

Application Report

AR-144

Eclipse Combustion installs state-of-the-art environmental powder coating line for top quality burner part finishing

As one of the world's leading producers of industrial heating systems, Eclipse Combustion, Inc. is keenly aware of the importance of well-engineered systems to processing and manufacturing production lines. The company's integrated combustion systems and controls play a critical role in maintaining product quality, efficiency and productivity for customers in a broad range of industries.

When Eclipse management decided to upgrade the parts finishing operation at its manufacturing headquarters in Rockford, Illinois, a team of managers and engineers set out to determine whether the latest finishing technology, supported by Eclipse's own state-of-the-art burners and control system, would be a worthwhile long-term investment.

The existing liquid paint system, in place for many years, was not only time- and labor-intensive, but also presented quality perception problems. Dan Mills, Director of Manufacturing, explains: "Our customers know we produce high quality, reliable burners. But when paint chips off components either in house or in the field, it creates a negative impression. A high quality product should look the part. It deserves a good-looking, long-lasting finish — and that was our aim. We also wanted a system upgrade that would streamline the finishing process by speeding up cleaning, coating and drying time. We have no doubt these improvements will help us increase overall productivity and capacity to meet customer demands."

Initially, the selection team evaluated alternative versions of traditional liquid paint coatings, including high solids and water-based finishes. However, with ever increasing OSHA and EPA regulations strictly limiting VOCs and other hazardous exposures and emissions, they decided instead to take a closer look at today's most environmentally advanced finishing technology — powder coating. Although powder coating (PC) systems are more expensive than liquid coating systems, they provide a multitude of benefits that can more than offset the additional cost.

Planning and Designing a State-Of-The-Art System

Based on careful research and several visits to other manufacturers using PC systems, Eclipse made the decision to commit to the substantial investment required to install a PC parts finishing line incorporating the most up-to-the-minute, environmentally sound technologies available. Several key factors were considered during the early planning and design phase.

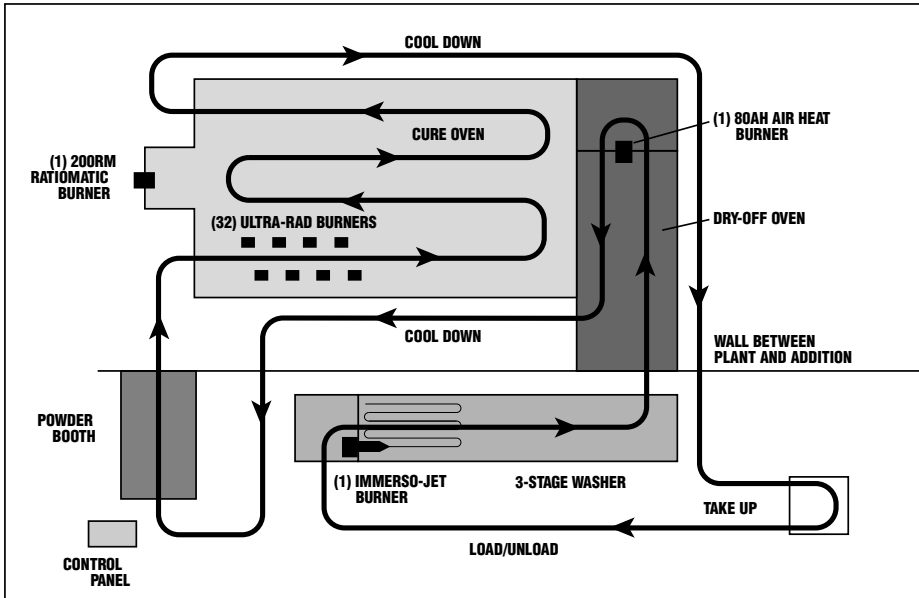
Logical Workflow. A complete evaluation of the burner production line was conducted to determine how to reconcile the batch-type nature of PC systems with Eclipse's cell-type manufacturing process. The decision was made to alter the existing workflow pattern by routing all burner part castings directly to the PC line first, even before machining. Once parts are powder coated, they are transported to the appropriate cell for machining, assembly and final inspection.



Inside the powder coating booth, parts are sprayed manually by an operator using an electrostatic spray gun. A powder reclamation system gathers and recycles excess powder residue.

Range of Parts. The wide range of parts needing finishing – from small light gauge sheet metal fabrications to large heavy castings – required special design and custom heating solutions.

