

SUSPENSION

Suspension General Diagnosis - Canyon, Colorado

SPECIFICATIONS

TRIM HEIGHT SPECIFICATIONS

Model	Option	Z Trim Height Cross Z Trim Height, L-R 0 Å ± 12 mm (0.47 in)	D Trim Height Cross D Trim Height, L-R 0 Å ± 12 mm (0.47 in)	P Trim Height Cross P Trim Height, L-R 0 Å ± 12 mm (0.47 in)	R Trim Height Cross R Trim Height, L-R 0 Å ± 12 mm (0.47 in)
1, T M/N/P43, 1, T M/N/P53	LFX & LCV w/o N8D	120 mm (5.0 in)	162 mm (6.0 in)	-	-
1, T M/N/P53	LCV w/ N8D	108 mm (4.25 in)	162 mm (6.0 in)	-	-
1, T M/N/P43, 1, T M/N/P53	All	-	-	889 mm (35.0 in)	934 mm (36.8 in)
1, T T/U/V43	All	-	-	889 mm (35.0 in)	939 mm (37.0 in)

DIAGNOSTIC INFORMATION AND PROCEDURES

SYMPTOMS - SUSPENSION GENERAL DIAGNOSIS

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

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. Refer to Vehicle Certification, Tire Placard, Anti-Theft, and Service Parts ID Label.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- Ride Diagnosis
- Vehicle Leads/Pulls
- Body Leans or Sways in Corners
- Suspension Bottoms
- Noise Diagnosis - Front Suspension
- Noise Diagnosis - Rear Suspension
- Suspension Strut and Shock Absorber Testing - On Vehicle
- Wheel Bearings Diagnosis
- Radial Tire Lead/Pull Correction

	OSIS	Action	Yes	No
Step	Action		Yes	No
1	Did you review the General Description and perform the necessary inspections?		Go to Step 2	Go to Symptoms - Suspension General Diagnosis
2	IMPORTANT: Verify the vehicle suspension package RPO. Verify that the ride is too soft or too hard. Does the vehicle ride normally?		System OK	Go to Step 3
3	Check the tire inflation and adjust to specifications. Refer to Vehicle Certification, Tire Placard, Anti-Theft, and Service Parts ID Label . Did you adjust the tire pressure?		Go to Step 6	Go to Step 4
4	Inspect the vehicle trim height. Refer to Trim Height Inspection . Did you find and correct the condition?		Go to Step 6	Go to Step 5
5	Inspect the following suspension components for wear or damage: - Shock Absorbers-Refer to Suspension Strut and Shock Absorber Testing - On Vehicle. - Springs Did you find and correct the condition?		Go to Step 6	-
6	Drive the vehicle in order to verify the repair. Did you correct the condition?		System OK	Go to Step 3

VEHICLE LEADS/PULLS

Step	Action	Yes	No
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 straight path.			
1	Did you review the General Description and perform the visual/physical inspections?	Go to Step 2	Go to Symptoms - Suspension General Diagnosis
2	Road test the vehicle in order to verify the complaint. Does the vehicle operate normally?	System OK	Go to Step 3
3	Inspect the tire/wheel assemblies for the following: - Correct tire pressure-Refer to the tire placard. - Correct tire size-Refer to the tire placard. - Abnormal tire wear or damage Did you find and correct the condition?	Go to Step 9	Go to Step 4
4	Perform the Radial Tire Lead/Pull Correction . Did you find and correct the condition?	Go to Step 9	Go to Step 5

	Action	Yes	No
5	Inspect and correct/adjust the suspension and steering systems for the following: - Vehicle trim height-Refer to Trim Height Specifications. - Excessively worn, loose, or damaged components Did you find and correct the condition?	Go to Step 9	Go to Step 6
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 needed to rotate the left wheel or the right wheel. Refer to Brakes Drag . Did you find and correct the condition?	Go to Step 9	Go to Step 7
7	Inspect the wheel alignment and adjust as necessary. Refer to Wheel Alignment Measurement . Did you correct the condition?	Go to Step 9	Go to Step 8
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?	System OK	Go to Step 3
9	Operate the vehicle in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

BODY LEANS OR SWAYS IN CORNERS

Step	Action	Yes	No
1	Did you review the General Description and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Suspension General Diagnosis
2	Verify the vehicle leans or sways in corners. Does the vehicle operate normally?	System OK	Go to Step 3
3	Inspect the following components for wear or damage: - Rear Coil Springs - Front Coil Springs Are the components worn or damaged?	Go to Step 5	Go to Step 4
4	1. Inspect the stabilizer shaft link for wear or damage. 2. Repair as necessary. Did you find and correct the condition?	Go to Step 6	Go to Step 2

	Action	Yes	No
5	Replace the springs as necessary. Did you complete the repair?	Go to Step 6	-
6	Operate the vehicle in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

