

## Applications

Cutting Tools Taps Shear Knives Blades Slicers Circular Slitters Engine Blocks Engine Components Transmissions	Drill Bits End Mills Crankshafts Camshafts Cam followers Axles Yokes Gears Copper Electrodes	Carbide Inserts Punch Dies Bearings Chain Hammermills Pulverizers Shredding Screens Granulators Extruders	Progressive Dies Press Dies Guns Musical Instruments Castings Dental Instruments Medical Instruments Farm Implements
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*The applications are endless*

## Proven Savings and Quality Improvements

"Increased the wear life of chain saw chain by over 400%."

- A major chain saw manufacturer to the timber industry

"Our M2 serration dies went from 33,000 pieces to 93,000 pieces after CI treatment."

- A major parking brake manufacturer

"Reduced catastrophic fractures in carbide tooling, dramatically increasing tool life."

- A hydraulic system manufacturer

"Increased useful life of M42 End Mills by 450%."

- An aerospace manufacturer

"Eliminated breakage of gears, axles and yokes in my car, so I could set a course record."

- A champion motor racer

Our thin walled aluminium casting were relieved of stresses and distortions reducing losses from 32% to 5%."

- A major computer/aerospace manufacturer

## KRYO SPACE offers

- ◆ Deep cryogenic treatment service
- ◆ Improvement from 2-5 times with most tools and components
- ◆ Lowest cost in the industry
- ◆ Careful and breakage free handling of your tools and components
- ◆ Most precisely controlled deep cryogenic treatment available
- ◆ Specific profiles and computer control optimize benefits and eliminate the chance of thermal shock of any material
- ◆ Very wide range of capacity, can treat almost any size object
- ◆ Quick delivery time.

*To increase wear life, quality and performance of your tools and components contact us at:*



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Pune 411014

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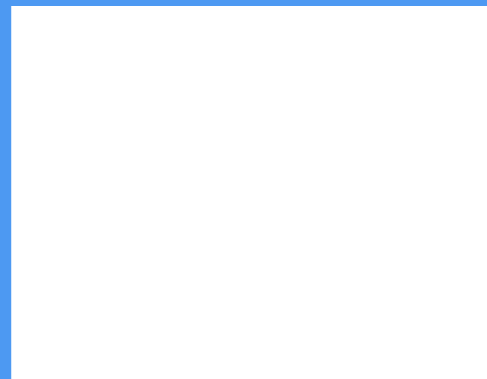
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## COLLECTION CENTRE



# KRYO SPACE

The Cryogenics Edge for Increased Performance and Productivity



## KRYO SPACE

Kryo Space is a Pune based firm offering a revolutionary cryogenic process making available the state-of-the-art DEEP CRYOGENIC treatment facility in India. As an integral part of this modern plant is a state of art thermal efficient treatment chamber.

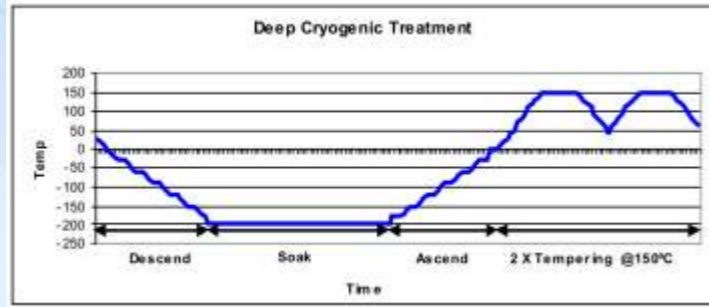
### DEEP CRYOGENIC TREATMENT

In today's highly competitive and quality conscious global market, this latest cryogenic technology enhances tool life, reduces wear and downtime resulting in cost reduction.

DEEP CRYOGENICS is the methodology of "Ultra Low Temperature" processing of materials to enhance their metallurgical properties to desired levels. This process is capable of treating a wide variety of materials such as ferrous and non ferrous metals, metallic alloys, carbides, ceramics and plastics (including nylon & teflon). The process involves reducing and raising the temperature. Thermal control is achieved by continuously monitoring inputs and regulating the flow of liquid nitrogen into the chamber and alternating the heat. Precise program control takes the cycle through its three phases of descend, soak and ascend. The entire cycle takes 48 to 72 hours depending on the weight and type of material. It is imperative that a slow descent is followed by a soak period of at least 24 hours at -193° C and raised to +150° C with a slow ascent. Strict computer control and precise processing profiles assure that optimum results are achieved with no dimensional change or fear of thermal shock. Cryogenics is not a surface treatment. It affects the entire mass of the tool or component being treated making it stronger throughout. This means the process keeps working even after numerous sharpenings.

The strength of the material treated actually increases without affecting the hardness. In most cases the toughness of the tools and components increases without any danger of chipping or breaking.

DEEP CRYOGENIC treatment is not a substitute for heat treatment but a complement to enhance material properties.



### Reasons for Enhanced Material Properties

Retained soft austenite is changed to hard, more stable abrasion resistant and higher heat resistant martensitic. During the process there is a wide distribution of fine ETA carbides throughout the martensitic matrix of the metal. Thermal and mechanical stresses are relieved thereby reducing the possibility of micro cracking, fractures or edge chipping, which are the principal causes of tool failure.

