Color TV Gives A Clearer Picture From Inside The Kiln

Allentown Cement Co.'s Evansville, Pa., facility installed a closed-circuit television system that produces clear color images from inside its kilns

by Steven Prokopy

Beginning in 1991, Allentown Cement Co.'s Evansville, Pa., works began to upgrade its combustion viewing system. In each of its two kilns, workers installed an air-cooled, solid-state, high-temperature, closed-circuit system that televised color images of the flame, the clinker load, and the walls of the kilns.

Typically in a cement plant, workers watch the firing process through a porthole, holding a blue glass filter to their eyes to cut down the light.

In 1965, the plant installed a water-cooled, black-and-white vidicon tube TV viewing system in the front of the two 520-ft-long, 15-ft-diam dry-process kilns. Since this system only showed general conditions, the kiln operator still would have to "eyeball" each kiln using the blue glass filter.

Viewing the color images the new system provides on monitors in the plant's central control room, operators can adjust coal feed, clinker cooling rates, and other variables. According to Plant Manager Dennis Wanner, the system, designed by Lenox Instrument Co., allows for a clearer picture than actually looking into the kiln.

Installed at the upper-left side of the kiln's firing hood, the system, called FireSight, views in the same direction as the flame being blown from the coal pipe. Its 90° field of view covers the complete flame on the end of the coal-feed pipe about 12 ft away; the sidewalls, top and bottom of the kiln; and the clinker being formed.

The camera's air-cooled quartz lens can see 15 to 25 ft into the kiln, as compared to the old vidicon cameras, which could only observe a few feet at the front of the kiln and provided a hazy image.

"The camera views the ignition from the pipe, and the configuration of the flame, so you can gauge the efficiency of the combustion," said Wanner. "If you have an extremely cold kiln, you'll see a long, black plume because the coal travels farther before it ignites and combusts. If the kiln is up to a good operating temperature, the coal ignites right at the tip."

In the plant's computer-aided central control room, the televised color images appear on two monitors, one for each kiln. The monitors give an extra visual dimension to the numerous gauges and indicators showing temperatures, air flow, kiln speeds, and cooler speeds. The operator in the control room can manually operate a motorized iris and spot filter in the lens to adjust the amount of light reaching the camera.

Plant personnel in the control room can watch coal igniting at the tip of the feed pipe inside the kiln on a monitor like this one. Corrective measures can be taken if workers spot problems.

How it works

The older vidicon camera was cooled by both water and air. Water obviously is an inherent problem with electricity. In addition, dirt and dust would cover the old camera so quickly that it had to be cleaned weekly. This new system does not have trouble with dirt or dust because it uses pressurized air and an air filter. In fact, the only maintenence this system requires is an annual changing of the air filter.

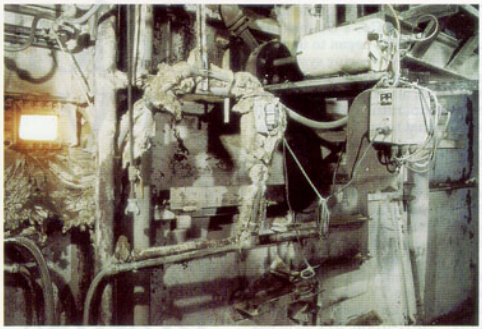
The system is mounted at the discharge end of the kiln within a wall box, which circulates primary cooling air under positive pressure from a mechanical air conditioner. An air filtration system removes aerosols, vapor, oil, and particles as small as 0.03 microns from this air.

A lens tube within the wall box encloses and protects a quartz objective lens at the tip of the tube, a series of achromatic relay lenses that carry the image of the flame back to the

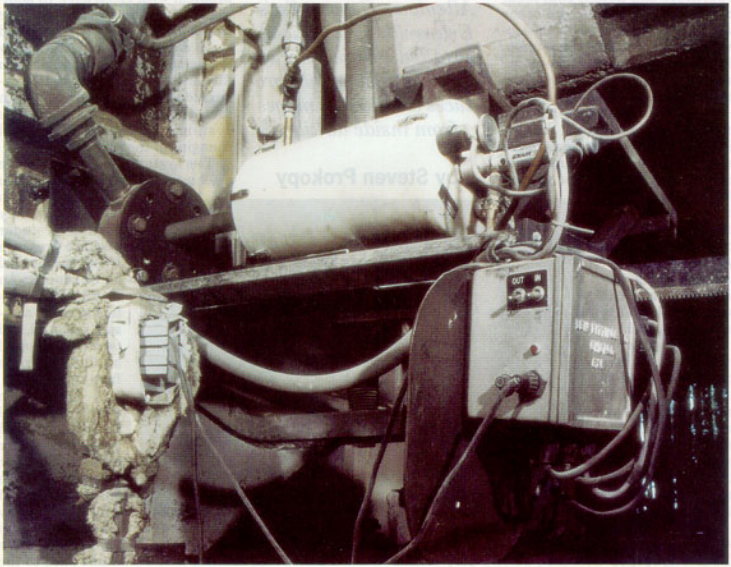
camera. The camera itself is located at the base of the tube. The pressurized air goes through the tube, cleaning and cooling the camera and lens before it goes out the front end of the tube.

The furnace lens, flush with the interior wall of the kiln, provides 90°, 60°, 45°, 30°, or 15° field of view. Thus, the operator can view directly along the axis of the scope, at a right angle to the axis, or forward obliquely from the axis. The lens also contains the motorized iris, which the operator can actuate to adjust the amount of light. The camera has a durable CCD solid-state chip that can withstand temperatures of 3,500° F and is similar to those that televise combustion from rocket engines.

The system is equipped with automatic retractors so that it can be pulled back about 2 ft if the kiln shuts down. This gives the lens additional protection from the heated air that would blow against the lens if fans stopped and negative pressure back into the kiln changed positive pressure toward the front of the kiln. "During the past four years, the automatic system has saved us quite a bit in terms of potential damage to the camera," Wanner said. ■



The camera's white cylindrical heat-resistant nylon housing is outside the kiln at Allentown Cement in Evansville, Pa. The lens tube of the closed-circuit camera extends through the wall of the kiln.



A close-up of the nylon housing.

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