Vehicle servicing and repairing

NTQF Level II

Learning Guide #28

Unit of Competence: **Maintain and Repair Under Chassis Systems**

Module Title: Maintaining and Repairing Under Chassis Systems

LG Code: **EIS VSR2 M08 0919 LO1-LG 28**
TTLM Code: **EIS VSR2 TTLM 0919V1**

LO2: Conduct inspection/test and analysis

Instruction Sheet	Learning Guide #28

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Identify methods for inspection/test procedures
- Compare Inspection/test results
- Document results
- Forward reports

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

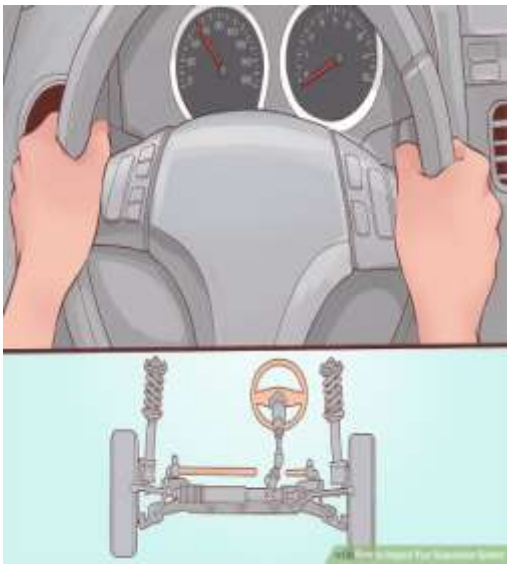
- ❖ Methods are identified for inspection/test procedures and manufacturer/ component supplier specifications
- ❖ Inspection/test results are compared with manufacturer/ component supplier specifications to indicate compliance or non-compliance
- ❖ Results are documented with evidence and supporting information and recommendation(s) made
- ❖ Report is forwarded to persons for action in accordance with workplace procedures

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 6.
3. Read the information written in the “Information Sheets 1, Information Sheets 2, Information Sheets 3 and Information Sheets 4 ”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1, Self-check 2, Self-check 3, Self-check” **in page - 27,29,31 and 36.**
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.

Information Sheet-01	Identify methods for inspection/test procedures

Identifying Signs of Suspension Issues



1. **Pay attention if your ride begins to feel rougher**

Over time, components of your suspension can wear out. While visually inspecting components can often let you know if they've become compromised, the easiest way to determine if you are having a suspension issue is by paying attention to how the ride in your vehicle feels. If it has become progressively rougher, it is likely because the suspension is no longer absorbing the bumps the way it is supposed to.

If you begin to feel more bumps and shakes as you drive, there may be an issue with your suspension.

Sometimes a rougher ride will come coupled with audible squeaks as the suspension struggles to manage bumps in the road.

2. **Take note if your vehicle pulls or squeaks during turns.**

If you begin to feel as though the vehicle is working against you as you turn, it is likely the result of a failing suspension component. Different parts of your suspension can affect the steering response, angle of the tires, and the center of balance of the vehicle. Each of these elements can make your vehicle cumbersome or difficult to turn. A bad tie rod end will make steering response sluggish. If you're an audible creek while turning the wheel, it may be the result of a bad lower ball joint. Conversely, if you hear knocking as the weight transfers in the vehicle during a turn, it may be caused by a bad sway bar end link.

- Pay attention to how the vehicle reacts as you turn and compare it to your previous experiences in the vehicle to assess if there is an issue.
- Listen carefully to see if components of your suspension are squeaking under pressure.
- Every vehicle behaves a little differently while turning, so previous experiences with the vehicle can make assessing issues much easier.

3. **Inspect the tread wear on your tires.**

Your tires should wear fairly evenly across the width of the tread. If you rotate your tires regularly, they should be worn close to evenly throughout. If you happen to notice the inside or outside of the tire is wearing at a faster rate than the rest, it could be an issue with the camber of your wheels and tires. Camber is the term used to describe the angle the wheel sits in relation to the vehicle and road.

- A vehicle with positive camber will wear the outsides of the tires more quickly.
- A vehicle with negative camber will wear the inside of the tires more quickly.
- Camber is determined by your suspension components and wheel alignment.

4. Try braking abruptly to see if the nose dives as you stop.

If you are having issues with your front struts or shocks, your suspension may struggle to keep the vehicle level under hard braking. Stop quickly in a safe area and pay attention to the front of your car. If the nose of the vehicle dives or drops as you slow down, it may be as result of bad shocks or struts. If you can hear an audible clunk from the front of the vehicle as you brake, there is either an issue with your control arm or sub frame bushing.

- Your suspension should be able to support the weight of your vehicle and keep it fairly level during most situations.
- The front corner of your vehicle may also drop as you turn in the same direction. This is caused by the same failure.

5. Look to see if the vehicle sits level.

With the vehicle parked, walk around it and visually assess how level it seems to be sitting. If one side of the car rests higher than the other, there are likely worn out or broken suspension components to blame.

- It is not uncommon for the front of the vehicle to ride slightly lower than the rear in many vehicles such as pickup trucks, but the vehicle should otherwise be level.

6. Pay attention to swaying and bouncing at low speeds.

Your vehicle should have no difficulty withstanding bumps in the road at low speeds. If you go over a bump and feel your vehicle sway back and forth or bounce after passing the bump, your suspension is

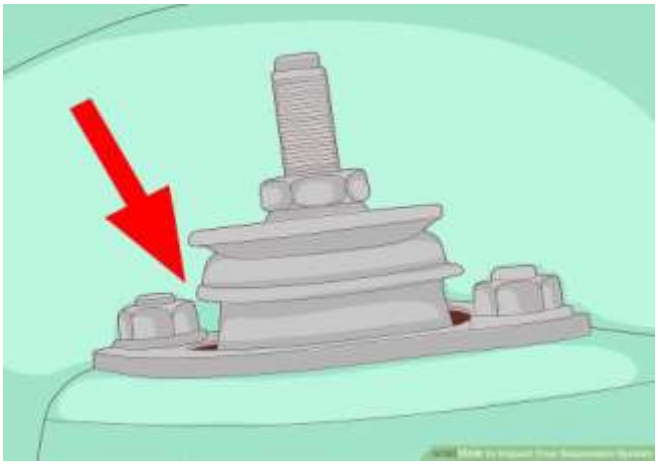
struggling to support the weight of the vehicle.

- Your vehicle should be able to go over a bump and quickly regain composure at low speeds.
- If your vehicle sways back and forth after going over a bump, there is likely an issue with your suspension.

