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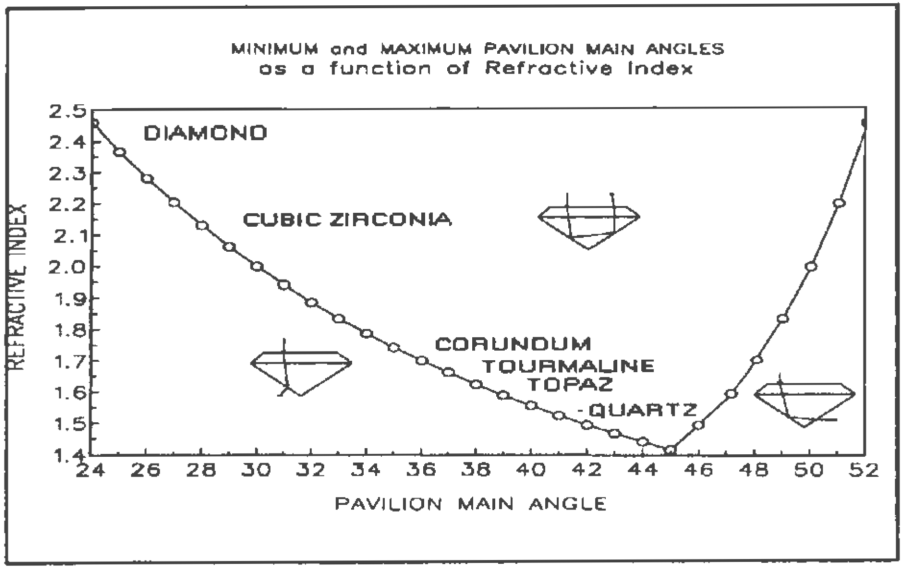

PAVILION ANGLE LIMITS

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Figure 1 is a chart which represents limiting conditions of refractive index and pavilion main angle to achieve a "bright center" with an SRB design if we consider only the light entering thru a normal flat table. This is a simplified model that does not consider the effects of facets other than the table itself and the main pavilion facets which converge at the PCP (culet). One of the advantages of the BRIGHTNESS PLOTS we have been featuring in recent Seattle Facetor Design issues is that whole design is considered at one time, so that facet interactions can be studied. Figure 1 does not do that, but is still useful model as an explanation for the central part of the stone which is primarily lit by light entering thru the table.

The left part of the curve in Figure 1 (below pavilion angle 45 degrees) is the well known "critical angle" limit. Any combination of Refractive Index (on the Y scale) with a Pavilion Main Angle (on the X scale) which falls below the curve will result in a DARK CENTER, because light rays entering thru the Table facet will penetrate, be refracted, and strike the main facet under it at an angle too steep to permit it to be reflected. Instead the ray would penetrate and be lost out the pavilion. The inset below the curve in Figure 1 is a schematic of this condition.

Note: Formula for this portion of the curve (Low Limit) is

$$LL = \sin^{-1} (1 / RI)$$

where RI = Refractive Index and LL = Pavilion Angle in degrees

Above the curve, conditions are such that a ray entering the Table would be refracted, then reflected from a pavilion main to the opposite pavilion main, and then reflected again to finally exit thru the Table as a light ray traveling generally in the reverse direction from when it entered the stone. The inset above the curve in Figure 1 is a schematic of this condition, which gives a "bright" center.

If this was all there was to the limiting curve (as is often implied by considering only the "Critical Angle"), one would expect to find some condition where bright centers could be found even on materials with very low refractive indices. Just make the pavilion main angle high enough and there it would be. However, experience has shown otherwise, there is an UPPER LIMIT as well as a LOWER LIMIT. If the pavilion angle is too high, the center goes dark. In Figure 1 this is the portion of the curve to the right of 45 degrees on the x-Scale.

Note: Formula for the UPPER LIMIT is $UL = (180 - LL) / 3$

For conditions below (and to the right of) the UPPER LIMIT curve, light rays entering the Table are refracted and reflected from the first pavilion main facet, but strike the second pavilion main facet at too steep an angle to be reflected and are again lost thru the pavilion.

Also shown on Figure 1 is the approximate position on the Refractive Index scale (y-Scale) of some common faceting grade materials. The difference between the angle corresponding to the UPPER LIMIT and the LOWER LIMIT is an indication of how sensitive the material is to this particular condition. Table I lists