VOLUME 6 • NO. 1 FEBRUARY 2023

Aerospace
Automotive
Medical
Energy
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Heat Treat Today

Technology, Tips & News for Manufacturers with In-House Heat Treat

Annual
Air & Atmosphere Furnace Systems

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In this Issue

Energy Smart Cooling

Start Counting Your Savings

RULE #1.
Optimize your heat rejection technology

When choosing a cooling system consider your climate and the maximum operating temperature of your equipment for optimum efficiency. Lower fluid temperatures increase energy usage and operating costs. Consider using hybrid cooling systems to optimize operation - such as an air cooled exchanger to offload chillers in the winter.

TYPE	OPERATING COST	TEMPERATURE
Air Cooled	$	105°F
Evaporative	$$	85°F
Chiller	$$$$	65°F

Air cooled heat exchanger

Evaporative cooling tower with outdoor mechanical room

Chiller (mechanical refrigeration)

RULE #2.
Specify Safe, Reliable, and Low Maintenance equipment

The Solanus Cooler shown at right is perfect for cooling quench tanks. By using free air for cooling it completely eliminates the need for precious water resources.

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RULE #3.
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The Lord's loving kindnesses indeed never ceases,
For His compassions never fail.
They are new every morning;
Great is Your faithfulness.
Holy Bible, Lamentations 3:22-23

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FEBRUARY 2023

Features

Cover image: Nutec Bickley

Columns

Departments

Doug Glenn, Publisher
Heat Treat Today

Letter from the Publisher

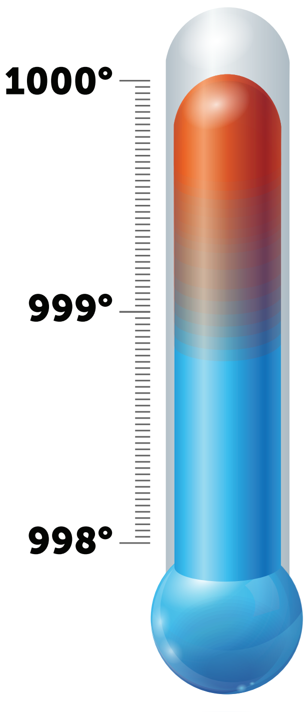
± 0.1°F – The Debate

When dealing with temperatures in excess of 1000°F, one would think that a ±0.1°F variation would not be a big deal. Apparently, not!

As of the most recent AMS2750 standard, 1/10th of a degree Fahrenheit matters — and if your process recorders are not recording temperatures down to 1/10th of a degree, you are out of compliance.

This is a big deal and a real hardship for many in the Heat Treat Today audience.

At the most recent Nadcap meeting held in Pittsburgh this last October, I had the chance to discuss this most recent stringent requirement with some of the people who were responsible for putting it in the standard. Even after talking to them, I'm not sure I fully understand why it is we went in this direction, and I'm not alone.



The Background

Here's a very short explanation of how we got here. Both Revision D and E of AMS2750 required compliance temperatures to be ±2°F or ±1.1°C ("or ±0.2%" was added in Revision E). That pesky ".1" in ±1.1°C appears to be the source of this most current "situation." The folks using °C were recording temperatures down to 1/10th of a degree, while the folks using °F — which was not a small number of people — were not. So, the standards committee needed to make a decision on what to do about this discrepancy. The options were to round up or down or to the nearest integer for both °F and °C people OR require EVERYONE to record their temperatures down to 1/10th of a degree. After surveying end-users, the committee decided that end-users wanted to be required to record the 1/10th of a degree rather than round it up or down to the nearest integer. Thus, the new AMS2750 standard requires accuracy to 1/10th of a degree.

Thoughts

1. Even as I type it, it doesn't make sense. Why would end-users want to record temperatures down to 1/10th of a degree? If you're at 1750°F, a full 1°F amounts to only 0.05% of your total temperature. It is inconceivable that 1% makes that much of a difference in nearly 100% of all standard heat treat processes. In those very few processes where temperature tolerances ARE required to be that tight, SAE's AMEC committee could have come up with a separate standard.
2. Most temperature recorders and reporting devices don't currently allow for the display of anything to the right of the decimal, especially above temperatures at or above 1000°F. That's because no instrumentation company in the history of heat treating ever anticipated that end-users would want to know, much less be required to record, anything to the right of the decimal.
3. Even if recorders and other instruments were capable of displaying 1/10th of a degree readings, most temperature sensing devices are nowhere near that accurate. Special case T/Cs can do it in certain situations, but by and large, thermocouples are calibrated to ±2°F or higher. How much sense does it make to worry about recording 1/10th of a degree accuracy from a thermocouple (and wire) that is rated at ±2°F or ±5°F.
4. Let's pretend for a minute that our thermocouples could accurately and consistently record temperatures down to 1/10th of a degree. The question that really needs to be asked is: Just because we CAN do it, does that mean we SHOULD do it? As stated earlier, for that vast majority of heat treatment processes a full degree of temperature variance won't typically make a difference.

As some of the people I've talked to about this situation have readily admitted, well-intended quality committees such SAE's AMEC committee, who have inadvertently started this little kerfuffle, are not perfect. This would be a case in point. The men and women who make up the heat treat industry's quality systems are excellent people: highly detailed and well-motivated. But, as all of us are, they are prone to over-do the things they're good at. In this case, that's deciding to take it down to 1/10th of a degree when rounding to the next closest integer probably would have done the trick.

Postscript: I'm open to your responses to this column, positive or negative. And, assuming there is no foul language or threats of physical violence (!), we would be glad to publish your comments. Please let us know what you think: *htt@heattreattoday.com* HTT

Bethany Leone, Managing Editor
Heat Treat Today

Message from the Editor

Running the Baton to the Library

In December, Karen Gantzer dedicated this Message from the Editor column to reflect on "passing the baton" of managing print editorial content. So here we are, running with the baton while paging through the first edition of **Heat Treat Today**'s 2023 print magazines.

First things first, let me share a summary about myself. My name is Bethany Leone, lover of art, puns, bonfires, and books. I believe the sweetest things in life originate from my dear niece or a hint of cocoa. It is good to learn new things, but more important is learning the wisdom to do those things well. You can bump into me in Pittsburgh, PA, though it is unlikely that you will see me in crowds of people (unless you are out partner dancing, too).

Now, before I run the managing editor baton to the "heat treat industry library" (i.e., The Heat Treat Doctor® series of books), let me share a few books in *my* library that have shaped who I am to give you better understanding of Bethany Leone.

The Holy Bible

Although it is a collection of books — and there are a few books in here that I haven't read more than once — the words from these pages have guided me many days of my life. Impossible passages, stunning creativity, wild histories, and a message of the Truth that inspires me daily.

Forests: The Shadow of Civilization

How do humans across civilizations through time perceive the looming darkness of the manifold trees? In reading Robert Pogue Harrison's book about how humans respond and are shaped by their conception of the sacred or treacherous or exploitable wood, you may also be stunned by how closely we define and are defined by our relationships with the environment around us.

The Body Keeps the Score

A book about how trauma effects the biology and neurology of the body, I began reading this book to better appreciate the effects of suffering. Sometimes hidden, sometimes manageable, the collection of anecdotes about how trauma alters our minds and bodies is a humbling and worthwhile read for anyone seeking to love their neighbor better.

The Past and Future City: How Historic Preservation Is Reviving America's Communities

Why buy historic homes? Apparently, there are many secondary benefits to the enjoyment of life in "older, smaller" neighborhoods. A walkable area where the old and young mingle as well as those from different income levels often means that people enjoy a better quality of life. The questions (and answers) on how to encourage and maintain this direction of civil values are explored in this reading by Stephanie Meeks.

The Singing Bowl: Collected poems by Malcolm Guite

Finally, this collection of poetry by Malcolm Guite is a treasure trove for searching hearts. For years, I was only captivated by the first poem, "The Singing Bowl." But if you care to wander the pages of "What if…" and "Lapis Lazuli," you won't regret the 60 seconds of introspection that Guite offers.

So that's it! A brief introduction of the new managing editor. I'll never fill the shoes of Karen Gantzer, but I am thrilled to see **Heat Treat Today** continuing to inform the heat treat industry from this new perspective.

Now, if we ever meet in-person, skip the introduction and answer me this: What's in your library? HTT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COMBUSTION CORNER

John Clarke, Technical Director,
Helios Electric Corporation

Improving Your Use of Radiant Tubes, Part 3

Over the last several months, the Combustion Corner series has challenged readers to spend some time researching opportunities to improve their use of radiant tubes — their performance, efficiency, and uniformity. So far, the series has explored the geometry of a tube, why radiant tubes matter, and what happens inside the tube. When it comes to radiant tube systems controls, what are your options? Read on to learn about the three modes of control.

This month we will discuss the various modes of control that can be applied to radiant tube systems. We will consider three typical modes of control: on/off, high/low, and proportional control.

When a radiant tube is operated in an on/off mode, the burner is fired full on or completely off. Using this mode of control, the burner must be re-lit at the start of each cycle. The advantage of this mode of control is that the on firing rate can be optimized to provide optimum heat transfer, and when the burner cycle is off, the tube will idle. If the pulses are rapid enough, there is very little cyclical variation in temperature. The heat capacity (stored heat) of the radiant tube provides a flywheel effect to smooth out the temperature swings between on and off periods. The drawback of this mode of control is that the ignition system, most commonly a spark plug, is energized frequently, loading the transformer and wearing material off the spark plug and the valves that control the air and fuel are cycled frequently. If the cycle time is one minute — the burner must relight, and the valves must cycle over 500,000 times a year. Care must be taken to ensure the components used in this system are rated to survive this demand.

Source: Alloy Engineering

Another mode of control is high/low firing. With this mode of control, the burner cycles between the high firing rate and low firing rate, but instead of shutting down completely, the burners are returned to a low firing condition. In this mode of control, care must be taken to ensure the low firing rate does not overheat the firing leg of the radiant tube. Other than that, this mode of control is very similar to on/off control.

The last mode of control is fully proportional. In this mode of control, the burner fires between 0 and 100 percent of the maximum output depending on the burner demand. The air can be adjusted using a proportional valve or by varying the combustion air blower speed using a variable frequency drive, or in some cases, both. The fuel gas is regulated by a proportional valve or a regulator that matches the output pressure to an impulse or control pressure. Using this mode, the burner fires more or less on ratio (with a consistent level of excess air), or some systems will increase the excess air at low fire to ensure clean combustion and to reduce the available heat at low fire. When a burner has higher levels of excess air, more energy is used to heat the air not used to burn the gas; therefore, less energy is available to heat the furnace chamber. This provides greater turndown (the difference between high and low firing).

Which method is best for a given furnace? That is impossible to say without considering the burner type and geometry of the radiant tube used in the furnace. All three methods can provide good uniformity and efficiency, provided it is appropriate for the equipment in question. In fact, there are applications that blend proportional with high/low firing to meet very specific needs. These systems simply alter the maximum — or high — firing rate to better meet the systems' requirements.

Again, the control approach is a function of the burner, the radiant tube, and the application. There is really no one-size-fits-all; each application must be approached with an open mind. The next column will address the role of heat recovery to efficiency in greater detail. HTT


The leader in quality and innovation.

Heat Treat Today News Chatter

Business briefs from around the industry

A Few Dozen Quick Heat Treat News Items To Keep You Current

Heat Treat Today *is pleased to highlight the announcements of heat treat-related growth and achievement throughout the industry by sharing them in* ***News Chatter****, where we feature representatives, transactions, moves, and kudos from aerospace, automotive, medical, energy, and other sectors of manufacturing. Here are just a few of the news items that appeared in the* **Heat Treat Daily** *during the past few months as well as "new" news items.*

Subscribe to the **Heat Treat Daily** *e-newsletter at heattreattodaycom/subscribe and receive one to two news items from around the heat treat industry five days a week. Submit your news items to editor@heattreattoday.com.*

EQUIPMENT CHATTER

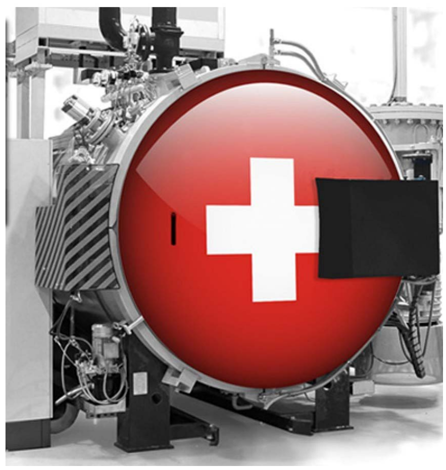
› Heat treat was brought in-house for a North American manufacturer, with the addition of a quench and temper furnace from **Can-Eng Furnaces International Limited**. The furnace aids in production of mining, construction, and materials handling components.

Can-Eng Furnaces International Limited quench and temper furnace

› **NASA's** Artemis 1 Mission included a critical part that was heat treated by **Solar Atmospheres of Western PA**. The large titanium manifold housing was designed to propel astronauts away from the rocket in the case of an emergency.

Solar Atmospheres of Western PA heat-treated component of Artemis 1 Mission

› A Swiss manufacturer using nickel and silver brazing ordered a vacuum furnace from **SECO/WARWICK**. This is the second system ordered from the furnace supplier.



SECO/WARWICK vacuum furnace for Swiss manufacturer

› **DELTA H®** and **Phillips Federal** provided a Dual Chamber Aerospace Heat Treat (DCAHT®) system to **Tinker Airforce Base, OK — USAF.** The system heat treats aluminum and other metals for military aircraft.

DCAHT® System to Tinker AFB, OK – USAF

› Pennsylvania-based **Solar Manufacturing, Inc.** had purchase orders for 10 vacuum furnaces in Q3.

10 furnace orders for PA-based Solar Manufacturing, Inc. in Q3

› Two **SECO/WARWCIK** Vector® vacuum furnaces are scheduled to be delivered to a national mint in Europe. The furnaces will be used to harden the dies necessary to produce coins for both circulation and collector series.

› The precision forging manufacturer **Jiangsu Pacific Precision Forging Company** has placed an order with **SMS group** for a fully automatic MP 3150 eccentric closed-die forging press. Pacific Precision will be able to forge aluminum chassis components on a much larger scale. This new expansion provides Pacific Precision with access to the growing automotive market segment for more lightweight designs.

