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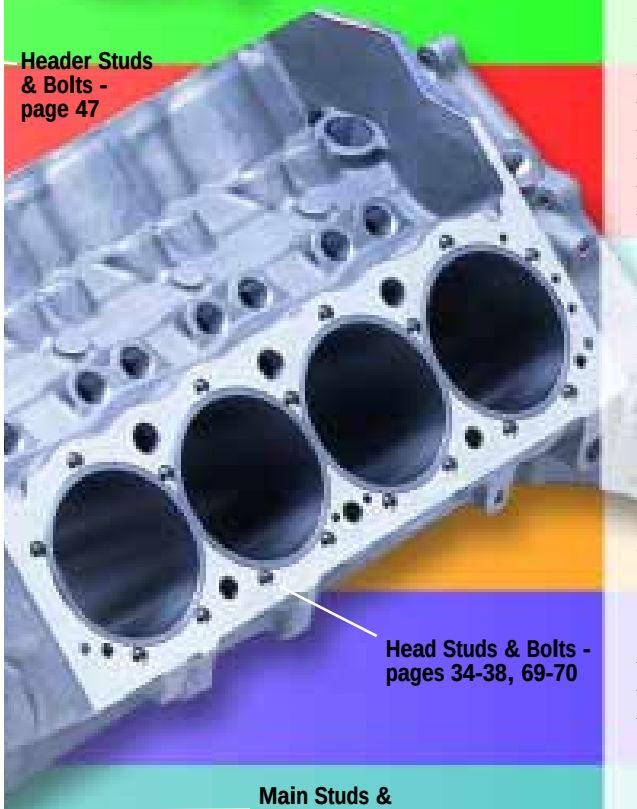

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ARP automotive Racing products

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A Brief History...

They say that to be successful you must identify a need and satisfy it. Back in 1968 racing enthusiast Gary Holzapfel saw that many of his friends' broken engines were caused by fastener failure. At the time, there were no commercially available studs and bolts up to the challenge. So Holzapfel called upon his many years of fastener making experience for a leading aerospace subcontractor and founded ARP® (Automotive Racing Products). In the ensuing years, the firm has grown from what was literally a backyard garage workshop into a highly diversified manufacturer with four operational entities in Southern California with a combined area in excess of 115,000 square feet. These include forging, machining, finishing and packaging/warehousing facilities in Santa Paula and Ventura, California. There is even a unique racing-themed restaurant at the main Santa Paula facility (called "Hozy's Grille" - which is open to the public).

Gary Holzapfel
Founder and C.E.O.

On hand at the Grand Opening of ARP's new manufacturing facility in Santa Paula, CA were (l to r) 11-time NHRA World Champ John Force, ARP's VP Sales & Marketing Bob Florine, Founder and CEO Gary Holzapfel, Racing Director Chris Raschke and ARP President Mike Holzapfel.

Today, ARP's product line contains of thousands of part numbers, and has expanded to include virtually every fastener found in an engine and driveline. These range from quality high performance OEM replacement parts to exotic specialty hardware for Formula 1, IndyCar, NASCAR and NHRA drag racing and marine applications.

As a matter of fact, ARP's customer list reads like a "who's who" of motorsports around the world. This past year saw virtually every major championship on the planet won with engines prepared by ARP® customers. These include NASCAR Winston Cup, CART, Formula 1, NHRA Top Fuel, Funny Car, and Pro Stock, NASCAR, Busch Cup, and Craftsman Truck Series. And so it goes. ARP® works closely with many, many teams as a supplier of engine and driveline fasteners, and has clearly become recognized as "the" pre-eminent source for serious racers.

In addition to its core automotive business, ARP® has an Aerospace Division, and is one of the very few companies in the world fully licensed by the United States Government to manufacture MS-21250 fatigue rated fasteners.

ARP® also manufactures a variety of industrial fasteners on a contract basis, and is known for its ability to promptly provide efficient solutions to problems at hand.

ARP's state-of-the-art new manufacturing facility in Santa Paula, California.

Packaging, warehousing and sales operations are handled out of Ventura, California.

All metal finishing operations are done in this Santa Paula plant.

This facility is home to ARP's forging and heat-treating operations.

The Manufacturing Process...

In order to ensure optimum quality control, ARP® has grown to be exceptionally self-reliant and come to control all aspects of the manufacturing process. All operations are performed in-house and closely monitored. This is how ARP® has been able to establish a reputation for "zero defects" quality throughout the industry.

The process begins right at the mill, where ARP® orders only premium grade materials—including several proprietary alloys. The ever-popular 8740 chrome moly steel, for example, comes from the mill in four distinct grades. The lowest is "commercial," which is followed by "aircraft quality." ARP® uses only the top two grades (SDF and CHQ), which cost twice as much, but provide the foundation for defect-free fasteners. These materials come in bar stock (for studs) and huge coils (for bolts). dedicated to forging bolts, studs and nuts, employing both.

Transforming raw material into a fastener begins with "hot" and "cold" heading processes. Material is fed into powerful devices and cold forged, or induction-heated and formed under tons of pressure.

Material comes from the mill in large coils...which subsequently will be fed into cold-headers and formed into bolts.

Some bolts begin as induction-heated lengths of bar stock that are forged on huge presses with the desired head shape.

ARP's bank of cold-headers can handle material up to 5/8" diameter and form bolts in a multi-phase operation.

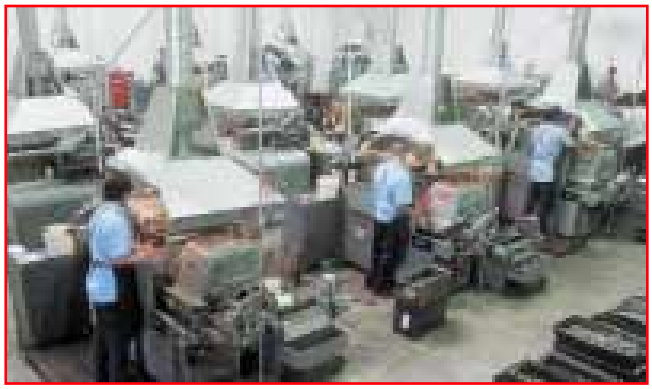
Here lengths of bar stock are automatically fed into special machines and cut to the appropriate length.

Here's an overview of just part of ARP's expansive machining operations. The shop is laid out for optimum efficiency.

Following the basic shaping, material is heat-treated to desired levels. This crucial process is done entirely in-house to assure total quality control. It should be pointed out that ARP® uses special vertical racks to hold each piece individually and assure complete 360° penetration. This is far superior to commonly-used methods of dumping items into a large bin and batch-treating everything.

Studs are centerless ground to guarantee concentricity. Thread rolling operations (to MIL-S-8879A specs) are done after heat-treat, which accounts for a fatigue strength up to *ten times better* than fasteners which are threaded prior to heat-treat.

ARP® manufactures nuts in a multi-step process that begins with raw material being fed into a giant forming device that "blanks" the hex and 12-point nuts, with highly sophisticated automated threading equipment tapping each nut with an accuracy of .001" (which is five times better than the aerospace standard). This ensures an exceptionally close tolerance fit between the bolt/stud and nut.



The Grinding Department is where all studs are centerless ground to ensure that they're perfectly concentric. As many as ten machining steps are required to achieve this level of accuracy.

Powerful cold-forging equipment is used to make ARP's hex and 12-point nuts. Multi-stage dies are employed to precision-form the finished "blanks."

A series of CNC-threading machines are employed by ARP® to accurately tap the threads in nuts. Tolerances held are 5 times better than aerospace standards.

ARP® performs the thread rolling operations after heat-treating, which results in a a fatigue strength up to 10-times better than fasteners with threads rolled prior to elevating the material's tensile strength.

Heat-treating is critically important in obtaining the correct tensile strength. Fasteners are placed in special vertical racks to ensure complete 360° penetration.

A bank of CNC machining centers are employed at ARP® to perform secondary operations (undercut bolt shanks and studs, etc.)

Contemporary EDM technology is used to perform special operations, such as hex-broaching the nose of a unique short-run fastener

Metal finishing is also performed in-house at ARP. Operations include black oxide coating of chrome moly or polishing stainless steel to a brilliant luster.

Also on the premises is a fully-equipped lab for R&D and quality control. It has everything required to ensure that ARP® products measure up to the company's ultra high standards. Some of the tests that ARP® personnel perform on an ongoing basis include proof loading (using a 120,000 lb. capability tensile machine), fatigue cycle (Amsler) and hardness (Rockwell). Visual inspections include use of an Optical Comparator (to check thread root contour, etc.), fixtured micrometers and microscopic grain flow analysis. The computer-controlled fatigue cycle testers allow ARP® to take fasteners to a failure point in millions of cycles—as opposed to the aerospace norm of 65,000 average to 130,000 cycles maximum. This allows ARP engineers to verify the design specifications of each fastener, and prove its ability to provide superior long-term service.

Finished products are packaged and warehoused in ARP's new Ventura facility, which is also home to the firm's customer service, technical and sales office.

ARP's popular stainless steel engine & accessory fasteners are polished to a brilliant luster using this specialized equipment.

Fasteners are shot-peened after heat-treatment to remove any surface irregularities and improve overall external integrity.

The finishing touch for most chrome moly fasteners is the black oxiding operation. Fasteners go through a series of "baths."

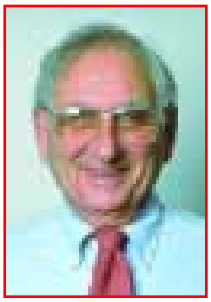
Behind The Scenes...

There are a number of important elements in the production of specialty fasteners, not the least of which are materials, design and manufacturing. As you read further on into this catalog, you will get a better idea of the extraordinary steps taken by ARP® to produce the very finest products of their kind on the market today. The key to success in all areas is personnel. And here's where ARP's cadre of highly qualified and dedicated specialists shines brightly.

Two valuable resources in the design of ARP® products are Dr. Kenneth Foster and Russell Sherman, P.E. Both men have extensive backgrounds in mechanical engineering, metallurgy and stress analysis. Their academic credentials are substantial, and real world experience equally impressive. Dr. Foster has a Ph.D. in Engineering Mechanics from Cornell University and has taught at several colleges. He was formerly the head of Stress & Dynamics at Hughes Aircraft, Space Systems division. Mr. Sherman was recently awarded a fellowship from A.S.M. International, and holds a number of fastener patents.

Carroll Smith
Special Consultant

Kenneth Foster, Ph.D
Consulting Engineer



Russell Sherman, P.E.
Consulting Engineer

Some of the most valuable work done by Foster and Sherman includes analyzing various aspects of engine, chassis and driveline structural loads, and coming up with solutions to the problems at hand. In this manner, the ARP® Research Team is able to continually expand the company's product line.

Additionally, ARP® utilizes the services of noted race car construction expert Carroll Smith (author of several highly regarded handbooks), who was also team manager for Shelby-American and Ford's GT-40 program. An experienced design,

High powered electronic microscopes are used to carefully inspect critical components. ARP's quality control team is relentless!

A series of special checking devices are employed to monitor the quality of threads. For every thread size, there's a checker.

A computer-controlled Amsler Proof Loading device is used to determine the ultimate tensile strength of studs and bolts.

ARP® has two of these highly sophisticated computer-controlled fatigue testers, which check fasteners through millions of cycles.

manufacturing and quality control team, as well as a staff of skilled production workers, rounds out ARP's rather substantial in-house resources.

ARP® also enjoys a solid working relationship with many of the most respected professional engine builders and race teams for world over—including those involved in Formula 1, NASCAR Winston Cup and Busch Series, NHRA, IHRA, World of Outlaws and a host of others. By constantly working with these racing experts to provide fasteners for a wide variety of competition applications, you can see why ARP® is on the cutting edge of technology.

ARP® fasteners are prominently featured at leading performance retailers.

You will find ARP® fasteners sold by leading performance retailers and professional engine builders from coast to coast. These firms know that ARP® fasteners are the standard of the industry, and smart consumers will accept no substitutions. As you can see, all ARP® fasteners are proudly made in the USA to the industry's highest standards. ARP® also supports racers through generous contingency awards programs with many racing programs. ARP® is a long-time NHRA Major Sponsor.

What ARP® Can Do For You...

In addition to manufacturing a comprehensive array of cataloged fasteners for automotive and aerospace applications, ARP® thrives on the challenges of developing fasteners to solve unique problems. Racers, Pro Street enthusiasts and street rodders have, over the years, approached ARP® about manufacturing special fasteners for unique applications, and the company has responded with innovative solutions.

ARP® can provide complete R&D services, including metallurgical research, product design, prototype machining and extensive laboratory testing. Moreover, ARP® has experience manufacturing fasteners from a wide variety of materials. All work can be performed under the strictest confidence. ARP® is well versed in facilitating proprietary research and custom manufacturing for corporations the world over.

It is for good reason that ARP® is recognized as "The World Leader In Fastener Technology!"

The finished goods are given a protective coating and stored in sealed containers, awaiting packaging. Millions are in stock!

Components for each kit are placed on the appropriate display cards, sealed and labeled. Through-put has been significantly increased.

After final packaging the kits are placed in storage racks and are ready for order fulfillment. Thousands of SKU's are warehoused.

Here are some of the staff at ARP's new Ventura, CA facility that handle sales, tech, administrative and order processing functions.

Gary Holzapfel (l) and Carroll Smith

About the author: ARP's Special Motorsports Consultant, Carroll Smith, is a renowned automotive engineer, racing team manager, car constructor and author whose racing involvement extends from LeMans to Sicily's Targa Florio to SCCA events across the United States. As manager of the highly successful Shelby-American Ford GT40 team, Smith received critical acclaim from the international motorsports community. In addition to authoring "Carroll Smith's Nuts, Bolts, Fasteners and Plumbing Handbook", Mr Smith has published 7 books that deal specifically with race car design, preparation and tuning.

THE MYTH OF "AEROSPACE QUALITY"

In areas from hose ends to engine fasteners the terms "Aerospace material and Aerospace Quality" have become buzz words implying the very best in design, materials and quality control.

"It isn't necessarily so", says Gary Holzapfel, founder and CEO of Santa Paula, California based ARP, Inc. ARP® (Automotive Racing Products) supplies extremely high strength and fatigue resistant threaded engine fasteners to NASCAR, CART, IRL, NHRA and Formula One engine builders and manufacturers. Holzapfel explained his reasons in a recent interview with Carroll Smith.

Smith: "Gary, do you believe that the term "aerospace quality" is over rated in the specialty fastener industry?"

"Yes I do. First of all, the term is meaningless. Any AMS (Aerospace Material Specification) material must be matched to the specific application. As an example, some airframe bolts (AN3-20) are legitimate "aerospace parts" and are very well suited for the low stress applications for which they were designed. But with a minimum ultimate tensile strength of 125,000 psi, and a relatively low temperature limit, they would be completely unsuitable for use in a racing engine.

We started out in the aerospace fastener business and we understand it. That's why we're not in it any longer. What is not generally understood about aerospace fasteners is that the fastener manufacturers do not design the product. The nuts, bolts and studs are spec'd by the airframe or engine designers and put out for bid. As long as the supplier certifies that the product meets the minimum requirement of the specification and it passes the customer's inspection procedures, low bid wins."

Smith: "Are you implying that the aerospace fastener manufacturers cut corners in order to win contracts?"

"No, it's a matter of manufacturing goals and simple economics. The aerospace market is price dominated. In order to get the contract, the fastener manufacturer's goal is to meet the specification at the least cost, not to produce the best possible part.

This means that they are going to use the least expensive steel and manufacturing processes that will meet the specification. There is nothing wrong with this approach.

It certainly does not mean that certified aerospace fasteners are unsafe in any aspect. They will do the job for which they were designed.

There is another factor. Airframe and aircraft engine manufacturers design their components to a very high margin of safety. Further, aerospace structures are designed to be "fail safe." There is a back up or second line of defense for virtually every structural component so that an isolated failure will not lead to disaster. They are also subjected to frequent and rigorous inspections."

Smith: "What's different about motor racing?"

"Quite a lot, really. While the demands for strength, fatigue resistance and quality control can be similar, and the assembly and inspection procedures in racing can be as rigorous as aerospace, in professional racing very few parts are over designed and there are no fail safe features.

There are no back up provisions for component failure. A failed (or even loosened) nut or bolt in a racing engine means disaster - instant catastrophic failure. An expensive engine is destroyed and a race is lost.

That is why random failures are unacceptable in motor racing, and why aerospace standards should be only a starting point. This means that a specialist in the production of high performance engine fasteners must design and manufacture the very best fasteners that can be produced."

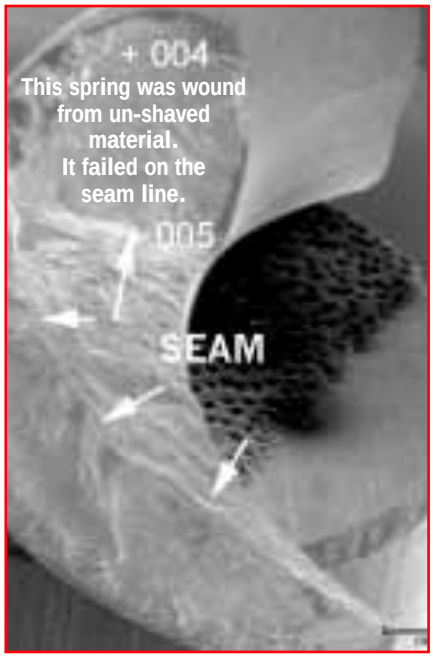
Smith: "So where does the production for a new racing fastener begin?"

"The design process begins with the customer's requirements—the operating conditions and loads to be expected, the packaging constraints and the weight and cost targets. This allows us to select the optimum material for the part, and to do the initial mechanical design.

There is more to material selection than simply choosing the best alloy. It means using only the cleanest and purest steel available, which, in turn, means researching to identify the best and most modern steel mills. It means working closely with the mills both to insure consistent quality and to develop new and better alloys.

There are not only a myriad of alloys to choose from; but for each alloy there are several grades of "aircraft specification" steel wire from which fasteners can be made. We believe that only the top (and most expensive) grade—shaved-seamless, guaranteed defect free," is suitable for racing engine applications.

We also believe that samples from each batch should be subjected to complete metallurgical inspection."



ARP's Mike Holzapfel and Russ Sherman discuss a fastener's alloy.

Smith: "How many alloys do you work with?"

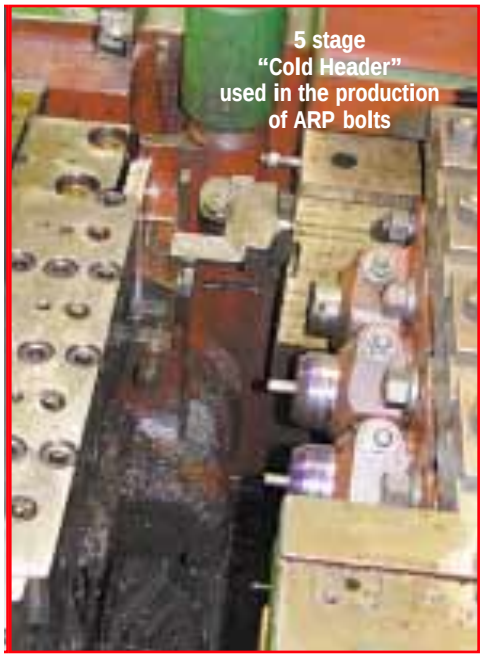
"We are currently producing fasteners from at least 6 different steel alloys from 8740 chrome moly to the very high strength chromium-cobalt-nickel alloys such as Custom Age 625+. We also use stainless steel and titanium. With UTSs (Ultimate Tensile Strength) from 180,000 to 270,000 psi, we can suit the material to the job and the customer's cost restraints. We are continually researching and experimenting with new alloys and manufacturing processes—some with all around better strength and fatigue properties."

Smith: "Once the design work is done and material has been selected, what's next?"

"Next comes the actual process of manufacturing. It goes without saying that all high strength bolts must have rolled rather than cut threads, and that the threads must be rolled after heat-treatment.

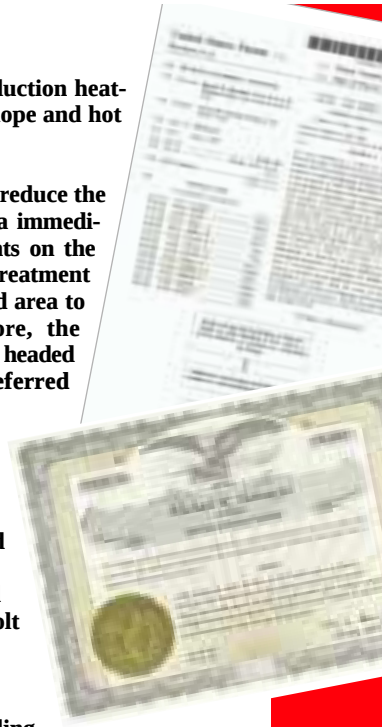
But there is more to it. The old saying to the effect of, "If you are doing something in a particular way because that's the way it has always been done, the chances are that you are doing it wrong," holds true in fastener technology.

Technology advances, and we have to advance with it. All of the manufacturing processes should be subject to continuous experimentation and development. As an example, with some alloys, cold heading produces a better product than hot heading, and vice versa. The number and force of the blows of the cold heading machine can make a significant difference in the quality of the end product. Excessive numbers of blows can lead to voids in the bolt head. ARP®, in fact, holds significant patents on cold heading procedures for the higher nickel and cobalt based alloys. In a typical aerospace manufacturing process, these alloys are hot headed from bars, reduced in diameter from 48 to 50% by cold drawing, resulting in a hardness of about Rockwell C46 which is too hard for cold heading. So, the blanks are locally induction heated in a very narrow temperature envelope and hot headed.



5 stage "Cold Header" used in the production of ARP bolts

If care is not taken the process can reduce the hardness of the bolt head and the area immediately under it as much as 3 to 5 points on the Rockwell C scale. Subsequent heat-treatment does not restore this partially annealed area to full hardness and strength. Therefore, the final result can be a relatively soft headed bolt. Therefore this process is not preferred by ARP®.



Our patented process begins with a softer wire that can be cold forged. The process work hardens the head and the under head area to the desired hardness. We then power extrude the front end to achieve the reduction and hardness in the shank resulting in a bolt with even strength and hardness from end to end.

The same is true of thread rolling. Temperature and die speed must be controlled and changed for different alloys. Many bolt manufacturers who meet the Aerospace Specifications don't come close to meeting our standards. We consistently go beyond standard Aerospace specs.

Our concern with the manufacturing processes extends to the details of heat-treating, shot -dressing the grinding wheels. In the arena where aerospace standards are a starting point and random failures are unacceptable, I feel ARP® stands alone as a primary engineering and manufacturing source for specialty and custom fasteners for use in motorsports.

It is important to realize that simply quoting an AMS (Aerospace Material Specification) number without strength and percentage of elongation numbers is meaningless. Statements that the use of a particular material will, in itself, result in extreme strength and resistance to fatigue can be misleading. In the world of high strength alloys, whether they are used for bolts or for landing gears, the manufacturing processes are at least as important as the material specification.

Some in our industry claim to inspect materials at the "molecular" level. In metallurgical terms, molecules are not necessarily part of the vocabulary. Our engineers tell us that talking about molecules is misleading. When reference is made to metal, it is typically in terms of atom structures. We routinely check metallurgical features microscopically. By the way, the same is true for claims of manufacturing to "zero tolerance."

"Our engineers tell us that this is technically unrealistic."

Smith: "How does the actual process work at ARP®?"

"For each new design, we produce a number of prototype parts using different design aspects and sometimes different methods.

We inspect and test after each process, choose the best design and method of manufacture, and then freeze the design and write the manufacturing specification."

Smith: "You have mentioned the importance of fatigue resistance. Is there a difference in the procedures for strength and fatigue testing between aerospace and the specialty racing industry?"

"Yes. While the ultimate tensile strength testing is the same, fatigue testing is different. Aerospace fasteners are fatigue tested to the relevant specification of fluctuating tension load and number of cycles—typically 130,000 cycles with the high tension load at 50% of the UTS and the low load at 10% of the high load. If all of the test samples last 85,000 cycles (per AMS 5842-D), the lot is accepted.

Even though racing fasteners are not continuously subjected to their maximum design load, at 18,000 rpm, 100,000 cycles takes just 5 minutes, thirty-four seconds. Except for drag racing, measured in seconds, no race lasts just 5 minutes. Therefore we consider this Aerospace Standard to be inadequate. At ARP®, we fatigue test to elevated loads (10% above aerospace requirements) and to a minimum cycle life that exceeds 350,000 cycles. The majority of samples are routinely tested to one million cycles. During material development...*and in the case of extremely critical new designs,* **we test to destruction.**

Thread rolling is the last mechanical operation in our manufacturing process. For each production run the thread rolling machine is shut down after a few parts. These parts are inspected for dimensional accuracy and thread quality, and are physically tested for both strength and fatigue before the run is continued. Random samples are inspected and tested throughout the run. Extremely critical components are individually inspected for dimensional integrity."

Smith: "What about out sourcing?"

"Economics often dictate that many processes in the manufacture of aerospace fasteners are out sourced or farmed out. In fact, 30 plus years ago, ARP® began as an out source thread rolling shop.

Over the years, however, we have found, through experience, that the only way to maintain the quality we require is to keep everything in-house. From heading through machining, grinding, heat-treat, thread rolling, and shot-peening to black oxide treatment—we perform every operation in house on our own equipment with our own employees."

Smith: "Gary, One of the things that I am hearing is that every aspect of the manufacture of racing engine fasteners is more expensive than that of similar aerospace items."

"True—but the bottom line is that we have to look at the cost aspect of the very best fastener versus the cost aspect of a blown engine and a lost race. In the end, the manufacturing of fasteners for racing comes down to a matter of attitude; a refusal to accept published standards and procedures as the best that can be done—and most of all a determination to learn and to make still better products."

There are literally hundreds of standards and specifications. For all types of applications, from bridges to spaceships. None are, however, as critical as those required for real-world—motorsports applications. In an environment where lighter is faster there is clearly no room for redundancy systems, like those found in military and aerospace applications. The mere nature of Motorsports requires designers to produce fasteners that are light; yet produce toughness, fatigue and reliability factors that extend far beyond other acknowledged application standards. The design and production of fasteners, exclusively for racing, clearly involves many complex factors. Some so special no standards or design criteria exist; and so everyone at ARP® is totally dedicated to the development and analysis of appropriate bolt designs—exclusively for special applications. Designs that take into account the special loads and endurance that must be carried, the material selection, processing, and the methods of installation that will continue to deliver ARP® quality and reliability.

The focus of the following material, prepared by the ARP® engineering staff, could be called:

"MOTORSPORTS FASTENER ENGINEERING—*for the* NON-ENGINEER."

It is hoped that by providing an overview of the engineering, design and production forces ARP® applies daily, you—as the end user will be better equipped to evaluate your initial fastener requirements, effectiveness and performance.

DESIGN PROCEDURES for AUTOMOTIVE BOLTS

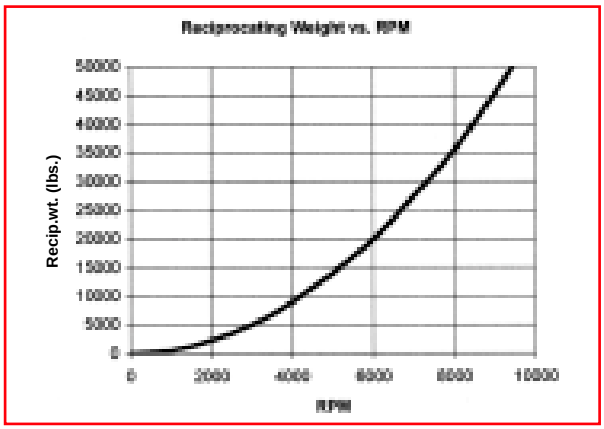
Presented by Dr. Kenneth Foster, PhD.

The design of automotive bolts is a complex process, involving a multitude of factors. These include the determination of operating loads and the establishment of geometric configuration. The process for connecting rod bolts is described in the following paragraphs as an example.

The first step in the process of designing a connecting rod bolt is to determine the load that it must carry. This is accomplished by calculating the dynamic force caused by the oscillating piston and connecting rod. This force is determined from the classical concept that force equals mass times acceleration. The mass includes the mass of the piston plus a portion of the mass of the rod. This mass undergoes oscillating motion as the crankshaft rotates. The resulting acceleration, which is at its maximum value when the piston is at top dead center and bottom dead center, is proportional to the stroke and the square of the engine speed. The oscillating force is sometimes called the reciprocating weight. Its numerical value is proportional to:

$$\left(\text{Piston Weight} + \frac{\text{Rod Weight}}{3}\right) \times \text{Stroke} \times (\text{RPM})^2$$

It is seen that the design load, the reciprocating weight, depends on the square of the RPM speed. This means that if the speed is doubled, for example, the design load is increased by a factor of 4. This relationship is shown graphically below for one particular rod and piston.



A typical value for this reciprocating weight is in the vicinity of 20,000 lbs. For purposes of bolt design, a "rule of thumb" is to size the bolts and select the material for this application such that each of the 2 rod bolts has a strength of approximately 20,000 lbs. (corresponding to the total reciprocating weight). This essentially builds in a nominal safety factor of 2. The stress is calculated according to the following formula:

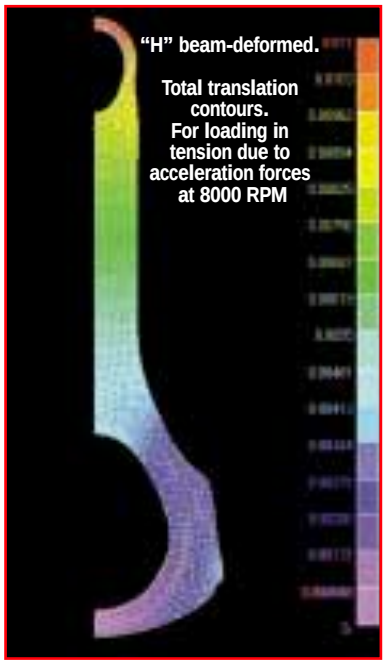
$$\text{Stress} = \frac{\text{Force}}{\text{Area}} = \frac{\text{Recip.Wt.}}{\frac{\pi}{4}D^2}$$

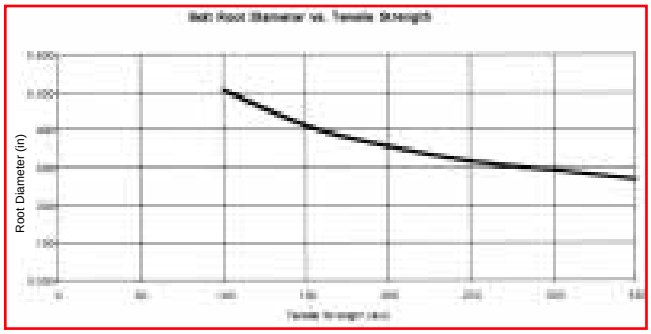
so that the root diameter of the thread can be calculated from the formula:

$$D = \sqrt{\frac{4 \times \text{Recip.Wt.}}{\pi \times \text{Allowable Stress}}}$$

This formula shows that the thread size can be smaller if a stronger material is used. Or, for a given thread size, a stronger material will permit a greater reciprocating weight. The graph (page 14) shows the relationship between thread size and material strength.

It must be realized that the direct reciprocating load is not the only source of stresses in bolts. A secondary effect arises because of the flexibility of the journal end of the connecting rod. The reciprocating load causes bending deformation of the bolted joint (yes, even steel deforms under load). This deformation causes bending stresses in the bolt as well as in the rod itself. These bending stresses fluctuate from zero to their maximum level during each revolution of the crank shaft.

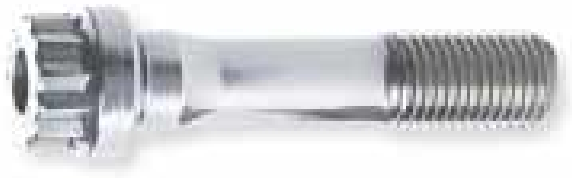




The next step is to establish the details of the geometric configuration. Here the major consideration is fatigue, the fracture that could occur due to frequent repetition of high stresses, such as the bending stresses described above. Several factors must be considered in preventing fatigue; attention to design details is essential.

Fatigue failure is frequently caused by localized stress risers, such as sharp corners. In bolts, this would correspond to the notch effect associated with the thread form. It is well known that the maximum stress in an engaged bolt occurs in the last engaged thread. By removing the remaining, non-engaged threads, the local notch effect can be reduced. This leads to the standard configuration used in most ARP® rod bolts: a reduced diameter shank and full engagement for the remaining threads. Providing a local fillet radius at the location of the maximum stress further reduces the local notch effect. Thus this configuration represents the optimum with respect to fatigue strength.

The reduced diameter shank is helpful in another sense. It reduces the bending stiffness of the bolt. Therefore, when the bolt bends due to deformation of the connecting rod, the bending stresses are reduced below what they would otherwise be. This further increases the fatigue resistance of the bolt. A typical bolt configuration is shown below.

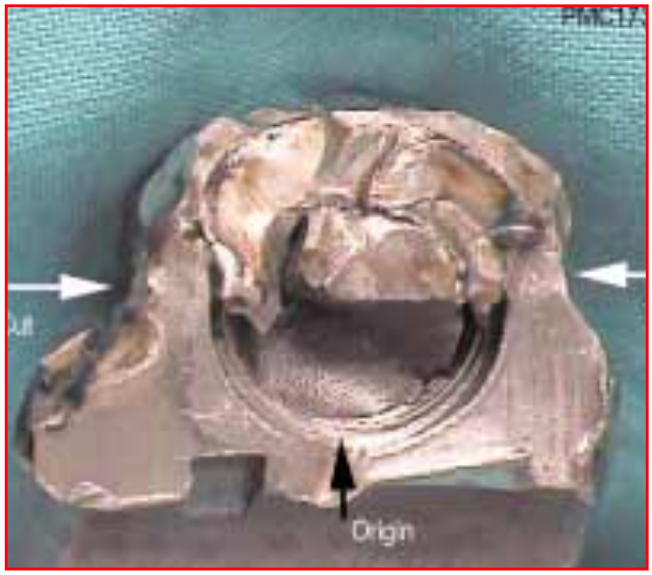


Once the bolt configuration has been established, the manufacturing process comes into play. This involves many facets, which are discussed in detail elsewhere. Here, however, one process is of primary interest. With respect to bolt fatigue strength, thread rolling is a major consideration. Threads are rolled after heat treating. This process, which deforms the metal, produces a beneficial compressive stress in the root of the thread. It is beneficial because it counteracts the fluctuating tensile stresses that can cause fatigue cracking. If heat-treatment were to occur after rolling, the compressive stresses would be eliminated. This would therefore reduce the fatigue resistance of the bolt.

An additional factor must be taken into account in defining the bolt configuration: the length of engaged thread. If too few threads are engaged, the threads will shear at loads that are lower than the strength of the bolt. As a practical matter, the thread length is always selected so that the thread shear strength is significantly greater than the bolt tension strength.

This problem is especially important in bolts used in aluminum rods because of the fact that the shear strength of aluminum is much lower than the shear strength of steel.

Finally, although not a design parameter, the subject of bolt installation preload must be addressed. It is a fundamental engineering concept that the force in a bolt in an ideal preloaded joint will remain equal to the preload until the externally applied force exceeds the preload. Then the force in the bolt will be equal to the external force. This means that fluctuating external forces will not cause fluctuating forces in a preloaded bolt as long as the preload exceeds the external force. The result is that fatigue failure will not occur. In a non-ideal joint, such as in a connecting rod, the bolt will feel fluctuating stresses due to fluctuating rod distortions. These are additive to the preload, so that fatigue could result. In connecting rods, precise preloads are required because if they are too low, the external forces (the reciprocating weights) will exceed the preloads, thus causing fatigue. If they are too high, they provide a high mean stress that combines with the fluctuating stresses due to rod distortion. Again, fatigue is promoted. The objective, then, is to preload a bolt so that it just exceeds the external load, and no higher. To sum up: both insufficient preloads and excessive preloads can lead to fatigue failures.



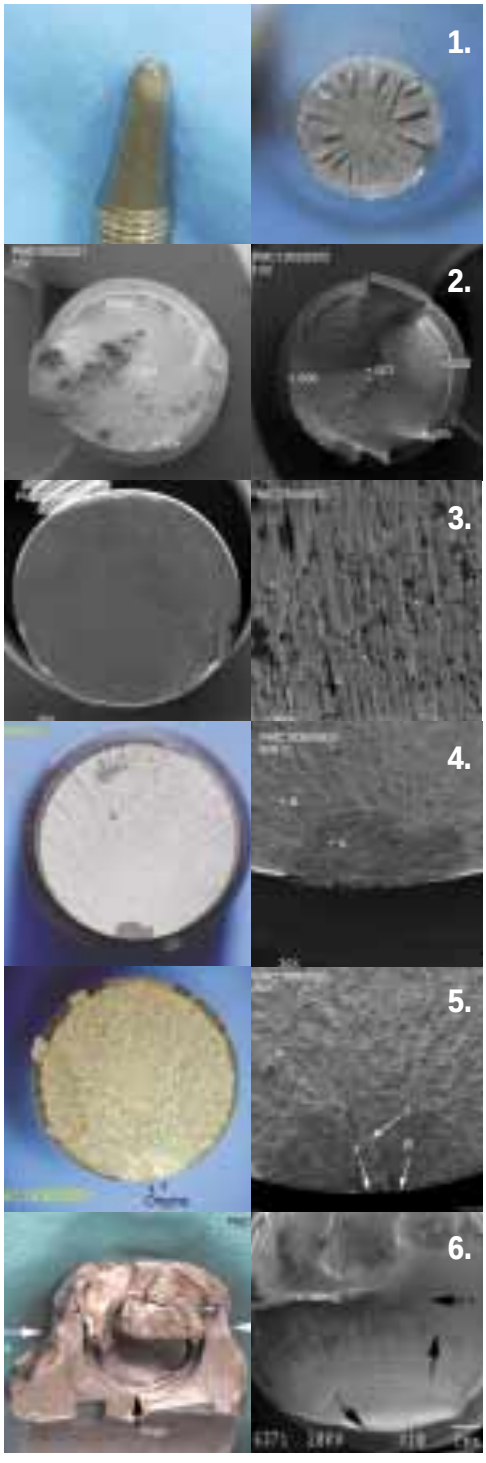
Appropriate preloads are specified for each ARP® bolt. These preloads can be attained in a connecting rod by applying proper torque using a torque wrench or by measuring the amount of stretch in the bolt using a stretch gauge (it is known that a bolt stretches in proportion to the tension in it). The torque method is sometimes inaccurate because of the uncertainty in the coefficient of friction at the interface between the bolt and the rod. This inaccuracy can be minimized by using the lubricant supplied by ARP®.

Other factors, equally as important as design, include material selection, verification testing, processing, and quality control. These aspects of bolt manufacturing are discussed elsewhere in this document.

The foregoing discussion concentrated on the design of bolts. The same considerations apply in the design of studs.

Recognizing Common Failures

There are six types of metallurgical failures that effect fasteners. Each type has unique identifying physical characteristics. The following chart is designed to be used like a spark plug reading chart to help analyze fastener failures. While few of us have access to sophisticated analysis equipment, a standard Bausch and Lomb three lens magnifying glass will generally show 98% of what we want to see. Several of the photos below have been taken utilizing a Scanning Electron Microscope (SEM) and are presented to simply illustrate typical grain configurations after failure.



1. Typical Tensile Overload

In a tensile overload failure the bolt will stretch and "neck down" prior to rupture. One of the fracture faces will form a cup and the other a cone. This type of failure indicates that either the bolt was inadequate for the installation or it was preloaded beyond the material's yield point.

2. Torsional Shear (twisting)

Fasteners are not normally subjected to torsional stress. This sort of failure is usually seen in drive shafts, input shafts and output shafts. However we have seen torsional shear failure when galling takes place between the male and female threads (always due to using the wrong lubricant or no lubricant) or when the male fastener is misaligned with the female thread. The direction of failure is obvious and, in most cases, failure occurs on disassembly.

