



CRITICAL CONNECTION

WHY QUALITY CONNECTING RODS MATTER

WHILE ALL ENGINES need connecting rods, today's manufacturers tell us they are selling more high-quality rods, and more custom-engineered rods, for a wider variety of engines and applications than ever before.

"Race engines today are turning more rpm, and making more horsepower," noted Stefan Verdi of Auto Verdi, Gagnef, Sweden. "The market for high-quality rods is bigger than ever. They contact us and they want to know how much rpm they can make with our rods, and they want them light. The market for cheap rods—the Chinese imports—will always be tremendously large, also. But today more and more people want to step up."

"We're always improving as rpm goes up," added Roger Friedman of Dyer's Top Rods, Forrest, Illinois. "On dirt they have wide-bore engines now, with 4.250 pistons, so the weight of the pistons is way up, and they're still turning 9000 rpm. So we've had to add weight to those rods."

And yet for all their differences in dimensions, details and weight, the engineering challenges presented by any high-performance connecting rod remain remarkably the same. "There are so many variables," noted Kerry Novak of Crower Cams

& Equipment, San Diego, California, "and yet it's no different. We could be talking to a team running an off-road truck, or an off-shore boat, or a monster truck, or a motorcycle. You'd think they would all be different worlds, but they're not. In fact, it's the same constant battle. It amazes us, the amount of power they are making. So we try to make them stronger, and at the same time not make them too heavy." And increasingly, engineers rely on computer-aided simulations to nail down the details.

Abounding Applications

The variety of applications demanded by today's racing market keeps manufacturers busy. "It's a struggle to stay on top of the applications," Novak

MANUFACTURERS ARE EXPLORING NEW OPPORTUNITIES WHILE CRAFTING STRONGER-YET-LIGHTER PRODUCTS IN A CATEGORY WHERE RESEARCH AND DEVELOPMENT IS A NEVER-ENDING PROCESS.

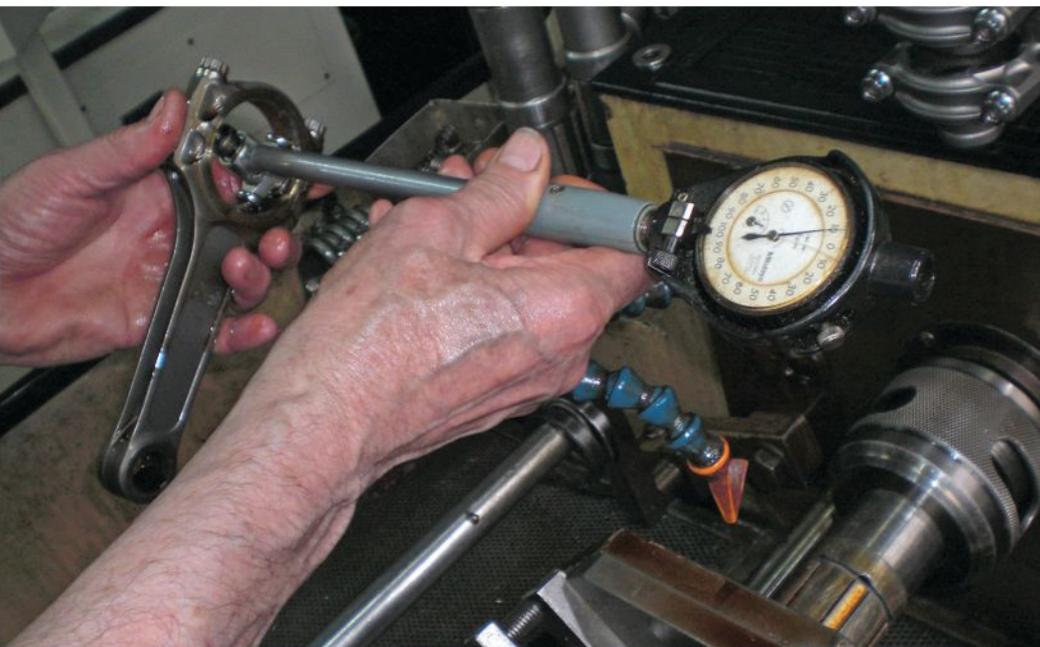
said. “The small block and big block Chevys will always be around”—but now there’s demand for additional applications as well. Novak brought about 40 different connecting rods to the 2015 PRI Trade Show, including Crower’s Sportsman rods that have been in production for 30 years, as well as the company’s latest billet rods for turbo applications, and rods for diesels and motorcycles.