Two vacuum furnaces for European mint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❯ A commercial heat treater in Mexico purchased a third vacuum furnace from **SECO/WARWICK Group**.

Vacuum furnace for heat treater in Mexico

❯ **L&L Special Furnace Company, Inc.** delivered a furnace to a Midwest manufacturer. The system is to be used for aerospace and military purposes.

L&L Special Furnace Company, Inc. furnace for Midwest manufacturer

❯ **Ecocat India**, a catalyst manufacturer, has ordered an advanced technology vacuum gas cooling furnace from **SECO/WARWICK**. The system will carry out brazing and annealing processes.

SECO/WARWICK vacuum gas cooling furnace for Ecocat India

❯ Manufacturer expands with a box furnace from **Lindberg/MPH**, a North American provider.

Box furnace for a manufacturer

❯ Several new CAB lines have been ordered from **SECO/WARWICK** to be delivered to manufacturers in China. Two companies specifically chose EV/CAB lines while another manufacturer purchased a CAB line.

❯ The **Lenox Group** added a nitriding system from **Nitrex** to produce windows, doors, solar panels, lighting systems, etc.

Lenox Group's new nitriding system from Nitrex

SECO/WARWICK delivered two CAB lines and one universal chamber furnace for aluminum brazing to an automotive manufacturer in China. The systems will braze large-size coolers for vehicle batteries.

Brazing furnaces for automotive manufacturer in China

❯ **Wisconsin Oven** provided a continuous conveyor furnace to a leading firearm manufacturer. Aluminum parts will be heat treated with this furnace prior to quenching.

Continuous conveyor furnace for firearm manufacturer

❯ **Oetzbach Edelstahl GmbH**, a hardening plant, has purchased a third furnace from **SECO/WARWICK**.

3rd furnace for Oetzbach Edelstahl from SECO/WARWICK

PERSONNEL AND COMPANY CHATTER

❯ **Gasbarre Products Inc.** expanded with a new facility in PA. 172 new jobs will be created as part of the expansion.

Expanded facility in Pennsylvania

❯ **Watlow**, a North American designer and manufacturer of complete industrial thermal systems, acquired **Eurotherm** from **Schneider Electric Company**.

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❯ Recently, **Nor-Cal Products** began doing business under **Pfeiffer Vacuum Valves & Engineering** in Yreka, CA.

> A new turbine airfoil plant is to open in Asheville, NC, for **Pratt & Whitney**. The plant will have casting capability for airfoil structures for turbofan and high-pressure jet engines.

> **Hubbard-Hall** has expanded its product offering and customer resources by acquiring the assets of **Torch Surface Technologies**, a specialty chemical company based in Whitmore Lake, MI.

> New simulation software is being launched at **CENOS Simulation Software**. The application portfolio expands with some new electromagnetic case software apps. The first apps will be launched in Q4 or a little later.

> **Solar Atmospheres of California** announced it has been awarded the approval to process parts for **Lockheed Martin (LMCO)** owned **Sikorsky**. The Sikorsky approval adds to the existing LMCO process specifications held for vacuum heat treatment of titanium, nickel alloys, and stainless steel per AMS 2801, AMS 2774, AMS 2759/3, and others.

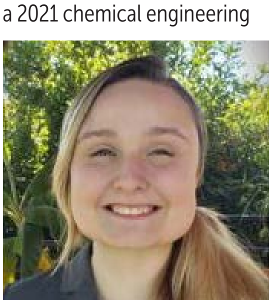
> **Nel Hydrogen US**, a subsidiary of **Nel**, has entered into a joint development agreement with **General Motors** to help accelerate the industrialization of Nel's proton exchange membrane (PEM) electrolyzer platform. The two companies are looking to enable more cost competitive sources of renewable hydrogen.

> **Joe Coleman**, cyber security officer of **Bluestreak Consulting™**, has earned his Cyber AB CMMC Certification as a Registered Practitioner (RP). CMMC is a U.S. Department of Defense (DoD) program that applies to Defense Industrial Base (DIB) contractors.

Joe Coleman, Cyber Security Officer, Bluestreak Consulting™

> The Supervisory Board of **thyssenkrupp AG** extended the appointment of chief human resources officer **Oliver Burkhard** by five years. Burkhard has been a member of the Essen-based group's Executive Board since February 2013, Thyssenkrupp AG director of Labor since April 2013, and additionally CEO of thyssenkrupp Marine Systems since May 2022.

> **CG Thermal** welcomes associate process engineer **Signe Laundrup** to the Process Systems Group. Laundrup is a 2021 chemical engineering graduate from the University of California, San Diego. Her background is in manufacturing and research and design.



Signe Laundrup, CG Thermal

> **Tata Steel** signed a memorandum of understanding with **SMS Group** to reduce carbon emissions at Tata's integrated steel plants across India.

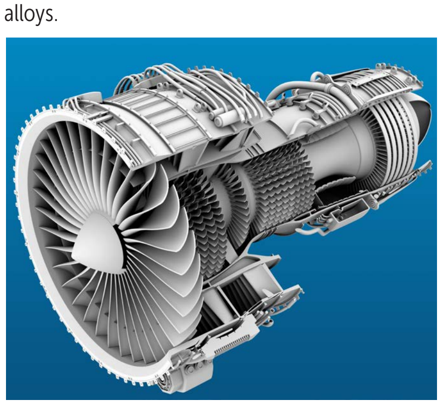
Tata Steel and SMS Group to reduce carbon emissions

> Two heat treat technology companies integrate: **C3 Data's** real-time pyrometry compliance software enables digital uploading of certificate data of all **TT Electronics** thermocouples.

> **Ipsen Japan** announced the addition of **Mr. Masakazu Kanaka** in the role of customer service director. Kanaka is responsible for the growth of all Ipsen Japan customer service business, which includes retrofits, parts, and service. He will oversee the aftermarket sales team and field service engineers.

Mr. Masakazu Kanaka, Customer Service Director, Ipsen Japan

> **Solar Atmospheres of California** announced **Honeywell** approval to heat treat austenitic steels, martensitic steels, pH steels, tool steels, nickel alloys, cobalt alloys, titanium alloys, and magnetic alloys.



Solar Atmospheres of CA now Honeywell approved

> **Aluplast – ZTG**, an **Altest** company, recently expanded its production capacity with a second **Nitrex** nitriding system. The second furnace, a model N-EXT-612, is capable of processing a load of extrusion dies weighing up to 1300lbs.

Aluplast-ZTG expands with Nitrex system

> **Solar Atmospheres of Michigan** is pleased to announce the addition of **Chris Molencupp** as their new sales manager.

Chris Molencupp, Sales Manager, Solar Atmospheres of Michigan

> **Metal Exchange Corporation** announced that **Matt Rohm**, current president and Chief Operating Officer (COO), will be promoted to Chief Executive Officer (CEO) of Metal Exchange Corporation effective January 1, 2023. At that time, current CEO **Rick Merluzzi** will assume the title of executive vice chairman, serving as an advisor to executive chairman, **Mike Lefton,** on key strategic initiatives for the organization, through the end of 2023.

Matt Rohm, CEO, Metal Exchange Corporation

› Quintus Technologies AB joins the newly opened Application Center at **RISE** to support further development of additive manufacturing. The AM Center will also include the Quintus press model QIH 15L-2070.

Quintus Furnace for Application Center at RISE

KUDOS CHATTER

› Dr. Valery Rudnev was awarded **ASM's** William Hunt Eisenman Award.

Dr. Rudnev with ASM Award

› The **Metal Treating Institute** presented the Master Craftsman Award to **Mike** and **Mary Reichling** of **The Cincinnati Steel Treating Co**. The award was presented at FNA.

Mike and Mary Reichling of The Cincinnati Steel Treating Co. with MTI Master Craftsman Award

› Global Thermal Solutions celebrates 15 years in Mexico.

› Hitchiner Manufacturing receives Nadcap Accreditation.

Hitchiner Manufacturing Nadcap accredited

Source: Trucal, Inc.

How To Choose the Right Thermocouple in Heat Treatment

By Víctor Zacarías, Managing Director of Global Thermal Solutions Mexico

Thermocouples: You can't accurately heat treat without them. But how can you choose the best one for your needs? What do current regulations require? Read this helpful explanation to find out how to choose the right thermocouple.

Keywords: Thermocouple, Heat Treatment, Pyrometry, Temperature Measurement and Control, AMS2750, CQI-9

The SAE AMS2750 aerospace standard and the AIAG CQI-9, CQI-11, CQI-12, and CQI-29 automotive assessments are the universally accepted standards for temperature control in thermal processing operations. Among many things, they describe the requirements for the use and control of thermocouples used in process ovens and furnaces. In this article you will find the requirements of these regulations so that you can make a correct decision when choosing a thermocouple, and thus have a repeatable measurement that ensures a reliable process.

1. Application

For the appropriate selection of a thermocouple for the control and/or recording of temperature, you must first take into account the type of process. In choosing the right thermocouple, consider some factors that could alter its performance, such as:

- The temperature range at which it will be in use
- The type of atmosphere to which it will be exposed
- Possible electrical interference
- The accuracy required by the applicable specification, etc.

Based on the above, existing regulations refer to a specific classification for thermocouples based on their manufacture and final application. These classifications are:

a) Base thermocouples and noble thermocouples

b) Expendable and non-expendable thermocouples

¿Cómo elegir el termopar correcto en Tratamientos Térmicos?

Por Víctor Zacarías, director general de Global Thermal Solutions México

Los termopares: elementos indispensables para lograr un acertado tratamiento térmico, pero ¿cómo elegir el más indicado para su necesidad particular? ¿Qué exigen las normas actuales? A continuación una explicación que le ayudará a saber escoger el termopar adecuado.

Palabras clave: Termopar, Tratamiento térmico, Pirometría, Medición y Control de Temperatura, AMS2750, CQI-9

La norma aeroespacial SAE AMS2750 y las evaluaciones automotrices de AIAG CQI-9, CQI-11, CQI-12, y CQI-29 son los estándares universalmente aceptados para el control de temperatura en operaciones de procesamiento térmico. Entre muchas cosas, describen los requisitos para el uso y control de los termopares empleados en hornos y estufas de proceso. En este artículo te comparto los requisitos de estas normativas para que puedas tomar una decisión correcta al elegir un termopar y de esta manera contar con una medición repetible que te asegure un proceso confiable.

1. Aplicación

Para la selección apropiada de un termopar para la medición, control y/o registro de la temperatura debes considerar en primer lugar el tipo de proceso previsto. En la elección del termopar adecuado, toma en cuenta algunos factores que pudieran alterar su desempeño como:

- El rango de temperatura en el que estará en uso
- El tipo de atmósfera al que estará expuesto
- Posible interferencia eléctrica
- La precisión requerida por la especificación aplicable, etc.

En función de lo anterior, las normativas refieren una clasificación específica para los termopares en función de su fabricación y su aplicación final:

a) Termopares *base* y termopares *nobles*

b) Termopares *desechables* y *no desechables*

	Maximun Temp. Range	Applications
K	1250C	Most popular due to the wide temperature range. Limited in Vacuum applications
J	760C	Stable in many environments. Popular for quench tanks. Limited use at high temperatures
N	1300C	Alternative to Type K due to great stability at high temperatures. More expensive than Type K
E	870C	Better stability than Type K but limited temperature range.
T	350C	Best for low temperature and cryogenic applications (-270C)
S & R	1450C	Higher temperature range than base thermocouples. Great accuracy. Long Life. The most expensive

Table 1: Temperature range and application of most common thermocouples
Tabla 1: Rango de temperatura y uso de los termopares más comunes
Source: GTS México

2. Types of Thermocouples and Their Insulation

2.1 Base Thermocouple or Noble Thermocouple

A base thermocouple is made of basic alloys such as iron, chrome, nickel, copper, etc., and they are the most common types in the industry due to their versatility and cost. Base thermocouples are types K, E, J, N, and T. A good supplier of sensors will recommend a thermocouple based on the application, the temperature range, and your budget (see Table 1).

On the other hand, a noble thermocouple is made from metals such as platinum and rhodium: types R, S, and B thermocouples. These thermocouples are more stable at high temperatures and maintain their accuracy for a longer time. However, they have the highest cost since they are made from precious metals. Due to this nature, noble thermocouples are the preferred choice for vacuum heat treatment applications and high temperature processes.

2. Tipos de termopar y su aislamiento

2.1 Termopar base o termopar noble

Un termopar base está fabricado de aleaciones básicas como hierro, cromo, níquel, cobre, etc., y constituyen los tipos más comunes en la industria por su versatilidad y costo: los termopares tipo K, E, J, N, y T. Un buen proveedor de sensores te recomendará un termopar de este tipo en función de la aplicación, el rango de temperatura y tu presupuesto (ver Tabla 1).

Por otro lado, un termopar noble está fabricado a partir de metales como platino y rodio: termopares tipo R, S y B. Éstos termopares son más estables a altas temperaturas y mantienen su precisión por mayor tiempo; sin embargo, tienen un costo elevado debido a que se fabrican a partir de metales preciosos. Debido a esta naturaleza, los termopares nobles son la elección preferida para aplicaciones de tratamiento térmico al vacío y procesos de alta temperatura.

2.2 Expendable or Non-expendable Thermocouples

The second criteria from the regulations are the material which protects the elements of the thermocouple.

Expendable thermocouples are those whose elements are covered by materials such as fiberglass, ceramic fabric, or polymeric coating and are generally provided in the form of a spool. This form allows the user to cut the cable to size and manufacture the thermocouple by joining the two wires by twisting or welding, making them ideal for single use applications such as a TUS test or charging thermocouples, for example (see Figure 1).

In contrast, a non-expendable thermocouple is normally protected with ceramic or mineral insulation and covered on the outside by a metallic sheath (the elements are not exposed in this configuration), which gives it a longer useful life. Therefore, it is preferred for use as a control or recording thermocouple (see Figure 2).

2.2 Termopares desechables o no desechables

El segundo criterio de las normativas lo constituye el material con el que se protegen los elementos del termopar.

