### Stoody Product Specifications

<table>
<thead>
<tr>
<th>Stoody Product</th>
<th>100HC</th>
<th>100HD</th>
<th>PR2009</th>
<th>CP2000</th>
<th>CP2001</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alloy Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Cr Carbides in Austenitic Matrix</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Cr Carbides in Austenitic Matrix</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Cr Carbides in Austenitic Matrix</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Cr Carbides and Secondary Nb + V Carbides in Austenitic Matrix</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Deposit Characteristics (typical)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Abrasion Resistance</strong></td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td><strong>Impact Resistance</strong></td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Deposit Layers, Maximum</strong></td>
<td>Multiple</td>
<td>3</td>
<td>2</td>
<td>Multiple</td>
<td>Multiple</td>
</tr>
<tr>
<td><strong>Hardness, Rockwell C</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On manganese steel</td>
<td>HRC 51 – 55</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Machinability</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Magnetic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On carbon steel</td>
<td>Slightly</td>
<td>Slightly</td>
<td>Slightly</td>
<td>Slightly</td>
<td>Slightly</td>
</tr>
<tr>
<td>On manganese steel</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>On iron</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Hot Wear Applications (up to)</strong></td>
<td>900° F / 482° C</td>
<td>900° F / 482° C</td>
<td>900° F / 482° C</td>
<td>900° F / 482° C</td>
<td>900° F / 482° C</td>
</tr>
<tr>
<td><strong>Wire Diameters Available</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/64” / 2.8 mm</td>
<td>7/64” / 2.8 mm</td>
<td>7/64” / 2.8 mm</td>
<td>7/64” / 2.8 mm</td>
<td>.045” / 1.2 mm</td>
<td>.156” / 1.6 mm</td>
</tr>
<tr>
<td>7/64” / 2.8 mm</td>
<td>7/64” / 2.8 mm</td>
<td>7/64” / 2.8 mm</td>
<td>7/64” / 2.8 mm</td>
<td>.156” / 1.6 mm</td>
<td>7/64” / 2.8 mm</td>
</tr>
<tr>
<td><strong>Packaging</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33# WB</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>60# Coil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11001000</td>
<td>11846200</td>
<td>11983200</td>
<td>11989000 (0.045”)</td>
<td>11986500 (0.156”)</td>
<td></td>
</tr>
<tr>
<td>200 HP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11141700</td>
<td>11501100</td>
<td>11996500</td>
<td>11967000 (0.045”)</td>
<td>11965000 (0.156”)</td>
<td></td>
</tr>
<tr>
<td>500# POP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11235400 (0.045”)</td>
<td>11485000 (0.045”)</td>
<td>11489000 (0.156”)</td>
<td>11979900 (0.045”)</td>
<td>11993400 (0.156”)</td>
<td></td>
</tr>
<tr>
<td>750# POP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11905600 (0.045”)</td>
<td>11905600 (0.156”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes:
- Unless stated otherwise, all hardness values shown are based on two applied layers of hardfacing overlay.
- When used in rebuilding of coal pulverizer rolls, greater than three layers can be applied using proper welding procedures.
- N/A = not applicable / not available

For detailed information, contact your Stoody representative or distributor.
Or, visit our website at www.Stoody.com

---

**Recommended Stoody® Open Arc Welding Wires**

---

**A Global Cutting & Welding Market Leader™**

---

[www.stoody.com](http://www.stoody.com)
Through extensive research and years of practical experience, Stoody® has proven that coal pulverizing rolls, rings, and other vulnerable components can be effectively and economically reclaimed at a fraction of the new part cost. The correct application of hardfacing can increase roll and ring service life by up to 100 percent and can outlast base casting materials.

This brochure provides cost-saving methods to rebuild the most vulnerable parts. The overlay alloys referenced in this document were developed specifically for coal pulverizing rolls and grinding rings. For detailed product information see the Stoody Product Selection Guide or contact your Stoody representative or distributor.

**Hardfacing Coal Pulverizer Rolls, Rings, and other components**

The hardfacing and rebuilding of the coal pulverizer rolls, rings, and other components of the crushe is now routine maintenance program in most coal fired power plants. Historically this type of maintenance was performed by contractors during major outages. Over the years an increasing number of power generating plants have invested in automated welding equipment and trained their maintenance crews to perform this critical service between major outages, allowing additional time for the more critical repairs of the boiler and other sections of the power plant. The enhancement in wear resistance experienced on the crushe components that have been hardfaced allow this critical repair to be made a part of a scheduled maintenance program, no longer relying on a major outage for completion. This allows the plant to remain online producing energy, thus reducing their outage cost and down time dramatically.

**Advantages**

The increase in wear resistance of the coal pulverizer rolls and rings has dramatically improved mill operation efficiency in power plants increasing the BTUs that the individual mill can produce. This can be directly attributed to the more uniform wearing of the surfaces on both the grinding ring and the rolls, and the increased consistency of fines that the mill produces.

