TMC Recommended Practice

Proposed RP 643A (T)

VMRS 016-008-000

AIR-RIDE SUSPENSION MAINTENANCE GUIDELINES

PREFACE

The following Recommended Practice is subject to the Disclaimer at the front of TMC's *Recommended Maintenance Practices Manual.* Users are urged to read the Disclaimer before considering adoption of any portion of this Recommended Practice.

PURPOSE AND SCOPE

This Recommended Practice (RP) provides a system approach to proper adjustment and maintenance of air-ride (low-friction) suspensions for medium- and heavy-duty trucks. This approach is designed to maximize suspension performance.

This document covers:

- Shock types, inspection and replacement recommendations.
- Air springs and related air components.
- Fastener and bushing maintenance for suspensions.

It also offers maintenance guidelines for torque rods used on Class 8 tractors and straight trucks used in on-highway applications. For recommended practices on selection and installation, see TMC RP 654, *Torque Rod Selection and OEM Installation Guidelines for On-Highway Vehicles*.

REFERENCES

1. DEVINE Project
2. Commercial Vehicle and Highway Dynamics (SP-1201)

INTRODUCTION

During the past 50 years, suspensions have evolved from a simple axle-to-frame connection system into sophisticated air-ride systems. Air ride suspensions offer reductions in tire wear, road wear, and fuel consumption. These suspensions reduce vibration by as much as 60 percent, helping to protect sensitive electronics component. They also contribute to driver comfort, cargo diversity, and cargo protection.

Although today's air ride suspensions are considered rather durable, system components must be maintained to prevent them from becoming damaged, misaligned or worn. This RP describes air-ride suspension characteristics and minimum maintenance requirements.

AIR-RIDE COMPONENT DESCRIPTIONS

1. Shock Absorbers—The shock absorbers' primary role is to dampen truck and trailer spring oscillation. Shocks' second functional responsibility, on many air ride suspensions, is limiting axle extension travel.

Shock absorbers' roles have changed dramatically in recent years. Previously, most suspensions had heavy, multi-leaf springs with limited travel and a great deal of inherent friction. These suspensions quickly self-damped and, therefore, limited the amount of work the shock needed to perform. With today's more sophisticated suspensions, shocks have become increasingly important to ride control and suspension maintenance.

Road impact studies,*[Ref. 1, 2] as they relate to air ride suspensions, indicate that peak forces experienced by tires are reduced in amplitude with air suspensions using properly working shocks. Tests also have shown that air ride suspensions with properly working shocks reduce road damage. A reduction in related stress also suggests lower maintenance costs.

Shock Absorber Types Described:

- ***Conventional Hydraulic—***This is the standard original equipment shock design used on Class 7-8 commercial vehicles. The flow of the fluid inside of a shock absorber is typically controlled by recoil and compression valves. The fluid is forced through the control paths by the motion of the suspension. As that occurs, the fluid heats up. The heat is energy that is being removed from the system. This process, converting energy into heat, dampens the motion.
- ***Twin Tube Gas—***Similar to a conventional hydraulic shock. The main difference is that the air within the conventional shock is replaced with pressurized nitrogen gas which

helps the shock on light suspensions react more quickly by replenishing the inner cylinder faster.

- ***Twin Tube Gas Cell***—A gas cell has been added to a conventional shock to separate the oil from the gas. By maintaining separation of hydraulic oil and gas/air helps reduce fade as a result of aeration (foaming).

Recommended Shock Absorber PM Maintenance

Scheduled Replacement:

TMC highly recommends establishing a shock replacement schedule. To protect vibration sensitive components and to provide for a safe ride and control, shocks should be changed before they break or are worn beyond effective dampening performance. The shock absorber is a wearable item designed to protect other more expensive components. The amount and rate of wear depends on the types of operating environments the truck experiences and the component design. No one application or fleet is identical due to differences in roads, cargo, type of suspension and operator.

