TRIM HEIGHT SPECIFICATIONS

Suspension	Z Height	D Height
Trim Height must be verified and adjusted before aligning the vehicle.		
With RPO ZM6	122 mm (4.8 in) ±6 mm (0.24 in)	132 mm (5.2 in) ±6 mm (0.24 in)
Without RPO ZM6	122 mm (4.8 in) ±6 mm (0.24 in)	140 mm (5.5 in) ±6 mm (0.24 in)

G00357727

Fig. 1: Trim Height Specifications
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION

DIAGNOSTIC STARTING POINT - SUSPENSION GENERAL DIAGNOSIS

Begin the system diagnosis by reviewing the system Description & Operation. See **REAR SUSPENSION - H2** . Reviewing the Description and Operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the Description and Operation information, and the vehicle RPO, will also help you determine if the condition described by the customer is normal operation. See **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS

The following steps must be completed before using the symptom tables.

1. Determine whether the vehicle is equipped with an electrically assisted or active suspension system. Perform electrical diagnosis prior to beginning mechanical diagnosis.
2. Review the system description and operation in order to familiarize yourself with the system functions. Refer to the appropriate description and operation:
    - General Description in Front Suspension.
    - General Description in Rear Suspension.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of any of the suspension subsystems.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect for proper tire size and inflation pressure.

Symptom List

- **BALL JOINT INSPECTION (LOWER BALL JOINT)**
- **BALL JOINT INSPECTION (UPPER BALL JOINT)**
- **BODY LEANS OR SWAYS IN CORNERS**
- **MEMORY STEER**
- **NOISE DIAGNOSIS - FRONT SUSPENSION**
- **NOISE DIAGNOSIS - REAR SUSPENSION**
- **POOR DIRECTIONAL STABILITY**
- **RIDE DIAGNOSIS**
- **STRUTS OR SHOCK ABSORBERS ON-VEHICLE TESTING**
- **SUSPENSION BOTTOMS**
- **TRIM HEIGHT INSPECTION PROCEDURE**
- **VEHICLE LEADS/PULLS**
- **WHEEL BEARING DIAGNOSIS**

BALL JOINT INSPECTION (LOWER BALL JOINT)

1. Raise and support the vehicle.
2. With the wheel and tire on the vehicle, lift the suspension corner by hand to determine if any looseness is present. If vertical free play is experienced proceed with the following instructions.
3. Remove the wheel and tire.
4. Clean and inspect the ball joint seals for cuts or tears. If the ball joint seals are damaged, replace the ball joint.
5. Install and position the dial indicator from J-8001 against the end of the ball joint. See **SPECIAL TOOLS** .

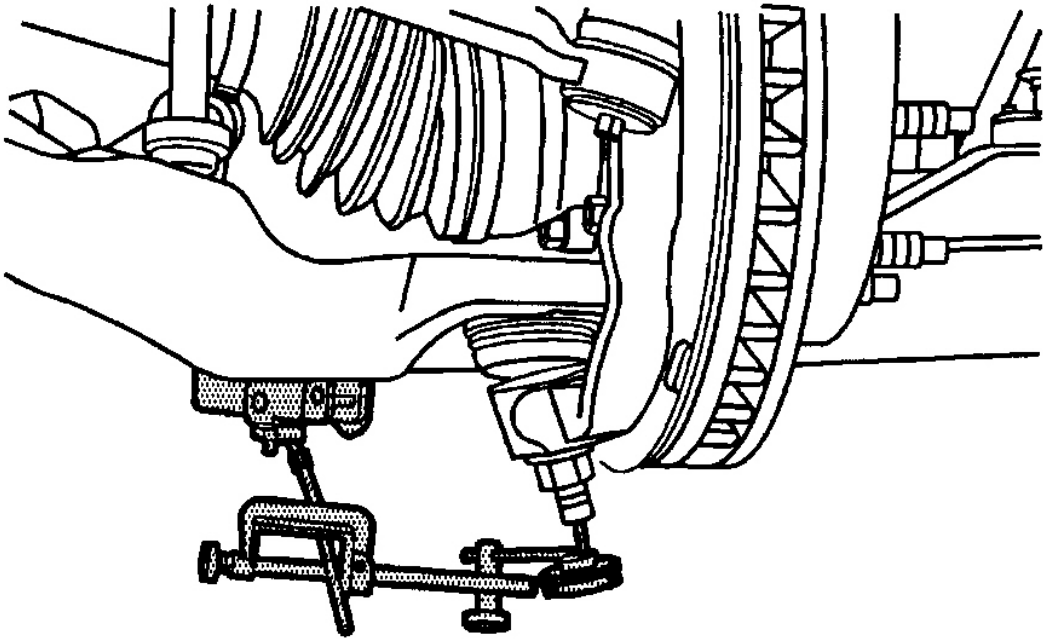

Fig. 2: Positioning Dial Indicator To Lower Ball Joint
Courtesy of GENERAL MOTORS CORP.

6.

