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Savings BY Design

Manufacturer/supplier partnerships lead to improved metalworking processes.

Castrol Industrial

Castrol Industrial Americas evaluates simultaneous-engineering process designs at its Machining Test Center, located in Naperville, Ill. Dynamometers, profilometers and other computer-calibrated equipment are used to measure forces generated on various machine axes, as well as perishable tooling from Castrol's alliance partners.

Automotive parts manufacturers are leaving considerable money "on the table" by not forming strategic-alliance partnerships with their suppliers.

Partnering leads to the development and implementation of simultaneous-engineering process designs on the factory floor. The cost savings such strategies yield can significantly exceed those possible with consolidated purchasing and e-procurement initiatives (see sidebar, page 44).

In metalworking operations, the process components for which suppliers can offer simultaneous-engineering assistance include:

- machine tools;
- perishable tooling, such as cutting tools and abrasives wheels;
- metalworking fluids;
- workpiece materials; and
- fluid filtration and delivery systems.

"We strongly endorse the process-design approach, as it allows each partner to bring their specific knowledge and experience to the problem-solving process," said Chris Erato, product manager for Oberlin Filter Co., Waukesha, Wis. "In automotive manufacturing plants, we have documented 15 percent increases in perishable tool life through proper resolution of high dirt loading in central fluid systems."

Let the Initiative Begin

The process-design initiative typically begins with an on-site evaluation of the existing machining process. This is done by suppliers, in conjunction with the manufacturer's production engineers, and includes identifying and targeting specific objectives, such as increasing productivity, extending tool life and improving part quality and uptime reliability.

Once these objectives are defined and understood, production parameters can be set. Details about tool setup, tool and grinding wheel grades, and dressing cycles are established. Then cycle time, feeds and speeds, tolerances and surface-finish requirements can be determined. Tool geometry and fluid flow rates and pressures are also carefully considered and incorporated into the process-design effort.

A team approach involving the parts manufacturer and tooling suppliers is necessary to achieve optimal results because of the level of detailed knowledge required for each aspect of the production process. For instance, when selecting a grinding wheel, 32 variables must be considered.

Once the production parameters have been defined, an assessment of the probability of success is conducted with input from each alliance partner. This is based on a multiple-step problem-solving process that includes root-cause analysis, actual-performance data from other installations, application-specific knowledge and machining-database analysis.

MACHINING ECONOMY EXAMPLE

- Shop spends $10,000 to make 1,000 parts
- Cost is $10 per part

VARIABLE	Today	30% discount on tooling	50% increase in tool life	20% increase in cutting rates
Tooling	$0.30	$0.21	$0.20	$0.45
Material	$1.70	$1.70	$1.70	$1.70
FIXED				
Machinery	$2.70	$2.70	$2.70	$2.16
Labor	$3.10	$3.10	$3.10	$2.48
Building	$2.20	$2.20	$2.20	$1.76
COST PER PART	$10.00	$9.91	$9.90	$8.55
SAVINGS		1%	1%	15%*

In addition to the 15% decrease in cost, there is also 20% additional machinery capacity.

Sandvik Coromant

The impact different tools have on the per-unit cost of a 1,000-piece run of parts, based on data from Sandvik Coromant. When applying a tool that costs 30 percent less but runs at the same cutting parameters, the savings is 9 cents per part. A lower-cost tool with 50 percent more wear life saves 10 cents per part. A tool that allows a 20 percent increase in cutting rates but costs 50 percent more saves $1.45.

Down the Hole

To demonstrate the problem-solving process, consider holemaking—one of the most common metalworking processes in automotive engine and transmission production. As opposed to milling and turning, which are easily observed, drilling is concealed and the dimensional tolerances and part finish are unknown until the operation is completed. Therefore, the machinist needs nonvisual performance indicators to make sure he isn't producing out-of-tolerance parts.

The first key performance indicator to successful holemaking is delivering cutting fluid to the tool/workpiece interface at a volume and pressure that's sufficient to remove chips from the hole. Second is selecting an appropriate fluid that will provide maximum cooling to prevent hole growth, which can lead to rework or, even worse, scrapped parts.