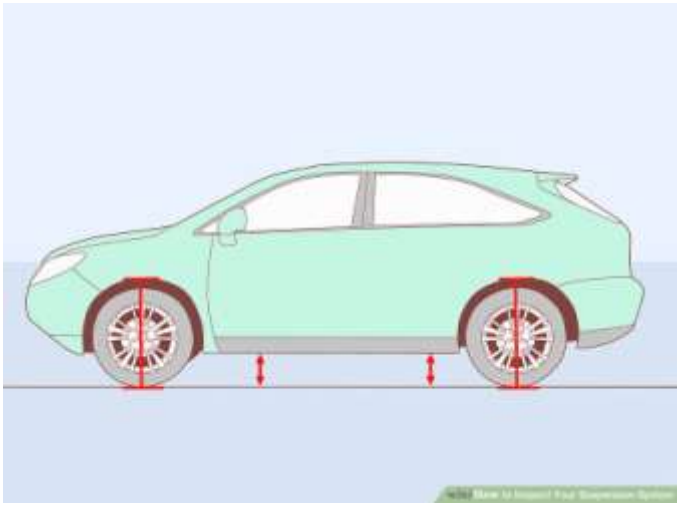
Method2

Going Over Your Front Suspension

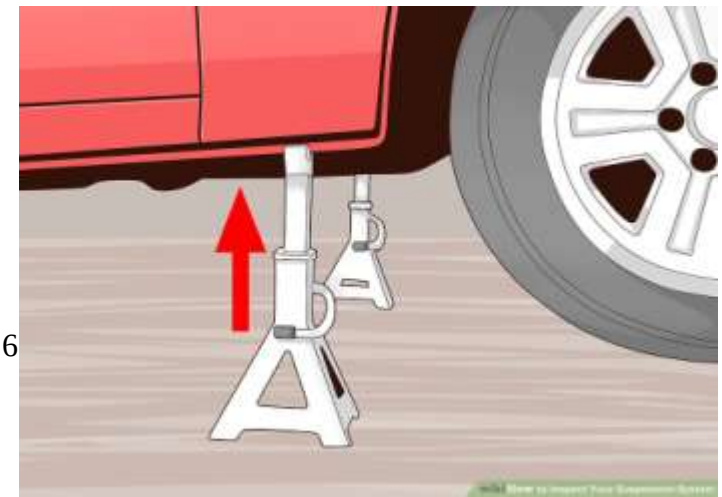
1. **Visually inspect your strut mounts or shock towers.**
   Open the hood of your vehicle and look to either side. The struts or shock towers will extend through the fender above each wheel and be secured with one or a series of bolts or nuts. Look the fasteners over and ensure they are not covered in rust, and are not loose or otherwise compromised.
   - If your strut mounts or shock towers are not properly secured, they cannot function properly.
   - Rust can compromise the nuts and bolts holding parts in place as well as the parts themselves.



2. **Measure the ride height on your front wheels.**
   Use a ruler or tape measure to determine the length of empty space between the top of the tire and the bottom of the fender well on the driver's side of your vehicle. Repeat the process on the passenger side and assess if there is a difference. While a slight variation is okay (a half inch or less) the two should be fairly equal.
   - If they are not even, the side that is lower is probably where the issue lies.
   - If they are even, there still may be an issue with the suspension that affects both sides equally.



1. **Jack up the vehicle.**
   You will need to get under the vehicle to visually inspect the condition of your suspension system. Place a trolley or scissor jack beneath the vehicle at one of its designated jack points for the front end. If you are unsure of where to locate your vehicle's jack points, refer to your vehicle's owner's

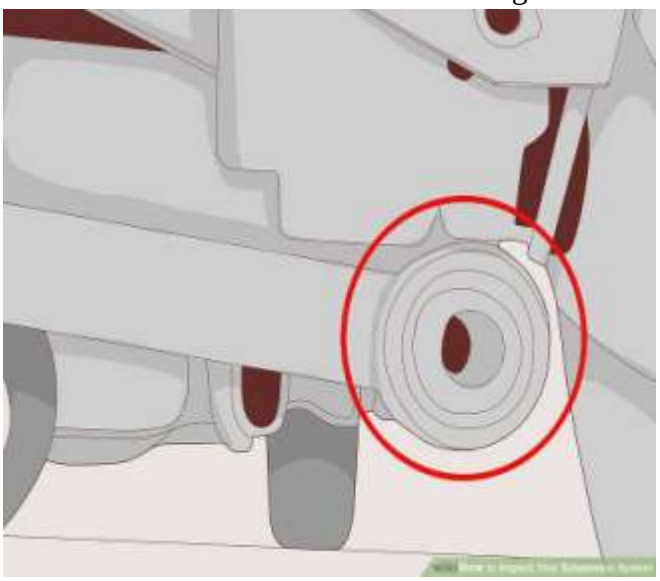


manual for clarification. Jack up the car until it's high enough to work beneath then place jack stands beneath the car to support its weight before beginning your visual inspection.

- Never work beneath a vehicle that is supported by a jack without jack stands.

2. Visually inspect grease boots and rubber bushings for signs of damage.

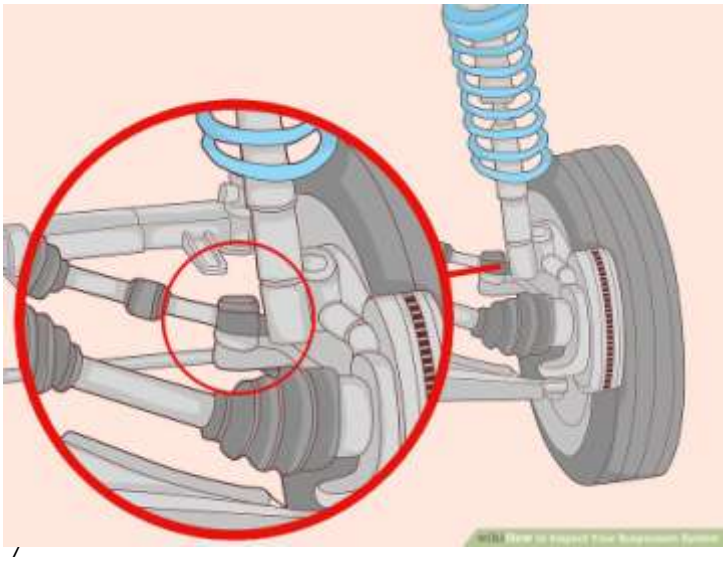
Once you are beneath your vehicle, start at one wheel and look around at the rubber bushings separating metal components of your suspension from one another. They are usually black, though they may fade into grey over time. There may be as many as forty individual bushings between components of your suspension, though they are often round with a hole in the middle (like a doughnut). Any time you find a piece of rubber in your suspension, it is considered a bushing. If you notice cracks or tears in any bushings, they will need to be replaced.



- Once a rubber bushing begins to wear out, it will allow more movement between suspension components than should be permitted, resulting in altered suspension dynamics and likely making your ride rougher.
- Torn or missing bushings can seriously compromise your vehicle's ability to withstand bumps or even steer.
- Common bushing failures in your suspension may include sway bar end links (at each end of the sway bar), trail arm bushings the axle pivot point on the vehicle, or the bushings in the upper or lower control arms.

3. Check for excess play in the tie rod ends.

Locate the power steering box and follow its arms toward the wheels. If you are unsure where the power steering box is located in your vehicle, refer to the service manual specific to the year, make and model of your car or truck. Tie rod ends serve as the connection points between the steering box and the wheels, so if the bushings become compromised it could result in dead spots in your steering and reduced handling ability.



- If you have noticed a "dead spot" in your steering wheel, it is likely the result of

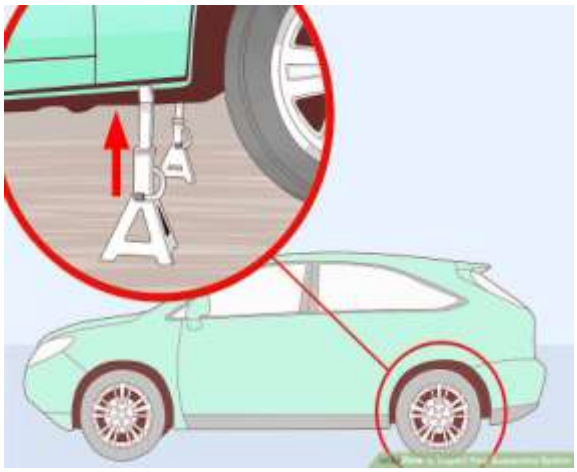
having too much play caused by a bad tie rod end.