Los termopares desechables son aquellos cuyos elementos están revestidos por materiales como fibra de vidrio, tejido cerámico o recubrimiento polimérico y generalmente se suministran en forma de carrete o bobina. Esta presentación permite al usuario cortar el cable a la medida y fabricar el termopar al unir los dos alambres de un extremo por torsión o soldadura, lo que los hace ideales por ejemplo para aplicaciones de un solo uso como una prueba TUS o termopares de carga (ver Figura 1).

En contraste un termopar no desechable normalmente está protegido con aislamiento cerámico o mineral y revestido en su exterior por una carcasa metálica (los elementos no están expuestos en esta configuración), lo que le proporciona un mayor tiempo de vida útil y por eso se prefieren para emplearse como termopares de control o registro (ver Figura 2).

Figure 1: TUS using type K expendable thermocouple insulated in ceramic fiber
Figura 1: TUS usando termopar desechable tipo K aislado en fibra cerámica
Source: Trucal, Inc.

Whatever the application, when wiring interconnections are required for sensor installation, these connections must be made using standard connectors and terminals such as those shown in Figure 3, as both AMS2750 and CQI-9 prohibit the wiring splice.

3. Calibration

According to regulations, all thermocouples used in the heat treatment operation must have been calibrated before being used for the first time. The user of the thermocouple must ensure that they have calibrations traceable to a national laboratory such as the NIST in the United States or its equivalent in Mexico (CENAM).

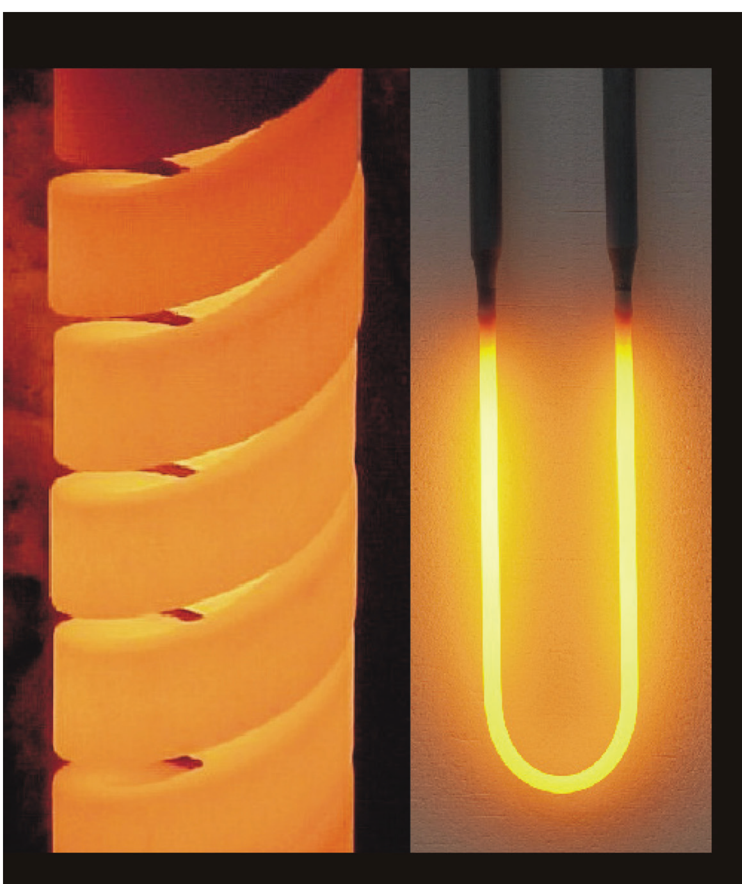
Figure 3: Standard type K connectors
Figura 3: Conectores estándar tipo K
Source: GTS México

Figure 2: Non-expendable type N and K mineral insulated thermocouples
Figura 2: Termopares no desechables tipo N y K de aislamiento mineral
Source: GTS México

Cualquiera que sea la aplicación, cuando se requiere realizar interconexiones de cableado para la instalación del sensor, dichas conexiones se deben realizar usando conectores y terminales estándar como las que se muestran en la Figura 3, ya que tanto AMS2750 como CQI-9 prohíben el empalme del cableado.

3. Calibración

De acuerdo con la normatividad, todos los termopares usados en operaciones de procesamiento térmico deben haber sido calibrados antes de usarse por primera vez. Para ello, el usuario del termopar debe asegurarse de contar con calibraciones trazables al laboratorio nacional como lo es el NIST en Estados Unidos o su equivalente en México (CENAM).



	Use	Calibration accuracy required by AMS2750 & CQI-9
Primary & Secondary Standards	Sensor calibration	±0.6C
Test Thermocouples	SAT and TUS testing	±1.1C
Control & Recording sensors	Furnace sensors	±1.1C
Load Thermocouples	Sensing of parts temperature	±1.1C

Table 2: Accuracy required for temperature sensors according to AMS2750 and CQI-9
Tabla 1: Rango de temperatura y uso de los termopares más comunes
Source: GTS México

Pyrometry standards define the acceptable error ranges for thermocouples depending on their final application. These categories for final application include: standard thermocouples, test thermocouples (SAT and TUS), control and recording thermocouples, and load thermocouples (see Table 2). Table 2 describes the maximum errors allowed to be selected depending on the use of the sensor.

Once the thermocouple is installed, the person responsible for the heat treatment operation must document the date on which it comes into service, since the regulations establish the life of a sensor based on its application.

When receiving the report/certificate of the thermocouple, the user must review the content of the document, since the standards specifically define the minimum information that shall appear in a calibration report, which includes but is not limited to:

Las normas de pirometría definen los rangos aceptables de error para los termopares en función de su aplicación final: 1) termopares patrón, 2) termopares de prueba (SAT y TUS), 3) termopares de control y registro y 4) termopares de carga. La Tabla 2 describe los máximos errores permitidos a elegir dependiendo del uso del sensor.

Una vez instalado el termopar, el responsable de la operación de tratamiento térmico tiene que deberá documentar la fecha en la que éste entra en servicio, ya que la norma establece un tiempo de vida útil de un sensor en función de la aplicación del mismo.

Al recibir el reporte/certificado del termopar, el usuario debe revisar el contenido del documento, pues las normas también definen de manera específica la información mínima que debe aparecer en un informe de calibración, que incluye pero no se limita a:

1. Test readings
2. Actual readings
3. Correction factors
4. Data source
5. Laboratory accreditation
6. Calibration method used

The calibration certificate can cover individual thermocouples or a group of thermocouples manufactured from the same lot (spool).

It is very important to note that both AMS2750 and CQI-9 require all calibrations to be conducted by ISO/IEC 17025 accredited organizations, so ensure that you review the accreditation certificate before selecting your supplier.

4. In Summary

If you've ever bought the wrong thermocouple, you know how annoying it can be. Therefore, here is a quick guide to select the right sensor for your application in five easy steps:

1. Define the type of thermocouple: base (K, T, J, E, N, and M) or noble (S, R, and B)
2. Define the type of insulation you require: textile fiber, polymer, ceramic, metallic, etc.
3. Specify the exact temperature range in which the sensor will operate
4. Specify the use of the sensor: standard thermocouple, SAT/TUS thermocouple, control/load thermocouple
5. Request the calibration certificate in accordance with the applicable regulations (AMS2750 or CQI-9) HTT

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ASTM International. ASTM E230, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, Rev. 2017.

Automotive Industry Action Group. CQI-9 Special Process: Heat Treat System Assessment, 4th Edition. June 2020.

International Organization for Standardization. ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories, 3rd Edition. 2017.

Nadcap AC7102/8 Audit Criteria for Pyrometry, Rev. A, 2021

SAE Aerospace. Aerospace Material Specification AMS2750: Pyrometry, Rev. G, 2022.

1. Lecturas de prueba
2. Lecturas observadas
3. Factores de corrección
4. Fuente de los datos
5. Acreditación del laboratorio
6. Método de calibración empleado

El certificado de calibración puede amparar termopares individuales o un grupo de termopares fabricados a partir del mismo lote (carrete).

Es muy importante observar que tanto AMS2750 como CQI-9 requieren que todas las calibraciones sean realizadas por organismos acreditados en la norma ISO/IEC 17025, por lo que siempre recomiendo que revises el certificado de acreditación antes de seleccionar a tu proveedor.

4. En Resumen

Si alguna vez has comprado el termopar equivocado, se lo molesto que puede resultar. Por lo tanto aquí te comparto un resumen para seleccionar el sensor adecuado para su aplicación en 5 sencillos pasos:

1. Define el tipo de termopar: base (K, T, J, E , N, y M) o noble (S, R, y B)
2. Define el tipo de aislamiento que requieres: fibra textil, polímero, cerámico, metálico, etc.
3. Especifica el rango exacto de temperatura en el que operará el sensor
4. Especifica el uso del sensor: termopar patrón (estándar), termopar para SAT/TUS, termopar de control / carga
5. Solicita el certificado de calibración conforme a la normativa aplicable (AMS2750 o CQI-9) HTT

Referencias

ASTM International. ASTM E230, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, Rev. 2017.

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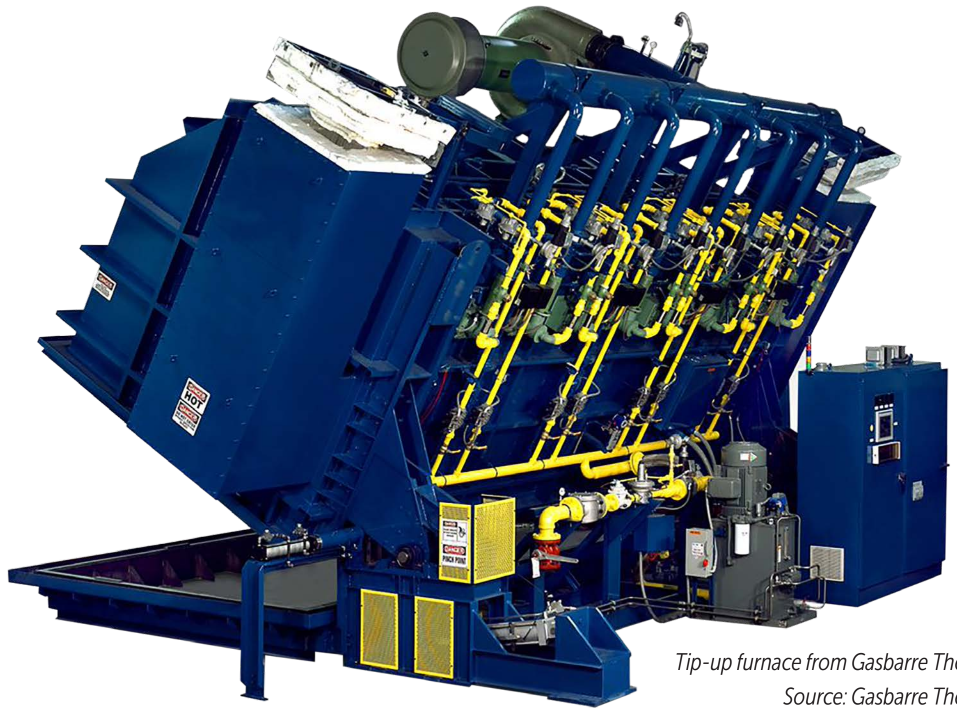

Tip-up furnace from Gasbarre Thermal Processing Systems
Source: Gasbarre Thermal Processing Systems

How Tip-Ups Forever Transformed Brake Rotor Manufacturing

By Michael Mouilleseaux, General Manager, Erie Steel, Ltd.

Are your brake rotors heat treated? Travel back in time to discover how ferritic nitrocarburizing (FNC) became the heat treatment of choice for automakers' brake rotors and why the tip-up furnace forever altered the production process for this part.

The Problem: Brake Rotor Corrosion

In the early 2000s, corrosion was one of the top three issues that U.S. automotive manufacturers found negatively affected the perception of the quality of their cars. Brake rotors are made of cast iron. These components sit out in the elements, and in places like the U.S. Midwest where salt is often used on the roads, unprotected steel or iron will corrode or rust. Even on the coast, there is salt water in the air.

What does rusting cause? The rotor rusts, and first, the cosmetics are negatively affected (i.e., rusty appearance). But more importantly, the first time you step on the brakes, it squeals like a pig, the vehicle shudders, and the driver feels pulsing in the pedal. He'll also feel it in the steering wheel because the amount of rust coating one area is different from the amount of rust that's on another. So, these brand-new, forty- to seventy-thousand-dollar cars have orange rust over the brake rotor and a shaky drive. . . it's not a good look!

Now, this is just a superficial coating of rust that will eventually abrade away; the rotor will look alright, the vehicle will stop better, and it won't squeal. However, since the rust on the rotor wears off unevenly, the car may never have smooth braking.

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SECO/WARWICK

A Move to FNC

In the early 2000s, all the big players were looking to FNC (ferritic nitrocarburizing) as a solution to corrosion, including Bosch Braking Systems, Ford, General Motors, Akebono, and the truck manufacturers. FNC was becoming popular since the process adds a metallurgical layer — called the "white layer" or "compound zone" — to the part, providing corrosion resistance and the bonus of improving wear.

To the OEMs, the benefits were perceived as:

1. The corrosion issue had an answer.
2. The life of the rotor doubled from roughly 40,000 to 80,000 miles. Although that meant half as many aftermarket brake jobs compared to before, consumers perceived it as a real advantage.
3. The rotors generated less dust. Brakes generate dust particles as the result of abrasion of the pads and the rotors. This particulate dust has been identified as both an environmental and a health concern. Now, flash forward to 2022: Electric vehicles are largely displacing the need to control emissions from ICE (internal combustion engine) vehicles. So, the new European standard on vehicle emissions implemented a requirement to control this dust that is harmful to the environment and which EV and traditional brake systems can emit.

But there were certain technical and practical challenges that automotive manufacturers faced when trying to implement this process at scale.

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Photo by Craig Morolf | Unsplash

#1 Distortion. Brake rotors may distort during FNC. Since rotors are (gray iron) castings, the process temperature for FNC may stress relieve the rotor, causing it to change shape or distort, rendering it unusable as a disc brake rotor. It was determined that if the rotor castings were stress relieved prior to machining and FNC, the distortion issue was rendered moot.

#2 Loss of Necessary Friction. FNC gives the white layer on the surface of a part with a diffusion zone underneath. The compound zone has a very low coefficient of friction, which means excellent wear properties. However, manufacturers want friction between the rotor and the brake pads to slow the car down. Reducing the friction on the rotors extends the braking distance of the car.

