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No. 291

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Celebrating 60 Years of Loyal
Service, The Sousa Corp.
Acquire New Thermal
Cycling Furnace

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FEATURED ARTICLE: **AJAX / CECO Erie Press** | Beverly, MA

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What's shakin', folks? The dog days of summer are upon us. Feels like summer barely got started, and now it's seemingly coming to a close. We hope you got to enjoy some time outdoors this summer, even if it was quite soggy out there this year. Speaking of things closing in, Q4 is right around the corner. How are you closing the year? What are your goals? What are your challenges? What stories do you have to tell? We'd love to hear them.

This month we've got two stories. The first comes to us from the Sousa Corp. who recently added a new Thermal Cycling Furnace to their floor. We had the opportunity to run some questions by VP Andrew Sousa who filled us in on what this new acquisition means to their business as well as their growing customer base. We've also included some company history in the piece to give an overview of their 60 years in business! Congrats to them on six decades of service!

Our second story comes to us from frequent contributor Del Williams who puts a spotlight this time around on stretch forming and finding the right fit for your unique needs. Stretch forming is a unique process where material such as steel, stainless steel, aluminum, or even titanium is stretched beyond its yield point and simultaneously wrapped around net shaped dies. Forming sheet or extruded material using this method essentially shifts the neutral axes of a part to the perimeter of the die resulting in a smooth, wrinkle-free contour that closely retains the shape of the die, improves the mechanical properties, and eliminates many post process steps used to attain dimensional accuracy. He always hits us with interesting stuff, and we hope you enjoy what he's pieced together!

That's it for now! We'll catch you in October!

Kind regards,



THE
Gateway
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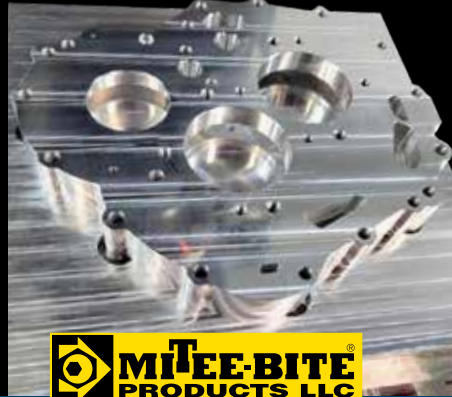
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SELECTING THE RIGHT STRETCH FORMING EQUIPMENT FOR YOUR APPLICATION



The stretch forming process can create stronger parts, increase production, and reduce processing steps, but selecting a machine with best-in-class capabilities is essential.

This month's industry spotlight is brought to us by Del Williams, a technical writer based in Torrance, California. He submitted this interesting piece on understanding and choosing the right stretch forming equipment which we felt could be of interest to our readership. If you've got an interesting story that you'd like to share, please submit it for potential placement in the pages of the Gateway Magazine!

For manufacturers striving to increase profitability while expanding their capabilities and improving their processes, adding stretch forming to their repertoire may be the answer.

Stretch forming is a unique process where material such as steel, stainless steel, aluminum, or even titanium is stretched beyond its yield point and simultaneously wrapped around net shaped dies. Forming sheet or extruded material using this

method essentially shifts the neutral axes of a part to the perimeter of the die resulting in a smooth, wrinkle-free contour that closely retains the shape of the die, improves the mechanical properties, and eliminates many post process steps used to attain dimensional accuracy.

Initially developed as an efficient means to produce components with complex curved profiles in the aircraft industry, stretch forming is now widely used

for similar components in automotive, aerospace, construction, rail, and rocketry.

“As part producers seek to expand their capabilities, many have approached us with new stretch forming applications. Combining modern CNC technology with our precise digital die mapping technology and historically robust machine structure provides for the finely tuned automated motion control necessary to maintain constant strain in the part throughout the cycle, all resulting in industry leading dimensional stability.” says Dave Gardner, Senior Mechanical Engineer at Erie Press Systems, a company that manufactures custom-engineered hydraulic presses for applications including metal forming, stretch forming, composite compression molding presses, cold extrusion, and forging. Park Ohio acquired Erie Press Systems in 2020 and is now a part of Ajax-CECO-Erie Press (ACE), the largest forging equipment supplier in North America, with over a century of experience in custom designing and building presses and forming machines.

