Since its foundation in 1966, the Welding Alloys Group, an independent group, has specialised in the manufacture of cored welding wires for surfacing applications – 100% produced in our modern factories – 100% our own technology.

This catalogue presents the Manual Welding Electrode program completing the Welding Alloys Flux Cored Wire range, offering a global product range of welding consumables to suit customers’ changing needs. Our wide range of non-alloyed, low-alloyed and high-alloyed coated electrodes meets or exceeds the most stringent standards for hardfacing, cladding and joining applications.

Our policy of continuous R&D along with industrial development, enables us to offer the quality guarantees required by international codes of practice, which exist in the nuclear, petrochemical, offshore, LNG and transport industries.

As a global company, our engineers and technicians are available locally. Technical support and service are provided where needed, from international WA welding specialists.
### Work-hardening Manganese Alloys

<table>
<thead>
<tr>
<th>Product name</th>
<th>Standard diameter and length [mm]</th>
<th>Composition [%]</th>
<th>Hardness - 3 layers</th>
<th>Polarity</th>
<th>Description and applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>HARDFACE AP-E</td>
<td>2.5 x 350 3.2 x 350 4.0 x 450</td>
<td>E Fe9</td>
<td></td>
<td>+ - 65V</td>
<td>• Rutile coated electrode for surfacing of equipment parts, constructions and tools, resistant to medium friction and compression</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>**</td>
<td>• Good resistance to cavitation, highly resistant to shocks.</td>
</tr>
<tr>
<td></td>
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<td>**</td>
<td>• Sound, crack free deposit, machinable with standard tools.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• General applications: Surfacing of rails and switches, roller guides, sideways, build up before hardfacing.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>**</td>
<td>• Rutile coated electrode for surfacing of machine and construction parts, as well as of tools made of towedloyed and cast steels which are mainly stressed by pressure and shock. Electrodes are easy to weld even on small welding equipment with low open arc voltage.</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>**</td>
<td>• Soft flow, almost no splatters, self releasing slag, nice aspect of the weld beads.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Sound, crack free deposit, machinable with carbide cutting tools.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• General applications: Surfacing of rollers, gear teeth, stamps, hammers, guide rails etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Basic electrode with 120% recovery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Quenching deposit for hardfacing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Wide field of application in the mining and civil engineering industries: bucket teeth and blades, slides, conveyor screws, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Complements Welding Alloys cored wire HARDFACE AP</td>
</tr>
<tr>
<td>HARDFACE L-E</td>
<td>2.5 x 350 3.2 x 350 4.0 x 450</td>
<td>T Fe8</td>
<td></td>
<td>+ - 70V</td>
<td>• Rutile coated electrode for surfacing of machine and construction parts, as well as of tools made of lowalloyed and cast steels which are mainly stressed by pressure and shock. Electrodes are easy to weld even on small welding equipment with low open arc voltage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Basic electrode with 120% recovery</td>
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<td></td>
<td>**</td>
<td>• Quenching deposit for hardfacing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Wide field of application in the mining and civil engineering industries: bucket teeth and blades, slides, conveyor screws, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Complements Welding Alloys cored wire HARDFACE L</td>
</tr>
<tr>
<td>HARDFACE 40-E</td>
<td>2.5 x 300 3.2 x 300 4.0 x 450</td>
<td>E Fe3</td>
<td></td>
<td>+ - 70V</td>
<td>• The weld deposit distinguishes itself by high hardness and toughness of the electrode is used for overlay and build up of machinery parts and tools subject to impact, compression and wear used at operating temperatures up to 650°C.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• It is widely used for building up hammers, dies, swages, hot shear blades, etc ...</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>**</td>
<td>• The weld deposit distinguishes itself by high hardness, toughness and resistance: the electrode is used for overlay and build up of machinery parts and tools subject to impact, compression and wear used at operating temperatures up to 550°C.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• It is widely used for building up hammers, dies, swages, hot shear blades, etc ...</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>**</td>
<td>• The weld deposit distinguishes itself by its toughness and heat resistance: the electrode is used for overlay and build up of machinery parts and tools subject to impact, compression and wear used at operating temperatures up to 550°C.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• It is widely used for building up hammers, dies, swages, hot shear blades, etc ...</td>
</tr>
</tbody>
</table>

