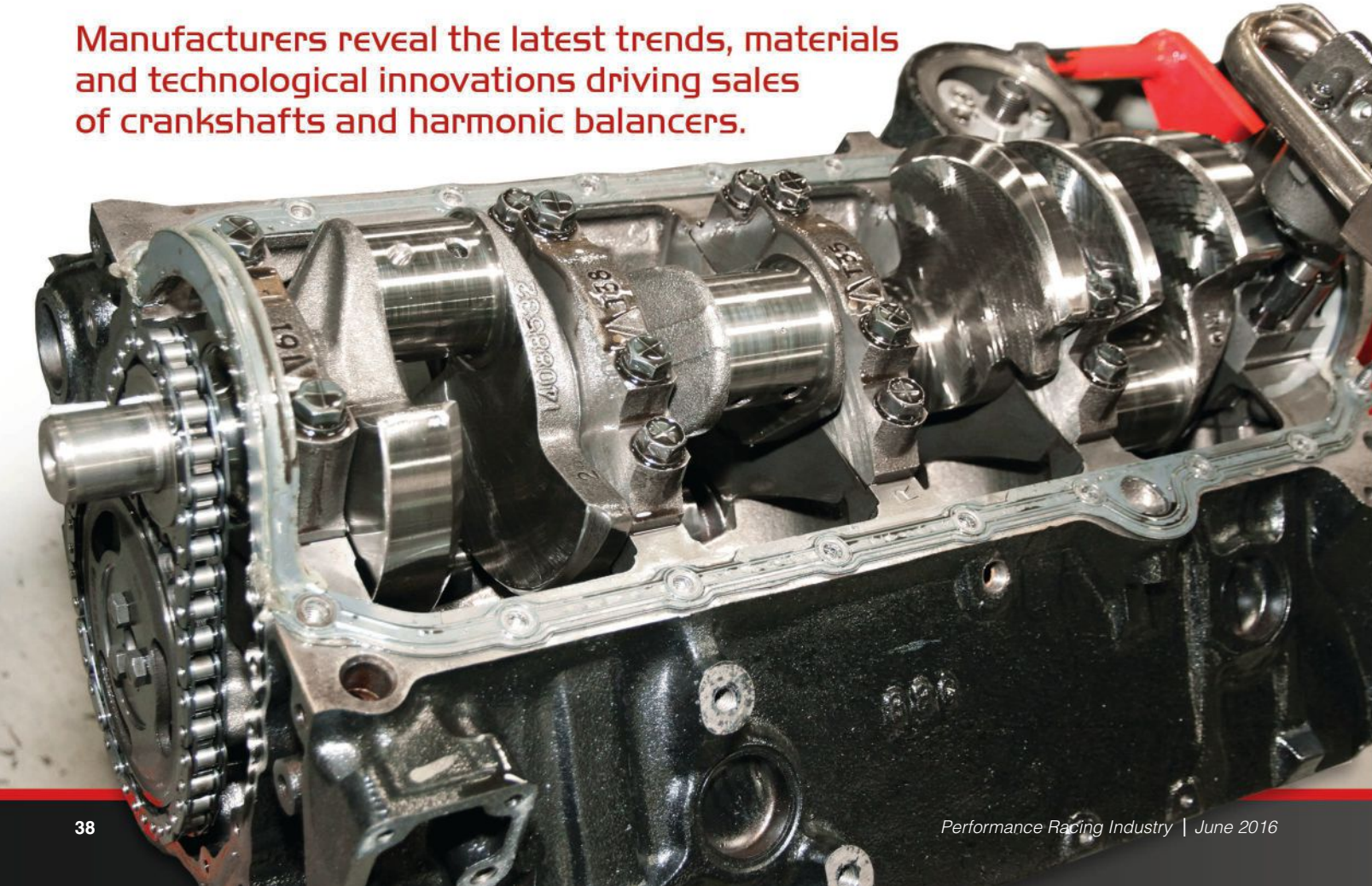
By David Hakim

PIVOTAL DEVELOPMENTS IN Racing Crankshafts

Manufacturers reveal the latest trends, materials and technological innovations driving sales of crankshafts and harmonic balancers.