“We’re discovering bases we haven’t covered,” added Tom Lieb of Scat, Redondo Beach, California. “We’ve added new lengths for our LS rods, and we’ve added some sport compact rods that weren’t yet available. There are engines from Volkswagen and Nissan that are old enough now that people are starting to work on them instead of worrying about the warranty.” Scat has even expanded its vintage lineup with connecting rods for Model T Fords. “If you want your business to grow,” Lieb added, “you have to be more things to more people.”

“We’re making rods we never made before,” Friedman echoed. “We’re making rods for GM Ecotec engines, which are being raced in midgets. We see growth in LS engines; Late Model Engines in Houston has built a 2500-horsepower LS using our heaviest 300M rod. If it fits our forging, we’ll make it. And we’re still making H-beams in 4340, and our customers really like those in lower horsepower applications.

“But our biggest growth area has been in off-road trucks,” Friedman continued—where a certain amount of experimentation seems to be the norm. “It’s basically a 430-cubic-inch aluminum small block, like what you’d run in a dirt late model. But it’s also unique, because some teams run very heavy rods, and some run very light rods. But that’s been a good market for us, where everyone is happy with our rods.”

Friedman also cited the relative strength of exports to Australia.



Throughout motorsports, the power generated by today’s engines continues to increase, providing numerous challenges for connecting rod manufacturers. Nonetheless, suppliers are busy addressing those challenges while producing components that can withstand greater horsepower and rpm, and meeting the demand for stronger yet lighter-weight rods. Photo courtesy of Saenz.



100% NEW, AND TESTED. DON'T SETTLE FOR LESS.



SCAN TO VIEW VIDEO!



<http://bit.ly/ProformStarter>

www.ProformParts.com

CONNECTING RODS

Show Stoppers

Dyer's was just one of several manufacturers that debuted new connecting rods at last December's PRI Trade Show.

Bryce Mulvey of CP-Carrillo in Irvine, California, listed some specialized items, including new aluminum forgings for rods up to 8.5 inches long, and a new line of Pro XD sport compact rods for extreme-boost applications. "We're also expanding our Sportsman line of Bullet shelf-stock rods," he said, "and we plan to display the new lightweight, stock-appearing 5.7- and 6.0-inch rods, which we've engineered to meet the rule requirements of several circle track sanctions, including USMTS, USRA and IMCA."

Lunati's latest 6.000-inch stroker rods make assembling a 383-cid small block much easier, said Matt Patrick, speaking from the company's plant in Olive Branch, Mississippi, "thanks to additional profile

In addition to delivering new designs, connecting rod manufacturers are constantly modifying existing products. For example, Lunati slightly revised the position of the rod bolts and the overall bolt length on its 6.000-inch stroker rods for a 383-cid small block to provide additional clearance inside the block.

clearance on the shoulder, where cam interference tends to be a problem. We also slightly revised the position of the rod bolts and the overall bolt length to provide additional clearance inside the block. They have been a great addition to our product line in 2015."

Ultra rods from Callies "are forged in Michigan from Timken steel, then fully machined at our own facility in Fostoria, Ohio," said Duane Boes. New applications include the Ford Modular V8, Nissan GTR, Buick 3.8-liter V6, "and a variety of LS variations. It seems the LS engine format continues to find new applications." Callies, Boes reported, is also fielding more requests for non-bushed wrist



pins, and for precise pin bore lengths to accommodate custom pistons engineered for minimal clearance between the pin tower and the rod.

"We're adding new connecting rods every day," added Tom Molnar of Molnar Technologies, Kentwood, Michigan. One new design the company debuted at PRI is its Duramax diesel rod—"an H-beam design made with the same strength and durability people have come to expect from all Molnar Technologies products." In fact, Molnar added 22 new rods to its lineup in 2015. "These cover many

MOROSO

THIS S.B.C. TWO PIECE REAR SEAL OIL PAN WAS DESIGNED FOR THE 305 SPRINT CAR SERIES BUT CAN BE IN SPRINT CAR AND OTHER CIRCLE TRACK CHASSIS WITHOUT CROSSMEMBERS UNDER THE ENGINE.

