

# Tightening the Bolt or Nut Makes No Difference

by Joe Greenslade

Several times I have been asked, "Does it make any difference in joint tightness if the tightening torque is applied to the bolt or the nut?"

Over the years I have heard a variety of opinions on this subject, but when I researched the question I did not find any written information. I reviewed several documents that refer to the torque calculation  $T=DPK$  and none of them mentioned that this formula, or any other, was applicable only when the torque was applied to just the bolt or just the nut.

Not finding a documented answer, I decided to conduct a simple test to see for myself whether applying torque to the bolt provided any different tension in the joint than did applying the torque to the nut.

## THE HYPOTHESIS

Being a fan of the scientific method, I first formed a hypothesis. I hypothesized that whether the torque is applied to the bolt or to the nut the tension would be virtually the same.

## THE TESTS

I then conducted some simple torque-tension tests to obtain my observations upon which I could test my hypothesis.

I tested six 1/4-20 Grade 5 zinc plated bolts and nuts using a calibrated hydraulic tension tester and a calibrated

Below are the results obtained from this series of tests:

Tension values obtained when applying 10 foot-pounds of torque to the nut:	Tension values obtained when applying 10 foot-pounds of torque to the bolt head:
1. 3250 pounds force	1. 3300 pounds force
2. 3200 pounds force	2. 3100 pounds force
3. 2800 pounds force	3. 2900 pounds force
Average: 3083 pounds force	Average: 3100 pounds force

Note: The difference between 3100 and 3083 is only .5%.

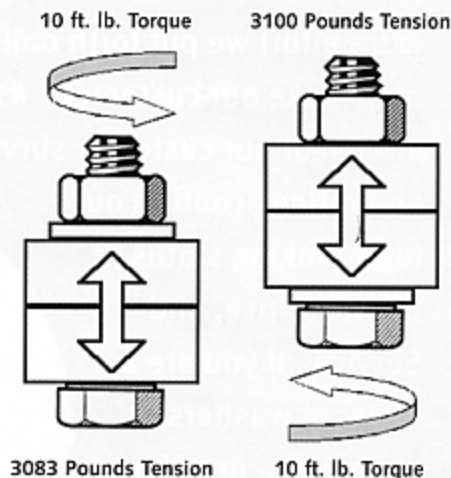
torque wrench. I referred to a recommended tightening torque chart based on the formula  $T=DPK$  and found that the recommended tightening value for the bolts and nuts of this size, grade, and finish is 10 foot-pounds.

I then conducted three tests in which I applied the 10 foot-pounds of torque to the nut and three additional tests in which I applied the torque to the bolt head.

When applying the torque to the nut I place a hardened flat washer under the nut for its bearing surface to rotate on and when applying the torque to the bolt head I placed a hardened washer under the bolt head for its bearing surface to rotate on. I used new bolts, nuts, and washers for each test.

## TEST CONCLUSION

Based on these tests it is my opinion that my hypothesis is correct.



The tension created in a particular joint is the same whether the tightening torque is applied to the nut or the bolt, provided the element that is driven (nut or bolt) is seated on a similar surface. ■



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