

# FASTENED UP

## HOW TO CORRECTLY PICK AND USE NUTS AND BOLTS

By Brent Ross

**N**uts and bolts have a jumbo job—they hold the entire truck together during tons of bashing and vibration. The darn things are all over the place, so naturally everybody has fiddled with his share of fasteners. But it's this familiarity that brings on a few problems since nuts and bolts are often not given enough thought. There's actually more going on with fasteners than most people give them credit for, so we decided to give the pawns of truck building some well-deserved attention.

### SIZE

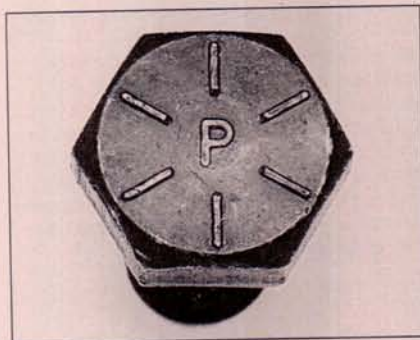
Nuts and bolts are available in two size classifications: standard and metric. Both come in various thread pitches. The pitch of a standard-thread bolt is the number of threads per inch. A 1/4-20 bolt has a 1/4-inch diameter and 20 threads per inch; this is a coarse-thread bolt. The fine-thread equivalent is the 1/4-28, with 28 threads per inch.

Working up in diameter from the 1/4-inch bolt, the standard nuts and bolts are expressed in fractions of an inch. However, smaller-diameter bolts are expressed by gauge, similar to wire sizes. The diameter of metric bolts is given in millimeters. An 8-1 metric bolt has an 8mm diameter and 1 mm between each thread; the 8-1 is a fine-thread bolt. There's also a coarse-

thread 8-1.25 which, as you might guess, has 1.25 mm between each thread, so there are fewer threads.

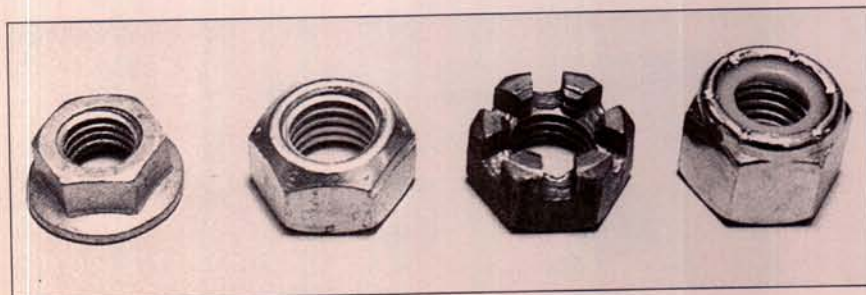
Metric and standard bolts are not interchangeable, although many may appear so. If possible, when you're bolting items to your truck, use the same type of fasteners already on your truck. For example, if your truck is metric but the accessories are secured with standard nuts and bolts, you'll have to drag out twice as many tools when working on it. Also, when selecting a bolt, choose the largest diameter that'll slide through the mounting hole without touching the sides.

Head styles and sizes also vary even among bolts of the same diameter and pitch. For example, a 5/16 bolt may be available with either a 7/16-inch or a 1/2-inch head. Similarly, a heavy-duty nut may take a bigger wrench size than a regular nut of the same thread type. If access is not limited, choose the same size and style head as the other nuts and bolts used in the area of the truck



Six evenly spaced radial lines are the correct markings for a Grade 8 bolt. A Grade 5 bolt is identified by three evenly spaced radial lines. Lines in any other combination are not grade markings.

PHOTOGRAPHY: BRENT ROSS & JIM BROWN



Lock nuts come in several varieties. The flange nut at the left has a knurled underside to lock against the surface of the part it secures. The last thread on the second nut from the left is slightly deformed so that it applies more pressure against the threads of the bolt, which prevents the nut from backing off. The castle nut requires the use of a cotter pin. The nylon-lock nut is held in place by the undersize nylon insert, not a good choice around heat or if the nut is frequently removed.

