PROCESS HEATING

A Special Supplement to *Energy Matters*

Indirect-Fired Kiln Conserves Scrap Aluminum and Cuts Costs

One successful example of a waste heat recovery application is at Wabash Alloys (formerly Roth Bros.), an aluminum recycler and provider of aluminum alloy in East Syracuse, New York. A demonstration project conducted at this plant by Energy Research Company (ERCo), of Staten Island, New York, involves a new energy-efficient kiln that heats scrap aluminum for reuse. This kiln has enabled Wabash to reduce metal loss and emissions of volatile organic compounds (VOCs) and, in addition, has reduced kiln energy use by more than half.

Aluminum scrap can be reused if it is decoated of oils and solid organics, such as rubber and plastics. ERCo's process uses an indirect-fired controlled atmosphere (IDEX™) kiln, which is better than traditional kilns at processing unwanted substances and reducing VOC emissions, product loss, and energy requirements. Thus, operational costs are also reduced. Figure 1 shows the IDEX kiln installed at Wabash Alloys.

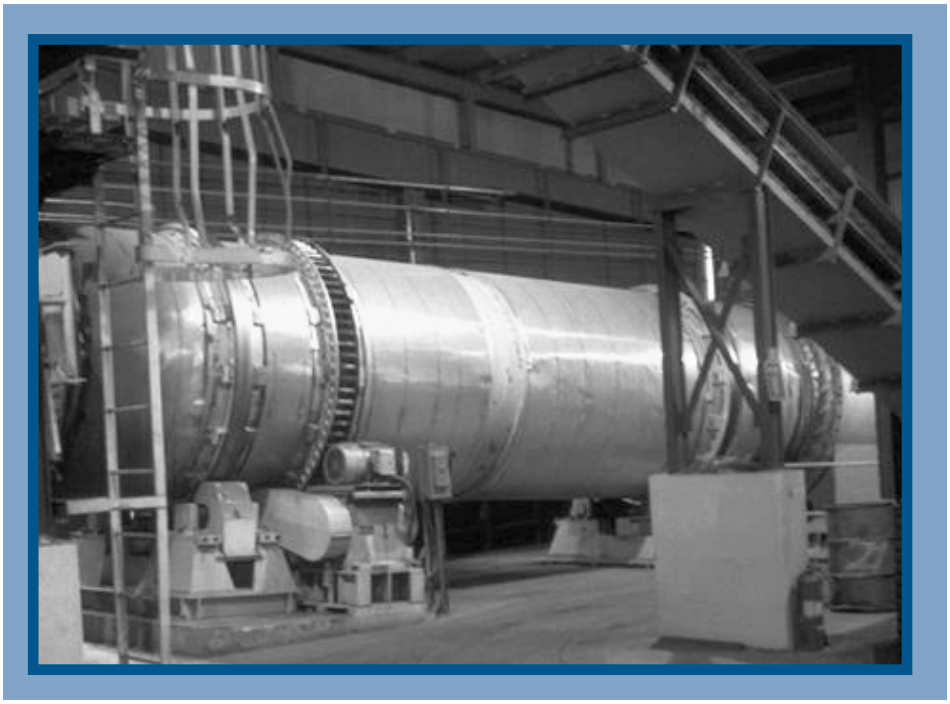

Figure 1. IDEX kiln at Wabash Alloys.

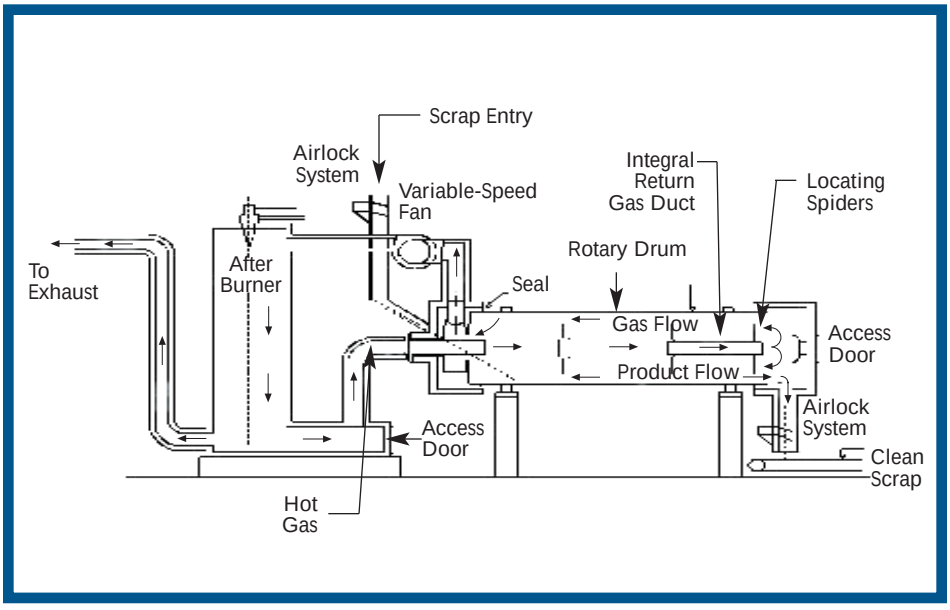

Figure 2. Schematic of IDEX kiln.

