COUNTERFEITERs:
CHEATING MAINTENANCE
WITH BAD BOLTS

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About a year ago, Gelco Truck Leasing's In-Service Center, Mt. Wayne, Ind., was alarmed by a rash of broken and seized-out 5th wheel mounting bolts. According to Gelco's district manager, Don Holms, the aftermarket mounting bolts were discovered to be counterfeit — imported bolts far weaker than their SAP Grade B head marks (i.e., six radial lines) indicated.

Since 5th wheels and substandard mounting bolts can be a deadly combination, Gelco decided to standardize on Grade B Huck-Flit fasteners from Huck Manufacturing Co.'s Industrial Fastener Div., Waco, Tex.

Installed with a special power tool that ensures proper torque, the Huck fasteners have eliminated 5th wheel bolt failures, Holms told CQJ.

Another example of failed counterfeit bolts is provided by Bill Larson, quality assurance inspector at the Metropolitan Transit Authority bus fleet of Harris County, Tex.

After reading an account of the hazards posed by counterfeit SAE-grade fasteners, "We wanted no time in surveying our mechanics about the frequency of bolt-related failures," Larson says. "We discovered, for example, that many flywheel bolts and after-market head bolts were breaking before our mechanics could apply the proper amount of torque," he says. "Worse than that, we determined that bolt breakage was responsible for numerous road failures and come-back repairs."

"Our solution was to identify and unscrew the counterfeits, buy head bolts exclusively from Detroit Diesel and stock our bins with nuts, bolts and washers from Bowman Distribution, Cleveland. Oh, since that time, bolt-related problems have virtually disappeared."

Larson claims that fasteners who purchase bolts on a low-bid basis from a variety of sources are asking for trouble. In fact, based on Larson's experience, it takes only one delivery of substandard bolts to nickel and claim a maintenance budget to death...in some cases, before anyone knows what's happening.

If a distributor slider a fleecy's bins with a mixed bag of bolts from several countries, and some of the bolts are substandard, failures will be sporadic rather than epidemic. As a result, maintenance managers may attribute bolt failures to over-torquing, and never consider that substandard bolts are to blame.

Instead, Larson advises, fleetmen should ask mechanics to retain the heads of failed bolts and/or record the maker's I.D. marks. Armed with that information, a carrier can purge its bins of substandard bolts and avoid purchasing them in the future.

Thread One: Bad bolts

Genuine SAP-grade steel bolts comply fully with Society of Automotive Engineers Standard J-429, Mechanical and Material Requirements for Externally Threaded Fasteners.

SAP's mechanical requirements include: hardness, proof load (the amount of stress endured without permanent elongation); and tensile strength (the amount of stress endured without breakage).

SAP material requirements specify the type of steel which must be used. "Marinite" refers to steel that has been hardened by rapid cooling.

The basic specs for selected SAP grades are:

- Grade 5: 85,000 psi proof load, 120,000 psi tensile strength, medium-carbon steel
- Grade 5.2: 85,000 psi proof load, 120,000 psi tensile strength, low-carbon martinite steel
- Grade 8: 120,000 psi proof load, 180,000 psi tensile strength, medium-carbon alloy steel
- Grade 8.2: 120,000 psi proof load, 180,000 psi tensile strength, low-carbon martinite steel

Genuine Grade 8 bolts are the most expensive because they are made of premium-priced alloy steel. Grade 5s are the second most costly because they are made of medium-carbon steel.

In contrast, counterfeit versions of those bolts are made of low-carbon martinite steel - a relatively inexpensive and easily-processed metal used in Grade 8.2 and Grade 5.2 bolts. Low-carbon bolts aren't inherently weak, but they tend to stretch and loosen when used in high-heat environments such as an engine or exhaust system.

Bolts most likely to fail, however, are counterfeits made of inferior steel and/or improperly heat treated, according to U.S. government investigators.

