2002 SUSPENSION

General Diagnosis - Camaro & Firebird

TRIM HEIGHT SPECIFICATIONS

Suspension	Tire Size	D	Z
F41	235-55	118 mm (4.6 in)	30 mm (1.2 in)
FE2	235-55	118 mm (4.6 in)	31 mm (1.2 in)
	245-50	125 mm (4.9 in)	37 mm (1.5 in)

G00369489

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. 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

Determine whether the vehicle is equipped with an electrically assisted or active suspension system. Perform electrical diagnosis prior to beginning mechanical diagnosis. Review the system Description and Operation in order to familiarize yourself with the system functions.

- GENERAL DESCRIPTION in FRONT SUSPENSION.
- **GENERAL DESCRIPTION** in REAR SUSPENSION.
- GENERAL DESCRIPTION in TIRES & WHEELS.

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

- **RIDE DIAGNOSIS - TOO SOFT**
- **RIDE DIAGNOSIS - TOO HARD**

- **VEHICLE LEADS/PULLS**
- **SUSPENSION BOTTOMS**
- **POOR DIRECTIONAL STABILITY**
- **TIRE HOP OR POOR HANDLING**
- **NOISE DIAGNOSIS - FRONT SUSPENSION**
- **NOISE DIAGNOSIS - REAR SUSPENSION**
- **STRUTS OR SHOCK ABSORBERS ON-VEHICLE TESTING**
- **WHEEL BEARINGS DIAGNOSIS**

RIDE DIAGNOSIS - TOO SOFT

1. Did you review the General Description and perform the necessary inspections? If so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that the ride is too soft. Does the vehicle ride normally? If so, then system is okay. If not, go to next step.
3. Check the tire inflation and adjust to specifications. Is the tire inflation pressure correct? If so, go to step 5 . If not, go to next step.
4. Inflate the tires to the correct pressure. After repair, go to next step.
5. Inspect the vehicle trim height. Refer to **TRIM HEIGHT INSPECTION PROCEDURE** . Repair as necessary. After repair, go to next step.
6. Inspect the struts and springs for wear or damage. Are any of the components the worn or damaged? If so, go to next step. If not, go to step 8 .
7. Replace all of the worn or damaged components.
   - For shock absorber replacement, refer to SHOCK ABSORBER REPLACEMENT in FRONT SUSPENSION or **SHOCK ABSORBER REPLACEMENT** in REAR SUSPENSION.
   - For spring replacement, refer to FRONT COIL SPRINGS REPLACEMENT in FRONT SUSPENSION.

   Did you complete the repair? If so, go to next step. If not, system is okay.
8. Drive the vehicle in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

RIDE DIAGNOSIS - TOO HARD

1. Did you review the General Description and perform the necessary inspections? If so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that the ride is too hard. Does the vehicle ride normally? If so, then system is okay. If not, go to next step.
3. Inspect the tires for the proper inflation pressure. Is the tire inflation pressure correct? If so, go to step 5 . If not, go to next step.
4. Inflate the tires to the correct pressure. After repair, go to next step.
5. Inspect the struts and shock absorbers for wear or damage. Refer to **STRUTS OR SHOCK ABSORBERS ON-VEHICLE TESTING** . Are any of the components the worn or damaged? If so, go to next step. If not, go to step 7 .
6. Replace all of the worn or damaged components.

- For shock absorber replacement, refer to SHOCK ABSORBER REPLACEMENT in FRONT SUSPENSION or **SHOCK ABSORBER REPLACEMENT** in REAR SUSPENSION.
- For spring replacement, refer to FRONT COIL SPRINGS REPLACEMENT in FRONT SUSPENSION.

Did you complete the repair? If so, go to next step. If not, system is okay.

7. Operate the system in order to verify the repair. Did you correct the condition? If so, system is okay. If not, go to step 3 .

VEHICLE LEADS/PULLS

NOTE: Lead/pull is the deviation of the vehicle from a straight path on a level road with no pressure on the steering wheel. Use the lead/pull correction table in order to verify that improper wheel alignment or worn components are not mistaken for tire lead.

1. Did you review the General Description and perform the necessary inspections? If so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Road test the vehicle in order to verify the complaint. Does the vehicle operate normally? If so, then system is okay. If not, go to next step.
3. Inspect the tire/wheel assemblies for:
   - Correct tire pressure.
   - Correct tire size.

   Do any of the above conditions apply? If so, go to next step. If not, go to step 5 .
4. Repair/replace the tire/wheel assemblies as necessary. After repair, go to step 15 .
5. Inspect and correct/adjust the suspension and steering systems for:
   - Vehicle trim height. See **TRIM HEIGHT INSPECTION PROCEDURE**
   - Excessively worn, loose, or damaged components. See **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
   - Excessive wheel bearing play. Refer to **WHEEL BEARINGS DIAGNOSIS** .

