<td></td>
<td></td>
<td></td>
<td>cooling rate below 550 °C max. 150 °C, above 550 °C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>max. 80 °C /h. In case of heat treatments less</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>than 2 hours the requirements have to be proved by a</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>procedure test. For optimised toughness values a</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>welding technology should be applied which produces</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>thin welding layers (approx. 2 mm).</td>
<td></td>
</tr>
</tbody>
</table>

### Characteristics and applications

- **Base metals**
  - Similar alloyed creep resistant steels
    - NF 616
    - ASTM A335 Gr.P 92(T92)
    - A213/213M Gr.T92
  - X20CrMoV12-1
  - X20CrMoV12-1 (W.-Nr. 14922)
  - X20CrMoV12-1 (W.-Nr. 14935)
  - X22CrMoV12-1 (W.-Nr. 14923)
  - X19CrMoWnb11-1 (W.-Nr. 14993)
  - X22CrMoV12-1 (W.-Nr. 14993)

### Base metals

- **Base metals**
  - X20CrMoV12-1
  - X20CrMoV12-1 (W.-Nr. 14922)
  - X20CrMoV12-1 (W.-Nr. 14935)
  - X22CrMoV12-1 (W.-Nr. 14923)
  - X19CrMoWnb11-1 (W.-Nr. 14993)
  - X22CrMoV12-1 (W.-Nr. 14993)
# High temperature and creep resistant steels

<table>
<thead>
<tr>
<th>Steels</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>20 MVW-IG</strong>&lt;br&gt;W CrMoWV12Si</td>
<td>GTAW</td>
<td>C 0.21 Si 0.4 Mn 0.6 Cr 11.3 Mo 1.0 W 0.45 V 0.3</td>
<td>PWHIT ≥ 760 °C/2h&lt;br&gt;Re 630 N/mm²&lt;br&gt;Rm 780 N/mm²&lt;br&gt;A5 18%&lt;br&gt;Av 60 J</td>
<td>2.0 2.4</td>
<td>TÜV-D, TÜV-A, DB, U, CL, UDT, KTA 9408.1, SEPR/OZ, OBB</td>
<td>GTAW rod for creep resistant, quenched and tempered 12 % Cr steels in turbine and boiler fabrication and in the chemical industry. Preferably used for the base metal X20CrMoV12-1. Approved in long-term condition up to +650 °C service temperature. The deposit exhibits high creep rupture strength and good toughness properties under long term stresses. Preheating and interpass temperatures 400-450 °C (austenitic welding) or 250-300 °C (martensitic welding). Root passes should principally be welded in the martensitic range. Lower preheat and interpass temperatures are possible, yet must be approved by practical welding tests and process qualification tests. After welding cooling to 90±10 °C, followed by tempering at 720-760 °C for three minutes/mm wall thickness (at least for 2 hours). Tempering, if specified, at 1050 °C for 1/2 hour and annealing at 760 °C for 2 hours.</td>
<td>X20C4CrMoV12-1&lt;br&gt;(W.-Nr. 1.4922)&lt;br&gt;X20CrMoV12-1&lt;br&gt;(W.-Nr. 1.4935)&lt;br&gt;X12CrMoV12-1&lt;br&gt;(W.-Nr. 1.4923)&lt;br&gt;X19CrMoVNb11-1&lt;br&gt;(W.-Nr. 1.4913)&lt;br&gt;G-X22CrMoV12-1&lt;br&gt;(W.-Nr. 1.4933)</td>
</tr>
</tbody>
</table>

| **Wire: 20 MVW-UP**<br>S CrMoWV12 | SAW | C 0.16 Si 0.3 Mn 0.8 Cr 10.3 Mo 0.85 Ni 0.4 W 0.45 V 0.25 | PWHIT ≥ 760 °C/2h<br>Re ≥ 550 N/mm²<br>Rm ≥ 660 N/mm²<br>A5 ≥ 15%<br>Av ≥ 47 J | 3.0 | TÜV-D, TÜV-A, KTA 9408.1 (8060.01), TÜV-A, SEPR/OZ | SAW wire/flux combination suited for analogous and similar creep resistant steels in turbine and steam boiler construction as well as in the chemical industry. Approved in long-term condition up to +650 °C service temperature. Preheating and interpass temperature 400-450 °C (austenitic welding) or 250-300 °C (martensitic welding). Root passes should principally be welded in the martensitic range. Lower preheat and interpass temperatures are possible, yet must be approved by practical welding tests and process qualification tests. After welding cooling to 90±10 °C, followed by tempering at 760 °C for three minutes/mm wall thickness (at least for 2 hours). Tempering, if specified, at 1050 °C for 1/2 hour and annealing at 760 °C for 2 hours. Further details on the welding technology available on request. | X6CrNi18-11<br>(W.-Nr. 1.4948)<br>X10CrNi18-11<br>(W.-Nr. 1.4949) |

| **Flux: BB24**<br>SA FB 2 65 DC H5 | SMAW | C 0.05 Si 0.3 Mn 1.3 Cr 19.0 Ni 19.3 | Re ≥ 420 N/mm²<br>Rm ≥ 580 N/mm²<br>A5 ≥ 40%<br>Av ≥ 85 J | 2.5 3.2 4.0 | TÜV-D, TÜV-A, KTA 9408.1 UDT, LTSS, CL, SEPR/OZ | Basic coated, core wire alloyed electrode with controlled ferrite content (3-8 FN) for austenitic CrNi steels with increased carbon contents (e.g. 1.4948/304H), in the boiler, reactor and turbine fabrication. Approved in long-term condition up to +700 °C service temperature (300 °C in the case of wet corrosion). Resistant to hot cracking, scaling and corrosion. Excellent weldability in all positions except vertical down. Preheating is not required, only in case of wall thickness above 25 mm preheat up to 150 °C. Interverpass temperature should not exceed 200 °C. Also suitable for German material no. 1.4550 and Nr. 1.4551, which are approved for temperatures up to 550 °C. | AISI 304H<br>(321H)<br>(347H) |

| **FOX CN 18/11**<br>E 19 9 4 2 H5<br>E308-15 | GMAW | C 0.05 Si 0.4 Mn 1.6 Cr 18.8 Ni 9.3 | Re ≥ 420 N/mm²<br>Rm ≥ 580 N/mm²<br>A5 ≥ 38%<br>Av ≥ 120 J<br>≥ 32J...-10 °C | 1.2 | TÜV-D, TÜV-A, KTA 9408.1 CL, UDT, LTSS, CL, SEPR/OZ | GTAW rod and GMAW wire with controlled ferrite content (3-8 FN). For austenitic CrNi steels with increased carbon contents (e.g. 1.4948/304H), in the boiler, reactor and turbine fabrication. Approved in long-term condition up to +700 °C service temperature (300 °C in the case of wet corrosion). Preheating is not required, only in case of wall thickness above 25 mm preheat up to 150 °C. Interverpass temperature should not exceed 200 °C. Steels to German material no. 1.4550 and Nr. 1.4551 which are approved for the high temperature range up to 550 °C, can also be welded. | X10CrNi18-11<br>(W.-Nr. 1.4949)<br>X1CrNi18-11<br>(W.-Nr. 1.4949) |

| **CN 18/11-IG**<br>G 19 9 H (GTAW)<br>G 19 9 H (GMAW)<br>ER19-10H | GTAW | C 0.05 Si 0.4 Mn 1.6 Cr 18.8 Ni 9.3 | Re ≥ 420 N/mm²<br>Rm ≥ 580 N/mm²<br>A5 ≥ 38%<br>Av ≥ 120 J<br>≥ 32J...-10 °C | 2.0 2.4 3.0 | TÜV-D, TÜV-A, KTA 9408.1 CL, UDT, LTSS, CL, SEPR/OZ | GTAW rod and GMAW wire with controlled ferrite content (3-8 FN). For austenitic CrNi steels with increased carbon contents (e.g. 1.4948/304H), in the boiler, reactor and turbine fabrication. Approved in long-term condition up to +700 °C service temperature (300 °C in the case of wet corrosion). Preheating is not required, only in case of wall thickness above 25 mm preheat up to 150 °C. Interverpass temperature should not exceed 200 °C. Steels to German material no. 1.4550 and Nr. 1.4551 which are approved for the high temperature range up to 550 °C, can also be welded. | X10CrNi18-11<br>(W.-Nr. 1.4949)<br>X1CrNi18-11<br>(W.-Nr. 1.4949) |

| **Wire: CN 18/11-UP**<br>S 19 9 H<br>ER19-10H | SAW | C 0.05 Si 0.55 Mn 1.2 Cr 18.4 Ni 9.3 | PWHIT ≥ 760°C/2h<br>Re ≥ 550 N/mm²<br>Rm ≥ 660 N/mm²<br>A5 ≥ 35%<br>Av ≥ 380 J | 3.0 | UDT | SAW wire/flux combination for high quality joint weld on high temperature austenitic CrNi-steels at service temperature up to 700 °C (300 °C in the case of wet corrosion). The controlled ferrite content (3-8FN) ensures hot cracking resistance. The deposit is insensitive to sigma phase embrittlement. Preheating is not required, only in case of wall thickness above 25 mm preheat up to 150 °C. The interpass temperature should not exceed 200 °C. Steels to German material no. 1.4550 and 1.4551 which are approved for the high temperature range up to 550 °C, can also be welded. | X10CrNi18-11<br>(W.-Nr. 1.4949)<br>X1CrNi18-11<br>(W.-Nr. 1.4949)<br>(347H) |
# High temperature and creep resistant steels

| BÖHLER Consumables for the chemical and petrochemical process industry |

## FOX E 308 H

**E 19 9 R H 42 HS**  
**E308H-16**  

**SMAW**  

<table>
<thead>
<tr>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td></td>
<td>mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C 0.05</td>
<td>Re 420 N/mm²</td>
<td>2.5</td>
<td>UDT, SEPROZ</td>
<td>Rutile-basic coated, core wire alloyed electrode for the use of high temperature CrNi austenitic steel for service temperatures up to 700 °C. Specially designed for the base metal AISI 304H (W. no. 1.4948). Controlled ferrite content of 3-8 FN. The deposit is less susceptible to embrittlement and is scaling resistant. Excellent weldability in all positions except vertical down. Preheating is not required, only in case of wall thickness above 25 mm preheat up to 150 °C. Interpass temperature should not exceed 200 °C.</td>
<td>1.4948 X6CrNi/18-11, 1.4878 X12CrNiTi18-9 AISI 304, 304H (321H), (347H)</td>
</tr>
<tr>
<td>Si 0.6</td>
<td>Rm 580 N/mm²</td>
<td>3.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mn 0.7</td>
<td>A5 40%</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cr 19.4</td>
<td>Av 75 J</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ni 10.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## ER 308 H-IG

**W 19 9 H**  
**ER308H**  

**GTAW**  

| C 0.06           | Re ≥350 N/mm²                  | 1.6   |           |                                  |            |
| Si 0.4           | Rm ≥350 N/mm²                  | 2.0   |           |                                  |            |
| Mn 2.0           | A5 ≥35%                        | 2.4   |           |                                  |            |
| Cr 20.0          | Av ≥70 J                       |       |           |                                  |            |
| Ni 9.5           |                               |       |           |                                  |            |
| Mo 0.2           |                               |       |           |                                  |            |

**Approvals**: UDT, SEPROZ  
**Characteristics and applications**: Rutile basic coated, core wire alloyed electrode for the use of high temperature CrNi austenitic steel for service temperatures up to 700 °C. Specially designed for the base metal AISI 304H (W. No. 1.4948). Controlled ferrite content of 3-8 FN. The deposit is less susceptible to embrittlement and is scaling resistant.  
**Base metals**: 1.4948 X6CrNi/18-11, 1.4878 X12CrNiTi18-9 AISI 304, 304H (321H), (347H)

## E 308 H-FD

**T Z 19 9 H R M (C) 3**  
**E308HT0-4/-1**  

**FCAW**  

| C 0.06           | Re ≥390 N/mm²                  | 1.2   |           |                                  |            |
| Si 0.5           | Rm ≥390 N/mm²                  |       |           |                                  |            |
| Mn 1.1           | A5 ≥42%                        |       |           |                                  |            |
| Cr 19.4          | Av ≥80 J                       |       |           |                                  |            |
| Ni 10.1          |                               |       |           |                                  |            |

**Approvals**: UDT  
**Characteristics and applications**: Flux cored wire with rutile slag characteristic for GMAW of austenitic CrNi steels like 1.4948 / AISI 304H. This wire is designed mainly for downhand and horizontal welding positions. The weld metal is suitable for service temperatures up to approx. 700 °C. This product achieves high productivity and is easy to operate achieving excellent welding characteristics, almost no spatter formation and temper discoloration, smooth weld finish and safe penetration. Increased travel speeds as well as little demand for cleaning and pickling provide considerable savings in time and money. The weld deposit is scaling resistant and because of the controlled low delta ferrite content (3-8 FN) less susceptible to embrittlement.  
**Base metals**: 1.4948 X6CrNi/18-11, 1.4878 X12CrNiTi18-9 AISI 304, 304H (321H), (347H)

## E 308 H PW-FD

**T Z 19 9 H P M (C) 1**  
**E308HT1-4/-1**  

**FCAW**  

| C 0.06           | Re ≥390 N/mm²                  | 1.2   |           |                                  |            |
| Si 0.5           | Rm ≥390 N/mm²                  |       |           |                                  |            |
| Mn 1.1           | A5 ≥42%                        |       |           |                                  |            |
| Cr 19.4          | Av ≥80 J                       |       |           |                                  |            |
| Ni 10.1          |                               |       |           |                                  |            |

**Approvals**: –  
**Characteristics and applications**: Flux cored wire with rutile slag characteristic for GMAW of austenitic CrNi steels like 1.4948 / AISI 304H. This wire is designed mainly for downhand and horizontal welding positions. The weld metal is suitable for service temperatures up to approx. 700 °C. This product achieves high productivity and is easy to operate achieving excellent welding characteristics, almost no spatter formation and temper discoloration, smooth weld finish and safe penetration. Increased travel speeds as well as little demand for cleaning and pickling provide considerable savings in time and money. The weld deposit is scaling resistant and because of the controlled low delta ferrite content (3-8 FN) less susceptible to embrittlement.  
**Base metals**: 1.4948 X6CrNi/18-11, 1.4878 X12CrNiTi18-9 AISI 304, 304H (321H), (347H)

## FOX E 347 H

**E 19 9 Nb B**  
**E347-15**  

**SMAW**  

<table>
<thead>
<tr>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td></td>
<td>mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C 0.05</td>
<td>Re 440 N/mm²</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Si 0.3</td>
<td>Rm 620 N/mm²</td>
<td>3.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mn 1.3</td>
<td>A5 35%</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cr 19.0</td>
<td>Av 85 J</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ni 10.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nb 28%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Approvals**: –  
**Characteristics and applications**: Basic coated, core wire alloyed electrode for the use of high temperature CrNi austenitic steel for service temperatures exceeding 400 °C. Specially designed for the base metal AISI 347H. Controlled ferrite content of 3-8 FN. The deposit is less susceptible to embrittlement and is scaling resistant.  
**Base metals**: X 1.2 CrNiTi18-9 AISI 321H, 347H
### Stainless steels – Austenitic

