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AN INFRARED FOREOPTICS ADAPTOR FOR THE LEARJET TELESCOPE

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16. Abstract

A foreoptics adapter has been built for the Learjet Telescope which permits simultaneous viewing of the visible star field in the image plane and acquisition of astronomical data at infrared wavelengths (≥ 1 micrometer). The device uses an adjustable dichroic beamsplitter to transmit visible wavelengths to an eyepiece (or television camera), and to reflect infrared wavelengths to a port where an infrared detector system can be mounted. The instrument is intended as a multiple user facility for the Learjet Telescope. This report describes the adapter and its use.

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AN INFRARED FOREOPTICS ADAPTOR FOR THE LEARJET TELESCOPE

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Abstract

A foreoptics adapter has been built for the Learjet Telescope which permits simultaneous viewing of the visible star field in the image plane and acquisition of astronomical data at infrared wavelengths ($\gtrsim$ 1 micrometer). The device uses an adjustable dichroic beamsplitter to transmit visible wavelengths to an eyepiece (or television camera), and to reflect infrared wavelengths to a port where an infrared detector system can be mounted. The instrument is intended as a multiple user facility for the Learjet Telescope. This report describes the adaptor and its use.

Summary

A foreoptics adapter has been built for the Learjet Telescope which permits simultaneous viewing of the visible star field in the image plane and acquisition of astronomical data at infrared wavelengths (≳ micrometer). The device uses an adjustable dichroic beamsplitter to transmit visible wavelengths to an eyepiece (or television camera), and to reflect infrared wavelengths to a port where an infrared detector system can be mounted. The instrument is intended as a multiple user facility for the Learjet Telescope. This report describes the adaptor and its use.

A cutaway view of the adaptor is shown in Figure 1. The nominal back focal distance (from the rear of the telescope backplate) is 230 mm, while the nominal distance from the face of the instrument mounting flange to the infrared focus is 70 mm. The reticle and eyepiece can be translated along the optical axis by ± 7 mm to optimize the visible focus once the telescope has been focussed for maximum infrared signal. Changing the back focal distance (reticle position) by more than ± 17 mm can be done by modifying the Eyepiece Extension or the Eyepiece Adaptor. The foreoptics with eyepiece weigh 1.6 kgm.

The dichroic beamsplitter has two micrometer adjustments to permit accurate alignment of the detector field of view with the secondary mirror of the telescope. These adjustments can be used to null infrared offset signals in flight as well. The beamsplitter is evaporated gold on glass. Its measured transmission and reflectivity are shown as a function of wavelength in Figure 2.

The foreoptics adaptor can be mounted either with the infrared beam horizontal or vertical, to accommodate either side-looking or down-looking detector cryostats. When side-looking dewars are employed, they should be mounted on the left (aft) side of the telescope axis, to counterbalance the weight of the finder telescope. A detail of the Instrument Mounting Flange is shown in Figure 3. Figure 4 shows a Suggested Instrument Mounting Adaptor which, when

bolted to the investigator's dewar, mates to the instrument mounting flange.