   Do any of the above conditions apply? If so, go to next step. If not, go to step 7 .
6. Repair/replace components as necessary.
   - Tighten components to specifications. Refer to FASTENER TIGHTENING SPECIFICATIONS in FRONT SUSPENSION or **FASTENER TIGHTENING SPECIFICATIONS** in REAR SUSPENSION.
   - Adjust or replace the wheel bearings. Refer to WHEEL BEARING/HUB REPLACEMENT - FRONT in FRONT SUSPENSION.

   After repair, go to step 15 .
7. Inspect the brake system for brake drag. Refer to **DIAGNOSTIC STARTING POINT (HYDRAULIC BRAKES)** . Do any of the above conditions apply? If so, go to next step. If not, go to step 9 .
8. Repair/replace components as necessary. After repair, go to step 15 .
9. Inspect the steering gear for an unbalance. If this is the cause, steering effort will be very light in the direction of the lead and effort will be heavy in the opposite direction with the vehicle parked on a smooth level surface. Does the above condition apply? If so go to next step. If not, go to step 11 .

10. Replace the steering gear. Refer to POWER STEERING GEAR REPLACEMENT in POWER STEERING SYSTEM.. After repair, go to step 15 .
11. Inspect the wheel alignment. Refer to MEASURING WHEEL ALIGNMENT in WHEEL ALIGNMENT. Is the wheel alignment in specifications? If so, go to step 13 . If not, go to next step.
12. Adjust alignment to specifications. Refer to MEASURING WHEEL ALIGNMENT in WHEEL ALIGNMENT. After repair, go to step 15 .
13. Cross-switch the front tire/wheel assemblies. Road test the vehicle on a smooth level surface. Does the vehicle still lead/pull? If so, go to next step. If not, then system is okay.
14. Does the vehicle lead/pull in the opposite direction? If so, go to RADIAL TIRE LEAD/PULL CORRECTION in TIRES AND WHEELS. If not, go to next step.
15. Operate the vehicle in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

BODY LEANS OR SWAYS IN CORNERS

1. Did you review the General Description and perform the necessary inspections? If so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify the vehicle leans or sways in corners. Does the vehicle operate normally? If so, then system is okay. If not, go to next step.
3. Inspect the front springs and the rear springs for wear or damage. Are the components worn or damaged? If so, go to step 5 . If not, go to next step.
4. Inspect the stabilizer shaft link for wear or damage. Is the stabilizer shaft link worn or damaged? If so, go to step 6 . If not, go to step 2 .
5. Replace the springs. Refer to the appropriate procedure:
   - FRONT COIL SPRINGS REPLACEMENT in FRONT SUSPENSION.
   - **COIL SPRING REPLACEMENT** in REAR SUSPENSION.

   After repair is complete, go to step 7 .
6. Replace the stabilizer shaft link. Refer to STABILIZER SHAFT LINK REPLACEMENT in FRONT SUSPENSION or **STABILIZER SHAFT LINK REPLACEMENT** in REAR SUSPENSION. After repair is complete, go to next step.
7. Operate the vehicle in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

SUSPENSION BOTTOMS

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 so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that the suspension bottoms. Does the vehicle operate normally? If so, then system is okay. If not, go to next step.
3. Inspect the vehicle for overloading. Is the vehicle overloaded? If so, go to step 6 . If not, go to next step.
4. Inspect the vehicle trim height. See **TRIM HEIGHT INSPECTION PROCEDURE** . Is the vehicle trim height incorrect? If so, go to step 7 . If not, go to next step.

5. Inspect the struts and shock absorbers. Refer to **STRUTS OR SHOCK ABSORBERS ON-VEHICLE TESTING** . Are the components in need of replacement? If so, go to step 8 . If not, go to step 9 .
6. Remove the excess weight from the vehicle. Go to step 9 .
7. Correct the vehicle trim height. Refer to **TRIM HEIGHT INSPECTION PROCEDURE** . After repair, go to step 9 .
8. Replace the components as necessary. After repair, go to next step.
9. Operate the vehicle in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

