

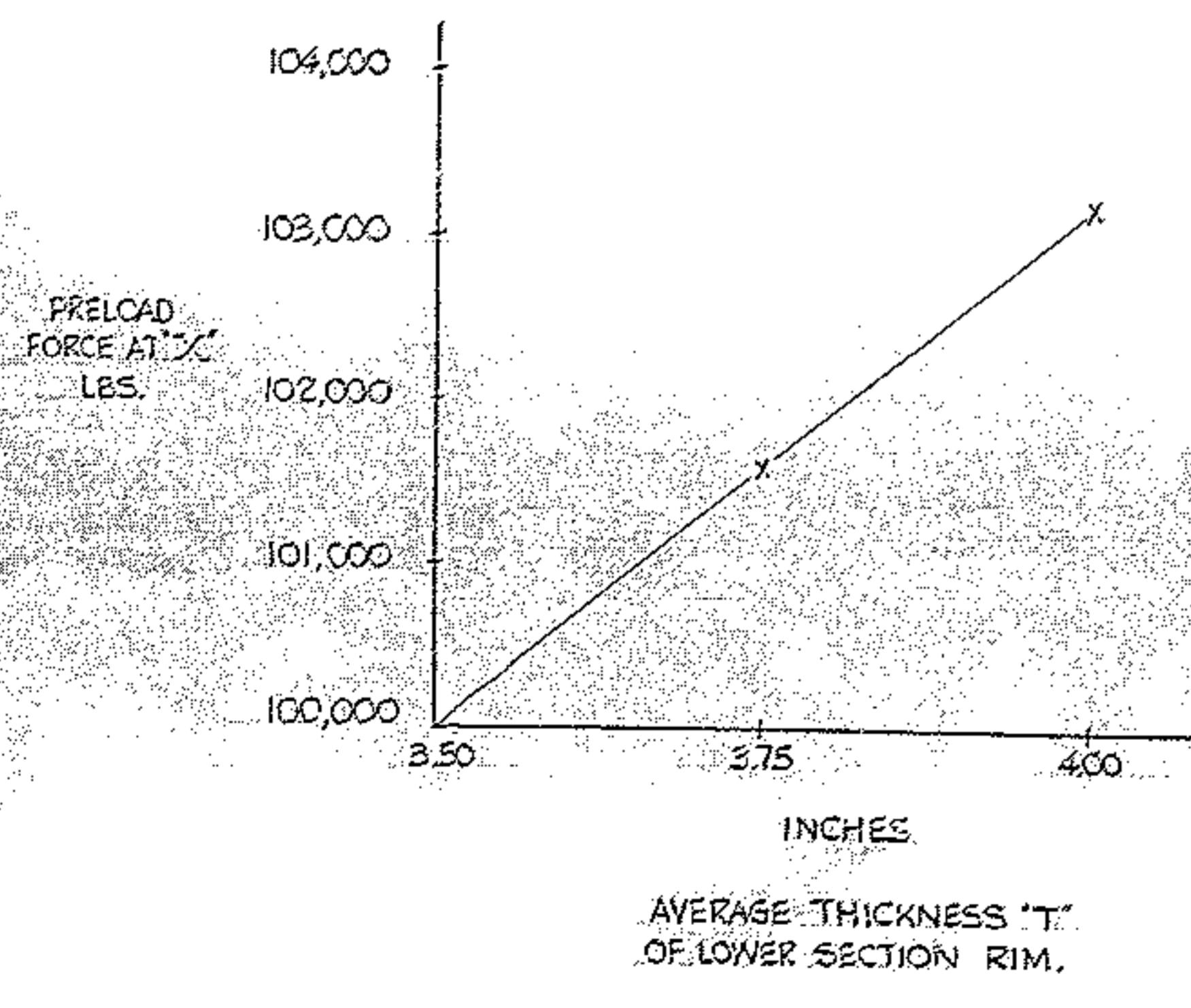
BILL OF MATERIAL				
ITEM	QTY	MATERIAL	DESCRIPTION	WEIGHT