<table>
<thead>
<tr>
<th>BOHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>Si</td>
<td>Mn</td>
<td>Cr</td>
<td>Ni</td>
<td>Re</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical analysis</th>
<th>%</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOHLER</td>
<td>SMAW</td>
<td>E 19 9 L B 22</td>
<td>E308L-15</td>
<td>C</td>
<td>0.03</td>
<td>Si</td>
</tr>
<tr>
<td></td>
<td>SMAW</td>
<td>E 19 9 L R 32</td>
<td>E308L-17</td>
<td>C</td>
<td>0.03</td>
<td>Si</td>
</tr>
<tr>
<td></td>
<td>SMAW</td>
<td>E 19 9 L R 15</td>
<td>E308L-17</td>
<td>C</td>
<td>0.02</td>
<td>Si</td>
</tr>
<tr>
<td></td>
<td>GTA</td>
<td>W 19 9 L</td>
<td>ER309L</td>
<td>C</td>
<td>0.02</td>
<td>Si</td>
</tr>
<tr>
<td></td>
<td>GMAW</td>
<td>G 19 9 L</td>
<td>ER308L</td>
<td>C</td>
<td>0.02</td>
<td>Si</td>
</tr>
<tr>
<td></td>
<td>FCAW</td>
<td>T 19 9 L R M (C) 3 E308LT1-4(t)</td>
<td>Ø 0.9 mm</td>
<td>T 19 9 L P M (C) 1 E308LT1-4(t)</td>
<td>C</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>FCAW</td>
<td>T 19 9 L P M (C) 1 E308LT1-4(t)</td>
<td>Ø 0.9 mm</td>
<td>T 19 9 L P M (C) 1 E308LT1-4(t)</td>
<td>C</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>SAW</td>
<td>S 19 9 L</td>
<td>ER308L</td>
<td>C</td>
<td>0.02</td>
<td>Si</td>
</tr>
<tr>
<td>BOHLER Standard EN AWS</td>
<td>Welding process</td>
<td>Typical analysis</td>
<td>Typical mechanical properties</td>
<td>Sizes</td>
<td>Approvals</td>
<td>Characteristics and applications</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------</td>
<td>------------------</td>
<td>-----------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>Stainless steels – Austenitic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FOX EAS 4 M</strong></td>
<td>SMAW</td>
<td>C 0.03</td>
<td>Re 460 N/mm² Rm 600 N/mm² A5 35 % Av 90 J ±3±3...-120°C</td>
<td>2.5</td>
<td>TÜV-D, TÜV-A, OBB, UDT, CL, DNV, Saasoil, SEPROZ, VUZ</td>
<td>Basic coated stainless steel electrode. Designed to produce first class weld deposits. Provides 100 % X-ray safety together with very good root pass and positional welding characteristics. Good gap bridging ability. easy weld pool and slag control. An excellent product for welding on site! Fully core wire alloyed and packed into hermetically sealed tins. Resistant to intergranular corrosion up to +400 °C.</td>
</tr>
<tr>
<td>E 19 12 3L R 22</td>
<td></td>
<td>Si 0.4</td>
<td>Mo 1.2</td>
<td>Cr 18.8</td>
<td>Mo 2.7</td>
<td>Ni 11.5</td>
</tr>
<tr>
<td>E316L-15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FOX EAS 4 M-A</strong></td>
<td>SMAW</td>
<td>C 0.03</td>
<td>Re 460 N/mm² Rm 600 N/mm² A5 35 % Av 70 J ±3±3...-120°C</td>
<td>1.5</td>
<td>TÜV-D, TÜV-A, OBB, DB, DNV, GL, ABS, CL, LR, UDT, Saasoil, SEPROZ, VUZ</td>
<td>Rutil coated stainless steel electrode. An acknowledged world leader, noted for its superior welding characteristics. Fully core wire alloyed ensures the most reliable corrosion resistance. Other advantages include high current carrying capacity, minimum spatter formation, self releasing slag, smooth and clean weld profile, safety against formation of porosity due to moisture resistant coating and packaging into hermetically sealed tins and VAC-packs. Resistant to intergranular corrosion up to +400 °C.</td>
</tr>
<tr>
<td>E 19 12 3L R 32</td>
<td></td>
<td>Si 0.8</td>
<td>Mo 0.8</td>
<td>Cr 18.8</td>
<td>Mo 2.7</td>
<td>Ni 11.5</td>
</tr>
<tr>
<td>E316L-17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FOX EAS 4 M-VD</strong></td>
<td>SMAW</td>
<td>C 0.03</td>
<td>Re 470 N/mm² Rm 600 N/mm² A5 35 % Av 55 J ±3±3...-120°C</td>
<td>2.5</td>
<td>TÜV-D, DNV, GL, UDT, CL, SEPROZ, LTSS</td>
<td>Rutil-base coated stainless steel electrode for vertical down welding. Ideal for welding thin sheet in the vertical down position. Extremely low heat input and little distortion due to the fast welding speed. An ideal product to save time and money in sheet metal fabrication. Resistant to intergranular corrosion up to +400 °C.</td>
</tr>
<tr>
<td>E 19 12 3L R 15</td>
<td></td>
<td>Si 0.7</td>
<td>Mo 0.7</td>
<td>Cr 19.0</td>
<td>Mo 2.7</td>
<td>Ni 11.5</td>
</tr>
<tr>
<td>E316L-17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FOX EAS 4 M-TS</strong></td>
<td>SMAW</td>
<td>C 0.03</td>
<td>Re 510 N/mm² Rm 630 N/mm² A5 35 % Av 40 J ±3±3...-120°C</td>
<td>2.0</td>
<td>TÜV-D, TÜV-A, UDT, SEPROZ</td>
<td>Special type low carbon rutil-base coated stainless steel electrode particularly designed for site welding of thin walled tubes and sheets. The very stable arc produces an excellent root penetration, bead configuration and gap bridging ability. A good economical alternative to GTA welding on difficult accessible on-site welding applications. High safety against formation of porosity by moisture resistant coating and packaging into hermetically sealed tin. Resistant to intergranular corrosion up to +400 °C.</td>
</tr>
<tr>
<td>E 19 12 3L R 12</td>
<td></td>
<td>Si 0.8</td>
<td>Mo 0.7</td>
<td>Cr 19.0</td>
<td>Mo 2.7</td>
<td>Ni 11.5</td>
</tr>
<tr>
<td>E316L-16(mod.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EAS 4 M-IG</strong></td>
<td>GTAW</td>
<td>C 0.02</td>
<td>Re 470 N/mm² Rm 630 N/mm² A5 35 % Av 40 J ±3±3...-196°C</td>
<td>1.6</td>
<td>TÜV-D, U, TÜV-A, GTAW rod designed to a very precise analysis to create a weld deposit of high purity, superior hot cracking and corrosion resistance. CVN toughness down to -196 °C. Resistant to intergranular corrosion up to +400 °C.</td>
<td></td>
</tr>
<tr>
<td>W 19 12 3L</td>
<td></td>
<td>Si 1.7</td>
<td>Mn 0.7</td>
<td>Cr 18.5</td>
<td>Mo 2.6</td>
<td>Ni 12.3</td>
</tr>
<tr>
<td>ER316L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EAS 4 M-IG (Si)</strong></td>
<td>GMAW</td>
<td>C 0.02</td>
<td>Re 450 N/mm² Rm 630 N/mm² A5 35 % Av 40 J ±3±3...-196°C</td>
<td>0.8</td>
<td>TÜV-D, U, TÜV-A, Saasoil, GL, DB, DNV, UDT, CL, UDT, SEPROZ</td>
<td>GMAW wire designed for first class welding, wetting and feeding characteristics as well as reliable corrosion resistance up to +400 °C and low temperature service down to -196 °C.</td>
</tr>
<tr>
<td>G 19 12 3LSi</td>
<td></td>
<td>Si 1.7</td>
<td>Mn 0.7</td>
<td>Cr 18.4</td>
<td>Mo 2.8</td>
<td>Ni 11.8</td>
</tr>
<tr>
<td>ER316LSi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EAS 4 M-FD</strong></td>
<td>FCAW</td>
<td>C 0.03</td>
<td>Re 400 N/mm² Rm 560 N/mm² A5 35 % Av 65 J ±3±3...-120°C</td>
<td>0.9</td>
<td>TÜV-D, U, TÜV-A, GL, DNV, UDT, CL, UDT, SEPROZ, VUZ</td>
<td>Rustle flux cored welding wire for downhand welding. This products achieve high productivity and are easy to operate. Self releasing slag, almost no spatter formation and temper discoloration. Smooth weld finish and safe penetration. Suitable for service temperatures from -120 °C to +400 °C.</td>
</tr>
<tr>
<td>T 19 12 3 L R M (C) 1</td>
<td></td>
<td>Si 0.7</td>
<td>Mn 0.5</td>
<td>Cr 19.0</td>
<td>Mo 2.7</td>
<td>Ni 11.2</td>
</tr>
<tr>
<td>E316L-Ti(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ø 0.9 mm T 19 12 3 L P M (C) 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E316L-Ti(4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EAS 4 PW-FD</strong></td>
<td>FCAW</td>
<td>C 0.03</td>
<td>Re 400 N/mm² Rm 560 N/mm² A5 35 % Av 65 J ±3±3...-120°C</td>
<td>1.2</td>
<td>TÜV-D, U, TÜV-A, CL, UDT, GL, DNV, UDT, CL, UDT, SEPROZ, VUZ</td>
<td>Rustle flux cored welding wire with fast freezing slag providing excellent positional welding characteristics and fast travel speeds.</td>
</tr>
<tr>
<td>T 19 12 3 L P M (C) 1</td>
<td></td>
<td>Si 0.7</td>
<td>Mn 0.5</td>
<td>Cr 19.0</td>
<td>Mo 2.7</td>
<td>Ni 11.2</td>
</tr>
<tr>
<td>E316L-Ti(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Stainless steels – Austenitic

<table>
<thead>
<tr>
<th>BOHLER Standard EN</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wire: EAS 4M-UP</strong></td>
<td>SAW FB 2 DC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SAW-wire/flux combination of type 316L for multi-pass welding. Smooth beads, easy slag removal without any slag residues and good welding characteristics are very much appreciated by users. BB 202 is a basic, agglomerated flux, providing a low flux consumption. Basicity 2.3 acc. to Boniczewski.</td>
<td>1.4583 X10CrNiMoNb18-12</td>
</tr>
</tbody>
</table>

| **FOX E 317L**      | SMAW |                  |                             |       |           | R Extract coated core wire alloyed electrode suited for corrosion resistant CrNiMoN-steels. It satisfies the high demands of offshore fabricators, shipyards building chemical tankers as well as the chemical/petrochemical, pulp and paper industries. Suitable for service temperatures from -60 °C to +300 °C. The weld metal exhibits resistance against pitting corrosion and intergranular corrosion resistance up to +300 °C (ASTM A 262 / Practice E). Good operating characteristics on AC and DC, minimum spatter formation, self releasing slag with smooth and clean bead surface. Recommended for wall thicknesses up to 30 mm. Preheating and post weld heat treatment is not required by the weld deposit. The interpass temperature should be kept below 150 °C. | CrNiMo6-steels with increased Mo-content like grade AISI 316LN/317LN or corrosion resistant cladings on mild steels | 1.4434 X2CrNiMoN18-12-4 | 1.4438 X2CrNiMo18-15-4 | 1.4429 X2CrNiMo17-13-3 | AISI 316L 316LN 317L 317LN |

| **E 317L-FD**       | FCAW |                  |                             |       |           | R Extract flux cored welding wire. This product achieves high productivity and is easy to operate achieving excellent welding characteristics, self releasing slag, almost no spatter formation and temper discoloration, smooth weld finish and safe penetration. Increased travel speeds as well as little demand for cleaning and pickling provide considerable savings in time and money. | CrNiMo-steels with increased Mo-content like grade AISI 316Cb 316 316Ti 53653 |

| **E 317L PW-FD**    | FCAW |                  |                             |       |           | R Extract flux cored welding wire with fast freezing slag providing excellent positional welding characteristics and fast travel speeds. It is designed for welding of corrosion resistant CrNiMo-steels and satisfies the high demands of offshore fabricators, shipyards building chemical tankers as well as the chemical/petrochemical, pulp and paper industries. Suitable for service temperatures from -60 °C to +300 °C. The weld metal exhibits resistance against pitting corrosion and intergranular corrosion resistance (ASTM A 262 / Practice E) up to +300 °C. For corrosion resistant single claddings the wire should be used under mixture gas (Argon + 15-25 % CO2). | CrNiMo-steels with increased Mo-content like grade AISI 316Cb 316 316Ti 53653 |

| **Wire: ASN 5 SY-UP** | SAW FB 2 DC |                  |                             |       |           | SAW-wire/flux combination for CrNiMo steels. It satisfies the high demands of offshore fabricators, shipyards building chemical tankers as well as the chemical/petrochemical, pulp and paper industries. Suitable for service temperatures from -60 °C to +300 °C. The weld metal exhibits resistance against pitting corrosion and intergranular corrosion resistance (ASTM A 262 / Practice E) up to +300 °C. The fluoride-based agglomerated flux provides a low flux consumption. Preheating and post weld heat treatment is not required by the weld deposit. The interpass temperature should be kept below 150 °C. | 1.4583 X10CrNiMoNb18-12 | 1.4435 X2CrNiMo18-14-3 | 1.4436 X2CrNiMo17-13-3 | 1.4404 X2CrNiMo17-12-2 | 1.4401 X2CrNiMo17-6-2 | 1.4571 X6CrNiMoTi 17-12-2 | 1.4580 X6CrNiMoNb17-12-2 | 1.4409 G-X2CrNiMo19-11-2 | AISI 316Cb 316 316Ti 53653 |
## Stainless steels – Austenitic

### BOHLER WELDING Consumables for the chemical and petrochemical process industry

<table>
<thead>
<tr>
<th>BOHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>E 18 16 S N L B 22</td>
<td>SMAW</td>
<td>C 0.04</td>
<td>Cr 18.5</td>
<td>Mn 17.0</td>
<td>Si 0.15</td>
<td>PREN 36.3</td>
<td>FN ≤0.5</td>
</tr>
<tr>
<td>E 18 16 S N L R 32</td>
<td>SMAW</td>
<td>C 0.035</td>
<td>Cr 18.0</td>
<td>Mn 16.0</td>
<td>Si 0.13</td>
<td>PREN 36</td>
<td>FN ≤0.5</td>
</tr>
<tr>
<td>W Z 18 16 S N L</td>
<td>GTAW</td>
<td>C 0.02</td>
<td>Cr 19.0</td>
<td>Mn 16.5</td>
<td>Si 0.36</td>
<td>PREN 38</td>
<td>FN ≤0.5</td>
</tr>
<tr>
<td>G Z 18 16 S N L</td>
<td>GMAW</td>
<td>C 0.03</td>
<td>Cr 19.0</td>
<td>Mn 17.5</td>
<td>Si 0.16</td>
<td>PREN 37.1</td>
<td>FN ≤0.5</td>
</tr>
<tr>
<td>S 18 16 S N L</td>
<td>SAW</td>
<td>C 0.02</td>
<td>Cr 18.5</td>
<td>Mn 16.3</td>
<td>Si 0.74</td>
<td>PREN 33.9</td>
<td>FN ≤0.5</td>
</tr>
<tr>
<td>E 22 18 4 L B 2 2</td>
<td>SMAW</td>
<td>C 0.04</td>
<td>Cr 21.8</td>
<td>Mn 18.1</td>
<td>Si 0.22</td>
<td>PREN 37.2</td>
<td>FN ≤0.5</td>
</tr>
<tr>
<td>W Z 22 17 8 4 N L</td>
<td>GTAW</td>
<td>C 0.03</td>
<td>Cr 21.8</td>
<td>Mn 17.5</td>
<td>Si 0.22</td>
<td>PREN 37.2</td>
<td>FN ≤0.5</td>
</tr>
</tbody>
</table>

### Additional Information
- **Sizes:**
  - **GMAW:** C ≤ 0.03
  - **GTAW:** C ≤ 0.02
- **N:**
  - **GMAW:** 0.13
  - **GTAW:** 0.22
- **Mo:**
  - **GMAW:** 4.5
  - **GTAW:** 3.6
- **Ni:**
  - **GMAW:** 16.0
  - **GTAW:** 17.5
- **Cr:**
  - **GMAW:** 18.0
  - **GTAW:** 21.8
- **Mn:**
  - **GMAW:** 1.1
  - **GTAW:** 7.5
- **Si:**
  - **GMAW:** 0.7
  - **GTAW:** 0.7
- **C:**
  - **GMAW:** ≤ 0.03
- **Typical properties:**
  - **GMAW:** Re 430 N/mm², Av ≥ 120 J
  - **GTAW:** Re 440 N/mm², Av ≥ 120 J
- **Typical toughness:**
  - **GMAW:** ≥ 32 J at -196 °C
  - **GTAW:** ≥ 32 J at -196 °C

### Base Metals
- **UNS:**
  - **GMAW:** 316LN
  - **GTAW:** 317LN
- **AISI:**
  - **GMAW:** 316L
  - **GTAW:** 317LN
- **EN:**
  - **GMAW:** 1.4439
  - **GTAW:** 1.4442
- **AWS:**
  - **GMAW:** E317LN-17(mod.)
  - **GTAW:** E317LN-15(mod.)
### Stainless steels – Austenitic

<table>
<thead>
<tr>
<th>BOHLER Welding process</th>
<th>Typical Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX SAS 2</strong>&lt;br&gt;E 19 9 Nb B 22&lt;br&gt;E347-15</td>
<td>SMAW 1.0 Re 470 N/mm²</td>
<td>2.5</td>
<td>TUV-D, UZ, TUV-A, OBB, DB, ABS, GL, UDT, LTSS, SEPROZ</td>
<td>Basic coated core wire alloyed electrode. Preferably used for Ti or Nb stabilised 1.4541 / 1.4550 / 321 / 347 CrNi-steel grades. Designed to produce first class weld deposits with reliable CVN toughness values down to -196 °C. 100 % X-ray safety together with very good root pass and positional welding characteristics, good gap bridging ability, easy weld pool and slag control as well as easy slag removal even in narrow preparations resulting in clean bead surfaces and minimum post weld cleaning. An excellent electrode for welding on-site! The product is resistant to intergranular corrosion up to +400 °C.</td>
<td>1.4550 X6CrNiNb18-10 1.4541 X6CrNiTi18-11 1.4522 G-XCrNiNb19-11 1.4301 X5CrNi18-10 1.4312 G-X10 CrNi18-8 1.4319 X2CrNi18-10 AISI/ASTM 347 321 A296 CF8c A157 Gr. C 9 321 A120 Gr. BB C a. D 304L 304 302</td>
</tr>
<tr>
<td><strong>FOX SAS 2-A</strong>&lt;br&gt;E 19 9 Nb R 32&lt;br&gt;E347-17</td>
<td>SMAW 1.0 Re 470 N/mm²</td>
<td>2.0</td>
<td>TUV-D, UZ, TUV-A, OBB, DB, ABS, CL, UDT, LTSS, VUZ, GL, SEPROZ</td>
<td>Rutile coated core wire alloyed electrode. Preferably used for Ti or Nb stabilised 1.4541 / 1.4550 / 321 / 347 CrNi-steel grades. An acknowledged world leader, noted for its superior welding characteristics and metallurgy. Can be used on AC or DC. Other advantages include high currents carrying capacity, minimum spatter Formation, self releasing slag, smooth and clean weld profile, safety against formation of porosity due to moisture resistant coating and packaging into hermetically sealed tins. Fully alloyed core wire ensures the most reliable corrosion resistance. The product is resistant to intergranular corrosion up to +400 °C.</td>
<td>1.4550 X6CrNiNb18-10 1.4541 X6CrNiTi18-11 1.4522 G-XCrNiNb19-11 1.4301 X5CrNi18-10 1.4312 G-X10 CrNi18-8 1.4319 X2CrNi18-10 AISI/ASTM 347 321 A296 CF8c A157 Gr. C 9 321 A120 Gr. BB C a. D 304L 304 302</td>
</tr>
<tr>
<td><strong>SAS 2-IG</strong>&lt;br&gt;W 19 9 Nb&lt;br&gt;ER347</td>
<td>GTAW 1.0 Re 490 N/mm²</td>
<td>1.6</td>
<td>TUV-D, UZ, TUV-A, OBB, CL, UDT, LTSS, SEPROZ</td>
<td>GTAW rod engineered to a very precise analysis to create a weld deposit of high purity, superior hot cracking and corrosion resistance. CVN toughness down to -196 °C, resistant to intergranular corrosion up to +400 °C.</td>
<td>1.4550 X6CrNiNb18-10 1.4541 X6CrNiTi18-11 1.4522 G-XCrNiNb19-11 1.4301 X5CrNi18-10 1.4312 G-X10 CrNi18-8 1.4319 X2CrNi18-10 AISI/ASTM 347 321 A296 CF8c A157 Gr. C 9 321 A120 Gr. BB C a. D 304L 304 302</td>
</tr>
<tr>
<td><strong>SAS 2-IG (Si)</strong>&lt;br&gt;G 19 9 Nb Si&lt;br&gt;ER347Si</td>
<td>GMAW 1.0 Re 460 N/mm²</td>
<td>0.8</td>
<td>TUV-D, UZ, TUV-A, OBB, CL, UDT, LTSS, SEPROZ</td>
<td>GMAW wire designed for first class welding, wetting and feeding characteristics as well as reliable corrosion resistance up to +400 °C and low temperature service down to -196 °C.</td>
<td>1.4550 X6CrNiNb18-10 1.4541 X6CrNiTi18-11 1.4522 G-XCrNiNb19-11 1.4301 X5CrNi18-10 1.4312 G-X10 CrNi18-8 1.4319 X2CrNi18-10 AISI/ASTM 347 321 A296 CF8c A157 Gr. C 9 321 A120 Gr. BB C a. D 304L 304 302</td>
</tr>
<tr>
<td><strong>SAS 2-FD</strong>&lt;br&gt;T 19 9 Nb R M (C) 3&lt;br&gt;E347T1-4(1)</td>
<td>FCAW 1.0 Re 420 N/mm²</td>
<td>1.2</td>
<td>TUV-D, UZ, TUV-A, OBB, CL, UDT, LTSS, SEPROZ</td>
<td>Rutile flux cored welding wire. This product achieves high productivity and is easy to operate achieving excellent welding characteristics, self releasing slag, almost no spatter formation and temper discoloration, smooth weld finish and safe penetration. Increased travel speeds as well as little demand for cleaning and pickling provide considerable savings in time and money. Suitable for service temperatures from -196 °C to +400 °C.</td>
<td>1.4550 X6CrNiNb18-10 1.4541 X6CrNiTi18-11 1.4522 G-XCrNiNb19-11 1.4301 X5CrNi18-10 1.4312 G-X10 CrNi18-8 1.4319 X2CrNi18-10 AISI/ASTM 347 321 A296 CF8c A157 Gr. C 9 321 A120 Gr. BB C a. D 304L 304 302</td>
</tr>
<tr>
<td><strong>SAS 2 PW-FD</strong>&lt;br&gt;T 19 9 Nb P M (C) 1&lt;br&gt;E347T1-4(1)</td>
<td>FCAW 1.0 Re 420 N/mm²</td>
<td>1.2</td>
<td>TUV-D, UZ, TUV-A, OBB, CL, UDT, LTSS, SEPROZ</td>
<td>Rutile flux cored welding wire with fast freezing slag providing excellent positional welding characteristics and fast travel speeds.</td>
<td>1.4550 X6CrNiNb18-10 1.4541 X6CrNiTi18-11 1.4522 G-XCrNiNb19-11 1.4301 X5CrNi18-10 1.4312 G-X10 CrNi18-8 1.4319 X2CrNi18-10 AISI/ASTM 347 321 A296 CF8c A157 Gr. C 9 321 A120 Gr. BB C a. D 304L 304 302</td>
</tr>
<tr>
<td><strong>Wire: SAS 2-UP</strong>&lt;br&gt;S 19 9 Nb&lt;br&gt;ER347</td>
<td>SAW 1.06 Re 2420 N/mm²</td>
<td>3.0</td>
<td>TUV-D, UZ, TUV-A, OBB, CL, UDT, LTSS, SEPROZ</td>
<td>SAW-wire/flux combination, smooth beads, easy slag removal without any slag residues and good welding characteristics even for fillet welds are very much appreciated by users. Suitable for service temperatures from -196 °C to +400 °C. The fluoride-basic, agglomerated flux, provides a low flux consumption. Basicity 2.3, Density 1.0 kg/dm³.</td>
<td>1.4550 X6CrNiNb18-10 1.4541 X6CrNiTi18-11 1.4522 G-XCrNiNb19-11 1.4301 X5CrNi18-10 1.4312 G-X10 CrNi18-8 1.4319 X2CrNi18-10 AISI/ASTM 347 321 A296 CF8c A157 Gr. C 9 321 A120 Gr. BB C a. D 304L 304 302</td>
</tr>
</tbody>
</table>