Let me illustrate this: I ferritic nitrocarburized a set of brake discs for Bosch Braking Systems, which eventually went to Germany and then on a vehicle. The customer absolutely loved the corrosion resistance, but when it was time for the downhill brake test, the car went straight through an instrument house because the brakes couldn't stop the car! Lesson: For rotors treated with FNC, the brake pads need to be made from a different frictional material!

#3 Cost. Overcoming the technical issues is simple. Stress relieving the casting at FNC temperatures *before* machining it would help the parts machine better and would eliminate distortion. Modifying the FNC process could reduce the depth of the white layer and, paired with the correct friction material, the acceptable braking capabilities were restored. Yet these additional steps presented a new challenge: higher costs.

The practical constraints of FNC in conventional batch or pit furnaces strained efforts to be cost-effective. The load (size) capacity of the conventional equipment, in conjunction with the time constraints of the FNC process presented a dilemma, as the OEMs' benchmark was about one dollar per rotor.

Here Comes the Tip-Up

With traditional furnaces for FNC, there was just no way to reach the economics that were necessary for it. A bigger pit furnace might be the way to go, but they really weren't big *enough*. So, here comes the tip-up.

Traditionally, a tip-up furnace has been used for processes with just air, no atmosphere. With direct fired burners, the furnace is used for tempering, stress relieving, annealing, and normalizing. Everything loads into the box, gets fired, and unloads, similar to a car-bottom furnace. With the appropriate external handling systems parts could be retrieved from the furnace and then quenched. This additional process increased the usefulness of the equipment and allowed for the processing of tubes, bars, big castings. . . big forgings for the oil industry and the like.

The question of how to heat treat brake rotors on a large scale still needed to be answered. It required a large, tightly sealed furnace with atmospheric integrity for excellent temperature uniformity. In ferritic nitrocarburizing, the processing range is about 950°F to 1050°F. It is well known that properties vary significantly across the temperature range. And they needed to be optimized to create the appropriate frictional properties for the rotors.

So, the answer was: Let's make a tip-up furnace that can be sealed for atmospheric integrity, has the appropriate temperature uniformity, and can circulate gas evenly. A lot of this would have to be iterative — create, test, compare, repeat.

The development of the perfect tip-up was essentially the work of one furnace manufacturer and one heat treater who together changed the industry.

Photo by roberto-r| Unsplash

American Knowhow Makes the Perfect Tip-Up

In the early 2000s, heat treaters worked with OEMs to develop a cost-efficient process in a tip-up. Manufacturers and service providers tested different methods, including atmosphere FNC and salt bath FNC.

By 2009, the perfect atmosphere furnace was complete and high volume brake rotors began to be processed for General Motors. The furnace manufacturer was JL Becker, Co., acquired by Gasbarre in 2011. The commercial heat treater was Woodworth, Inc., located in Flint, MI. Together, they spent a lot of time and money looking into FNC and figuring out how to make it work in a tip-up furnace.

General Motors was the first one to get on board, utilizing the FNC processed rotors on their pickup trucks and big SUVs, like the Escalade and Tahoe. Ford was not far behind using it on their F150 pickup truck. I was shocked the first time I saw the commercial: a Silverado pickup truck, out in the snow, and the speaker saying, "We now have an 80,000-mile brake system because of a heat treating process called FNC!"

It's a great story of American knowhow and a collaborative effort between someone who saw a need and someone else who saw the way. To this day, if you want to get a replacement set of brake rotors for your car, go to a place like AutoZone; they will tell you that the difference in cost between the OEM parts and an off-brand is the fact that the off-brand is not heat treated. HTT

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Michael Mouilleseaux has been at Erie Steel, Ltd. in Toledo, OH, since 2006 with previous metallurgical experience at New Process Gear in Syracuse, NY, and as the Director of Technology in Marketing at FPM Heat Treating LLC in Elk Grove, IL. Having graduated from the University of Michigan with a degree in Metallurgical Engineering, Michael has proved his expertise in the field of heat treat, co-presenting at the Heat Treat 2019 show and currently serving on the Board of Trustees at the Metal Treating Institute.

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Tip-Ups: A Viable Solution To Customize Your Heat Treat Department

Heat Treat Today asked tip-up manufacturers to help heat treaters understand the variability of tip-up options in the market today. In this article, Gasbarre Thermal Processing Systems and Premier Furnace Specialists share unique approaches on how their own gargantuan furnaces serve heat treaters. As you read, note that customization is the critical component to operating a tip-up in your heat treat department.

Gasbarre Thermal Processing Systems

What is your system and how does it differ from historic tip-up systems?

Gasbarre has a unique offering of tip-up style furnaces. We offer systems for conventional applications such as austenitizing, solution treating, stress relieving, and tempering. In addition, we also offer atmosphere processes such as annealing and ferritic nitrocarburizing (FNC). For us, tip-up systems are not one-size-fits-all type systems. Systems are designed around our customer's specific processing requirements. This would include thermal process requirements, load geometry and weight, temperature ranges and uniformity requirements, as well as time to quench specifications.

What are its operational advantages?

When evaluating a tip-up furnace system, they are typically compared against box-style furnaces and car bottom furnaces. So, what differentiates a tip-up from these other style furnaces? First, you can achieve the main goal of large capacity batch processing, while gaining advantages over box furnaces with wider temperature ranges and tighter uniformity requirements. Box furnaces are more challenging to evenly distribute heat due to the large space requirement for the furnace door, where it is difficult to include heating elements or gas fired burners. Second, you can achieve faster time-to-quench speeds in a tip-up furnace over a car bottom furnace. Car bottom furnaces require the load to be pulled out of the furnace and then the load is typically manually moved from the furnace hearth to the quench. In a tip-up, this process can be automated and completed in 60 seconds or less. Finally, when special atmosphere processes are required, a tip-up furnace offers a superior atmosphere seal to the other furnaces mentioned. With tip-up furnaces, you can seal the furnace using its own weight. Other furnaces require additional mechanical assemblies to achieve a proper seal, which ultimately is more susceptible to leaks and requires more maintenance than a tip-up furnace seal.

Why should people be paying attention to what you have to offer?

Gasbarre's broad product offering gives us the ability to evaluate your requirements objectively and offer the best solution for you and your company, whether that be box furnace, car bottom, or tip-up. Tip-up furnace

Continued on page 30

Heat Treat Today's

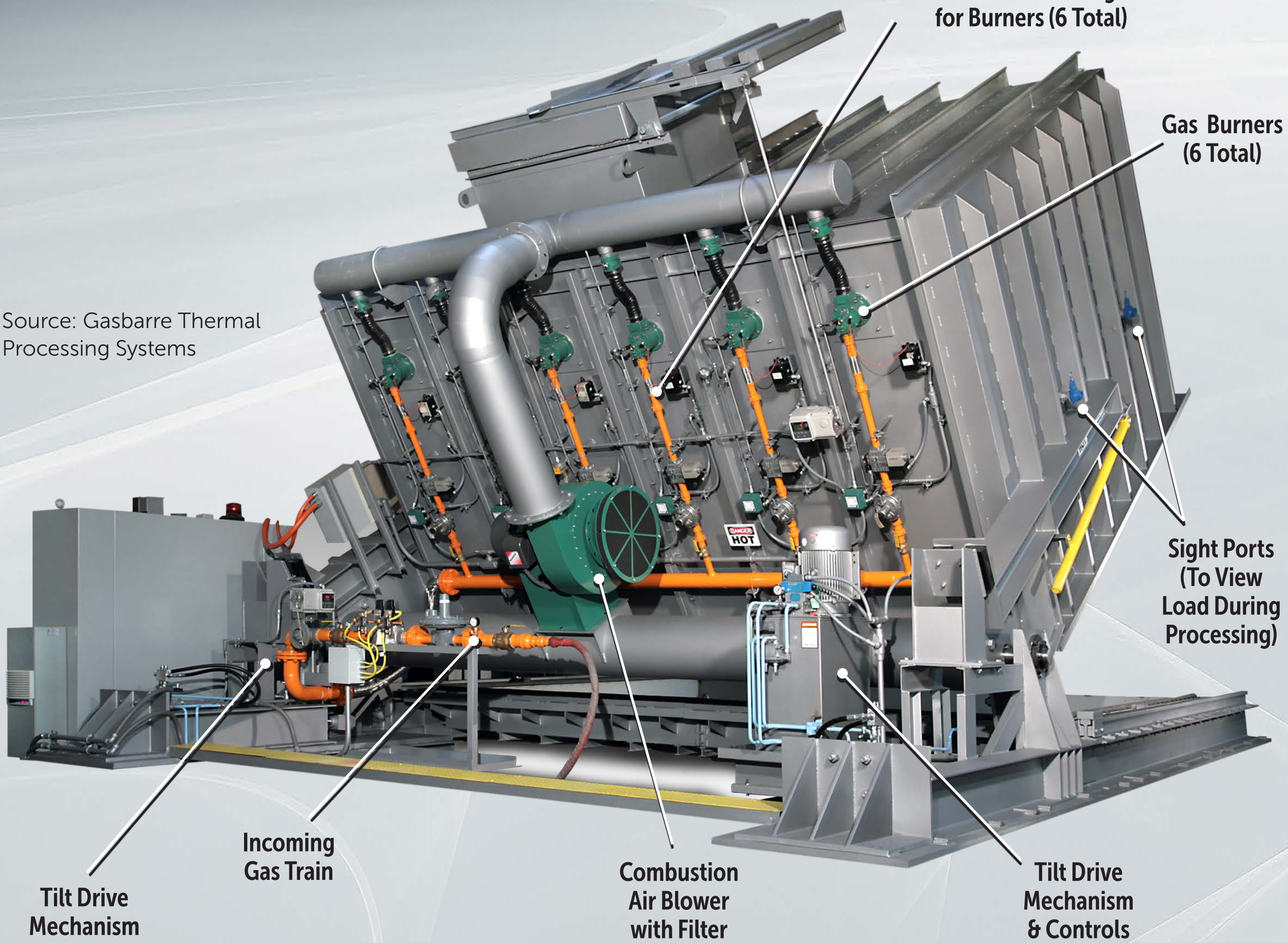
Anatomy of a Furnace: Tip-Up Furnace

Annotations by Dan Herring, The Heat Treat Doctor®, The HERRING GROUP, Inc.

Every feature you need to know in this furnace corpus.

Consider the numerous systems in your heat treat operations. What makes up the anatomy of each furnace? In this "Anatomy of a Furnace" series, industry experts indicate the main features of a specific heat treat system. For this inaugural feature, note how the schematics demonstrate how the tip-up furnace is able to process massive loads in an atmospheric sealed environment at highly controlled temperatures.

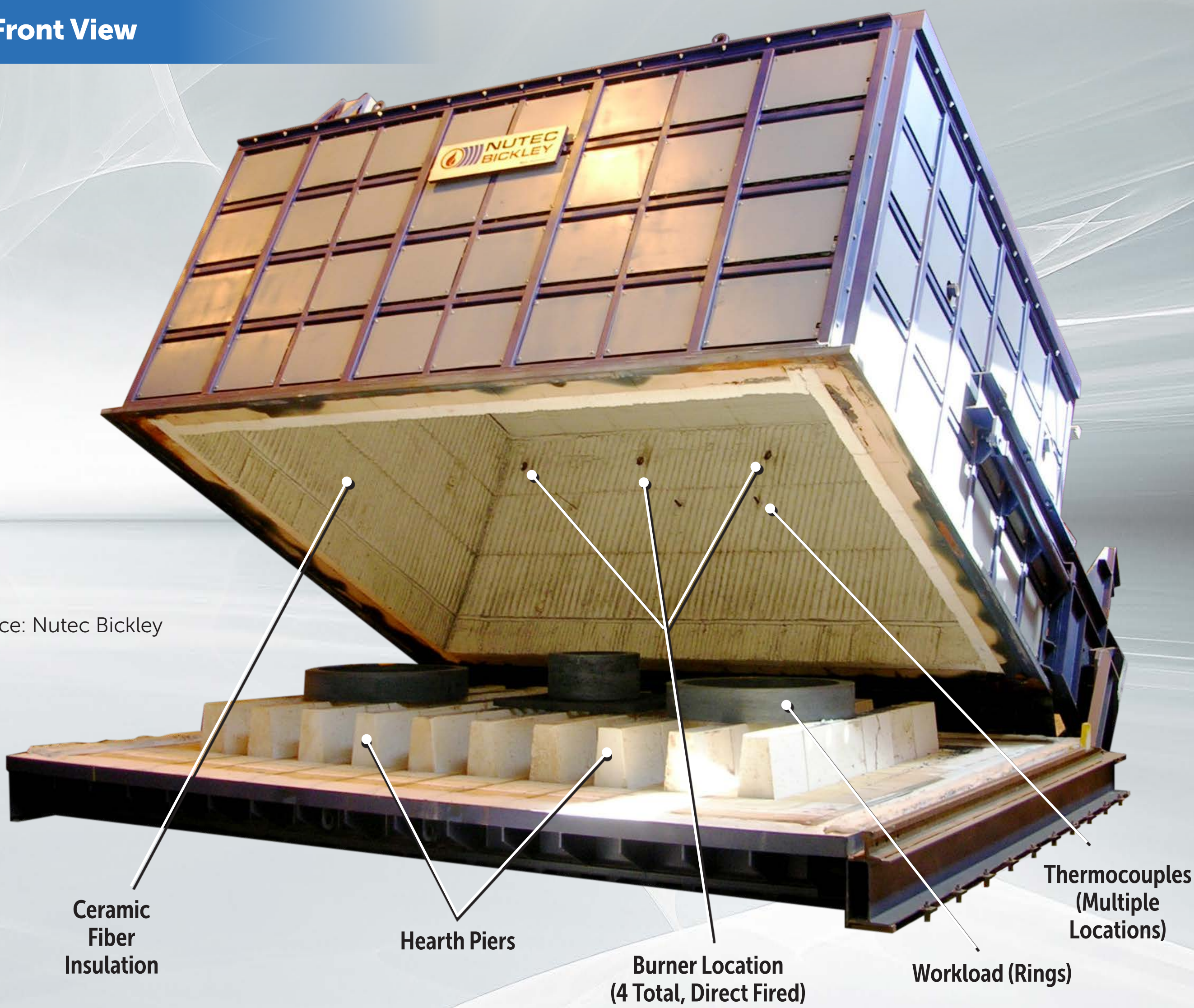
Back View



Source: Gasbarre Thermal Processing Systems

*Electrically heated tip-up systems are also available.

