




THERMACLAD®

**A New
Generation of
Build-Up and
Overlay Alloys**

**Engineered for the Toughest
Roll Rebuilding Applications**

STOODY®

A THERMADYNE® Company



THERMACLAD® BUILD-UP AND OVERLAY SUBMERGED ARC WELDING WIRES

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.**

STOODY®
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STANDARD THERMACLAD® OVERLAY ALLOYS

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 0.6, 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

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 420

The deposit is a martensitic stainless steel. It is an excellent choice for steel mill roll applications, because it offers good resistance to fire cracking, thermal fatigue and corrosion. Machinability with carbide tools is good.

Applications: Continuous Caster Rolls, Idler Rolls

Typical Deposit Characteristics

Thermal Fatigue Resistance Good
Abrasion Resistance Very Good
Compressive Strength High
Hardness HRC* 45
Machinability w/carbide tools Good

Typical Deposit Chemistry - (wt. % with specified flux):

C 0.17, Mn 1.2, Si 0.5, Cr 12.0, Fe Balance

ThermaClad 423

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

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

STANDARD THERMACLAD® OVERLAY ALLOYS

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

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

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

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.	Good
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

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	Excellent
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*	45
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*	53
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*	55
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.

STANDARD THERMACLAD® BUILD-UP ALLOYS

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

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

MECHANICAL PROPERTIES

	Preheat (F°)	Interpass Temp. (F°)	Post Weld Heat Treatment (F°)	Ultimate Tensile (ksi)	Yield Strength (ksi)	Elongation %	Reduction in Area %	Average CVN (ft-lb)
ThermaClad Roll Build 3	200	550	6 hr. @ 1175	110	96	25	66	117
ThermaClad 8620	200	550	6 hr. @ 1175	99	85	24	64	102
ThermaClad MultiPass 2	200	550	6 hr. @ 1175	114	105	24	64	52

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