NOTE: Do not pry between the lower arm and the wheel drive shaft boot or in such a manner that the ball joint seal is contacted. Damage to the wheel drive shaft boot will result (4WD).

Gently lift or pry the suspension upward then let it settle.

7. The dial indicator reading should be no more than 2 mm (0.079 in). If the reading is out of specification, replace the ball joint.

BALL JOINT INSPECTION (UPPER BALL JOINT)

1. Raise and support the vehicle.
2. With the wheel and tire on the vehicle, lift the suspension corner by hand to determine if any looseness is present. If vertical free play is experienced proceed with the following instructions. Remove the wheel and tire.
3. Remove the wheel and tire.
4. Support the lower control arm with a floor stand or jack, as far outboard as possible.
5. If a seal is cut or torn, replace the ball joint.

6. Clean and inspect the ball joint seals for cuts or tears. If the ball joint seals are damaged, replace the ball joint.
7. Check the wheel bearing for looseness in the wheel bearing is present, refer to **WHEEL BEARING DIAGNOSIS** .
8. Check the upper ball joint for vertical looseness.
9. Remove the lower shock absorber mounting bolt. This will ensure that the suspension is unloaded.
10. Install and position the dial indicator from J-8001 against the rim of the upper ball joint. See **SPECIAL TOOLS** .

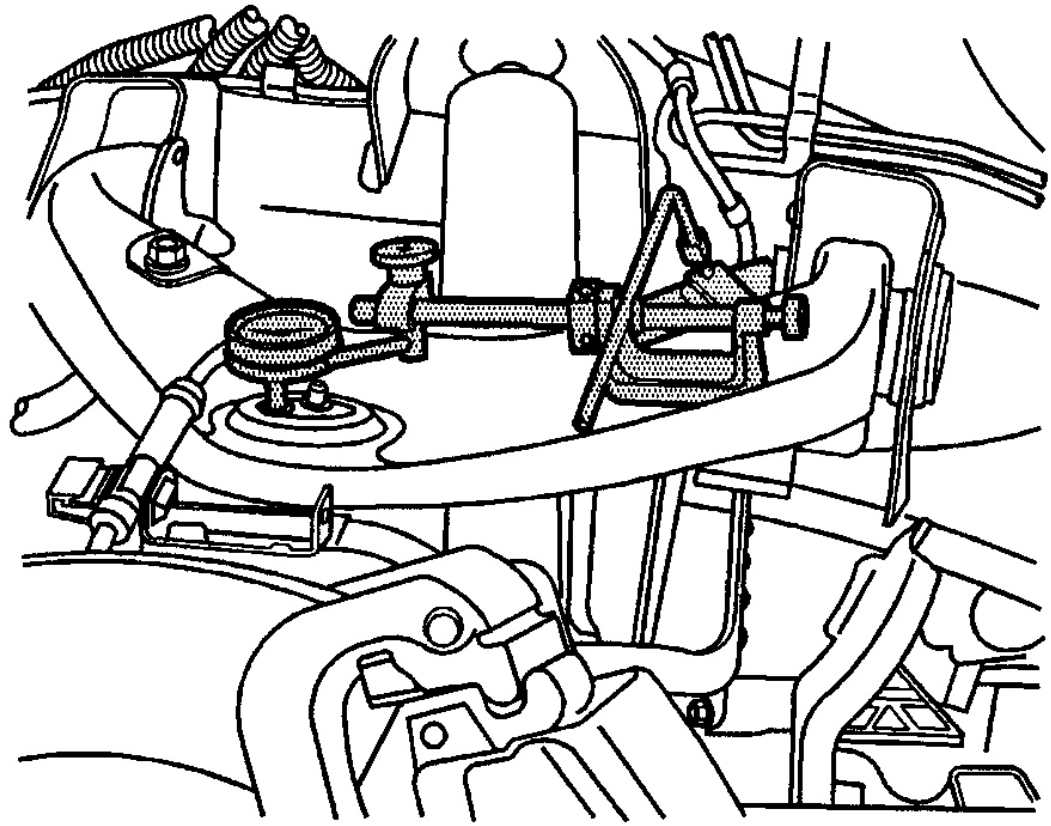

Fig. 3: Positioning Dial Indicator To Upper Ball Joint
Courtesy of GENERAL MOTORS CORP.

11. Apply downward force to the upper control arm and zero the indicator pointer/pad against the rim of the upper ball joint.
12. Release the arm and check the dial indicator. The dial indicator reading should be no more than 2 mm (0.079 in). If the reading is too high, replace the upper control arm.

BODY LEANS OR SWAYS IN CORNERS

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify the vehicle leans or sways in corners. Does the vehicle operate normally? If yes, then system is okay. If no, go to next step.
3. Inspect the rear coil springs and torsion bars for wear or damage. Are the components worn or damaged? Are the components worn or damaged? If yes, go to step 5 . If no, go to next step.
4. Inspect the stabilizer shaft link for wear or damage. Is the stabilizer shaft link worn or damaged? If yes, go to step 6 . If no, go to step 2 .
5. Replace the springs. Refer to the appropriate procedure:
   - Coil Spring Replacement in Rear Suspension.
   - Torsion Bar Replacement in Front Suspension.

