MODULE CONTENT

| Unit of Competency | **DIAGNOSE AND REPAIR SUSPENSION SYSTEM** |
| --- | --- |
| Module Title | **DIAGNOSING AND REPAIR SUSPENSION SYSTEM** |
| Module Descriptor | This unit identifies the competencies required to diagnose and repair the suspension system. |
| Nominal Duration | **hours** |
| Summary of the Learning Outcomes: | |
| Upon completion of this module the student must be able to: | |
| LO1. Prepare to diagnose and repair suspension system | |
| LO2. Diagnose suspension | |
| LO3. Repair suspension system | |
| LO4. Complete work processes | |

**LEARNING EXPERIENCES**

**LEARNING OUTCOMES NO. 2**

**DIAGNOSE SUSPENSION**

| **Learning Activities** | **Special Instructions** |
| --- | --- |
| Read Information Sheet 3.1-1 Diagnose suspension | If you have some problem with the content of the information sheet don’t hesitate to approach your Trainer.  If you feel that you are now knowledgeable on the content of the information sheet, you can now answer the self-check provided in the module. |
| Answer Self-Check 3.1-1 on Diagnose suspension | Try to answer the Self-check without looking at the Answer Key  Compare your answer to Answer Key 3.1-1 |
| Observe Trainer’s demonstration on Task Sheet 3.1-1 on Diagnose suspension | Listen carefully and attentively so that you may be able to perform a task correctly  Ask questions if are in doubt for clarification |
| Perform the Task Sheet 3.1-1 on Diagnose suspension | Remember the step-by-step procedure the Diagnose suspension |
| Evaluate the performance using the Performance Criteria Checklist 3.1-1 | Repeat the task in case fail to meet the criteria |

**INFORMATION SHEET 1.1-1**

**DIAGNOSE SUSPENSION**

**Learning Objectives:**

After reading this **Information Sheet**, you must be able to:

1. Made final inspection.
2. Turned-over vehicle.
3. Restored work area.
4. Managed wastes.
5. Checked and stored tools and equipment.
6. Accomplished workplace documents.

**Diagnose suspension system failure**

**GENERAL FRONT-SUSPENSION INSPECTION**

To minimize the chance of performing an unnecessary service, the following preliminary or general inspections should be made:

1. Check all tires proper inflation pressure.

2. Check the tires for telltale indications of improper front-end alignment, wheel and tire imbalance, and physical deflect or damage.

3. Check the vehicle for optional suspension equipment, such as that provided for heavy-duty applications or trailer towing packages. They have a firmer ride quality.

4. Check vehicle attitude for evidence of overloading or sagging. Be sure the chassis height is correct.

5. Raise the vehicle off the floor. Grasp the upper and lower surfaces of the tire and shake each front wheel to check for worn wheel bearings.

6. Check all the ball joints for looseness and wear.

7. Check the condition of the struts’ upper mounts.

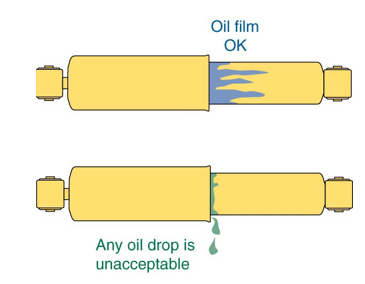
8. Check the shock absorbers and strut for signs or fluid leakage **(Figure 43-27)** and damage.

9. Check all the mountings for the shocks and struts.

10. Check all suspension bushings for looseness, splits, cracks, misplacement, and noises.

11. Check the steering mounts, linkages, and all connections for looseness, binding, or damage.

If any problems or unusual conditions are found during the visual inspection, the parts should be replaced.



**Figure 43-27** Check the shock absorbers for signs of fluid leaks.

| | **SHOP TALK**  Before visual inspection or suspension height measurements can be performed, the vehicle must be on a level surface. Tires must be at recommended pressures; gas tank must be full; and there should be no passenger or luggage compartment load. Beginning at the rear bumper, jounce the car up and down several times. Proceed to the front bumper and repeat, releasing during the same cycle rear jounce. | | --- | |
| --- | --- |

|  |  |
| --- | --- |
|  |  |

**Chassis Height Specifications**

A quick overall visual inspection detects any obvious sag from the from to rear or from side to side. Under the car, at the level of the two ends of the control arms, check for out-of-level, damaged, or worn rubber bumpers, or shiny or worn spring coils. All indicate weak coil springs.