Space Constraints. Interior space limitations necessitated the design of a compact system to be situated adjacent to an end wall of the plant. An extension



Compact, speedy and efficient, Eclipse Combustion's new powder coating line has improved part surface quality and significantly reduced the time and labor required to finish burner parts before they are machined, assembled and inspected.

was added to the plant exterior to accommodate the dry-off and curing ovens. And, to provide automatic transport of cast metal parts throughout the PC line, an enclosed track monorail conveyor was designed.

Environmental Criteria. Once the decision was made for a powder coating system, the Eclipse team formulated its performance and environmental objectives. One of these was to seek out and specify the most technologically advanced equipment — including the spray wash system, conveyor, PC booth, and dry-off and curing ovens. The goal was to ensure that all emissions and wastewater would not only meet, but far exceed, federal and local standards. As a manufacturer, Eclipse has set the standards worldwide for effective emissions control in industrial heating systems — and the selection team wanted to ensure the rest of the PC system offered the same environmental advantages.

Supplier Selection Criteria. To assist in the selection of primary suppliers of equipment and components, design and engineering assistance, and installation services, Eclipse designed a spreadsheet-style decision matrix that would enable accurate comparisons of eligible suppliers and their product lines. The matrix ranked criteria such as product technology, quality standards, technical support and service, financial stability, geographic considerations and price/value ratios.

Ultimately, Eclipse selected Precision Quincy to provide the ovens, wash tanks and conveyor line, and Nordson to supply the coating booth, spray guns, powder application equipment and powder reclamation system. Eclipse provided its own state-of-the-art conventional and infrared burners, and designed control, monitoring and burner safety systems.

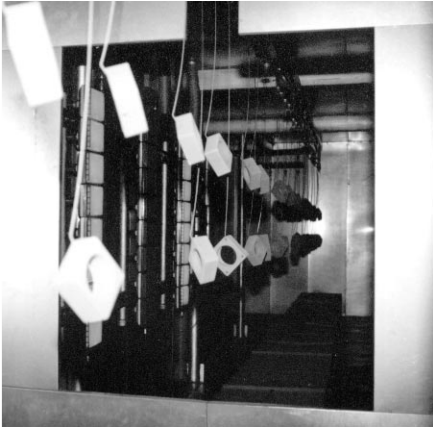
The New Powder Coating Line: A Model of Efficiency and Control

The new powder coating line has been up and running since November, 1995 and meets all of the performance and productivity criteria. In the take-up area, 300 to 400 of the 40- to 50-pound incoming metal castings are loaded onto the monorail conveyor, which can run at speeds ranging from two to ten feet per minute (fpm). Traveling at an average speed of six fpm, the full powder coating cycle takes about 80 minutes total, from raw part to finished part. This cycle includes:

Three-Stage Wash. Parts progress through a three-stage wash system, 9.3 feet high by 34 feet long by 7 feet high. In the first phase, parts are sprayed with a cleaning solution and phosphatizing chemical in an 1100-gallon tank. In phase two, they are sprayed with clear water in a 600-gallon tank. And, in the third and final phase, they are sprayed with a water solution that includes a chemical sealer to inhibit rust formation and prepare the surface for powder coating.

The entire washing system is a closed, "no-dump" system that eliminates any hazardous wastewater. The wash water in the tanks is heated to a temperature of approximately 145° F by an Eclipse IJ ImmersoJet heater designed for high efficiency (greater than 83%).

Four banks of Eclipse UltraRad™ infrared burners line the interior of the curing oven to quickly gel the powder coating. At the far end, an Eclipse 200 RM Ratiomatic burner provides consistent convection heating for the final cure.



