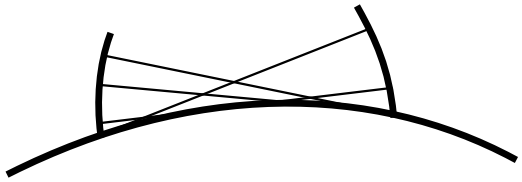
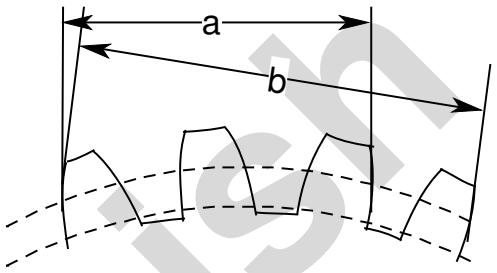
Procedure for measuring the Base Tangent Length by using a disc micrometer and thereby calculating Tooth Thickness and Base Pitch.

PRINCIPLE:
The length of the base circle intersected by the opposite flanks over a certain number of teeth is the base tangent length, also known as the span. For involute profiles, the distance between parallel lines embracing several teeth is a constant and equal to the base tangent length. This distance can be conveniently measured using a flange or disc micrometer.

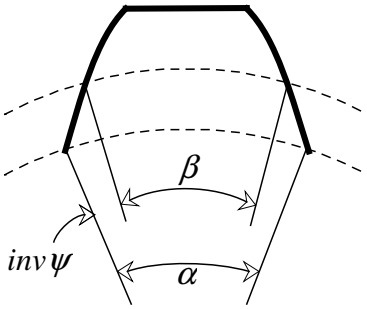


The tooth thickness can be directly calculated from the Base Tangent Length. Since this calculation is a little involved, an alternative approach is to calculate the difference in base tangent lengths over two different numbers of teeth. This will be equal to the base pitch multiplied by the difference in number of teeth.



PROCEDURE:

1) Keep the jaws of the disc micrometer between the chosen number of teeth t_1 with no shake and force, so that the jaws are tangential to the teeth.
2) Note the reading of the disc micrometer as 'a'. This is the length of the base tangent over t_1 teeth.
3) The Arc Tooth Thickness can be calculated as $T = \frac{a}{\cos\psi} - mN\left[\tan\psi - \psi + \frac{\pi S}{N}\right]$, where T is the required tooth thickness at the pitch circle, a the measured Base Tangent Length, ψ the pressure angle in radians, m the module, N the total number of teeth in the gear and $S = t_1 - 1$ is the number of spaces between the measured teeth. [The arc tooth thickness at the base circle $L_b = a - (t_1 - 1)P_b$, where P_b is the base pitch $\pi m \cos\psi$. Then, the angle in radians subtended by this arc at the gear centre $\alpha = \frac{2L_b}{D_b}$, where D_b is the base circle diameter. Now, the angle between the radii intersecting a flank of a tooth at the pitch circle and base circle (see Fig) is the involute function $(inv\psi) = \tan\psi - \psi$ where both ψ and $inv\psi$ are in radians. The angle β subtended at the centre by the arc tooth thickness at the pitch circle is $\beta = \alpha - 2inv\psi$ (radians). Therefore, the length of the arc on the pitch circle $L_a = \beta D_p / 2$, where D_p is the Pitch Circle Diameter.]



4) Repeat the above procedure for 't_2' number of teeth and note the reading of the disc micrometer as 'b'.
5) The base pitch can be calculated by using the formula $P_b = \frac{b - a}{t_2 - t_1}$