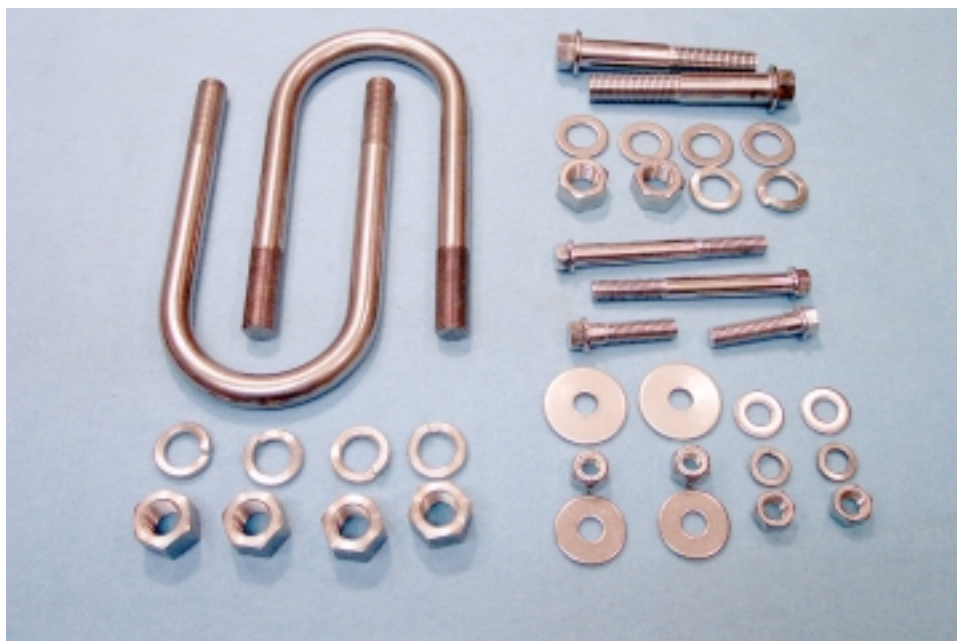


HIGH STRENGTH *and*

Totally Stainless

Finally, the look and corrosion resistance of Stainless for high strength applications

Since the beginning of my automotive insanity, one goal for my projects was to have a finished, clean, and professional look to whatever I did. In the early days, when I scrounged change for that five gallons of gas a dollar would buy, the real goal was to make a \$50 car look like something better (and get quality cruise time in with my worthless buddies or current girl). You were what you drove and what we were was teenagers with empty pockets.



An example of the kits available now that high strength stainless is available for chassis components. This one is used on 1967-72 GM trucks and is a complete rear suspension bolt kit.

Early on fasteners became a focus because everything I owned needed work and rusted, crusted hardware made keeping my heaps running harder. I spent time on a bench grinder/wire wheel knocking rust off. I bead blasted others. I tried paint, powder, and even plating. Still, when all was said and done, fasteners reverted back to rust. When I finally discovered stainless steel hardware, I was happy as a pig dipped in slop.

I found a lot of use for the various types of available hardware, and discovered such gems as stainless hex socket-head pipe plugs. When Totally Stainless and I were introduced, the horizons expanded

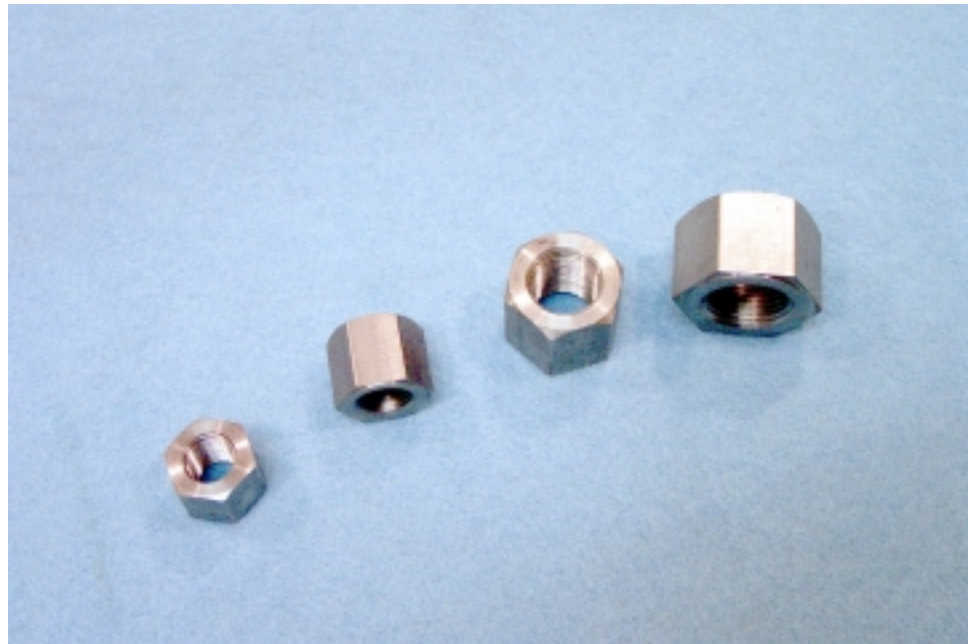
considerably because those guys have reproduced a tremendous amount of the odd-ball OEM specialty fasteners we all look for and never seem to find. For a while I thought everything in the known universe I needed in stainless fasteners was to be found at Totally Stainless. Then the bottom dropped out.

