Carbide Processors, Inc.

Northwest Research Institute, Inc.
Newsletter September 2004
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Our Tools and Supplies are the Finest In The World

We started in 1981 helping Weyerhaeuser build better saw blades. Our focus has always been the material that actually does the cutting whether it is saw tips or knife blades, carbide, steel, ceramics or hard surface alloys. Over the years we have developed new materials, new equipment and new techniques that bring tools to new levels of performance.

Emerson Smith & Improved Stellite® Performance

Emerson Smith is Lead Benchman - Warm Springs Forest Products Warm Springs, OR I spoke at the Wood Machining conference on saws in Portland on March 15, 2004. At lunch I sat next to Emerson Smith. Emerson brought up many good things. One in particular was a question about plate cleanliness and welding Stellite®. P.7

Dave Strom of Super Thin Saws & Plate Cleaning

Dave Strom of Super Thin Saws called. Dave is another saw guy who is really good. Dave also talked about the importance of plate cleaning and some new things he was trying especially blasting with baking sodat .

Curtis Heard of Malheur Lumber in John Day Oregon.

His carbide supplier told Curtis his tips were breaking because he hit too many rocks. Because Curtis is honest he believed the supplier for awhile. Because Curtis is smart he decided to try other tips. We sent him some tips and his breakage problems stopped.

Emily Erskine

This is the new voice on our phone. Emily comes to us after six years of customer service and management at CompUSA. She is working in sales and customer service.

Do We Owe You Anything?

As Tom goes out and speaks he gets requests for more information. He is much better at research and new concepts than he is at details. If we owe you information or anything else please call Emily and she will see that you get it.

Cast Stellite© Saw tips

Al Bouchard is Head Filer at Willamette Industries in Warrenton, OR. Al is extremely thorough and very, very good at analyzing what he uses and how he uses it. Al is using cast Stellite® teeth from Stoody Deloro Stellite. We pretin these for him. We developed a procedure to give Al the quality he wants. If you are interested in using these tips contact: Louw DeJong at Stoody Deloro Stellite Maple Ridge, BC (604)463-2140 ldejong@stellite.com

Lower Cost, Higher Quality, Faster Grinding, Reduced Diamond Wheel Use,
Wall Mount Filter Units

Rob Rzasa of Equipment Ltd. (800) 533 2006 has been selling our filter systems for couple years. Last year he called and asked for simpler system. We developed a system exclusively for him that uses the pump on the machine and matches it with our high performance canisters and filters. This gives excellent coolant cleaning at a much lower equipment cost.

Rob came up with a solution that works and costs the customer less money.

The secret is in the filters. It took us over a year to find the right combination of filters to give you long filter life and really good cleaning.

Automatic tipping – Precision products at good prices

Talonite® round tipping rod – premium quality HIPed to be void free precision ground.
Silver Solder (braze alloy) Special grades for greater performance. Premium quality and great prices for automatic brazers
Precision pretinning for smooth, jam free feeding and great bonding

Tip Failure Analysis

Prepared for Mike Halterman, Simonds International

This is a very short version of an analysis I did for Mike. The mill was using tips from another supplier and they weren't working. We did the analysis and Mike sold them good pretinned tips which solved their problems.

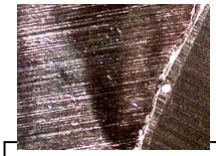
Problems:

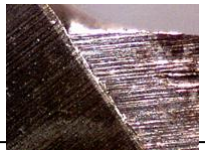
The quality of the carbide and /or the grade used is questionable. It doesn't look like the tips were sandblasted properly after sintering. The tips have a surface that will only partially bind to silver solder. There was not enough silver solder used. The amount of silver solder used varied widely.

Brazing The brazing shows exceptionally good temperature control. The tips are very uniform tip to tip. The tips are also very uniform from side to side of the same tips. The only thing I can think to suggest is the use of more flux on the plate as a heat barrier.

I would like to see just a bit more flow of silver solder back onto the plate. You might double check the plate cleaning before brazing. If it is laser cut plate make sure the notch has been gummed past the point where the laser affected the steel. Make sure the plate in the notch and on the shoulders has been cleaned of oil and grease using a caustic based solution. Solvents do not always work well.

