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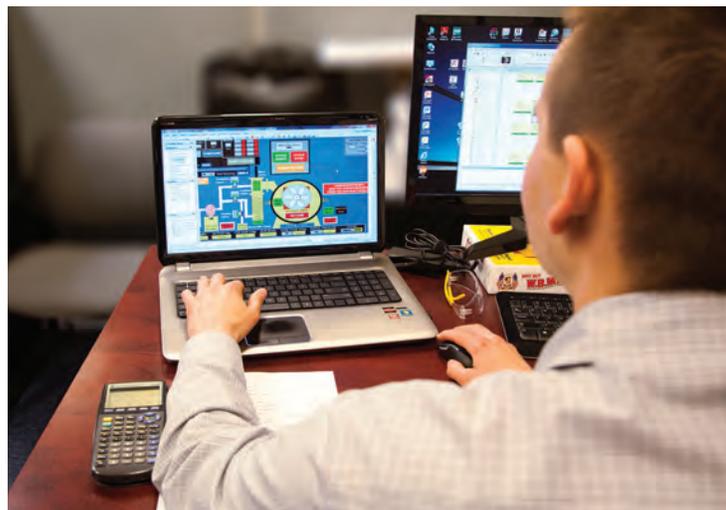
# hot zone

*Solar Manufacturing's Quarterly Newsletter*

## Building SMART Furnaces

Because of Solar Manufacturing's unique relationship with our affiliate company, Solar Atmospheres, we have access to an outstanding concentration of experience and expertise called SMART. Solar Metallurgical Advanced Research Team (SMART) is a fully-fledged Research and Development group comprised of an experienced professional metallurgist, a PhD chemist, a vacuum furnace and heat treat process engineer, a vice-president-level special projects engineer, and two technicians. The SMART team also includes a heat treat expert with 40+ years of practical heat treating experience with a focus on quality control, a titanium heat treat expert, and the vice president of engineering for Solar Manufacturing.

So far, since its inception, SMART has helped customers develop six surface treatments and has added them to Solar Atmospheres' already extensive list of heat treatment capabilities. These six include low pressure vacuum carburizing, vacuum gas nitriding, oxynitriding, high



temperature solution nitriding of stainless steels,



**SMART**  
*Metallurgical R&D Team*

low temperature vacuum carburizing of stainless steels, and solution nitriding of titanium alloys. In addition to these surface treatments, SMART has developed various precision processes for raw materials, scrap materials, powder alloys, and non-metallic compounds. These precision processes include hydriding and dehydriding of titanium and tantalum alloys, nitriding of chromium flake, degassing and sintering of high purity alloys, purification of nanopowders, and compound conversion treatments for materials used as melt additions in the steel industry. We highly value and respect our customers' trade developments by protecting them with mutual non-disclosure agreements, and we do not reveal such developments to other entities.

Required metals properties vary widely depending on the application. The desired property may be strictly physical in nature, such as electrical resistivity or magnetic permeability, or may be primarily mechanical, such as strength and fatigue resistance. Most often, however, a combination of properties is required, such as wear and corrosion resistance like that expected of any good quality knife blade. There are generally trade-offs between desirable and undesirable properties.

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# New Product Development

## SAMI's Newest Furnace Design: "The Mentor"

The design engineers and manufacturing personnel at Solar Manufacturing are proud to announce the addition of a small and mighty production-scale furnace to the company's offerings. The Mentor (the name to be explained below) is not your typical lab furnace. It is a ruggedly designed production-scale furnace that is compact and able to withstand the rigors of day-to-day production demands.

First, the name. "The Mentor" was the name given to this compact furnace because the first unit was donated to ASM International by Solar Atmospheres' CEO, William Jones, to help instruct students taking vacuum heat treating courses at ASM. Ginny Osterman, Ph.D., a member of Solar's SMART (Solar Metallurgical Advanced Research Team), was one of the first to benefit from the use of The Mentor installed at Materials Park, Ohio, home of ASM. She taught a three-day course in October 2013 on vacuum heat treating and used the furnace constantly during the class to give the students hands-on experience programming, operating, and maintaining a production-scale vacuum furnace.

So how about the furnace itself? The effective work-zone measures 12" wide x 12" high x 18" deep and is capable of processing loads up to 250 pounds. The hot zone utilizes .060" thick graphite foil hot face backed by four layers of half-inch rayon graphite felt. This allows for operation up to 2500°F with temperature uniformity of  $\pm 10^\circ\text{F}$  from 1000°F to 2400°F. The vacuum system consists of an Alcatel Model 2033, 33 CFM mechanical pump backed by a Varian Model VHS-6 water-cooled diffusion pump allowing for vacuum levels down to the 10<sup>-6</sup> torr range. An internal 2 bar gas cooling system is incorporated using a 7.5 HP motor and heat exchanger for rapid quenching.