Manufacturers that are unfamiliar with stretch forming as well as those with special requirements often require guidance to select equipment that meets their specific needs.

Drawing on Erie Press’s decades of experience in aerospace applications and ACE’s century of fabricating machinery, Gardner covers the basics of stretch forming and provides tips for selecting equipment that can help to maximize product quality, reliability, and productivity.

Stretch Forming Basics

According to Gardner, stretch forming machines may be classified into three primary design types, depending on the client’s intended production requirements. Sheet stretch forming machines are used to produce complex curved sheet metal parts such as exterior panels and leading edges on aircraft, high-speed trains, RVs, buses, and commercial rockets. Extrusion stretch forming machines are used to produce extruded structural components with complex cross sections and curved profiles such as stringers and support beams for aircraft, skeletal components for locomotive, buses, transportation structures, and various curved shapes used in the elevator and architectural (building) industry. High-speed, high-volume stretch forming machines are generally reserved for forming extrusions in automotive or other high production applications.

Each design type classification can be further broken down into a series of machines with specialized features that are better suited for producing specific types of parts.

“Due to the wide range of features and options that are available, we work with our clients to develop the technical details of a machine that will fully meet their unique production requirements,” says Gardner.



Stretch forming offers numerous advantages, including the ability to accurately form complex shapes while maintaining the part's total volume. Once the component is stretched into the yield state, less force is required to wrap the part around the die than with other forming methods. Part cost is substantially reduced by the ability to form accurate and repeatable components with little wasted material and, in most cases, a scuff-free quality finish that doesn't require dimensional or cosmetic improvement. Additionally, the process induces work hardening in many materials, which increases strength while reducing internal residual stress and spring back as compared to conventional bending operations.

From Gardner's decades of machine design experience in various applications, he advises that clients consider the purchase of stretch forming machines with these important qualities:

Structural Integrity and Longevity

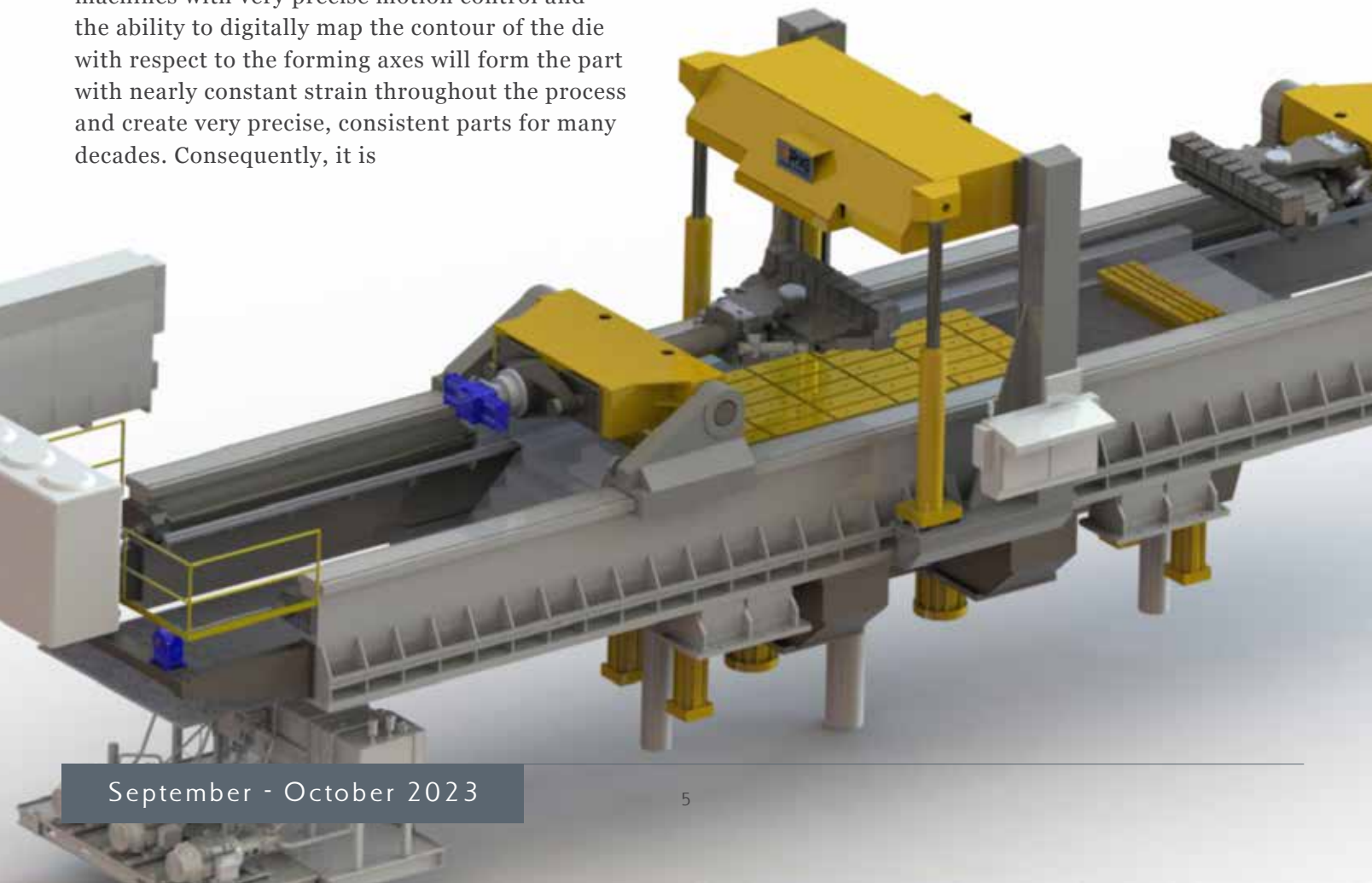
Stretch forming is not a high impact process, but forces involved can be over 3,000 tons in some aerospace applications. High-quality stretch forming machines with very precise motion control and the ability to digitally map the contour of the die with respect to the forming axes will form the part with nearly constant strain throughout the process and create very precise, consistent parts for many decades. Consequently, it is

