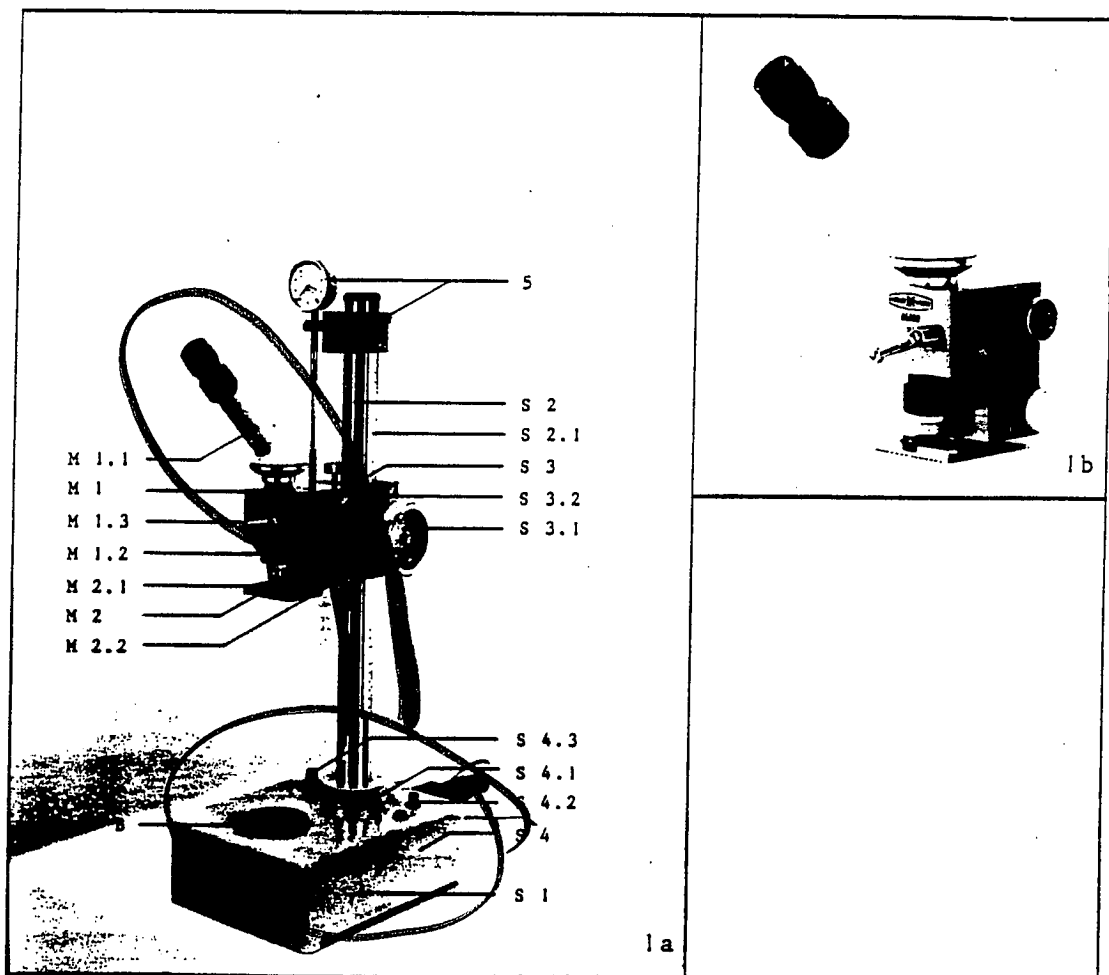


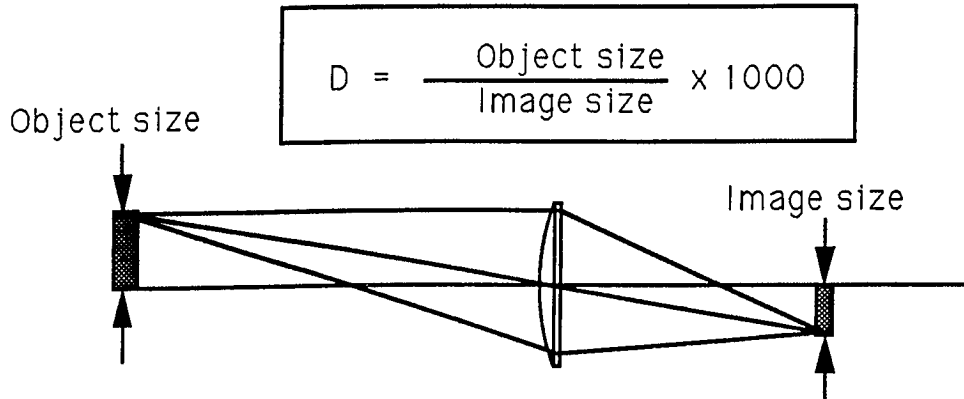
MELOS 500 FOCOMETER OPERATION - EFFECTIVE FOCAL LENGTH