Amount of braze alloy and non-binding surface The tip on the left has good flow and about 75% enough silver solder. The four tips on the right show the non-binding surface.



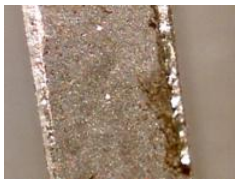


60x – steel saw body is to the left of white solder line and the carbide tip is right of the white solder line.

The braze joints are not thick enough It looks like they may be 0.001" thick on the average. They should be 0.003" to 0.005" thick. This is the best compromise between braze joint tensile strength and the critical cushioning for impact resistance and relieving thermal stress.

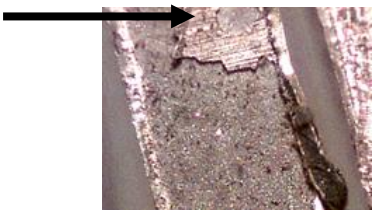
The reason the joints are too thin is that there is not enough braze alloy used in the pretinning. It is worth noting that these are extremely good joints. The clearance between body and tip is very uniform.

Heat Stress – The "L" shaped curved breaks are the classic sign of failure from heat stress. During brazing steel grows about 3 times as much as carbide. When it cools this puts the carbide under a lot of tension which is very bad for carbide. This happened because there was not enough braze alloy to provide a soft layer to relieve stress. Also these two tips have very different breaks. They are both heat stress but in good, consistent carbide the shape of the breaks is pretty close to identical from tip to tip.



Tips knocked off. -

Two reasons. First there is not enough braze alloy. A thinner joint is stronger but only to a point. In the picture below you can see a gray area with horizontal lines through it at the end of the arrow. The gray is the carbide showing between lines of silver solder.



Bad carbide & bad surface treating This photo shows the braze alloy peeling up off the carbide surface. You can also see a hole in the braze alloy in the very top right. Below the arrow is the carbide with the skin peeled off. This is poor quality carbide with a very bad surface treatment,

Your supplier owes you. Your supplier has an obligation to sell you things that work and they have an obligation to tell you how to use them. We can usually do an analysis in 24 hours. We do these free for customers using our tips or for our distributors who sell our products. An analysis costs $300 otherwise.

Cermets Give Cleaner Cuts

Carbide

Cermet

Western red cedar fencing from Tubafor in Morton, WA.

Cermet saws make a difference in grade worth as much as $0.30 per board

Tubafor in Morton, WA. makes western red cedar fencing and were having a problem with the machine that dog-ears their 4" boards. The machine does not support the rather narrow board very well and the product has a lot of "whiskering" which down grades a percentage of the product. The machine uses a 14" X 80 tooth trim saw. They put a cermet tipped saw on one of the two sawing positions on the machine and carbide on the other. They were thrilled with the improvement. There was very noticeably less whiskering on the cut made with the cermet than on the cut made with the carbide. The QC person was very pleased with the results and has made recommendations to continue and expand the use of cermets. They had only run one week when these pictures were taken and will leave the cermet saw on when they change the carbide saws to do a run life test.

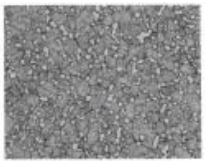
Two New Tool Tipping Materials & Nicut is Back

Comet Reinforced Tungsten Carbide and TiCN Cermets

Order these now – available in quantities as small as 1,000 tips –usually 3 -4 weeks delivery

New "Comet" Grades

The concept is simple. Ordinary carbide is like poured concrete, hard grains in a matrix. It is hard but it breaks easily. Comet grade carbide is like concrete poured over tied rebar. The internal rebar structure makes it much harder to break and a special chemical binder it also makes it more corrosion resistant.



Carbide

Comet

Comets Work Better

	Carbide	Comet
Sawmill	40 hrs.	422 hrs.
Copper tube	5,408 cuts	22,743 cuts
Fiberglass	16 - 18 holes	24 holes

It is enhanced tungsten carbide so it still grinds like tungsten carbide. We chemically enhance the material to improve wear, corrosion resistance and greatly improve impact strength. We do this by chemically creating the equivalent to reinforcing bars.