- A completely failed tie rod end can be extremely dangerous, as it can prevent you from being able to control the vehicle. Replace tie rod ends before they become so worn out they fail completely.

Method3

Inspecting Your Rear Suspension

1. **Jack up the rear of the car.**



Locate the rear jack points for your vehicle and place a jack beneath it. If the front of your vehicle is resting on jack stands, you may leave it in the air, but if you only have two jack stands you should lower the front end of the vehicle and use those stands to support the rear of it while you work.

- While the vehicle's front wheels don't have to be on the ground to inspect the rear suspension, you must place jack stands beneath the rear in order to climb under the vehicle.
- If the front tires are on the ground, place a wheel chock in front of them to ensure the vehicle can't shift forward while you jack it up or once it is on the jack stands.

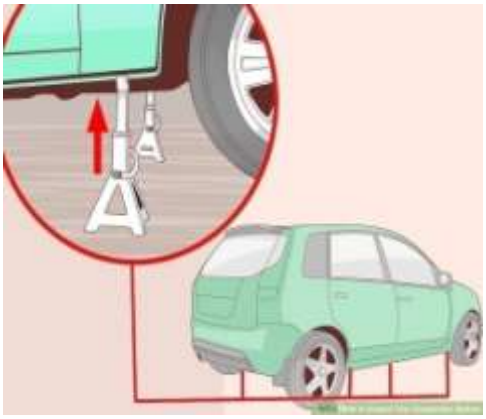
2. **Wipe each joint clean and inspect the bushings for damage.**

The rear suspension has far fewer components than the front, but they need to be inspected for the same signs of damage. It is likely that a lot of mud and debris has gotten trapped by the rear suspension, so you may need to wipe the bushings off with some water and a rag to be able to properly inspect them.

- There is no need to wipe the joints and bushings down if you can easily see them.
- Look for the same signs of cracking or tearing in the rubber bushings.

3. **Inspect bolts and nuts for rust and tightness**. Check the nuts and bolts used to secure components of the suspension to one another and the vehicle for signs of excessive rust and to make sure they are tight. Use a screw driver to poke at the fastening hardware that appears rusty. If bits of the rusted nut or bolt comes off as you poke at it, the hardware will need to be replaced.
   - If you notice any of the nuts or bolts have become loose over time, use an appropriate hand or socket wrench to tighten them again.
   - If portions of the frame or the suspension components themselves are too rusted, you will need to take the vehicle to a mechanic to have it repaired.
4. **Inspect one wheel at a time with an independent rear suspension.**

If your vehicle came equipped with an independent rear suspension, you will need to jack up each side of the vehicle to inspect the suspension on that side. Although you may not need to with some vehicle, you should anticipate needing to remove the wheel and tire in order to access and inspect the suspension components.



- Inspect an independent rear suspension by looking for signs of damage on the bushings or excess rust on the fastening hardware or suspension components.
- Suspension components are designed to support the weight of the vehicle under load, so you should not be able to move any by hand. If you can move a component by hand, it is either too loose or the bushing has gone bad.

Method4

Conducting a Bounce Test

1. Park your vehicle on firm, even ground.

In order to conduct a bounce test you need to remove any variables that could affect how the vehicle recovers from being bounced. Soft or uneven ground can affect how the vehicle sits, giving you a less reliable outcome.

- Blacktop or concrete are the preferred surfaces to conduct this test on.
- An uneven surface will shift the weight of the vehicle, causing the suspension to respond differently than it would otherwise.

1. **Push down firmly on the front of the vehicle.**

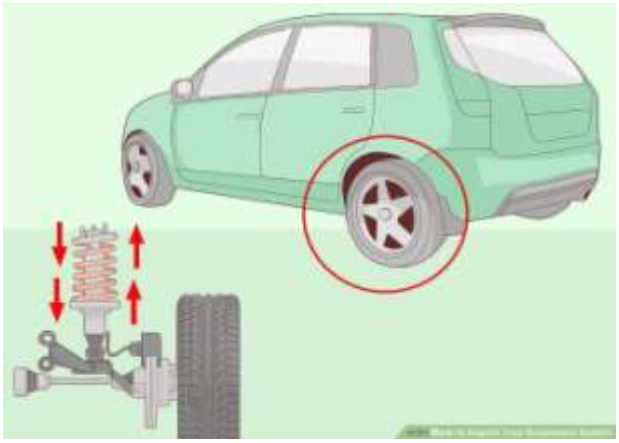
The bounce test requires that you compress the suspension of the vehicle and assess how it recovers. In order to do so, place both of your palms on a stable part of the front of the vehicle (the hood will suffice) and press down with all of your weight. Take your hands away and watch the vehicle as it rises again.

- Press on the hood near the very front of the car to prevent putting a dent in it.
- If you are unable to put enough pressure on the vehicle to compress the suspension, ask a friend to help.

2. **Count how many bounces the suspension needs to recover.**

After releasing the vehicle, it should bounce back up and right itself in a single bounce. If it bounces a few more times as it settles, the shock absorbers in the front of your vehicle are likely bad.

- Even if you push down on the hood several times before releasing it, it should still right itself with only one bounce.

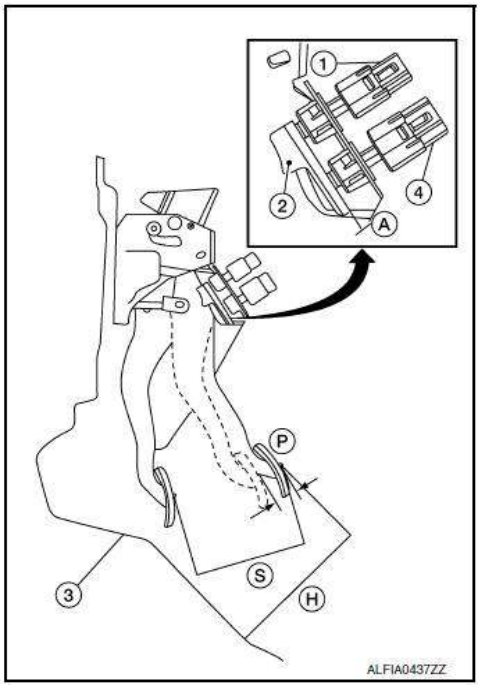


3. **Repeat the test on the rear of the vehicle.**

Once you have assessed the front suspension, move to the rear of the vehicle and repeat the process by pressing down on the trunk lid. Like the front, the rear suspension should be able to right itself after a single bounce.

- If the vehicle bounces a few times before settling again, take it to a professional to have the shock absorbers looked at.
- Do not press down on spoilers or fins, as they are often made of fiberglass and will break under pressure.

Brake wear measurement



Inspection

BRAKE PEDAL HEIGHT

Check the brake pedal height (H) between the dash lower panel (3) and the brake pedal upper surface.

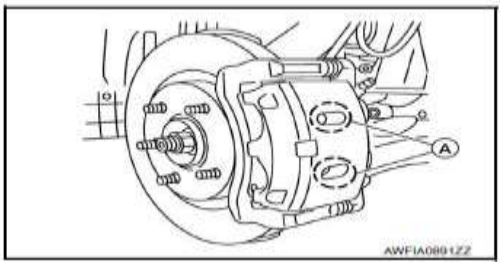
CAUTION: Check the brake pedal height with the floor trim removed.