Shock absorbers used on air-ride or taper-leaf suspensions for on-highway vehicles should typically provide effective dampening control for 150,000 miles (100,000 miles for vocational applications). Beyond this point, greater consideration should be given to the effectiveness of the shock's dampening value due to performance deterioration. At some point this deterioration could have an effect on other components. For example, tire wear can be attributed to worn shocks. Because of this, some fleets have found it beneficial to install new shocks when installing new tires so as to maximize tire life.

NOTE: Shock absorber service life varies among manufacturers. Equipment users should consult with their component supplier for specific recommended product life cycle estimates.

Fig. 1

Maintenance Schedule

"A" PM Inspection (15,000 miles)

Visual Inspection

- Replace shock if end mount or dust tube is cracked or the body is dented.
- Replace bushings (or the shock if the bushing is not replaceable) if upper or lower bushing is deformed or worn.
- Tighten loose mounting hardware (do not over squeeze bushing).
- Replace shock if leaking. Be sure the shock is leaking vs. misting. A shock is leaking when the upper rod seal is damaged and allows a steady flow of fluid to leak out. Misting occurs when oil on the rod evaporates due to high heat and then condenses on the body leaving a fine oily residue. This is common in the summer and in hot environments and should not be of concern. (See **Fig. 1**.)

"B" PM inspection (50,000 miles)

Heat Test

If there is ride deterioration and it is suspected that a shock has internal failure, which is visually undetectable, perform the following heat test within a few minutes of operating the equipment. (A heat gun may speed the process.)

1. Touch the metal portion of the chassis to get a temperature reference point.
2. Carefully touch or take a temperature, reading on the main body of the shock absorber near the bottom mount. Be careful not to measure the heat of the dust tube.
3. Proceed to the opposite side of the truck and again and carefully touch or measure the shock body temperature on the shock opposite its counterpart on the same axle. (This should be done for each of the shocks.)
4. Both shocks should be warmer than the reference point when touched, and be similar in temperature to each other.
5. Suspect a cooler or cold shock as possibly having failed. (If measuring the temperature with a heat gun, there may be up to a 20 percent temperature difference between the two compared shocks. If greater than 20 percent, it may indicate a shock failure and should be removed for closer examination.
6. If a shock fails the heat test, remove it for closer inspection. Check for visible signs of wear. Turn the shock upside down and shake while listening for any rattling which would indicate a broken internal piece. Also stroke

the shock several times in an upright position to determine if there is any resistance.

7. Additional Maintenance Steps for Gas and GasCell Shocks.
   - *Gas Charged Shocks*—Disconnect the shock from the upper bracket or bolt. Compress the shock by pushing down on the shock towards the lower mount. After compressing the shock, release the upper portion. It should quickly extend upward to its full length. If it does not fully extend, replace it.
   - *Gas Cell Shocks*—After the shock suspected of failure is removed, hold the unit horizontally and stroke back and forth. If a lag develops, replace the shock.

Other Possible Indications of Worn Shocks

1. Tire cupping (Per PM inspection recommendations). Other causes which may aggravate tire cupping are:
   - Out of balance tires.
   - Loose suspension components.
   - Alignment-related issues.
2. Ride deterioration.
3. Excessive vibration causing premature wear on cab, electrical, and cooling system components.

AIR SYSTEM MAINTENANCE

TMC RP 643 defines air systems to include air springs, air lines, and leveling valves. Normal air system maintenance must be performed because dirt, water and other contaminants can damage the air system. Many systems include an air line filter to reduce the effects of contaminants. TMC recommends routine inspection and filter replacement if an air line filter is used.

Recommended Air System Maintenance and Inspection

Daily Maintenance

Drain air tank using the moisture ejector valve.