3. Impact Shear

Fracture from impact shear is similar in appearance to torsional shear failure with flat failure faces and obvious directional traces. Failures due to impact shear occur in bolts loaded in single shear, like flywheel and ring gear bolts. Usually the failed bolts were called upon to locate the device as well as to clamp it and, almost always, the bolts were insufficiently preloaded on installation. Fasteners are designed to clamp parts together, not to locate them. Location is the function of dowels. Another area where impact failures are common is in connecting rod bolts, when a catastrophic failure, elsewhere in the engine (debris from failing camshaft or crankshaft) impacts the connecting rod.

4. Cyclic fatigue failure originated by hydrogen embrittlement.

Some of the high strength "quench and temper" steel alloys used in fastener manufacture are subject to "hydrogen embrittlement." L-19, H-11, 300M, Aeromet 100 and other simular alloys popular in drag racing, are particularly susceptible and extreme care must be exercised in manufacture. The spot on the first photo is typical of the origin of this type of failure. The second is a SEM photo at 30X magnification.

5. Cyclic fatigue cracks propagated from a rust pit (stress corrosion)

Again, many of the high strength steel alloys are susceptible to stress corrosion. The photos illustrate such a failure. The first picture is a digital photo with an arrow pointing to the double origin of the fatigue cracks. The second photograph at 30X magnification shows a third arrow pointing to the juncture of the cracks propagating from the rust pits. L-19, H-11, 300M and Aeromet 100, are particularly susceptible to stress corrosion and must be kept well oiled and never exposed to moisture—including sweat. Inconel 718, ARP3.5 and Custom age 625+ are immune to both hydrogen embrittlement and stress corrosion.

6. Cyclic fatigue cracks initiated by improper installation preload

Many connecting rod bolt failures are caused by insufficient preload. When a fastener is insufficiently preloaded during installation the dynamic load may exceed the clamping load resulting in cyclic tensile stress and eventual failure. The first picture is a digital photo of such a failure with the bolt still in the rod. The arrows indicate the location of a cut made to free the bolt. The third arrow shows the origin of the fatigue crack in the second picture—an SEM photo at 30X magnification that clearly shows the origin of the failure (1), and the telltale "thumbprint" or "beach mark" (2). Finally (3) tracks of the outwardly propagating fatigue cracks, and the point where the bolt (unable to carry any further load) breaks-away.

The following material is intended to provide a brief overview of the metallurgical considerations that, daily, influence the design and production of the most reliable fasteners in motorsports. It is hoped that a simple understanding of the knowledge and commitment required to produce this reliability will make your future fastener decisions much, much easier.

Metallurgy *for the* Non-Engineer

By Russell Sherman, PE

Metallurgist, Russell Sherman, PE, and stress/dynamics engineer Dr. Kenneth Foster, PhD, are the heart of ARP's technical power-team.

1. What is grain size and how important is it?

Metals freeze from the liquid state during melting from many origins (called allotropic) and each one of these origins grows until it bumps into another during freezing. Each of these is a grain and in castings, they are fairly large. Grains can be refined (made smaller); therefore, many more of them can occupy the same space, by first cold working and then by recrystallizing at high temperature. Alloy steels, like chrome moly, do not need any cold work; to do this—reheat treatment will refine the grain size. But austenitic steels and aluminum require cold work first. Grain size is very important for mechanical properties. High temperature creep properties are enhanced by large grains but good toughness and fatigue require fine grain size-the finer the better. (high temp creep occurs at elevated temperature and depending on material and load could be as much as .001 per inch/per hour). *All ARP® bolts and studs are fine grain—usually ASTM 8 or finer. With 10 being the finest.*

ARP® engineers use "Scanning Electron Microscopic" inspection capable of detecting all elements in the periodic table with atomic numbers greater than 5—permitting the acquisition of high resolution imaging.

2. How do you get toughness vs. brittleness?

With steels, as the strength goes up, the toughness decreases. At too high a strength, the metal tends to be brittle. *And threads accentuate the brittleness. A tool steel which can be heat-treated to 350,000 psi, would be a disaster as a bolt because of the threads.*

3. Define Rockwell as we use it. Why do we use the C scale?

The man's name was Rockwell and he developed a means of measuring hardness of metals which was superior to other methods. A Rockwell hardness tester measures the depth of penetration into the metal when a load is applied. For hard materials, a diamond penetrator is used. For soft material, small balls are used-1/16" or 1/8" diameter-and the machine measures the depth. We use the C scale for the 120,000 psi strength level and above. The C scale uses the greatest load—150 Kg. The A scale uses only a 60 Kg. load but can be correlated with C. It is necessary to use the A scale for thin sheets because using the 150 Kg load would cause the diamond to penetrate almost all the way through.

4. What is "micro hardness?"

Some parts are too small to be Rockwell hardness tested. They are placed in hard plastic and a microscope is used to place a small indenter into the metal. Using the microscope the length of the impression is measured.

5. How does modulus of elasticity refer to our products?

The modulus of elasticity of all alloy steels is exactly the same—30,000,000 psi. This is true whether it is heat-treated or not—whether it is 100,000 psi strength level or 300,000 psi. Metals are like a spring—put a load on them and they will stretch—double the load and they will stretch double. *This is important in connecting rod bolts because by measuring the stretch we really are measuring the load. Load is what is important and measuring stretch of a given size and configuration bolt will indicate how much load is stretching the bolt.*

6. What are metal carbides and what is their significance?

The strength of all alloy and carbon steels is derived from the metal carbides formed during the mill processing. The carbon in steels combines with iron, vanadium and with chromium, as well as many other metal alloy additions to form compounds, which are a very hard phase within the iron matrix. *Tool steels generally have high carbon content (above .8%) and can be made very hard—but brittle.*

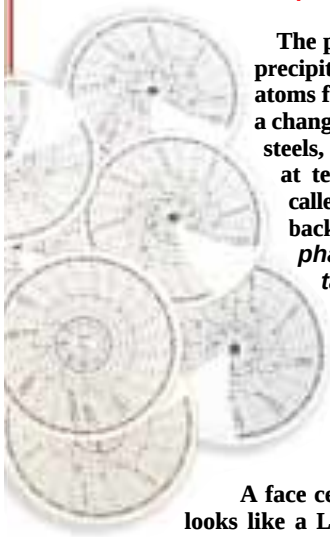
7. What exactly is chromium?

Chromium is a metal and is typically used for plating because it is shiny. It is also used as an alloy addition to iron to form a stainless steel. A stainless steel must contain at least 12% chromium, but these lean chromium steels can still show some rust on the surface. Using 18% chromium will make a more rust resisting stainless. Exposing any stainless to oxygen at temperatures above 1200°F will cause the chromium to join the oxygen and therefore leave the surface depleted in chromium—if it falls below 12% the surface will show rust.

8. What does it mean when a broken part looks crystallized?

When the fracture face has a rocky appearance it is because the material had a very large grain structure. *Basically the grain grew during manufacturing due to poor technique and handling.* **A properly processed part will have a silky smooth appearance which is an indication of fine grain size.** *So crystallization does not occur as a result of load or fatigue—it was present in the material at the time of manufacture.*

9. Define "precipitation hardening" and "phase change."



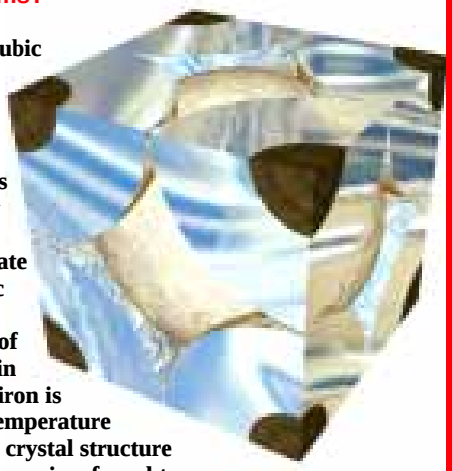
The precipitation hardening comes from microscopic precipitation of hard phases which serve to keep rows of atoms from moving under stress. Some metals undergo a change in atomic structure at high temperature. Alloy steels, which are bcc at room temperature, become fcc at temperatures above 1400°F. This switch over is called a phase change. When cooled down they revert back to the bcc structure. ***Management of this phase is extremely critical and ARP® maintains a complete in-house heat-treatment facility. It's the only way we can assure material integrity.***

10. What does a "face centered cubic" (fcc) atom arrangement look like? How many atoms?

A face centered cubic arrangement of atoms (austenitic) looks like a Las Vegas die with a five showing on all six faces. This can't be seen visually by any type of microscope.

The number of atoms in any one cubic cell would be 14—these do not stand alone but are attached to other cells which share some of the atoms.

11. How does a "body center cubic" (bcc) atom look? How many atoms?



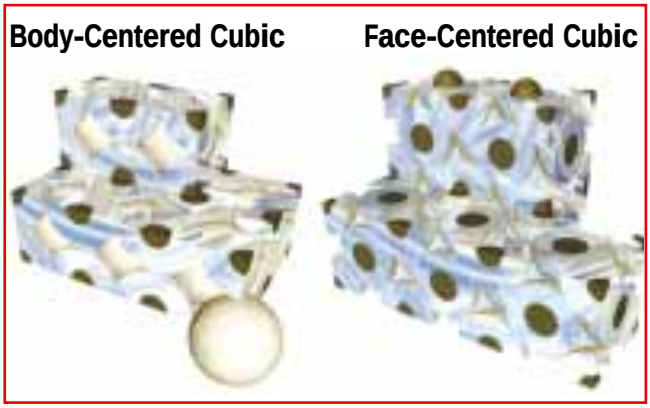
The body center cubic structure would look like a die with a four on all faces and one atom in the center of the cube. Pure iron is bcc a structure below 1674°F and above 2540°F (at intermediate temperatures) is a fcc structure.

A rearrangement of atoms within the grain occurs when steel or iron is heated through the temperature where the changes in crystal structure occur. This shift in atoms is referred to as allotropic change—and is one of the most important because the science of metallurgy and heat-treatment of steel depends largely on the allotropy of iron.

12. What does a "stainless steel" atom arrangement look like? How many atoms?

A face centered cubic arrangement of atoms Stainless Steel 300 series is not heat-treatable. But heavy reduction (Power Dumping), in the cross section, during forging causes a dramatic increase in strength. ***This is the process ARP® uses to make 304 Stainless Steel reach 170,000 psi UTS.***

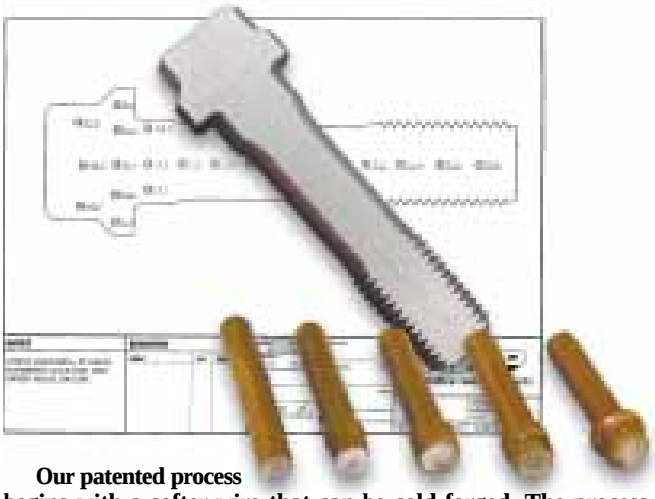
13. How do the space lattice or crystal structures appear?



All grains or crystals are composed of atoms bound together in a definite pattern. These structures are called space lattice or crystal structures. At a fixed temperature, the atoms in an array are spaced a definite distance from one another, although they vibrate about their mean position. Even though atoms are actually not held together in this manner, it is helpful to picture the crystals as a 3-dimensional latticework connected by imaginary lines. Metallurgists who primarily study ferrous metal are interested in only two basic crystal structures: bcc (body-centered cubic) and fcc (face-centered cubic).

14. What are the metallurgical ramifications of "cold heading" vs. "hot heading?"

Cold heading is a more efficient process and allows the part to be cold worked. The temperatures used for hot forging will reduce the effect of work hardening. This is important for metals which derive much of their strength from the cold work. Cold heading produces a better product than hot heading. The number and force of the blows of the cold heading machine can make a significant difference in the quality of the end product. Excessive numbers of blows can lead to voids in the bolt head. ***ARP®, in fact, holds significant patents on cold heading procedures for the higher nickel and cobalt based alloys.***



Our patented process begins with a softer wire that can be cold forged. The process work hardens the head and the under head area to the desired hardness. We then power extrude the front end to achieve the reduction and hardness in the shank resulting in a bolt with even strength and hardness from end to end.

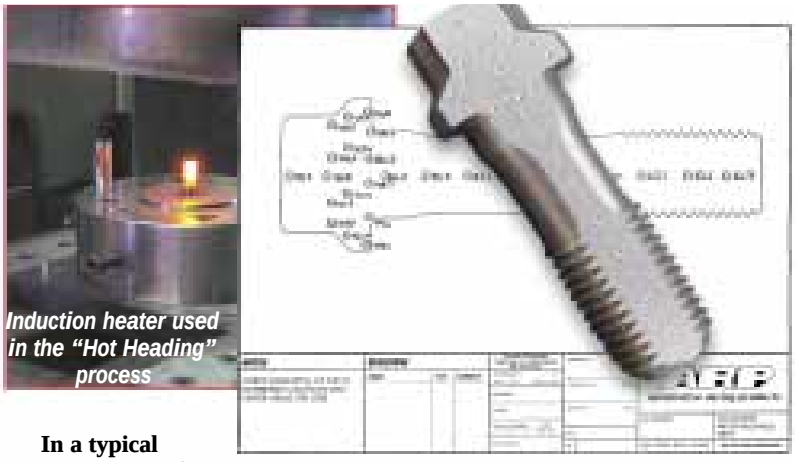
15. What is the difference between the usage of "bar" material vs. "wire?"

Bars produced by the mill in straight sections are normally shipped in 12 foot lengths. Wire is supplied in continuous coil form and is hundreds of feet in length. Bars are cut to length and the bolts are hot forged from these lengths. Wire on the other hand is fed into a cold header in a continuous manner.

16. What exactly is A286? And to what is it compared?

A286 is a 25% nickel and 18% chromium alloy with smaller amounts of titanium and aluminum, which precipitate during aging—after solution treatment. It is a true stainless steel due to the high chromium and it is austenitic due to the high nickel. A286 was developed as a high temperature alloy for use in pre-jet aircraft engines. The strength level was only 140,000 psi, but it had good high temperature strength and exceptional toughness, making it an excellent fastener alloy.

Rocketdyne became interested in it for rocket engines being developed in the early 60's. But they required higher strength. We were part of the team that developed a thermo mechanical method to produce a strength level of 200,000 psi. This involved severe cold reduction after solution treatment and before aging. An aerospace material spec (AMS) was then written requiring this treatment for 200,000 psi strength level. There is no other steel alloy, at this level, which can match A286 for corrosion resistance, toughness or bolt fatigue strength.



Induction heater used in the "Hot Heading" process

In a typical aerospace manufacturing process, these alloys are hot headed from bars, reduced in diameter from 48 to 50 % by cold drawing, resulting in a hardness of about Rockwell C46 which is too hard for cold heading. So, the blanks are locally induction heated in a very narrow temperature envelope and hot headed. The process reduces the hardness immediately in the area under the head approximately 3 to 5 points on the Rockwell C scale. Subsequent heat treatment does not restore this partially annealed area to full hardness and strength. ***The final result is a relatively soft headed bolt.Therefore this process is not used by ARP®.***

5 stage "Cold Header" used by ARP®

17. Define "Power Dump."

This is a term used to define the heavy extrusion of the fastener body during forging. The part is forced into a die much smaller than the blank thereby causing a severe reduction in cross section area. This reduction of the cross sectional area is accompanied by an increase in length because metals can't be compressed. ***However, power dumping or reduction, delivers a significant increase in strength properties and is part of the patented process we use to produce fasteners from 304 stainless steel with 170,000 psi UTS and AMS 5844 (ARP 3.5) with ultimate tensile strengths in the 270,000 psi UTS range—with outstanding fatigue.***

18. What is the difference between 4130 and 8740 chrome moly?

Both are alloy steels with similar chemistry. The 4130 has only .3% carbon and can't be hardened as high as 8740, which has .4% carbon. Also, 8740 has about .45% nickel and 4130 has none. Both have moly (most alloy steels have moly). The chromium content of 4130 is slightly higher, .95% instead of .55%. However, 8740 is generally considered to have slightly better toughness due to the nickel.

19. What exactly is ARP2000 and how does it compare to 8740 and 4340?

ARP2000 is a heavily alloyed martensitic quench and temper steel, initially developed for use in steam power plants. As such it has excellent stability at high temperatures. But most important, ARP® research discovered that in addition to temperature stability it has excellent notch toughness in the higher strength ranges and is alloyed to be tempered to Rc44/47. 8740 and 4340 can be tempered to the same hardness. But, the tempering temperature would yield material in the "temper brittle zone" (between 500° and 700°F), producing significant notch sensitivity. ARP2000 is tempered above that temperature range and has a strength between 200,000 and 220,000psi.

20. How does L19 compare to ARP2000?

L19 differs from ARP2000 in that it is a vacuum melted alloyed steel with sufficient chromium and carbon to achieve high hardness (but below the level of a stainless steel). L19 is air-cooled from the hardening temperature in a way that does not require an oil quench to achieve full hardness and is tempered to assure full conversion to martensite between 1025°F and 1075°F. L19 is a proprietary material capable of achieving strengths of 220,000/230,000 or 260,000/270,000psi as may be required. Both L19 and ARP2000 steels are modified bcc (MARTENSITE) at room temperature. L19 has the same advantage as ARP2000 in that a high strength is obtained at a high tempering temperature. This alloy is easily contaminated and requires special handling.

21. What is AMS5844? And how does it compare to AMS5842E?

Both of these alloys are considered multiphase, non steel, austenitic materials. Both derive their strength (260,000 psi) from severe cold work (48/50%) which raises the hardness from Rockwell C 46 up to 49/50. The AMS5842 (for MP159) was developed much later than AMS5844 (for MP35) in order to increase the usable service temperature by about 100° so it could be used in hotter sections of jet engines.

22. Provide a brief overview of the metallurgy required to produce AN, AMS & other Aerospace type fasteners.

All alloy steel fasteners are essentially manufactured by the same process. Incoming steel from the mill is forged to specification, then heat treated and thread rolled. Regular AN bolts are forged to size and are normally not precision ground. They may even have threads on them when heat treated.

Expensive aerospace fasteners are more likely suited for some motorsport applications. These fasteners require precision forging, careful heat treatment and then precision grinding, fillet rolling under the head and a great deal of skill in thread rolling.

23. What is moisture tolerance and how or where is it important?

Non-stainless steels have low moisture tolerances because the water attacks the steel by forming iron oxide (rust). Therefore none of these have a high tolerance for moisture and the surface must be protected by oil or plating. *ARP® maintains an in-house plating facility to assure all non-stainless product is delivered 100% corrosion free.*

24. How do the various standards compare to each other with regard to fasteners? Where are the standards?

A standard fastener is one that can be referenced from a nationally or internationally recognized standards document and may be produced by any interested manufacturer.

In all fastener categories the custodian of each group (MS-AN-NAS) have tried to standardize the processing of specifications such as AS (American Standard) heat-treating, MIL-H-6875 cadmium plating, AMS QQ-P-416 passivation and AMS QQ-P-35 testing, MIL.-Std 1312 and NDT in aerospace applications are generally by sample.

ASTM stands for the American Society for Testing Materials, a large industry funded group used to write standards for many materials and testing procedures. It compares directly to AMS (Aerospace Material Standard).

In the case of ARP®, 100% raw material is purchased to AMS specification—with the exception of special alloys used in proprietary products. All materials are carefully examined for proper chemistry—and finally, periodic examination by an independent laboratory. ARP® consistently strives to exceed industry specifications for quality and product management.

MS (Military Standards): MS bolt specifications cover a wide range of fastener hardware, high strength bolts, nuts and washers with spec's for materials and processing. MS fasteners have various tensile strengths.

AN (Army-Navy) Specifications: Generally lower strength bolts and studs primarily in the 125 psi UTS range. AN also covers a wide range of nuts, washers and other hardware.

NAS (National Aerospace Standard): These specifications cover fasteners in the strength ranges 160,000/180,000/200,000 psi UTS.

ISO (International Standards Organization):

ISO 9001-94: is a quality control system designed to for manufacturers with design control.

ISO 9002-94: is a quality control system designed for manufacturers who build build parts to customer specifications, and do not have design control.

ISO 9001-2000: is current ISO system well suited for manufacturers with engineering design functions, drawing control and statistical techniques to achieve demanding quality requirements.

This system is the main focus of ARP's World Quality Concept.

25. What metallurgical issues cause common failures?

The most common cause of failure of connecting rod bolts (and wheel bolts) is too little induced load (stretch) during installation. This allows the alternating load to impose cyclic loading on the bolt. Over tightening is also another cause, because the induced stress is too close to the yield point.

MATERIAL SPECIFICATIONS

ARP® manufactures fasteners from a wide assortment of materials…ranging from popular stainless steel and 8740 chrome moly to exotic alloys that have been developed to handle space travel. You should also know that there are grades within specific alloys. For example, 8740 is available in four grades: 1. SDF (guaranteed seamless and defect free). 2 CHQ (cold head quality). 3. Aircraft. 4. Commercial. ARP® uses only the first two (SDF and CHQ), even though they cost more than double "Aircraft" quality.

STAINLESS STEEL: Ideally suited for many automotive and marine applications because stainless is tolerant of heat and virtually impervious to rust and corrosion. ARP® "Stainless 300" is specially alloyed for extra durability. It's polished using a proprietary process to produce a beautiful finish. Tensile strength is typically rated at **170,000 psi**.

8740 CHROME MOLY: Until the development of today's modern alloys, chrome moly was popularly considered a high strength material. Now viewed as only moderate strength, 8740 chrome moly is seen as a good tough steel, with adequate fatigue properties for most racing applications, but only if the threads are rolled after heat-treatment, as is the standard ARP® production practice. Typically, chrome moly is classified as a quench and temper steel, that can be heat-treated to deliver tensile strengths between **180,000** and **210,000 psi**.

ARP2000: An exclusive, hybrid-alloy developed to deliver superior strength and better fatigue properties. While 8740 and ARP2000 share similar characteristics—ARP®2000 is capable of achieving clamp loads in the **215,000-220,000 psi** range. ARP®2000 is used widely in short track and drag racing as an up-grade from 8740 chrome moly in both steel and aluminum rods. Stress corrosion and hydrogen embrittlement are typically not a problem, providing care is taken during installation.

L19: This is a premium steel that is processed to deliver superior strength and fatigue properties. L19 is a very high strength material compared to 8740 and ARP®2000 and is capable of delivering clamp loads in the **230,000-260,000 psi** range. It is primarily used in short track and drag racing applications where inertia loads exceed the clamping capability of ARP®2000. Like most high strength, quench and temper steels—L19 requires special care during manufacturing to avoid hydrogen embrittlement. This material is easily contaminated and subject to stress corrosion. It must be kept well-oiled and not exposed to moisture.

AERMET® 100: With a typical tensile strength of **280,000 psi**, Aermet 100 is a new martensitic super-alloy that is stronger and less expensive than the super-alloy austenitic materials that follow. Because it is capable of achieving incredibly high clamping loads, it is ideal for short but

AERMET® 100: (continued) extreme environments like top fuel, funny car and some short track applications. Although Aermet 100 is a maraging steel that is far superior to other high strength steels in its resistance to stress corrosion, it must be kept well-oiled and not exposed to moisture.

INCONEL 718: A nickel based material that is in the high temperature, super-alloy class, it is found to be equally suitable in lower temperature applications. This material delivers tensile strengths into the **220,000 psi** range and exhibits improved fatigue properties. Best of all, Inconel 718 is completely immune to hydrogen embrittlement and corrosion.

ARP3.5 (AMS5844): While similar to Inconel 718, these super-alloys are found in many jet engine and aerospace applications where heat and stress attack the life of critical components. The high cobalt content of this alloy, while expensive, delivers a material with superior fatigue characteristics and typically tensile strength in the **270,000 psi** range. The immunity to hydrogen embrittlement and corrosion of these materials is a significant design consideration. These materials are primarily used in connecting rods where extremely high loads, high RPM and endurance are important factors—Formula 1, Winston Cup and CART applications.

CUSTOM AGE 625 PLUS®: This newly formulated super-alloy demonstrates superior fatigue cycle life, tensile strength and toughness—with complete resistance to atmospheric corrosion and oxidation. ARP® is the first to develop manufacturing and testing processes for fasteners with Custom Age 625+. Best of all it is less expensive and expected to soon replace MP-35 as the material of choice in the high strength, super-alloy field. Typical tensile strength is **260,000 psi**.

TITANIUM: ARP® now offers special order fasteners made of an alloy (Ti6Al-4V) that is specially heat-treated (a process developed by ARP's own Russ Sherman) and provides superior strength to other titanium alloys employed in racing and aerospace. The material has a nominal tensile strength of **180,000 psi**, and is very corrosion resistant. The main advantage of titanium, of course, is its weight—which is about 40% lighter than a comparable fastener made of steel. Head studs and accessory bolts are ideal applications for this lightweight material.

QUICK REFERENCE GUIDE TO MATERIALS USED IN FASTENERS

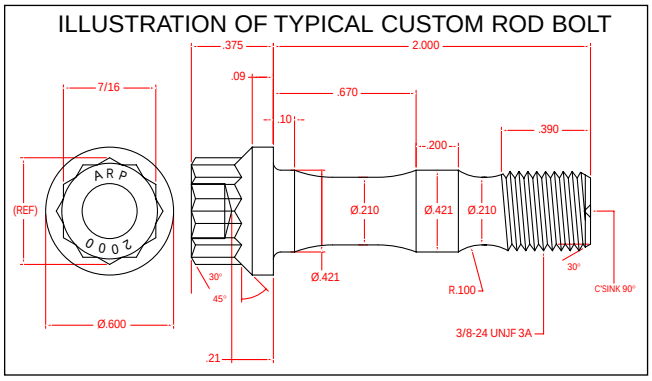
MATERIAL	USE?	YIELD STRENGTH	TENSILE STRENGTH	USED FOR
Grade 5	No	90,000 psi	120,000 psi	Accessory bolts and studs
Grade 8	No	120,000 psi	150,000 psi	Accessory bolts and studs
"Stainless 300"	Yes	140,000 psi	170,000 psi	Accessory bolts & studs, head studs
Custom 450®	Yes	150,000 psi	180,000 psi	Head bolts, accessory bolts
8740 chrome moly	Yes	160,000 psi	190,000 psi	Rod bolts, head & main studs & bolts
A286	Yes	170,000 psi	200,000 psi	Head bolts, accessory bolts
ARP®2000	Yes	180,000 psi	215-220,000 psi	Connecting rod bolts
L19	Yes	200-230,000 psi	230-260,000 psi	Connecting rod bolts
Inconel 718	Yes	190-210,000 psi	220-240,000 psi	Connecting rod bolts
Custom Age 625+	Yes	235-255,000 psi	250-280,000 psi	Head studs, connecting rod bolts
ARP® 3.5	Yes	220-250,000 psi	250-280,000 psi	Connecting rod bolts
AerMet® 100	Yes	258,500 psi	300,000 psi	Connecting rod bolts
Titanium	Yes	160,000 psi	180,000 psi	Head studs, accessory bolts

SPECIAL NOTE: The U.S. Government has implemented guidelines relating to rating fastener strength. Unless a specific fastener has been tested in a government approved independent lab, manufacturers are enjoined from using a specific rating. Even though, in the case of ARP®, the very same equipment and testing procedures are used in-house. Rather than have expensive duplicate tests run on literally hundreds of part numbers, which would drive the cost of each fastener through the roof, ARP® is following approved guidelines by using generalities to describe strength ratings.

YOU CAN GET ARP® FASTENERS MADE TO YOUR REQUIREMENTS!

The following pages in this catalog detail the vast number of "off the shelf" fasteners available from ARP®. However, it's important for you to know that a significant amount of ARP's business comes from the development and manufacture of custom fasteners. For example, many top Formula 1, CART and IRL race teams and constructors have come to rely on ARP® for a myriad of special purpose fasteners. Many of these have been developed on a proprietary basis, and we cannot go into details about "what" is being manufactured for "whom" by ARP®. But suffice to say that that ARP® has established a reputation within the racing industry for doing cutting edge R&D and following it up with fasteners made to the most stringent quality control standards on the planet. ARP® also "private labels" a number of special fasteners for various manufacturers in the performance industry.

8740 *ARP 2000* *L19*



ARP® can custom manufacture fasteners from nearly a dozen different materials, with tensile strengths ranging from 170,000 PSI to over 300,000 psi. By way of example, we have made cylinder head studs for the same application from 8740 chrome moly, our own Stainless 2000™ and L19.

The bottom line is that because of ARP's extensive in-house R&D and manufacturing capabilities, the firm is in a position to design and build fasteners on a custom basis. Serious inquiries from members of the high performance industry are always welcome. Look to ARP® to provide effective solutions to all your fastener needs!

Custom-Made ARP® Titanium Studs & Bolts

One of ARP's best-kept "secrets" is the company's deep involvement in the manufacture of titanium fasteners. As a matter of fact, ARP's resident metallurgist, Russ Sherman, literally "wrote the book" when he developed the original procedures for the heat treatment of the most popular titanium alloy in use today (Ti6Al-4V), and presented the research data to the American Society for Metals. Sherman's procedure of solution-treating, warm processing and aging brings the titanium to strength levels never before achieved, and has also been instrumental in setting new standards for the aerospace industry.

This particular titanium alloy and process lends itself well to a number of racing applications, including head studs and accessory fasteners. Of course, the primary advantage of using titanium instead of steel is weight; titanium is about 40% lighter. The material ARP® uses has a tensile strength of 180,000 psi, comparable to heat-treated chrome moly—but about half the weight.

ARP stands ready to manufacture Ti6AL-4V titanium fasteners custom-made to your specifications. Contact our Special Projects Dept. at **805-525-1497**.

GLOSSARY OF TECH TERMS

Austenitic: *Refers to the atomic arrangement of some metals, such as nickel based alloys, and some steels with about 18% chromium. This atomic arrangement is called "face centered cubic." Austenitic steels can not be heat treated, but can be strengthened by cold working.*

CHQ: *A term used to grade heading wire and stands for "cold heading quality." This grade is superior to both Commercial and Aircraft quality.*

Clamp Load: *This is the force exerted by a tightened bolt and is the same as preload.*

Fatigue: *The process by which failure is caused after many repetitions of loads smaller than the ultimate strength of the material.*

Ferritic: *Refers to steels with an atomic arrangement different from austenite and martensite. These steels are not strong and the widest use is in steam power plants and accessory fasteners made by some companies, because they are able to withstand wet environments. Newer steels such as ARP300™ and A286 are far superior.*

Hydrogen Embrittlement: *This condition results from the accumulation of hydrogen gas in the atomic structure of the metal. This gas flows to the point of high stress (stress risers) and causes microscopic cracks. The hydrogen then flows to the "new" crack tip and causes it to crack further. In this way the crack moves across the part, because the crack-tip IS the stress riser. Finally the crack gets so large that the section is not large enough to support the load. No hydrogen embrittlement can take place without tensile stress. ARP® employs a baking process that purges hydrogen gas from the steel.*

Knurling: *A process of creating serrations in a part by rolling a die, under pressure, against the part. Normally these serrations are very sharp and can create cracks and ARE stress risers. The process is used on knobs so the user can get a firm grip. But in the case of fasteners, the body can be knurled so the part can be forced into and retained in an irregular hole—stress risers and all.*

Maraging: *Refers to steels that are a low carbon version of martensitic steels, specially alloyed so that the martensite is not hard. These steels can be worked in the quenched condition and then be hardened by low temperature aging. The strength comes from the formation of complex metal carbides.*

Martensitic: *Refers to atomic arrangement and in the case of steels, is a modified body centered cubic structure. These steels can be heat-treated because martensite is iron carbide, which is very hard. However, these steels can be hydrogen embrittled and will rust. Generally, martensite normally refers to metal structures which are formed by quenching from high temperature.*

MS21250: *A military specification for a 12-point, 180,000 psi bolt which specifies the fatigue load required for testing every size.*

Notch Sensitivity: *Refers to the ability of a metal to withstand the increased stress at a notch. Some materials, such as glass, crack very easily if notched. While others, such as soft gold or tin stretch out under stress—even with a notch. Normally, the stronger the steel, the more likely it is to break quickly at the notch. "Toughness" is wanted because this is associated with opposite of notch sensitivity. Austenitic metals are usually less notch sensitive than martensitic steels of the same strength levels.*

O.A.L.: *Means "Over All Length."*

Preload: *The force IN a bolt when it is installed with a torque greater than simply hand tight. Preload can be established by measuring torque or bolt stretch or by the less than accurate "turn-of-the-nut" method.*

Qualified Products List: *A government requirement that simply mandates that bolts be manufactured only by companies which have qualified by making bolts that have been submitted for testing and approval to a government agency. ARP® has qualified for this list.*

Quench & Temper: *A method of heat-treating martensitic steels. The parts are heated into the austenitic range (usually above 1450°F) then quenched into water or oil. This leaves the part in a very hard martensitic condition which then must be tempered by heating at lower temperatures (between 350°F and 1200°F), depending upon the steel and strength desired.*

Reciprocating Load: *The acceleration force exerted on a connecting rod due to the up and down motion of the piston and its associated mass ie; wrist pin, rings, small end of the rod.*

Stretch: *The increase in length of a bolt when installed with a preload.*

Stress: *The load applied to a part divided by the cross-sectional area of the part, usually expressed in pounds per square inch (psi).*

Stress Corrosion: *This is a special form of hydrogen embrittlement in which the metal is attacked while under stress. Without the stress the crack will not move. But under stress the crack moves and corrosion takes place at the freshly opened crack face.*

Stress Ratio: *The ratio of the minimum stress to the maximum stress in a structure which is subject to fluctuating loads.*

Stress Riser: *You have a notch, ding or some change in section size, so now the stress at these points is increased above nominal stress. Compare this kind of stress to the flow of water in a river. When the river hits a narrow point it flows faster. Perhaps there is a rock in the middle—the river flows faster around the rock. The stress at these points can be so high that the part will fail—even though the average stress on the part never exceeded the tensile strength of the part.*

S.D.F.: *Seam and defect free. A designation for premium steel. This is typically the highest grade available, and is the only steel used by ARP®.*

Thread Engagement: *This refers to the number of threads engaged in a nut or threaded hole. Full engagement, meaning all the female threads are engaged, is a desirable configuration to maximize fatigue strength.*

Ultimate Tensile Strength: *The maximum stress that a particular material can support without breaking. It is expressed in terms of lbs. per square inch, and is measured by means of a tensile test. The maximum force (lbs.) that a test specimen can support is divided by the cross-sectional area (square inches) of the specimen, the result is ultimate tensile strength in psi.*

Torque Angle: *A method of tightening a fastener relative to the amount of degrees turned once the underside of the bolt head or nut face contacts the work surface. This procedure is suitable for engine assembly only when the installation has been calibrated in terms of bolt stretch relative to the exact application (the amount of compression of the clamped components is critical).*

U.H.L.: *Means "Under Head Length." The distance as measured from tip of the fastener to a place directly at the base of the head.*

Yield Strength: *The stress at which a given material or component exhibits a permanent deformation (i.e. "takes a set"). When the load that caused the stress is removed, the part will not return to its original dimensions. If you exceed the yield strength of a fastener (tighten it until it feels funny and then back it off a bit) the fastener is ruined and must be replaced.*

PROPER FASTENER RETENTION

There are three methods that can be employed to determine how much tension is exerted on a fastener; using a torque wrench, measuring the amount of stretch, and turning the fastener a predetermined amount (torque angle). Of these methods, use of a stretch gauge is the most accurate.

To obtain the correct amount of clamping force a fastener should actually be stretched a measured amount. A properly used fastener works like a spring!

It is important to note that in order for a fastener to function properly it must be "stretched" a specific amount. The material's ability to "rebound" like a spring is what provides the clamping force. You should know that different materials react differently to these conditions, and ARP® engineers have designed each fastener to operate within specific ranges.

On the other hand, if a fastener is over torqued and becomes stretched too much—you have exceeded the yield strength and it's ruined. If the fastener is longer than manufactured—even if it is only .001", it is in a partially failed condition. Therefore, ARP® has engineered its fasteners with the ductility to stretch a given amount and rebound for proper clamping.

Heat, primarily in aluminum, is another problem area. Because the thermal expansion rate of aluminum is far greater than that of steel it is possible to stretch a fastener beyond yield as the aluminum expands under heat. An effective way of counteracting material expansion is through producing a more flexible bolt.

The Torque Angle Method

Since the amount that a bolt or nut advances per degree of rotation is determined by the thread pitch, it would appear that the amount of stretch in a given bolt or stud can be accurately predicted by measuring the degrees of turn from the point where the underside of the bolt head or nut face contacts the work surface. Termed the "torque angle" method, this procedure has long been the standard of civil engineering. It has been suggested that torque angle is a relatively simple and valid procedure to use in our "blind" installations—where it is not possible to physically measure the actual bolt stretch.

ARP® has conducted extensive evaluations of the torque angle method. We have concluded that, for our purposes, it is suitable only when individually calibrated for each installation.

Simple calculation of bolt stretch based on thread pitch is not accurate. No material is incompressible. When a bolt or a stud is preloaded or stretched, the components being clamped compress to some small extent. When we are looking for bolt stretch of only a few thousandths of an inch, the amount of clamped material compression becomes a very real factor. Our investigation has proven that installed stretch is dependent, not only on the pitch of the thread and the degree of rotation, but also on the amount of compression of the clamped components, the length of the male fastener, the amount of engaged thread, the type of lubrication and the number of times that the fastener has been cycled. For example, for the same degree of rotation, the actual amount of bolt stretch will be critically different between an aluminum cylinder head and a cast iron cylinder head—or a steel main cap on an aluminum block and a steel main cap on a cast iron block. Further, there is a significant difference between the long and short cylinder head bolts or studs on the same head. The torque angle method can be accurate—but only if each individual installation has been previously calibrated by direct measurement of bolt stretch. When using the torque angle method, it is best to begin rotation from some small measured torque—no more than ten lb./ft.—rather than the first point of contact with the work face. To achieve accuracy it is also best to cycle the fasteners five times before either calibrating or installing.

Using A Torque Wrench

If the stretch method cannot be used in a particular installation, and the fasteners must be installed by torque alone, there are certain factors that should be taken into account. ARP® research has verified the following "rules" pertaining to use of a torque wrench:

1. The friction factor changes from one application to the next. That is, the friction is at its highest value when the fastener is first tightened. Each additional time the fastener is torqued and loosened, this value gets smaller. Eventually the friction levels out and becomes constant for all following repetitions. Therefore, new fasteners should be tightened and loosened through several cycles before applying final torque. The number of times depends on the lubricant. For all situations where ARP® lubricants are used, five cycles are required before final torquing.

2. The lubricant used is the main factor in determining friction, and therefore, the torque for a particular installation. Motor oil is a commonly used lubricant because of it's ready availability. If less friction is desired in order to install the fasteners with less torque, special low friction lubricants are available. With special lubes, the required torque can be reduced as much as 20 to 30 percent. It is important to keep in mind that the reverse is also true. If the torque value has been specified for a particular fastener on the basis of low friction lube, installing the fastener with motor oil will result in insufficient preload; the torque has to be increased to compensate for the extra friction caused by the motor oil.

3. Surface finish is also important. For example, black oxide behaves differently than a polished fastener. It is therefore important to observe the torque recommendations supplied with each fastener.

NOTE: It is possible for even the most expensive of torque wrenches to lose accuracy. We have seen fluctuations of as much as ten (10) foot pounds of torque from wrench to wrench. Please have your torque wrench checked periodically for accuracy

The Stretch Gauge

We highly recommend using a stretch gauge when installing rod bolts and other fasteners where it is possible to measure the length of the fastener. It is the most accurate way to determine the correct preload in the rod bolt. Simply follow manufacturer's instructions, or use the chart on page 25 of this catalog for ARP® fasteners. Measure the fastener prior to starting, and monitor overall length during installation. When the bolt has stretched the specified amount, the correct preload, or clamping load, has been applied. We recommend you maintain a chart of all rod bolts, and copy down the length of the fastener prior to and after installation. ***If there is a permanent increase of .001" in length, or if there is deformation, the bolt should be replaced.*** A sample stretch monitoring chart is on page 26.