### Steels for tooling

<table>
<thead>
<tr>
<th>Product name</th>
<th>Standard diameter and length [mm]</th>
<th>Composition [%]</th>
<th>Hardness - 3 layers</th>
<th>Polarity</th>
<th>Description and applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>HARDFACE 40-E</td>
<td>2.5 x 300 3.2 x 300 4.0 x 450</td>
<td>E Fe3</td>
<td></td>
<td>+ - 70V</td>
<td>• Rutile basic electrode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Superalloy offering similar performance to cobalt based alloys</td>
</tr>
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<td></td>
<td>**</td>
<td>• High cracking resistance little affected by diffusion, highly resistant to thermal shock, may be polished and keeps its properties to 550°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Applications: Traction rollers in continuous casting installations, valves for diesel engines, steam valves, deforming stamps and dies, moulds for ceramic tiles, screws for filled plastic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Complements Welding Alloys cored wire HARDFACE DCO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td>• Complements Welding Alloys cored wire HARDFACE AP</td>
</tr>
</tbody>
</table>

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**Note:**
- **Suitable**
- ** Highly suitable
**Product Name** | **Composition [%]** | **Hardness** | **As welded** | **Work hardened** | **Hardfaces**
--- | --- | --- | --- | --- | ---
**HARDFACE HC-E** | C: 0.50 Mn: 0.50 Si: 1.00 Cr: 35.0 W: Balance | Balance | Nb: 7.00 | 64 HRC | 950 - 1450
**HARDFACE CN-E** | C: 1.50 Mn: 1.50 Si: 24.0 W: Balance | Balance | Mo: 7.00 Nb: 7.00 V: 1.00 | 65 HRC | 950 - 2900
**HARDFACE CNV-E** | C: 1.50 Mn: 22.0 W: 2.00 Balance | Balance | Mo: 2.50 Nb: 2.50 | 35 HRC | 220 HB
**STEELCABW-E** | Deposit containing tungsten carbide particles in a steel matrix | WC/WC: 65 | | 60 HRC | 950 - 2900
**STELLOY 25-E** | C: 0.10 Mn: 1.00 Si: 0.80 Cr: 20.0 W: 15.0 | Ni: 10.00 Co: Balance | Nb: 5.00 | 220 HB | 64 HRC
**STELLOY 21-E** | C: 0.30 Mn: 0.50 Si: 0.80 Cr: 28.0 | Ni: 3.00 Co: Balance | Nb: 2.50 | 35 HRC | 220 HB
**STELLOY 6-E** | C: 1.10 Mn: 1.00 Si: 28.0 Cr: 4.50 W: 3.00 | Co: Balance | Nb: 1.00 | 44 HRC | 66 HRC

### Description and applications

**Anti-abrasion**

- **HARDFACE HC-E**
  - 3.2 x 350
  - 4.0 x 350
  - 5.0 x 450
  - E Fe15
  - **− 50V**
  - Polarity: E Fe15
  - Description and applications:
    - Very high recovery basic electrode (190%)
    - Highly abrasion resistant chromium carbide deposit
    - Combination of primary and eutectic chromium carbides in a tough matrix.
    - Final weld pass when joining Integra™ and Hardlite™ wear plates
    - Applications: components for crushing and mineral conveying equipment, dredger pumps, mixers and riddle plates

- **HARDFACE CN-E**
  - 3.2 x 350
  - 4.0 x 450
  - 5.0 x 450
  - E Fe15
  - **− 50V**
  - Polarity: E Fe15
  - Description and applications:
    - Very high recovery basic electrode (190%) with very pleasing arc characteristics and a slag-free deposit
    - High concentration of niobium and chromium carbides

- **HARDFACE CNV-E**
  - 3.2 x 350
  - 4.0 x 450
  - 5.0 x 450
  - E Fe16
  - **− 50V**
  - Polarity: E Fe16
  - Description and applications:
    - Very high recovery rutile electrode (200%)
    - Highly-alloyed chromium cast iron with a high concentration of complex carbides
    - Excellent weldability, very soft spatter-free fusion, no slag
    - Resists combined abrasion and impacts at high temperatures. The properties are reached in only three layers

- **STEELCABW-E**
  - 4.0 x 350
  - 5.0 x 350
  - E Fe15
  - **− 45V**
  - Polarity: E Fe15
  - Description and applications:
    - Tubular electrode filled with carbide particles
    - Extreme resistance to abrasives, especially fine-grained
    - Applications: dust extractor fans in the mining, cement and steel industries, scraper blades, components for agriculture, etc.

