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Faster and Cleaner Iron Melting ... on its way to China

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The new cupola system slated for Weichai Power boasts a 38 tons/hour melt rate with pollution control never before seen in Chinese foundries.

Weichai Power Ltd. is one of the main diesel-engine manufacturers in the People's Republic of China, its products used in heavy-duty vehicles and buses, construction machines, vessels, and generators. Providing the engines strictly for Chinese domestic use, Weichai Power boasts a nationwide service network and a strong research-and-development component. Its WD615 and WD618 diesel engines have more than 60 percent of the Chinese heavy-duty-vehicle and construction-machine markets.

What it hasn't had is a way to produce gray iron economically in large quantities without the pollution problems characteristic of China's heavy industries. But, that has changed. Weichai Power is preparing to place online a new 38 tons/hour cupola melting system with state-of-the-art pollution control to provide molten metal for the production of 10-13-liter engine blocks. The melt system comes via a partnership of U.S. firms, spearheaded by [Electric Controls & Systems Inc.](#)

Birmingham-based EC&S is responsible for integrating the individual molten-metal-production equipment under centralized control. Its partners are [Kodiak Group](#), as design engineer and supplier of various equipment; [Wrib Manufacturing](#), providing a long-campaign — 10-12-weeks — cupola and blower to supply air to the cupola; [Maumee Valley Fabricators Inc.](#) Escher division, responsible for a hot-gas recuperator and waste-gas coolers; and [GMD Environmental Technologies Inc.](#), providing baghouse emission-control equipment.

"December 2006 will be the debugging month for the Weichai Power cupola, and we want iron by the last day of January 2007," says Greg Bray, president of EC&S.

Higher melt rate, less emissions — While China has literally thousands of cupolas, most of these range in melt rates from 2 to 5 tons/hour with short campaign lengths of only hours, or a few days at most, and none offer extensive integrated emission control. Contrast that with U.S. iron foundries, averaging about 35 tons/hour melt rates with multi-day campaigns and the latest in emissions-control technology.

With three bidders on this project, the winning team was able to harness the leading-edge technologies of each partner and wow the Weichai Power team with a high-tech presentation, according to Alabama's Birmingham Business Journal. That report pegs the design-build effort as a \$12-million project. And, because Weichai Power wanted its bidders to match the environmental standards required in suppliers' home countries, the cupola project boasts emission control in line with the newly enacted MACT (maximum achievable control technology) standards, and related U.S. EPA requirements.

So what will Weichai Power get for its investment in the U.S team? "The long-campaign scrap-charge cupola will operate between 10 and 12 weeks before it drops bottom," says Rick Rubin, co-owner of Wrib Manufacturing. "I read some articles dealing with foundries in this particular area of China where this cupola will be installed, and one company brags that it can melt three tons per hour. This one can spill more than that. And, they have not heard of a campaign length of much over two days. This will really be something for them to see. We brought some Weichai Power officials to the United States to see some of our cupolas operating and talk with some of the people running them, and those officials were amazed."

Escher is supplying the hot-gas recuperator, according to Robert Schuler, project manager for Escher. The company also is manufacturing waste-gas coolers to be installed downstream from the recuperator, to cool gases down from about 1,100°F for baghouse filtering.

"The heat generated by burning carbon monoxide in the combustion chamber is utilized in the hot-blast recuperator, to preheat combustion air to be returned into the cupola," Schuler explains. "That amounts to about 17,000 standard cubic feet per minute of air being preheated to 1,000°F."

Waste gases cool from about 1,500° to 1,100°F by the time they reach the flue-gas coolers prior to entering the baghouse units.

"Chinese companies are not well-versed in recuperative hot-blast furnaces, waste flue-gas cooling and baghouse technology," he says. "This is new technology for them."

GMD Environmental is providing what Gerald Reier, president, describes as the cupola emission-reduction system.

"It consists of eight modular baghouses, and each has approximately 300 bags fabricated from DuPont Nomex," says Reier. "We are furnishing everything from the inlet manifold — the air inlet for the dust collectors — through the exhaust stack. That includes those baghouses, related ducting, dampening equipment, the induced-draft fan, and the stack."

"Until recently," Reier continues, Chinese foundries have not even looked at meeting the kind of emission-control standards that we provide with our equipment."

Kodiak Group is responsible for project design engineering, including all of the mechanical and structural layouts and details.

"We are designing all of the flue-gas flows, including the combustion-air requirements, and also designing for the additives system, which would be the coal conversion," explains Howard Wood, Kodiak Group president, noting that his company's scope on the project includes practically designing the Btus throughout the entire system. That coal-conversion facet includes everything from coal hoppers under the 'grizzly' grid to vibratory equipment that feeds the elevating conveyors. "Some of the conveyors we are designing inhouse, and some are being purchased," he adds.

Also designed by Kodiak Group: the weigh system for the coke, stone, and scrap metal; scrap-yard trim deck; cupola charge system; and the structural tower. The company also is supplying equipment such as the below-charge takeoff, charge bucket, charge car, and charge-bucket bail.

EC&S is providing integration of all individual system components via inhouse-designed controls.

"We are integrating from the main incoming power all the way down to the control power, plus the actual control system," explains Bray. "We'll make sure that the cupola works as an individual piece of equipment, but at the same time works in conjunction with the recuperator cooler and the baghouse. If there's an upset condition or something happens, every system component changes its conditions to match up."

MACT standards foster partnership — The project partners describe the Weichai Power cupola installation as a close cousin to the system recently placed online at Ward Manufacturing's steel coupling plant in Blossburg, PA. And, it was the ability of the partners to unite in this way that led them to numerous projects, chiefly in the United States, since 2000. Their partnership grew out of rumblings about the iron-and-steel-foundry MACT standards, enacted in 2003.

"Back when the EPA started talking about the new MACT standards, around 2000, I contacted these major foundry-equipment suppliers and said, 'Something is going to happen here and there is going to be a lot of work coming up on cupolas,'" recalls Bray. "Electric Controls & Systems had done work individually with all of these companies and they had, in turn, worked with each other individually on various projects. We got together and decided on a team approach and they asked that I lead the team. We actually do not have anything formally signed between us, but have stuck together for these projects."

The exception to that scenario is GMD Environmental, which joined the partnership later, in 2002.

"We are the latecomer into this group, but had been part of the MACT standards early on, and in a substantial way, because we were involved in foundry projects used in MACT evaluations," says Reier. "Resulting from the impending MACT standards, Greg Bray opened a conversation with me and asked if I thought GMD Environmental would want to be a part of the team. It was no-brainer — this is a significant pool of talent that has been put together."

Bray had no prior plans to target China as a market until Kodiak Group officials brought the potential Weichai Power project to the team's attention about a year-and-a-half ago, he recalls. As mentioned, the partnership had already established its credibility thanks to its work in the U.S. market. Besides Ward Manufacturing, recent team projects include installations for Tyler Pipe in Tyler, TX, and Griffin Pipe in Lynchburg, VA. In addition, the team has under construction a cupola system for American Brass & Iron, Oakland, CA.

"We were at the last foundry show as a team," says Wood, hinting at the strong bonds of the partnership, which boasts the ability to supply state-of-the-art foundry technology that exceeds the MACT standards.

The partnership's unique capabilities spanning cupola construction and operation have enabled project successes worldwide, according to officials with team members, and the

Weichai Power installation has demonstrated that U.S. firms can succeed in bringing back Chinese contracts — and dollars — to the American manufacturing landscape.

by Foundry M&T staff (fdryeditor@penton.com)

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