Wet Sump, 9.5 Quart Capacity, 7 1/4" Deep

Fits: Sprint Car and any chassis with no cross-member under the engine

Features

- Fully fabricated aluminum with billet end seals to ensure a consistent sealing surface
- Fits 4 bolt main cap blocks
- Large kick out design for maximum horsepower and oil temperature reduction
- Advanced oil containment system comprised of 5 Trap Doors and a diagonal runner
- Pan rail crank scraper and windage tray
- Inspection bung with plug
- Oil level check and a magnetic drain plug



NEW FOR 2016

Part No. 21330

Inspection Bung with plug

Oil Level Check

Large Kickout for Max H.P. & oil temp reduction

MOROSO PERFORMANCE PRODUCTS

phone: 203.453.6571 / tech line: 203.458.0542 / www.moroso.com

markets, from sport compact to our new GM LS stroker turbo rods with increased camshaft clearance.”

In addition to the company's respected rods for Pro Stock drag racing, Auto Verdi planned to show rods for Mercury Formula 1 outboards. “We've made nearly all of Mercury's Formula 1 rods for several years,” said Verdi, “and that market is increasing tremendously.” Designed for severe duty in a two-stroke engine, these rods require “a very deep case-hardening on the bearing surface, where the needle bearings run. It has to be 58-60 Rockwell, 1.5-mm deep.” These engines are limited to 9700 rpm now, but only a few years ago they were turning 10,500. Otherwise engineering requirements are little different from those of a four-stroke rod running in a big-displacement V8.

Of course, Pro Stock is also “a very high-end application,” Verdi continued. “The engines are turning more and more

rpm, requiring a very well-manufactured rod, using the best material, machining, and surface finish.” He plans to watch closely as the class switches over to EFI and electronic rev limiters this year. “We'll see what the effect will be.” In the meantime, however, Verdi's success in Pro Stock has brought orders for rods for high-revving, highly stressed four-cylinder Honda engines in both drag racing and circle track.

Hypermax Engineering of Gilberts, Illinois, manufactures high-performance connecting rods for Ford Powerstroke diesels and International Harvester tractor-pulling engines. “We start with aircraft-quality 4340 forgings,” said Jerry Lagod, “which are vacuum heat-treated for optimum tensile and yield strength, cryogenically treated to improve grain structure, and shot peened to improve fatigue life.” Quality control includes Magnaflux inspection, and all Hypermax

rods are assembled with ARP bolts. Lagod reported healthy growth in the multi-turbocharged tractor pulling market, while sales for street-performance diesel pickups remain solid.

At the 2015 PRI Trade Show, as well as throughout the year, MGP Connecting Rods in Colorado Springs, Colorado, fielded multiple inquiries for its Diesel Drag Race Series rod. “We are excited about our newest research and development in this untapped market,” noted Anthony Giannone. “We are currently in the prototype stages and anticipate great success as we begin offering our MGP Diesel Application connecting rod innovation to this booming market. MGP has advanced our successful position within the tractor pulling series with our connecting rod applications.”

Giannone added, “MGP Connecting Rods anticipates rolling out our newest oiling solution on the pin end of our



FEATURED PRODUCTS

- Forged From 4340 Steel • Weight Balanced to +/- 1.5 grams
- Magnafluxed • Heat Treated • Shot Peened
- Stress Relieved • Three Levels of Bolts
- Bronze Bushed Pin Bores

Our connecting rods perform on the track *and* on your bottom line

Engine Pro lets you offer your customers high value performance engine parts and an exclusive brand they can't get from online discounters. Engine Pro's H-Beam Connecting Rods are a perfect example. They come standard with ARP bolts and are suitable for applications of up to 850 horsepower. Our rods are finished in the USA to ensure precise big-end and pin-end bore sizes. Get more profit from your engine parts with Engine Pro.

www.enginepro.com

ENGINE PRO BRAND ENGINE PRODUCTS

Engine Parts Group, Inc. Wheat Ridge, CO 80033



CONNECTING RODS

connecting rods. Plus, exactly as we have implemented a highly successful 'Hard Bore Technology Finish' to the small end of our connecting rods, we are now working toward full implementation of this process to include offering it on the big end. Both of these upgrades were introduced during the PRI Trade Show, with our customers being highly positive and quite receptive to this process."

