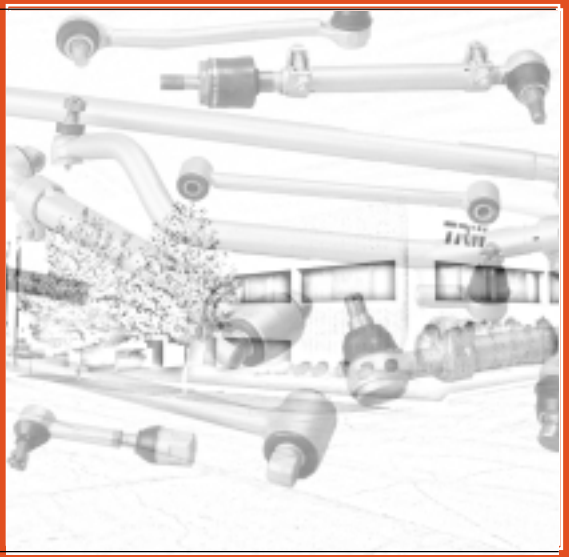
TRW Automotive

Commercial Steering Systems

Linkage Service Manual

STEERING LINKAGE COMPONENTS



Hazard Warning Definitions

⚠ WARNING	**A warning describes hazards or unsafe practices which could result in severe personal injury or death.**
⚠ CAUTION	**A caution describes hazards or unsafe practices which could result in personal injury or product or property damage.**
NOTE	A note gives key information to make following a procedure easier or quicker.

Disclaimer

This Service Manual has been prepared by TRW Commercial Steering Division for reference and use by mechanics who have been trained to repair and service steering components and systems on heavy commercial vehicles. TRW Commercial Steering Division has exercised reasonable care and diligence to present accurate, clear and complete information and instructions regarding TRW Commercial Steering linkage components. Since this is a general Service Manual, the photographs and illustrations may not look exactly like the components being serviced. The procedures, therefore , must be carefully read and understood before servicing.

If inspection or testing reveals evidence of abnormal wear or damage to TRW linkage components or if you encounter circumstances not covered in the Manual, STOP - CONSULT THE VEHICLE MANUFACTURER'S SERVICE MANUAL AND WARRANTY. DO NOT TRY TO REPAIR OR SERVICE ANY LINKAGE COMPONENT WHICH HAS BEEN DAMAGED OR INCLUDES ANY PART THAT SHOWS EXCESSIVE WEAR UNLESS THE DAMAGED AND WORN PARTS ARE REPLACED WITH ORIGINAL TRW REPLACEMENT AND SERVICE PARTS AND THE UNIT IS RESTORED TO TRW'S SPECIFICATIONS FOR THAT SPECIFIC COMPONENT.

It is the responsibility of the mechanic performing the maintenance, repairs or service on a particular TRW linkage component to (a) inspect components for abnormal wear and damage, (b) choose a repair procedure which will not endanger his/her safety, the safety of others, the vehicle, or the safe operation of the vehicle, and (c) fully inspect and test the TAS linkage components and the vehicle steering system to ensure that the repair or service of the component has been properly performed and that the component and system will function properly.

Patents

TRW Commercial Steering Division linkage components are covered by several United States and foreign patents, either issued or pending.

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⚠ WARNING **All steering mechanisms are safety critical items. As such, it is imperative that the instructions in this booklet be followed to the letter. Failure to observe the procedures set forth in this pamphlet may result in a loss of steering.**

Section 1 General Information

Directory for Chart Your Way to Easy Steering Users 5

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Chart Your Way to Easy Steering Directory

Chart Your Way to Easy Steering is a separate publication (actually a Manual, Flow Charts and two Videotapes) that facilitates troubleshooting steering system complaints. If, while using this tool, your system has failed one or more tests, you probably have been directed to this Service Manual for repairs. The following directory will help you locate the specific repairs you will need to make to proceed with the Chart Your Way to Easy Steering process.

Use Example: The driver of the vehicle you are working on complains of "Steering Wheel Kick". You have first determined (using Chart Your Way to Easy Steering) that there is no air in the system. The book then directs you to perform test #18 to check for lash in the system. While performing this test you detected lash or lost motion from the pitman arm to output shaft connection. Since this loose-ness is linkage-related, you would refer to this Service Manual and locate the test number of the failed test, test #18. The problem is listed below as: Pitman Arm to Output Shaft. The solution is to Time the Pitman Arm. You would then proceed to section 3 of this Service Manual and perform the timing procedure.

Failed Test	Problem	Solution	Section
Test 4	Binding in Steer Axle Linkage or Kingpins	Replace Socket Ends	4
Test 15	Mistimed Pitman Arm to Output Shaft	Pitman Arm Timing	3
Test 16	Misadjusted Draglink	Center Drag Link	3
Test 18	Pitman arm to output shaft	Pitman Arm Timing	3
	Drag link to pitman arm connection	Lash in Sockets	2
	Drag link ends (sockets) and adjustable areas	Replace Socket Ends Adjust Drag Link	4 3
	Axle arm to drag link connection	Lash in Sockets	2
	Tie rod arms to tie rod connection	Lash in Sockets	2
	Toe rod ends (sockets) and adjustable areas	Lash in Sockets Adjust Drag Link Adjust Tie Rod	2 3 3

Introduction

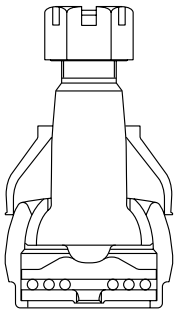
This new Linkage Service Manual was written as a guide to help you install, maintain, inspect and service TRW linkage components.