In the kiln, gases heated to 1500°F enter a center tube (Figure 2) and flow parallel to the scrap aluminum in a rotary drum while the center tube indirectly heats the scrap. The heat from the gases vaporizes the organics, but because the oxygen concentration is kept below the organics' flammability limits, no combustion occurs.

The gases are then passed to an incinerator that elevates their temperature to 1500°F. The organic vapors combust, which releases heat and destroys the VOCs. Part of the gases are vented and part are recirculated back to the kiln via a fan. The hot recirculated gases perpetuate the kiln heating and vaporization process.

Upon exiting the IDEX, the cleaned aluminum scrap is fed into a furnace where it is melted to produce specification ingots for die casters.

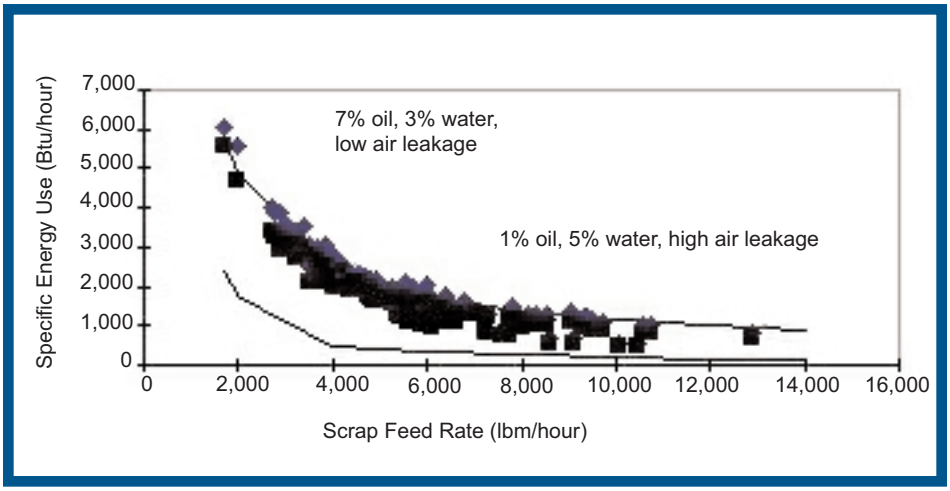

Figure 3. IDEX specific energy use.

Energy Savings

Figure 3 shows the measured specific energy use of the IDEX at Wabash Alloys, which is an energy savings of 55% over conventional equipment. Furthermore, the scrap is at 628°F after being processed by the IDEX; if this hot scrap is fed into the furnace, an additional energy savings of 370 Btu per pound of mass (Btu/lbm) is possible, for a total savings of 820 Btu/lbm.[1]

If air leaks are eliminated and preheated scrap is utilized, this technology could save 3 trillion Btu per year in the secondary aluminum market alone.

Loss Reduction

Furnace measurements were also taken. With the IDEX making up only 20% of the furnace feedstock, metal loss was reduced from 8.2% to 7.5% on one set of furnace data runs. Using this data, it is estimated that loss could be reduced by 2.8% for a metal yield gain of 2.35 million pounds per year per unit.

In Figure 4, scrap metal that has been processed using a conventional dryer is being charged into the furnace. Flames are clearly visible, indicating the presence of organics that are burning and oxidizing the metal. In Figure 5, the scrap charge has been processed in the IDEX. The only flames visible are those left over from the previous charge.

Neal Schwartz, who was general manager of Roth Bros. at the time of the installation, said, "The quality of the scrap that comes out of the IDEX is much much better…[when] we were using the older technology, scrap would burn and smoke... now we get a better product and there is no smoke at all, and we are really very happy with it."

Figure 4. Conventionally processed scrap being fed to the charging well.

Figure 5. Scrap that has been processed by the IDEX kiln sitting in charging well.

Emissions Reduction

Emission measurements were taken from the IDEX by Galston Measurement of Syracuse, New York. Nitrogen oxide (NO_X), sulfur dioxide (SO_2), VOCs, and particulates were measured to be at 19%, 2%, 2%, and 6%, respectively, compared to New York State's Department of Environmental Conservation standards.

The EPA has proposed emissions regulations for scrap dryers.[2] The IDEX meets and betters these EPA-proposed standards in all measured categories.

Project Participants

This project was funded by DOE's National Industrial Competitiveness through Energy, Economics, and Environment (NICE^3) program and the New York State Energy Research and Development Authority. Other participants in the project included O'Brien & Gere, of Syracuse, who built and installed the equipment, and two technology marketers—Gillespie & Powers of St. Louis, Missouri, and Stein Atkinson Stordy, of Wolverhampton, United Kingdom.

By saving energy, reducing emissions, improving product quality, reducing solid waste, and decreasing operating cost, the IDEX kiln clearly has a bright future in the aluminum industry.

For more information on this project, contact Bob DeSaro at (718) 442-2725 or rdesaro@er-co.com. ●

[1]Due to scheduling problems, Wabash Alloys does not feed the scrap immediately into the furnace, and so does not take advantage of the preheating.

[2]EPA CFR Part 63 [IL-64-5807;FRL].

To read a similar article about a heat recovery application involving high-temperature annealing in the steel industry, see the Energy Matters Extra Web site at www.oit.doe.gov/bestpractices/explore_library/emextra/.