RECOMMENDED SET-UP PROCEDURE FOR NORTH & SOUTH JOURNALS ASSEMBLY TO OBTAIN PROPER DECLINATION AXIS PRELOAD

The horseshoe is to be machined and assembled to the south journal in its free condition, except for only that deformation to be caused by the preloading across the declination axis. Ideally, to obtain the free condition, the horseshoe could be submerged in a liquid of equal density so that it is evenly supported at two points. This is not a practical method of supporting the horseshoe to obtain the free condition. However, nearly the same results may be obtained from a 3-point suspension with vertical cables to the four tube flange positions. In this suspended condition, the preload is applied at the declination axis. To provide the necessary support for handling and machining, a rigid strut is then substituted and there is no significant deflection in the horseshoe structure between the declination axis and the horseshoe points. Thus, this substitution should cause no undesired deflections in the horseshoe assembly during machining, handling and telescope assembly. To carry out these requirements, the following procedure steps are to be accomplished after the machining of the West Horseshoe Weldment, No. 2150.251E003; the East Horseshoe Weldment, No. 2150.251E004; and the Lower Horseshoe Structure Assembly, No. 2150.251E005, except that all the concrete and steel counterbalancing weight is to be left out during this entire procedure and the proper counterweighting, as directed by instructions in a separate report that is to follow, will then be added.

- Step No.
- Using vertical cables above the two points "D", and a horizontal bar that is suspended from its mid-point and connected with vertical cables above the two points at "E", suspend the horseshoe assembly in a horizontal position. With the horseshoe in this position, check all symmetrical points and adjust the position for sufficient material for machining. Mark a horizontal datum line around the outer surface of the bearing rim "R" within ±.005 inch of true position. This horizontal datum line will be used as a reference for positioning the assembly for machining.
 - Obtain the "Unloaded B" dimension across the horseshoe declination axis with a measuring system that is not affected by the loading system. This measuring system will be used to obtain the change of distance across the horseshoe. It need not measure the actual dimension but must be able to repeat the total distance to within ±.002 inch.
 - Apply a preload force at "X" across the declination axis. The amount of this force is to be obtained from the graph shown on the drawings. This graph shows the average thickness of the bearing rim "R" around the lower section of the horseshoe vs the preload force at "X" in pounds.
 - Measure the change in dimension "B", that is the "AB" obtained. Send this "AB" information to AURA for approval before continuing this procedure. (Note: Theoretically, this difference, "AB", should be 0.192 inch.)
 - Upon approval by AURA of the "AB" information, preload the horseshoe assembly to the "Preloaded B" dimension as in Step 3. With the dimension "Preloaded B" held and the datum line on bearing rim "R" obtained in Step 1 in one plane, place the preload strut "Y" in position between the points of the horseshoe assembly with the strut supported only at the two points "Z". This will position the ends of the strut with no angular deflections from its own weight. Bolt the strut end marked "1" to the pad on the horseshoe point marked "1" (the first horseshoe set is to be marked with "KP" and the second horseshoe set is to be marked with "CP") with the shim marked "1" at position "M". (A set of shims to be used at "M" and "N" marked "KP1" and "KP2" and a set of shims marked "CT1" and "CT2" will be required for use with the same strut "Y".) If the bolt holes at strut end marked "2" do not align and have a free fit for the bolts to the pad on the horseshoe point marked "2", then alter the shim marked "1" to permit proper alignment.
 - With the shim marked "1" bolted tightly in place, measure the clearance at position "N" at sufficient points across the face of the strut end marked "2" between the pad on the horseshoe point marked "2". Machine the shim marked "2" in whatever tapered shape is required to fit in this space with a clearance of .010 ±.001 inch. (This clearance of .010 inch permits the strut to stretch under the preloading force to give the proper dimension for "Preloaded B".)
 - With the strut end marked "2" with its shim bolted tightly, remove the preloading force at "X" and recheck that the dimension for "Preloaded B" is correct.
 - With the "Preloaded B" dimension held and with the horizontal datum line on "R", from Step 1, within ±.005 of true position as the basic reference for positioning the assembly, complete the machining of the horseshoe assembly. Strut "Y" or equivalent restraint is to be used during the machining operation.
 - After the bearing rim "R" is machined to final dimensions, suspend the horseshoe assembly in the horizontal position as in Step 1. With the strut "Y" and shims in place but loose (unbolted), measure the preload force at "X" and the "AB" necessary to bring the horseshoe assembly to the "Preloaded B" dimension. With this preload, measure the strut end clearance. The preload force only should have decreased slightly due to this rim thickness change. Proceed with the next step and report these results by letter to AURA.
 - Upon completion of the machining of the parts for the horseshoe assembly, assemble the horseshoe with strut "Y" and shims tightly in place and the horseshoe in the horizontal position. In this position with the polar axis vertical (and not horizontal as pictured on Dwg No. 2150.215E001), assemble the Coude Struts, No. 2150.201E003 and E004, and the Pipes, No. 2150.201E005 and E006, on the horseshoe. Hold each part so there are no deflections due to flange matching or their own weight when they are in their proper positions for attachment to the south journal. Assemble the South Journal, No. 2150.210E003, to the struts and pipes to conform to the concentricity and squareness requirements as shown on Outline, North and South Journals Assembly, No. 2150.215E001. Demonstration of the conformance to the required specifications to AURA representatives is to be performed in this same position with the polar axis vertical. (See: Specifications for 150" Stellar Telescope Mounting, Section 3, Article 3.6, Page 3-10 Revised, concerning 2150.200E000, Polar Axis and Tube Assembly.)
 - After completion of the above assembly with the strut "Y" and shims in place, suspend the North and South Journals Assembly in a similar manner to Step 1. With the strut "Y" and shims in place but loose (unbolted), measure the preload force at "X" and the "AB" necessary to bring this assembly to the "Preloaded B" dimension. With this preload, measure the strut end clearance. All these measurements may change slightly from those obtained in Step 9. Report these results to AURA.