"B" Inspection (50,000 miles) – Air Spring

1. Visually inspect air spring for cracks, gouges, distortions, bulges and chafing. Replace damaged air springs. If the air spring is damaged, there is a high probability that there may be other problems with the suspension.
2. Check air suspension for leaks. With vehicles loaded and the air system at normal operating pressure, apply a coating of soap and water to all air suspension line connections, valves, and air springs. Soap bubbles at any point in the air system will reveal a leak.
3. Test pressure protection valve. Air suspensions are equipped with a pressure protection valve. When the air brake air pressure is below the predetermined level, the pressure protection valve will close not, allowing air to flow into the air suspension system until the brake systems air pressure rises to the appropriate level. Follow suspension manufacturer procedures for checking the pressure protection valve on the chassis.
4. For more diagnostic guidelines, see **Table 1**.

Annual Air System Inspection

1. Replace air line filter element when used. These filters are typically found between the leveling valve in the line from the supply tank and between the leveling valve and the air spring.
2. Check the inlet leveling valve adapter screen. If clogged clean or replace.
3. Check air suspension leveling valve adjustment as outlined in the suspension manufacturer's manual. This is a critical part of addressing many ride complaints. If the leveling valve is suspected of excessive leaking, follow the manufacturer's field test and/or bubble bench test instructions.
4. Clean air springs with soapy water, methyl alcohol, ethyl alcohol, or isopropyl alcohol. This will help expose problems hidden from normal visual inspection. Do not expose air spring to open flames, direct pressure from steam or water, or use organic solvents or abrasives of any kind to clean rubber components of the air spring.

FASTENER AND BUSHING MAINTENANCE FOR AIR RIDE SUSPENSIONS

All suspension systems share two things in common: fasteners and bushings. Nuts and bolts are used to fasten the suspension together and provide some flexibility and ease of replacing worn or damaged parts such as bushings, air springs, trailing arms, and torque arms (radius rods).

Air ride suspensions are designed to be more complaint to road surfaces than multi-leaf suspensions. As a result, air-ride suspensions experience more twisting movement abuse during day-to-day operation. Although today's air ride suspensions are extremely rugged, greater awareness and diligence

TABLE 1
VISUAL INSPECTION GUIDE OF AIR SPRING DAMAGE

Type of Air Spring Damage	Possible Causes
Misalignment (See **Fig. 2**.):	
Holes rubbed in sidewall	Worn bushings
Loose internal bumper	Suspension out of alignment
Loose Girdle Hoop (See **Fig. 3**.):	
Girdle hoop torn loose	Improperly set or inoperative leveling valve/pressure regulator
Bottom-out/Abrasion (See **Figs. 4 and 5**.):	
Top plate concave	Broken or wrong shock
Loose internal bumper	Leveling valve or pressure regulator
Hole in girdle hoop area	Pressure set too low
Hole in top plate junction area	Overloaded vehicle
Holes rubbed in sidewall	Wrong air spring (too tall)
Circumferential Cuts (See **Fig 6**.):	
Bellows cut in circle at top plate junction	Inoperative leveling valve and or pressure regulator
Bellows cut in circle at piston juncture	Inoperative leveling valve and or pressure regulator
Over Extension (See **Fig 7**.):	
Top plate convex	Broken or worn shock
Bellows separated from top plate	Broken shocks or leveling valve set too high
Air leak at top plate fitting	Improperly set or inoperative leveling valve/pressure regulator
Leaking at end closure (reversible style	Defective upper stop/Wrong air spring (too short)