A more accurate inspection reveals less obvious problems by measuring heights are specific points on each side of the suspension system.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | |  |
|  |  |  |  |
|  |  |  | |

| | **USING SERVICE MANUAL**  For the most accurate measurement of chassis height, use the service manual to check against the manufacturer’s recommendations for the specific model. Photo Sequence 46 shows the typical procedure for checking vehicle ride height. Be careful. The measurement points vary from one model to another even if manufactures by the same company. When coil spring wear is suspected, it might be necessary to load the vehicle to the manufacturer’s suggested capacities and measure at the designated points. | | --- | |
| --- | --- |

**FRONT-SUSPENSION COMPONENT SERVICING**

As is the case in all sections of this text, specific troubleshooting procedures are given in detail in the *Tech Manual.* However, the following is information on servicing the major components assemblies of front suspension.

**Coil Springs**

The never-ending twisting and untwisting of the torsion bar) lead to inevitable loss of elasticity and spring sag. Coil springs, then require replacement because they sag in service. A sagged coil spring upsets vehicle trim height resulting in upset wheel alignment angles, steering angles, headlight aiming, braking distribution, riding quality, tire tread life, shock life, and U-joint life.`

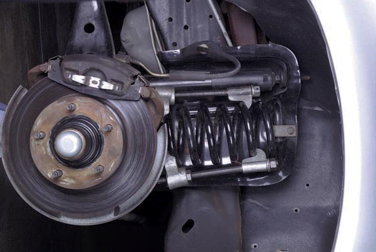
Coil springs also break. Downside cars are often forced to carry the same loads ass their counterparts, mostly because people and their hauling needs did not downsize with the cars.

|  |  |
| --- | --- |
|  |  |

**Removing a Spring** To remove a coil spring, raise and support the vehicle by its frame. Let the control arm hand free. Remove wheels, shock absorbers, and stabilizer links. Disconnect the outer tie-rod ends from their respective arms.

Unload the ball joints with a roll-around floor jack. Jack under the lower control arm from the opposite side of the vehicle. This allows the jack to roll back when the control arm is lowered. Position the jack as close to the lower ball joint as possible for maximum leverage against the spring.

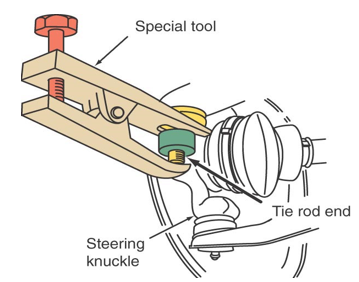
The spring is read for the installation of the spring compressor **(Figure 43-28).** There are many different types of spring compressors. One type uses a threaded compression rod that fits through two plates, an upper and lower ball nut at either end. The upper ball nut is pinned to the rod. The thrust washer and forcing nut are threaded onto the rod. Turning the forcing nut draws the two plates together and compresses the spring.



**Figure 43-28** A coil spring compressor is used to compress the spring before disconnecting some suspension parts.

In some cases, it is necessary to break the tapers of both upper and lower ball joints so the steering knuckle can be moved to one side **(Figure 43-29).** If the vehicle is equipped with a strut rod, this must be disconnected at the lower control arm. Push the control arm down until the spring can be remove the spring from its lower seat. Remove the spring and compressor.

If the same spring is to be reinstalled, leave the compressor in position. If a new spring from is to be used, slowly release the pressure on the tool by backing off the forcing nut.

****

**Figure 43-29** When this tool is expanded, it can force the tie rod or ball joint stud out is the steering knuckle taper.

**Torsion Bar**

Torsion bars are subjected to many of the same conditions affecting coil springs. Periodic adjustment of the torsion bar suspensions are the same for coil springs. However, sagging can usually be corrected by adjusting the bars. Procedures for adjusting torsion bars are given in the service manual.

Height inspection and measurements foe vehicles with torsion bar suspensions are the sane for coil springs. However, sagging can usually be corrected be adjusting the bars. Procedures for adjusting torsion bars are given in the service manual.

**Ball Joints**

Begin your inspection of a ball joint by checking to see if the ball joint has a wear indicator on it. If it does, check the placement of the grease fitting. If it does, check the placement of the grease fitting. If it is recessed, the ball joint is worn and should be replaced. On some vehicles it is recommended that you check to see if the grease fitting can wiggle in the ball joint. If it does, the ball joint should be replaced. Always check the service manual when clicking ball joints.

Look carefully at the joint’s boot. A damaged boot or joint seal will allow lubricant to leak out and allow dirt to enter and contaminate the lubricant. If the boot is damaged, the ball joint should be replaced.