How about the commercial viability of The Mentor? For years, the heat treating industry has been asking for a rugged, compact furnace that allows commercial heat treat companies to competitively quote and process smaller loads which cannot be processed economically in larger production furnaces. The Mentor is that furnace. In addition, this smaller furnace design can be used to develop and test new heat treating processes and cycles for the larger production furnaces. Captive heat treaters have also been looking for this type of furnace, one that can withstand the demands of 24/7/365 processing in a true for-profit production environment. Medical, tool & die, additive manufacturing, and the brazing industries will all find this furnace economical.



A second unit was installed in Solar Manufacturing's affiliate company's Hermitage, Pennsylvania, plant, Solar Atmospheres of Western Pennsylvania. The sales manager there, Michael Johnson, said, "This compact furnace gives us the ability to process a variety of loads that we were not previously able to quote using our larger furnaces. Also, it provides added capacity regarding our ongoing research programs we continue to develop for our customers."

Solar Manufacturing designs and manufactures all types of vacuum heat treating and brazing furnaces and offers replacement hot zone and spare parts for various vacuum furnace brands. To learn more about Solar Manufacturing's diverse product line and services, contact Pete Reh, VP of Sales, at 267-384-5040 x1509 or [pete@solarmfg.com](mailto:pete@solarmfg.com). Additional information can be at [solarmfg.com](http://solarmfg.com).

If you'd like to read more about The Mentor, search [solarmfg.com](http://solarmfg.com) for "Mentor."

### SMART, continued from cover

Heat treating may degrade one desired property while enhancing another. For example, both ductility and toughness will be lost when strength or hardness are increased. SMART has the experience to optimize heat treatment processes and obtain the best set of material properties.

Optimal heat treating processes for best properties and consistent results are the focus in designing and building vacuum furnaces that are also efficient, reliable, and cost effective. Solar Manufacturing engineers draw on SMART to engineer and build best solutions for customers' furnaces.



[solaratm.com/smart](http://solaratm.com/smart)

## Potential Hazards of Vacuum Furnace Operation

**Over the decades** since the advent of vacuum heat treating, a small number of workers have been killed due to entering a vacuum furnace that had been backfilled with argon from the previous cycle but not properly purged with air prior to the worker entering the furnace. Although this has not happened with a Solar Manufacturing furnace, it is extremely important that all furnace personnel understand the hazards of entering any chamber that has been backfilled with argon or nitrogen.

Any environment with an oxygen content below 19.5% or above 23.5% will not support life and is considered hazardous. Critical enclosures on a vacuum furnace include the furnace chamber, large diffusion pumps, high vacuum valves, external gas cooling housings, interconnecting pipes, and gas reservoirs.

Most furnace cycles include backfilling with inert gas such as nitrogen or argon for cooling the workload and bringing the furnace temperature down for unloading. Argon and nitrogen will not sustain life. Since argon is heavier than air, it will normally collect in the bottom of the chamber and remain there. Purging the chamber of argon usually requires a fan to force the argon out and replace it with fresh air. Neither argon nor nitrogen has a discernable odor and both gases are colorless. Unconsciousness due to the gas remaining in the furnace can occur with no warning symptoms.

### Vertical Bottom-loading or Top-loading Vacuum Furnaces

Due to their construction, these furnaces are particularly vulnerable to trapped inert gas in the chamber. Climbing down into a vertical top-loading furnace without air purge (fan) is certain death.

A bottom-loading furnace can be equally dangerous, as inert gas collected in the furnace will not automatically mix with air and flow out. Again, entering such a furnace will be certain death without an air purge using a fan.

On all vacuum furnaces, there should be a large sign posted in a highly visible location that highlights – “DANGER” and “Furnace Entry Procedures” on exactly what must be done prior to any personnel entering the chamber. This procedure must include the need to:

1. Properly shut down the furnace and deactivate the furnace utilizing lock out/tag out procedures.
2. Open and mechanically block the door to prevent the possibility of it closing while someone is inside.
3. Position a high-CFM shop fan to blow air into the furnace for at least 5 minutes before entering, and leave the fan on when inside.
4. Only authorized personnel are permitted to enter the furnace after the minimum 5 minute fan operation.

Always obey the following rules when operating and maintaining a vacuum furnace:

1. Never enter a vacuum chamber immediately after opening the furnace door even to adjust something in the furnace, until proper purging of the cooling gas has occurred with a high-CFM shop fan and the chamber has clean, breathable air.
2. Maintenance and leak checking of any furnace chamber internals should only be attempted when the chamber has been completely purged of any residual gas remaining from a prior cycle. Residual quench gases could still remain in the chamber even when the door has been opened and could cause asphyxiation and possible death.
3. Suffocation can be caused by breathing small quantities of argon and nitrogen.
4. Lack of oxygen can cause light-headedness, dizziness, and nausea. If any of these symptoms occur, IMMEDIATELY exit the chamber and seek fresh air.



# Hot Zone Facts

## Did You Know...

...that Solar Manufacturing specializes in rebuilt hot zones? And did you know that we provide expertly rebuilt hot zones for furnaces made by every major vacuum furnace manufacturer and not just furnaces built by Solar Manufacturing?