important to select a machine with these features to extend its accuracy, longevity, and reliability.

"Machines with inherent compliance (deflections) or off-line programming systems that only approximate the die profile in respect to the axes positioning system cannot assure constant strain in the process, often leading to inaccurate or non-repeatable part production," says Gardner. "Lighter construction machines with weak or bolt together frames are simply not designed to hold up to extended use."

Selecting a stretch forming machine with a robust, heavy frame, and properly designed connection points to the die table is therefore essential to ensure its accuracy and reliability for decades. ACE has systematically improved the structural integrity of its core design since acquiring the legendary Hufford and Sheridan Grey design rights in 2001, many of which have been in production since the 1940's.

For sheet stretch forming equipment, it is particularly important to maintain a rigid structural frame to ensure accurate, consistent part creation.



“If you want to form accurate parts with a high degree of repeatability, you need to minimize compliance, that is deflection, from the machine structure,” says Gardner.

However, this is an issue in machines with “optimized” construction which tend to allow greater deflection during the stretch forming process. ACE’s robust structure is complimented by stiff connection points between moving machine members, which provide a system that reduces the total deflection throughout the forming cycle. The result is a process that is more precise and accurate, with predictable part quality.

Superior Control

Stretch forming operates within the material conditions between the yield point and its ultimate strength. Commonly, high temper materials have a narrow operating band to form above the yield point and do not exceed its ultimate strength. Precise motion and force control of the process is a vital consideration in machine selection if you expect to consistently achieve repeatable part production.

According to Gardner,

“A perfectly envisioned stretch forming cycle would include the ability for the machine to monitor the strain rate within the part as force increases along its axis, capture the strain when the part transitions slightly above the yield point of the material, and form the part with nearly constant strain throughout the forming cycle.”

Practical limitations that affect a forming cycle include variations in the materials cross section, variations in the mechanical properties within the part (or batch of parts), dynamic deflections in the machine structure, discrepancy in the machines axes controls to properly adjust for the contour of the die, and even the ability to program a precise profile path that duplicates the contour of the die.

He points out that attaining finer control of the stretch forming process is imperative to automated part production and achieves two important aims.

“First, it regulates the forming process so you can operate within a tighter band between the yield strength and the ultimate strength of the material to reduce part breakage,” says Gardner. “Secondly, it allows the machine to very accurately approximate constant strain within the part by comparing its measure length to the applied axial force once it transitions into the yield state. In this way, the yield stress in the part and the length of the part remains consistent through the forming process.”