**Cobalt base**

- **STELLOY 25-E**
  - 3.2 x 350
  - 4.0 x 350
  - E Z Co 1
  - **− 70V**
  - Polarity: E Z Co 1
  - Description and applications:
    - Rutile basic coated electrode
    - Highly resistant to high temperature wear and metal-to-metal abrasion
    - Particular ease of application due to its low cracking tendency
    - Maintains a good level of hardness at high temperatures. Work-hardenable.
    - Applications: straightening guides, vertical mill rolls and foot rolls in continuous casting

- **STELLOY 21-E**
  - 2.5 x 300
  - 3.2 x 300
  - 4.0 x 350
  - E Co1
  - **− 70V**
  - Polarity: E Co1
  - Description and applications:
    - Rutile basic coated electrode
    - Ideal choice for resisting multiple combinations of stresses
    - Resists corrosion and cavitation
    - Maintains a good level of hardness at high temperatures
    - Work-hardenable, can be polished, low coefficient of friction
    - Applications: industrial valve work, forging dies and hot shearing blades

- **STELLOY 6-E**
  - 2.5 x 300
  - 3.2 x 300
  - 4.0 x 350
  - 5.0 x 350
  - E Co2
  - **− 70V**
  - Polarity: E Co2
  - Description and applications:
    - Rutile basic coated electrode
    - Combines all the outstanding properties of the cobalt base alloys, including abrasion and erosion resistance
    - Deposit of intermediate hardness with good machinability
    - Wide field of applications: hot shearing tools, petrochemical and industrial valves, valves and valve seats of marine engines, pump sleeves and shafts
    - Applications: Hot shearing tools, petrochemical and industrial valves, etc.
## Electrodes for joining

