

Torque Wrench Design

CAD Model

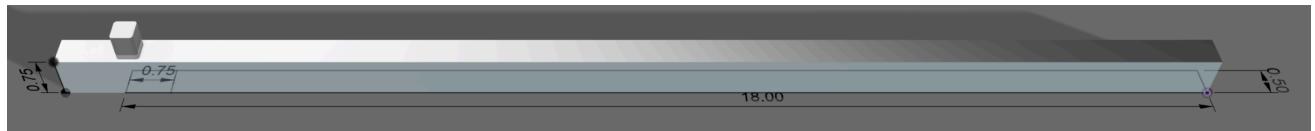


Figure 1: CAD model of overall torque wrench with dimensions.

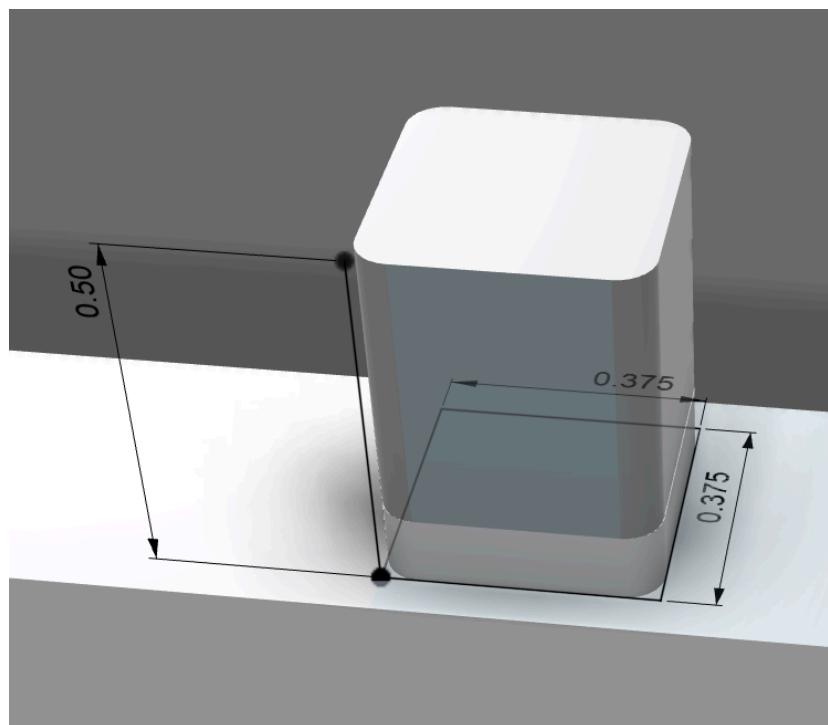


Figure 2: CAD model of drive with dimensions.

Material Information

Material Name: titanium, alpha alloy, Ti-5Al-2.5Sn-0.5Fe, annealed

Mechanical Properties:

Young's modulus (psi)	16E6
Yield strength (ksi)	118
Fracture toughness (ksi \sqrt{in})	88
Fracture strength for 10^6 cycles (ksi)	70

From FEM Analysis

Load and Boundary Conditions in FEM Model

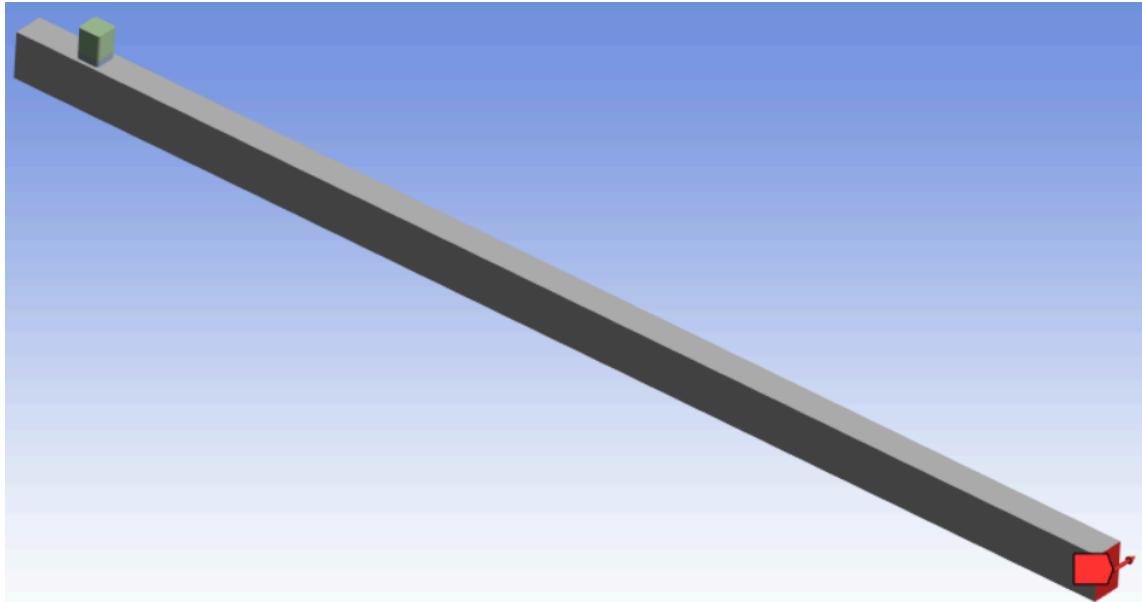


Figure 3: Model with load at end of wrench.

