

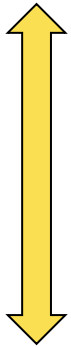
Stoody Hardfacing and High Alloy Joining

ESAB Product Training Applications – Sugar Mills

Guy Chouinard, M.Sc., Eng.
Stoody R&D Engineering Manager

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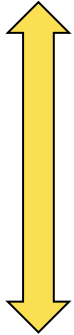


Impact resistance – more affordable

- ❖ Stoody 965 AP-G (*Martensitic steel*)
- ❖ Stoody 964 AP-G (*Niobium carbide steel*)
- ❖ Stoody 101HC (*Chromium carbides*)
- ❖ VanCar-O (*Vanadium carbide*)

Abrasion resistance – higher value





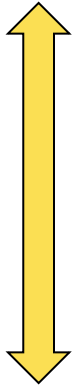
Impact resistance – more affordable

- ❖ **Stoody 965** (*Martensitic steel*)
- ❖ **Stoody 600** (*Titanium carbide steel*)
- ❖ **Stoody 100HC** (*Chromium carbides*)

Abrasion resistance – higher value



Cane table combs



Impact resistance – more affordable

- ❖ **Stoody 110** (MnCr austenitic steel)
- ❖ **Stoody 111** (*TiC/NbC in austenitic steel*)
- ❖ **Stoody 600** (*Titanium carbide steel*)
- ❖ **Stoody 100HC** (*Chromium carbides*)
- ❖ **CP-2000** (*Chromium carbides*)

Abrasion resistance – higher value



Crusher hammers



Shredder knives



Wear pattern from impact and abrasion





1. Preparation:

Clean-up of worn out material
Bevelling of working edges

2. Build-up:

Work-hardening buffer layer
Classic alloy: Stooddy 110
Suggestion: Stooddy 111





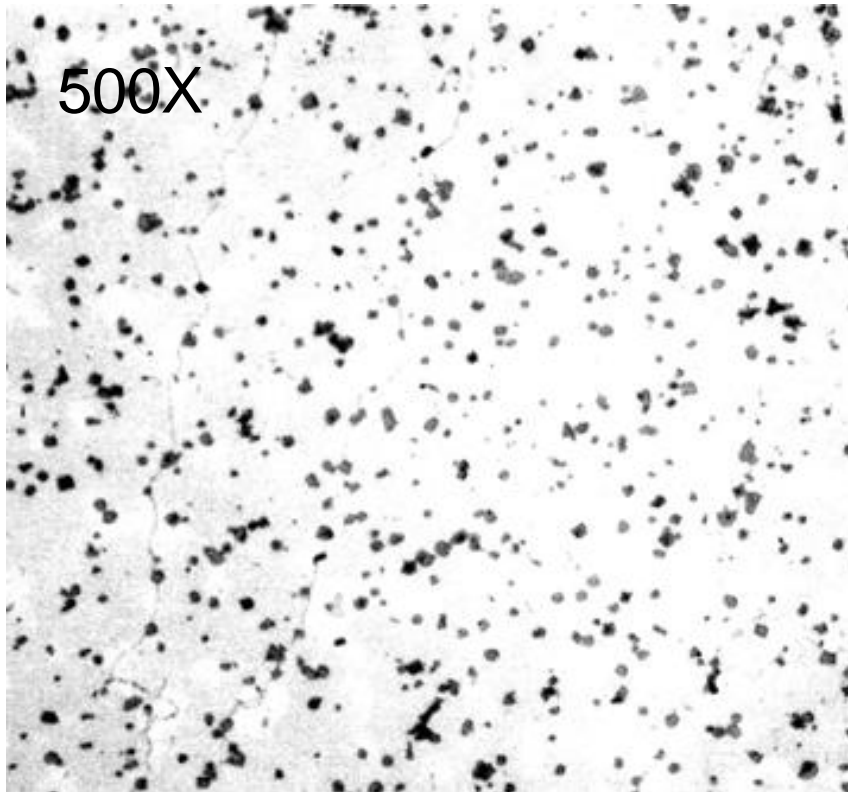
3. Grinding:

Clean-up of build-up layer
Original dimensions
Aproximate balancing

4. Hardfacing:

Final weld overlay
Impact: Stody 600
Abrasion: Stody 100HC
Suggestion: CP-2000



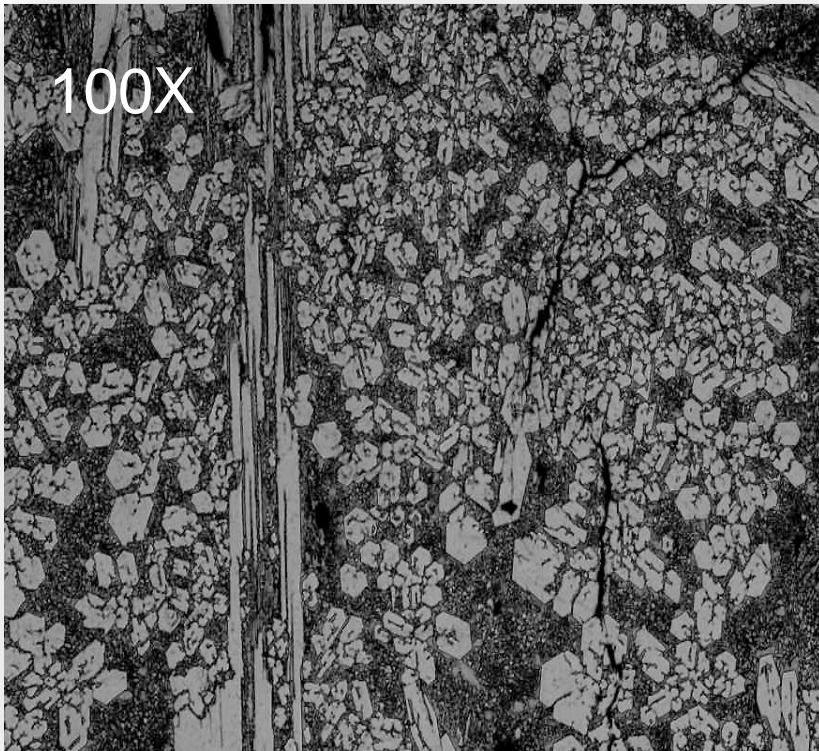


Stoody 600 typical FCAW deposit microstructure

Evidence of fine titanium carbide precipitates throughout the martensitic matrix

Macro-hardness ranging between 55 and 63 HRC

2.0% C - 8% Cr - 1.5% Mo - 5.5% Ti - Base Fe

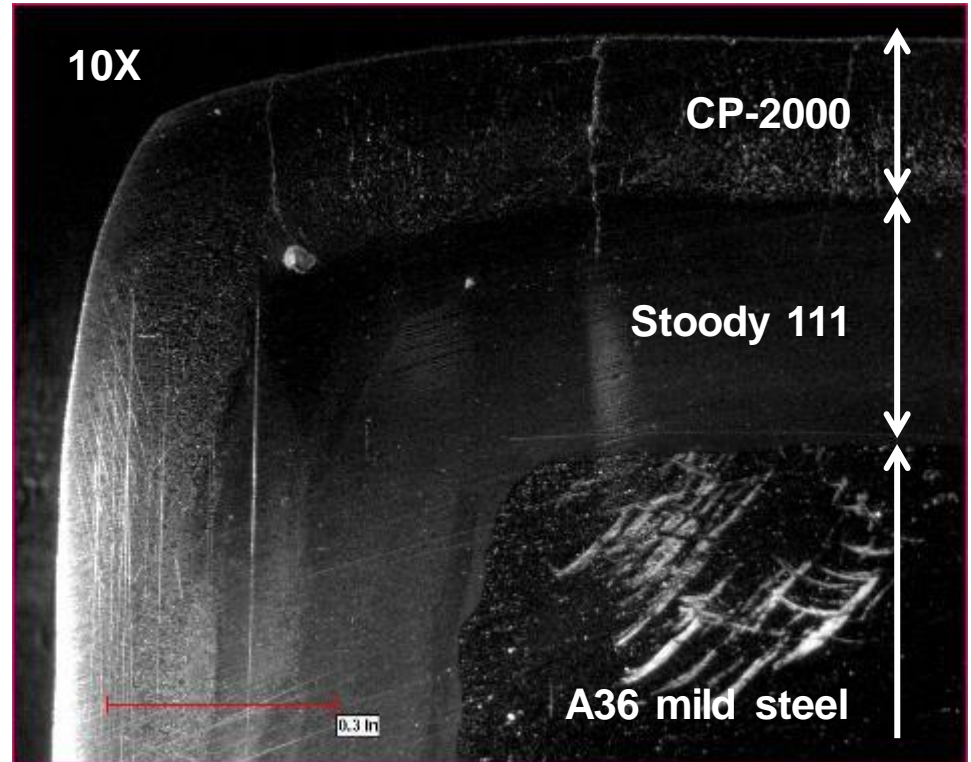
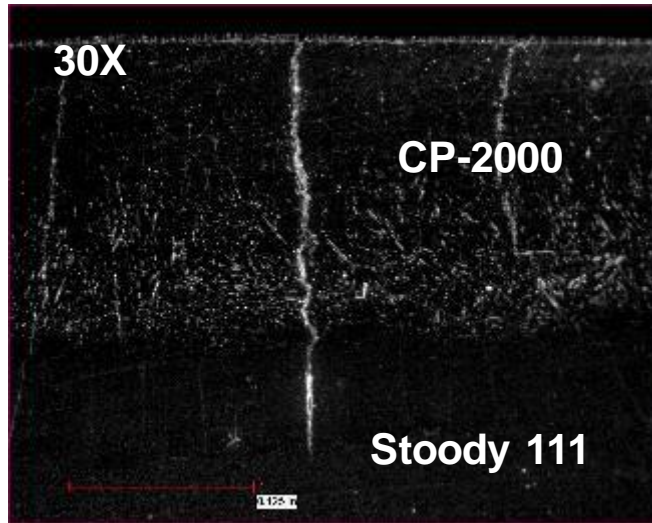


Stoody 100HC typical FCAW deposit microstructure

Commonly applied over a Stoody 110 build-up finish ground to size

Macro-hardness from 58 to 62 HRC

4.3% C - 25% Cr - 1% Mo - Base Fe

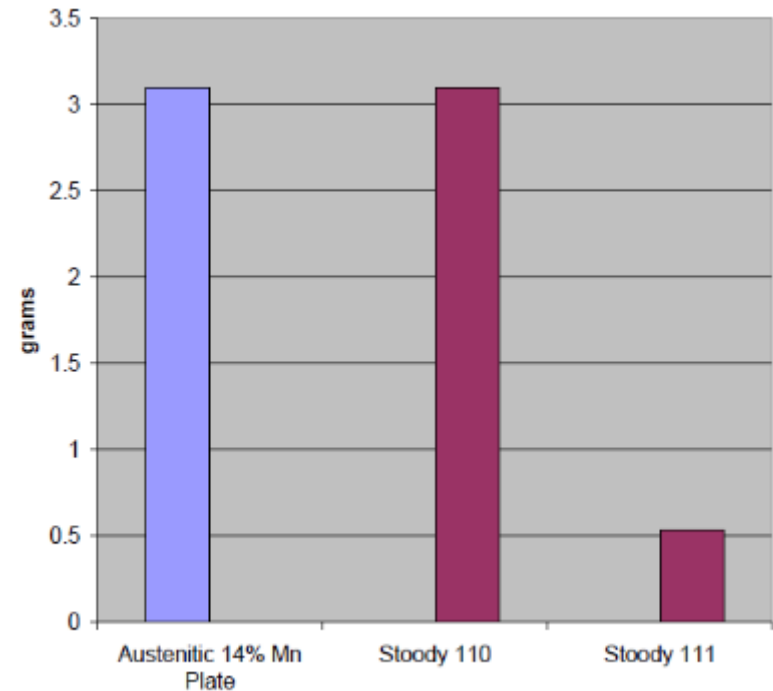


The Stody 111 does not allow crack propagation.

