THERMACLAD

A New Generation of Build-Up and Overlay Alloys

Engineered for the Toughest Roll Rebuilding Applications

STOODY

A THERMADYNE® Company
Stoody Company has a long history of supplying the Steel Industry with superior hardfacing products. For the past thirty years, Stoody has been a pioneer in developing surfacing alloys designed specifically for steel mill rolls. Now, with the ThermaClad® line of submerged arc wires, Stoody looks to the future with the best roll rebuilding products the industry has to offer.

**BUILD-UP ALLOYS**
Stoody designs the ThermaClad line of build-up wires to run with neutral fluxes. The resulting deposits are of low alloy steel composition and have an excellent combination of compressive strength and impact resistance. These build-up alloys can be deposited crack-free without regard to deposit thickness. Deposits are also machinable and can be flame cut.

**OVERLAY ALLOYS**
Stoody designs all ThermaClad overlay wires to run in neutral fluxes. The weld metal is martensitic with some residual ferrite. The deposit chemistries are closely controlled to result in the optimum microstructure for the application.

This produces deposits with the best possible combination of wear and corrosion resistance. Stoody has evaluated thermal fatigue (fire cracking) and ranked the resistance of ThermaClad overlay wires to help you select the exact combination of deposit characteristics you need.

The complete line of ThermaClad wires can be used with either Stoody R-20 or ThermaFlux B fluxes. The use of these fluxes ensures the designed deposit chemistry of the ThermaClad wires and provides excellent slag removal at elevated temperatures. While best when used with these Stoody fluxes, all ThermaClad wires work well with any of a number of good neutral fluxes. Contact your Stoody representative for specific details concerning non-Stoody fluxes.

All ThermaClad products are manufactured to precise specifications and standards to ensure consistency and quality and are lot number controlled for traceability. Stoody also includes actual chemical analysis of its ThermaClad products with every shipment at NO CHARGE!

ThermaClad products offer a variety of alloy chemistries to match your particular cladding requirements. Whether you require a high abrasion resistant alloy or the ultimate in thermal fatigue resistance, use only the best . . . Stoody ThermaClad.
**ThermaClad 102**

The deposit is of modified H-12 tool steel composition. Its high hardness level provides excellent abrasion resistance and will withstand high compressive loading and softening at elevated temperatures. The deposit can be applied crack free when proper welding procedures are followed. The deposit is difficult to flame cut and can be machined using carbide tools. This alloy is not recommended where resistance to fire-cracking is required.

Applications: Work Rolls, Vertical Edger Rolls, Bell Seats, Leveler Rolls, Tool Steel Crane Wheels

Typical Deposit Characteristics
- Abrasion Resistance: Excellent
- Impact Resistance: Good
- Compressive Strength: High
- Hardness HRC*: 51
- Machinability w/carbide tools: Difficult

Typical Deposit Chemistry - (wt. % with specified flux):
- C 0.28, Mn 1.5, Si 0.8, Cr 6.0 Mo 1.4, W 1.2, Fe Balance

**ThermaClad 105**

The deposit is a low alloy medium hardness martensitic steel. Provides excellent resistance to abrasion and cold deformation, and can be machined using carbide tools.

Applications: Rollers, Idlers, Arch Wheels, Changing Car Wheels

Typical Deposit Characteristics
- Abrasion Resistance: Very Good
- Impact Resistance: Good
- Compressive Strength: High
- Hardness HRC*: 45
- Machinability w/carbide tools: Difficult

Typical Deposit Chemistry - (wt. % with specified flux):
- C 0.16, Mn 2.7, Si 1.2, Cr 3.0 Mo 0.5, V 0.15, Fe Balance

**ThermaClad 205HD**

A higher deposition rate version of ThermaClad 105.

Applications: Idlers, Rollers

Typical Deposit Characteristics
- Abrasion Resistance: Moderate
- Impact Resistance: Good
- Compressive Strength: High
- Hardness HRC*: 42
- Machinability w/carbide tools: Good

Typical Deposit Chemistry - (wt. % with specified flux):
- C 0.15, Mn 2.3, Si 0.8, Cr 2.1, Mo 0.5, V 0.15, Fe Balance

*Typical Rockwell C scale hardness as welded - three layers on 1020 steel.