SUSPENSION BOTTOMS

Step	Action	Yes	No
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?	Go to Step 2	Go to Symptoms - Suspension General Diagnosis
2	Verify that the suspension bottoms. Does the vehicle operate normally?	System OK	Go to Step 3
3	Inspect for vehicle overloading and correct the overloading condition as necessary. Refer to Vehicle Certification, Tire Placard, Anti-Theft, and Service Parts ID Label for specifications. Did you find and correct the condition?	Go to Step 6	Go to Step 4
4	Inspect the following components: - Inspect the shock absorbers. Refer to Suspension Strut and Shock Absorber Testing - On Vehicle. - Inspect for damaged coil springs, torsion bar or leaf springs and replace as necessary. Did you find and correct the condition?	Go to Step 6	Go to Step 5
5	Inspect the vehicle trim height. Refer to Trim Height Inspection . Did you complete the trim height inspection procedure?	Go to Step 6	-
6	Operate the vehicle in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

MEMORY STEER

Step	Action	Yes	No
DEFINITION: A lead or pull in the direction the driver previously turned the vehicle. Additionally, after turning in the opposite direction, the vehicle will want to lead or pull in that direction.			
1	Did you review the General Description and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Suspension General Diagnosis
2	Verify that memory steer is present. Does the system operate normally?	System OK	Go to Step 3

	Action	Yes	No
3	1. Raise and support the vehicle. <u>Lifting and Jacking the Vehicle</u> 2. Lubricate the tie rod ends and the ball joints if applicable. 3. Inspect the suspension system for worn or damaged components. 4. Repair as necessary. Did you find and correct the condition?	Go to Step 7	Go to Step 4
4	Inspect for binding in the upper ball joints. If joint is binding, replace the upper control arm. <u>Upper Control Arm Replacement</u> Did you find and complete the repair?	Go to Step 7	Go to Step 5
5	Inspect for binding in the lower ball joints. If joint is binding, replace the lower control arm. <u>Lower Control Arm Replacement (2WD) Lower Control Arm Replacement (4WD)</u> Did you find and complete the repair?	Go to Step 7	Go to Step 6
6	Inspect the wheel alignment and adjust as necessary. <u>Wheel Alignment Measurement</u> Did you complete the wheel alignment?	Go to Step 7	-
7	Operate the vehicle in order to verify the repair. Did you correct the condition?	System OK	-

NOISE DIAGNOSIS - FRONT SUSPENSION

Step	Action	Yes	No
DEFINITION: Any noise emitted from the front of the vehicle that is induced by VEHICLE SPEED or DRIVING TERRAIN as related to the front suspension.			
1	Did you review the General Description and perform the necessary inspections?	Go to Step 2	Go to <u>Symptoms - Suspension General Diagnosis</u>
2	Attempt to duplicate the condition. Road test the vehicle. Did you duplicate the condition?	Go to Step 3	System OK
3	Is the noise reactive to vehicle load or speed?	Go to Step 4	Go to Step 7
4	Inspect the tires for the following conditions: - Proper Tire Inflation and Adjust as Necessary. <u>Vehicle Certification, Tire Placard, Anti-Theft, and Service Parts ID Label</u> - Unusual Tire Wear. <u>Vibration Analysis - Tire and Wheel</u> . - Inspect the wheel nuts for looseness and tighten as necessary. <u>Fastener Specifications</u> Did you find and correct the condition?	Go to Step 14	Go to Step 5

	Action	Yes	No
5	Inspect the front wheel bearings. Symptoms - Suspension General Diagnosis Did you find and correct the condition?	Go to Step 14	Go to Step 6
6	Inspect for front axle noises. Symptoms - Front Drive Axle Did you find and correct the condition?	Go to Step 14	Go to Step 7
7	Bounce the front of the vehicle in order to duplicate the noise. Did you duplicate the noise?	Go to Step 8	Go to Step 9
8	1. Raise and support the vehicle. Lifting and Jacking the Vehicle 2. Inspect the front suspension components for looseness. Fastener Specifications . 3. Inspect the front suspension components for damage and repair as necessary. Did you find and correct the condition?	Go to Step 14	Go to Step 9
9	1. Install the J 39570 Chassis Ear or equivalent. 2. Bounce the front of the vehicle, using the J 39570 Chassis Ear or equivalent in order to locate the source of the noise. If necessary, road test the vehicle. 3. Repair or replace any damaged components, as necessary. Did you find and correct the condition?	Go to Step 14	Go to Step 10
10	Inspect the ball joints and steering components for the following conditions: • Lack of lubrication where applicable • Looseness in the Ball Joints Symptoms - Suspension General Diagnosis • Looseness in the Steering Linkage Lower Control Arm Ball Joint Inspection, and Upper Control Arm Ball Joint Inspection • Looseness in the Tie Rods Steering Linkage Inner Tie Rod Inspection , and Steering Linkage Outer Tie Rod Inspection Did you find and correct the condition?	Go to Step 14	Go to Step 11
11	Inspect for damaged shock absorbers. Suspension Strut and Shock Absorber Testing - On Vehicle Did you find and correct the condition?	Go to Step 14	Go to Step 12