Fig. 2

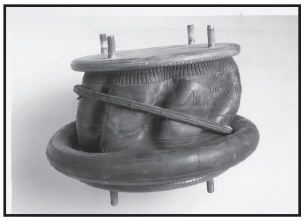


Fig. 3

Fig. 4

Fig. 5

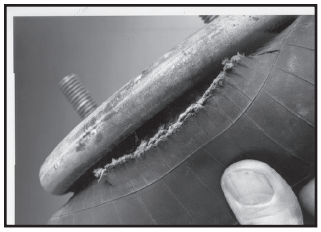


Fig. 6

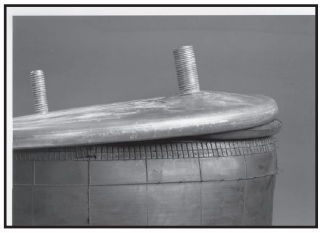


Fig 7A

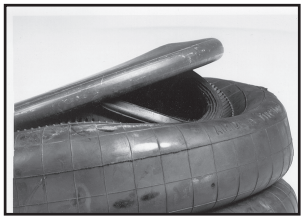


Fig. 7B

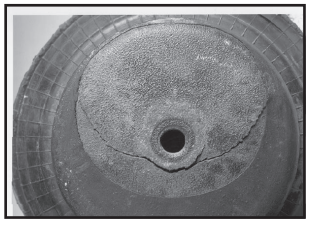


Fig. 7C

should be paid to bushing wear and maintaining proper U-bolt torque to ensure proper performance and durability of the suspension, primarily because of increased suspension movement.

The following section covers basic removal, installation, torquing and inspection of nuts, bolts and bushings for air suspensions. Because of the diversity among air ride suspension manufacturers, the following guidelines address the most common and consistent maintenance practices. Always follow specific manufacturer's maintenance guidelines.

A. Huckbolt Removal

Many of today's new suspensions use 1-1/8" C50L Huckbolt® fasteners, which are designed to be permanent, helping to maintain a consistent tight clamp.

⚠ **CAUTION**: Because it is sometimes necessary to remove the bolts to replace worn or broken parts, proper caution should be exercised since the fastener is clamped at a very high torque and it may release suddenly. Wear proper eye protection and keep your face a least two feet away from collar. *Do not use a cutting torch for removal.* The following directions offer the proper mechanical process for removing the collar and bolt.

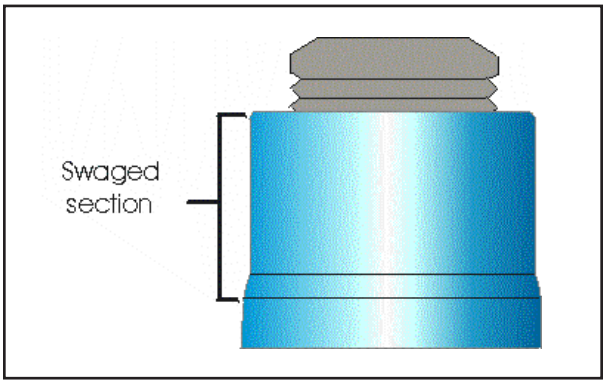
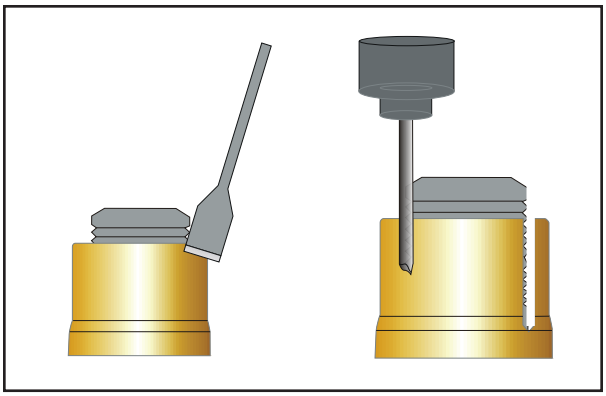


Fig. 8

An installed fastener (see **Fig. 8**) has a collar that is cold-worked or "swaged" over the grooved C50L pin.

No amount of twisting or hammering will dislodge the pin from the collar. The collar must be cut longitudinally to the extent of the swaged section. This may best be accomplished with a small wheel grinder. Other options may be to use a drill or chisel to create openings on the collar wall as shown in **Figs. 9 and 10**.



