



## MULTIPLE MIRROR TELESCOPE OBSERVATORY

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### MMTO INTERNAL TECHNICAL MEMORANDUM 92-2

**From:** Shawn Callahan and J.T. Williams

**Subject:** Procedure for Preloading Building Drive Wheel Bearings — Technique used March 6, 1992

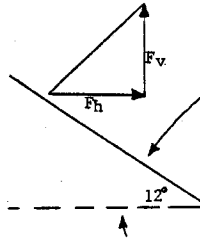
**Date:** March 25, 1992

1. Remove grease cover plate opposite to the drive (closest to the wall). There are eight 3/8" bolts on a 20" B.C. to remove.
2. Remove excess grease.
3. Remove nut retainer clip. (4 - 5/16" bolts, wired)
4. Attach Building Drive Preloading Plate (wrench)
  - Set wrench on preload nut (11.50 - 6TPI)
  - Insert four 7/8 keys into nut keyways.
  - Rotate building with manual crank (1000:1) until 20."B.C. on wrench is aligned with grease cover 20" B.C.
  - Use 3/8 - 16 x 1 3/4" grade 5 or higher bolts tightened to 35ft-lbs. to attach wrench to wheel housing.
5. Remove handle on one of the building drive hand cranks. Using an accurate torque wrench, rotate the 7/8" deep socket ccw to rotate the building wheel/axle cw/right to apply 16ft-lb. torque. On all four building wheels it took 14ft-lbs torque to tighten the nut. The torque dramatically increased when the nuts became tight. They were preloaded to 16ft-lbs on the hand crank. This applies 16,000ft-lbs to the nut. Relieve bolt static friction and residual stress by striking the shaft axially with a maul and soft steel block. Retorque nut to 16,000ft-lbs.
6. Make and install new nut retainer clips. Verify nut retainer clips are intact on the inside axle nuts.
7. Apply new grease.
8. Replace grease cover.

## Engineering Calculations

Cup angle of tapered roller bearing is  $24^\circ$ .

$$\frac{F_{\text{VERTICAL}}}{F_{\text{HORIZONTAL}}} = \text{TAN}12^\circ$$



\* This neglects friction.

If the building weight per wheel is 450 Kips, then the bearing preload is  $450/\tan 12^\circ = 96$  Kips. This corresponds to a nut preload torque:

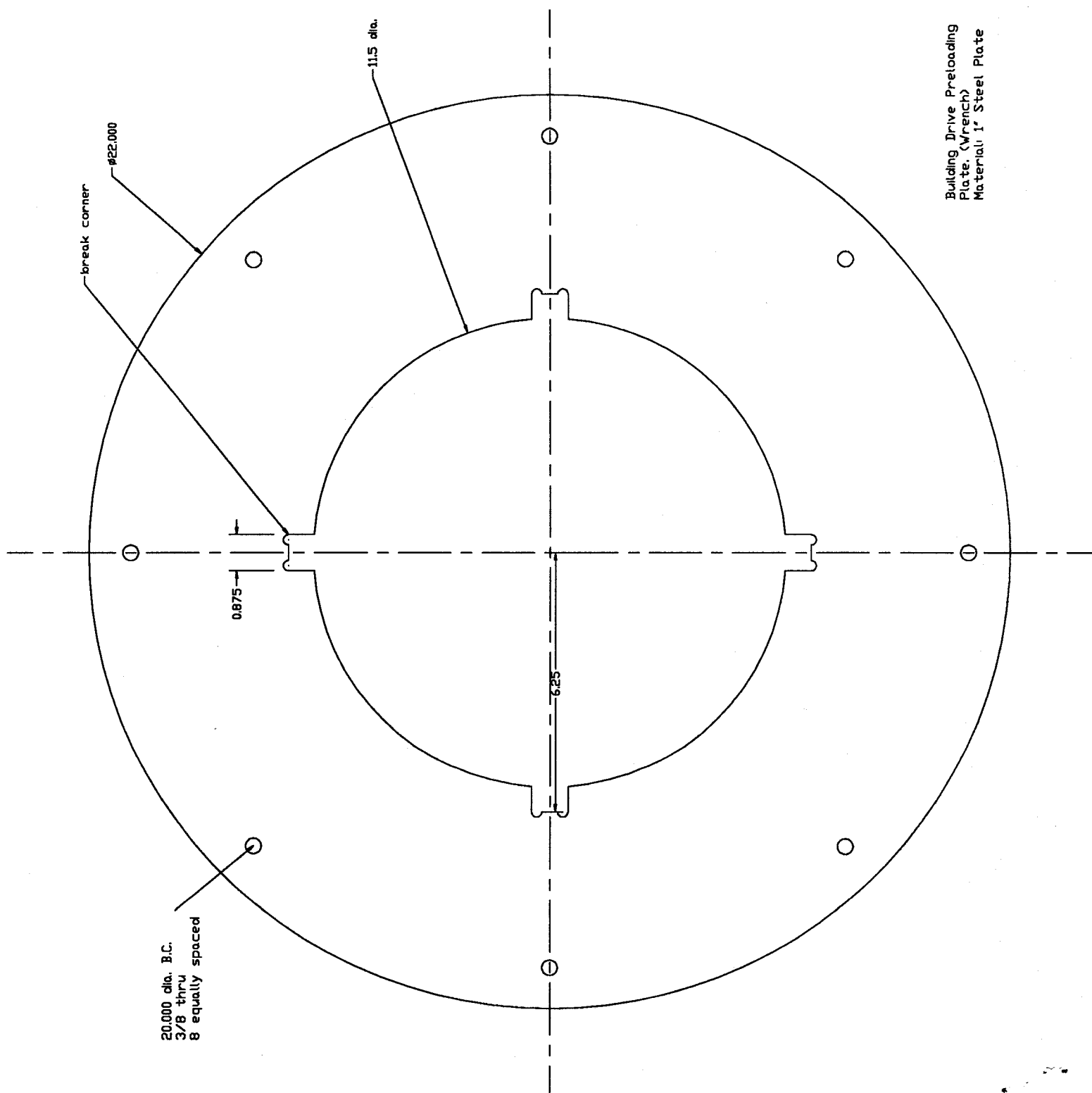
$$T = 2(96 \text{ Kips}) \left( \frac{10''}{12''} \right) = 16,000 \text{ ft}\cdot\text{lbs.}$$

The mechanical advantage of the building drive hand crank is 1000:1.

The preload on the hand-crank is 16ft-lbs.

MMTO 3/17/92

Building Drive Preloading  
Plate, (Wrench)  
Material: 1" Steel Plate



20.000 dia. B.C.  
3/8 thru  
8 equally spaced

break corner  
R22.000

11.5 dia.

0.875

6.25