The block may be the foundation of any engine, but within that engine it's the crankshaft that contributes the most in making power while taking the bulk of the punishment. And, as some racers and engine builders have experienced, any catastrophic failure within the crank can spell certain death for the rods, pistons, block and even cylinder heads. What's more, since the crank anchors the rotating assembly, one misstep during the assembling process—much like the cumulative effect of consistent abuse in a racing environment—is an expensive lesson to learn.

That's why it's hypercritical that suppliers direct their customers to the correct type of crankshaft. For a mild street car, whose main purpose may be to show up at cruise nights and look good, a cast crank might suffice. On the other hand, a forged or billet crankshaft is required to withstand all-out race applications.

Know Your Customers' Needs

While racers and race teams have become parts-savvier, with many choosing to source their own components to save money, "sometimes they are sacrificing quality for an additional discount," said Nickolaus DiBlasi of K1 Technologies, part of Performance Motorsports International, Huntington Beach, California. "Retailers and builders need to adapt to this marketplace and communicate to the end users why they need to choose the products they are selling and backing. K1 Technologies crankshafts are manufactured with racing in mind, and hold tolerances that match

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crankshafts that can be found in the highest levels of racing. The products are designed and tested to handle the most rigorous applications. Retailers not offering crankshafts are limiting themselves."

In addition to selling crankshafts, the racing retailer or engine builder must be able to direct customers to the correct product to perform as needed.

"We've seen a growth in all racing markets, and have evolved our products to meet or exceed the engine builders' and racers' expectations," explained Tom Molnar of Molnar Industries, Kentwood, Michigan. "We focus on quality and affordability, and are in it for the long run. We spend time with the customer discussing their needs to ensure they get the right crank for the application."

Many retailers who sell crankshafts will stock a variety of rod and main bearings along with a comprehensive selection of connecting rods, especially in different lengths for engine builders and racers doing a stroker build, who may be looking for a specific cubic-inch displacement.

"The crankshaft is the foundation of the performance engine build, and with the new stroke combinations being offered in the Chevrolet late model LT and LS engines, retailers have the opportunity to sell complete rotating assemblies," described Kirk Peters of Lunati, Olive Branch, Mississippi.

Many customers are also purchasing "stroker" crankshafts that increase the engine's displacement for power, especially low-end torque. This leads to incremental sales for specific pistons and rods for the customer's engine combinations.

Unfortunately, many customers get sticker shock when pricing a high-quality forged crank, but that's short-term thinking. A conscientious retailer can show the customer why it's important to install a premium crankshaft in the engine, especially if it's spinning at high engine speeds and/or is subjected to nitrous oxide, or a supercharger is forcing mass quantities of air into the engine and cylinder pressure is dramatically increased.

"Crankshafts provide great opportunities for retailers to drive sales of connecting rods, pistons, rings and bearings," said John Partridge of Bullet Racing Cams, Olive Branch, Mississippi. "In addition, it provides opportunities for additional sales for items like crank dampers, gaskets and more. They also provide retailers who have machine shop capabilities with balancing and engine machining opportunities."

However, for many race engine builders, one size does not fit all. "Our distribution network is more like hardcore engine builders," said Kerry Novak of Crower Cams, San Diego, California. "They don't know what they're building tomorrow. One day it might be a Pro Mod, next day a road racer, the other a sprint car engine. That's why our customers don't normally stock one

particular style of crankshaft."

New Trends & Technology

The newest trends cited by manufacturers are balancing weight and strength. There is a fine line between offering a product that can withstand the demands of racing, but at the same time reduce weight off the rotating assembly. "By advancing our designs with Finite Element Analysis (FEA), we can design a product that can hold up to the racing demands and reduce engine stress," said DiBlasi. "The trends typically start at the highest levels of racing and work their way down to the weekend racer."