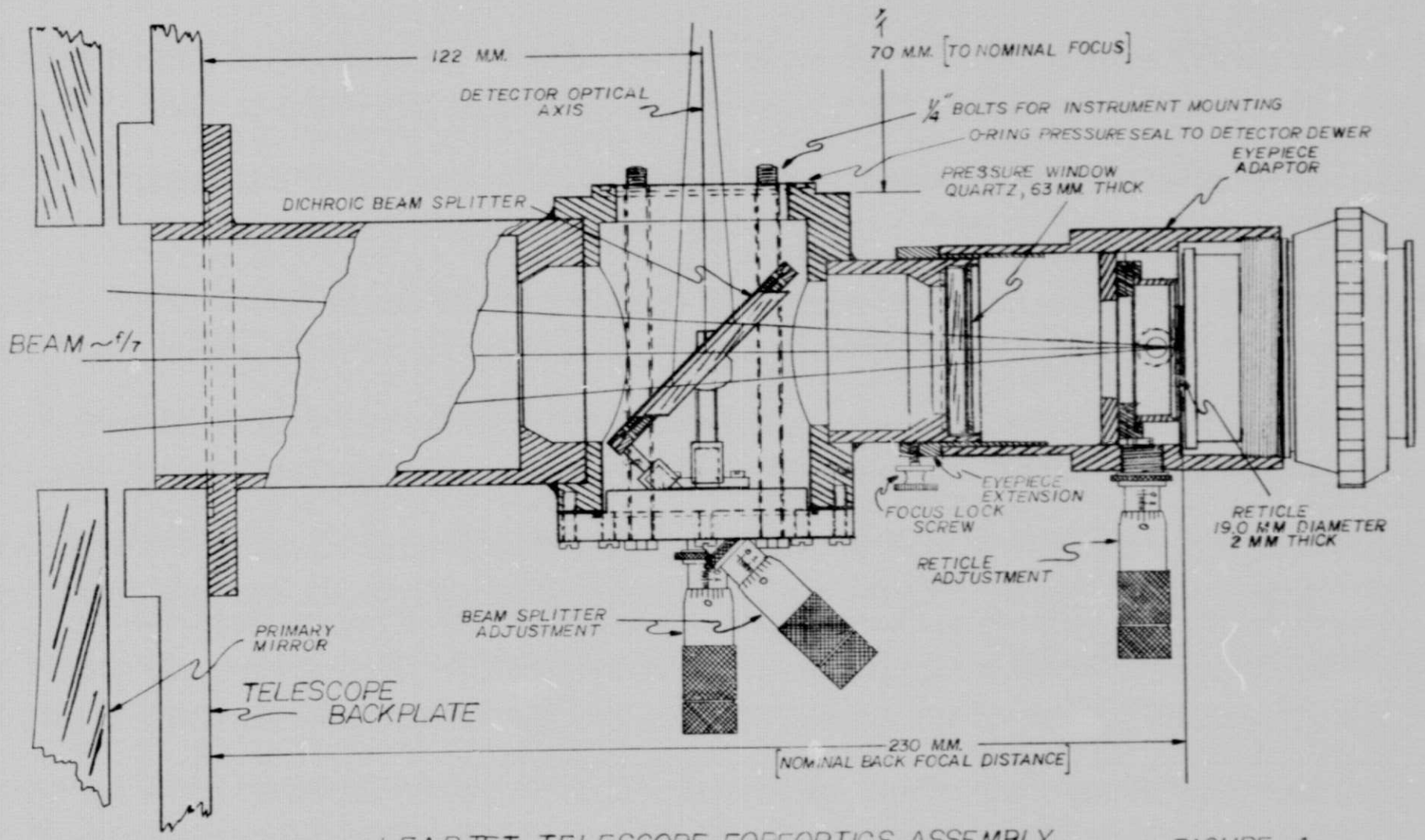
Two reticles are available, mounted in separate eyepiece adaptors. The two reticle patterns are shown in Figure 5. The smaller reticle is mounted with orthogonal position adjustments, and is shown in Figure 1. The larger reticle is fixed in its mount and is intended primarily for use with the fiber-optics bundle leading to the television camera. The reticle light circuit is shown in Figure 6. The reticle light power is provided by the telescope stabilization electronics.

It is recommended that the beamsplitter be kept clean by covering the instrument and telescope ports when not in use.

Reference: E.F. Erickson, D. Goorvitch, M.G. Dix, and M.J. Hitchman, "Lear Jet Telescope System" NASA Technical Memorandum TM X-62,389.

Figures

1. Assembly drawing of the foreoptics showing pertinent optical distances.
2. Dichroic beamsplitter transmission and reflection as a function of wavelength.
3. Detail of the instrument mounting flange.
4. Suggested infrared detector mounting adaptor.
5. Available reticle patterns.
6. Reticle light circuit.