	Action	Yes	No
12	Inspect the front stabilizer shaft and stabilizer shaft links for damage and repair as necessary. Stabilizer Shaft Replacement , or Stabilizer Shaft Link Replacement Did you find and correct the condition?	Go to Step 14	Go to Step 13
13	Inspect for control arm damage and repair as necessary. Lower Control Arm Replacement (2WD) Lower Control Arm Replacement (4WD) , and Upper Control Arm Replacement Did you find and correct the condition?	Go to Step 14	-
14	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

NOISE DIAGNOSIS - REAR SUSPENSION

Step	Action	Yes	No
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?	Go to Step 2	Go to Symptoms - Suspension General Diagnosis
2	Attempt to duplicate the condition. Road test the vehicle. Did you duplicate the condition?	Go to Step 3	System OK
3	Is the noise reactive to vehicle load or speed?	Go to Step 4	Go to Step 6
4	Perform the following inspections: - Inspect and adjust the tire inflation. Refer to Vehicle Certification, Tire Placard, Anti-Theft, and Service Parts ID Label . - Inspect for unusual tire wear. Refer to Vibration Analysis - Tire and Wheel . - Inspect the wheel nuts for looseness. Refer to Fastener Specifications . Did you find and correct the condition?	Go to Step 10	Go to Step 5
5	Inspect the rear axle for rear axle noises. Refer to Symptoms - Rear Drive Axle . Did you find and correct the condition?	Go to Step 10	Go to Step 6
6	Bounce the rear of the vehicle in order to duplicate the noise. Did you duplicate the noise?	Go to Step 7	Go to Step 9

	Action	Yes	No
7	1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Inspect the rear suspension components for looseness and tighten as necessary. Refer to Fastener Specifications . 3. Inspect the rear suspension components for damage and repair as necessary. Did you find and correct the condition?	Go to Step 10	Go to Step 8
8	Inspect the rear shock absorber. Refer to Suspension Strut and Shock Absorber Testing - On Vehicle . Did you complete the inspection?	Go to Step 10	Go to Step 9
9	1. Install the J 39570 Chassis Ear or equivalent. 2. Bounce the rear of the vehicle, using the J 39570 Chassis Ear or equivalent, in order to locate the source of the noise. If necessary, road test the vehicle. 3. Repair or replace any defective component as necessary. Did you find and correct the condition?	Go to Step 10	System OK
10	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

LOWER CONTROL ARM BALL JOINT INSPECTION

Special Tools

J 8001 Dial Indicator

For equivalent regional tools, refer to [Special Tools](#) .

NOTE:

- The vehicle must rest on a level surface.
- The vehicle must be stable. Do not rock the vehicle on the floor stands.

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Clean and inspect the ball joint seal for cuts or tears. If the ball joint seal is damaged, replace the ball joint or the lower control arm as applicable for this vehicle.
3. Support the lower control arm with a floor stand as far outboard as possible and raise the suspension until the lower control arm moves 25 mm (1 in).

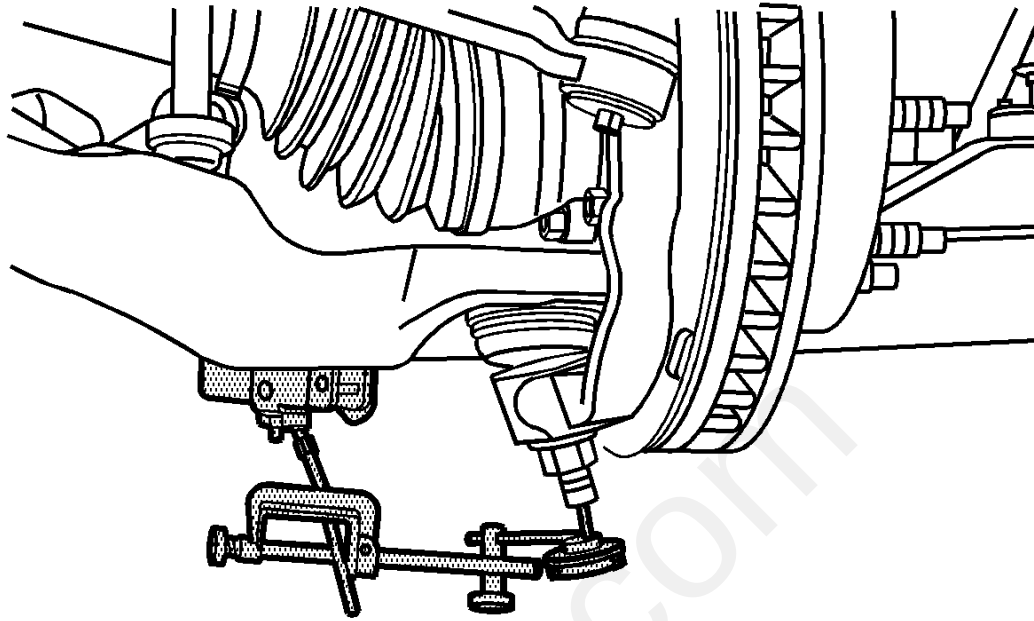


Fig. 1: View Of Dial Indicator Installed Against End Of Lower Ball Joint

Courtesy of GENERAL MOTORS COMPANY

4. Install the **J 8001** dial indicator, or suitable dial indicator, to measure the vertical lash in the ball joint.

CAUTION: Do not pry in such a way that the ball joint seal is contacted. Damage to the seal may result.