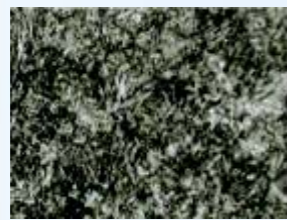
The particles within the metal matrix develop a more uniform refined microstructure with greater density. The material's porosity is reduced due to a denser molecular structure supported by fine ETA carbides and tight lattice matrix. Since residual stresses affect the ability of the cutting edge to absorb

energy, tools treated by DEEP CRYOGENIC process are not only relieved of internal stresses but are also resistant to further work hardening.

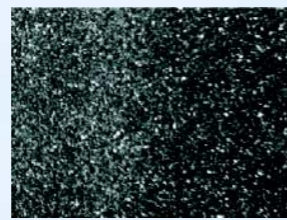
In case of steel and steel alloys, the molecular structure of the material is realigned by removing the built in kinetic energy



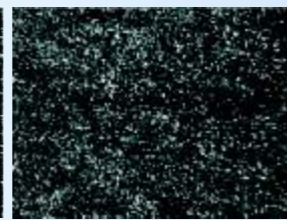
AISI H13 Before



AISI H13 After



AISI T42 Before



AISI T42 After

Fifteen years of research, however, has neither dented or even scratched the surface. New applications for the process appear everyday.

### Life Improvements of various machine elements after Cryogenic Treatment

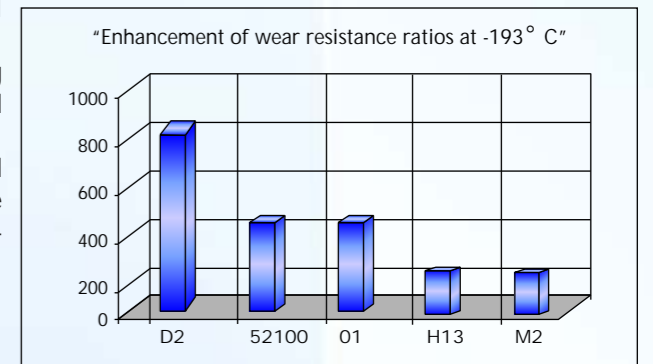
Item	Average life before treatment	Life after treatment	Ratio
Progressive press tool	50,000 hits	2,50,000 hits	5.00
HSS Single point cutting tool	5 pieces	16 pieces	3.2
HSS drill used on alloy steel	10 pieces	46 pieces	4.6
Lamination Stamping of rotor and stator	60,000 hits	2,00,000 hits	3.33
Thread rolling dies for high tensile fasteners	2,50,000 pieces	10,00,000 pieces	4.00
HSS Taps used for tapping holes in cast iron	70 pieces	150 pieces	2.14
Dies for cold heading operation	425 pieces	900 pieces	2.11
Broaching operation on forged Connecting Rod	1500 pieces	8600 pieces	5.73

### Wear Resistance After Cryogenic Treatments

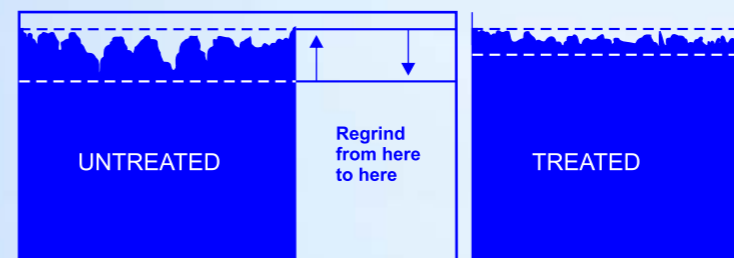
Metals AISI#	Metals Description	% Increase in Wear Resistance of alloys
D-2	High Carbon / Chromium die steel	817
S-7	Silicon tool steel	503
52100	Ball bearing steel	420
O-1	Oil hardening cold work steel	418
A-2	Graphite tool steel	264
H13	Chromium / moly high speed steel	209
M2	Tungsten / moly high speed steel	203
T-1	Tungsten high speed steel	176
P-20	Moly steel	130

### Benefits

- Processed materials have increased wear resistance
- Increased toughness, reduced brittleness, but are not harder
- There is increase in impact resistance, fatigue limit
- Creates denser molecular structure resulting in larger contact surface area which reduces friction, heat and wear
- The material can withstand higher temperatures as heat dissipation is greater;
- Processed items can be machined to closer tolerances with less scrap, distortion and stress;
- Items that are re-sharpened or reground need less material removal;
- Cryogenic processing saves you money with longer lasting equipment, reduced maintenance, reduced downtime and enhanced performance;
- Cryogenic treatment is not a surface treatment; it is a solid treatment; the entire mass is affected thus the effect of the treatment is retained even after regrinding and re-sharpening.
- Processed items are more corrosion resistant;
- There is no change in hardness
- It works on any part that is coated like TiN (titanium-nitride), TiAlN, etc.



### Severe Wear vs Less severe wear



Less regrinding needed to renew the cutting edge. This high magnification of the cutting edges shows that the deep cryogenic treatment increases wear life and requires lesser regrinding.