Reflector Calculations

June 2022

Conic Shape to Flat Piece

If we start with the dimensions of the reflector in the conic shape, we can recover the dimensions of the corresponding flat piece using the following calculations. In this case, our conic shape dimensions are:

- Angle from vertical: $\theta = 31.7°$

- Length of diagonal: $D = 13mm$

- Outer radius: $R = 44.78mm$

- Inner radius: $r = 37.95mm$

The flat piece will be a section from an annulus, which will be defined by inner and outer radii (call them x and y, respectively), and an arc angle, ϕ. The difference between these radii is of course just the length of the diagonal of the conic piece, D. To find these quantities, we can first note that the circumference of the inner circle of the conic piece is just $2\pi r$, and similarly the circumference of the outer circle is $2\pi R$. These values correspond to the arc-lengths of the inner and outer sides of the portion of the annulus we are interested in. Thus, we have

$$2\pi r = x\phi \; ; \;\; 2\pi R = y\phi$$

We can note that $y = x + D$. Solving for x gives

$$x = \frac{rD}{R - r} \approx 72.22mm$$

The corresponding value for the outer radius of the annulus is

$$y = \frac{rD}{R - r} + D \approx 85.22mm$$

Using the previous equations, we can solve for ϕ:

$$\phi = \frac{2\pi r}{x} = 3.30 \; rad \rightarrow 189.17°$$