5. Lift the knuckle towards the lower control arm and record the dial indicator measurement.
6. If the dial indicator reading is more than 0.50 mm (0.020 in), replace the ball joint or the lower control arm as applicable for this vehicle.

UPPER CONTROL ARM BALL JOINT INSPECTION

Special Tools

J 8001 Dial Indicator Set

For equivalent regional tools, refer to [Special Tools](#) .

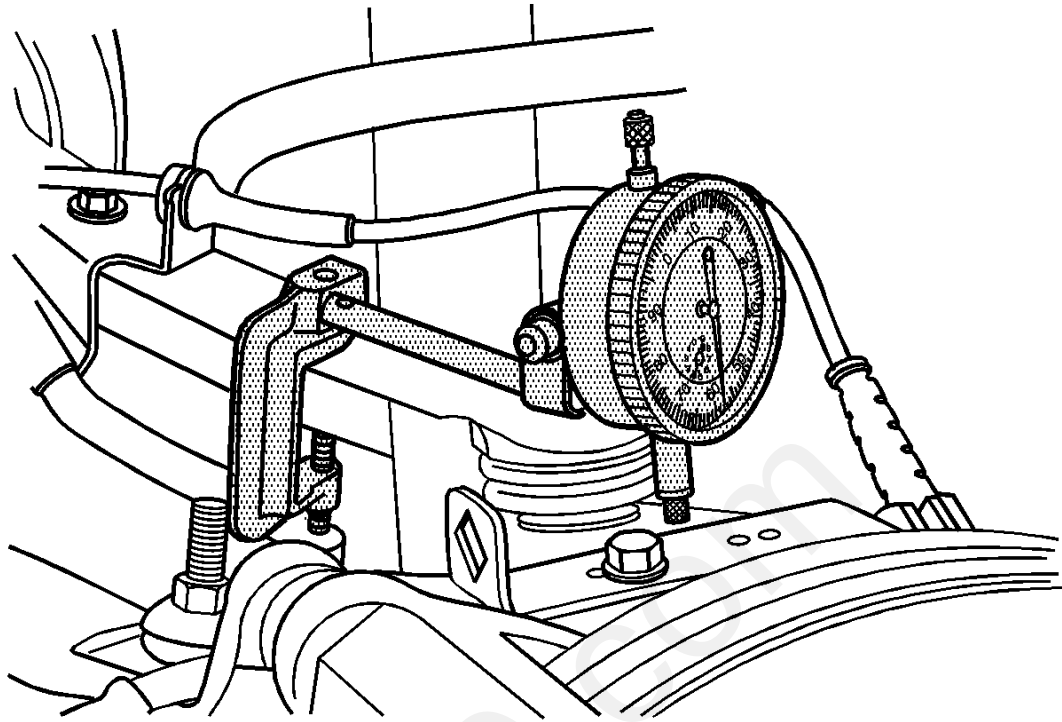


Fig. 2: Measuring Vertical Ball Joint Lash
Courtesy of GENERAL MOTORS COMPANY

NOTE:

- The vehicle must rest on a level surface.
- The vehicle must be stable. Do not rock the vehicle on the floor stands.
- This procedure was developed for checking the vertical movement of the upper ball joint. If there is movement in the horizontal or any other direction greater than the below specification, replace the upper control arm ball joint or upper control arm as applicable for this vehicle.

1. Raise and support the vehicle. Refer to [Lifting and Jacking the Vehicle](#) .
2. Clean and inspect the ball joint seal for cuts or tears. If the ball joint seal is damaged, replace the ball joint or upper control arm as applicable for this vehicle.
3. Support the lower control arm with a floor stand as far outboard as possible and raise the suspension until the lower control arm moves 25 mm (1 in).
4. Install the **J 8001** dial indicator, or suitable dial indicator, to measure the vertical lash in the ball joint.

CAUTION: Do not pry in such a way that the ball joint seal is contacted. Damage to the seal may result.

5. Apply downward force to the upper control arm and zero the indicator.

upward force to the upper control arm and check the dial indicator. Record the measurement.

7. If the dial indicator reading is more than 0.50 mm (0.020 in), replace the ball joint or the upper control arm as applicable for this vehicle.