What broke my little heart was the discovery that high strength fasteners were simply not available in stainless - except as very expensive one-off hand-made items. Of course, as most of us know, ARP stepped up a few years ago and began offering a limited line of stainless high-strength bolts for dressing up our project engines.

That's right, you DID see high strength stainless U-bolts. Totally Stainless offers them in an extensive range of sizes and lengths. In most cases they will either have what you need in stock or can have it special ordered for you.



At this point the only sticking point for U-bolts is the labor-intensive fabrication of the special long nuts required in many applications. Totally Stainless has them, but is working at a new process to fabricate them at significantly lower cost.



A reminder of just why you might want to replace the old carbon steel hardware with high strength stainless. I'll leave it up to you: What U-bolt do you think looks better and will last longer?

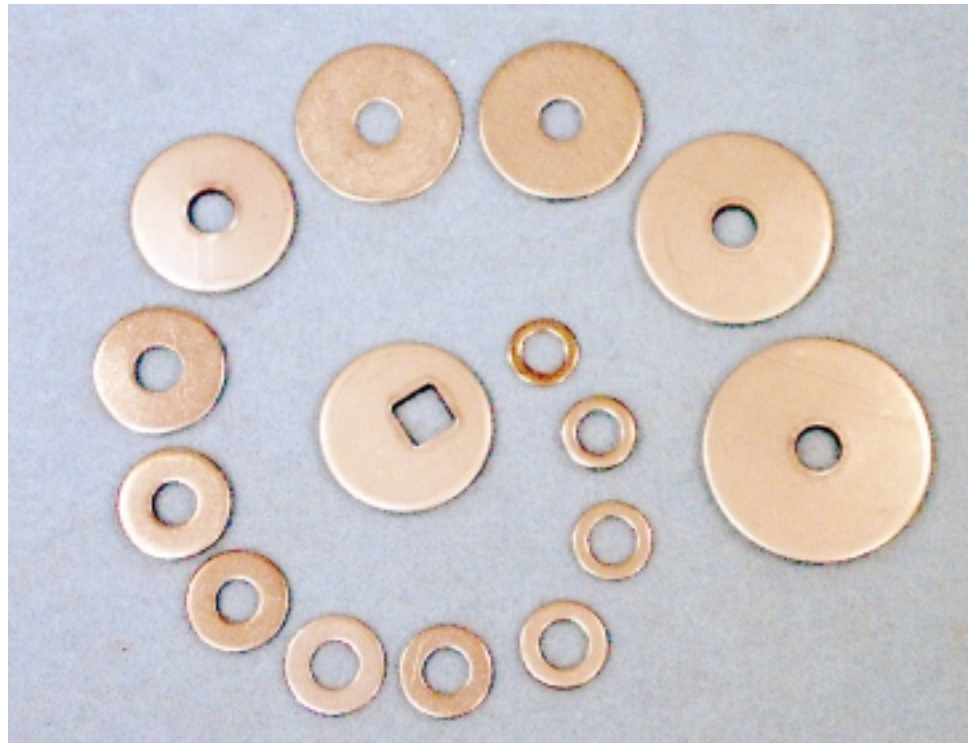
They cover a fair number of common 1/4, 5/16, 3/8, and 7/16 sizes in up to 6-inch lengths, so in many cases at least the engine dress could be completed in stainless. Totally Stainless stocks the entire ARP line of high-strength stainless hardware. This still left the larger sizes and lengths missing and meant that suspension hardware was still pretty much left to carbon steel high-strength, grade 5 and 8 components.

Unfortunately, some of the more foolhardy tried using low-strength stainless. When it failed and suspension parts went missing I can only suspect whoever was behind the wheel had a wild ride to try to survive. Doc Hammett at Totally Stainless got

tired of telling people, "No, there isn't any high-strength stainless available for suspension use and NO, you should NOT use low-strength stainless." So he spent a lot of time and money to develop a variety of just those items everyone was asking for of a quality and strength that would let us relax and feel confident behind the wheel.