MEMORY STEER

NOTE: 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 so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that memory steer is present. Does the system operate normally? If so, then system is okay. If not, go to next step.
3. Ensure that all of the tires are inflated to the correct pressure. After the inspection/adjustment been performed, go to next step.
4. Lubricate the tie rod ends and the ball joints if applicable. Inspect the suspension system for worn or damaged components. Repair as necessary. Road test the vehicle in order to verify the customer complaint. Does the vehicle still exhibit memory steer? If so, go to next step. If not, then system is okay.
5. Check for proper wheel alignment. Refer to MEASURING WHEEL ALIGNMENT in WHEEL ALIGNMENT. Adjust as necessary. Road test the vehicle in order to verify the customer complaint. Does the vehicle still exhibit memory steer? If so, go to next step. If not, then system is okay.
6. Raise and support the vehicle. Disconnect both of the outer tie rod ends from the steering knuckles. Refer to TIE ROD END REPLACEMENT - OUTER in POWER STEERING SYSTEM. Use your hands in order to move the tie rod ends. Are either of the tie rod ends abnormally difficult to move? If so, go to next step. If not, go to step 8 .
7. Replace the outer tie rod ends as necessary. Refer to TIE ROD END REPLACEMENT - OUTER in POWER STEERING SYSTEM. After repair, go to step 14 .
8. Inspect for binding lower ball joints. Are either of the lower ball joints abnormally difficult to move? If so, go to step 10 . If not, go to next step.
9. Replace the lower ball joint. Refer to LOWER BALL JOINT REPLACEMENT in FRONT SUSPENSION. After repair, go to step 14 .
10. Raise and support the vehicle. Rotate the steering wheel ONE revolution in either direction. Rotate the steering wheel back to the original position. Was the steering wheel abnormally difficult to rotate in either direction? If so, go to next step. If not, go to step 14 .
11. Disconnect the intermediate shaft. DO NOT rotate the steering wheel more than one complete revolution. Note the position of the steering wheel and rotate the steering wheel ONE revolution in either direction. Rotate the steering wheel back to the original position as previously noted. Was the steering wheel abnormally difficult to rotate in either direction? If so, go to next step. If not, go to step 13 .
12. Repair the power steering gear as necessary. Refer to POWER STEERING GEAR REPLACEMENT

in POWER STEERING SYSTEM. Road test the vehicle in order to verify the customer complaint. After repair, go to step 14 .

13. Repair the steering column as necessary. After repair, go to next step.
14. Operate the vehicle in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

POOR DIRECTIONAL STABILITY

NOTE: The 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 so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that the directional stability is poor. Does the system operate normally? If so, then system is okay. If not, go to next step.
3. Inspect the stabilizer shaft, links, and insulators for wear or damage. Replace as necessary.
   - See STABILIZER SHAFT LINK REPLACEMENT in FRONT SUSPENSION.
   - See STABILIZER SHAFT INSULATOR REPLACEMENT in FRONT SUSPENSION.
   - See STABILIZER SHAFT REPLACEMENT in FRONT SUSPENSION.

   Does the vehicle still exhibit poor directional stability? If so, go to next step. If not, then system is okay.
4. Inspect the following suspension and steering components for wear or damage:
   - LOWER CONTROL ARM REPLACEMENT in FRONT SUSPENSION.
   - LOWER BALL JOINT REPLACEMENT in FRONT SUSPENSION.
   - TIE ROD END REPLACEMENT - OUTER in POWER STEERING.

   Does the vehicle still exhibit poor directional stability? If so, go to next step. If not, then system is okay.
5. Inspect the wheel bearings. Refer to **WHEEL BEARINGS DIAGNOSIS** . Does the vehicle still exhibit poor directional stability? If so, go to next step. If not, then system is okay.
6. Inspect the vehicle trim height. See **TRIM HEIGHT INSPECTION PROCEDURE** . Repair as necessary. Does the vehicle still exhibit poor directional stability? If so, go to next step. If not, then system is okay.
7. Inspect and adjust the wheel alignment as necessary. Refer to MEASURING WHEEL ALIGNMENT in WHEEL ALIGNMENT. Does the vehicle still exhibit poor directional stability? If so, go to next step. If not, then system is okay.
8. Inspect the steering column for looseness. Repair as necessary. Did you complete the repair? After repair, go to next step.
9. Inspect the steering gear mounting bolts for looseness. Refer to FASTENER TIGHTENING SPECIFICATIONS in POWER STEERING. Repair as necessary. After repair, go to next step.
10. Operate the vehicle in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

TIRE HOP OR POOR HANDLING

NOTE: The tire/wheel bounce with a frequency directly related to the vehicle speed.