LEARJET TELESCOPE FOREOPTICS ASSEMBLY

FIGURE 1

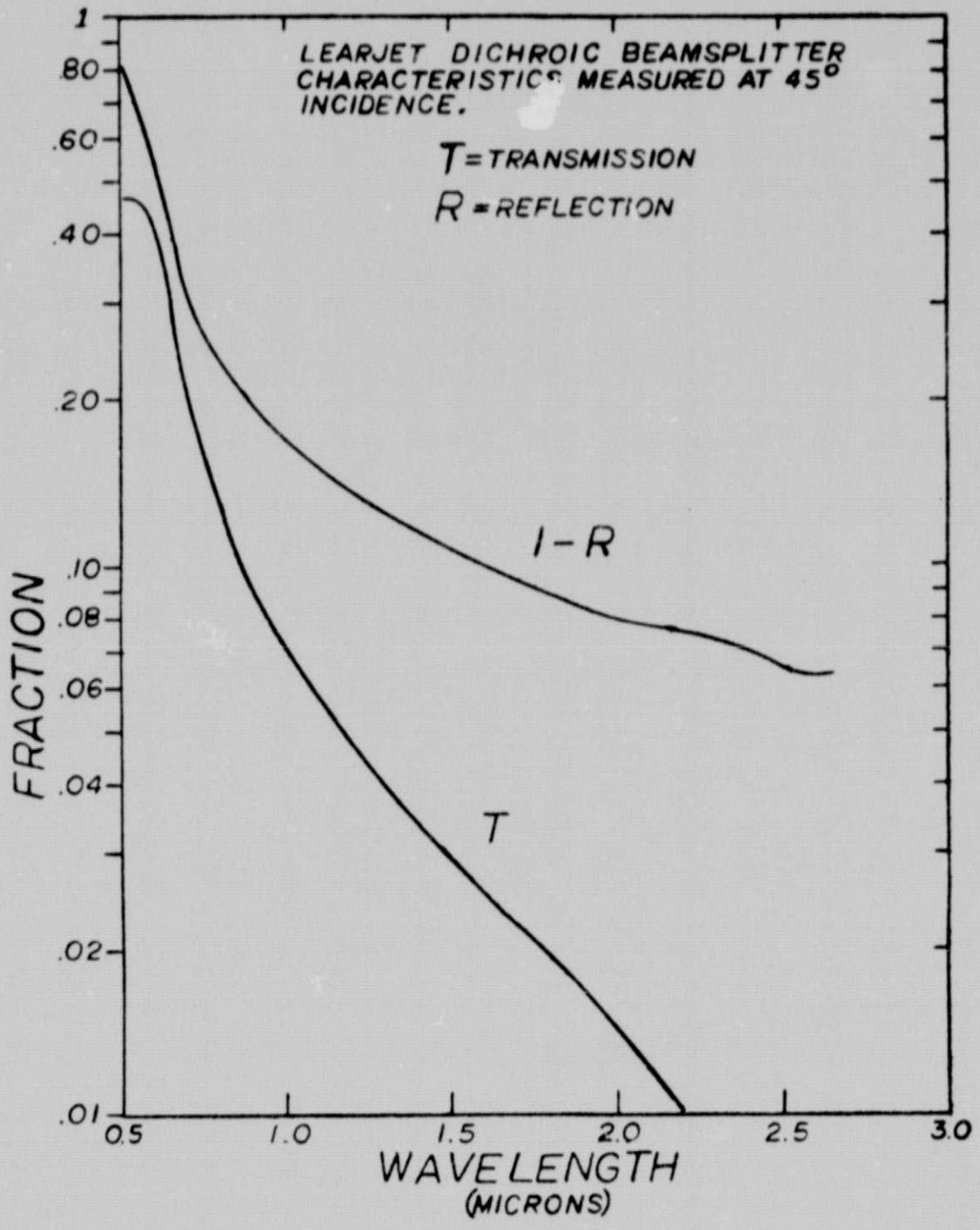

LEARJET DICHROIC BEAMSPLITTER
CHARACTERISTICS MEASURED AT 45°
INCIDENCE.
T = TRANSMISSION
R = REFLECTION
1-R
T
FRACTION
1
.80
.60
.40
.20
.10
.08
.06
.04
.02
.01
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH
(MICRONS)