That's good to know, because oftentimes the end-user simply does not understand the differences in the manufacturing and machining of various crankshafts. While it may look like the same design with little change over the past few decades, customers may not be aware of the focus to reduce the weight of the crank and minimize the parasitic loss of power from the rotating assembly.

"High-level racing technology always finds its way to the weekend racer eventually," observed Alan Davis of Eagle Specialty Products, Southaven, Mississippi, "unless it is cost prohibitive. The most recent trends include a move to smaller rod journals to reduce bearing shear speed and reduce friction. Lighter weight cranks have always been around, but usually most rule packages will only let the racer go so far. Since the weight reduction is limited, we have turned our attention to reducing drag and friction. We've developed our revolutionary ESP Armor finishing process to help combat these issues found in many racing engines."

Davis cited another recent trend, but not necessarily a positive one. "We have seen more and more racers trying to use entry-level cranks in competition engines," he said. "Crankshafts should always be used in their intended application. Cranks designed and intended for use in street engines should not be used in a sprint car application. Always follow the manufacturer's recommendations for power, rpm,

While high-quality forged products can cause sticker shock, savvy parts sellers should be able to show customers why it's important to use a premium crank in their engine, especially if it's spinning at high speeds or is subject to the effects of power adders. Photo courtesy of K1 Technologies.

and intended use. I guess the economy has got everyone trying to save every penny they can. But saving a few dollars on the front end can cost you more in the long run."

Yet another recent development in crankshafts is reducing the weight to free up more power, since a lighter rotating assembly will help the engine make power by reducing drag and parasitic loss in the crankcase.

"For small blocks we are seeing an increase in lighter weight units. With big blocks we are seeing an increase of billet crank sales for the more aggressive higher-horsepower engines," explained Brian Adix of Competition Products, Oshkosh, Wisconsin.

Do lighter weight crankshafts affect durability? "Lightweight configurations and counterweight-specific applications are some of the most influencing considerations," explained Partridge from Bullet Racing Cams, "and this trend has driven the custom crank market for some time, and will continue to do so. Every racing segment has its specific needs, but the driving force is more power and stability at high rpm's."

This design trend applies to nearly every racer, from the local Saturday night dirt tracker to the top echelon of NHRA's Pro Mod class, which means all types of racing are benefiting from this technology.

"Some of the latest trends in crankshaft design are shorter, smaller counter weight designs and smaller journal sizes, which follows suit with 'lighter is better' when it comes to crankshaft design," commented Lunati's Peters.

However, Molnar noted, "A lightweight crankshaft is fine out of the box, but if a customer has to spend $500 in Mallory metal to get it to balance, then it's no longer a lightweight crank. That additional money just on the rotating assembly could have been spent in other areas of the engine that would've increased power."

Materials & Manufacturing

With so many different materials used for performance crankshafts, how does one decide which is correct for a specific application? Competition Products outlines some helpful tips on its website (www.competitionproducts.com). The basic rule of thumb is that OE cast is acceptable stock for minor performance applications. The 4340-grade forged steel is good for econo-racers (those that compete in bracket drag racing and sportsman level oval track classes). For all-out race applications, engine builders use 4340 (American sourced) high-purity, high-nickel, aircraft-quality material with advanced heat-treating and machining held to strict standards.

"The 4340 steel is the most popular crankshaft material, but some of the newer materials like EN30B that have a

Continued on page 46

Beyond Traditional Markets

While product development has traditionally been toward domestic V8 engines, some manufacturers are venturing into new territory.

"We get many road racing requests, and have expanded our fitments for Volkswagen, Subaru and Mitsubishi," said LeBarron of Fluidampr.

Fluidampr has found success by collaborating with other companies within the racing industry. "Production race engine and accessory kit manufacturers have also approached us direct to develop custom harmonic damper solutions. For that we are capable of conducting a full OEM quality torsional vibration analysis, computer modeling, prototypes and validation testing to exceed their needs," added LeBarron.