<table>
<thead>
<tr>
<th>Product name</th>
<th>Standard diameters and length [mm]</th>
<th>Standards</th>
<th>Composition [%] - Fe balance</th>
<th>Mechanical properties</th>
<th>Description and applications</th>
<th>Base material</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPEEDARC 6013-E</td>
<td>2.5 x 350, 3.2 x 350, 4.0 x 450, 5.0 x 450</td>
<td>AWS A5.1: E6013 E 62S</td>
<td>C: 0.10, Si: 0.50</td>
<td>~ 70VSPEEDARC HLE 700-E &gt; 760 &gt; 690 &gt; 20 +20</td>
<td>Welding of high strength steels for service temperatures from -60°C to +400°C.</td>
<td>AWS A5.1: E6013 E 62S, EN ISO 517 Gr A, B, C, E, F, H, J, K, M, P, A 442 grade 55, 60.</td>
</tr>
<tr>
<td>SPEEDARC 7016-E</td>
<td>2.5 x 350, 3.2 x 350, 4.0 x 450, 5.0 x 450</td>
<td>AWS A5.1: E7016 E 38 2 B 12 H 50</td>
<td>C: 0.10, Si: 1.10, Ni: 0.40</td>
<td>~ 70VSPEEDARC HLE 620-E &gt; 760 &gt; 690 &gt; 20 +20</td>
<td>Welding of high strength steels for service temperatures from -50°C to +400°C.</td>
<td>AWS A5.1: E7016 E 38 2 B 12 H 50, EN ISO 517 Gr A, B, C, E, F, H, J, K, M, P, A 442 grade 55, 60.</td>
</tr>
<tr>
<td>SPEEDARC Ni1-E</td>
<td>2.5 x 350, 3.2 x 350, 4.0 x 450, 5.0 x 450</td>
<td>AWS A5.5: E9018-C3 E 48 5 Ni B 42</td>
<td>C: 0.10, Ni: 0.50</td>
<td>~ 70VSPEEDARC HLE 700-E &gt; 760 &gt; 690 &gt; 20 +20</td>
<td>Welding of high strength steels for service temperatures from -70°C to +400°C.</td>
<td>AWS A5.5: E9018-C3 E 48 5 Ni B 42, EN ISO 517 Gr A, B, C, E, F, H, J, K, M, P, A 442 grade 55, 60.</td>
</tr>
<tr>
<td>SPEEDARC HLE 550-E</td>
<td>2.5 x 350, 3.2 x 350, 4.0 x 450, 5.0 x 450</td>
<td>AWS A5.1: E9018-G E 55 5 Ni Mo B 42</td>
<td>C: 0.10, Ni: 0.50</td>
<td>~ 70VSPEEDARC HLE 700-E &gt; 760 &gt; 690 &gt; 20 +20</td>
<td>Welding of high strength steels for service temperatures from -70°C to +400°C.</td>
<td>AWS A5.1: E9018-G E 55 5 Ni Mo B 42, EN ISO 517 Gr A, B, C, E, F, H, J, K, M, P, A 442 grade 55, 60.</td>
</tr>
<tr>
<td>SPEEDARC HLE 620-E</td>
<td>2.5 x 350, 3.2 x 350, 4.0 x 450, 5.0 x 450</td>
<td>AWS A5.1: E1016-G E 62 5 1.5 Ni Mo B 42</td>
<td>C: 0.10, Ni: 0.50</td>
<td>~ 70VSPEEDARC HLE 700-E &gt; 760 &gt; 690 &gt; 20 +20</td>
<td>Welding of high strength steels for service temperatures from -70°C to +400°C.</td>
<td>AWS A5.1: E1016-G E 62 5 1.5 Ni Mo B 42, EN ISO 517 Gr A, B, C, E, F, H, J, K, M, P, A 442 grade 55, 60.</td>
</tr>
<tr>
<td>SPEEDARC HLE 700-E</td>
<td>2.5 x 350, 3.2 x 350, 4.0 x 450, 5.0 x 450</td>
<td>AWS A5.1: E69 4 Mn 2Ni Cr Mo B 42</td>
<td>C: 0.10, Cr: 1.10, Mo: 0.50</td>
<td>~ 70VSPEEDARC HLE 700-E &gt; 760 &gt; 690 &gt; 20 +20</td>
<td>Welding of high strength steels for service temperatures from -70°C to +400°C.</td>
<td>AWS A5.1: E69 4 Mn 2Ni Cr Mo B 42, EN ISO 517 Gr A, B, C, E, F, H, J, K, M, P, A 442 grade 55, 60.</td>
</tr>
</tbody>
</table>
# Electrodes for joining

## Product name

<table>
<thead>
<tr>
<th>Product name</th>
<th>Composition [%]</th>
<th>Fe balance</th>
<th>Mechanical properties</th>
<th>Description and applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>TETRA 308-E</td>
<td>&lt; 0.03 0.10 1.00</td>
<td>1.00 18.0</td>
<td>Rm&gt;[200] &gt; 500 &gt; 20</td>
<td>Rutile basic coated electrode</td>
</tr>
<tr>
<td>TETRA 316-E</td>
<td>&lt; 0.03 0.10 1.00</td>
<td>1.00 18.0</td>
<td>Rm&gt;[200] &gt; 500 &gt; 20</td>
<td>Rutile basic coated electrode</td>
</tr>
<tr>
<td>TETRA 904L-E</td>
<td>&lt; 0.03 0.70 0.80</td>
<td>0.80 22.5</td>
<td>Rm&gt;[200] &gt; 500 &gt; 20</td>
<td>Rutile basic coated electrode</td>
</tr>
</tbody>
</table>