- Up to 30% tougher than regular carbide grades
- More corrosion resistant - 475% better in Hydrochloric Acid
- 10 times the life in sawmills
- 4 times the life cutting copper tubing
- 50% better life in fiberglass
- 100% better life in vinyl laminated particleboard

Blade life was increased by more than 100 percent. Other tests have shown that tools with Comet grades had an extended cutting life of 20 to 30 percent on hard aggregate and 1,100 percent on green oak.

Edger Saws

The standard blade lasted 40 hours. The blade with Comet tips lasted 422 hours and was still cutting well when it was removed for evaluation.

Cermets Outperform Carbide 4:1

Preliminary Cermet and Tungsten Carbide Saw Tooth Wear Test on Western Red Cedar

By Darrell Wong, Brian Jung and Anthony Barbosa- Forintek Canada Corp.
prepared for Kennametal Inc. and Carbide Processors June 2004 Contract No. 2003-4329

A wear test was conducted on two Cermet and one tungsten carbide tool materials when cutting green western red cedar. Three 4.35-inch diameter sawblades were custom manufactured for the KT125 (Cermet), KT195 (Cermet) and K3030C (tungsten carbide) tool materials with a 0.140-inch kerf. The cutting test was conducted on a Delta vertical single-spindle shaper using a bite of 0.026 inches. Wear measurements by impression method were taken at 0, 5000, 10000, 15000 and 20000 lineal feet of cutting. The KT 125 grade Cermet fractured early in the test after 140 lineal feet of cutting and would not be consider appropriate for green western red cedar. At the completion of the test, the tungsten carbide tool material had reached the end of its useful life. Wear measurements showed that it had experienced substantial wear. The Cermet, on the other hand, showed significantly lower wear and remained in a running condition after 20000 lineal feet of cutting. Since the Cermet did not reach its end of life, it is difficult to estimate its wear advantage over the tungsten carbide. Based on the wear rate measurements of recession, width and diameter and making several comparative assumptions, a preliminary estimate of the wear advantage may be obtained. It is projected that the wear advantage of KT195 is 1.7 to 4 times beyond that of K3030C under the conditions in this test. Validation of this wear advantage and the determination of the optimum operating conditions for Cermets will require more extensive testing and sawmill trials.

NiCut® is Back

Nicut was a very popular saw tip because it was much tougher than regular carbide. There was an interruption in the flow of Nicut when Sintex was sold.

Now Nicut is back in production and readily available.

The new Nicut is better than ever. Dr. Rudy, who invented Nicut, was truly a genius and he loved research. When he passed away he left a huge amount of research that he had done but that had never been put into use in making better Nicut tips. Now that research is starting to be used and the Nicut tips are really are better than they ever were.

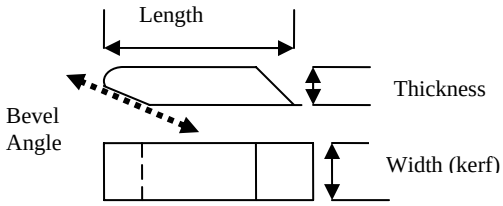
Wear grade This grade is 2 to 1 (200%) more fracture resistant (tougher) than conventional C-2 grades and is specified for aluminum cutting, particleboard, plywood, clean dry wood, and highly abrasive plastics.

Standard grade Results from a one-year service evaluation program in saw mills show this grade gave a 2 to 5 fold (200% - 500%) improvement in wear life and a 5 to 10 fold (500 % - 1,000 %) decrease in edge chipping frequency over conventional C-1 and C-2 cobalt-carbide grades in cutting green lumber. Grade 400-S is 4 to 1 (400 %) more fracture resistant (tougher) than conventional C-2 carbides.

Tough exceptional toughness, such as edger saws with high (400) hook angles. Wear resistance is approximately 2 to 1 (200 %) over conventional carbides while its fracture resistance (toughness) is 8 to 1 (800 %) over conventional C-2 carbides.

