Be sure to let our advertisers know you saw their ad in the Free Riders Press

In Pat Hahn's article last month there was a misprint. It says "After riding at varied throttle settings for a couple of miles, repeat the acceleration up to ten grand." This should say FIVE grand.

Torque, the Nuts and Bolts Kind

Applying the correct amount of torque to a nut or bolt is important, but many of us do not understand exactly why. We know that things like fenders and spark plugs tend not to fall off or unscrew if we tighten them without the benefit of a torque wrench. Since this is the case, why are torque specifications and torque wrenches considered so important? I can best answer this by examining how a bolt works and what happens when you or I tighten one.

Bolts are springs that hold our motorcycles together. The tighter they are (within limits) the greater the spring pressure they apply to the parts they clamp. If the bolts are too loose, oil falls out or the head gasket blows. If they are too tight, parts become distorted or even break and the oil falls out or the gasket blows.

Bolts and the parts they hold together resist distortion. If you flex a fender to the side a bit, it resists the force and springs back to its original shape when you remove the pressure. When you tighten a bolt, you flex it and make it slightly longer. The bolt resists this flexing and becomes a spring, just like the fender did.

If you severely over-tighten the bolt or push too hard on the fender you could bend them. A bolt that has been bent (permanently stretched) by over tightening does not apply the correct amount of clamping pressure and is likely to eventually fail, either by loosening or breaking. The trick is to apply a correct amount of tension to the bolt and have that tension remain when the bolt is in use. Using a torque wrench allows a reasonably precise amount of spring tension to be applied to the bolts.

Let's take a look at how these things are accomplished.

Lubrication

Threaded fasteners like nuts and bolts are high-friction devices. We depend upon that friction of the threads to hold them in position. However, if there is too much friction, the critical stretch may not be correct because much of the torque we apply to the wrench is used in overcoming the friction rather than tightening the spring pressure of the bolt. The purpose of lubrication is to ensure that the applied torque deforms the bolt along it axis (stretch) instead of around its diameter (twist). If you have ever had a bolt 'back-off' a little when you released the torquing force of a wrench, then there was too much friction between the threads and the bolt did receive the intended amount of stretch. Lubrication of the bolt threads is important only to ensure that this does not occur. The common standard for thread lubrication is a light coat of oil of about 10W viscosity. A thin coat of ordinary engine oil does just fine. The idea is to allow the threads to move against one another, and light oil does that reliably. Of course, this standard assumes that the threads of the bolt, nut, engine case, or whatever have reasonably smooth finishes. Exotic or extreme pressure lubricants such as gear oil or Moly pastes are mostly a waste of time and can actually be harmful if they reduce friction too much.

Friction and Locking Devices

There must be some friction between the bolt and the parts it clamps.

If there were none, the pull of the tensioned bolt would cause it to unscrew. The trick is to control the friction so that there is enough to prevent unscrewing but not so much that torquing becomes inaccurate. Generally, a bolt remains tight if it is not shaken or heated. Vibration can unscrew bolts. So can thermal cycling. This loosening problem is as old as machinery. We are all aware of some of the traditional ways manufacturers deal with this problem.

There are split washers with sharp offset ends that allow the bolt to turn easily in the tightening direction but strongly resist loosening. Star washers, while meant for low-stress applications, really dig-in and keep things tight. There are also Belleville washers, wobble washers, and countless other gadgets designed to prevent loosening.

Then there are the chemicals. Most of us have used Loctite and similar products. Harley relies heavily on such chemicals to maintain the torque of a majority of their fasteners. Those little stripes of paint-like material on your genuine Harley bolt contains micro-balloons filled with a thread locker similar to Loctite (it may be Loctite, for all I know). When you tighten such a bolt, some of those micro-balloons burst and release the locking compound. As I understand it, this feature is good for four uses after which one needs to replace the bolt or start adding Loctite.

Back in the fifties and sixties, we used 3M Weather Strip cement to keep all those poorly made bolts attached to our Triumph racers. We'd tighten or (mostly) over tighten the bolts without benefit of a torque wrench and then entomb the bolt head with the 3M "Gorilla Snot" (it was bright yellow). Honda bolts didn't need the help because of their superior thread design, more precise manufacture, and harder aluminum that created and maintained greater friction between the threads of the bolts, nuts, and threaded cases. Bolts can loosen for other reasons too. Harley head gaskets continue to be of composite construction. These gaskets crush and thin due to repeated thermal expansion of the engine. The thinned gasket allows the tightened cylinder studs to shorten which reduces the clamping pressure.

I measured this torque loss back when I was working with the early Evo engines. An initial torque of 40 ft-lbs would reduce to 25 after a couple of hours running. This loss of clamping pressure was the main reason those engines had a problem with head gasket failures. I do not know what Harley engineers did, but they have not had a significant problem with blown head gaskets for some years now. Most of the motorcycle industry has moved on to all-metal head gaskets to remove this particular concern. The Screamin' Eagle gaskets are all metal (Cometic makes them) and are most reliable.

Summary

When you torque a bolt, you slightly stretch it and invoke its spring (elastic) properties, which apply a clamping force that holds the assembly together. Lubrication ensures that all the torque force becomes tension in the bolt. Friction, chemicals, and gadgets then hold the tensioned bolt in position so that it does not loosen.

This article was penned by Joe Minton (Branch Flowmetrics) and reproduced in the soon-to-be-released Sportster Performance Handbook (2006) by Buzz Buzzelli. I've read the book, it's terrific, and I wish Joe and Buzz much success with it.

Pat Hahn

Press Release

Torbleau Trikes would like to announce the opening of our brand new trike manufacturing facility.

Now located in Stoughton, Wisconsin, Torbleau Trikes has been building and designing quality trikes since 1982. Torbleau trikes is a family business that strives to make every one of our customers feel they are our family too.

Since our beginning, Torbleau Trikes has come a long way. We have had a lot of firsts in the trike industry from designing the first electric reverse for the Harley conversions, to developing a raked front-end for the conversions offering a more safe and enjoyable ride.

We also specialize in converting other models of motorcycles into trikes that other manufacturers do not so that all of our customers get the trike of their dreams. This specialization has led us to the development of many different and unique handicap controls for our trikes so that everyone can enjoy the ride.

At Torbleau Trikes we are always striving to build the best trike. We are located at 501 Business Park Circle, Stoughton, WI. 53589. Phone # (608) 873-0200, e-mail, torbleautikes@sbcglobal.net and on the web at www.torbleautrikes.com