FIGURE 2

INSTRUMENT MOUNTING FLANGE

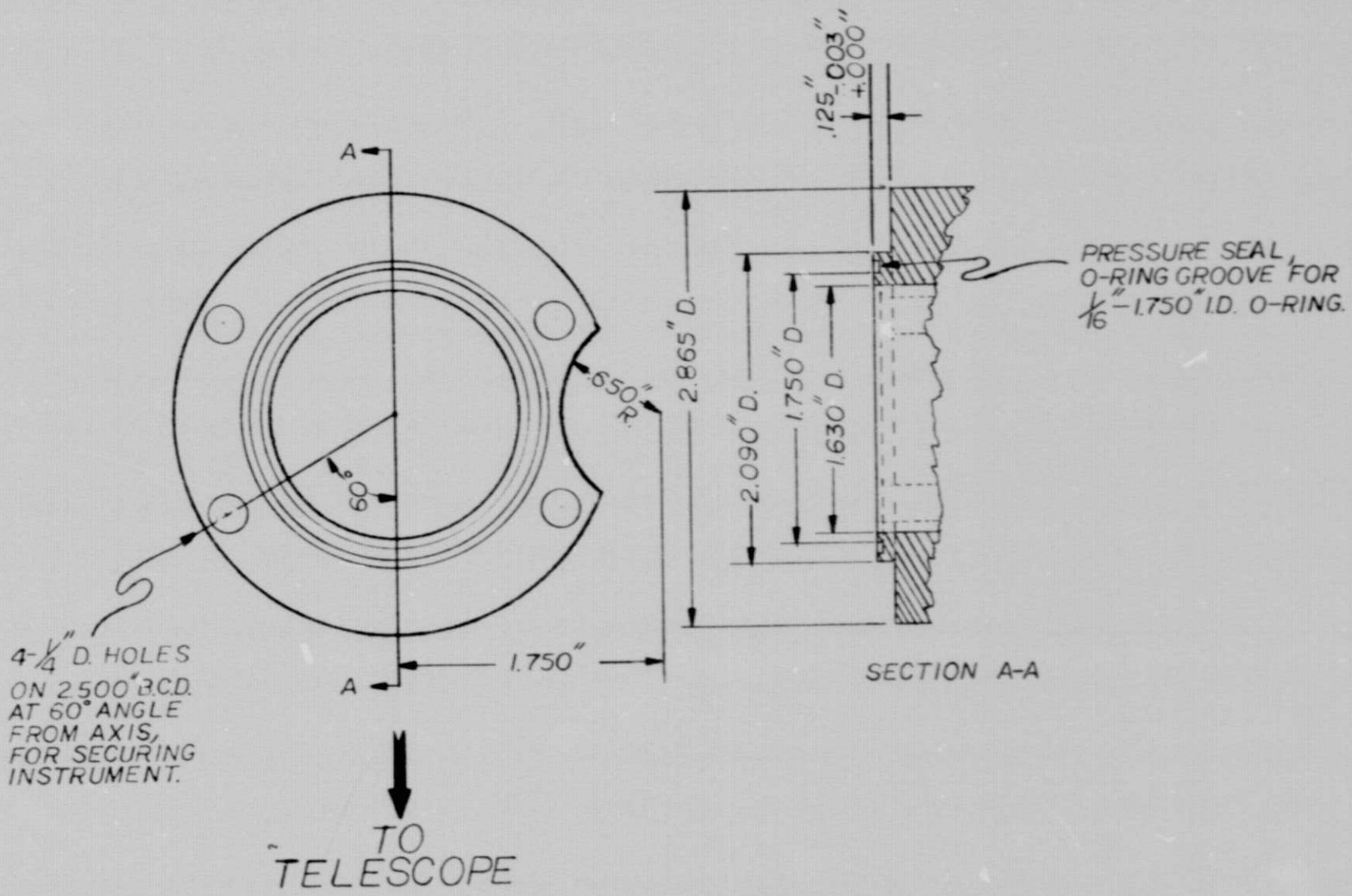


FIGURE 3

SUGGESTED INSTRUMENT MOUNTING ADAPTOR

[MATES WITH INSTRUMENT MOUNTING FLANGE]