   After repair is complete, go to step 7 .
6. Replace the stabilizer shaft link. Refer to **GENERAL DIAGNOSIS - H2** . After repair is complete, go to next step.
7. Operate the vehicle in order to verify the repair. Did you correct the condition? If yes, then system is okay. If no, go to step 3 .

MEMORY STEER

DEFINITION: The steering wheel does not return to center after completing a turn.

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that memory steer is present. Does the system operate normally? If yes, system is okay. If no, go to next step.
3. Check the tire inflation and adjust to specifications. Did you adjust the tire pressure? If yes, go to step 13 . If no, go to next step.
4. Raise and support the vehicle. Lubricate the tie rod ends and the ball joints if applicable. Inspect the suspension system for worn or damaged components. Repair as necessary. Did you find and correct the condition? If yes, go to step 13 . If no, go to next step.
5. Rotate the steering wheel ONE revolution in both directions. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult to rotate in either direction? If yes, go to next step. If no, go to step 9 .
6. **NOTE: Do NOT rotate the steering wheel more than one complete revolution.**

   Remove the steering column pinch bolt in order to disengage the column from the steering system. Note the position of the steering wheel and rotate the steering wheel ONE revolution in both directions. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult to rotate in either direction? If yes, go to step 12 . If no, go to next step.
7. Remove the front tire and wheel assemblies. Disconnect both of the outer tie rod ends from the steering

knuckles. Use your hands in order to move the tie rod ends. Are either of the tie rod ends abnormally difficult to move? If yes, go to step 10 . If no, go to next step.

8. Inspect for binding ball joints. Use your hands to push and pull the steering knuckle inboard and outboard. Are either of the steering knuckles abnormally difficult to move? If yes, go to step 11 . If no, go to next step.
9. Inspect the wheel alignment and adjust as necessary. Refer to **SPECIFICATIONS & PROCEDURES** . Did you complete the wheel alignment? After performing wheel alignment, go to step 13 .
10. Replace the outer tie rod end. After replacing tie rod end, go to step 13 .
11. Replace the damaged ball joint. Refer to Upper Control Arm Replacement or Lower Ball Joint Replacement in Front Suspension. After repairs, go to step 13 .
12. Repair the steering column as necessary. Refer to Steering Column. After repairs, go to next step.
13. Operate the vehicle in order to verify the repair. Did you correct the condition? If yes, system is okay. If no, go to step 3 .

NOISE DIAGNOSIS - FRONT SUSPENSION

DEFINITION: A loud bang or thump that can usually be felt and/or heard when the vehicle is driven over bumps. This condition is commonly noticed when the vehicle trim height is too low.

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Attempt to duplicate the condition. Road test the vehicle. Did you duplicate the condition? If yes, go to next step. If no, system is okay.
3. Is the noise reactive to vehicle load or speed? If yes, go to next step. If no, go to step 7 .
4. Inspect the tires for proper tire Inflation and adjust as necessary. Inspect for unusual tire wear. Inspect the wheel nuts for looseness and tighten as necessary. Did you find and correct the condition? If yes, go to step 14 . If no, go to next step.
5. Inspect the front wheel bearings. Refer to **WHEEL BEARING DIAGNOSIS** . Did you find and correct the condition? If yes, go to step 14 . If no, go to next step.
6. Inspect for front axle noises. Did you find and correct the condition? If yes, go to step 14 . If no, go to next step.
7. Bounce the front of the vehicle in order to duplicate the noise. Did you duplicate the noise? If yes, go to next step. If no, go to step 9 .
8. Raise and support the vehicle. Inspect the front suspension components for looseness. Inspect the front suspension components for damage and repair as necessary. Did you find and correct the condition? If yes, go to step 14 . If no, go to next step.
9. Install the J-39570 Chassis Ear or equivalent. See **SPECIAL TOOLS** . Bounce the front of the vehicle, using the J-39570 or equivalent in order to locate the source of the noise. If necessary road test the vehicle. Repair or replace any damaged components as necessary. Did you find and correct the condition? If yes, go to step 14 . If no, go to next step.
10. Inspect the ball joints and steering components for lack of lubrication where applicable, looseness in the ball joints, looseness in the steering linkage, or looseness in the tie rods. Did you find and correct the condition? If yes, go to step 14 . If no, go to next step.

11. Inspect for damaged shock absorbers. Did you find and correct the condition? If yes, go to step 14 . If no, go to next step.
12. Inspect the front stabilizer shaft and stabilizer shaft links for damage and repair as necessary. Did you find and correct the condition? If yes, go to step 14 . If no, go to next step.
13. Inspect for control arm damage and repair as necessary. Did you find and correct the condition? If yes, go to next step.
14. Operate the system in order to verify the repair. Did you correct the condition? If yes, system is okay. If no, go to step 3 .

