

Application Report

AR-148

Positive experience with early models prompts Eastern Metal Treating to opt for today's generation of ThermThief and ImmersoJet burners

When Eastern Metal Treating of Enfield, Connecticut sought to double production capability — in a new 20,000 square foot facility — with the installation of a state-of-the-art austempering line, they opted for a trio of Eclipse products to make it happen. “It was an easy call,” says vice president Bob Lyman who, with dad Larry, president, was in charge of the

one operates on a North American burner system, the other with an Eclipse system.”

“The Eclipse system consists of early models of both ThermThief (Model 63 TFB without recuperators) and ImmersoJet (IJ) burners. Over the 10 years both lines have been in operation, we found the Eclipse burners to be superior across the board. They light more reliably and heat up more rapidly. We also experienced significantly longer radiant tube life with the Eclipse TFB system than with the North American counterpart. When it came time to specify burners for the new austempering line...the choice was obvious,” says Bob Lyman.

Eastern Metal Treating provides metal treating services for numerous manufacturers in diverse industries — from automotive to fasteners — on a regional basis...predominately New England. Says Larry Lyman, “Austempering is a hardening process most generally utilized for medium and high carbon steel parts to achieve a bainite — hard but ductile — structure in the metal. It's a three stage process. Parts such as metal stampings or fasteners are emptied from their containers into a hydraulically operated dumper. The dumper in turn loads the parts onto a magnetic feed conveyor. The feeder distributes the parts onto the hardening furnace belt. The parts are



In the first stage, parts are conveyed into the 3-zone 1500° F hardening furnace heated by 14 Eclipse ThermThief (Model 30 TFB) burners firing horizontally into radiant tubes equipped with Bayonet-Ultra recuperators at 3,000,000 BTU/hr.

expansion project. “We had two 10 year old austempering lines operating in our existing 10,000 square foot facility when we decided to relocate and expand our capability in response to market demand. The lines are identical in size and design except that

conveyed through the 1500° F hardening furnace in which an Eclipse programmable temperature controller maintains an endothermic gas atmosphere — the ratio of nitrogen/hydrogen to oxygen — which protects the parts from oxidation.”

When the parts exit the austempering furnace, they are dropped into a molten salt bath, operating in a range of 500° F to 750° F, which quenches them and where they achieve the desired end hardness. After leaving the salt bath, they are conveyed into a



The austempering line at Eastern Metal Treating is a four-stage process. Parts are heat treated in 3-zone 1500° F hardening furnace, quenched to one desired hardness in a molten salt bath, desalinized in a cold water washer, and desalinized and rust treated in a final hot water washer.

cold water washer, designed to desalinize the parts, and then on to a second hot water washer which removes any residual salt and may contain a caustic cleaning solution or a rust inhibitor. The four stage system is capable of processing up to 2000 lbs./hr. of austempered heat treated parts.

TFBs fitted with Bayonet-Ultra recuperators deliver max efficiency in three-zone furnace

On Eastern Metal’s new continuous mesh belt austemper furnace line, custom designed and constructed on site by Thermal-Basic, Inc. of Enfield, Connecticut, 14 Eclipse ThermThief burners (Model 30 TFBs), fire into horizontally mounted radiant tubes to heat the three zone furnace to a total of 3,000,000 BTU/hr. Eclipse Bayonet-Ultra recuperators are installed in the

exhaust leg of each of the U-shaped radiant tubes to recover the thermal energy from the exhaust gases and return it as preheated combustion air to the respective burner. Says Bob Lyman, “The Bayonet recuperators represent a huge improvement in the austempering process. By returning hot exhaust gases to the combustion process, they significantly boost the furnace’s efficiency, cut fuel costs, and lower NOx and CO emissions.”

Eclipse ThermThief tube-firing burners (TFBs) produce precise, uniform temperatures for better part quality and longer tube life. They are designed to efficiently fire radiant and immersion tubes with inputs up to 2,000,000 BTU/hr. Their uniform corkscrew flame enhances heat transfer by actually, “scrubbing” the inside of the firing tube, removing the gas film boundary layer and adding to tube longevity as well as providing consistently uniform process temperatures.

Designed to fit into the exhaust leg of “U”, “O” or Trident-type radiant tubes, Eclipse Bayonet-Ultra recuperators are encapsulated within the furnace wall to minimize heat loss to the external furnace area. Their large multi-tube surface area recovers heat from the high temperature exhaust (up to 2100° F) and returns it to the combustion process for fuel savings of up to 30%.

Eastern Metal’s new austempering furnace also features an alloy/silicon carbide hearth, water cooled Thermal-Basics (TBI) high temperature fans, automatic carbon control and lightweight fiber insulation.