**Basicity 2.3, Density 1.0 kg/dm³.**

**Flux: BB 202 SA FB 2 DC**
### Stainless steels – Austenitic

<table>
<thead>
<tr>
<th>BÖHLER</th>
<th>Welding process</th>
<th>Typical mechanical properties</th>
<th>Sizes (mm)</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOEHLER</strong> Standard EN AWS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FOX SAS 4</strong> E 19 12 3 Nb B 22 E318-15</td>
<td>SMAW</td>
<td>C 0.03 Si 0.4 Mn 1.3 Cr 18.8 Mo 2.7 Ni 11.5 Nb +</td>
<td>Re 490 N/mm² Rm 660 N/mm² Av 120 J ≥32 J…-90°C</td>
<td>2.5 3.2 4.0</td>
<td>TUV-D, UZ, TUV-A, OBB, DB, ABS, GL, UDT, SEPROZ, SEPROZ, VUZ</td>
</tr>
<tr>
<td><strong>FOX SAS 4-A</strong> E 19 12 3 Nb R 32 E 318-17</td>
<td>SMAW</td>
<td>C 0.03 Si 0.8 Mn 0.8 Cr 19.0 Mo 2.7 Ni 11.5 Nb +</td>
<td>Re 520 N/mm² Rm 700 N/mm² Av 150 J ≥32 J…-120°C</td>
<td>1.0 1.2 2.4 3.0</td>
<td>TUV-D, UZ, TUV-A, CL, OBB, DB, UDT, LTSS, SEPROZ, SEPROZ, VUZ</td>
</tr>
<tr>
<td><strong>SAS 4-IG</strong> W 19 12 3 Nb ER318</td>
<td>GTAWE</td>
<td>C 0.04 Si 0.4 Mn 1.7 Cr 19.2 Mo 2.7 Ni 11.5 Nb +</td>
<td>Re 490 N/mm² Rm 640 N/mm² Av 60 J ≥32 J…-60°C</td>
<td>2.5 3.2 4.0</td>
<td>TUV-D, UZ, SEPROZ, VUZ</td>
</tr>
<tr>
<td><strong>SAS 4-IG (Si)</strong> G 19 12 3 Nb Si ER318(mod.)</td>
<td>GMAW</td>
<td>C 0.035 Si 0.8 Mn 1.4 Cr 19.0 Mo 2.8 Ni 11.5 Nb +</td>
<td>Re 490 N/mm² Rm 670 N/mm² Av 100 J ≥32 J…-120°C</td>
<td>1.0 1.6</td>
<td>TUV-D, UZ, SEPROZ, VUZ</td>
</tr>
<tr>
<td><strong>SAS 4-FD</strong> T 19 12 3 Nb R M (C) 3 E318T0-4(1)</td>
<td>FCAW</td>
<td>C 0.03 Si 0.6 Mn 1.3 Cr 18.8 Mo 2.6 Ni 12.2 Nb +</td>
<td>Re 430 N/mm² Rm 570 N/mm² Av 65 J ≥35 J…-120°C</td>
<td>1.2 1.6</td>
<td>TUV-D, UZ, SEPROZ, VUZ</td>
</tr>
<tr>
<td><strong>SAS 4 PW-FD</strong> T 19 12 3 Nb P M (C) 1 E318Ti-4(1)</td>
<td>FCAW</td>
<td>C 0.03 Si 0.6 Mn 1.3 Cr 18.8 Mo 2.6 Ni 12.2 Nb +</td>
<td>Re 430 N/mm² Rm 570 N/mm² Av 65 J ≥35 J…-120°C</td>
<td>1.2</td>
<td>TUV-D, UZ, SEPROZ, VUZ</td>
</tr>
<tr>
<td><strong>Wire: SAS 4-UP</strong> S 19 12 3 Nb ER318 Flux: BB 202 SA FB 2 DC</td>
<td>SAW</td>
<td>C 0.025 Si 0.65 Mn 1.3 Cr 18.8 Mo 2.7 Ni 11.4 Nb +</td>
<td>Re ≥430 N/mm² Rm ≥630 N/mm² Av ≥80 J ≥32 J…-120°C</td>
<td>3.0</td>
<td>TUV-D, UZ, SEPROZ, UDT</td>
</tr>
</tbody>
</table>

### BÖHLER WELDING Consumables for the chemical and petrochemical process industry

**Base metals**

- **AI**
- **S31653**
- **AISI**
- **316Cb**
- **316L**
- **316Ti**
- **UNS**

---

**Typical analysis (w/o Nb +)**

- Ni 11.4 Mo 2.7 Cr 18.8 Mn 1.3 Si 0.65
- Ni 11.5 Mo 2.6 Cr 18.8 Si 0.6
- Ni 11.5 Mo 2.7 Cr 19.5 Mn 1.7 Si 0.4
- Ni 11.5 Mo 2.7 Cr 18.8 Mn 1.3 Si 0.6
- Ni 11.5 Mo 2.7 Cr 19.0 Mn 1.7 Si 0.4

**Typical analysis (w/ Nb +)**

- Ni 12.2 Mo 2.6 Cr 18.8 Mn 1.3 Si 0.6
- Ni 12.2 Mo 2.7 Cr 18.8 Mn 1.3 Si 0.6

**Mechanical properties**

- Re ≥430 N/mm²
- Rm ≥630 N/mm²
- Av ≥80 J

**Sizes**

- 2.0
- 2.5
- 3.0
- 4.0
- 5.0

**Approvals**

- TÜV-D
- UZ
- TÜV-A
- OBB, DB, ABS, GL, UDT, SEPROZ

---

**Chemical composition**

- X6 CrNiMoNb 17-12-2 (1.4580)
- X6 CrNiMoTi 17-12-2 (1.4571)
- X6 CrNiMo 17-12-2 (1.4580)
- X6 CrNiMoNb 17-12-2 (1.4583)
- X2 CrNiMo 18-14-3 (1.4436)
- X2 CrNiMo 17-12-2 (1.4404)
- X5 CrNiMo 17-12-2 (1.4401)

---

**Characteristics and applications**

- Basicity 2.3, Density 1.0 kg/dm³
- Suitable for service temperatures from -120 °C to +400 °C
- The product is resistant to intergranular corrosion up to +400 °C
Stainless steels – Austenitic

<table>
<thead>
<tr>
<th>BOHLER Standard EN AWS</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX CN 20/25M</strong></td>
<td>SMAW</td>
<td>C 0.04</td>
<td>Re 440 N/mm²</td>
<td>2.5</td>
<td>TÜV-D, TÜV-A, UDT, SEPROZ,</td>
<td>Basic (with rutile contents) coated core wire alloyed electrode for corrosion resisting high-molybdenum Cr-Ni steels like 1.4539 / N08904. Recommended for highly corrosive environments encountered e.g. in the chemical industry, in flue gas desulphurisation and sea water desalination plants, as well as in cooling and power plants using brackish or sea water. Particularly recommended for steels containing up to 5 % molybdenum. The above average molybdenum content (6.5 %) is characteristic to FOX CN 20/25 M, thus compensating for segregation in high molybdenum alloyed weld metals. The fully austenitic weld metal possess a marked resistance towards pitting and crevice corrosion in chloride containing media. Highly resistant against Sulphur-, Phosphorus-, Acetic- and Formic acid, as well as sea and brackish water. Caused from the low C-content of the weld metal, the risk of intergranular corrosion can be avoided. The high Ni-content in comparison to standard Cr-Ni-weld metals leads to high resistance against stress corrosion cracking. It is advisable to grind out the end craters of root passes. For root pass welding it is expedient to apply the GTAW process using CN 20/25 M-IG. FOX CN 20/25 M-A is a rutile-basic coated electrode and should be preferably used up to wall thicknesses of 14 mm. It is designed for excellent operating characteristics on DC/AC.</td>
<td>1.4539 X1NiCrMoCu25-20-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Si 0.4</td>
<td>Rm 650 N/mm²</td>
<td>3.2</td>
<td></td>
<td></td>
<td>1.4439 X2CrNiMoN17-13-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 20.0</td>
<td>AS 35 %</td>
<td>4.0</td>
<td></td>
<td></td>
<td>1.4537 X1CrNiMoCu25-25-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mo 6.5</td>
<td>Av 75 J</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 35.0</td>
<td>≥32 J…269°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cu 1.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N 0.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FOX CN 20/25M-A</strong></td>
<td>SMAW</td>
<td>C 0.03</td>
<td>Re 410 N/mm²</td>
<td>2.5</td>
<td>TÜV-D, UDT, SEPROZ,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Si 0.7</td>
<td>Rm 640 N/mm²</td>
<td>3.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mn 2.0</td>
<td>AS 34 %</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 20.5</td>
<td>Av 70 J</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mo 6.2</td>
<td>≥32 J…196°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 35.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cu 1.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N 0.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PREN ≥45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CN 20/25M-IG</strong></td>
<td>GTAW</td>
<td>C 0.02</td>
<td>Re 440 N/mm²</td>
<td>1.6</td>
<td>TÜV-D, TÜV-A, UDT, SEPROZ,</td>
<td>GTAW rod and GMAW wire for 4-5 % Mo alloyed CrNi steels like N08904. The weld metal shows a stable austenitic microstructure with excellent pitting resistance (PREN &gt;45) and crevice corrosion resistance as well as resistance to stress corrosion cracking. Both rod and wire have an increased Mo content (6.2 %) to compensate for segregation in high Mo alloyed weld metals, thus producing equivalent corrosion resistance to the relevant base metals offering 4-5 % Mo.</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Si 0.7</td>
<td>Rm 670 N/mm²</td>
<td>2.0</td>
<td></td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mn 2.0</td>
<td>AS 42 %</td>
<td>2.4</td>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 20.0</td>
<td>Av 115 J</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mo 6.2</td>
<td>≥32 J…269°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 35.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cu 1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N 0.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PREN ≥45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CN 20/25M-IG (Si)</strong></td>
<td>GMAW</td>
<td>C 0.02</td>
<td>Re 410 N/mm²</td>
<td>0.8</td>
<td>TÜV-D, TÜV-A, UDT, SEPROZ,</td>
<td>Shielding gases for GMAW Ar + 20-30 % He + max. 2% CO₂ or Ar + 2% He + 0.5 % CO₂.</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Si 0.7</td>
<td>Rm 650 N/mm²</td>
<td>1.0</td>
<td></td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mn 4.7</td>
<td>AS 39 %</td>
<td>1.2</td>
<td></td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 20.0</td>
<td>Av 100 J</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mo 6.2</td>
<td>≥32 J…196°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 35.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cu 1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N 0.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PREN ≥45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sizes**: mm

**Characteristics and applications**

**Base metals**

<table>
<thead>
<tr>
<th>UNS</th>
<th>ASTM</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>N08904</td>
<td>1.4439</td>
<td>1.4301</td>
</tr>
<tr>
<td>S31726</td>
<td>1.4539</td>
<td>1.4557</td>
</tr>
<tr>
<td>X1NiCrMoCu25-20-5</td>
<td>1.4537</td>
<td>1.4557</td>
</tr>
<tr>
<td>X2CrNiMoN17-13-5</td>
<td>1.4439</td>
<td>1.4557</td>
</tr>
</tbody>
</table>
Stainless steels – Ferritic / Martensitic

<table>
<thead>
<tr>
<th>BÖHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>%</td>
<td></td>
<td>mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOX KW 10</td>
<td>SMAW</td>
<td>C 0.08</td>
<td>PWHT ≥ 750 °C/2h</td>
<td>0.07</td>
<td>Cr 13.5</td>
<td>2.5</td>
</tr>
<tr>
<td>E 13 B 2 2</td>
<td></td>
<td>Si 0.7</td>
<td>Re ≥ 530 N/mm²</td>
<td>2.0</td>
<td>Cr 210</td>
<td>3.2</td>
</tr>
<tr>
<td>E410-15(mod.)</td>
<td></td>
<td>Mn 0.8</td>
<td>Rm 700 N/mm²</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KW 10-IG</td>
<td>GTAW</td>
<td>C 0.08</td>
<td>PWHT ≥ 720 °C/2h</td>
<td>1.1</td>
<td>Cr 14.5</td>
<td>2.0</td>
</tr>
<tr>
<td>W Z 13 (GTAW)</td>
<td></td>
<td>Si 0.6</td>
<td>Re ≥ 550 N/mm²</td>
<td>2.0</td>
<td>Cr 210</td>
<td>3.2</td>
</tr>
<tr>
<td>G Z 13 (GMAW)</td>
<td></td>
<td>Mn 0.6</td>
<td>Rm ≥ 500 N/mm²</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER410(mod.)</td>
<td></td>
<td>Cr 14.5</td>
<td>A5 ≤ 15%</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER409Cb</td>
<td></td>
<td></td>
<td>HB 320 (as welded)</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K W 5 Nb-IG</td>
<td>GMAW</td>
<td>C 0.05</td>
<td>PWHT ≥ 720 °C/2h</td>
<td>0.6</td>
<td>Cr 11.5</td>
<td>1.0</td>
</tr>
<tr>
<td>G Z 13 Nb L</td>
<td></td>
<td>Si 0.6</td>
<td>Re ≥ 500 N/mm²</td>
<td>2.0</td>
<td>Cr 210</td>
<td>3.2</td>
</tr>
<tr>
<td>ER409Cb</td>
<td></td>
<td>Mn 0.6</td>
<td>Rm ≥ 500 N/mm²</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nb *</td>
<td>A5 ≤ 15%</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOX SKWA</td>
<td>SMAW</td>
<td>C 0.08</td>
<td>PWHT ≥ 750°C/2h</td>
<td>0.3</td>
<td>Cr 17.0</td>
<td>2.5</td>
</tr>
<tr>
<td>E 17 B 2 2</td>
<td></td>
<td>Si 0.6</td>
<td>Re ≥ 500 N/mm²</td>
<td>2.0</td>
<td>Cr 210</td>
<td>3.2</td>
</tr>
<tr>
<td>E430-15</td>
<td></td>
<td>Mn 0.6</td>
<td>Rm ≥ 500 N/mm²</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SKWA-IG</td>
<td>GMAW</td>
<td>C 0.07</td>
<td>PWHT ≥ 750°C/2h</td>
<td>0.3</td>
<td>Ti *</td>
<td>1.0</td>
</tr>
<tr>
<td>G Z 17 Ti</td>
<td></td>
<td>Si 0.6</td>
<td>Re ≥ 500 N/mm²</td>
<td>2.0</td>
<td>Cr 210</td>
<td>3.2</td>
</tr>
<tr>
<td>ER430(mod.)</td>
<td></td>
<td>Mn 0.6</td>
<td>Rm ≥ 500 N/mm²</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KWA-IG</td>
<td>GMAW</td>
<td>C 0.06</td>
<td>PWHT ≥ 800°C/2h</td>
<td>0.6</td>
<td>Cr 17.5</td>
<td>1.2</td>
</tr>
<tr>
<td>G 17</td>
<td></td>
<td>Si 0.6</td>
<td>Re ≥ 500 N/mm²</td>
<td>2.0</td>
<td>Cr 210</td>
<td>3.2</td>
</tr>
<tr>
<td>ER430(mod.)</td>
<td></td>
<td>Mn 0.6</td>
<td>Rm ≥ 500 N/mm²</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base metals</td>
<td></td>
<td>Cr 12%</td>
<td>A5 ≥ 20%</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rm ≥ 500 N/mm²</td>
<td>4.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surfacings:</td>
<td></td>
<td></td>
<td>Re ≥ 340 N/mm²</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PWHT a 800 °C/2h</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HB 150</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Surfacings:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>all weldable backing materials, unalloyed and low-alloyed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Weld joints:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>corrosion resistant Cr-steels as well as other similar-alloyed steels with C-contents ≤ 0.2 % (repair welding), heat resistant Cr-steels of similar chemical composition. Be careful with dilution and welding technology.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Stainless steels – Ferritic / Martensitic

