

Chapter 9 Calculations for types of gear

9.1 Calculation for Standard spur gear

1. Finishing method		4. Module	$m =$	7. Addendum	$h_a = m =$
2. Number of teeth of Pinion	$z_1 =$	5. Reference pressure angle	$\alpha =$	8. Dedendum	$h_f = m + c =$
3. Number of teeth of Gear	$z_2 =$	6. Bottom clearance	$c =$	9. Tooth depth	$h = h_a + h_f =$

Gear terms	Pinion 1	Gear 2
10. Centre distance	$a = \frac{m(z_1 + z_2)}{2} = \frac{d_1 + d_2}{2}$	
11. Reference diameter	$d_1 = z_1 m$	$d_2 = z_2 m$
12. Tip (Outside) diameter	$d_{a1} = d_1 + 2h_a = m(z_1 + 2)$	$d_{a2} = d_2 + 2h_a = m(z_2 + 2)$
13. Sector span of teeth	$z_{m1} = \frac{\alpha z_1}{180} + 0.5$	$z_{m2} = \frac{\alpha z_2}{180} + 0.5$
14. Sector span	$W_1 = m \cos \alpha \{ \pi(z_{m1} - 0.5) + z_1 \operatorname{inv} \alpha \}$	$W_2 = m \cos \alpha \{ \pi(z_{m2} - 0.5) + z_2 \operatorname{inv} \alpha \}$
15. Base diameter	$d_{b1} = d_1 \cos \alpha$	$d_{b2} = d_2 \cos \alpha$
16. Circular pitch	$p = \frac{\pi d_1}{z_1} = \pi m$	$p = \frac{\pi d_2}{z_2} = \pi m$
17. Circular thickness	$s = \frac{p}{2} = \frac{\pi m}{2}$	
18. Base pitch	$p_b = \frac{\pi d_{b1}}{z_1} = \frac{\pi d_1 \cos \alpha}{z_1} = \frac{\pi d_2 \cos \alpha}{z_2} = \pi m \cos \alpha$	
19. Working depth	$h_1 = h_{a1} + h_{a2}$	
20. Transverse contact ratio	$\epsilon_a = \frac{\sqrt{\left(\frac{d_{a1}}{2}\right)^2 - \left(\frac{d_{b1}}{2}\right)^2} + \sqrt{\left(\frac{d_{a2}}{2}\right)^2 - \left(\frac{d_{b2}}{2}\right)^2} - \frac{m(z_1 + z_2)}{2} \sin \alpha}{\pi m \cos \alpha}$	

9.2 Calculation for Standard Internal gear

1. Finishing method		4. Module	$m =$	7. Addendum	$h_a = m =$
2. Number of teeth of Pinion	$z_1 =$	5. Reference pressure angle	$\alpha =$	8. Dedendum	$h_f = m + c =$
3. Number of teeth of Gear	$z_2 =$	6. Bottom clearance	$c =$	9. Tooth depth	$h = h_a + h_f =$

Gear terms	Pinion 1	Gear 2
10. Centre distance	$a = \frac{m(z_2 - z_1)}{2} = \frac{d_2 - d_1}{2}$	
11. Reference diameter	$d_1 = z_1 m$	$d_2 = z_2 m$
12. Tip (Outside) diameter	$d_{a1} = d_1 - 2h_a = m(z_1 - 2)$	$d_a = d_2 + 2h_a = m(z_2 - 2)$
13. Root diameter	$d_{f1} = d_1 - 2h_f$	$d_{f2} = d_2 + 2h_f$
14. Sector span of teeth	$z_{m1} = \frac{\alpha z_1}{180} + 0.5$	$z_{m2} = \frac{\alpha z_2}{180} + 0.5$
15. Sector span	$W_1 = m \cos \alpha \{ \pi(z_{m1} - 0.5) + z_1 \operatorname{inv} \alpha \}$	$W_2 = m \cos \alpha \{ \pi(z_{m2} - 0.5) + z_2 \operatorname{inv} \alpha \}$
16. Transverse contact ratio	$\epsilon_a = \frac{\sqrt{\left(\frac{d_{a1}}{2}\right)^2 - \left(\frac{d_{b1}}{2}\right)^2} - \sqrt{\left(\frac{d_{a2}}{2}\right)^2 - \left(\frac{d_{b2}}{2}\right)^2} + \frac{m(z_2 - z_1)}{2} \sin \alpha}{\pi m \cos \alpha}$	

Refer to 4.2 Method of Over balls or Rollers (page 63-64).