Front View



Source: Nutec Bickley

Tip-Up Furnace Providers

Search www.heattreatbuyersguide.com for a list of tip-up furnace providers to the North American market.

- CAN-ENG Furnaces International Ltd.
- Consolidated Engineering Company
- Gasbarre Thermal Processing Systems
- Heat Treat Equipment Co.
- Heat Treat Furnaces
- Kleenair Products Co.
- Lindberg/MPH
- McLaughlin Furnace Group LLC
- Nutec Bickley
- Premier Furnace Specialists, Inc.
- Surface Combustion, Inc.
- Wellman Furnaces, Inc.
- Williams Industrial Service, Inc.

Are you a tip-up furnace supplier and not listed here, please let us know at editor@heattreattoday.com.

This series will continue in subsequent editions of **Heat Treat Today's** *print publications.*

For more information:
Contact editor@heattreattoday.com

Continued from page 27

systems are usually not one-off installations. These systems usually involve quenching equipment, material handling, load staging, and other integration. Gasbarre has the experience and personnel to manage such large projects and support the customer to effectively implement a system.

Premier Furnace Specialists

What is your system and how does it differ from historic tip-up systems?

The controls and automation capabilities of our furnaces set us above many older systems still in use today. On the control panel of an older system, you're likely to see paper chart recorders, maybe a PanelView screen, and dozens of switches, pushbuttons, and pilot lights. Some of our customers prefer these control systems for their familiarity, and that's fine because we are capable of building this style of enclosure, but most come to us for improvements or new systems entirely. Our standard panel comes with a 23.8″ color touchscreen display that lets operators manage or record almost every aspect of the furnace's operation. This package can be added to existing furnaces as well, as we have performed many control and combustion upgrades on older systems to keep them functional and reduce operating costs. We also offer tip-up furnaces that operate via jackscrews for customers who want to avoid the maintenance and flammability of hydraulics.

Modern burner technology also offers a massive improvement over older systems. With rising energy costs for all fuel types, any increase in efficiency will quickly become a source of savings which can be redirected into other areas of your company. Improvements to burner design offer increased preheat, recuperative, and regenerative possibilities, which offer fuel savings across multiple temperature ranges and reduce emissions to keep in line with changing regulations. A standard burner can heat up and cool down faster, take less time to tune, and reduce maintenance hours and headaches compared to older models of burners with knowledgeable air and gas train design coupled with modern burners.

What are its operational advantages?

Our systems allow greater flexibility for integration with existing and future equipment as well as simplified operation. One of the largest complaints we hear in every industry is about the struggle to retain maintenance and equipment operators' knowledge once a senior member leaves a company. For this reason, it is important

Tip-up furnace from Gasbarre Thermal Processing Systems
Source: Gasbarre Thermal Processing Systems

Indirect gas-fired atmosphere furnace used to handle a variety of parts. Work chamber is approximately 31′ x 9′ x 9′ and has a load capacity of 90,000 lbs. Source: Premier Furnace Specialists

to have a simplified controls interface that allows new operators to get up to speed quickly. As a service company as well as an OEM, we have extensive experience working on and upgrading many brands of equipment. This enables us to easily integrate our solutions to match what customers are familiar with while also reducing maintenance requirements.

Why should people be paying attention to what you have to offer?

Despite OEMs trying to convince you, sometimes a standard "cookie cutter" model just isn't the right fit for a job. It can take years to build up a budget for a new furnace system. Don't invest those hard earned dollars into a piece of equipment that won't do everything you need, exactly how you need it done. We are willing to take on the jobs that require creative solutions and extensive automation. Premier's custom engineered systems live up to our namesake. Some of our recent projects have included a 130 ft long roller hearth furnace system with automated cooling/sequencing/handling of over 40 loads simultaneously; and a car bottom furnace with a 15′ x 15′ x 15′ work chamber capable of controlled heating and cooling of 160,000-pound loads. HTT

A Dozen Air & Atmosphere Heat Treat Tips

By Heat Treat Today Editorial Team

*Let's discover new tricks and old tips on how to best serve air and atmosphere furnace systems. In this print edition, **Heat Treat Today** compiled top tips from experts around the industry for optimal furnace maintenance, inspection, combustion, data recording, testing, and more.*

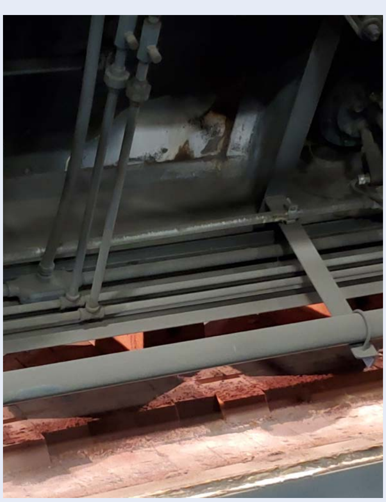
#1 Tip-Up Furnace Perimeter Insulation Maintenance Is Key to Efficiency & Quality

Due to their construction, the insulation at the perimeter of a tip-up furnace is subject to more abuse than typical furnace insulation. Whether from the repeated stress of cycling the case open and closed — or from high temperature operation — fiber modules will eventually begin to shrink/compact. Be watchful for high case temperatures (or worse: case discoloration and paint damage) as a signal that insulation issues are present in that area.

An air/atmosphere tight seal is critical for maintaining heating efficiency and process quality. Inspect the seal material around the furnace perimeter often and replace sections that are worn. Common perimeter seals are sand seals, fiberglass tadpole tapes, and insulating fiber blankets. These sealing materials are easy to keep on hand to ensure a quality seal is never delayed by lengthy lead times or supply chain issues.

Source: Premier Furnace Specialists

#tip-up #maintenance #insulation #heatingefficiency



Heat-damaged case wall

#2 Use AI To Simplify Your Maintenance

Simplify your maintenance! Today, using artificial intelligence (AI) software allows the "Cloud" to do the hard work. Nitrex has introduced QMULUS, a web-based software solution, with each of its nitriding systems, which examines key parameters to determine if your furnace is having any issues. Gas flows, amperage, motors, and cycles are all monitored for health factors. But QMULUS is so much more than that. It also analyzes input usages and calculates the cost of each run; logs all data relevant to running processes more efficiently; and provides an easy and seamless cloud view of heat treating operations.

Source: Nitrex

#maintenance #iiot #AI #costsavings

#3 Slight Positive Pressures Are Best

Atmosphere furnace pressure should be only slightly above ambient. The range should be between 0.25-0.35 inches water column. Higher pressures in multiple zone pusher furnaces will cause carbon control issues. High pressures in batch furnaces will cause high swings when doors and elevators move.

Source: AFC-Holcroft

#atmosphericpressure #furnacezones #batchfurnace #multizone

#4 Operating with a Multiple Burner System

"If a furnace or oven has a multiple burner combustion system with only one valve train, a multi-burner combustion safeguard should be used. This ensures that if one burner fails, they all go out."

Source: Bruce Yates, "Ten Tips for Safeguarding Combustion Processes," 2021

#multiburner #combustion #safety

#5 Mind Your Seals

Seals are everywhere on any furnace. Do you know where all the seals and leak points are? Rope gaskets is an obvious example; high temperature gaskets need to be flat, smooth, and unbroken. Another clear example is in the world of vacuum furnaces: O-rings need to be clean and protected from abrasion. Almost every item of your furnace is sealed in some manner. It is best to replace seals as part of a preventative maintenance program. While your nose can detect ammonia, vacuum leaks require special helium leak detectors and a lot of training. Your furnace manufacturer's service technician can assist in identifying problem areas and developing a maintenance routine to keep your furnace running. And a simple electronic manometer is great to have handy for running leak-down tests using positive pressures. Auto supply stores sell inexpensive halogen detectors, and some people use smoke bombs to detect leaks.

Source: Nitrex

#leaks #tests #preventivemaintenance

#6 Understand What Flame Detection Is

"Flame supervision may be defined as the detection of the presence or absence of flame. If a flame is present during the intended combustion period, the supervisory system will allow a fuel flow to feed combustion. If the absence of flame is detected, the fuel valves are de-energized.

"This basic definition does not consider the hazard potential during startup or ignition, however. A dangerous combustible mixture within a furnace or oven consists of the accumulation of combustibles (gas) mixed with air, in proportions that will result in rapid or uncontrolled combustion (an explosion). It depends on the quantity of gas and the air-to-fuel ratio at the moment of ignition."

Source: **Bruce Yates, "Ten Tips for Safeguarding Combustion Processes," 2021**

#flamedetection #combustion #valves

#7 Out of Control Carburizing? Try This 11-Step Test

When your carburizing atmosphere cannot be controlled, perform this test:

1. Empty the furnace of all work.
2. Heat to 1700°F (926°C).
3. Allow endo gas to continue.
4. Disable the CP setpoint control loop.
5. Set generator DP to +35°F (1.7°C).
6. Run a shim test.
7. The CP should settle out near 0.4% CP.
8. If CP settles out substantially lower and the CO_2 and DP higher, there's an oxidation leak — either air, water, or CO_2 from a leaking radiant tube.
9. If the leak is small, the CP loop will compensate, resulting in more enriching gas usage than normal.
10. Sometimes, but not always, a leaking radiant tube can be found by isolating each tube.
11. To find a leaking radiant tube, not only the gas must be shut off but combustion air as well.

Source: **AFC-Holcroft**

#carburizingheattreat #radianttubes #checklists #endogas #carburizingatmosphere

#8 Remember that Flame Safety Starts with Purging

"The sequence for flame safety starts with purging the furnace or oven. Purge time should allow for four air changes.

"Fuel valves can — and do — leak gas. The purpose of purging is to remove combustible gases from the combustion chamber before introducing an ignition source. The four air changes in the combustion chamber are based on a worst-case scenario that includes having a burner chamber that is completely filled with gas.

"Once airflow for purge is verified, the proof-of-valve closure is confined and safety limits are proven. Then the purge timer — which may or may not be integral to the combustion safeguard — determines the period of time required to evacuate the combustion chamber."

Source: Bruce Yates, "Ten Tips for Safeguarding Combustion Processes," 2021

#combustion #fuelvalves #combustionchamber #safety

#10 Regularly Inspect Retort Alloys

Retort alloys must be inspected on a regular basis. Hot spots can be identified by bulges. Plastic deformation occurs due to overheating, causing the hotter section to bulge because it is surrounded by stronger metal. Inspect your retorts or radiant tubes for deformations. In addition, constant thermal cycling can cause problems with some alloys. Look for cracks in welds or near welds. Some leak detection methods can also detect alloy issues or overheating. Localized overheating could indicate a problem with the burner or the heating element. Early detection and correction can save you a lot of money on expensive alloys.

Source: Nitrex

#retortalloys #maintenance #burner #moneysaving

#9 Carbon Probe Trouble Shooting

If you're having atmosphere problems with a furnace that has been operating normally for some time, avoid the temptation to remove the carbon probe. There are several tests you can run on nearly all carbon probes while the probe is still in the furnace, at temperature, in a reducing atmosphere. Super Systems Inc. provides an 11-step diagnostic procedure in a white paper on their website, in a paper titled, *"Carbon Sensor Troubleshooting"* by Stephen Thompson.

Source: Super Systems Inc.

#troubleshoot #reducingatmosphere #diagnostictest

#11 Record System Settings Before Issues Arise

This is a very simple tip that is often overlooked when customers are focused on meeting production goals instead of the maintenance of their equipment. It is critical to record the operating settings of their furnace systems when parts are coming out at their best, or simply before issues arise. When something goes awry in the process and troubleshooting is required, service technicians hear all too often that there is no record of what the ideal or correct setpoints are for various systems. Nearly every item on a modern heat treating furnace (or in its control panel) has a setpoint or position that can be recorded or physically marked. Now, clearly some items are more critical than others when it comes to air and atmosphere settings. Below are a few items you'll want to have setpoint/positioning records of before they require troubleshooting:

1. Flowmeter setpoints (at the furnace and generator)
2. Blower/pump/motor VFD setpoints (primarily frequency setpoints and ramp rates)
3. Manual or actuated damper positions on flues
4. Regulator setpoint (from pressure gauge or in-line test port)
5. High/low pressure switch setpoints
6. Any air/gas/atmosphere ratios for various recipe steps
7. Burnout frequency and duration (if applicable)

An added incentive to record these settings is the preventative maintenance benefit. The best way to avoid supply chain issues and delivery delays is to fix a problem before it grows into a bigger issue. When a setpoint/setting is correct but product quality begins changing, it is a warning sign that consumables may be approaching end of life (such as nickel catalyst in endothermic gas generators) or components require maintenance (such as air inlet filter replacements).

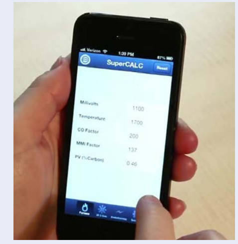
Source: Premier Furnace Specialists

#preventativemaintenance #troubleshooting #furnaceequipment

#12 What To Do When Parts Are Light on Carbon

Many factors can contribute to why parts are not meeting the correct hardness readings. According to Super Systems Inc., here is a quick checklist of how to start narrowing down the culprit:

1. Review process data for abnormalities. The first thing to do is make sure the parts were exposed to the right recipe. Check the recorders to make sure the temperature profile and atmosphere composition were correct. Make sure all fans and baffles were working correctly. Determine if any zones were out of scope and that quench times were acceptable. If any red flags appear, hunt down the culprit to see if it may have contributed to soft parts.
2. Check the generator. Next, check the generator to make sure it is producing the gas composition desired for the process. If available, check the recorders to make sure the gas composition was on target. If not, check the generator inputs and then the internal workings of the generator.
3. Check the furnace atmosphere. If the generator appears to be working correctly, the next step would be to check the furnace itself for atmosphere leaks. Depending on what type of furnace you have, common leak points will vary; for continuous furnaces, common leak points are a door, fan, T/C, or atmosphere inlet seals. Other sources of atmosphere contamination may be leaking water cooling lines in water-cooled jackets or water-cooled bearings. More than likely, if the generator is providing the correct atmosphere but parts are still soft, there is a leak into the furnace. This will often be accompanied by discolored parts.