And we know hot zones because we are continually rebuilding and improving hot zones for our affiliate commercial heat treating company, Solar Atmospheres. In this demanding business, with nearly 50 furnaces operating in five heat treating plants, we strive to outperform and outlast the hot zone we are replacing.

*So here is our offer: Schedule an inspection soon by one of our hot zone experts and you'll get a FREE hot zone evaluation. Here's all you have to do: Call Bryant Strelecki, Solar's Aftermarket Sales Manager, and he will arrange to have one of our hot zone experts on site in your plant.*

It doesn't matter who manufactured your furnace or who last rebuilt your hot zone. Bryant and his aftermarket team will inspect and assess your hot zone and offer you the option to purchase a new Solar Manufacturing worry-free hot zone that will last longer and require less maintenance.

In addition, the aftermarket team can provide you with competitively priced, genuine Solar Manufacturing replacement parts for your Solar Manufacturing vacuum furnaces or replacement parts for other brands as well. And if you need a complete furnace re-lining or other major overhaul – controls, pumps, insulation, etc. – give Bryant a call at 267-384-5040 x1537 or email him at [bryant@solarmfg.com](mailto:bryant@solarmfg.com).



Listen at  
[solarmfg.com/podcast](http://solarmfg.com/podcast)

### Solar Manufacturing is on iTunes!

That's right, iTunes. On your smart device, open iTunes and search for "Industrial Heating Vacuum Heat Treat Minute" and subscribe to have the latest podcast automatically downloaded to your smart device when a new installment comes out every other month. Solar Manufacturing produces these podcasts in cooperation with industry-leading thermal processing media brand, *Industrial Heating* ([www.industrialheating.com](http://www.industrialheating.com)). There are at least eight podcasts for your listening enjoyment and education already on iTunes and a new one is added every other month.

The latest podcast, released in April, is the first in a two-part series discussing the use of molybdenum and graphite inside vacuum furnaces. April's podcast focuses on graphite and moly heating elements. In June, graphite and moly as furnace insulation will be discussed.

Jim Nagy, President of Solar Manufacturing and his monthly guest, William Jones, CEO of the Solar Atmospheres family of companies, engage each other in every podcast and discuss topics important for vacuum furnace owners and operators.



This newsletter is published quarterly by Solar Manufacturing, a leader in world-class vacuum heat treating furnaces.

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Don't settle for ordinary when you really need innovative engineering based on experience. "One-size-fits-all" vacuum furnaces may not suit your heat treat operation or your facility. Go beyond ordinary and you'll be rewarded with greater value from our high-performance vacuum furnaces hand-crafted with ingenuity and integrity.

Call us at 267-384-5040 or visit [www.solarmfg.com](http://www.solarmfg.com)



## Our Newest Employees



**Dan Insogna**  
*Inside Sales Rep*

Dan came to Solar on March 13. He has a number of years of sales experience. Dan is quickly learning the details of serving customers in the context of vacuum furnace construction, maintenance, and repair. He will be an asset to our Aftermarket Sales team, headed by Bryant Strelecki.



**Ed Berry**  
*Field Service Engineer*

Ed came to Solar Manufacturing on February 24 with decades of vacuum furnace experience. Ed knows vacuum furnaces, and can diagnose and fix the problems of any manufacturer's equipment. He was most recently with a manufacturer in California, but is a Pennsylvania resident.



**Steve Bilger**  
*Hot Zone Mechanic*

Steve is an experienced, skilled tradesman, having worked previously in another metal fabrication facility. Steve will be working on hot zones, both new and rebuilt, under the leadership of our Hot Zone Group Leader. He joined the company on February 24.



**Andrew Bower**  
*Electrical Technician*

Andrew is a recent graduate of Triangle Tech in Bethlehem, PA, with a degree in Maintenance Electricity. He will work on complex furnace and control cabinet wiring under the supervision of our Electrical Group Leader. Andrew began working for Solar on March 31.

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Souderton, PA 18964

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# READY TO SHIP

## Model HFL-5748-2IQ



Solar Manufacturing is offering a new high powered production vacuum furnace and it's ready to ship to you IMMEDIATELY! Model HFL-5748-2IQ is a horizontal front loading vacuum heat treating and brazing furnace generally designed for high production commercial and captive heat treating shops. It is a high temperature, high vacuum, batch-type furnace with electrical resistance heating elements.

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### Energy Efficient

Graphite Felt Insulated Hot Zone

### Sized for Production

36" W x 36" H x 48" D  
5,000 LB Capacity

### Interactive Control System

SolarVac® 5000 with Wonderware

### Internal Gas Quench System

150 HP Motor for 2 Bar Positive Pressure

### Industry Leading Support

Full One Year Warranty

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PROUDLY MADE IN THE USA

For a complete and detailed price proposal with equipment specification, contact Pete Reh, Vice President of Sales at 267-384-5040 x1509.