1. Did you review the General Description and perform the necessary inspections? If so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that the tires hop or that the vehicle handles poorly. Does the vehicle handle normally? If so, then system is okay. If not, go to next step.
3. Inspect the tires for uneven wear or damage. Are the tires worn or damaged? If so, go to step 7 . If not, go to next step.
4. Inspect the tires and wheels for missing wheel weights. Are the wheel weights missing? If so, go to step 8 . If not, go to next step.
5. Inspect the tires and wheels for excessive runout. Does the tire and wheel have excessive runout? If so, go to step 7 . If not, go to next step.
6. Inspect the shock absorbers for wear or damage. Refer to **STRUTS OR SHOCK ABSORBERS ON-VEHICLE TESTING** . Are the shock absorbers worn or damaged? If so, go to step 9 . If not, go to step 10 .
7. Replace the tire/wheel if necessary. After repair, go to step 10 .
8. Balance the tire and wheel assembly. After repair, go to step 10 .
9. Replace the shock absorbers. Refer to SHOCK ABSORBER REPLACEMENT in FRONT SUSPENSION or **SHOCK ABSORBER REPLACEMENT** in REAR SUSPENSION. After repair, go to next step.
10. Operate the system in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

NOISE DIAGNOSIS - FRONT SUSPENSION

NOTE: Any noise from the front of the vehicle that is induced by Vehicle Speed or Driving Terrain as related to the front suspension.

NOTE: Required Tools: (J-39570) Chassis Ear

1. Did you review the General Description and perform the necessary Inspections? If so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Compare this vehicle to an identical vehicle in order to determine if the customer's concern is a normal operating characteristic of the vehicle. Attempt to duplicate the condition. Road test the vehicle. Is the front suspension noisy? If so, go to next step. If not, then system is okay.
3. Shift the transmission into Park. Turn the ignition off. Bounce the front of the vehicle in order to duplicate the noise. Is the noise present? If so, go to next step. If not, go to step 5 .
4. Bounce the front of the vehicle. Use J 39570 in order to locate the source of the noise. Repair or replace the suspect components as necessary. After repair, go to step 25 .
5. Raise and support the vehicle. Inspect all of the front suspension components for any damage. Are any components damaged? If so, go to next step. If not, go to step 7 .
6. Repair any damaged components. After repair, go to step 25 .
7. Inspect the tires for proper inflation. Correct the tire inflation pressure as necessary. Inspect the tires for unusual wear. Does either tire exhibit unusual tread wear? If so, go to next step. If not, go to step 10 .
8. Rotate the tires. Road test the vehicle. Is the noise now emitted from the rear of the vehicle? If so, go to next step. If not, go to step 10 .

9. Replace the tires that are causing the noise. After repair, go to step 25 .
10. Ensure that the ball joints and steering linkage are lubricated, if applicable. Lubricate/replace as necessary. Did you service any components? If so, go to step 25 . If not, go to next step.
11. Ensure that all of the wheel nuts are tightened to the correct specification. Tighten as necessary. Refer to FASTENER TIGHTENING SPECIFICATIONS in TIRES AND WHEELS. Did you tighten any wheel nuts? If so, go to step 25 . If not, go to next step.
12. Use your hands in order to push and pull the shock absorbers. Is the shock absorber loose? If so, go to next step. If not, go to step 15 .
13. Inspect the shock absorber fasteners for the correct fastener tightening specification. Tighten as necessary. Refer to FASTENER TIGHTENING SPECIFICATIONS in FRONT SUSPENSION. Use your hand to push and pull the shock absorber. Is the shock absorber loose? If so, go to next step. If not, go to step 24 .
14. Replace the loose or worn shocks absorber. Refer to SHOCK ABSORBER REPLACEMENT in FRONT SUSPENSION. After replacement, go to step 24 .
15. Use your hands in order to push and pull on the stabilizer shaft. Is the stabilizer shaft loose? If so, go to next step. If not, go to step 20 .
16. Inspect all of the stabilizer shaft fasteners. Tighten as necessary. Refer to FASTENER TIGHTENING SPECIFICATIONS in FRONT SUSPENSION. Use your hands in order to push and pull on the stabilizer shaft. Is the stabilizer shaft loose? If so, go to next step. If not, go to step 24 .
17. Observe the location of the stabilizer shaft looseness. Is the looseness observed at the stabilizer shaft links? If so, go to next step. If not, go to step 20 .
18. Replace the stabilizer shaft links. Refer to STABILIZER SHAFT LINK REPLACEMENT in FRONT SUSPENSION. After replacement, go to step 25 .
19. Replace the stabilizer shaft insulators and/or brackets. Refer to STABILIZER SHAFT INSULATOR REPLACEMENT in FRONT SUSPENSION. After replacement, go to step 25 .
20. Inspect the control arms for looseness or movement. Is any looseness or movement observed? If so, go to next step. If not, go to step 22 .
21. Inspect the control arm fasteners for the correct fastener tightening specification. Refer to FASTENER TIGHTENING SPECIFICATIONS in FRONT SUSPENSION. Tighten as necessary. Inspect the control arm for looseness. Is the control arm loose? If so, go to next step. If not, go to step 24 .
22. Replace any worn or loose control arm bushings. Refer to UPPER CONTROL ARM BUSHINGS REPLACEMENT or LOWER CONTROL ARM BUSHINGS REPLACEMENT in FRONT SUSPENSION. After replacement, go to step 25 .
23. Inspect the wheel bearings for looseness or noise. Refer to **WHEEL BEARINGS DIAGNOSIS** . Does either wheel bearing exhibit looseness or noise? If so, go to next step. If not, go to step 8
24. Replace the wheel bearing. Refer to WHEEL BEARING/HUB REPLACEMENT - FRONT in FRONT SUSPENSION. After replacement, go to next step.
25. Operate the system in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