Where:-

- ✓ Brake pedal height (H) from dash lower panel (3)
- ✓ Clearance (A) between brake pedal stopper bracket (2), stop lamp switch (4) and brake pedal position switch (1) contact ends
- ✓ Brake pedal full stroke (S)
- ✓ Brake pedal play (P)

Brake pad wear thickness

Check brake pad wear thickness from an inspection hole (A) on cylinder body.
Check using a scale if necessary.

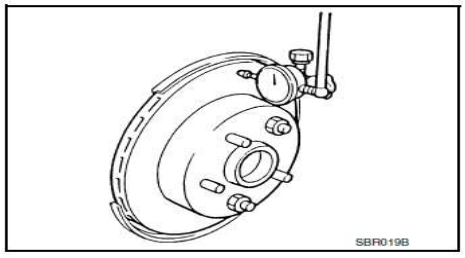


Disc brake rotor

Appearance
Check surface of disc brake rotor for uneven wear, cracks or damage.
Replace if any abnormal conditions exist.

Run out

1. Check the wheel bearing axial end play before the inspection.
2. Secure the disc brake rotor to the wheel hub and bearing with wheel nuts at two wheel nut locations.
3. Inspect the run out with a dial gauge, measured at 10 mm (0.39 in) inside the disc brake rotor edge.
4. Find the installation position with a minimum run out by shifting the disc brake rotor-to-wheel hub and bearing installation position by one hole at a time if the run out exceeds the limit value.
5. Refinish the disc brake rotor if the run out is outside the limit even after performing the above operation. When refinishing, use Tool.

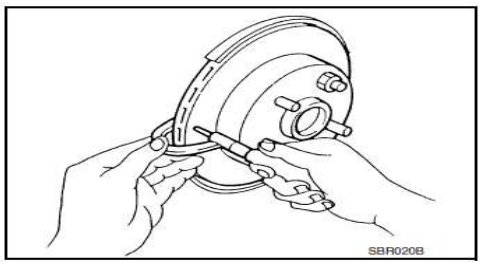


Caution:

- Check in advance that the thickness of the disc brake rotor is wear thickness + 0.3 mm (0.012 in) or more.
- If the thickness is less than wear thickness + 0.3 mm (0.012 in), replace the disc brake rotor.

Thickness

Check the thickness of the disc brake rotor using a micrometer.
Replace the disc brake rotor if the thickness is below the wear limit.



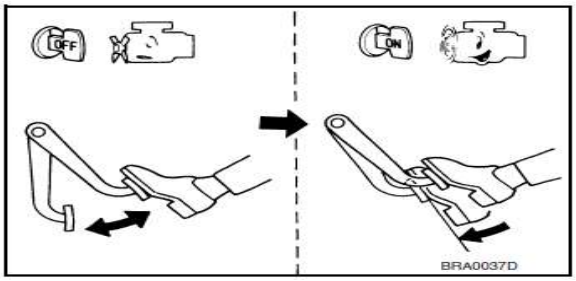
Brake booster functionality test

Inspection

Operation

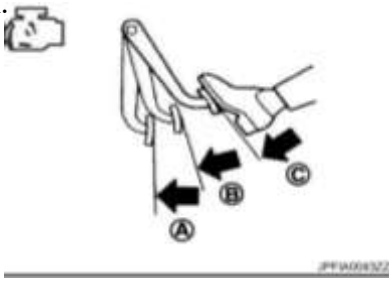
1. Depress the brake pedal several times at five second intervals with the engine stopped.
2. Start the engine with the brake pedal fully depressed.
3. Check that the clearance between brake pedal and dash lower panel decreases.

NOTE: A slight impact with a small click may be felt on the pedal when the brake pedal is fully depressed. This is normal brake system operation.



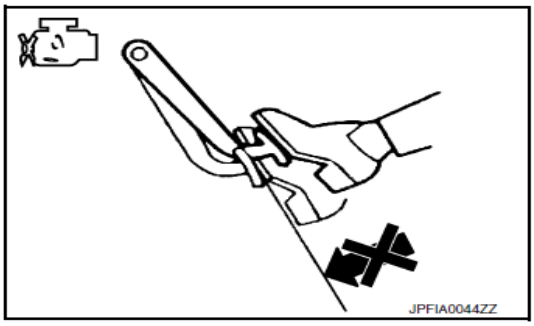
Vacuum Inspection

1. Idle the engine for one minute to apply vacuum to the brake booster.
2. Stop the engine.
3. Depress the brake pedal several times at five second intervals until the accumulated vacuum is released to atmospheric pressure.
4. Check that the clearance between brake pedal and dash lower panel gradually increases (A → B → C) each time the brake pedal is depressed during this operation.



5. Depress the brake pedal with the engine running. Then stop the engine while holding down the brake pedal.
6. Check that the brake pedal stroke does not change after holding down the brake pedal for 30 seconds or more.

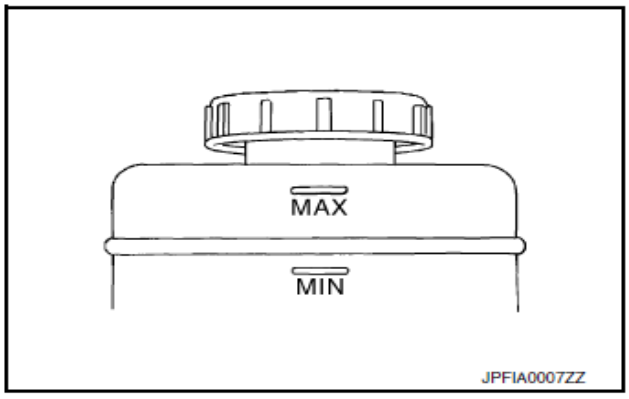
NOTE: A slight impact with a small click may be felt on the pedal when the brake pedal is fully depressed. This is normal brake system operation.



Inspection

BRAKE FLUID LEVEL

1. Make sure that the brake fluid level in the reservoir tank is between the MAX and MIN lines.
2. Visually check around the reservoir tank for brake fluid leakage.
3. If the brake fluid level is excessively low, check the brake system for leakage.
4. If brake warning lamp remains illuminated after parking brake pedal is released,
5. Check the brake system for brake fluid leakage.



Brake line

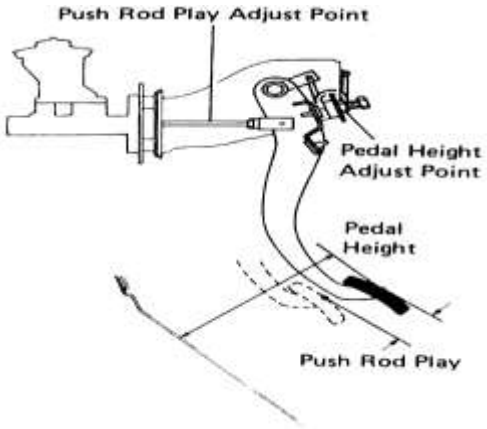
1. Check brake line (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts.
2. Check for brake fluid leakage by fully depressing brake pedal while engine is running.

CAUTION: If brake fluid leakage occurs around joints, retighten or replace damaged parts as necessary.

Pedal height adjustment

The pedal height measurement is gauged from the angled section of the floorboard to the center of the brake pedal pad.

