Letters to Editor

Pushing the Envelope with Plastic

Steve Druley, Marketing Manager, UFE Inc.

We were delighted to see the plastic gear set pictured on the cover of your March/April issue. UFE played the lead role in its design and manufacture. It is indeed a geartrain worth showcasing, and even more so when the largest gears—the 18" internal bevel ring gears—are added to complete the system. This system was integral to the design of a new clothes washing machine bringing many attractive features to the market.

The system was conceived from the start with plastic gears because of the advantages of plastic in the application—especially cost, noise, and weight. UFE was awarded the project, from gear design analysis to mold manufacture and part molding for all the molded parts pictured.

So, of course, we are proud to submit for your readers a photo of the completed gear assembly, including the largest gears in the system. As your articles in the March/April issue discussed, plastic gear design and production requires experience and resourcefulness to be delivered within the allowable time and budget. While plastic gears have long been used in products of all kinds, and their employment is growing, the need for combining the art and science of injection molding increases exponentially as the size of the gear grows. This gear set is an excellent case-in-point of plastic gearing potential and challenges.

The large bevel ring gears presented challenges in gear design, mold design

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and moldability. From a gear design standpoint, little has been published regarding the design of an internal bevel ring gear (whether made from metal or plastic). As a result, the desired mesh and tooth profile required gear design resourcefulness, including collaboration with a gear cutting machine manufacturer—The Gleason Works—who ultimately provided the basic tooth form unique to internal bevel gears. This led UFE to the development of an optimized gear tooth form for the application. The next challenge was the design and development of the mold.

The material used in all the gears was a glass-filled resin specified for its strength, resistance to water absorption and compatibility with chemicals. In the final analysis, the most notable production challenges were borne out of the molding properties of the glass-filled resins. Specifically, the uniform alignment of the fibers in glass-filled resins results in non-uniform shrinkage in the molded gears, potentially producing several gear defects. This required UFE to redevelop the original tooth profiles for each gear. But that's not all. Each tooth in each gear then required modification from the original design. In addition, to maintain roundness and optimum part strength, several gating schemes in the mold design were evaluated with Moldflow analysis. Each gear profile in the gear train was revised, and the gating and runner system were optimized in mold design specifically for the resin.

Gears present unique challenges for injection molders. Thanks to many ongoing advances on several fronts in the injection molding industry, the increased use of plastic gears will continue. Every day, reliable plastic gears are shipped and assembled into a widening range of products—from washers and dryers to gas engines and digital printers—and there's no end in sight.

—Steve Druley,
Marketing Manager UFE Inc.

Why Do Customers Want to Reinvent OUR Wheel?

Ian Shearing, VP Sales, Mitsubishi Gear Technology Center, Wixom, MI

Over many years of being in the machine tool business, it has been interesting to observe the way we suppliers are forced to quote and sell machine tools to many large companies. Often, we put ourselves through all manner of contortions to win an order, and then—if we do win it—we have to face the eventual ramifications that exist because of that success. Why is this? The answer is very simple: CUSTOMER-SPECIFIC SPECIFICATIONS.

Many large companies have their own machine tool purchasing specifications, which typically include the following:

- Quoting format
- Forms for build reporting
- Frequency of progress report meetings
- Machine configuration to be employed, i.e. horizontal, vertical, etc.
- Individual components to be used in the machine, including electric, hydraulic, lubrication and pneumatic
- Wiring methods to be used, including wire sizes and color
- Piping methods to be used, including type of piping and pipe threads
- Pipe fittings
- Operators screens (HMI)
- Type of PLC logic
- Ancillary equipment to use, such as chillers, oil mist collectors, dust collectors, chip conveyors, etc.
- Special paint specifications
- Vibration sensors and how many are to be used per spindle
- Extended machine acceptance procedures
- Machine noise acceptance levels
- Machine vibration acceptance levels
- Extended warranty demands
- Delivery penalties
- Extended payment demands

The above list is but a small sample of the specifications which must be adhered to when quoting large companies. Normally, these specifications are supplied as a book, but often they are available only via a website whereby we have to print volumes of paper to produce the complete set of specifications, which include specifications for machines

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other than the ones you are quoting. These specifications are often written in a language which is foreign to us as a builder and thus, open to varied interpretations.