**TRUCK STOP?**

**STOP FASTER . . .  
STOP BETTER!**

**with Bolt-on  
Rear Disc Brakes**

- Ford F-Series
- Explorer/Bronco/Bronco II
- Chevy/GMC
- Blazer/Jimmy
- Jeep Wrangler; CJ 5-7-8



- Easy bolt-on installation
- All O.E. parts
- Safety tested
- Available from stock
- Under \$600 (plus freight)



**stainless steel  
brakes corp.**

11470 Main Road/ Clarence, NY 14031  
Order Toll Free 800-448-7722  
In N.Y. (716) 759-8666  
Fax: (716) 759-8688 (24 hours)



Stainless Steel  
Brakes Corp. © 1995

Please send me more information on truck rear disc kits. P4W

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Year & Make \_\_\_\_\_

Model \_\_\_\_\_

# FASTENED UP

you're working on. That way you'll need only one size wrench. If the part being secured is thin, select a bolt with a large-diameter head and use a large flat washer to spread the load and reduce the chances of the bolt pulling through the material.

## STRENGTH

Bolts are rated for a combination of their shear and tensile strengths. The Society of Automotive Engineers (SAE) grading system is based on a number system and is indicated by marks on the head of the bolt. Grade 1 and 2 bolts are the lowest quality and are unmarked. Grade 1 and 2 bolts should be used only for assembly applications and not for structural integrity. Grade 5 bolts are where the acceptable range begins. A Grade 5 bolt in some appli-



An antiseize compound acts as a lubricant during torquing to yield accurate measurements. Unplated fasteners use 85 percent of the required torque just to overcome friction between the male and female threads. Antiseize agents also reduce galling of stainless steel fasteners and prevent galvanic coupling of fasteners of dissimilar material.

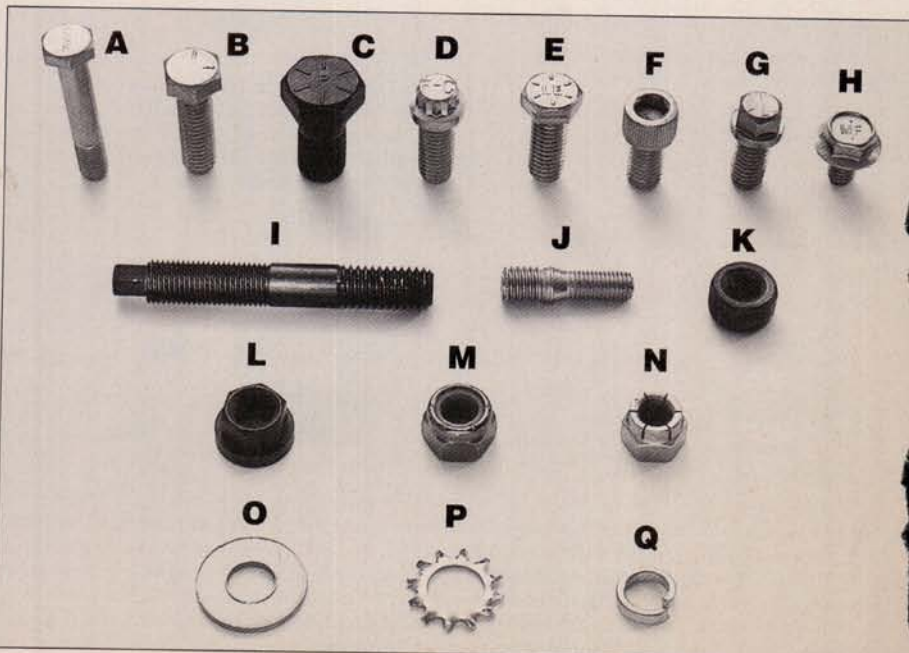
cations is better than a stronger Grade 8 bolt because the 5 has a greater fatigue cycle and lasts longer when frequently tightened and loosened. It also provides greater shear strength but less tensile strength. Grade 6 bolts are fairly rare and most people use either Grade 5 or 8, which are the strongest in the SAE system.