1. Adjust the pedal height by loosening the locknut and turning the pedal stop bolt which is located above the pedal toward the driver's seat.
2. Tighten the locknut after the adjustment.

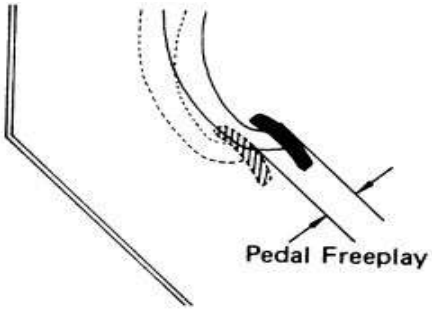


Pedal height and pushrod play adjustments

3. Correct pedal height from the floor pan sheet (not the carpet)

Free-play

1. Check the pedal free-play to see if it is correct push in on until the beginning of the brake resistance is felt.
2. To adjust, loosen the locknut and turn the pushrod until the free-play is correct.
3. Tighten the locknut.
4. After adjusting the free-play, check the pedal height.



Free-play is the amount of pedal movement before the brake engages

Pedal pushrod play

The pedal pushrod play is the distance between the clutch master cylinder piston and the pedal pushrod located above the pedal towards the firewall. Since it is nearly impossible to measure this distance at the source, it must be measured at the pedal pad.

1. Adjust the pedal play by loosening the pedal pushrod locknut and turning the pushrod.
2. Tighten the locknut after the adjustment (see manual).

Adjust a Parking Brake Cable

Locate the parking brake cable adjuster

Step 1: Check the parking brake clicks. Slowly pull up on the parking brake and feel the engagement point.

- ✓ Count the number of clicks it takes before the brake becomes tight.
- ✓ Compare the number of clicks to the number recommended by the owner's manual.

Step 2: Locate the parking brake lever boot. The parking brake lever mounted on the center console contains a boot around the brake lever.

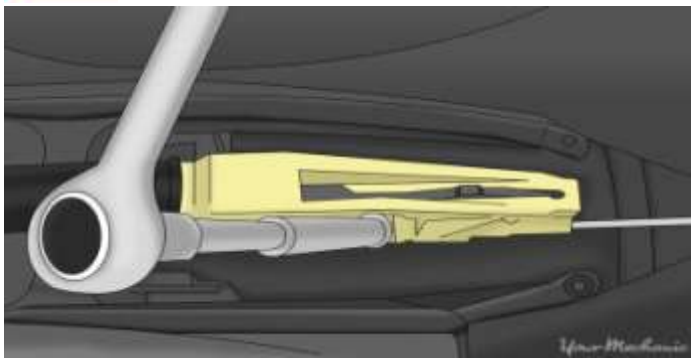
- ✓ Under this boot you will find the workings of the parking brake.

Note: Some cars may have a different procedure to access the adjuster and additional components in the console may need to be removed on your specific vehicle.

- ✓ Use a plastic pry tool to gently pry around the edges of the boot. Raise the boot up until you can view the adjustment bolt.

Adjust the parking brake

Step 1: Adjusting the parking brake. The adjustment bolt will be located on the parking brake lever. This bolt tightens the cable leading to the rear brakes.



- ✓ Tighten the bolt by a few turns and then check the parking brake cable. Check the brake by pulling the lever up and feel for tightness. Keep tightening the bolt until the proper tightness is achieved.

Check the final operation

Step 1: Put the brake lever boot back. Once the parking brake cable is adjusted to a satisfactory level, put the parking brake lever boot back into its original location.

- ✓ Reinstall any other parts that were removed to access the parking brake assembly, if needed.

Step 2: Check the operation of the parking brake. To check the parking brake operation engage the parking brake and place the transmission in neutral. It should be tight at this point.

- ✓ Exit the vehicle and go to the front of the vehicle. Gently push back on the car, it should not move at all with the brake engaged.
- ✓ Now that your parking brake is adjusted, you can safely park on hills with the knowledge that your vehicle will not roll down hill when you leave it.

Steering Part Inspection and Steering Linkage Inspection

- Inspect steering system before wheel alignment
  - Inspect wheel bearings
    - Wheel bearing is loose: wheel alignment equipment cannot make accurate readings
- Steering linkage inspection
  - Best way to discover looseness is dry park check
  - Look for loose parts while observing the steering and suspension as wheels turn
  - Steering linkage cab be inspected while vehicle is in air during lube inspection

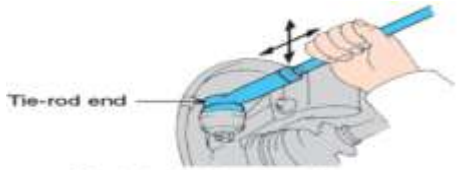
Steering Gear Looseness

- Causes of excessive steering wheel free play
  - Worn steering linkage

  - Worn flexible coupling at steering column
  - Worn or misadjusted steering gear
- Steering wheel free play
  - Check with the engine off

Parallelogram Inspection

- Important points
  - Check sockets for looseness or damage to seal
  - Idler arm movement can cause tire wear
  - Small amount of movement where pitman arm attaches to steering linkage is often normal
  - Inspect tie-rods for wear



Checking for tie-rod end wear.

Servicing a Steering System

- **Step-by-step instructions on how to service a steering system.**

  Personal safety:

  - Whenever you perform a task you must use personal protective clothing and equipment that is appropriate for the task. Among other items, this may include: clothing

    • Work, such as overalls and steel-capped footwear.

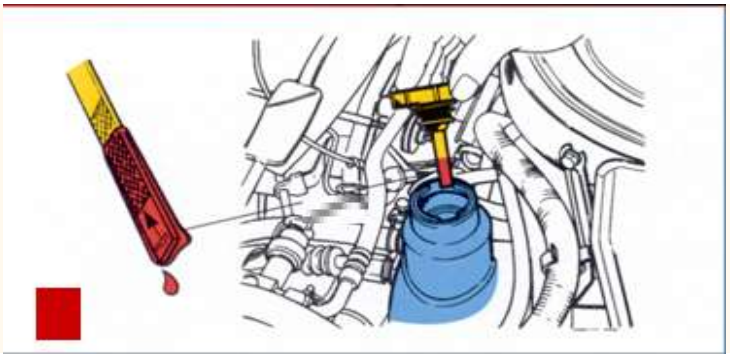
    • Eye protection, such as safety glasses and face masks.

    • Ear protection, such as earmuffs and earplugs.

    • Hand protection, such as rubber gloves and barrier cream.

    • Respiratory equipment, such as face masks

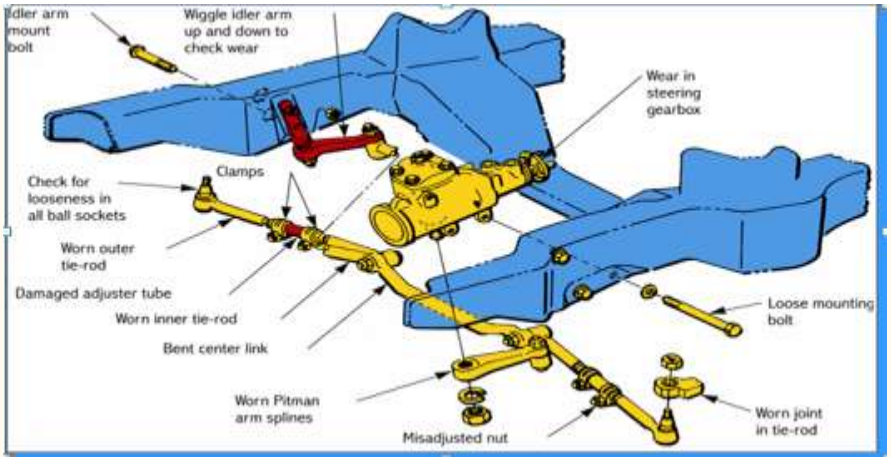
1. **Check the amount and quality of the oil**



2. **Check for oil leaks that may occur on the pipe / hose coupling**

3. Check the steering link arm (steering linkage) dry park test

   With the vehicle on the ground rotate the steering wheel back and forth while some one watch for part wears.