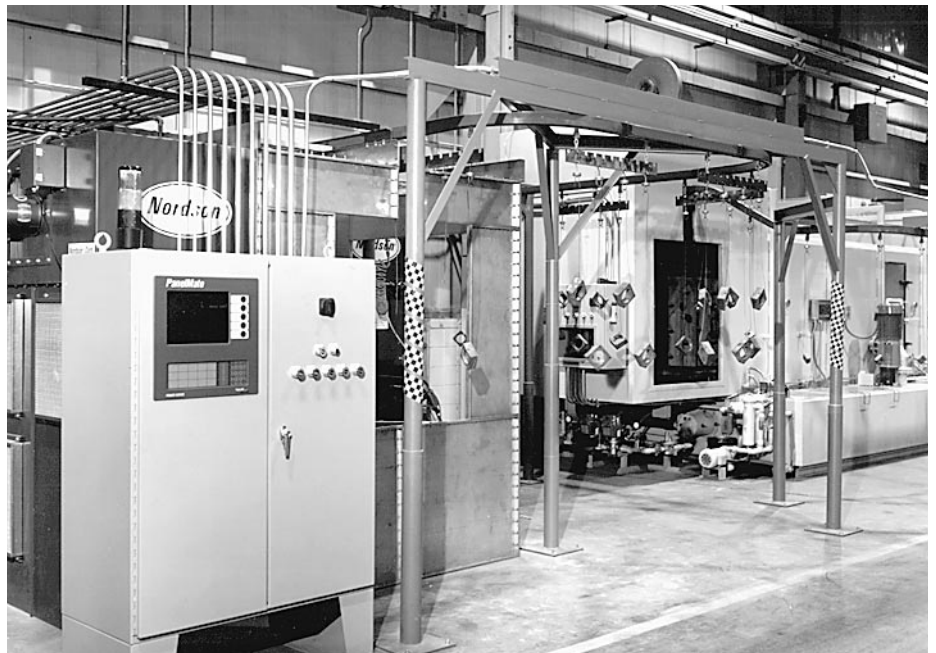
Dry-Off Oven. The parts are dried for approximately 12-15 minutes in a drying chamber where an Eclipse 80 AH Air Heat burner maintains a constant temperature of 350°F.

Cool-Down. During this 9-10 minute transport to the powder coating booth, the parts are cooled down to about 100° F.

Powder Coating Booth. In this 11 by 11 by 9-foot booth, the powder is applied evenly to all part surfaces using electrostatic spray guns. Working with its material supplier, Eclipse has been able to formulate a close match with its "signature" green color. A powder reclamation system collects any overspray and recycles it back into the system, so there is no waste to dispose of.

Curing Oven. Here the powder finish is set, cured and baked to a hard, smooth and durable finish. In the oven's first stage, two to four banks of Eclipse UltraRad™ Infrared Burners, mounted along an 8-foot path, quickly bring the dense cast metal parts up to the temperature required to quickly set the powder coating into a gel-like consistency. In the second stage, an Eclipse 200 RM Ratiomatic burner, operating at 390° F, provides efficient convection heating for the final baking. After exiting the oven, the parts receive their final cool-down during transit back to the load/unload area.

System Control, Display Panel and Burner Safety System. Designed internally by Eclipse, the sophisticated process control system provides precise, yet flexible control, plus complete status monitoring and diagnostics of every operation. At the heart of the system is GE Fanuc's Genius Bus PLC 9030, a microprocessor-based programmable controller which starts and stops the system, and runs all of the stepper motors, pumps, electricals and temperature controls smoothly and efficiently. Each stage of the process has a separate control panel that permits stand-alone control of a single operation, should that be required. The master control panel incorporates an easy-to-operate, graphical machine interface — a digital display screen that provides operators full access and visibility, providing set-up screens, status screens, alarm functions and more. To assure burner flame safety, Eclipse VeriFlame™ Safety Systems are installed to monitor three of the four Eclipse burners.



A remote programmable logic controller provides complete system control as well as automatic monitoring, feedback and diagnostics. The master control panel, with built-in graphical display screen, is easy to operate and offers full visibility of every phase of operation.

Early Results: Increased Productivity, Better Quality Finish

Although the new powder coating system is still in the process of being fine-tuned, early results are overwhelmingly positive. For Eclipse customers, the primary benefit is quality related. The surface finish of burner components is now smoother, harder and more consistent, resulting in greater durability and abrasion resistance over their long service life.

From a production point of view, Eclipse has already realized measurable benefits, as well. Air emissions have been reduced to virtually zero, since no solvents are used and steam is the only substance released into the atmosphere. Finishing of up to 400 parts at a time can now be accomplished in less than 90 minutes, compared with one or more days with the previous system. The result is higher productivity with a significant reduction in time and labor costs. The new powder coating system has also eliminated the "hidden costs" previously incurred when parts required repainting.

According to Mills, Eclipse views the \$350,000 finishing system upgrade as an excellent sales and marketing tool. "The powder coating system is an ideal showcase for Eclipse industrial heating systems," he notes. "As we continue to develop more advanced burner and control technologies, we plan to incorporate them into the line. Even now, we're looking at a reverse osmosis (RO) system for the wash tanks that will enable wash water to be filtered, cleaned and recirculated. Our goal is to maintain this system as state of the art, so our customers can see first-hand the benefits to be gained from well-designed, expertly implemented systems within their own manufacturing and processing lines."

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