NOISE DIAGNOSIS - REAR SUSPENSION

DEFINITION: Any noise emitted from the rear of the vehicle that is induced by VEHICLE SPEED or DRIVING TERRAIN as related to the rear suspension.

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Attempt to duplicate the condition. Road test the vehicle. Did you duplicate the condition? If yes, go to next step. If no, system is okay.
3. Is the noise reactive to vehicle load or speed? If yes, go to next step. If no, go to step 6 .
4. Inspect and adjust the tire Inflation. Inspect for unusual tire wear. Inspect the wheel nuts for looseness. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
5. Inspect the rear axle for rear axle noises. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
6. Bounce the rear of the vehicle in order to duplicate the noise. Did you duplicate the noise? If yes, go to next step. If no, go to step 9 .
7. Raise the vehicle. Inspect the rear suspension components for looseness and tighten as necessary. Inspect the rear suspension components for damage and repair as necessary. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
8. Inspect the rear shock absorber. Did you complete the inspection? If yes, go to step 10 . If no, go to next step.
9. Install the J-39570 Chassis Ear or equivalent. See **SPECIAL TOOLS** . Bounce the rear of the vehicle, using the J-39570 or equivalent, in order to locate the source of the noise. If necessary road test the vehicle. Repair or replace any defective component as necessary. Did you find and correct the condition? If yes, go to next step. If no, system is okay.
10. Operate the system in order to verify the repair. Did you correct the condition? If yes, system is okay. If no, go to step 3 .

POOR DIRECTIONAL STABILITY

DEFINITION: Driver is unable to maintain consistent, predictable vehicle driving control in any direction.

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .

2. Verify that the directional stability is poor. Does the system operate normally? If yes, system is okay. If no, go to next step.
3. Inspect the front stabilizer fasteners for looseness. Inspect for damaged stabilizer bar, stabilizer bushings, or damaged and missing stabilizer links. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
4. Inspect control arms, ball joints, and inner and outer tie rod ends for wear and damage. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
5. Inspect the wheel bearing. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
6. Inspect the vehicle trim height. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
7. Inspect the steering column for looseness. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
8. Inspect the steering gear mounting bolts for looseness. Did you find and correct the condition? If yes, go to step 10 . If no, go to next step.
9. Inspect and adjust the wheel alignment as necessary. Did you complete the alignment? Go to next step.
10. Operate the vehicle in order to verify the repair. Did you correct the condition? If yes, system is okay. If no, go to step 3 .

RIDE DIAGNOSIS

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. **NOTE: Verify the vehicle suspension package RPO.**

   Verify that the ride is too soft or too hard. Does the vehicle ride normally? If yes, then system is okay. If no, go to next step.
3. Inspect the tires for the proper inflation pressure. Is the tire inflation pressure correct? If yes, go to step 7 . If no, go to next step.
4. Inspect the vehicle trim height. Refer to **TRIM HEIGHT INSPECTION PROCEDURE** . Did you find and correct the condition? If yes, go to step 7 . If no, go to next step.
5. Inspect the strut and shock absorbers. Refer to **STRUTS OR SHOCK ABSORBERS ON-VEHICLE TESTING** . Inspect torsion bars and springs. Did you find and correct the condition? If yes, go to step 7 . If no, go to next step.
6. If equipped with the Air Suspension system refer to Air Suspension. Did you find and correct a condition? If yes, go to next step. If no, system is okay.
7. Drive the vehicle in order to verify the repair. Did you correct the condition? If yes, system is okay. If no, go to step 3 .

STRUTS OR SHOCK ABSORBERS ON-VEHICLE TESTING

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If

no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .

2. Verify that the customer's concern is present. Does the vehicle operate normally? If yes, system is okay. If no, go to next step.
3. **NOTE: A light film of oil on the top portion of the shock reservoir is normal.**

   Inspect each shock absorber for external fluid leakage. Is a strut or shock absorber leaking? If yes, go to step 5 . If no, go to next step.
4. Use your hands in order to lift up and push down each corner of the vehicle 3 times. Remove your hands from the vehicle. Locate a shock or strut that exceeds 2 cycles. Did you locate shock or strut that exceeds 2 cycles? If yes, go to next step. If no, go to step 6 .
5. **NOTE: Inspect the vehicle trim height in order to correct any possible causes of shock/strut failures. Refer to TRIM HEIGHT INSPECTION PROCEDURE .**

   Replace the shock absorber. After replacing shock absorber, go to next step.
6. Operate the vehicle in order to verify the repair. Did you correct the condition? If yes, system is okay. If no, go to step 3 .

SUSPENSION BOTTOMS

DEFINITION: A loud bang or thump that can usually be felt and/or heard when the vehicle is driven over bumps. This condition is commonly noticed when the vehicle trim height is too low.