Sweating the Details

The latest CAD and FEA technology makes it possible for crankshaft manufacturers to keep pace with this expanding demand. "That's where the computer program can show us how much we can add in any particular area," said Novak. "The computer simulates stretching, twisting, bending, etc., and it will show us exactly where the weak spots are. Thirty years ago, we didn't have that." Certainly the engineers had very accurate formulae for computing

stresses in all the cross-sections, radii and angles. But "connecting rods weighed 725 grams, for an engine that made 750 horsepower. Now, the computer programs have enabled us to make rods weighing 625 grams for engines making 900 horsepower. But still, on our rods for sprint cars and dirt late models, we've had to raise the weight 15–20 grams."

"Peak firing pressure, peak horsepower and torque, peak rpm, bore, stroke, piston assembly weight and application have always been the major factors in designing rods," added Mulvey. "From there we calculate loads and adjust cross-sectional areas based on the requirements for optimal performance and longevity. If the customer has specific requests, such as clearance issues, then we work with a customer-supplied model to set our maximum envelope. If needed, we can 3D-print a mockup rod that the customer can use to check clearances."

"It's all in the combination," Novak agreed. "So you have to ask a lot of questions. You have to ask how the driver drives the vehicle. Say in a road race application, a customer calls and says they're having trouble with connecting rods. They say they want to keep weight down so they can get around corners. So the first thing we ask is, 'How hard does the driver use downshifting to slow the car down?' And the guy says, 'Oh, our driver bangs it down about as hard as he can.' And we say, 'Well, that's what's killing your connecting rods. You may have a chip in there that shuts off the fuel at 8200 rpm, but if your driver is downshifting that hard, he's revving the engine beyond what the chip allows. And then they say, 'Yes, we noticed that. He breaks rods while downshifting into a corner.'"

In fact, connecting rods almost always break on the exhaust stroke. It isn't the fiercest, forced-induction-induced

**CHAMPIONSHIP RACERS
USE CHAMPIONSHIP PARTS**

SPEEDWAY ENGINEERING

^ 9" FORD FLOATERS
Now available with our exclusive billet gear receiver.

**TORQUE TOUGH™
< 3-PIECE SWAY BARS**
Many applications for stock cars and road racing.

< TORQUE TOUGH™ AXLES
Top choice by NASCAR teams.

**PROVEN!
SE 08 SPINDLE**
For NASCAR applications.

SUPERMAX ^ QUICK CHANGE REAR ENDS
Super strong and reliable, yet lightweight.

WIDE 5 > RACING HUB
Built tough with removable rotor adaptor.

2" BEARING SPEEDWAY HUB >
Built tough with new integrated seal.

**CALL TODAY! (818) 362-5865 | VISIT OUR WEBSITE! www.1speedway.com
13040 Bradley Avenue, Sylmar, CA 91342 | *Call for Free Catalog**

combustion pressure that breaks them, but the weight and speed (equals inertia of a piston flying upward toward freedom but instead hitting the end of its tether—that is, the connecting rod).

“Lighter reciprocating parts reduce inertial forces,” explained Gabriel Casella of Saenz in Buenos Aires, Argentina. “But there’s a point where deformation due to stress begins to consume power and cause premature fatigue. One of the most common failure points is at the wrist pin, so we use only rigid pins that we have tested in a variety of engines.” In any application, he added, “at high rpm, inertia stresses a rod twice as much as combustion pressure. So fractures usually begin in tension.” Longer strokes aggravate this situation by producing high piston speeds at TDC. “Willow” rods may buckle in compression, but even then failure begins on the side of the rod that is in tension. “And once a crack is

started, it’s just a matter of time before the big bang.”

