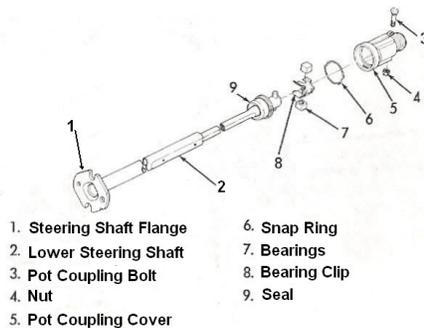


**STEERING WHEEL & STEERING SYSTEM CENTERING PROCEDURE  
(GM A & G-CARS, 2<sup>ND</sup> & 3<sup>RD</sup> GENERATION F-CARS, AND  
OTHER GM FRONT STEER VEHICLES)**

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This procedure is valid for power and manual steering systems for the following Chevrolet vehicles; A & G-Cars (Chevelles, El Camino, Monte Carlo), Second and Third Generation F-Cars (Camaros), and other General Motors vehicles derived from those bodies. Also other GM vehicles with steering systems where the steering linkage tie rods connect to steering arms that are located in forward of the centerline of the road wheels (commonly known as front steer vehicles). These vehicles typically will have a separate intermediate steering shaft assembly (I-shaft asm) which connects the steering column to the steering gear. The I-shaft asm will be located underhood and have a “pot” type coupling at the connection to the steering column and it will have a flexible coupling at the steering gear connection. All of the I-shaft asms starting in 1967 will have steering shafts that are in two pieces and are designed to telescope over each other in case of a severe frontal collision.



INTERMEDIATE STEERING SHAFT ASSEMBLY

The I-shaft asm shown has a low cost, stamped steering shaft flange (1) that is a press fit and permanently staked to the lower steering shaft tube (2). Big block Chevelles have a detachable, cast flange in place of the stamping. A cast detachable flange is shown in the picture on page 3 of this paper. It is bolted in place with the same pinch bolt (GM #7807271) that is used to attach the flexible coupling to the gear input shaft. This allows the tubular end of the I-shaft asm to be inserted past the engine exhaust manifolds and upper control arms. The cast flange is then assembled and secured on the tube with a pinch bolt.

All of the steering components (i.e. steering linkage, pitman arm, steering gear, flexible coupling, I-shaft asm, steering column, steering hub, and steering wheel) were designed by General Motors and Saginaw Steering Gear Division such that they could be put together with great integrity, reliability, and dependability. They were designed so that they only went together one way and had good visual indication that the assembly was correct.

It is very important that steering components are in good condition and assembled correctly (not only from a safety standpoint) but for the following functional reasons:

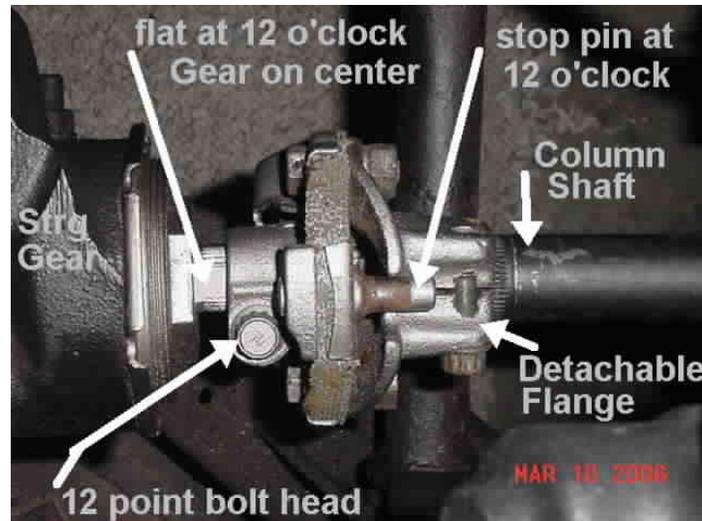
- 1). All Saginaw recirculating ball steering gears (power, manual, variable ratio, etc) are designed so that when the car is driven straight down the road, the steering gear should be exactly on its design center. This is because the gear set inside the steering gear was manufactured with slight interference or “high spot” exactly on center to insure a crisp and precise steering feel. Starting about one half turn either side of center, the gear mesh actually has a small amount of clearance designed into it. If your steering gear is not exactly on center when the car is driving straight, you could be feeling some “looseness” in your steering from this designed-in gear mesh clearance.
- 2). Starting in 1969 all Saginaw locking steering columns were designed such that the turn signal switch cancels equally from right and left turns with the column right on its design center position. The canceling cam has a very limited movement since it sticks through the steering column locking plate. So locking steering columns have a 12 o’clock position just like steering gears.
- 3). The left and right tie rods depend upon the gear being on center so that they will be of roughly equal length with the proper front wheel toe settings.

