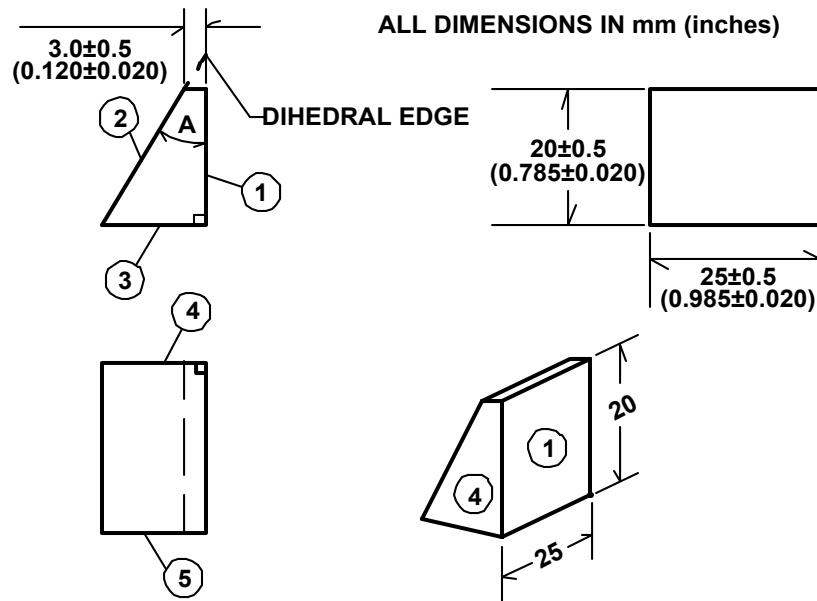


OSC CRYOGENIC REFRACTOMETER - PRISM SPECIFICATIONS

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Our cryogenic refractometer uses a modified minimum deviation method for the measurement of refractive index as a function of temperature and wavelength. The wavelength range of the instrument extends from 254 nm in the ultraviolet to 35 μm in the infrared (limits are imposed by the transmission of the windows available for the measurement Dewar). We have measured over the temperature range from 10K to 500°C. Overall measurement uncertainties on the order of $n/10^4$ are routinely achieved.

The Dewar in which the sample is placed for cryogenic measurements has fixed windows, requiring a nominal deviation angle of 30°. A working drawing of a typical prism is shown below. The encircled numbers identify the various surfaces.

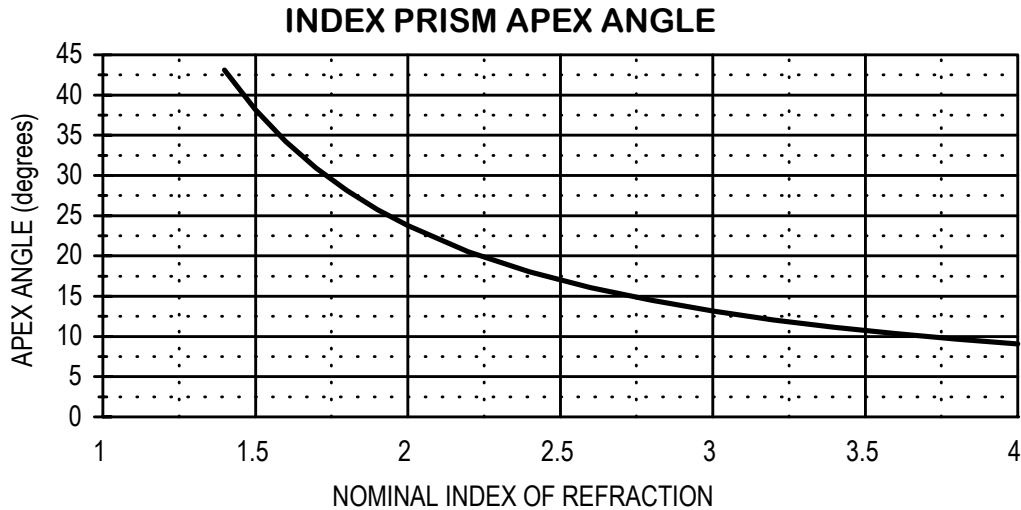


Dimensions are given in millimeters (inches). All edges should have a 0.5 mm (0.020") \times 45° chamfer. The intersection of the projections of surfaces 1 and 2 is a straight line, named the dihedral edge. The primary mounting surface 4 must be $90^\circ \pm 0.1^\circ$ with respect to the dihedral edge. Mounting surface 3 must be parallel to the dihedral edge with a tolerance of $\pm 0.5^\circ$, and surface 1 and surface 3 must be perpendicular to surface 4 with a tolerance of $\pm 0.5^\circ$. Deviations from these angular specifications will compromise the achievable uncertainty.

The equation below is used to determine the prism apex angle A to achieve the required 30° deviation angle.

$$A = \tan^{-1}\left(\frac{0.5}{n - 0.866}\right)$$

where n is the nominal (mid-band) index of refraction. The tolerance on A is 0.01A, or 1%. A plot of A vs. n is shown below. We do the precise apex angle measurement using a Wild spectrometer.



The angle A will vary from 40° (SiO₂, n = 1.45) to 9° (germanium, n = 4). The drawing shows the prism dimensions needed to fit our standard fixtures. Other prism sizes can be accommodated, but will require special tooling at extra cost. The following table shows the surface specifications for the prism:

SURFACE	FINISH	FLATNESS	FIGURE	SURFACE QUALITY
1	polished	λ/2	λ/4	80/50
2	polished	λ/2	λ/4	80/50
3	ground	2λ	N/A	N/A
4	ground	2λ	N/A	N/A
5	ground	N/A	N/A	N/A

NOTE: λ is specified as 632.8 nm (He-Ne).

The costs involved in making these measurements are based primarily on the specified wavelength and temperature ranges. A typical order consists of five temperatures between 65K and 300K and 15 wavelengths over the range 1 and 15 μm. The cost for such an order is approximately \$6000. Longer wavelengths and colder temperatures have a significant cost impact due to the need for liquid helium. The measurement time is typically two weeks setup and two weeks per prism. Write, call, FAX or e-mail for further details.

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