

Machining Task Manager

Weir Minerals North America, a Madison, Wis., manufacturer of large pumps for mining slurry applications, needed 108-in.-by-108-in. pump housing Class 40 iron castings machined, including milling, drilling and boring. Each pump housing consisted of a frame and cover section, each requiring an A and B load, which entailed four setups for a complete housing assembly.

By Alvin Goellner

Tackling challenges and costs on 5,000-lb pump housings

The manufacturer contacted Advanced Machine & Eng. Co. (AME), Rockford, Ill., and several other contract manufacturers to do the machining on these parts, approximately two to three sets per week. Each housing section weighed more than 5,000 lb, presenting substantial challenges for the fixturing. Rigidity was key, as well as the vibrational distortion from the enormous load and tooling masses involved.

These slurry pumps currently are used in the Athabasca tar sand fields of Alberta, Canada, for oil extraction operations. Specifically, the pumps are being utilized for flue gas desulfurization (FGD).

Support Needed

Although AME began delivering the machined FGD pump sets on time by using non-dedicated fixturing, setup was taking too long per part, resulting in higher costs per pump set, according to Steve Schubert, AME vice president of operations. Changeover took up to six to eight hours each time. Locating and clamping the pump housings was quite tedious, and the methods used raised safety concerns in regard to materials handling, strapping and clamp positioning. Clamping forces were less than optimal, which had a negative effect on the manufacturing cycle time and the tool life. AME needed to reduce the total setup and machining time, plus improve operator safety.

“The challenge was to design a fixture that was within the weight limitations of our machine tool table, without compromising the structural integrity and rigidity of the fixture itself,” Schubert said. “Too light a fixture would yield poor finishes, dimensions out of tolerance, etc. We also needed a design that would allow for quick change of the workpiece, as we did not have a two-pallet machine.”

“Clever swing clamps were designed to ‘get out of the way’ so we could remove the completed part and put a new one on,” Schubert said. “Finally, but most important of all, we were extremely concerned with safety. We needed a fixture that would allow safe usage for the operator to climb onto repeatedly, as well as being secure enough to not allow one of these massive parts to fall off of the table.”

The solution to this challenge was devised as AME designed a single dedicated AMROK fixture, measuring 120 in. by 110 in., to hold each GFD pump section for both A and B loads that reduced setup times to less than 50% of the previous method. Additionally, due to improved locating and clamping methods, milling and drilling operations were optimized, resulting in a 45% reduction in the overall machining cycle time per pump set. The keys to these substantial savings lay in the adjustable jacks built into the fixtures, which allowed proper support for the sections during the machining process on a horizontal milling machine.

AME shared these savings with Weir. In addition,

machining quality and surface finish improved by using only one fixture instead of multiple separate fixtures, thus allowing tighter tolerances to be repeated and maintained more easily. Machine operator safety also was enhanced due to the standardized lifting, locating and clamping methods that were employed with this fixture design.

Benefits Abound

Weir was so pleased with the results that it implemented a multiple-vendor reduction process and awarded the entire project to AME. Production of the FGD pumps improved from three units per day to five per day at Weir.

The pumps feature:

- Size range (discharge) of 24 to 40 in.;
- Capacities to 80,000 gal per minute;
- Heads to 105 ft; and
- Pressures to 125 psi.

Notable benefits of the pumps include:

Back pull-out design. A minimum number of larger-diameter fasteners allows all rotating and wearing components, including the mechanical seal, to be inspected without disturbing the suction or discharge pipework.

Modular design bearing cartridge. They allow simple removal of the entire assembly for maintenance in a clean environment. A split release collar fitted on the bearing side of the shaft sleeve makes impeller removal fast and simple.

Long wear life. Specifically designed for handling abrasive and corrosive conditions found in FGD applications, the GSL design fully utilizes Weir’s long experience in solids pumping.

Lower corrosion in impellers. Specially designed high-chromium irons, developed in Weir’s material technology laboratories, combine with optimum impeller vane designs to minimize wear in pumps.

No corrosion in liners. Natural rubber liners are corrosion proof against acidic limestone/gypsum slurries, avoiding corrosion risks that can plague metal-lined pumps, particularly when low-pH slurries are left within the pumps when not operating.

Long bearing and mechanical seal life. A large diameter, stiff shaft and short impeller overhand minimize shaft deflection and provide excellent conditions for the mechanical seal. Fully protected oversized heavy-duty oil-lubricated roller and taper roller bearings carry the radial and thrust loads with high service factors. **www**

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CAD models of the two halves of the slurry pump housing on the dedicated fixture.



The slurry pump housing half-mounted on the fixture, situated on a horizontal boring mill.