And Engine Pro's Weber told us the company now supplies SFI-approved balancers for Chevrolet LS6 and GM 3.6L High Feature OHC LY7 V6 engines. "They were introduced to meet the needs for race balancers for late model engines," he said. "Like all our SFI-approved series balancers, they have forged steel hubs and rings for greater strength without greater weight. Steel is stronger and more wear-resistant than the aluminum alloy used on some race balancers."

When it comes to harmonic balancers/dampers, there's more than meets the eye. To start, always determine the intended use of a customer's engine, including projected horsepower and torque levels. And find out if it will be raced in a class that requires the unit to be SFI approved. These simple questions go a long way toward ensuring the customer purchases the right balancer the first time. *—David Hakim*

Continued from page 42

much higher nickel content have become more common in high-horsepower applications such as blower or turbo applications," explained Partridge. "Cast cranks have their place in certain classes such as Stock Eliminator drag racing and hobby stock-type circle track classes."

Many companies also heat-treat their cranks after forging to a range of 32–34 Rockwell. After they go through final machining, its ion nitride surface hardening creates a 62–65 Rockwell surface that's about 0.012–0.020 inches deep.

When it comes to EN30B crankshafts, Crower's Novak observed, "We've looked at these and have noticed that EN30B material is good for Top Fuel cars, but there's no significant gains. The one thing you have to watch is the heat-treat procedure; [if it's] not done correctly, the crank becomes too brittle."

With that, 4340 chromoly steel is still

the most common among various racing applications. Many manufacturers use top-of-the line 'aerospace quality' materials, and some manufacturing methods include a 'non-twist' drop forge that help make the crankshaft stronger in certain racing applications.

one-off crankshafts, our sources agreed.

"The 4340 chromium-molybdenum steel (chromoly) is the most commonly used material and will most likely continue to be used," offered DiBlasi of K1 Technologies. "It balances cost and material properties, and is used throughout racing engines.

"If the driver uses the engine more for braking going into a corner, we can tailor the crank for that."

For racers on tight budgets, cast crankshafts are great for the lower class or hobby stock racers, according to the manufacturers interviewed for this article. A forged crankshaft works best in mid-horsepower standard combinations where an off-the-shelf crankshaft can be used. And billets are better suited for extreme- or high-horsepower engines, or custom

The use of cast crankshafts is less and less, as more readily available and cost-effective forged counterparts are being introduced. We typically see billet versions of crankshafts being used with low production quantities and doing engine development. As designs are proven out, the billet variants are usually replaced with forged versions."

"The 4340 forging or 4340 billet are popular materials because they can withstand a great deal of punishment," confirmed Novak. "But regardless if it's a 400-horsepower street motor or going in an 8000-horsepower Top Fuel Dragster, all our crankshafts have the same material, heat-treating procedures, and machining specifications. If a crankshaft is going to fail, it's usually lack of oil, detonation, and/or constant hammering from tire shake, over-revving the engine, and things like that. The engines in many racing environments, including off-shore boats, get loaded and unloaded, and that's hard on an engine—and especially the crank, as it takes almost all the abuse."

Nick Boes at Shaftech in Fostoria, Ohio, who sees a great deal of crank carnage, told us, "On the repair side we do everything from grinding journals to an undersize, welding/machining damaged journals back to standard dimensions, re-nitride

hardening and so on. The abuse is primarily damaged rod journals, either spun or worn journals. We do see quite a few worn thrust face surfaces as well."

Who's Driving the Market?

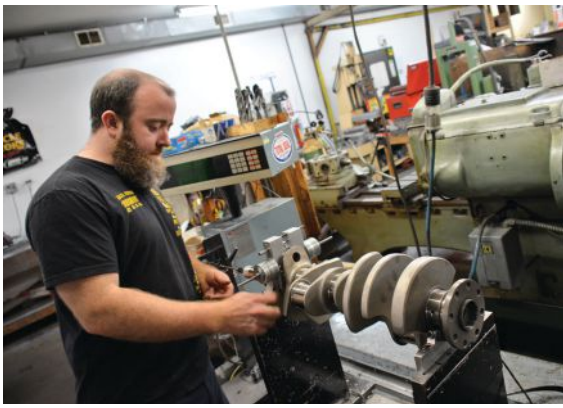
By all accounts, no single racing venue appears to have a monopoly on driving sales of crankshafts. Regardless of the segment, all race engine builders seem to demand the same thing: Crankshaft forgings made with high-strength materials and machined to exact tolerances. They want a superior product to install with confidence, knowing it can take the punishment doled out in motorsports.