Austenitic build-up with TiC/NbC addition: Stody 110 → Stody 111 (3-4 passes)
Hardfacing with enhanced microstructure: Stody 100HC → CP-2000 (2-3 passes)



ASTM G65 Abrasion Wear Test

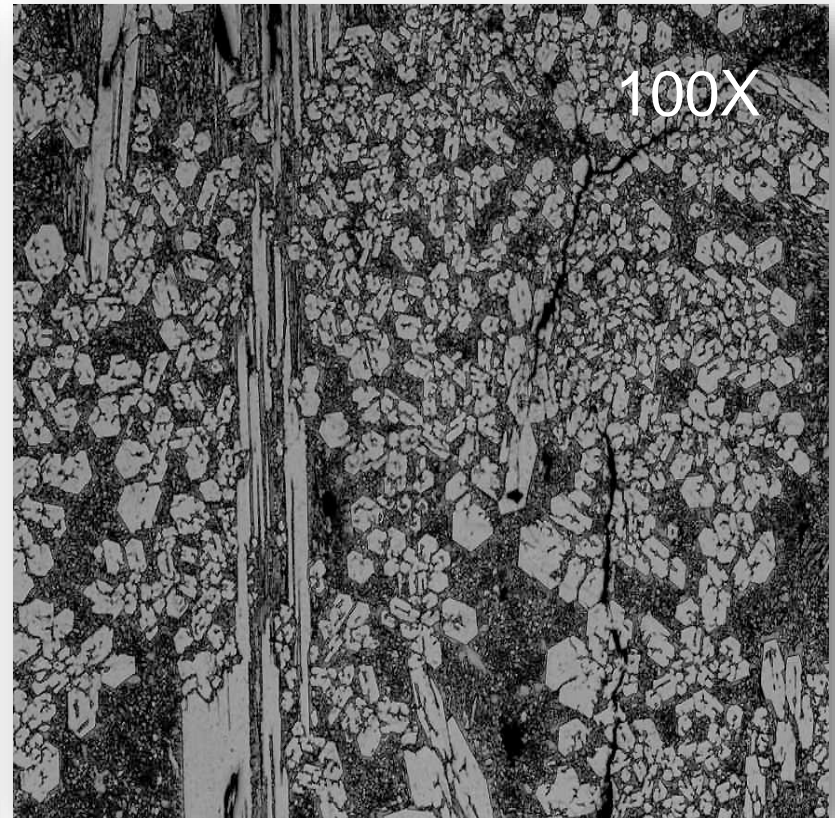
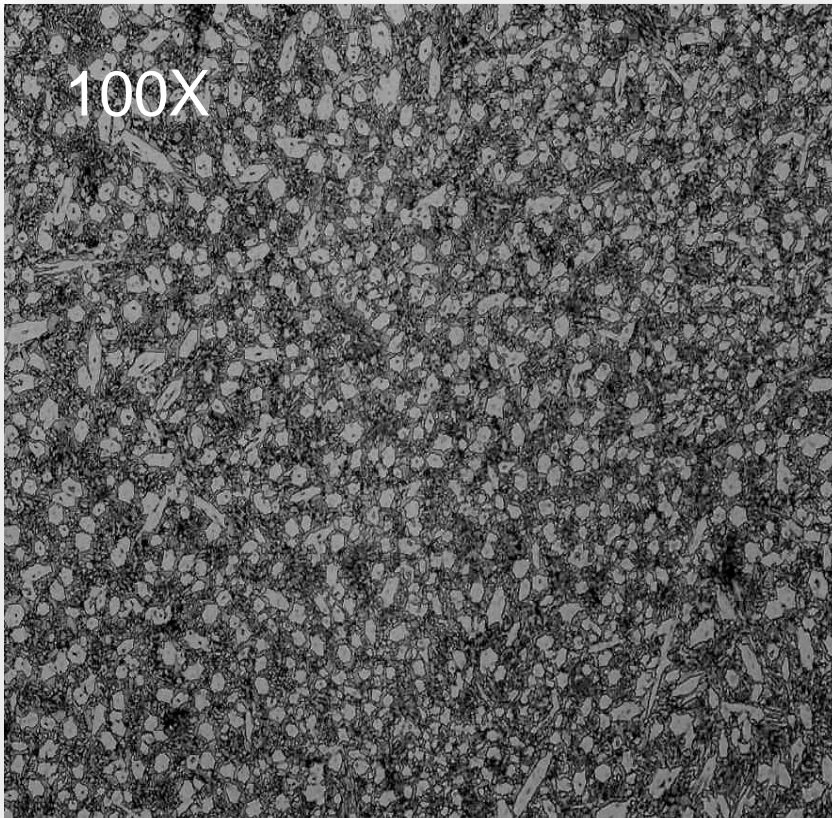


Stoodly 111 typical FCAW deposit microstructure

Evidence of fine titanium carbide (TiC) and niobium carbide (NbC) precipitates

Work-hardening up to 50 HRC with improved resistance over Stoodly 110

1.65% C - 15.5% Mn - 12.5% Cr - 3.4% Nb - 3.0% Ti - Base Fe



Stoody CP-2000

Micro-alloyed formulation (58-64 HRC)