**ThermaClad 107**

The deposit is a low alloy medium hardness martensitic steel and combines good compressive strength and resistance to plastic deformation and abrasion with excellent impact resistance. It is readily machinable with carbide tools, and can be flame cut. It can be used for both build-up and hardfacing on rollers and idlers.

Applications: Rollers, Idlers, Crane Wheels, Mine Car Wheels

Typical Deposit Characteristics
- Abrasion Resistance: Good
- Impact Resistance: Very Good
- Compressive Strength: High
- Hardness HRC*: 38
- Machinability w/carbide tools: Good

Typical Deposit Chemistry - (wt. % with specified flux):
- C 0.18, Mn 1.9, Si 0.8, Cr 2.8 Mo 0.6, Fe Balance

**ThermaClad 205**

The deposit is a modified martensitic stainless steel. It is specifically designed for weld overlay on continuous caster rolls and provides the greatest resistance to thermal fatigue cracking and corrosion. Overlays exhibit excellent wear properties, hot hardness, and uniform tempering response.

Applications: Continuous Caster Rolls, Table Rolls

Typical Deposit Characteristics
- Thermal Fatigue Resistance: Excellent
- Abrasion Resistance: Very Good
- Compressive Strength: Good
- Hardness HRC*: 47
- Machinability w/carbide tools: Fair

Typical Deposit Chemistry - (wt. % with specified flux):
- C 0.12, Mn 1.2, Si 0.4, Cr 13.5, Ni 2.5, Mo 1.2, V 0.18, Cb 0.18, Fe Balance
**ThermaClad 423L**
The deposit is a modified martensitic stainless steel with lower chromium content than the ThermaClad 423, and without columbium. It has good resistance to thermal fatigue cracking and corrosion resistance. Overlays exhibit excellent wear properties, hot hardness and uniform tempering response.

**Applications:** Continuous Caster Rolls

**Typical Deposit Characteristics**
- Thermal Fatigue Resistance: Excellent
- Abrasion Resistance: Good
- Compressive Strength: Good
- Hardness HRC*: 45
- Machinability w/carbide tools: Fair

**Typical Deposit Chemistry - (wt. % with specified flux):**
- C 0.15, Mn 1.2, Si 0.5, Cr 11.7, Ni 2.0, Mo 1.0, V 0.15, Fe Balance

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**ThermaClad 423H**
The deposit is a modified martensitic stainless steel with higher carbon content than ThermaClad 423. This results in a higher initial hardness than the 423. It has good resistance to thermal fatigue cracking and improved hot hardness, uniform tempering response and excellent wear resistance.

**Applications:** Continuous Caster Rolls, Table Rolls

**Typical Deposit Characteristics**
- Thermal Fatigue Resistance: Good
- Abrasion Resistance: Excellent
- Compressive Strength: High
- Hardness HRC*: 49
- Machinability w/carbide tools: Fair

**Typical Deposit Chemistry - (wt. % with specified flux):**
- C 0.18, Mn 1.2, Si 0.4, Cr 13.5, Ni 2.5, Mo 1.2, V 0.18, Cb 0.18, Fe Balance

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**ThermaClad 423Co**
The deposit is of ThermaClad 423 composition to which cobalt has been added to further enhance resistance to thermal fatigue cracking. Additionally, the deposit has good corrosion resistance and excellent wear properties, as well as hot hardness and uniform tempering response.

**Applications:** Continuous Caster Rolls

**Typical Deposit Characteristics**
- Thermal Fatigue Resistance: Excellent
- Abrasion Resistance: Very Good
- Compressive Strength: Good
- Hardness HRC*: 47
- Machinability w/carbide tools: Fair

**Typical Deposit Chemistry - (wt. % with specified flux):**
- C 0.12, Mn 1.2, Si 0.4, Cr 13.5, Ni 2.5, Mo 1.2, V 0.18, Cb 0.18, Co 2.5, Fe Balance

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**ThermaClad 440**
The deposit is modified 410Ni/Mo stainless steel. It offers good resistance to corrosion and thermal fatigue fire cracking encountered by steel mill rolls. Overlays exhibit relatively good ductility and uniform tempering response.

