HARDSURFACING

Select-Arc Hardsurfacing Products

Hardsurfacing encompasses a broad range of alloy compositions which are designed for a variety of applications. The basic concept is to deposit, by an arc welding process, an alloy onto a metallic component which resists wear more effectively than the base metal of the component. By doing so, you increase the component life. The hardsurfacing alloy may also be required to provide additional resistance to other conditions including impact, adhesion, corrosion, erosion or elevated temperatures.

Reasons for Hardsurfacing

Metal components eventually wear out from use or break in service. Until the advent of buildup and hardsurface welding operations, the part was discarded and replaced with a new O.E.M. part. Initially, the idea was to reclaim the worn part by building up the worn area with welding and/or subsequent machining. This practice of reclaiming the worn component proved to be a significant cost savings over the purchase of a new component. Some time later, the concept of improving the life of a metal component by welding a more wear resistant alloy to the components surface evolved. Again, this proved to be a great value in reducing the cost of operation.

Hardsurfacing does the following:

1. Reduces the cost of operation by reclaiming worn components at a fraction of the new O.E.M. price.
2. Increases the life of components by utilizing more wear-resistant alloys.
3. Reduces machinery downtime by increasing component life.

In conclusion, reclamion by the use of buildup and hardsurface welding reduces costs of operation, making you more competitive in your industry.

Alloy, Hardness vs. Wear

One common misconception is that higher hardness in the weld deposit yields better wear-resistance. Greater hardness does not always equate to less wear and longer component life. Different alloys with similar hardness values can result in entirely differing wear-resistance properties. Typically, the volume density, or amount of carbide present in the alloy matrix, imparts the wear-resistant properties to the alloy deposit. Therefore, the greater the volume of carbide, the greater the wear-resistance of the alloy. In some cases, the most wear-resistant alloy is not always the best solution for the application. As carbide volume increases, the more crack sensitive and less impact resistant the deposit becomes. The choice of which hardsurfacing alloy to use is normally a compromise between wear-resistance and impact-resistance of the alloy for a given application.

Surfacing Alloy Groups

Hardsurfacing and buildup alloys are generally broken down into broad groups. Some groups can be broken down into smaller, more specific groups, but this is unnecessary for the majority of the market.

Buildup Alloys

The buildup group is composed of lower carbon, low alloy steels, similar in range of chemistry to the component being reclaimed. By arc welding, the component is rebuilt to near original dimensions prior to final hardsurfacing operations. Typically, these alloys are machinable and offer a good combination of hardness and toughness.

Consideration should be given to heat treating procedures when welding with these alloys to reduce residual stresses caused by the welding process, reducing the potential for cracking.

Austenitic Alloys

Typically, austenitic steels exhibit very good toughness and strength under high impact conditions. As deposited, these alloys can be very ductile, yielding hardnesses in the range of 17 to 23 Rockwell C scale hardness (HRC). Under impact, the alloy microstructure deforms, or work hardens, resulting in a hard, tough surface layer. Hardness can be increased to a range of 44 to 54 HRC. Because of the initial ductility of the deposit, buildup depth is generally unlimited. Some of the austenitic group can be considered both buildup and hard-surfacing alloys due to their ability to be deposited as a very ductile alloy and then work harden in service. This work hardening property makes them an ideal choice for rebuilding manganese crusher parts where extreme impact with low abrasion is encountered.

Martensitic Alloys

The martensitic group includes a wide variety of hardsurfacing and some buildup alloys. These alloys are generally considered a good choice for metal-to-metal wear resistance. Weld deposits yield good impact and abrasion properties. These alloys are also termed “air hardenable” meaning that the cooling rate is directly related to final hardness. Faster cooling promotes formation of the martensitic structure. Care must be taken with regard to heat treatment procedures (preheat, interpass, postweld stress relief) to avoid residual stresses and cracking of the weld deposit.

Carbide Containing Alloys

This group of alloys can include many different carbide forming elements either alone or in combination. Typically high in carbon content, the weld deposit is composed of single, primary...
type carbides or multiple carbides (complex carbides) in an iron matrix. The design of these alloys is such to allow the matrix material to hold the carbides in place under impact or abrasion conditions. The carbide structures impart the wear-resistant properties to the deposit, but require the matrix material to be tough enough to endure the impact. High density carbide alloys are considered the best choice for high abrasion wear conditions with some impact. Carbide forming elements include boron, chromium, columbium (niobium), molybdenum, titanium, tungsten and vanadium. The deposits tend to stress relief, crack check and are limited in depth of deposit depending on specific application.

