

Controlled Dry Cryogenic Process

...a unique process that significantly extends the productive life of metal tools and machine parts.



CRYOGENIC TEMPERING SERVICES, INC.

CRYO-TECH

Serving you for more than 30 years.

Cryo-Tech, Inc. was established in 1966 under the name of Materials Improvement [Inc. by](#) former heat treat businessman Edward Busch. It was later changed to Cryo-Tech, [Inc. to](#) coincide with the name of the process.

Ed owned several heat treat companies for over 20 years. In the early 1960s he started to get requests for stabilizing tool steels after the heat treat process by using liquid nitrogen. Ed would comply, of course, but the results were not satisfactory. By submerging the parts in liquid nitrogen, the tools would warp, bow, crack, or become brittle.

Always a problem solver, Ed started researching cryogenics and learned as much as he could. Although there was not a lot of information available on the subject, he was intrigued enough to sell the heat treat business and start a new venture into the world of cryogenics. Ed was able to locate a used cryogenerator out east that came off of a naval aircraft carrier.

After several attempts at processing tooling in various ways, Ed was able to develop the first dry cryogenic processor. By using the dry cryogenic processor, he was able to control the temperature while "ramping down" and maintaining the frigid temperatures for a long period of time. By bringing it slowly back to room temperature, the tooling no longer cracked or bowed from thermal shock. Now that he tackled one problem, he was faced with another... no one had ever heard of cryogenics. It was a hard

sell, and he was dubbed a "con man" by many, and was often accused of practicing "black magic." Ed's perseverance and dedication soon proved worthy and business started coming in.

In 1973, Ed was brought to the attention of Dr. Randall Barron from the University of Louisiana. Dr. Randall Barron is the most noted academic authority on the subject of cryotreatment. Ed contacted Dr. Barron and funded an extensive study into this marvelous new technology. Cryo-Tech supplied all of the tooling and cryogenic processing for the study. Several customers of Cryo-Tech also offered their support by donating their tooling for research, testing the pieces in their operation and then submitting their results. Over a year's time, the research team was able to attain a wide range of tool steels studied. Through this study, the standard for cryogenic treatment was established.

In October of 1999, 300°- Below, Inc. acquired Cryo-Tech. The processing operations are now completed at the new industrial plant in Decatur, IL. The company is today the largest processor in the country, as well as the founder of commercial cryogenic processing since 1966. 300 Below customers are treated with Ed's original courtesy and honesty, preserving the business practices and integrity. 300 Below [Inc. is](#) also a GREEN business. Cryogenic processing saves customers downtime, increases throughput, and sharply decreases maintenance and tooling costs. In the words of a customer, "Cryogenic processing for us is like trading \$10 cash for \$100 in cash... it's found money free for the asking!"

What is the Cryo-Tech Process?

RYO-TECH is an exceptional method of improving the physical and mechanical properties of various materials by putting them through our unique Controlled Dry Cryogenic Process.

Unlike so-called "cold" treatments that are generally limited to temperatures in the -110°-F range, Cryo-Tech is controlled between **-300°- and -320°-F**. And unlike techniques that involve use of cryogenic liquids, the Cryo-Tech Process is completely dry. Its "chilling" cycle provides ample time for the material to adjust thoroughly to the progressively

colder environment. Time in the low temperature range is long enough to establish an orderly arrangement of crystals, increase internal bonding energy, and achieve a structural balance throughout the mass of the material. The slow, gradual warming cycle is controlled to bring the material back up to room temperature without disturbing the basic uniformity of its transformed and stabilized molecular structure.

While the Cryo-Tech Process is now being applied to parts and products made of many materials, it has been most widely used to improve the properties of high speed, high carbon/high chrome and other steels.

Experience has shown that it greatly increases the strength, stability and wear life of cutting tools, dies and wear parts - resulting in substantial savings in reconditioning, replacement and down-time costs.