**Applications:** Continuous Caster Rolls

**Typical Deposit Characteristics**
- Thermal Fatigue Resistance: Good
- Abrasion Resistance: Excellent
- Compressive Strength: Good
- Hardness HRC*: 40
- Machinability w/carbide tools: Fair

**Typical Deposit Chemistry - (wt. % with specified flux):**
- C 0.04, Mn 0.8, Si 0.6, Cr 13.0, Ni 4.5, Mo 0.9, Fe Balance

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**ThermaClad 4552**
The deposit is modified high carbon 420 martensitic stainless steel and offers a higher initial hardness than extended 420 deposits. It combines good abrasion and impact resistance and is machinable with carbide tools. This alloy is not recommended where thermal fatigue is a primary consideration.

**Applications:** High Wear Rolls, Leveler Rolls, Edger Rolls

**Typical Deposit Characteristics**
- Thermal Fatigue Resistance: Fair
- Abrasion Resistance: Excellent
- Hardness HRC*: 53
- Machinability w/carbide tools: Difficult

**Typical Deposit Chemistry - (wt. % with specified flux):**
- C 0.25, Mn 1.5, Si 0.6, Cr 14.5, Fe Balance

*Typical Rockwell C scale hardness as welded - three layers on 1020 steel.*
ADVANCED ALLOYS FOR BUILD-UP AND OVERLAY

In recent years, Stoody has led the development of new alloys for steel mill rolls by fundamentally analyzing the problems encountered in service then applying sound metallurgical principles to design solutions to these problems. Break the paradigm in roll rebuilding by using these technologically superior alloys!

ADVANCED BUILD-UP ALLOYS

The build-up material can be just as important in determining the useful life of a caster roll as is the overlay material. A good foundation must be provided before the overlay can be applied. This build-up must have sufficient compressive strength to withstand service stresses, and must have excellent fracture toughness to inhibit the propagation of cracks that might develop in the overlay. ThermaClad RollBuild 3 was designed with these characteristics in mind, and provides the best combination of strength and toughness in a build-up material. Further, unlike conventional build-up materials, ThermaClad RollBuild 3 can be applied over a wide range of preheat/interpass temperatures as well as welding heat inputs to result in excellent mechanical properties.

**ThermaClad 423N**

The deposit is a modified martensitic stainless steel with a lower carbon content than the ThermaClad 423. The deposit has improved resistance to sensitization resulting from alloy modifications.

**Applications:** Continuous Caster Rolls

**Typical Deposit Characteristics**

- Thermal Fatigue Resistance: Excellent
- Abrasion Resistance: Good
- Corrosion Resistance: Good
- Hardness HRC*: 41
- Machinability w/carbide tools: Fair

**ThermaClad 435**

The deposit is a modified martensitic stainless steel with a lower carbon content than the ThermaClad 423. Significant additions of columbium, tungsten, vanadium and molybdenum result in an excellent combination of good strength, ductility and corrosion resistance.

**Applications:** Continuous Caster Rolls

**Typical Deposit Characteristics**

- Thermal Fatigue Resistance: Excellent
- Abrasion Resistance: Good
- Corrosion Resistance: Good
- Hardness HRC*: 35
- Machinability w/carbide tools: Fair

**ThermaClad 437**

The deposit is a modified martensitic stainless steel alloy with a higher molybdenum content when compared to ThermaClad 435. The enhanced molybdenum content improves the corrosion resistance as well as resistance to tempering.

**Applications:** Continuous Caster Rolls

**Typical Deposit Characteristics**

- Thermal Fatigue Resistance: Excellent
- Abrasion Resistance: Excellent
- Compressive Strength: Excellent
- Hardness HRC*: 37
- Machinability w/carbide tools: Fair

**ThermaClad 445**

The deposit is of modified tool steel composition and has been developed specifically for the rebuilding of work rolls. It has good resistance to abrasion and excellent resistance to thermal fatigue and is machinable with carbide tools.