Basic Saw Tip Ordering Information

This is one pages of a seven page document – please contact us any way you wish if you want full information on grades, sizes, conversion and other designations



Common length and thickness combinations

Long L		Thick T	May be	
1/4"	(.250)	.062	WA	**Always**
9/32	(.281)	.078	WB	**double**
9/32	(.281)	.093	WC	**check**
5/16	(.312)	.093	WD	**before**
3/8	(.375)	.093	WE	**ordering**
1/2	(.500)	.125	WF	**by letter size**
3/8	(.375)	.125	WG or WS	**It is better**
11/32	(.344)	.125	WH	**to order by**
3/8	(.375)	.156	WQ	**length – 3/8”**

Letter Designations

W is the chemical symbol for tungsten.
The next letter A,B,C etc. designates length and thickness
C as a third letter means European. May also use E.
European can be CWG or CWE or WGC
No third letter means it is American
7 as the first number means straight sides
8 as the first number means slanted sides
165 is the width (kerf) in thousandths of an inch

WGC 7165

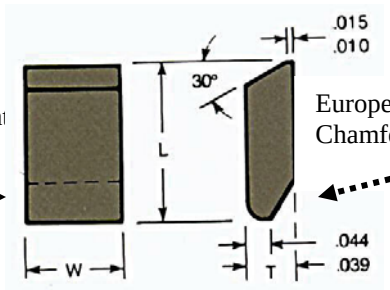
W – Tungsten Carbide
Size
European
Straight side
Width (thousandths)

European tips have a chamfer on the back (left pic below) and American tips have a straight back (Rt. pic below)

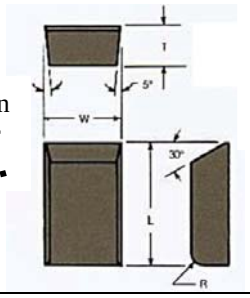
Tungsten Carbide Grades

The US "C" designation, the ISO designation and other designations are not necessarily relevant. Tungsten carbide from two different manufacturers may have identical designation but vary widely in almost every imaginable way including performance. The nineteen “C” grades are sixty years old. Now there are over 5,000 grades of tungsten carbide.

7000 series Straight sides



European Chamfer



8000 series Tapered sides

7000 series tips have straight sides (left pic above) while 8000 series tips have slanted sides (rt. pic above)

C grades Originally Buick and the Department of Defense set this up in World War II

The original concept was to rate tungsten carbides according to the job that they had to do. If you had a particular job you would specify a "C" grade of tungsten carbide and you could buy from anybody. Manufacturers decide what grades their materials are suited for. This has lead to a situation where a C-7 tungsten carbide is can be almost anything. According to Machinery's Handbook it can range from 0 - 75% tungsten carbide, 8 to 80% titanium tungsten carbide, 0 - 10% Cobalt and 0 - 15% Nickel. The problem is that two C-7 tips from two manufacturers will almost certainly work very differently in two different applications.

C-1 to C-4 are general grades for cast iron, non-ferrous and non-metallic materials
C-1 Roughing
C-2 General Purpose
C-3 Finishing
C-4 Precision

C-5 to C-8 Steel and steel alloys These grades resist pitting and deformation
C-5 Roughing
C-6 General Purpose
C-7 Finishing
C-8 Precision

C-9 to C-11 Wear Surface
C-9 No shock
C-10 Light shock
C-11 Heavy shock

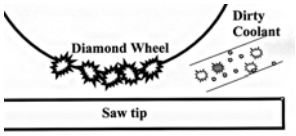
C-12 to C-14 Impact
C-12 Light
C-13 Medium
C-14 heavy

C-15 to C-19 Miscellaneous
C-15 Light cut, hot flash weld removal
C-15A Heavy cut, hot flash weld removal
C-16 Rock bits
C-17 Cold header dies
C-18 Wear at elevated temperatures and/or resistance to chemical reactions
C-19 Radioactive shielding, counter balances and kinetic applications

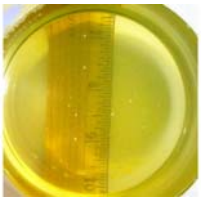
Filter System Benefits – One page

(We have a couple hundred more if you are interested)

1. **Chunks of diamond and carbide** - The CP 2020 removes the chunks of diamond and carbide as well as oils and grease. If you leave carbide and diamond in the coolant then they get between the wheel and the Carbide. This breaks down the diamonds and the carbide. With dirty coolant there is more dressing, the grinds are worse and wheel life is shorter.