The long and short of it is Totally Stainless now has high-strength bolts in sizes including 1/2, 9/16, 5/8, and 3/4 in lengths up to 12 inches. TS uses a special stainless steel that develops a minimum of 180,000 psi yield and 200,000 psi tensile strength. The bolt heads are all reduced-hex washer-head 6-point type.

To compliment the HS stainless bolts, you need a lot of different styles and shapes of washers. Doc Hammett has been relentless in developing all the required washers for OEM reproduction applications and much more. This shows a selection of just 3/8 flat washers.



In addition, TS has an ever-growing selection of U-bolts in the same high-strength stainless. These are developed for specific application, but it turns out there are enough different sizes so most applications can be covered. The U-bolts come in sizes from 7/16 to 3/4 inches and 1-1/2 to 3-5/8 inch tube diameters and lengths up to 9 inches currently and more are coming as needs are identified.

Definitions

If you are going to get it right and make sure you are using the right fasteners to keep you and your project safe and secure, you'll need to know a little about fastener science. Let's take a look at it.

Tensile strength is a term often used to quantify fastener strength. What tensile strength is is the point at which the fastener material will break. Almost all low-strength stainless is either 302 or 304 and has a tensile strength of about 70,000 psi.

Another kit. As you can see, there's a lot more to a complete kit than just a handful of bolts. You've got bolts, nuts, washers, studs, self-locking nuts, cotter pins, and grease zerks in this kit alone. By the way, if Totally stainless doesn't already have a kit for your application, they can easily work with you to supply all the needed parts for your project.





That's right, I said cotter pins and grease zerks. Don't you hate the idea of having your entire suspension detailed out, only to discover these items rusting away?

As mentioned above, the new TS hardware has 200,000 psi tensile strength minimum. For comparison, Grade 2 carbon steel has 69,000, Grade 5 has 120,000 and Grade 8 150,000 psi tensile strength.

Of equal importance is yield strength. Yield strength is the point at which the fastener material begins to bend or deform. Obviously, this is critical because if a fastener is bent out of shape it can be disastrous to suspension integrity and geometry. Low strength stainless has a 45,000 psi yield, Grade 2 carbon steel 40,000, Grade 5 100,000, and Grade 8 140,000. Compare this to the TS high-strength stainless at 180,000 psi.

While hardness is a common way to identify the overall strength of carbon steel, it has a lot less validity in discussing stainless. Hardening, either case-hardening where just the outer layer of the metal is hardened, or through hardening are typically done by heat treating. Low-strength stainless is more ductile (and therefore less prone to fatigue than carbon steel) and strength can be increased in 300-series stainless alloys by working the metal in hardware up to about 3/8 inch diameter. This can be done by compression (where the wire is drawn through a die at high pressure) or by extrusion in the process of forming the hardware. The material Totally Stainless uses for its high-strength hardware is called 17-4 PH. It is a precipitation-hardened special formula that's heat treated for strength.



The new HS bolts come in quite a variety. As you can see they are available in thread sizes from 3/8 through 3/4 and in stocked lengths up to 12 inches. The goal was to make sure Totally Stainless could offer this hardware to cover all possible applications.



If you add the line of ARP fasteners offered through Totally Stainless to their own line of HS stainless, you can see that almost every standard size and length bolt is available.

The bottom line is that the conventional Rockwell hardness testing as a means to compare strength between stainless and carbon steel is not done because it has no relevance.

Advantages/disadvantages

A good way to get a handle on where to use the various options might be to look at how stainless and carbon steel compare. Carbon steel hardware is most often marked as to Grade in aftermarket fasteners (although a lot of OEM fasteners are not). It is also relatively inexpensive material so it keeps costs down. On the other hand, carbon steel is subject to corrosion - the major reason we seek out the stainless alternatives. Another problem comes to the front when high carbon steel is electroplated. Because of problems with hydrogen embrittlement plated graded hardware should be re-certified after plating. That's why you will find little reminders along with some hardware that tells you it is **ONLY** for display purposes and not intended for highway use.

Stainless also has advantages and disadvantages. On the down side is its tendency to gall. For this reason, you **MUST** use either a thread locker or anti-seize on stainless or you could end up welding the hardware into the parts. This is particularly critical when running stainless into aluminum or other stainless. Stainless is also **MOSTLY** low strength and Grade markings or other ID is not common. Both ARP and Totally Stainless mark their high-strength stainless, though. Because of a lack of education, the use of low-strength stainless in inappropriate places means stainless is too often misused. You'll note that Totally Stainless goes to extremes to inform its customers about the use of both low-strength and high strength fasteners and warn of improper uses. Of course there will always be those who will not pay attention or ignore warnings and use the wrong fastener, but some people are just less bright or value their health and safety less than others. Finally, although prices have dropped significantly, HS stainless still costs a little more to use than standard stainless.