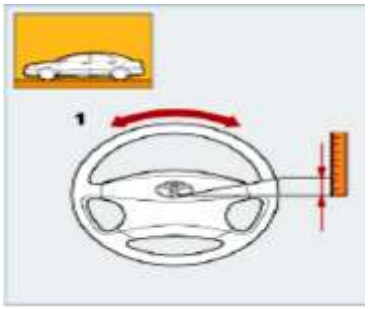
4. **Check Steering Wheel Free-play**

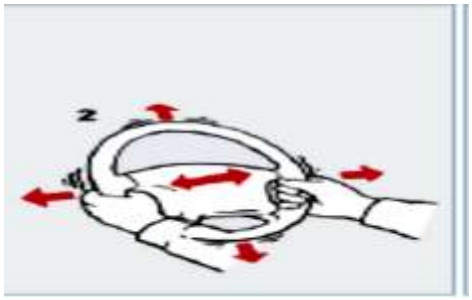
On a vehicle equipped with power steering, start the engine, and point the vehicle straight ahead. Gently move the steering wheel and use a ruler to measure the movement (free-play) of the steering wheel until the wheels barely start to move.

5. **Check for Steering Wheel Looseness and wobble**

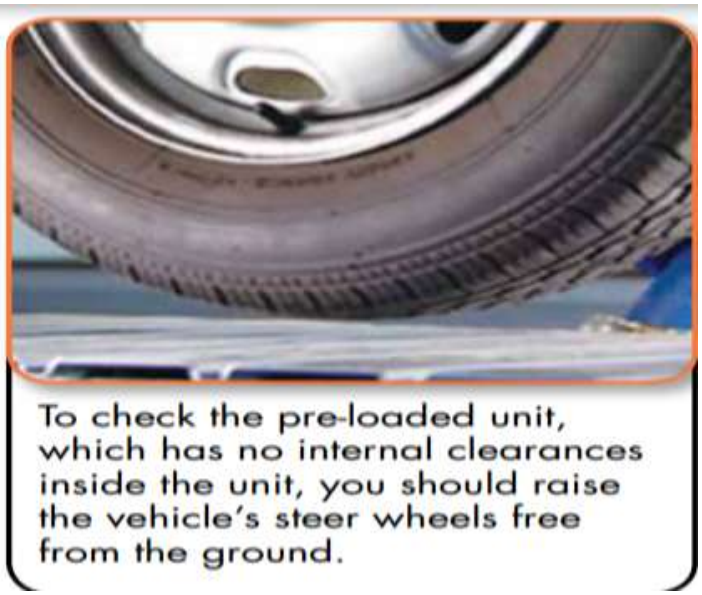
Hold the steering wheel with both hands. Move it axially, vertically, and side to-side to make sure that there is no looseness or wobbling.

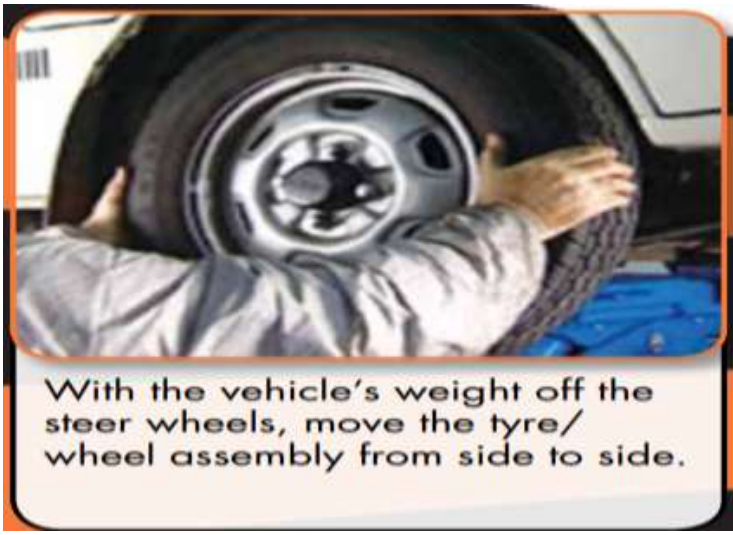
HINT: On a vehicle equipped with tilt steering or telescopic steering, inspect for looseness in the entire movement range of the steering wheel.

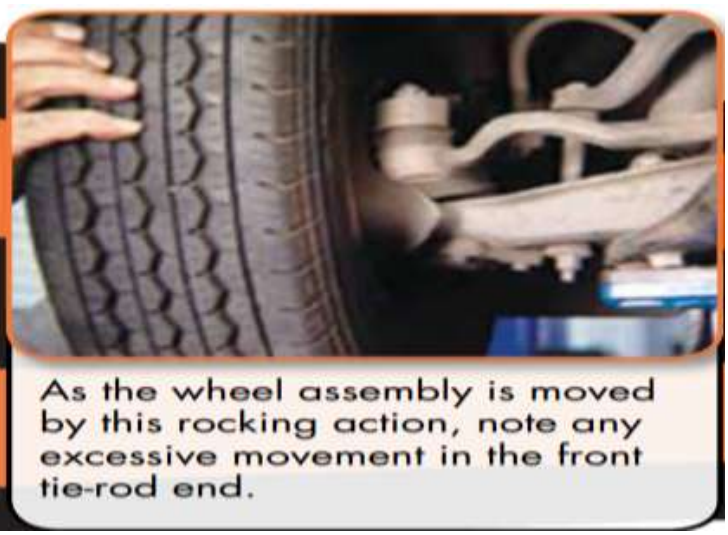




6. **Check pre-loaded tie-rod ends**







7. Check spring-loaded tie-rod ends

On a spring-loaded unit, one test is to compress the spring. Spring-loaded sockets should have a firm spring pressure when compressed all the way.

To check these types of joints use a large pair of channel lock pliers which are also known as multigrip type pliers, and place one jaw under the base of the ball joint...

...and the other on top of the end of the joint.

By squeezing the handles of the pliers, you should be able to see the movement inside the joint.

8. Check the ball joints for wear

Some manufacturers add a wear indicator to their ball joints. The most common type of wear indicator has a shoulder that sticks out of the bottom of the joint by 1. 27mm when new.

Other manufacturers provide a specification for the maximum amount of movement that is permissible. You should consult the vehicle manufacturer's manual for this tolerance, and for the correct procedure for checking it.

In the case of a torsion bar, or a long arm/short arm type suspension, where the spring is acting on the lower arm, you can test ball joints by having the vehicle raised off the ground slightly...

...and supported under the lower arms. This places the weight of the vehicle on the ball joints.

Now place a lever under the tyre and pull the tyre assembly up.

Take note of any movement in the ball joint.

9. Inspect rubber boots

Inspect the rubber boot on the tie-rod end for any signs of being torn or damaged.