2. **Oil, grease and used coolant** – New coolant is made to form very small droplets. As the coolant gets used the droplets get bigger. There can also be hydraulic fluid, oil off saw bodies and similar products. These clog the diamond wheel. They also feed bacteria which further helps to break down coolant. The blobs of dirty coolant, oil, etc. are large enough and sticky enough to get trapped in the filters.



Clean coolant

Dirty

Filtered

Filtered & cobalt removed

Coolant in saw shops gets changed weekly or monthly. Coolant in machine shops gets changed once or twice a year. The biggest difference was the filtering. If a saw or tool grinder comes with a filter system it is usually inadequate. We built a simple, sturdy filter system so that saw shops could get the same results machine shops did. It took us several years to get the right components in the right balance. (It took us six months to find the right valve. Those that are welded break so we wanted one cast as a single piece.) We worked for about four years before we found the best filter combination.

As part of our consulting work with Boeing we developed a standard that says you should filter out everything larger than 10% of your tightest dimension. Many saw shops are trying to get smooth grinds with tolerances of .001" using coolant where the average piece of grit is about half that size. It is the difference between driving a car with 20" tires and running over a 2x4 or running over a 10" high speed bump.

The CP filter systems remove solids from liquids. That part is pretty easy. What has been hard is getting good filtering and good filter life. It took us a couple years but CP 2002 and CP 2020 with bag filters followed by string wound filters remove 98% to 99% of everything bad and none of the good stuff (rust inhibitors, lubricants, fungicides, bactericides, etc.) The CP 2002 needs a filter change once every month or two. The CP 2020 has twice the capacity so it filters need changing less often. (By one month we mean 22 days of double shifts.)

Helps keep coolant in good condition

	Dirty	Filtered	Unused
pH	8.08	8.04	8.02
turbidity	45,000	15	7.02
conductivity	2,210	1,508	1,683
Viscosity	0.73	0.67	0.76

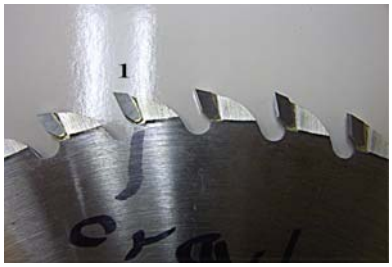
Removes Cobalt and other metals

	Dirty	Filtered	Unused
cobalt mg/L	3,210	299	0.138

Removes 99.8% of all particles

particle size	particles per cubic centimeter		
microns	number		
(.00003937 in.)	dirty	filtered	unused
<1	0	17,209	0
1	140,317	25,575	11
2	14,382,515	21,432	1,049
3	15,364,737	9,720	1,935
4	19,644,411	4,223	3,367
5	13,751,087	2,550	3,618
6	9,120,620	1,673	1,181
7	1,894,282	558	372
8	631,427	239	142
9	420,952	80	55
10	280,634	478	66
11	0	319	22
12	140,317	0	0
13	70,159	159	22
14	70,159	0	0
15	140,317	80	11
16	70,159	0	29
17	65,774	32	5
18	85,506	112	
19	26,309	80	
20		48	
21		16	
totals	76,299,682	84,583	11,885

Microscopic Examination of Saw Blades



Really famous 10” saw blade naked eye view

Magnified view showing cracks

A good microscope can be a great help for a saw filer. You can see things you wouldn’t see otherwise and things you might notice if you looked carefully are much easier to see with a microscope.

We have been doing failure analysis of saws and tools for many years. First we used film and then a desktop digital microscope. A few months ago we bought a hand held portable microscope. We had just received a brand new blade from a very famous manufacturer. We peeled the plastic off a couple teeth to look at it. We found one tip very badly cracked and several tips where the braze alloy had been severely overheated.