(see page 81 for complete data on stretch gauges)

FASTENER TORQUE RECOMMENDATIONS

Listed are the recommended torque values for most ARP® fasteners. Recommended torque is equal to 75% of the fastener's yield strength. **THE TORQUE VALUES REPRESENTED HERE ARE INTENDED TO BE FOR GENERAL INFORMATION, NOT FOR SPECIFIC INSTALLATIONS!** In special instances, where supplied instructions deviate from the torque values recommended here, always follow the instructions. Simply read down to the correct fastener size, then cross to find the torque value for your application. Stud torque values are based on the coarse thread yield strength and torque being applied to the fine thread i.e. (7/16-14 into the block and torque applied to 7/16-20 threaded nut). NOTE: **ALWAYS LUBRICATE FASTENERS PRIOR TO APPLYING TORQUE TO ENSURE ACCURATE READINGS**.

Recommended Torque to Achieve Optimum Preload (Clamping Force) Using ARP® Moly Assembly Lubricant or 30-wt. oil - Torque (ft./lbs.) - Preload (lbs.)

Note: For those using Newton/meters as a torquing reference, you must multiply the appropriate ft./lbs. factor by 1.356.

Thread Size and Type	Fastener Tensile Strength (PSI)								
	170,000/180,000 (1171 N/mm²)			190,000/200,000 (1309 N/mm²)			220,000 (1515 N/mm²)		
	Torque w/30 wt. oil	Torque w/ARP® Moly	Preload	Torque w/30 wt. oil	Torque w/ARP® Moly	Preload	Torque w/oil *Not recommended*	Torque w/ARP® Moly	Preload
1/4" stud	12	10	3,804	14	11	4,280	15	12	4,755
1/4-20	13	10	3,804	14	11	4,280	16	13	4,755
1/4-28	14	11	4,344	16	13	4,887	18	14	5,430
5/16" stud	25	20	6,264	28	22	7,047	32	25	7,830
5/16-18	26	21	6,264	29	23	7,047	32	26	7,830
5/16-24	28	22	6,948	32	25	7,817	35	28	8,685
3/8" stud	45	35	9,276	50	39	10,436	56	44	11,595
3/8-16	46	36	9,276	51	41	10,436	57	45	11,595
3/8-24	50	39	10,512	57	44	11,826	63	49	13,140
7/16" stud	71	56	12,720	80	63	14,310	89	70	15,900
7/16-14	73	58	12,720	82	65	14,310	91	72	15,900
7/16-20	80	62	14,220	90	70	15,998	100	78	17,775
1/2" stud	108	84	16,992	122	95	19,116	135	105	21,240
1/2-13	111	88	16,992	125	99	19,116	138	110	21,240
1/2-20	122	95	19,164	137	107	21,560	152	119	23,955
9/16" stud	156	122	21,792	175	137	24,516	195	152	27,240
9/16-12	159	126	21,792	179	142	24,516	199	158	27,240
9/16-18	174	136	24,312	196	153	27,351	217	170	30,390
5/8" stud	214	167	27,072	241	187	30,456	268	208	33,840
5/8-11	220	174	27,072	247	196	30,456	275	217	33,840
5/8-18	243	189	30,660	273	212	34,493	303	236	38,325
8mm stud	25	20	6,264	28	22	7,047	32	25	7,830
10mm stud	54	42	10,680	70	60	12,015	68	53	13,350
11mm stud	80	63	14,220	90	71	15,998	100	79	17,775
12mm stud	97	77	15,540	109	86	17,483	122	96	19,425

In other types of bolted joints, this careful attention to tightening is not as important. For example, flywheel bolts need only be tightened enough to prevent them from working loose. Flywheel loads are carried either by shear pins or by side loads in the bolts; they don't cause cyclic tension loads in the bolts. Connecting rod bolts, on the other hand, support the primary tension loads caused by engine operation and must be protected from cyclic stretching. That's why proper tightening of connecting rod bolts is so important. See the adjacent charts for recommended stretch and torque.

Friction is an extremely challenging problem because it is so variable and difficult to control. The best way to avoid the pitfalls of friction is by using the stretch method. This way preload is controlled and independent of friction. Each time the bolt is torqued and loosened, the friction factor gets smaller. Eventually the friction levels out and becomes constant for all following repetitions. Therefore, when installing a new bolt where the stretch method can not be used, *the bolt should be tightened and loosened several times before final torque.* The number of cycles depends on the lubricant. When using ARP® recommended lubes, five loosening and tightening cycles is enough. This will "break in" the threads sufficiently.

Drag racing's winningest driver, John Force, relies on ARP®

ROD BOLT STRETCH & TORQUE SPECS

Make	Rod Bolt Part No.	Stretch *(inches)*	Torque w/ ARP® Lube *(ft./lbs.)*
AMC	112-6001	.0067	40
	114-6001	.0067	40
	114-6002	.0072	50
	114-6003	.0062	40
	114-6004	.0061	50
BMC/TRIUMPH	206-6002	.0067	35
	206-6001	.0067	50
	206-6003	.0067	44
	206-6004	.0061	44
	206-6005	.0060	42
	206-6006	.????	??
	206-6007	.????	??
BUICK	123-6001	.0063	50
	123-6002	.0064	50
	124-6001	.0057	40
	125-6001	.0057	50
CHEVY	131-6001	.0062	40
	132-6001	.0062	40
	132-6002	.0057	25
	133-6001	.0064	50
	133-6002	.0068	40
	134-6001	.0062	40
	134-6002	.0061	50
	134-6003	.0063	50
	134-6005	.0063	50
	134-6006	.0055	45
	134-6401	.0062	40
	134-6402	.0066	50
	134-6403	.0063	50
	135-6001	.0080	75
	135-6002	.0063	50
	135-6401	.0080	75
	135-6402	.0064	50
	234-6301	.0065	40
	234-6401	.0070	40
	234-6402	.0055	45
	234-6403	.0065	50
	235-6401	.0075	60
	235-6402	.0070	45
	235-6403	.0075	60
CHRYSLER	141-6001	.0063	50
	141-6401	.0064	50
	142-6001	.0069	50
	142-6002	.0063	50
	144-6001	.0063	50
	145-6001	.0072	75
	145-6002	.0063	50
	145-6402	.0064	50
	244-6401	.0072	55
	245-6402	.0075	50
FORD	150-6004	.0063	50
	150-6005	.0063	50
	150-6404	.0064	50
	151-6001	.0065	40
	151-6002	.0065	40
	151-6003	.0050	26
	151-6004	.0055	22
	151-6005	.0049	36
	152-6001	.0071	50
	152-6002	.0063	50
	153-6001	.0069	30
	154-6001	.0063	50
	154-6002	.0069	30
	154-6003	.0063	50
	154-6004	.0055	50
	154-6005	.0063	50
	154-6402	.0069	28
	154-6403	.0064	50
	155-6001	.0063	50
	155-6002	.0063	50
	155-6003	.0063	50
	250-6404	.0063	50
	251-6201	.0047	30
	251-6301	.0061	44
	251-6402	.0065	38
	254-6402	.0070	25

Make	Rod Bolt Part No.	Stretch *(inches)*	Torque w/ ARP® Lube *(ft./lbs.)*
FORD continued	254-6403	.0065	45
	255-6402	.0062	40
HONDA	208-6001	.0055	26
	208-6401	.0077	40
MITSUBISHI	107-6001	.0060	40
	107-6002	.0069	37
	107-6003	.0068	35
	107-6004	.0068	32
NISSAN	102-6001	.0063	30
	202-6001	.0065	40
	202-6002	.0063	30
	202-6003	.0065	40
	202-6004	.0070	40
	202-6005	.0066	40
OLDSMOBILE	181-6001	.0060	50
	184-6001	.0062	50
	185-6001	.0067	50
PONTIAC	190-6001	.0085	50
	190-6002	.0063	50
	190-6003	.0080	75
	190-6004	.0057	61
	191-6001	.0062	40
	194-6001	.0062	40
PORSCHE	204-6001	.0117	45
	204-6002	.0112	50
	204-6003	.0094	45
	204-6005	.0120	35
	104-6006	.0050	40
TOYOTA	203-6001	.0057	40
	203-6002	.0063	50
	203-6003	.0055	35
	203-6004	.0065	45
	203-6005	.0074	50
VOLKSWAGEN	104-6001	.0050	40
	104-6002	.0070	40
	104-6003	.0077	40
	104-6004	.0087	30
	104-6005	.0050	32
	204-6006	.0078	38
OTHERS	109-6001	.0053	32
	109-6002	.0054	24
	116-6001	.0049	36
	117-6101	.0072	35
	200-6001	.0045	60
	200-6002	.0048	60
	200-6003	.0061	60
	200-6004	.0042	60
	200-6006	.0054	60
	200-6201	.0071	75
	200-6202	.0071	75
	200-6203	.0066	75
	200-6204	.0071	75
	200-6205	.0066	75
	200-6206	.0061	75
	200-6207	.0060	45
	200-6208	.0070	45
	200-6209	.0047	58
	200-6210	.0056	26
	200-6506	.0067	70
	205-6001	.0063	50
	205-6002	.0062	40
	209-6003	.0059	38
	216-6301	.0065	40
	216-6302	.0065	40
	300-6602	.0069	50
	300-6603	.0045	50
	300-6608	.0057	32
	300-6701	.0070	85
	300-6702	.0067	50
	300-6703	.0069	50
	300-6706	.0065	75
	300-6708	.0060	30

Red part numbers indicate new items.

THE IMPORTANCE OF PROPER ROD BOLT STRETCH/TORQUE...

Whether measured by stretch or by torque, properly preloading a rod bolt is essential for trouble-free performance. If a bolt is installed without sufficient preload (or pre-stretch), every revolution of the crankshaft will cause a separation between the connecting rod and rod cap. This imposes additional stretch in the bolt. The stretch disappears when the load is removed on each revolution, or cycle. Over time, this cycle stretching and relaxing can cause the bolt to fail due to fatigue, just like a paper clip that is bent back and forth by hand. To prevent this condition, the bolt's pre-load must be greater than the load caused by engine operation.

A properly installed bolt remains stretched by its preload and isn't exercised by the cyclic loads imposed on the connecting rod. A quality bolt will stay stretched this way for years without failing. The important thing is to prevent the bolt from failing due to fatigue by tightening it to a load greater than the demand of the engine. Protect your bolts—tighten them as recommended.

You can easily monitor the condition of the rod bolts through use of a stretch gauge, or a micrometer for that matter. Prior to installing the rod, measure the length of the bolt in a "relaxed" (untorqued) state. Write this down. You can make up a chart similar to the one shown on this page to properly keep track of the data. When you tear the engine down for maintenance, again measure the length of each rod bolt—being careful to keep everything in the proper order. If any of the rod bolts have taken a permanent set and have stretched by .001" or longer you should replace the fastener **IMMEDIATELY!** The stretching is a sure indicator that the bolt has been compromised and taken past its yield point.

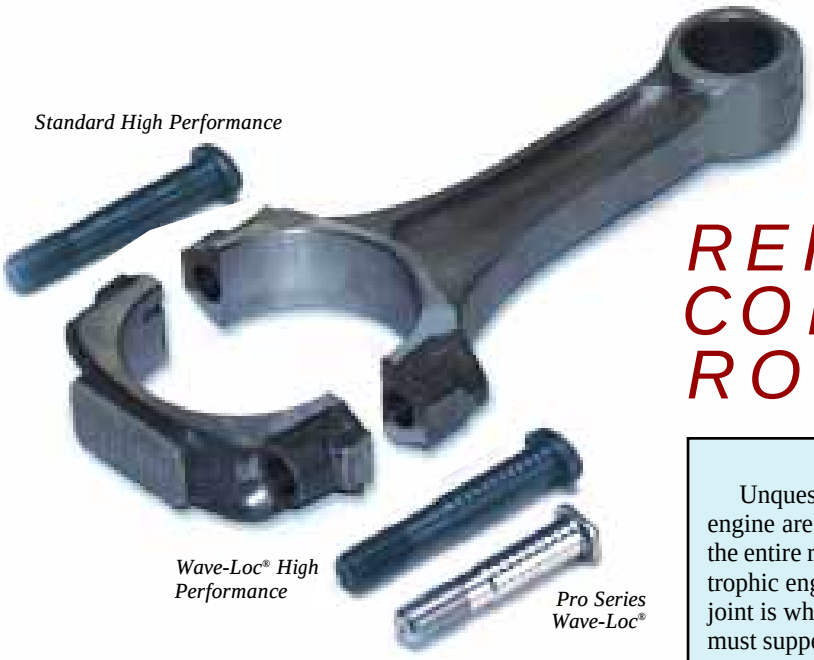
In other types of bolted joints, this careful attention to tightening is not as important. For example, flywheel bolts need only be tightened enough to prevent them from working loose. Flywheel loads are carried either by shear pins or by side loads in the bolts; they don't cause cyclic tension loads in the bolts. Connecting rod bolts, on the other hand, support the primary tension loads caused by engine operation and must be protected from cyclic stretching. That's why proper tightening of connecting rod bolts is so important. See the adjacent charts for recommended stretch and torque.

Friction is an extremely challenging problem because it is so variable and difficult to control. The best way to avoid the pitfalls of friction is by using the stretch method. This way preload is controlled and independent of friction. Each time the bolt is torqued and loosened, the friction factor gets smaller. Eventually the friction levels out and becomes constant for all following repetitions. Therefore, when installing a new bolt where the stretch method can not be used, the bolt should be tightened and loosened several times before final torque. The number of cycles depends on the lubricant. For ARP® recommended lubes, five loosening and tightening cycles is sufficient.

A rod bolt stretch gauge is one of the most important tools a serious engine builder can own. It's valuable in properly setting up a rod for resizing, obtaining the proper torque load when installed in the engine, and monitoring the condition of the bolt while in use.

ROD BOLT STRETCH MONITORING CHART

ROD #1	ROD #2	ROD #3	ROD #4
INSIDE BOLT	*INSIDE BOLT*	*INSIDE BOLT*	*INSIDE BOLT*
IN_____OUT_____	IN_____OUT_____	IN_____OUT_____	IN_____OUT_____
OUTSIDE BOLT	*OUTSIDE BOLT*	*OUTSIDE BOLT*	*OUTSIDE BOLT*
IN_____OUT_____	IN_____OUT_____	IN_____OUT_____	IN_____OUT_____
ROD #5	**ROD #6**	**ROD #7**	**ROD #8**
INSIDE BOLT	*INSIDE BOLT*	*INSIDE BOLT*	*INSIDE BOLT*
IN_____OUT_____	IN_____OUT_____	IN_____OUT_____	IN_____OUT_____
OUTSIDE BOLT	*OUTSIDE BOLT*	*OUTSIDE BOLT*	*OUTSIDE BOLT*
IN_____OUT_____	IN_____OUT_____	IN_____OUT_____	IN_____OUT_____



Standard High Performance

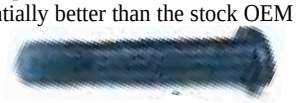
Wave-Loc® High Performance

Pro Series Wave-Loc®

REPLACEMENT CONNECTING ROD BOLTS

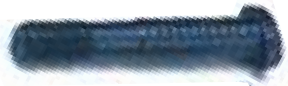
Choose From Three ARP® Replacement Rod Bolts:

Because factory connecting rods (or aftermarket versions of OEM rods) are used in a variety of applications from rebuilt stock motors to modified powerplants used in circle track, marine and drag racing engines—including those with superchargers and/or nitrous oxide injection systems—ARP® offers replacement rod bolts in three different models. All of them are substantially better than the stock OEM and most aftermarket bolts.



GOOD: STANDARD HIGH PERFORMANCE BOLTS

A premium grade 8740 alloy chrome moly steel is used to manufacture ARP® High Performance connecting rod bolts. This material is heat-treated to provide a tensile strength in the 200,000 psi range, which is substantially stronger than the OEM bolts. Cycle testing shows ARP® High Performance rod bolts to be nearly five times more reliable than stock bolts.



BETTER: WAVE-LOC® HIGH PERFORMANCE BOLTS

The same heat-treated 8740 chrome moly steel is used to make these rod bolts as ARP's standard High Performance rod bolts. The big difference is in the shank design, with ARP's exclusive (and patented) Wave-Loc® technology providing substantial benefits. Because there are fairly wide tolerances in factory bolt holes, the bolt must be able to fit snugly and a knurl is applied. Unfortunately, these knurls cut deep into the bolt material, leaving sharp edges and enormous "stress risers" that promote failure. That's why ARP® developed the Wave-Loc® design that features symmetrical waves and has an effective interference range of .0005" to .007" for proper cap alignment.

BEST: "PRO" SERIES WAVE-LOC® BOLTS

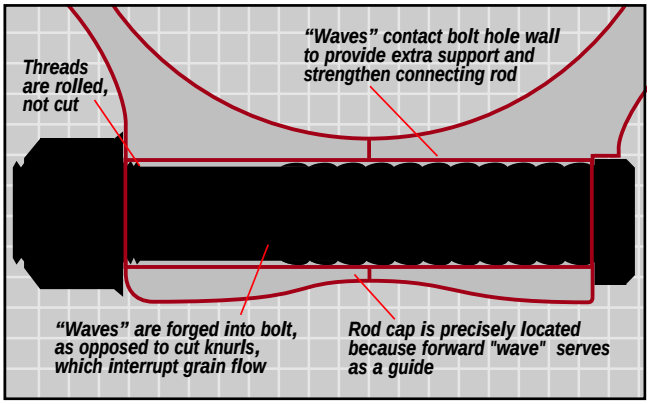
For the most severe applications, in conjunction with aftermarket I-beam rods, ARP® has developed the "Pro" Series Wave-Loc® bolts. These ultra heavy-duty rod bolts are made from a special material designated ARP®2000. It has approximately 200% the fatigue life of 8740 chrome moly steel and has a tensile strength of about **220,000 psi**, and is capable of more than 12,000 lbs. clamping force.

TECH NOTE: ROD BOLTS

Unquestionably the most important fasteners in any engine are the connecting rod bolts, as they hold the key to the entire rotating assembly. A broken bolt will lead to catastrophic engine failure. As you can imagine, the most critical joint is where the connecting rod halves mate. The rod bolts must support the primary tension loads caused by each rotation (or cycle) of the crankshaft. When the crank rotates, the big end of the connecting rod essentially becomes oval-shaped and the rod bolts bend. As the crankshaft continues to rotate, the rod becomes round again. With alternating tension loads and cyclic bending of the bolts, it is very important to install fasteners that are able to exert a clamping force greater than the load imposed upon the joint (tension).

In addition to utilizing a rod bolt with sufficient strength to withstand the tremendous cyclical strains placed upon it, it is absolutely imperative that the bolts be properly tightened. The preferred method of monitoring the correct amount of tension is through use of a stretch gauge. This is far more accurate than using a torque wrench. Moreover, through subsequently checking the rod bolts length at tear-downs, it is possible to determine if it has been stressed beyond safe limits and must be replaced.

ADVANTAGES OF WAVE-LOC® ROD BOLTS:



- Wave-Loc® surface contacts the rod and cap for optimum alignment and reduction of fluctuating stress—which strengthens the rod itself!
- Provides snug fit for all OEM connecting rods (interference range of .0005" to .007"), despite wide range of factory rod bolt hole tolerances.
- Available for most applications.
- Superior material grain flow because of patented Wave-Loc® surface design as compared to knurled bolts that have sharp edges and "built in" stress risers.
- Galling and scoring of the rod is virtually eliminated because there is only smooth contact and absolutely no "digging."

Application ①Replacement for 13/32" bolt * Not Wave-Loc®	Head Style	Hi-Perf 8740 (complete)	Hi-Perf 8740 (2-PC)	HP Wave 8740 (complete)	HP Wave 8740 (2-PC)	Pro Wave ARP®2000 (complete)	Pro Wave ARP®2000 (2-PC)	Pro Series ARP®2000 (complete)	Pro Series ARP®2000 (2-PC)
ALFA ROMEO									
2.0 GTV	A	126-6101							
AMC									
258 c.i.d. 6-cylinder	D	112-6001							
290-343-360 c.i.d. 11/32"	D	114-6001							
304 c.i.d.	D	114-6003							
390 '68-'69	D	114-6004							
390-401 c.i.d., '68-up, 3/8"	D	114-6002							
BMC/TRIUMPH/ROVER									
A-Series, 3/8"	J	206-6001							
A&B Series, 11/32"	C	206-6002							
B-Series, cap screw, 3/8", '64-'68, 18GB, 18GF	E	206-6003							
K-Series	E	206-6007							
Spitfire 1296 & 1500	E	206-6004							
TR6 GT6	E	206-6005							
TR7	K	206-6006							
BMW									
E36, E46	E							201-6102	
BUICK									
90° (cap screw type) 1.500" U.H.L.	E							123-6001	123-6021
90° (cap screw type) 1.700" U.H.L.	E							123-6002	123-6022
215 c.i.d. V8, aluminum	D	124-6001							
350 c.i.d.		124-6002							
455-430-400-401-425 c.i.d.	B	125-6001							
CADILLAC									
472-500 with 12 pt. nuts	D	135-6003							
CHEVROLET, SMALL BLOCK									
7/16" "K" rod with 12 pt. nuts	A	134-6004							
283-327 c.i.d. and inline 6	D	134-6001	134-6021	134-6401	134-6411	234-6401	234-6421		
305-307-350 c.i.d.	B	134-6003	134-6023	134-6403	134-6423	234-6403	234-6423		
350 c.i.d. PM Rod 96 LTI/LT	B	134-6005							
400 c.i.d.	A	134-6002	134-6022	134-6402	134-6422	234-6402	234-6422		
LS 1 "Cracked Rod"	E	134-6006	134-6026					234-6301	234-6321
CHEVROLET, BIG BLOCK									
396-427 c.i.d. 3/8"	A	135-6002	135-6022	135-6402	135-6422	235-6402	235-6422		
409 c.i.d.	B	134-6003	134-6023	134-6403	134-6423	234-6403	234-6423		
454 & 502 c.i.d. 7/16"	A	135-6001	135-6021	135-6401	135-6421	235-6401	235-6421	235-6403	
CHEVROLET, 4 and 6-CYLINDER									
Corvair, 5/16", now Wave-Loc®	D			132-6002	132-6022				
Inline 6, 194 c.i.d.	D	132-6001	132-6021						
Vega 4-cylinder	D	131-6001	131-6021						
V6, 2.8L 60°	D	133-6002	133-6022						
V6, 4.3L 90°	A	133-6001	133-6021						
CHRYSLER									
4-cylinder, 2.2L	D	141-6001		141-6401					
6-cylinder, 170-225 c.i.d.	F	142-6001							
SL6	D	142-6002							
318-340-360 c.i.d.	D	144-6001	144-6021	144-6401	144-6421	244-6401	244-6421		
383-440 wedge, 354-392 Hemi, 413	M	145-6002	145-6022	145-6402		245-6402	245-6422		
426 late Hemi, 7/16"	M	145-6001	145-6021						
FORD, SMALL BLOCK									
239, 256, 272 & 292 Y block, rod marked EBU	M	154-6005							
239, 256, 272 & 292 Y block, rod marked ECZ	F	154-6004							
289-302 standard 5/16"	B	154-6002	154-6022	154-6402	154-6422	254-6402	254-6422		
302 c.i.d. Sportsman SVO, 3/8"	C	150-6005	150-6025						
312 c.i.d.	C	154-6004	154-6024						
351 Cleveland	C	154-6003	154-6023	154-6403	154-6423	254-6403	254-6423		
351-400M	C	154-6001	154-6021						
Boss 302 & 351W	C	150-6004	150-6024	150-6404	150-6424	250-6404	250-6424		
FORD, BIG BLOCK									
390-428 c.i.d. ①	G	155-6002	155-6022			255-6402	255-6422		
428 Cobra Jet	A	155-6001	155-6021						
429-460 c.i.d., 351W square head	M	155-6003	155-6023						

Red part numbers indicate new items.

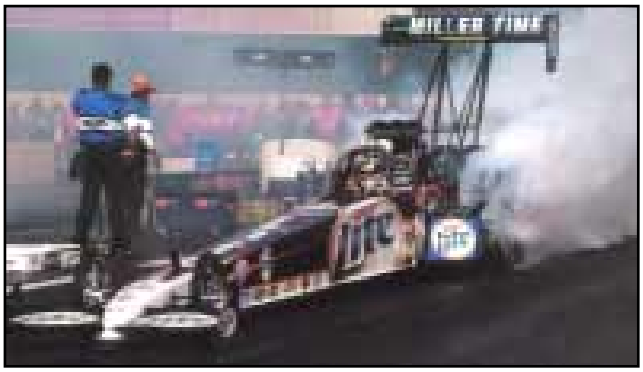
Application NOTE: To help identify the proper replacement rod bolts, we are showing photos of all available styles per head design. These are indicated as A-M on the previous page. Please verify style similarities when replacing rod bolts.	Head Style	Hi-Perf 8740 *(complete)*	Hi-Perf 8740 *(2-PC)*	HP Wave 8740 *(complete)*	HP Wave 8740 *(2-PC)*	Pro Wave ARP®2000 *(complete)*	Pro Wave ARP®2000 *(2-PC)*	Pro Series ARP®2000 *(complete)*	Pro Series ARP®2000 *(2-PC)*
FORD, BIG BLOCK continued									
Boss, 429-460 c.i.d.	C	150-6004	150-6024	150-6404	150-6424	250-6404	250-6424		
FORD, 4 and 6-CYLINDER									
Cosworth Sierra/Escort	E					251-6301			
CVH M8X1.0	E	151-6004							
Ford RS 2000 8mm	E							251-6201	251-6222
Inline 6, 240-300 c.i.d.	G	152-6001							
Inline 6, 4.9L	C	152-6002							
Pinto 2000cc inline 4	D	151-6001	151-6021						
Pinto 2300cc inline 4	F	151-6002	151-6022			251-6402	251-6422		
Zetec, 1.6L 8mm	E	151-6003	151-6023						
Zetec, 2.0L 9mm	E	151-6005							
V6, 2.8L and 2.9L	B	153-6001							
Duratech 1.8L	E							251-6202	
Super Coupe 3.8L V-6	F	151-6006	151-6026						
HOLDEN									
3/8"	B	205-6001							
11/32"	B	205-6002							
HONDA									
1.2L to 1.8L, 8mm	A	208-6001							
1.8L, 9mm	A							208-6401	
MITSUBISHI									
2.6L	C	107-6003	107-6023						
3.0L V6, 3.5 V6, 6G74	C	107-6004	107-6024						
4G63, pre 1994, 9mm	C	107-6001	107-6021						
4G63, 1994-present, 8mm	C	107-6002	107-6022						
NISSAN									
L16 Series	C	102-6001							
L20 Series, 4-cylinder Z22	C	202-6001							
L24 (early), 8mm	C	202-6002							
L24 (late), L26, L28 6-cylinder, 9mm,	C	202-6003							
SR20	C	202-6005							
VG30E & VG30ET	C	202-6003							
VG30 V6 D (Four Cam), DET, DETT	C	202-6004							
OLDSMOBILE									
307-350-403-425 c.i.d. (small block), 225	A	184-6001	184-6021						
455 c.i.d. (big block)	F	185-6001	185-6021						
Quad 4	I	181-6001							
OPEL/VAUXHALL									
1.4-1.6L 8-valve, 8mm	E	109-6002							
2.0L, 16-valve, 9mm	E	109-6001				209-6003*			
PONTIAC									
301 c.i.d.	D	194-6001							
326-389-400-455 c.i.d. (3/8"), '63 to present	I	190-6001	190-6021						
455 c.i.d. Super Duty, 7/16"	M	190-6003	190-6023						
455 c.i.d. Super Duty cap screw type, 7/16-24	E	190-6004							
4-cylinder "Iron Duke", 11/32"	D	191-6001							
V8, 1955-62	D	190-6002	190-6022						
PORSCHE									
911, 9mm, Turbo 930, 933	H					204-6005			
911, 10mm	H					204-6001			
911S, 1969 2.0L	H					204-6003			
944	K					204-6002			
Type IV, 1.7L and 2.0L	K	104-6006							
RSR Ti rod	H					204-6004			
PEUGEOT									
306 &205	M	117-6101							
RENAULT									
5 Turbo (Mid-Engine)	E							216-6302	
12 Gordini/Alpine 807g	E	116-6001							
Clio, 16V 9mm	E							216-6301	

Red part numbers indicate new items.

Application NOTE: To help identify the proper replacement rod bolts, we are showing photos of all available styles per head design. These are indicated as A-M on the previous page. Please verify style similarities when replacing rod bolts.	Head Style	Hi-Perf 8740 *(complete)*	Hi-Perf 8740 *(2-PC)*	HP Wave 8740 *(complete)*	HP Wave 8740 *(2-PC)*	Pro Wave ARP®2000 *(complete)*	Pro Wave ARP®2000 *(2-PC)*	Pro Series ARP®2000 *(complete)*	Pro Series ARP®2000 *(2-PC)*
TOYOTA									
4AGE, 9mm	A	203-6001							
4ALC	A	203-6001							
2TC, 3TC, 2TG	A	203-6003							
22R & 3SGTE	A	203-6002							
Supra, 2JZA80	E	203-6005							
Supra, 7MGTE	A	203-6004							
VOLKSWAGEN									
1600cc air cooled	K	104-6001							
2L & 1800cc water cooled	L			104-6004	104-6024				
Cap screw Super Vee (Audi style rod)	A			104-6003	104-6023				
Corrado G60 & 1600cc water cooled Rabbit	K	104-6002							
Formula Vee, 9mm cap screw	E	104-6005	104-6025						
VR6	E							204-6006	

Red part numbers indicate new items.

"Big Foot" - The premiere "Monster Truck" in the world!



Larry Dixon, Jr. - 2002 NHRA Top Fuel World Champion

Jim Hughes - NHRA Super Comp points champion for 2002

Mike Saye - NHRA Comp Eliminator points champion

Corey Kruseman - SCRA Sprint Car points standout

Terry Newton - IHBA points champion and record holder

HOW TO: INSTALL CAP-STYLE ROD BOLTS

Replace your original connecting rod cap screws with these ARP® products for enhanced durability and improved strength. Use whenever cap screw-style bolts are used for rod cap retention.

TECH TIP

Be sure the torque spec used when *re-sizing* a rod **and** final engine *assembly* are the **same**. Communicate with your machinist! Use a stretch gauge for both functions, if possible.

NOTE: The only way to know if a bolt is ready to fail is if it has permanently yielded .001" or more. *See page 26.*

1. Clean and inspect all hardware for obvious damage. If necessary, chase or re-tap con rod threads to ensure proper thread engagement and accurate torque readings.

2. Position washer under bolt head to ensure it clears the under head radius. NOTE: Improper installation will cause premature bolt failure.

3. Assemble cap to rod, then lubricate with ARP® Moly lube and install bolt & washer. Measure pre-torqued bolt length. You should keep a log of the original free standing length. A sample is on page 26.

4. Using a stretch gauge or micrometer to measure fastener stretch, torque rod bolt until recommended bolt stretch is achieved. A rod bolt stretch chart is on page 26.

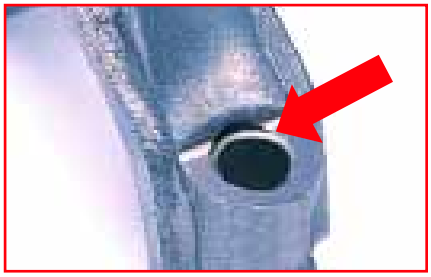
5. Once properly preloaded, have the rods resized before assembling them to the pistons, then install in engine using the prescribed bolt-stretch method.

HOW TO: INSTALL OEM-STYLE ROD BOLTS

Improved reliability and optimum strength are the main attributes of ARP's replacement rod bolts. These are the finest fasteners available today, and are recommended for all high performance applications.

TECH TIP

Be sure the torque spec used when *re-sizing* a rod **and** final engine *assembly* are the **same**. Communicate with your machinist! Use a stretch gauge for both functions, if possible.



1. Inspect rods to ensure there is adequate chamfer to clear radius under heads, then install bolts after inspecting for damaged hardware.

2. Reinstall the rod cap, then measure bolt length using a micrometer (free standing length).

3. Lubricate rod nuts with ARP® Moly lube, torque nuts to achieve recommended bolt stretch. A rod bolt stretch chart is located on page 25.

4. With proper preload applied, have rods resized. **This procedure is recommended any time rod bolts are replaced.**

5. Install rod and piston assemblies in engine using the prescribed bolt stretch method or by following recommended torque values.

PRO SERIES CONNECTING ROD BOLTS

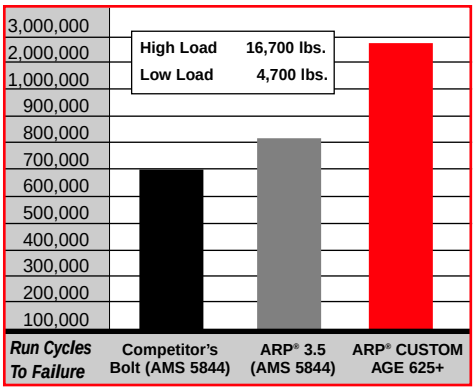
A large number of connecting rod manufacturers have chosen ARP® bolts as standard equipment. They're proud to advertise their products as being equipped with ARP® rod bolts. And for good reason. The "weak link" in a connecting rod has always been the bolt, and racers know that nobody builds a better bolt than ARP®. However, it is critically important to monitor the stretch of each bolt and replace it when it has permanently elongated by .001". Below you will find an extensive listing of aftermarket connecting rods and replacement bolt specifications.

In some instances, you may want to go to an ARP® rod bolt made from a better grade of material. This will provide you with improved reliability. However, please understand that when you want bolts made from exotic, super high strength materials, the cost will increase significantly. If you're on a budget, it's best to go with the most cost-effective solution. This is typically defined by the loads that are carried by the bolts in terms of piston/rod weight and the rotational speed of the engine. The most cost effective design is the one in which the bolt strength is just great enough to handle its anticipated load—plus a safety margin for the occasional overloads. Using a material which has far more strength than required is not as cost effective…but will definitely give you an extra margin of safety and longer service life.

You should also know that ARP® rod bolts are superior to those from other manufacturers. Especially in the area of fatigue strength. Testing has shown ARP® rod bolts to have ten times the fatigue strength of other bolts. In the chart below, you'll find a bar chart that graphically shows the difference between ARP® Pro Series rod bolts and the fastener made by a leading competitor. It's easy to see why ARP® bolts are superior. As such, it makes good sense to rely on ARP® for optimum connecting rod service and reliability. Make the most of your racing budget and rely on ARP® rod bolts. You'll find the ARP name proudly stamped on each bolt as your assurance of quality.

- *Forged in-house at ARP® using only the finest quality materials*
- *Heat-treated using special vertical racks to assure complete 360° penetration*
- *Threads rolled after heat-treat to provide up to 10-times longer fatigue strength*
- *Precision CNC-machined to exacting specifications*
- *Specially designed for optimum reliability in each application*

ARP® connecting rod bolts are used in everything from exotic 18,000 rpm Formula 1 engines to 6,000 horsepower nitro-burning Top Fuel motors



It's important to note that a number of premium quality connecting rods come from their respective manufacturers with ARP® rod bolts as standard equipment. We are pleased to consider these key firms our "Performance Partners" and embarked upon a program to recognize this alliance. ARP® also manufactures replacement connecting rod bolts for products from other firms. We feel that our fasteners are substantially better than those OEM offerings, and they will serve to increase the durability and service life of these rods. For information pertaining to obtaining replacement bolts for these rods, contact our tech department.

Application	Material	Under Head Dimensions	Thread Dia.	Wrench Dia.	Complete Set	2-Piece Pack
Ford 427 (LeMans) and general replacement for aluminum rods, with washer	8740	1.800"	7/16	7/16	200-6001	200-6021
Venolia, BRC, aluminum rod replacement, with washer	8740	1.800"	7/16	7/16	200-6002	200-6022
Manley Elgin replacement, aluminum rod part no.14050 & 14054	8740	1.800"	7/16	7/16	200-6003	200-6023
General replacement, aluminum rods, with washers	8740	2.000"	7/16	7/16	200-6004	200-6024
Manley replacement rods	8740	1.600"	7/16	7/16	200-6006	200-6026
Manley replacement, rod part number 14051 and 14055	ARP®2000	1.850"	7/16	7/16	200-6201	200-6221
Carrillo replacement for CARR bolt, with washers	ARP®2000	1.800"	7/16	1/2	200-6202	200-6222
Carrillo replacement for H-bolt, without washers	L19	1.700"	7/16	1/2	200-6203	200-6223
Lentz replacement with washers	ARP®2000	1.800"	7/16	1/2	200-6204	200-6224
Lentz replacement without washers	ARP®2000	1.725"	7/16	1/2	200-6205	200-6225
Venolia, Brooks, KB, Aluminum rod replacement with washer	ARP®2000	2.000"	7/16	1/2	200-6206	200-6226
General replacement, steel rods, 8 piece set	ARP®2000	1.600"	3/8	7/16	200-6209	
General replacement, steel rods, 8 piece set	ARP®2000	1.500"	5/16	3/8	200-6210	
Venolia, Brooks, KB, Aluminum rod replacement with washer	L19	2.000"	7/16	1/2	200-6506	200-6526
Venolia, Brooks, KB, Aluminum rod replacement with washer	Custom Age 625+	2.000"	7/16	1/2	300-6706	300-6726
Carrillo, Lentz, Ferrea replacement without washer	ARP®3.5	1.750"	7/16	1/2	300-6601	300-6621
Carrillo, Lentz, Ferrea replacement without washer	Custom Age 625+	1.750"	7/16	1/2	300-6701	300-6721
Carrillo Replacement, 16 piece set	ARP®3.5	1.600"	3/8	7/16	300-6602	300-6623
Carrillo Replacement, 16 piece set	Custom Age 625+	1.600"	3/8	7/16	300-6702	300-6722
Carrillo replacement, 8 piece set	ARP®3.5	1.600"	3/8	7/16	300-6603	300-6623
Carrillo replacement, 8 piece set	Custom Age 625+	1.600"	3/8	7/16	300-6703	300-6723
Carrillo replacement, 8 piece set	ARP®3.5	1.500"	5/16	3/8	300-6608	300-6628
Carrillo replacement, 8 piece set	Custom Age 625+	1.500"	5/16	3/8	300-6708	300-6728
General replacement, steel rods, 8 piece set	ARP®2000	1.500"	3/8	7/16	200-6207	200-6227
General replacement, steel rods, 8 piece set	ARP®2000	1.750"	3/8	7/16	200-6208	200-6228

Red part numbers indicate new items.

MATERIALS USED IN THE MANUFACTURE OF CAP SCREW TYPE CONNECTING ROD BOLTS

8740 CHROME MOLY: Until the development of today's modern alloys, chrome moly was popularly considered a high strength material. Now viewed as only moderate strength, 8740 chrome moly is seen as a good tough steel, with adequate fatigue properties for most racing applications, but only if the threads are rolled after heat-treatment, as is the standard ARP® production practice. Typically, chrome moly is classified as a quench and temper steel, that can be heat-treated to deliver tensile strengths between **180,000** and **210,000 psi**.

AERMET® 100: With a typical tensile strength of **280,000 psi**, Aermet 100 is a new martensitic super-alloy that is stronger and less expensive than the super-alloy austenitic materials that follow. Because it is capable of achieving incredibly high clamping loads, it is ideal for short but extreme environments like top fuel, funny car and some short track applications. Although Aermet 100 is a maraging steel that is far superior to other high strength steels in its resistance to stress corrosion, it must be kept well-oiled and not exposed to moisture.

ARP2000: An exclusive, hybrid-alloy developed to deliver superior strength and better fatigue properties. While 8740 and ARP2000 share similar characteristics—ARP®2000 is capable of achieving clamp loads in the **215,000-220,000 psi** range. ARP®2000 is used widely in short track and drag racing as an up-grade from 8740 chrome moly in both steel and aluminum rods. Stress corrosion and hydrogen embrittlement are typically not a problem, providing care is taken during installation.