### **Setting the Steering Gear Exactly On Center**

Before beginning any inspection or adjustment procedure it is best to set the steering gear right on center. Here is the procedure. Turn your steering wheel from full lock to full lock. Carefully count the number of turns and partial turn (X). Now take that number and divide it in half (X/2). Starting at full lock, come back exactly X/2 turns. Your steering gear should now be very close to its design center. Here is the most important part, on all gears from around 1969 forward, the flat on the steering gear input shaft will be exactly at 12 o’clock when the gear is on center. Please note that clock positions are given as you look down the steering column from the driver’s position.

There are a few GM A & G-cars (1973 and 1974 time frame) that actually have slightly more travel right turn than left. If you suspect that you have one of those gears, approximate the center of travel as above but then place the flat on the input shaft exactly at 12 o’clock to place the gear right on center.

Now, take a piece of chalk or a crayon and mark the flexible coupling right at its top most position (12 o’clock.) With the mark you can just peak under the hood and know when your gear is right on center.



Picture of a typical GM steering gear, flexible coupling, and steering column flange looking over the front fender, straight down at the parts. Components are shown with the steering gear exactly on center. Many GM steering columns and intermediate steering shaft assemblies have a press fit, stamped lower flange instead of the cast, detachable type as shown.

### **Checking the Condition of Front End Components**

Because most of us were not privileged to be around for the approximate 30+ year history of our cars, we really don't know if Bubba messed with any of the steering components. For this reason I have provided some Visual Identification (**VIS-IDEN**) clues to help assure that components and assemblies are correct.

You will need to have a floor jack where you can raise and lower your car for inspections and to adjust the tie rod lengths. **IN ADDITION USE JACKSTANDS TO SECURELY SUPPORT THE CAR.** It is also a good idea to have the car in a location where it can be let down and easily driven forward a short distance when adjusting tie rod lengths. This paper assumes that the front end is aligned acceptably.

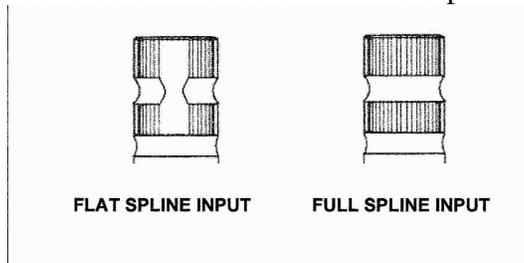
First you should inspect your front end and all steering components to look for obvious problem areas. Look for such things as a bent frame, damaged tie rods, control arms, or relay rod, bent steering arms, pitman arm, etc. One possible hidden condition can be the steering gear sector shaft being twisted from a severe front impact.

**(VIS-IDEN)** With the gear exactly on center, the flat on the input shaft should be at 12 o'clock and the twelve point head on the bolt that attaches the flexible coupling to the gear should be sticking straight up as shown in the photo on this page. The stop pins on the flexible coupling should be vertical (one at 6 o'clock and the other at 12 o'clock) as shown in the above picture.

**(VIS-IDEN)** With the gear exactly on center, the pitman arm should be pointing rearward straight down the centerline of the gear.

### Checking the Condition of Front End Components (Continued)

**(VIS-IDEN)** Up until early 1969 the steering gear input shaft and the flexible coupling had what is called “full serrations.” There was no flat on the gear input shaft nor was there a flat machined into the flexible coupling flange that attaches to it. This means that the flexible coupling will assemble on any of the 30 splines (or serrations) on the gear input shaft. However, you still want the gear to be on center and the flexible coupling stop pins and the pinch bolt to be oriented as shown in the picture on the preceding page.



Early in the 1969 model year, steering gear input shafts and flexible coupling flanges were changed so that they had mating flats. The flat on the gear input shaft will be at 12 o'clock when the gear is exactly on center. You can see a portion of the input shaft flat sticking out from the flexible coupling flange in the photo on the previous page.

The flats insured that they could only assemble together one way. So it is possible to have the flexible coupling incorrectly indexed on the gear on vehicles built before 1969. Also, it is permissible to mix and match an early flexible coupling (one with full serrations) and install it on a later gear with a flat.

With the gear exactly on center, now is a good time to check the position of your pitman arm. Go under the car and look. It should be pointing straight rearward along the centerline of the gear.

As noted above, it is possible to actually have a twisted sector shaft from an accident involving front end components. If you pull the pitman arm, it is sometimes possible to see the twist in the sector shaft splines. Sometimes the pitman shaft can be twisted inside the gear box. Needless to say, if this type of deformation is noted, throw the gear away and purchase a new one.

### Steering Column Shaft to Steering Wheel Hub Alignment

First check to determine that your steering wheel hub is assembled to the steering column correctly. Remove the horn cap (or pad) and just remove the steering wheel nut. There should be a chisel mark on the very end of the upper steering column shaft and a corresponding chisel mark on the steering wheel hub. Check to determine if the two marks are aligned. If they are not, there is a problem somewhere in the steering or suspension system. If they aren't aligned, you should pull the hub and align the marks before beginning any centering procedures.