Figs. 9 and 10

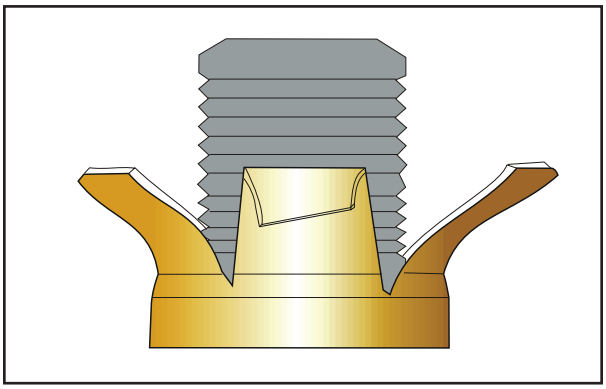


Fig. 11

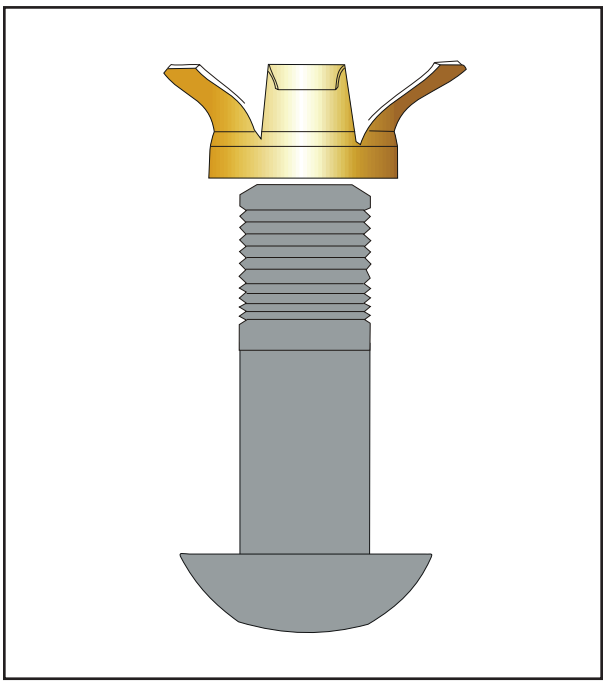


Fig. 12

Once the collar has been opened over the length of the swaged portion on two or more opposing sides, as shown in **Fig. 11**, the pin may become free. If does not become freed, additional collar material needs to be pulled away from the swaged section of the collar using vice grips or a chisel.

The pin will become free when sufficient material has been pulled away from the swaged section of the collar shown in **Fig. 12**. Any fastener that is removed should be replaced with a fastener of equal or greater strength. Huckbolts used on air-ride suspensions are of Grade 5 (120,000 psi) rated material.

B. Recommended U-bolt Specifications, Installation and Service Practices

The function of a U-bolt is to clamp the axle to the suspension system. To do so, the suspension system the U-bolt joint must be in proper tension. The U-bolt joint must be, and remain, tighter than the forces that are trying to pry the joint apart. Therefore, the U-bolt must be strong enough, tight enough, and maintained properly to hold the suspension together.

U-bolt Strength and Tension

The strength of most threaded fasteners is a function of thread size and material grade (strength). A U-bolt is a unique fastener because the bend radius is also a factor of its design strength. When material is bent around a radius, it must stretch and reduce in diameter. SAE J429 outlines the mechanical and material specifications for Grade 5 and 8 U-bolts.

For a U-bolt to properly clamp the axle to the suspension system the U-bolt joint must be in proper tension. The method to use to place the U-bolt joint in tension is applied torque. The user must understand the correlation between applied torque and resulting tension to know how tight the U-bolt joint must be.

Most of the energy applied through torque is lost to friction. Therefore, any factor which increases or decreases friction will alter the amount of torque necessary to achieve the required tension. Some of the factors that affect friction include:

- Rolled threads versus cut threads.
- Nut finish or coating.
- Washer face finish or coating.
- U-bolt thread finish or coating.
- U-bolt and nut thread fit or tolerance.
- Stiffness of clamped materials.
- The number of surfaces being clamped.
- Assembly speed.
- Lubrication.

U-bolt Installation Procedures

NOTE: Do not reuse U-bolts. Because of cross-threading and material elongation, it is difficult to achieve and maintain consistent and accurate torque.