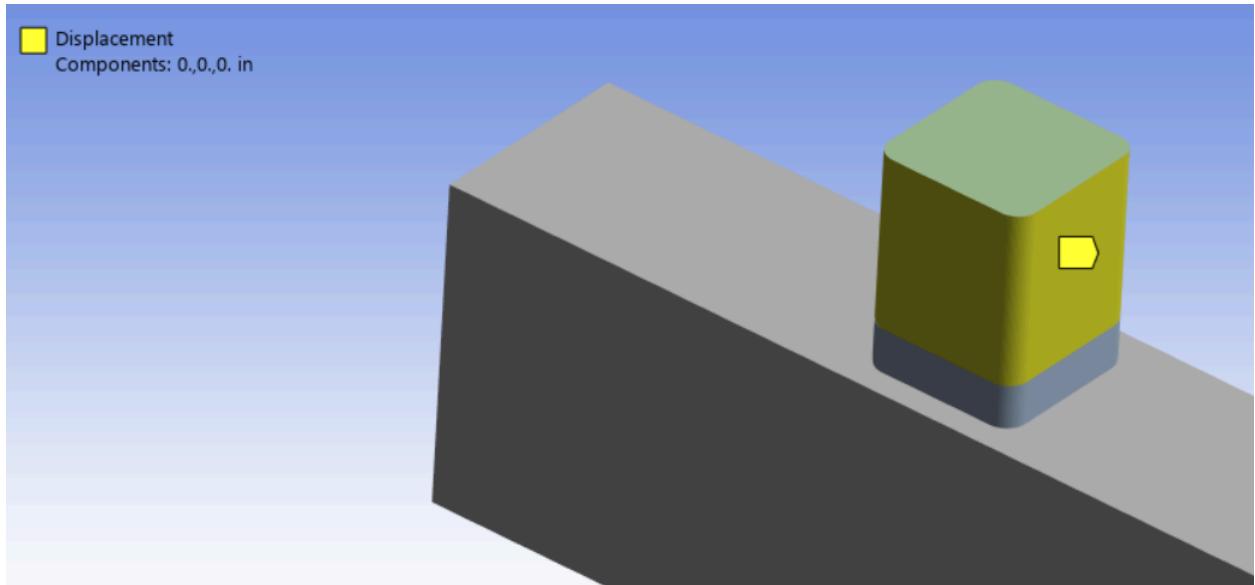


Figure 4: Model with fixed drive.