FIGURE 1. FOCOMETER FOR POSITIVE OPTICAL SYSTEMS



Lens Power by Image Magnification

PRINCIPLE: The size of an image formed by a lens is a measure of the optical power of the lens. For sizes in mm, the power in diopters of a lens is simply,



This relation holds for the lens in air or water, etc.

APPROACH:

The object used is the standard USAF 1951 target which is already used in the BFL bench collimator.

This target features groups of bars with various spacings. The distance across any set of bars on the target is easily measured with a microscope equipped with a micrometer "filar" eyepiece. Comparing the known spacings of the target bars with the measured spacings in the image, gives the magnification, and so the power of the lens producing the image.

CALIBRATING THE BFL BENCH

to determine the power of the lens being tested, Three characteristics of the BFL bench must first be measured: The Collimator EFL, the true target dimensions, and the microscope objective magnification. This requires disassembly of the collimator.

The Collimator EFL is measured using the MELOS lensometer.

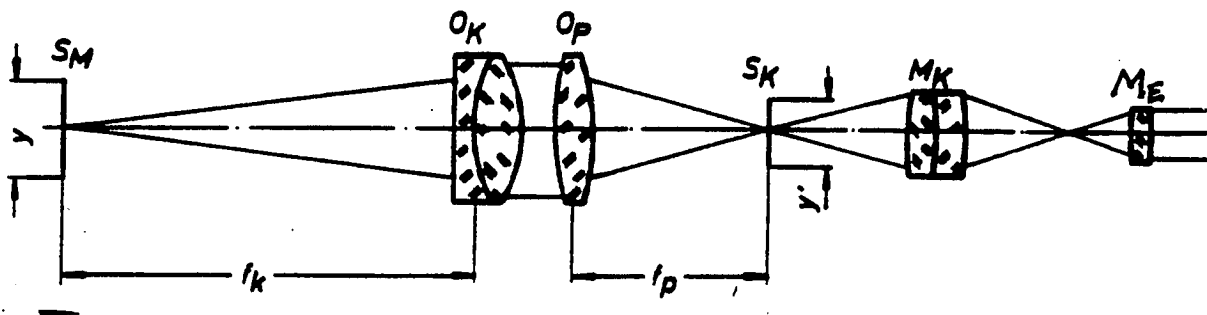
The Microscope magnification is determined by measuring the Nikon micrometer slide with the filar eyepiece to be used, and comparing the image size to object size.

$$\text{Magnification} = \frac{\text{Image size}}{\text{Object size}}$$

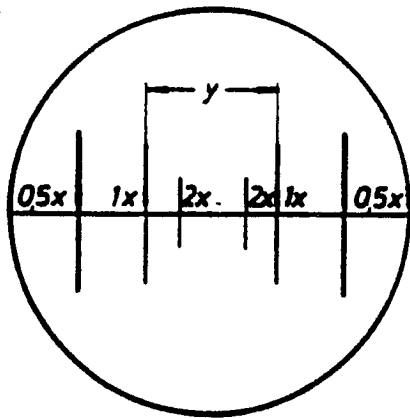
MELOS 500 FOCOMETER OPERATION - EFFECTIVE FOCAL LENGTH

FIGURE 2. MEASUREMENT PRINCIPLE FOR FOCOMETER FOR POSITIVE OPTICAL SYSTEMS

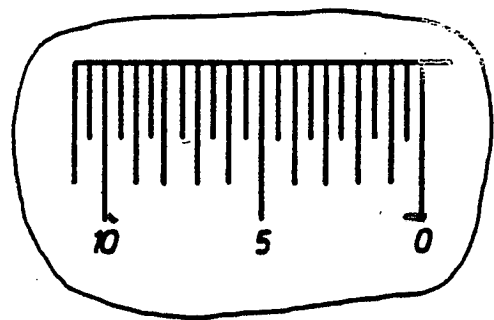
$$\left(\frac{f_k}{y}\right) y' = f_p$$



?