Quality, Controlled

Casella offered us some insight into the engineering and manufacturing of a quality connecting rod. Saenz, he noted, makes connecting rods for applications ranging from “small bikes to pulling tractors. But our target is always the top of the pyramid, where the customer appreciates quality and understands the cost behind it”—that is, “the cost of all the details that make a difference. In the past, we’ve lost some customers who found less costly rods, rods made elsewhere that were supposedly ‘the same,’ but for one-third the price. But time has proven that one gets what one pays for, and some of these customers have returned to us.”

Casella emphasized the importance of “maintaining our material, heat-treatment process, and tolerance protocols—as our customers are very happy with the

standard we’ve achieved. Our quality starts with exclusively US-supplied material, plus our physical and chemical controls. Every bar of material is identified, and samples are kept for two years.

“The quality of the forging, the first heat-treat to regenerate internal structure, and then the machining process are all designed to minimize deformation and stress. Then the definitive heat-treat follows the CNC machining process. All Saenz heat-treatments are performed in-house; every piece is controlled for hardness; and again, we keep samples from each step for microscopic analysis. Then our rods are machine-polished until all marks disappear and all corners are slightly rounded before a calibrated shot-peening creates a smooth, compression-stressed surface.”

Boes agreed that, “The slow but steady increase in the operating rpm of racing engines continues to amplify the inertia

ATL DESIGNING & MANUFACTURING THE WORLD'S FINEST CRASH-RESISTANT FUEL CELLS FOR OVER 45 YEARS!

WE BUILD FUEL CELLS

INNOVATIVE PERFORMANCE FUEL SYSTEMS & REFUELING EQUIPMENT

ALL ATL FUEL CELLS ARE **APPROVED**

MADE IN THE USA

800-526-5330
1-201-825-1400

RACING ATL FUEL CELLS
atracing.com

atl@atlinc.com

facebook
/ATLRacingFuelCells

ATL

CONNECTING RODS

load on rotating components. This strain not only manifests itself on the connecting rod beam and wrist pin, but to a significant degree on the bearing housing as well. To address these loads, extremely close attention is paid to the thread quality in the beam side of the cap-to-rod interface. Any permanent deformation of these threads will affect the roundness of the housing bore, thus affecting the load-carrying oil film. Studies have shown that the oil film separating a bearing insert from a crank journal is commonly three microns or less in thickness. If the bolt threads begin to deform plastically due to poor geometry, clamping load is decreased and the integrity of the housing is compromised.”

Patrick cited “the challenge of reducing rod weight while still ensuring sufficient strength and durability. The level of precision a manufacturer achieves when machining connecting rods is just as important as the quality of the material and

the heat-treat used. Racers and engine builders need to select a manufacturer whose rods are dimensionally accurate and consistent in weight. This not only assures that the engine will assemble with the proper clearances, it also ensures more accurate balancing.” Among Lunati’s design strategies is the use of premium, 7/16-inch ARP2000 bolts for “every rod we manufacture. While more expensive than run-of-the-mill rod bolts, these ARP2000 fasteners add strength and durability to our designs.”

The connecting rod-and-bolt combination is one of the most critical components in an engine, according to Mulvey, who added, “Choosing an assembly that meets the requirements of your combination is more important than initial cost.”

The Power of Powder

Howards Racing Components of Oshkosh, Wisconsin, offers powder-metal

connecting rods for the high-performance market. Howards’ powder-metal rods are produced in partnership with global giant GKN, using a proprietary alloy that contains ASTM 4260 but “rivals 300M for strength,” said Steve Mugerauer. “We use CAD solids modeling for proof of concept and machined models from billet. We also use FEA to simulate stress and reaction to stress, which provides better strength and leads to weight reduction in the correct areas.”

The powdered materials are sintered at 1500 degrees F and then hot-forged with a 750-ton press.

“The result is unlike a traditional billet or forging in that the grain structure is identical throughout,” Mugerauer continued. “No matter how you cut it, it will look the same under an electron microscope.” An additional advantage is uniformity from piece to piece; each finished rod weighs within two grams of

The Best Solutions for every Engine Builder!

MR. RACE OIL® Engine Assembly Products



Also try our Cam-shield® PREMIUM ZDDP additive



Made in USA

Contact us today: 862-251-4968 www.MRRACEOIL.com

MR. RACE OIL
PROFESSIONAL HIGH PERFORMANCE LUBRICANTS

any other sharing the same part number. That's close enough that an engine builder can replace one rod without re-balancing the rotating assembly.