SUSPENSION STRUT AND SHOCK ABSORBER TESTING - ON VEHICLE

Step	Action	Yes	No
1	Did you review the General Description and perform the necessary inspections?	Go to Step 2	Go to Symptoms - Suspension General Diagnosis
2	Verify that the customer's concern is present. Does the vehicle operate normally?	System OK	Go to Step 3
3	IMPORTANT: A light film of oil on the top portion of the shock reservoir is normal. Inspect each strut or shock absorber for external fluid leakage. Is a strut or shock absorber leaking?	Go to Step 5	Go to Step 4
4	1. Use your hands in order to lift up and push down each corner of the vehicle 3 times. 2. Remove your hands from the vehicle. 3. Locate a shock or strut that exceeds 2 cycles. Did you locate a shock or strut that exceeds 2 cycles?	Go to Step 5	Go to Step 6
5	IMPORTANT: Inspect the vehicle trim height in order to correct any possible causes of shock/strut failures. Trim Height Inspection Replace the strut or shock absorber. Shock Absorber, Shock Absorber Component, or Spring Replacement , for the front suspension or Shock Absorber Replacement for the rear suspension. Did you complete the repair?	Go to Step 6	-
6	Operate the vehicle in order to verify the repair. Did you correct the condition?	System OK	Go to Step 3

WHEEL BEARINGS DIAGNOSIS

Step	Action	Values	Yes	No
1	Did you review the General Description and perform the necessary inspections?	-	Go to Step 2	Go to Symptoms - Suspension General Diagnosis
2	Road test the vehicle in order to verify the customer complaint. Does the vehicle operate normally?	-	System OK	Go to Step 3

	Action	Values	Yes	No
3	1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle . 2. Inspect for tire or wheel damage. Refer to Tire and Wheel Assembly Runout Measurement - On-Vehicle . Did you find and correct the condition?	-	Go to Step 7	Go to Step 4
4	1. Install the J 39570 chassis ear. 2. Road test the vehicle to verify the location of the wheel bearing noise. Did you locate the source of the wheel bearing noise?	-	Go to Step 6	Go to Step 5
5	IMPORTANT: Support the vehicle by the lower control arms or the rear axle to prevent movement during wheel bearing/hub inspection. 1. Mount and secure the J 8001 dial indicator. 2. Ensure that the dial indicator 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 in order to inspect the total travel indicated by the dial indicator. Is the measurement greater then the specified value?	0.127 mm (0.005 in)	Go to Step 6	System OK
6	Replace the wheel bearing. Refer to Front Wheel Bearing and Hub Replacement (4WD) Front Wheel Bearing and Hub Replacement (2WD) . Did you complete the repair?	-	Go to Step 7	-
7	Road test the vehicle to verify the repair. Does the vehicle operate normally?	-	System OK	Go to Step 3

TRIM HEIGHT INSPECTION

NOTE: Before performing any of the following adjustment procedures, inspect the entire suspension system for worn or damaged suspension components. Replace those components before any measurements or adjustments are performed. Also check for any collision damage.

Trim Height Measurements

Trim height is a predetermined measurement relating to vehicle ride height. Incorrect trim heights can cause the vehicle to bottom over bumps, damage to the suspension components, and symptoms similar to wheel alignment

Check the trim heights when diagnosing suspension concerns and before checking the wheel alignment.

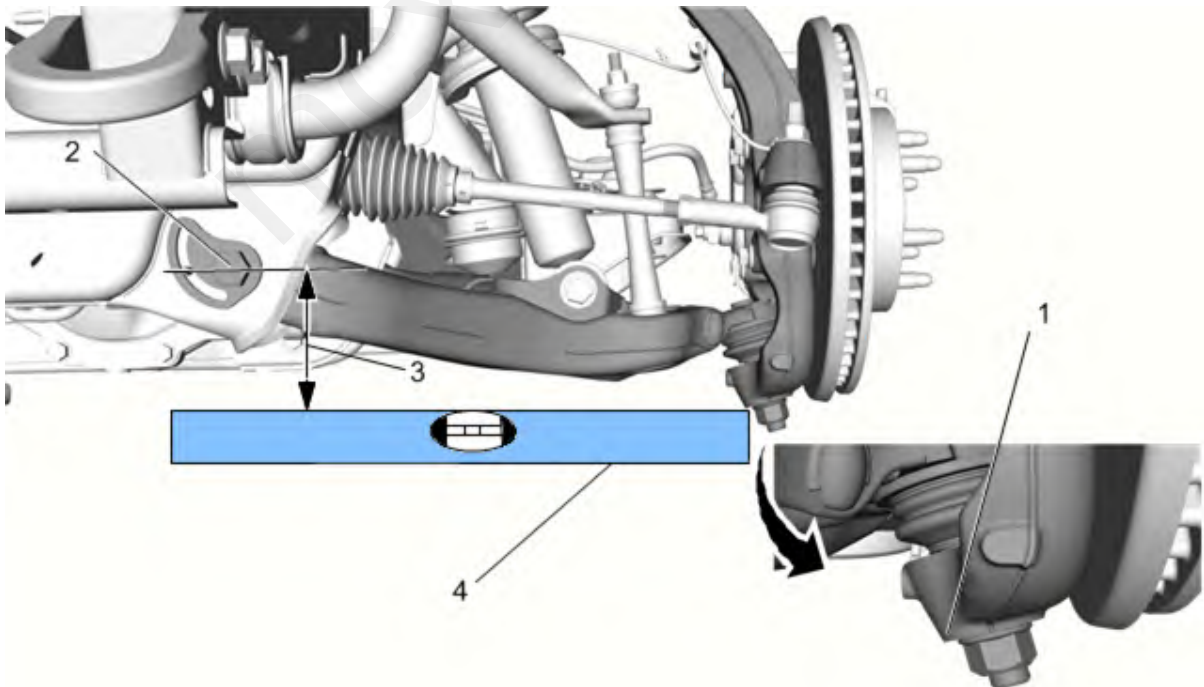
Perform the following before measuring the trim heights:

- Ensure the vehicle is on a level surface, such as an alignment rack.
- Set the tire pressures to the pressure shown on the certification label. Refer to [Vehicle Certification, Tire Placard, Anti-Theft, and Service Parts ID Label](#).
- Ensure that the suspension is fully supporting the vehicle.
- If the vehicle is equipped with automatic level control, ensure that the system is functioning properly.
- Check for installed after market accessories or modifications that could affect trim height measurements:
 - Tire and wheel sizes other than production
 - Lifting or lowering kits
 - Wheel Opening Flares
 - Ground Effects
- Ensure that the passenger and rear compartments are empty, except for the spare tire.
- Check the fuel level. Add additional weight if necessary to simulate a full tank of fuel. (One U.S. gallon of gasoline weighs approximate 6.5 lbs. One liter of gasoline weighs 0.70 kg.)
- Close all doors, lift gate/trunk and the hood.
- Remove the alignment rack floating pins.

Z Height Measurement

The Z height dimension measurement (3) determines the proper ride height for the front end of the vehicle. No adjustment are possible and could require replacement of suspension components.

1. Jounce the front suspension of the vehicle by pushing the vehicle down and lifting up.
2. Allow the vehicle to settle and take a measurement.



Setting Top Edge Of Level On Reference Surface Of Steering Knuckle

Courtesy of GENERAL MOTORS COMPANY

NOTE: Perform steps 3-9 for both sides of the vehicle.

3. Set the top edge of the level (4) on the reference surface of the steering knuckle (1) and extend the level directly under the front end of the front attachment bolt of the lower control arm.
4. While keeping the level in contact with the knuckle reference surface, adjust the level up/down until the bubble indicates it is horizontally level.
5. Measure the distance between the center of the front bolt (2) and the top of the level for your first measurement
6. Keep the top edge of the level on the reference surface of the steering knuckle (1) and move the level directly under the rear end of the rear attachment bolt of the lower control arm.
7. Measure the distance between the center of the rear bolt and the top of the level for your second measurement.
8. Average the measurements between the front and rear bolts taken in step 6 and step 8.
9. Record the measurement.

Z Height Adjustment

1. Replace worn or damaged components as necessary.

D Height Measurement

1. Jounce the rear suspension of the vehicle by pushing the vehicle down and lifting up.
2. Allow the vehicle to settle and take a measurement.