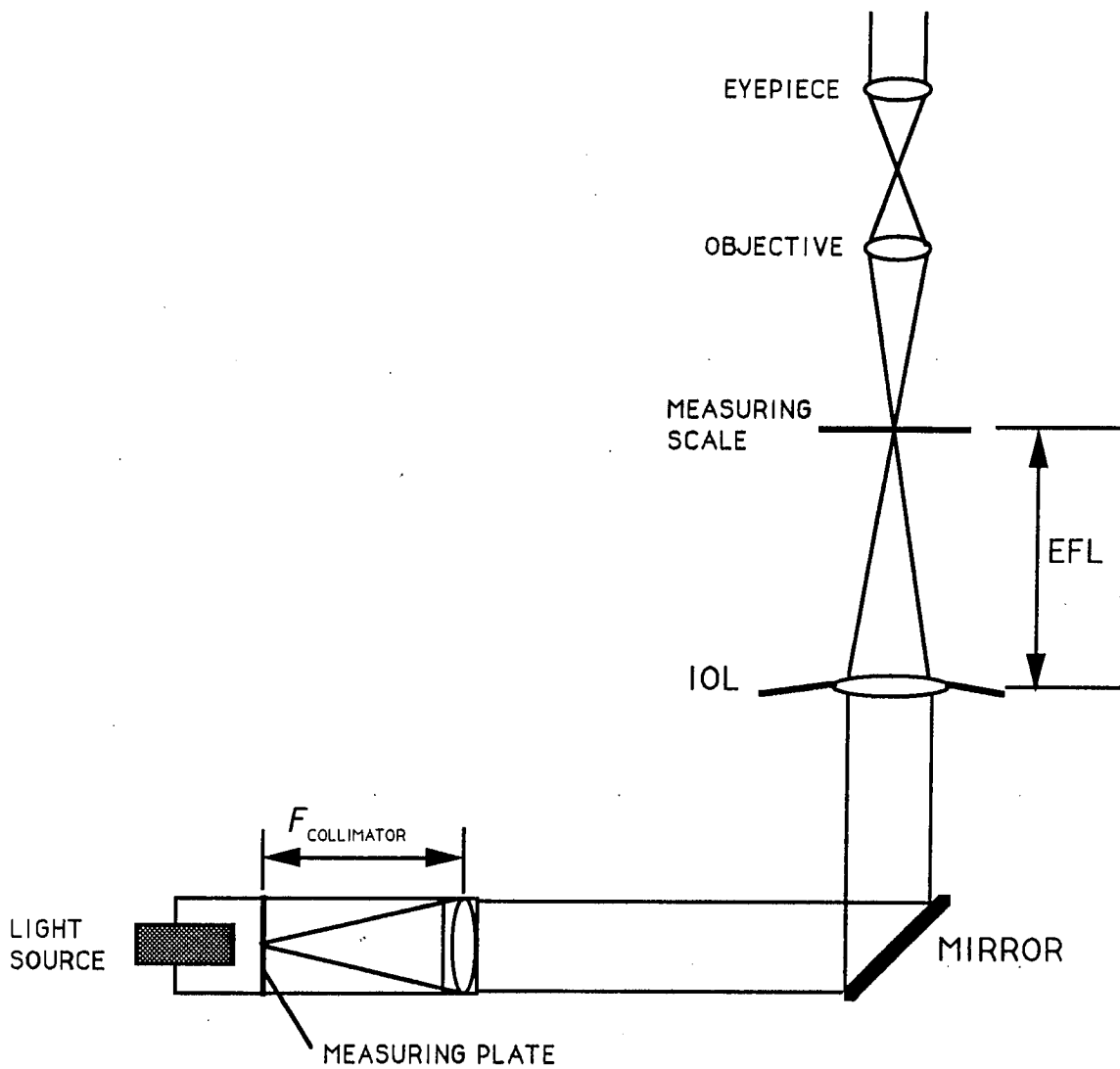
Measuring Plate S_M



Scale plate S_K

MEASUREMENT PRINCIPLE OF THE MELOS 500 FOCOMETER

(SIDE VIEW)



The target dimensions must be carefully measured using an optical comparator. The most useful target dimensions are across the elements of group 2. These distances are labeled OA, OB, OC, OD, and OE in figure 1. (The 1951 USAF target is highly standardized, but variations of 0.6% have been measured.)

