

History of Whitworth

Although written for a British motorcycle audience, this also applies to many earlier British cars. It was reproduced on the British Cars list with permission from the author Charles Falco.

A lecture on the meaning of "Whitworth"

First, a tiny bit of history. In the 19th Century every British factory which needed to bolt something to something else devised their own fasteners to do it. Clearly, this caused all sorts of compatibility problems. So, along came Mr. Whitworth (I forget his first name right now) who invented a standardized system of coarse threads (with 55 degree thread angle and rounded roots and crests).

This standardization was a Good Thing. Along with his threads came heads for the bolts that were based on the length *along* the side of one flat, rather than across the flats. Hence, there is no simple fractional number for the length across the flats, which is why your American wrenches don't fit. The fractional number on your English wrenches refers to the diameter of the bolt (which is 1/4", 3/8" etc. just like in the U.S.); not to the distance across the flats (which ends up being various weird dimensions). Some years later the Brits decided they needed a finer pitch for some applications, so another thread series was introduced (same 55 degrees). They also decided that the heads were too big for the bolts, so for most applications they switched to using the next size smaller heads. Because of this, and to add one more bit of confusion to life, one manufacturer will mark a particular wrench (spanner) "3/8BS," while a different manufacturer will mark the same sized wrench "7/16W." They fit the same diameter bolt.

The first thing any fledgling Brit biker learns is that his (or her) motorcycle has "Whitworth bolts." They think this is interesting, buy a set of "Whitworth wrenches," discover these wrenches fit their bolts, and believe they now know everything they need to know about British fasteners. Unfortunately, at this point they know only enough to make themselves dangerous. Instead, what they *should* have said to themselves is "Ohmygod, what other weird and incomprehensible things have the Brits done to the fasteners on my machine?" The answer to this question is:

British Standard Whitworth (BSW)

These are the original, 19th Century, coarse-threaded industrial bolts designed to hold locomotives together. Because of their coarse pitch, they are more prone to vibrating loose, so are little used on motorcycles. Except for threading into Aluminum (e.g. crankcase studs), where a coarse thread is less prone to stripping than a fine one. It turns out that, except for 1/2" (where the Brits use 12 tpi, and the Americans 13 tpi) the thread pitches are the same as for American Unified Coarse (UNC). However, the thread *form* is different; Whitworth = 55 degrees; UNC = 60 degrees. In spite of this, mismatched nuts and bolts mate nicely, so you're likely to find UNC bolts or studs where BSW should have been.

British Standard Fine (BSF)

A finer pitch series, analogous to the American Unified Fine (UNF), although--unlike the case of BSW/UNC--with none of the pitches in common with UNF. Many motorcycle manufacturers commonly used a lot of BSF threads.

CEI (Cycle Engineers' Institute) or BSC (British Standard Cycle)

-these are different names commonly used for the same threads.

60 degree thread angle, rather than the 55 degree of BSW and BSF. For sizes from 1/4" through 1/2" by far the most common are 26 tpi, although 24 tpi appear as well. *Most*, but by no means all, fasteners on post-War BSA's (through the late '60's, when it got more complicated) were CEI. Although the thread form and pitch is different, the head sizes on CEI-threaded fasteners use the same wrenches as BSW/BSF.

British Association (BA)

47-1/2 degree thread angle. This is a metric thread system devised by the British for small screws used in components like speedos. Not metric like you might expect, but with diameters determined by a factor proportional to a power of the logarithm to the base 10 of the thread pitch in millimeters. I couldn't possibly be making this up. Ah, the English. You'll find lots of BA threads on any British bike, but only for fasteners smaller than 1/4". BA fasteners have their own set of wrench sizes. Typically, a set of "Whitworth" sockets will include a 0BA (and maybe a 2BA--bigger number = smaller size) socket.

British Standard Pipe (BSP)

A tapered, self-sealing thread system used to seal fluids (interestingly, the US *and* the metric world standardized on the BSP system for threading all their pipes).

UNF and UNC

In the late 1960's, when even the U.S. was thinking of going metric, the giant BSA corporation decided it was finally time to scrap that old 19th Century Whitworth-based system, and switch to....yes, you guessed it, American. Since they had lots of money invested in tooling, the switch wasn't made suddenly (or completely), so bikes from the late '60's and later had a mix of all sorts of thread forms. Typically, engine internals (e.g. the thread on the end of a camshaft) stayed with whatever form it used to have, while simple fasteners (e.g. holding the fenders on) switched to UNF.

"None of the Above"

While the above systems account for well over 95% of all threads you'll ever run across on a British bike, some manufacturers--again BSA springs to mind, but others were guilty as well--couldn't restrain themselves from inventing a few oddball pitches of their own. This is why, when dealing with British bikes, you should assume nothing. You must have a pitch gauge and calipers.

So, let's get back to the question someone asked a few days ago about buying a set of "Whitworth" taps and dies to last him the rest of his Brit biking life. The first thing I'd say is that if you want it to last, be sure you buy a HSS set (rather than carbon steel), even though it will be at least 2x the price. Then, in order of overall usefulness, I believe you'll find in first place it will be a CEI set, then BSF, then BA. Unless/until you really get deeply involved, make do with UNC to "simulate" BSW (although you'll want to buy an individual 1/2"-12 at some point to supplement the UNC set). Thus, if you follow my recommendation, the very *last* thing you'll want to buy for working on your British motorcycle is a "Whitworth" set (I have one, by the way, but only got it after I'd had CEI, BSF etc. for a long time).

Charles Falco



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