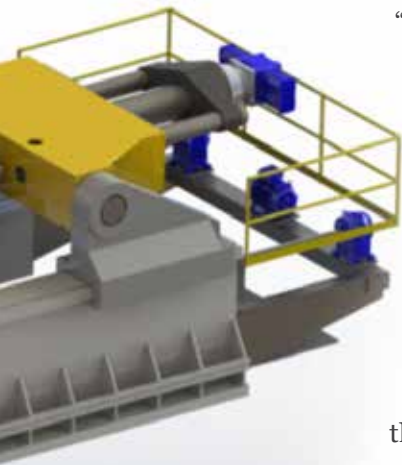
Control System Upgrades

Most of the sophistication in today’s stretch forming machines involves control system improvements for axes positioning systems, hydraulic force control, part programming, and ease of use for operators.

In ACE’s stretch forming presses, for instance, the OEM simplifies operation by incorporating touchscreen, menu-based Human Machine Interfaces (HMIs) to automate the forming cycle. Traditional stretch forming machines which employ manual controls require highly specialized operators that make intuitive adjustments during the cycle to achieve acceptable results.

Utilization of the HMI approach facilitates automated production, reliability, and consistency while greatly reducing broken or out-of-tolerance parts. Modern, high quality control systems for stretch forming machines include automatic yield point detection systems, the ability to automate the programming process, monitor the forming process, contain machine diagnostic protocols, and have advanced safety systems for operator protection.

Along with the standard features listed above, ACE offers a two-pronged approach to provide forming predictability with integrated part programming. Standard supply includes an easy-to-use and highly accurate, proprietary automated part programming system that utilizes the machine axes to digitally map the profile and synchronize axes positioning during a simulated forming cycle with the die installed on the



machine. Additionally, off-line programming software is offered that contains modules for FEA-based forming feasibility studies, spring back prediction to aid die design, machine collision detection, and that is capable for two-way communication with the machine for off-line part programming.

“Traditionally, spring back is a problem when forming tempered parts. Our software predicts these reactions based on actual material properties at the time of forming. Spring back values are used to make virtual die geometry adjustments and the feasibility study is duplicated until simulations indicate accurate parts are produced. Our beta version is provided with the latest machine we sold, which is a sheet stretch forming press,” says Gardner.

Gardner explains the need for die customization in the extrusion stretch forming machine process.

“Certain types of alloyed material, particularly some grades of extruded aluminum, will age harden at room temperature in a relatively short amount of time. Processing these parts directly from the annealing furnace, before age hardening occurs, will improve the consistency of the formed profile. Age hardening after they have been formed usually will not affect the dimensional stability of a properly racked part.” says Gardner.