Bad braze from dirty plate left

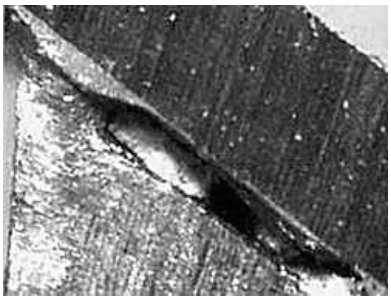
Proscope

Package 1:. Full package for computer $1,034.69. Scope, case, 3 lenses and stand. Plugs into the USB port on a computer.

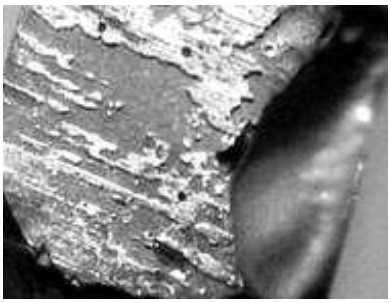
Package 2: Plugs into the video feed in a television set. Does not need a computer. $1,620.41 Scope, case, 3 lenses and stand.

Package 3: Small computer package scope & 1 lens $475.51. Scope, most popular lens for saws and tools (30x) and case. Plugs into the USB port on a computer.

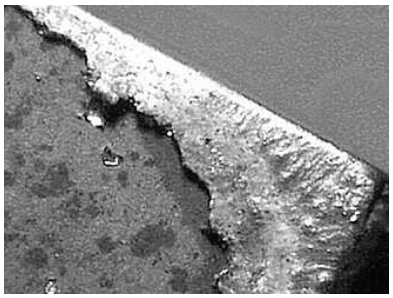
Common Causes of Saw Failure



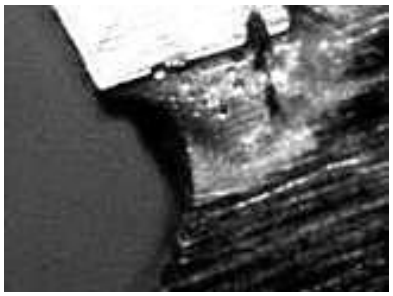
Bad carbide and dirty saw plate – the braze alloy formed round balls between the two



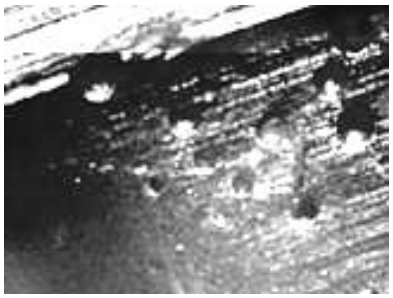
Not enough braze alloy and it didn’t stick to the carbide



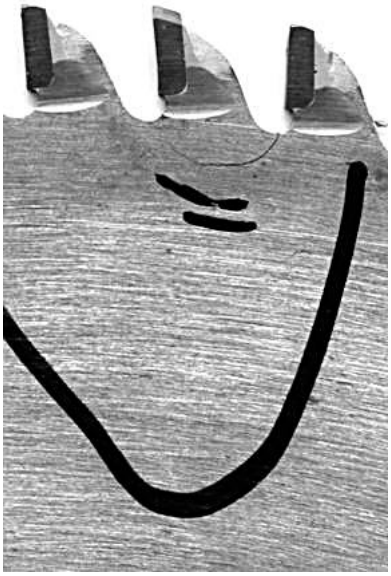
Very bad surface treatment of carbide braze alloy peels off



Overheated braze alloy – zinc boiled out leaving pits



Really overheated saw shoulder showing pits boiled in the steel

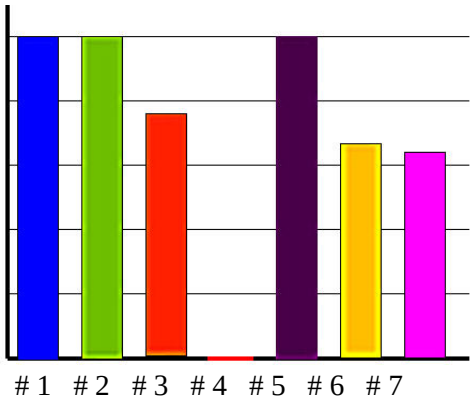


Cracked saw body

Braze Alloys (Silver Solders)

(part of a 2 pg report)

The Right Braze alloy can make a huge difference in performance.