Alerted by the fact that substandard counterfeit bolts were discovered in military vehicles and weapons, commercial airliners, interstate highway bridges, NASA's Titan missiles and space shuttles, and nuclear power plants, Congressman John Dingell (D-Mich.), chairman of the House subcommittee on Oversight and Investigation of the Committee on Energy and Commerce, held hearings on counterfeit bolts in Congress.
LONGWALL ROOF BOLTER

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In a telephone interview with CCI, Grant said he helped the Harris County Metropolitan Transit Authority bus fleet purge its bins of substandard bolts. He lamented the fact that honest bolt distributors and their fleet customers continue to be victimized by dishonest U.S. importers.

Grant's implication that the influx of substandard bolts is far from accidential is supported by testimony presented to the House subcommittee by William Rosenblatt, assistant commissioner of the U.S. Customs Service's Office of Enforcement, Washington, D.C.

Rosenblatt testified that counterfeit bolts are imported (as finished products or blanks that require cutting, threading and heat treating) by off-shore companies under direct contract to domestic importers. Additional testimony by representatives of U.S. Customs indicates that Korea and Taiwan may have taken the lead in counterfeiting fasteners for export to the U.S. Reportedly, that's because the leading Japanese bolt makers appear to have cleaned up their act after being visited by outraged U.S. government officials.

According to Steve Sims, special assistant to the House subcommittee, legislative countermeasures are being pursued. A few months ago, Sims circulated a draft legislative proposal to IPI, selected test labs and other concerned parties, asking for comment. A House bill designed to thwart the flow of counterfeit fasteners is expected to be introduced by next month.

In the meantime, many distributors and retail suppliers, unknowing of the menace, continue to sell a mixture of counterfeit and up-to-spec imported bolts to motor carriers.

According to Sims, it is unlikely that those distributors and suppliers know they're selling counterfeiters, for one thing, there's nothing inherently inferior about foreign-made bolts. And it is a common practice for dishonest importers to falsify certification papers and laboratory test results that indicate total compliance with SAE J-429 and/or comparable industry specs. Sims says.

Enforcement of countermeasures may prove difficult because counterfeiters are resourceful. Sims tells CCI. In one case, a federal authorities, fasteners made in Japan, Korea, Taiwan and Poland were being sent into the U.S. in cartons labeled "Made in Canada."

In other instances, bolts with Canadian markings are showing up in boxes marked "Made in USA," according to Sims.

In addition, counterfeiters have expanded their product line by producing high priced, stainless steel bolts. Some of these bolts bend but not while still in the distributor's stockroom, according to IPI.

"Consequences [from the influx of counterfeiters] have been so grave that the U.S. government now requires traceability for any fasteners it purifies," notes Michael Oster, customer service manager, Norman Products -- a Cincinnati-based supplier of bolts and other hardware. That is, manufacturer's head marks must be present and traceable to a specific source.

However, the lack of a maker's mark does not necessarily indicate a substandard bolt. Instinct Tony Pidgeon, senior product design engineer, Fontaine Fifth Wheel Co., Birmingham, Ala. Fontaine uses Grade 8 bolts with no maker's marks but tests each batch for compliance with SAE J-429. Pidgeon says. But any OEM who fails to take that precaution is asking for potentially serious trouble, he admits.

Typically, Grade 5 and Grade 11 (for comparably-specified metric) bolts sold in the U.S. display a maker's I.D. mark. A mark may indicate:

• a U.S. bolt maker;
• a foreign bolt maker;
• a U.S. importer who has contracted with a foreign bolt maker to affix the importer's mark and desired grade marks;
• a Canadian bolt maker which, under contract to one or more U.S. importers, sub-contracts with one or more off-shore suppliers to affix a Canadian mark and SAC grade marks;
• a dead end, that is, a bolt that can't be traced using standard references listed under "For more information."

