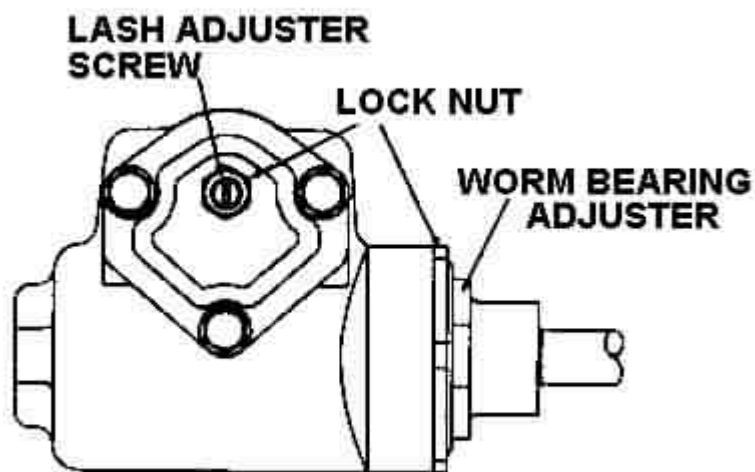


IN VEHICLE CORVETTE STEERING GEAR ADJUSTMENT

A Point of Clarification: Some of the Chevrolet and Corvette shop manuals show a picture of a recirculating ball steering gear with a worm adjuster nut and jam nut on the forward (in the car) side of the gear housing. That picture is **not** the manual gear that is in your Corvette. The Corvette manual gear has the worm bearing adjuster and jam nut on the input shaft (steering column) side of the gear as shown on the drawing below.



**1963-82 CORVETTE MANUAL
STEERING GEAR**

Vehicle Pretest

Before making any adjustments to your Corvette steering gear it is important to make a careful check of your steering system and chassis components to assure that they are in good condition and not the cause or the major reason for steering lash or looseness. Check for such things as; front end toe adjustment, tire inflation pressures, condition of the flexible coupling, wheel balance, condition of the idler arm and linkage pivot points, loose sway bars, and even the shock absorbers can contribute to the complaint of steering looseness.

Take a good look at your steering gear. When you look over your fender at the gear, you will see the lash adjuster screw and lock nut sticking straight up at you out of the gear side cover. (It has always been called a side cover even though it is on the top of the gear.) The lash adjuster screw should have several threads exposed as it sticks out of the lock nut. If the adjuster screw is flush with the nut (or worse, down inside the nut) this most likely means that the sector shaft has been adjusted previously and there is no adjustment left. If this is the case, I highly recommend that you pull the gear and have it rebuilt (or rebuild it yourself) with new internal components.

Some History and Background

It is important to understand that all Corvette steering systems from 1963 thru 1982 were essentially the same. All of them started with the same recirculating ball manual steering gear regardless if it was a manual steering or a power assisted steering system. The power steering option just added a belt driven power steering pump, a control valve mechanism attached to a special linkage intermediate rod, an assist cylinder (ram), and power steering hoses. So the same procedures apply to adjust the Corvette steering gear regardless if you have power assisted or manual steering.

SHOP MANUAL ADJUSTMENT METHODS

The Corvette shop manual describes two procedures to adjust the manual gear. They are the only ones sanctioned by Chevrolet. The first method is to pull it out of the car and do it on a bench with an inch pound torque wrench. The second way is to do it in the car but you must remove the pitman arm and take torque measurements by placing a torque wrench on the steering wheel hub and measuring steering gear torque through the steering column.

These two methods of adjusting the gear are well described and documented in the Chevrolet or Corvette shop manuals (manual steering gear.)

IN CAR METHOD

There is a third way that can be used to adjust the gear – that is by feel in the car. The real concern when doing it by feel is that overtightening some of the adjustments can result in internal damage in the gear (which can be very expensive to fix.) Also, overtightening can result in sticky steering and poor to non-existent steering returnability. In other words, the steering wheel may not come back to the straight ahead position after making a turn and you will have to turn it back yourself. Obviously, adjusting a critical system such as steering and driving the car to confirm the settings must be done with great care!

