

Solar Atmospheres

“Our relationship with the people at Solar Atmospheres over the years has been especially rewarding because we have a lot in common. They take care of their customers. So do we.”

Shawn Smith, Sales Account Executive, Air Products



With business growing an average 17% per year, Solar Atmospheres has become the largest commercial vacuum heat treater in the United States. Founder and CEO Bill Jones says the secret is an uncompromising commitment to customer satisfaction...and working with suppliers, like Air Products, who share that philosophy.

Established in 1983, Solar Atmospheres began as a vision of its founder, William R. (Bill) Jones, a well-known figure in the thermal processing industry with more than 30 years of experience. In his position then as president of Vacuum Furnace Systems (VFS) and as an active member of ASM International, Bill listened to his customers' frustrations in finding a heat treater who would be responsive to their needs. Solar Atmospheres was born, operating first as a subsidiary of VFS. The rest, as they say, is history.

Today, Solar Atmospheres employs 70 people and generates more than \$10 million in revenues from heat-treating operations. The company's three facilities in Pennsylvania—Souderton, Hatfield, and a new plant in Hermitage—comprise over 55,000 square feet, with 10,000 more scheduled to be added to the Hatfield plant in 2002.

Specializing in vacuum processing, Solar Atmospheres maintains 25 furnaces in continuous operation. Capabilities include annealing, surface hardening, sintering, ion nitriding, normalizing, and stress relieving. In addition, they offer vacuum brazing, air tempering, lab furnaces for cycle development, and other services not generally available from commercial heat treaters, such as cryogenic freezing and graphite coating.

With many customers in many demanding fields, quality and consistency are critical factors in Solar Atmosphere's remarkable success. Equally important is being responsive to customers' needs. And that's where industrial gas supplier Air Products comes in. "We've been the exclusive supplier of bulk and cylinder industrial gas to Solar since the beginning and have also worked closely with them in suggesting ways to reduce quench cycle times and save on gas-related costs," says Shawn Smith, Air Products' sales account executive. "When Bill Jones and his team, along with the engineers at VFS, were in the process of designing a new vacuum furnace (the world's largest of its type), we were happy to do our part."

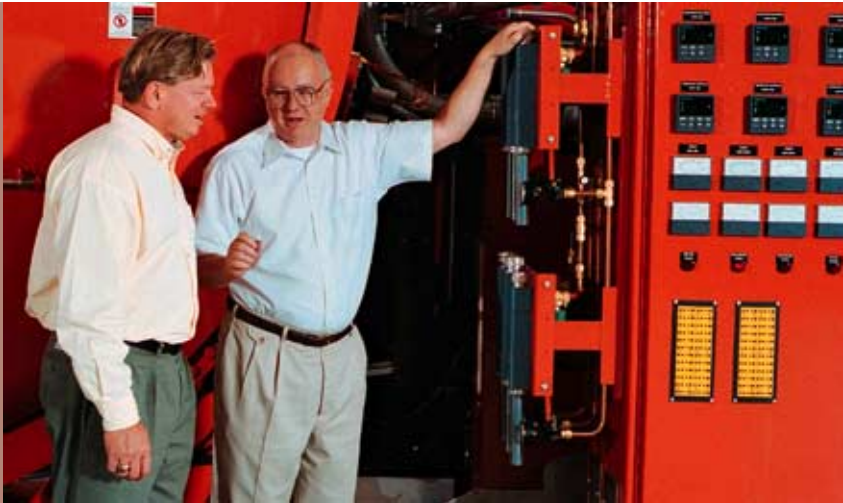


What's a Heat Treater Doing in Hermitage?

A 23,000-square-foot building located in western Pennsylvania, about sixty miles from both Pittsburgh and Cleveland, is the home of Solar Atmosphere's new heat-treating facility at Hermitage. Here you will also find the largest horizontal vacuum furnace you're ever likely to see, a 24-foot-deep marvel of thermal processing technology with a 50,000-pound capacity and a yawning 6.5-foot-diameter hot zone with two autoclave doors for loading and unloading.

The idea for this mammoth furnace actually preceded the plans for the Hermitage facility, officially called Solar Atmospheres of Western Pennsylvania. As Bill Jones tells it, the furnace was already being built and they needed some place to put it. Fortunately, the building became available and the \$5 million project was under way. The building, with its strategic location, high ceilings, open design, and five acres of land for expansion, was ideal. It even included a 25-ton full-span bridge crane to help in furnace installation and transporting ultra-heavy loads, such as 20,000-pound coils of titanium, onto the furnace's specially designed car-bottom load-handling system. However, much work was needed to deliver the electric power required—a staggering 2500 kW. A dedicated substation had to be constructed to accommodate the plant's prodigious appetite for electricity.

Bill Jones, CEO of Solar Atmospheres (right), points out the programmable multizone controllers used to monitor and regulate process variables in the "world's largest horizontal vacuum furnace" to Gary Beveridge, Air Products' sales account executive. The furnace operates at temperatures up to 3000 °F and vacuum pressures of 10^{-5} torr.



In actuality, the move to Hermitage was more than just happenstance. The location will help Solar better serve the growing demand for heat treating in the western Pennsylvania, Ohio, and Great Lakes region, with pickup and delivery services available to local customers within a 100-mile radius.