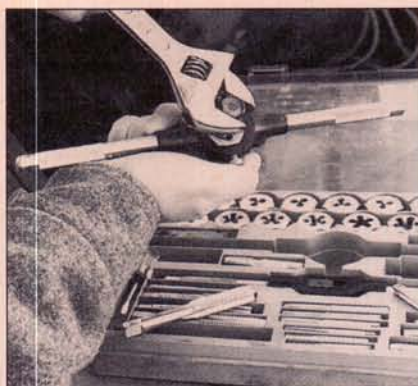
Today virtually all bolts are made with rolled threads, although nuts still have cut threads, but the strength of a bolt depends on whether the threads were rolled before or after heat-treating. Rolling after heat-treating work-hardens the base metal and produces a stronger bolt. This is partly how Automotive Racing Products (ARP) and other companies make fasteners that are much stronger than Grade 8s. Grade 8 bolts have a tensile strength of about 156,000 psi, while some bolts from ARP are rated as high as 220,000 psi. Also note that normal stainless steel bolts have tensile strengths of about 78,000 psi, and good high-strength stainless steel bolts have tensile strengths of about 120,000, or about equal to Grade 5.

Chrome plating a bolt destroys the grade rating due to hydrogen embrittlement in the chroming process. In



Studs are often used to secure soft non-ferrous parts. The course-threaded side of the stud is threaded into the non-ferrous part, while the nut threads onto the fine threads on the other end to generate the required clamping load.





A tap and die set is essential for quality automotive work. Dies can be used to clean up the threads on bolts and studs, while the taps are used to clean up threaded holes and nuts. A clean, uniform thread is a must for proper torque and clamp loading. Note that if a threaded hole is not relieved, a bottoming tap (not a starter tap) is used to reach the bottom few threads.

fact, the higher the grade the bolt is to start with, the worse the problem. Only use chromed bolts on nonstructural parts. Better results are achieved by using polished stainless steel bolts such as those from Totally Stainless. The company can advise where and when not to use its fasteners.

#### TORQUE

A properly bolt used works like a spring. By using a torque wrench for control, you can stretch the bolt to a predetermined amount, which applies the correct clamping load (the amount of pressure that squeezes the parts together). In fact, the connecting-rod bolts in performance engines are often tightened using a bolt stretch gauge. However, most applications use torque

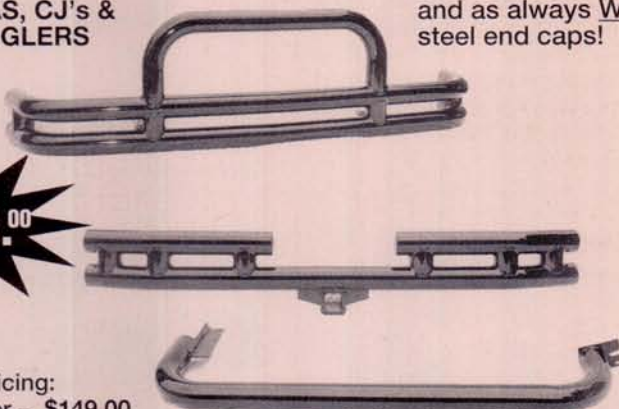
- A. Bolt with nonthreaded grip area
- B. Two marks at a right angle denote a stainless steel bolt
- C. Grade 8 bolt
- D. 12-point bolt with undersize head for counter-bore applications
- E. Grade 8 bolt
- F. Allen-head bolt
- G. Grade 5 flange bolt
- H. Unspecified flange bolt
- I. Aluminum blower stud (designed to break before the blower case does)
- J. Stud
- K. Pipe plug
- L. Flange nut
- M. Nylon-lock nut
- N. Flex nut
- O. Flat washer
- P. Star washer
- Q. Split lock washer

## DERWIN DIVERSIFIED

DERWIN'S  
SPECIAL PACKAGE  
DEAL FOR  
TOYOTAS, CJ's &  
WRANGLERS

3" Tube Bumpers  
and Nerf Bars,  
Black powdercoat  
and as always WITH  
steel end caps!