For a fleet that buys hardware from numerous suppliers on a low bid basis, tracking the origin of a bolt is likely to be difficult, if not impossible. Many domestic and foreign bolts display virtually identical single-letter maker's I.D. marks. An "A" mark, for example, is especially widespread.
For example, some Grade 5 bolts tested and sold by Durman Products are marked "DOMAN" while others are marked "KY" (Kynel of Japan), "A" (presumably Ashahi of Japan), "FX" (Flexalloy of Ohio), which imports hardware from Japan, Taiwan, Korea, Hong Kong, and China, according to the House subcommittee hearings; "L5" (RB&W Co. of Ohio).

As another example, Sharon Fasteners Corp., Ashton, Mass., labels its mixed-bag boxes of Grade 5 bolts as being sourced from Japan, Taiwan, Italy, China, West Germany, and India.

In the final analysis, a fleet has three options for protecting itself:
- Purchase bolts with maker's marks easily traced to domestic suppliers.
- Purchase bolts from a single, reputable distributor.
- Retain failed bolts, record the maker's marks and adjust purchasing habits accordingly.

**Threat Two: Bad maintenance**

A word of warning. Before assigning any or all failures of replacement bolts or studs to substandard hardware, be sure inaccurate torqueing and other maintenance shortcomings aren't to blame.

Even the best imported or U.S.-made replacement bolts and studs can fail if improperly applied to vehicles. OEM bolts always should be replaced with bolts of the same or higher grade.

Torque gaskets from anastirred impact wrenches to cheater bars suitable for pole vaulting. By applying too little or too much torque, they can break or deform bolts and loosen the nuts on steel disc wheels.

Nuts on steel disc wheels, which require twice as much force to nut on cast- and shell-molded nuts or deformable nuts, may loosen under the following circumstances:
- **Problem:** Wheels with a heavy coat of white paint look nice, and make it easy to spot a leaking oil seal. Unfortunately, paint also invades wheels to loosen, since a 3.000 in. coat of paint around bolt holes can reduce lug nut torque by 50% within 100 miles of travel. That's because paint tends to creep and wear off.
- **Solution:** Remove excess paint from bolt holes before mounting.

- **Problem:** The men have repeatedly over-torqued a wheel, causing raised edges at the bolt holes. Raised edges prevent nuts from getting a good grip and won't permit duals to seat properly.
- **Solution:** Grind off raised edges before mounting. Being cautious not to damage countersunk ball seats. If studs are breaking, switch to Grade 8 studs/nuts and avoid over-torquing. Use a torque wrench for final tightening.

- **Problem:** Something or someone has reduced air pressure to the impact wrench used to mount wheels, causing torque to be inadequate. Conversely, excessive air pressure may result in excessive torque and broken studs.
- **Solution:** Periodically check impact wrench performance by testing torque of newly-installed nuts with a torque wrench. If torque is incorrect, adjust the air regulator. If that doesn't work, check the wrench because it may be worn-out or inherently underpowered.

- **Problem:** Air pressure to a wrench is periodically reduced by operating another air operating device (such as a vehicle lift) at the same time.
- **Solution:** Install an in-line pressure gauge that the tire man can monitor, or install audible alarms to signal dangerously low air pressure.

- **Problem:** An impact wrench in the tire line has been replaced by one of identical size but vastly different performance.

At 100 psi line pressure, makes and models of wrenches with the same size of square drive can vary significantly:
- Peak torque of 3/8-in. square drive tools may vary in peak torque from 60 ft-lb to 135 ft-lb.
- Peak torque of 1/2-in. square drive tools is 90 ft-lb to 175 ft-lb.
- Peak torque of 1/2-in. square drive tools is 250 ft-lb to 1,100 ft-lb.
- Peak torque of 1/2-in. square drive tools is 1,200 ft-lb to 2,500 ft-lb.

To illustrate the negative effect of repeatedly reusing a nut, Bowman Distribution conducted a lab test using a 3/8-in. Allen bolt. The test shows the torque required to remove the nut.

