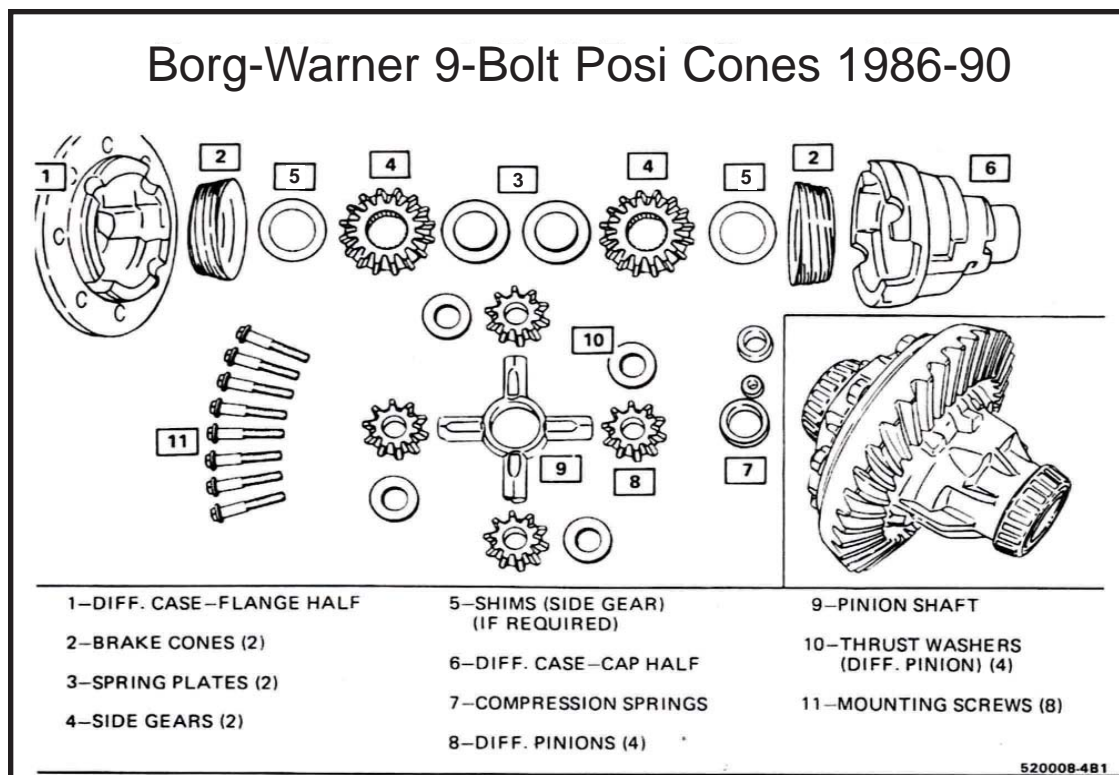


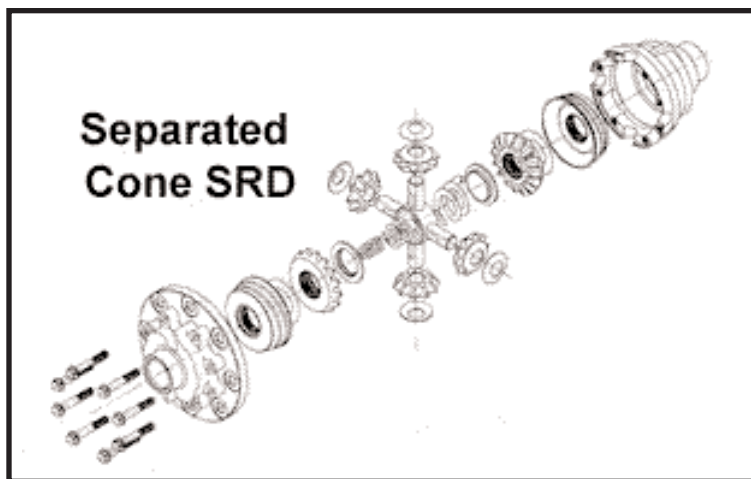
BW 9-bolt positraction cone repair

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This article describes how to repair the posi cones used in Borg Warner "Separated Cone Slip Resistant Differentials" by removing worn, irregular material from the cones in a lath, then re-shimming the location of the cone in the carrier with the end result allowing the cones' tapered sides to wedge against the inside wall of the carrier and generate the necessary friction and resistance to enable the axles to move at the same speed as the carrier housing. The way positraction cones work, the friction of the tapered sides of the cones against the housing allows the axles to turn at different speeds while turning corners without locking the axles, while generating more turning force to an axle loaded instead of unloaded, thus equalizing torque to the axles depending on the load on each axle.



due to worn out pinion bearings or improper pinion preload) or between the side gear and the pinion gears (usually due to worn out brake (ie posi cones). Either of these usually results in broken gear teeth.



Axle held in the vise gripping the tapered end.

Since the posi units use friction as the means of redirecting torque, Borg Warner 9-Bolt posi units eventually wear out, some faster than others, depending on driver use or abuse. Some of the most common reasons for failures are excessive backlash between the ring gear and pinion (usually

This article shows how to repair brake-cones with excessive wear on the surface on the cones radius. Directions are also included about selecting shims to be inserted under the side gears to compensate for the increased brake-cone depth and locate the side gears and brake-cones in the case to perform properly. Start by installing the axle in the vise with the jaws grabbing the tapered end and making sure

a sufficient length of the splines are sticking up to fully seat and hold the posi, then place the posi unit on the axle with the gear teeth facing down.