L19: This is a premium steel that is processed to deliver superior strength and fatigue properties. L19 is a very high strength material compared to 8740 and ARP®2000 and is capable of delivering clamp loads in the **230,000-260,000 psi** range. It is primarily used in short track and drag racing applications where inertia loads exceed the clamping capability of ARP®2000. Like most high strength, quench and temper steels—L19 requires special care during manufacturing to avoid hydrogen embrittlement. This material is easily contaminated and subject to stress corrosion. It must be kept well-oiled and not exposed to moisture.

INCONEL 718: A nickel based material that is in the high temperature, super-alloy class, it is found to be equally suitable in lower temperature applications. This material delivers tensile strengths into the **220,000 psi** range and exhibits improved fatigue properties. Best of all, Inconel 718 is completely immune to hydrogen embrittlement and corrosion.

ARP3.5 (AMS5844): While similar to Inconel 718, these super-alloys are found in many jet engine and aerospace applications where heat and stress attack the life of critical components. The high cobalt content of this alloy, while expensive, delivers a material with superior fatigue characteristics and typically tensile strength in the **270,000 psi** range. The immunity to hydrogen embrittlement and corrosion of these materials is a significant design consideration. These materials are primarily used in connecting rods where extremely high loads, high RPM and endurance are important factors—Formula 1, Winston Cup and CART applications.

CUSTOM AGE 625 PLUS®: This newly formulated super-alloy demonstrates superior fatigue cycle life, tensile strength and toughness—with complete resistance to atmospheric corrosion and oxidation. ARP® is the first to develop manufacturing and testing processes for fasteners with Custom Age 625+. Best of all it is less expensive and expected to soon replace MP-35 as the material of choice in the high strength, super-alloy field. Typical tensile strength is **260,000 psi**.

CYLINDER HEAD STUDS

It is for good reason that virtually every top professional engine builder relies on ARP® Pro Series head studs for their all-out competition powerplants. Simply stated, there's not a better stud setup on the market today.

For openers, ARP® uses a premium grade 8740 alloy that is rated far superior to "aircraft" quality. Then, each stud is placed vertically in special racks and precisely heat-treated to 200,000 psi. This procedure ensures complete heat penetration and the results are far superior to those lesser quality studs from other manufacturers who just dump pieces in a basket and hope for the best.

Following heat-treat, each stud is centerless ground to make it as close to perfectly concentric as possible. This procedure involves about ten very slight cuts and results in an exceptionally straight part. It's important to note that lesser quality studs are not even centerless ground—the material is thread rolled in bar stock form (mostly before heat-treat, when the material is easier to machine). Because ARP® studs are manufactured to such exacting tolerances, you will note that gaskets and cylinder heads literally glide into position and are perfectly aligned—something that won't happen with inferior quality head studs.

ARP® studs are thread rolled *after* heat-treat, which gives them about 1000% (that's ten times) better fatigue strength than those studs that are threaded prior to heat-treat (a very common industry practice). It costs a lot more to do it this way, because it's tough on tooling, but the results are well worth the extra effort.

You will also note that ARP® offers specially undercut studs for several engines. This procedure (done only to the shorter studs) more equalizes the "stretch" of both studs, which makes for a more consistent clamping force—and one that compensates for head gasket compression when the cylinder heads are installed. This helps prevent blown head gaskets, and assures optimum engine sealing!

Premium quality heat-treated 8740 chrome moly steel head stud kits are available for most every domestic and import applications. You won't find a better quality stud on the market from any other source. Look for ARP® stamped on each stud as your assurance of quality.

ARP® head stud kits are available with your choice of conventional hex nuts or compact 12-point nuts. Premium quality parallel ground washers are also included with each kit. Clearly, they are the best on the market today, and the favorite of leading professional engine builders in all forms of racing.

HEAD STUDS vs. BOLTS... A TECHNICAL DISCUSSION

ARP®'s factory Tech Representatives are often asked which is better, cylinder head studs or bolts. The answer, invariably, depends on the installation. On many street-driven vehicles, where master cylinders and other items protrude into the engine compartment, it's probably necessary to use head bolts so that the cylinder heads can be removed with the engine in the car.

For most applications, however, studs are recommended. And for good reason. Using studs will make it much easier to assemble an engine (especially a racing powerplant which must be serviced frequently and quickly!) with the cylinder head and gasket assured of proper alignment.

Studs also provide more accurate and consistent torque loading. Here's why. When you use bolts to secure the head, the fastener is actually being "twisted" while it's being torqued to the proper reading. Accordingly, the bolt is reacting to two different forces simultaneously. A stud should be installed in a "relaxed" mode—never crank it in tightly using a jammed nut. If everything is right, the stud should be installed finger tight. Then, when applying torque to the nut, the stud will stretch only on the vertical axis. Remember, an undercut shorter stud will have a rate similar to a longer, standard shank stud. This provides a more even clamping force on the head. Because the head gasket will compress upon initial torquing, make sure studs and bolts are re-torqued after the engine has been run.

"On the basis of superior material, a special heat-treating process, and advanced manufacturing technology, ARP® Pro Series head studs are clearly the very finest on the market today!"

Application	Hex Nuts	Hex Nuts U/Cut Studs	12-Point Nuts	12-Point Nuts U/Cut Studs
AMC				
258 c.i.d., 6-cylinder	112-4001			
343-401 c.i.d., through '69	114-4001		114-4201	
343-401 c.i.d., '70 and up	114-4002		114-4202	
BMC/TRIUMPH				
A-series, 9 studs			206-4201	
A-series, 11 studs			206-4204	
A-series, 11 studs, shaved head			206-4206	
B-series			206-4202	
Triumph GT6			206-4205	
Triumph Spitfire			206-4203	
Triumph TR4			206-4207	
Triumph TR7				206-4208
BMW				
2002, 318I, 320I				201-4601
535, 635, 735				201-4602
M50 2.5L 6-cylinder				201-4603
BUICK, SMALL BLOCK				
215 c.i.d.	124-4002		124-4202	
215 c.i.d., Rover V8	124-4003			
350 c.i.d.	124-4001		124-4201	
BUICK, BIG BLOCK				
401 c.i.d., nail head	124-4004		124-4204	
455 c.i.d.	125-4001		125-4201	
BUICK, V6				
'86-'87 Grand National and T-type	123-4003		123-4203	
GN 1 Champion head			223-4204	
Stage I, '77-'85	123-4001		123-4201	
Stage II, 28 pieces	223-4002		223-4202	
Stage II Champion head			223-4203	
CADILLAC				
472-500 with 6 & 12 pt. nuts for clearance	135-4007			
CHEVROLET, SMALL BLOCK				
23° OEM cast iron and aluminum Chevrolet, Gen III Vortec/Truck	134-4001	234-4401	234-4301	234-4601
18° standard port	234-4107	234-4507	234-4307	234-4707
18° raised port	234-4108	234-4508	234-4308	234-4708
18° with raised intake 3/8" #10134363 and 64			234-4321	234-4721
with Bowtie aluminum and cast block, .950, coarse thread			234-4320	234-4720
18° with 3/8" holes			234-4322	
7/16"-3/8" stepped	234-4015		234-4315	
Airflow Research, Brownfield	134-4001	234-4401	234-4301	234-4601
Aluminum Block with Brodix -12 & 12x heads	234-4123			
Aluminum Bowtie splayed bolt head			234-4213	
Brodix -8,-10,-11, Track I, Dart Sportsman and Dart II & most Edelbrock	134-4001	234-4401	234-4301	234-4601
Brodix, -12, and Brodix 18°	234-4103	234-4503	234-4303	234-4703
Brodix -12 rollover (angle mill)			234-4311	
Brodix, 18° rollover			234-4310	
Brodix, 18 RLVR			234-4310	
Brodix, canted valve			234-4312	
Brodix-Pontiac raised port	234-4106	234-4506	234-4306	234-4706
Brodix-Pontiac standard port	234-4105	234-4505	234-4305	234-4705
Bowtie Block with 14° Pro Action head			234-4725	
Bowtie cast iron and aluminum block with Brodix -8,-10,-11,-10x				
Bowtie with Brodix 12 Weldtech, HBK				234-4723
Dart II, Brodix Track 1	234-4109	234-4509	234-4309	234-4709
Dart, 18°			234-4323	
Dart, 18° II Generation steel block	234-4036		234-4336	
Dart, Buick	234-4102	234-4502	234-4302	234-4702
Dart, Oldsmobile 14°	234-4104	234-4504	234-4304	234-4704
Dart Sportsman, .950, coarse thread	134-4002	234-4402	234-4332	234-4602
Pro Action 14°			234-4334	
Pro Action 14° Tall Deck			234-4335	
Pro Action head			234-4333	234-4433
Rodeck aluminum block with 18° Chevy heads			234-4710	
Rodeck aluminum block with Brodix canted valves			234-4711	
SB2				234-4722
SB2-2 Winston Cup			234-4724	
SBC LS1, LS6 5.7L & 6.0L	234-4110		234-4316	

Red part numbers indicate new items.

Application	Hex Nuts	Hex Nuts U/Cut Studs	12-Point Nuts	12-Point Nuts U/Cut Studs
CHEVROLET, BIG BLOCK				
Cast OEM, Aluminum factory heads, also early Bowtie	135-4001	235-4401	235-4201	235-4601
409	135-4002	235-4402	235-4202	235-4602
Bowtie	235-4110		235-4310	
Late Bowtie, Dart Merlin, iron and aluminum Dart 360, Edelbrock, Dart Pro 1	235-4103	235-4503	235-4303	235-4703
Long exhaust studs, only 8 pcs (with nuts and washers)	235-4106		235-4306	
Brodix, -2, -4, 2x, 3x, Canfield	235-4102	235-4502	235-4302	235-4702
With Edelbrock Performer RPM heads	235-4018	235-4518	235-4318	235-4718
With Edelbrock Victor heads	235-4019	235-4519	235-4319	235-4719
Brodix, Pontiac Pro Stock	235-4107	235-4507	235-4307	235-4707
Symmetrical-spread port Chevy	235-4104	235-4504	235-4304	235-4704
With GM aluminum block, 7/16" diameter	135-4005	235-4505	135-4205	235-4705
With GM aluminum block, 1/2" diameter	135-4006	235-4506	135-4206	235-4706
Dart Big Chief	235-4112	235-4512	235-4312	235-4712
Oldsmobile DRCE	235-4109	235-4509	235-4309	235-4709
Mark V, with Brodix/Canfield heads	235-4114	235-4514	235-4314	235-4714
Mark V, with Dart or AFR heads	235-4113	235-4513	235-4313	235-4713
Mark V, with Mark V heads or Edelbrock heads	235-4108	235-4508	235-4308	235-4708
Merlin - World	235-4016		235-4316	235-4716
CHEVROLET, V6				
2.8L 60°, 11mm	233-4003		233-4303	
4.3L 90°	233-4001	233-4401	233-4301	233-4601
4.3L 90° with 18° raised port	233-4108	233-4508	233-4308	233-4708
4.3L 90° with 18° standard port	233-4107	233-4507	233-4307	233-4707
4.3L 90° with Oldsmobile 14-° heads	233-4104	233-4504	233-4304	233-4704
4.3L 90° with Pontiac raised runner	233-4102	233-4502	233-4302	233-4702
CHEVROLET, 4 and 6-CYLINDER				
GMC Vega 140	131-4002			
Inline 4-cylinder, '62 and up	131-4001		131-4201	
Inline 6-cylinder, '62 and up	132-4001		132-4201	
CHEVY/FORD DIESEL				
Chevy/GMC 6.2 diesel, 12mm	130-4062			
Ford, International 6.9 diesel	150-4069			
CHRYSLER, SMALL BLOCK				
B1-BS heads	144-4004		144-4204	
Mopar "A" engine	144-4001		144-4201	
Mopar "A" engine with W-2 or Edelbrock cylinder heads	144-4002		144-4202	
Mopar "A" engine with W-5, W-7 cylinder heads	144-4003		144-4203	
Mopar "A" engine with Edelbrock Performer RPM	144-4005			
CHRYSLER, 6 CYLINDER				
Cast Iron Slant 6	142-4001			
CHRYSLER, 4 CYLINDER				
2.2L, 4-cylinder, 11mm			141-4201	
Dodge Neon DOHC, H.S.K. block #4667642, head #4667086			141-4202	
Dodge Neon SOHC, H.S.K. block #4667642, head #4556737			141-4203	
CHRYSLER, BIG BLOCK				
392, factory Hemi, Edelbrock RPM	145-4001		145-4201	
426, factory Hemi, 7/16"	145-4003		245-4203	
426, factory Hemi, modified for 1/2"	145-4002		245-4202	
Indy 440 cylinder head	145-4011		245-4311	
KB Hemi, inner			245-4306	
KB Hemi, short deck, 1/2"			245-4308	
KB Hemi, standard deck, 1/2"	245-4005		245-4305	
KB Hemi, long deck, 1/2"			245-4309	
KB Hemi, standard deck, 9/16"			245-4310	245-4710
Mopar B and RB Wedge with B-1 heads	145-4007		245-4307	
Mopar B, RB and 413-426 Wedge, Edelbrock RPM	145-4006		145-4206	
Mopar Koffel BTS full	145-4012			
FORD, SMALL BLOCK				
289-302 with factory heads, 7/16" and Edelbrock 60259, 60379	154-4001	254-4401	154-4201	254-4701
289-302 with 351W head, 7/16-14 cylinder block thread				
M-6049-J302, SVO high port & M-6049-L302	154-4005	254-4405	154-4205	254-4705
Edelbrock aluminum , GT-40 style with insert "T"				
1/2" to 7/16" washer				
302 Boss	154-4002		154-4202	

Red part numbers indicate new items.

Application	Hex Nuts	Hex Nuts U/Cut Studs	12-Point Nuts	12-Point Nuts U/Cut Studs
FORD, SMALL BLOCK continued				
351W with factory heads, M-6049-J302, SVO high port and M-6049-L302 GT-40 style, Edelbrock aluminum and Iron Dart with 1/2-13 cylinder block threads 1/2" to 7/16" Step T-washers ONLY (10 pcs. 200-8598)	154-4003	254-4503	154-4203	254-4703
351 Cleveland, 400M	154-4004		154-4204	
SVO and Fontana aluminum blocks w/'94 or later Yates heads	254-4102	254-4101	254-4302	254-4301
351 SVO high port and improved SVO high port, part #'s M-6049-C302, M-6049-C302B	254-4107		254-4307	
351 SVO Yates design	254-4109		254-4309	
351 SVO Yates 1994 design	254-4110		254-4310	
351 "R" block with C3 heads	254-4111	254-4501	254-4311	254-4601
351 "R" block w/6049-N351 heads	254-4112		254-4314	
Std. 351 Block w/6049-N351 Heads	254-4113		254-4315	
351 "R" block with Brodix/Neal heads			254-4312	
FORD, BIG BLOCK				
390-428 c.i.d. FE series, also Edelbrock	155-4001		155-4201	
SOHC 427	155-4002		155-4202	
429-460 385 series & new 429CJ SVO alum #6049-A 429, also Edelbrock	155-4003		155-4203	
460 SVO aluminum, PN#'s M-6049-A460 & M-6049-B460 (must use 12-pt. nuts)			255-4304	
460 c.i.d., with Blue Thunder heads	255-4101		255-4301	
Trick Flow "Pro Stock"			255-4305	
FORD, V6				
2.5L Duratech V-6			253-4701	
4.5L, SVO inline valve head #M6049-H380	253-4102		253-4302	
Ford T-Bird Supercoupe	153-4001		153-4203	
FORD, Inline 4 and 6-CYLINDER				
2L Zetec				251-4702
Cosworth Sierra/Escort (12mm)				251-4701
Escort 1600cc, 10mm			151-4203	
Inline 6, 240-300 c.i.d.	152-4001		152-4201	
Pinto 2000cc			151-4201	
Pinto 2300cc			151-4202	151-4702
FORD, MODULAR				
4.6L, 2 valve & 4 valve	156-4101		156-4301	
HOLDEN				
304			205-4602	
308, 1/2"	254-4009		234-4201	
308 V8	205-4001		205-4601	
HONDA/ACURA				
Acura B18A1, 11mm			208-4302	
Acura VTEC B18CI, 11mm, GSR			208-4303	
B16A			208-4601	
B20B, w/B16A head			208-4306	
Civic D16Y			208-4305	
Honda D16Z - Only			208-4301	
Honda H22A4, VTEC			208-4304	
H23A			208-4307	
MAZDA				
Miata			218-4701	
MITSUBISHI				
2.0, 4-cylinder, 16 valve, 12mm, 4G63 up to 1994			207-4201	207-4701
2.0L, 4-cylinder, 16 valve, 11mm, 4G63 1994 to present			207-4203	207-4702
2.6L 4-cylinder			207-4202	
NISSAN				
A-12 engines			202-4202	
A-14 engines			202-4203	
L20 series, 4-cylinder			202-4201	
L24, L26, L28 series, 6-cylinder			202-4206	
OLDSMOBILE, SMALL BLOCK				
215 c.i.d., aluminum heads	184-4002		184-4202	
350 c.i.d., diesel 5.7L	184-4003			
4-cylinder Quad 4			281-4301	
403 c.i.d.	184-4004		184-4204	
Batten 12 pt.			184-4205	

Red part numbers indicate new items.

Application	Hex Nuts	Hex Nuts U/Cut Studs	12-Point Nuts	12-Point Nuts U/Cut Studs
OLDSMOBILE, BIG BLOCK				
455 c.i.d., 7/16" and Edelbrock	185-4001		185-4201	
PONTIAC				
400 c.i.d., with Edelbrock aluminum heads (mfg. after 3/15/02)			190-4304	
'67 and previous, 400-428 and 350 c.i.d.	190-4002		190-4202	
'68-'79, 400-428 c.i.d., 400 Ram Air 2 and 4, 455 c.i.d.				
HO and Super Duty	190-4003		190-4203	
"Iron Duke", 4-cylinder, 1/2"	191-4001		191-4201	
Ram Air 2 & 455			190-4201	
Ram Air 5	190-4005		190-4205	
Super Duty with "Iron Duke" heads	290-4101		290-4301	
PORSCHE				
911 & 930 Turbo, stainless studs - Dilvar replacement			204-4206	
SUBURU				
2.0L, 2.2L, 2.5L			260-4701	
TOYOTA				
22R			203-4201	
7M GTE-Supra			203-4202	203-4701
4AG, 16 valve			203-4203	
3SGTE			203-4204	
2JZA80 Supra			203-4205	203-4702
TRICK FLOW				
Pro Stock			255-4305	
VAUXHALL/OPEL				
2.0L, 16 valve			209-4301	209-4701
Opel 2.5L, V6			209-4302	209-4702
VOLKSWAGEN				
1600cc Air Cooled			204-4201	
Super Vee			204-4202	
Golf/Jetta, 1.8L & 2L, 8 valve			204-4203	204-4701
Golf/Jetta, 1.8L & 2L, 16 valve			204-4204	204-4702
Audi 5 cylinder, 10 valve			204-4205	204-4703
Audi 5 cylinder, 20 valve			204-4207	204-4704
VR6				204-4705

Red part numbers indicate new items.

TECH TIPS: HEAD STUD INSTALLATIONS

1. Clean and chase all bolt threads in block to ensure proper thread engagement and accurate torque readings.

2. All hardware should be cleaned and inspected for possible shipping damage prior to installation.

3. Since most studs extend into the water jacket, coat threads with ARP® thread sealer and screw in hand tight ONLY.

4. Install gasket and head, then lubricate washers and nuts with oil or ARP® moly assembly lubricant prior to their installation.

5. Following the engine manufacturer's torque pattern, torque each stud nut three times to recommended values found in the general fastener chart on page 24.

NOTE: *To ensure positive sealing of "wet" head studs, a hardening or semi-hardening sealant, such as Loc-Tite or Permatex, etc. should be used. Some engine builders employ a sealer in the coolant, such as Aluma-Seal, Silver Seal or K&W sealer, etc. You may also use high temperature RTV silicone. Whatever product is used, it is imperative that the cylinder head is installed and torqued to proper levels* ***BEFORE THE SEALANT HAS CURED!***

CYLINDER HEAD BOLTS

All kits come complete with hardened parallel-ground washers.

HIGH PERFORMANCE SERIES

High Performance head bolts are available with a reduced wrenching hex or 12-point and wide area flanged head that eliminates the need for valve train removal to facilitate cylinder head retorquing. All High Performance Series bolts are **180,000 psi** (which is 15% stronger than Grade 8) and kits come complete with hardened parallel-ground washers.

PROFESSIONAL SERIES

All Pro Series bolts are cold-forged to ensure molecular integrity, heat-treated prior to thread rolling and machining, and are rated nominally at **200,000 psi**. ARP® Pro Series head bolt kits are application specific—designed for use with typically competition only components. These fasteners deliver superior strength and meet the ARP® "ZERO defect—ZERO failure" quality standard. Hardened and parallel-ground washers are included with each kit to ensure even load distribution and accurate torque readings. All Pro Series head bolts have a reduced wrenching 12-point head and wide area flange to eliminate the need for valve train removal for cylinder head retorquing and permits the use of larger diameter valve springs. Most applications have undercut short bolts that can help eliminate head gasket failures through providing more "stretch" to compensate for the additional compression of gaskets.

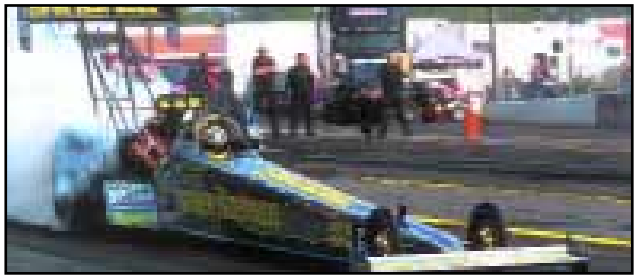
Refer to Head & Main Bolt Instructions on page 43.

Application	High Performance Hex	High Performance 12-Point	Pro Series 12-Point	Pro Series 12-Pt. U/C	Stainless Hex	Stainless 12-Point
AMC						
258 c.i.d.	112-3601					
343-401 c.i.d., '69 and earlier, 7/16"	114-3601					
343-401 c.i.d., '70 through present, 1/2"	114-3602					
BUICK						
V6 Champion heads with Stage II block			223-3704			
V6, Duttwieler and M&A aluminum heads	123-3602					
V6 '86-'87, Grand National and T-Type	123-3603	123-3703	223-3703			
V6 Stage I, '77-'85	123-3601	123-3701	223-3701		423-3601	423-3701
V6 Stage II			223-3700			
455 c.i.d.	125-3601					
CHEVROLET, SMALL BLOCK						
23° Cast iron OEM, Gen III Vortec/Truck & most Edelbrock LT-AFR, Brodix-8,-10,-11,-11xb, LT-1, Pro-1	134-3601	134-3701	234-3701		434-3601	434-3701
12-Rollover Brodix, 18° Brodix, -10x	134-3602	134-3702	234-3703			
18° hi-port with 3/8" holes, casting #10134363 and 64			234-3721			
18° standard port	134-3607					
18° hi-port	134-3608		234-3708			
18° standard port			234-3707			
Same as above except, with outer row only stainless steel	134-3603	134-3703				
Bowtie with Brodix 12 - Weld Tech			234-3703			
Dart II, WP Sportsman II, Brodix Track I			234-3702			
Dart-Buick			234-3709			
Oldsmobile 14°			234-3705			
Pontiac Brodix aluminum heads, raised intake, -10xz RI			234-3704			
SBC LS1 & LS6 5.7L, 6.8L	134-3609					
V8 with 18° Hi-Port heads				234-3720		
CHEVROLET, BIG BLOCK						
Cast iron OEM	135-3601	135-3701	235-3701		435-3601	435-3701
Mark V block with World Merlin, late Bowtie and Dart aluminum, AFR	135-3607	135-3707	235-3707			
Mark V or Mark IV with Brodix aluminum heads	135-3609	135-3709	235-3709			
Mark V with 502 head		135-3706	235-3706			
409, cast iron OEM	135-3602					
BBC with Edelbrock head 60409, 60429, 60459, 60479, 60499, 60559	135-3610	135-3710				
BBC with Edelbrock head 7760, 7765	135-3611	135-3711				
BBC with Brodix aluminum head (-2, -4), Canfield	135-3606	135-3702	235-3702			
BBC with late Bowtie aluminum, World Prod. Merlin, Iron Dart, Pro-1	135-3603	135-3703	235-3703			
BBC Dart aluminum head exhaust bolts only, (8 pieces)	135-3605	135-3705	235-3708			
BBC with Pontiac Pro Stock aluminum head, Brodix			235-3704			
BBC with Pontiac Pro Stock aluminum head, Dart Big Chief with outer rows only in stainless steel	135-3604	135-3704	235-3705			

Red part numbers indicate new items.

Application	High Performance Hex	High Performance 12-Point	Pro Series 12-Point	Pro Series 12-Pt. U/C	Stainless Hex	Stainless 12-Point
CHEVROLET, V6						
90°			233-3701			
90°, with 18° hi-port			233-3708			
90°, with 18° standard port	133-3607		233-3707			
90°, hi-port 3/8" holes			233-3721			
CHRYSLER, SMALL BLOCK						
2.2L, 4-cylinder, 11mm			241-3701			
w/Edelbrock head	144-3603					
"A" engine with W2 heads	144-3601					
"A" engine, 273-360 c.i.d.	144-3602					
360 Magnum, also fits W-5 cyl. heads	144-3604					
CHRYSLER, BIG BLOCK						
B and RB Wedge, 383-440 c.i.d., 7/16" / Edelbrock RPM	145-3608					
B and RB Wedge / Edelbrock 60929	145-3606	145-3706	245-3706		445-3606	445-3706
1964-71 426 Hemi & NEW 2001-on Hemi Crate Motor	145-3901					
440 Indy Aluminum head	145-3607					
FORD, SMALL BLOCK						
289-302 standard, Edelbrock head 60259, 60379	154-3601	154-3701			454-3601	454-3701
302 Boss, V6 4.5L, inline valve	154-3602	154-3702	254-3702		454-3602	454-3702
302 with Windsor heads 1/2"-7/16" stepped washer, with 7/16" bolts	154-3605	154-3705			454-3605	454-3705
302 with Windsor heads 1/2"-7/16" stepped bolt, 1/2"-7/16"			254-3708			
351 Windsor, Edelbrock head 60259, 60379	154-3603					
351 Cleveland, 400M	154-3604		254-3704			
351 Cleveland SVO, iron block			254-3701			
351 SVO, Yates design			254-3709			
351 SVO, Yates 1994 design			254-3710			
351R block with C3/C3L heads			254-3711			
SVO, V6 4.5L, inline valve, HBK			253-3702			
1/2" to 7/16" step I washers ONLY (10 pcs. - #200-8598)						
FORD, BIG BLOCK						
390-428 FE series, Edelbrock head 60069, 60079	155-3601					
427 SOHC	155-3602					
460			255-3701			
460 with Edelbrock head 60669, 60079, 61669, 61649	155-3603					
HOLDEN						
304		205-3702				
308	205-3601	205-3701	254-3703			
OLDSMOBILE						
350-455 c.i.d., 7/16" diameter, '76 and earlier, Edelbrock head 60519	180-3600	180-3700	280-3700		480-3600	480-3700
350-455 c.i.d., 1/2" diameter, '77 to present	180-3601					
403 c.i.d.	185-3602					
PONTIAC						
350-455 four barrel, D-port head, '68-'79	190-3607					
with Edelbrock head 60569 (mfg. before 3/15/02)	190-3604					
with Edelbrock head 60569 (mfg. after 3/15/02)	190-3605					
400-428 c.i.d., '63-'66 Hi-Perf. heads	190-3608					
400-428 c.i.d., '67 and earlier	190-3602					
400-428 c.i.d., "Ram Air" 2 and 4 Super Duty, 455 HO, '68-'79	190-3603					
TOYOTA						
7M GTE, Supra			203-3902			
1600				203-3901		
HARLEY MOTORCYCLE						
'48-'84 All pan heads & Shovel heads					460-3601	
'57-early '73 XL's					460-3602	

Anthony Bertozzi - A winner on both NHRA and IHRA drag racing circuits



Clay Millican - IHRA Top Fuel points champion in 2001/2002

MAIN STUD KITS

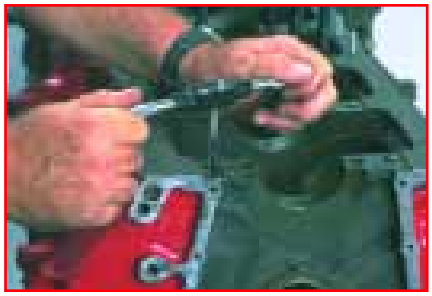
STUDS vs. BOLTS

ARP® recommends the use of main studs over bolts whenever possible for several key reasons. First is the ability to obtain more accurate torque readings because studs don't "twist" into the block. All clamping forces are on one axis. By the same token, there is less force exerted on the block threads, which contributes to improved block life (very critical on aluminum blocks). Finally, there are factors of easier engine assembly and proper alignment of caps every time.

There are many important reasons to use ARP® main stud kits, including the elimination of main cap walk and fretting, as well as protecting the threads in your engine block. The studs are manufactured in our own factory using the best materials, processes, designs and engineering. Every ARP® main stud kit exceeds the most stringent aerospace specifications. All kits come complete with hardened parallel-ground washers and aerospace quality nuts. Some applications have provisions for mounting windage trays and have specially designed standoff studs with serrated lock nuts to position the windage tray and lock it securely in place. The studs are manufactured from 8740 chrome moly steel, heat-treated in-house to **200,000 psi** tensile strength, and precision J-form threads rolled after heat-treat to create a fastener that has threads 1000% stronger than others. Don't settle for anything less than the best. Insist on genuine ARP® studs…you'll find the name stamped right on the end!

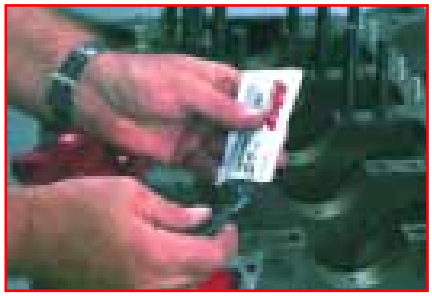
TECH TIPS: MAIN STUD INSTALLATION

There are a number of important considerations when installing ARP® main studs. First and foremost is making sure the block and studs are as clean as possible. Foreign matter and debris can easily affect the quality of thread engagement and cause erroneous torque readings. Do not re-cut threads in the block—use the special "chaser" taps as listed on page 80 of this catalog. This will preserve the integrity of the threads and provide better engagement. You should also make sure your torque wrench has been calibrated. Even new wrenches have been known to be off by as much as 10 foot pounds! Use consistent tightening techniques.



1. Clean and chase appropriate threads in block to ensure proper thread engagement and accurate torque readings.

2. All hardware (and caps) should be cleaned and inspected prior to installation, looking for any shipping damage or defects.



3. Screw studs into block, finger tight ONLY. For permanent installation, apply Loc-tite (or similar adhesive) sparingly to threads. Be sure and install the caps promptly before the cement sets to prevent misalignment of studs in block.

4. Install main caps, checking for binding and misalignment. Lubricate threads, nuts and washers with oil or ARP® moly assembly lubricant before installation. Note that torque specs will vary by lubricant. Moly lube is most consistent. Have block align honed.

5. Using the instructions provided with the studs, tighten the nuts to proper torque values three times. NOTE: If using Loc-Tite or similar cement, proper preload must be achieved prior to it setting up.

Application	2-Blt. Mn.	4-Blt. Mn.
BMC		
A series	206-5401	
B series, 3 cap main	206-5402	
B series, 5 cap main	206-5403	
Triumph TR7	206-5404	
BMW		
M50	201-5000	
BUICK		
V6 Stage I & II	123-5401	
V6 Stage II, without windage tray		222-5602
V6 Stage II, with splayed cap bolts		322-5802
215 c.i.d., aluminum V8	124-5401	
350 c.i.d.	124-5402	
401 c.i.d. (nail head)	124-5404	
455 c.i.d.	125-5401	
455 c.i.d., 12 pt. nuts	125-5402	
CADILLAC		
472-500, hex	135-5507	
CHEVY, SB		
283/327	130-5402	
400, with windage tray		234-5606
400, w/windage tray, w/3.0" outer stud		234-5607
400, splayed cap bolts & wedge tray		234-5605
Large journal, without windage tray	134-5401	
Large journal, with windage tray	234-5501	
Large journal, with straps (F & R caps)	234-5503	
Small journal, w/o windage tray	134-5402	
Large journal, 12 pt. ①	134-5403	
Small journal,with windage tray	134-5501	
Large journal, without windage tray		134-5601
Large journal, with windage tray		234-5601
Large journal, with straps (F & R caps)		234-5603
Large journal, with splayed cap bolts		234-5602
Large journal, with straps & splayed caps		234-5604
LS1, LS6 5.7L & 6.0L		234-5608
SB2, including 4-bolt, F & R caps, without windage tray		134-5602
Dart Little M		234-5801
SBC rocket block		184-5403
CHEVY, BB		
Without windage tray	135-5402	135-5601
With windage tray	235-5502	235-5701
Aluminum block, without windage tray		135-5603
Mark V, 502, without windage tray		135-5606
Mark V, 502, with windage tray		235-5606
Mark IV Bowtie, with windage tray		235-5702
Dart Big M		235-5601
CHEVY, V6 and Inline 6		
90°, without windage tray		233-5602
90°, with windage tray		233-5702
90°, with splayed cap bolts		233-5601
Inline 6, '54-62, without windage tray	132-5402	
Inline 6, '63-present, without windage tray	132-5401	
CHRYSLER		
Chrysler, 2.2L, ③ 4-cylinder, 11mm	141-5401	
Dodge Neon DOHC/SOHC with block #4667642	141-5801	
Cast Iron SL6	142-5401	
Mopar, all V8	140-5401	
Chrysler 354 Hemi ③	145-5404	
Mopar, with 12 pt. nuts	140-5402	
KB Hemi 426	245-5602	
Mopar 426 Hemi	145-5601	145-5602
Mopar all V8, with windage tray	240-5501	
FORD, SMALL BLOCK		
289-302 c.i.d.	154-5401	
289-302 c.i.d., with windage tray	254-5501	
289/302 with 1/2" straps	154-5408	
302, dual or rear sump oil pan	154-5407	
302, with girdle	154-5410	
Boss 302, with windage tray		154-5602
302 R-block, 1/2" studs		254-5601

Application	2-Blt. Mn.	4-Blt. Mn.
FORD continued		
351 c.i.d., Windsor	154-5403	154-5606
351 c.i.d., Windsor, with windage tray	154-5503	
351 c.i.d. Windsor, with dual or rear sump oil pan	154-5409	
351 c.i.d., SVO		154-5603
351 c.i.d., SVO, without windage tray		354-5604
351 c.i.d., Cleveland	154-5404	154-5604
SVO 302		154-5605
351 "R" block		354-5605
Ford Australian 7/16"	154-5405	
Ford Australian 1/2"	154-5406	
FORD, BIG BLOCK		
390-428 c.i.d. FE series hex	155-5401	
390-428 c.i.d. FE series, 12 pt.	155-5421	
429-460-385 c.i.d. series	155-5402	155-5501
429-460-385 c.i.d., with windage tray ②	255-5502	255-5702
FORD, MODULAR (1998 & earlier)		
4.6L, 2 valve	156-5401	256-5801
4.6L, 4 valve	156-5402	156-5802
4.6L, 4 valve with windage tray		256-5701
FORD 4 and 6-CYLINDER		
1600 4-cylinder	151-5403	
Pinto 2000cc	151-5401	
Pinto 2300cc	151-5402	
Inline 6, 240-300 c.i.d.	152-5401	
Zetec 2.0L	151-5404	
FORD V6		
2.5 Duratec V6	253-5402	
4.5L, without windage tray	253-5401	
HOLDEN		
308, V8	205-5401	205-5501
HONDA		
B16A & VTEC, 12 pt. nuts	208-5402	
H22A, H23A, 12 pt. nuts	208-5401	
MAZDA		
Miata, 1.6L, 1.8L, 12 pt.	218-5401	
MITSUBISHI		
2.0L, 4-cylinder, 16-valve, 4G63	207-5401	
2.6L, 4-cylinder	207-5402	
NISSAN		
Nissan L20 series, 4-cylinder	202-5401	
Nissan L24, L26, L28 series, 6-cylinder	202-5406	
OLDSMOBILE		
Quad 4	281-5401	
350 c.i.d.	184-5401	
350 c.i.d., diesel 5.7	184-5402	
455 c.i.d.	185-5401	
DRCE-iron block	285-5801	
PONTIAC		
4-cyl super duty - cast block	291-5801	
4-cyl super duty - mag block	291-5802	
V8, 400, 455 c.i.d.	194-5401	194-5601
TOYOTA		
22R	203-5406	
3SGTE	203-5404	
3SEE & 4AG, 16 valve	203-5403	
Supra 2JZA80	203-5405	
Supra 7M GTE, Supra	203-5402	
VAUXHALL/OPEL		
2.0L, 16 valve	209-5401	
2.5L, V6	209-5402	
VOLKSWAGEN		
Rabbit, Golf and Jetta, 1.6L-2L	204-5402	
VR6	204-5403	

Red part numbers indicate new items.

① *Includes large journal 327ci.* ② *Ford Motorsports windage tray.* ③ *Except 426 Hemi.*

MAIN BOLTS

Far superior to any other main bolt kit offered for use in competition engines. ARP® main bolts are designed to meet the exacting standards and demands of professional engine builders. Forged from 8740 chrome moly, all bolts feature generous under-head radius and rolled threads for the utmost reliability. The threads are rolled after heat-treating, which makes them about 1000% longer fatigue life than most main bolts, which are threaded prior to heat-treating. Available in the popular **High Performance Series**, which, at a nominal rating of 180,000 psi, is a premium replacement for OEM fasteners, or the 200,000 psi nominal rated **Pro Series**, application-specific main bolts with reduced wrenching head and are designed for use in competition applications. Parallel-ground, hardened washers are included with each kit.

Application	High Perf. Part No.	Pro Series Part No.
BUICK		
V6 Stage I, 4-bolt main	123-5201	
Stage II, MBK	123-5202	
455 c.i.d., 2-bolt main	125-5201	
Stage II		223-5202
CHEVROLET, SMALL BLOCK		
2-bolt main, large journal	134-5001	
2-bolt main, small journal	134-5002	
4-bolt main, large journal	134-5202	
4-bolt main, large journal, 12 pt.		234-5201
Lg. Jrnl. 4-bolt, w/1/2" straps on F&R caps		234-5203
V6, 90° 4-bolt main		233-5201
V6, 90° 4-bolt main, w/1/2" straps on F&R		233-5203
CHEVROLET, BIG BLOCK		
2-bolt main	135-5002	
4-bolt main	135-5201	
CHEVROLET, V6		
90° 4-bolt main		233-5201
90° 4-bolt main, w//2" straps on F&R caps		233-5203
CHRYSLER, BIG BLOCK		
2-bolt main, Mopar, all V8 (except Hemi)	140-5001	
426 Hemi, 4-bolt main	145-5201	

Application	High Perf. Part No.	Pro Series Part No.
FORD, SMALL BLOCK		
2-bolt main	154-5001	
4-bolt main	154-5201	
351 Windsor, 4-bolt main	154-5203	
351 Windsor, 2-bolt main	154-5003	
351M, 400M		
351 Cleveland, 2-bolt main	154-5004	
351 Cleveland, 4-bolt main	154-5204	
SVO 351 c.i.d., 4-bolt main, 3/8" outer bolts		254-5202
SVO 351 c.i.d., 4-bolt main, 7/16" outer bolts		254-5203
FORD, BIG BLOCK		
390-428 c.i.d. FE series	155-5201	
429-460 c.i.d. 385 series	155-5202	
HOLDEN		
308 V8	205-5001	
OLDSMOBILE		
350 c.i.d., 2-bolt main	184-5001	
350 c.i.d. diesel, 2-bolt main	184-5002	
455 c.i.d., 2-bolt main	185-5001	
TOYOTA		
Toyota 1600cc		203-5001

MAIN AND HEAD BOLT INSTALLATION

Recommended for applications requiring the utmost in reliability and the convenience of bolts. ARP® bolt kits yield optimum reliability.