Once a request for quotation (RFQ) has been received, a supplier is lucky to get as many as 30 days to quote. Normally, it is less. Keep in mind that quoting to these specifications often involves a complete redesign of one's machine, interfacing with unfamiliar suppliers and—because of the timeframe for quoting—a certain degree of guesswork. The end result is a quotation for machines which has some ingredients of conservatism, guesswork, assumptions and hopes that if the order is won, "it will all work out in the end." Typically, it is a recipe for disaster.

Let's review for a minute some of the specification requests and their impact on the machine supplier.

The seemingly simple quoting format. As suppliers we have all developed our own quotation formats, which present the machines and their options in a logical and understandable way. Now we are asked to quote in a totally different format with options being grouped and divided in such a way so that various supplier offerings can be, supposedly, directly compared. The end result involves many revisions until it meets the satisfaction of the customer. The cost of this extra work is rarely factored into the machine price, so it ends up being time and material that is absorbed. And so the diminishing profit margin begins.

Individual components for electric, hydraulic, etc. With the short time given to quote and the unfamiliarity with the component suppliers we have to use, it is impossible to get the same pricing levels per our normal component suppliers. In addition, there is a certain amount of trepidation in using unfamiliar components in our machines. All these unknowns will affect the reliability of our product and its reputation.

Operator screens (HMI). The basic function here is to try and make every machine's startup the same in order for operators to be able to easily switch from one machine to another. However, after the startup screens have been navigated, it is impossible to make the screens the same for a hobber, shaper, machining center and lathe, etc. Therefore why bother? We, as suppliers, have developed screens to make the use of our machines as simple as possible. It seems to us that these special HMI screens only serve to complicate and confuse.

Extended warranties. The reluctance by the machine tool industry to offer warranties longer than a year for large companies is largely based on the fact that we have to use unfamiliar components, and we have a lack of knowledge about their reliability and maintainability.

These specifications, to which we are required to adhere, are updated periodically by our customers to an extent where it is not always possible to assume, because we have supplied machines before, that subsequent

machines can be built to the same specifications. In addition, every large company has its own specifications. They are not the same.

We are sure that the selection of components to be used is born of suppliers' lobbying or selling their individual wares to these large companies. Naturally the logic of installing large quantities of machine tools all using the same components is not lost on us as suppliers. The advantages of stocking spare parts, training employees and familiarity with components used are obvious. However, as suppliers we believe that these advantages never seem to be fully exploited, as requests for us to supply these customer-specific parts and to diagnose their faults are numerous.

The consequences, in many cases, are projects which result in much higher purchase prices for the customer; delivery delays through having to deal with unfamiliar component suppliers; redesign of standard products with new, supporting and sometimes inaccurate documentation; probably lower machine reliability; and lower, if any, profit margins. Sometimes we are convinced that large customers do not want to purchase our machines but instead want a supplier to build their machines.

Is this article a complaint? I hope it is perceived more along the lines of presenting facts with the hope that changes for the better will be forthcoming, thereby avoiding the inevitable dissatisfaction on both sides.

Having made the aforementioned observations, it must be stated that there are large companies who do purchase our standard product. The reliability afforded them in this endeavor even encourages them to purchase the machines without any warranty, thereby lowering the purchase price. The companies with this vision employ our service at pre-negotiated rates with commitments to provide service and maintain the equipment at regular intervals. These companies also report back data regarding reliability and maintainability which is meaningful to us because it is what we manufacture and assemble on a daily basis. The advantages are constant product improvements which can be passed on to all customers, not to just a few.

Will the expansion and ever-increasing complication of these specifications ever cease? Probably not in the short term. There is, however, a glimmer of hope which is surfacing because of the unfortunate economic plight of some of these large companies. The desire to purchase capital goods at reduced prices and maintain a healthy supplier base is causing large companies to look again at the way they do business. Does hope spring eternal? As suppliers, we like to think so, because it is our desire to offer products in the full belief that they are the best that we can produce, with documentation which supports that fact.

–Ian Shearing, VP Sales
Mitsubishi Gear Center