**Non-Ferrous Alloys**

When discussing non-ferrous alloys used in the hardsurfacing industry, we are mainly referring to the cobalt and nickel based alloys. These alloys contribute additional properties including corrosion resistance, oxidation resistance, high temperature hardness, strength and creep resistance. Due to their higher cost over other iron based alloys, their use is limited to very specific applications where the additional material cost is justified.

Select-Arc has designed a line of hardsurfacing products which offer the highest level of metallurgical and welding performance. These cored wires are formulated to produce consistency of deposit composition and welding characteristics. From incoming inspection of alloy and mineral powders to the mixing operation to the fabrication of the wire, measures are in place to ensure that every pound of product meets specified performance criteria.

Rigorous checks of all raw materials are ongoing to verify that they conform to purchasing requirements. Dimensional requirements of steel are continuously monitored for accuracy and conformance. Fill percentages are checked every 600 pounds to ensure consistency throughout each mix of product. Chemical analysis is performed on finished wire produced from each dry mix of every electrode. This translates into a deposit chemistry for every 1000-2000 lb. of manufactured wire. Weldability evaluations are conducted for wire samples representative of each dry mix; these evaluations are used to assess the arc characteristics, spatter levels, feedability, deposit appearance and overall welding performance of the electrode. These cored products which offer the highest level of metal compositions that can be tailored to each application problem. Their mission is to

Customer and technical services are essential to satisfying customer expectations, by means of proper internal and external communications. Information must be transferred accurately and promptly, and responses must be timely. Select-Arc prides itself on providing excellent customer service, accurate technical service and professional technical support. Select-Arc also has a staff of application specialists for assisting customers with welding and application problems. Their mission is to provide solutions to problems and assistance in applying the proper product to specific welding situations. These specialists are available for training customers in the proper use of our products and the selection of the best welding electrode for each application.

It is not possible to develop, implement and expand a line of tubular hardsurfacing electrodes without a good product development team, and Select-Arc has one of the best in the industry. Our staff of engineers and technicians can react swiftly to customers’ requests, whether they are development of new products or modifications to existing ones. Select-Arc’s development engineers, all with metallurgical backgrounds, have the unique ability to formulate both the slag systems and alloy compositions that can be tailored to each customer’s requirements.
**SelectWear BU**

**ALLOY GROUP:** Low Alloy Steel

SelectWear BU is a low alloy wire designed for buildup on carbon steels. BU has excellent compressive strength and resistance to cracking. Machinability is very good. Buildup thickness is generally unlimited with proper heat treatment procedures.

SelectWear BU-GV is a gas-shielded, all position, flux cored wire that may be used with CO₂, or Ar/CO₂ gas mixtures. It has excellent operating characteristics in vertical and overhead welding.

**APPLICATIONS:** Steel mill rolls, shafts, steel hammers, gear teeth, shovel pads

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Mn-Cr
- Hardness (4 layers): R₇-25-35
- Machinable
- Good crack resistance

**AVAILABLE AS:**
- Diameters:
  - BU-FCG .045", 1/16", 3/32", 7/64", 1/8"
  - BU-FCO .045", 1/16", 7/64", 1/8"
  - BU-MCG .035", .045", 1/16"
  - BU-S 7/64", 1/8", 5/32"
  - BU-GV .045", 1/16"

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**SelectWear MN**

**ALLOY GROUP:** Austenitic Manganese

SelectWear MN is an austenitic manganese alloy designed for severe impact with moderate abrasion. MN yields a very tough, impact-resistant deposit which work hardens in use. Primarily utilized for buildup and repair of manganese steel components. Deposit thickness is generally unlimited and does not crack.

**APPLICATIONS:** Manganese rock crushing hammers and rolls, impactor bars, gyratory mantles, dredge components

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Mn-Cr
- Hardness (4 layers): R₇-22, work hardens to R₇-45-52
- Machinable
- Will not cross crack

**AVAILABLE AS:**
- Diameters:
  - MN-FCG .045", 1/16", 3/32", 7/64", 1/8"
  - MN-FCO 7/64"

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**SelectWear GP**

**ALLOY GROUP:** Austenitic Manganese

SelectWear GP is a premium grade austenitic manganese wire with a modified high chromium level. Utilized in the joining, repair and buildup of manganese steel parts. Weld deposits exhibit very good impact resistance. Sometimes used as a final layer of hardfacing in high impact applications with moderate wear. Buildup depth is generally unlimited.