By inducing virtually complete transformation of retained austenite to martensite, it eliminates the need for tempering at temperatures high enough to cause a loss of hardness. And because improvements produced by Cryo-Tech extend throughout the material, one treatment lasts the life of the tool or component - regardless of any subsequent finishing operations or successive regrinds.



Why -300°F?

STEEL is heat treated to give it the desired combination of hardness, toughness, wear resistance and ductility.

These characteristics depend on the alloy ingredients of the steel and on the time and temperatures used in the heat treatment. The microstructure of the finished steel can be changed only by subsequent thermal treatment... or by dry cryogenic processing.

In the past, the use of dry ice or other methods of cooling steel to around -100° has been utilized as a way to improve the stability and wear resistance of certain steels. This type of "sub-zero" treatment results in some transformation of retained Austenite to Martensite. However, it involves a long and arduous procedure and only improves stability to a degree. Since retained Austenite is large and unstable, while Martensite is hard and stable, the less retained Austenite you have in a tool or wear part, the better. Unfortunately, the effects of a "sub-zero" (-100°F to -120°F) treatment are minimal unless it is performed as an integral part of the heat treatment cycle (no later than 6 minutes after the steel is quenched to room temperature). Even performed properly, this "sub-zero" treatment cannot remove all the retained Austenite from a piece of steel, nor does it have any other improved

effect on the microstructure of the steel.

A true dry cryogenic treatment (below -280°F), on the other hand, has been shown to improve the microstructure of steels regardless of how long it has been since they were heat-treated or in use. In a series of tests conducted at Louisiana Tech University, Dr. Randall F. Barron discovered that the cryogenic process such as Cryo-Tech concluded:

The transformation of virtually all the retained Austenite to Martensite.

Significant increases in the wear resistance of the treated steels, compared to normally heat-treated control samples.

Improvements in the wear resistance even of steels previously given a -120°F "sub-zero" treatment.

The formation of many additional fine carbon carbide particles within the microstructure of the steel.

No statistically significant changes in hardness.



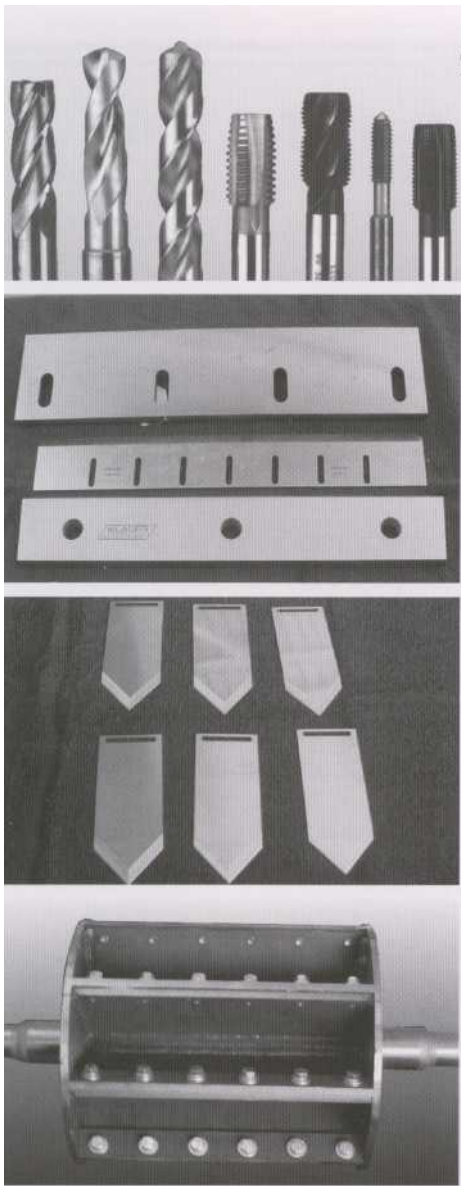
ADVANTAGES WITH CRYO-TECH PROCESS

- ① Transformation of retained austenite to martensite
- ② Increase wear life and durability
- ③ Increase tensile strength
- ④ One-time treatment lasts the life of the tool
- ⑤ Aluminum aging and dimensional stabilization
- ⑥ Formation of additional fine carbide particles within the microstructure of the steel
- ⑦ Fast three-day turnaround
- ⑧ Largest equipment in the industry
- ⑨ Shrink fitting capabilities

INCREASE THE LIFE OF YOUR TOOLING 200-400%!