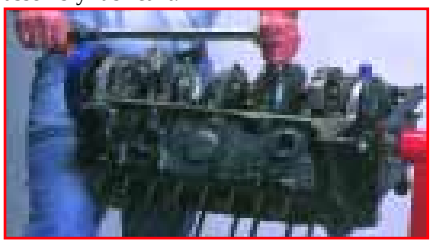
SPECIAL NOTE: Where the stretch method cannot be used, the bolts must be installed by torque and several factors should be taken into account. Please refer to bolt stretch info on page 26.

1. Clean and chase all block threads to ensure maximum thread engagement and accurate torque readings.

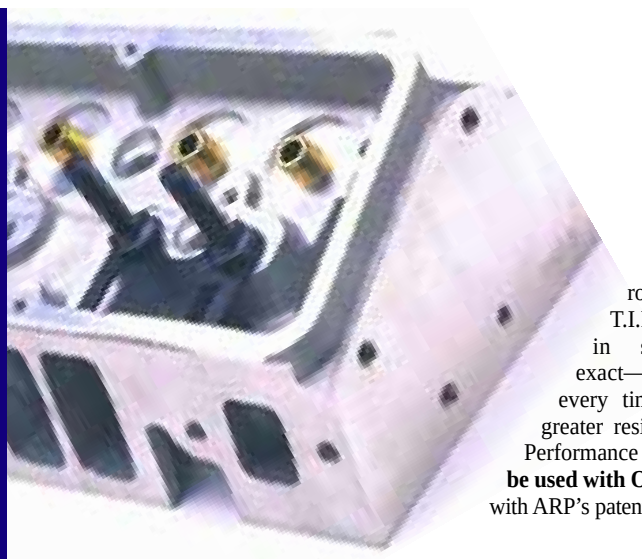
2. Inspect all hardware prior to installation, then clean and lubricate with ARP® moly assembly lubricant.

3. Seal all threads extending into the water jacket with ARP® thread sealer.

4. Install the main cap or head gasket and head, checking for improper fit or binding. Make sure all mating surfaces are fully seated. Install all bolts hand-tight.

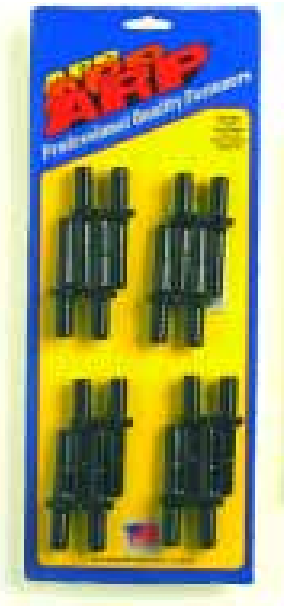


5. Using an accurate torque wrench, cycle bolts three times to recommended values found in the general fastener torque chart located on page 24.



ROCKER ARM STUD KITS

If you have ever installed a rocker stud into a cylinder head and watched it wobble as it screwed in—you knew from the beginning that the rocker geometry was going to be inconsistent all over the place. ARP® rocker studs are concentric within .005 T.I.R. thread pitch to thread pitch. They run-in straight and true. Lengths are exact—designed to provide positive seating every time. An extra-large radius base offers greater resistance to flex. Available in both High Performance and Pro Series models. **NOTE: Not to be used with OEM-style, self-locking nuts**. To be used with ARP's patented Perma-Loc™ adjusters (see next page).

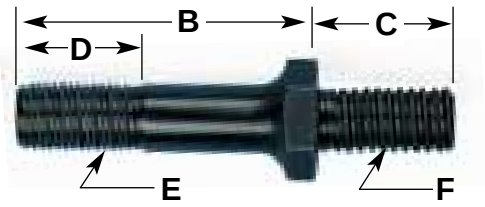


HIGH PERFORMANCE SERIES

Made of 8740 chrome moly forgings and heat-treated to **180,000 psi**. Excellent for E.T. Bracket Racing, limited rule oval track competition and street use. Tip ground flush for optimum adjuster seating.

PRO SERIES

Designed for competition applications, ARP's *Pro Series* rocker arm studs are made of premium grade 8740 chrome moly steel and heat-treated to a tensile strength of **200,000 psi**.



NOTE: To verify the application and part number, please review the various dimensions: (B) overall stud height, (C) screw-in thread depth, (D) adjuster thread depth, (E) shank diameter and thread, (F) base diameter and thread.

Application	B	C	D	E	F	High Perf.	High Perf. *(2 PC-Pack)*	Pro Series
3/8" typical small block application ②	1.750	.700	.800	3/8-24	7/16-14	134-7101	134-7121	234-7201
3/8" with roller rockers ⑦	1.895	.710	1.000	3/8-24	7/16-14	134-7104	134-7124	
7/16" typical small block application	1.770	.700	.670	7/16-20	7/16-14	134-7103	134-7123	234-7202
Aluminum heads, intake studs only, 8 pieces ①	2.000	.820	.700	7/16-20	7/16-14			235-7204
Dart aluminum, 16 pieces ①	2.000	1.3, .820	.700	7/16-20	7/16-14			235-7205
Aluminum heads, exhaust studs only, 8 pieces ①	2.000	1.650	.700	7/16-20	7/16-14			235-7203
Mark V	1.900	.750	.750	7/16-20	3/8-16	135-7102	135-7122	
With roller rockers and stud girdle ①	2.100	.750	.800	7/16-20	7/16-14			334-7203
With roller rockers and stud girdle ①	2.000	.750	.800	7/16-20	7/16-14			334-7204
With roller rockers and stud girdle ①	2.100	.850	.800	7/16-20	7/16-14			334-7202
With roller rockers and stud girdle	1.900	.860	.830	7/16-20	7/16-14			234-7205
With roller rockers and stud girdle	1.900	.660	.830	7/16-20	7/16-14			334-7201
7/16" typical small block application ③	1.900	.750	.850	7/16-20	7/16-14			200-7202
7/16" typical big block application ④	1.750	.800	.850	7/16-20	7/16-14	135-7101	135-7121	235-7201
With roller rockers and stud girdle ①	1.900	.850	.850	7/16-20	7/16-14			234-7206
Chevrolet big block (aluminum heads)	2.350	.850	.850	7/16-20	7/16-14	135-7202	135-7222	
With roller rockers and girdles	1.900	.750	1.000	7/16-20	7/16-14	100-7101	100-7121	200-7201
Typical Ford small block ⑥	1.900	.750	1.000	7/16-20	7/16-14	100-7101	100-7121	200-7201
With roller rockers and girdles	1.900	.750	1.000	7/16-20	7/16-14	100-7101	100-7121	
Dart aluminum heads, 16 pieces	2.000	1.3, .820	1.000	7/16-20	7/16-14			235-7202
Aluminum heads, exhaust studs only, 8 pieces	2.000	1.650	1.000	7/16-20	7/16-14			235-7206
Aluminum heads, intake, 8 pieces	2.000	8.20	1.000	7/16-20	7/16-14			235-7207
7/16" with 1/2" coarse, '64 and later	2.000	1.025	1.050	7/16-20	1/2-13			290-7201
SVO 351 c.i.d., with roller rockers and girdle	2.700	.850	1.300	7/16-20	7/16-14			354-7204
SVO 351 c.i.d., with roller rockers and girdle	2.800	.800	1.500	7/16-20	7/16-14			354-7203
SVO 351 c.i.d., with roller rockers and girdle	3.000	.660	1.930	7/16-20	7/16-14			354-7202
SVO 351 c.i.d., with roller rockers and girdle ①	3.000	.950	2.100	7/16-20	7/16-14			254-7201
Chevrolet late model Vortec	1.750	.600	.850	3/8-24	M8 x 1.25	134-7201	134-7221	
GM 60° V6	1.595	.800	.580	3/8-24	M10 x 1.50	100-7201	100-7221	
Chevrolet big block 496 c.i.d. (8100 series)	1.750	.750	.600	7/16-20	M10 x 1.50	135-7201	135-7221	

Red part numbers indicate new items.

①These parts have a shank portion under hex to locate guide plate.
②Fits most stock SB Chevy with 3/8 screw-in studs
③Fits most stock SB Chevy with 7/16 screw-in studs
④Fits most stock BB Chevy with 7/16 screw-in studs
⑤Fits most stock BB Ford with 7/16 screw-in studs
⑥Fits most SB Ford with 7/16 screw-in studs
⑦Fits most SB Ford with 3/8 screw-in studs

IMPORTANT TECH NOTE

It is highly advisable to determine what the optimum rocker arm stud length is for your particular application. This is especially true when "long" pushrods and valves are employed—you should raise the "installed height" of the rocker arm to compensate for the longer-than-stock components.

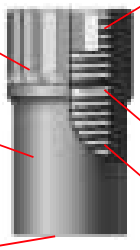
- ***Exclusive 12-point head***
- ***Patented design***
- ***Heat-treated premium grade 8740 chrome moly steel***
- ***190,000 psi tensile strength***
- ***Precision machined threads***
- ***Locking set screw ground flush with rocker arm stud***
- ***Doesn't require special tools***

ARP® Has The Key Missing Link In Valve Train Reliability…A Rocker Arm Adjuster That Won't Loosen!

PERMA-LOC™

PERMA-LOC™ SPECIAL FEATURES:

CUT-AWAY VIEW



12-point head with special shouldered "stop" to hold wrench. Eliminates need for special adjusting tools.

Forged in-house from 8740 alloy chrome moly steel and heat-treated throughout (not simply case hardened, as others are).

Bottom flush-ground perpendicular to threads.

Threads are precision CNC-machined exactly perpendicular to the bottom of adjuster to ensure an optimum seat and even pressure.

Set screw has flush-machined tip for optimum contact and seating on stud.

Threads machined for maximum engagement.

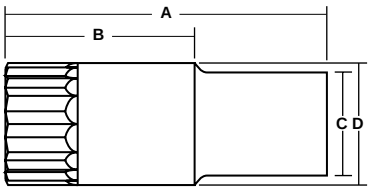
Patent #5,323,741

One of the more aggravating things found in many high performance engines is constantly having to re-adjust rocker arms. Fact is, up until ARP® introduced the patented *Perma-Loc*™ adjuster, there wasn't a "poly lock" on the market that you didn't have to keep after.

There are several important reasons why ARP®'s exclusive *Perma-Loc*™ rocker arm adjusters won't loosen like others. First, the adjuster body is heat-treated all the way through (not just case hardened). This eliminates the thread "movement" common to others. Secondly, the threads are machined exactly perpendicular to the bottom of the adjuster, so it seats evenly and applies pressure on a full 360° circle. Lastly, the set screw is machined flush on the bottom (not pointed) so it will have optimum contact on the rocker arm stud.

You'll find ARP® Perma-Loc™'s easy to use, too. The compact 12-point head is designed to hold your wrench in position while you lock the set screw with an Allen wrench. With most "poly locks" you have to invest in a special tool to do the job.

All in all, they're the best you can buy!



Because there are many different style rocker arms made by each manufacturer, we suggest that you verify the physical dimensions and thread requirements prior to ordering. If you have any questions, call ARP's tech staff toll-free for details.

Application	Thread Size	Shank Size (C)	Body Dia. (D)	Length (A)	16 PC-Pack
Stamped steel rocker	3/8-24	.650	.650	1.200	300-8241
Stamped steel rocker	7/16-20	.650	.650		300-8242
Aluminum rocker	3/8-24	.550	.650	1.200	300-8243
Aluminum rocker	3/8-24	.600	.650	1.200	300-8244
Aluminum rocker	7/16-20	.550	.650	1.200	300-8245
Aluminum rocker	7/16-20	.600	.650	1.200	300-8246
Stud girdle	7/16-20	.550	.750	2.000	300-8247
Stud girdle	7/16-20	.550	.750	2.600	300-8248
Big block with girdle	7/16-20	.550	.750	2.6&2.0	300-8249

VALVE COVER BOLTS & STUDS

To ensure proper sealing of valve covers, ARP® manufactures a variety of special application-specific bolt and stud kits. Many professional engine builders prefer to use studs because of their ability to properly position the gasket and guide the cover into position. ARP® offers studs and bolts in a choice of chrome moly steel with a black oxide finish or stainless steel. You have a choice between conventional hex head bolts and nuts or compact, easy access 12-point designs. The nuts feature a wide base for better load distribution and sealing, while the compact head is easily accessed. Stud kits come complete with nuts and washers, while bolt kits are shipped with the required flat washers.

Special bullet nose accurately guides nuts into position

Choice of studs or bolts in polished stainless steel or black oxide finish

NOTE: Studs come with flanged lock nut. Bolts come with washers.

Application	Qty.	Size	STUD O.A.L. / BOLT U.H.L.	STUDS: Black Oxide Hex	STUDS: Black Oxide 12-Point	STUDS: Stainless 300 Hex	STUDS: Stainless 300 12-Point	BOLTS: Black Oxide Hex	BOLTS: Black Oxide 12-Point	BOLTS: Stainless 300 Hex	BOLTS: Stainless 300 12-Point
CHRYSLER											
KB Hemi	20	1/4-20	2.450		245-7601						
CAST ALUMINUM COVERS											
Bolt kit	8	1/4-20	.812					100-7507	100-7503	400-7507	400-7503
Bolt kit	14	1/4-20	.812					100-7504	100-7508	400-7508	400-7504
Chevrolet SB2	16	1/4-20	1.800			434-7609					
Stud kit, with nut and washer	8	1/4-20	1.500	200-7603	200-7613	400-7603	400-7613				
Stud kit	12	1/4-20	1.500	200-7610	200-7620	400-7606	400-7616				
Stud kit, with nut and washer	14	1/4-20	1.500	200-7604	200-7614	400-7604	400-7614				
Stud kit, with nut and washer	16	1/4-20	1.500	200-7605	200-7615	400-7605	400-7615				
Stud kit, Dart, Brodix, B&B	8	1/4-20	3.500	200-7606	200-7616						
Stud kit, Dart, Brodix, B&B	14	1/4-20	3.500	200-7607	200-7617						
Stud kit, Dart, Brodix, B&B	16	1/4-20	3.500	200-7608	200-7618						
Bolt kit, Brodix hd., SB	4	1/4-20	4.000					100-7511	100-7514	400-7511	400-7514
Bolt kit, Brodix hd., SB	4	1/4-20	4.250					100-7512	100-7515	400-7512	400-7515
Bolt kit, Brodix hd., SB	4	1/4-20	4.500					100-7513	100-7516	400-7513	400-7516
Bolt kit, Brodix hd., BB	7	1/4-20	4.000					100-7517	100-7520	400-7523	400-7526
Bolt kit, Brodix hd., BB	7	1/4-20	4.250					100-7518	100-7521	400-7524	400-7527
Bolt kit, Brodix hd., BB	7	1/4-20	4.500					100-7519	100-7522	400-7525	400-7528
STAMPED STEEL COVERS											
350 Chevy, cntr blt'd vlv cvr	8	1/4-20	3.250					100-7509	100-7510	400-7509	400-7510
Bolt kit	8	1/4-20	.515					100-7505	100-7501	400-7505	400-7501
Bolt kit, 1/4-20, 14 pieces	14	1/4-20	.515					100-7506	100-7502	400-7506	400-7502
Stud kit	8	1/4-20	1.170	200-7601	200-7611	400-7601	400-7611				
Stud kit	14	1/4-20	1.170	200-7602	200-7612	400-7602	400-7612				

Kayle Robidoux - Hard-charger in D.I.R.T. Series (358 c.i.d.)

Steve Francis - Top runner on the U.D.T.R.A. circuit

HEADER BOLTS & STUDS

ARP® manufactures a variety of premium grade bolt and stud kits to facilitate installation of exhaust headers including the popular stainless stud kit with 12-point nuts. The Stainless 300 material is not affected by corrosion or extreme heat, making it ideal for the application. What's more, the compact 12-point nut lets you easily slip a socket close to the pipe. Each ARP® accessory stud or bolt kit includes the specific number of parts for your application, plus premium-quality washers and hex or 12-point nuts, as required. Studs are manufactured with a unique nut-starter nose that helps prevent cross-threading. Studs and bolts come either black oxide chrome moly or Stainless 300. Both are nominally rated at **170,000 psi** tensile strength; substnatially stronger than Grade 8 hardware. Specially drilled "NASCAR" models available for those who wish to safety wire their header bolts to prevent loosening.

Special "NASCAR" model header bolts are available that are drilled for use of safety wire. Perfect for any racer who desires the ultimate in security. Available for small block and big block Chevrolet engines, plus many "universal" applications.

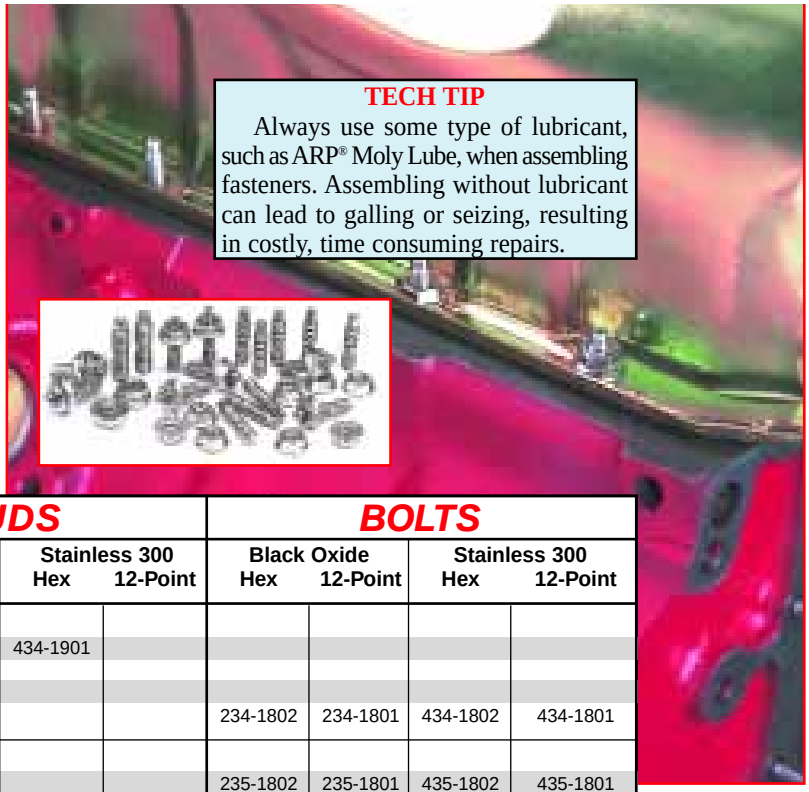
NOTE: *8mm metal studs listed on page 67.*

Studs come with flanged nut. Bolts come with washers. For varying flange thicknesses see "universal." Application	Qty.	Size	STUD O.A.L. / BOLT U.H.L.	STUDS Black Oxide Hex	STUDS Black Oxide 12-Point	STUDS Stainless 300 Hex	STUDS Stainless 300 12-Point	BOLTS Black Oxide Hex	BOLTS Black Oxide 12-Point	BOLTS Stainless 300 Hex	BOLTS Stainless 300 12-Point
BUICK											
3.8L, V6	12	3/8	1.670	120-1412	120-1402	420-1412	420-1402				
350-455 c.i.d., stud	14	3/8	1.670	120-1411	120-1401	420-1411	420-1401				
350-455 c.i.d., bolt	14	3/8	.750					120-1101	120-1201	420-1101	420-1201
CHEVROLET, SMALL BLOCK											
3/8" dia. bolt, 3/8" wrench	12	3/8	.750					100-1101	100-1201	400-1101	400-1201
3/8" dia. bolt, drilled, 3/8" wrench	12	3/8	.750					100-1103	100-1203	400-1103	400-1203
3/8" dia. stud	14	3/8	1.670				400-1400				
3/8" dia. stud	12	3/8	1.670	100-1412	100-1402	400-1412	400-1402				
LS1, LS6 5.7L & 6.0L	12	M8	1.750				434-1301				
CHEVROLET, BIG BLOCK											
3/8" dia. bolt, 3/8" wrench	16	3/8	.750					100-1102	100-1202	400-1102	400-1202
3/8" dia. bolt, drilled, 3/8" wrench	16	3/8	.875							400-1104	400-1204
stud	16	3/8	1.670	100-1413	100-1403	400-1413	400-1403				
CHRYSLER											
5/16" dia. bolt	14	5/16	.750					144-1102	144-1202	444-1102	444-1202
KB Hemi, stud w/prov for blower brackets, Mopar 340-360 c.i.d	16	3/8	.750	245-1311	245-1301	445-1311	445-1301				
Neon, Spt, PT Cruiser 2.4 turbo	10	M8	2.000					441-1302			
Neon, SOHC & DOHC	8	M8	2.000						441-1301		
FORD											
3/8" bolt	16	3/8	.750					100-1102	100-1202	400-1102	400-1202
3/8" stud	16	3/8	1.670	100-1414	100-1404	400-1414	400-1404				
OLDSMOBILE											
330-455 c.i.d.	14	3/8	.750				180-1101	180-1201	480-1101	480-1201	
330-455 c.i.d.	14	3/8	1.670	180-1411	180-1401	480-1411	480-1401				
UNIVERSAL											
Bolt kit, 5/16" wrench	12	3/8	.750					100-1107	100-1207	400-1107	400-1207
Bolt kit, 5/16" wrench	16	3/8	.750					100-1108	100-1208	400-1108	400-1208
Bolt kit, 5/16" wrench	12	3/8	1.000					100-1109	100-1209	400-1109	400-1209
Bolt kit, 5/16" wrench	16	3/8	1.000					100-1110	100-1210	400-1110	400-1210
Bolt kit, drilled, uses 3/8" socket	16	3/8	.750							400-1105	400-1205
Bolt kit, drilled, uses 3/8" socket	12	3/8	.875							400-1106	400-1206
Stud kit	16	3/8-5/16	1.500	100-1401	100-1411						
Stud kit, broached w/12-pt locking nut, 3/8"	14	7/16	1.125		100-1415						

Red part numbers indicate new items.

OIL PAN BOLT & STUD KITS

The engineers at ARP® spent quite a bit of time developing these highly effective, unique oil pan studs. They're designed to make it as easy as possible to install a pan and seal it properly. You'll note that the studs have a radiused bullet nose that serves to locate the pan rails, then allow the nuts to be easily installed without the worry of cross-threading. For those who prefer bolts, ARP's got you covered, too. Both are available in black oxide finished chrome moly steel or rust-proof stainless steel. Also, take your pick from conventional hex nuts (or bolt heads) and a space-saving 12-point design. The stud kits come complete with a special locking flanged nut, while the bolt kits come with washers.



TECH TIP

Always use some type of lubricant, such as ARP® Moly Lube, when assembling fasteners. Assembling without lubricant can lead to galling or seizing, resulting in costly, time consuming repairs.

NOTE: Studs come with flanged lock nut. Bolts come with washers.	STUDS				BOLTS			
	Black Oxide		Stainless 300		Black Oxide		Stainless 300	
Application	Hex	12-Point	Hex	12-Point	Hex	12-Point	Hex	12-Point
CHEVROLET, SMALL BLOCK								
Stud kit	234-1901	234-1902	434-1901					
With Girdle, 5/16" diameter	334-1902							
V6, 90°	333-1901							
Bolt kit					234-1802	234-1801	434-1802	434-1801
CHEVROLET, BIG BLOCK								
Bolt kit					235-1802	235-1801	435-1802	435-1801
Stud kit	235-1901	235-1902	435-1901					
CHRYSLER, SMALL BLOCK								
Mopar, bolt kit					200-1802	200-1801	400-1802	400-1801
Mopar, stud kit	200-1901	200-1902	400-1901	400-1902				
CHRYSLER, BIG BLOCK								
KB Hemi, 1.300"	245-1901	245-1903						
KB Hemi, 1.700"	245-1902	245-1904	445-1902	445-1904				
FORD, SMALL and BIG BLOCK								
289-302, 351C & 351W, stud kit, small block	254-1901	254-1902	454-1901	454-1903				
289-302, 351C & 351W, bolt kit, (late model)					254-1802	254-1801	454-1802	454-1801
302/351W with side rail	254-1903	254-1904	454-1902	454-1904				
351C & W with stamped steel pans							454-1804	454-1803
FE series, big block					255-1802	255-1801	455-1802	455-1801
Small block, 8 pack (early model)					254-1804	254-1803		
PONTIAC								
Bolt kit					200-1802	200-1801	400-1802	400-1801Stud
Stud kit	200-1901	200-1902	400-1901	400-1902				

Red part numbers indicate new items.

OIL PUMP BOLTS & STUDS

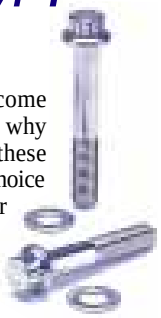
You've probably heard many a horror story about someone losing an engine when the oil pump fell off into the pan because of a broken bolt. Well, you can put your mind at ease when using ARP's premium grade oil pump bolt and stud kits. You have a choice of black oxide finished 8740 chrome moly steel or low maintenance stainless steel. Both are nominally rated at **170,000 psi** tensile strength to provide you with plenty of clamping force. Moreover, take your pick between conventional hex head or 12-point designs. This is "insurance" no conscientious engine builder should be without! The studs come with flat washers and nuts, while the Ford bolt kit has flat washers only. These inexpensive fasteners can literally save your engine. Get 'em!

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
CHEVROLET, V8 (studs only)				
Small block, stud kit	230-7001	230-7002		
Small & big block, 3.125", high volume, stud kit	230-7003	230-7004		
FORD				
5/16", 4 Pc. complete bolt kit	150-6902	150-6901	450-6902	450-6901
Oil pump to pickup, stud kit	154-7005			
SVO, external oil pump, stud kit, 5/16"x7.0"	154-7006			

FRONT COVER, WATER PUMP & ALTERNATOR KITS

ARP's timing cover bolts are available in both polished stainless steel or black oxide finish chrome moly. You also can choose between standard hex head bolts or compact 12-point fasteners. Also available as part of ARP's complete Engine & Accessory kits. Please go to page 59 for listings of available Engine & Accessory kits.

Studs are preferred by many Pro engine builders because they eliminate the chance of pinching gaskets and contribute to easier engine assembly. You will note that ARP® studs feature a special "bullet nose" to guide the nut accurately into place. Available in black oxide finish 8740 chrome moly or polished stainless steel with 6-point or 12-point nuts.



Alternators that come loose are a pain, so that's why ARP® came up with these super tough bolts (your choice of chrome moly steel or beautiful polished stainless (ARP® 300 - both rated **170,00 psi**). The stainless has the added advantage of not being affected by rust and corrosion. It's the fastener of choice!

NOTE: Studs come with flanged lock nuts. Bolts come with washers.	STUDS				BOLTS			
	Black Oxide		Stainless 300		Black Oxide		Stainless 300	
Application	**Hex**	**12-Pt.**	**Hex**	**12-Pt**	**Hex**	**12-Pt**	**Hex**	**12-Pt**
CHEVROLET								
3/8 alternator pivot bolt kit							430-3303	430-3304
All V8	200-1401	200-1411	400-1401					
All V8, timing cover bolt kit					200-1502	200-1501	400-1502	400-1501
All V8, water pump bolt kit					130-3202	130-3201	430-3202	430-3201
All V8, alternator bracket bolt kit					130-3302	130-3301	430-3302	430-3301
V6, 90°	333-1401							
With Jesel belt drive or gear drive	334-1401							
CHRYSLER								
KB Hemi	245-1511	245-1501	445-1511	445-1501				
FORD								
289-302, cast-iron, timing cover & water pump					154-1502	154-1501	454-1502	454-1501
289-302, aluminum, timing cover & water pump					154-1504	154-1503	454-1504	454-1503
4.5L, V6	353-1401							
SVO, 351 c.i.d.	354-1401							
Windsor, alternator bracket bolt kit					150-3302	150-3301	450-3302	450-3301
PONTIAC								
All, alternator bracket bolt kit					190-3302	190-3301	490-3302	490-3301
All, timing cover and water pump					190-1502	190-1501	490-1502	490-1501

Red part numbers indicate new items.

FUEL PUMP BOLT KITS

Application	Black Oxide		Stainless 300	
	Hex	12-Point	Hex	12-Point
CHEVROLET	130-1602	130-1601	430-1602	430-1601
PONTIAC	190-1602	190-1601	490-1602	490-1601

Make sure that mechanical fuel pumps stay properly aligned by using ARP's durable black oxide finished chrome moly or rust-proof stainless bolts (both materials are rated at 170,000 psi and considerably stronger than Grade 8 hardware). Your choice of either conventional hex heads or 12-point head. Washers are included.

MOTOR MOUNT BOLT KITS

Secure any engine with complete confidence with ARP's rugged motor mount bolts. You can choose between black oxide finished 8740 chrome moly or corrosion-resistant stainless steel; choice of hex or 12-bolt head. Kits come complete with flat washers.

Application	Black Oxide		Stainless 300	
	Hex	12-Point	Hex	12-Point
Chevy, mount to block	130-3102	130-3101	430-3102	430-3101
Chevy, mount to frame	130-3105		430-3105	
Ford Windsor	150-3102	150-3101	450-3102	450-3101
Pontiac	190-3102	190-3101	490-3102	490-3101

BELLHOUSING STUD KITS

Here's just what you need to secure a bellhousing in place. The studs are designed with a bullet nose to guide the bellhousing into position and accept nuts without the fear of cross-threading. Choice of rugged 8740 heat-treated alloy or rust-proof stainless steel. Complete with nuts and flat washers.

Application	Dia.	Length	Pro Series	Stainless
Chrysler, Chevy with 12-point nuts	3/8	2.00	245-0901	445-0901
Top Fuel motor plate, std.	7/16	2.14	245-0202	
with 1/4" spacer	7/16	2.40	245-0201	

STARTER BOLT KITS

Installing starter motors in the cramped confines of a race car is simplified by use of ARP's special bolts, which feature small diameter heads to make accessibility more convenient. They are stronger than OEM and industrial grades, and especially suited for use on cars that use rear motor plates. These starter bolts are made from ARP®300, a 100% maintenance free stainless steel material that is stronger than Grade 8 hardware and tough enough to easily withstand the strain of a 10 to 15 pound starter cantilevered off the back of an engine. Bolts have standard shank knurling. Rated at **170,000 psi**. Includes washers, as required.

Application	U.H.L.	Part No.
CHEVROLET		
All standard, 12-point	3.700	430-3501
All standard, hex	3.700	430-3502
All with high torque starter, 12-point	3.700	430-3503
All with high torque starter, hex	3.700	430-3504
All with long and short	1.880 & 4.450	430-3505
All with long and short, 10mm	1.775 & 4.470	430-3506
All, 2 ea. long, 3/8" bolt, hex	4.450	430-3507
FORD		
2-bolt	1.500	450-3501
3-bolt	1.500	450-3502

Red part numbers indicate new items.

SEAL PLATE & ACCESSORY CAM DRIVE

SPECIFICATIONS

- Drive: forged ARP2000, **220,000 psi** alloy chrome moly steel with corrosion-resistant oxide finish.
- Concentricity: .001 T.I.R., between shaft and hex, 1" and 1.5" length
- Threads: form rolled 9/16" x .625 on cam end, 3/8" hex on drive
- Seal Plate: CNC-machined 7075-T4 aluminum with Viton seal

If the survivability of your camshaft drive, through an entire race without stripping or breaking, has been a matter of concern—ARP's new cam drive should put your mind to rest. We built this setup to be "bulletproof." Totally reliable. A through-hardened, not just case hardened, chrome moly shaft, premium grade Viton seal, plus anodized aluminum plate are manufactured in-house to insure that every part is guaranteed ARP® quality.

Application	1"	1.5"
All 9/16-18 x .625	934-0005	934-0006

The perfect compliment to our "bulletproof" cam drives are these precision seal plates. They're made of CNC-machined 7075-T4 alloy aluminum and anodized to resist corrosion. Available in 2.100" and 2.380" diameters to fit most any OEM or aftermarket block.

Application	Part No.	Diameter
SB GM, 2.100 O.D. block	934-0007	2.100
Dart, aluminum block	934-0008	2.380

Johnny Saathoff - Many-time IMCA Modified Champion

"Grave Digger" - Popular Monster Truck series competitor

INTAKE SYSTEM MANIFOLD BOLT/STUD KITS

Prevent intake manifold leaks with ARP's quality fasteners. They're rated at **170,000 psi** and precision machined for optimum thread engagement. Wide underhead flange and companion washers provide even load distribution. Precision rolled threads prevent galling while promoting more consistent torque loading. Facilitates optimum sealing of gasket surfaces. Available in choice of black oxide finish chrome moly or corrosion resistant stainless steel, as well as hex or 12-point heads. Washers included.

Application	Black Oxide Hex	Black Oxide 12-Point	Stud	Stainless 300 Hex	Stainless 300 12-Point	NASCAR (1 drilled bolt per kit)
AMC						
290-343-390 c.id., uses 3/8" socket	114-2001			414-2001	414-2101	
BUICK						
215 c.id., uses 3/8" socket	124-2001	124-2101		424-2001	424-2101	
V6, 3.8L	123-2001			423-2001		
CHEVROLET						
V6 Chevy 90°, 1.000", drilled						333-2101
SB 2, drilled						334-2104
SB 2, tall deck						334-2105
SB Vortec, fits most aftermarket alum. intakes	134-2002	134-2103		434-2002	434-2102	
Small block, 265-400 c.id., factory OEM	134-2001	134-2101		434-2001	434-2101	
Small block, 1.000", drilled						334-2102
Small block, 1.250", drilled						334-2103
Big block, 396-454 c.id., U.H.L. 1.250"	135-2001	135-2101		435-2001	435-2101	
Big block, 502, U.H.L. 1.500"	135-2002				435-2102	
CHRYSLER						
Small block, 273-440 Wedge, uses 3/8" socket	144-2001	144-2101		444-2001	444-2101	
FORD						
260-289-302-351W, uses 3/8" socket	154-2001	154-2101		454-2001	454-2101	
289, 302, 351W intake stud kit			354-2103			
351 Cleveland, 351M, 400B	154-2004	154-2104		454-2004	454-2104	
351W, uses 3/8 wrenching	154-2002	154-2102		454-2003	454-2103	
Big block, 390-428 c.id., FE series	155-2002	155-2102		455-2002	455-2102	
Big block, 429-460 c.id., 385 series					455-2101	
Big block, V8	155-2005	155-2105		455-2001		
Ford 4.5L, V6						353-2101
Ford SVO 351 c.id., Jack Roush design, drilled						354-2102
Small Block 289, 302, 35W stud kit		354-2103				
PONTIAC						
350-400 c.i.d., uses 3/8" socket	194-2001	194-2101		494-2001	494-2101	

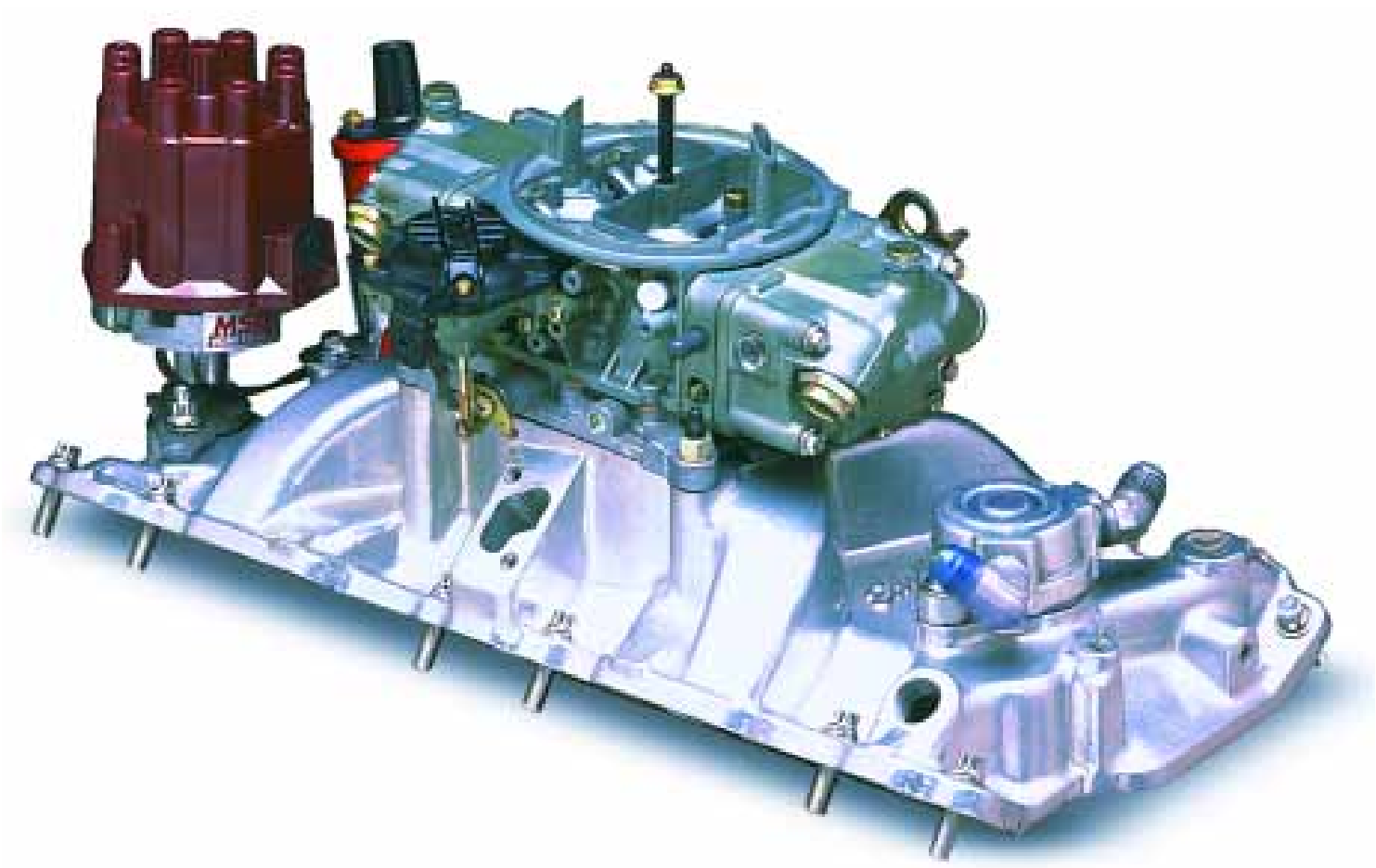
Red part numbers indicate new items.

CARB STUD KITS

The best way to make sure that carburetors stay perfectly sealed to the intake manifold is through the use of ARP's carb studs, which feature J-form threads to resist loosening from vibration. They're offered in a variety of heights to accommodate most any combination of carb and spacer, and are available in 8740 chrome moly with a black oxide finish or rust-proof stainless steel. Special ARP® Pro Series NASCAR type stud kits have **one of the studs drilled** to facilitate sealing the carburetor in the engine by race officials. All carb stud kits come with hex nuts and washers.

Application	Qty.	Size	O.A.L.	Black Oxide	Stainless 300	Pro Series
Standard	4	5/16	1.700	200-2401	400-2401	
1/2" spacer	4	5/16	2.225	200-2403	400-2403	
1" spacer	4	5/16	2.700	200-2402	400-2402	
2" spacer	4	5/16	3.700	200-2404		300-2404
3" spacer	4	5/16	4.700	200-2405		
1-1 /4" Moroso spacer	4	5/16	3.200	200-2408	400-2408	
2" Moroso spacer	8	5/16	1.250 & 1.700	200-2409		
Dominator with 1/2" or 1" spacer	4	5/16	3.200	200-2412	400-2412	
Dominator carb stud, no spacer	4	5/16	2.225	200-2414	400-2414	
2" spacer (drilled for NASCAR wire seal)	8	5/16	1.700 & 2.225		300-2406	
1" spacer (drilled for NASCAR wire seal)	4	5/16	2.700		300-2403	
1" Moroso spacer (drilled for NASCAR wire seal)	4	5/16	2.700			300-2407
1-1/4" Moroso spacer (drilled for NASCAR wire seal)	4	5/16	3.200			300-2408
2" Moroso spacer (drilled for NASCAR wire seal)	8	5/16	1.250 & 1.700			300-2409
Quadrajet (all), with 1/4" base gasket	4	5/16	1.700 & 4.400	200-2413	400-2413	

Red part numbers indicate new items.