NOISE DIAGNOSIS - REAR SUSPENSION

NOTE: **Any noise from the rear of the vehicle that is induced by Vehicle Speed or Driving Terrain as related to the rear suspension.**

NOTE: Required Tools: Chassis Ear (J-39570).

1. Did you review the General Description and perform the necessary inspections? If so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that the rear suspension is noisy. Is the rear suspension noisy? If so, go to next step. If not, then system is okay.
3. Shift the transmission into Park. Turn the ignition off. Bounce the rear of the vehicle in order to duplicate the noise. Is the complaint noise present? If so, go to next step. If not, go to step 5 .
4. Bounce the rear of the vehicle. Use J 39570 in order to locate the source of the noise. Repair or replace the suspect components as necessary. After repair, go to step 15 .
5. Raise and support the vehicle. Inspect all of the rear suspension components for any damage. Are any components damaged? If so, go to next step. If not, go to step 7 .
6. Repair or replace any damaged components. After repair, go to step 15 .
7. Inspect the tires for proper inflation. Correct the tire inflation pressure as necessary. Inspect the tires for unusual wear. Does either tire exhibit unusual tread wear? If so, go to next step. If not, go to step 10 .
8. Rotate the tires. Road test the vehicle. Is the noise now emitted from the front of the vehicle? If so, go to next step. If not, go to step 10 .
9. Replace the tires that are causing the noise. After repair, go to step 15 .
10. Ensure that the park brake cable and the spare tire are secured properly. Did you service any components? If so, go to step 15 . If not, go to next step.
11. Ensure that all of the wheel nuts are tightened to the correct specification. Tighten as necessary. Refer to FASTENER TIGHTENING SPECIFICATIONS in TIRES AND WHEELS. Did you tighten any of the wheel nuts? If so, go to step 15 . If not, go to next step.
12. Raise and support the vehicle. Use your hand to push and pull the shock absorbers. Is either shock absorber loose? If so, go to next step. If not, go to step 15 .
13. Inspect the shock absorber fasteners for the correct fastener tightening specification. Tighten as necessary. Refer to **FASTENER TIGHTENING SPECIFICATIONS** in REAR SUSPENSION. Use your hands in order to push and pull the shock absorber. Is the shock absorber loose? If so, go to next step. If not, go to step 15 .
14. Replace the loose or worn shock absorber. Refer to **SHOCK ABSORBER REPLACEMENT** in REAR SUSPENSION. After repair, go to next step.
15. Operate the system in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

BALL JOINT INSPECTION

NOTE: Tools Required: J 8001 Dial Indicator

NOTE: The vehicle must rest on a level surface. The vehicle must be stable. Do not rock the vehicle on the jack stands. The upper control arm bumper must not contact the frame. If a seal is cut or torn, replace the ball joint.

1. Raise and support the vehicle with safety stands. Support the lower control arm with a jack stand, as far outboard as possible, near the lower ball joint.
2. Wipe the ball joints clean. Check the seals for cuts or tears. Check the wheel bearings for looseness. If

looseness in the wheel bearings is present, refer to **WHEEL BEARINGS DIAGNOSIS** .

3. Check the ball joints for horizontal looseness.
   A. Position the J 8001 dial indicator against the lowest outboard point on the wheel rim.
   B. Rock the wheel in and out while reading the dial indicator. This shows horizontal looseness in both joints.
   C. The dial indicator reading should be no more than 3.18 mm (0.125 in). If the reading is too high, check the lower ball joints for vertical looseness.
4. Check the lower ball joints for wear and for vertical looseness using the following procedure:
   A. Inspect by sight the lower ball joint for wear. The position of the housing into which the grease fitting is threaded indicates wear. This round housing projects 1.27 mm (0.050 in) beyond the surface of the lower ball joint cover on a new ball joint. Under normal wear, the surface of the lower ball joint housing retreats inward very slowly.
   B. First observe, then scrape a scale, a screwdriver, or a fingernail across the cover. If the round housing is flush with or inside of the cover surface, replace the lower ball joint. Refer to LOWER BALL JOINT REPLACEMENT in FRONT SUSPENSION.
5. Place a J 8001 dial indicator against the spindle in order to show vertical movement. Pry between the lower control arm and the outer bearing race while reading the dial indicator. This shows vertical looseness in the ball joints. The lower ball joint is not preloaded and may show some looseness.
6. If the dial indicator reading is more than 3.18 mm (0.125 in), replace the lower ball joint. Refer to LOWER BALL JOINT REPLACEMENT in FRONT SUSPENSION.
7. If the lower ball joint is within specifications, and there is too much horizontal looseness, check the upper ball joint for wear. Disconnect the upper ball joint from the steering knuckle. Refer to UPPER BALL JOINT REPLACEMENT in FRONT SUSPENSION. If you find any looseness or can twist the stud with your fingers, replace the upper ball joint.