ALLOY	WEAR RESISTANCE $R_w = FV / WHv$		
	Untreated	Soaked at -120°F	Soaked at -310°F
52100	25.2	49.3	135
D-2	224	308	878
A-2	85.6	174.9	565
M-2	1961	2308	3993
O-1	237	382	996

Wear resistance as a function of cryogenic soak temperature. (Data taken in the Department of Mechanical Engineering, Louisiana Tech University, Ruston, Louisiana.)



A SAMPLE OF VARIOUS INDUSTRIES USING CRYO-TECH PROCESS:

PAPER AND PLASTIC INDUSTRY

LUMBER AND CARPET MILLS

FURNITURE AND WOODWORKING INDUSTRY

STAMPING AND STEEL FACTORIES

FORGING COMPANIES

AEROSPACE AND AIRCRAFT INDUSTRY

CAR AND BOAT RACING INDUSTRY

FOOD AND GARMENT INDUSTRY

**Cryo-Tech Process will enhance the performance and
increase the wear life of any metal component.**

CALL 800-550-2796

Variety of Tooling

MILL CUTTERS

DRILLS

PUNCHES

DIES

BALLSCREWS

CIRCULAR SLITTERS

TRIMMER BLADES

CUTTERS

HOBBS

CYLINDER HEADS

PISTONS

ENGINES

TRANSMISSIONS

CAM SHAFTS

CRANKSHAFTS

GRANULATORS

EXTRUDERS

FORM TOOLS

PROPELLERS

RAZOR BLADES

GUN BARRELS

BEARINGS

COPPER

ELECTRODES*

CUT-OFF BLADES

HYBRID KNIVES

GERBER KNIVES

WOLF KNIVES

PERFORATORS

RECYCLING KNIVES

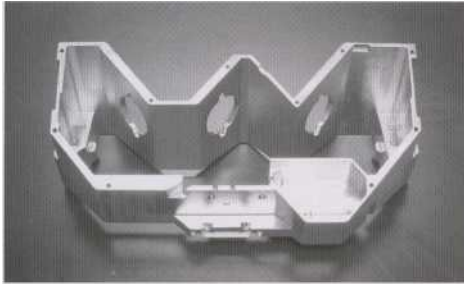
*WELDING APPLICATION

Copper electrodes exhibit longer life, show less wear and deformation and they can be used with less power input. Cryo-Tech will reduce tip burn-off and carry amperage on heliarc tungsten electrodes.

THE RESULTS
After your parts have been cryogenically treated, you will see a substantial increase in their wearability. Exposing the material to this environment will actually transform its chemical microstructure into a more refined, uniform grain substructure.

More On Aluminum

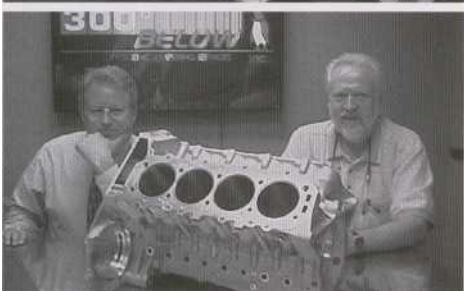
All Aluminum and aluminum alloy castings have built-in stress due to the shrinkage of the molten metal after it cools in the molds. Some of these stresses can be reduced and in some areas eliminated by good casting design, by the foundry properly incorporating stress risers.