An additional advantage has been the increased cycle time on the maintenance of the pulverizer. This time has increased from 9-12 months to 18-24 months on average. In some cases much longer, depending on the type of crushe being operated and the type coal being used.

**Stoody Recommended Alloys**

Stoody 100HC, 100HD, CP2000, and CP2001 are the best choices when using a multiple layer hardfacing process to restore worn crushe components in coal fired power plants. These alloys are iron based high carbon, high chromium wires that form a high density of evenly distributed chromium carbides in a high hardness deposit matrix. Hardness ranges between HRC 55 – 64. The unique attribute of these alloys is their ability to be applied in multiple layers when welded using stringer beads and proper welding procedures. All develop a thin cross check in a regular pattern ranging from 0.88” to 1.02” (22-13 mm) between cross checks, which is critical for this procedure.

Stoody Open Arc Hardfacing Alloys

Open arc welding is the most commonly used welding process for the automated hardfacing of coal pulverizing equipment because it is a simpler process to use and exhibits high deposition rates. Stoody  has developed several open arc high-alloy abrasion-resistant wires for overlaying new and for reclaiming worn coal pulverizer equipment parts. With a proven track record, Stoody is the leader in providing cost-effective solutions to wear problems for power generating, cement, and other industries utilizing pulverized coal. Stoody 100HC is the first generation open arc wire for rebuilding worn coal crushe components. Stoody next developed 100HD, long considered the industry standard due to its high deposition rate and excellent wear resistance. Stoody’s CP2000 is the first in the next generation of chrome carbide overlay products utilizing micro alloying technology to provide improved wear and impact resistance. Figure 1 compares the microstructure of Stoody CP2000 and 100HD, a conventional iron-based chromium carbide wire. Figure 1A shows the complex carbide microstructure of CP2001. Figure 2 shows a pulverizer roll after processing 500,000 tons of coal. The roll clad with CP2000 wire exhibited approximately half the wear as the roll clad with conventional carbide.

![Figure 1 - Microstructure Comparison](image1)

![Figure 1A - CP2001 Microstructure](image2)

Stoody developed CP2001 to further enhance wear resistance by utilizing secondary carbides of elements that include Mo, Nb, V, and W. Although complex carbide wires of the Fe-6C-19Cr-5Mo-5Nb-2W-2V composition have been available they suffered from two inherent disadvantages: a) relative brittleness and, b) only two layers could be applied without overlay spalling. Stoody CP2001 can be applied in multiple passes and optimizes wear resistance and toughness. Field tests using CP2001 alloy on pulverizing rolls confirm greatly improved performance over conventional chromium carbides. Stoody alloys for pulverizer roll and ring rebuilds Stoody 100HC, 100HD, CP2000, and CP2001 all have their own special properties that offer big advantages when choosing them for your application. Stoody 100HC offers the highest ductility of this group, making it the best choice for roll tire type crushers, reducing the chance of the hardfacing spalling from the occasional metal-to-metal contact that can happen during mill operations.

![Figure 2 - Roll Wear Comparison](image3)

![Figure 3- G65 Low Abrasion Tests, Or Carbide Wires](image4)

![Figure 4- High Stress Pin-on-Disc Tests](image5)
Through extensive research and years of practical experience, Stoody® has proven that coal pulverizing rolls, rings, and other vulnerable components can be effectively and economically reclaimed at a fraction of the new part cost. The correct application of hardfacing can increase roll and ring service life by up to 100 percent and can outlast base casting materials.

This brochure provides cost-saving methods to rebuild the most vulnerable parts. The overlay alloys referenced in this document were developed specifically for coal pulverizing rolls and grinding rings. For detailed product information see the Stoody Product Selection Guide or contact your Stoody representative or distributor.

**Hardfacing Coal Pulverizer Rolls, Rings, and other components**

The hardfacing and rebuilding of the coal pulverizer rolls, rings, and other components of the crus her is now a routine maintenance program in most coal fired power plants. Historically this type of maintenance was performed by contractors during major outages. Over the years an increasing number of power generating plants have invested in automated welding equipment and trained their maintenance crews to perform this critical service between major outages, allowing additional time for more critical repairs of the boiler and other sections of the power plant. The enhancement in wear resistance experienced on the crusher components that have been hardfaced allow this critical repair to be made a part of a scheduled maintenance program; no longer relying on a major outage for completion. This allows the plant to remain online producing energy, thus reducing their outage cost and down time dramatically.

**Advantages**

The increase in wear resistance of the coal pulverizer rolls and rings has dramatically improved mill operation efficiency in power plants increasing the BTUs that the individual mill can produce. This can be directly attributed to the more uniform wearing of the surfaces on both the grinding ring and the rolls, and the increased consistency of fines that the mill produces.

An additional advantage has been the increased cycle time on the maintenance of the pulverizers. This time has increased from 9-12 months to 18-24 months on average. In some cases much longer, depending on the type of crusher being operated and the type coal being used.

