Herb's Corner:

Spin Control is more than a PR Problem

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Herb Tobben creates solutions to customer problems at ZERO's Sample Processing facility.

The Problem:

A job shop created its own set-up to process diesel turbine impellers. They complained they were having trouble with spin control. I told them I normally don't get involved in public relations issues, but I offered to help in any other way I could.

Each impeller is a single casting that includes the backing wheel and 16 vanes in two alternating types, short and long. After casting, the parts are blasted once to remove residual casting material. The wheels undergo precision machining, then get blasted a second time to clean and deburr them, prior to final balancing.

In operation, some of these parts spin at speeds in excess of 100,000 rpm, so balance is critical. Any burrs or flashings that fly off will leave the impeller unbalanced, making it prone to rapid disintegration.

The parts are complex, but the process is straightforward –

- aim a sufficient number of blast nozzles at the part to get the desired coverage,
- process some parts,
- adjust the parameters until you achieve the desired result.

The company's technician had processed samples in a hand cabinet using a custom-made motorized fixture. These samples demonstrated their ability to produce parts that met the specifications set by the customer. The cast/blast/machine/blast again process meant the company would process each part twice.

Once they were awarded the project, the job shop moved the work to their BNP A-200 indexing-turntable cabinet with eight powered satellites. The automated cabinet would easily handle hundreds of parts per hour.

For the first blast, the technicians installed fixtures with a 1/2-inch ID bore to fit the shafts. The machining process reduces the shaft ID to 7/16-inch, so the company switches to fixtures with a smaller ID to maintain a snug fit for the second blast.

The initial blast worked fine, removing the casting residue in a single pass. Their first batch of finish-blast parts, however, was clearly not right. Substantial areas of the turbine blade surfaces were almost untouched.

Then they called me.

The Solution:

Just about any part that's designed to rotate will rotate when blasted. In fact, one of the parameters in this particular setup is part rotation. To blast deep inside the valleys between the turbine vanes, the job shop technicians had set their satellites to rotate at about 12 rpm.

These perfectly balanced turbine wheels are designed to convert moving air into rotational force. As soon as the blasting started, the turbines did what they do best – spin! While the satellites turned at just 12 rpm, the turbines probably reached several hundred rpm.

Now, the faster the wheels spin, the shorter the window is open to allow shot to reach the spaces between the vanes. Further complicating things, the speed of the vane moving away from the blast reduced the blast intensity on trailing edges.

So why did the test parts turn out so good, when the actual process was so obviously flawed? And why did the first blast work, when the second did not?

The special setup in the hand cabinet gripped the turbine shafts and limited the rotation speed to 12 rpm. The shafts on the raw castings are just rough enough to prevent spinning within the fixtures. The machined fixtures for the second blast fit the impeller shaft snugly, but not tight enough to prevent the smoothed parts from spinning.

So, what to do?

If there's even the slightest chance a part will spin within the fixture, you must either stop the spinning or account for that rotation in your parameters.

Clamp it (gently please). Screw it in, if it's threaded, then blast in a way that does not unscrew it.

For this application, we machined grooves into their fixtures to accept O-rings. These soft rubber rings gripped the shafts just enough to stop them from turning. (If you use this trick, remember to replace the O-rings frequently because they tend to glaze and harden with the little bit of twisting force they do receive.)

For any parts that have a tendency to spin, aim the nozzles carefully to equalize the blast pressure on leading and trailing surfaces.

So the next time you hear a machine shop operator ask about spin control, you'll know he's not just talking about getting good publicity.

Got a question about peening, cleaning, or sample processing? ZERO can help. Call 636 239-8135 or submit your request online at www.clemcoindustries.com.

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