"The biggest market for us," reported Tom Lieb of Scat Enterprises, Redondo Beach, California, "is the street and bracket racer. Regarding circle track racing, it's regional and some areas of the country show greater movement than others. The hardcore professional racer is one of the smallest markets based on volume, but regardless, we have products for all these segments."

"Circle track has been the leader, and is currently leading the way in lightweight crankshaft technology, and Lunati has increased its offerings with our new Voodoo Lightweight Crankshafts. With circle track racing, it's important to accelerate and decelerate quickly to help the car get off the corner," commented Peters.

Crower's Novak added, "Oval track is huge for us because of the size of the market and the diversity of engines being used. There are even some oval track racing organizations that allow big block Chevy engines to be used, so that provides even more opportunity for us."

All forms of racing seek greater efficiency, so each segment focuses on making incremental changes each season. Retailers and WDs that work closely with manufacturers, for example, can help engine builders and racers with specific custom, one-off crankshafts for their unique racing applications.



According to one industry source, more racers today are "trying to use entry-level cranks in competition engines.... I guess the economy has got everyone trying to save every penny they can. But saving a few dollars on the front end can cost you more in the long run."

Novak stated, "There is no more 'standard' in a race crank—most cranks are made to the unique needs of engine

builder and racer. This means the journal sizes, strokes, crank weight, nose diameter—all can be custom made. We even consider the driver's style, which is important in some racing environments. For example, if the driver uses the engine more for braking going into a corner, we can tailor the crank for that."

Current Bestsellers & Big Movers

Small and big block Chevy cranks are big sellers at Bullet Racing Cams, Partridge told us, "but the GM LS series engine cranks are becoming very popular and will continue to drive a lot of crankshaft sales. Small block Ford cranks in various strokes are very popular as well."

Several other key manufacturers in this category have jumped into the Chevy LS world. "Our Lunati Signature Series Forged LS crankshafts are doing very well," said Peters. "They utilize a specialized non-twist 4340 forged steel design, and the crankshaft features items such as gun-drilled mains, lightened rod journals, all journals micro-polished and a windage-contoured wing counterweight, making it the crankshaft of choice for turbo, supercharged and big-cubic-inch drag racing applications."

Crower's Novak noted the company's 4340 forgings for small and big block Chevrolets remain quite popular. "We also manufacture cranks for the modern Chevy LS engine family," he added. "However, the LS market is very tricky for us, and here's why: The LS is primarily a drag race and street engine, and there are a lot of them. Unfortunately, this is a very price-driven market, and many consumers and retailers want the low-cost sourced Chinese cranks. That can make it tough to compete in this market, as all our cranks are forged and machined in the United States."

However, Lieb cited Scat Enterprises' small block Chevy cranks for the older engine architecture as their bestsellers. "I don't see the Chevy LS overtaking the 'traditional' small block engine family anytime soon," he observed. "The LS crankshaft is more expensive due to the reluctor wheel, and if you're making a stroker crank for the LS, you need to add Mallory metal to make it balance due to counter weight issues due to the design of the LS block, and this adds to the cost."

But, it's not totally a Chevy world, as Molnar from Molnar industries informed us. "The LS Chevrolet and Mopar GEN III Hemi markets are big," he said. "We especially see a lot of customers building the GEN III 5.7L, 6.1L and 6.4L Hemi for many racing applications; we get a lot of good play from the Mopar market. When it comes to the various strokes, the 4.000-inch version for the Chevy LS small block is one of our most popular sellers, but we are seeing an increase in sales from numerous Mopar applications. PRI