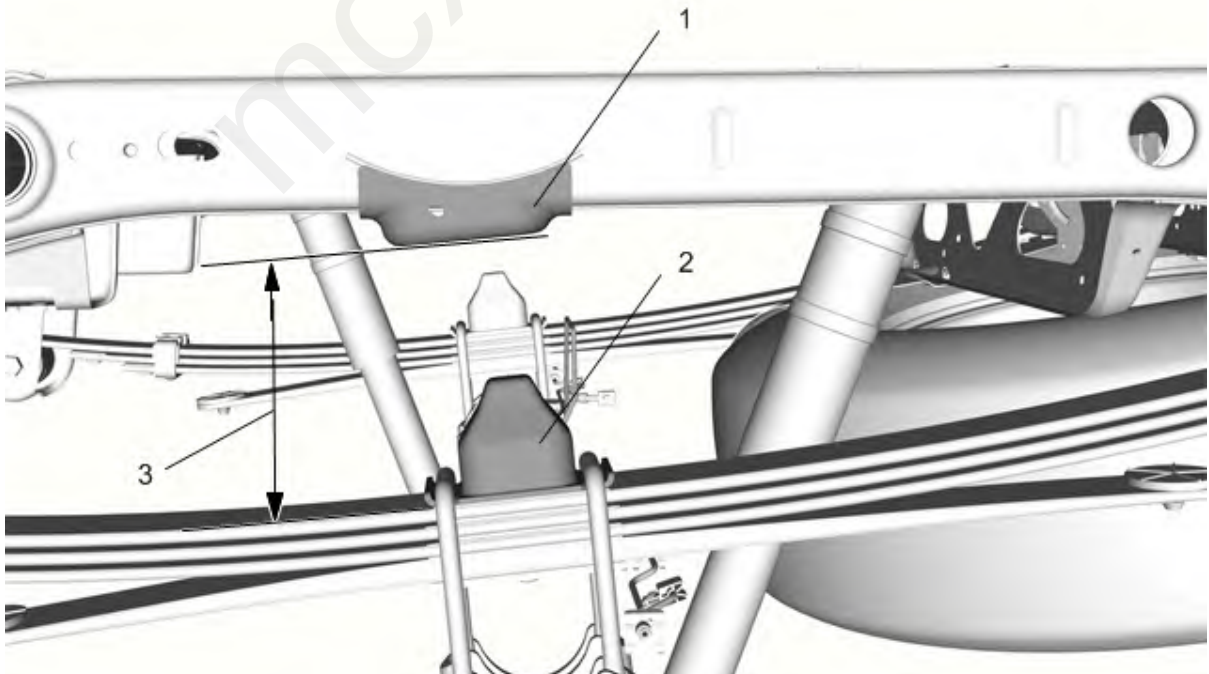


Fig. 4: Measure D Height From Axle Bumper To Jounce Bracket

Courtesy of GENERAL MOTORS COMPANY

the D height (3) from the axle bumper (2) to the jounce bracket (1). Refer to **Trim Height Specifications.**

4. If any of these measurements are out of specifications, inspect for the following conditions:

- Worn or damaged suspension components
- Collision damage

P-R Height Measurement

1. Jounce the front and rear suspension of the vehicle by pushing the vehicle down and lifting up.
2. Allow the vehicle to settle and take a measurement.

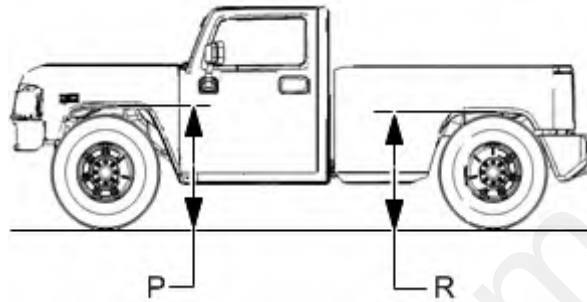


Fig. 5: Measure (P) And (R) Height From Top Of Wheel Opening
Courtesy of GENERAL MOTORS COMPANY

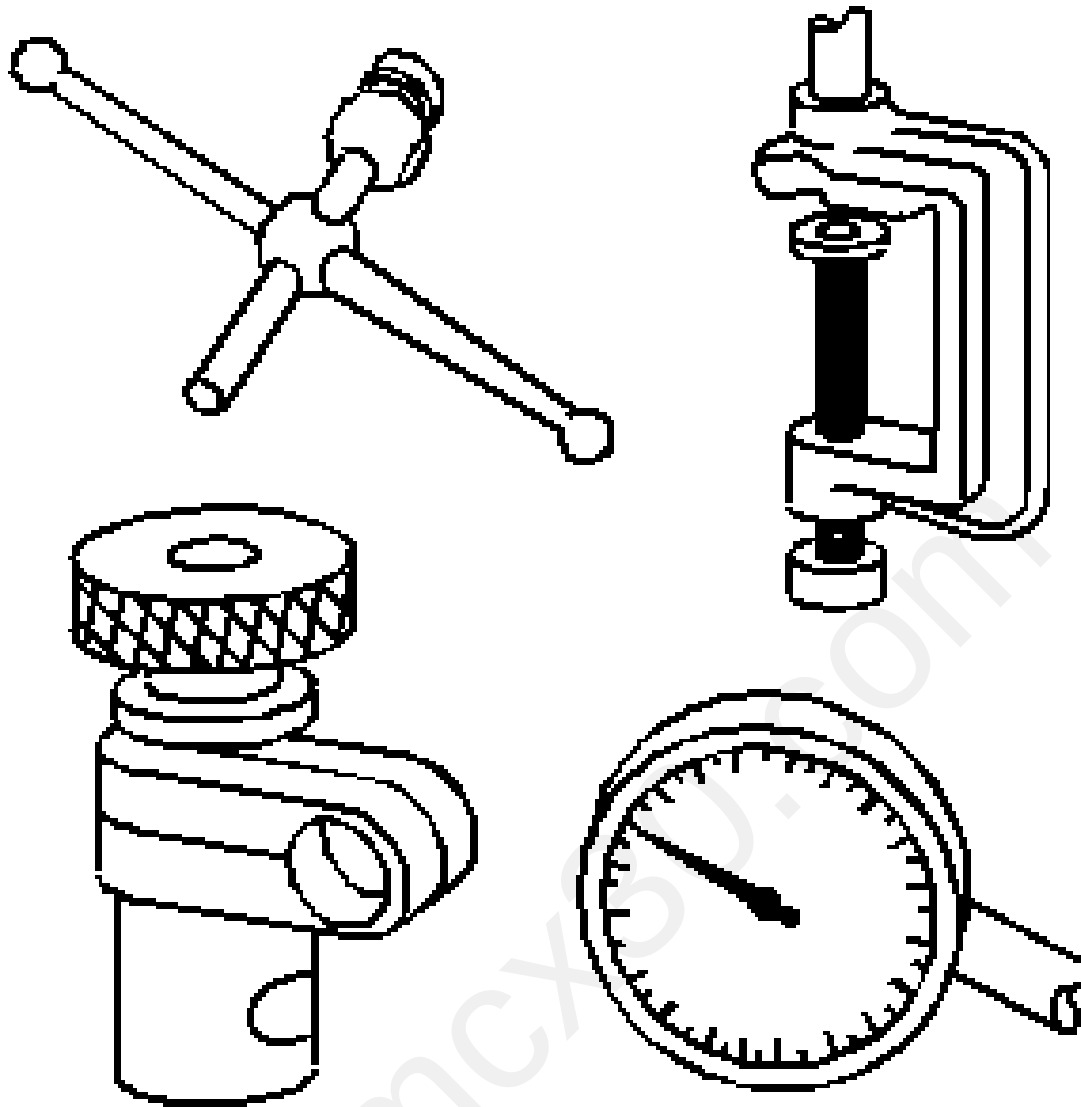
3. Measure the (P) height from the top of the wheel opening through the center of the wheel to the ground
Trim Height Specifications.
4. Measure the (R) height from the top of the wheel opening through the center of the wheel to the ground
Trim Height Specifications.
5. If any of these measurements are out of specifications, inspect for the following conditions:
 - Worn or damaged suspension components
 - Collision damage