If no boot damage is evident, gently squeeze the boot. If the boot is filled with grease, use a grease gun and refill the joint. Fill the joint until fresh grease is seen flowing out the boot’s vent. If too much grease is forces into the joint or it is forced in too quickly, the boot can unseat or tear.

Ball joints should be checked for excessive wear. Load-carrying joints will have some slop when the weight of the vehicle is taken off them. Follower joints should never have play. To check a load-carrying joint, it must be unloaded.

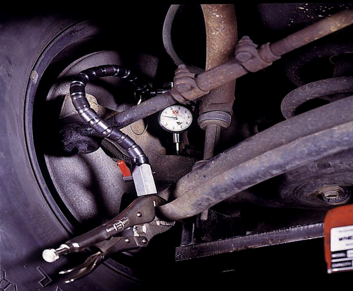
When the coil spring is on the lower-carrying arm, raise the vehicle by jacking under the control arm as close to the ball joint as possible. This gives the maximum amount of leverage against the spring. The ball joint is unloaded when the upper strike out bumper is not in contact with the control arm or frame. A quick check for looseness can be made by using a pry bar between the tire and the ground. To find out if the ball joint is loose beyond manufacturer’s specifications, use an accurate measuring device. The following checking procedures demonstrate the use of a dial indicator. The dial indicator is a precision instrument and should be handled carefully to prevent damage. The mounting procedure for the checking might vary depending on the style of ball joint used on the vehicle. Manufacturer’s tolerances can be axial (vertical), radial (horizontal), or both. To conduct these checks, follow these procedures.

**Typical Radial Check** For a radial check, attach a dial indicator to the control arm of the ball joint being checked. Position and adjust the plunger of the dial indicator against the edge of the wheel rim nearest to the ball joint being checked. Slip the dial ring to the zero marking. Move the wheel in and out and note the amount of ball joint radial looseness registered on the dial **(Figure 42-30).** The procedure for checking the radial movement of a lower ball on a MacPherson strut suspension is shown in Photo Sequence 47.



**Figure 43-30** A typical mounting of radial indicator for a radial check.

**Typical Axial Check** For an axial check, first fasten the dial indicator to the control arm, then clean off the flat on the spindle next to the ball joint stud nut. Position the dial indicator plunger on the flat of the spindle and depress the plunger approximately 0.350 inch. Turn the lever to tighten the indicator in place. Pry the bar between the floor and tire. Record the reading **(Figure 43-31).**

****

**Figure 43-31** A typical mounting of a radial indicator.

If the ball joint looseness reading in the dial indicator exceeds manufacturer’s specifications, the ball joint should be replaced.

When the load-carrying ball joints are on the upper control arm (spring mounted on the upper arm), raise the vehicle by its frame using support tools to unload the ball joints and hold them in their normal position. To determine the condition of the non-load-carrying (or follower) ball joint, vigorously push and pull on the tire, while watching the ball joint for signs of movement. Refer to the manufacturer’s specifications for tolerance.

**Inspection of Wear Indicators** Wear-indicator-type ball joints must remain to check for wear. The vehicle should be checked with the suspension at curb height. The most common type has a small diameter boss, which protrudes form the center of the lower housing. As wear occurs internally, boss recedes very gradually into the housing. When it is flush with the housing, the ball joint should be replaced. To remove and install a ball joint, follow the procedure given in the service manual.

Ball joints are mounted to the control arm in one of four basic ways: rivets, bolts, press, fit, and threaded. The most common method is press fit. Some manufacturers require you to replace the entire control arm assembly if a ball joint is to be replaced. In these cases, the ball joint and control arm are made as a single assembly and individual parts are not available.

Press-fit ball joints are removed and installed using special tools and a hydraulic press. The control arm must be removed before attempting to remove the ball joint. While pressing the ball joint out of or into the control arm, make sure you do not damage the arm.

|  |  |
| --- | --- |
|  |  |

**Control Arm Bushings**

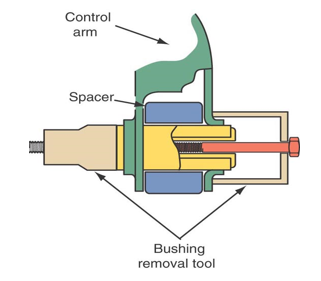
If the bushings, which attach the arms to the frame, are not in good condition, precise wheel alignment settings cannot be maintained.