STRUTS OR SHOCK ABSORBERS ON-VEHICLE TESTING

1. Did you review the General Description and perform the necessary inspections? If so, go to next step. If not, go to **SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS** .
2. Verify that the malfunction is present. Does the vehicle operate normally? If so, then system is okay. If not, go to next step.

NOTE: A light film of oil on the top portion of the shock reservoir is normal.

3. Inspect each strut or shock absorber for external fluid leakage. Is a strut or shock absorber leaking? If so, go to step 7 . If not, go to next step.
4. Inspect the vehicle trim height. Refer to **TRIM HEIGHT INSPECTION PROCEDURE** . Is the vehicle trim height correct? If so, go to next step. If not, go to step 6 .
5. Use your hands in order to lift up and push down each corner of the vehicle 3 times. Remove your hands from the vehicle. Does the vehicle stop bouncing after 2 cycles? If so, go to step 8 . If not, go to step 7 .
6. Replace the front spring or the rear spring.
   - Refer to FRONT COIL SPRINGS REPLACEMENT in FRONT SUSPENSION.
   - Refer to **COIL SPRING REPLACEMENT** in REAR SUSPENSION.

   After repair, go to step 8 .
7. Replace the strut or shock absorber.

- Refer to SHOCK ABSORBER REPLACEMENT in FRONT SUSPENSION.
- Refer to **SHOCK ABSORBER REPLACEMENT** in REAR SUSPENSION.

After repair, go to next step.

8. Operate the vehicle in order to verify the repair. Did you correct the condition? If so, then system is okay. If not, go to step 3 .

WHEEL BEARINGS DIAGNOSIS

NOTE: Tools Required: (J-8001) Dial Indicator Set and (J 39570) Chassis Ear.

NOTE: The following procedure describes how to inspect the wheel bearing/hub for excessive looseness.

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.

1. Raise and support the vehicle.
2. Mount and secure the J 8001 to a stand. Ensure that the J 8001 contacts the vertical surface of the wheel as close as possible to the top wheel stud.
3. Push and pull on the TOP of the tire. Inspect the total movement indicated by the J 8001.
4. If the measurement exceeds 0.127 mm (0.005 in), replace the wheel bearing/hub. Refer to WHEEL BEARING/HUB REPLACEMENT - FRONT in FRONT SUSPENSION.

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.
5. Close the doors.
6. Close the hood.
7. All dimensions are measured vertical to the ground. Trim heights should be within 13 mm (0.5 in) to be considered correct.

Measuring the Z Dimension

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

1. Using your hands, lift the front bumper approximately 38 mm (1.5 in). Gently remove your hands and allow the vehicle to settle. Repeat this operation a total of 3 times.
2. Measure from the pivot bolt center line (3) down to the lower corner of the lower ball joint (5), in order to obtain the Z height measurement (4). See **Fig. 2** .
3. Push the front bumper of the vehicle down about 38 mm (1.5 in). Gently remove your hands. Allow the vehicle to settle into position. Repeat the jouncing operation 2 more times for a total of 3 times.
4. Measure the Z dimension. The true Z height dimension number is the average of the high and the low measurements. Refer to **TRIM HEIGHT SPECIFICATIONS** .