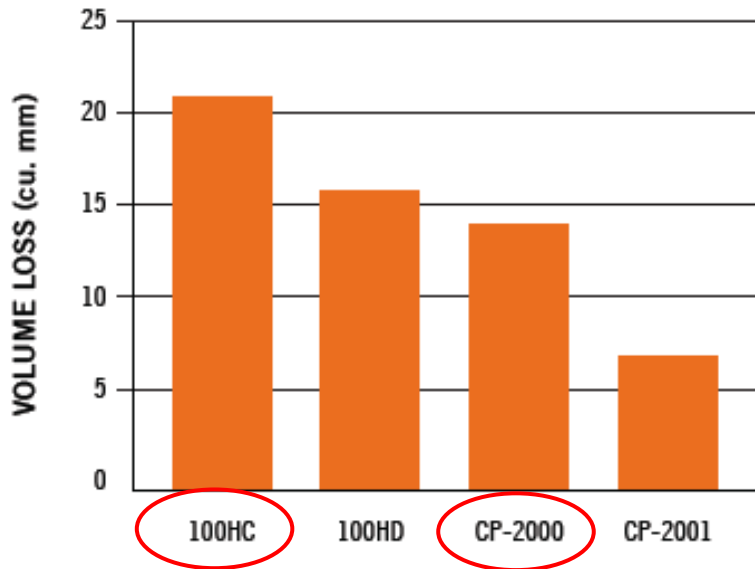
4.8% C - 24% Cr - 1% Mo - 0.6% B

Stoody 100HC

Standard formulation (58-62 HRC)

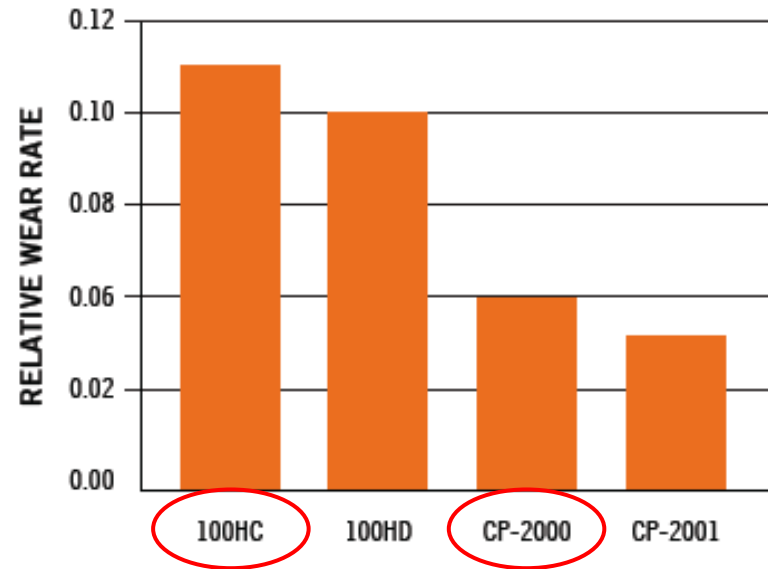
4.3% C - 25% Cr - 1% Mo

ASTM G65 Procedure A / Wear Test Results



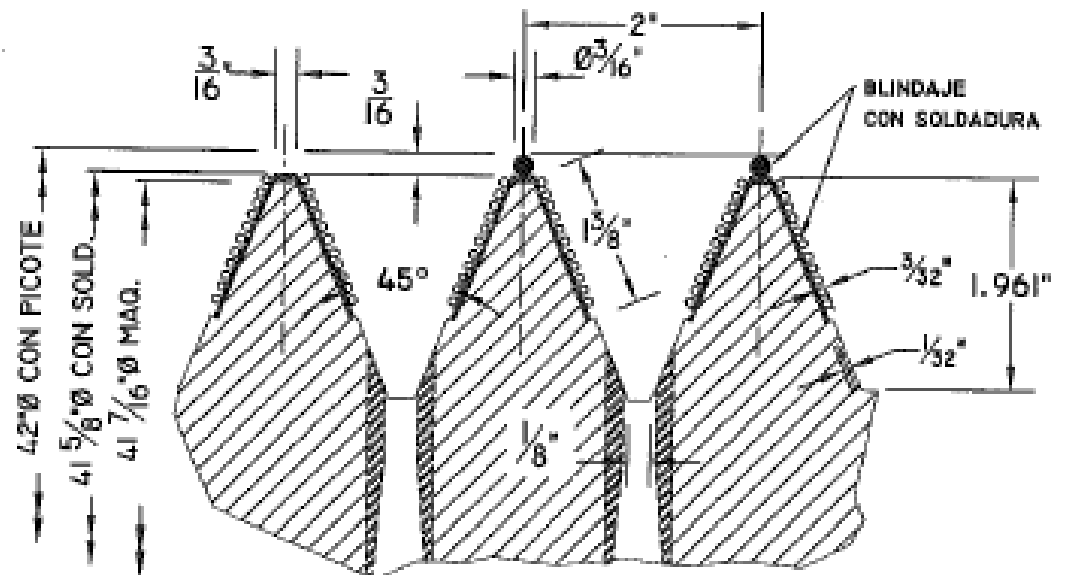
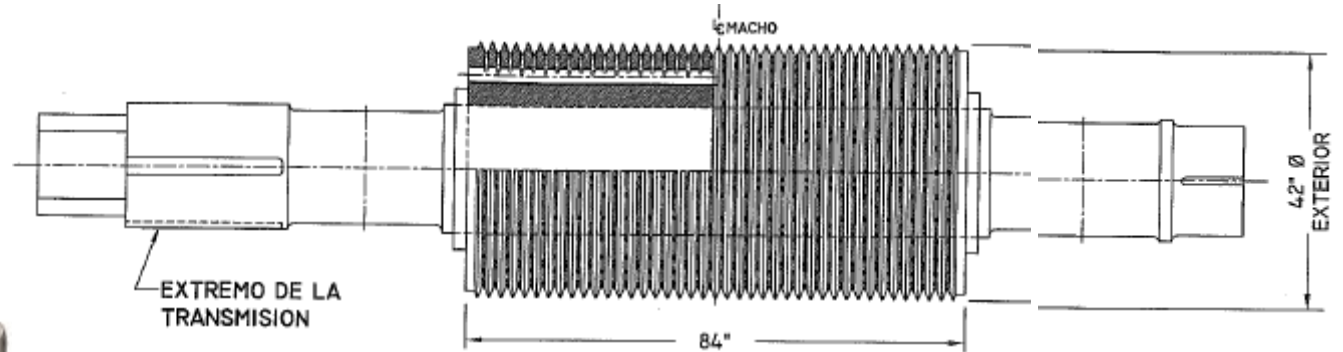
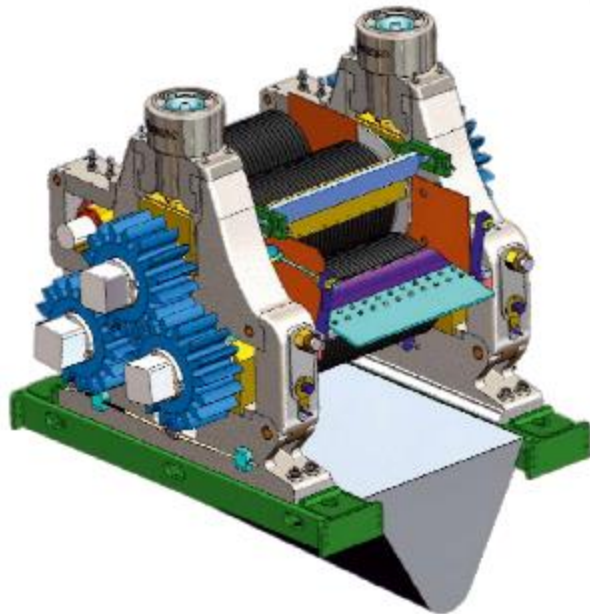
**G65 Low Abrasion Tests,
Cr Carbide Wires**