Normal Strain Contours

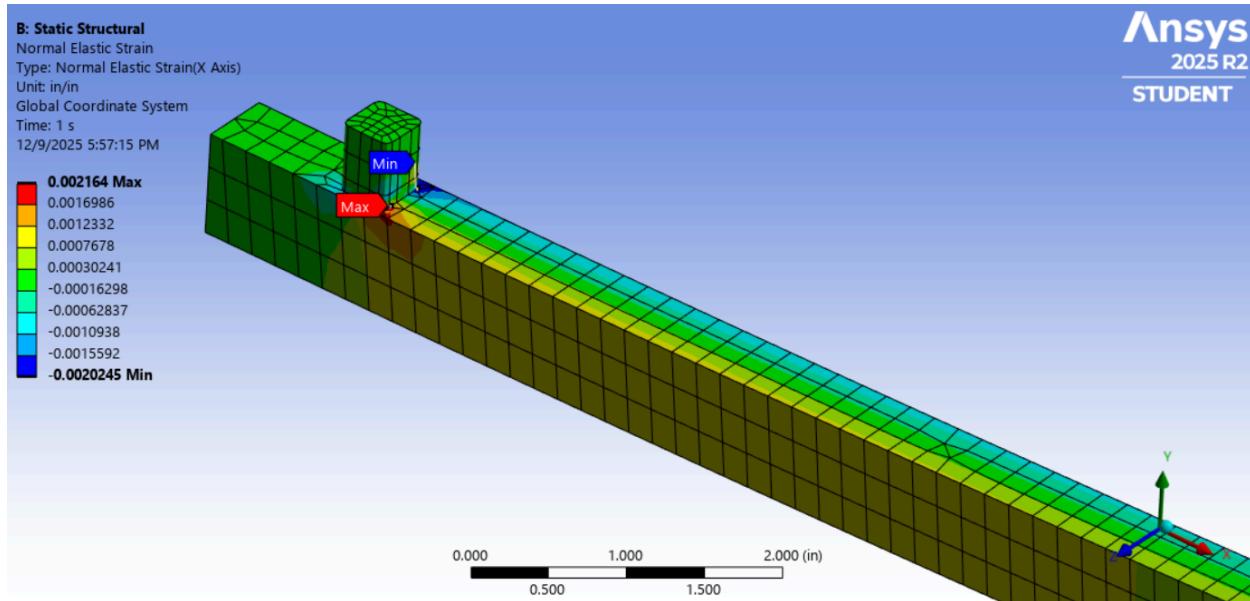


Figure 5: Normal strain contours at upper half of the wrench.

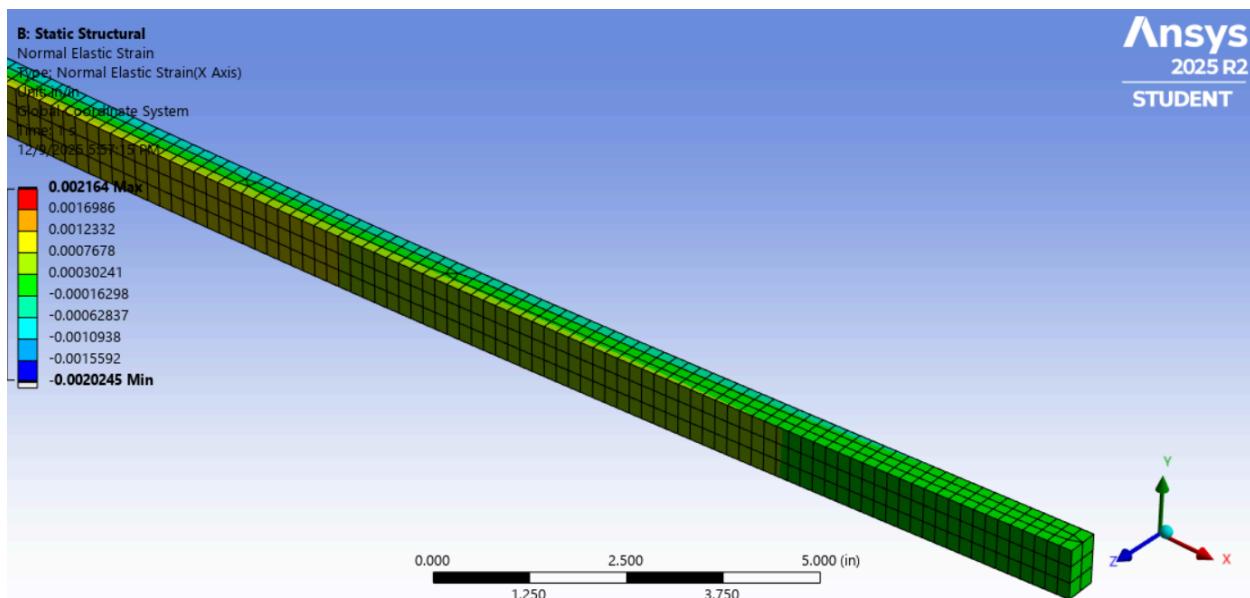


Figure 6: Normal strain contours at lower half of the wrench.