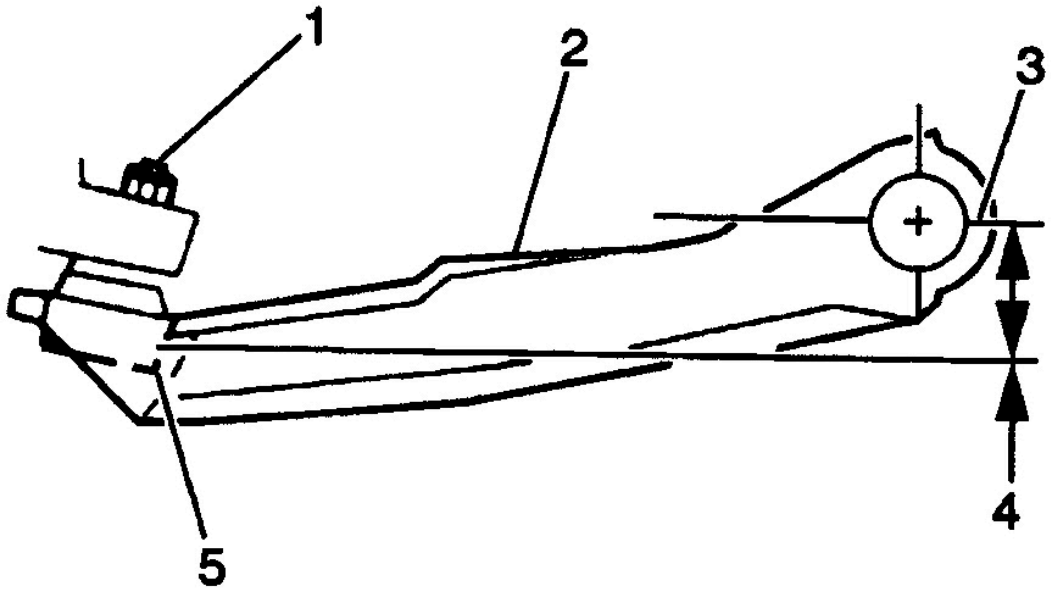

Fig. 2: Measuring Z Height
Courtesy of GENERAL MOTORS CORP.

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 level surface, lift upward on the rear bumper 38 mm (1.5 in). Gently remove your hands and allow the vehicle to settle. Repeat the jouncing operation 2 more times.
2. Measure the D height by measuring the distance between the bumper bracket and the top of the rear axle tube. Push the rear bumper downward to 38 mm (1.5 in). Gently remove your hands. Allow the vehicle to settle into position. Repeat the jouncing operation 2 more times for a total of 4 times.
3. Measure the D height dimension. The true D height dimension number is the average of the high and the low measurements. Refer to **TRIM HEIGHT SPECIFICATIONS** .
4. If these measurements are out of specifications, inspect for the following conditions:

- Sagging front suspension. Refer to FRONT COIL SPRINGS REPLACEMENT in FRONT SUSPENSION.
- Sagging rear suspension. Refer to **COIL SPRING REPLACEMENT** in REAR SUSPENSION.
- Improper tire inflation.
- Improper weight distribution.
- Collision damage.