4. Check carbon controller to make sure it matches furnace atmosphere reading (verify probe accuracy and adjust carbon controller). This can be done using a number of different methods: dew point, shim stock, carbon bar, three gas analysis, coil (resistance), etc. Each of these methods provides a verification of the furnace atmosphere which can be compared to the reading on the carbon controller. If the atmosphere on the carbon controller is higher than the reading on the alternate atmosphere check, that would indicate the amount of carbon available to the parts is not as perceived. The COF/PF on the carbon controller should be modified to adjust the carbon controller reading to the appropriate carbon atmosphere. If the reading is way off, it may require the probe to be replaced.
5. Check the carbon probe.
6. Replace the probe – CALL SSI.

Source: Super Systems Inc.

#checklist #hardening #carbon #furnaceatmosphere #probes #controller

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Energy Efficiency Through Combustion Monitoring

By Taylor Smith, Technical Sales and Marketing Specialist, PSNERGY, LLC

With energy costs soaring and environmental commitments expanding across the industry, is it enough to just tune your industrial combustion burners, or can IIoT devices provide greater insight to achieve burner energy efficiency?

Introduction

Industrial furnaces are inherently inefficient and constantly degrading due to high operating temperatures. In most cases, less than 50% of the energy generated through combustion goes to heating the load, while most energy is lost through the exhaust stack or is used to heat the atmosphere, fixtures, and walls of the furnace. An improperly tuned furnace loses 10-30% efficiency on top of the energy losses previously mentioned. This is why keeping industrial furnace combustion systems in tune is critical to performance. This was recently highlighted in John Clarke's featured article, "How To Make $17,792.00 in a Couple of Hours."

Continuous Monitoring Is Key

Built on years of experience and field data, combustion engineers at PSNERGY know that only tuning combustion systems annually, or semi-annually, is a good start, but it is not enough. Customer case studies led the team to recognize the importance of frequent combustion monitoring to achieve optimal performance, and ultimately drove the design of their proprietary IIoT monitoring system: Combustion Monitoring and Alerting (CMA).

To get the most BTUs to the load per unit of natural gas purchased, tuning must be combined with continuous combustion monitoring. Tuning without continuously monitoring combustion increases the risk of losing energy to the load, decreasing efficiency, and creating excessive carbon emissions.

Case Studies: Data-Driven Furnace Efficiency

The following case studies represent two examples of data collected throughout the country on furnaces of all sizes and

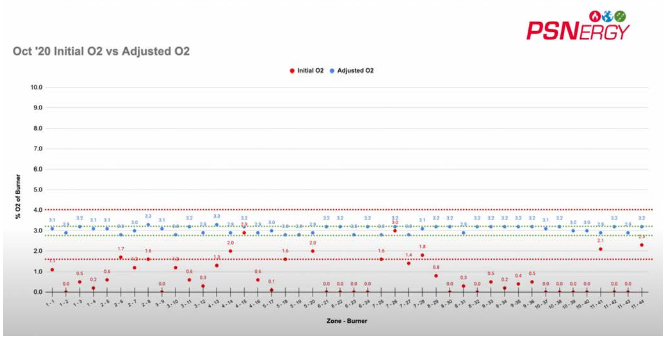

Figure 1.

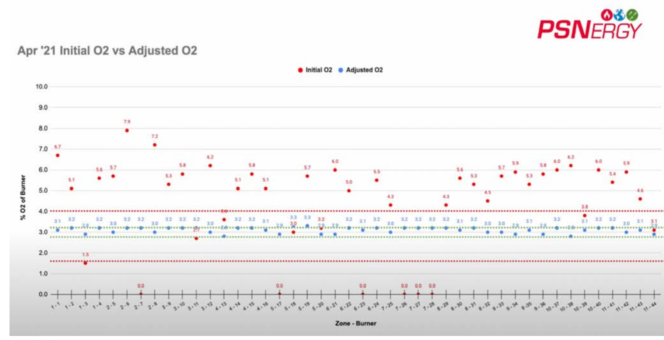

Figure 2.

configurations. One thing remains consistent: simply checking combustion once or twice per year does not ensure optimal furnace performance.

These figures show before and after measurements taken on the same forty-four burner radiant tube roller hearth furnace, six months apart. The red points on the graphs represent excess oxygen in each burner's exhaust when the team arrived on site, while the blue points represent excess oxygen in each burner's exhaust after tuning the furnace. A significant variance in combustion performance can be observed in the six months between tunings, which means a large portion of the natural gas purchased is being wasted out the stack and creating carbon emissions.

To ensure maximum energy is being applied to the load for every BTU burned, combustion should be tuned to the ratio of 11.5:1. This 11.5:1 ratio of air to gas results in an ideal excess oxygen measurement of 3%. When PSNERGY engineers perform combustion tuning on an industrial furnace, they set the excess oxygen at the burner between 2.8% and 3.2%. This optimal range is marked by the green dashed lines on the graphs.

You may be questioning, "Does too little or too much excess oxygen really affect combustion performance?" Yes! Burners operating above 4% or below 1.5% are considered outside of the control limit range, marked by the red dashed lines on the graphs. With less than 1.5% excess oxygen at the burner, furnaces produce carbon monoxide and soot, which can clog burners, making them even more inefficient. These carbon emissions can also create an unsafe work environment for plant employees. When operating at 5% excess oxygen, 8% of energy to the load is lost. When operating at 7% excess oxygen, 21% of energy to the load is lost. Imagine buying the same amount of natural gas and only getting 79% of the energy!

A few things to notice on these graphs: burners are rarely, if ever, found in the ideal performance zone after six months. There is no way to know when each burner drifted out, because continuous monitoring was not yet implemented. Therefore, this drift in combustion performance, which significantly decreases furnace efficiency, could have happened anytime during the six month period between combustion tunings. Tunings may be scheduled, but combustion does not operate on a fixed schedule. You cannot know when the burners drift out of tune without monitoring. Another point to note is that the burners do not always move in the same direction as they go out of tune. In Figure 1, thirty one out of the forty four burners were burning under 1.5% excess oxygen, which means they were burning rich and creating carbon emissions and soot. The PSNERGY service team tuned all of those burners back into the optimal performance range. As you can see in Figure 2 data, taken six months later, out of the same forty four burners, seven burners were burning rich, while thirty one of the burners were operating lean with over 4% excess oxygen, which significantly decreases the amount of energy to the load. These figures demonstrate why it is crucial to continuously monitor and tune your combustion system as needed based on the data, not the calendar.

Combustion Monitoring and Alerting (CMA)

Circling back to our initial question of, "Can IIoT devices provide greater insight to achieve burner energy efficiency?" the data presented here answers with a resounding YES! In fact, various companies across steel, aluminum, and heat treating industries have already successfully implemented this solution.

Not only does continuous monitoring help achieve burner efficiency, but it also helps bridge the gap in combustion knowledge and manufacturing by making combustion performance easy to see and maintain. With manufacturing leaders facing fourteen-year-high natural gas prices and a generational gap in manufacturing expertise, systems like CMA are proving to be crucial to business success. Delivering 10-20% improvement in furnace efficiency, less waste, reduced carbon emissions, and ensured quality, takes your furnaces from being a necessary expense to a strategic asset.

Now the question is: Are you performing combustion maintenance on a fixed schedule or are you trusting real time data?

HTT

About the Author:

Taylor Smith is a specialist of Technical Sales and Marketing at PSNERGY, located in Erie, Pennsylvania. Her tenacity and competitiveness as a Division I athlete have helped her quickly gain knowledge and hands-on experience in the heat treating industry. Taylor has a deep passion for manufacturing and works hard to build the next generation of leaders, serving on the board of directors for Women in Manufacturing WPA.

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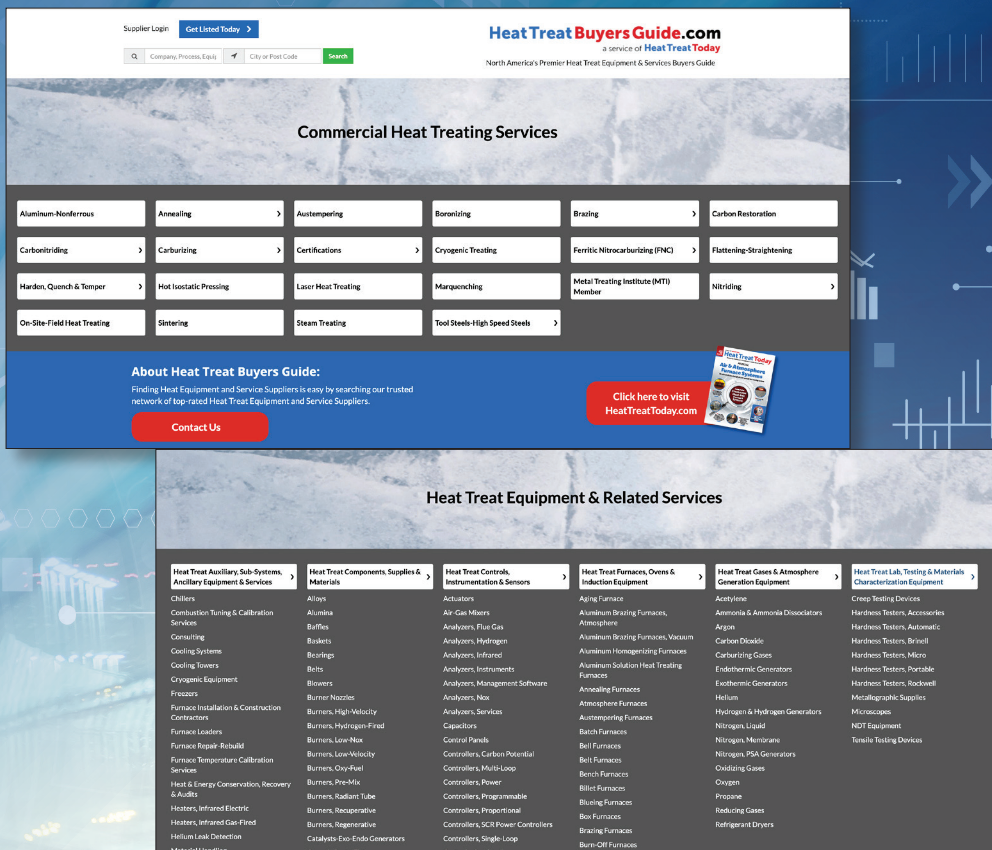

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HT BG

Source: Alloy Engineering

Radiant Tubes: Exploring Your Options

By Marc Glasser, Director of Metallurgical Services, Rolled Alloys

There are many radiant tube options on the market, so which one is best for your furnace and your budget? In this column that compares radiant tubes in carburizing and continuous annealing furnaces, discover how two major types of radiant tubes stack up.

Introduction

Radiant tubes are used in many types of heat treating furnaces from carburizing furnaces to continuous annealing of steel strip. Generally, a heat treater has three options for radiant tubes: cast tubes, wrought tubes, and ceramic silicon carbide tubes. Silicon carbide tubes are rarely used by heat treaters, so this article will not delve too deeply into this option. Suffice it to say, ceramic materials can often handle much higher temperatures at the expense of ductility; ceramics are more brittle than metals, making them prone to failure from the small impacts, so metal cages are sometimes fabricated to protect them. Most of the tubes being used today are cast radiant tubes. With new casting technology — primarily centrifugal casting — thinner tubes are being cast at a lower cost, which then results in a shorter life.

The primary factors for choosing radiant tube material are tube temperature and carbon potential of the furnace atmosphere. Cost-benefit analysis should also be considered. There are multiple applications for radiant tubes, including carburizing furnaces, continuous annealing furnaces for steel sheet galvanizing, steel reheat furnaces, and aluminum heat treating. This article will explore two of the aforementioned radiant tube options, specifically for carburizing and continuous annealing furnaces.

Radiant Tubes for Carburizing Furnaces

Gas carburization is traditionally performed between 1650°F and 1700°F at a carbon potential of 0.8% approximating the eutectoid composition. In today's competitive environment, more heat treaters are increasing temperatures to 1750°F and pushing carbon potentials as high as 1.6% to get faster diffusion of carbon while spending less time at temperature. INCONEL® HX (66% Ni, 17% Cr) has been a common cast alloy seen in carburizing furnaces. This alloy is regularly selected for its resistance to oxidation and carburization up to 2100°F. Super 22H is more heavily alloyed than HX and is seeing more use as carbon potentials increase but at a premium price. With advances in centrifugal castings, cast tube wall thicknesses have decreased from 3/8-inch to 1/4-inch. Some heat treaters have shared that this decrease in wall thickness has also led to shorter tube life.

Fabricated and welded radiant tubes in alloys 601 and RA 602 CA® have been tested in industry. When tested, these wrought alloys were fabricated to have a wall thickness of 1/8-inch. At the extremes, tubes fabricated from 601 only lasted 50% as long as cast HX. Historically, HX tubes have been approximately 33% higher in cost than that of 601 and utilize heavier 3/8-inch walls. A little-known fact is that by switching to a thinner wall cast tube, the life drops by 50%. By switching to 1/8-inch wall thickness, RA 602 CA tube life has been extended to eight years or more, while running at 1750°F and up to 1.6% carbon potential, at just a 33% premium over cast HX. Life cycle data are presented in Figure 1.

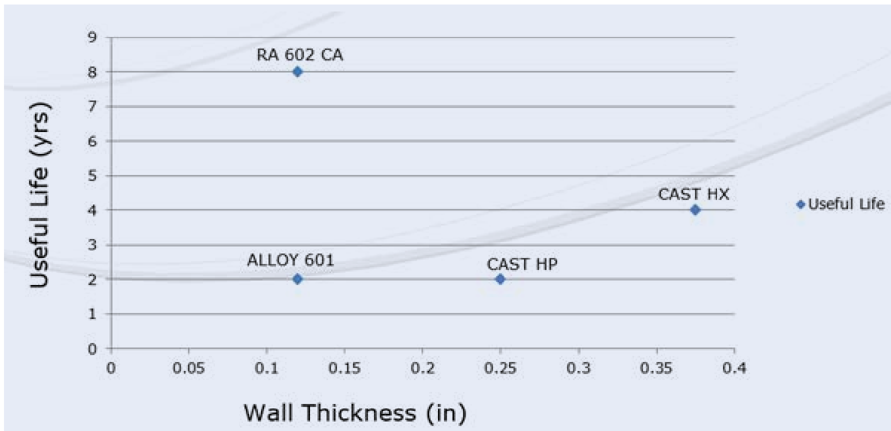

Figure 1. These life cycle comparisons were done in carburizing furnaces only. In non-carburizing furnaces, justification of alloy selection is dependent on actual operating conditions and each individual operator's own experience.