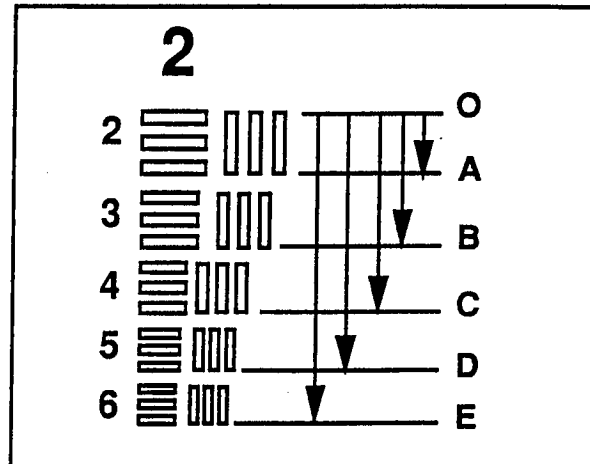


Figure 1: Dimensions of group 2 elements for measuring magnification

Determination of Power From Magnification

The formulas which relate the BFL bench constants to the power of the test lens are as follows:

$$\text{Test Lens EFL} = \frac{T'}{T} \times \frac{F_c}{M} \times \frac{n'}{n} \times 1000$$

$$\text{Test Lens Power (Diopters)} = \frac{1}{(\text{Test Lens EFL})}$$

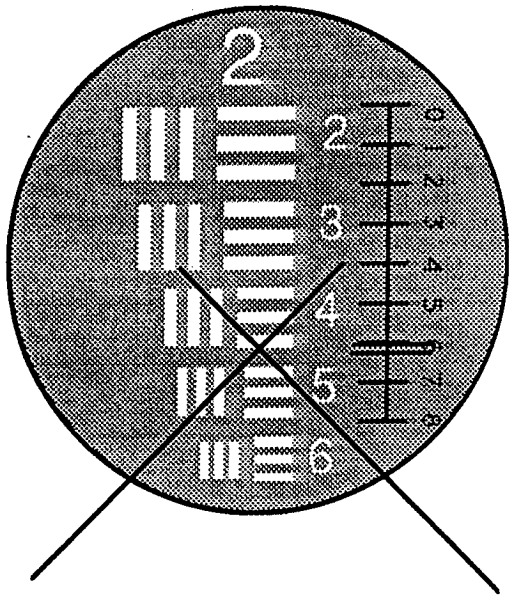
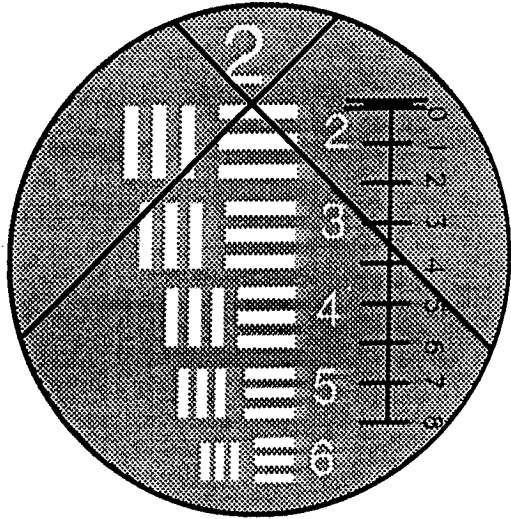
Where,

- T is the target dimension measured with the comparator.
- T' is the size of its image as measured with the filar eyepiece.
- F_c is the collimator EFL.
- M is the microscope objective's true magnification.
- n' is the index of the medium containing the lens, (air or water).
- n is the index of air.
- 1000 is the number of mm per meter

Note that for any particular target dimension, all the values but T' will remain fixed. Therefore, once the characteristics of the BFL bench system have been determined, the first formula above will become:

$$\text{Test lens EFL} = (\text{conversion factor}) \times T'$$

from which, the lens power is quickly determined.





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CERTIFICATE OF CALIBRATION

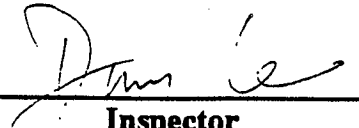
For: _____

LENS ID #	EFFECTIVE FOCAL LENGTH	TOLERANCE
3687-01	25.03 mm	± 0.08 mm
3687-02	37.78 mm	± 0.11 mm
3687-03	49.94 mm	± 0.15 mm
3687-04	75.23 mm	± 0.23 mm
3687-05	99.57 mm	± 0.30 mm
3687-06	99.50 mm	± 0.30 mm

COMMENTS: _____

We hereby certify that the above lens(es) have been tested according to IOLAB R&D Standard Operating Procedure no. C-DPD-03-109. All measurements are traceable to the German Institute of Standards (Physikalische-Technische Bundesanstalt).

Test # 3687

By 
Inspector

Supervisor  Date Feb. 21, 1992