WHY YOU SHOULD

Freeze

YOUR TOOLS

Cooling your tooling to -320° can double or triple the time between sharpenings.

And here's the real kick: it's inexpensive and companies that offer this deep cryogenic freezing are becoming more common.However, here's what you absolutely need to know before you try it.

About 150 years ago, Swiss watchmakers noticed that extreme cold changed the properties of their metal clock parts for the better. So after manufacturing their gears or what have you, some watchmakers would then store the parts in caves during the cold Swiss winters and let them freeze.

Unwittingly, they had given birth to what is now commonly known as cryogenics.

During the last century, toolmakers and metal heat treaters have explored what extremely cold temperatures do to tooling, metals and other materials. And they have come to some remarkable conclusions. For certain types of metals, cooling them to -320° Fahrenheit can make them at least twice as resistant to wear as untreated metal.

The wear resistance is permanent. You have to treat your tooling only once, and it will remain that durable forever, experts say. And the price of cryogenically treating your tooling is becoming quite reasonable. We found that treating about four pounds of metal will cost you about $30 to $50. (If you treat a lot of items, the cost can be as little as $1 a pound — and prices continue to drop). Cryo labs themselves are also becoming more common because commercial heat treaters are investing in the technology so they can offer the service to their customers. If you live in an industrial area, you'll probably be able to find a cryo lab locally. But even if you live in the sticks, there are cryo labs you can ship your tooling to for treatment.

So what's the catch? If cryo is so amazing why doesn't anyone sell cryogenically treated planer knives or router bits? Many of the manufacturers we talked to, including Freud, had experimented with the process in its early days and found it had little or no effect.

That's not surprising, says Bill Bryson, author of the book "Cryogenics" (Hanser Gardner Publications) and the president of the company Advisor in Metals in Milton, New Hampshire.

"Back in the 1970s it was a free-for-all, and it hurt the industry," Bryson says. "People were dumping tools in liquid nitrogen and they were cracking, or they weren't tempering the tools after the (cryogenic) process."

As a result, cryogenics got a bad rap in the steel and tooling industry, Bryson says. Not only for the early mistakes that were made but because some people thought that cryogenics would hurt sales. If tooling lasted twice as long, they might sell only half as many tools.

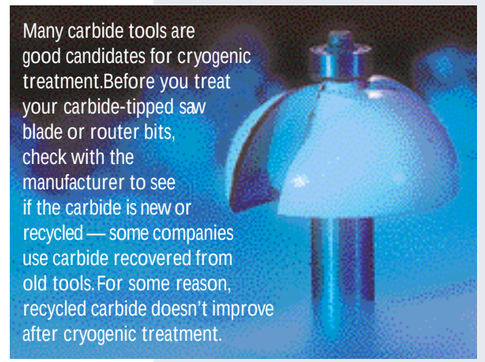
But during the last 30 years, heat treaters and cryogenic advocates began figuring out more about how, why and when cryogenics works. And today, most people in the industry acknowledge that it works well for certain types of metals, Bryson says, particularly the more complex alloys (more on that later).

In the home woodworking market, we've seen only a few cryogenically treated tools on the market. A few years ago, Vermont American announced it would sell "Ice Bits," cryogenically hardened screwdriver bits. Hock Tools recently began offering a line of cryogenically treated A2 plane blades. The cryo blades cost between $5.50 and $12.50 more than the same-size high-carbon steel blades. And toolmakers Bridge City Toolworks and Steve Knight, owner of Knight Toolworks, also offer cryogenically treated blades.

But cryogenic treatment can help woodworkers with a lot more than plane blades or screwdriver bits, Bryson says. Just ask James Larry Poole of P & K Custom Cabinets in Lula, Ga.

A couple years ago Poole sent out his carbide-tipped sawblades, router bits and shaper cutters to a lab for treatment.