The super-sized furnace, which passed its AMS 2750 qualification and earned Class I Vacuum Furnace status, is now up and running. Initial production runs have been impressive, with cycle times for four titanium coils weighing 30,000 pounds cut in half, and a power efficiency that exceeds design specs and rated capacity by 50%. Other equipment includes two advanced VFS 10-bar furnaces, a vacuum tempering furnace, and a cryogenic freezer. Offered at the new facility are annealing, solution heat treating, stress relieving, and vacuum brazing services. But the “big” story coming out of Hermitage is the 24-foot furnace and the unique, rapid gas quenching system developed to cool down these huge loads in a hurry.

The Bigger They Are, the Faster They Quench

Well, not really. But Bill Jones has managed to pull a rabbit out of his hat by achieving quench rates in his furnaces—even the biggest—fully 30% faster than before. He’s done it simply and effectively by switching from 100% argon to 100% helium, using a highly efficient power supply, and “overspeeding” the fans. Bill tested quench rates on identical workloads using nitrogen, argon, and helium in 2-bar, 5-bar, and 10-bar furnaces and found helium to be far superior to the other gases tested. But not just any helium would do. It had to be of the highest purity and readily available, so Bill entered into an agreement with Air Products to supply his long-term needs. In addition, Bill intends to work with John Dwyer from Air Products’ research group to test various blends of helium and other gases to further improve the quench rates.





The Helium Hat Trick

Solar Atmospheres has achieved its breakthrough in quenching speed through the use of helium gas, which is supplied by Air Products in tube trailers and piped directly into the furnace. The excellent heat transfer characteristics of helium make it an ideal medium for quenching. But its other properties are what most intrigued Bill Jones. Because it is the second-lightest element (after hydrogen), helium molecules are more spread out and move more quickly when “pushed.” That means up to 75% less power is required to move a given volume of helium, when compared to argon.

The second part of the equation has to do with what’s doing the “pushing.” Bill noticed that the furnaces’ cooling fans, even though rated to 7000 rpm, were rarely operated over 3450 rpm because of higher motor horsepower and electric power requirements, resulting in heat of compression and poor cooling, particularly with argon and to a lesser extent with nitrogen. He reasoned that if helium used so much less power than argon, then using the same amount of power would result in faster quench rates. Of course, he was right. But he also knew that helium, being so much lighter than argon, would allow the fans to operate at higher motor speed with much less heat of compression and power loss. That’s when he installed a variable-speed motor drive and turned it up to its rated motor capacity. According to Bill, “At these quench speeds, I can cool thick sections of 4140 and 4340 stainless steels and bearing steels right in the furnace, where before they would have to be removed and quenched in oil.”

To squeeze out even more efficiency, he looked at the third variable: power conditioning. He switched to an ultrahigh-efficiency power supply (with a power factor approaching 100%). While the special power supply (Magnetic Specialties Inc.) is somewhat more expensive than standard units, Bill says it more than pays for itself through lower energy costs and better productivity.

Air Products: Quenching the World's Thirst for Helium

Don't tell Bill Jones that there's a worldwide shortage of helium. His business and many other vital industries depend on a reliable supply of this rare element.

But not many people know there are only a few places in the world that have the special composition of natural gas required to obtain helium. And there are even fewer companies that have the global resources and expertise to keep a stable supply of helium flowing through the pipeline. In fact, the demand for helium is expected to exceed supply through early 2005.

As the world's largest producer and supplier of helium, Air Products is in a unique position to help Solar Atmospheres and other customers weather the shortage. According to Ronald Sheppard, worldwide general manager for Air Products' helium business, "We designed and built the first cryogenic helium extraction system in the 1950s and, today, over two-thirds of the helium plants in the world were built by us."

Even more importantly, no other industrial gas company has access to as much helium as Air Products. The company's production facilities include the world's largest helium liquefier in Liberal, Kansas, capable of processing over one billion standard cubic feet per year of capacity. Air Products also sources from plants in the Texas panhandle; Keyes, Oklahoma; La Barge, Wyoming; and Arzew, Algeria through a Helios joint venture with Sonatrach, the Algerian state-owned oil and gas company.

"Our supply is significantly more secure because, unlike many other companies, we don't 'buy' helium on the commercial market," says Sheppard. "We're involved as an owner or joint venture partner in its worldwide production, distribution, and storage. We continue to make significant capital investments, more than any other helium producer or supplier, in new capacity, transportation equipment, and an expanded distribution fleet." In fact, Air Products owns Gardner Cryogenics, the only producer of liquid helium distribution equipment in the world.



"We really couldn't take a chance on any other helium supplier. We needed to be sure of a reliable helium supply and confident in its purity. A vacuum furnace is one place where you don't want contaminants and artifacts."

Robert Hill, Jr.,
President of Solar Atmospheres
of Western Pennsylvania, Inc.

It's only fitting that the world's largest helium producer should supply Solar's new vacuum furnace. Joe Schillinger, product manager (right), and Ron Sheppard, worldwide general manager, discuss logistics of distribution from the company's five production plants and 38 transfill facilities around the world.



Adds Sheppard, “We also understand the need for conservation of this precious resource and pride ourselves on recovering and recycling the most helium of any industrial gas company.”

Air Products’ position as the leading helium supplier, along with its world-class technology and strong applications engineering experience, is what earns the confidence and business of forward-looking companies, such as Solar Atmospheres, with a vital interest in a ready source of helium.

Air Products would like to thank the following people at Solar Atmospheres for their kind assistance in preparing this case study:

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