If torn or dislodged from its seat, dirt or abrasives may have entered the tie-rod end, accelerating wear in the unit.

1. Check the idler arm bush

2. Check the rack and pinion assembly

Check that the rack housing is securely mounted to the cross member...

...and check the tightness of these mounting bolts.

Inspect the rubber boots for any signs of being torn or damaged. If torn or dislodged from its seat, dirt or abrasives may have entered the unit, accelerating wear.

With the vehicle raised, have an assistant turn the steering wheel from side to side.

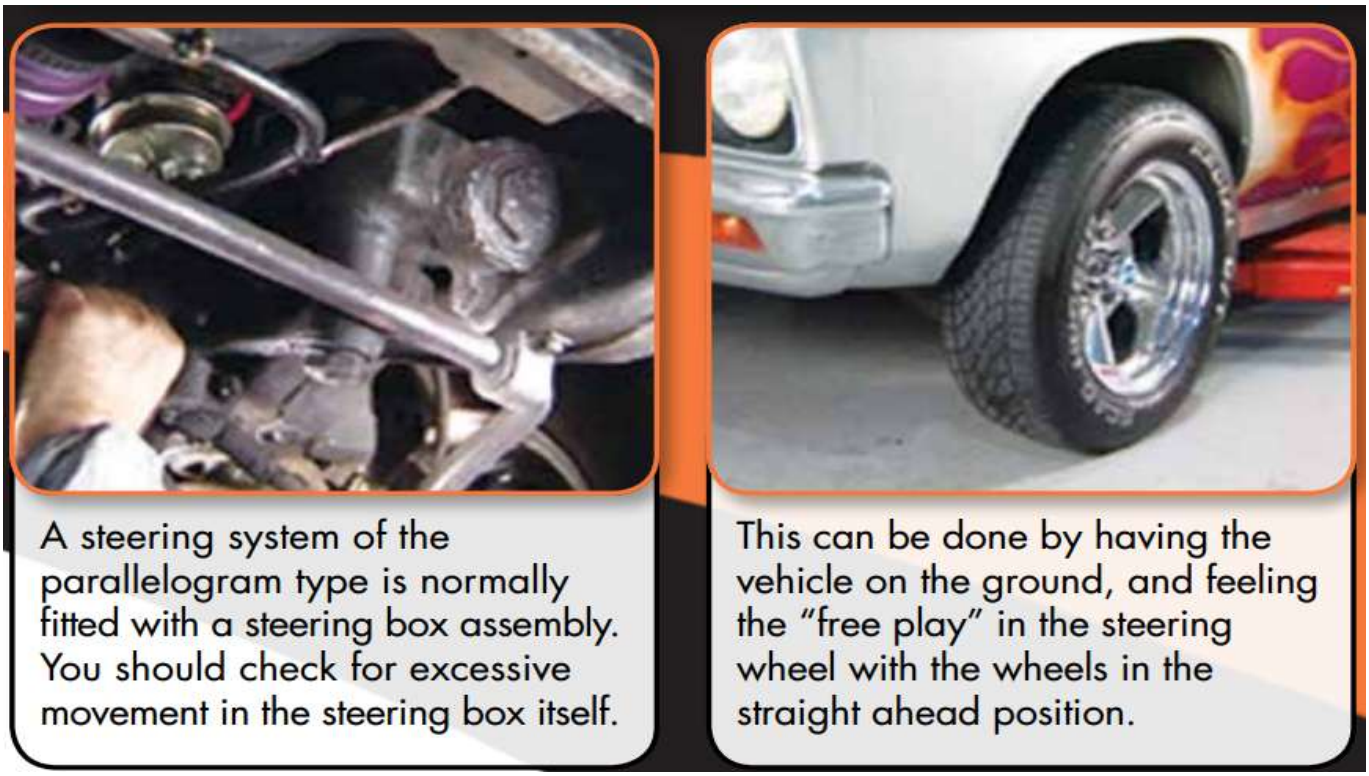
Squeeze the boots so that you make contact with the inner ball joint, and feel for any excess movement to check for wear in...

... the inner ball joint attached to the rack. You will need to repeat this procedure for the other side.

Check for wear in the steering shaft universal joints.

Rotate the steering wheel from lock to lock and ensure these universal joints rotate smoothly.

3. **Check steering boxes for excessive wear**

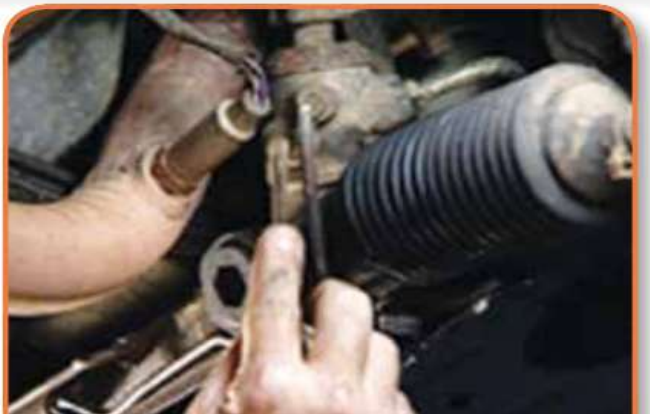


A steering system of the parallelogram type is normally fitted with a steering box assembly. You should check for excessive movement in the steering box itself.

This can be done by having the vehicle on the ground, and feeling the "free play" in the steering wheel with the wheels in the straight ahead position.

While watching the wheels, see how much you can move the steering wheel, before the wheels start to move.

4. **Check power steering lines**



Chafing can necessitate the replacement of the lines, if rubbed through.

Check the fittings for tightness.

Check the flexible hoses for cracks, wear and hardening.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. How to inspection Steering linkage(5 point)

2. Causes of excessive steering wheel free play(5point)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-02	Compare Inspection/test results

Compare Inspection/test results

Under Vehicle Search Systems (UVSS) also referred to as Under Vehicle Inspection Systems (UVIS) consist of a robust waterproof enclosure that the target vehicle drives over, within it are a number of illuminated cameras that provide a stitched together image of the underside of a Road vehicle, or Train Rolling Stock, the system operator can then identify suspicious items.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. The abbreviation UVSS is:(10 point)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-03	Document results

Vehicle Inspection Report

The Vehicle Inspection Report (VIR) is the document explaining the results of emission test. It is printed at the conclusion of every inspection and given to the motorist. It lists the Inspection result; PASS – FAIL – ABORT – REJECTED – WAIVER, and explains the reasons for each. The VIR is designed to provide the motorist information needed to understand the results of the inspection and also provides helpful information on what to do if the vehicle Fails.

The first line of the VIR lists the inspection result – PASS, FAIL, etc., - in large type. The second row lists details about the Private Inspection Facility - Station Name, Address, Inspector name.

The next row contains information about your vehicle such as the Vehicle Identification Number (VIN), Make, Model, Gross Vehicle Weight Ratio (GVWR), Fuel type and Odometer mileage.

The Test Details row is next and contains items like the test date, test beginning and end times and test number, which is how many times your vehicle has been inspected in this cycle.

The next row contains the result of the On Board Diagnostic II emission inspection (OBDII). The items listed are the state and federal requirements that must be checked at every inspection.

The last row provides useful information for the motorist based on the result of the inspection. If the inspection result is a Pass the information reminds you to please renew your vehicle registration. If the result is a Fail the information provides information on what you can do to get your vehicle repaired, your right to chose your own repair facility and how to get a re-inspection.