"It really makes them last longer," he says. "I had one sawblade in par-



Many carbide tools are good candidates for cryogenic treatment.Before you treat your carbide-tipped saw blade or router bits, check with the manufacturer to see if the carbide is new or recycled — some companies use carbide recovered from old tools.For some reason, recycled carbide doesn't improve after cryogenic treatment.

by Christopher Schwarz

Comments or questions? Contact Chris at 513-531-2690 ext. 407 or ChrisS@FWPubs.com.

CRYO: It's Not Just for Tools Anymore

Sure, cryogenics can make your tools last longer, but it also has a lot of other benefits,some practical and some wild.Here's a short list of claims we've gathered from books, magazine articles and the internet:

- **PANTIHOSE:Nylon stockings that have been cryogenically treated are less likely to develop runs.**
- **GOLFING:Cryogenically treated golf clubs hit balls 3 percent to 5 percent farther. Cryogenically treated balls can be hit farther.**
- **RACING:Hickson Engines has treated small-block Chevy engines and found significantly less cylinder wear during a racing season.Many other racing professionals have also used cryo.**
- **FIREARMS: Treated rifles are more accurate.**
- **MUSICAL INSTRUMENTS: Cryogenically treated instruments have a better tonal quality and the valves slide more easily.**
- **GUITAR STRINGS:It doesn't even have to be the entire instrument. Some people treat guitar strings and say it improves their tone.**
- **SPORTS: Baseball bats that have been frozen hit balls 2 percent to 4 percent farther.**

Where to go for Cryo

If you can't find a cryogenics lab or a heat treater locally, here are a few labs across the country that provide the service. Please contact them for pricing and shipping information.

Advisor in Metals
Bill Bryson
336 Governors Road
Milton,NH 03851
603-755-9232

Applied Cryogenics
Bruce Medlyn
Fort Smith, AR
800-734-7042

Down River Cryogenics
Mike Pate
606 West St.
Whitehall,AR 71602
501-397-7189

ADS Cryogenics
Aaron Bennett
P.O. Box 3401
Crestline, CA 92325
909-338-6756

Advanced Cryo Techniques
Jim Sabinas
110 E.Center St.
North Fort Wayne, IN 46554

Cryogenic Services
Jim Younger
18308 West 79th St.
Viola,KA 67149
316-545-7555

York Cryogenics
Leon Patterson
3945 Farm Road
York, PA 17402
717-309-0639

Cryotron, LTD
Gordon McKay
75 E.Shep St.
Spruce Grove, Alberta Canada
780-960-0960

ticular that just would not wear out."

Poole used to be involved in car racing, and he had heard about the benefits of cryogenically treating some car parts, including crankshafts and pistons. So when a friend of his from the racing business started a cryo lab, Poole decided to see if it would help his tools.

"You really can tell the difference," he says. "I get twice the life at least... so it's worth the money."

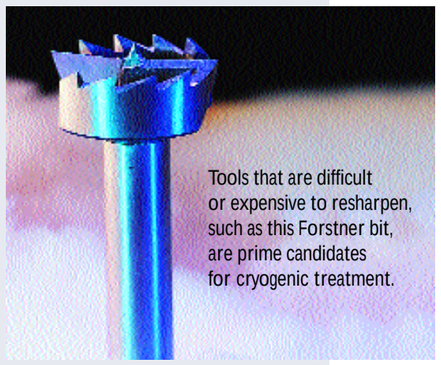
But before you start gathering all the cutting tools in your shop to take to a lab, there are some things you need to know.

In a Nutshell: What Cryo Does

There's a little science here, but it's easy to digest. When tooling is made, the manufacturer heats it to make it hold an edge. During heat treatment, the structure of the steel changes. As it is heated, the steel has a structure that is called "austenite," which is softer and has a coarse, irregular grain. When the blade is quenched (reduced quickly in temperature), the austenite changes into "martensite," which has a finer grain and is more resistant to wear.

The problem is that the transformation from austenite to martensite is never 100 percent. If a tool is carefully heat treated, it might end up with 90 percent martensite and 10 percent austenite. Commercial heat treating typically results in 75 percent martensite, Bryson says. In low-quality tooling, it can be as low as 50 percent martensite.