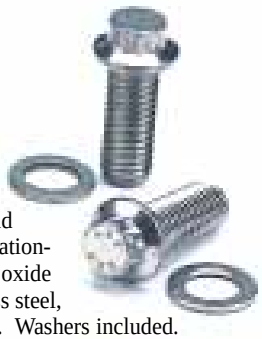
AIR CLEANER STUD KITS

Keep your air cleaner firmly in position with an ARP® stud kit. Includes your choice of a black oxide finished chrome moly or stainless steel stud with an appropriate nut. Vastly superior to the cheap fasteners that sometimes get used.

Application	Black Oxide	Stainless
5/16 x 2.225" O.A.L.	200-0301	400-0301
5/16 x 2.700" O.A.L.	200-0302	400-0302
5/16 x 3.200" O.A.L.	200-0303	400-0303
1/4 x 2.225" O.A.L.	200-0304	400-0304
1/4 x 2.700" O.A.L.	200-0305	400-0305
1/4 x 3.200" O.A.L.	200-0306	400-0306

Application	Black Oxide		Stainless 300	
	Hex	12-Point	Hex	12-Point
CHEVY	130-7402	130-7401	430-7402	430-7401
FORD FE	155-7402	155-7401	455-7402	455-7401
FORD Wndsr	150-7402	150-7401	450-7402	450-7401
PONTIAC	190-7402	190-7401	490-7402	490-7401

THERMOSTAT HOUSING BOLTS

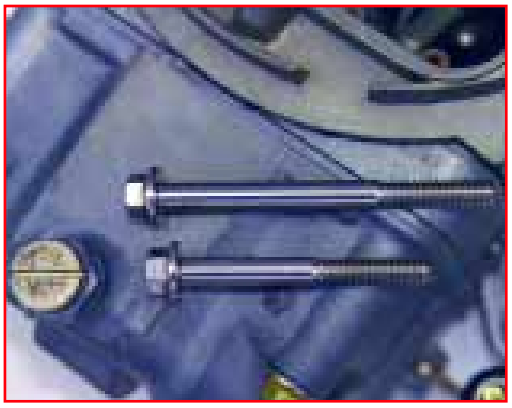


Nobody likes water leaks. And here's ARP's contribution to the solution. These premium grade bolts are engineered to properly engage the manifold threads and resist loosening. They're application-specific, and come in your choice of black oxide finished chrome moly or rust-proof stainless steel, with handy 12-point or standard hex heads. Washers included.

COIL BRACKET BOLTS

Add a touch of class to your coil bracket installation with an ARP® bolt kit. Available in black oxide finished chrome moly or rust-proof stainless steel, as well as with a conventional hex head or 12-point (great for tight, hard-to-reach coils). Washers included.

Application	Black Oxide		Stainless 300	
	Hex	12-Point	Hex	12-Point
CHEVY	130-2302	130-2301	430-2302	430-2301
FORD Wndsr	150-2302	150-2301	450-2302	450-2301



CARBURETOR FLOAT BOWL KITS

The smart way to attach a Holley float bowl is with ARP's special new bolts. They're made from 304 stainless steel and are virtually impervious to corrosion. A polished finish makes them an enhancement to any carb. They are 5/16" wrenching and nominally rated at **170,000 psi**. Available for both single and dual metering block applications.

Application	Hex
2-barrel, 4 pieces	400-0312
Dual metering blocks, 8 pieces	400-0310
Single metering blocks, 8 pieces	400-0311

BREAK-AWAY BLOWER STUDS

Engineered to minimize damage to either manifold or blower housing during unexpected blower explosions—these break-away blower studs are designed to allow separation of manifold and blower. Use of these special studs could save you thousands of dollars! Manufactured from premium-quality aluminum and heat-treated to provide the optimum balance between keeping the supercharger in place and breaking under a predetermined amount of force. Kit comes complete with anodized studs, 12-point, aerospace quality steel nuts and heavy-duty parallel-ground and hardened steel washers.

Application	Part No.
Aluminum blower stud, 7/16" dia., 2.880" O.A.L.	100-0601
SSI blower studs, 2.500" O.A.L.	100-0602

DISTRIBUTOR STUD KITS

One of the most critical—yet often overlooked—fasteners used in any engine locks the timing in place. ARP® offers these premium grade studs, which are equipped with vibration-resistant J-form threads, in black oxide finished chrome moly or rust-proof stainless steel. A special bullet nose helps guide nut into place without crossthreading. Choice of conventional 6-point or space-saving 12-point nuts. Washers included.

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
CHEVY	130-1702	130-1701	430-1702	430-1701
FORD	150-1702	150-1701	450-1702	450-1701
PONTIAC	190-1702	190-1701	490-1702	490-1701

Warren Johnson - 5-time NHRA Pro Stock Champion

Bob Reiger - Pro Mod record holder & 2-time P/S Champ

HARMONIC BALANCER BOLT KITS

Application	Socket Size	Underhead Length	Dia. & Thrd. Size	Part No.
BUICK				
V6 & V8	13/16	1.300	3/4-16	120-2501
CHEVROLET				
Small block	5/8	2.470	7/16-20	134-2501
Small block	13/16	2.470	7/16-20	234-2501
Small block	1-1/16	2.470	7/16-20	234-2502
CHEVROLET				
Big block	5/8	1.550	1/2-20	135-2501
Big block	13/16	1.550	1/2-20	235-2501
Big block	1-1/16	1.550	1/2-20	235-2502
CHRYSLER				
KB Hemi	1-1/16	1.420	3/4-16	245-2501
FORD				
All (except 351C)	5/8	2.050	5/8-18	150-2501
351C, 1.800" U.H.L.	5/8	1.800	5/8-18	154-2501
4.6L, V8, 12 pt.	18mm	1.800	M12 x1.5	156-2501
OLDSMOBILE				
V8	13/16	1.300	3/4-16	180-2501
PONTIAC				
350, 400, 455 ci engines	5/8	1.580	5/8-18	190-2501

Red part numbers indicate new items.

As the crankshaft flexes and twists, the balancer absorbs incredible amounts of kinetic energy. To ensure that the balancer is locked in position, ARP® has developed these ultra strong **200,000 psi** bolts that let you exert maximum clamping force. Special features include 1/4" thick, wide area washer and an extra tall 12-point head that accepts a deep socket and eliminates the worry of stripping the head.

SQUARE DRIVE BALANCER BOLTS

ARP® offers a special version of its rugged balancer **200,000 psi** rated balancer bolt that can accept a standard 1/2" drive ratchet or breaker bar to facilitate rotating the crank assembly.

- 1/2" square drive forged into bolt head, enabling the rotation of an engine with any 1/2" drive tool
- Made from heat-treated 8740 chrome moly steel with heavy-duty black oxide finish

Application	Part No.	Application	Part No.	Application	Part No.	Application	Part No.
BUICK	120-2502	**CHEVY, BB**	135-2503	**FORD** 351C	154-2502	**OLDSMOBILE**	180-2502
CHEVY, SB	134-2503	**CHRYSLER**	145-2503	**FORD** (All except 351C)	150-2503	**PONTIAC**	190-2502

FUEL PUMP PUSHROD KIT

Stock fuel pump pushrods leave a lot to be desired. In fact, they've been known to break at the most inopportune time. To provide you with required reliability and improved performance, ARP® has developed these sophisticated and durable pushrods. They're made from premium grade aerospace chrome moly and centerless ground to precise diameter. A hollow core serves to reduce the reciprocating mass, which requires less energy to operate. The less drag on the motor, the more power available to you!

Application	Part No.
CHEVROLET	
BB Chevy, 1/2 x 5.750" O.A.L.	135-8701
SB Chevy, 1/2 x 5.750" O.A.L.	134-8701

CAM BOLT KITS

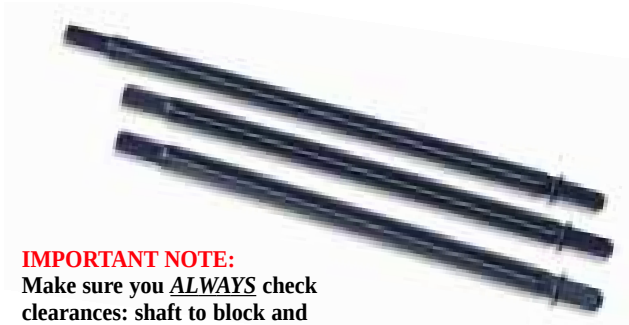
Install an ARP® cam bolt kit and end your camshaft timing worries! ARP® quality delivers increased pre-load clamping force and assures positive timing gear register. Includes appropriate fasteners for your application. Increased material strength overcomes valve train harmonics and stress. Added features include oversized bolt head flange for cam button retention and reduced socket head size to facilitate easy installation and removal. Available in both *High Performance* and *Pro Series* kits.

Application	Underhead Length	Diameter & Thread Size	Socket Size	High Perf. 170,000 psi	Pro Series 200,000 psi
BUICK, V6					
All	.560	5/16-18	3/8	123-1001	
CHEVROLET					
Chevy with oversize head for use with cam button	.750	5/16-18	7/16		300-1001
Small and big block,	.750	5/16-18	1/2	134-1001	234-1001
CHRYSLER, V8					
3-bolt pattern,	.750	3/8-16	5/8	144-1001	
Mopar, 3-bolt pattern	.750	3/8-16	9/16		244-1001
FORD, SMALL BLOCK					
351 SVO cam retention plate bolts	.750	1/4-20	7/16		250-1001
4.6L, V8 cam sprocket bolt	1.800	M12 x1.5	18mm		256-1001
260-289-302-351W, 1.460"	1.460	3/8-16	5/8	154-1001	254-1001
'70 to present 351C-351M, '71 to present 400,	1.970	3/8-16	5/8	154-1002	254-1002
Zetec 2.0L Cam Cap Studs		M7 x1.0			251-1001
FORD, BIG BLOCK					
'68 to present 302-429, 460, '69- to present 351W	1.580	3/8-16	5/8	155-1001	255-1001
All FE engines; 390-406-427-428,	1.750	7/16-14	5/8	155-1002	255-1002

Red part numbers indicate new items.

OIL PUMP DRIVESHAFT KITS

Many an engine has been destroyed as a result of oil pump driveshaft failure. To cure this all-too-common problem, ARP® has designed an extra heavy-duty shaft that will provide you with the necessary reliability. The shaft is made from heat-treated, premium grade aerospace chrome moly steel. Moreover, the shaft diameter is a larger diameter than the OEM unit. These features combine to enable ARP® shafts to handle the added torque requirements of increased capacity oil pumps or heavy viscosity lubricants. Rated at **190,000 psi**, the ARP® oil pump driveshafts provide reliability "insurance" for any powerplant.



IMPORTANT NOTE:
Make sure you *ALWAYS* check clearances: shaft to block and pump to distributor.

CHEVY DRIVES

Made from premium grade 8740 and heat-treated to 190,000 psi, ARP® uses a unique manufacturing process where the alignment sleeve is roll formed onto the shaft (not welded or pinned), enabling the sleeve to float, allowing for slight misalignment.

Application	Part No.
CHEVROLET	
Big block, all	135-7901
Small block, all	134-7901
Tall big block +.400	135-7902

FORD DRIVES

Made from ARP®2000 and heat-treated to **220,000 psi**. These pump drives feature a CNC milled (not broached) hex, and has the retaining washer installed.

Application	Part No.
FORD	
239-312 Y block	154-7906
289-302 c.i.d., 5.0L, Boss 302	154-7904
351 Windsor	154-7901
351C-400M	154-7905
FE series, 360-428 c.i.d.	154-7902
429-460 c.i.d.	154-7903

INDIVIDUAL ACCESSORY BOLT KITS

Just about any fastener type you can think of is available from ARP® in convenient skin-packed cards by product group. Look for them at your favorite performance parts retailer. And note that all ARP® fasteners are proudly manufactured in the U.S.A. in our own factory. It will pay you to invest in the best.

For your convenience, ARP® has taken the most popular combinations and compiled complete Engine & Accessory Bolt Kits. You'll find them all on page 59 of this catalog. Each kit contains about a dozen different fastener groups. They're available for engines ranging from Briggs & Stratton to big block Chevy, Ford and Chrysler powerplants.

Also available, display skin-packed in groups of five are "bulk" fasteners that are offered in 1/4-20, 5/16-18, 3/8-16 and 7/16-14 threads. These 5-packs come in a wide array of lengths, ranging from about 1/2" to 5-inches. They are offered in ARP's highly desired "ARP®300" polished stainless steel or in black oxide finished 8740 chrome moly. You can also get companion 5-packs of nuts in both standard and Nyloc models, with polished stainless steel and black oxide finished chrome moly nuts available. See the complete listing on page 73 of this catalog.

ALTERNATOR STUD KITS

Strange as it may seem, there have been many races lost in oval track, off-road and endurance competition due to the OEM alternator stud failing and the subsequent loss of electrical power. To prevent this from ever happening, conscientious engine builders rely on ARP's "bulletproof" alternator studs. They're made from a premium grade 8740 chrome moly steel alloy and heat-treated to a nominal **200,000 psi** tensile strength. They are very rigid and won't bend under the stress of competition, eliminating problems with alternator pulley alignment. Here's more reliable "insurance" from the innovators at ARP®. Available in 5.000" and 5.250" lengths. Includes a 12-point nut and flat washer.

Application	Part No.
7/16 x 5.000" stud, 1" coarse thread length	300-0501
7/16 x 5.250" stud, 1" coarse thread length	300-0502

COIL BRACKET BOLT KITS

Add a touch of class to your coil bracket installation with an ARP® bolt kit. Available in black oxide finished chrome moly or rust-proof stainless steel, as well as with a conventional hex head or compact 12-point (great for use with those coils mounted in tight, hard-to-reach places. Washers included. Coil bracket bolts also included in ARP's popular Engine & Accessory kits.

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
CHEVY	130-2302	130-2301	430-2302	430-2301
FORD Wndsr	150-2302	150-2301	450-2302	450-2301

DISTRIBUTOR STUD KITS

One of the most critical—yet often overlooked—fasteners used in any engine locks the timing in place. ARP® offers these premium grade studs, which are equipped with vibration-resistant J-form threads, in your choice of black oxide finished chrome moly or rust-proof stainless steel. Select from conventional 6-point or space-saving 12-point nuts. Washers included.

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
CHEVY	130-1702	130-1701	430-1702	430-1701
FORD	150-1702	150-1701	450-1702	450-1701
PONTIAC	190-1702	190-1701	490-1702	490-1701

COVER, PUMP & ALTERNATOR

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
CHEVROLET				
3/8 alternator pivot bolt kit			430-3303	430-3304
All V8, timing cover bolt kit	200-1502	200-1501	400-1502	400-1501
All V8, water pump bolt kit	130-3202	130-3201	430-3202	430-3201
All V8, alternator bracket bolt kit	130-3302	130-3301	430-3302	430-3301
FORD				
289-302, aluminum, timing cover & water pump	154-1504	154-1503	454-1504	454-1503
289-302, cast-iron, timing cover & water pump	154-1502	154-1501	454-1502	454-1501
Windsor, alternator bracket bolt kit	150-3302	150-3301	450-3302	450-3301
PONTIAC				
All, alternator bracket bolt kit	190-3302	190-3301	490-3302	490-3301
All, timing cover and water pump	190-1502	190-1501	490-1502	490-1501

We have an assortment of premium quality stainless steel and black oxide finish 8740 chrome moly bolts for the most popular applications. Washers included. These bolts are also available as part of our complete Engine & Accessory Kit packages (see page 59 for details).

Red part numbers indicate new items.

FUEL PUMP BOLT KITS

Absolute security is yours with ARP's durable fuel pump bolts. Your choice of black oxide finished chrome moly steel or rust-proof stainless steel. Both are nominally rated at **170,00 psi** and considerably stronger than Grade 8 hardware. Hex or 12-point head. Washers included.

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
CHEVROLET	130-1602	130-1601	430-1602	430-1601
PONTIAC	190-1602	190-1601	490-1602	490-1601

HEADER BOLTS

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
BUICK				
350-455 c.i.d., 3/8" dia. bolt, .750" U.H.L., 14 pcs.	120-1101	120-1201	420-1101	420-1201
CHEVROLET, SMALL BLOCK				
3/8" dia. bolt, .750" U.H.L., 12 pieces	100-1101	100-1201	400-1101	400-1201
3/8" dia. bolt, .750" U.H.L., drilled, 12 pieces	100-1103	100-1203	400-1103	400-1203
CHEVROLET, BIG BLOCK				
3/8" dia. bolt, .750" U.H.L., 16 pieces	100-1102	100-1202	400-1102	400-1202
3/8" dia. bolt, .875" U.H.L., drilled, 16 pieces			400-1104	400-1204
CHRYSLER				
Mopar 340-360 c.i.d., 5/16" dia. bolt, .750" U.H.L., 14 pieces	144-1102	144-1202	444-1102	444-1202
FORD				
3/8" dia. bolt, .750" U.H.L., 16 pieces	100-1102	100-1202	400-1102	400-1202
OLDSMOBILE				
330-355 c.i.d., 3/8" dia. bolt, .750" U.H.L., 14 pcs.	180-1101	180-1201	480-1101	480-1201
OTHERS				
3/8" bolt, .750" U.H.L., 12 pcs., 5/16" wrenching	100-1107	100-1207	400-1107	400-1207
3/8" bolt, .750" U.H.L., 16 pcs., 5/16" wrenching	100-1108	100-1208	400-1108	400-1208
3/8" bolt, 1.00" U.H.L., 12 pcs., 5/16" wrenching	100-1109	100-1209	400-1109	400-1209
3/8" bolt, 1.00" U.H.L., 16 pcs., 5/16" wrenching	100-1110	100-1210	400-1110	400-1210
3/8" bolt, .750" U.H.L., 16 pcs. 3/8" socket,drilled			400-1105	400-1205
3/8" bolt, .875" U.H.L., 12 pcs. 3/8" socket,drilled			400-1106	400-1206

ARP® manufactures premium grade bolt kits to facilitate installation of exhaust headers in both stainless steel or 8740 chrome moly steel. The Stainless 300 material is not affected by corrosion or extreme heat, making it ideal for the application. What's more, the compact 12-point nut version lets you easily slip a socket close to the pipe. Each ARP® bolt kit includes the specific number of parts for your application, plus premium-quality washers and hex or 12-point nuts, as required. The black oxide finished chrome moly bolts and stainless steel fasteners are nominally rated at **170,000 psi** tensile strength. Specially drilled "NASCAR" models available for those who wish to safety wire their header bolts to prevent loosening.

THERMOSTAT HOUSING BOLTS

These premium grade bolts are engineered to properly engage the manifold threads and resist loosening. They're application-specific, and come in your choice of black oxide finished chrome moly or rust-proof stainless steel, with handy 12-point or standard hex heads. Washers included.

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
CHEVY	130-7402	130-7401	430-7402	430-7401
FORD FE	155-7402	155-7401	455-7402	455-7401
FORD Wndsr	150-7402	150-7401	450-7402	450-7401
PONTIAC	190-7402	190-7401	490-7402	490-7401

INTAKE MANIFOLD BOLTS

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
AMC				
290-343-390 c.id., uses 3/8" socket	114-2001		414-2001	414-2101
BUICK				
215 c.id., uses 3/8" socket	124-2001	124-2101	424-2001	424-2101
V6, 3.8L	123-2001		423-2001	
CHEVROLET				
Big block, 396-454 c.id., uses 3/8" socket	135-2001	135-2101	435-2001	435-2101
Big block, 502	135-2002			
Small block, 265-400 c.id., uses 3/8" socket	134-2001	134-2101	434-2001	434-2101
SB Vortec, fits most aftermarket alum. intakes	134-2002	134-2103	434-2002	434-2102
CHRYSLER				
Small block, 273-440 Wedge, uses 3/8" socket	144-2001	144-2101	444-2001	444-2101
FORD				
260-289-302-351W, uses 3/8" socket	154-2001	154-2101	454-2001	454-2101
351 Cleveland, 351M, 400B	154-2004	154-2104	454-2004	454-2104
Big block, 390-428 c.id., FE series	155-2002	155-2102	455-2002	455-2102
Big block, 429-460 c.id., 385 series				455-2101
PONTIAC				
350-400 c.i.d., uses 3/8" socket	194-2001	194-2101	494-2001	494-2101

Prevent intake manifold leaks with ARP's quality fasteners. They're super strong and precision machined for optimum thread engagement. Wide underhead flange and companion washers provide even load distribution. Precision rolled threads prevent galling while promoting more consistent torque loading. Also facilitates optimum sealing of gasket surfaces. Available in choice of black oxide finished chrome moly or corrosion resistant stainless steel, as well as hex or 12-point heads. Both materials are nominally rated at **170,000 psi**. Washers included.

OIL PAN BOLTS

ARP's premium grade pan bolts combine sealing efficiency with good looks. They are available in black oxide finished chrome moly steel or rust-proof stainless steel. Also, take your pick from conventional hex bolt heads and a space-saving 12-point design. Includes washers. For details on ARP® oil pan stud kits refer to page 48 of this catalog.

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
CHEVROLET, SMALL BLOCK				
Bolt kit	234-1802	234-1801	434-1802	434-1801
CHEVROLET, BIG BLOCK				
Bolt kit	235-1802	235-1801	435-1802	435-1801
CHRYSLER, SMALL BLOCK				
Mopar, bolt kit	200-1802	200-1801	400-1802	400-1801
FORD, SMALL and BIG BLOCK				
289-302, 351C & 351W, bolt kit, (late model)	254-1802	254-1801	454-1802	454-1801
FE series, big block	255-1802	255-1801	455-1802	455-1801
Small block, 8 pack (early model)	254-1804	254-1803		
PONTIAC				
Bolt kit	200-1802	200-1801	400-1802	400-1801

NOTE: Bolts come with washers.

VALVE COVER BOLT KITS

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
CAST ALUMINUM COVERS				
Bolt kit, 1/4-20, 8 pieces	100-7507	100-7503	400-7507	400-7503
Bolt kit, 1/4-20, 14 pieces	100-7504	100-7508	400-7508	400-7504
STAMPED STEEL COVERS				
350 Chevy, center bolted valve cover	100-7509	100-7510	400-7509	400-7510
Bolt kit, 1/4-20, 8 pieces	100-7505	100-7501	400-7505	400-7501
Bolt kit, 1/4-20, 14 pieces	100-7506	100-7502	400-7506	400-7502

ARP® offers special valve cover bolts both as individual packages, or included in complete Engine & Accessory Kits (see page 59). The bolts are offered in a choice of chrome moly steel with a black oxide finish or corrosion-proof polished stainless steel (ARP® Stainless 300 material) Additionally, you have a choice between conventional hex head bolts and nuts or compact, easy access 12-point designs. The heads feature a wide base for better load distribution and sealing (helps prevent those pesky gasket leaks), while the compact head is easily accessed. Kits are shipped with the required flat washers. ARP® also manufactures valve cover stud kits, which are listed on page 46 of this catalog.

ENGINE & ACCESSORY FASTENER KITS

It's easy to assemble a show-quality engine when you use ARP's handy Engine & Accessory Fastener Kit. Virtually everything you need comes completely organized in one convenient package (no need to deal with twelve different part numbers)! More importantly, each and every fastener is superior in strength to the OEM bolts, and also significantly better than hardware grades (even Grade 8). You have a choice of two premium quality materials and finishes.

Traditionalists will appreciate the strength and functionality of ARP's heat-treated 8740 Chrome Moly steel alloy bolts, which feature a black oxide finish.

Those who desire a dazzling engine will no doubt prefer fasteners made of ARP's specially alloyed Stainless 300 material, which has the added benefit of being virtually impervious to rust and corrosion. The stainless steel is polished to achieve a brilliant luster, and provides a distinctive, maintenance-free environment. Each kit has a dozen different type fasteners, all neatly organized and labeled in protective vacuum-wrapped packages.

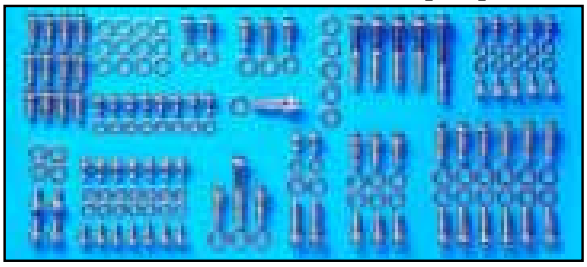
Both materials are nominally rated at **170,000 psi** tensile strength and come in both hex and 12-point heads.

Please note that these kits are designed for carbureted engines. Newer EFI applications may require the purchase of additional fasteners.

- **Each Kit Contains 12 Groups of Fasteners.***
- **Polished Stainless Steel or Black Oxide Finish 8740 Chrome Moly Steel.**
- **Stronger Than Any Hardware Grades.**
- **Choice Of Hex or 12-Point Heads.**
- **Available For All Popular Engine Types.**
- **100% Satisfaction Guaranteed.**
- **Save Time, Money and Hassles!**

Everything you need to attach components and accessories from a long block on up is packaged in one economical, convenient kit!

- **Intake manifold bolts**
- **Valve cover bolts**
- **Thermostat housing bolts**
- **Alternator bracket bolts**
- **Distributor bracket bolts**
- **Motor mount bolts**
- **Oil pan bolts**
- **Coil bracket bolts**
- **Header bolts**
- **Front cover bolts**
- **Water pump bolts**
- **Fuel pump bolts**



Application	Available in a choice of… Chrome Moly Black Oxide Hex	Chrome Moly Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
BRIGGS & STRATTON				
Jr. Dragster, 4-cycle 5 horsepower B&S			500-9601	500-9501
CHEVROLET				
350-400 c.i.d., small block †	534-9801	534-9701	534-9601	534-9501
396-454 c.i.d., big block †	535-9801	535-9701	535-9601	535-9501
CHRYSLER				
340-360 c.i.d. "A" small block †	544-9801	544-9701	544-9601	544-9501
383-460 c.i.d. "B" and "RB" big block	545-9801	545-9701	545-9601	545-9501
FORD				
289-302 c.i.d., small block †	554-9801	554-9701	554-9601	554-9501
351 Cleveland, small block	554-9804	554-9704	554-9604	554-9504
351 Windsor, small block	554-9803	554-9703	554-9603	554-9503
360-390-428 c.i.d. FE series, big block	555-9802	555-9702	555-9602	555-9502
429-460 c.i.d. 385 series, big block †	555-9801	555-9701	555-9601	555-9501
Boss 302, small block †	554-9802	554-9702	554-9602	554-9502
PONTIAC				
350-400-455 c.i.d. †	594-9801	594-9701	594-9601	594-9501
PORSCHE				
911-930 turbo				504-9501

*** except Briggs & Stratton** **† 1987 and newer EFI engines may require additional fasteners to be purchased**

FLYWHEEL/FLEXPLATE BOLTS

Flywheel and Flexplate bolts play an important role in the performance and safety of race cars and street machines alike. That's why the fastener experts at ARP® have developed special bolts that are far superior to OEM hardware. ARP® offers two styles of Flywheel/Flexplate bolts: High Performance and Pro Series. They are both forged from aerospace alloy and heat-treated prior to thread rolling and machining. Both feature an exclusive, flat, 12-point head design and larger than stock shank diameter for increased strength and improved flywheel register. The popular High Performance series is rated at **180,000 psi**, and the premium grade Pro Series, originally developed for NASCAR Winston Cup competition, has a **200,000 psi** rating. Complete with washers (and nuts where applicable).

NOTE: The thread size of metric fasteners is listed using international designations. For example, "M10" indicates a 10mm thread size.

Red part numbers indicate new items.

Application	U.H.L.	Thread Size	High Perf.	Pro Series
FLYWHEEL BOLT KITS				
BMC, A-series, 1600cc	.900	3/8-24		206-2802
Chevy & Ford, (6 pieces)	1.000	7/16-20	100-2801	200-2802
Chevy 1 pc., rear seal, '87-up	1.000	7/16-20		200-2807
Chevy LS1 flywheel bolt	.800	M11 x 1.5		330-2802
Chevy V8 w/Tilton flywheel, uses 1/2" socket	.875	7/16-20		330-2801
Ford 2.0L Zetec	.900	M11 x 1.0		251-2801
Ford 351 flywheel, uses 3/4" socket	.925	7/16-20		350-2802
Ford Pinto, 2000cc stock	1.150	M10 x 1.0	151-2801	
Ford V8 w/Tilton flywheel, uses 1/2" socket	.950	7/16-20		350-2801
Pontiac, 4-cylinder, Iron Duke (12 pieces)	.750	7/16-20		291-2801
Pontiac	.750	1/2-20		290-2802
Top Fuel	1.000	1/2-20		200-2804
Top Fuel, L19	1.000	1/2-20		200-2805
Toyota 20/22R (6 pieces)	1.040	M11 x 1.25		203-2803
Toyota 3SGTE (8 pieces)	1.000	M12 x 1.25		203-2801
Toyota 4AG (8 pieces)	1.050	M10 x 1.25		203-2802
FLEXPLATE BOLT KITS				
Chevy internal balance & Ford, 3/4 socket	.680	7/16-20	100-2901	200-2902
Chevy ext. bal., 5/8 socket, 1 pc. rear seal	.725	7/16-20		200-2906
Chrysler 440	.500	7/16-20		200-2903
Chrysler Hemi, 8 bolt	.500	1/2-20		200-2905
Pontiac	.500	1/2-20		200-2904

TORQUE CONVERTER BOLTS

You can forget about the problem of shearing a torque converter bolt after you install these super strong **200,000 psi** gems. They are designed for each specific application and provide the optimum grip. Kits come with hardened parallel-ground washers.

Application	U.H.L.	Dia.	Part No.
CHRYSLER			
All w/prod. conv.	.450	5/16-24	240-7301
GM			
Turbo 350, 400, 200 4R, 10" dia. conv.	1.250	7/16-20	230-7303
Turbo 350, 11" dia. conv.	.750	3/8-24	230-7301
Turbo 400, 10" dia. conv. with tabs	.725	7/16-20	230-7302

Red part numbers indicate new items.

PRESSURE PLATE BOLT KITS

The importance of pressure plate bolts in a racing or hi-performance street application cannot be emphasized nearly enough. These fasteners play a key role in both the performance and safety of a vehicle. Because of this, ARP® has developed special pressure plate bolts that are application specific to ensure the optimum grip length. ARP® offers High Performance Series bolts that are made from a premium grade chrome moly and hardened to a nominal tensile strength of **180,000 psi**. The Pro Series bolts, originally developed for NASCAR Winston Cup competition, are stronger and rated at **200,000 psi**. Both models feature a large diameter, low-profile design. Complete with washers.

Application	Dia. & Thrd. Size	High Perf.	Pro Series
CHEVROLET			
9/16" head size	3/8-16	130-2201	230-2202
with Tilton flywheel and 3 disk AP clutch	5/16-24		330-2202
FORD			
1/2" head size	5/16-18	150-2201	250-2201
with Tilton flywheel and 3 disk AP clutch	5/16-24		350-2202
PONTIAC			
All	3/8-16	190-2201	290-2201

BELLHOUSING STUD KITS

Here's just what you need to secure a bellhousing in place. The studs are designed with a radiused head to position the bellhousing and accept nuts without the fear of cross-threading. Choice of rugged 8740 heat-treated alloy or rust-proof stainless steel. Complete with nuts and flat washers.

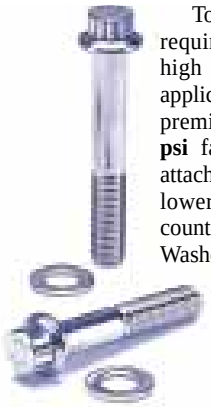
Application	Diameter	Pro Series	Stainless
Chrysler, Chevy with 12-point nuts	3/8	245-0901	445-0901
Top Fuel motor plate,	7/16	245-0202	
standard with 1/4" spacer	7/16	245-0201	
Porsche			504-9502

AUTO TRANS PAN BOLT KITS

Application	12-Point
CHEVROLET	
GM Turbo 350-400	430-0401

Here's another area in which ARP® provides a superior strength, vibration-resistant fastener that will provide better reliability than the OEM hardware. Made of rust-proof stainless steel, they're attractive, too. Includes washers.

PUMP & LOWER PULLEY BOLTS



To provide the reliability required in racing and high performance street applications, ARP® offers premium grade **170,000 psi** fasteners to securely attach the water pump and lower pulleys. You can count on them to perform. Washers included.

Application	Dia.	U.H.L.	Socket Size	8740 Part No.	S/S Part No.
LOWER PULLEY					
Ford, 12-pt, blk, 3-pc.	3/8-16	1.000	3/8	350-6801	
Ford, 12-pt, blk, 4-pc.	3/8-16	1.000	3/8	350-6802	
Ford, 12-pt, 3-pc.	3/8-16	1.000	3/8		450-6803
Ford, 12-pt, 4-pc.	3/8-16	1.000	3/8		450-6805
SB & BB GM, 12-pt, 3-pc.	3/8-24	.750	3/8		430-6801
SB & BB GM, 12-pt, blk, 3-pc.	3/8-24	2.125	1/2	334-6801	
WATER PUMP PULLEY, 12-pt.	5/16-24	.750	3/8		430-6802

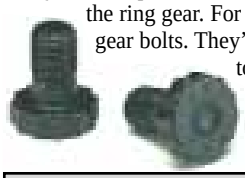
MOTOR MOUNT BOLTS

Secure any engine with complete confidence with ARP's rugged motor mount bolts. You can choose between black oxide finished 8740 chrome moly or corrosion-resistant stainless steel; choice of hex or 12-point head. Kits come complete with flat washers.

Application	Black Oxide Hex	Black Oxide 12-Point	Stainless 300 Hex	Stainless 300 12-Point
Chevy	130-3102	130-3101	430-3102	430-3101
Chevy, mount to frame	130-3105		430-3105	
Ford Windsor	150-3102	150-3101	450-3102	450-3101
Pontiac	190-3102	190-3101	490-3102	490-3101

RING GEAR BOLT KITS

The tremendous shock loads generated at launch by most any drag racing vehicle equipped with today's sticky tire compounds or the acceleration and deceleration of oval track cars put considerable strain on the ring gear. For this reason, the fastener experts at ARP® have developed the Pro Series ring gear bolts. They're forged from premium grade 8740 chrome moly steel and are heat-treated to a nominal rating of **200,000 psi** tensile strength. Specially hardened, precision-ground washers are included where required. Available to fit most any ring gear setup ranging from popular 9" Ford GM 10 & 12-bolt rear ends to the beefy Strange differentials found in Top Fuel and Funny Car applications.



TECH NOTE

It is critically important to properly tighten ring gear bolts and make sure they don't loosen. This is especially important in drag cars with tire shake. It's a good idea to check bolt tightness on a routine basis. If you use a locking compound (like Loc-Tite), for best results install the ring gear first without any compound, then remove the bolts one at a time, cleaning lubricant from both the fastener and spool or differential threads, reinstalling it with the compound. Be sure and torque each bolt before going on to the next one, because the Loc-Tite sets up fast. Install and torque the bolts in a crossing pattern so as to distribute the loading.

Application	U.H.L.	Shank Dia.	Thread	Part No.
CHRYSLER				
7-1/4,8-1/4,8-3/4,9-1/4 axles, LH thrd	.835	3/8	3/8-24 LH	240-3001
Clutch-type LSD case - half bolts, LH thread	2.800	3/8	3/8-24 LH	250-3006
FORD				
8", ring gear bolt kit	.940		7/16-20	250-3009
9", 5/8 socket size	.940	7/16	7/16-20	250-3002
9", 3/4 socket size	.750	7/16	7/16-20	250-3003
Ring gear	1.060	1/2	7/16-20	350-3004
GM				
10 and 12-bolt	.800	3/8	3/8-24	230-3001
OTHERS				
Strange Top Fuel differential	1.200	7/16	7/16-20	250-3001
Tru-Trac ring gear	1.065	1/2	7/16-20	300-3001
VW 020 ring gear	1.200	M9	M9 x 1.00	204-3001
VW 02A ring gear	1.180	M10	M10 x1.25	204-3002

Red part numbers indicate new items.

CARRIER FASTENERS

When assembling a rear end, optimum reliability can be obtained by employing these rugged chrome moly bolts and studs. They're made of 8740 alloy, heat-treated to a nominal tensile strength rating of **200,000 psi**, and black oxide finished. Keep the housing sealed with ARP®!

Application	U.H.L.	Shank Dia.	Thread	Part No.
FORD				
8", carrier bearing stud kit	2.600	7/16	7/16-14,7/16-20	250-3008
8 and 9", pinion support bolt kit	1.000	3/8	3/8-16	250-3007
9", carrier bearing stud kit	3.250	1/2	1/2-13,1/2-20	250-3004
9", housing stud, 10 pieces	1.645	3/8	5/8-24	250-3005
9", 12 pt, ss, pinion support stud kit	2.000	3/8	3/8-16, 3/8-24	250-3010
9", hex, ss, pinion support stud kit	2.000	3/8	3/8-16, 3/8-24	250-3011
9", 12 pt, blk, pinion support stud kit	2.000	3/8	3/8-16, 3/8-24	250-3020
9", hex, blk, pinion support stud kit	2.000	3/8	3/8-16, 3/8-24	250-3021

STAINLESS STEEL REAR END COVER

Here's an easy way to enhance the appearance of any GM 10 or 12-bolt rear end setup. ARP's stainless steel rear end cover bolts offer a lustrous contrast to a painted OEM cover or perfectly compliment a chrome plated aftermarket version. These sturdy **170,000 psi** bolts are much stronger than stock (or even Grade 8) hardware, have precision machined threads for secure engagement, and won't rust. The best! Washers included.

Application	U.H.L.	Thread	Part No.
CHEVROLET			
10-bolt	.750	5/16-18	437-3001
12-bolt	.750	5/16-18	437-3002

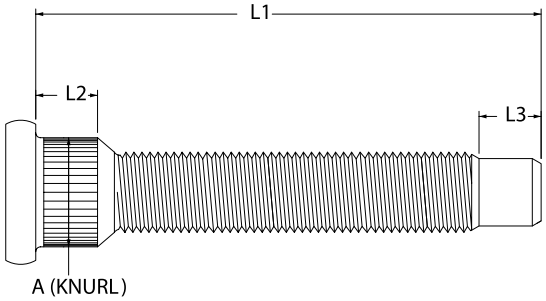
BRAKE HAT BOLT KITS

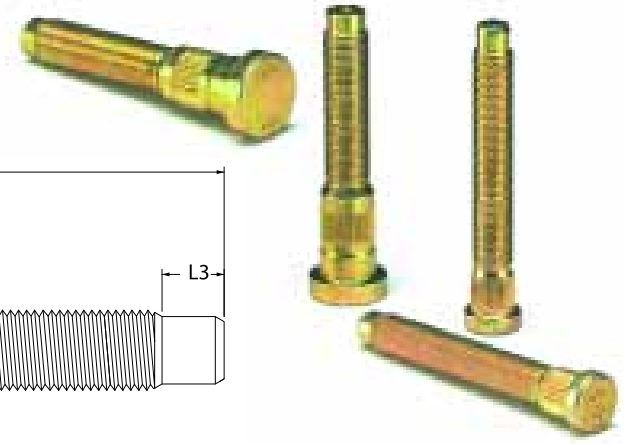
The perfect upgrade for many original brake hat bolts, this ARP® kit features bolts produced from only the finest quality 8740 chrome moly. Features an exclusive 12-point cap screw design and appropriate grip length per the application. All ARP® brake hat bolts are drilled to permit safety wiring. Rated **200,000 psi** tensile strength.