ASTM G99 PIN-ON-DISC TEST



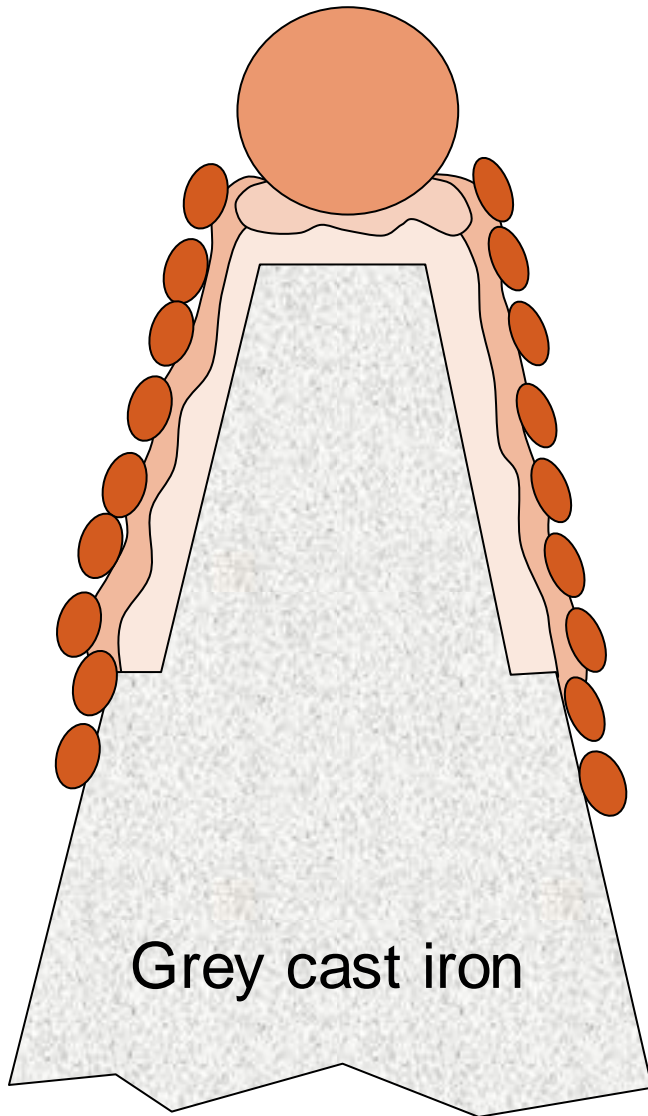
High Stress Pin-on-Disc Tests

Sugar Mills – Press Roll Hardfacing Process





*Press rolls machined out of
grey iron cast cylinders*



- 5 Arcing (*Chapisco*)
- 4 Tear drop (*Picote*)
- 3 Side hardfacing (Underlay)
- 2 Top hardfacing (Underlay)
- 1 Base or buffer layer

Warning:

- ❖ The grey cast iron roll shall not reach an overall temperature higher than 210F (100C).
- ❖ The forged steel roll shafts shall be inspected for cracks and journal tolerances.



Typical press roll casting alloy:

*Grey cast iron ASTM A48 G2500
Tensile strength: 25 ksi (170 Mpa)
Yield strength: 20 ksi (140 Mpa)
Hardness: 170-229 HB*

A proper buffer layer should:

*Allow better weld interface ductility
Avoid hardfacing crack propagation
Match thermal expansion coefficients*

Castweld Ni55-O FCAW cored wire:

*Nickel-iron alloy as per AWS A5.15 NiFeT3-CI
Tensile strength: 75 ksi (520 MPa)
Yield strength: 46 ksi (320 Mpa)
Hardness: 149 HB*





Hardfacing underlay should:
Cover top and sides of milling teeth
Support the following tear drop welds
Protect from high-pressure abrasion
Resist possible residual stones impact



Impact resistance – more affordable

- ❖ **Stoody 102** (*Martensitic tool steel*) *
- ❖ **Stoody 117** (*Chromium carbides*) *
- ❖ **Stoody 965** (*Martensitic steel*)
- ❖ **Stoody 600** (*Titanium carbide steel*)
- ❖ **Stoody 100HC** (*Chromium carbides*)
- ❖ **CP-2000** (*Chromium carbides*)