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that the suspension bottoms. Does the vehicle operate normally? If yes, system okay. If no, go to next step.
3. Check for vehicle overloading and correct the overloading condition as necessary. Did you find and correct the condition? If yes, go to step 6 . If no, go to next step.
4. Inspect the shock absorbers, coil springs, and torsion bars for damage or wear and repair as necessary. Did you find and correct the condition? If yes, go to step 6 . If no, go to next step.
5. Inspect the vehicle trim height. Refer to **TRIM HEIGHT INSPECTION PROCEDURE** . Did you complete the trim height inspection procedure? If yes, go to next step.
6. Operate the vehicle in order to verify the repair. Did you correct the condition? If yes, system is okay. If no, go to step 3 .

TRIM HEIGHT INSPECTION PROCEDURE

Trim Height Measurements

Trim height is a predetermined measurement relating to vehicle ride height. Incorrect trim heights can cause bottoming out over bumps, damage to the suspension components and symptoms similar to wheel alignment problems. Check the trim heights when diagnosing suspension concerns and before checking the wheel

alignment. Perform the following before measuring the trim heights:

1. Set the tire pressures to the pressure shown on the certification label.
2. Check the fuel level. Add additional weight if necessary to simulate a full tank.
3. Make sure the rear compartment is empty except for the spare tire.
4. Make sure the vehicle is on a level surface, such as an alignment rack.

Z Height Measurement

1. Lift the front bumper of the vehicle up about 38 mm (1.5 in).
2. Remove your hands.
3. Allow the vehicle to settle into position.
4. Repeat this jouncing operation 2 more times for a total of 3 times.
5. Measure from the pivot bolt center line (3) down to the lower corner (5) of the lower ball joint (1) in order to obtain the Z height measurement (4). See **Fig. 4** .

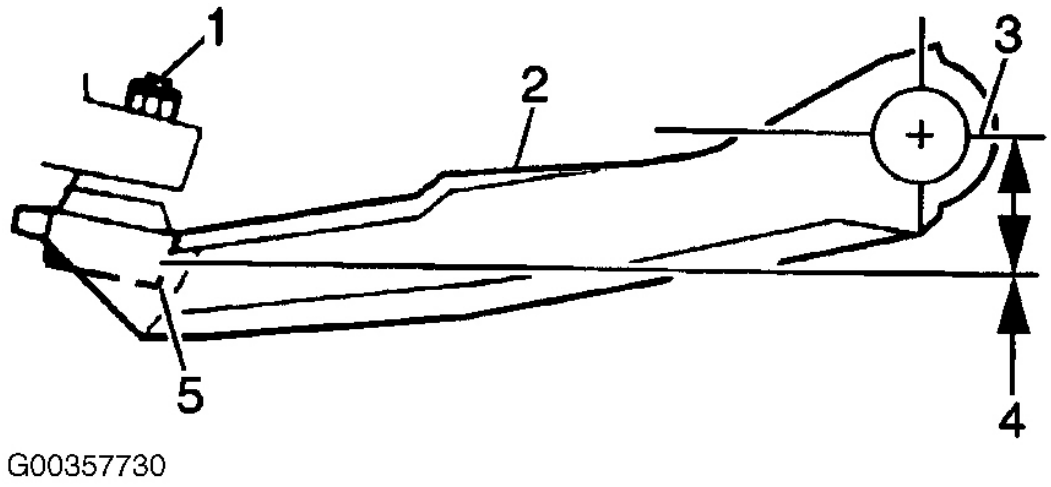

Fig. 4: Z Height Measurement
Courtesy of GENERAL MOTORS CORP.

6. Push the front bumper of the vehicle down about 38 mm (1.5 in).
7. Remove your hands.
8. Allow the vehicle to rise.
9. Repeat the operation for a total of 3 times.
10. Measure the Z dimension.
11. Measure the Z dimension. The true Z height dimension number is the average of the high and the low

measurements. See **TRIM HEIGHT SPECIFICATIONS** .

Z Height Adjustment

1. For vehicles equipped with a torsion bar suspension turn the bolt (1) that contacts the torsion arm clockwise to raise the and counterclockwise to lower the height adjustment. One revolution of the bolt (1) into the nut increases the Z height by approximately 6.0 mm (0.2 in). See **Fig. 5** .

