

ISO 9001:2015 certified

Metallurgical Solutions, Inc.

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About Metallurgical Solutions, Inc.

Metallurgical Solutions, Inc. is the finest heat-treating company in New England for the heat-treatment of High-Speed steel, (HSS), and alloy steel tools. MSI was formed in 1989 as several of our large, local tool manufacturing companies were experiencing difficulties with escalating energy costs, and dwindling sales due to imports. MSI is still owned by the two families that started the company. With almost half the workforce family members, chances are good that the person who answers the phone is one of the owners. MSI specializes in the proper heat-treatment of tools and short run production jobs that have very stringent metallurgical requirements. Although most of our work is done in High-Speed molten salt baths, (Barium chloride run typically at upwards of 2100°F), we are capable of many other applications. (See our list of capabilities on page 4.)

About Our Processes

Molten salt baths are the oldest of the processes used today in the hardening of high-speed cutting tools. As old as the technology is, Salt still produces the most desirable characteristics in a cutting tool. For example we produce harder, tougher, finer grained cutting tools, with lower levels of retained austenite.

There is no need to compromise a tool's integrity when hardening in molten salt. We work our way up the temperature range on each shift, giving each customer's work the exact time and temperature his job requires to obtain the optimum combination of hardness and toughness to suit his application. Since we can obtain higher hardness in the "as quenched" condition, we don't have to cut corners in the tempering process to maintain the desired hardness. This also allows us to remove virtually all retained austenite by tempering at the prescribed tempering temperatures. Experienced tool manufacturers realize that if a tool is to be coated after heat-treating, too much ▶



Heat-treatment of steel shafts up to 48" long.



Overbend straightening



Peen straightening



Selective heat-treating

retained austenite can result in dimensional changes after the part is subjected to the temperatures used in the coating process.

Many of the same benefits derived by heat-treating HSS in molten salts apply to processing alloy steel product in salts. For example, increased toughness can be obtained by quenching into salt, rather than oil. As important is the fact that, a part quenched in salt will experience less distortion than that same part quenched in oil.

When heat-treating in molten salt, we load everything vertically. This helps keep very thin parts, long slender parts, and tubular type product straighter than laying them down in a basket. We harden very thin blades of HSS for several customers. They appreciate the fact that we can give them back flatter parts than they bring to us. Because the parts are still at approximately 1000°F when they come out of our quench, we can tweak them a bit to help keep them flat. Naturally, this means our customer can buy a thinner material and reduce their grinding, both of which saves them money.

A little more about our Salt Bath heat treating

Austempering is an almost forgotten process except for the gun industry. MSI is one of the very few heat-treating companies remaining in New England who can perform this process. For years, gun manufacturers have known that this process produced gun parts that could withstand the explosions that take place within the confines of a gun regularly. The very same qualities that make gun parts so tough are being rediscovered, and employed by other manufacturers in their products.

We process steel bars up to **48" long x 7" diameter** with very specific metallurgical properties, such as tensile and yield strengths, used in mounting ship deck hardware, and ordinance.

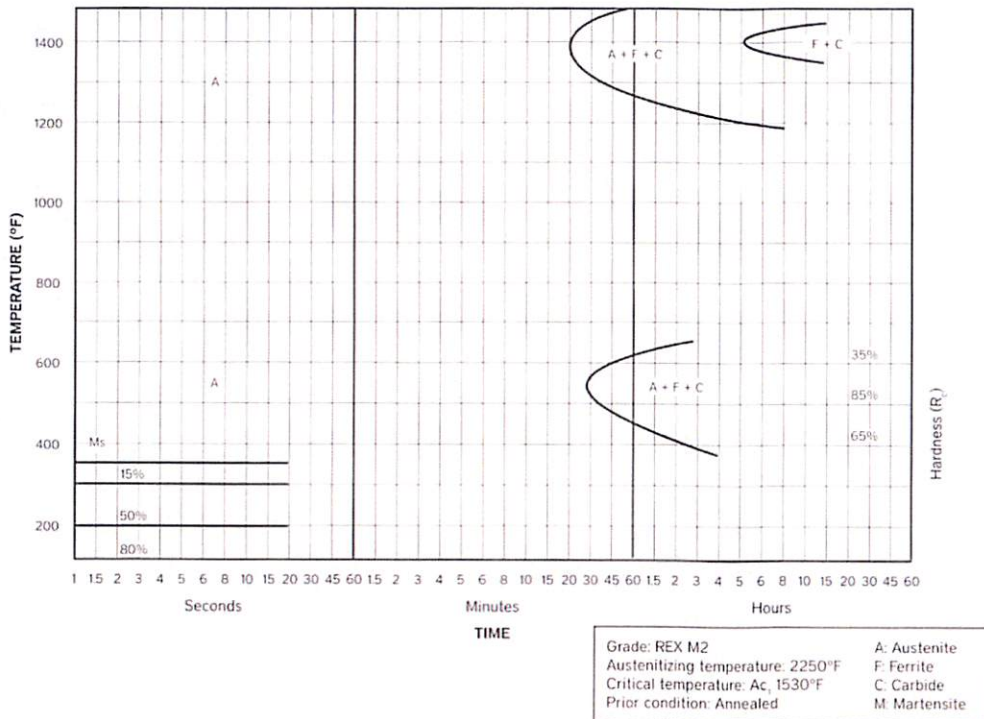
Many tool manufacturers are finding that when their tools are **cryogenically** treated as part of their heat-treatment, they get increased life out of the tool. This is so because the cryogenic processing helps to remove that last little bit of retained austenite in the matrix, giving the tool a harder tougher matrix of tempered martensite. This not only improves the cutting action, but reduces the risk of dimensional instability.