**APPLICATIONS:** Manganese rock crushing hammers and rolls, impactor bars, gyratory mantles, dredge components

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Cr-Mn-C
- Hardness: As welded - R₇-22, work hardens to R₇-45-52
- Machinable with carbide tools
- Will not cross crack

**AVAILABLE AS:**
- Diameters:
  - GP-FCO .045", 1/16", 5/64", 7/64", 1/8"
**SelectWear 42**

**ALLOY GROUP:** Medium Alloy
Martensitic Steel

SelectWear 42 yields a low alloy, martensitic steel of mid-range hardness. 42 has very good metal-to-metal wear resistance. Multiple layers can be welded crack free.

SelectWear 42GV is a gas-shielded, all position, flux cored wire that may be used with CO₂ or Ar/CO₂ gas mixtures. It has excellent operating characteristics in vertical and overhead welding.

**APPLICATIONS:** Earthmoving idlers and rollers, mine car wheels

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Cr-Mn
- Hardness (3 layers): R₄₀⁻₅₅
- Machinable with carbide tools
- Will not cross crack

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>42-FCO</td>
<td>.045&quot;, 1/16&quot;, 7/64&quot;, 1/8&quot;</td>
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<tr>
<td>42-MCG</td>
<td>.045&quot;, 1/16&quot;</td>
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<tr>
<td>42-S</td>
<td>1/8&quot;</td>
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<tr>
<td>42-FCG</td>
<td>.045&quot;, 1/16&quot;</td>
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<tr>
<td>42GV-FCG</td>
<td>.045&quot;, 1/16&quot;</td>
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**SelectWear 52W**

**ALLOY GROUP:** Modified H12 Tool Steel

SelectWear 52W is designed to deposit a martensitic alloy similar to an H12 tool steel. 52W provides excellent abrasion resistance and high hardness without stress relief crack checking. Good resistance to high compressive loads. Can be machined with some difficulty.

**APPLICATIONS:** Steel mill edger rolls, work rolls, leveler rolls, blast furnace bell seat areas

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Cr-W-Mo-C
- Hardness (2 layers): R₅₀⁻₅₅
- Machinable with carbide tools
- Will not cross crack

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<td>52W-FCO</td>
<td>.045&quot;, 7/64&quot;, 1/8&quot;</td>
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<tr>
<td>52W-MCG</td>
<td>.035&quot;, .045&quot;, 1/16&quot;, 7/64&quot;, 1/8&quot;</td>
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**SelectWear 420**

**ALLOY GROUP:** Martensitic Stainless Steel

SelectWear 420 produces a hard, martensitic stainless steel deposit. It has good resistance to hot wear, fire cracking and corrosion.

**APPLICATIONS:** Steel mill caster rolls, idler rolls

**DIAMETERS AND PACKAGING:**
- 1/8", 5/32" 250#, 500# Drum

**CHEMISTRY:**
- Carbon: 0.30
- Manganese: 1.10
- Silicon: 0.60
- Chromium: 12.50
- Iron: Bal

**HARDNESS:** (HRC) As Deposited 50

<table>
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<tr>
<th>AVAILABLE AS:</th>
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<tr>
<td>420-S*</td>
<td>3/32&quot;, 7/64&quot;, 1/8&quot;</td>
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* For use with neutral fluxes, such as Lincoln 801
**SelectWear 423**

**ALLOY GROUP:** Martensitic Stainless Steel

SelectWear 423 produces a deposit with improved resistance to thermal fatigue and corrosion as well as excellent wear resistance and high hot hardness.

**APPLICATIONS:** Steel mill caster rolls, table rolls

**CHEMISTRY:**
- Carbon: 0.15
- Manganese: 1.20
- Silicon: 0.40
- Chromium: 13.70
- Nickel: 2.50
- Molybdenum: 1.10
- Niobium: 0.20
- Vanadium: 0.20
- Iron: Bal

**HARDNESS:** (HRC) As Deposited 48

**AVAILABLE AS:**
- 423-FCG: 5/64”, 3/32”,
- 423-S*: 3/32”, 7/64”, 1/8”

* For use with neutral fluxes, such as Lincoln 801

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**SelectWear 44**

**ALLOY GROUP:** Medium Alloy Carbide Steel

SelectWear 44 is an open arc wire designed to deposit chromium carbides in a semi-austenitic matrix. Alloy has good impact and abrasion properties. Weld deposit will stress relief cross crack.