By carefully cooling the tooling to -320° and then thoroughly retempering the metal, nearly all of the austenite is transformed into martensite. Bryson says it's proven to be a 99.9-percent transformation or more.



Tools that are difficult or expensive to resharpen, such as this Forstner bit, are prime candidates for cryogenic treatment.

All tooling will benefit from cryogenics, Bryson says. But if the steel is an alloy containing cobalt or tungsten, the cryogenic process will create very fine micro-carbides, which add even more durability to the edge.

The alloy A2 steel, which is now found on some hand plane blades, contains carbon and chrome, so it reacts well to cryogenic treatment. High speed steel (HSS) contains molybdenum (which makes the tool resistant to heat), chromium and sometimes tungsten, which makes it ideal for cryo treatment. You'll find HSS in your planer knives, your jointer knives and in other cutting tools. As a rule with metals, the higher the alloy content, the better the cryogenics will work.

But what about carbide tools? Will saw blades and router bits benefit from cryogenic freezing? According to Bryson, that depends.

If the carbide is newly manufactured and not recycled from old carbide tooling, cryogenic treatment works, Bryson says. Carbide that has been reclaimed or recycled is not improved.

"And we don't know why," he says.

In new carbide, cryogenic treatment strengthens the binder between the individual carbides, he says. Cryogenically treated bits should last twice as long between sharpenings, Bryson says, though some people report even longer times between sharpenings.

Beware of the Thin Film

Perhaps one of the strangest aspects of cryogenic treatment is something that experts have yet to fully explain. It seems that after a tool has been frozen and then retempered, some report you won't get the added wear-resistance until the tool is resharpened.

Bryson says there's a layer of metal that's between .00007" and .0001" thick on the outside that remains untreated. After you remove this layer by sharpening, the tool works great. Bryson calls this the "Thin Film Phenomenon," and he says it's one of the reasons some people thought cryogenics was a crock in the early days. People would treat their sharp new tools, put them to use and see almost no difference in the tool's life. But if you sharpen the tools after treatment, Bryson says, that's when you see the the full benefits of cryogenic treatment.

How to Shop for Cryo

There are several ways to cryogenically treat tools, and experts say some are better than others.

• Warmer Cryo: Some labs use dry ice to cool the tools. Dry ice will take the temperature down to -109° Fahrenheit. This process works, but you won't get a full transformation of austenite to martensite.

• Quick Dip: Some labs dip the tools into liquid nitrogen (-320°), leave it there for a short period of time, remove the tools and let them return to room temperature. This process can cause the tools to shatter from thermal shock. It also can transform only the outer layer and leave the core untreated. Many of the experts we talked to do not recommend this procedure.

• Long Bath: Other cryo labs use gaseous nitrogen to reduce the temperature slowly; they keep it there for 20 hours or more (using either gas or liquid nitrogen), and then slowly return the tools to room temperature. Bryson says he's tried a variety of methods, and the equipment he prefers (and sells to other cryo labs) takes the temperature down using gas and then soaks the tools in liquid nitrogen. Either process works, however.

One of the keys to getting the best results is to choose a lab that has some knowledge of heat-treating and metallurgy and is willing to soak the tools for a long time, says Randall Barron, professor emeritus at Louisiana Tech University's Department of Mechanical Engineering. Barron's pioneering research in the 1970s, 1980s and 1990s helped convince many industries to use the process in manufacturing.

Barron's studies showed that bringing the temperature down to -320° created a more durable tool. Plus, his research showed that soaking the tools for hours was what led to the creation of the micro-carbides, which lend additional wear resistance.

No matter which process is used, after the tools return to room temperature, the tools need to be retempered because the new martensite is fragile and can shatter, experts say. This retempering process is almost always included in the price for the cryo treatment.

Bryson recommends that the tools be tempered at 300° to 350° for two hours for every inch of thickness of the tool. He also says you should make sure that the items are not stacked on top of one another during tempering.

