

# Some Wrenching Talk Concerning Torque

By Rick Astley

As Harry Mac Lean and I were working on my back-axle, it was necessary to torque some bolts to some pretty serious values and he asked me if I trusted my torque wrench. Frankly I didn't, it had cost \$9.99 from Harbor Freight and I regard it only as a good value-for-money long ratchet-wrench. Fortunately, Harry had his altogether better torque-wrench in his car and we used that. Later, seeing the same 1/2-inch drive wrench as mine still advertised at Harbor Freight for \$9.99 with a claimed accuracy of  $\pm 4\%$  clockwise and  $\pm 6\%$  counter-clockwise, I decided to attempt to determine how good mine is.



1 lb 9 oz, so I calculated that over the 17 inch length, the wrench was producing 2.2 lb-ft of its own torque.

Secondly, I had to check if our digital type bathroom scale was accurate. It proved to be surprisingly so, much to our chagrin because Anne and I always claim that it must be reading high! I tried adding weights to the empty scale and also picking them up while I was already on it, and each time it precisely recorded the change in weight.

The third stage was to stand on the scale and record its reading while pushing down on the wrench at the point chosen. So as to apply the force precisely, I pushed on my reference point with my thumbs, which was easy to begin with but became quite painful when, with the tool set

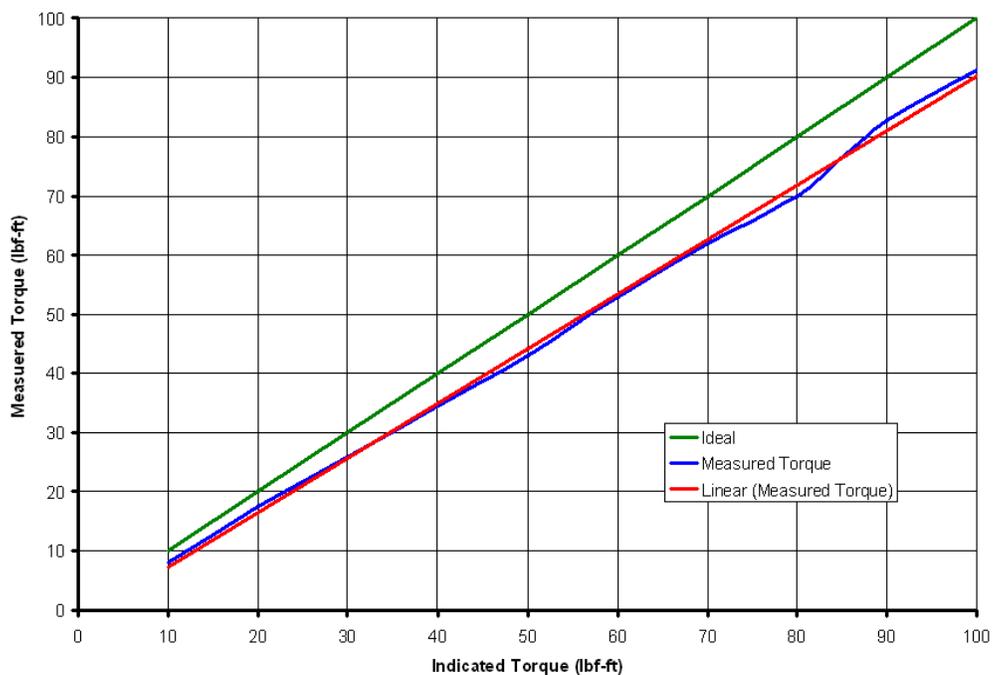
My plan was to clamp the square drive in a vice and hang weights from the horizontal handle to see how the actual torque values corresponded with those indicated on the tool. The distance from the center of the square drive to my reference point at the end of the handle, where I was to apply the weights, was 17 inches, or 1.42 feet. Therefore, if I hung 50 lb from this point I would be applying a torque of 1.42-ft x 50 -lb = 71 lb -ft. I was using dumbbell weights and wanted to test the tool to 100 lbf-ft, so I needed to be able to hang at least 70 lb from the handle. I soon realized that I was going to end up with broken toes as the several weights needed to reach the target kept falling from my jury-rigged suspension system. There had to be a better way and soon I had a new idea; with the tool still clamped in the vice, if I stood on our bathroom scales and lifted myself up by pushing down on the tool handle, the loss of weight from the bathroom scale reading would indicate the force transferred to the tool.

First it was evident that the wrench, with its heft and length, applied some torque of its own. To measure it I placed the reference point at the end of the handle on a postage scale while I supported the square drive at the other end. The scale read

to 100 lb -ft, I had to press over 60 lb. You'll have to picture how this was done for yourself, the image of a senior citizen standing on a bathroom scale in his workshop while doing thumb presses on something attached in a vice, is not one that that a respectable publication should print.

Using the measured values and adding the self-applied torque of the tool, I was able to evaluate how accurate my wrench is. The graph shows the results. The green line would be an ideal result, with the measured torque

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absolutely corresponding with that indicated on the tool. The blue line is what I actually measured. That line is a little wavy due to small inaccuracies, but the red line, a so called 'trend line', shows that my measurements were quite consistent. As the graph shows, my wrench reads low, actually by between 12% at the low end to 9% at the high end. That's probably not a bad thing; I'd rather apply a tad too little torque than too much and end up with a broken stud or bolt head.

As I have no use for a tool that measures how much torque is needed to undo a bolt, I only checked my wrench by applying clockwise force. The fact that I found it to be out of specification compared with the claimed accuracy in the Harbor Freight advertisements is neither intended as an aspersion on that company nor its products. My wrench is at least 5 years old and has seen some considerable usage. Moreover, my test method, which I believe it to be fairly accurate, was far from scientific.

So what did I achieve? Well on a rainy afternoon I: (1) learned how - along with some caution - I can now use my torque wrench for its intended purpose (2) determined that our bathroom scale is accurate and (3) toned up my thumbs. ?