**APPLICATIONS:** Dredge pump shells and components, crusher rolls, gyratory cones and mantles

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Cr-Mo-C
- Hardness (3 layers): R₄,42–45
- Not machinable
- Will cross crack

**AVAILABLE AS:**
- 44-MCO: 1/16”, 7/64”, 1/8”

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**SelectWear 50**

**ALLOY GROUP:** Medium Chromium Carbide

SelectWear 50 is an open arc, medium chromium carbide alloy. Weld deposit exhibits resistance to both moderate wear and impact. Multiple pass applications are possible dependant on application. Deposit stress relieves itself by cross cracking.

**APPLICATIONS:** Rock crushing hammers and rolls, impactor bars, gyratory mantles, dredge components, augers, pug mill paddles

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Cr-C
- Hardness (2 layers): R₅,50–54
- Not machinable
- Will cross crack

**AVAILABLE AS:**
- 50-MCO: .045”, 1/16”, 5/64”, 7/64”, 1/8”

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**Hardsurfacing Note:**

Select-Arc hardsurfacing products come in a variety of forms to match the welding process being used. The designators following each product name indicate the operational characteristics of that particular electrode.

- **FCG** Flux cored electrode for use with a shielding gas
- **FCO** Flux cored electrode for use without a shielding gas
- **MCG** Metal cored electrode for use with a shielding gas
- **MCO** Metal cored electrode for use without a shielding gas
- **S** Submerged arc electrode
SelectWear 57GW

**ALLOY GROUP:** Martensitic Tool Steel

SelectWear 57GW is an iron-based, martensitic alloy. It offers high hardness (Rc 54-58) and good abrasion resistance combined with enhanced impact resistance. SelectWear 57GW is often used as a matrix for tungsten carbide particles that are dropped into its weld puddle. The deposit is ductile enough so that the tungsten carbide particles are less likely to be pulled out in service. The deposit is magnetic, will not cross check and is not readily machineable. This wire is designed to operate with argon/2% oxygen.

**APPLICATIONS:** Debarking knives, agricultural tillage, chisel plows, dredge components, earthmoving bucket lips, extruder screws

**DEPOSIT PROPERTIES:**
Chemistry: Fe-Cr-C
Hardness (2 layers): R 54-58
Not machinable
Will not cross crack

**AVAILABLE AS:**
57GW-MCG

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SelectWear 58

**ALLOY GROUP:** Martensitic Tool Steel

SelectWear 58 is a martensitic alloy designed as a general purpose hardfacing wire. It is available in gas-shielded or open-arc versions. 58 offers high hardness with good balance between abrasion and impact resistance. It is an excellent choice for components that are required to maintain a sharp edge.

SelectWear 58-GV is a gas-shielded, all-position, flux cored wire version that may be used with either CO₂ or 75%Ar/25%CO₂ shielding. The specially designed slag system allows for easy use in vertical or overhead welding, with low spatter and fume.

**APPLICATIONS:** Debarking knives, agricultural tillage tools, chisel plows, dredge components, earthmoving bucket lips, extruder screws

**DEPOSIT PROPERTIES:**
Chemistry: Fe-Cr-Mo-V-C
Hardness (2 layers): R 54-60
Not machinable, grinding only
Will not cross crack

**AVAILABLE AS:**
58-FCO 0.045", 1/16", 7/64", 1/8"
58-MCG 0.035", 0.045, 1/16", 7/64", 1/8"
58GV-FCG 0.045", 1/16"

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SelectWear 60HC

**ALLOY GROUP:** Chromium Carbide

SelectWear 60HC is designed to deposit an alloy composed of a high density of primary chromium carbides in an iron matrix. Most economical of hardfacing alloys in high wear applications. Deposit has high abrasion resistance with moderate resistance to impact. Deposit stress relieves itself by cross cracking. Can be utilized in hot wear applications up to 1,100°F.