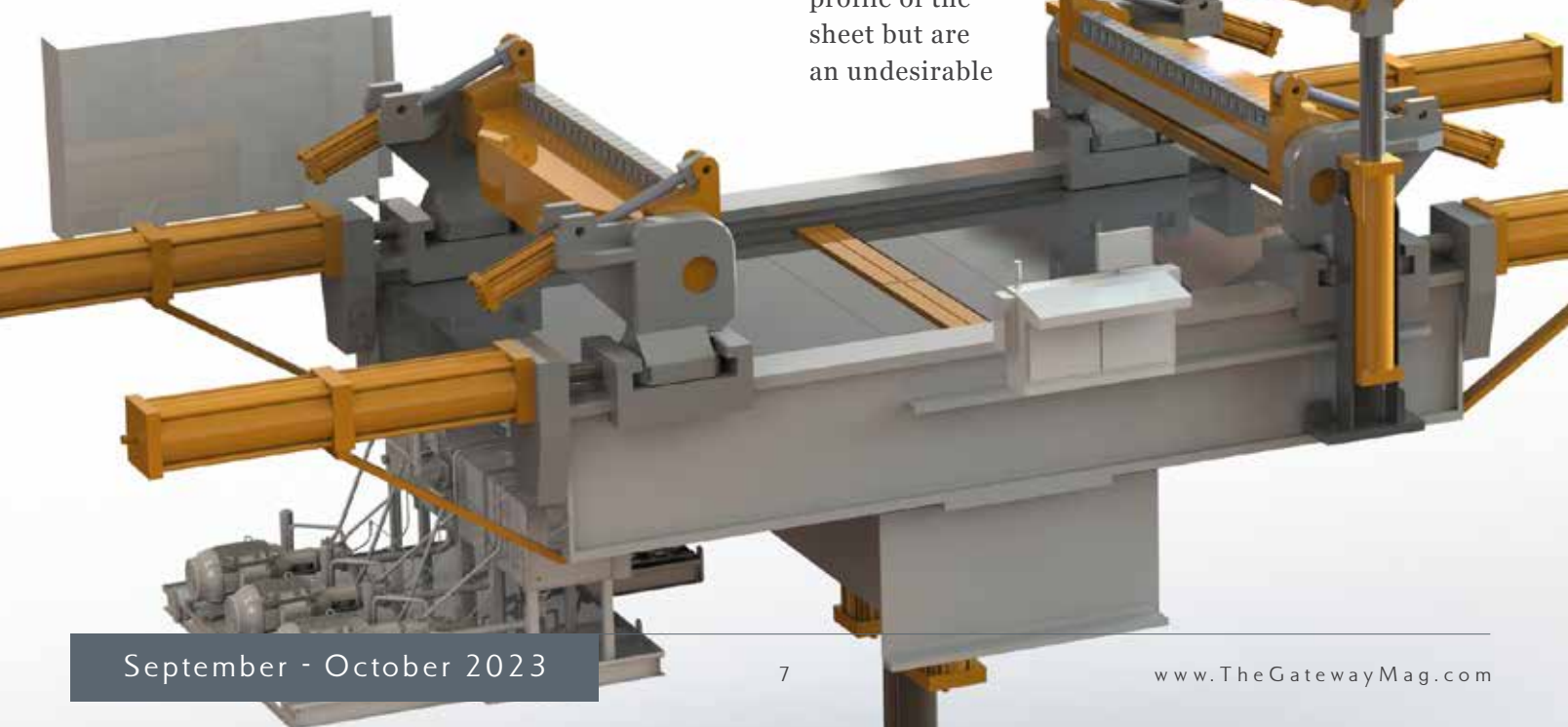
Forming aluminum closer to the ‘o’ temper condition (or annealed condition) results in a consistent process that will more closely adhere to the net shape of the die, according to Gardner.

“A lot of our clients will form tempered aluminum extrusions, say up to a T4 temper condition, but tempered material retains some amount of residual stress during the forming process and the die must be designed to accommodate some degree of spring back. So, you will have some spring back when forming tempered material, but certainly a lot less than witnessed in normal bending operations,” says Gardner.

Options to Speed Production

Manufacturers often seek options to speed the stretch forming process. However, expediting the process generally involves part or tool handling, not part forming, according to Gardner.

“If the part forming process is too fast, particularly on sheet material, Lüder lines [surface markings] occur on the surface from unwanted elastic flow of the material caused by improper strain control. These normally will have little effect on the profile of the sheet but are an undesirable





processes, depending on the unique requirements of each specific application.” says Gardner.

Whether manufacturers are new to stretch forming or seasoned industry veterans that simply want to extend their capabilities, thoughtful selection of a machine specifically engineered to satisfy their unique requirements will result in the most robust, reliable, and cost-effective solution for expanding their capabilities and improving their processes.

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visual effect, so you can only form as fast as the material will allow,” says Gardner.

To facilitate faster, higher rate production, ACE offers options for automated part loading/unloading and improved tool change systems in their stretch forming machines.

For example, extrusion stretch forming machines may use fixed dies rigidly mounted to the die table and jaw inserts that are manufactured specifically to grip the unique shape of the extrusion being formed. Machines furnished with the standard balanced lifting brackets allow complete tooling changes in around 30 minutes by experienced operators. Automating the process will reduce the complete change out times to around 5 - 10 minutes, depending on the machine size.

Adding to the challenge of selecting options, certain manufacturers may need to frequently perform complete tooling changes due to short production runs and may benefit significantly from automating the tool change system. Other manufacturers have very high production quantities of the same part and may receive greater benefit from automating the part loading systems.