<table>
<thead>
<tr>
<th>BOHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX SKWAM</strong>&lt;br&gt;E Z 17 Mo B 2 2&lt;br&gt;–</td>
<td>SMAW</td>
<td>C 0.22&lt;br&gt;Si 0.4&lt;br&gt;Mn 0.4&lt;br&gt;Cr 17.0&lt;br&gt;Mo 1.3</td>
<td>PWHT ≥ 700 °C/2h&lt;br&gt;HV 250</td>
<td>2.5&lt;br&gt;3.2&lt;br&gt;4.0&lt;br&gt;5.0</td>
<td>KTA 1408.1&lt;br&gt;DB&lt;br&gt;UZ&lt;br&gt;OBB&lt;br&gt;UDT&lt;br&gt;SEPZ</td>
<td>Basic coated core wire alloyed low-hydrogen electrode with good operating characteristics in all positions except vertical-down. Mainly used for surfacing on sealing faces of gas, water and steam valves to meet stainless and heat resistant overlays for instance. In the machined condition, at least a two layer build up should remain. Joint welding of similar, stainless and heat resistant chromium steels provides matching colour of weld metal with very good ability to polishing. Hydrogen content in weld deposit &lt; 3 ml/100 g. Weld metal retention of hardness up to +500 °C. Scaling resistant up to 900 °C. Preheating as required by the base metal, with temperatures between 100 °C and 200 °C being generally sufficient (for joint welding operations 250-400 °C). Annealing at 650-750 °C may be carried out to improve the toughness values in the weld metal and in the transition zone of the base metal.</td>
<td>Surfacing; all weldable backing materials, unalloyed and low-alloyed. Joint welds: corrosion resistant Cr-steels as well as other similar-alloyed steels with C-contents up to 0.20 % (repair welding). Be careful with dilution and welding technology</td>
</tr>
<tr>
<td><strong>SKWAM-IG</strong>&lt;br&gt;G Z 17 Mo H&lt;br&gt;–</td>
<td>GMAW</td>
<td>C 0.20&lt;br&gt;Si 0.7&lt;br&gt;Mn 0.7&lt;br&gt;Cr 17.0&lt;br&gt;Mo 1.1</td>
<td>PWHT ≥ 720 °C/2 h&lt;br&gt;HV ≥500 N/mm²&lt;br&gt;Rm ≥700 N/mm²&lt;br&gt;A5 ≥15%&lt;br&gt;HV 200</td>
<td>1.2&lt;br&gt;1.6</td>
<td>KTA 1408.1&lt;br&gt;DB&lt;br&gt;UZ&lt;br&gt;OBB&lt;br&gt;SEPROZ&lt;br&gt;UDT</td>
<td>GMAW solid wire of type 17 % Cr 1 % Mo for surfacing on sealing faces of gas, water and steam valves and fittings made from unalloyed or low-alloy steels, for service temperatures up to 450 °C. Excellent anti-friction properties. The weld deposit is still machinable. Scaling resistant up to 900 °C. SKWAM-IG wire is also suited for joint welding of stainless ferritic steels containing 15-18 % chromium, above all for applications where uniform colour of the base metal and weld seam is required. For thick-walled components it is recommendable to use A 7-IG wire for the filler passes in order to improve the ductility behaviour of the joint weld. Preheating to 250-450 °C for joint welding operations. Annealing at 650-750 °C improves the toughness of the weld deposit.</td>
<td></td>
</tr>
<tr>
<td><strong>Wire: SKWAM-UP</strong>&lt;br&gt;S Z 17Mo H&lt;br&gt;Flux: BB 203</td>
<td>SAW</td>
<td>C 0.16&lt;br&gt;Si 0.6&lt;br&gt;Mn 0.7&lt;br&gt;Cr 17.0&lt;br&gt;Mo 1.1</td>
<td>PWHT ≥ 720 °C/2 h&lt;br&gt;HV ≥500 N/mm²&lt;br&gt;Rm ≥700 N/mm²&lt;br&gt;A5 ≥15%&lt;br&gt;HV 200</td>
<td>3.2</td>
<td>TÜV-D</td>
<td>SAW wire/flux combination of type 17 % Cr 1 % Mo for surfacing on sealing faces of gas, water and steam valves and fittings made from unalloyed or low-alloy steels, for service temperatures up to 450 °C. Excellent anti-friction properties. The weld deposit is still machinable. Scaling resistant up to 900 °C</td>
<td></td>
</tr>
<tr>
<td><strong>CAT 430 L Cb-IG</strong>&lt;br&gt;G Z 18 Nb L&lt;br&gt;ER430(mod.)</td>
<td>GMAW</td>
<td>C ≥0.02&lt;br&gt;Si 0.5&lt;br&gt;Mn 0.5&lt;br&gt;Cr 18.0&lt;br&gt;Nb ≥12xC</td>
<td>PWHT ≥ 760 °C/2 h&lt;br&gt;HV 130</td>
<td>1.0</td>
<td>–</td>
<td>Special GMAW welding wire for catalytic converters as well as exhaust sinencers, mufflers, manifolds and manifold elbows of analogous or similar materials. Resists scaling up to 900 °C. Outstanding feeding characteristics. Very good welding and flow characteristics.</td>
<td>1.4511&lt;br&gt;1.4016&lt;br&gt;430</td>
</tr>
</tbody>
</table>
## Stainless steels – Soft martensitic

<table>
<thead>
<tr>
<th>BOHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX CN 13/4</strong></td>
<td>SMAW</td>
<td>C 0.035 Si 0.3</td>
<td>PWHT a 600 °C/2h Re 680 N/mm²</td>
<td>2.5</td>
<td>TÜV-D, UDT, SEPROZ</td>
<td>Basic coated low-hydrogen electrode suited for similar soft martensitic and martensitic-ferritic rolled, forged, and cast steels. Mainly used in the construction of hydro turbines, compressors. Resistant to corrosion from water, steam, and sea water atmosphere. Thanks to an optimum balance of alloying components the weld deposit yields very good ductility and toughness &amp; cracking resistance despite of its high strength. Excellent operating characteristics, easy slag removal, and smooth bead appearance. Metal recovery approx. 130 %. Positional weldability is offered up to ø 3.2 mm electrodes.</td>
<td>1.4371 G-XCrNiNMo13-4, 1.4370 X1CrNiNMo13-4, 1.4331 X2CrNiN13-4, 1.4414 X4CrNiMoN13-4</td>
</tr>
<tr>
<td>E 13 4 B 4 2</td>
<td></td>
<td>Cr 12.2 Mo 0.5</td>
<td>Rm 910 N/mm²</td>
<td>3.2</td>
<td></td>
<td></td>
<td>AISI/UNS ACI Gr. CA6NM S41500</td>
</tr>
<tr>
<td>E410NiMo-25</td>
<td></td>
<td>Ni 4.5</td>
<td>Av 66 J</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **FOX CN 13/4 SUPRA**        | SMAW            | C 0.03 Si 0.3    | PWHT a 600 °C/2h Re 680 N/mm²| 3.2   | TÜV-D, UDT, SEPROZ   | Basic coated core wire alloyed electrode for welding of similar alloyed soft martensitic steels. Due to an optimum balanced alloying concept the weld deposit offers very good ductility and cracking resistance despite of its high strength. Out of position weldable except vertical down. Preheating and interpass temperatures of heavy-wall components 100-160 °C. Maximum heat input 15 kJ/cm. Post weld heat treatment at 580-620 °C. |                                      |
| E 13 4 B 4 2                 |                 | Cr 12.5 Mo 0.5   | Av 70 J                       | 4.0   |                      |                                                                                                                 |                                      |
| E410NiMo-15                  |                 | Ni 4.5           | 55 J...-60°C                  | 5.0   |                      |                                                                                                                 |                                      |

| **CN 13/4-IG**               | GTAW            | C ≤0.02 Si 0.7   | PWHT 600 °C/3h8 Re 750 N/mm²  | 2.0   | TÜV-D, UDT, SEPROZ   | GTAW rod and GMAW wire for welding of similar alloyed soft martensitic steels, with precisely tuned alloying composition for ductile weld metal with best CVN toughness and crack resistance. The preferred gas for MAG welding is Argon +8-10 % CO₂. | 1.4505 G-X5CrNiMo16-5, 1.4301 X10CrNi16-5 |
| W 13 4 (GTAW)                |                 | Mn 0.6 Cr 12.3   | Rm 830 N/mm²                  | 2.4   |                      |                                                                                                                 | AISI/UNS ACI Gr. CA6NM S41500         |
| G 13 4 (GMAW)                |                 | Mo 0.5 Ni 4.7   | Av 150 J                      | 1.2   |                      |                                                                                                                 |                                      |
| E410NiMo(mod.)               |                 |                 | ≥32 J...-60°C                 |       |                      |                                                                                                                 |                                      |

| **CN 13/4-MC**               | FCAW            | C ≤0.025 Si 0.9  | PWHT 580 °C/3h8 Re 760 N/mm²  | 1.6   | SEPROZ               | Metal cored wire for welding of similar alloyed soft martensitic steels and cast steels. CN 13/4-MC offers favourable spray or pulsed arc characteristics, minimum spatter formation, flat and smooth bead profiles, an excellent wetting behaviour and safe penetration as well as best productivity. Best impact values and extra low hydrogen contents (< 4 ml/100 g acc. to AWS 4.3-93). Recommended preheating and interpass temperatures in case of heavy wall thicknesses are 100-160 °C. Maximum heat input 15 kJ/cm. Tempering at 580-620 °C. | 1.4456 G-XCrNiMo16-5, 1.4418 X4CrNiMo16-3 |
| T 13 4 MM 2                  |                 | Mn 0.9 Cr 12.0   | Rm 890 N/mm²                  |       |                      |                                                                                                                 | AISI/UNS ACI Gr. CA6NM S41500         |
| EC410NiMo(mod.)              |                 | Mo 0.6 Ni 4.6   | Av 80 J                       |       |                      |                                                                                                                 |                                      |
|                             |                 |                 | ≥47 J...-20°C                 |       |                      |                                                                                                                 |                                      |

| **Wire: CN 13/4-UP**         | SAW             | C 0.025 Si 0.20  | PWHT 600 °C/3h8 Re 2600 N/mm² | 3.0   | SEPROZ, UDT         | Sub-arc wire flux combination for welding similar soft-martensitic steels. The weld deposit featuring very good ductility and CVN toughness as well as high crack resistance. The fluoride-basic, agglomerated flux provides good operating characteristics, smooth beads and a low hydrogen weld metal (H₂ > 5 ml/100g). Recommended preheating and interpass temperatures in case of heavy wall thicknesses are 100-160 °C. Maximum heat input 15 kJ/cm. Tempering at 580-620 °C. | 14505 G-XCrNiMo16-5, 14418 X4CrNiMo16-3 |
| S 13 4                       |                 | Mn 0.6 Cr 12.1   | Rm 2800 N/mm²                 |       |                      |                                                                                                                 | AISI/UNS ACI Gr. CA6NM S41500         |
| ER410NiMo(mod.)              |                 | Ni 4.7 Mo 0.5   | Av 65 J                       |       |                      |                                                                                                                 |                                      |
| Flux: BB 203                 |                 |                 | ≥47 J...-20°C                 |       |                      |                                                                                                                 |                                      |

| **FOX CN 16/6M-HD**          | SMAW            | C 0.03 Si 0.3    | PWHT 580 °C/4h/air Re 650 N/mm²| 2.5   | TÜV-D, UDT, SEPROZ   | Basic coated, high efficiency electrode for welding of soft martensitic forged and cast steels. The high chromium content enhances the corrosion resistance in water, steam and sea atmosphere. Main applications are found in turbines, pumps- and combustion building. Popular in hydro turbine engineering. The electrode shows very good features in regard to arc stability, weld puddle control, slag detachability and seam cleanliness. Suitable for all positions except vertical down (positional welding up to a 3.2 mm). Metal recovery approx. 135 %. Low hydrogen (H₂ > 5 ml/100g) is a essential and necessary prerequisite of this product. The maximum interpass temperature should not exceed 120 °C. | 1.4416 G-XCrNiMo16-5, 1.4418 X4CrNiMo16-3 |
| E Z 16 6 Mo B 6 2 H5         |                 | Cr 15.5 Ni 5.8   | Rm 920 N/mm²                  | 3.2   |                      |                                                                                                                 | AISI/UNS ACI Gr. CA6NM S41500         |
| –                            |                 | Mo 1.1           | Av 48 J                       | 4.0   |                      |                                                                                                                 |                                      |

**BOHLER WELDING** Consumables for the chemical and petrochemical process industry
## Stainless steels – Precipitation hardening

<table>
<thead>
<tr>
<th>BÖHLER Standard EN AWS</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
</table>
| **FOX CN 17/4 PH**  
E Z 17 4 Cu B 4 3 HS  
E630-15(mod.) | SMAW | C 0.04 | Si 0.3 | Mn 0.6 | Cr 16.0 | Mo 0.4 | Ni 4.9 | Nb 0.2 | Cu 3.2 | P W H T $\pm 40\ ^\circ C$ /3h  
Re 940 N/mm² | Rm 1030 N/mm²  
A5 10%  
Av 20 J | HRC 37-40 | 3.2 | 4.0 | UDT, SEPROZ | Basic coated electrode with strength properties for joint and fabrication welding of analogous precipitation hardening Cr-Ni-Cu alloyed rolled-, forged- and cast steels. Popular for components in the paper industry, rotors of compressors, fan blades, press plates in the plastic processing industry and for the aerospace industry. The electrode shows very good features in regard to arc stability, weld puddle control, slag detachability and seam cleanliness. Lowest hydrogen content in the deposit is a prerequisite (H D $< 5 $ ml/100 g). The electrode is suitable for welding in all positions except vertical down. The interpass temperature has to be kept very low (maximum 80 °C). With the use of the proper PWHT (solution annealing + precipitation hardening impact values down to -50 °C are still achievable. |

## Stainless steels – Duplex / Superduplex

<table>
<thead>
<tr>
<th>BÖHLER Standard EN AWS</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
</table>
| **FOX CN 22/9 N**  
E 22 9 3 N L R 3 2  
E2209-17 | SMAW | C ≤0.03 | Si 0.3 | Mn 0.8 | Cr 23.0 | Mo 3.2 | Ni 9.0 | N 0.17 | PREN ≥35 | Re 650 N/mm²  
Rm 820 N/mm²  
A5 25 %  
Av $\geq 55 $ J $\leq 22 $ J $\leq -20 $ °C | 2.5 | 3.2 | 4.0 | 5.0 | TUV-D, TUV-A, DNV, CL, UDT, FI, GL, RINA, SEPROZ | FOX CN 22/9 N is a rutile-basic coated electrode which offers excellent positional weldability and thus is perfectly suited for pipe welding of grade UNS S31803. Good wetting characteristics and slag removability. Resistant to porosity, reliable CVN toughness down to -20 °C. It is designed with a fully alloyed core wire providing best corrosion resistance and a very homogeneous micro structure with specified ferrite content of 30 - 60 FN (WRC). |
| **FOX CN 22/9 N-B**  
E 22 9 3 N L B 2 2  
E2209-15 | SMAW | C ≤0.03 | Si 0.3 | Mn 0.1 | Cr 23.0 | Mo 3.2 | Ni 8.8 | N 0.16 | PREN ≥35 | Re 630 N/mm²  
Rm 830 N/mm²  
A5 27 %  
Av $\geq 102 $ J $\geq 40 $ J $\leq -60 $ °C | 2.5 | 3.2 | 4.0 | 5.0 | TUV-D, CL, UDT | The basic coated electrode FOX CN 22/9 N-B is recommended for wall thicknesses > 25 mm or impact requirements down to -60 °C |
| **CN 22/9 N-IG**  
W' 22 9 3 N L (GTAW)  
G 22 9 3 N L (GMAW)  
ER2209 | GTAW | C ≤0.015 | Si 0.4 | Mn 0.46 | Cr 22.6 | Mo 3.2 | Ni 8.8 | N 0.15 | PREN ≥35 | Re 600 N/mm²  
Rm 800 N/mm²  
A5 33 %  
Av $\geq 150 $ J $\geq 2 $ J $\leq -60 $ °C | 1.6 | 2.0 | 2.4 | 3.2 | TUV-D, CL, TUV-A, LR, DNV, CL, UDT, GL, ALS, Staatst. | GTAW rod and GMAW wire of type ER 2209 for standard duplex stainless steels. Designed for first class welding, wetting and feeding characteristics as well as reliable resistance to stress corrosion cracking and pitting. Ferrite content 30-60 FN (WRC). |