One of the things that a lot of enthusiasts are forgetting (or don't realize) is that there are two adjustments to reduce or eliminate lash on the manual steering gear. There is one on the input side of the gear (steering column side) called the worm bearing adjuster and one that affects the gear mesh inside the gear called the pitman shaft lash adjuster.

If you have a gear with worm bearing adjuster lash, you will not eliminate it by just tightening the pitman shaft lash adjuster. With a 20+ year old steering gear you may have a combination of input shaft (worm shaft) **and** output shaft (pitman shaft) lash.

You must address worm bearing lash first. Worm bearing lash will show up as an axial movement of the input shaft (in and out of the gear) as you turn the steering wheel clockwise and counterclockwise. This axial movement is lost motion and will result in you moving the steering wheel with no movement of the road wheels until the input shaft bottoms out against the internal gear bearings. You may even detect a small polished area on the gear input shaft that will be an indication of it moving in and out.

Checking the Settings in a Brand New Gear

If you have a brand new gear and you are checking the settings, you will want to loosen the pitman shaft adjuster lock nut and turn the screw a full turn counterclockwise to reduce friction from that location before starting on the worm bearing adjustment. With a car with any appreciable miles on it, you do not have to loosen the pitman shaft adjuster screw before starting to adjust the gear.

Worm Bearing Adjustment

What we are trying to do is eliminate worm shaft axial motion without adding unacceptable friction. First turn the steering wheel all the way to the right corner and then turn back about one-half turn. Make the worm shaft adjustment with the gear in this position.

Have someone rotate the steering wheel back and forth; look at the gear input shaft to determine if there is any axial motion.

If you are doing this test without anyone to help you, try this approach. Unlock the steering column, grip the flexible coupling with your hand and rotate it back and forth. Look and try to feel if there is an increase or decrease of the gap between the flange and the face of the gear as you oscillate the coupling by hand.

If you have noted any axial motion or you are still suspicious that there may be some slight looseness proceed as follows. Loosen the worm bearing adjuster locknut. You will probably have to use a blunt chisel or a large punch to tap the nut counterclockwise. The nut is actually a stamping so the rolled over edges that form the hex nut shape will allow you access for your punch. When you are done loosening the nut it will probably be dinged up a bit and not concourse perfect any longer.

Rotate the worm bearing adjuster clockwise until it is snug but not tight. (Don't forget that corrosion, paint, etc on the adjuster threads can give you some false indications that things are snug!)

Alternately tighten the adjuster then look and feel for axial input shaft motion until there is none.

The specifications say to tighten the locknut to (85 foot-lbs). Take care that when you retighten the locknut that you don't cause the adjuster to tighten further. A helpful hint would be to mark the housing and the adjuster with a piece of chalk or a crayon to insure that the adjuster remains in the same place when you tighten the locknut. Carefully drive the car to check that the adjuster setting is not too tight and causing returnability problems. Don't forget that during this driving evaluation you may still have lash because so far we have only addressed one set of adjustments. Right now you are checking to make sure that your gear adjustment to eliminate input shaft movement did not add unacceptable friction to the gear.

Pitman Shaft Adjustment Pretest

Once you feel that you have the worm bearing adjusted, you can now address the pitman shaft lash adjustment. For this adjustment you need to place the steering gear right on center. Conduct the following procedure. Turn the steering wheel from lock to lock, counting the total number of turns. Now, turn the steering wheel back from full lock exactly one-half the total number of turns. For the most part, your steering wheel should now be in the straight ahead position and your car should travel straight. If the steering wheel is not straight ahead and/or your car does not travel in a straight path, you will need to center the rest of the steering system before completing the gear adjustment.

Special Steering System Centering Procedure (If Needed)

After you have set your steering gear exactly on center (one half of the travel lock to lock), take a piece of chalk or a crayon and mark the flexible coupling right at its top most position (12 o'clock.) Now you can just peak under the hood and know when your gear is right on center. Note, that the stop pins on the flexible coupling should now be vertical (one at 6 o'clock and the other at 12 o'clock) and the flexible coupling attaching bolt to the gear should be vertical (passing through the 9 o'clock position) with its head sticking straight up at you.