Proven ImmersoJets specified for salt bath process

Heating the integral salt bath, which contains over 75,000 lbs. of molten salt, are two ImmersoJet-4 v.2.00 burners — each rated for up to 1.8 M BTU/hr. — firing into immersion tubes at 1,000,000 BTU/hr. each for 2,000,000 BTU/hr. total. Says Bob

Lyman, "I was on hand ten years ago when components for the two original austempering lines were specified. The IJ was a new Eclipse product at the time and, believe me, everyone involved in the project, both at Eastern and Eclipse, respected that reality. But we specified the burner anyway primarily because we were confident — based on years of experience — that Eclipse would do whatever it took to make sure the new IJ product would meet or exceed our expectations...or, should I say, our hopes. Plus, we were the first Eclipse customer to specify the IJ for a salt melting operation. To be honest, there were some wrinkles that had to be ironed out...but Eclipse took care of them all. After that early fine-tuning, I'm pleased to say that those vintage IJs have performed beautifully ever since. So, once again, when it came time specify immersion burners for the new line, we went with Eclipse."

"In the last ten years, and in keeping with its long-standing tradition, Eclipse has made continuous improvements in all of its products and systems...and the ImmersoJet is no exception. Today's IJ is a marvel of efficiency and simplicity. We've had no problems whatsoever from the moment we first fired them up in the new salt bath tank. And, thanks to the compact design of the ImmersoJet, we were able save valuable space inside the tank while increasing the heat transfer rate for greater efficiency."

ImmersoJet packaged burner/blower systems from Eclipse Combustion deliver maximum 80%+ heat efficiency and space-saving tube requirements. Combustion gases from the burner scrub the inner tube surfaces to produce the highest heat transfer rate available. ImmersoJet also provides faster heat-up times than any other immersion burner.

Other user preferred features of the new generation IJ burners include a redesigned combustion chamber which is outside the tank, taking up less space and providing more

uniform heat; a unique nozzle design to ensure quiet operation; and ease of installation.

The heated washer — the fourth and final stage of austempering process — utilizes an Eclipse Model 30 TFB, firing into an immersion tube, to heat the 1500 gallon tank to an operating temperature of 160° F. "Again, it was selected because we know it to be reliable, easily maintained and competitively priced," says Larry Lyman.

Veri-Flame controls selected for reliability; value

The control panel for Eastern Metal's new austempering system includes Eclipse single loop temperature and over-temperature controllers, a programmable logic controller,



Eclipse Veri-Flame burner controls and other diagnostic components. A TBI semi-closed loop cooling system helps keep fans, hot pulley bearings, and cooling jackets cool utilizing a non-toxic coolant.

Says Bob Lyman, "We didn't hesitate to specify Eclipse burner controls for the new austempering line. The Veri-Flame system has been our standard for years. We have found it to be an excellent value for cost...at least as reliable as much more costly products."

Upon exiting the austempering furnace, parts are quenched in a stainless steel molten salt tank heated to an operating range of 500° F to 750° F by two ImmersoJet burners firing at 1,000,000 BTU/hr. each. Finally, the parts are desalinated and treated with a rust inhibitor in a water washer (far background) heated to 160° F by a single Eclipse Model 30 TFB firing into an immersion tube.

Eclipse Combustion's versatile Veri-Flame systems provide microprocessor-controlled monitoring for single and multiple burner systems. Each Veri-Flame Monitoring System will control the startup sequence and monitor the flame of an individual gas, oil or combination gas/oil burner. Three basic models are available: Purge, No Purge and Modulation. Furthermore, each model comes in a range of performance specifications to fit a variety of custom applications.

DIP switches, conveniently located on the back of each Veri-Flame unit, make it a snap to set sequence and timing functions and to configure the system. Says Larry Lyman, "A great feature of this combustion system is that the burner controls allow the burners to shut off and pass high fire air only for speedy temperature reduction changes."

Trouble free startup; unexpected benefits

Total system installation time — from order placement to startup — was 8 months. "Not a long time, considering the relocation to a new facility and the scope of the project," says Bob Lyman. "In all of my years in the business, I've never seen an installation and startup go smoother. And due to the continuous improvements Eclipse has made in their products over the years, every component in the system has been performing great ever since. Of course a lot of the credit for that goes to Rod Fuller, our regional Eclipse factory rep, who saw to it that the job was accurately sized and speced from the get go and closely monitored the project from initial ordering to installation and system startup."

"Even though the Eastern Metal installation involved burners and controls from our standard line," says Eclipse Combustion factory rep Rod Fuller of Vernon, Connecticut, "each product was nonetheless designed and manufactured specific to the application...as is the case with every burner in each combustion system we sell. The factory rep's job is to provide local support for the customer...to assist in the final project design, specifications and layout; oversee installation and startup; and ultimately review and evaluate the working system." Says Fuller, "In this business there's no such thing as one size fits all. But having said that, even I was impressed by how trouble-free the installation and startup went down. It was a beautiful thing!"

According to Bob and Larry Lyman, Eastern Metal Treating's production has more than doubled since the installation of the new austempering line — producing up to 2000 lbs. per hour as designed. Part quality is more consistent than on the old lines. Although a preventive maintenance program is in place, no failures have been experienced since the system startup. Says Bob Lyman, "Another unexpected benefit we've realized is a boost in employee morale...and a pervasive sense of pride. Everyone at Eastern is proud of our investment in this state-of-the-art new austempering line. It's made it possible to grow our business, better serve our customers, and position ourselves for the next century. We couldn't be more pleased."

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