## Base material

- **Austenitic steels**
  - **TETRA 308L-E**
    - AWS A5.4: E 308L-16
    - Polarity: + 70°
    - Rm > 540 > 360 > 35 20°C > 70
    - Rutile basic coated electrode
      - Austenitic deposit in CrNi steel – type 308L
      - Dissimilar joints, welding of steels of unknown types, armouring steels, buffering
      - Service temperatures from -120°C to +300°C
  - **TETRA 316L-E**
    - AWS A5.4: E 316L-17
    - Polarity: + 70°
    - Rm > 560 > 400 > 35 20°C > 70 120°C > 40
    - Rutile basic coated electrode
      - Austenitic deposit in CrNiMo steel – type 316L – resistant to intercrystalline corrosion under humid conditions up to 400°C
      - Joining of low-carbon or stabilised steels with similar compositions
      - Cladding of coated plates of the same or similar compositions
      - Service temperatures from -110°C to +450°C
    - Complements Welding Alloys cored wires TETRA S 316L and TETRA V 316L
  - **TETRA 904L-E**
    - AWS A5.4: E 309L-18
    - Polarity: + 70°
    - Rm > 570 > 370 > 35 20°C > 70
    - Rutile basic coated electrode
      - Austenite-ferritic deposit in over-alloyed CrNi steel – type 309L, with optimised ferrite content for joining dissimilar materials
      - Joining of steels with similar compositions and joining carbon steels to stainless steels
      - Service temperatures from -110°C to +550°C
    - Complements Welding Alloys cored wires TETRA S 904L and TETRA V 904L

- **Dissimilar assemblies and repairs**
  - **TETRA 307-E**
    - AWS A5.4: E 307-18
    - Polarity: + 70°
    - Rm > 600 > 400 > 30 20°C > 70
    - Rutile coated electrode
      - Work-hardening austenitic deposit in CrNiMn steel – modified type 307
      - Dissimilar joints, welding of steels of unknown types, armouring steels, buffering
      - Joining of 14% Mn austenitic steels
      - Service temperatures from -120°C to +300°C
    - Complements Welding Alloys cored wires TETRA S 307 and TETRA V 307
  - **TETRA 309L-E**
    - AWS A5.4: E 309L-18
    - Polarity: + 70°
    - Rm > 560 > 400 > 35 20°C > 60
    - Rutile basic coated electrode
      - Austenite-ferritic deposit in over-alloyed CrNi steel – type 309L
      - Dissimilar joints, welding of steels of unknown types, armouring steels, buffering
      - Joining of steels of similar compositions and joining carbon steels to stainless steels
      - Service temperatures from -40°C to +550°C
    - Complements Welding Alloys cored wires TETRA S 309L and TETRA V 309L
  - **TETRA 309L Mo-E**
    - AWS A5.4: E 309L Mo-17
    - Polarity: + 70°
    - Rm > 650 > 450 > 25 20°C > 55 40°C > 45
    - Rutile basic coated electrode
      - Austenite-ferritic deposit in over-alloyed CrNiMo steel – type 309LMo, for joining dissimilar metals
      - Joining of stainless steels to mild or low-alloyed steels at high dilution levels
      - Buffering before cladding
      - Service temperatures from -40°C to +550°C
    - Complements Welding Alloys cored wires TETRA S 309LMo and TETRA V 309LMo
  - **TETRA 312-E**
    - AWS A5.4: E 312-18
    - Polarity: + 50°
    - Rm 700-820 500 > 20
    - Rutile basic coated electrode
      - Austenite-ferritic deposit in CrNi steel – type 312, offering exceptional cracking resistance
      - Joining of unknown or hard-to-weld steels
      - Dissimilar joints, including those to steels with high carbon equivalents: high speed steels, tool steels, Mn steels, high strength constructional steels, wear plates
      - Complements Welding Alloys cored wires TETRA S 312 and TETRA V 312
## Electrodes for joining

