

Sub-Zero Metal Treatment Catching On Fast

By Mick Lane

From cultivator points to racing engines, gun barrels to hitch pins, subjecting metal parts to extreme sub-zero temperatures is catching on fast as a way to increase useful life.

Cryogenic processing of steel involves using liquid nitrogen to lower the temperature of parts to -320° F.

But don't try this at home, experts warn. For the treatment to be effective, it must be done as part of a controlled process.

"You can't just immerse a piece of steel in a tank of liquid nitrogen," says Rick Diekman, Controlled Thermal Processing, Inc., Streamwood, Illinois. He says that although cryogenic processing is starting to catch on for agricultural equipment, the majority of the company's customers are motor sport enthusiasts. A cryogenically treated race car transmission, for example, will last two to three times as long as an untreated one. "That's typical," says Diekman, noting that cryogenic processing normally doubles product life.

Les Baych, Dave Snyder and Bruce Melick opened Cryogenic Engineering, Inc., in Cedar Rapids, Iowa, last year. The three formerly worked for Midland Forge. Baych says they got into the business after sending out parts for cryogenic processing. A die that was normally good for 7,000 pieces lasted through 193,000 pieces after treatment.



Cultivator blade on left was used as purchased. Blade on right was cryogenically treated. Blades were attached next to each other on the same cultivator and were used to cultivate 3,600 acres.

Seeing the potential, the three contacted "300 Below", a Decatur, Illinois, company that sells cryogenic equipment. They bought what they needed and set up shop.

Diekman says a New England knife manufacturer pioneered the idea of cryogenic processing nearly 60 years ago. It was later refined by Applied Cryogenics, a Waltham, Mass., company which developed equipment that it now sells to other companies.

Diekman says the process is just beginning to be used for agricultural equipment like cultivator chisel points.

In cryogenic processing, the temperature of the item to be treated is lowered to at least -300 degrees F. "It is very important that the temperature of an object be brought down at a controlled rate that is compatible with the

material," he says. "Our process involves placing an object into a chamber at room temperature. The chamber is sealed and the temperature is dropped to -320 degrees F over a period of 8 hours or so. The temperature is dropped by allowing liquid nitrogen to enter a heat exchanger that cools the air in the chamber," he says. Liquid nitrogen is never allowed to actually touch the parts being treated.

Once the temperature in the treatment chamber has reached -320 degrees F, it is held there for at least 6 hours. Some items, however, may be held at the low temperature for as long as 36 hours. "It depends on the materials being processed," Diekman says.

After the part has been at -320 degrees F for the proper length of time, the machine then brings it back to ambient temperature, again very slowly to avoid damaging it. Most materials require an additional tempering process. The cryogenic processing machines Diekman uses can continue warming the parts inside up to +300 degrees F. and then cool them again at a controlled rate.

"In some cases, this tempering cycle is repeated a second or even a third time. Again, the rate of change of temperature is rigidly controlled during each cycle," he says. "This is much more effective than the rapid heat and quench process alone that some use to temper steel."

The cryogenic process works on all types of steel and most other commonly used metals. Some sources say steel needs to have

a carbon content of at least 0.4 percent while others say this isn't important. Likewise, some say softer type 300 stainless steel doesn't benefit from treatment, while Diekman has conducted studies that suggest otherwise. Harder type 400 stainless steel does respond, as do most other metals, such as brass (musical instruments), copper, aluminum alloys and some, but not all, cast iron. In addition, some plastics also benefit from cryogenic processing.

Baych says they've approached manufacturers about cryogenic treatment of wear parts on farm equipment, but with few successes. "Manufacturers have an interest in selling parts, so anything that would make them last longer might not be in their best interests," Baych theorizes.

Cryogenics Engineering says they've found that the process adds life to non-steel items too. They've even tried it on panty hose.

"If you have something you'd like to process, call us," Baych says. "If we've had experience with it, we'll tell you what you can expect from the process. If we haven't had experience with it, we might try it anyway, particularly if we can then run tests to compare the results with identical untreated items."