Abrasion resistance – higher value

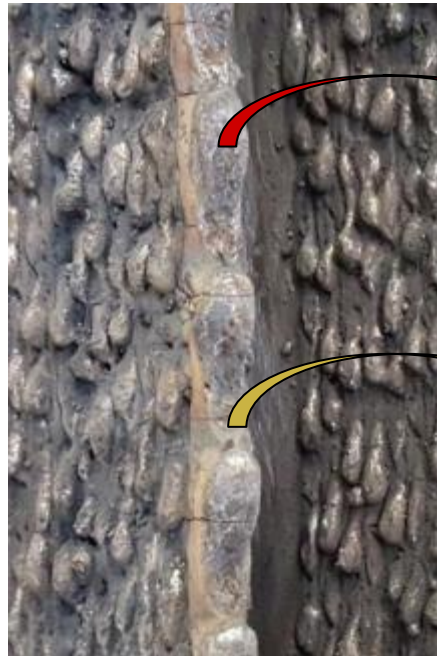
(*) Combined buffer and underlay material on gray iron

Alternate hardfacing material for top underlay: **Stoody 117** cored wire

*Semi-austenitic deposit strengthened with chromium carbides and fit to build-up.
As-welded hardness of 43-45 HRC and work-hardening up to 55-60 HRC.
Recommended as underlay for the tear drop welds when the latter are spaced out.
Still allows for harder tear drop hardfacing alloys like **Stoody 100HC** or **CP-2000**.*



Detail of a milling tooth top



Stoody 100HC

Tear drop welds (*Picote*):
Primary wear material

Stoody 117

Exposed underlay:
Secondary wear zone



Tear drop hardfacing welds should:
Resist impact and high-stress abrasion
Achieve the right profile within three layers
Allow to grab the sugar cane fibers (bagasse)
Insure the overall efficiency of the mill

Typical pearl diameter: 3/16" (5 mm)



Impact resistance – more affordable

- ❖ **Stoody 600** (*TiC in martensitic steel*)
- ❖ **Stoody 100HC** (*Chromium carbides*)
- ❖ **CP-2000** (*Chromium carbides*)

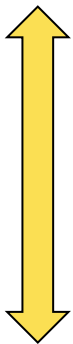
Abrasion resistance – higher value





Arcing hardfacing droplets should:
Resist sliding abrasion from the bagasse
Insure surface roughness down tooth sides
Allow to drag and split the sugar cane fibers
Improve the overall efficiency of the mill

Typical droplet size: 3/32" (2.5 mm)



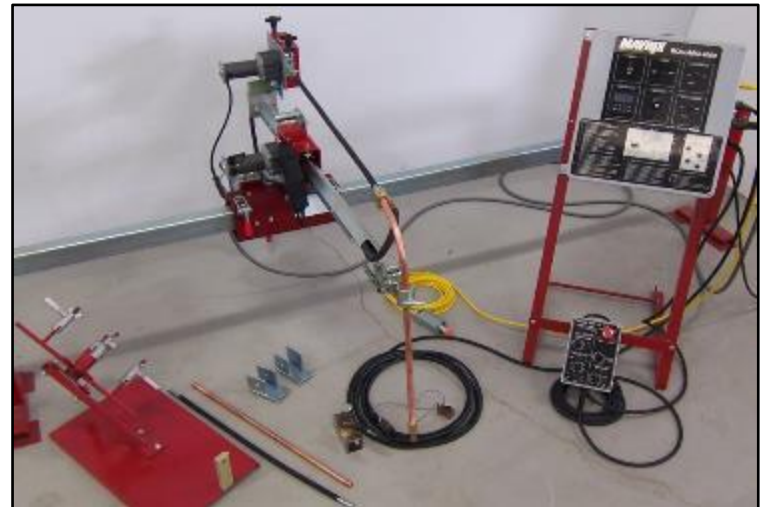
Impact resistance – more affordable

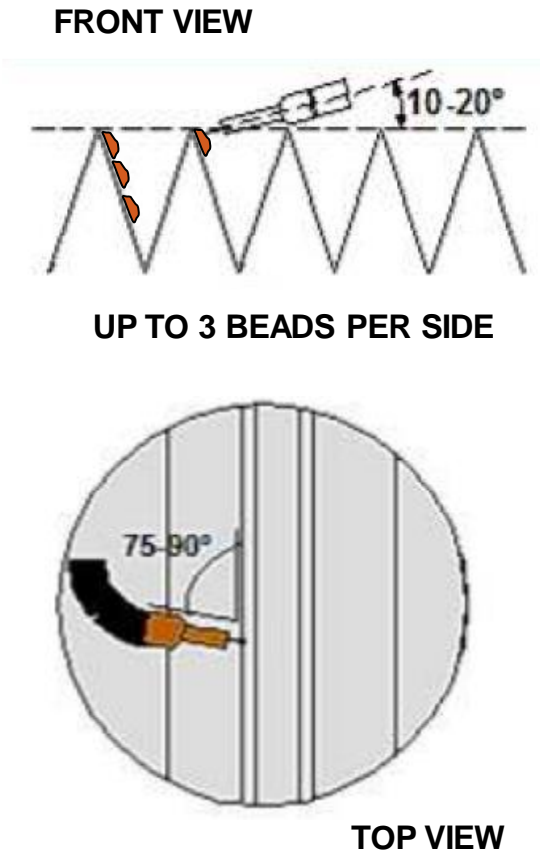
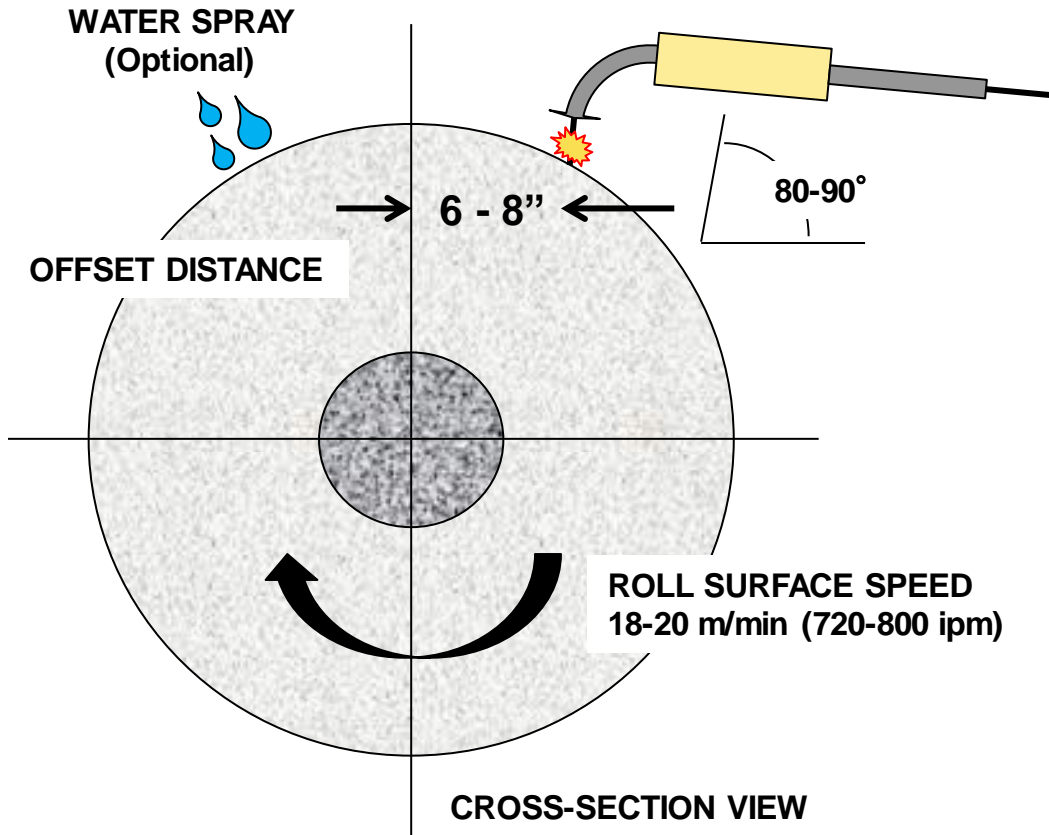
- ❖ **Stoody 100HC** (*Chromium carbides*)
- ❖ **CP-2000** (*Chromium carbides*)
- ❖ **CP-2001** (*Complex carbides*)
- ❖ **VanCar-O** (*Vanadium carbide*)