1. Check for dirt or debris in the threads. The thread should be clean with a light wax-based lubricant. Motor oil, because of detergent additives, is not recommended.
2. Check for defects in the top pad. Defects in the top pad may create excessive stresses in the U-bolt.
3 Align the top pad and other components. Loads should be applied in a straight vertical direction.
4. Check and use only U-bolt manufacturer's and/or vehicle manufacturer's torque recommendations.
5. Assembly hardware should include only hardened washers and class "C" nuts, preferably a Hi-nut style which increases thread engagement and reduces cross-threading.
6. Apply initial installation torque incrementally in a cross pattern. Torque all U-bolt legs to half of the finish torque requirement in a cross pattern. Then in the same cross pattern torque all legs to the torque requirement.
7. Apply finish torque with a torque wrench. For efficiency it is acceptable to apply initial installation run-up with an air gun. However, finish torque must be applied with a torque wrench for accuracy.
8. Drive the vehicle to settle suspension system components. It is important to articulate the suspension system so that the components take set.
9. Re-torque after loaded. Most of the settling that is going to occur in the suspension system occurs shortly after initial loading. Re-torque after initial loading of the suspension system is critical in maintaining proper tension in the U-bolt joint.
10. Re-torque after 3000-5000 miles.

C. Bushings

Contrary to popular belief, a bushing's main function is not to absorb shock, but to allow temporary misalignment of suspension components and then return to alignment when the stress or load is removed. The bushing in the transverse rod of an air suspension needs to be at neutral stress when the air bag is adjusted to proper ride height. If the bushings have undue "windup" or do not return quickly to their

neutral state, there will be a negative effect on the air suspension's operation.

Types of Bushings:

- **Conventional Elastomeric Rubber Bushings**.
- **Elastomeric Urethane Bushings** are a more durable rubber alternative in some applications.
- **Metal/Metal on Metal/Plastic Bushings** offer 360° rotation eliminates wind up. However, they need to be greased on a regular basis to maintain in good operating condition.

Bushing Inspection

Rubber & Urethane Elastomeric bushings normally do not require a preventive maintenance schedule, but they should be inspected annually. One method of checking the elastomeric bushing is by applying force to the bushing with a jack or bar. Scribe a line midway between the bushing pin and the outer diameter of the bushing. When applying a force, the scribe line on the bushing should not be displaced more than 1/8". On a bushing that has less than 1/4" thickness of elastomer material, the movement must be less than half the elastomer material.

Metal/Metal on Metal/Plastic non-sealed bushings should be lubricated every 10,000 –20,000 miles or as the manufacturer recommends. Inspection for this design normally calls for no movement between the pin and bushing when force is applied.

Fastener and Bushing Maintenance Schedules

Pre-service Inspection—All torque values should be verified to manufacturer's specification prior to placement in service.

First Service Inspection—New suspensions have a break-in period that is very important for fasteners. All bolts, nuts, U-bolts, and components will stretch and form themselves to the contours of surrounding attachment parts. Therefore, after 1,000 –3,000 loaded miles, all fasteners should be re-torqued to manufacturer's specifications.

Annual Inspection—There are several means of scheduling annual inspections:

1. Concurrently with DOT "C" inspection.
2. One year from in-service date.
3. Mileage/year.

Part Replacement—Anytime parts are replaced for service, damage, wear, or failure, inspect the suspension for loose components and cracks in hangers or axle connection brackets.

Driver Visual Inspection—Prior to major hauls or after long hauls, any obvious abnormalities—such as loose or missing fasteners, abnormal tire wear, and loose bushing connections—should be reported to maintenance as soon as possible.

AIR SUSPENSION RECOMMENDED MAINTENANCE PRACTICE OVERVIEW

Pre-service Inspection

All torque values should be verified to manufacturer's specification.

"A" Service Inspections

1. For new suspensions, on the first service inspection, all nuts, bolts and U-bolts should be re-torqued to manufacturer's specification
2. Check shocks for damage or leakage.
3. Drain air-tank valve
4. Look for loose fasteners or abnormal tire wear.
5. Grease non-sealed metal/metal on metal/plastic bushings.