ALLOY	WALL	COST ($)	LIFE (Yr)	ANNUALIZED COST	TOTAL 8 YEAR COST
601	1/8	1000	2	500	4000
Cast	3/8	1300	4	325	2600
Cast	1/4	1000	2	500	4000
RA 602	1/84	1700	8	212	1700

Table 1

Radiant Tubes for Continuous Annealing Furnaces

In the area of continuous annealing, the cast alloy of choice is HP/HT (35% Ni, 17% Cr, 1.7% Si, 0.5% C). Here again, this casting has been compared to 601 and RA 602 CA, with the same results. The total life data from these trials are also incorporated into Figure 1. During the collection of this data, there has been no effort to measure the actual tube temperature, so the effect of tube temperature is not clearly defined. In these continuous annealing furnaces, it has been reported that the tubes at the entry end are subject to more heat absorption as burners are firing more due to the continuous introduction of cold material; in trials, the operators have not kept adequate documentation of specific tubes, making justification more difficult.

Justification for the higher cost wrought alloy needs to take into consideration initial fabricated tube cost, actual tube life, AND the lost production of each anticipated downtime cycle as these downtime costs are often much more than material costs. Only individual fabricators can determine these costs.

The Economics

Table 1 above shows the economics of metal alloy choice. To properly interpret, understand that the costs are not actual, but rather relative to 601, so a round number of 1000 was used. With a 30% greater cost of cast tubes, that translates to a relative cost of $1300. The annual cost is the amortized cost over the life of the tube. The total eight-year cost is the relative cost times the number of tubes that would have to be purchased to obtain the life cycle of one tube of the longest-lasting material over its full life cycle.

Missing in this analysis is the additional cost of downtime and lost production. For the replacement of radiant tubes in a carburizing furnace, this typically entails a full week to turn a furnace off, allow it to cool, replace the tubes, and then heat it up again. Many heat treaters do not consider this, and therefore it is a hidden cost. Even without the downtime being considered, by examining the total cost of materials (including replacements) compared to the longest-lasting tube, it turns out that the most expensive tube is the cheapest tube. The obstacle to overcome is whether the heat treater is willing to wait eight years to realize these cost savings.

There can be additional factors to consider. With improvements in the efficiency of casting, the actual costs of the thinner wall casting may be somewhat less, but to match the overall cost of the longest-life material, it would have to be less than half the expected cost. As better, more expensive cast alloys become accepted and actual life data becomes available, these more costly alloys can be added to this table for comparative analysis, too.

This same method of analysis can be applied to radiant tubes for continuous annealing furnaces, but more details will need to be added including furnace position. Different alloy candidates will have to be put to the test in actual operations, carefully document what alloy is in what position or location, and when it gets changed out. This becomes quite cumbersome when annealing furnaces (depending on design and manufacture) can have over 200 radiant tubes.

Conclusion

Currently, cast alloy tubes dominate the market. The concept of total life cycle cost has been introduced as a means of more accurately justifying one's choice of radiant tube. This comes into play more as processes are pushed beyond traditional process conditions. Cost-benefit analysis must be balanced over acceptable amortization time, of course. However, performing the full analysis as well as the costs saved from downtime may lead some heat treaters to some alternate materials. HTT

About the Author:

Marc Glasser is the director of Metallurgical Services at Rolled Alloys and is an expert in process metallurgy, heat treatment, materials of construction, and materials science and testing. Marc received his bachelor's degree in materials engineering from Rensselaer Polytechnic Institute and a master's degree in material science from Polytechnic University, now known as the NYU School of Engineering.

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Contact Marc at mglasser@rolledalloys.com

DUAL PERSPECTIVES: Europe vs. North America

Changes are inevitable, but the world today is shifting oh so rapidly, keeping us on our toes. Two men from different parts of the world, both with significant experience within the heat treating community, reflect on the implications of these changes in the heat treat industry. With each new topic, will their views align?

The experts are Thomas Schneidewind, editor-in-chief of **heat processing** magazine, and Doug Glenn, publisher and founder of **Heat Treat Today**. Thomas's expertise lies in the European market while Doug's resides in the North American market.

To what extent have high energy prices affected heat treaters?

Thomas Schneidewind, Editor-in-Chief,
heat processing magazine

In Europe, many companies are in shock. The energy crisis threatens the existence of energy-intensive companies. The hardening industry is coming under pressure as sharp price increases for electricity and gas lead to business losses. This is because the higher prices cannot be passed on to the customers, whose contracts do not allow price increases during the term of a contract. Most hardening shops are small or medium-sized businesses, while their customers are large companies and corporate groups.

Hardening plants must find short-term solutions to cushion the cost shock and ensure the survival of their business. And this with a view to the long-term goal of decarbonization. Because, in the future, process heat must be carbon-free. Whether energy-intensive production is still possible in Europe in the future will be decided by the flexibility and inventiveness of the industry. The task now is to find intelligent answers and to reduce the use of fossil fuels more quickly than planned.

An important step in this direction is the modernization of existing plants — retrofitting can become the efficiency turbo that saves the day in difficult times. Hardening plants should further develop electrically operated equipment and strive for intelligent furnace control. The use of energy-saving motors for pumps, circulators, and fans is another option. Insulation on side walls and ceilings in high-temperature furnaces and energy recovery from waste heat are among the basic measures.

Modern burner technology also offers the potential to reduce energy consumption. Hydrogen as a heating gas will become an important option in the future. Hydrogen-fueled burners have been around for some time but are not currently used in contract hardening shops. Because there are good ideas and positive trials, but no long-term experience and reliable cost comparisons, it will take a little longer until a significant introduction in contract heat treatment takes place. Until then, there are still some problems to be solved, such as safety, availability, investment costs, and especially the price of green hydrogen.

One thing is certain: investments are necessary. OEMs are already making high demands on future carbon-neutral processing and delivery in their contracts, since many automotive manufacturers are striving for a climate-neutral value chain — dictated by regulatory framework conditions. Hardening shops first must survive this difficult phase to then benefit from modernization investments. The aim is to offer customers carbon-neutral heat treatment. Companies can only achieve this by using green technologies. There is no other way.

Doug Glenn, Publisher,
Heat Treat Today

In North America, energy is typically one of the top three expenses in nearly all heat treat processes. Commercial heat treaters know this well because it is their business to know the costs associated with their livelihood. Manufacturers with in-house heat treaters, on the other hand, often don't properly allocate all the true costs associated with their heat treating processes. However, energy costs are fairly easy to allocate, even for them, and it's safe to say: energy prices are skyrocketing.

The impact of rising energy prices can be measured in the price for each BTU that goes into the heat treat process. Often, 50% to 200% increases have not been unusual in the U.S.

But less obvious costs that are not so easy to measure also impact heat treaters. For example, transportation, which is energy intensive, adds to overall processing costs, especially if not done in-house.

Even LESS obvious is the effect that rising energy costs have on quality, innovation, and standard operating procedures (SOP). When corporate profits plummet due to rising energy costs, all aspects of the business are scrutinized, not just the areas where energy is most intensively used. This oftentimes results in cuts to "non-essential" expenses, which may mean reducing new product or process development initiatives, cutting back on borderline or "unnecessary" quality or safety measures (!), and re-examining SOPs to make further cuts.

The rising cost of energy could even impact the competency of heat treat operators. During COVID, I spoke to a nurse who explained that quality of care was reduced when a large number of nurses left the profession because they chose not to take the vaccines or boosters. Patients receiving emergency medical care did not notice any shortage of personnel, but the fact was that the nurses filling the critical roles were not as proficient or qualified as the expert nurses they replaced. In a similar way, when energy prices skyrocket and cuts must be made, the internal allocation of resources may compromise some aspects of the business that are not as clear to the customer.

When energy prices rise as drastically as they have, companies will examine how they can cut costs and help maintain profits, which is a GOOD and appropriate thing. It will take time for heat treaters to adjust to the recent energy price spike. Adjustments won't be cost-free. The question is: Which part of the company will pay?

Heat Treat Today partners with two international publications: heat processing, a Vulkan-Verlag GmbH publication that serves mostly the European and Asian heat treat markets, and Furnaces International, a Quartz Business Media publication that primarily serves the English-speaking globe. Through these partnerships, we are sharing the latest news, tech tips, and cutting-edge articles that will serve our audience — manufacturers with in-house heat treat.

In this issue, we look at updates on industry events around the globe, such as mills, mints, and the Middle East.

Recycled Steel from China

"Shiu Wing Steel, Hong Kong's first and only steel-rolling mill, plans to produce recycled steel to meet growing demand created by China's green ambitions in Hong Kong and other cities in the Greater Bay Area (GBA) development zone, according to a report by South China Morning Post. The 65-year-old steelmaker plans to build an electric-arc furnace at its plant in Tuen Mun to produce 700kt (kilotons) of recycled steel a year by 2025 and expand its presence in the GBA, Dario Pong, Shiu Wing's executive director, said in an interview."

Read More: *"Hong Kong's only steel-rolling mill to produce recycled steel"* at furnaces-international.com

Shiu Wing Steel to produce recycled steel
Source: Furnaces International

European Mint Chooses Vacuum Furnace To Harden Dies for Coins

"This is the eighth mint to choose SECO/WARWICK solutions. The Vector furnaces will be used to harden the dies necessary for the production of coins for both circulation and collector series. Vector vacuum furnaces with 15 Bar high-pressure gas quenching perfectly match the mint's operating characteristics. Vector enables fast heat treatment while the working space is optimal for the production of dies, coins, medals and orders."

Read More: *"Seco/Warwick's furnaces chosen by European mint"* at heat-processing.com

Vector furnaces to harden the dies
Source: SECO/WARWICK

Mathevon Group and Bodycote Partner for Oil & Gas Industry Solution

"Bodycote has entered into a partnership with Mathevon Group to develop the market in the [Middle East] and, in particular, Saudi Arabia. The agreement brings together Bodycote's expertise in thermal spray coatings for the oil & gas industry and Mathevon's knowledge of the production of internal components of gate valves for oil & gas. Mathevon is a world-class provider of safety parts in stainless steel and superalloys, which are subject to severe service applications and has a long history of servicing oil & gas OEM supply chains."

Read More: *"Bodycote to offer new services in the Middle East"* at heat-processing.com

Mud rotors for surface coating
Source: Bodycote

Heat Treat Shop

Heat Treat Today believes that people are happier and make better decisions when they are well informed. To get a sense of what options the market has for you, check out some of the heat treat components, parts, services, and supplies listed below. These products have been featured in our monthly e-newsletter called Heat Treat Shop, where manufacturers with in-house heat treat departments — especially in the aerospace, automotive, medical, and energy sectors as well as general manufacturing — can easily share this information.

Want to see your product listed here? Contact Doug Glenn at **doug@heattreattoday.com**.

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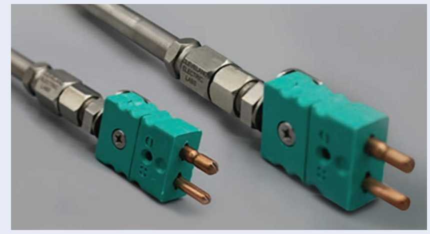

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For more information: email@protectioncontrolsinc.com

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www.drycoolers.com

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Combustion 911's C911-P are automatic reset pressure switches for use with gas and air in industrial combustion systems. FM Approved, in stock in Kent, OH, and ready for fast shipping!

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Improve Your Process with Gasbarre Oil Quench Vacuum Furnaces!

Gasbarre's dual chamber vacuum oil quench furnace is designed for a wide range of heat treat applications. Gasbarre's efficient design allows for faster floor-to-floor times and an extremely pure vacuum environment. Systems can be configured for both batch & continuous processing.

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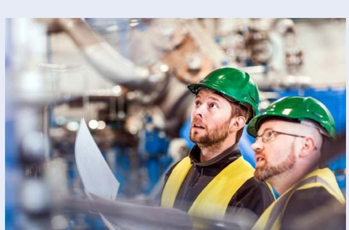

https://afc-holcroft.com/company/downloads

Honeywell

The future of thermal is connected

Honeywell's Connected Thermal Solutions platform powered by Thermal IQ™ automates the process of extracting thermal process data and helps drive better business outcomes with real-time thermal analytics developed by Honeywell Thermal Solutions experts.

process.honeywell.com

Performing Your Basic & Final NIST SP 800-171 Self-Assessments

Joe Coleman
Cybersecurity Officer
Bluestreak Consulting™

Introduction

Do you have plans to perform your NIST SP 800-171 self-assessment, but need more clarity about what's involved? DFARS 252.204-7012 and the DFARS Interim Rule, including DFARS 252.204-7019, state that all DoD contractors in the Defense Industrial Base (DIB) that process, store, and/or transmit CUI (Controlled Unclassified Information) and want to be eligible for any contract award must complete a self-assessment (or basic assessment) using the DoD's NIST SP 800-171 Assessment Methodology and generate a points-based score. This score will then be uploaded into the Supplier Performance Risk System (SPRS). At the time of contract award for a DoD contract containing the new 7019 clause, a DoD contracting officer will verify that a score has been uploaded to the SPRS.

For any heat treater interested in getting these high-security contracts, review the following steps that will help you successfully complete your basic and final self-assessment.

Identifying and Defining Your Organization's CUI

Your NIST 800-171 basic self-assessment should start by identifying CUI sources and flows and mapping them within your organization's IT systems. Organizations need to understand that CUI is an information category that includes Covered Defense Information (CDI) and Controlled Technical Information (CTI).

Define the Scope of the Self-Assessment

When finished identifying all CUI, you're ready to scope the environment. To scope the environment correctly, first, determine what systems, applications, and business procedures that process, store, or transmit CUI. Second, define details of how data moves through your network.