Abrasion resistance – higher value

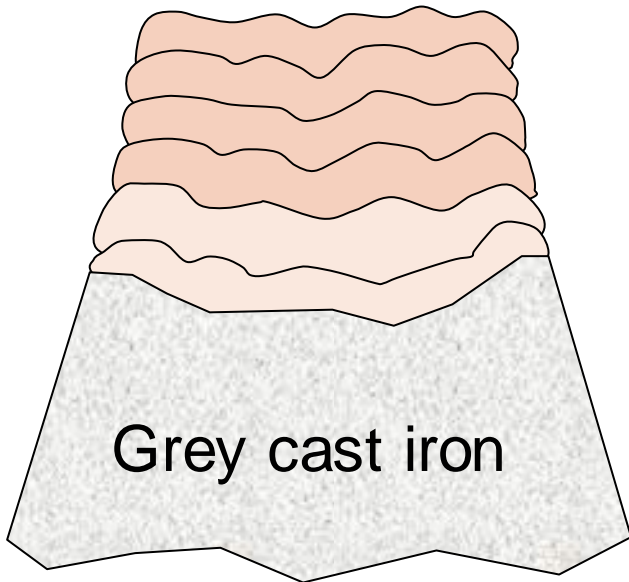


Automated arcing system set-up
Guadalajara, Mexico





Globular arc transfer required for blowing weld droplets properly
Welding current adjusted well below common practice (~50%)
A wet roll will allow for a finer and rougher arcing pattern



- 2 *Build-up / Build-up AP-G*
- 1 *Castweld Ni55-O buffer*



Build-up / Super Build-up





Sugar mill shaft bearing lands:
Submerged arc welding process (SAW)
Stoody R-20 neutral basic flux