As an example of the kind of specialized hardware Totally Stainless has developed, check out these starter bolts. These three sets cover almost all GM engines. So it's not just header bolts, but a staggering quantity of specialized hardware in the warehouse.



You can't complete many suspension and driveline projects in stainless unless you have stainless shims and spacers. Yep, you've got it. TS also offers a good selection.



On the plus side, stainless doesn't rust like carbon steel, looks the same over time, and can be polished easily. I guess you can see the appearance benefits. In addition, stainless is more ductile and less prone to fatigue failures. I've seen low-strength stainless fasteners work well in accessory drive fasteners where grade 5 and 8 carbon steel bolts failed.

Uses

If the OEM fasteners were un-graded, this means they were usually no more than Grade 2. In those cases, you can use standard low-strength stainless, although you have to use some common sense. There are some

unmarked OEM fasteners used in places where a grade 5 or grade 8 is needed. In general, high-strength stainless should be used in high-stress applications such as engines, drivetrain assemblies, and suspension. About the only reason not to use stainless is if you are pinching pennies and cost is an issue.

Unlike plated carbon steel parts which pose a failure problem due to hydrogen embrittlement, stainless can be polished and re-polished without adversely affecting strength to look good all the time.

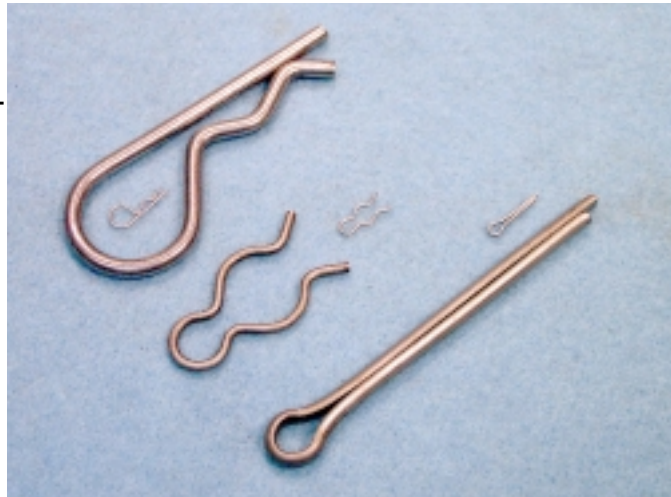


What kind of zerk do you need? Large and small-base sizes and straight, 45 degree or right angle zerks are in stock. Again, it isn't complete until you get rid of all the rusty hardware.

Right now the cost of the high-strength stainless is a mixed bag. In the case of the U-bolts, many are priced at about the same as parts-house carbon steel pieces. Unfortunately, the special tall nuts are still the costly item because they have to be fabricated using several labor-intensive hand operations. Totally Stainless is working at developing alternative manufacturing processes to get this cost down, but even now the prices are not unreasonable.

One piece that's not yet available is the common suspension castle nut. This again suffers from process problems. As we speak, the only way to make castle nuts in high-strength stainless is to machine the nuts by hand. The cost of EACH nut would be between \$12 and \$14, so Doc Hammett is working with manufacturers to figure out a less expensive way to get these done. Fortunately, you can use stainless lock washers, LockTite, or nylock nuts where appropriate (you can't always do this) and get around the castle nut issue for now.

I'm again a happy camper. Although at times when I'm using up a lot of elbow grease buffing and polishing (or when I see something develop rust or corrosion) I start to fantasize about a totally stainless car, I have to admit that with this line of high-strength stainless a lot of the crucial gaps have been plugged.



In an effort to accommodate all the various types of pins used over the years, TS offers hair pin coppers, hair pin clips, and standard cotter pins. Can you believe the range in sizes?

As for now, you'll have to excuse me while I nip on out to the shop and hammer a few crusty-rusty old carbon steel suspension bolts out of one of my projects and wrench some of that H/S stainless back in. I may even spend some time admiring the improvement and feeling smug about not having to face corrosion again.



This picture tells a lot. If you haven't all the hardware, you just haven't done the job. Here we have standard studs, high strength studs, ARP studs, set screws (often used as short studs because of the handy indented Allen ends), flange-head nuts, high strength reduced-head flare nuts, and metric studs with a similar selection.



When Totally Stainless ships its kits and components, they pack it up in labeled plastic bags like this. Each is identified so you can tell exactly where it is used. I find that such kits are a distinct improvement over most OEM hardware because, aside from the obvious advantages of stainless hardware, you don't have to hunt for and rehab old crusty stuff.