

CROWN WHEEL AND PINION SPACING AND TOUCH DISTANCE CALIBRATION

Periodic Maintenance

It's important and necessary to do the maintenance to ensure the maximum use of a crown wheel and pinion gear set. The most important element of maintenance is lubrication. Lacking or improper lubrication may cause serious harm on the gears. It is always recommended to use proper lubrication, change it at specified intervals and maintain the lube level. (USE HYPOID LUBE)

Rebuilding and Adjusting

Proper reassembly and readjustment of damaged or defective parts is extremely important to lengthen the life of the revised gear set. Careful inspection and proper cleaning of the parts is essential. To achieve the best result from the revision, it's advised to change all low-cost parts like thrust washers, seals and bushings along with any worn and damaged parts. The instructions must be followed carefully to adjust bearing pre-load. Because the bearing pre-load adjustment method differs for different makes and models, it's recommended to refer to the manual of the original manufacturer.

Recommended Backlash

Backlash is the space between the teeth of the crown and pinion and it must be measured perpendicular to the teeth surface. This parameter is very important. Too low backlash may cause teeth seizure, too high space may cause noise and eventually teeth breaking. To measure the backlash, position the comparator at the a teeth of the crown, close to the base of the teeth perpendicularly, like in figure 3. Move the crown slowly back and forth, keeping the pinion from moving. The needle of the comparator will show you the value of the backlash. Adjust the backlash using bearing adjusters and shims until the value recommended by the manual of your axle service is achieved. If you don't have the service manual, using the practical method below may give you the recommended backlash value.

1. Measure the outer diameter of the crown gear ('Q' in Figure 2)
2. Count the teeth number of the crown wheel - 'Z'
3. The ratio between the outer diameter 'Q' (in millimeters) and number of teeth 'Z' gives the approximate value of module 'M': $M=Q/Z$. If the diameter Q is measured in inches, multiply the value by 25.4 to convert it to millimetres.
4. Find the recommended marked backlash (✓) from the table below.

MODULE millimetres	Recommended Backlash		MODULE millimetres	Recommended Backlash	
	m m	inches		m m	inches
20.32-25.40	0.508-0.762	0.020-0.030	7.26- 8.47	0.203-0.279	0.008-0.011
16.93-20.32	0.457-0.660	0.018-0.026	6.35- 7.26	0.178-0.229	0.007-0.009
14.51-16.93	0.406-0.559	0.016-0.022	5.08- 6.35	0.152-0.203	0.006-0.008
12.70-14.51	0.356-0.458	0.014-0.018	4.23- 5.08	0.127-0.178	0.005-0.007
10.16-12.70	0.305-0.406	0.012-0.016	3.18- 4.23	0.102-0.152	0.004-0.006
8.47-10.16	0.254-0.330	0.010-0.013	2.54- 3.18	0.076-0.127	0.003-0.005

Adjusting the tooth contact pattern

To make the tooth contact pattern visible, apply a thin layer of white or yellow paint on about a quarter of the crown wheel's circumference (Figure 1). Braking the crown wheel, turn the pinion in both directions. For long term use and noiseless working, the contact pattern should have centered in the center of the tooth surface as shown in figure 4. The tooth contact pattern must be checked on the drive side of the teeth, the convex side. The position of the contact pattern may be adjusted by changing the distance between the pinion and the crown wheel center. This position is determined by the size of the taper roller bearing shim pack. Please note that no general rule exists in this phase: for some axles adding shims moves the pinion towards the crown wheel's center and removing them moves the pinion away, but for some makes and models the opposite situation applies. Below are some practical tips for adjusting the wrong tooth contact pattern by adjusting the pinion shim pack. Please remember that after changing the axial position of the pinion, it's necessary to restore the gear set backlash.

Figure 4- Correct Contact Pattern (✓)

The adjustment is correct if the contact pattern looks like Figure 4 after the gear is set.

Figure 5- Low Contact Pattern

Move the pinion away from the crown wheel (X), then restore the backlash by moving the pinion towards the crown wheel (Y).

Figure 6- High Contact Pattern

Move the pinion towards the crown wheel (X), then restore the backlash by moving the pinion towards the crown wheel.

Figure 7- Contact on the Toe of the Tooth

This incorrect pattern is observed when there's not enough backlash distance. Move the crown wheel away from the pinion to increase the backlash. Do not exceed the maximum backlash distance.

Figure 8- Contact on the Heel of the Tooth

This incorrect pattern is observed when there's too much backlash distance. Move the crown wheel towards the pinion to reduce the backlash. Maintain at least the minimum backlash distance.