ThermaClad 8620 - Build-up
ThermaClad 410 - Overlay



Boiler exhaust fan

Stooddy 100HD / 101HD



Mill drive main gear

Build-up / Super Build-up



Stoody 100HC / CP-2000

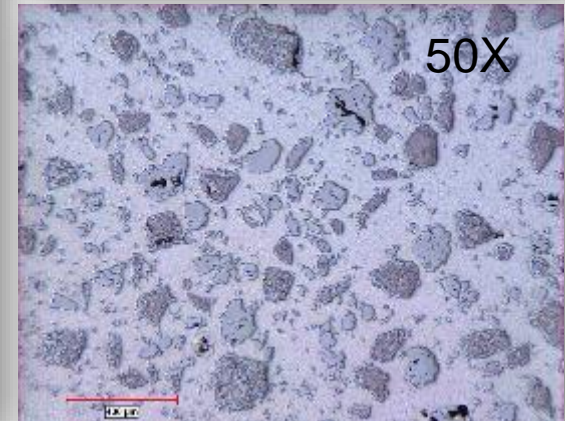
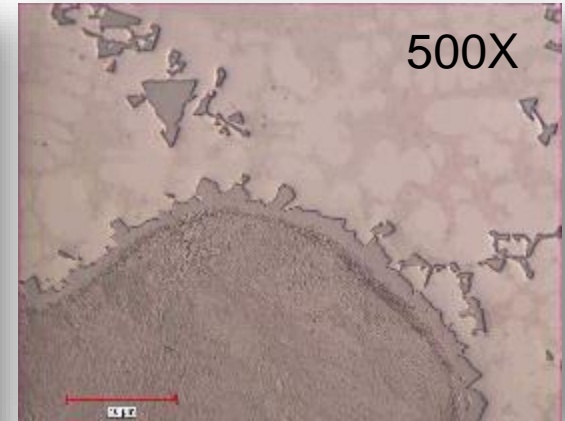
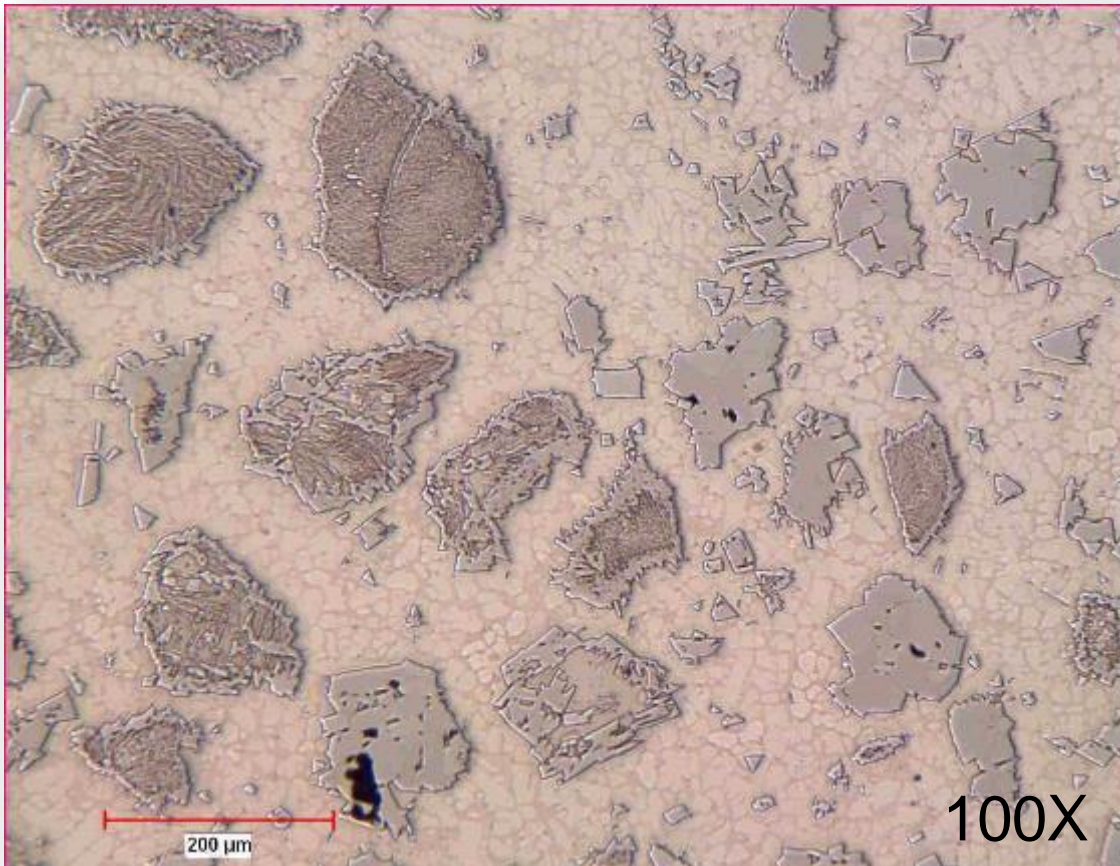
Bagasse shredder anvils





Stoody 100HC / CP-2000 / 160FC





*Even blend of Cast-WC/W₂C and Macro-WC at 40 weight % in a 40-45 HRC nickel (NiSiB) matrix
Stoody 160FC 1/16" (1.6 mm) under C25 mixed gas at 16-18V and 150 ipm WFS*

ESAB-Stoody FCAW	Böhler-UTP SMAW	Böhler-UTP FCAW	General Product Description
Versalloy AP-G	UTP 63	SK 402-O	Dissimilar metals joining.
Stoody 110	UTP BMC	SK AP-O	High-impact MnCr build-up
Castweld Ni55-O	UTP 86-FN	SK FNM-G	Cast iron NiFe buffer layer.
Super Build-up	UTP Dur 350	SK 350-O	High-load build-up (35-40 HRC).
Stoody 102-O	---	~ SK 258L-O	Hot work tool steel (48-53 HRC).
Stoody 965-O	~ UTP Dur 670	SK 600-O	Martensitic steel (56-60 HRC).
Stoody 600	---	SK 258 TiC-O	Impact and high-stress abrasion.
Stoody 100HC	~ UTP Ledurit 60	SK 255 Mo-O	Enhanced chromium carbide.
Stoody CP-2000	---	---	Micro-alloyed chromium carbide.
Stoody 101HC	UTP 718S	SK Cane Grip S	Basic chromium carbide. Arcing.
Stoody CP-2001	~ UTP 713	~ SK A 45-O	Complex carbides. Arcing.
VanCar-O	~ Vanadium 500	~ SK A 64-O	Vanadium carbide. Arcing.

ESAB-Stoody FCAW	Eutectic FCAW	Welding Alloys FCAW	General Product Description
Versalloy AP-G	~ OA 690	Tetra V312-G	Dissimilar metals joining.
Stoody 110	OA 3205	Hardface AP-O	High-impact MnCr build-up
Castweld Ni55-O	~ DO 21 NiTi	~ Cast NiFe-G	Cast iron NiFe buffer layer.
Super Build-up	OA 3010	Hardface T-O	High-load build-up (35-40 HRC).
Stoody 965-O	OA 4415	Hardface L-O	Martensitic steel (56-60 HRC).
Stoody 102-O	AN 4617	Hardface W-O	Hot work tool steel (48-53 HRC).
Stoody 600	OA 4923	Hardface TiC-O	Impact and high-stress abrasion.
Stoody 100HC	~ AN 4633	~ Hardface HC-O	Enhanced chromium carbide.
Stoody CP-2000	---	---	Micro-alloyed chromium carbide.
Stoody 101HC	OA 4601	Hardface FC-O	Basic chromium carbide. Arcing.
Stoody CP-2001	~ OA 3952	~ Hardface CV-O	Complex carbides. Arcing.
Stoody 160FC	DO 11	Hardface NiCarbW	Extreme abrasion (WC/W ₂ C).