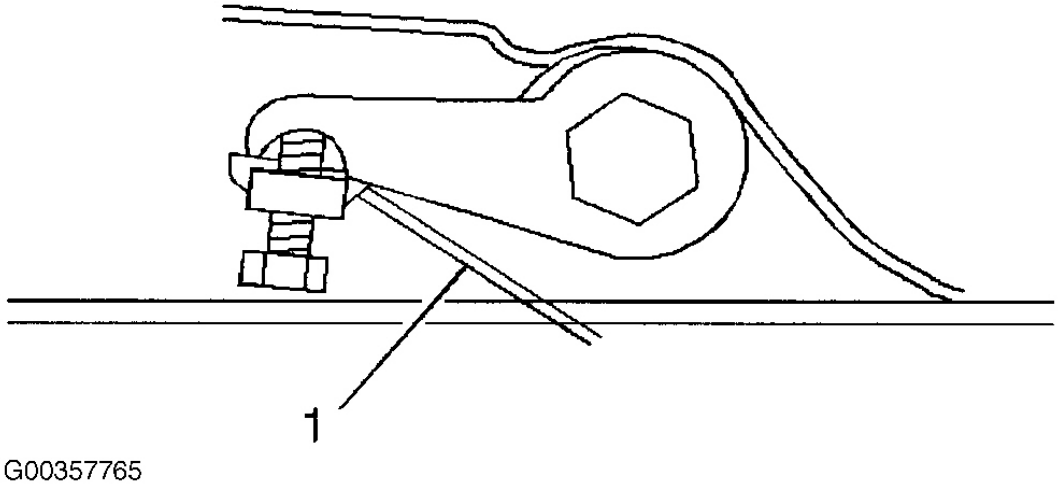

Fig. 5: Z Height Adjustment
Courtesy of GENERAL MOTORS CORP.

2. For vehicles without torsion bars, replace damaged or worn components as necessary.

D Height Measurement

NOTE: The D height dimension measurement determines the proper rear end ride height. There is no adjustment procedure. Repair may require replacement of suspension components.

1. With the vehicle on a flat surface, lift upward on the rear bumper 38 mm (1.5 in).
2. Remove your hands.
3. Allow the vehicle to settle into position.
4. Repeat the jouncing operation 2 more times for a total of 3 times.
5. The D height is obtained by measuring the distance between the edge of the jounce cup along the jounce bumper center line and the jounce pad on the rear axle. See **Fig. 6** .

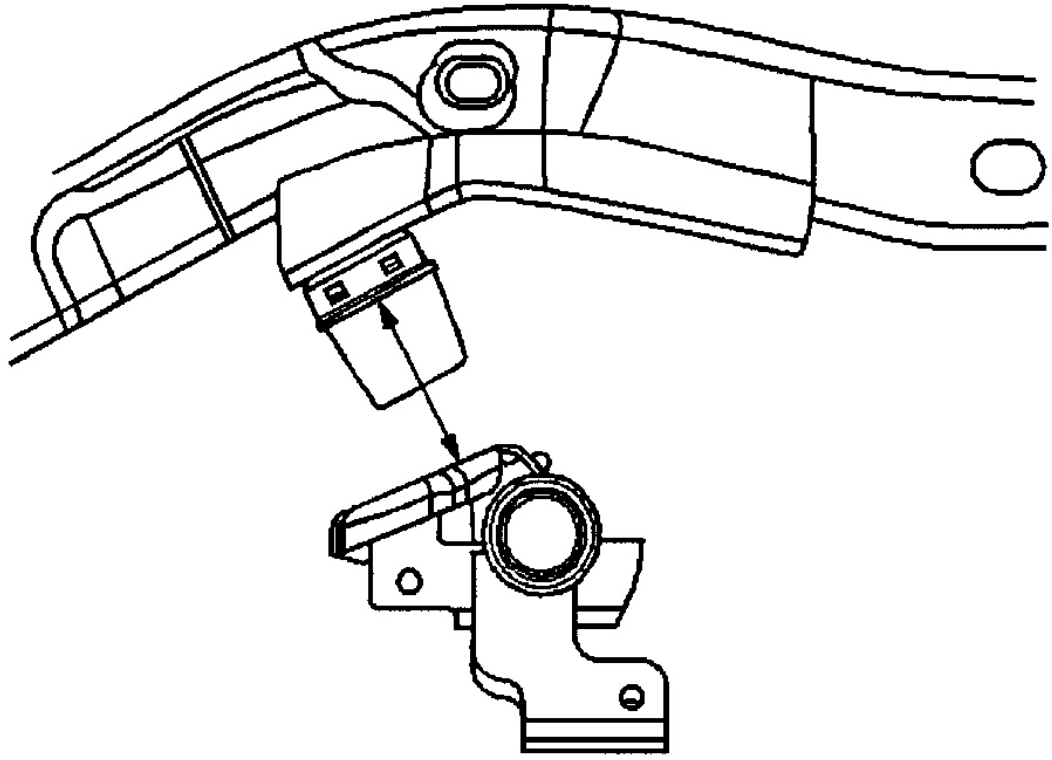

Fig. 6: D Height Measurement
Courtesy of GENERAL MOTORS CORP.

6. The true D height dimension number is the average of the high and the low measurements. Refer to **TRIM HEIGHT SPECIFICATIONS** .
7. If these measurements are out of specifications, inspect for the following conditions:
    - Sagging front suspension Refer to Torsion Bar Replacement in Front Suspension.
    - Sagging rear coil springs Refer to **COIL SPRING REPLACEMENT** .
    - Proper air suspension operation.
    - Worn rear suspension components.
    - Improper tire inflation.
    - Improper weight distribution.
    - Collision damage.

VEHICLE LEADS/PULLS

Definition: At a constant highway speed on a typical straight road, lead/pull is the amount of effort required at the steering wheel to maintain the vehicle's straight path.

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Road test the vehicle in order to verify the complaint. Does the vehicle operate normally? If yes, system is okay. If no, go to next step.
3. Inspect the tire/wheel assemblies for:
   - Correct tire pressure.
   - Correct tire size.