Check to ensure the case halves are marked for reassembly. [*NOTE* for some reason GM marks the case halves using either white or red paint and possibly other colors, so marking case might not be necessary. If the cases were unmarked and you

forgot to do so, during reassembly the halves can only be installed two ways since there are only two openings that show the side gears. Now that the case halves are clearly marked, mount the posi on the axle and remove the retaining bolts using a 7/16 socket. The half's will spring apart about 2" or a bit more. Then lift the top half off, and since the cone and gear are now only held in by gear lube, be aware that they may drop out on their own. [See photo Top Half taken off]



Worn out cone -- Severely worn cones with raised centers and indented wear rings can't be fixed.

Next set the case top half on it's own clean rag with the cone and gear next to it and mark the spider gear locations.

Inspect the cone smaller end to determine if it is fixable or not. The *Worn out cone photo* shows a raised center and indented wear ring (this one was worn so severely that the groove worn in it was



Top half taken off -- The cone and gear are now only held in by gear lube and may drop out if moved.



Depth -- Measure the depth before turning the end in the lathe to keep the same dimensions when the job is completed, not much was taken off the cone ends.



Inside the case housing -- shows why worn cones would quickly bottom out.

deeper than where the full axle spines start). The reason badly worn cones can't be fixed is because turning the cone on a lath until the whole inside end is the same depth as the badly worn



Chucked -- during this repair, not much was taken off the cone on the lath.

groove, would result in so much material being removed from the splined area that it would only leave a very thin splined cone that would wear out very quickly or break. This is shown in the photo of *inside the case housing*.



In car -- Cone is close, not bottomed.

If the cone has light grooves or none it is rebuildable. Measure the depth before turning the end in the lath to



At right, one of two large side gears.

keep the same dimensions when the job is completed. The photo *Incar* shows the cone end is close to the case but, does not bottom. This allows the cone to function correctly by moving down and retain full traction holding power by using the wedging action of the cone to the case).



During reassembly, shims are placed under the side gear and the top of the cone. [Side gears are the two large gears and the spider gears are the (four



Shimming -- Spider gears in the case during the shimming process. Shims are inserted in .005 steps to obtain the desired shimming. Make sure the shimming doesn't create pressure on the gears.

in this case) smaller gears that are placed at 90 degrees to the side gears. For those needing more explanation of how differentials work, here is a link <http://www.howstuffworks.com/differential.htm>

Shims are inserted in .005 steps to obtain the desired clearance when placing the spider gear cross in the case to make sure it fully seats without any pressure from the shimming.

In this thread provided by **Drain89**, the following shim specifications and setups are listed: Install brake cones in the differential case. Measure the distance from differential case mating surface to flat surface on brake cone when it is fully seated. This is done to determine the size brake cone shim required.

Distance Measured In.(mm) Shim Size In.(mm)

1.155-1.162 (29.34-29.51) No shim required

1.163-1.167 (29.54-29.64) .005 (.13)

1.168-1.172 (29.67-29.77) .010 (.25)

ADVANCED SETUP- SOFT FEEL shim each side until all play is removed and cross shaft seats properly in case, then remove .005 to .010 inch of shim.

ADVANCED SETUP- HARD FEEL shim each side until all play is removed and cross shaft seats properly in case and add up to BUT NO MORE THAN .005" of shim per side. This will provide additional preload to the differential that is not possible unless the gears themselves are loaded. **RECOMMENDED FOR RACE USE ONLY.** If the vehicle is to be street driven on a regular basis it is not recommended to preload the gears.

The optimal amount of shim for Street-Race use is the point where all play is removed from the side gears and the cross shaft and spider gears seat properly in the housing. All one wheel peel will be eliminated and the differential will still operate normally.

More very useful information about the shimming process and sources is available at:

www.thirdgen.org/techbb2/showthread.php?s=&threadid=239666
<http://www.thirdgen.org/techbb2/showthread.php?s=&threadid=239666>

Both cones were processed in the same way, then everything was cleaned three times to remove lots of metal residue, then everything was stacked back up on the axle to center the side gear on the axle and the shimming was double-checked, then the bottom half was reinstalled [see photo *Reinstalling*].



Reinstalling parts

The top case half is then placed on top, making sure the case marks are aligned and all the retaining bolts tightened by hand a few turns. Next the second axle is placed in the posi and with the assistance of a second person the case half bolts are tightened down by hand in a star pattern [see photo

starting bolts]. When the case is bottomed the bolts are tightened to specs and the axles can then be removed. Check again to make sure everything is clean and finally after installing the carrier back into



Starting Bolts --

the axle housing check the dry backlash of the ring gear to pinion to ensure it is within specs. Nothing should change if everything was put together in the original locations (it's just cheap insurance when you are right there) Note: all the housings I have seen taken apart have one carrier bearing cap marked by the factory (using a letter or number) and e housing near it's location.

What happens if the cones are toast?

Apparently GM doesn't stock these parts anymore and with thousands of 9-bolt rears pushing 200K miles, replacement cones will have to come from somewhere to keep 9-bolts running. For now, www.diffsolutions.com has new posi cones for \$135 delivered, and cones might be available from www.spiceraxle.com.au/products.htm#srd.

Looks like 82-92 ThirdGens are old enough to have parts shortages, but not old enough to have sufficient third-party support. If anyone knows other sources please post to thirdgen.org so this data file can be updated.