**Stoody Recommended Alloys**

Stoody 100HC, 100HD, CP2000, and CP2001 are the best choices when using a multiple layer hardfacing process to restore worn crusher components in coal fired power plants. These alloys are iron based high carbon, high chromium wires that form a high density of evenly distributed chromium carbides in a high hardness deposit matrix. Hardness ranges between HRC 55 – 64. The unique attribute of these alloys is their ability to be applied in multiple layers when welded using stringer beads and proper welding procedures. All develop a thin cross check in a regular pattern ranging from 3/8” to 1.0” (10-13 mm) between cross checks, which is critical for this procedure.

**Stoody Open Arc Hardfacing Alloys**

Open arc welding is the most commonly used welding process for the automated hardfacing of coal pulverizing equipment because it is a simpler process to use and exhibits high deposition rates. Stoody has developed several open arc high-alloy abrasion-resistant wires for overlaying new and for reclaiming worn coal pulverizer equipment parts. With a proven track record, Stoody is the leader in providing cost-effective solutions to wear problems for power generating, cement, and other industries utilizing pulverized coal.

Stoody 100HC is the first generation open arc wire for rebuilding worn coal crusher components. Stoody next developed 100HD, long considered the industry standard due to its high deposition rate and excellent wear resistance.

Stoody’s CP2000 is the first in the next generation of chrome carbide overlay products utilizing micro alloying technology to provide improved wear and impact resistance. Figure 1 compares the microstructure of Stoody CP2000 and 100HD, a conventional iron-based chromium carbide wire. Figure 1A shows the complex carbide microstructure of CP 2001. Figure 2 shows a pulverizer roll after processing 500,000 tons of coal. The roll clad with CP2000 wire exhibited approximately half the wear as the roll clad with conventional carbide.

Stoody developed CP2001 to further enhance wear resistance by utilizing secondary carbides of elements that include Mo, Nb, V, and W. Although complex carbide wires of the Fe-60-19Cr-5Mo-5Nb-2W-2V composition have been available they suffered from two inherent disadvantages: a) relative brittleness and, b) only two layers could be applied without overlay spalling. Stoody CP2001 can be applied in multiple passes and optimizes wear resistance and toughness. Field tests using CP2001 alloy on pulverizing rolls confirm greatly improved performance over conventional chromium carbides.

Stoody alloys for pulverizer roll and ring rebuilds Stoody 100HC, 100HD, CP2000, and CP2001 all have their own special properties that offer big advantages when choosing them for your application.

Stoody 100HC offers the highest ductility of this group, making it the best choice for roll tire type crushers, reducing the chance of the hardfacing spalling from the occasional metal-to-metal contact that can happen during mill operations.
Tips For Open Arc Welding on Coal Pulverizing Rolls

When hardfacing Ni-Hard or ductile cast iron material, the part to be welded should be preheated slowly to 200° F (95° C). This accomplishes two things: 1) It reduces the amount of thermal shock the part experiences during welding, and 2) It promotes a light cross-check pattern in the weld deposit. Allow larger rolls to “soak” for one hour per inch of thickness until a temperature of 200° F (95° C) is reached. To achieve uniform heating, deposit. Allow larger rolls to “soak” for one hour per inch of thickness until during welding, and 2)

Multiple Layer Hardfacing Welding Tips

For best results apply stringer beads with little or no tie-in to establish a uniform and tight cross-check pattern (see Figure 6). Cross-check cracks are perpendicular hairline fractures spaced approximately 1/4” to 5/8” (6 to 16 mm) apart along a single bead.

Horizontal Welding: Stringer Bead Profile

It is recommended that the first layer of hardfacing is applied at least 1” (25 mm) from either edge of the roll to prevent possible bi-axial stress that can lead to spalling. Gradually widen succeeding layers to achieve the desired roll contour. The three factors that determine cross-check frequency and spacing are the interpass temperature, cooling rate and bead configuration. If the interpass becomes excessively high or the bead width too wide, the cross-check pattern will grow to greater than 1 1/4” (32 mm) apart, with large cracks, as opposed to the desired hairline stress fractures perpendicular bead. Cooling rates that are either too fast or too slow also may lead to undesirable cross-check patterns. Large cracks can lead to catastrophic failure (spalling).

A proper cross-check crack pattern in the cladding is critical to avoid distortion. Rotation travel speeds control bead thickness and width. String beads should be 3/8” (10 mm) wide and 1/8” (3 mm) thick for best results (see Figure 7).

Figure 6

Lead distance – how far the arc is ahead of the top dead center – should be 1/2” to 3” (13 to 76 mm), depending on the roll diameter. Lead distance determines the bead profile (convex, concave, or flat). A flat bead profile will achieve consistent fusion.