Preventing the occurrence of these undesirable events is part of the reason

Procuring, purchasing and losses vs. gains

The trend of outsourcing administrative purchasing responsibilities and centralizing automated e-procurement systems has reduced administrative costs and streamlined processes. An argument can be made, though, that this new procurement architecture results in lost flexibility and innovation on the manufacturing floor.

Various contract models drive outsourced integrated-supply programs. One such model is the cost-plus contract. This model enables the integrated-supply contractor to pass through to the customer the item cost, along with a management fee, for its on-site purchasing personnel and a profit-margin fee based on the total value of the purchases. The incentive for the integrated supplier with this contract model, and others, is based on purchases rather than productivity. This begs the question: From where will productivity improvements come?

"Time and again, the results of various contract-mandated product changes based on issues other than productivity enhancements have led to disastrous results," said Bill Stewart, sales engineer for Indianapolis-based tooling distributor Jack Dustman & Associates. "When this happens, it all falls into the lap of the plant manufacturing engineers to figure out a solution to accommodate the mandate but, usually, with a major loss in productivity."

When discussing the productivity-enhancing features of cutting tools, Allen Poponick, product manager at Kennametal Inc., Latrobe, Pa., mentioned drill selection: "The bottom-line customer savings for solid-carbide holemaking products is cost per hole, not the list price of the drill. A high-performance drill will have a higher list price. However, inches per minute could be doubled, tool life increased and the overall hole quality improved to the point where a reaming operation can be eliminated or a separate chamfering/countersinking operation can be combined with drilling. Addressing these factors gives the customer real and long-term savings that are more concrete and justifiable than a reduced list price."

—D. Moon

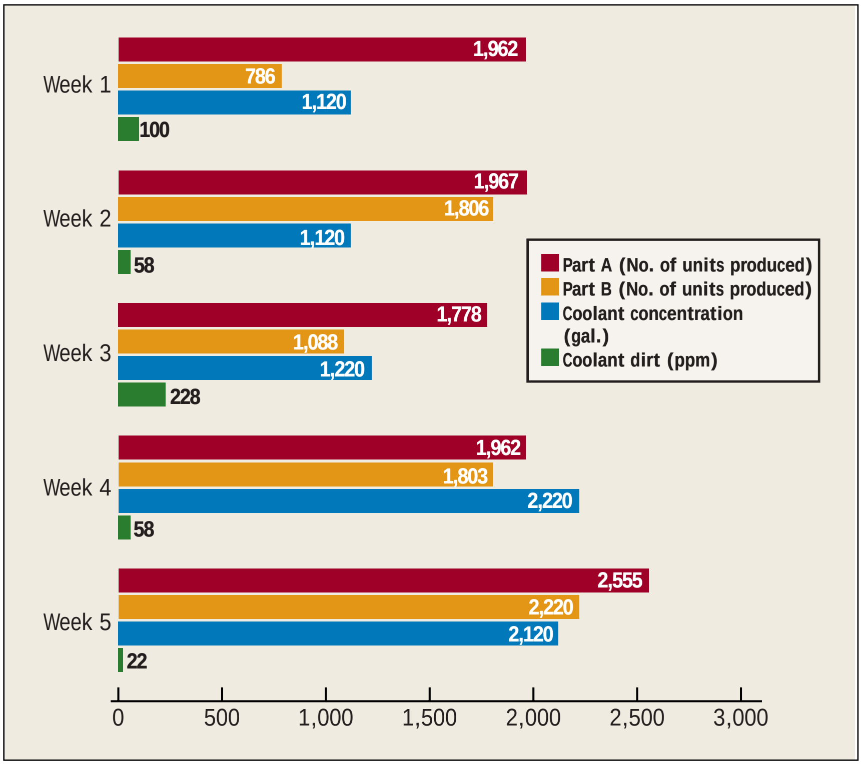

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Table 1: The relationship between coolant dirt-count levels and number of parts made before changing tools at a major automotive plant. The coolant system holds 20,000 gal.