**APPLICATIONS:** Grinding/Pulverizing rolls and table segments, wear plates, clad pipe, dredge pump shells and related components, hammers

**DEPOSIT PROPERTIES:**
Chemistry: Fe-Cr-C
Hardness (2 layers): R 58-62
Not machinable
Will cross crack

**AVAILABLE AS:**
60HC-MCO 1/16", 5/64", 3/32", 7/64", 1/8"
SelectWear 60PW

**ALLOY GROUP:** Chromium Carbide

SelectWear 60PW wire is similar to the 60HC but deposits an alloy composed of a higher density of primary chromium carbides and higher hardness than 60HC. Designed specifically for single and double pass overlay plate applications.

**APPLICATION:** Wear plate

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Cr-C
- Hardness (2 layers): R₆₉-63
- Not machinable
- Will cross crack

**AVAILABLE AS:**
- Diameters: 7/64", 1/8"

SelectWear 63

**ALLOY GROUP:** Complex Carbide

SelectWear 63 is an open arc wire used to yield a deposit of primary chromium carbides and secondary columbium carbides in a martensitic matrix. Weld deposit gives high abrasion resistance with moderate impact. Typical wear life increase of 33% over standard chromium carbide alloys. Designed for single and double pass overlay applications. Deposit will stress relief cross crack. Maintains hardness and wear resistance into 1200°-1400°F range.

**APPLICATIONS:** Clad wear plate, slurry pipe, grinding rolls and table segments, aggregate screens, fan blades

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Cr-Nb-C
- Hardness (2 layers): R₆₉-63
- Not machinable
- Will cross crack

**AVAILABLE AS:**
- Diameters: 5/64", 7/64", 1/8"

SelectWear 65

**ALLOY GROUP:** Complex Carbide (High Temp)

SelectWear 65 is an open arc wire composed of a high density of primary chromium carbides with multiple secondary carbides. Designed specifically for single and double pass applications in high temperature environments. Weld deposit will stress relief cross crack. Maintains hardness and wear resistance into 1400°-1500°F range.

**APPLICATIONS:** Clad wear plate, slurry pipe, cement furnace components, sinter plant parts, fan blades, mixer blades, screws

**DEPOSIT PROPERTIES:**
- Chemistry: Fe-Cr-Nb-Mo-C
- Hardness (2 layers): R₆₉-63
- Not machinable
- Will cross crack

**AVAILABLE AS:**
- Diameters: 3/32", 7/64", 1/8"

Hardsurfacing Note:
Select-Arc hardsurfacing products come in a variety of forms to match the welding process being used. The designators following each product name indicate the operational characteristics of that particular electrode.

**FCG** Flux cored electrode for use with a shielding gas

**FCO** Flux cored electrode for use without a shielding gas

**MCG** Metal cored electrode for use with a shielding gas

**MCO** Metal cored electrode for use without a shielding gas

**S** Submerged arc electrode
<table>
<thead>
<tr>
<th><strong>SelectWear 600TIC</strong></th>
<th><strong>SelectWear Zucar</strong></th>
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<tbody>
<tr>
<td><strong>ALLOY GROUP:</strong> Titanium Carbide</td>
<td><strong>ALLOY GROUP:</strong> Chromium Carbide</td>
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<tr>
<td><em>SelectWear 600TIC</em> is designed as a tubular, self-shielded wire for hardfacing applications. Deposit is composed of a martensitic steel matrix containing a high volume fraction of titanium carbides. 600TIC is best suited for applications involving extreme wear under high pressure.*</td>
<td><em>SelectWear Zucar is a self-shielded electrode designed specifically to arc sugar cane crusher rolls.</em></td>
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<tr>
<td><strong>APPLICATIONS:</strong> Roller presses, grinding/pulverizing rolls, dredge pump shells, rock crushing hammers</td>
<td><strong>APPLICATION:</strong> Sugar cane crusher rolls</td>
</tr>
<tr>
<td><strong>DEPOSIT PROPERTIES:</strong> Chemistry: Fe-Cr-Ti-C Hardness (2 layers): R&lt;sub&gt;c&lt;/sub&gt; 54-58 Not machinable Will not cross crack</td>
<td><strong>DEPOSIT PROPERTIES:</strong> Chemistry: Fe-Cr-C <strong>HARDNESS:</strong> (HRC) As Deposited 48</td>
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<td><strong>AVAILABLE AS:</strong> Diameters:</td>
<td><strong>AVAILABLE AS:</strong> Diameters:</td>
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<td><strong>ZUCAR-MCO</strong> 3/32&quot;, 1/8&quot;</td>
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