Figure 7

In some cases, the first layer over an existing overlay may exhibit gas porosity in the weld deposit. This is caused by welding over residues trapped in the cross check cracks. If the gas porosity is excessive, spalling may occur at the fusion zone between the existing deposit and the new overlay being applied. Use Stoody® PR2000, a newly developed first layer and second layer repair wire, to reduce the gas porosity and spalling potential at the fusion zone.

Multiple Layer Hardfacing Welding Tips

For best results apply stringer beads with little or no tie-in to establish a uniform and tight cross-check pattern (see Figure 6). Cross-check cracks are perpendicular hairline fractures spaced approximately 1/4” to 5/8” (6 to 16 mm) apart along a single bead.

Horizontal Welding: Stringer Bead Profile

It is recommended that the first layer of hardfacing is applied at least 1” (25 mm) from either edge of the roll to prevent possible bi-axial stress that can lead to spalling. Gradually widen succeeding layers to achieve the desired roll contour. The three factors that determine cross-check frequency and spacing are the interpass temperature, cooling rate and bead configuration. If the interpass becomes excessively high or the bead width too wide, the cross-check pattern will grow to greater than 1 1/4” (32 mm) apart, with large cracks, as opposed to the desired hairline stress fractures perpendicular bead. Cooling rates that are either too fast or too slow also may lead to undesirable cross-check patterns. Large cracks can lead to catastrophic failure (spalling).

A proper cross-check crack pattern in the cladding is critical to avoid distortion. Rotation travel speeds control bead thickness and width. String beads should be 3/8” (10 mm) wide and 1/8” (3 mm) thick for best results (see Figure 7).

Figure 6

Lead distance – how far the arc is ahead of the top dead center – should be 1/2” to 3” (13 to 76 mm), depending on the roll diameter. Lead distance determines the bead profile (convex, concave, or flat). A flat bead profile will achieve consistent fusion.

Figure 7

In some cases, the first layer over an existing overlay may exhibit gas porosity in the weld deposit. This is caused by welding over residues trapped in the cross check cracks. If the gas porosity is excessive, spalling may occur at the fusion zone between the existing deposit and the new overlay being applied. Use Stoody® PR2000, a newly developed first layer and second layer repair wire, to reduce the gas porosity and spalling potential at the fusion zone.

Multiple Layer Hardfacing Welding Tips

For best results apply stringer beads with little or no tie-in to establish a uniform and tight cross-check pattern (see Figure 6). Cross-check cracks are perpendicular hairline fractures spaced approximately 1/4” to 5/8” (6 to 16 mm) apart along a single bead.

Horizontal Welding: Stringer Bead Profile

It is recommended that the first layer of hardfacing is applied at least 1” (25 mm) from either edge of the roll to prevent possible bi-axial stress that can lead to spalling. Gradually widen succeeding layers to achieve the desired roll contour. The three factors that determine cross-check frequency and spacing are the interpass temperature, cooling rate and bead configuration. If the interpass becomes excessively high or the bead width too wide, the cross-check pattern will grow to greater than 1 1/4” (32 mm) apart, with large cracks, as opposed to the desired hairline stress fractures perpendicular bead. Cooling rates that are either too fast or too slow also may lead to undesirable cross-check patterns. Large cracks can lead to catastrophic failure (spalling).

A proper cross-check crack pattern in the cladding is critical to avoid distortion. Rotation travel speeds control bead thickness and width. String beads should be 3/8” (10 mm) wide and 1/8” (3 mm) thick for best results (see Figure 7).

Figure 6

Lead distance – how far the arc is ahead of the top dead center – should be 1/2” to 3” (13 to 76 mm), depending on the roll diameter. Lead distance determines the bead profile (convex, concave, or flat). A flat bead profile will achieve consistent fusion.

Figure 7

In some cases, the first layer over an existing overlay may exhibit gas porosity in the weld deposit. This is caused by welding over residues trapped in the cross check cracks. If the gas porosity is excessive, spalling may occur at the fusion zone between the existing deposit and the new overlay being applied. Use Stoody® PR2000, a newly developed first layer and second layer repair wire, to reduce the gas porosity and spalling potential at the fusion zone.

Multiple Layer Hardfacing Welding Tips

For best results apply stringer beads with little or no tie-in to establish a uniform and tight cross-check pattern (see Figure 6). Cross-check cracks are perpendicular hairline fractures spaced approximately 1/4” to 5/8” (6 to 16 mm) apart along a single bead.

Horizontal Welding: Stringer Bead Profile

It is recommended that the first layer of hardfacing is applied at least 1” (25 mm) from either edge of the roll to prevent possible bi-axial stress that can lead to spalling. Gradually widen succeeding layers to achieve the desired roll contour. The three factors that determin...
Tips For Open Arc Welding on Coal Pulverizing Rolls

When hardfacing Ni-Hard or ductile cast iron material, the part to be welded should be preheated slowly to 200° F (95° C). This accomplishes two things: 1) It reduces the amount of thermal shock the part experiences during welding, and 2) It promotes a light cross-check pattern in the weld deposit. Allow larger rolls to “soak” for one hour per inch of thickness until a temperature of 200° F (95° C) is reached. To achieve uniform heating, deposit. Allow larger rolls to “soak” for one hour per inch of thickness until during welding, and it promotes a tight cross-check pattern in the weld.