Caps are not sawed off, but rather are fractured from the forging. The resulting surface roughness guarantees that the cap can only fit back on exactly where it broke off, ensuring perfect alignment and eliminating fretting or movement during re-assembly. Howards assembles these rods using 3/8-inch ARP2000 fasteners. A typical 6.0-inch small block Chevy rod weighs 585 grams, can handle 700 horsepower, and retails around \$500 for a set of eight.

Tech Questions

Perhaps it's not surprising then that bolts—and their proper installation—figure prominently in the most common tech questions these manufactures field on a daily basis.

"The most common tech support



Advanced technology such as CAD and FEA allows connecting rod manufacturers to develop highly detailed designs, as well as showing engineers where to strategically place weight on the rods to improve strength. Photo courtesy of K1 Technologies.

question of all is how to torque a bolt," stated Lieb. "The high-end engine builders—and by that I mean the ones who are actually building NASCAR or equivalent engines—have tools and skills that the average engine builder does not have. People talk about stretch, but you have to have sophisticated tools to measure it. You have to know what you're doing and know why you are doing it."

Lieb has found customers confused about other matters as well. "We also field questions about the big-end bore not being parallel to the pin bore. And then we find they've tried to measure the rod after it's installed in the block. And then, of course, it's affected by the alignment of the crankshaft, all the clearances on the crank and rod bearings, and on the main bearings; and then you have the centerline of the bore in relationship to the crank centerline, and the perpendicularity of the bore to the deck of the block to the line bore of the main. You have clearances at the wrist pin. You have all these variables, and people try to measure it, and it's impossible to do.

"Or they think that the side clearance at the big end controls the oil pressure—but it doesn't," he continued. "Oil pressure is controlled by the bearing clearance. The oil has to get through that .002 bearing clearance, or .003, or whatever, before it

UNITED ENGINE & MACHINE Co.

PISTONS





NEW  **Abradable Skirt Coatings**

- Polymer-based and engineered to be applied thicker on the piston than liquid-style coatings.
- Designed to hone in to the ideal oil film clearance during engine break-in.
- Under operating conditions, if the piston expands further, the coating will again burnish in to safely maintain an ideal minimum oil film clearance.
- Allows the piston to operate at a tighter running clearance which means the piston will rock less in the bore and maintain optimal ring seal.
- Ideal for high-expanding 2618 aluminum alloy pistons that require larger clearances.
- The main benefits of the coating are to keep the piston square in the bore and prevent scuffing.

Toyota Supra Shown

NEW **In-House Anodizing**



GM350 Flat Top Shown

- Anodizing the Top Groove provides a hard surface for the ring to rotate on, virtually eliminating micro-welding.
- Anodized Crown offers corrosion resistance and some heat reflection
- Available on some off the shelf part numbers

Abradable Skirt Coating is done in-house with licensed equipment and materials from Line 2 Line for fast shipping.



World Headquarters
 1040 Corbett Street • Carson City, Nevada 89706 USA • 775.882.7790 • TOLL FREE US: 800.648.7970
www.uempistons.com

CONNECTING RODS

even reaches the side clearance.”

According to Boes, by far the most common question is, “What torque should I tighten the bolts to?” Our answer is always the same: Please invest in a good bolt stretch gauge. A variety of factors influence the amount of energy required to turn a fastener and the torque reading that might result. Measuring a fastener’s elastic deformation is the only way to truly know what the clamping force will be.”

“Although we supply specifications regarding clamping force with every rod set,” said Casella, “it is still common for customers to ask how much they should torque the bolts. Our answer is always that only the stretch method can assure the correct clamping force between the rod and the cap. Stretch is what ARP recommends, and it is well-explained on their web page.” Saenz uses and recommends ARP bolts.

“Bolt torque or stretch,” added Mulvey,

“that’s the most commonly asked question. The correct way to get a proper clamp load on the bolt is by stretching them.”