The first use of the nut, as the assembly torque to 170 ft-lb, produced a clamping force of 13,250 lb. Subsequent applications provided the following results:
- Second use: 12,500 lb.
- Third use: 11,500 lb.
- Fourth use: 10,700 lb.
- Fifth use: 9,200 lb.
- Sixth use: 7,500 lb.

Clearly, progressive decline of clamping force could permit parts to shift, resulting in misalignment and a risk of fatigue cracking. It's critical that high-grade bolts be used with nuts of the same or higher grade. If a lower-numerical-grade nut is mated with a Grade 8 bolt, for example, the nut's threads probably will distort before the desired amount of torque can be applied.

As a result, the nut is likely to freeze to the bolt, perhaps inducing the mechanic to use a cheater bar. At that point, it is easy to bend or bolt head or strip the threads in the nut.

Similar problems can result from using a high-grade nut with a lower grade bolt.

To properly complete an assembly, two flat washers should be used - one under the bolt and one under the nut. Washers prevent the nut or bolt from embrittlement in the work surface and make it easier to apply proper torque.

Washers are available in two basic sizes:
- "USW" washers are especially wide, so they're ideal for application to sheet metal or thin-tin materials. Typically, US washers are larger than standard bolts.
- "SAE" washers are narrower. Holes match precisely with standard bolt widths. SAE washers are recommended for securing anything thinner than sheet metal.

SAE standards require that bolt head markings identify grade and source. From left: Grade 5/origin unknown; Grade 8/Infasco of Canada; Grade 5/Dorman Products, Cincinnati, Ohio; Grade 8/Rockford Products, Rockford, Illinois; Bowman super bolt (exceeds Grade 8) Bowman Distribution, Cleveland, Ohio; L9 super bolt (exceeds Grade 8) RB & W Corp., Mentor, Ohio; metric Property Class 8.8 bolt (roughly equivalent to SAE Grade 5)/LOBO SpA, Italy. Most common counterfeit Grade 8's are marked: FM, H, KS, M, MF, or KT.
USS and SAE washers may be soft or hard. Specifically:
- "Wrought" washers are soft and easily distorted. When used with high-grade bolts and nuts, they compress progressively and make it impossible to apply and/or retain proper torque. For this reason, they're too weak for heavy-duty applications.
- "Hardened" or "heat-treated" washers have a tough surface finish and are somewhat thicker. They are the only choice for heavy-duty applications.

Even hardened washers are produced by stamping, however, and may have a sharp edge on one side. Always place the sharp-edged side against the work surface to prevent it from slicing into (and weakening) the bolt head.

Many mechanics think split lock washers belong in the same league as motherhood and apple pie. But they have their limits, according to Bowman Distribution.
- Electroplated, poorly-made lock washers are prone to crack during assembly, or shortly thereafter. All lock washers aren't created equal.
- Lock washers can damage bolt heads and encourage fatigue failure.
- Used under a nut that becomes loose in a harsh operating environment, cheaply made lock washers are prone to flex themselves to pieces and fall off. So SAE recommends not using split lock washers in critical vehicular applications.

Torque values for nut and bolt assemblies only apply to turning the nut, not the bolt head. If the bolt head must be torqued while restraining the nut, increase the recommended torque by 20%.

Further, torque charts are for clean and dry threads, unless otherwise noted. Lubricated bolts or nuts require a reduction in recommended dry torque. For example:
- Bowsman and Selco compounds: 40% reduction;
- heavy oil or graphite: 30% reduction;
- synthetic white lead: 35% reduction;
- Loc-Tite compound: 20% to 28% reduction;
- various light oils: 10% to 24% reduction.

Contrary to popular belief, lubricating a nut or bolt and applying it with lower torque will not reduce clamping force or make the assembly prone to vibrate loose, according to Bowman Distribution.

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Management Bottom Line

- Dangerously sub-standard bolts are flooding the U.S.
- Buy bolts with maker's marks traceable to domestic sources.
- Or purchase bolts from a single, reputable distributor.
- Even top-quality bolts may fail if improperly torqued.

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