Cost of cryogenic processing is usually based on the weight of the material being processed. Prices start at \$6 and \$10 per pound and may go down with increased volumes.

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stands outside my shop because it was too big to fit inside it. I operate a small machine shop and use my press to build or repair things for my customers. It can do everything from small to big jobs - the biggest metal I've bent was 1 3/4 in. thick.

"The legs have steel plates welded to them at the bottom and are simply buried in the ground. The cylinder is operated by a small hydraulic pump and an electric motor."

Myers Machine & Mfg., 587 Thomas Rd., Hollsopple, Pa. 15935 (ph 814 629-9632): "We custom build hydraulic cylinders, mostly for specialized equipment used in industrial applications. However, we can custom build cylinders for farmers, too. All we need are the specifications and dimensions that you want. We think there's a market in agriculture for our service, especially with foreign equipment where hydraulic cylinders are often priced 'out of sight'. For example, a steering cylinder for a Deutz tractor can sell for up to \$600 whereas we can build the same cylinder for \$200 to \$300. We also custom build accumulators and pressure intensifiers."

Donald Davies, Dawn, Mo.: "We have four Deere 4020 tractors and they're all equipped with two long slender batteries. If we don't replace both of them at the same

replaced both batteries with a single 4D battery that's commonly used on construction equipment. It has about the same power as the tractor's original two batteries. We paid a little over \$100 for this battery, whereas the two Deere batteries cost about \$90 apiece. The main advantage is that now we don't have to replace batteries as often. We had to make a new mounting bracket for the new battery."

Wayne Zimmer, Roblin, Manitoba: "Here's a photo of a bolt rack that I made using gangs off an old disk. I can turn it to any position and find anything I want at a



glance. I removed the gangs and welded short lengths of angle iron to the bearing holders on all the gangs. I welded two gangs to a pipe opposite each other. The next two gangs are welded opposite each other but are lower than the two gangs welded to the pipe. The stand that holds the rack upright is the rear wheel of a disk which has weights on it.

"The entire rack revolves, which means I can move all four gangs at once, or move each gang one at a time."



time, often the battery that we don't replace is a little weaker and will cause the new battery to go bad. It gets expensive. We

Where To Get Cryogenic Processing

Following is a list of companies that do cryogenic processing of parts:

Applied Cryogenics, Inc.
Contact: Jeff Levine
15 Wall Street
Waltham, Mass. 02153
ph 781 642-7860
www.huron.org/cryogenic
nsengine@aol.com

300 Below
2101 E. Olive St.
Decatur, Ill. 62526
ph 217 423-3070
Fax 217 423-3075
www.300below.com

American Cryogenics, Inc.
305 Travis Lane
Waukesha, Wis. 53186 USA
ph 414 513-0486
fax 414 513-0485
e-mail: aci@americancryogenics.com
http://www.americancryogenics.com

Controlled Thermal Processing, Inc.
Contact: Rick Diekman
1521 Bourbon Parkway
Streamwood, Ill. 60107
ph 630 540-1510
www.metal-wear.com

Cryogenic Engineering, Inc.
Contact: Les Baych
1131 Wenig Road NE
Cedar Rapids, Iowa 52402
ph 319 861-3343
www.cryoeng.com

Motion Improvements
Contact: Leo Fortey
276 Ayr Road
Paris, Ont. N3L 3E2
ph 519 861-6611
www.motion.fortey.net/

Bob Burton, Loveland, Okla.: "I've come up with a wire tie tool that eliminates the need for any other tool when tying barbed wire to T-posts. It's a 4 1/2-in. long, 1/2-in. dia. steel rod with a small hole in one end that's used to twist the wire. The other end is narrowed up and has a notch in it. You use the notched end to bring one side of the wire clip under the barbed wire and pointing up. Then you insert the end of the clip into the hole end of the tool and twist the clip around the wire. It's simple, but works great."