Michael Hafke, national sales manager for Guhring Inc., Brookfield, Wis., advocates simultaneous-engineering process-design initiatives. "The machining of aluminum materials used in automobile power train and transmission components lends itself to the process-design approach," he said. "We have greater confidence in producing high-quality production parts when using the approach with those strategic-alliance partners' products we know. Once we have established the baseline data, we feel comfortable that we can prove productivity increases with our alliance partners' input."

Saint-Gobain Abrasives Inc., Worcester, Mass., is another company that has formed strategic partnerships and conducted process-design initiatives. According to Phil Perzan, the company's national accounts manager for North America, cooperative working relationships with a defined procedure and specified goals have saved customers significant amounts of money, improved overall grinding efficiency and increased productivity. "We are finding significant cost savings in high-speed CBN grinding using metal-bond plated wheels with highly fortified grinding fluid, high-pressure delivery and 10µm filtration," Perzan said. "This combination has enabled us to eliminate costly intermediate machining steps and grind castings directly to net shape." For this high-speed grinding application, the surface speeds exceed 100m/sec.

Regardless of whether the application is high-speed grinding or some other metal-removal operation, significant productivity and product-life improvements are achievable in each of the component categories.

For example, Table 1 shows the relationship between coolant dirt-count levels and number of parts produced before changing tools on machines at a major automaker's plant. In general, by reducing the amount of coolant dirt via improved filtration, cleaner fluid is reintroduced to the tool/workpiece interface, which increases the number of parts that can be machined before replacing tools. While two of the three variables (the cutters and fluid) remained constant during the first 2 weeks, a reduction in dirt from 100 to 58 ppm resulted in a minimal productivity increase for part A, but a 130 percent increase for part B. As dirt loads climbed in the third week, parts per tool dropped while the fluid concentration remained relatively unchanged. When the amount of dirt was reduced to 22 ppm, tool life increased significantly.

Though such results are impressive, without a "synergy" achieved through simultaneous engineering, total process optimization will not occur. The key to successfully employing process-design enhancements for a major automotive parts manufacturer is to establish relationships with those suppliers that strongly subscribe to and implement simultaneous-engineering evaluations and testing in concert with other component suppliers.

Discussing his company's position on simultaneous engineering, David Barber, marketing manager for United Grinding Technologies Inc., Miamisburg, Ohio, said, "Our customers want a final product that transcends the individual items delivered by stand-alone suppliers. We seldom deliver one of our high-speed creep-feed grinders without all of the components engineered into the final process design."

Barber added that it is for this reason that UGT has maintained close working relationships and alliances with key

The following companies contributed to this report:

Jack Dustman & Associates
(800) 333-3537
www.jackdustman.com

Guhring Inc.
(800) 776-6170
www.guhring.com

Kennametal Inc.
(800) 446-7738
www.kennametal.com

Oberlin Filter Co.
(262) 547-4900
www.oberlinfilter.com

Saint-Gobain Abrasives Inc.
(508) 795-5000
www.carborundumabrasives.com

Sandvik Coromant Co.
(800) 726-3845
www.coromant.sandvik.com/us

United Grinding Technologies Inc.
(937) 859-1975
www.grinding.com

component suppliers that have a full understanding of the dynamics that occur in the grinding zone. The type of grinding fluid and its performance characteristics, along with the proper type and grade of wheel, and correct fluid-filtration and -delivery system, must all be designed based on the part dimension, finish requirements and workpiece material.

Optimization Confusion

A trend is emerging wherein process optimization is being confused with cost minimization. Buying the lowest cost product, though, can decrease productivity and increase overall costs, particularly when it comes to machining operations.

Machining is a system in which each component affects every other component. For example, when machining aluminum, many end users shy away from diamond tools because of their high initial cost. However, the life of diamond tools far exceeds the life of carbide cutters. This greatly enhances productivity and minimizes the labor costs and toolchange times associated with carbide tools.

Similarly, buying low-cost cutting fluids may result in shorter sump life, which may lead to more frequent dumping, cleaning and refilling of the sump. This decreases productivity and increases cooling costs.

Only by examining all system components simultaneously can process optimization be accomplished. Until automotive parts manufacturers recognize this, the trend of cost minimization at the expense of process optimization will continue.

About the Author

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