**\$295.<sup>00</sup>**



Individual Pricing:  
Front Bumper - \$149.00  
Rear Bumper - 149.00  
Nerf Bars - 69.00

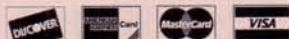
TO ORDER DIRECT CALL:  
**(805) 525-3496**

OR WRITE:  
**DERWIN DIVERSIFIED, INC.**

130 E. Santa Maria Street  
Santa Paula, CA 93060

Products and prices are for  
Toyota, CJ's, Wrangler, Nissan,  
Ranger, S-10 and S-15. All items  
shipped UPS.

CA Residents add 7.25% tax



Send Us A Self-Addressed Envelope  
FOR A FREE BROCHURE

**PROTHANE™** Hi-Tech Urethane suspension products will give you a smoother, better handling ride! These components out-perform the stock rubber bushings in daily driving, highway cruising or off-roading. **PROTHANE™** suspension parts are chemically engineered, providing progressive rates of shock absorption. Impervious to salt, water, smog, oil or grease. **PROTHANE™** offers a comprehensive selection of suspension components for domestic and foreign cars, trucks and vans. Ask your dealer for **PROTHANE™** Hi-Tech Urethane Products. For more information send \$5.00 today for our New 1995 **PROTHANE™** Parts Catalog. **PROTHANE™** is a division of **DEE Engineering, Inc.**

**PROTHANE™**  
Hi-Tech Urethane™

3560 Cadillac Avenue, Costa Mesa, Ca 92626, Fax: (714) 979-3468

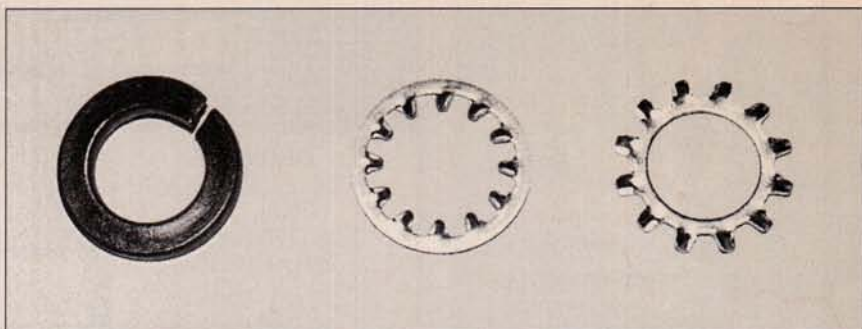
**(714) 979-4990**

For information on **PROTHANE™** Distributorship Contact Our Sales Dept.

● Shock Eyes ● Grommets ● Bump Stops ● Coil Spring Inserts  
● Manufacturers of ● Sway Bar & Suspension Bushings ● Body Mounts ● Transmission Mounts

# FASTENED UP

specs that are generally given for both dry and lubricated threads. When a bolt is tightened, it stretches and tries to return to its original length. When torqued to the maximum spec, a bolt generates the maximum possible clamping. If the bolt is overtightened, the bolt becomes permanently stretched, so clamping load is actually reduced. If way overtightened, the bolt breaks or the threads strip.