"B" Service Inspections:

In addition to "A" service inspection items:

1. Perform shock heat tests.
2. Inspect air-bags for deterioration or damage.
3. Check air suspension for leaks.
4. Test pressure protection valve.

Annual Inspection:

1. Replace air line filter element.
2. Check inlet leveling valve adapter screen.
3. Check air suspension leveling valve adjustment. (See TMC RP 634, *Ride Height Concerns and Adjustment Procedures for Air Ride Suspensions*.)
4. Clean air spring to insure no hidden damage.
5. Check bushing for fatigue in transverse rod.

Replacement Items:

1. Replace filter elements.
2. Schedule replacement of shocks (typically between 150,000 – 200,000) based on application and environment.
3. Replace any item showing excessive wear or damage.

NOTE: Shock absorber service life varies among manufacturers. Equipment users should consult with their component supplier for specific recommended product life cycle estimates.

TORQUE ROD MAINTENANCE AND INSPECTION PROCEDURES

This section offers maintenance guidelines for torque rods used on Class 8 tractors and straight trucks used in on-highway applications. For recommended practices on selection and installation, see TMC RP 654, *Torque Rod Selection and OEM Installation Guidelines for On-Highway Vehicles*.

In recent years, the trucking industry has reportedly experienced an increase in torque rod related field issues caused by improper selection, installation, and maintenance practices. These issues can be costly and affect other component performance. TMC believes that many of these issues can be avoided by following the recommendations detailed in both this document and TMC RP 654.

The primary focus of torque rod maintenance is proper inspections at regular intervals. TMC recommends that torque rods be inspected at 90 day intervals in vocational applications. Failure to conduct proper inspections will result in a loss of suspension performance, and premature wear of other related components.

At time of vehicle delivery, torque rods should be inspected for proper installation. Likewise, all torque rod fasteners should be inspected and verified for proper torque values. Refer to original equipment manufacturer (OEM) guidelines for these values.

Subsequent inspections will be primarily a visual inspection looking for worn, torn, cut, "walked out" bushings, or rod contact with other vehicle components. If any of these conditions are found replace per OEM recommendations.

In the case of ball and socket style bushings, a physical check for movement is required. Using a pry bar, attempt to move torque rod ends. If any movement is observed, replace according to OEM recommendations.

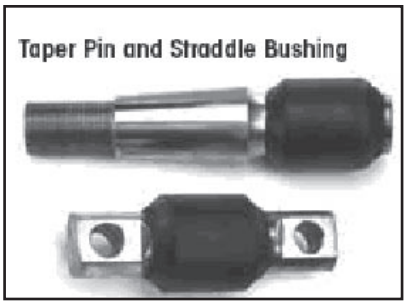


Fig. 13

TORQUE ROD REPLACEMENT

Determining the root cause of failure is a must when replacing either a longitudinal or transverse torque rod so that proper replacement rods/bushings are chosen. Depending on the cause of failure, the following items may need to be reviewed:

- Rating of torque rod/bushings— follow OEM guidelines.
- Length of torque rods (center to center)— follow OEM guidelines.

RUBBER BUSHING REPLACEMENT PROCEDURE: LONGITUDINAL AND TRANSVERSE RODS

Disassembly

The technician will need:

- A vertical press with a capacity of at least 10 tons.
- A push out tool that mates with the bushing being removed.
- A receiving tool that mates with the bushing being removed.

⚠ WARNING :Do not use heat or use a cutting torch to remove the bushings from the torque rod. The use of heat will adversely affect the strength of the torque rod; heat can change the material properties. A component damaged in this manner can result in the loss of vehicle control and possible personal injury and property damage.