26
### Stainless steels – Duplex / Superduplex

<table>
<thead>
<tr>
<th>BOHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CN 22/9 N-FD</strong>&lt;br&gt;T 22 9 3 N L R M (C) 3&lt;br&gt;E2209T0-4(T)</td>
<td>FCAW</td>
<td>C 0.03&lt;br&gt;Si 0.8&lt;br&gt;Mn 0.9&lt;br&gt;Cr 22.7&lt;br&gt;Mo 3.2&lt;br&gt;Ni 9.0&lt;br&gt;N 0.13</td>
<td>Re 600 $N/mm^2$&lt;br&gt;Rm 800 $N/mm^2$&lt;br&gt;Av 60 J $+32...-46^\circ C$</td>
<td>12</td>
<td>TÜV-D, UDT, CL, RINA, GL, DNV, ABS, LR, CWB, SFP/OZ</td>
<td>CN 22/9 N-FD is a rutile flux cored wire for downhand welding. Self releasing slag, almost no spatter formation and temper discoloration, smooth weld finish and safe penetration. Ferring 38-308N, CPT 22 °C acc. to ASTM G48/A or A 923 method C.</td>
<td>1.4462 X2CrNiMoN22-5-3, 14462 X2CrNiMoN22-5-3 with 1.4583 X10CrNiMoNb18-12, 14462 X2CrNiMoN22-5-3 Disimilar joints, UNS S31803 S32205</td>
</tr>
<tr>
<td><strong>CN 22/9 PW-FD</strong>&lt;br&gt;T 22 9 3 N L P M (C) 1&lt;br&gt;E2209T1-4(T)</td>
<td>FCAW</td>
<td>C 0.03&lt;br&gt;Si 0.8&lt;br&gt;Mn 0.9&lt;br&gt;Cr 22.7&lt;br&gt;Mo 3.2&lt;br&gt;Ni 9.0&lt;br&gt;N 0.13</td>
<td>Re 600 $N/mm^2$&lt;br&gt;Rm 800 $N/mm^2$&lt;br&gt;Av 60 J $+32...-46^\circ C$</td>
<td>12</td>
<td>TÜV-D, UDT, CL, RINA, GL, DNV, ABS, LR, CWB, SFP/OZ</td>
<td>Rutile flux cored welding wire with fast freezing slag providing excellent positional welding characteristics and fast travel speeds.</td>
<td>1.4462 X2CrNiMoN22-5-3</td>
</tr>
<tr>
<td><strong>Wire: CN 22/9 N-UP</strong>&lt;br&gt;S 22 9 3 N L&lt;br&gt;ER 2209</td>
<td>SAW</td>
<td>C 0.015&lt;br&gt;Si 0.55&lt;br&gt;Mn 1.3&lt;br&gt;Cr 22.5&lt;br&gt;Mo 3.1&lt;br&gt;Ni 8.9&lt;br&gt;N 0.14</td>
<td>Re ≥550 $N/mm^2$&lt;br&gt;Rm ≥750 $N/mm^2$&lt;br&gt;Av ≥50 J $+32...-40^\circ C$</td>
<td>3.0</td>
<td>TÜV-D, DNV, CL, ABS, LR, UDT, GL, RINA, CWB</td>
<td>SAW-wire/flux combination of type 2209 duplex stainless steel for multi-pass welding. Smooth beads, easy slag removal without any slag residues and good welding characteristics are very much appreciated by the users. BB 203 is a basic, agglomerated flux, providing a low flux consumption. Basicity 2.3 acc. to Boniczewski.</td>
<td>1.4571 X2CrNiMoN22-5-3</td>
</tr>
<tr>
<td><strong>flux: BB 203</strong>&lt;br&gt;SA FB 2 DC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FOX CN 25/9 CuT</strong>&lt;br&gt;E 25 9 4 N L B 2 2&lt;br&gt;E2553-1S(mod.)</td>
<td>SMAW</td>
<td>C &lt;0.03&lt;br&gt;Si 0.5&lt;br&gt;Mn 1.1&lt;br&gt;Cr 25.0&lt;br&gt;Ni 9.3&lt;br&gt;Mo 3.7&lt;br&gt;N 0.22&lt;br&gt;Cu 0.7&lt;br&gt;T 0.7&lt;br&gt;PREN &gt;340</td>
<td>Re ≥600 $N/mm^2$&lt;br&gt;Rm ≥750 $N/mm^2$&lt;br&gt;Av ≥50 J $+50^\circ C$</td>
<td>2.5</td>
<td>–</td>
<td>Basic coated electrode for welding of Superduplex stainless steels. Excellent resistance to stress corrosion cracking and pitting corrosion. The operating temperature is -50 °C up to +250 °C.</td>
<td>25 % Cr-Superduplex steels e.g. 1.4501 X10CrNiMoCuWN 25-7-4&lt;br&gt;UNS S32760 S32760 S32750 ZERON 100, SAF 25/07, PALL 100</td>
</tr>
<tr>
<td><strong>CN 25/9 CuT-IG</strong>&lt;br&gt;W 25 9 4 N L (GTAW)&lt;br&gt;G 25 9 4 N L (GMAW)&lt;br&gt;ER2553(mod.)</td>
<td>GTAW</td>
<td>C 0.02&lt;br&gt;Si 0.3&lt;br&gt;Mn 1.5&lt;br&gt;Cr 25.5&lt;br&gt;Ni 9.5&lt;br&gt;Mo 3.7&lt;br&gt;N 0.22&lt;br&gt;Cu 0.8&lt;br&gt;T 0.6&lt;br&gt;PREN &gt;340</td>
<td>Re ≥600 $N/mm^2$&lt;br&gt;Rm ≥750 $N/mm^2$&lt;br&gt;Av ≥80 J $+50^\circ C$</td>
<td>2.0</td>
<td>–</td>
<td>GTAW rod and GMAW wire for welding of Superduplex stainless steels. Excellent resistance to stress corrosion cracking and pitting corrosion. The operating temperature is -30 °C up to +250 °C.</td>
<td>Shielding gases for GMAW Ar + 20-30 % He + max. 2 % CO2 or Ar + 20-30 % He + max. 1 % O2. For applications requiring low hydrogen, we offer the product CN 25/9 COT-IG-LH with hydrogen content guaranteed less than 3 ppm.</td>
</tr>
<tr>
<td></td>
<td>GMAW</td>
<td>C 0.02&lt;br&gt;Si 0.3&lt;br&gt;Mn 1.5&lt;br&gt;Cr 25.5&lt;br&gt;Ni 9.5&lt;br&gt;Mo 3.7&lt;br&gt;N 0.22&lt;br&gt;Cu 0.8&lt;br&gt;T 0.6&lt;br&gt;PREN &gt;340</td>
<td>Re ≥650 $N/mm^2$&lt;br&gt;Rm ≥800 $N/mm^2$&lt;br&gt;Av ≥80 J $+50^\circ C$</td>
<td>1.0</td>
<td>–</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Special applications

<table>
<thead>
<tr>
<th>BOHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOX A 7</td>
<td>SMAW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| E 18 8 Mn B 22 |           | C 0.1            | Re 460 N/mm²                | 2.5   | TÜV-D     | Basic resp. rutile basic coated stainless steel electrodes. Very popular for numerous applications. The weld deposit offers exceptionally high ductility and elongation together with crack resistance. There is no fear of embrittlement when operating between -110 °C and +850 °C above can be PWHT without any problems. The deposit will work harden and offers good resistance against cavitation. Ductility is good even after high dilution when welding problem steels or when subjected to thermal shock or scaling. An excellent alloy providing cost effective performance. | For fabrication, -repair and maintenance! Dissimilar joints, tough buffer and intermediate layers prior to hardfacing, 14 % manganese steels, 13-17 % Cr heat resistant steels, armour plates, high carbon and quenched & tempered steels, 
| E307-15(mod.) |                 | Si 0.7            | Rm 660 N/mm²                 | 3.2   | DIN, GL   |                                  |             |
|          |                  | Mn 6.5            |                           | 4.0   | TÜV-D     |                                  |             |
|          |                  | Cr 18.8           | Av 90 J                     | 5.0   | SEPROZ    |                                  |             |
|          |                  | Ni 8.8            | ≥32 J up to +110 °C         | 6.0   | SEPROZ    |                                  |             |
| FOX A 7-A | SMAW           |                  |                              |       |           |                                  |             |
| E 18 9 Mn Mo R 32 |          | C 0.1            | Re 520 N/mm²                | 2.5   | TÜV-D     |                                  |             |
| E307-16(mod.) |                 | Si 1.2            | Rm 720 N/mm²                | 3.2   | DIN, UDT  |                                  |             |
|          |                  | Mn 4.2            |                           | 4.0   | DIN, UDT  |                                  |             |
|          |                  | Cr 19.5           | Av 75 J                     | 4.0   | SEPROZ    |                                  |             |
|          |                  | Mo 0.7            | ≥32 J up to -100 °C        | 5.0   | SEPROZ    |                                  |             |
|          |                  | Ni 8.5            |                              |       |           |                                  |             |
| A 7 CN-IG | GTA W          |                  |                              |       |           |                                  |             |
| W 18 8 Mn |                 | C 0.08           | Re 430 N/mm²                | 1.6   | TÜV-D     | GTAW rod and GMAW wire. Very popular stain- |             |
| ER307(mod.) |                 | Si 0.9            | Rm 640 N/mm²                | 2.0   | DIN, UDT  | less-steel wires for numerous applications. The weld deposit offers exceptionally high ductility and elongation together with crack resistance. There is no fear of embrittlement when operating between -110 °C and +850 °C above can be PWHT without any problems. |             |
|          |                  | Mn 7.0            |                           | 2.4   | DIN, UDT  |                                  |             |
|          |                  | Cr 1.0            | Av ≥32 J up to -110 °C     | 3.0   | SEPROZ    |                                  |             |
|          |                  | Ni 9.0            |                              |       |           |                                  |             |
| A 7-IG   | GMAW            |                  |                              |       |           |                                  |             |
| G 18 8 Mn |                 | C 0.08           | Re 430 N/mm²                | 0.8   | TÜV-D     |                                  |             |
| ER307(mod.) |                 | Si 0.9            | Rm 640 N/mm²                | 1.0   | DIN, UDT  |                                  |             |
|          |                  | Mn 7.0            |                           | 1.2   | DIN, UDT  |                                  |             |
|          |                  | Cr 19.2           | Av ≥32 J up to -110 °C     | 1.6   | SEPROZ    |                                  |             |
|          |                  | Ni 9.0            |                              |       |           |                                  |             |
| A 7-FD   | FCAW            |                  |                              |       |           |                                  |             |
| T 18 8 Mn R M (C) 3 |          | C 0.1            | Re 420 N/mm²                | 1.2   | –         | Rutile flux cored welding wire. These products achieve high productivity and are easy to operate achieving excellent welding characteristics, self releasing slag, almost no spatter formation and temper discolouration, smooth weld finish and safe penetration. The weld deposit offers exceptionally high ductility and elongation together with crack resistance. There is no fear of embrittlement when operating between -100 °C and +850 °C above can be PWHT without any problems. |             |
| E307T1-G |                 | Si 0.8            | Rm 630 N/mm²                | 1.6   | –         | A7 PW-FD is a rutile flux cored welding wire with fast freezing slag providing positional welding characteristics and fast travel speeds. |             |
|          |                  | Mn 6.8            |                           |       | –         |                                  |             |
|          |                  | Cr 19.0           | Av ≥32 J up to -110 °C     |       | –         |                                  |             |
|          |                  | Ni 9.0            |                              |       | –         |                                  |             |
| A 7 PW-FD | FCAW           |                  |                              |       |           |                                  |             |
| T 18 8 Mn P M (C) 2 |          | C 0.1            | Re 420 N/mm²                | 1.2   | –         |                                  |             |
| E307T1-G |                 | Si 0.8            | Rm 630 N/mm²                |       | –         |                                  |             |
|          |                  | Mn 6.8            |                           |       | –         |                                  |             |
|          |                  | Cr 19.0           | Av ≥32 J up to -110 °C     |       | –         |                                  |             |
|          |                  | Ni 9.0            |                              |       | –         |                                  |             |
| Wire: A 7 CN-UP | SAW |                  |                              |       |           |                                  |             |
| S 18 8 Mn |                 | C 0.08           | ≥390 N/mm²                  | 3.0   | UDT       | SAW wire/wire combination for numerous applications. A 7 CN-UP / BB 203 yields a weld deposit offering exceptionally high ductility and elongation together with outstanding crack resistance. There is no fear of embrittlement when operating down to service temperatures of -110 °C or above 500 °C. The scaling resistance goes up to 850 °C. When working at service temperatures above 650 °C please contact the supplier. The weld metal can be post weld heat treated without any problems. The deposit will work harden and offers good resistance against cavitation. Ductility is good even after high dilution when welding problem steels or when subjected to thermal shock or scaling. An excellent alloy providing cost effective performance. Preheating and post weld heat treatment as required by the base metal. The fluoride-based, slagformer and flux provides good operating characteristics, smooth beads and a low hydrogen weld metal. |             |
| ER307(mod.) |                 | Si 0.9            | Rm ≥260 N/mm²               |       | –         |                                  |             |
|          |                  | Mn 6.8            |                           |       | –         |                                  |             |
|          |                  | Cr 18.5           | Av 95 J                    |       | –         |                                  |             |
|          |                  | Ni 8.8            | ≥40 J up to +110 °C        |       | –         |                                  |             |
| Flux: BB 203 | SAW |                  |                              |       |           |                                  |             |
| SA FB 2 DC |                 |                  |                              |       |           |                                  |             |
|          |                  |                  |                              |       |           |                                  |             |
| FOX CN 19/9 M | SAW |                  |                              |       |           |                                  |             |
| E 20 10 3 R 32 | SMAW | C 0.04           | Re 520 N/mm²                | 2.5   | TÜV-D     | Rutil coated electrode designed for dissimilar joints and weld cladding. It offers a lower Cr and ferrite content than a 309 Mo L weld deposit with the result that carbon diffusion and Cr-carbide formation is reduced after PWHT and lower ferrite contents can be achieved in the second layer of 316 L weld claddings. Suitable for service temperatures from -80 °C to +300 °C. Safety against formation of porosity due to the moisture resistant coating | High-strength, mild steels and low-alloyed constructional steels, Q7-steels and armour plates among themselves or among each other, non-alloy as well as alloyed boiler or constructional steels with highloyally stainless Cr- and Cr-Ni-steels, austentic manganese steels and dissimilar joints. |             |
| E308Mo-17(mod.) |                 | Si 0.8            | Rm 700 N/mm²                | 3.2   | UDT       |                                  |             |
|          |                  | Mn 1.0            |                           | 4.0   | DIN, UDT  |                                  |             |
|          |                  | Cr 12.0           | Av 70 J                    | 5.0   | DIN, UDT  |                                  |             |
|          |                  | Mo 3.2            | ≥32 J up to -80 °C         |       | DIN, UDT  |                                  |             |
|          |                  | Ni 10.3           |                              |       | DIN, UDT  |                                  |             |
|          |                  | N 0.09            |                              |       | DIN, UDT  |                                  |             |
### BÖHLER WELDING
Consumables for the chemical and petrochemical process industry

#### Special applications

<table>
<thead>
<tr>
<th>BÖHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
</table>
| **CN 19/9 M-1G**  
W 20 10 L (GTAW)  
G 20 10 J (GMAW)  
ER308Mo(mod.) | GTA W  
GMA W | C 0.06  
Si 0.7  
Mo 1.3  
Cr 20.0  
Mo 3.3  
Ni 10.0 | Re 550 N/mm²  
Rm 750 N/mm²  
As 35%  
Av 150 J  
≥32 J …-80 °C | 1.6  
2.0  
2.4 | TÜV-D,  
DNV | GTAW rod and GMAW wire designed for dissimilar joints and weld cladding. It offers a lower Cr and ferrite content than a 309 Mo L weld deposit with the result that carbon diffusion and Cr-carbide formation is reduced after PWHT and lower ferrite contents can be met in the second layer of 316 L weld claddings. For GMAW shielding gas Ar + max. 2.5 % CO₂ or Ar + max. 1 % O₂ is recommended. | High-strength, mild steels and low-alloyed constructional steels; QT-steels and armour plates among themselves or among each other; non-alloy as well as alloyed boiler or constructional steels with high alloy stainless Cr- and Cr-Ni-steels; austenitic manganese steels and dissimilar joints. |
| **FOX CN 23/12-A**  
E 23 12 L R 32  
E309L-17 | SMA W  
GMA W | C 0.02  
Si 0.7  
Mo 1.3  
Cr 23.0  
Ni 12.5 | Re 440 N/mm²  
Rm 570 N/mm²  
As 40%  
Av 60 J  
≥32 J …-60 °C | 2.5  
3.2  
4.0  
5.0 | TÜV-D,  
DB,  
UTD,  
ABS,  
TÜV-A,  
UZ,  
GL,  
DNV,  
SEPROZ,  
BV,  
LR,  
CL,  
VUZ,  
OBB | Rustle coated stainless steel electrodes. Superior welding characteristics. Can be used on AC or DC. Other advantages include high current carrying capacity, minimum spatter formation, self releasing slag, smooth and clean weld profile, safety against formation of porosity due to the moisture resistant coating and its packaging into hermetically sealed tins or VAC-packs. Suitable for service temperatures from -60 °C up to +300 °C. | For welding stainless to mild steel and low alloy steel, for surfacing of mild steel and for root pass welding of clad steel and the first layer of corrosion resistant claddings on mild and low alloyed steels. |
| **CN 23/12-IG**  
W 23 12 L (GTAW)  
G 23 12 L (GMAW)  
ER309L | GTA W  
GMA W | C 0.02  
Si 0.5  
Mo 0.7  
Cr 24.0  
Ni 13.2 | Re 440 N/mm²  
Rm 590 N/mm²  
As 34%  
Av 150 J  
≥32 J …-120 °C | 1.6  
2.0  
2.4 | TÜV-D,  
TÜV-A,  
UTD,  
CL,  
SEPROZ,  
BV,  
LR,  
CL,  
VUZ,  
OBB | GTAW rod and GMAW wire designed for good welding, wetting and feeding characteristics as well as good safety after dilution when welding dissimilar joints. Suitable for service temperatures between -120 °C (GTAW) and -80 °C (GMAW) up to +300 °C. For GMAW shielding gas Ar + max. 2.5 % CO₂ or Ar + max. 1 % O₂ is recommended. | |
| **CN 23/12-FD**  
T 23 12 L R M (C) 3  
E309LT0-4(l)  
ø 0.9 mm  
T 23 12 L P M (C) 1  
E309LT1-4(l) | FCA W  
GMA W | C 0.03  
Si 0.7  
Mn 1.4  
Cr 22.8  
Ni 12.5 | Re 400 N/mm²  
Rm 540 N/mm²  
As 35%  
Av 45 J …-60 °C | 0.9  
1.2  
1.6 | TÜV-D,  
UZ,  
TÜV-A,  
GL,  
CL,  
DB,  
UZ,  
DNV,  
SEPROZ | Rustle flux cored welding wires. These products achieve high productivity and are easy to operate achieving excellent welding characteristics, self releasing slag, almost no spatter formation and temper discolouration, smooth weld finish and safe penetration. Increased travel speeds as well as little demand for cleaning and pickling provide considerable savings in time and money. Suitable for service temperatures from -60 °C up to +300 °C. | |
| **CN 23/12 PW-FD**  
T 23 12 L P M (C) 1  
E309LT1-4(l) | FCA W  
GMA W | C 0.03  
Si 0.7  
Mn 1.4  
Cr 22.8  
Ni 12.5 | Re 400 N/mm²  
Rm 540 N/mm²  
As 35%  
Av 65 J  
50 J …-60 °C  
Ar + 18% CO₂ | 1.2  
1.6  | TÜV-D,  
LR,  
UTD,  
ABS,  
SEPROZ,  
CBW,  
CL,  
DB,  
OBB  
UZ | Rustle flux cored welding wire with fast freezing slag providing excellent positional welding characteristics and fast travel speeds. | |
| **Wire: CN 23/12-UP**  
S 23 12 L  
ER309L  
Flux: BB 202  
SA FB 2 DC | SAW  
DINW | C 0.015  
Si 0.65  
Mn 1.3  
Cr 23.4  
Ni 13.1 | Re >320 N/mm²  
Rm >520 N/mm²  
As >30%  
Av >70 J | 3.0 | DNV,  
UTD  
Wire: TÜV-D | SAW wire/flux combination for welding dissimilar joints, steels with poor weldability and weld clad- dings for multi-pass welding. Smooth beads, easy slag release without any slag residues and good welding characteristics. The average ferrite content is 16 FN. Suitable for service temperatures up to +300 °C. BB 202 is a basic, agglomerated flux, providing a low flux consumption. Basicity 2.3 acc. to Boniczewski. | |
## Special applications