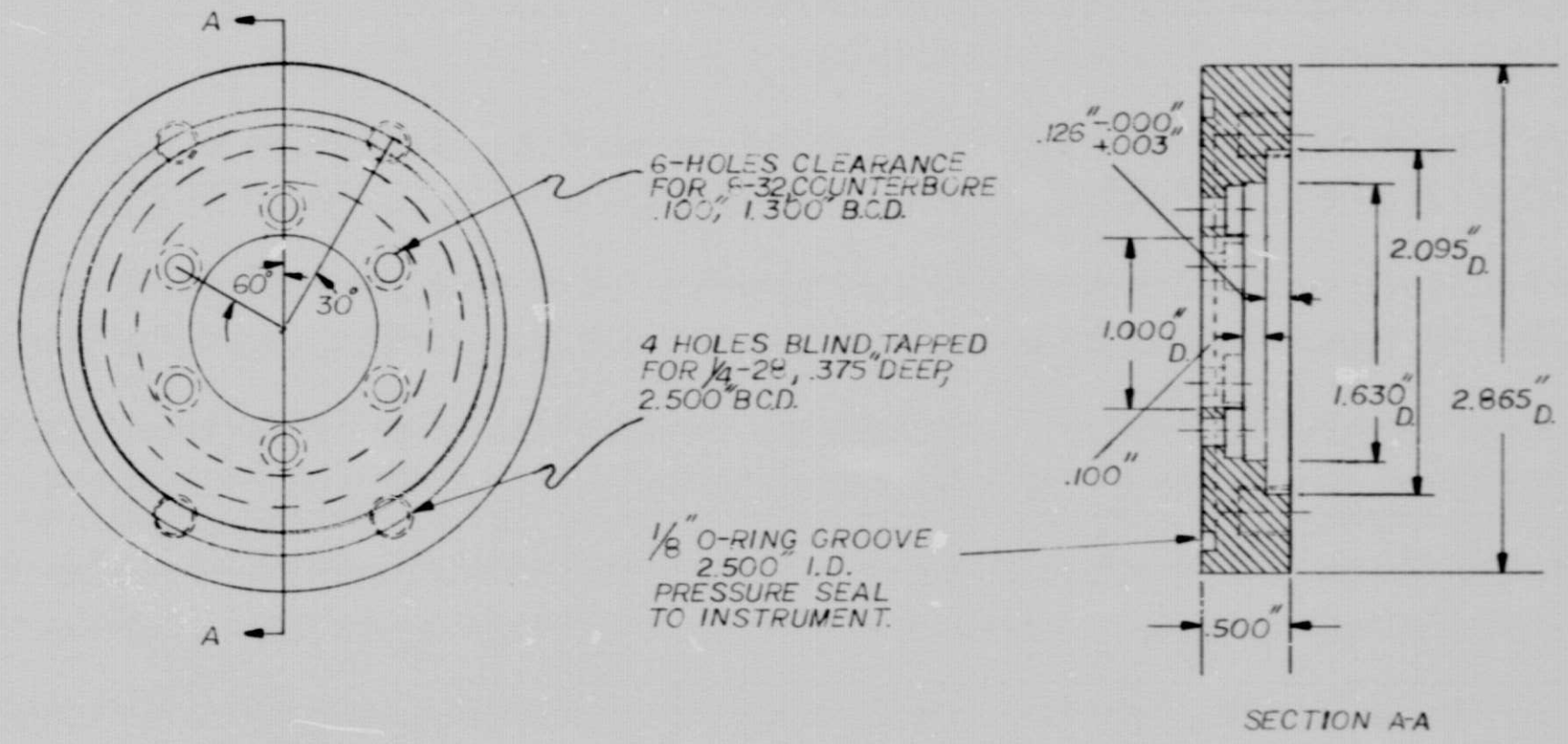


FIGURE 4

RETICLE PATTERNS

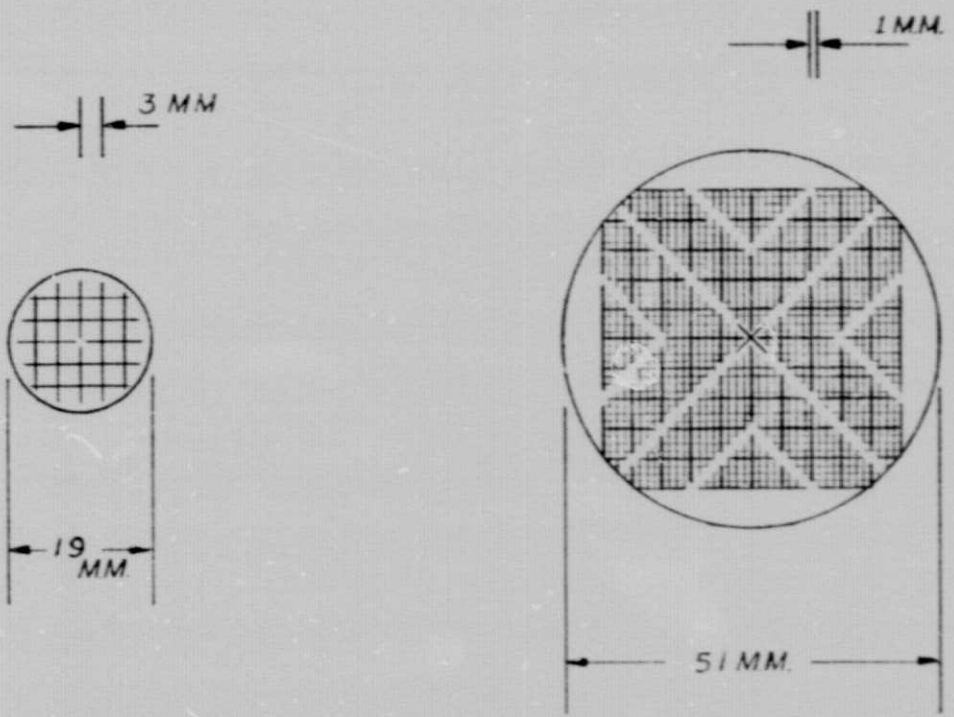