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description

Illustration

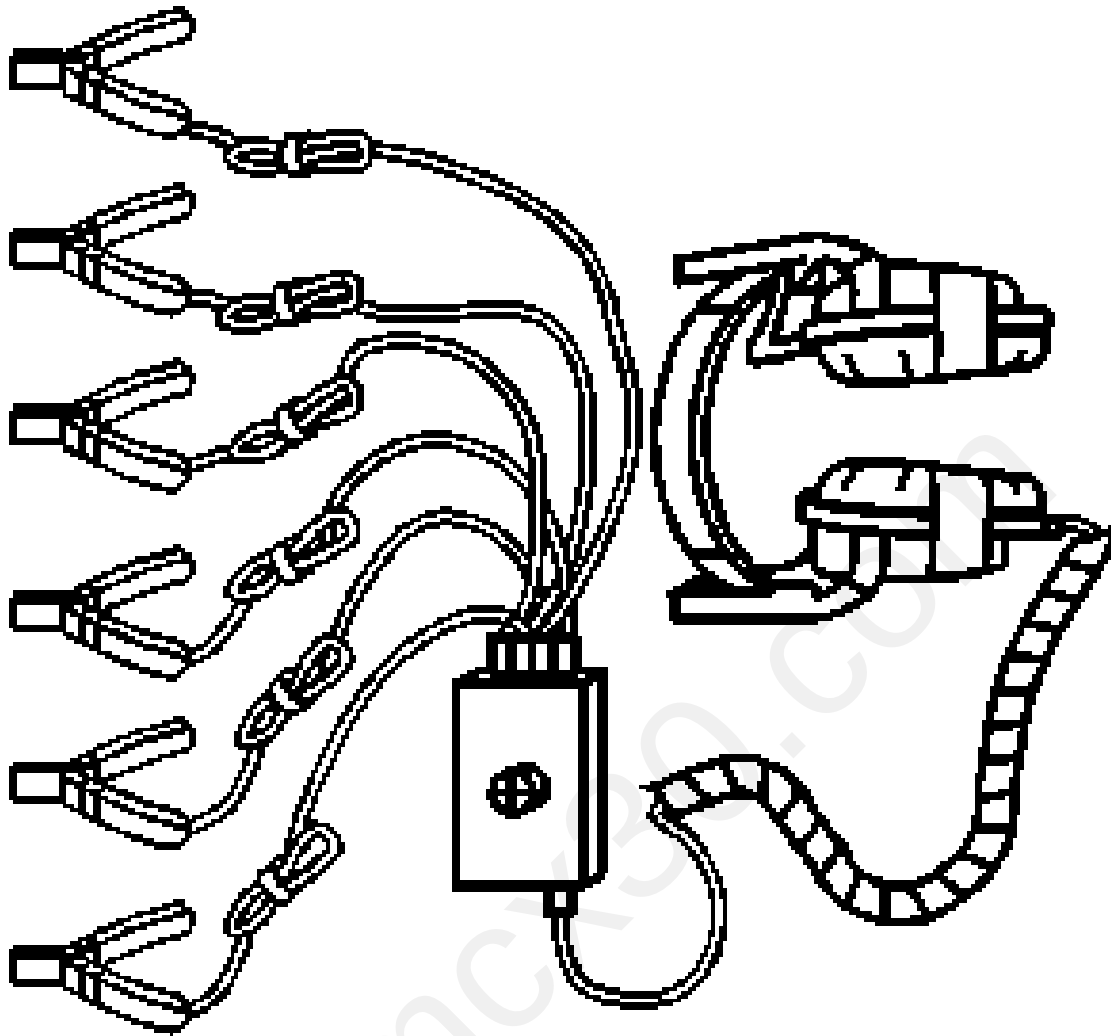


Tool
Number/
Description

J 8001
Dial Indicator
Set

Illustration

Tool
Number/
Description



J 39570
Chassis Ear