A Contract Review is Your Best 'Assurance' Policy

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We manufacture critical components for a number of advanced technologies where human safety is in the balance. We also manufacture in a world increasing in volatility, uncertainty, complexity and ambiguity. "Zero defects" and "100 percent on time" are what our customers claim to get from their ordinary suppliers. How can we assure that we intelligently manage the risk faced by ourselves, our customers, their customers or the general public? My answer is having an effective contract review process.

There is an apocryphal story that given five minutes to chop down a tree, Abraham Lincoln said he would, "spend the first three to sharpen his axe." Legend or not, the truth this story conveys is that the best time to make a positive difference for the outcome of our work is before the actual work gets started.

As contract manufacturers, we do a great job of vetting the explicit requirements for a part, as given on the print and purchase order. But I wonder if we can say we do as good of a job on the implicit issues that our customers might not choose to share with us.

Unknown Knowns

Are there aspects of further fabrication or end use for which the material choice or our fabrication process might be inappropriate or downright wrong for the application? These are unknown to us, but might be known to our customer, or their customers, if only we would ask. I have written about this before in my piece, "What is Expected of the Part?" (**short.productionmachining.com/ExpectPart**) but in this article, we will explore a couple of aspects of this unknown known paradox.

Ductility for Further Fabrication and Assembly

Many times, the parts we produce for our customers will need some final cold-working operation by the customer to finish assembly. Staking, swaging, crimping or spinning to complete the assembly or connection are operations that our customers may perform on our parts. These operations can only be successful if there is sufficient ductility remaining to allow the cold movement of the metal during the final cold-working operation. The amount of cold work performed on the material prior to our machining operation is an important factor for both our machinability and the customer's ability to successfully crimp, stake or swage the

part. Especially with materials that are heavy drafted or drawn from round to hex, remaining ductility may not be sufficient to permit cold metal movement in the customer's operation without cracking.

Nitrogen can also be a factor that limits the amount of cold metal movement performed after machining by our customers. Nitrogen is a ferrite strengthener, and steels that have higher nitrogen levels (re-nitrogenized) tend to have lower ductility after cold drawing and machining than steels that are not nitrogen treated (non-re-nitrogenized). This idea came to light for me while working for a steel company. We had sold some free machining steel to a service center, that sold it to a machine shop, that used it to make a part that was to be crimped to secure an automotive emergency brake cable. Unknown (and unspecified by any of the buying parties, such as an OEM, machine shop or service center) was the need for sufficient ductility to allow the material to be severely crimped. The re-nitrogenized steel purchased met all purchase requirements, but after the automaker changed its crimping process from eight points to four points, it started encountering cracks in the parts after crimping. Had anyone mentioned cold work after machining, another version of the steel could have been provided. Contract review is the perfect time to ask, "What exactly are the processes that our parts will encounter after we ship them to you?," and then evaluate the suitability of your material, process and finishing treatments to provide parts that will perform as expected, without surprises.

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Welding and Brazing

Another aspect of assembly that can be affected by our parts is how they will be joined. Welded and brazed joints are frequently used to attach our parts to structural members where they can then secure other parts that apply or are acted upon by repeated or cyclic force. Welded joints, depending on the type of weld, can be weakened by the presence of higher levels of sulfur that are intentionally added to the specified steel to enable its economic machining. In brazing, bismuth that is added to improve machinability was identified as a factor resulting in low strength connections in standard brazed joints. It took almost two years for the industry to realize that the bismuth in certain free machining grades was a factor in weakening the brazed connections, and a new method of brazing was developed for bismuth-treated steels.

Beyond Shipping Your Parts

It is not enough for us to produce the part to print and then wave the checkered flag at the shipping dock and say, "We're finished." Our parts are just beginning their work, and it is incumbent on us to assure we have considered not only the requirements explicitly stated on the print, but also those factors under the customer's control that might be affected by the material, processes or finishing operations that we have employed to produce their parts. It is too late to do that once the parts have been produced. The time for assuring that what we ship will meet both the customer's stated and unstated expectations is before production, through a robust process of contract review.

HOT TOPICS

PMPA members support one another through email Listserves, where they can solve problems, share advice, sell excess material and equipment, and learn about new developments and opportunities. Here is a list of topics that were recently discussed:

- Copper brazing source
- Square broaching
- Machine foundations
- Cylindrical OD/ID grinding
- 430FR stainless source
- Prototype parts
- G160 programming for servo load monitoring
- Bagging and heat sealing parts
- Holding size after heat treating
- 360 full hard brass source

PMPA CALENDAR

For the latest chapter meeting information, please view the "Events" listed on our homepage at **pmpa.org**. If you have any questions about PMPA conferences or meetings, please contact Monte Guitar, director of technical programs, at 440-526-0300 or **mguitar@pmpa.org**.

2016 Annual Meeting
October 21-25, 2016
Westin Hilton Head Island
Resort & Spa
Hilton Head, South Carolina

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