FIGURE 5

RETICLE LIGHT CIRCUIT

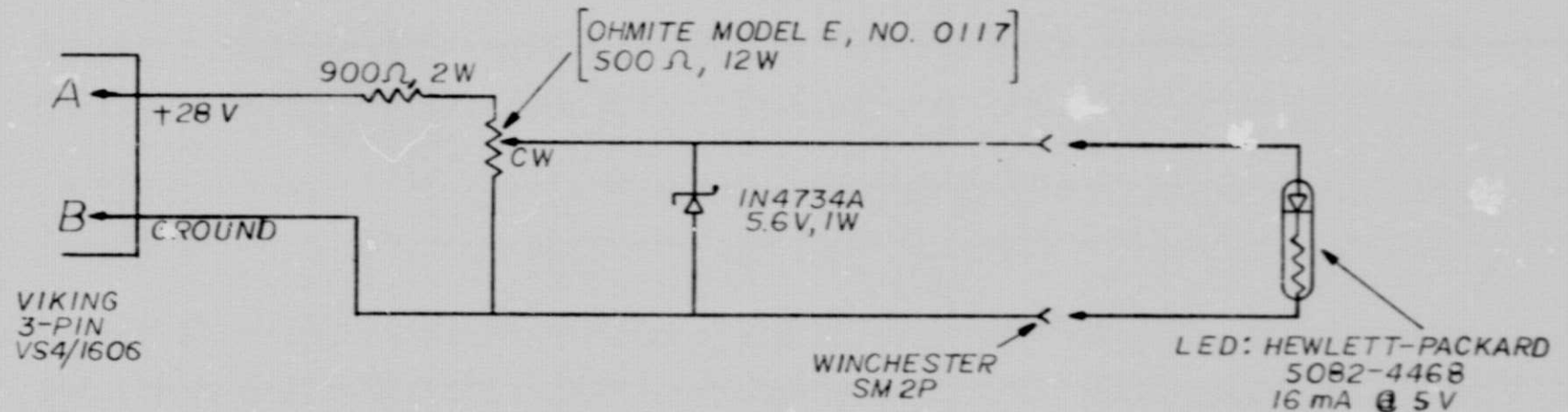


FIGURE 6