In some cases, the first layer over an existing overlay may exhibit gas porosity in the weld deposit. This is caused by welding over residues trapped in the cross check cracks. If the gas porosity is excessive, spalling may occur at the fusion zone between the existing deposit and the new overlay being applied. Use Stoody® PR2000, a newly developed first layer and second layer repair wire, to reduce the gas porosity and spalling potential at the fusion zone.

Multiple Layer Hardfacing Welding Tips

For best results apply stringer beads with little or no tie-in to establish a uniform and tight cross-check pattern (see Figure 6). Cross-check cracks are perpendicular hairline fractures spaced approximately 1/4” to 5/8” (6 to 16 mm) apart along a single bead.

Horizontal Welding: Stringer Bead Profile

**Figure 6**

- It is recommended that the first layer of hardfacing is applied at least 1” (25 mm) from either edge of the roll to prevent possible bi-axial stresses that can lead to spalling. Gradually widen succeeding layers to achieve the desired roll contour. The three factors that determine cross-check frequency and spacing are the interpass temperature, cooling rate and bead configuration. If the interpass becomes excessively high or the bead width too wide, the cross-check pattern will grow to greater than 1 1/4” (32 mm) apart, with large cracks, as opposed to the desired hairline stress fractures perpendicular bead. Cooling rates that are either too fast or too slow also may lead to undesirable cross-check patterns. Large cracks can lead to catastrophic failure (spalling).

- A proper cross-check crack pattern in the cladding is critical to avoid disbonding. Rotation travel speed controls bead thickness and width. String beads should be 3/8” (10 mm) wide and 1/8” (3 mm) thick for best results (see Figure 7).

- Lead distance – how far the arc is ahead of the top dead center – should be 1/2” to 3” (13 to 76 mm), depending on the roll diameter. Lead distance determines the bead profile (convex, concave, or flat). A flat bead profile will achieve consistent fusion.

- **Horizontal Welding: Stringer Bead Profile**

- **Base Metal**

- **Weld Direction**

- **30 - 40% Weld bead overlap**

- **10 - 60% Weld bead overlap**

**Multiple Layer Hardfacing Welding Tips**

For best results apply stringer beads with little or no tie-in to establish a uniform and tight cross-check pattern (see Figure 6). Cross-check cracks are perpendicular hairline fractures spaced approximately 1/4” to 5/8” (6 to 16 mm) apart along a single bead.

**Horizontal Welding: Stringer Bead Profile**

**Figure 6**

- It is recommended that the first layer of hardfacing is applied at least 1” (25 mm) from either edge of the roll to prevent possible bi-axial stresses that can lead to spalling. Gradually widen succeeding layers to achieve the desired roll contour. The three factors that determine cross-check frequency and spacing are the interpass temperature, cooling rate and bead configuration. If the interpass becomes excessively high or the bead width too wide, the cross-check pattern will grow to greater than 1 1/4” (32 mm) apart, with large cracks, as opposed to the desired hairline stress fractures perpendicular bead. Cooling rates that are either too fast or too slow also may lead to undesirable cross-check patterns. Large cracks can lead to catastrophic failure (spalling).

- A proper cross-check crack pattern in the cladding is critical to avoid disbonding. Rotation travel speed controls bead thickness and width. String beads should be 3/8” (10 mm) wide and 1/8” (3 mm) thick for best results (see Figure 7).

- Lead distance – how far the arc is ahead of the top dead center – should be 1/2” to 3” (13 to 76 mm), depending on the roll diameter. Lead distance determines the bead profile (convex, concave, or flat). A flat bead profile will achieve consistent fusion.

**Multiple Layer Hardfacing Welding Tips**

For best results apply stringer beads with little or no tie-in to establish a uniform and tight cross-check pattern (see Figure 6). Cross-check cracks are perpendicular hairline fractures spaced approximately 1/4” to 5/8” (6 to 16 mm) apart along a single bead.

**Horizontal Welding: Stringer Bead Profile**

**Figure 6**

- It is recommended that the first layer of hardfacing is applied at least 1” (25 mm) from either edge of the roll to prevent possible bi-axial stresses that can lead to spalling. Gradually widen succeeding layers to achieve the desired roll contour. The three factors that determine cross-check frequency and spacing are the interpass temperature, cooling rate and bead configuration. If the interpass becomes excessively high or the bead width too wide, the cross-check pattern will grow to greater than 1 1/4” (32 mm) apart, with large cracks, as opposed to the desired hairline stress fractures perpendicular bead. Cooling rates that are either too fast or too slow also may lead to undesirable cross-check patterns. Large cracks can lead to catastrophic failure (spalling).