<table>
<thead>
<tr>
<th>BOHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX CN 23/12Mo-A</strong>&lt;br&gt;E 23 12 2 L R 32&lt;br&gt;E309MoT1-7(mod.)</td>
<td>SMAW</td>
<td>C 0.02&lt;br&gt;Si 0.7&lt;br&gt;Mn 0.8&lt;br&gt;Cr 23.0&lt;br&gt;Mo 2.7&lt;br&gt;Ni 12.5</td>
<td>Re 580 N/mm²&lt;br&gt;Rm 720 N/mm²&lt;br&gt;Av 55 J...-20 °C</td>
<td>2.0</td>
<td>TÜV-D, TÜV-A, CL, UDT, LTSS, DNV, RINA, ABS, VUZ, SEPROZ, LR</td>
<td>Rutil coated stainless steel electrodes. Superior welding characteristics. Can be used on AC or DC. Other advantages include high current carrying capacity, minimum spatter formation, self releasing slag, smooth and clean weld profile, safety against formation of porosity due to the moisture resistant coating and its packaging into hermetically sealed tins or VAC-packs. Operating temperature up to +300 °C and for weld claddings up to +400 °C.</td>
<td>For welding stainless to mild steel and low alloy steel, for surfacing of mild steel and for root pass welding of clad steel and the first layer of corrosion resistant claddings on mild and low alloyed steels.</td>
</tr>
<tr>
<td><strong>CN 23/12 Mo-FD</strong>&lt;br&gt;T 23 12 2 L R M (C) 3&lt;br&gt;E309LMoT0-4(1)</td>
<td>FCAW</td>
<td>C ≤0.03&lt;br&gt;Si 0.6&lt;br&gt;Mn 1.4&lt;br&gt;Cr 22.7&lt;br&gt;Mo 2.7&lt;br&gt;Ni 12.3</td>
<td>Re 530 N/mm²&lt;br&gt;Rm 720 N/mm²&lt;br&gt;Av 65 J...-60 °C</td>
<td>1.2</td>
<td>TÜV-D, UDT, SEPROZ, BV, LR</td>
<td>Rutil flux cored welding wires. These products achieve high productivity and are easy to operate achieving excellent welding characteristics, self releasing slag, almost no spatter formation and temper discolouration, smooth weld finish and safe penetration. Increased travel speeds as well as little demand for cleaning and pickling provide considerable savings in time and money. Suitable for service temperatures from -60 °C up to +300 °C. It can also be used for 316 L weld cladding of un- or low alloyed base metals with very economic results.</td>
<td>For buffer layers on weldable unalloyed, high tensile, high temperature or alloyed base metals.</td>
</tr>
<tr>
<td><strong>FOX CN 24/13</strong>&lt;br&gt;—&lt;br&gt;E309L-15</td>
<td>SMAW</td>
<td>C 0.03&lt;br&gt;Si 0.3&lt;br&gt;Mn 1.3&lt;br&gt;Cr 24.0&lt;br&gt;Ni 13.0</td>
<td>Re 430 N/mm²&lt;br&gt;Rm 570 N/mm²&lt;br&gt;Av 70 J</td>
<td>3.2</td>
<td>–</td>
<td>Special basic coated electrode with controlled alloying elements to meet the metallurgical requirements of buffer layers. Stringer bead technique is recommended. Normally used in combination with different corrosion resistant claddings. For service temperatures up to 400 °C. Preheating and interpass temperature acc. the base materials, but not higher than 200 °C.</td>
<td>For problem steels with high strength, joining of dissimilar materials, tool steels, heat treatable or quenched and tempered steels, spring steels, high carbon steels etc.</td>
</tr>
<tr>
<td><strong>FOX CN 24/13 Nb</strong>&lt;br&gt;E 23 12 Nb B 2 2&lt;br&gt;E309Cb-15</td>
<td>SMAW</td>
<td>C 0.03&lt;br&gt;Si 0.4&lt;br&gt;Mn 1.0&lt;br&gt;Cr 24.5&lt;br&gt;Ni 12.5&lt;br&gt;Nb 0.85</td>
<td>Re 505 N/mm²&lt;br&gt;Rm 690 N/mm²&lt;br&gt;Av 95</td>
<td>3.2</td>
<td>TÜV-D</td>
<td>Special basic coated electrode with controlled alloying elements to meet the metallurgical requirements of buffer layers. Excellent welding properties, stable arc, well detaching slag without residual. Stringer bead technique is recommended. Normally used in combination with different corrosion resistant claddings, usually with an additional PWHT. For service temperatures up to 400 °C. Preheating and interpass temperature acc. the base materials, but not higher than 200 °C.</td>
<td>For problem steels with high strength, joining of dissimilar materials, tool steels, heat treatable or quenched and tempered steels, spring steels, high carbon steels etc.</td>
</tr>
<tr>
<td><strong>FOX CN 29/9</strong>&lt;br&gt;E 29 9 R 12&lt;br&gt;E312-16(mod.)</td>
<td>SMAW</td>
<td>C 0.11&lt;br&gt;Si 1.0&lt;br&gt;Mn 0.7&lt;br&gt;Cr 28.5&lt;br&gt;Ni 10.2</td>
<td>Re 620 N/mm²&lt;br&gt;Rm 770 N/mm²&lt;br&gt;Av 30 J</td>
<td>2.5</td>
<td>OBB, DB, UDT, UZ, SEPROZ</td>
<td>Rutil-basic resp. rutil coated (FOX CN 29/9-A) stainless steel electrode for repair &amp; maintenance. These electrodes offers outstanding operating characteristics and weld metals of high strength combined with high crack resistance when welding problem steels or dissimilar joints.</td>
<td>For weld claddings up to +400 °C. Preheating and interpass temperature as required by the base metal.</td>
</tr>
<tr>
<td><strong>FOX CN 29/9-A</strong>&lt;br&gt;E 29 9 R 32&lt;br&gt;E312-17(mod.)</td>
<td>SMAW</td>
<td>C 0.11&lt;br&gt;Si 0.9&lt;br&gt;Mn 0.7&lt;br&gt;Cr 28.5&lt;br&gt;Ni 9.5</td>
<td>Re 650 N/mm²&lt;br&gt;Rm 830 N/mm²&lt;br&gt;Av 30 J</td>
<td>2.5</td>
<td>DB, UDT, UZ, OBB, SEPROZ</td>
<td>The weld metal also work hardens making it suitable for wear resisting build-ups on clutches, gear wheels, shafts, etc. Also suitable for repair welding of tools. Preheating and interpass temperature as required by the base metal.</td>
<td>For problem steels with high strength, joining of dissimilar materials, tool steels, heat treatable or quenched and tempered steels, spring steels, high carbon steels etc.</td>
</tr>
</tbody>
</table>
## Special applications

<table>
<thead>
<tr>
<th>BÖHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX EAS 2 Si</strong>&lt;br&gt;E Z 19 14 Si B 22</td>
<td>SMAW</td>
<td>C &lt;0.025</td>
<td>Re 500 N/mm²</td>
<td>2.5</td>
<td>TÜV-D, UDT, SEPROZ</td>
<td>Special basic coated core wire alloyed electrode for joint welding of the special steel X2CrNiSi1815, 1.4461 (BOHLER A 610), which resists the attack of highly concentrated nitric acid as well as of nitric acid which additionally contains strong deoxidants. Also recommended for weld cladding of analogous type steels. Operating temperatures up to +350 °C.</td>
<td>Nitric acid resistant&lt;br&gt;1.4361 X1CrNiSi18-15-4&lt;br&gt;UNS S30600</td>
</tr>
<tr>
<td><strong>EASN 2 Si-IG</strong>&lt;br&gt;W Z 19 13 Si NL</td>
<td>GTAW</td>
<td>C ≤0.015</td>
<td>Re 520 N/mm²</td>
<td>1.6</td>
<td>TÜV-D, UDT</td>
<td>GTAW rod designed for joint welding of the special stainless steel grade X2CrNiSi18-15, mat-no. 1.4361 (BOHLER A 610), which is resistant to the attack of highly concentrated nitric acid and of nitric acid additionally containing strong deoxidants. Also suited for cladding applications on analogous materials. Operating temperatures up to +350 °C.</td>
<td></td>
</tr>
<tr>
<td><strong>FOX EASN 25 M</strong>&lt;br&gt;EZ 25 22 2 NL B 2 2</td>
<td>SMAW</td>
<td>C &lt;0.035</td>
<td>Re 405 N/mm²</td>
<td>2.5</td>
<td>TÜV-D, UDT, SEPROZ</td>
<td>Basic coated core wire alloyed for Cr-Ni-Mo electrode. Characterised by a low C-content, a limited Mo-content (for better Huey-test-resistance), a well-defined N-alloying as well as a high Ni-content to assure a fully austenitic structure (ferrite contents &lt; 0.5 %). The corrosion rates in the Huey-test are 0.08 g/m²h (4 mils/year). The stick electrode is suited for urea plant components exposed to extremely severe corrosion at high pressures and temperatures. The weld deposit will exhibit superior resistance to boiling concentrated nitric acid (optimum condition: 60-80 % HNO₃) when made to join components of the highest Huey test quality. It is also recommendable for weldments wetted by strong chloride solutions at high temperatures. The chromium and molybdenum percentages create good resistance to pitting from solutions containing chlorine ions. Further applications involve severe corrosive service in such industries as dyeing and dyeing baths, textiles, paper, leather, chemicals, pharmaceuticals, and rayon. During welding an interpass temperature of 150 °C and a weaving above two times core wire diameter should be avoided. The arc should be kept short. Grind out root pass end craters and use intermediate current settings.</td>
<td>UREA plant engineering&lt;br&gt;X2CrNiMoN25-22-2 (1.4466) and in combination with&lt;br&gt;X1CrNiMoN25-25-2 (1.4465), X2CrNiMo18-14-3 (1.4415)</td>
</tr>
<tr>
<td><strong>EASN 25 M-IG</strong>&lt;br&gt;W 25 22 2 L</td>
<td>GTAW</td>
<td>C 0.025</td>
<td>Re 400 N/mm²</td>
<td>1.6</td>
<td>TÜV-D</td>
<td>GTAW rod for joining and surfacing applications on matching/similar steels. For weld cladding on high temperature steels and for fabrication joints on claddings. Resistant to intercrystalline corrosion and wet corrosion up to +350 °C (662 °F). Good resistance to Cl-bearing environment, pitting corrosion and nitric acid. Huey test acc. to ASTM A262: max. 1.5 µm/48 h (0.25 g/m²h), selective attack max. 100 µm. Particularly suited for corrosion conditions in urea synthesis plants.</td>
<td></td>
</tr>
</tbody>
</table>
## Low temperature

<table>
<thead>
<tr>
<th>BÖHLER Standard EN AWS</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX 2.5 Ni</strong> E 46 8 2 Ni B 4 2 H5 EB018-C1H4R</td>
<td>SMAW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2.5 Ni-IG</strong> W 2 Ni 2 (GTAW) G 2 Ni 2 (GMAW) ER805-Ni2</td>
<td>GTAW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wire: Ni 2-UP</strong> S2Ni2 ENi2 Flux: BB 24 SA FB 1 65 DC H5</td>
<td>SAW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Low temperature – Stainless steels

#### BÖHLER WELDING Consumables for the chemical and petrochemical process industry

<table>
<thead>
<tr>
<th>BÖHLER Standard</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOX EAS 2</td>
<td>SMAW</td>
<td>C 0.03</td>
<td>Re 430 N/mm², Rm 580 N/mm²</td>
<td>2.5</td>
<td>TÜV-D, U, TÜV-A, DB, CL, UDT, SEPROZ</td>
<td>Basic coated stainless steel electrode. Designed to produce first class weld deposits with reliable CVN toughness values up to +350 °C.</td>
<td>1.4306</td>
</tr>
<tr>
<td>E 19 9 L B 22</td>
<td></td>
<td>Si 0.4</td>
<td></td>
<td>3.2</td>
<td></td>
<td></td>
<td>X2CrNi19-11</td>
</tr>
<tr>
<td>E308L-15</td>
<td></td>
<td>Mn 1.3</td>
<td></td>
<td>4.0</td>
<td></td>
<td></td>
<td>X5CrNi18-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 19.5</td>
<td>Av 100 J ≥34 J...-196 °C</td>
<td></td>
<td></td>
<td></td>
<td>1.4541</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 10.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X6CrNi18-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.4311</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X2CrNi18-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.4546</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X5CrNi18-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.4312</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>G310C18-8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EAS 2-IG</td>
<td>GTAW</td>
<td>C ≤0.02</td>
<td>Re 450 N/mm², Rm 620 N/mm²</td>
<td>1.6</td>
<td>TÜV-D, U, TÜV-A, OBB, DB, CL, UDT, GL, DNV, SEPROZ</td>
<td>GTAW rod, suitable not only for standard welding jobs but also for cryogenic applications down to -269 °C. As well as the good welding and wetting characteristics of EAS 2-IG corrosion resistance up to +350 °C is achieved.</td>
<td>AISI J304 L</td>
</tr>
<tr>
<td>W 19 9 L</td>
<td></td>
<td>Si 0.5</td>
<td></td>
<td>2.0</td>
<td></td>
<td></td>
<td>J304</td>
</tr>
<tr>
<td>ER308L</td>
<td></td>
<td>Mn 1.7</td>
<td>Av 150 J ≥32 J...-269 °C</td>
<td>2.4</td>
<td></td>
<td></td>
<td>321</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 20.0</td>
<td></td>
<td>3.0</td>
<td></td>
<td></td>
<td>J304 LN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 10.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A320 Gr. B 8 C a. D 302</td>
</tr>
<tr>
<td>EAS 2-IG (Si)</td>
<td>GMAW</td>
<td>C ≤0.02</td>
<td>Re 420 N/mm², Rm 630 N/mm²</td>
<td>0.8</td>
<td>TÜV-D, U, TÜV-A, OBB, CL, DB, GL, DNV, SEPROZ</td>
<td>GMAW wire designed for first class welding, wetting and feeding characteristics and excellent weld metal CVN values down to -196 °C. Resistant to intergranular corrosion up to +350 °C.</td>
<td>AISI J304</td>
</tr>
<tr>
<td>G 19 9 L Si</td>
<td></td>
<td>Si 0.8</td>
<td></td>
<td>1.2</td>
<td></td>
<td></td>
<td>J304</td>
</tr>
<tr>
<td>ER308L(Si)</td>
<td></td>
<td>Mn 1.7</td>
<td>Av 110 J ≥32 J...-196 °C</td>
<td>1.0</td>
<td></td>
<td></td>
<td>321</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 20.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>J304 LN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 10.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A320 Gr. B 8 C a. D 302</td>
</tr>
<tr>
<td>EAS 2-FD</td>
<td>FC AW</td>
<td>C ≤0.03</td>
<td>Re 380 N/mm², Rm 540 N/mm²</td>
<td>0.9</td>
<td>TÜV-D, U, TÜV-A, DB, CL, UDT, DB, CWB, SEPROZ, GL, OBB</td>
<td>Rustie flux cored welding wire. This product achieves high productivity and is easy to operate achieving excellent welding characteristics, self-releasing slag, almost no spatter formation and temper discoloration, smooth weld finish, safe penetration. Increased travel speeds as well as little demand for cleaning and pickling provide considerable savings in time and money. Suitable for service temperatures from -196 °C to +350 °C.</td>
<td>AISI J304</td>
</tr>
<tr>
<td>T 19 9 L R M (C) 3</td>
<td></td>
<td>Si 0.7</td>
<td></td>
<td>1.2</td>
<td></td>
<td></td>
<td>J304</td>
</tr>
<tr>
<td>E308LT0-4-1(l)</td>
<td></td>
<td>Mn 1.5</td>
<td>Av 40 % ≥32 J...-196 °C</td>
<td>1.6</td>
<td></td>
<td></td>
<td>321</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 19.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>J304 LN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 10.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A320 Gr. B 8 C a. D 302</td>
</tr>
<tr>
<td>EAS 2 PW-FD</td>
<td>FC AW</td>
<td>C ≤0.03</td>
<td>Re 380 N/mm², Rm 560 N/mm²</td>
<td>1.2</td>
<td>TÜV-D, U, TÜV-A, DB, CL, UDT, CWB, SEPROZ, DB, OBB</td>
<td>Rustie flux cored welding wire with fast freezing slag providing excellent positional welding characteristics and fast travel speeds.</td>
<td>AISI J304</td>
</tr>
<tr>
<td>T 19 9 L P M (C) 1</td>
<td></td>
<td>Si 0.6</td>
<td></td>
<td>1.6</td>
<td></td>
<td></td>
<td>J304</td>
</tr>
<tr>
<td>E308LT1-4-1(l)</td>
<td></td>
<td>Mn 1.4</td>
<td>Av 40 % ≥32 J...-196 °C</td>
<td></td>
<td></td>
<td></td>
<td>321</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 19.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>J304 LN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 10.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A320 Gr. B 8 C a. D 302</td>
</tr>
<tr>
<td>EAS 2 PW-FD (LF)</td>
<td>FC AW</td>
<td>C ≤0.03</td>
<td>Re 380 N/mm², Rm 560 N/mm²</td>
<td>1.2</td>
<td></td>
<td></td>
<td>AISI J304</td>
</tr>
<tr>
<td>T 19 9 L P M (C) 1</td>
<td></td>
<td>Si 0.6</td>
<td></td>
<td>1.6</td>
<td></td>
<td></td>
<td>J304</td>
</tr>
<tr>
<td>E308LT1-4-1(l)</td>
<td></td>
<td>Mn 1.4</td>
<td>Av 40 % ≥45 J...-196 °C</td>
<td></td>
<td></td>
<td></td>
<td>321</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr 19.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>J304 LN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 10.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A320 Gr. B 8 C a. D 302</td>
</tr>
<tr>
<td>Wire: EAS 2-UP</td>
<td>SAW</td>
<td>C 0.02</td>
<td>Re ≥350 N/mm², Rm ≥350 N/mm²</td>
<td>3.0</td>
<td>TÜV-D, UDT</td>
<td>SAW-wire/flux combination. Smooth beads, easy slag removal without any slag residues and good welding characteristics even for fillet welds are very much appreciated by users.</td>
<td>Suitable for service temperatures from -196 °C to +350 °C. The fluoride-basic, agglomerated flux, provides a low flux consumption. Basicity 2.3. Density 1.0 kg/dm³.</td>
</tr>
<tr>
<td>S 19 9 L</td>
<td></td>
<td>Mn 1.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X2CrNi19-11</td>
</tr>
<tr>
<td>ER308L</td>
<td></td>
<td>Cr 19.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X5CrNi18-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ni 9.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.4541</td>
</tr>
</tbody>
</table>