SPECIAL TOOLS

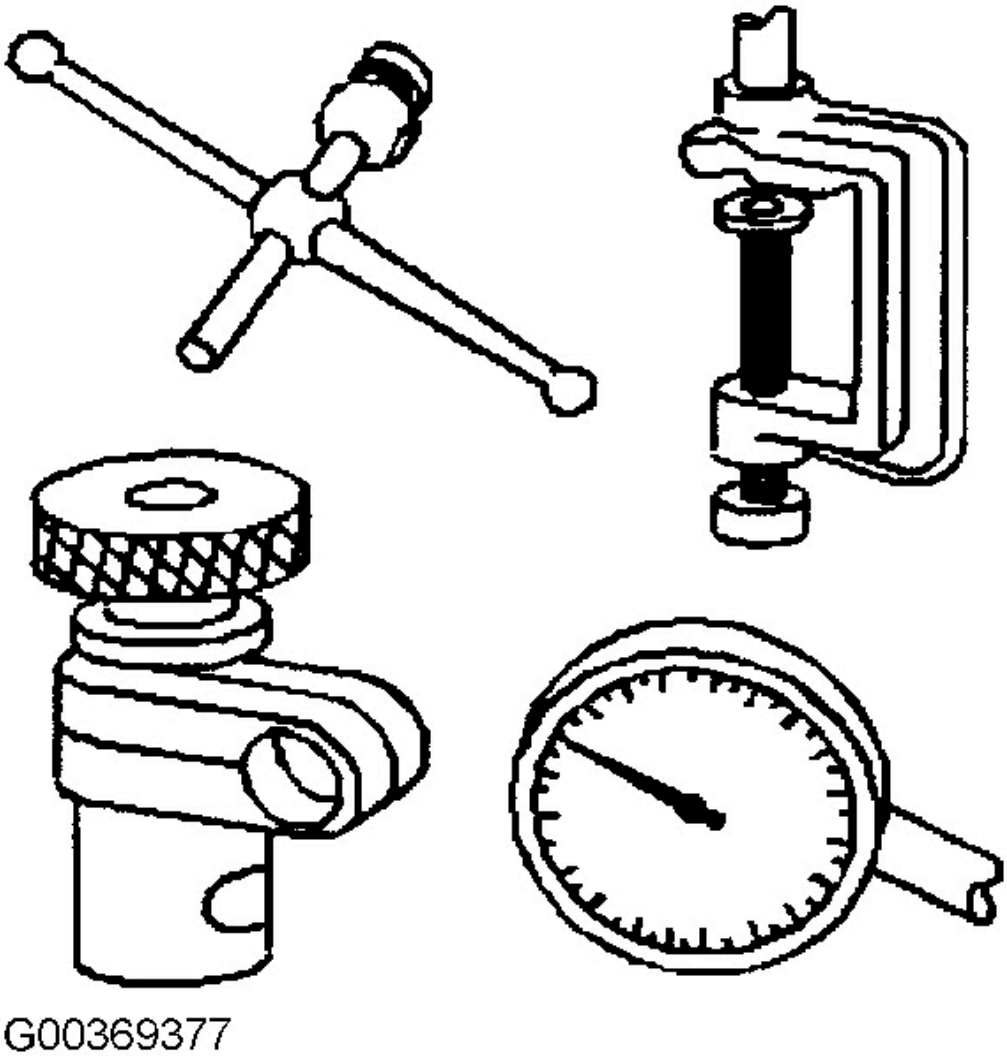

Fig. 3: Dial Indicator Set (J-8001)
Courtesy of GENERAL MOTORS CORP.

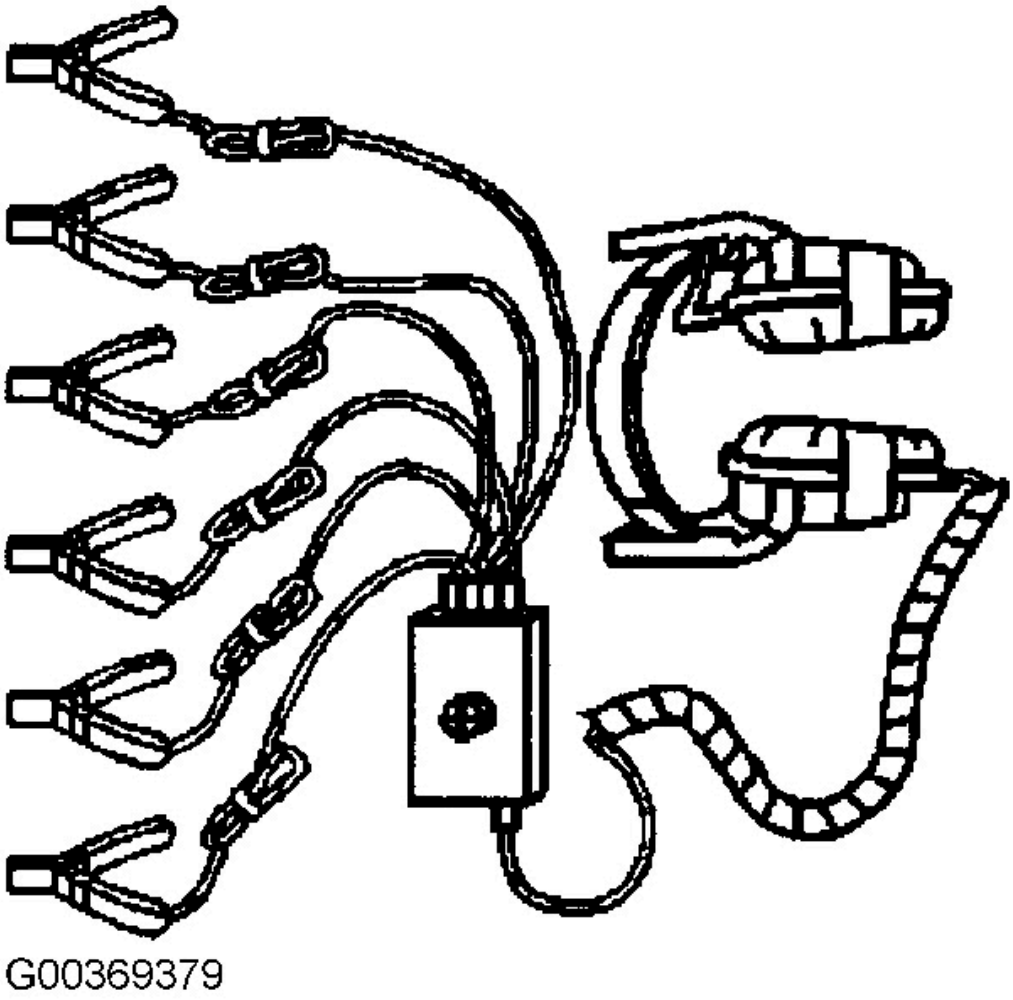

Fig. 4: Chassis Ear (J-39570)
Courtesy of GENERAL MOTORS CORP.