   Did you find and correct the condition? If yes, go to step 9 . If no, go to next step.
4. Perform the Radial Tire Lead/Pull Correction. Did you find and correct the condition? If yes, go to step 9 . If no, go to next step.
5. Inspect and correct/adjust the suspension and steering systems for the following conditions:
   - Vehicle trim height. See **TRIM HEIGHT INSPECTION PROCEDURE**
   - Excessively worn, loose, or damaged components.

   Did you find and correct the condition? If yes, go to step 9 . If no, go to next step.
6. Inspect the brake system for brake drag. With the vehicle suspended on a hoist, brake drag can be identified by rotating each wheel several times and observing whether more force is need to rotate the left wheel or the right wheel. Did you find and correct the condition? If yes, go to step 9 . If no, go to next step.
7. Inspect the wheel alignment and adjust as necessary. Refer to **SPECIFICATIONS** . Did you correct the condition? If yes, go to step 9 . If no, go to next step.
8. Inspect the steering gear for unequal effort. The vehicle must be suspended on a hoist, the engine running, and the transmission in park or neutral. Grasp the tire assembly and manually simulate a turn from the left of center and the right of center observing whether more force is needed to turn to the left or to the right. If this condition exists replace the steering gear. Did you correct the condition? If yes, system is okay. If no, go to step 3 .
9. Operate the vehicle in order to verify the repair. Did you correct the condition? If yes, system is okay. If no, go to step 3 .

WHEEL BEARING DIAGNOSIS

1. Did you review the General Description and perform the necessary inspections? If yes, go to next step. If no, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Road test the vehicle in order to verify the customer's complaint. Does the vehicle operate normally? If yes, system is okay. If no, go to next step.
3. Raise and support the vehicle. Inspect for tire or wheel damage. Did you find and correct the condition? If yes, go to step 7 . If no, go to next step.
4. Install the J-39570 chassis ear. See **SPECIAL TOOLS** . Road test the vehicle to verify the location of the wheel bearing noise. Did you locate the source of the wheel bearing noise? If yes, go to step 6 . If no, go to next step.
5. **NOTE: If you are inspecting the FRONT wheel bearing/hub, support the front of**

the vehicle by the lower control arms in order to load the lower ball joint.

Raise and support the vehicle. Remove the wheel and tire. Mount and secure the J-8001 to the steering knuckle. Firmly push the hub flange towards the vehicle. Ensure that the J-8001 contacts the vertical surface of the hub flange as close as possible to the center of the flange. Firmly pull the hub flange away from the vehicle. Inspect the total movement indicated by the J-8001. Is the measurement greater than 0.051 mm (0.002 in)? If yes, go to next step. If no, system is okay.

6. Replace the wheel bearing. Refer to FRONT SUSPENSION. After repairs, go to next step.
7. Road test the vehicle to verify the repair. Does the vehicle operate normally? If yes, system is okay. If no, go to step 3 .