“To speed production for both short and long production run manufacturers, we can accommodate complete or partial automation for tooling or part changing systems. Generally, we expect the lost time of these non-production related events to decrease by 60–75% when compared to standard, non-automated

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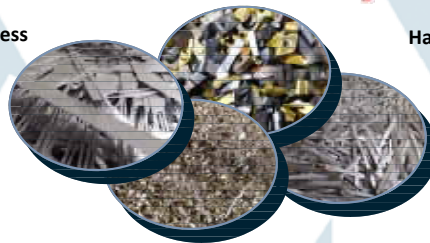
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CELEBRATING 60 YEARS OF LOYAL SERVICE, THE SOUSA CORP. ACQUIRE NEW THERMAL CYCLING FURNACE

Founded in 1963 by Norman Sousa Sr., the Sousa Corp is a commercial and aerospace business providing quality heat treating services for over 50 years. What started out as a small heat treat shop in West Hartford, CT. that mainly performed hardening and pack carburizing has grown in size and capabilities ever since. As the business grew, Norm Sr. increased the size of the facility and purchased new equipment.

Norman Sousa Jr. purchased the business from his father in 1994 and has been instrumental in growing and modernizing the business. In 2012, The Sousa Corp moved to a much larger, more modern facility in Newington, CT. With the extra room to grow, they immediately increased capacity. They now offer a variety of thermal processes on a wide range of ferrous and non-ferrous materials.

Today, the business is run by Norm Jr. and his three children. They proudly carry on the tradition of their father & grandfather by embracing his values of quality, integrity, and customer service. The Sousa Corp. continues to grow and expand its capacity and capabilities (which range from heat treating to black oxide, material testing, and laboratory services).

Recently, The Sousa Corp. purchased a new thermal cycling furnace to add to their fleet. Vice President Andrew Sousa kindly answered some questions for us about their new acquisition and what it means for the company and its customers.

Tell us about the new machine. What is it? Why'd you decide on it?

Manufacturer: DMP Cryosystems Inc.

Model: CryoFurnace

This is a thermal cycling furnace that is capable of -300F to 1,200F

Give us the applicable specs.

Working zone: 24" Wide x 36" Deep x 24" High
It's capable of 1,800 lbs.

Temperature range -300F to 1,200F

How does acquisition and installation of this machine bolster The Sousa Corp capabilities?

We are able to offer true cryogenic capabilities to -300F for the first time.

This also increases our thermal cycling temperature range capabilities.

What are The Sousa Corp's current thermocycling capabilities? Describe what you do for your customers and how the thermocycling process fits in.

Current capabilities are: -150F to 325F

CORRECTED: This article originally ran in our September edition of The Gateway Magazine, and, regretfully, the article had a number of unfortunate typos in the copy. In order to properly frame up the fine work the Sousa Corp. is doing; we are republishing this entire article in the correct format.

**What are the benefits of thermal cycling?
Why is it important?**

Thermal cycling, heating, and cooling of material stabilize the crystal structure to minimize or eliminate dimensional changes that would have occurred due to repeated service in environments the experience repeated temperature fluctuation. One example is spacecraft, where being in sunlight and total darkness causes extreme temperature changes every 90 minutes.

How has thermocycling grown as a service offering for The Sousa Corp over the years?

In 2010, we first started performing a thermal cycle process to one customer specification on a few different part numbers. Over the years, this has continually increased, and we now process to many different specifications & temperature ranges for several customers.



What industries do you serve the most in this space? What are common thermocycling requests from these industries?

Aerospace is currently the most common request, partly due to the fact that any poor performance or failure is impossible to correct.

Are there other industries you'd like to expand in and hope to with this new machine?

Tool steels are an area that can benefit from one or more cryogenic cycles, especially when dimensional stability is critical, such as gages. Some studies have shown tool life is extended by cryogenic treatment.

What excites you about the future of The Sousa Corp? What else should customers look forward to?

Since The Sousa Corp purchased Bennett Metal Treating in 1963, we have provided personalized service and decades of experience for three generations to assist customers in all facets of metal improvement.

Customers appreciate being able to talk to a representative when needed. They get the answers they need in a timely fashion, both by phone and email.

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Company History

The Sousa Corp. was founded in 1963 when Norman W. Sousa Sr. purchased the assets of The Bennett Metal Treating Company. “Bennett Metal” was founded by Mr. Bennett about 1903.