- NOTES:
- The above procedure modifies Note 3 on Western Gear Dwg No. 2150.251E002 Rev. B, Horseshoe Structure Assembly; Note 3 on Western Gear Dwg No. 2150.215E001, Rev. B, Outline, North and South Journals Assembly; and Note 5 on Western Gear Dwg No. 2150.251E001 Rev. F, Outline, Horseshoe Structure.
 - If manufacturing procedures require variation from the intent of this preload procedure, approval from AURA will be required before proceeding.
 - Strut "Y" is intended for use as a common tool with both sets of telescope parts during telescope final assembly. This strut has been designed to have .010 increase in length under the preloading forces and to properly align and stiffen the horseshoe points during assembly of the telescope. If necessary to change the cross-sectional area or general configuration for manufacturing purposes, it will be necessary to recalculate the effect of these changes.



FOR ASSEMBLY SEE		TOLERANCES UNLESS OTHERWISE NOTED		KITT PEAK NATIONAL OBSERVATORY			
DECIMAL DIMENSIONS 0.0005 ±.003		FRACTIONAL DIMENSIONS UP TO 1" 1/16" 1/32" 1/64" 1/8" 1/4" 3/8" 1/2" 5/8" 3/4" 1" 1 1/4" 1 1/2" 2" 3" 4" 6" 8" 12" 18" 24" 30" 36" 48" 60" 72" 96" 120" 144" 180" 240" 300" 360" 480" 600" 720" 960" 1200"		OPERATED BY THE ASSOCIATION OF UNIVERSITIES FOR RESEARCH IN ASTRONOMY, INC.		DRAWING NUMBER 2120-E55	
BREAK SHARP EDGES		ALL SURFACES TO HAVE 100 FINISH UNLESS OTHERWISE NOTED		SCALE NOTED PRINT ISSUED			
DRAWING RELEASED TO		DATE		REV.			
REVISION		DATE		REV.			