Dr. Die Cast

Words That We All Get Tired of Hearing

If you've ever worked with a customer in the die casting industry you have probably heard this statement from one or more of your customers. "How is it possible for you to send me thousands of good castings and then I get a shipment with one (or more) piece of junk?"

Those occurrences are "the bane of our existence". At the least, those meetings are an embarrassment to both people. The answer to why these castings show up at our customers may be a lot simpler than the solution. In statistical training these castings show up as just outside the "Bell Curve". That is that grey area at the extreme ends of the bell curve that sales people and designers sometimes like to pretend doesn't exist, or at least it is so unlikely that it won't be a problem... RIGHT!

There is a reason that customers ask for a "Process Capability" of 1.66. However, the reasons we agree to it is because, well, after all, our competitors agreed to that specification.

Normal variation and repeatability: Sometimes, the solution is simply looking a little closer at the data. A friend of mine used to say, "Sometimes you just need a bigger magnifying glass." An example is a heat sink that was about 6 inches x 8 inches. It had a seal surface opposite several thick features. The seal surface was out of tolerance when it came from the trim operations so the die caster was using a CNC mill to machine the seal surface flat. Technically this was "rework" since it was not included in the original price of the casting. The inspection criterion was to measure the seal surface in several locations on a regular basis to see how much it was "warped". Since it was never within specification all the castings were sent to CNC.

We took another approach to better understand what was happening. First we measured the seal surface in the die and it was found to be nearly perfect. Next we took measurements about every half inch all around the seal surface and did a statistical study of the "height of the seal surface". What we discovered was that the surface variation was shrinkage due to the geometry on the opposite side of the casting. In addition, we observed that the dimension was actually very repeatable. Our next step was to modify the seal surface in the die to take advantage of the "normal shrinkage pattern". We made the die seal surface mirror the irregularity so that when the casting cooled it was "flat" and to specification. The CNC operation was no longer necessary. As long as the geometry of the casting didn't change the steel dimensions could be codified and used over and over again.

Random happenings: On a high volume automotive water pump we received scrap returns of about four bad parts per month from our customer. The part ran in two - four cavity dies in machines of different manufacture and vintage. We could never "catch it in the act" of making the bad castings until we hooked up a process monitor with the ability to monitor continuously 24 hours a day. Fortunately, we didn't have to wait a month to identify the problem. By analyzing 36 hours worth of data we were able to identify one bad cycle that would have created the bad castings. The cause was the intensifier misfired. It simply did not actuate. It was a design weakness in the machine's hydraulic circuit. We were able to modify the circuit and eliminate the problem. More modern process monitoring systems can both identify this type of

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anomaly and signal the extractor to scrap the bad casting.

Winning the battle: Sometimes we just need to get better at stating our case. It would be ideal if the casting designer, the die caster, and the end user were all in the same room during the development of the design. Dimensions and tolerances should only be used to help the product function or perform better. I have seen dimensions and tolerances that created problems for the die caster. Not because he failed to make the die to the design but exactly because he did. When casting models are "translated into "dimensioned" and "toleranced" drawings, a lot of dimensions can be subject to "rounding". What if the dimension that was "rounded" conflicts with the model? Who wins? We had a new four cavity die that was built to the model. One "True Position" feature on all four cavities was "out of tolerance" per the Geometric toleranceing on the "dimensioned drawing". The die steel checked to print. The toolmaker was reluctant to change the dimension when it was correct to the model. Finally, we checked the coordinates in the model and compared that to the dimensioned drawing. It was a rounding issue. The customer's engineer revised the drawing to reflect the model more precisely and we were approved with the tool as built.

Don't be afraid to ask for clarification when you're working with a new product. Be sure to learn all you can about the final product and how the casting must perform. Sometimes the specifications are chosen out of convenience rather than process capability and final product requirements.