- A proper cross-check crack pattern in the cladding is critical to avoid disbonding. Rotation travel speed controls bead thickness and width. String beads should be 3/8” (10 mm) wide and 1/8” (3 mm) thick for best results (see Figure 7).

- Lead distance – how far the arc is ahead of the top dead center – should be 1/2” to 3” (13 to 76 mm), depending on the roll diameter. Lead distance determines the bead profile (convex, concave, or flat). A flat bead profile will achieve consistent fusion.

**Multiple Layer Hardfacing Welding Tips**

For best results apply stringer beads with little or no tie-in to establish a uniform and tight cross-check pattern (see Figure 6). Cross-check cracks are perpendicular hairline fractures spaced approximately 1/4” to 5/8” (6 to 16 mm) apart along a single bead.

**Horizontal Welding: Stringer Bead Profile**

**Figure 6**

- It is recommended that the first layer of hardfacing is applied at least 1” (25 mm) from either edge of the roll to prevent possible bi-axial stresses that can lead to spalling. Gradually widen succeeding layers to achieve the desired roll contour. The three factors that determine cross-check frequency and spacing are the interpass temperature, cooling rate and bead configuration. If the interpass becomes excessively high or the bead width too wide, the cross-check pattern will grow to greater than 1 1/4” (32 mm) apart, with large cracks, as opposed to the desired hairline stress fractures perpendicular bead. Cooling rates that are either too fast or too slow also may lead to undesirable cross-check patterns. Large cracks can lead to catastrophic failure (spalling).

- A proper cross-check crack pattern in the cladding is critical to avoid disbonding. Rotation travel speed controls bead thickness and width. String beads should be 3/8” (10 mm) wide and 1/8” (3 mm) thick for best results (see Figure 7).

- Lead distance – how far the arc is ahead of the top dead center – should be 1/2” to 3” (13 to 76 mm), depending on the roll diameter. Lead distance determines the bead profile (convex, concave, or flat). A flat bead profile will achieve consistent fusion.
Welding should start on the inside diameter and progress outward, with the rotation speed being slowed to keep travel speed under the welding head constant. As the weld moves out it will have to “step” up as well. Though bowl segments often have deep cracks, gouges, or pits, these areas do not have to be filled in prior to automatic rebuilding. The welding process compensates for these depressions and fills them to the proper thickness during the course of welding.

The following are suggestions for rebuilding coal pulverizer segmented grinding rings in place, using automated equipment. The recommendations listed below are to help understand proper technique when refurbishing worn grinding rings.

- **LOCK OUT** all start controls for the pulverizer mill functions before entering pulverizer unit.
- Clean the pulverizer of all debris, including reject areas; this is to ensure proper rotation of the bowl during the welding operation.
- Clean and inspect segmented grinding ring. Brake segments should be replaced using a segment having similar wear whenever possible. Uneven segments normally will level out during the welding process, usually after 2 to 3 layers.
- Use a sizing template to ensure proper angle and height of grinding ring. It is important to mark the bowl at the highest wear area and in the lowest wear area and gauge from these two marks only. Set electrical stick-out distance to work surface of the lowest wear area or the highest point on the grinding ring. This is important to even out uneven wear areas during the welding process.

<table>
<thead>
<tr>
<th>Table A - Typical Welding Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
</tr>
<tr>
<td>7/8&quot; / 0.88 mm</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>0.023&quot; - 0.027&quot;</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>0.035&quot; - 0.040&quot;</td>
</tr>
</tbody>
</table>

**WARNING:** Protect yourself and others. Before you use this product, read and understand the material safety data sheet (MSDS), the manufacturer’s instructions, and your employer’s safety practices. The MSDS is available upon request from your distributor, your employer, or the manufacturer. HEAT RAYS (INFRARED RADIATION) from the arc can injure eyes and burn skin. FUMES AND GASES can be hazardous to your health.

- Keep your head out of the fumes. The primary entry route for welding fumes and gases are the respiratory system. Short-term over-exposure to welding fumes may result in local irritation, dryness, nausea, or dizziness or irritation of nose, throat or eyes and may aggravate pre-existing respiratory conditions. Long term over-exposure to welding fumes may harm your respiratory function and pulmonary function and may lead to ailments (iron deposits in the lungs). Marganese over-exposure may affect the central nervous system, resulting in impaired speech and movement. OSHA considers chromium and nickel compounds carcinogenic.
- Use vibration dampened and exhaust at the arc (flame) to keep fumes and gases from you breathing zone and general area. If you are concerned about the ventilation of your work area, request that your employer conduct appropriate testing.
- This product contains or produces a chemical known to the state of California to cause cancer and birth defects (or other reproductive harm). (California Health and Safety Code 25249.5, et. seq.)
- Wear correct eye, ear, and body protection.
- Do not permit electrically live parts to touch skin, clothing or gloves. Insulate yourself from work and ground.
- IN CASE OF EMERGENCY immediately call for medical aid. Employ first aid techniques recommended by the Red Cross.