NIST 800-171 Self-Assessment Procedure

You can find the self-assessment procedure for all compliance requirements in NIST SP 800-171A. Basically, a self-assessment is performed evaluating all 320 assessment/control objectives. Assessment/control objectives include the determination statements related to a particular security requirement. The 320 assessment/control objectives are divided among 110 separate controls which are included in 14 different control families.

Self-assessment methods include:

- Examining: reviewing, inspecting, observing, or analyzing assessment objects
- Interviewing: discussing with individuals to facilitate understanding, clarification, or gather evidence
- Testing: confirming that assessment objects under specified conditions are met

Organizations are not expected to use all assessment methods and objects in NIST 800-171A. Instead, they have the freedom to determine which methods and objects are best for them to get the desired results.

Must Have a System Security Plan (SSP)

One of the most important requirements for a successful self-assessment is having a System Security Plan (SSP). Not having an SSP is a definite obstacle.

The SSP describes the system boundaries, how the IT system operates, how the security requirements are implemented, and the relationships with, or connections to other systems. It also includes information on security requirements.

Plan of Action & Milestones (POA&M)

To best protect CUI, organizations need to implement the CUI security requirements to the fullest extent possible. But, when some of the requirements are not completely implemented, a POA&M must be generated. The POA&M includes the tasks needed to resolve deficiencies, along with the resources and timelines required.

The purpose of the POA&M is to identify, assess, prioritize, and monitor the progress of corrective actions, allowing the organization to achieve the desired assessment score.

Next month we will discuss: "Submitting Your Basic Self-Assessment Score(s) To The SPRS." HTT

Scan to download a list of cybersecurity acronyms.

Heat Treat Today's
MTI MEMBER PROFILE

Cincinnati Steel Treating

Technicians with a combined 100+ years of metallurgical and heat treating experience . . . one of the largest commercial nitriding departments in the country . . . and the recipient of the 2022 Master Craftsman Award. . . . All of these attributes characterize The Cincinnati Steel Treating Company (CST), a heat treater serving clients in multiple industries, a few being the large gear, automotive, and industrial knife, as well as hundreds of general-purpose machine shops.

The company was founded in 1941 to accommodate the gear industry's metal-treating needs in the Cincinnati, Ohio, area. By 1950, they had diversified and moved to 5701 Mariemont Avenue in Cincinnati. Now, after two major expansions, the 45,000-square-foot facility provides heat treating services nationwide. Some of these heat treat services include: carbonitriding, FNC, sub-zero metal treating, and tool steel processing. The dimensional capacities of their furnaces accommodate large loads of smaller parts as well as parts too large for most furnaces. For example, their pit furnace vertically processes parts up to 120" to prevent warpage, and the max capacity of their car bottom and nitriding furnaces is 8' x 17' x 6' and 57" x 107" respectively.

CINCINNATI STEEL TREATING

In addition to their heat treatment services, CST also provides metallurgical lab testing services and failure analysis for both in-house and outside treated parts. A fully equipped metallurgical laboratory includes a metallurgical cutoff saw, metallographs, microscopes, stereoscopic equipment, and more. The lab includes capabilities for macro-etching, quench oil testing, and other chemical testing for metallic parts. Some applications of metallurgical analysis include tool steel industrial knives, highly alloyed rolling mill rolls, flat-rolled carbon sheet steel products, and carburized and hardened gears. With experience analyzing various types of materials, such as stainless steel, brass, aluminum, titanium, and cast iron, the company's lab analysis has saved CST's clients thousands of dollars, both by helping them to improve their processes and determining the root cause of a failed component.

Heat treatment of long parts

Cincinnati Steel Treating is proud of the difference that it has made in terms of the parts it has heat treated over the years. Two specific jobs stand out; first, heat treating the armor plating of the military's Humvee for combat. The client emphasized that the job was an integral part of saving lives, and the company saw letters from soldiers and their families expressing their gratitude.

The second job was solution treating and aging an aluminum mounting bracket for the external booster rockets affixed to a space shuttle for NASA. These parts were designed to withstand being jettisoned from the space shuttle (with the external booster rockets) once the rockets' fuel depleted. Made of aluminum, the components could more easily disintegrate during re-entry into the earth's atmosphere. CST even purchased a high-speed crane and affixed it to the bridge of their existing overhead crane to maintain the desired quench delay time specific in the military specifications for aluminum. This program ceased when the space shuttle program ended, but the high-speed crane is still used for jobs requiring specific quench delays.

Plans for the future are looking bright as Cincinnati Steel Treating rounded out 2022 with the Master Craftsman Award for Commercial Heat Treater of the Year. At the beginning of 2023, CST added a new IQ furnace and continues to increase capacity and capabilities as needed.

Carburization of gears

Photo source: The Cincinnati Steel Treating Company

For more information, contact

The Cincinnati Steel Treating Company
5701 Mariemont Ave
Cincinnati, OH 4522
Phone: (513) 271-3173

www.steeltreating.com

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Serial Number:	02615 (manufactured 2004)
Max Temperature:	1450°F
Burners:	Maxon 800,000 BTU
Workable Dim's:	36" wide x 72" deep x 36" high
Rated:	480 V, 3-Phase, 60 Cycle, 40 Amp
Max Fuel Demand:	1000 CFH
Controls:	SSI controls
General:	3" x 5" rollers, 8" fiber lined Recirculating fan: Garden City Fan, 20 HP

AFC IQ Furnace with Top Cool

Max Fuel Demand:	Natural Gas – 1,200,000 BTU's
Max Temp:	1800°F
Max Load:	3,500 pounds
Power:	480V, 3-Phase, 60 Hz, 70 Amps
Working Dim's:	36" wide x 48" deep x 36" high
Quench Tank:	3,500 gallon capacity
Flow Meters:	Nitrogen, endo, natural gas, air
Controls:	Allen Bradley PLC SSI Touchscreen (missing) Honeywell digital controls Atmosphere Engineering flow controls
General:	System 1 rear handler Oil heaters Dual Cartridge continuous filtering system

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Batch Temper Furnaces

C0189	Williams Industrial Batch Temper Furnace (30"W x 48"D x 30"H, 1250°F, gas)
U3737	Wisconsin Oven Batch Temper Furnace (24"W x 48"D x 24"H, 1250°F, elect, 48kw, 66amp)
U3764	Lindberg Batch Temper Furnace (33"W x 65"D x 36"H, 1400°F, gas)
U3765	Sunbeam Batch Temper Furnace (30"W x 57"D x 34"H, 1200°F, gas)
U3782	Williams Batch Temper Furnace (36"W x 72"D x 36"H, 1450°F, gas)
U3785	Unique Batch Temper Furnace (40"W x 40"D x 51"H, 1200°F, gas)
U3789	Industrial Furnace Batch Temper Furnace (36"W x 60"D x 40"H, 500°F, gas)
V1170	Grieve Batch Temper Furnace (48"W x 48"D x 48"H, 1100°F, gas)
U3697	B&W Temper Furnace (36"W x 72"D x 36"H, 1400°F, gas)
V1182	Wisconsin Oven Temper Furnace (24"W x 18"D x 36"H, 1250°F, gas)

Batch High-Temp Furnaces

UV1130	Onspec High-Temp Batch Furnace (72"W x 96"D x 48"H, 2400°F, gas)
V1165	Park Thermal Batch Temper Furnace (36"W x 60"D x 24"H, 1850°F, elect)
V1185	Cooley High Temperature Batch Furnace (12"W x 32"D x 16"H, 2000°F, elect)

Car Bottom Furnaces

V1166	Rockwell Car Bottom Furnace (60"W x 121"D x 72"H, 1000°F, gas)
V1179	Tilt-Up Car Bottom Furnace (8'W x 16'D x 8'H, 1600°F, gas)

Internal Quench Furnaces

C0187	Pacific Scientific Straight-Thru Furnace (24"W x 36"D x 18"H, 1750°F, gas)
C0193	Surface Combustion IQ Furnace (30"W x 48"D x 30"H, 1850°F, gas)
U3687	Surface Combustion IQ Furnace with Top Cool (36"W x 72"D x 36"H, 1750°F, gas)
U3718	Surface Combustion IQ Furnace (36"W x 48"D x 36"H, 1750°F, gas)
U3768	AFC IQ Furnace with Top Cool (36"W x 48"D x 36"H, 1800°F, gas)
UV1082	Holcroft IQ Furnace with Top Cool (36"W x 48"D x 30"H, 1850°F, gas)
V1173	AFC IQ Furnace with Top Cool (36"W x 48"D x 36"H, 1800°F, gas)

Vacuum Furnaces

C0170	Seco Warwick Vacuum Carburizer Furnace (36"W x 48"D x 32"H, 2300°F, elect)
C0179	Vacuum Industries Vacuum Furnace (24"W x 36"D x 24"H, 2100°F, elect, 171kw)
U3759	Abar Ipsen Vacuum Furnace (36"W x 48"D x 30"H, 2500°F, elect)
U3803	Abar Ipsen Vacuum Furnace 6-Bar (36"W x 30"H x 72"D, 2500°F, elect)
V1131	Abar Vacuum Furnace 2-Bar (24"W x 60"D x 24"H, 2450°F, elect, 150kw)
V1138	Ipsen Vacuum Furnace 5-Bar (24"W x 36"L x 14"H, 2400°F, elect, 112.5kw)

Mesh Belt Brazing Furnaces

UV1035	Seco Warwick Mesh Belt Brazing Furnace (18"W x 12"H x 10' heated, 2100°F, elect, 120kw)

Pit Nitriding Furnaces

U3727	Surface Combustion Nitriding Pit Furnace (27"Dia x 35"D, 1050°F, electric, 90KW)

Roller Hearth & Rotary Furnaces

V1091	Finn & Dreffein Rotary Hearth Furnace (13'3"ID x 5'3"ID x 4'W x 2'8"H, 2275°F, electric)

Steam Tempering Furnace

U3616	Degussa Durferrit Steam Tempering Furnace (24"Dia x 48"D, 1200°F, electric)

Heat Treat Lines

U3687	Surface Combustion IQ Furnace Line (36"W x 72"D x 36"H, 1750°F, gas)
UV1082	Holcroft IQ Furnace Line with Top Cool (36"W x 48"D x 30"H, 1850°F, gas)

Scissors Lifts, Holding Tables, Conveyors

U3690	Surface Combustion Scissors Lift (36"W x 72"D)
UV1086	Holcroft Scissors Lift & (2) Holding Tables (36"W x 48"D)
U3779	AFC Scissors Lift (36"W x 48"D)

Ovens - Cabinet & Batch

U3752	Precision Quincy Batch Oven (36"W x 36"D x 36"H, 500°F, gas)
U3753	Blue M Batch Oven (24"W x 20"D x 20"H, 1300°F, elect, 25amps)
U3754	Blue M Batch Oven (16.5"W x 16"D x 20"H, 482°F, elect, 3kw)
U3792	Grieve Batch Oven (24"W x 24"D x 24"H, 1250°F, elect)
U3699	Wisconsin Cabinet Oven (25"W x 24"D x 25"H, 650°F, elect, 12kw)

Ovens - Walk-In

C0195	Grieve Walk-In Oven (60"W x 72"D x 72"H, 500°F, elect)
U3788	Wisconsin Walk-In Oven (96"W x 240"D x 96"H, 650°F, gas)
U3791	Jensen Walk-In Oven (72"W x 72"D x 72"H, 600°F, gas)
U3797	Steelman Walk-In Oven (96"W x 96"D x 96"H, 450°F, gas)
U3799	Walk-In Oven (72"W x 72"D x 72"H, 800°F)
U3802	Sahara Walk-In Oven (48"W x60"D x 55"H, 500°F, elect)
V1181	Grieve Walk-In Oven (52"W x 76"D x 72"H, 750°F, elect)

Charge Cars

U3688	Surface Combustion DE Charge Car (36"W x 72"D)
U3763	JL Becker Charge Car DE (30"W x 48"D)
U3762	Surface Combustion Charge Car DE/DP (36"W x 72"D)
UV1085	Holcroft Charge Car DE/DP (36"W x 48"D)

Washers

U3711	AFC Holcroft Washer SD (24"W x 36"D x 24"H, gas)
U3800	Ipsen - Spray/Dunk Washer (36"W x 48"D x 24" H, elect)
UV1084	Holcroft Washer SD (36"W x 48"D x 30"H, 190°F, elect)
U3689	Surface Combustion Washer - spray only (36"W x 72"D x 36"H, elect) with holding station
V1194	Surface Combustion S/D/A Washer (42"W x 72"D x 42"H, 190°F, gas)
C0134	Surface Combustion Washer SDA (60"W x 60"D x 48"H, 180°F, gas)

Endothermic Gas Generators

C0194	Lindberg Endothermic Gas Generator (1500 CFH, 1950°F, gas)
U3594	Atmosphere Furnace Endothermic Gas Generator (3000 CFH, gas)
U3635	Lindberg Hydryzing Endothermic Gas Generator (6000 CFH, gas)

Exothermic Gas Generators

C0196	JL Becker/Gasbarre Exo-Generator w/dryer (4000 cfh)
U3652	Surface Combustion Exothermic Gas Generator (10,000 CFH, gas)

Nitrogen Gas Generators

C0154	South-Tek Systems Nitrogen Generator (2,138 CFH)
C0155	South-Tek Systems Nitrogen Generator (1,000 CFH)

Ammonia Dissociators

U3767	Nitrex Ammonia Dissociator 500cf
V1180	CI Hayes Ammonia Dissociator (500 cfh)

Heat Exchanger Systems

U3787	SBS Air-Cooled Heat Exchanger, 2 fans
U3801	MRM/SBS Heat Exchanger, 1 fan
V1197	SBS Oil Cooler

Water Chiller

U3710	Koolant Koolers Chiller (HCR 20,000 PR-MB)

Water Cooling Systems

U3646	HydroThrift, Duplex Pump Base, Water Cooling System
U3565	Hytrol Conveyor - Roller (48"W x 10'D each)
U3690	Surface Combustion Scissors Lift (36"W x 72"D)
U3779	AFC Scissors Lift (36"W x 48"D)
UV1086	Holcroft Scissors Lift & (2) Holding Tables (36"W x 48"D)

Leak Detectors - Vacuum

U3804	Varian 938-41 Vacuum Leak Detectors

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