### **Steering Column Shaft to Steering Wheel Hub Alignment (Continued)**

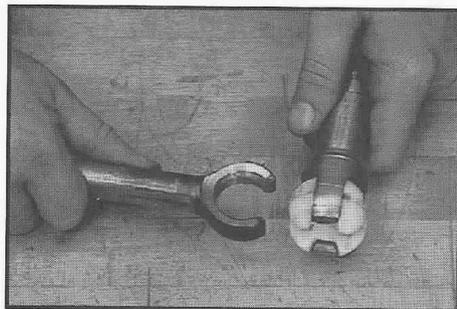
**(VIS-IDEN)** With the steering gear exactly on center, the chisel mark on the end of the steering column upper shaft should be at the 12 o'clock position and the steering column will be right on its design center position. If the chisel mark is NOT at 12 o'clock the turn signal switch will not cancel equally left turn versus right turn.

**(VIS-IDEN)** On tilt columns, with the chisel mark at 12 o'clock the lower end of the column (the part that connects to the separate intermediate steering shaft) must have its clamp bolt horizontal and passing through the 12 o'clock position on the column shaft. Note that there is a notch on the steering column lower shaft that allows the clamp bolt to pass through. So the chisel mark on the upper steering column shaft and the notch on the lower steering column shaft must both be at 12 o'clock when the steering column is on center.

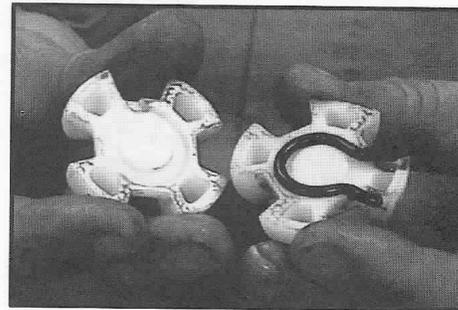
If the clamp bolt is horizontal and on the bottom of the shaft (the 6 o'clock position) when the chisel mark on the upper shaft is at 12 o'clock, Bubba has incorrectly assembled the upper to lower steering shafts inside the steering column by 180 degrees. You have a choice of the following procedures:

#### **1). Repair the Column (the correct fix)**

Remove the steering column from the car and disassemble the steering column head so that the upper steering shaft can be removed and the shafts reoriented at the plastic tilt sphere. It will be very helpful to download the appropriate adjustable steering column disassembly and repair papers from the host website for instructions.



**Separating Upper and Lower Shaft Sections**



**Joint Preload Spring in Centering Sphere**

#### **2). Modify the Flexible Coupling (the easy fix)**

Disconnect the two nuts and lock washers that attach the flexible coupling to the steering column flange. Remove the appropriate fasteners and pull the steering column back into the car a short distance. Remove the flexible coupling from the gear. There are two different size bolts that attach the flexible coupling to the steering column flange. With the gear on center, the larger bolt (3/8-24) should be at the 9 o'clock position. The smaller bolt (5/16-24) at the 3 o'clock position. Interchange them. This will rotate the steering column shaft 180 degrees and the turn signals will cancel correctly.

## **Drive Evaluation and Tie Rod Adjustment**

Now drive your car 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 it is not on center, then the gear has somehow been moved off its center position and 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 and the mark on the flexible coupling to the 12 o'clock position, you will need to lengthen the left tie rod assembly and shorten the right tie rod. If the steering wheel needs to be rotated counterclockwise, the left needs to be shortened and the right one lengthened.

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. If you closely follow this procedure you 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 exact same number of turns.

Please refer to your AIM sheets or other shop manuals for important tie rod clamp location and orientation information.

## **Final Steering Wheel and Tie Rod Adjustments**

With the wheels straight ahead and the gear on center, check the steering wheel alignment. The 6 o'clock steering wheel spoke (or the center of the very bottom of the steering wheel rim) should be pointing straight down into your lap. If you measure at the steering wheel rim, that center point should be within 1 inch of being exactly straight down. If the wheel is close but not in exact alignment, remove it and try to reindex the hub on the steering column shaft by one spline to center the wheel as closely as possible. With 30 serrations on the steering wheel hub and steering column shaft, you should be able to get the steering wheel centered within 6 degrees or less. (If your steering wheel is off by more than 6 degrees, there are other problems in your steering system.)

Now, if you want to fine tune the steering wheel to get it perfectly on center, you will have to adjust the tie rods one last time. If the steering wheel needs to be adjusted clockwise to get it on center - the left tie rod will need to be lengthened and the right shortened by equal amounts. If the steering wheel needs to be adjusted counterclockwise - the left needs to be shortened and the right lengthened.

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