#### Notes

- **Consumables for the chemical and petrochemical process industry**
- **BÖHLER WELDING**
- **Typical analysis**
- **Typical mechanical properties**
- **Sizes**
- **Approvals**
- **Characteristics and applications**
- **Base metals**

---

**Characteristics and applications**

- **Basic coated stainless steel electrode. Designed to produce first class weld deposits with reliable CVN toughness values up to +350 °C.**
- **High productivity and is easy to operate achieving excellent welding characteristics, self-releasing slag, almost no spatter formation and temper discoloration, smooth weld finish, safe penetration.**
- **Increased travel speeds as well as little demand for cleaning and pickling provide considerable savings in time and money.**
- **Suitable for service temperatures from -196 °C to +350 °C.**
- **Rustie flux cored welding wire. This product achieves high productivity and is easy to operate achieving excellent welding characteristics, self-releasing slag, almost no spatter formation and temper discoloration, smooth weld finish, safe penetration.**
- **Increased travel speeds as well as little demand for cleaning and pickling provide considerable savings in time and money.**
- **Suitable for service temperatures from -196 °C to +350 °C.**
- **Rustie flux cored welding wire with fast freezing slag providing excellent positional welding characteristics and fast travel speeds.**
- **Rustie flux cored welding wire, with controlled weld metal ferrite content (FN 3-6), particularly for good cryogenic toughness and lateral expansion down to -196 °C like specified for LNG applications.**
- **The slag system of the wire provides excellent positional welding characteristics and fast travel speeds.**
- **SAW-wire/flux combination. Smooth beads, easy slag removal without any slag residues and good welding characteristics even for fillet welds are very much appreciated by users.**
- **Suitable for service temperatures from -196 °C to +350 °C. The fluoride-basic, agglomerated flux, provides a low flux consumption. Basicity 2.3. Density 1.0 kg/dm³.**
Low temperature – Nickel base alloys

<table>
<thead>
<tr>
<th>BOHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard EN AWS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOX NIBAS 60/15</td>
<td>SMAW</td>
<td>C &lt;0.1 Si &lt;0.6 Mn 1.5-3.5 Cr 12-16 Mo 0.6-8.0 Ni bal. Nb 0.5-1.5 Fe &lt;10.0 W 1.0-1.5</td>
<td>Re ≥20 N/mm² Rm ≥260 N/mm²</td>
<td>2.5 3.2 4.0</td>
<td>–</td>
<td>The high-nickel electrode NIBAS 60/15 is especially suited for welding cold-tough nickel steels, such as X8Ni9. The electrode is designated for welding with ac, in order to avoid the magnetic arc blow effects which occur when welding cold-tough nickel steels with dc. It is weldable in flat, horizontal and vertical-up position. Stable arc, easy slag removal. The weld zone must be bare and properly degreased. Prior to welding, the electrodes must be predried for 2-3 hours at 250-300 °C. The electrode is welded with a slight tilt, short arc and sufficient high amperage adjustment. To avoid end crater cracks the crater must be filled properly and the arc drawn away to the side.</td>
<td>9 % nickel steel base metal: X 8 Ni 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIBAS 625-IG</td>
<td>GTAW</td>
<td>C ≤0.02 Si ≤0.2 Mn ≤0.3 Cr 21.5 Mo 9.0 Ni 260 Nb 3.6 Fe ≤2.0 PREN &gt;52</td>
<td>Re 540 N/mm² Rm 800 N/mm²</td>
<td>1.6 2.0 2.4</td>
<td>TUV-D, TUV-A, Staalpro SEPROZ</td>
<td>GTAW rod and GMAW wire of type AWS ERNiCrMo-3 suitable for welding of the 6 % Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625. Rod, wire and weld metal meet highest quality and corrosion requirements. Extremely resistant to stress corrosion cracking and pitting. Due to the weld metal embrittlement between 650-850°C, this temperature range should be avoided. The pitting resistance equivalent is &gt;52. Highly resistant to hot cracking. For GMAW shielding gas to EN 439 II Argon or 13 Ar + He is recommended.</td>
<td>2.4856 NiCr 22 Mo 9 Nb, 2.4858 NiCr 21 Mo, 2.4848 NiCr 15 Fe, 1.4583 X10CrNiMoNb18-12, 1.4876 X 10 NiCrAlTi 22 20 H, 1.4876 X 10 NiCrAlTi 22 20, 1.4529 X1NiCrMoCuN25-20-7, 1.2X CrNiMoCuN 20 18 6, 2.4641 NiCr 21 Mo 6 Cu</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire: NIBAS 625-UP</td>
<td>SAW</td>
<td>C 0.032 Si 0.15 Mn 0.2 Cr 21 Mo 9.0 Ni 260 Nb 3.2 Fe 1.5 PREN &gt;52</td>
<td>Re 420 N/mm² Rm 700 N/mm²</td>
<td>2.4</td>
<td>TUV-D</td>
<td>For SAW wire and flux combination, suitable for welding of the 6 % Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625. Weld metal meet highest quality and corrosion requirements. Extremely resistant to stress corrosion cracking and pitting. The pitting resistance equivalent is &gt;52.</td>
<td>Joint welds of listed materials with non alloy and low alloy steels. e.g. P285NH P295GH 16Mo3, 1.4589 X5CrNiMoCuN 25-20-7, X 1 CrNiMoCuN 20 18 6, 2.4641 NiCr 21 Mo 6 Cu</td>
</tr>
<tr>
<td>Flux: BB 444</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flux: BB 444</td>
<td>SAW</td>
<td>C 0.05 Si 0.4 Mn 0.4 Cr 22.0 Mo 8.5 Ni 260 Nb 3.3</td>
<td>Re 480 N/mm² Rm 750 N/mm²</td>
<td>1.2</td>
<td>–</td>
<td>Rust FCAW wire of type E NiCrMo-3 suitable for welding of the 6 % Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625. The wire can be used in all positions except vertical down. Extremely resistant to stress corrosion cracking and pitting. Shielding gases Ar + 15-25 % CO₂.</td>
</tr>
<tr>
<td>NIBAS 625-FD</td>
<td>FCAW</td>
<td>C 0.03 Si 0.15 Mn 0.3 Cr 21 Mo 9.0 Ni 260 Nb 3.2 Fe 1.5 PreN &gt;52</td>
<td>Re 540 N/mm² Rm 800 N/mm²</td>
<td>1.6 2.0 2.4</td>
<td>TUV-D</td>
<td>For SAW wire and flux combination, suitable for welding of the 6 % Mo superaustenitic grades S31254, N08926, N08367 and the matching alloy 625. Weld metal meet highest quality and corrosion requirements. Extremely resistant to stress corrosion cracking and pitting. The pitting resistance equivalent is &gt;52.</td>
<td>Joint welds of listed materials with non alloy and low alloy steels. e.g. P285NH P295GH 16Mo3, 1.4589 X5CrNiMoCuN 25-20-7, X 1 CrNiMoCuN 20 18 6, 2.4641 NiCr 21 Mo 6 Cu</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Characteristics and applications

**FOX FA**  
E 25 4 B 22  
-  
Basic coated core wire alloyed electrode for heat resistant steels and service temperatures up to +1700 °C. An excellent product when increased resistance against reducing and oxidizing, sulphur containing gases is required. Can also be used for the capping of joint welds which have been welded with higher nickel alloyed filler metals (e.g. FOX FF-A, FOX FFB) where better joint toughness is required. Preheating and interpass temperatures 200-400 °C, depending on the relevant base metal and material thickness.

**FA-IG**  
W 25 4 (GTAW)  
G 25 4 (GMAW)  
-  
GTAW rod and GMAW wire for heat resistant steels and service temperatures up to +1700 °C. An excellent product when increased resistance against reducing and oxidizing, sulphur containing gases is required. Also for the capping of joints which have been welded with higher nickel alloyed filler metals (e.g. FF-IG, FFB-IG) where better joint toughness is required. Preheating and interpass temperatures 200-400 °C, depending on the relevant base metal and material thickness.

**FOX FF**  
E 22 12 B 22  
E309-15(mod)  
Basic coated resp. rutile coated (FOX FF-A) core wire alloyed electrodes for welding analogous, heat resistant rolled, forged and cast steels as well as heat resistant ferritic CrSiAl steels, e.g. in annealing plants, hardening plants, steam boiler construction, the crude oil industry and the ceramics industry. For weld joints exposed to reducing, sulphurous gases, the final layer has to be deposited by means of FOX FA, or FA-IG. Satisfactory resistance up to +800 °C. Preheating and interpass temperatures for ferritic steels 200-300 °C.

**FOX FF-A**  
E 22 12 R 32  
E309-17  
Basic coated resp. rutile coated (FOX FF-A) core wire alloyed electrodes for analogous, heat resistant rolled, forged and cast steels as well as heat resistant ferritic CrSiAl steels, e.g. in annealing plants, hardening plants, steam boiler construction, the crude oil industry and the ceramics industry. For weld joints exposed to reducing, sulphurous gases, the final layer has to be deposited by means of FOX FA, or FA-IG. Satisfactory resistance up to +800 °C. Preheating and interpass temperatures for ferritic steels 200-300 °C.

**FF-IG**  
W 22 12 H (GTAW)  
G 22 12 H (GMAW)  
ER309(mod)  
GTAW rod and GMAW wire for analogous, heat resisting rolled, forged and cast steels as well as for heat resisting, ferritic CrSiAl steels, e.g. in annealing shops, hardening shops, steam boiler construction, the crude oil industry and the ceramics industry. Austenitic deposited with a ferrite content of approx. 8 %. Preferably used for applications involving the attack of oxidizing gases. The final layer of joint welds in CrSiAl steels exposed to sulphurous gases must be deposited by means of FOX FA or FA-IG. Scaling resistance up to +1000 °C. Preheating and interpass temperatures for ferritic steels 200-300 °C.

**FOX FFB**  
E 25 20 B 22  
E310-15(mod)  
Basic coated resp. rutile coated (FOX FFB-A) core wire alloyed electrode for analogous, heat resisting rolled, forged and cast steels as well as for heat resisting, ferritic CrSiAl steels, e.g. in annealing plants, hardening plants, steam boiler construction, the crude oil industry and the ceramics industry. Joint welds in heat resisting CrSiAl steels exposed to sulphurous gases should be given a final layer deposited by means of FOX FA.

**FOX FFB-A**  
E 25 20 R 32  
E310-16  
The service temperature range between +650 °C and +900 °C should be avoided owing to the risk of embrittlement. Preheating and interpass temperatures for ferritic steels 200-300 °C.

### Base metals

- **Ferritic-austenitic**: 1.4821 X20CrNiN 25 4, 3271.4823(*) G-X40CrN15 27 4 A297HC
- **Ferritic-perlitic**: 1.4713 X10CrA17, 1.4724 X10CrA113, 1.4726 X10CrA125 1.4770(*) X10CrNi6 1.4740(*) G-X40CrSi17 (*) limited weldability
### Heat resistant

<table>
<thead>
<tr>
<th>BÖHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FFB-IG</strong>&lt;br&gt;G (WV) 25 20 Mn&lt;br&gt;ER310 (mod.)&lt;br&gt;</td>
<td>GTAW</td>
<td>C 0.12 Si 0.9 Mn 3.2 Cr 25.0 Ni 20.5</td>
<td>Re 420 N/mm² Rm 630 N/mm² As 33% Av 85 J</td>
<td>1.6 2.0 2.4</td>
<td>UDT, SEPROZ</td>
<td>GTA welding rod and GMAW wire for analogous heat resisting, rolled, forged and cast steels, e.g. in annealing shops, hardening shops, steam boiler construction, the crude oil industry and the ceramics industry. Fully autentitc deposit.</td>
<td>Austenitic 1.4841 X15CrNi25-20 1.4845 X15CrNi25-21 1.4828 X15CrNi25-12 1.4846 G-X5 CrNi25-20 1.4848 G-X40 CrNi25-21 1.4826 G-X40 CrNi25-29</td>
</tr>
<tr>
<td><strong>FOX CN 21/33 Mn</strong>&lt;br&gt;EZ 21 33 B 4 2&lt;br&gt;–</td>
<td>SMAW</td>
<td>C 0.14 Si 0.3 Mn 4.5 Cr 22.0 Ni 33.0 Fe bal.</td>
<td>Re 480 N/mm² Rm 700 N/mm² As 5% Av 70 J</td>
<td>2.0 2.4 3.2</td>
<td>TÜV-D, TÜV-A, CL</td>
<td>Basic coated electrode for joining and surfacing of heat resistant steels and cast steels of the same or similar chemical composition. Suitable for operating temperatures up to 1050 °C in carburized low-sulphur gas. Typical alloy for welding of pyrolysis furnace tubes.</td>
<td>X10NiCrAlTi31-32-20 (1.4876) X10NiCrAlTi31-20 (1.4859) X5NiCrAlTi31-20 (1.4958) X25NiCrAlTi31-21 (1.4959) Alloys 800 H / 800 UNS N08810 N08811</td>
</tr>
<tr>
<td><strong>CN 21/33 Mn-IG</strong>&lt;br&gt;W Z 21 33 Nb (GTAW)&lt;br&gt;G Z 21 33 Nb (GMAW)&lt;br&gt;–</td>
<td>GMAW</td>
<td>C 0.2 Si 0.2 Mn 2.3 Cr 22.0 Ni 33.0 Nb 1.7 Fe bal.</td>
<td>Re 430 N/mm² Rm 620 N/mm² As 25% Av 50 J</td>
<td>2.0 2.4 3.2</td>
<td>TÜV-D</td>
<td>GTA welding rod and GMAW wire are also best suited to meet all before mentioned characteristics. For GMAW shielding gas Ar + 2.5% CO₂.</td>
<td></td>
</tr>
<tr>
<td><strong>FOX CN 25/35 Nb</strong>&lt;br&gt;EZ 25 35 Nb B 6 2&lt;br&gt;–</td>
<td>SMAW</td>
<td>C 0.40 Si 1.0 Mn 1.5 Cr 25.0 Ni 35.0 Nb 1.2 Fe bal.</td>
<td>Re 480 N/mm² Rm 700 N/mm² As 8%</td>
<td>2.0 2.4 3.2</td>
<td>TÜV-D, TÜV-A, Controles</td>
<td>Basic coated electrode for joining and surfacing of heat resistant steels and cast steels of the same or similar chemical composition. Resistant to scaling up to 1150 °C. Typical alloy for welding of pyrolysis furnace tubes.</td>
<td>XG40NiCr55Nb35-25 (1.4852) X-G40NiCr55Nb35-25 (1.4857)</td>
</tr>
<tr>
<td><strong>CN 25/35 Nb-IG</strong>&lt;br&gt;W Z25 35 Nb (GTAW)&lt;br&gt;G Z25 35 Nb (GMAW)&lt;br&gt;–</td>
<td>GTAW</td>
<td>C 0.42 Si 1.2 Mn 1.8 Cr 26.0 Ni 35.0 Nb 1.3</td>
<td>Re &gt;400 N/mm² Rm &gt;600 N/mm² As &gt;8%</td>
<td>2.0 2.4 3.2</td>
<td>TÜV-D, TÜV-A, Controles</td>
<td>GTA welding rod and GMAW wire are also best suited to meet all before mentioned characteristics. For GMAW shielding gas Ar + 2.5% CO₂.</td>
<td></td>
</tr>
<tr>
<td><strong>FOX CN 35/45 Nb</strong>&lt;br&gt;EZ 35 45 Nb B 6 2&lt;br&gt;–</td>
<td>SMAW</td>
<td>C 0.45 Si 1.0 Mn 0.8 Cr 35.0 Ni 45.5 Nb 0.9 Fe bal.</td>
<td>Re &gt;450 N/mm² Rm &gt;600 N/mm² As &gt;8%</td>
<td>2.5 3.2 4.0</td>
<td>–</td>
<td>Basic coated electrode for joining and surfacing of heat resistant steels and cast steels of the same or similar chemical composition. Resistant to scaling up to 1150 °C. Typical alloy for welding of pyrolysis furnace tubes.</td>
<td></td>
</tr>
<tr>
<td><strong>CN 35/45 Nb-IG</strong>&lt;br&gt;W Z 35 45 Nb H (GTAW)&lt;br&gt;G Z 35 45 Nb H (GMAW)&lt;br&gt;–</td>
<td>GTAW</td>
<td>C 0.42 Si 1.5 Mn 2.1 Cr 35.0 Ni 45.5 Nb 0.8</td>
<td>Re &gt;450 N/mm² Rm &gt;550 N/mm² As &gt;6%</td>
<td>2.0 2.4 3.2</td>
<td>–</td>
<td>GTA welding rod and GMAW wire are also best suited to meet all before mentioned characteristics. For GMAW shielding gas Ar + 2.5% CO₂.</td>
<td></td>
</tr>
</tbody>
</table>
## Nickel base alloys