Now drive your Corvette a short distance on a flat surface in order to determine the steering wheel and gear position when it is traveling a straight path. With the front wheels in the straight ahead position, now check the mark on the flexible coupling. The mark should be right at the top (at the 12 o'clock position.) If the gear has been moved off its center position you will now need to adjust the tie rods to reposition the gear back so that the mark is again at 12 o'clock.

If your steering wheel needs to be rotated clockwise in order to bring the steering gear on center, you will need to shorten the left tie rod assembly and lengthen the right tie rod assembly. If the gear needs to be adjusted counterclockwise, the left tie rod assembly will need to be lengthened and the right shortened.

Loosen the tie rod adjuster tube clamps on both the left and right tie rods, then turn both tubes an equal number of turns **in the same direction** to bring the gear back on center. **DO NOT** turn the sleeves an unequal number of turns. This procedure will not change your front toe setting. If you turn the tubes in one direction and the steering wheel position gets worse, start turning them in the opposite direction. Just make sure that you rotate them the same direction and the same number of turns.

For a more complete explanation as to tie rod ends and adjuster tubes, you can refer to the following paper and pictures entitled Steering Linkage Tie Rod Adjustment Specs Explained - Revised 21JA06 available in the Jim Shea steering papers section at www.corvettefaq.com. The paper and pictures also instruct you on how to correctly orient and tighten the tie rod clamps at the end of the adjustment procedure.

Special Steering System Centering Procedure (Continued)

With the wheels straight ahead and the gear on center, check the steering wheel alignment. The 6 o'clock steering wheel spoke measured at the steering wheel rim should be within 1 inch of being exactly at the bottom. If the wheel is not in alignment, remove it and reindex the hub on the steering column splines to center the wheel as closely as possible. "Fine tune" the steering wheel to place it on center by adjusting the tie rods a final small amount.

Pitman Shaft Adjustment

Now, with the steering gear on center, loosen the pitman shaft locknut and carefully tighten the screw (clockwise), until it is snug but not tight. Retighten the locknut to 25 foot-lbs. Drive the car and check for lash, check for stickiness over center, and for slow speed and moderate speed returnability.

I would suggest the following type road test:

Drive the car and make ninety degree right and left hand turns at about 12 to 15 mph. It helps to do this on an actual street corner so you can assess how well the steering wheel returns. Also, drive the car straight ahead at about 45 mph. Just make small inputs to the steering wheel, (you don't even need to change lanes). The steering wheel should return to center.

Please note, very small adjustments of the pitman shaft lash adjuster screw can make a very big differences in gear mesh loads. You should always complete your screw adjustment in the clockwise direction. If you go too far, make note of the screw location, turn the screw counterclockwise and begin tightening in the clockwise direction and tightening the jam nut.

Final Road Test

After making the above adjustments your steering should be crisp with very little lash. If there is still some lash it may be necessary to go through this procedure a second time, starting with the worm shaft adjustment and then the pitman shaft adjustment.

A Word About Lubrication

The correct Corvette steering gear lubricant is GM #12377985 available from most GM dealers. Or use a good quality lithium based grease (ball joint grease in a tube.) Today there are probably synthetic types of greases that may be very acceptable. I just don't have any information on them. You want grease in your gear for lubrication. If you substitute oil in its place, the oil will almost immediately begin leaking.

Do not overfill the gear. It only needs to be $\frac{3}{4}$ full. You need air pockets in the gear to allow for grease expansion with engine temperature. Also there is a ball nut inside the gear that traverses back and forth when you steer right and left. You need air pockets around the nut so that you aren't always squeezing grease back and forth around the nut and causing friction in the gear. Last of all, some of the oils will separate out of the grease with time. Air pockets in the gear help the internal motion of the gear components to mix the grease.