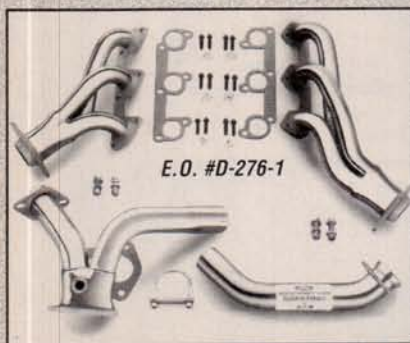
The split lock (left) is the most-common lock washer and is also very effective; it can be reused many times. Inside and outside star washers are generally saved for applications requiring clamp loads too light to flatten split lock washers.



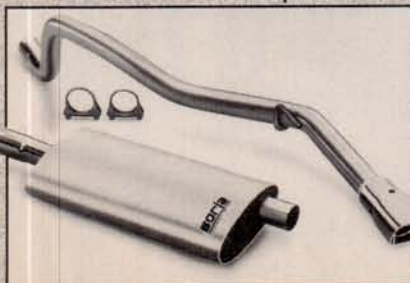
**OFF-ROAD AND HIGHWAY**

## BORLA Stainless Steel Exhaust Products For Unbeatable Horsepower, Cool Sound & Superb Reliability!

*Off-road legend Ivan "Iron Man" Stewart knows a thing or two about winning and going the distance. That's why he relies on a BORLA stainless steel exhaust system!*



Headers for Ford Explorer



Jeep Cherokee Cat-Back™

BORLA uses only 100% Aircraft Quality T-304 Stainless Steel in all headers and exhaust components (like the 50-state legal 4.0 liter Ford V6 header kit shown here) to ensure total reliability. You'll find BORLA's workmanship equally impressive.

We have developed unsurpassed Cat-Back™ systems (in fact, we coined the term) for most popular vehicles. And BORLA's patented technology provides increased performance significantly beyond most expectations! You will experience quicker acceleration and better gas mileage.

Of course, you can't improve upon the distinctive style and cool sound a BORLA system adds to your truck or SUV.

More importantly, you should know that BORLA stainless steel exhaust products are made right here in the U.S.A. and backed by a written Million-Mile Warranty. What could be better? Send \$1 for catalogs.

# BORLA

PERFORMANCE INDUSTRIES  
5901 Edison Drive, Dept. WOR, Oxnard, CA 93033  
(805) 986-8600 (FAX 805-986-8999)

Fine-thread bolts require more torque than coarse-thread bolts of the same diameter. Therefore, fine-thread bolts exert higher clamping loads. For example, a Grade 5 3/16-16 bolt can be torqued to 30 in-lbs, while a 3/8-24 bolt can go to 35 in-lbs. The clamping loads for the two bolts are 4950 and 5600 pounds, respectively. If Grade 8s are used, clamping loads jump to 7000 and 7900 pounds because they can withstand more tightening. However, never exceed the clamping required by the component being secured. The clamping load dictates the grade bolt used and how much it's torqued.

### STUDS

When it's necessary to thread a bolt into a soft nonferrous part (without an insert), such as an aluminum cylinder



All critical fasteners must be properly torqued to ensure proper clamping load. Improper clamping load can cause the fastener to loosen or break, which will cause the part being secured to deform (if it was overtightened). When possible, use the manufacturer's recommended torque spec rather than the max torque capability for the size of bolt used because the part that the bolt is threaded into may not withstand the load (for example, a valve-cover bolt torqued into an aluminum head).

# FASTENED UP

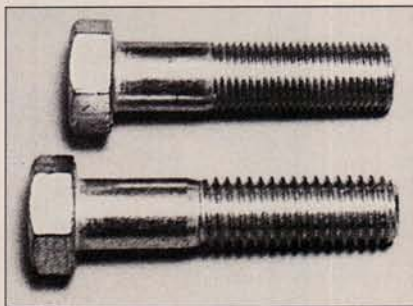
head, it's best to use a course-thread bolt so the threads have more meat to hang onto. However, a better method is to use a stud. Aluminum engine blocks often use studs for securing the cylinder heads. These studs have coarse threads on one end and fine threads on the other. The coarse end threads into the block until the nonthreaded center portion of the stud contacts the block. The head then slips over the studs, and the traditional fine-thread nuts are torqued to apply the correct clamping load.