### BOHLER WELDING Consumables for the chemical and petrochemical process industry

<table>
<thead>
<tr>
<th>BOHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOX NIBAS 70/15</td>
<td>SMAW</td>
<td>C 0.025</td>
<td>Re 400 N/mm²</td>
<td>2.5</td>
<td>TUV-D, UDT</td>
<td>Basic coated core wire alloyed electrode for high quality welding of nickel base alloys, high temperature and creep resisting steels, heat resisting and cryogenic materials, dissimilar joints and low alloy problem steels. Suitable in pressure vessel fabrication for -196 °C to +450 °C, scaling resistance temperature of +1200 °C (S-free atmosphere). Electrode and weld metal meet highest quality requirements.</td>
<td>NiCr 15 Fe (Inconel 600) UNS N06600, ASTM B168, as well as Ni-alloys of similar or same chemical composition; non alloy and low alloy steels for elevated temperatures, e.g. P235GH, P265GH, S255NB, P355GH-P355GH, 16Mo3, high temperature steels as well as constructional steels with comparable tensile strength, creep resistant austenitic steels, e.g. X8CrNiN16-13, X8CrNiMoN16-16, X8CrNiMoP16-13. Ni-steels containing 1.5 % up to and including 3 % Ni, low alloyed constructional and pressure vessel steels, also X20CrMoV12-1 and X20CrMoV12-1 on stainless and creep resistant austenitic steels; also suitable for Incoloy 800.</td>
</tr>
<tr>
<td>FOX NIBAS 70/20</td>
<td>SMAW</td>
<td>C 0.025</td>
<td>Re 420 N/mm²</td>
<td>2.5</td>
<td>TUV-D, UDT</td>
<td>Basic coated core wire alloyed electrode corresponding to DIN EL-NiCr 79 Nb for high-grade welding of nickel-base alloys, high-temperature and creep resisting steels, heat resisting and cryogenic materials, low-alloyed problem steels and dissimilar joints. Ferritic-austenitic joints for service temperatures above +300 °C or for applications where a post weld heat treatment is required. Suitable in pressure vessel fabrication for -196 °C to +450 °C, otherwise up to the scaling resistance temperature of +1200 °C (S-free atmosphere). Insusceptible to embrittlement, highly resistant to hot cracking. Furthermore, C-diffusion at high temperature or during heat treatment of dissimilar joints is largely reduced. Thermal shock resistant, stainless, fully austenitic, low coefficient of thermal expansion between the coefficient values of C-steel and austenitic Cr-Ni (Mo)-steel. Excellent welding characteristics in all positions except vertical-down, easy slag removal, high resistance to porosity, absence of undercutts, high degree of purity. Electrode and weld metal meet highest quality requirements.</td>
<td>2.4816 Ni Cr 15 Fe, 2.4877 LC-NiCr 15 Fe, Inconel 600, Inconel 600 L, UNS N06600 ASTM B168镍和镍基合金，低温焊接温度可达 -196 °C，适用于 5 % Ni 钢，合金化和低 alloy 钢，高温-低温焊接，高-低温-低温焊接，抗高温-低温-低温焊接，Cr-和 CrNiMo 钢特别适合于点焊焊接，低温焊接时，低温焊接钢，不锈钢和耐电腐蚀钢；也适合于 Incoloy 800.</td>
</tr>
<tr>
<td>NIBAS 70/20-IG</td>
<td>GTA/W</td>
<td>C ≤0.03</td>
<td>Re 440 N/mm²</td>
<td>1.6</td>
<td>TUV-D, UDT, VUZ</td>
<td>GTAW rod and GMAW wire for welding of nickel-base alloys, high-temperature and creep resisting steels, heat resisting and cryogenic materials, low-alloyed problem steels and dissimilar joints. Ferritic-austenitic joints for service temperatures above +300 °C or for applications where a post weld heat treatment is required. Suitable in pressure vessel fabrication from -196 °C to +550 °C, otherwise resistant to scaling up to +1200 °C (S-free atmosphere). Not susceptible to embrittlement, C-diffusion at elevated temperatures largely inhibited. Resistant to thermal shocks, corrosion resistant, fully austenitic, low coefficient of thermal expansion. Excellent welding characteristics in all positions; creep resistant, C-steel and austenitic Cr-Ni (Mo)-steel.</td>
<td>2.4816 Ni Cr 15 Fe, 2.4877 LC-NiCr 15 Fe, Inconel 600, Inconel 600 L, UNS N06600 ASTM B168镍和 nickel 钢，低温焊接温度可达 -196 °C，适用于 5 % Ni 钢，合金化和低 alloy 钢，高温-低温焊接，高-低温-低温焊接，抗高温-低温焊接，Cr-和 CrNiMo 钢特别适合于点焊焊接，低温焊接钢；也适合于 Incoloy 800.</td>
</tr>
<tr>
<td>NIBAS 70/20-FD</td>
<td>FCAW</td>
<td>C 0.03</td>
<td>Re 400 N/mm²</td>
<td>1.2</td>
<td>TUV-D</td>
<td>Rutil basic flux cored welding wire for downhand and horizontal welding positions. It provides very good operating characteristics, good side wall wetting, safe penetration and a smooth weld finish. The shielding gas should be Argon +5-15 % CO₂.</td>
<td>NiCr 15 Fe (Inconel 600) UNS N06600, ASTM B168, as well as Ni-alloys of similar or same chemical composition; non alloy and low alloy steels for elevated temperatures, e.g. P235GH, P265GH, S255NB, P355GH-P355GH, 16Mo3, high temperature steels as well as constructional steels with comparable tensile strength, creep resistant austenitic steels, e.g. X8CrNiN16-13, X8CrNiMoN16-16, X8CrNiMoP16-13. Ni-steels containing 1.5 % up to and including 3 % Ni, low alloyed constructional and pressure vessel steels, also X20CrMoV12-1 and X20CrMoV12-1 on stainless and creep resistant austenitic steels; also suitable for Incoloy 800.</td>
</tr>
</tbody>
</table>

### Base metals

- NiCr 15 Fe (Inconel 600) UNS N06600, ASTM B168, as well as Ni-alloys of similar or same chemical composition; non alloy and low alloy steels for elevated temperatures, e.g. P235GH, P265GH, S255NB, P355GH-P355GH, 16Mo3, high temperature steels as well as constructional steels with comparable tensile strength, creep resistant austenitic steels, e.g. X8CrNiN16-13, X8CrNiMoN16-16, X8CrNiMoP16-13. Ni-steels containing 1.5 % up to and including 3 % Ni, low alloyed constructional and pressure vessel steels, also X20CrMoV12-1 and X20CrMoV12-1 on stainless and creep resistant austenitic steels; also suitable for Incoloy 800. |
Nickel base alloys

<table>
<thead>
<tr>
<th>Wire: NIBAS 70/20-UP</th>
<th>SAW</th>
<th>C</th>
<th>Ni</th>
<th>Cr</th>
<th>Mo</th>
<th>Nb</th>
<th>Fe</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes mm</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Ni 6082</td>
<td>35</td>
<td>20.5</td>
<td>2.4</td>
<td>0.10</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>Re</td>
<td>350 N/mm²</td>
<td>600 N/mm²</td>
<td>80 J</td>
<td>1.6</td>
</tr>
<tr>
<td>ERNiCr Mo-3</td>
<td>Flux: BB 444</td>
<td>SA-FB 2 AC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NIBAS 625-IG</th>
<th>GTAW</th>
<th>C</th>
<th>Ni</th>
<th>Cr</th>
<th>Mo</th>
<th>Nb</th>
<th>Fe</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes mm</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Ni 6625</td>
<td>35</td>
<td>20.5</td>
<td>2.4</td>
<td>0.025</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>Re</td>
<td>540 N/mm²</td>
<td>800 N/mm²</td>
<td>80 J</td>
<td>1.6</td>
</tr>
<tr>
<td>(NiCr 22 Mo 9 Nb)</td>
<td>ERNiCrMo-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIBAS 625-UP</td>
<td>SAW</td>
<td>C</td>
<td>Ni</td>
<td>Cr</td>
<td>Mo</td>
<td>Nb</td>
<td>Fe</td>
<td>Typical analysis</td>
<td>Typical mechanical properties</td>
<td>Sizes mm</td>
<td>Approvals</td>
<td>Characteristics and applications</td>
</tr>
<tr>
<td>S Ni 6625</td>
<td>35</td>
<td>20.5</td>
<td>2.4</td>
<td>0.012</td>
<td>0.015</td>
<td>0.015</td>
<td>0.015</td>
<td>Re</td>
<td>420 N/mm²</td>
<td>700 N/mm²</td>
<td>80 J</td>
<td>1.6</td>
</tr>
</tbody>
</table>
## Nickel base alloys

<table>
<thead>
<tr>
<th>BÖHLER Welding Consumables for the chemical and petrochemical process industry</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOX NIBAS C 276</strong>&lt;br&gt;ENiCrMo-4</td>
<td><strong>Welding process</strong>&lt;br&gt;SMAW</td>
</tr>
<tr>
<td><strong>TYPICAL ANALYSIS</strong></td>
<td><strong>TYPICAL MECHANICAL PROPERTIES</strong></td>
</tr>
<tr>
<td>C &lt; 0.02</td>
<td>Re &gt; 450 N/mm²</td>
</tr>
<tr>
<td>Si &lt; 0.2</td>
<td>Rm &gt; 720 N/mm²</td>
</tr>
<tr>
<td>Mn &lt; 0.6</td>
<td>AS &gt; 30%</td>
</tr>
<tr>
<td>Cr &lt; 16.5</td>
<td>Av &gt; 70 J</td>
</tr>
<tr>
<td>Mo &lt; 16.5</td>
<td></td>
</tr>
<tr>
<td>Ni bal.</td>
<td></td>
</tr>
<tr>
<td>Fe &lt; 5.0</td>
<td></td>
</tr>
<tr>
<td>T 2.0</td>
<td></td>
</tr>
<tr>
<td><strong>NIBAS C 276-IG</strong>&lt;br&gt;NiCrMo-4</td>
<td><strong>GTAW</strong></td>
</tr>
<tr>
<td><strong>C</strong> &lt; 0.01</td>
<td>Re &gt; 450 N/mm²</td>
</tr>
<tr>
<td>Si &lt; 0.1</td>
<td>Rm &gt; 720 N/mm²</td>
</tr>
<tr>
<td>Mn &lt; 0.5</td>
<td>AS &gt; 30%</td>
</tr>
<tr>
<td>Cr &lt; 16.0</td>
<td>Av &gt; 90 J</td>
</tr>
<tr>
<td>Mo &lt; 16.0</td>
<td></td>
</tr>
<tr>
<td>Ni bal.</td>
<td></td>
</tr>
<tr>
<td>Fe &lt; 6.0</td>
<td></td>
</tr>
<tr>
<td>V 0.2</td>
<td></td>
</tr>
<tr>
<td>T 3.5</td>
<td></td>
</tr>
<tr>
<td><strong>NIBAS C 276-UP</strong>&lt;br&gt;NiCrMo-4</td>
<td><strong>SAW</strong></td>
</tr>
<tr>
<td><strong>WIRE</strong>&lt;br&gt;NiCrMo-4</td>
<td><strong>SMAW</strong></td>
</tr>
<tr>
<td><strong>SMAW C</strong> &lt; 0.015</td>
<td>Re &gt; 400 N/mm²</td>
</tr>
<tr>
<td>Si &lt; 0.25</td>
<td>Rm &gt; 660 N/mm²</td>
</tr>
<tr>
<td>Mn &lt; 0.6</td>
<td>AS &gt; 35%</td>
</tr>
<tr>
<td>Cr &lt; 14.5</td>
<td>Av &gt; 80 J</td>
</tr>
<tr>
<td>Mo &lt; 16.0</td>
<td></td>
</tr>
<tr>
<td>Ni bal.</td>
<td></td>
</tr>
<tr>
<td>Fe &lt; 7.0</td>
<td></td>
</tr>
<tr>
<td>T 3.6</td>
<td></td>
</tr>
<tr>
<td><strong>NIBAS C 24</strong>&lt;br&gt;ENiCrMo-13</td>
<td><strong>Welding process</strong>&lt;br&gt;SMAW</td>
</tr>
<tr>
<td><strong>TYPICAL ANALYSIS</strong></td>
<td><strong>TYPICAL MECHANICAL PROPERTIES</strong></td>
</tr>
<tr>
<td>C &lt; 0.02</td>
<td>Re &gt; 450 N/mm²</td>
</tr>
<tr>
<td>Si &lt; 0.2</td>
<td>Rm &gt; 720 N/mm²</td>
</tr>
<tr>
<td>Mn &lt; 0.5</td>
<td>AS &gt; 30%</td>
</tr>
<tr>
<td>Cr &lt; 22.5</td>
<td>Av &gt; 75 J</td>
</tr>
<tr>
<td>Mo &lt; 16.0</td>
<td></td>
</tr>
<tr>
<td>Ni bal.</td>
<td></td>
</tr>
<tr>
<td>Fe &lt; 1</td>
<td></td>
</tr>
<tr>
<td><strong>NIBAS C 24-IG</strong>&lt;br&gt;NiCrMo-13</td>
<td><strong>GTAW</strong></td>
</tr>
<tr>
<td><strong>TYPICAL ANALYSIS</strong></td>
<td><strong>TYPICAL MECHANICAL PROPERTIES</strong></td>
</tr>
<tr>
<td>C 0.01</td>
<td>Re &gt; 450 N/mm²</td>
</tr>
<tr>
<td>Si 0.1</td>
<td>Rm &gt; 720 N/mm²</td>
</tr>
<tr>
<td>Mn 0.5</td>
<td>AS &gt; 35%</td>
</tr>
<tr>
<td>Cr 23.0</td>
<td>Av &gt; 90 J</td>
</tr>
<tr>
<td>Mo 16.0</td>
<td></td>
</tr>
<tr>
<td>Ni bal.</td>
<td></td>
</tr>
<tr>
<td>Fe &lt; 1.5</td>
<td></td>
</tr>
<tr>
<td><strong>NIBAS C 24-UP</strong>&lt;br&gt;NiCrMo-13</td>
<td><strong>SAW</strong></td>
</tr>
<tr>
<td><strong>WIRE</strong>&lt;br&gt;NiCrMo-13</td>
<td><strong>SAW C</strong> &lt; 0.015</td>
</tr>
<tr>
<td>Si &lt; 0.25</td>
<td>Rm &gt; 660 N/mm²</td>
</tr>
<tr>
<td>Mn 0.6</td>
<td>AS &gt; 30%</td>
</tr>
<tr>
<td>Cr 22.5</td>
<td>Av &gt; 80 J</td>
</tr>
<tr>
<td>Mo 15.5</td>
<td></td>
</tr>
<tr>
<td>Ni bal.</td>
<td></td>
</tr>
<tr>
<td>Fe &lt; 1.5</td>
<td></td>
</tr>
<tr>
<td>BOHLER Welding process</td>
<td>Typical analysis</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><strong>FOX NIBAS 400</strong> SMAW</td>
<td>C &lt;0.05 Si 0.7 Mn 3.0 Ni bal. Cu 29.0 Fe 1.0 Al 0.3</td>
</tr>
<tr>
<td><strong>NIBAS 400-IG</strong> GTAW</td>
<td>C &lt;0.02 Si 0.3 Mn 3.2 Ni bal. Cu 29.0 Fe 1.0 Ti 2.4</td>
</tr>
<tr>
<td><strong>FOX NIBAS 617</strong> SMAW</td>
<td>C &lt;0.06 Si 0.7 Mn 0.1 Cr 21.0 Mo 9.0 Ni bal. Co 11.0 Al 0.7 Ti 0.3 Fe 1</td>
</tr>
<tr>
<td><strong>NIBAS 617-IG</strong> GTAW</td>
<td>C 0.05 Si 0.1 Mn 0.1 Cr 21.5 Mo 9.0 Ni bal. Co 11.0 Al 1.0 Ti 0.5 Fe 1</td>
</tr>
<tr>
<td><strong>Wire: NIBAS 617-UP</strong> SAW</td>
<td>C &lt;0.06 Si &lt;0.4 Mn&lt;0.3 Cr 20.0 Mo 8.8 Ni bal. Co 10.0 Al 0.8 Ti 0.25 Fe &lt;1.0</td>
</tr>
</tbody>
</table>

**Characteristics and applications**

- **Sizes**: mm
- **Approvals**: TÜV-D, ABS, GL, CI
- **Nickel base alloys**
  - SMAW: FOX NIBAS 400 E Ni 4060 (NiCu 30 Mn 3 Ti) ENiCu-7
  - GTAW: NIBAS 400-IG S Ni 4060 (NiCu 30 Mn 3 Ti) ERNiCu-7
  - SMAW: FOX NIBAS 617 E Ni 6617 (NiCr 22 Co 12 Mo) ENiCrCoMo-1(mod.)
  - GTAW: NIBAS 617-IG S Ni 6617 (NiCr 22 Co 12 Mo 9) ERNiCrCoMo-1
  - SAW: Wire: NIBAS 617-UP S Ni 6617 (NiCr 22 Co 12 Mo 9) ERNiCrCoMo-1
  - Flux: BB 444 SA-FB 2 AC

**Typical analysis**

- **%**: C, Si, Mn, Ni, Cu, Fe, Ti, Al

**Typical mechanical properties**

- **N/mm²**: Re, Rm
- **%**: AS, Av
- **J**: Re, Rm, A5, Av

**Sizes**

- **mm**: 2.5, 3.2, 4.0, 5.0, 1.6, 2.0, 2.4, 1.0, 1.2, 2.5, 3.2, 4.0, 2.0, 2.4, 1.0, 1.2, 2.0
## Non-ferrous Alloys

<table>
<thead>
<tr>
<th>BÖHLER</th>
<th>Welding process</th>
<th>Typical analysis</th>
<th>Typical mechanical properties</th>
<th>Sizes</th>
<th>Approvals</th>
<th>Characteristics and applications</th>
<th>Base metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOX CuNi 30Fe</td>
<td>SMAW</td>
<td>C 0.03  Si 0.3  Mn 1.2  Ni 3.0  Fe 0.6  Cu bal.</td>
<td>Re &gt;240 N/mm²  Rm &gt;390 N/mm²  AS &gt;30%  Av &gt;80 J</td>
<td>2.5  3.2  4.0</td>
<td>TÜV-D, GL, CL</td>
<td>CuNi base electrode for joining and surfacing of similar alloyed base metals with up to 30 % Nickel, as well as for non-ferrous alloys and steels of different nature. Due to the excellent resistance to sea water the electrode is best suitable for offshore applications and seawater desalination plants, ship building and also for chemical industry. The electrode can be operated in all positions except vertical down.</td>
<td>Copper nickel alloys with up to 30 % nickel, CuNi 10 Fe 1 Mn (2.0872), CuNi20Fe (2.0878), CuNi30Fe (2.0882)</td>
</tr>
<tr>
<td>CuNi 30Fe-IG</td>
<td>GTAW</td>
<td>C &lt;0.05  Mn 0.8  Ni 3.0  Fe 0.6  Ti &lt;0.5  Cu bal.</td>
<td>Re &gt;200 N/mm²  Rm &gt;360 N/mm²  AS &gt;30%  HB 120</td>
<td>1.6  2.0  2.4</td>
<td>TÜV-D, GL, CL</td>
<td>GTAW rod for joining and surfacing of similar alloyed base metals with up to 30 % Nickel, as well as for non-ferrous alloys and steels of different nature. Due to the excellent resistance to sea water, the wire is best suitable for offshore applications and seawater desalination plants, ship building and also for chemical industry.</td>
<td>Pure Titan and Titan alloys with a similar composition.</td>
</tr>
<tr>
<td>ER Ti 2-IG</td>
<td>GTAW</td>
<td>C 0.03  Fe 0.2  O &lt;0.1  H &lt;0.008  N 0.02  Ti bal.</td>
<td>Re 295 N/mm²  Rm 500 N/mm²  AS 42%  Z 76%</td>
<td>1.6  2.0  2.4</td>
<td></td>
<td>GTAW rod for welding of pure Titan and Titan alloys with similar chemical composition. Titanium can be tungsten arc welded employing techniques similar to those used for welding of stainless steel. However, Titanium requires a greater cleanliness and the use of auxiliary gas shielding to protect the molten puddle and cooling weld zone from atmospheric contamination.</td>
<td>Pure Titan and Titan alloys with a similar composition.</td>
</tr>
</tbody>
</table>
Synthesis gas and oxoalcohol plant
Thousands of welders use and prove BÖHLER WELDING products day by day – worldwide!