Sean Crawford of K1 Technologies in Mentor, Ohio, also endorsed the stretch method “to ensure you’re actually achieving your desired fastener preload. Rod bolt torque is influenced by the surface finish of the bolt and receiving threads, and by the lubricant. If the thread finish is rough, or you use motor oil instead of rod bolt lubricant, the friction will be different as you tighten the bolt—resulting in a different preload/clamping force holding the cap on the rod. The stretch method, however, is not influenced by these factors and provides a better indication of the actual preload.”

Patrick reported three common questions—and provided his answers to each. The first question he noted is, “Should I tighten the rod bolts with a torque wrench? Or use a rod bolt stretch

gauge? While both methods have been successful for years, a stretch gauge provides greater precision during the tightening process. This greater precision allows more clamping force without damaging the bolts. When using a torque wrench, it is critical that the connecting rod threads and bolt threads are clean, and that the proper lubricant is used.

“How many times can I re-use my rod bolts?” he asked next. “As long as the bolts have not been over-torqued, or permanently stretched more than .001 over their initial length, they can be re-used.”

Finally, “Which are better, H-beam or I-beam rods? Lunati offers both, and has found that each performs well in a variety of street and racing applications. Our H-beam rods are generally rated up to 1000 horsepower and are great for engine builders on a budget. Our I-beam rods are our top-of-the-line offering and have

Torco
RACING OILS & FUELS

Dirt to Asphalt ... Torco has you covered

SAE 30W50
SAE 10W30

ACCELERATOR
Race Fuel Concentrate

distributed by:
Motor-State **PRO-MOTION**
DISTRIBUTING

Made in USA

800 649 5722 • torco.com

Performance Racing Industry | February 2016

been used successfully in race engines with 1800-plus horsepower," he said.

Dyer's has fielded far fewer questions about fasteners, said Friedman, since the company opted seven or eight years ago to use custom-engineered bolts from ARP exclusively. Now, customers don't have problems with rod bolts. But they still ask about torque and stretch, "even though we provide them with an instruction sheet. If they don't feel comfortable about something, they call us. We tell them to torque the bolts to 40 pounds first and 68 pounds after that. But stretch is most important. We seem to have most of our engine builders educated about that, so it's not an issue any more. We sell stretch gauges, and so does ARP. We sell a digital gauge from Mitutoyo; it's pricey, but it's a very nice piece."

Molnar's answer provided some variety: "We deal daily with the fictitious horsepower ratings that people use to sell

rods, as well as why it is important to use the stretch method for tightening bolts."

Finally, since customers often ask about I-beam versus H-beam configurations, Casella prefers to avoid "a direct answer. Instead, we ask the customer's preference, and whether or not they would rely on us to decide which is better for their application. And, of course, we ask about rod length, big-end and pin bore, and the application. Then, based on our experience, we offer the customer a digital solid of our proposal. In our experience, an I-beam or H-beam with the same reciprocating weight work the same in most modern engines. For very long rods, the I-beam has some advantage; while H-beams are somewhat better for applications with exceptionally large big-end bores. We usually achieve the best result by mixing I- and H-beam configurations, changing profile and thickness according to the engine and application.

"With our years of racing experience, plus the help of FEA, customers are able to see the exact design and know the exact weight of their custom-ordered rods within hours. So we can tailor the exact rod for every engine project," he said.

Crawford offered this additional advice: "Most modern racing engines can make more cylinder pressure and turn more rpm than in prior years. It's important to be aware of this, and to evaluate your engine components to be sure they're designed to operate in these conditions. Speak with your connecting rod manufacturer and tell them your goals for maximum rpm and torque. They should be able to give you confidence the products will run safely."

Casella said, "There are no magic solutions." There are "specific alloys, and heat-treatments require specific protocols" to "desired mechanical characteristics."

And you very definitely get what you pay for.

PR1

CNC MACHINED FLANGES

MANDREL BENDS

HEADERS

CUSTOM FAB

Merge Collectors

VIEW OUR CATALOG ONLINE

SPD SPECIALTY PRODUCTS DESIGN INC.

- Merge
- Double Slip Merge
- Weld-On Merge
- Bent Merge
- Tri-Y
- Flat Merge

888.778.3312
www.spdexhaust.com
Exhaust Engineering Excellence Since 1969