### Nickel base

<table>
<thead>
<tr>
<th>Product name</th>
<th>Composition [%]</th>
<th>Description and applications</th>
<th>Base material</th>
</tr>
</thead>
</table>
| GAMMA 182-E    | < 0.04 6.00 0.40 16.5 Balance 0.20 6.00 2.00 | - Basic coated electrode giving a NiCrFe alloy deposit  
- Joining and cladding of corrosion and heat resisting type 600 nickel alloys  
- Dissimilar joints between stainless steels and CrMo steels  
- Joining of heat resisting steels  
- Joining and repair of steels with limited weldability  
- Service temperatures from -196°C to +900°C  
- Complements Welding Alloys cored wire GAMMA 182 | (1.4816) NiCr 15Fe, 600 alloys, 600L, 800H |
| GAMMA 625-E    | < 0.04 6.00 0.40 22.0 Balance 9.00 3.00 3.40 | - Basic coated electrode giving a 625 type alloy deposit  
- Joining and cladding of Ni base alloys of corresponding types  
- Joining of steels exposed to low temperatures : CrNi (Mo,N) austenitic steels and 5-9% Ni steels  
- Dissimilar joints between Ni base alloys or to low alloy or stainless steels  
- Joining of super-austenitic stainless steels  
- Service temperatures from -196°C to +1100°C  
- Complements Welding Alloys cored wire GAMMA 625 and Gamma V625 | (2.4856) NiCo22Mo9Nb, (2.4858) NiCo21Mo, (1.4876) X10 NiCrAlTi 32-20H, (1.4876) X10 NiCrAlTi 32-21, X8 Ni9, ASTM A 533 Gr1, 625 alloys, 800H |
| GAMMA 276-E    | < 0.02 6.00 0.20 16.5 Balance 16.0 5.00 W: 4.00 | - Basic coated electrode giving a fully austenitic NiCrMoW deposit, highly resistant to corrosion in reducing and oxidising media  
- Exceptional resistant to hot cracking  
- Wide range of application including joints between mild or low alloyed steels and nickel alloys, hardfacing on wrought alloys, and hardfacing or repair of hot working tooling  
- Service temperatures from -196°C to 900°C  
- Complements Welding Alloys cored wire GAMMA 276 and Gamma V276 | 2.4819 NiMo 16 Cr 15 W |

### Cast iron

<table>
<thead>
<tr>
<th>Product name</th>
<th>Composition [%]</th>
<th>Description and applications</th>
<th>Base material</th>
</tr>
</thead>
</table>
| FONTE Ni-E     | 0.60 0.20 0.50 55.0 Balance 6.00 Cu: 0.60 | - Graphite-containing basic electrode with nickel core giving a machinable deposit for welding of cast iron  
- Particularly suited to welding from cold of old and new grey and malleable cast iron, even when impregnated with oil  
- Very soft fusion, good bead appearance free of undercut  
- Hardness deposit and heat affected zone, easily machinable  
- Particularly suited to repairing holes and cracks  
- Peening recommended immediately after each pass for efficient elimination of internal contraction stresses  | GG 10 to GG 40, GT53 to GT60, GTW55 to GTW60, GGG 40 to GGG 070, GGQL to 170 N/ mm² GGG N 1 to 375 N/ mm² |
| FONTE BI-NIFE-E| 1.30 0.30 0.80 | - Graphite-containing basic electrode with NiFe bimetal core for joining heavy-gauge ductile and spheroidal cast iron and for heavily restrained joints  
- Reduced heat affected zone  
- Easily machinable deposit  
- Excellent weldability and good mechanical properties  
- Complements Welding Alloys cored wire CAST NIFE | GG 15, GG40, GGG 40, GGG 70, GTS 35, GTS 65 |
This catalogue presents the Manual Welding Electrode program completing the Welding Alloys. 100% produced in our manufacture of cored welding wires for surfacing applications. Since its foundation in 1966, the Welding Alloys Group, an independent group, has specialised our policy of continuous R&D along with industrial development, enabling us to offer the quality meets or exceeds the most stringent standards for hardfacing, cladding and joining applications.