Because we heat-treat so many long slender pieces for our customers, we do a fair amount of **straightening** at MSI. Parts that are small in diameter, and will be ground afterwards, are often "**peen straightened.**" This involves tapping the surface of the piece with a small hammer in the proper place. This leaves the piece with little "ding" marks, which are later ground out. Larger diameter pieces are processed in straightening presses in a process called "**overbend straightening.**" In this process, the piece is bent very slightly in the direction opposite the bend until the piece is straightened to within tolerance.

Finally, because of our diversity, we are able to do combinations of heat-treating procedures. We have some customers who want us to heat-treat their product all over, and either draw back, or increase the hardness of certain areas of the product, (the blades of hand knives, tips or edges of cutting tools, drawn journals on rolls, drawn shanks on shank type tools, etc.) This is called **selective heat-treating.**

Give us a call and let us show you what we can do for you.

Figure 1: Typical time, temperature and transformation (TTT) diagram for M2 high speed steel



Quality that Lasts

Tools and components heat treated by MSI using salt bath processes will out perform those heat treated using vacuum and controlled atmosphere furnace processes. By out perform, we mean increased wear resistance, toughness and ductility under the most arduous working conditions imaginable. Whether it is metal cutting tools (milling cutters, saws, slitter knives, drills, taps, reamers), metal forming tools (punches, dies), down hole hammer drills for gas and oil well drilling, or pneumatic chisels used in the construction trades; MSI's heat treating procedures instill optimum superior metallurgical properties in the parts we process.

Knowledge and Experience to Get the Job Done

The management team at MSI, comprised of four family members, collectively has close to one hundred and twenty years of hands on experience in the business of heat treating. Our work force, guided by this team, works diligently to heat treat customer's tools and components with an ever focused eye on quality.

Our metallurgical experience in material's characterization, heat treating processes, laboratory testing, nondestructive testing and failure analyses provides us with the skills and knowledge to get the job done right the first time, every time!

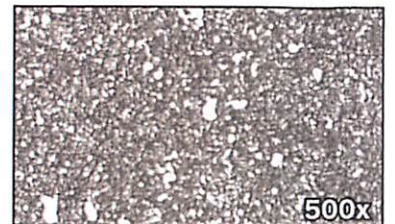
MSI has an in-house metallurgist with over 35 years experience in the heat treating field; familiar with the art of salt bath furnace processing, metallurgical evaluations, nondestructive testing, process development, set up and trouble shooting. When we see areas where our recommendations would prove beneficial, we never hesitate to contact our customers to advise them of our thoughts regarding the processing of their work. We believe an ounce of fore sight is worth a pound of cure!

**Meet the competition
and see for yourself**



Brand X (Vacuum furnace)

M42 HSS cutting tool vacuum furnace austenitized at 2175°F, followed by nitrogen gas-quench cooling to room temperature and triple tempering at 1025°F each cycle. Microstructure is composed of incipient-melted grain boundary carbides and spheroidal carbides in a matrix of coarse acicular plate martensite and retained austenite. Microstructure is representative of overheating, which occurred during vacuum furnace hardening.



MSI (Molten salt bath)

M42 HSS cutting tool salt bath austenitized at 2175°F, held at temperature for 5 minutes; followed by salt quenching and air cooling to room temperature and triple tempering at 1025°F each cycle. Microstructure is composed of spheroidal carbides in a matrix of fine grained tempered martensite. Retained austenite is not visually apparent in the martensitic matrix. Microstructure is representative of properly austenitized and multiple tempered high speed steel.



Salt bath hardening



Vacuum furnace processing



Cryogenic work



Metallurgical Solutions, Inc.

Complete List of Services

- **Salt Bath Heat-Treatment of High-Speed Steel and Alloy Tool Steels**
We are in a position to heat-treat any of the high-speed or alloy tool steels on each and every shift. We start heat-treating at the lower end of the temperature spectrum, working our way up in temperature, and heat-treating the various alloys at their prescribed temperatures along the way. Whether your product is T15, M2, or 4140, it gets exactly what it needs without compromise.
- **Air Tempering**
- **Steam Tempering**
- **Salt Tempering**
- **Bright Tempering**
- **Full Annealing**
- **Sub-critical Annealing**
- **Isothermal Annealing**
- **Spheroidized Annealing**
- **Graphitized Annealing**
- **Cryogenic Work**
-150°F, or -320°F capabilities
- **Hardness Testing**
All scales, & Microhardness, & Portable hardness testing
- **Peen Straightening**
- **Overbend Straightening**
- **Flame Straightening**
- **Induction**
Both high frequency and low frequency induction machines available
- **48" Deep Fluid Bed and Companion Marquench**
Allows us to heat-treat carbon & alloy tool steel shafts up to 48" long
- **Precipitation (Age) Hardening**
- **Solution Treating**
- **Normalizing**
- **Austempering**
- **Marquenching**
- **Carburizing**
- **Carbon Restoration**
- **Jominy Testing**
- **Selective Heat-treating**
- **Consulting Engineering/**

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