Visually inspect each rubber bushing for signs of distortion, movement, off-center condition, and presence of heavy cracking. Check metal bushings for noise and loose seals.

To remove the control arm bushings, raise the vehicle and support the frame on safety jack stands. Remove the wheel assembly. Install a spring compressor on the coil spring.

Disconnect the ball joint studs from the steering knuckle as describe previously. Remove the bolts attaching the control arm assembly to the frame and remove the control arm.

Bushing are pressed in and out of their bores by using special tools. A special tool is installed over the bushing **(Figure 43-32)** after the correct size adapter for the tool has been selected. Tightening the tool pushes the brushing out of the control arm. The same process is used to press a new bushing into the control arm. As the special tool is tightened, the bushing moves into its bore. When installing new bushing, make sure they stay straight while they are being pressed in.



**Figure 43-32** Removing a control-arm bushing.

Once the new bushings are started into the control arm, measure and mark the center between mounting holes and center and mark the center between mounting holes and center the control arm. Now, alternately press in the bushings on each side, keeping the reference marks aligned. This ensures the shaft is not off center, causing binding. End cap nuts or bolts should be torque until the vehicle is at curb height and the suspension has been bounced allowed to settle out.

Rebolt the control arm and tighten the bolts to specifications, then install the coil spring into position. Install the ball joint studs into the control arms. Remove the coil spring compressor. Install the wheel assembly and lower the car. Road test the car retighten all bolts, and set wheel alignment.

**Strut Rod Bushings**

Except in the case of accidental damaged, the strut rod itself is rarely replaced. Rather, it is the bushing that wears, deteriorates, and needs replacement.

**Sway Bar Bushing**

These bushing anchor the sway bar securely to the vehicle frame and the control on each side. The condition of the bushings affects the performance of the bar. Visual inspection of mounting bushing indicates if the bushings are worn, have taken a permanent set, or are possibly missing.

**Shock Absorbers**

A shock absorber that is functioning properly ensures vehicle stability, handling, and rideability. Most motorists fail to notice gradual changes in the operation of their cars as a result or worn shock absorbers. Some common indications of shock absorber failure follow:

Steering and handling are more difficult.

Braking is not smooth.

Bouncing is excessive after stops.

Tire wear patterns are unusual, especially cupping.

Springs are bottoming out.

Vibrations set up a worn shock absorber can cause premature wear in many of the undercar systems. They can cause wear in many of the undercar systems. They can cause wear in the front and rear component parts of the steering system, and the U-joint and motor or transmission mounts of the driveline. Also, vibrations can cause unnatural wear patterns on the tires.

A shock absorber can be bench tested. First, turn it up in the same direction it occupies in the vehicle. Then extend it fully. Next, turn it upside down and fully compressed it. Repeat this operation several times. Install a new shock absorber if a lag or skip occurs near mid-stroke of the shaft’s change in travel direction, or if the shaft seizes at any point in its travel, except at the ends. Also, install a new shock absorber if noise, other than a switch or click, is encountered when the stroke is reversed rapidly, if there are any leaks, or if action remains erratic after purging air.

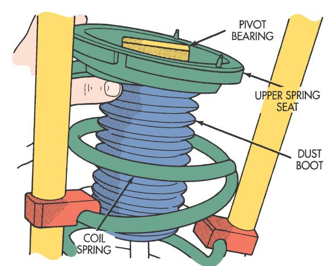
When removing and installing shock absorbers, be sure to follow the aftermarket manufacturer’s instructions or those given in the service manual.

**MacPherson Strut Suspension**

The MacPherson strut suspension system is based on a triangular design. The strut shaft is a structural member that does away with the upper control arm bushings and upper ball joint. Since this upper ball joint. Since this shaft is also the shock absorber shaft, it receives a tremendous amount of force vertically and horizontally. Therefore, this assembly should be inspected very closely for leakage, bent shaft, and poor damping.

To remove and replace the MacPherson strut, proceed as shown in Photo Sequence 48.

During the disassembly of the strut, make sure you check the strut pivot bearing **(Figure 43-33).** Move the bearing with your hand. If the bearing is hard to move or seems to bind, it must be replaced. When replacing the bearing, make sure the correct side is up. Manufacturers normally mark the up side with paint or some other marking. Make sure you check all rubber insulators for deterioration and other damage and replace them if necessary. Also make sure you mark the eccentric camber bolts before loosening them. Returning the bolts in the same location will help maintain the correct camber angle after reassembly.



**Figure 43-33** Check the strut’s pivot bearing for free movement.