Castings that have to be machined for closer tolerances, flatness and better surface finishes will, in most cases, distort on these surfaces, which in turn affects the tolerances and flatness of the critical areas. This distortion starts when the outer layer is removed by machining... this outer layer locks in the stresses and when removed, the machined surface will be distorted.



What can be done to relieve these stresses before machining? Through the advancement of cryogenic science, it has been discovered and proven that when these castings are treated in a cryogenic chamber at temperatures of 88° Kelvin (-300° F) at a controlled time/temperature cycle, all internal stresses are relieved. These components will now retain a flatness/parallelism heretofore not possible. They will maintain a dimensional stability in their use function far above the non-treated part. This is due to the realignment of molecular structure that has been distorted during the casting or heat treating process. When these cryogenically treated castings are machined, there is no distortion on the machined surfaces... if there is a distortion, it is caused by improper machining, dull cutting tools, speeds and feeds being too slow and/or not enough material removed at the first cut.



SIMULATED MICROSCOPIC VIEWS



TOOLS HARD TO RESHARPEN?

No! The Cryo-Tech Process does not increase the hardness of steels. Instead, because of the more uniform substructure, a more lasting uniform cutting edge is likely to be achieved after Cryo-Tech processing than prior to treatment.

ANY BRITTLENESS PROBLEMS?

Tools and parts which have been Cryo-Tech processed will resist the chipping that can result from improper alignment. Again, this is a case where the more refined, homogenous substructure of greater density pays off in dividends of more uniform wear patterns.

WEAR SLOWER, LESS SEVERE

With the Cryo-Tech treatment, not only do you achieve an impressive increase in wear resistance, but when the tool does finally wear, the degree of wear is less severe and more uniform. Thus, less material needs to be removed to sharpen or redress the tool.

This is shown graphically in the illustration to the left.

QUESTIONS ABOUT CRYO-TECH

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A

Q. Should I have my production tools heat-treated before being Cryo-Tech processed?

A. Yes! Cryo-Tech is not a substitute for heat treatment. Rather, it is a supplemental treatment which further improves the steel's operational performance.

Q. Should the tool be sharpened before you process it?

A. Not necessarily. Your tools can be processed sharp or dull, before or after finish grinding (in the case of new tools). A "superfine" edge will be obtained the first time you sharpen the tool so the benefits of the processing will be noticed sooner.

Q. Is the sharpening more difficult after Cryo-Tech, or does sharpening reduce the benefits of the cryogenic treatment?

A. No! No change will be needed in grinding techniques or materials and, since Cryo-Tech is not a surface treatment, the benefits of the improved microstructure last the life of the tool. One Cryo-Tech treatment is all the tool needs, regardless of how often it is sharpened.

Q. Will the size or hardness be changed by your process?

A. Only if the tool was not properly heat-treated when originally manufactured.

Q. How much extra life will I get from Cryo-Tech processed tools?

A. That depends on the type of tool and the material it is used on. Reported increases have

ranged from 25% to 3000%; in metalworking, the average is 50% to 150%; in other industries, 100% to 300% is the average. Whatever your average improvement, we believe it will result in a cost savings.

Q. What is the cost of Cryo-Tech processing?

A. Cryo-Tech can provide cryogenic treatment at much lower costs than other businesses in this industry. This is possible because of our long history, the volume of our business, and because we have the largest equipment in the world (all the chambers are computer controlled). The price is based on the size, weight and type of tool. You can be sure it will be very inexpensive in view of the savings that you will gain! There is a minimum charge of \$49.50... and our standard turnaround time is only 3 days! Call us for a *competitive quote!*

Q. Will Cryo-Tech work on (you name it!)?

A. Yes, generally, but there are probably some applications for our process that you think of which we have not mentioned in this brochure. Please write or phone.

If we are not experienced with what you have in mind, we'll be happy to run samples for you to test.



Try our CRYO-TECH Process - You have nothing to lose but a problem!