How Well Does it Work?

This, of course, is the big question. Some of the claims seem outright outrageous. A dowel maker claimed his A2 knives lasted 800 percent longer. A titanium aircraft bit that once lasted for 15 holes was replaced by a common bit that had been cryogenically treated that would last for 200 holes.

Most cryogenic labs will tell you it's reasonable to expect your tooling to last two or three times longer between sharpenings. Considering how inexpensive cryogenic treatment can be, you'll make your money back after one sharpening.

In August, we sent a batch of tooling from our shop here at *Popular Woodworking* to a cryo lab for treatment — everything from a chisel to 12" jointer knives. We're going to compare the durability of these tools with the identical untreated tooling we recently installed in our machinery.

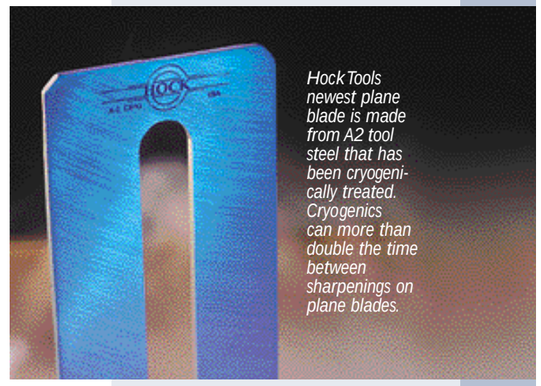
Next year, we'll let you know what we found. But even if we find out that cryogenic processing really works, don't be surprised if you don't see cryogenic planer blades for sale in woodworking catalogs.

Professor Barron says that one of the studies he did in the early days was for a manufacturer of razor blades. The company wanted to see if the cryogenic process could improve the dies they used in making the blades.

"I asked if they wanted to treat the razor blades to make them last longer," he says with a chuckle. "They said no, because then they might not make as much money." **PW**

Ron Hock's A2 blades and Thomas Lie-Nielsen's planes are both available from Woodcraft (800-225-1153),Japan Woodworker (800-537-7820) and Garrett Wade (800-221-2942).The products are also available directly from the manufacturers:

- **Hock Tools**
  888-282-5233
  www.hocktools.com
- **Lie-Nielsen**
  800-327-2520
  www.lie-nielsen.com



Hock Tools newest plane blade is made from A2 tool steel that has been cryogenically treated. Cryogenics can more than double the time between sharpenings on plane blades.

In Search of Proof Cryo Really Works

To many people, cryogenics sounds too good to be true. So we went looking for some stories to back up the claims we'd read so much about.
Ron Hock,the founder of Hock Tools,began offering A2 plane blades this year that have been cryogenically treated — in addition to his line of high-carbon steel blades that he's offered for years.

He says he began offering the A2 tools after other plane blade manufacturers,such as Veritas of Canada,began selling A2 blades. Hock says he isn't entirely convinced that A2 can be made as sharp as his high-carbon blades, but it does appear to wear longer and be slightly more corrosion-resistant.

"It was adding the cryo that tipped it for me," Hock says. "Without the cryo improvement, I wouldn't use the A2."

Hock says he's getting good reports back from customers who are seeing longer edge life.

Thomas Lie-Nielsen,the founder of Lie-Nielsen Toolworks in Warren,Maine, was also looking for answers.During the summer, he was considering switching to a different type of blade for his line of high-quality planes.For years he's used a high-carbon steel that he carefully heat treated.Lie-Nielsen was considering switching to A2 that was cryogenically treated.

So he took three A2 blades (some of which had been cryogenically treated) and three high-carbon blades and made 300 identical cuts with each.He then sent them to an independent lab to examine the blades.Lie-Nielsen says it was obvious that the A2 blades retained their edge longer than the high-carbon blades.And he hopes the lab will be able to tell him how the cryogenically treated blades fared. We promise to share the results with you in a future issue.