Understanding wear phenomena and material attributes

<table>
<thead>
<tr>
<th>Wear Mechanism</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal/metal friction</td>
<td>Metal surfaces in relative motion forced into contact with or without lubricant. Degradation by the formation of micro-wear at the contacting surfaces.</td>
</tr>
<tr>
<td>Mineral abrasion</td>
<td>Wear by relative movement of mineral particles of suitable hardness, shape and texture to remove material from the metal surface.</td>
</tr>
<tr>
<td>Abrasion under pressure</td>
<td>Wear by relative movement of mineral particles of suitable hardness, shape and texture to remove material from the metal surface, leaving superficial deformation.</td>
</tr>
<tr>
<td>Hot abrasion</td>
<td>An above but in a high-temperature environment, leading generally to softening of the metal or its constituents.</td>
</tr>
<tr>
<td>Erosion</td>
<td>Repeated high-speed impacts between mineral particles and a material surface. Local destruction by tearing out of metallic grains.</td>
</tr>
<tr>
<td>Cavitation</td>
<td>Tearing out of grime from the metal surface by the formation and implosion of bubbles in a liquid in rapid motion.</td>
</tr>
<tr>
<td>Impact</td>
<td>Impact between two materials, one of which provokes deformation or rupture of the surface of the other. This phenomenon is controlled by the toughness or ductility of the two materials.</td>
</tr>
<tr>
<td>Mechanical fatigue</td>
<td>Cyclic deformation not exceeding the elastic limit of the material. Degradation over time by localized stress concentrations.</td>
</tr>
<tr>
<td>Thermal fatigue</td>
<td>Cyclic exposure to high temperatures leading to permanent deformation by alternate expansion and contraction. Alteration of the structure and properties of the material.</td>
</tr>
<tr>
<td>Hot oxidation</td>
<td>Creation of a poorly adhering oxide layer that reforms constantly. Degradation by loss of material thickness.</td>
</tr>
<tr>
<td>Corrosion</td>
<td>Degradation of the material by chemical reaction with its environment. Complete phenomena involving numerous parameters.</td>
</tr>
</tbody>
</table>

Attributes: Rebuilding or cladding, Buffer or layer or assembly, Cutting ability, Work-hardening, Machinability

Chemical Composition

Each alloy is composed of elements expressed as percentages by weight. The values of those elements essential to the physical, chemical and mechanical properties of the deposit are highlighted in the composition table.

Example:

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Composition [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
</tr>
<tr>
<td>HARDFACE AP</td>
<td>0.60</td>
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Packaging

<table>
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<tr>
<th>Ø2.5 x 300mm</th>
<th>Ø2.5 x 350mm</th>
<th>Ø3.2 x 350mm</th>
<th>Ø3.2 x 450mm</th>
<th>Ø4.0 x 350mm</th>
<th>Ø4.0 x 450mm</th>
<th>Product Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 kg ~ 240 pcs</td>
<td>5 kg ~ 147 pcs</td>
<td>5 kg ~ 98 pcs</td>
<td>5 kg ~ 104 pcs</td>
<td>5 kg ~ 94 pcs</td>
<td>5 kg ~ 97 pcs</td>
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<td>5 kg ~ 98 pcs</td>
<td>5 kg ~ 104 pcs</td>
<td>5 kg ~ 94 pcs</td>
<td>5 kg ~ 97 pcs</td>
<td>FONTE Bi-Mo-E</td>
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<td>5 kg ~ 94 pcs</td>
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<td>5 kg ~ 91 pcs</td>
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<td>5 kg ~ 97 pcs</td>
<td>5 kg ~ 91 pcs</td>
<td>5 kg ~ 97 pcs</td>
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<td>5 kg ~ 91 pcs</td>
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<td>5 kg ~ 91 pcs</td>
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<td>5 kg ~ 96 pcs</td>
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<tr>
<td>5 kg ~ 250 pcs</td>
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<td>5 kg ~ 98 pcs</td>
<td>5 kg ~ 96 pcs</td>
<td>5 kg ~ 96 pcs</td>
<td>5 kg ~ 96 pcs</td>
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<td>6 kg ~ 140 pcs</td>
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<td>6 kg ~ 140 pcs</td>
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<td>5 kg ~ 94 pcs</td>
<td>5 kg ~ 94 pcs</td>
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<td>5 kg ~ 143 pcs</td>
<td>5 kg ~ 94 pcs</td>
<td>5 kg ~ 94 pcs</td>
<td>5 kg ~ 94 pcs</td>
<td>5 kg ~ 94 pcs</td>
<td>TETRA 308-E</td>
<td>10</td>
</tr>
</tbody>
</table>

Standard packaging: explanation of the information in the above table

3 boxes per carton (except for 1 kg boxes)

Standard weight per box (Consult us for all other requirements)

Approximate number of electrodes per box

Technical Information

- All chemical compositions given are for all weld metal deposits.
- All mechanical properties are typical values.
- Technical data sheets and safety data sheets are available for all products.

Welding products and techniques evolve constantly. All descriptions, illustrations and properties given in this catalogue are subject to change and can only be considered as general guidance.
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