Additional Tip for Build-Up and Hardsurfacing of Coal Pulverizers

Several grinding segment rebuild systems are available, yet they all deal with the same problem. First, you must be familiar with the grinding ring on the bowl you are servicing. This ring is located at the center of the mill; therefore to service the grinding ring you will need to lift the mill rotor out of the shell. As the grinding ring is lifted out of the shell, the grinding ring will be removed from the bowl assembly. The grinding ring is a high chrome cast iron or steel product, and may contain impurities of tungsten, cobalt, chrome, molybdenum, and copper. The grinding ring is a high chrome cast iron or steel product, and may contain impurities of tungsten, cobalt, chrome, molybdenum, and copper.

**Equipment Installation Warning:** Caution should be taken to reduce the chances of welding current passing through the mill bearings when welding on the pulverizer housing and grinding ring. This risk can be mitigated during installation of the automatic equipment by attaching the welding ground to the parts being welded. This will help to reduce the chances of welding current passing through the mill bearings.

**Rotary Ground:** Improper installation of the rotary ground can greatly affect the quality of the welding process. The installation of the rotary ground on to the center of the hub (cover plate), may sometimes produce a poor connection between center hub and the segmented grinding ring. It may be necessary to back-weld two or three ground plates from the base of the rotary ground to the toe of the segments, equally spaced. This will ensure proper grounding.

**Warning:** When starting the welding process, caution should be taken to control heat input. If pulverizer bowl is cold, it’s best to warm the crushe using hot blowers. Welding on cold parts causes uneven heating and expansion leading to higher stresses being exerted on the grinding ring and bowl. This can lead to bowl breakage and failure. Pacing between first and second weld layers will allow the heat to transfer from grinding ring to bowl and equalize expansion. Air cooling may be necessary between passes during the welding process in the third and fourth weld layers to keep parts from over heating. Do not cool below 200°F minimum preheat.

**U.S. Customer Care:** 800-426-1888 / FAX 800-553-0557
**Canada Customer Care:** 905-827-4515 / FAX 800-588-1714
**International Customer Care:** 940-381-1212 / FAX 940-483-8178
**www.stoody.com**
SEGMENTED BOWL REBUILDING, OPEN ARC

Segmented bowls are constructed of cast Ni-Hard segments that form a continuous ring. Stoody open-arc 100HC, 100HD, CP2000, and CP2001 hardfacing alloys should be applied to these components to greatly improve wear resistance. All worn components in the bowl assembly can be hardfaced, including bowl segments, hub, and extension ring.

Welding should start on the inside diameter and progress outward, with the rotation speed being slowed to keep travel speed under the welding head constant. As the weld progresses, it will have to “step” up as well. Though bowl segments often have deep cracks, gouges, or pits, these areas do not have to be filled in prior to automatic rebuilding. The welding process compensates for these depressions and fills them to the proper thickness during the course of welding.

Wire stick-out, amperage, voltage, and drag angle are the same for both roll and segmented bowl rebuilding. The weld puddle should be centered on the fusion line of the bead for approximately 35 percent tie-in. Rotation speed of the bowl directly under the welding heads should be 50 to 65’ (3 to 17 cm) per minute, except for the first layer. To allow proper fusion and penetration, the first layer may be welded at a slightly lower application rate.

Typical welding parameters for 7/64” (2.8 mm) and 1/8” (3.2 mm) wires are shown in Table A. Note that 1/8” (3.2 mm) wires have been designed to weld at a higher amperage and deposition rates.

<table>
<thead>
<tr>
<th>Wire Diameter</th>
<th>Wire Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/64” / 2.8 mm</td>
<td>1/8” / 3.2 mm</td>
</tr>
</tbody>
</table>

Welding on cold parts causes uneven heating and expansion leading to higher stresses being exerted on the grinding ring and bowl. This can lead to bowl breakage and failure. Pausing between first and second weld layers will allow the heat to transfer from grinding ring to bowl and equalize expansion. Air cooling may be necessary between passes during the welding process in the third and fourth weld layers to keep parts from overheating. Do not cool below 200°F minimum preheat.

Additional Tips for Build Up and Hardfacing of Coal Pulverizers

- **Segmented Grinding Rings**
  - The following are suggestions for rebuilding coal pulverizer segmented grinding rings in place, using automated equipment. The recommendations listed below are to help understand proper technique when refurbishing worn grinding rings.
  - **LOCK OUT** all start controls for the pulverizer mill functions before entering pulverizer unit.
  - Clean the pulverizer of all debris, including reject areas; this is to ensure proper rotation of bowl during the welding operation.
  - Clean and inspect segmented grinding ring. Brake segments should be replaced using a segment having similar wear whenever possible.
  - Uneven segments normally will level out during the welding process, usually after 2 to 3 layers.
  - Use a sizing template to ensure proper angle and height of grinding ring. It is important to mark the bowl at the highest wear area and in the lowest wear area and gauge from these two marks only. Set electric stick out distance to work surface of the lowest wear area or the highest point on the grinding ring. This is important to even out uneven wear areas during the welding process.