Application	U.H.L.	Part No.
5/16-24, 32 pieces	.880	300-0801
5/16-18, 32 piece	.850	300-0802
1/4- 28, 48 pieces	.750	300-0803

WHEEL STUDS

ARP's heat-treated 8740 chrome moly wheel studs are a much-needed replacement for any car engaged in oval track or drag racing competition. They have a tensile strength of **190,000 psi** and are able to easily handle the tremendous acceleration shock loads (shear) and lateral forces (elongation) found in racing. The studs are sold in packs of 5 and are cadmium plated for extra durability. Nuts not included. Now available for all popular applications, including General Motors, Ford, Honda and Chrysler replacements, as well as for oval track racing and aftermarket street and strip axles.



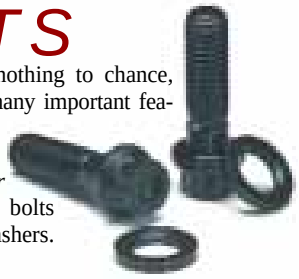


	A	L1	L2	L3		
Application	**Knurl Diameter**	**Underhead Length**	**Knurl Length**	**Nose Length**	**Thread Size**	**Part Number**
GM, late drum brake	.486	3.165	.420	.308	7/16-20	100-7701
GM, late disc brake and early drum brake	.580	3.200	.300	.305	7/16-20	100-7702
Ford, rear disc brakes/Chrysler front	.625	3.500	.400	.437	1/2-20	100-7703
Aftermarket axles, 12-point style head	none	3.470	none	.500	1/2-20	100-7704
Chrysler, rear	.680	3.125	.400	.400	1/2-20	100-7705
Speedway Eng, Pro 4 disc	.568	2.970	.710	.437	1/2-20	100-7706
Ford, front disc brakes, early	.618	3.050	.800	.250	1/2-20	100-7707
Camaro, Firebird, Corvette, late GM	.509	2.500	.315	none	M12x1.5	100-7708
Honda '80-'00 stk. replacement, 4 pack	.485	1.850	.275	.350	M12x1.5	100-7709
Honda '80-'00 stk. replacement, 5 pack	.485	1.850	.275	.350	M12x1.5	100-7710
Honda '80-'00, 4 pack	.485	2.850	.275	.350	M12x1.5	100-7711
Honda '80-'00, 5 pack	.485	2.850	.275	.350	M12x1.5	100-7712

Red part numbers indicate new items.

DRIVE PLATE BOLT KITS

Developed for racers who leave nothing to chance, ARP's special drive plate bolts have many important features, including use of a premium grade chrome moly alloy, heat-treating to **200,00 psi**, J-form thread rolling *after* heat-treat and a special profile. The bolts come with special precision-ground washers.

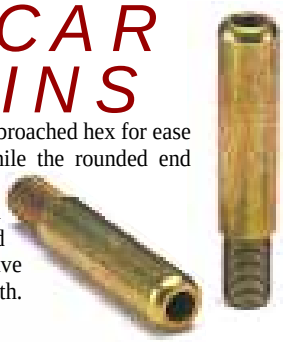


Application	Part No.
Wilwood drive plate bolt, 7/16-14 x 1.500" 12-pt, drilled, 8 pieces	200-3401

For use with Wilwood rear drive hub; also fits Speedway hubs.

SPRINT CAR DRIVE PINS

ARP® sprint car drive pins feature a broached hex for ease of installation and proper pre-load while the rounded end facilitates quick, positive wheel location. All critical shear points feature a large radius for improved reliability and maximum load carrying capacity. Drive pins are rated **200,000 psi** tensile strength.



Application	Thread Size	Part No.
Front, 2.450" O.A.L	1/2-20	200-2601
Rear, 3.275" O.A.L.	1/2-20	200-2602

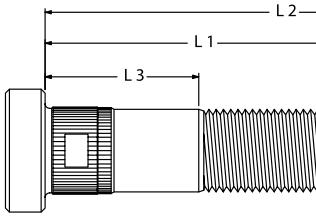
Del Worsham - Many-time NHRA National event winner

Top Street Rods, like the innovative "Quad Rod," rely on ARP® fasteners

NOTE: The products listed in this section have been designed to comply with NASCAR® rules. No specific endorsement by NASCAR® is implied.

SPEED STUDS™

Because races can be won or lost in the pits, the engineers at ARP® set about to create the ultimate oval track competition wheel stud that facilitates accurate wheel positioning and quicker release/tightening of lug nuts. ARP's new "Speed Studs" (and companion "Speed Nuts") are so good that a large number of NASCAR teams in Winston Cup, Busch and Craftsman Truck series use them exclusively. They're made from heat-treated **190,000 psi** chrome moly steel and feature precision J-form threads (formed after heat-treat for improved fatigue strength), exclusive nut-starter and bullet shape radius that all but eliminates cross-threading, shot-peening, special baked-on dry lube (reduces possibility of galling and assures consistent clamp loads), and double magnaflux inspection. A new head design is employed that fits the registers of all popular hubs without grinding, and studs are available in 20 underhead lengths to provide you with the optimum thread engagement for your particular setup. The finest studs available!



Note: All applications fit Stock Car Products and Speedway Engineering Hubs without grinding or modifications.

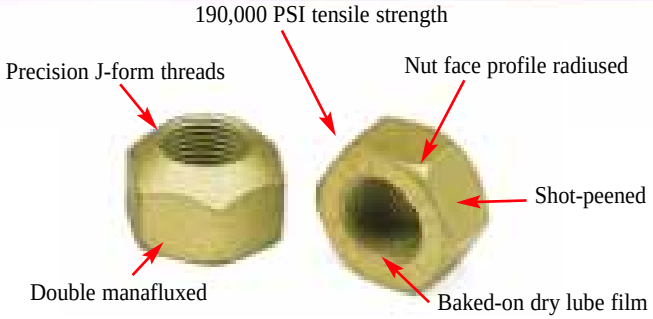
L1	L2	L3	Kit Number
1.900	2.750	.675	300-7705
2.050	2.900	.825	300-7706
2.400	3.250	1.200	300-7707
2.550	3.400	1.350	300-7708
2.750	3.600	1.550	300-7709
1.600	2.450	.500	300-7710
1.700	2.550	.600	300-7711
1.800	2.650	.700	300-7712
2.000	2.850	.900	300-7713
2.100	2.950	1.000	300-7714
2.200	3.050	1.100	300-7715
2.300	3.150	1.200	300-7716
2.500	3.350	1.400	300-7717
2.600	3.450	1.500	300-7718
2.700	3.550	1.600	300-7719
2.800	3.650	1.700	300-7720
2.900	3.750	1.800	300-7721
3.000	3.850	1.900	300-7722
3.100	3.950	2.000	300-7723
3.200	4.050	2.100	300-7724

Red part numbers indicate new items.

SPEED NUTS™

Designed for professional racing environments where split-second improvements in pit stop times can make the winning difference, and "unbustable" reliability is an absolute must. ARP's Speed Nuts™ feature precision J-formed threads plus a profiled nut face for easy installation, quicker socket releases and resistance to jamming. They're made from premium heat-treated chrome moly that's nominally rated at 190,000 psi tensile strength, shot-peened to remove stress risers and double magnafluxed after heat-treating and thread-forming to assure 100% metallurgical integrity. As a finishing touch, ARP® adds a baked-on dry lube film to reduce the chance of galling, ensure more consistent clamping, and provide an easier-to-clean surface. Speed Nuts™ are ready for "instant" use (thread chasing not required).

NOTE: You will find these to be far superior to the "yellow nuts" that are in common use. The smart teams have switched!



Application	Thread Size	Part No.
NASCAR, 10-pc. fine	5/8-18	300-7801
IMCA Wide-5, 10-pc., coarse	5/8-11	300-7802

Tony Stewart - 2002 NASCAR Winston Cup points Champion

Bobby Labonte - Another strong Joe Gibbs entry: 2000 Winston champ

INTAKE MANIFOLD BOLT KITS

Not only will these premium quality ARP® fasteners help prevent intake manifold leaks, but they're all drilled to accommodate safety wire. What's more, they're rated at **170,000 psi** and feature precision rolled threads for optimum engagement, to prevent galling and promoting more consistent torque loading. Wide underhead flange design and companion flat washers provide even load distribution and facilitates optimum sealing of gasket surfaces. Made of corrosion resistant stainless steel. Washers included and bolt drilled for NASCAR® inspector's wire lock.

Application	NASCAR
CHEVROLET	
SB 2, drilled	334-2104
SB 2, tall deck	334-2105
Small block, 1.000", drilled	334-2102
Small block, 1.250", drilled	334-2103
V6 Chevy 90°, 1.000", drilled	333-2101
FORD	
Ford 4.5L, V6	353-2101
Ford SVO 351 c.id., Jack Roush design, drilled	354-2102

DRILLED HEADER BOLTS

ARP® offers special "NASCAR" header bolts that have been drilled for use of safety wire. They are made from heat-treated 8740 chrome moly steel (with a black oxide finish - rated at **180,000 psi**) or Stainless 300™ that is polished to a bright shine (nominally rated at 170,000 psi tensile strength—considerably stronger than Grade 8 hardware), and engineered to provide complete reliability in the most severe racing environments. They are available in hex or 12-point heads. Through use of safety wire, exhaust headers will maintain original tightness and can't back off!

Application	Qty.	Bolt Size	U.H.L.	Wrench Head	Black Oxide		Stainless 300™	
					Hex	12-pt	Hex	12-pt.
Chevy small block, drilled	12	3/8	.750	3/8	100-1103	100-1203	400-1103	400-1203
Chevy big block, drilled	16	3/8	.875	3/8			400-1104	400-1204
Universal, drilled	16	3/8	.750	3/8			400-1105	400-1205
Universal, drilled	12	3/8	.875	3/8			400-1106	400-1206

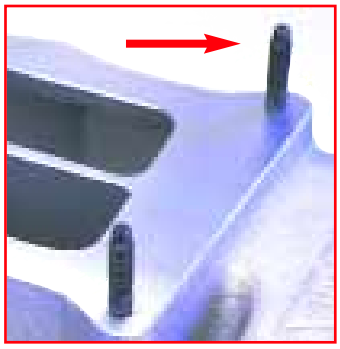
BRAKE HAT BOLT KITS

The perfect upgrade for many original brake hat bolts, this ARP® kit features bolts produced from only the finest quality 8740 chrome moly. Features an exclusive 12-point cap screw design and appropriate grip length per the application. All brake hat bolts are drilled for safety wire lock. Rated **200,000 psi** tensile strength.

Application	Part No.
5/16-24, 32 pieces	300-0801
5/16-18, 32 pieces	300-0802
1/4- 28, 48 pieces	300-0803

NASCAR®

DRILLED CARB STUDS



The best way to make sure that carburetors stay perfectly sealed to the intake manifold is through the use of ARP's carb studs, which feature J-form threads to resist loosening from vibration. They're offered in a variety of heights to accommodate most any combination of carb and spacer, and are available in 8740 chrome moly with a black oxide finish or rust-proof stainless steel. Special NASCAR type studs have **one of the studs drilled** to facilitate sealing the carb by race officials. All carb stud kits come with hex nuts and washers.

Application	Pro Series
Std. stud kit, 4 piece, drilled for NASCAR wire seal	300-2401
1/2", 4 piece, drilled for NASCAR wire seal	300-2402
1", 4 piece, drilled for NASCAR wire seal	300-2403
2", 8 piece, drilled for NASCAR wire seal	300-2406
1" Moroso spacer, 4 piece, drilled for NASCAR wire seal	300-2407
1-1/4" Moroso spacer, 4 piece, drilled for NASCAR wire seal	300-2408
2" Moroso spacer, 8 piece, drilled for NASCAR wire seal	300-2409

Red part numbers indicate new items.

ALTERNATOR STUDS

Strange as it may seem, there have been many races lost in oval track, off-road and endurance competition due to the OEM alternator stud failing and the subsequent loss of electrical power. To prevent this from ever happening, conscientious engine builders rely on ARP's "bulletproof" alternator studs. They're made from a premium grade 8740 chrome moly steel alloy and heat treated to a nominal **200,000 psi** tensile strength. They are very rigid and won't bend under the stress of competition, eliminating problems with alternator pulley alignment. Here's more reliable "insurance" from the innovators at ARP®. Available in 5.000" and 5.250" lengths. Includes a 12-point nut and flat washer.

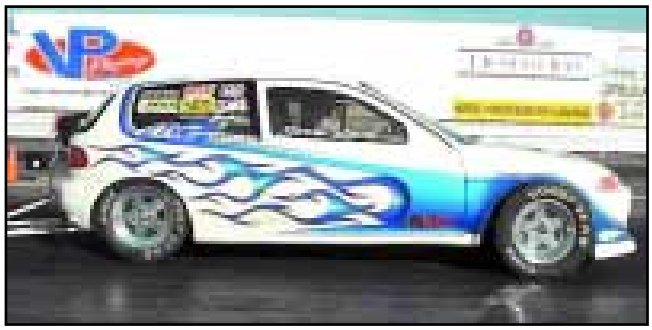
Application	Part No.
7/16 x 5.000" stud, 1" coarse thread length	300-0501
7/16 x 5.250" stud, 1" coarse thread length	300-0502

FRONT MANDREL BOLTS

Get maximum reliability through the use of ARP's rugged 8740 chrome moly steel front mandrel bolts. They're undercut to provide the required stretch, shot-peened for extra durability and designed for full thread engagement. Nominally rated at **200,000 psi** tensile strength for durability you can count on! Available for GM and Ford applications.

Application	Dia.	Length	Thread Length	Socket Size	Head Style	Part No.
GM						
	7/16	6.000	1.100	1/2	12-point	330-0701
	1/2	6.000	1.100	9/16	12-point	330-0702
	7/16	6.250	1.150	9/16	12-point	330-0703
	1/2	4.000	.750	15/16	Hex	330-0704
	1/2	4.000	.625	15/16	Hex	330-0705
	1/2	3.750	.625	15/16	Hex	330-0706
	1/2	3.250	.750	15/16	Hex	330-0707
	7/16	5.000	1.000	1/2	12-point	330-0708
	7/16	5.500	1.000	1/2	12-point	330-0709
FORD						
	5/8	8.000	1.100	15/16	Hex	350-0701
	5/8	8.375	1.000	15/16	Hex	350-0702
	5/8	7.000	1.000	15/16	Hex	350-0703

The World's Fastest Sport Compact Competitors Rely On ARP Fasteners!



Saverio Leone has been a dominant force in the "Quick" class, winning the I.D.R.C. points chase with his low 9-second Honda Civic

Matt Scranton was undefeated in 2002, winning all ten of the Summit NHRA series in the Pro V8 class, also breaking the 6-second barrier.

STAINLESS ACCESSORY STUDS

ARP® has developed an innovative multi-purposes accessory stud that can be used for exhaust systems, intake manifold and a host of other uses. The studs are manufactured from a proprietary alloy developed by ARP (Stainless 300™) and are impervious to the rust and corrosion that plagues ordinary fasteners. This stainless steel alloy is nominally rated at 170,000 PSI tensile strength, which is substantially stronger than Grade 8 hardware. Ideally suited for installing exhaust headers, the 8mm studs have a unique "nut starter" nose and a hex-broached tip —which allows the studs to easily be installed using an Allen wrench. The studs come with "easy wrenching" 12-point nuts, which work great in the tightest of quarters. Flat washers are also included. Offered in five different lengths, in quantities of 4, 8, 10 and 16-packs.

Great for Intake & Exhaust Systems

SIZE	4-Pack	8-pack	10-Pack	16-Pack
M8 x 1.25 x 32mm (1.250")	400-8001	400-8011	400-8021	400-8031
M8 x 1.25 x 38mm (1.500")	400-8002	400-8012	400-8022	400-8032
M8 x 1.25 x 45mm (1.750")	400-8003	400-8013	400-8023	400-8033
M8 x 1.25 x 51mm (2.000")	400-8004	400-8014	400-8024	400-8034
M8 x 1.25 x 57mm (2.250")	400-8005	400-8015	400-8025	400-8035

NOTE: #400-8014 fits SOHC & DOHC Neon (exhaust) and #400-8024 fits Neon & PT Cruiser (2.4L engine)

CONNECTING ROD BOLTS

ARP® manufactures replacement rod bolts for many popular import and domestic Sport Compact engines that are made of premium grade 8740 chrome moly steel and heat treated to a nominal tensile strength of **200,000 psi**. Threads are rolled after heat treat to ensure optimum fatigue strength. They are far superior to OEM fasteners in terms of durability and service life—fully capable of handling the extra stress of high combustion pressure engines. For extreme applications, rod bolts made of special ARP 2000® material (rated at a **220,000 psi** nominal tensile strength) are available, including those with the patented Wave-Loc design. Special high strength bolts also available for aftermarket connecting rods. Call for details.

Complete Rod Bolt Application Chart on next page

TECH TIP: Measuring Rod Bolt Stretch

The most accurate method of obtaining the correct torque load on a correcting rod bolt is through measuring the amount of bolt stretch. This is preferred to using a torque wrench. See chart on page 25 for the appropriate amount to stretch the bolt over its relaxed state to achieve the proper torque. ARP's rod bolt stretch gauge (see page 81) can also be used to determine the condition of a rod. If it has permanently stretched .001" or more, the bolt has been compromised beyond its yield. Replace it immediately! Use the adjacent chart (or a version thereof) to keep track of the bolt's length at installation and prior to removal.

ROD #1	ROD #2	ROD #3	ROD #4
***Driver Side** Bolt* Length at Installation _____	***Driver Side** Bolt* Length at Installation _____	***Driver Side** Bolt* Length at Installation _____	***Driver Side** Bolt* Length at Installation _____
Length prior to removal _____	Length prior to removal _____	Length prior to removal _____	Length prior to removal _____
***Passenger Side** Bolt* Length at Installation _____	***Passenger Side** Bolt* Length at Installation _____	***Passenger Side** Bolt* Length at Installation _____	***Passenger Side** Bolt* Length at Installation _____
Length prior to removal _____	Length prior to removal _____	Length prior to removal _____	Length prior to removal _____

Application	Head Style	Hi-Perf 8740 *(complete)*	Hi-Perf 8740 *(2-PC)*	HP Wave 8740 *(complete)*	HP Wave 8740 *(2-PC)*	Pro Wave ARP®2000 *(complete)*	Pro Wave ARP®2000 *(2-PC)*	Pro Series ARP®2000 *(complete)*	Pro Series ARP®2000 *(2-PC)*
ALFA ROMEO									
2.0 GTV	A	126-6101							
BMC/TRIUMPH/ROVER									
A-Series, 3/8"	J	206-6001							
A&B Series, 11/32"	C	206-6002							
B-Series, cap screw, 3/8", '64-'68, 18GB, 18GF	E	206-6003							
K-Series	E	206-6007							
Spitfire	E	206-6004							
TR6 GT6	E	206-6005							
TR7	K	206-6006							
BMW									
E36, E46	E							201-6102	
FORD, 4 and 6-CYLINDER									
Cosworth, Sierra/Escort	E					251-6301			
CVH M8x1.0	E	151-6004							
Ford RS 2000 8mm	E							251-6201	251-6222
Zetec, 1.6L 8mm	E	151-6003	151-6023						
Zetec, 2.0L 9mm	E	151-6005							
Duratec 1.8L	E							251-6202	
HOLDEN									
3/8"	B	205-6001							
11/32"	B	205-6002							
HONDA									
1.2L to 1.8L, 8mm	A	208-6001							
1.8L, 9mm	A							208-6401	
MITSUBISHI									
2.6L	C	107-6003	107-6023						
3.0L V6, 3.5 V6, 6G74	C	107-6004	107-6024						
4G63, pre 1994, 9mm	C	107-6001	107-6021						
4G63, 1994-present, 8mm	C	107-6002	107-6022						
NISSAN									
L16 Series	C	102-6001							
L20 Series, 4-cylinder Z22	C	202-6001							
L24 (early), 8mm	C	202-6002							
L24 (late), L26, L28 6-cylinder, 9mm,	C	202-6003							
SR20	C	202-6005							
VG30E & VG30ET	C	202-6003							
VG30 V6 D (Four Cam), DET, DETT	C	202-6004							
OPEL/VAUXHALL									
1.4-1.6L 8-valve, 8mm	E	109-6002							
2.0L, 16-valve, 9mm	E	109-6001				209-6003*			
PORSCHE									
911S, 1969 2.0L	H					204-6003			
911, 9mm, Turbo 930 & 993	H					204-6005			
911, 10mm	H					204-6001			
944	K					204-6002			
Type IV, 1.7L and 2.0L	K	104-6006							
RSR Ti rod	H					204-6004			
PEUGEOT									
306 &205	M	117-6101							
RENAULT									
5 Turbo (Mid-Engine)	E							216-6302	
12 Gordini/Alpine 807g	E	116-6001							
Clio, 16V 9mm	E							216-6301	
TOYOTA									
4AGE, 9mm	A	203-6001							
4ALC	A	203-6001							
22R & 3SGTE	A	203-6002							
2TC, 3TC, 2TG	A	203-6003							
Supra, 7MGTE	A	203-6004							
Supra, 2JZA80	E	203-6005							
VOLKSWAGEN									
1600cc air cooled	K	104-6001							
2L & 1800cc water cooled	L			104-6004	104-6024				
Cap screw Super Vee (Audi style rod)	A			104-6003	104-6023				
Corrado G60 & 1600cc water cooled Rabbit	K	104-6002							
Formula Vee, 9mm cap screw	E	104-6005	104-6025						
VR6	E							204-6006	

HEAD STUDS

Obtaining the optimum cylinder head-to-block sealing is especially critical in small displacement engines employing high compression pistons or power adders like turbochargers, nitrous oxide and superchargers. That's why ARP® head studs are popular among leading Sport Compact/Import racers.

You should know that ARP® uses a premium grade 8740 alloy that is rated far superior to "aircraft" quality. Then, each stud is precisely heat-treated to **200,000 psi**. Following heat-treat, each stud is centerless ground to make it as close to perfectly concentric as possible. This procedure involves about ten very slight cuts and results in an exceptionally straight part. It's important to note that lesser quality studs are not even centerless ground—the material is thread rolled in bar stock form (mostly before heat-treat, when the material is easier to machine). Because ARP® studs are manufactured to such exacting tolerances, you will note that gaskets and cylinder heads literally glide into position and are perfectly aligned—something that won't happen with inferior quality head studs.

ARP® studs are thread rolled *after* heat-treat, which gives them about 1000% (that's ten times) better fatigue strength than those studs that are threaded prior to heat-treat .

You will also note that ARP® offers specially undercut studs for several engines. This procedure (done only to the shorter studs) more equalizes the "stretch" of both studs, which makes for a more consistent clamping force—one that compensates for head gasket compression when the head is installed. This helps prevent blown head gaskets, and assures optimum sealing!

Premium parallel ground washers are also included with each kit.

Application	Hex Nuts	12-Point Nuts	12-Point Nuts U/Cut Studs
BMC/TRIUMPH			
A-series, 9 studs		206-4201	
A-series, 11 studs		206-4204	
A-series, 11 studs, shaved head		206-4206	
B-series		206-4202	
Triumph GT6		206-4205	
Triumph Spitfire		206-4203	
Triumph TR4		206-4207	
Triumph TR7			206-4208
BMW			
2002, 318I, 320I			201-4601
535, 635, 735			201-4602
M50 2.5L 6-cylinder			201-4603
FORD, 4 and 6-CYLINDER			
2L Zetec			251-4702
2.5L Duratech V-6		253-4701	
Cosworth Sierra/Escort (12mm)			251-4701
Escort 1600cc, 10mm		151-4203	
Pinto 2000cc		151-4201	
Pinto 2300cc		151-4202	151-4702
HOLDEN			
304			205-4602
308, 1/2"	254-4009		234-4201
308 V8	205-4001		205-4601
HONDA/ACURA			
Acura B18A1, 11mm		208-4302	
Acura VTEC B18CI, 11mm, GSR		208-4303	
B16A		208-4601	
B20B, w/B16A head		208-4306	
Civic D16Y		208-4305	
Honda D16Z - Only		208-4301	
Honda H22A4, VTEC		208-4304	
H23A		208-4307	

Red part numbers indicate new items.

Application	Hex Nuts	12-Point Nuts	12-Point Nuts U/Cut Studs
MITSUBISHI			
2.0, 4-cylinder, 16 valve, 12mm, 4G63 up to 1994		207-4201	207-4701
2.0L, 4-cylinder, 16 valve, 11mm, 4G63 1994 to 1999		207-4203	207-4702
2.6L 4-cylinder			207-4202
NISSAN			
L20 series, 4-cylinder		202-4201	
A-12 engines		202-4202	
A-14 engines		202-4203	
L24, L26, L28 series, 6-cylinder		202-4206	
PORSCHE			
911, stainless studs - Dilvar replacement		204-4206	
SUBARU			
2.0L, 2.2L, 2.5L		260-4701	
TOYOTA			
22R		203-4201	
7M GTE-Supra		203-4202	203-4701
4AG, 16 valve		203-4203	
3SGTE		203-4204	
2JZA80 Supra		203-4205	203-4702
VAUXHALL/OPEL			
2.0L, 16 valve		209-4301	209-4701
Opel 2.5L, V6		209-4302	209-4702
VOLKSWAGEN			
1600cc air-cooled		204-4201	
Super Vee		204-4202	
Golf/Jetta, 1.8L & 2L, 8 valve		204-4203	204-4701
Golf/Jetta, 1.8L & 2L, 16 valve		204-4204	204-4702
Audi 5 cylinder, 10 valve		204-4205	204-4703
Audi 5 cylinder, 20 valve		204-4207	204-4704
VR6		204-4208	204-4705

Red part numbers indicate new items.

HEAD BOLTS

Please Refer to Head & Main Bolt Instructions on page 43.

HIGH PERFORMANCE SERIES

High Performance head bolts are made of 8740 chrome moly and available with a reduced wrenching hex or 12-point with a wide area flanged head. They are nominally rated at **180,000 psi** and kits come complete with hardened parallel-ground washers.

PROFESSIONAL SERIES

All Pro Series bolts are designed for competition applications and are rated nominally at **200,000 psi**. Available with undercut short bolts that can help eliminate head gasket failures through providing more "stretch" to balance the longer bolts and compensate for the additional compression of gaskets.

Application	High Performance Hex	High Performance 12-Point	Pro Series 12-Point	Pro Series 12-Pt. UC
HOLDEN				
304		205-3702		
308	205-3601	205-3701	254-3703	
TOYOTA				
7M GTE, Supra			203-3902	
1600				203-3901

Red part numbers indicate new items.

SPECIAL PORSCHE FASTENERS

ARP engineers have developed a number of special fasteners for Porsche 911 and 930 Turbo applications that provide the reliability needed for serious competition. These fasteners are manufactured from high grade materials, and are superior to OEM Porsche bolts and studs. A number of special rod bolts are also available for Porsche engines. They are listed on pages 29 and 68 of this catalog.

Application	Part No.
Accessory stud kit, 911-930 Turbo	504-9501
Trans mount stud kit, 911-930 Turbo	504-9502
Crankcase thru bolt kit, 911-930 Turbo	204-5405
Head stud kit, 911-930 Turbo	204-4206

MAIN STUDS

ARP® main studs are manufactured from 8740 chrome moly steel, heat-treated in-house to **200,000 psi** tensile strength, and precision J-form threads rolled after heat-treat to create a fastener that has threads 1000% stronger than others. All kits come complete with hardened parallel-ground washers and aerospace quality nuts. Reduce crankshaft flex and main cap freeting with these premium quality main studs. Don't settle for anything less than the best!

Application	2-Blt. Mn.	4-Blt. Mn.
BMC		
A series	206-5401	
B series, 3 cap main	206-5402	
B series, 5 cap main	206-5403	
Triumph TR7	206-5404	
DAIMLER/CHRYSLER		
Neon SOHC & DOHC	141-5801	
FORD 4 and 6-CYLINDER		
Pinto 2000cc	151-5401	
Pinto 2300cc	151-5402	
1600 4-cylinder	151-5403	
Zetec 2.0L	151-5404	
2.5 Duratec V6	253-5402	
HOLDEN		
308, V8	205-5401	205-5501
HONDA		
H22A, H23A, 12-pt. nuts	208-5401	
B16A & VTEC, 12-pt. nuts	208-5402	

Red part numbers indicate new items.

Application	2-Blt. Mn.	4-Blt. Mn.
MAZDA		
Miata 1.6L & 1.8L	218-5401	
MITSUBISHI		
2.0L, 4-cylinder, 16-valve, 4G63	207-5401	
2.6L, 4-cylinder, non-turbo	207-5402	
NISSAN		
Nissan L20 series, 4-cylinder	202-5401	
Nissan L24, L26, L28 series, 6-cylinder	202-5406	
TOYOTA		
3SGTE	203-5404	
Supra 7M GTE, Supra	203-5402	
4AG, 16 valve, 3SEE	203-5403	
Supra 2JZA80	203-5405	
22R	203-5406	
VAUXHALL/OPEL		
2.0L, 16 valve	209-5401	
2.5L, V6	209-5402	
VOLKSWAGEN		
VR6	204-5403	
Rabbit, Golf and Jetta, 1.6L-2L	204-5402	

MAIN BOLTS

Far superior to any other main bolt kit offered for use in competition engines. ARP® main bolts are designed to meet the exacting standards and demands of professional engine builders. Forged from 8740 chrome moly, all bolts feature generous under-head radius and rolled threads for the utmost reliability. The threads are rolled after heat-treating, which gives them about 1000% longer fatigue life than most main bolts, which are threaded prior to heat-treating. Available in the popular High Performance Series, which, at a nominal rating of **180,000 psi**, is a premium replacement for OEM fasteners, or the **200,000 psi** nominal rated Pro Series, application-specific main bolts with reduced wrenching head and are designed for use in competition applications. Parallel-ground, hardened washers are included with each kit.

Application	High Perf. Part No.	Pro Series Part No.
HOLDEN		
308 V8	205-5001	

Application	High Perf. Part No.	Pro Series Part No.
TOYOTA		
Toyota 1600cc		203-5001

CAM TOWER STUD KIT

Camshaft positioning is critical on overhead cam engines and ARP® makes sure that the cam towers are properly secured through use of these durable studs. They're made from 8740 chrome moly steel, with threads rolled after heat treat to ensure optimum fatigue strength. Far superior to OEM fasteners.

Application	Part No.
DODGE	
Neon DOHC stud kit, head #466 7086	141-1001

Red part numbers indicate new items.

STAINLESS STEEL & CHROME MOLY 5-PACKS

NOTE:
Packed 5 on a card

Stainless Steel & Chrome Moly Bolts Available In Sizes From 1/4" to 7/16" With Underhead Lengths Ranging From 1/2" to 5". Hex or 12-Pt. Heads. Packaged In Convenient 5-Pack Cards.

Now you can use premium quality ARP® stainless steel or chrome moly fasteners to install most anything on a car, boat or trailer. The specially alloyed "ARP® 300" stainless steel and heat-treated 8740 chrome moly bolts (black oxide finish) are nominally rated at **170,000 psi** tensile strength to provide a substantial extra margin of safety over Grade 8 hardware.

What's more, you can't beat the gorgeous looks of ARP's specially polished stainless steel fasteners, and their ability to resist rust. They're truly maintenance free!

You can get **5-packs** of any size bolt from 1/4" to 7/16" in lengths ranging from 1/2" to 5", with a choice of hex or 12-point heads. Matching nuts are also available (see pages 74-75).

Thread Size	Underhead Length	Wrenching	Stainless Steel Hex 5-pack	Stainless Steel 12-Pt. 5-pack	Wrenching	Black Oxide Hex 5-pack	Black Oxide 12-Pt. 5-pack
1/4-20	0.515	5/16	621-0515	611-0515	5/16	650-0515	640-0515
1/4-20	0.750	5/16	621-0750	611-0750	5/16	650-0750	640-0750
1/4-20	1.000	5/16	621-1000	611-1000	5/16	650-1000	640-1000
1/4-20	1.250	5/16	621-1250	611-1250	5/16	650-1250	640-1250
1/4-20	1.500	5/16	621-1500	611-1500	5/16	650-1500	640-1500
1/4-20	1.750	5/16	621-1750	611-1750	5/16	650-1750	640-1750
1/4-20	2.000	5/16	621-2000	611-2000	5/16	650-2000	640-2000
1/4-20	2.250	5/16	621-2250	611-2250	5/16	650-2250	640-2250
1/4-20	2.500	5/16	621-2500	611-2500	5/16	650-2500	640-2500
1/4-20	2.750	5/16	621-2750	611-2750	5/16	650-2750	640-2750
1/4-20	3.000	5/16	621-3000	611-3000	5/16	650-3000	640-3000
1/4-20	3.250	5/16	621-3250	611-3250	5/16	650-3250	640-3250
1/4-20	3.500	5/16	621-3500	611-3500	5/16	650-3500	640-3500
1/4-20	3.750	5/16	621-3750	611-3750	5/16	650-3750	640-3750
1/4-20	4.000	5/16	621-4000	611-4000	5/16	650-4000	640-4000
1/4-20	4.250	5/16	621-4250	611-4250	5/16	650-4250	640-4250
1/4-20	4.500	5/16	621-4500	611-4500	5/16	650-4500	640-4500
5/16-18	0.560	3/8	622-0560	612-0560	3/8	651-0560	641-0560
5/16-18	0.750	3/8	622-0750	612-0750	3/8	651-0750	641-0750
5/16-18	1.000	3/8	622-1000	612-1000	3/8	651-1000	641-1000
5/16-18	1.250	3/8	622-1250	612-1250	3/8	651-1250	641-1250
5/16-18	1.500	3/8	622-1500	612-1500	3/8	651-1500	641-1500
5/16-18	1.750	3/8	622-1750	612-1750	3/8	651-1750	641-1750
5/16-18	2.000	3/8	622-2000	612-2000	3/8	651-2000	641-2000
5/16-18	2.250	3/8	622-2250	612-2250	3/8	651-2250	641-2250
5/16-18	2.500	3/8	622-2500	612-2500	3/8	651-2500	641-2500
5/16-18	2.750	3/8	622-2750	612-2750	3/8	651-2750	641-2750
5/16-18	3.000	3/8	622-3000	612-3000	3/8	651-3000	641-3000
5/16-18	3.250	3/8	622-3250	612-3250	3/8	651-3250	641-3250
5/16-18	3.500	3/8	622-3500	612-3500	3/8	651-3500	641-3500
5/16-18	3.750	3/8	622-3750	612-3750	3/8	651-3750	641-3750
5/16-18	4.000	3/8	622-4000	612-4000	3/8	651-4000	641-4000
5/16-18	4.250	3/8	622-4250	612-4250	3/8	651-4250	641-4250
5/16-18	4.500	3/8	622-4500	612-4500	3/8	651-4500	641-4500
5/16-18	4.750	3/8	622-4750	612-4750	3/8	651-4750	641-4750
5/16-18	5.000	3/8	622-5000	612-5000	3/8	651-5000	641-5000
3/8-16	0.500	3/8	623-0500	613-0500	3/8	652-0500	642-0500
3/8-16	0.750	3/8	623-0750	613-0750	3/8	652-0750	642-0750
3/8-16	1.000	3/8	623-1000	613-1000	3/8	652-1000	642-1000
3/8-16	1.250	3/8	623-1250	613-1250	3/8	652-1250	642-1250
3/8-16	1.500	3/8	623-1500	613-1500	3/8	652-1500	642-1500
3/8-16	1.750	3/8	623-1750	613-1750	3/8	652-1750	642-1750
3/8-16	2.000	3/8	623-2000	613-2000	3/8	652-2000	642-2000
3/8-16	2.250	3/8	623-2250	613-2250	3/8	652-2250	642-2250
3/8-16	2.500	3/8	623-2500	613-2500	3/8	652-2500	642-2500
3/8-16	2.750	3/8	623-2750	613-2750	3/8	652-2750	642-2750
3/8-16	3.000	3/8	623-3000	613-3000	3/8	652-3000	642-3000
3/8-16	3.250	3/8	623-3250	613-3250	3/8	652-3250	642-3250
3/8-16	3.500	3/8	623-3500	613-3500	3/8	652-3500	642-3500
3/8-16	3.750	3/8	623-3750	613-3750	3/8	652-3750	642-3750
3/8-16	4.000	3/8	623-4000	613-4000	3/8	652-4000	642-4000
3/8-16	4.250	3/8	623-4250	613-4250	3/8	652-4250	642-4250
3/8-16	4.500	3/8	623-4500	613-4500	3/8	652-4500	642-4500
3/8-16	4.750	3/8	623-4750	613-4750	3/8	652-4750	642-4750
3/8-16	5.000	3/8	623-5000	613-5000	3/8	652-5000	642-5000
7/16-14	1.500	1/2	624-1500	614-1500	7/16	653-1500	643-1500
7/16-14	1.750	1/2	624-1750	614-1750	7/16	653-1750	643-1750
7/16-14	2.000	1/2	624-2000	614-2000	7/16	653-2000	643-2000
7/16-14	2.250	1/2	624-2250	614-2250	7/16	653-2250	643-2250
7/16-14	2.500	1/2	624-2500	614-2500	7/16	653-2500	643-2500
7/16-14	2.750	1/2	624-2750	614-2750	7/16	653-2750	643-2750
7/16-14	3.000	1/2	624-3000	614-3000	7/16	653-3000	643-3000
7/16-14	3.250	1/2	624-3250	614-3250	7/16	653-3250	643-3250
7/16-14	3.500	1/2	624-3500	614-3500	7/16	653-3500	643-3500
7/16-14	3.750	1/2	624-3750	614-3750	7/16	653-3750	643-3750
7/16-14	4.000	1/2	624-4000	614-4000	7/16	653-4000	643-4000
7/16-14	4.250	1/2	624-4250	614-4250	7/16	653-4250	643-4250
7/16-14	4.500	1/2	624-4500	614-4500	7/16	653-4500	643-4500
7/16-14	4.750	1/2	624-4750	614-4750	7/16	653-4750	643-4750
7/16-14	5.000	1/2	624-5000	614-5000	7/16	653-5000	643-5000

STANDARD & NYLOC 5-PACKS

To compliment ARP® "bulk" 5-pack chrome moly and stainless steel fasteners we have assembled matching groups of nuts. They, too, come in convenient 5-pack skin cards. Take your pick from stainless steel and black oxide finished standard nuts and stainless steel Nyloc self-locking nuts. Available sizes include 1/4-20, 5/16-18, 3/8-16, 7/16-14 and 1/2-13.

5-Packs of Stainless & Chrome Moly Nuts

Thread Size	Style	Stainless Hex	Black Oxide
1/4-20	Standard	400-8651	200-8651
1/4-20	Nyloc	400-8661	
5/16-18	Standard	400-8652	200-8652
5/16-18	Nyloc	400-8662	
3/8-16	Standard	400-8654	200-8654
3/8-16	Nyloc	400-8664	
7/16-14	Standard	400-8656	200-8656
7/16-14	Nyloc	400-8666	
1/2-13	Standard	400-8657	200-8657
1/2-13	Nyloc	400-8667	

HEX NUTS

Constructed from the finest aerospace-quality materials, these hex nuts are available in most sizes to meet your needs. All hex nuts meet ARP's exacting quality control standards and are black oxided. All hex nuts are rated **180,000 psi** tensile strength.

Thread Size	Socket Size	Hex *(1 PC bulk)*	Hex *(2 PC-Pack)*	Hex *(10 PC-Pack)*
1/4-28 ①	7/16	200-8601	200-8621	200-8631
5/16-24	1/2	200-8602	200-8622	200-8632
11/32-24	1/2	200-8603	200-8623	200-8633
3/8-24	9/16	200-8604	200-8624	200-8634
7/16-20	5/8	200-8605	200-8625	200-8635
7/16-20	11/16	200-8606	200-8626	200-8636
1/2-20	3/4	200-8607	200-8627	200-8637
9/16-18	7/8	200-8608	200-8628	200-8638

① This nut comes cad-plated.

12-POINT NUTS

Available in a variety of sizes to suit your needs, all ARP® 12-point nuts are constructed from aerospace-quality materials and meet their high standards of excellence. Rated **180,000 psi** tensile strength.