Mr. Bennett was a one-armed blacksmith, and the company operated in one of the Goodwin Pottery buildings. Pack carburizing, oil-fired furnaces, and oil tempers were standard practice through WWII and into the sixties. Norman began working there in 1947 for then-owner John German. Mr. Bennett had sold and reopened a shop in New Jersey. Soon, Norman had learned the trade and was manager for the new owners, Frederick H. Waterhouse, William J. Luby, and Joseph B. Burns. As absentee owners, they realized they didn’t have control of their investment and decided to sell. Norman had convinced them in 1954 to buy a Dow integral quench furnace, and the modernization began. A C.I. Hayes bright hardening furnace was purchased

in 1963, and the oil-fired carburizing furnaces gave way to two L&N Homocarb furnaces.

Norm Jr. joined the company in 1971, and in the late 70’s, a new addition was put on, and a second larger Dow integral quench furnace and Dow tempers were added. Two vacuum furnaces, a black oxide line, a Cincinnati Sub Zero freezer, a metallurgical lab with a Tukon Microhardness tester, and a Kevex X-Ray spectrometer round out the equipment upgrades. Recently, a Wilson 2000, NIST capable hardness tester with loadcell and electronic depth measurement and SPC capabilities was installed.

The Sousa Corp and its predecessors have been processing commercial, military, and aircraft parts for nearly 100 years. They look forward to continued growth in services and capabilities to serve their customers better as manufacturing changes at an ever-increasing rate.

Contact Information:

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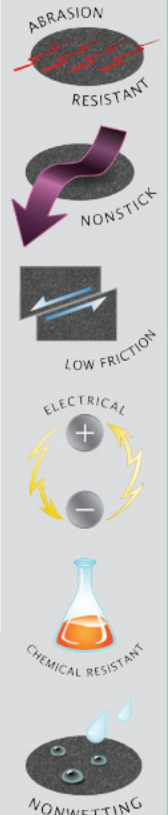


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19th Annual Northeast Lean Conference to Support Lean Practitioners

The highly anticipated 19th Annual Northeast Lean Conference is set to take place on October 3-4, 2023, at the DCU Center in Worcester, MA. Organized by The Greater Boston Manufacturing Partnership (GBMP), this prestigious event is a prime platform for professionals, experts, and enthusiasts from diverse industries to converge to share their Lean initiatives and learn from one another. With the theme “It’s About Time: Motivation & Methods for Saving It, Making It and Not Wasting It”, this year’s conference promises to be an unparalleled opportunity for attendees to gain valuable insights, engage in meaningful discussions, and foster new connections within the Lean community.

Key Highlights of the 19th Annual Northeast Lean Conference:

- **Distinguished Speakers:** Renowned thought leaders, industry experts and Lean practitioners will deliver more than 40 engaging sessions covering a wide array of Lean topics. Participants will be exposed to the best of the best practices used by Lean organizations around the country.
- **A Thoughtfully Planned Agenda:** Recognizing that different industries have unique challenges and opportunities; the conference will offer a track devoted to the implementation of Lean in healthcare and other non-production work environments. With five concurrent tracks, participants can choose sessions that align with their specific interests and organizational needs.
- **The Community of Lean Lounge:** The conference will feature Poster Presentations designed to facilitate practical learning, benchmarking, and networking. Participants will have multiple opportunities throughout the 2-day event to talk one-on-one with Lean practitioners to hear how they have applied Lean principles and tools effectively in their organizations.

- **Lean Excellence Awards:** Celebrating exceptional achievements in Lean implementation, the conference will once again bestow the Silver Toaster Award for Employee Excellence in Lean. In addition, the inaugural Northeast Lean Pioneer Award will be awarded. This recognition honors individuals who have advanced Lean thinking beyond its current bounds.

Connecting with like-minded professionals is one of the major draws of the Northeast Lean Conference. Attendees will have ample opportunities to network, share experiences, and make meaningful connections that can foster ongoing learning and growth. We hope you will join us and more than 400 of your professional peers to be a part of this transformative experience. Together, we will learn, grow, and shape the future of Lean practices in the region.

For more information and registration details, please visit www.gbmp.org/ne-lean-conference.

About Northeast Lean Conference:

The Northeast Lean Conference is an annual event that brings together Lean practitioners, experts, and enthusiasts from diverse industries to foster knowledge sharing, professional growth, and the promotion of Lean practices. With a history of excellence and innovation, the conference continues to be a driving force in advancing Lean methodologies in the Northeast region and beyond.

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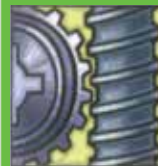


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