Maximum Principle Stress Contours

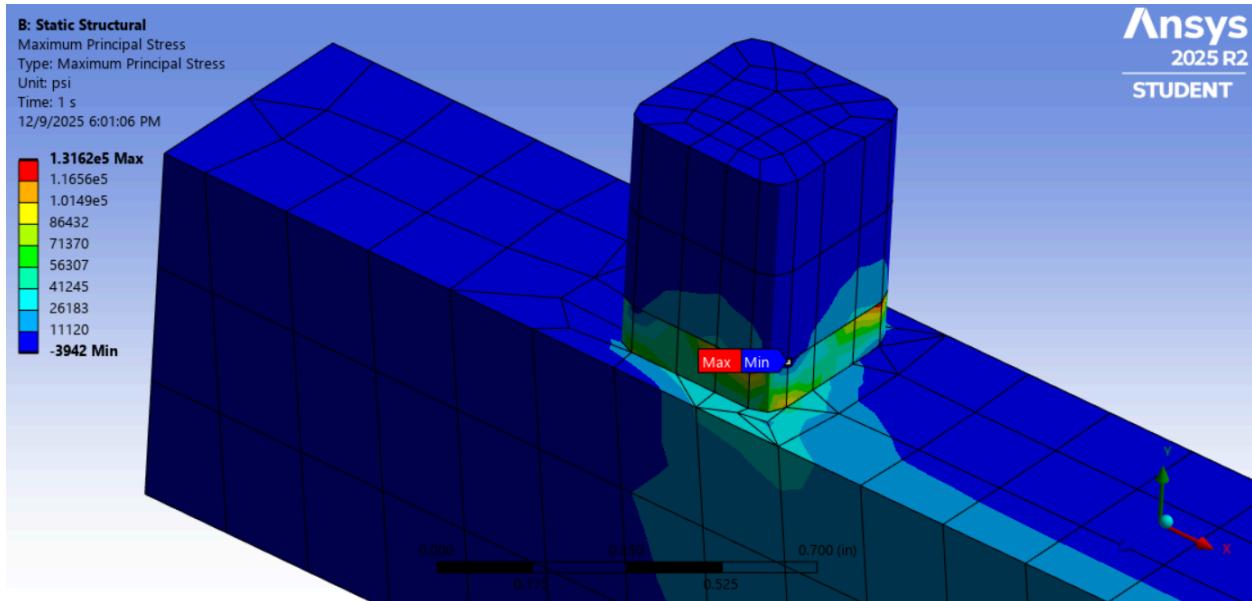


Figure 7: Maximum principle stress contours near the drive.

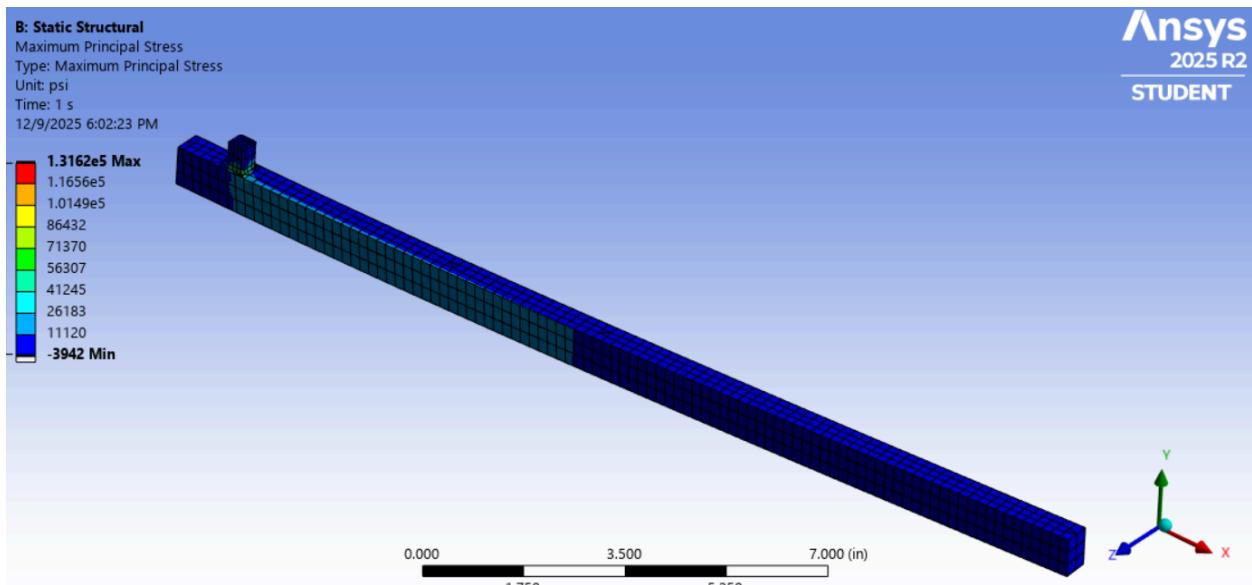


Figure 8: Maximum principle stress contours of the entire torque wrench.

FEM Calculations

Maximum Normal Stress

Overall Maximum: 68.8 ksi

Near the area where hand calculations are tabulated:
19.2 ksi

Load Point Deflection 0.60677 inch

Strains at Strain Gauge Location
X: -1.15E-3 in/in
Y: -3.71E-4 in/in
Z: -3.80E-4 in/in

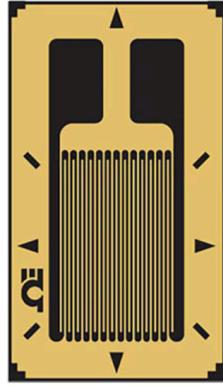
Torque Wrench Sensitivity

$$1.15\text{E-}3 \text{ in/in} = 1.15 \text{ mV/V}$$

Strain Gauge Selection

SGD-3/350-LY13

3 mm Grid Length, 1.5 mm Grid Width 120 Ω Resistance, ST STC Number



The gauge type is linear pattern leads/pads at one end of the grid.

The strain gauge is about 7 mm X 4 mm (0.276 in X 0.157 in). This will fit onto the proposed design and will reserve room for more gauges if needed.