SPECIAL TOOLS

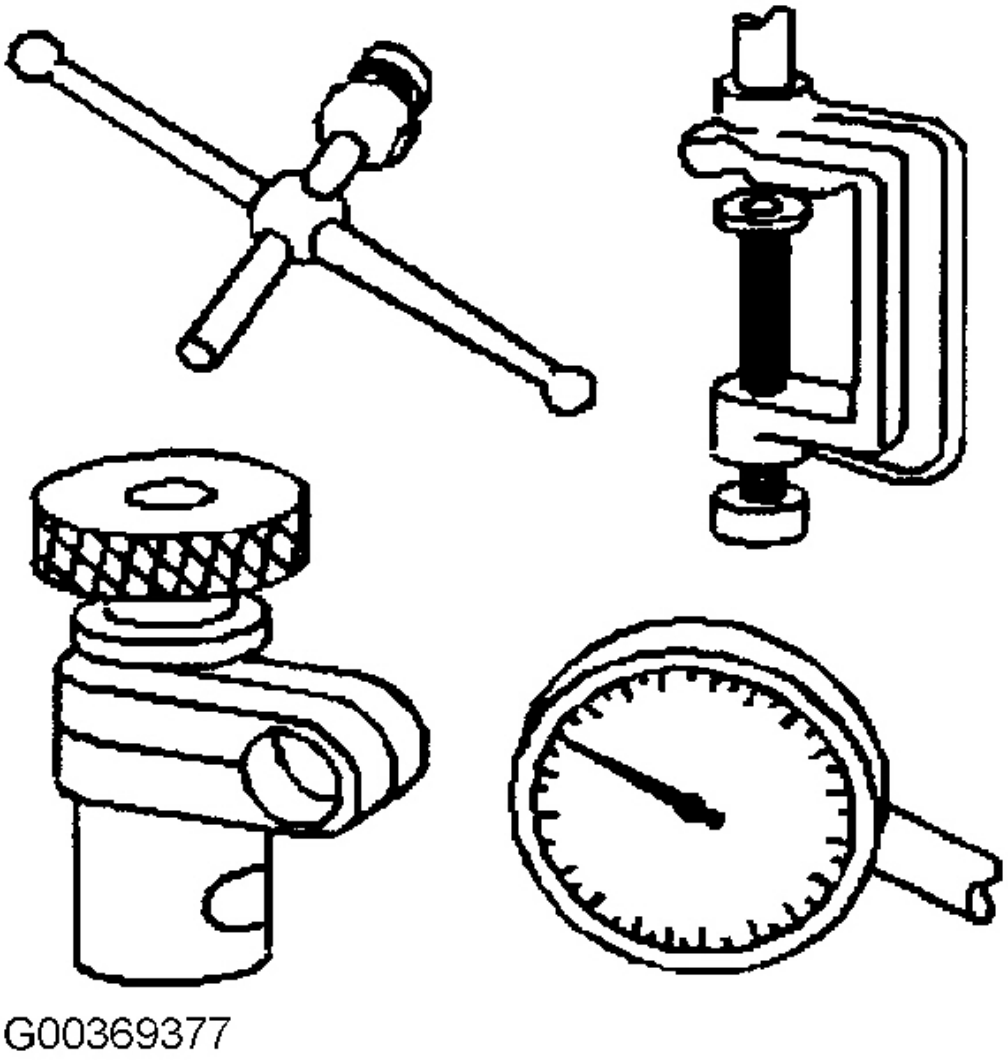

Fig. 7: Dial Indicator Set (J-8001)
Courtesy of GENERAL MOTORS CORP.

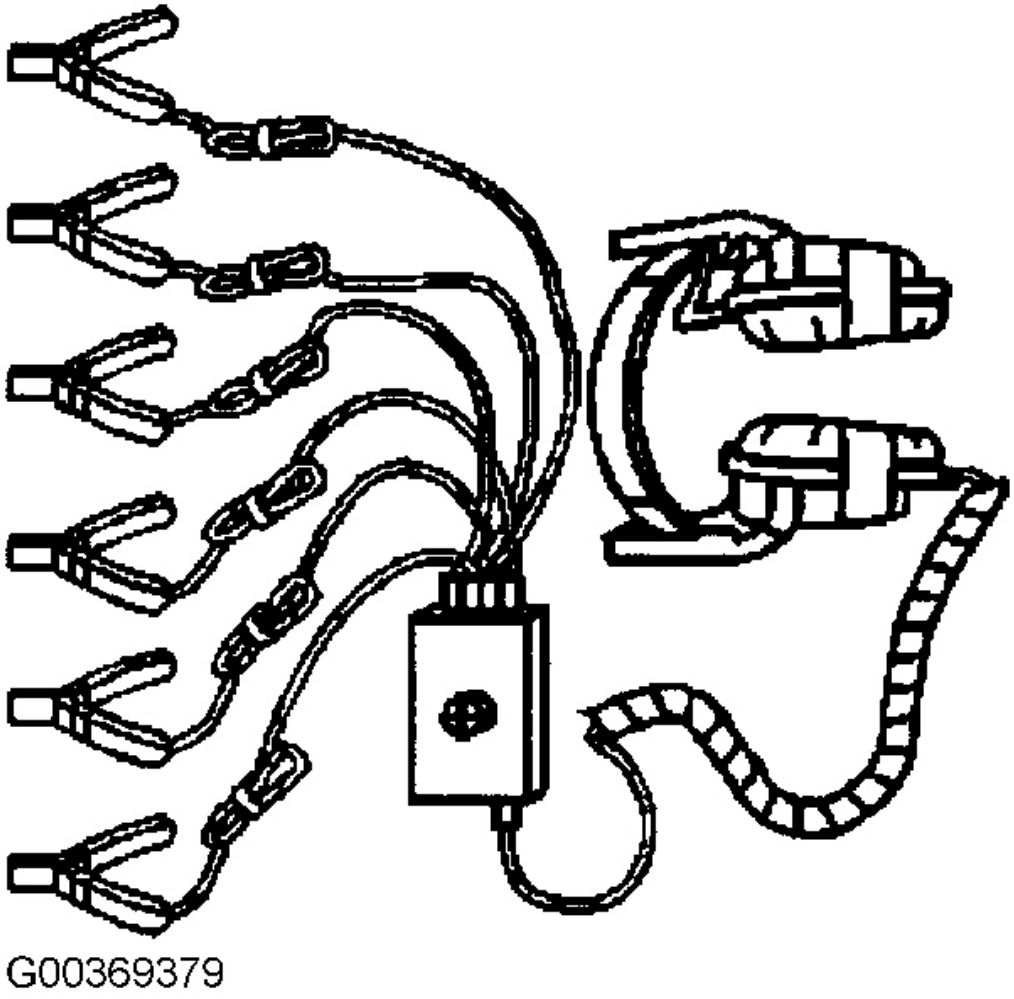

Fig. 8: Chassis Ear (J-39570)
Courtesy of GENERAL MOTORS CORP.