## LOCKING DEVICES

Nuts and bolts tend to vibrate loose unless something stops 'em. That's where lock washers and lock nuts come in. Star washers are the least expensive form of lock washers. These are used only on applications with low clamping loads such as for securing sheetmetal. The common split lock washer, which looks like a sliced and bent flat washer, is a very effective locking device. However, it can't be used on low-load applications because the load must be great enough to flatten the washer. These washers are also rated for the amount of locking effort they exert, although they're not marked. The harder the

washer is to flatten, the greater the locking force. The flat washer, although not a locking device, deserves mention because its use is almost always recommended to spread the load, prevent the bolt head from galling the part it secures, or give accurate torque-wrench readings. All of the mentioned washers can be used repeatedly.

The flex nut is probably the best locking nut for automotive applications but is often overlooked. The exit side of the flex nut has a slightly smaller diameter and is cut so the sides flex outward to permit the bolt to pass. The flex nut applies force on the bolt as the nut tries to spring back to its original shape and increases the friction required to remove the nut.



These are both  $\frac{3}{8}$ -inch bolts but one is a fine thread, the other a coarse. The fine-thread bolt generates the highest clamping load, but the coarse-thread bolt is the better choice for threading into aluminum parts.

The most overused and misused nut is the nylon-lock nut. This nut works because its exit side houses an under-size nylon insert. When the nut threads onto the bolt, the bolt cuts threads into the insert. The deformed nylon insert exerts pressure on the bolt and prevents the nut from loosening. However, nylon locks can be used only a couple of times before the threads are permanently cut, making the insert useless. Engine heat also destroys the nylon, as do common automotive chemicals. Finally, nylon-lock nuts are not Grade 8 rated because installing the insert compromises the heat-treating process. Chemical thread-locking components are also very effective. **4w**

## SOURCES

**Automotive Racing Products,**  
Dept. 4WOR, 250 Quail Ct., Santa  
Paula, CA 93060, 800/826-3045 or  
805/525-5152 (in CA)

**Specialty Fasteners,** Dept. 4WOR,  
1537 W. McKinley St., Unit 18, Azusa,  
CA 91702, 818/969-6789

**Tavia Performance Products Inc.,**  
Dept. 4WOR, 12851 Western Ave., Unit D,  
Garden Grove, CA 92641, 714/892-4057

**Totally Stainless,** Dept. 4WOR, 1709  
Old Harrisburg Rd., Gettysburg, PA  
17325, 717/337-2151

# As a Matter of Fact...

**RANCHO** was **FIRST**  
to introduce **"SOFT RIDE"**  
Leaf Spring Suspension Systems in 1978.

Now, nearly 20 years later, some companies are advertising "flex" this or "super" that. Face the facts. Rancho was the first to develop fully engineered *Performance Suspension Systems* that provided increased vehicle ride height and maintained comfortable O.E. ride characteristics.

Performance handling and comfort is designed in by Rancho's team of highly experienced "hands-on" engineers. Material thickness, number of leaves, arch and progressive spring rates are precisely matched. Rancho Leaf Springs deliver both the muscle needed to handle the worst terrain and the flexibility necessary for maximum wheel travel and a smooth ride.

Don't settle for less, insist on Rancho Suspension...because a copy is never as good as the original.

©1996 Rancho Industries • 6925 Atlantic Ave. • Long Beach, CA 90805

# RANCHO SUSPENSION

**Built for TRUCKS by People Who KNOW TRUCKS**

For ordering information call 310-630-0700  
Please reference ad code 10-03-03

Warning: Installation of a  
Rancho Suspension can  
increase the risk of vehicle  
rollover in abrupt maneuvers.