1. Support the torque rod end tube centered on the receiving tool. Be sure the torque rod is squarely supported on the press bed for safety.
2. Identify and mark bushing relationship of bar pin to torque rod body. This will be used for replacement bushing orientation at time of reassembly.
3. Push directly on the straddle mount bar pin until the top of the pin is level with the top of torque rod end tube. Place the push out tool directly on top of the bar pin and press until the bushing clears the torque rod end tube.
4. Remove the bolt and washer from the tapered bar pin bushing, and support the torque rod end on the receiving tool with the tapered stud pointing up and the end tube centered on the tool. Be sure the torque rod is squarely supported on the press bed for safety.

5. Push directly on tapered stud until the bushing clears the torque rod end tube.
6. Clean and inspect the inner diameter of the torque rod end tubes, removing any nicks with emery cloth or a rotary sander (see **Figure 14**).

Fig. 14

Bushing Installation

1. Lubricate the inner diameter of the torque rod end tubes and the new rubber bushings with vegetable base oil (cooking oil). See **Figure 15**. Do not use a petroleum or soap base lubricant; it can cause an adverse reaction with the bushing.

Fig. 15

2. Support the torque rod end tube centered on the receiving tool. Be sure the torque rod is squarely supported on the press bed for safety. The straddle mount bar pin bushings must have the mounting flats positioned at zero degrees to the shank of the torque rod.
3. Push directly on the straddle mount bar pin, or the tapered stud. The bushing must be centered within the end tubes of the torque rod.
   - When pushing in the new bushings, overshoot the desired final position by approximately 3/16". See **Figure 16**.

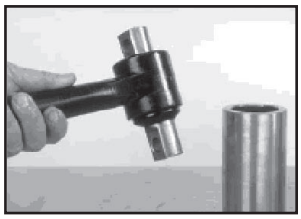


Fig. 16

   - Push the bushing again from the opposite side to center the bar pin, or taper within the end tube. See **Figure 17**.

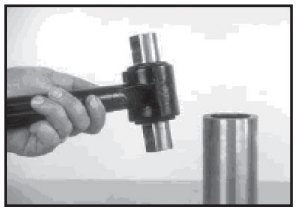


Fig. 17

4. Wipe off excess lubricant. Allow the lubricant four hours to dissipate before operating vehicle.
5. Reinstall torque rod into vehicle per OEM recommended procedure.

TABLE 1: TROUBLESHOOTING CHART		
Problem	**Causes**	**Corrections**
Bent Torque Rods	Impact load.	Replace torque rod and inspect mating parts for damage; replace as required and correct cause of impact load.
	Incorrect rod length (center to center).	Replace with correct length rod (center to center).
Broken Torque Rods	Exceeding rating of torque rod.	Replace torque rod with one of proper rating.
Bushing Walkout	Excessive angle of inclination and / or parallelism.	Do not exceed +5° for transverse; +/-5° for longitudinal rods.
	Incorrect position of rod at time of installation.	Connect TVTR so it is perpendicular (90°) at loaded ride height within +/- 1.5°.
	Not allowing installation lubricant to dissipate at time of installation.	Reinstall new bushing and allow four hours for lubricant to dissipate / cure.
Bushing Deformation	Exceeding rating of bushing.	Replace bushing with properly rated bushing / rods.
	"Oil soaked" / contamination.	Replace bushing and correct source of contamination.
Torn / Cut Bushings	Improper preparation of bore at time of bushing installations.	Refinish bore and replace bushing.
Rip / Torn Grease Seal	Age or contact with foreign material.	Replace torque rod.
Excessive bushing endplay (Greaseable type bushing)	Wear due to age or excessive load.	Replace torque rod.
Damaged Bar Pin	Loose fasteners. Out of round bracket eye due to improper bushing removal.	Replace bushing, hardware, and brackets and torque to OEM specification.
Broken / Worn Straddle Pins	Loose fasteners. Out of round bracket due to improper bushing removal	Replace bushing, hardware, and brackets and torque to OEM specification.
NOTE: Where corrective action calls for replacement of bushing; the equipment owner may have to replace the torque rod if non-replaceable bushings are used; or if so desired.		