1 Our High Impact alloy
2 50 % with Cadmium
3 50 % Cadmium free
4 56% with tin
5 50 % with Cadmium
6 50 % Cadmium free
7 50 % Cadmium free + Copper

Braze Alloy Impact & Bond Strength Tests	
High Impact	**100%**
S50N - 50% Silver with Cadmium	100%
A50N - 50% Silver - Cadmium free	75%
A56T - 56% Silver with Tin	0%
S50N - 50% Silver with Cadmium	100%
A50N - 50% Silver - Cadmium free	64%
A50N with copper spheres added	67%

How Solder Works (Also called Braze Alloy or Filler Metal)

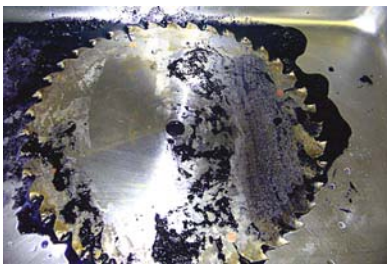
The silver solder we use is an alloy which means it is a combination of metals each of which adds something unique to the mixture so that the combination works much better than any of the individual metals. In these silver solders it is the combination of silver, copper and nickel that provides the strength. Nickel also improves the flow of the alloy. Zinc and Cadmium are added to lower the melting point of the materials. Cadmium is a very soft metal so it adds a cushioning effect to the braze alloy. High Impact has unique properties to absorb shock so it also cushions the braze joint.

Cleaning Steel for Brazing or Welding

Good saw plate has a coating to keep it from rusting. This coating can interfere with brazing and welding if it is not removed thoroughly.

This is an old saw plate sprayed with WD 40. A thick, water based ink solution was poured over it to show the underlying grease.

The left side was sprayed with Easy Off oven cleaner and the right side was wiped three times using a paper towel soaked in acetone. In this picture you can see the oven cleaner bubbling up on the left and the streak marks on the right from the acetone wipe.



Finally the plate was rinsed under running water. The oven cleaner side rinsed clean and the acetone left side has streaks.

Laser Cut Saw Plate

In laser cut saw plate it may be necessary to gum out the notch to get a good weld or braze joint. I have heard this both ways but, if you are having tip loss problems it may help.

Newer, Better "Purified Black Flux"

It works much better and you can order it now

We do lot of testing of various brazing products. When you do half a million to a million brazes a month you can really give a product a good test.

We were testing Black Flux and its equivalents from various suppliers as well as white flux, dispensable flux, brazing paste and similar. We told one guy that his competition's product was better than his. He reacted about the way we do. He went out and invented something a whole lot better.

The Difference the Right Flux Makes

Good tips top row & bad tips bottom

Old style flux

New Purified Black Flux

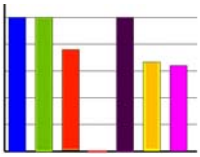
Saw Filer T – shirts

$14.95 or free

Saw filers do a tough exacting job and don't always don't get enough recognition so we decided to do something about it. We had an artist do a drawing of a typical saw filer and we are offering it on T shirts.

We are selling them for $14.95 plus $3.95 S&H. If you are buying our pretinning, tips, filter systems or anything else, just give us a call and find out how to get your free T shirt.

Braze Alloy Performance Values



This chart show tip loss with various braze alloys. The right alloy can prevent tip loss and can stop edge chipping as well as outright breakage. See P. 7

Cermets Outperform Carbide 4:1 In Western Red Cedar

We are looking for cedar mills to do further testing.

A Great New Tool Why You Need It

See page 5

Proscope with three lens kits start at $475.51

TOOL TIPS
THE BEST IN THE WORLD
Tungsten Carbide, Cermet & Ceramics

- Comet – Reinforced cobalt matrix tungsten carbide
- NiCut - nickel matrix tungsten carbide
- Cermets - Titanium Carbonitride with a nickel / chrome binder

This Newsletter & Further Information

This is the first newsletter in a year and a half. It has been an extremely good year for research and we have some great new products.

We can't possibly cover everything here. The best we can do is give a brief overview. If you wish more information please call or see www.carbideprocessors.com

In This Issue

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