Thread Size	Socket Size	12-Point *(1 Pc Bulk)*	12-Point *(2 PC-Pack)*	12-Point *(10 PC-Pack)*	12-Point *(SS per PC)*
1/4-28	5/16	300-8300	300-8320	300-8330	
5/16-24	3/8	300-8301	300-8321	300-8331	400-8301
3/8-24	7/16	300-8302	300-8322	300-8332	400-8302
7/16-20	1/2	300-8303	300-8323	300-8333	
1/2-20	9/16	300-8304	300-8324	300-8334	
1/2-20	5/8	300-8306	300-8326	300-8336	
9/16-18	11/16	300-8305	300-8325	300-8335	
5/8-18	13/16	300-8309	300-8329	300-8339	
M8 x 1.00	10mm	300-8340	300-8350	300-8360	
M8 x 1.25	10mm	300-8310	300-8311	300-8312	
M9 x 1.00	11mm	300-8341	300-8351	300-8361	
M9 x 1.25	11mm	300-8342	300-8352	300-8362	
M10 x 1.25	12mm	300-8343	300-8353	300-8363	
M10 x 1.25	12mm	300-8344	300-8354	300-8364	
M10 x 1.50	12mm	300-8345	300-8355	300-8365	
M12 x 1.25	14mm	300-8307	300-8327	300-8337	
*M12 x 1.25	14mm	300-8308	300-8328	300-8338	

**Small collar*

GENERAL PURPOSE NUTS

These hex nuts with flanged collars are available especially for carburetor, valve cover, front cover, oil pan studs and windage tray studs. Made from premium-quality material, they are black oxided or cad-plated. All general purpose nuts are rated **150,000 psi** tensile strength.

Thread Size	Socket Size	Hex *(1 PC bulk)*	Hex *(2 PC-Pack)*	Hex *(10 PC-Pack)*
1/4-28	7/16	200-8609	200-8629	200-8639
5/16-24 ①	1/2	200-8610	200-8620	200-8630
3/8-24 ①	9/16	200-8600	200-8640	200-8650

① This nut comes cad-plated.

Note: Do not use on cylinder heads, mains, or rods!

PLATE NUTS

Plate Nuts are a quick and efficient way to provide a captive self-locking nut wherever you might need one. Ideal for use in difficult to reach areas, particularly when in a hurry. Available in a wide variety, these represent a selection of popular applications. Can be riveted, screwed or welded in position. Made of carbon alloy steel. Finished in cadmium and chromate.

Floating, with Replaceable Nut

Size	NAS	Part No.
10-32	-3	200-9111
1/4-28	-4	200-9112
5/16-24	-5	200-9113

2-Lug, Fixed

Size	NAS	Part No.
10-32	-3	200-9101
1/4-28	-4	200-9102
5/16-24	-5	200-9103
3/8-24	-6	200-9104

2-Lug, Fixed with Counter Sunk Rivet Holes

Size	NAS	Part No.
10-32	-3	200-9106
1/4-28	-4	200-9107
5/16-24	-5	200-9108

Replacement Nut

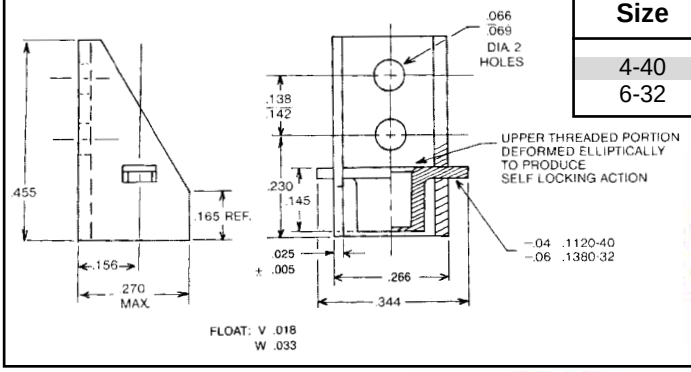
Size	NAS	Part No.
10-32	-3	200-9116
1/4-28	-4	200-9117
5/16-24	-5	200-9118
3/8-24	-6	200-9119

Retaining Clips

Size	NAS	Part No.
10-32	3-3K	200-9201
1/4-28	4-4K	200-9202
5/16-24	5-5K	200-9203

Right Angle, Miniature Floating Panel Fastener

Size	Part No.
4-40	200-9121
6-32	200-9122



SELF-LOCKING NUTS

For high stress, high temperature and severe vibration—all metal six point Jet-nuts and 12-point K-nuts are ideal for use practically everywhere. Features include elliptically offset, light weight, temperature resistant, positive locking and almost indefinitely reusable. The upper portion of the nut is distorted or offset elliptically. The elastic deformation creates a friction hold sufficient to lock the nut. Made of carbon alloy steel, cadmium and chromate finish.

Hex (Jet Nut)

Size	NAS	Part No.
10-32	-3	200-8101
1/4-28	-4	200-8102
5/16-24	-5	200-8103
3/8-24	-6	200-8104

12-Point Reduced Wrenching

Size	NAS	Part No.
10-32	-3	200-8201
1/4-28	-4	200-8202
5/16-24	-5	200-8203
3/8-24	-6	200-8204

Hex, 1/2 Height, Drilled

Size	NAS	Part No.
10-32	-3	200-8112
1/4-28	-4	200-8113
5/16-24	-5	200-8114
3/8-24	-6	200-8115

Hex, 1/2 Height

Size	NAS	Part No.
10-32	-3	200-8107
1/4-28	-4	200-8108
5/16-24	-5	200-8109
3/8-24	-6	200-8110

SPECIAL PURPOSE WASHERS

A true high performance washer from ARP®, available in a variety of sizes and thickness, and with or without I.D. (inside diameter) chamfers. All are constructed from premium chrome moly and are parallel-ground, hardened, and finished in black oxide. Our 3/8" I.D. washers, for example, come in four different sizes (O.D.) and different thicknesses. Special connecting rod washers are available, as are some of the more popular metric sizes. All of the washers are available individually, with most of them also offered in handy 2-piece and 10-piece packages. Build up an inventory of these premium quality washers so you won't get caught short when the need arises.

Application	Inside Dia.	Outside Dia.	Thickness	1 PC. Bulk	2 PC. Pack	10 PC. Pack
Washer, no I.D. chamfer	3/8	5/8	.120"	200-8504	200-8544	200-8554
Washer, with I.D. chamfer	3/8	5/8	.062"	200-8505	200-8675	200-8685
Washer, no I.D. chamfer	3/8	.675	.120"	200-8506	200-8546	200-8556
Washer, no I.D. chamfer	3/8	3/4	.120"	200-8507	200-8677	200-8687
Washer, with I.D. chamfer	3/8	3/4	.120"	200-8517	200-8547	200-8557
Washer, radiused O.D., no I.D. chamfer	3/8	7/8	.150"	200-8508	200-8678	200-8688
Washer, no chamfer	5/16	.550	.120"	200-8593	200-8578	200-8584
Washer, with chamfer	5/16	.550	.120"	200-8594	200-8579	200-8585
Washer, no chamfer	5/16	.675	.120"	200-8595	200-8580	200-8586
Washer, with chamfer	5/16	.675	.120"	200-8575	200-8581	200-8587
Washer, no chamfer	5/16	13/16	.120"	200-8576	200-8582	200-8588
Washer, with chamfer	5/16	13/16	.120"	200-8577	200-8583	200-8589
Washer, with I.D. chamfer	7/16	13/16	.120"	200-8509	200-8529	200-8539
Washer, no I.D. chamfer	7/16	13/16	.120"	200-8510	200-8520	200-8530
Washer, with I.D. chamfer, stainless	7/16	13/16	.120"	400-8509	400-8529	400-8539
Connecting rod washer, with I.D. chamfer	7/16	.675	.062"	200-8501	200-8671	200-8681
Connecting rod washer, with I.D. chamfer	7/16	3/4	.073"	200-8502	200-8672	200-8682
Washer, no I.D. chamfer	7/16	3/4	.120"	200-8511	200-8521	200-8531
Washer, with I.D. chamfer	7/16	3/4	.120"	200-8518	200-8548	200-8558
Washer, with I.D. chamfer	7/16	7/8	.120"	200-8512	200-8522	200-8532
Washer, no I.D. chamfer	.471	1.300	.120"	200-8429	200-8439	200-8449
Washer with I.D. chamfer	1/2	7/8	.120"	200-8513	200-8523	200-8533
Washer, no I.D. chamfer	1/2	7/8	.120"	200-8514	200-8524	200-8534
Washer, no I.D. chamfer	9/16	1	.120"	200-8515	200-8525	200-8535
Washer, no I.D. chamfer	8mm	.575"	.062"	200-8641	200-8642	200-8643
Washer, no I.D. chamfer	10mm	3/4	.120"	200-8519	200-8679	200-8689
Washer, no I.D. chamfer	10mm	.850	.120"	200-8590	200-8591	200-8592
Washer, no I.D. chamfer	12mm	3/4	.120"	200-8516	200-8526	200-8536
Washer, no I.D. chamfer	12mm	7/8	.120"	200-8500	200-8527	200-8537

Red part numbers indicate new items.

GENERAL PURPOSE WASHERS

Quality washer for many applications, such as attaching accessories, chassis components, etc. They are not of the hardness required for use on cylinder heads, mains and connecting rods. Available in black oxide and stainless steel. Stainless demonstrates excellent corrosion resistance. Washers have over-sized I.D. (inside diameter) to clear most under-bolt head radii. Available for 1/4, 5/16, 3/8, 7/16 and 1/2" shank bolts and studs. ***Note: Not for use on cylinder heads, mains, or rods!***

Application	Inside Dia.	Outside Dia.	Thickness	Black Oxide	Stainless
General purpose washer	1/4	1/2	.063"	200-8401	200-8414
General purpose washer	1/4	9/16	.063"	200-8408	200-8409
General purpose washer	5/16	9/16	.063"	200-8402	200-8403
General purpose washer	5/16	5/8	.063"	200-8410	200-8411
General purpose washer	3/8	5/8	.063"	200-8404	200-8405
General purpose washer	3/8	11/16	.075"	200-8412	200-8413
General purpose washer	7/16	3/4	.063"	200-8406	200-8415
General purpose washer	1/2	7/8	.063"	200-8407	

Red part numbers indicate new items.

INSERT WASHERS

These handy washers are made to protect the top of holes from galling or collapsing around studs or bolts. They're ideal for head bolt holes, mid-motor plates, or any other high-wear area that requires a washer. Easy to install by just oversizing hole and pressing in washer. ARP® Insert Washers are fully CNC machined from premium thru-hardened 8740 stock.

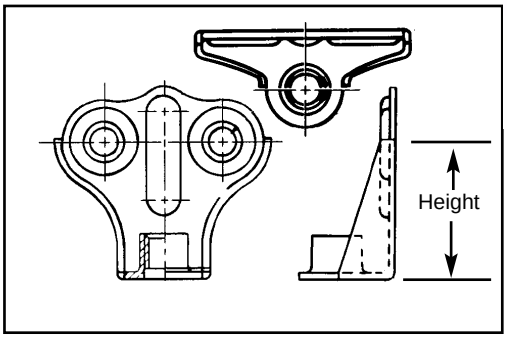
Note: Step washers for Ford applications also listed on head bolt pages

Size I.D.	Size O.D.	1 PC-Bulk	2 PC-Pack	10 PC-Pack
1/4	.317	200-8560	200-8565	200-8570
5/16	.380	200-8561	200-8566	200-8571
3/8	.443	200-8562	200-8567	200-8572
7/16	.812	200-8563	200-8568	200-8573
7/16	.875	200-8596	200-8597	200-8598
1/2	.565	200-8564	200-8569	200-8574

Red part numbers indicate new items.

STAND-OFF BRACKETS

These handy devices are excellent for attaching hydraulic lines, control cables or wire bundles to the chassis. They're stamped from 125,000 psi steel, heat-treated, and cadmium plated for extra durability. They have a ribbed back for extra strength. Attach with 10/32 bolts. Available in three heights.



Application	Part No.
10.32 x .465" Height	200-9301
10.32 x .665" Height	200-9302
10.32 x .865" Height	200-9303

WELD BUNGS

ARP® has introduced a line of premium quality weld-in bungs. The parts are CNC machined from solid aluminum billet (6061) or 1018 mild steel. Applications include, but are not limited to: oil or fuel tanks, radiators, valve covers, manifolds, and rear axle housings. Fittings are available with female pipe threads, male AN, and female O-ring types. The fittings come in sizes: 1/4, 3/8, 1/2, 3/4, and 1 inch sizes; NPT -6 thru -20 AN; and -6 thru 120 O-ring sizes.

NPT

Aluminum Size	Aluminum Part No.	Steel Size	Steel Part No.
1/4	800-8101	1/4	800-8201
3/8	800-8102	3/8	800-8202
1/2	800-8103	1/2	800-8203
3/4	800-8104	3/4	800-8204
1	800-8105	1	800-8205

AN Male

Aluminum Size	Aluminum Part No.	Steel Size	Steel Part No.
AN6	800-8106	AN6	800-8206
AN8	800-8107	AN8	800-8207
AN10	800-8108	AN10	800-8208
AN12	800-8109	AN12	800-8209
AN16	800-8110	AN16	800-8210
AN20	800-8111	AN20	800-8211

AN O-Ring

Aluminum Size	Aluminum Part No.	Steel Size	Steel Part No.
-6	800-8112	-6	800-8212
-8	800-8113	-8	800-8213
-10	800-8114	-10	800-8214
-12	800-8115	-12	800-8215
-16	800-8116	-16	800-8216
-20	800-8117	-20	800-8217

GETTING THE CORRECT ARP HEAD STUD/BOLT FOR THE APPLICATION

Today, there are literally dozens of different cylinder head and engine block combinations for the more popular applications, and new offerings coming out all the time. It is virtually impossible for ARP's engineering staff to obtain detailed information from all of these various sources, so it may be necessary for customers to calculate exactly what they have so the correct cylinder head studs or bolts are used. Whether it's a small block Chevy engine or a Honda VTEC, the procedure remains the same.

The illustration on the right shows the nine different variables that come into play when determining the proper fastener for a particular position. Many cylinder heads have different column heights, etc. at various positions, and additional variables come into play when using aftermarket engine blocks (some of which have "blind" tapped holes for attaching the heads that are shallower than OEM). It is therefore critically important that you determine exactly how many different bolt/hole combinations exist for the cylinder head installation.

You must have the following data:

A. Depth of cylinder head counter bore _____

B. Diameter (o.d.) of head counter bore _____

C. Column height (net thickness of head) _____

D. Diameter (o.d.) of bolt hole in block _____

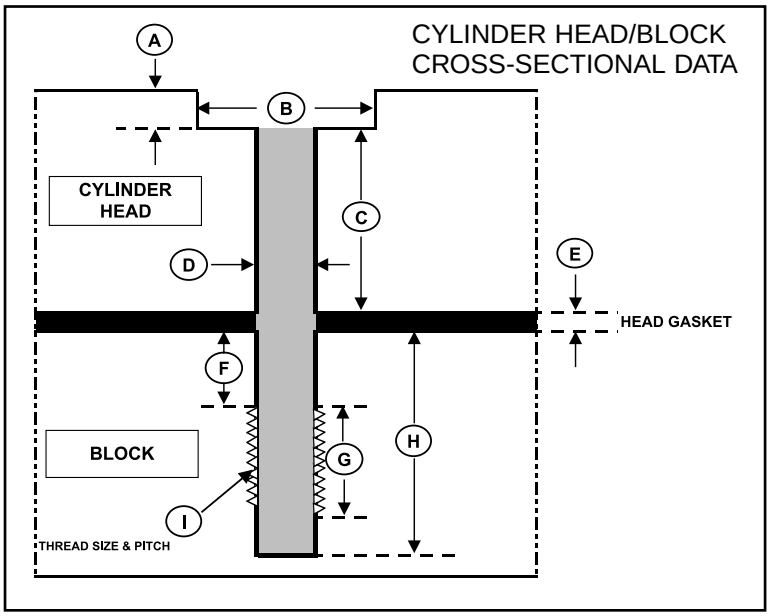
E. Head gasket thickness (uncompressed) _____

F. Depth of counter bore in block _____

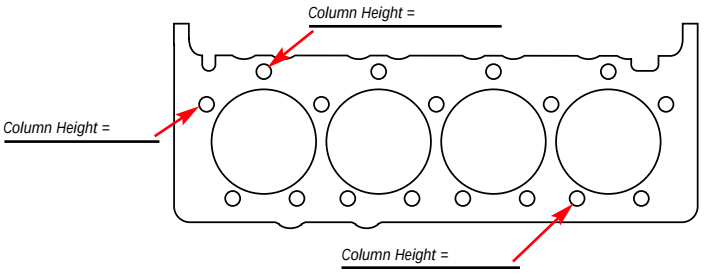
G. Length of thread in block _____

H. Depth of hole from surface to bottom _____

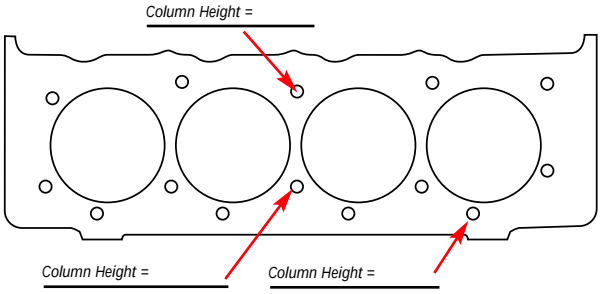
I. Thread size and pitch _____



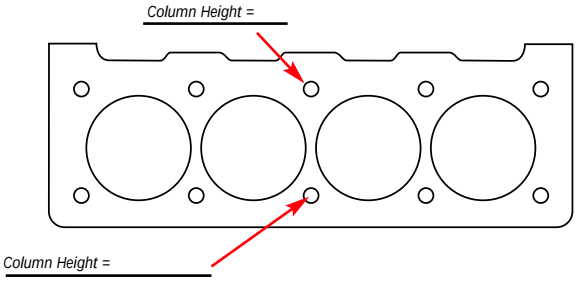
STANDARD SMALL BLOCK CHEVROLET

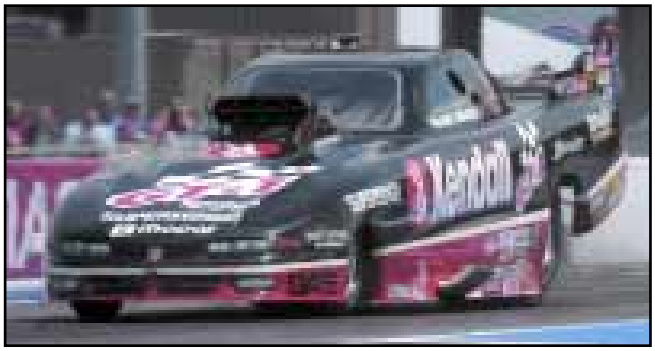


STANDARD BIG BLOCK CHEVROLET



CHRYSLER, FORD & MOST 4-CYLINDER





Frank Manzo - Many-time NHRA Champ in Alcohol F/C

Art Gallant - 2002 NHRA Champ in Alcohol Dragster

ASSEMBLY LUBE & SEALER

It's difficult to determine the amount of torque required to provide the correct preload and clamp force of a given fastener. For example—when tightened, dry uncoated fasteners use up about 95% of the applied torque simply by overcoming the friction between the male and female threads. To ensure that all ARP® fasteners provide the optimum level of service, the installed residual stress is calculated and verified experimentally using a superior quality lubricant. It is important to note that the friction coefficients of lubricants vary dramatically, making it difficult to consistently produce the exact amount of stress within the fastener to clamp the components together. That's why ARP® developed an ultra-consistent lubricant and recommend the use of our premium grade **ASSEMBLY LUBRICANT** or **THREAD SEALER** in order to precisely duplicate the recommended tightening specifications provided with all ARP® fasteners.

Assembly Lubricant

- Premium grade Moly base with rust and corrosion inhibitors.
- Effective lubrication range: -30˚F to 750˚F.
- Load range: **500,000 psi**.
- Other applications: Primary assembly lube for engine components, press fitting, gear trains and general machinery.

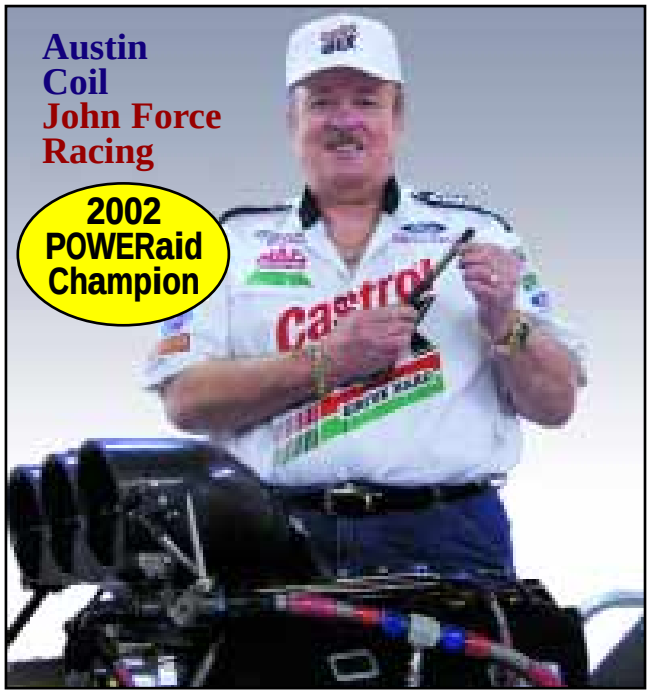
Thread Sealer

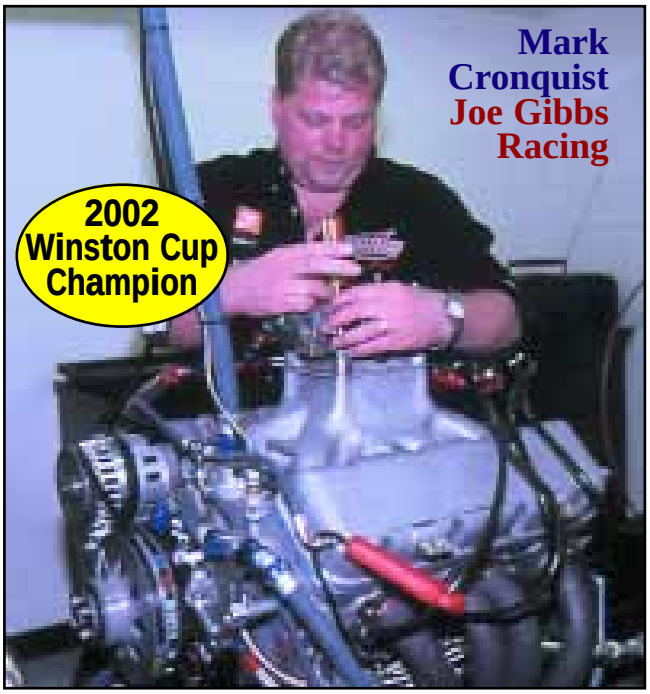
- Teflon based w/rust & corrosion inhibitors.
- Effective range: -30˚ to 550˚F.
- Sealant range: **10,000 psi** (pressure).
- Application: delivers a flexible leak-proof seal in aluminum, steel, stainless steel and plastic against coolants, water, gasoline, natural gas and LPG.
- Designed for use with bolts

NOTE: These products are formulated for use on fasteners. Not recommended for use on rotating components.

Assembly Lubricant (0.5 fl. oz.)	**100-9902**
Assembly Lubricant (1.69 fl. oz.)	**100-9903**
Assembly Lubricant (1 pt. brush top container)	**100-9905**
Assembly Lubricant (1/2 pt. brush top container)	**100-9906**
Thread Sealer (1.69 fl. oz.)	**100-9904**

Top Engine Builders Insist On ARP!





Space limitations prevent listing all the top notch professionals who use ARP® fasteners to build the nation's premiere racing engines. Two of the most diverse are Austin Coil, award-winning Crew Chief for drag racing's winningest driver, Funny Car champion John Force, and Mark Cronquist, the man in charge of the successful Winston Cup engine program at Joe Gibbs Racing for Winston Cup standouts Tony Stewart and Bobby Labonte.

THREAD CLEANING CHASERS

ARP's handy thread cleaning chaser taps are designed with correct thread pitch and diameter to clean dirty blind or thru holes. Three flute designs offer added strength with an easy starting point. Taps come in five SAE sizes: 1/4", 5/16", 3/8", 7/16" and 1/2", as well as metric. They are sold individually or in sets. Please note that these are strictly *cleaning* taps and are not designed to cut thread. They are a handy addition to the tool box of any serious engine builder and an essential aid to preparing any block for final assembly. Don't take a chance on weakening block and cylinder head threads. Use these handy thread cleaning chasers whenever possible!

Size	Part No.	Size	Part No.
1/4-20	911-0001	M8 x 1.25	912-0001
5/16-18	911-0002	M10 x 1.25	912-0002
3/8-16	911-0003	M10 x 1.50	912-0003
7/16-14	911-0004	M11 x 1.25	912-0004
1/2-13	911-0005	M11 x 1.50	912-0005
		M12 x 1.25	912-0006
		M12 x 1.50	912-0007
		M12 x 1.75	912-0008

Combination Sets	
SAE Combo Pack. 5-pc (1/4 through1/2)	911-0006
Metric Combo Pack, 4-pc 1.25 Pitch	912-0009
Metric Combo Pack, 4-pc 1.50 & 1.75 Pitch	912-0010

Red part numbers indicate new items.

SPARK PLUG INDEXER

By allowing you to consistently position spark plug ground electrodes out of harm's way, the ARP® indexing tool takes the guess-work out of installing spark plugs where the combustion chamber and high dome piston clearances is critical. Designed to fit in the palm of your hand, this tool eliminates the need to perform cylinder head calibration. Best of all, the ARP® indexer is made from aluminum alloy with precision machined threads that allows you to proof the quality of spark plug threads before installation in expensive cylinder heads. Anodized for protection and quick recognition. For use with tapered gasket 14mm plugs.

Part No.
920-0001

OIL PUMP PRIMER KITS

Those first moments an engine runs prior to building oil pressure are when damage can easily occur. ARP's Oil Pump Primer Kit lets you spin the oil pump with a drill motor and bring up the oil pressure prior to starting the engine. This prevents any unnecessary wear or damage to rotating, reciprocating and valve train components. ARP's rugged primer shafts are rated at **170,000 psi** to ensure extended service life of this valuable tool. They feature a special billet aluminum sleeve that accurately positions the shaft and keeps it from wobbling.

Application	Part No.
CHEVROLET	
SB & BB and 90° deluxe, 9.00" O.A.L.	130-8802
FORD	
Small block, 1/4" hex drive	150-8801
351C, 351W, 351M, 400, 429/460, 5/16" hex dr.	150-8802

ROD BOLT EXTENSIONS

A long taper and full radius prevents nicking and scratching of crankshaft journals during connecting rod installation. ARP® rod bolt extensions act as a guide during piston and rod installation—they will also hold the bearing shell in position in some applications. Available in 5/16", 3/8" and 7/16" extensions are packaged in pairs and are hard anodize color coded for ease of identification.

Size	Part No.
5/16	910-0001
3/8	910-0003

Size	Part No.
7/16	910-0004
Set of 3	910-0005

TAPERED RING COMPRESSORS

Available in inches & millimeters

ARP's new ring compressors are CNC machined from 6061-T6 billet tube material and feature a true radius for each different bore diameter. What's more, they are relieved for wire O-rings on bottom. Type 3 anodizing is used for long life, and the bore size is prominently engraved in 3/4" high numbers for easy identification. Standard stocking sizes from 4" to 4.65" (SAE) and 75mm to 95.5mm (metric). The true radius design is far superior to conventional "tapered" devices, and widely acclaimed by professional engine builders! This is truly the very best piston ring compressor on the market today.

Size	Part No.	Size	Part No.	Size	Part No.	Size	Part No.
4.000	900-0000	4.110	900-1100	4.187	900-1870	4.350	900-3500
4.005	900-0050	4.115	900-1150	4.220	900-2200	4.360	900-3600
4.010	900-0100	4.125	900-1250	4.235	900-2350	4.375	900-3750
4.020	900-0200	4.130	900-1300	4.250	900-2500	4.390	900-3900
4.030	900-0300	4.135	900-1350	4.255	900-2550	4.400	900-4000
4.040	900-0400	4.140	900-1400	4.260	900-2600	4.440	900-4400
4.060	900-0600	4.145	900-1450	4.270	900-2700	4.470	900-4700
4.070	900-0700	4.155	900-1550	4.280	900-2800	4.500	900-5000
4.080	900-0800	4.165	900-1650	4.290	900-2900	4.530	900-5300
4.090	900-0900	4.170	900-1700	4.310	900-3100	4.560	900-5600
4.100	900-1000	4.175	900-1750	4.320	900-3200	4.600	900-6000
4.105	900-1050	4.185	900-1850	4.330	900-3300	4.625	900-6250

Red part numbers indicate new items.

Size	Part No.	Size	Part No.	Size	Part No.
75.00mm	901-7500	82.00mm	901-8200	89.00mm	901-8900
75.50mm	901-7550	82.50mm	901-8250	89.50mm	901-8950
76.00mm	901-7600	83.00mm	901-8300	90.00mm	901-9000
76.50mm	901-7650	83.50mm	901-8350	90.50mm	901-9050
77.00mm	901-7700	84.00mm	901-8400	91.00mm	901-9100
77.50mm	901-7750	84.50mm	901-8450	91.59}m	901-9150
78.00mm	901-7800	85.00mm	901-8500	92.00mm	901-9200
78.50mm	901-7850	85.50mm	901-8550	92.50mm	901-9250
79.00mm	901-7900	86.00mm	901-8600	93.00mm	901-9300
79.50mm	901-7950	86.50mm	901-8650	93.50mm	901-9350
80.00mm	901-8000	87.00mm	901-8700	94.00mm	901-9400
80.50mm	901-8050	87.50mm	901-8750	94.50mm	901-9450
81.00mm	901-8100	88.00mm	901-8800	95.00mm	901-9500
81.50mm	901-8150	88.50mm	901-8850	95.50mm	901-9550

ROD BOLT STRETCH GAUGE

We highly recommend using a stretch gauge when installing rod bolts and other fasteners where it is possible to measure the length of the bolt after tightening. It is the most accurate way to determine the correct pre-load in the rod bolt. Simply follow manufacturer's instructions, or use the chart on page 26 of this catalog for ARP® fasteners. Measure the fastener prior to starting, and monitor overall length during installation. When the bolt has stretched the specified amount, the correct preload, or torque, has been applied. We recommend you maintain a chart of all rod bolts, and copy down the length of the fastener prior to and after installation. If there is a permanent increase of .001" in length or more, or if there is deformation, the bolt should be replaced immediately. Don't chance it! A sample chart is as follows:

ARP® offers a highly accurate stretch gauge with a dial indicator that reads in increments of .0005". Features extra heavy springs for consistent repetition. Comes with a heavy-duty, insulated plastic carrying case for protection. A "must" for any serious engine builder.

Stretch Gauge **100-9941**

ROD #1	ROD #2	ROD #3	ROD #4
INSIDE BOLT IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	*INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	*INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	*INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____
ROD #5 *INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	**ROD #6** *INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	**ROD #7** *INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	**ROD #8** *INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____

ROD #1	ROD #2	ROD #3	ROD #4
INSIDE BOLT IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	*INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	*INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	*INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____
ROD #5 *INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	**ROD #6** *INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	**ROD #7** *INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____	**ROD #8** *INSIDE BOLT* IN_____OUT_____ *OUTSIDE BOLT* IN_____OUT_____

TRIBUTE TO SMOKEY YUNICK

For many years "Smokey" Yunick served as a valued tech consultant and spokesman for ARP®. He was a popular host of our Tech Seminars at trade shows, and his knowledge of fasteners was truly astounding. Smokey passed away in 2002, but his wit and wisdom will live on. Here are a few of his observations and tech tips. R.I.P, Smokey!

Yesterday, fastener technology was pretty much "cut and try." Often times the thinking was, if it breaks…go to one size bigger. The game of substituting aircraft fasteners didn't work either. Although the quality was there, aviation fasteners simply didn't exist for across-the-board substitution. They still don't.

In real life there was no bullet-proof manufacturer of fasteners specifically for race cars. There were attempts by various fastener manufacturers to claim expertise on a few special applications like rod bolts and wheel studs. But in reality, results were mixed, from good to terrible.

Hall of Fame Mechanic "Smokey" Yunick

It's this simple; properly designing racing fasteners requires the skills of metallurgists, stress analysts and engineers. And to make them requires special machinery and manufacturing techniques. It is also a fact that there is no way to do this cheaply, or in high volume production.

I was asked to be a spokesman for ARP®. Because I had never done this before, I made it a point to visit the ARP® manufacturing facilities to see if their products were good enough for me to endorse comfortably. The visit blew my mind. I've been around some nut and bolt joints before, but nothing I'd seen before could compare with the quality of inspection of the raw materials and their manufacturing process.

Examining the "Over-Kill" fallacy

If there's one thing I've heard over and over from visitors to trade shows and races it's,"*Your fasteners are great. I'm not having any problems but I'm being told, by your competitors, that ARP® is over-kill and therefore I'm wasting some money when I buy ARP® pan bolts, manifold bolts or just about everything except for certain critical engine, drive train or suspension fasteners.*" My first instinct is to say they are full of _ _ _ _.

But the subject is worth talking about. Cost is an important consideration when you choose a particular vendor's offering. Still, if you use lesser quality fasteners and they were not subject to many assembly and disassembly cycles, by people with varying skills from professional to rank amateur. Maybe, just maybe, you could make a case for minimum grade fasteners that are over designed, sizewise, to allow a reasonably safe application for conservative usage.

Now, lets get back in our world. The real world. We can expect the engines and vehicles to be leaned on, from a little to beyond any sensible extreme. We can expect 10 or more assembly/disassembly cycles. We can expect over-torquing, which will leave the fastener looking 100%—but actually in a condition RED, semi-failed mode. We can expect some fasteners that are minimal in quality to end up in a critical, high stress area. We can't expect everyone to be able to look at a fastener and determine its quality—by looks, or even by markings. So we leave ourselves wide open for expensive and possibly dangerous results. For the amount of money saved by "type rating" every fastener's capability, and consideration of a long range view of the best mix of customers—I recommend all fasteners be of a quality that *does* exceed the minimum standards.

"It's to your advantage to know fasteners."

To thoroughly understand it all would require at least 4 specific engineering degrees and 20 years of hands on experience in each. Nothing is forever, but take my word for it, ARP® is the only game in town today. Just about every successful racer I know today uses their stuff 100%. You can help yourself in reference to material specs, thread lubes and torque techniques, also in fastener maintenance and handling. If you do a good job here, you'll never lose position in a race from fastener failure.

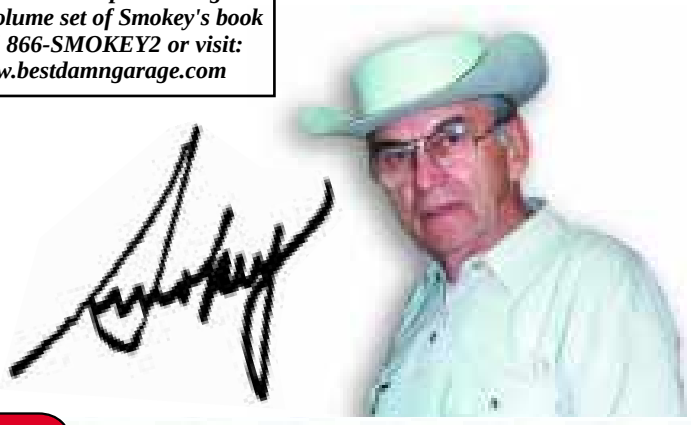
There are many "little things" to consider

1. When you use a locking chemical for studs, bolts or even nuts, consider if you really need it.
2. If you are using a locking chemical, don't force nuts off or studs out without a proper first step, like heat or release chemical.
3. If you can't easily screw a nut and bolt together by hand they shouldn't be used.
4. Consider the importance in regard to how many exposed threads are left when fastener is set. Turns out this has a bearing on necessary torque and ultimate strength of the fastener.
5. Gradually try to understand and learn the difference in the various steels used in fasteners.
6. Turns out, the best way to consider a fastener as a spring of correct elasticity for that specific job. Yup, a fastener works best when stretched a specific amount.
7. You have got to start studying fasteners just like you do pistons, cranks, rods, etc. There's a lot to learn if you know what to look for.
8. The more you understand all the design limitations of fasteners, the better the engine durability will be.
9. If you can't stretch the bolt enough, it can still fatigue, lose torque or get loose.
10. Use a stretch gauge whenever possible. This is the only foolproof method of getting the correct clamping force.
11. Get access to a master gauge to check your torque wrenches. You'd be surprised at how many torque wrenches read incorrect.
12. Don't forget that you'll get different torque readings when using different lubricants.
13. Use ARP's moly lube whenever possible.

Get the "Inside Scoop" in Smokey's book…

In addition to being one of racing's most famous innovators and personalities, Smokey Yunick was known for being opinionated on many matters. He told it like it was, according to Smokey. Before his passing, Yunick spent considerable effort compiling anecdotes from his illustrious career. It's a "must have" book for anyone who is into auto racing. From Daytona Beach to Indy, Smokey lets it rip!

For details on purchasing a 3-volume set of Smokey's book call 866-SMOKEY2 or visit: www.bestdamngarage.com



APPAREL

You know that ARP® fasteners are excellent quality, and the same goes for our line of racing apparel. We're proud of our jackets, T-shirts, hats, patches and pins. We'd be honored if you wear our colors. They are distinctive, to say the least.

RACING JACKETS

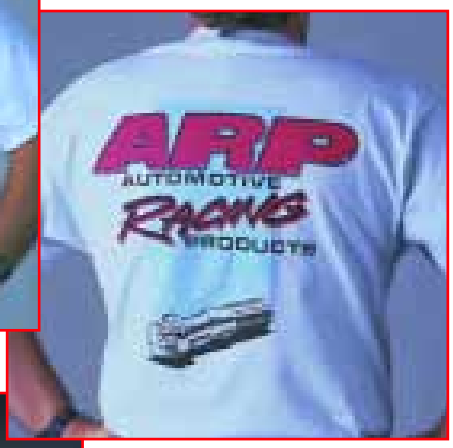
Here are a couple distinctive designs that combine attractive styling with superior quality through and through. First of all, they're American made. That's one thing we believe in strongly at ARP®! Take your pick from the traditional black suede-like material or new "checkered flag" motif. There's a full nylon lining with a handy zippered pocket. A heavy-duty metal zipper provides closure, while an elastic waistband and cuffs, plus generous side pockets, round out the technical features. Graphically, there's a large ARP® logo embroidered on the back and a smaller version in front. The jackets are available in sizes M to XXXL. Call for current prices.

BLACK RACING JACKET

CHECKERED FLAG

RACING T-SHIRTS

Our T-shirts are heavy-duty 100% cotton and built to last! They are available in three popular colors: white, natural, ash and pebble. On the back is a large silk-screened full-color graphic with a "blueprint" theme and a small Automotive Racing Products logo is screened on the front. ARP® T-shirts are available in sizes Small to XXXL. Children sizes also available. Please state sizes when ordering. All ARP® apparel is sold on the basis of your being responsible for sizes. If there is a problem, you must return the garment to ARP® within a week of receipt. Any garment that has been worn and soiled, dry cleaned or laundered, cannot be returned. Please call for current pricing.



RACING T-SHIRTS

BASEBALL CAPS

These elegant, pin-striped hats are made of a premium grade cotton and "breathe" well for year-around comfort. The familiar ARP® logo is embroidered on the front. One size fits all. Please call toll-free for current pricing.

LAPEL PINS

No collection is complete without one of these nifty cloisonné replicas of the ARP® logo. Features two attachment pins for extra security. Please call for current pricing.

UNIFORM PATCHES

Add color to your jacket, crew uniform, driving suit, shop apron, or ??? with these top quality embroidered emblems. They measure approximately 5" wide by 2" tall. Please call for current pricing.

BASEBALL CAPS

UNIFORM PATCHES

LAPEL PINS

ORDERING PROCEDURES

All apparel must be ordered directly from ARP®. Our dealers do not handle apparel. You may charge the order to your Visa or Master Card account. Please make sure you order the correct sizes, as we have a very strict return policy. Appropriate shipping charges will be added to each order; plus sales tax for California residents.