If the result is a Fail the motorist will also receive additional helpful information in addition to the VIR. This includes the Ten closest Recognized Repair facilities, vehicle repair check list for your repair technician, and important information on what to do now that your vehicle has failed.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is document result? (10 point)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-04	Forward reports

Tridecs
CORPORATION
Prototype & Production Machining

DATE: _____/_____/_____

FINAL
INSPECTION REPORT

TOLERANCES
Fractions
.X _____
.XX _____
.XXX _____
.XXXX _____
Finish _____
Angles _____

Lot# _____
Lot Size _____
Sample Size _____

JOB NUMBER _____
CUSTOMER NAME: _____ PURCHASE ORDER NO. _____
PART NAME _____ PART NO. _____ REV. _____

No.	Print Dimensions	Actual Dimensions	Accepted	Rejected
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				

INSPECTOR'S NAME _____ INSPECTOR'S SIGNATURE _____

Exhibit E

Vehicle Maintenance & Condition Report

Month	

General Information

Vehicle registration number:		Driver:	
Speedometer reading (beginning of Month):		Speedometer reading (end of Month):	
Monthly mileage:		Total Mileage	
Fuel used during Month (Litres):		Fuel consumption (M.P.L):	

Servicing / Repairs During Month

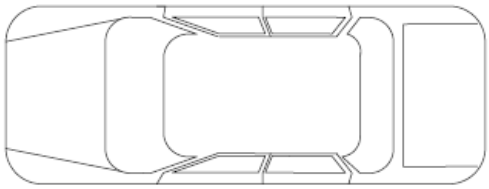
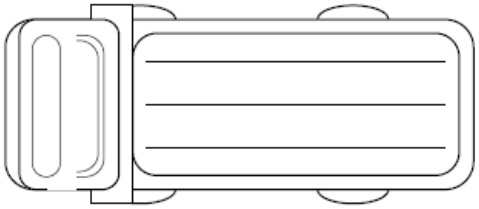
Date	Speedometer reading	Brief details / cost	Name of Garage

Monthly Checklist

Item	Checked	Comments
No instrument panel warning lights showing		
All lights, indicators and horn operational		
Windscreen and other glass (inc mirrors) undamaged		
Wiper blades and washers serviceable		
Tyre condition and tread OK		

Tyre pressure OK		
Spare wheel serviceable		
Wheel brace, jack and tool kit available		
Roof rack and/or tow bar secure		
Engine oil and other fluid levels adequate		
Emergency equipment serviceable (e.g. first aid kit, fire extinguisher, hi-vis jacket)		
Seat belts operational		
Generally clean and tidy		

(… continued): Vehicle Maintenance & Condition Report

Bodywork Condition (list details of any damage and mark position on diagram)
 
Any other comments

Driver's signature		**Date**	

Manager's signature		Date	

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is forward report? (10point)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	Identify signs of suspension issues

Techniques for Identify signs of suspension issues:

Step 1-Pay attention if your ride begins to feel rougher

Step 2-Take note if your vehicle pulls or squeaks during turns.
Step 3- Inspect the tread wear on your tires
Step 4- Try braking abruptly to see if the nose dives as you stop
Step 5- Look to see if the vehicle sits level
Step 6- Pay attention to swaying and bouncing at low speeds

Operation Sheet 2	Going over your front suspension

Techniques for Identify going over your front suspension
Step 1- Visually inspect your strut mounts or shock towers.
Step 2- Measure the ride height on your front wheels.
Step 3- Check for excess play in the tie rod ends

Operation Sheet 3	Inspection your rear suspension

Techniques for Identify rear suspension
Step 1- Jack up the rear of the car
Step 2- Wipe each joint clean and inspect the bushings for damage
Step 3- Inspect bolts and nuts for rust and tightness.
Step 4- Inspect one wheel at a time with an independent rear suspension.

Operation Sheet 4	Conducting a bounce test

Techniques for Identify Conducting a bounce test
Step 1- Push down firmly on the front of the vehicle.
Step 2- Count how many bounces the suspension needs to recover.
Step 3- Repeat the test on the rear of the vehicle

Operation Sheet 5	Brake booster functionality test

Techniques for Identify brake booster functionality test

Step 1- Depress the brake pedal several times at five second intervals with the engine stopped.

Step 2- Start the engine with the brake pedal fully depressed.

Step 3- Check that the clearance between brake pedal and dash lower panel decreases.

Operation Sheet 6	Vacuum Inspection

Techniques for Identify Vacuum Inspection

Step 1- Idle the engine for one minute to apply vacuum to the brake booster.

Step 2- Stop the engine.

Step 3- Depress the brake pedal several times at five second intervals until the accumulated vacuum is released to atmospheric pressure.

Step 4- Check that the clearance between brake pedal and dash lower panel gradually increases (A → B → C) each time the brake pedal is depressed during this operation

step 5- Depress the brake pedal with the engine running. Then stop the engine while holding down the brake pedal.

Step 6- Check that the brake pedal stroke does not change after holding down the brake pedal for 30 seconds or more.

Operation Sheet 7	Brake fluid level

Techniques for Identify Brake fluid level

Step 1- Make sure that the brake fluid level in the reservoir tank is between the MAX and MIN lines.

Step 2- Visually check around the reservoir tank for brake fluid leakage.

Step 3- If the brake fluid level is excessively low, check the brake system for leakage.

Step 4- If brake warning lamp remains illuminated after parking brake pedal is released,

Step 5- Check the brake system for brake fluid leakage.

Operation Sheet 8	Brake line

Techniques for Identify Brake line

Step 1- Check brake line (tubes and hoses) for cracks, deterioration or other damage. Replace any damaged parts.

Step 2- Check for brake fluid leakage by fully depressing brake pedal while engine is running.

Operation Sheet 9	Pedal height adjustment

Techniques for Identify Pedal height adjustment

Step 1- Adjust the pedal height by loosening the locknut and turning the pedal stop bolt which is located above the pedal toward the driver's seat.

step 2- Tighten the locknut after the adjustment.

Step 3- Correct pedal height from the floor pan sheet (not the carpet)

Operation Sheet 10	Free-play

Techniques for Identify free-play

Step 1- Check the pedal free-play to see if it is correct push in on until the beginning of the brake resistance is felt.

Step 2- To adjust, loosen the locknut and turn the pushrod until the free-play is correct.

Step 3- Tighten the locknut.

Step 4- After adjusting the free-play, check the pedal height.

Operation Sheet 11	Adjust a Parking Brake Cable

Techniques for Identify adjust a Parking Brake Cable

Step 1: Check the parking brake clicks

Step 2: Locate the parking brake lever boot.

LAP Test	Practical Demonstration

Name: _____ Date: _____
Time started: _____ Time finished: _____
Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 6 hour.
Task 1. Inspect suspension system
Task 2. Inspect brake system.
Task 4. Adjust brake pedal free play.

List of Reference Materials

1. SHAMES,I.,Engineering Mechanics:Dynamics. Prenctice Hall,1960
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3. Asbestos brake dust still a hazard, 24th, May, 2016, www.aa1car.com/library/trtu796.htm
4. Automobile brake system, 24th, May, 2016, www.baidu.com/view/2235434.htm
5. Automotive Chassis Systems by: Birch, Thomas W. 2.
6. Automotive Mechanics 10th Ed. by: Crouse and Anglin 3.
7. Automotive Excellence 4. Hilton's Truck & Van Repair Manual (93-97)