**Applications:** Work Rolls

**Typical Deposit Characteristics**

- Abrasion Resistance: Good
- Impact Resistance: Good
- Compressive Strength: High
- Hardness HRC*: 53
- Machinability w/carbide tools: Difficult

**ThermaClad 453**

The deposit is a modified tool steel composition and provides better resistance to oxidation and to oxidation pick-up than conventional tool steels. It can be applied to crack-free and has been developed specifically to improve the life of pinch rolls.

**Applications:** Pinch Rolls

**Typical Deposit Characteristics**

- Abrasion Resistance: Excellent
- Impact Resistance: Good
- Compressive Strength: Good
- Hardness HRC*: 55
- Machinability w/carbide tools: Difficult

**ThermaClad 455**

The deposit is a modified tool steel composition with a higher carbon content than ThermaClad 445. It provides increased abrasion resistance and better hot hardness when compared to ThermaClad 445.

**Applications:** Work Rolls, Straightener Rolls, Piercing Mill Rolls, Scale Breaker Rolls

**Typical Deposit Characteristics**

- Abrasion Resistance: Excellent
- Impact Resistance: Good
- Compressive Strength: High
- Hardness HRC*: 57
- Machinability w/carbide tools: Difficult

**ThermaClad 457**

The deposit is a modified tool steel composition. Its higher hardness level provides excellent abrasion resistance and better resistance to tempering than conventional tool steels. It can withstand high compressive loading and softening at elevated temperatures and can be applied crack free with proper control of preheat and interpass temperatures.

**Applications:** Straightener Rolls, Leveler Rolls, Scale Breaker Rolls

**Typical Deposit Characteristics**

- Abrasion Resistance: Excellent
- Impact Resistance: Good
- Compressive Strength: High
- Hardness HRC*: 57
- Machinability w/carbide tools: Very Difficult

*Typical Rockwell C scale hardness as welded - three layers on 1020 steel.*
### ThermaClad® Hardness Typical Deposit Chemistry

<table>
<thead>
<tr>
<th>ThermaClad® Alloy</th>
<th>Hardness HRC*</th>
<th>Typical Deposit Chemistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multipass 1</td>
<td>30</td>
<td>C 0.15 Mn 0.9 Si 0.5 Cr 1.6 Ni – Mo 0.6 V – Fe Bal.</td>
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<tr>
<td>Multipass 2</td>
<td>21</td>
<td>C 0.08 Mn 0.8 Si 0.5 Cr 0.8 Ni 1.2 Mo 0.4 V 0.15 Fe Bal.</td>
</tr>
<tr>
<td>104</td>
<td>26</td>
<td>C 0.12 Mn 1.8 Si 0.8 Cr 1.0 Ni – Mo – V – Fe Bal.</td>
</tr>
<tr>
<td>8620</td>
<td>19</td>
<td>C 0.15 Mn 0.8 Si 0.4 Cr 0.5 Ni 0.5 Mo 0.2 Fe – Fe Bal.</td>
</tr>
</tbody>
</table>

*Typical Rockwell C scale hardness as welded - three layers on 1020 steel.

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### MECHANICAL PROPERTIES

<table>
<thead>
<tr>
<th>Preheat (F°)</th>
<th>Interpass Heat Treatment (F°)</th>
<th>Post Weld Heat Treatment (F°)</th>
<th>Ultimate Tensile Strength (ksi)</th>
<th>Yield Strength (ksi)</th>
<th>Elongation %</th>
<th>Reduction in Area %</th>
<th>Average CVN (ft-lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ThermaClad Roll Build 3</td>
<td>200</td>
<td>550</td>
<td>6 hr. @ 1175</td>
<td>110</td>
<td>96</td>
<td>25</td>
<td>66</td>
</tr>
<tr>
<td>ThermaClad 8620</td>
<td>200</td>
<td>550</td>
<td>6 hr. @ 1175</td>
<td>99</td>
<td>85</td>
<td>24</td>
<td>64</td>
</tr>
<tr>
<td>ThermaClad MultiPass 2</td>
<td>200</td>
<td>550</td>
<td>6 hr. @ 1175</td>
<td>114</td>
<td>105</td>
<td>24</td>
<td>64</td>
</tr>
</tbody>
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