• **Equipment Installation Warning!** Caution should be taken to reduce the chances of welding current passing through the mill bearings when welding on the pulverizer housing and grinding ring. The risk can be mitigated during installation of the automatic equipment by attaching the welding ground to the parts being welded. This will help to reduce the chances of welding current passing through the mill bearings.

• **Rotary Ground** Improper installation of the rotary ground can greatly affect the quality of the welding process. The installation of the rotary ground on to the center of the hub (cover plate), may sometimes produce a poor connection between center hub and the segmented grinding rings. It may be necessary to back-weld two or three ground straps from the base of the rotary ground to the toe of the segments, equally spaced. This will ensure proper grounding.

• **Waring!** When starting the welding process, caution should be taken to control heat input. If pulverizer bowl is cold, it’s best to warm the crusher using blower blowers. Welding on cold parts causes uneven heating and expansion leading to higher stresses being exerted on the grinding ring and bowl. This can lead to bowl breakage and failure. Pausing between first and second weld layers will allow the heat to transfer from grinding ring to bowl and equalize expansion. Air cooling may be necessary between passes during the welding process in the third and fourth weld layers to keep parts from overheating. Do not cool below 200°F minimum preheat.

**Table A - Typical Welding Parameters**

<table>
<thead>
<tr>
<th>Wire Diameter</th>
<th>Wire Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/64” / 2.8 mm</td>
<td>1/8” / 3.2 mm</td>
</tr>
</tbody>
</table>

* Details on Mavix equipment can be obtained from www.mavixweld.com

U.S. Customer Care: 800-426-1888  /  FAX 800-555-0557
Canada Customer Care: 905-827-4515  /  FAX 800-588-1714

International Customer Care: 940-381-1212  /  FAX 940-483-8178
www.stoody.com
### Stoody Product 100HC 100HD PR2009 CP2000 CP2001

<table>
<thead>
<tr>
<th>Alloy Type</th>
<th>100HC</th>
<th>100HD</th>
<th>PR2009</th>
<th>CP2000</th>
<th>CP2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposit Characteristics (typical)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abrasion Resistance</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Impact Resistance</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Deposit Layers, Maximum</td>
<td>Multiple</td>
<td>3</td>
<td>Multiple</td>
<td>Multiple</td>
<td>Multiple</td>
</tr>
<tr>
<td>On carbon steel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On manganese steel</td>
<td>HRC 51 – 55</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Machinability</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Magnetic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On carbon steel</td>
<td>Slightly Slightly Slightly Slightly Slightly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On manganese steel</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>On iron</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hot Wear Applications (up to)</td>
<td>900° F / 482° C</td>
<td>900° F / 482° C</td>
<td>900° F / 482° C</td>
<td>900° F / 482° C</td>
<td>900° F / 482° C</td>
</tr>
<tr>
<td>Wire Diameters Available</td>
<td>7/64&quot; / 2.8 mm</td>
<td>7/64&quot; / 2.8 mm</td>
<td>7/64&quot; / 2.8 mm</td>
<td>7/64&quot; / 2.8 mm</td>
<td>.045&quot; / 1.2 mm</td>
</tr>
<tr>
<td>Packaging</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33# WB</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>60# Coil</td>
<td>11001000</td>
<td>11846200</td>
<td>11983200</td>
<td>11890000 (0.045&quot;)</td>
<td>11961200 (0.045&quot;)</td>
</tr>
<tr>
<td>200# HP</td>
<td>11141700</td>
<td>11501100</td>
<td>11996500</td>
<td>11870400 (0.045&quot;)</td>
<td>11905100 (0.045&quot;)</td>
</tr>
<tr>
<td>500# POP</td>
<td>11235400 (0.045&quot;)</td>
<td>11489500 (0.045&quot;)</td>
<td>11899000 (0.045&quot;)</td>
<td>11939400 (0.045&quot;)</td>
<td>11933500 (0.045&quot;)</td>
</tr>
<tr>
<td>750# POP</td>
<td>11905600 (0.045&quot;)</td>
<td>11905600 (0.045&quot;)</td>
<td>11905600 (0.045&quot;)</td>
<td>11905600 (0.045&quot;)</td>
<td>11905600 (0.045&quot;)</td>
</tr>
</tbody>
</table>

*Unless stated otherwise, all hardness values shown are based on two applied layers of hardfacing overlay.

*a* When used in rebuilding of coal pulverizer rolls, greater than three layers can be applied using proper welding procedures.

N/A = not applicable / not available

For detailed information, contact your Stoody representative or distributor.

Or, visit our website at www.Stoody.com