Material in this manual is organized so you can work on TRW linkage components and get results without wasting time or being confused. To get these results, you should review the contents of this manual before you begin work on any TRW linkage component.

The three-column format used in the Service Manual will help make it easy for you to service steering linkages. Column 1 illustrates the procedure with photographs, column 2 gives a brief key as well as tools to be used for each procedure, and column 3 explains in detail the procedure you should follow. **Pay special attention to the notes, cautions and warnings.**

As you gain experience in servicing TRW linkage components, you may find that some information in this Service Manual could be clearer and more complete. If so, let us know about it. Don't try to second-guess the Service Manual; if you do not understand a procedure, or are stuck, contact a TRW service representative at (765) 423-5377. Servicing TRW linkage components should be safe and productive.

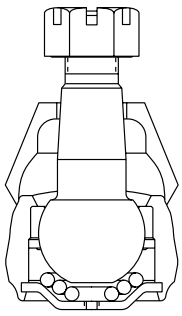
General Socket Design



Series 5000
L.E.M. Socket

L.E.M. ball sockets use proven all-steel dual bearing construction and an integral pre-load spring that limits ball stud end movement and continuously compensates for ball and spherical bearing surface wear. L.E.M. or Low End Movement sockets are used on both medium and heavy duty trucks, as well as off highway vehicles.

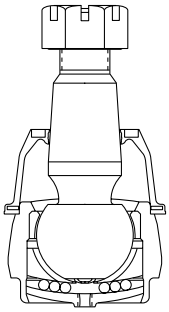
The L.E.M. Socket has a half ball stud and one bearing. On the outside you can use the flat cap and vertical closure to identify the design.



Series 7000
Dual-Seat Socket

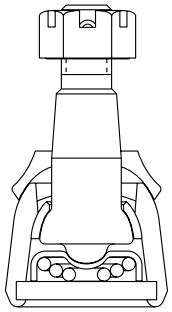
Dual seat sockets are used on both medium and heavy duty trucks, as well as off highway vehicles.

The Dual Seat Socket has a full ball stud and two bearings (one plastic, one steel). On the outside you can use the domed cap and rolled-over closure to identify the design. End movement is controlled with a pre-loaded spring as in the L.E.M. design, but due to the "fixed cap", axial movement is significantly greater under load than the L.E.M. socket.



Series 8000
DL Socket

Each 8000 series ball socket features a hardened steel spherical ball stud captured between a hardened steel upper bearing and a spring pre-loaded thermoplastic lower bearing. Ball stud radial and axial movement is extremely limited by constant compression of the dual bearings around the ball. 8000 Series vertical ball sockets are used on medium and heavy duty trucks, as well as off highway vehicles. The 8000 series sockets combine the full ball, dual seat design with the low end movement feature of the L.E.M. design.



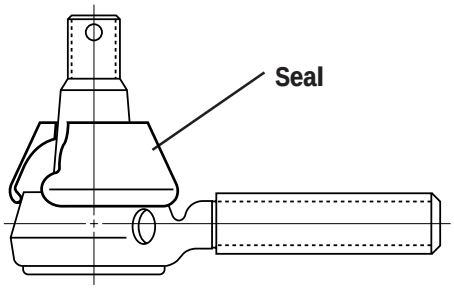
Designer Series
Sockets

Designer series ball sockets are used on such applications as snowmobiles, golf carts, lawn and garden tractors and agriculture implements as well as clutch and throttle linkage systems on medium and heavy trucks.

General Operation

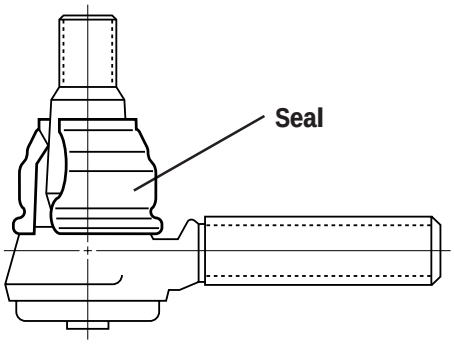
Vertical ball sockets as used in automotive steering linkage systems are essentially pivot joints that provide universal motion. They must be rugged enough to withstand severe under-vehicle environments, while at the same time be refined to provide precise movement with minimal lash. Wheel turn and jounce envelopes often require steering linkage ball sockets capable of high angle oscillations. Certain applications demand restricted movement ball sockets offering little or no oscillation.

Available Seals



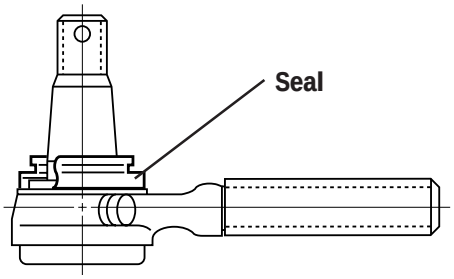
Sliding Seal

The most common seal for vertical ball sockets is the sliding seal. When rocking motion of the ball stud occurs the seal slides over the socket body.



Boot Seal

A boot seal securely attaches around the circumference of the socket body. Rocking motion of the ball stud is accommodated by flexing of the convoluted part of the seal. A metal reinforcing ring molded into the seal aperture snaps over the socket body, holding it in position as the stud oscillates. This seal is well suited to permanently lubricated ball socket assemblies, extended lube assemblies and severe service environments.



Anti-Tilt Seal

This seal configuration consists of a molded polymer element, and may include a steel side washer. The rigid seal assembly presses down over the ball stud and seats firmly over the socket body shoulder. Angular movement of the ball stud is restricted, while stud rotation is accommodated. Anti-tilt seals are particularly useful in applications where long drag links or shift rods must maintain a defined travel path.

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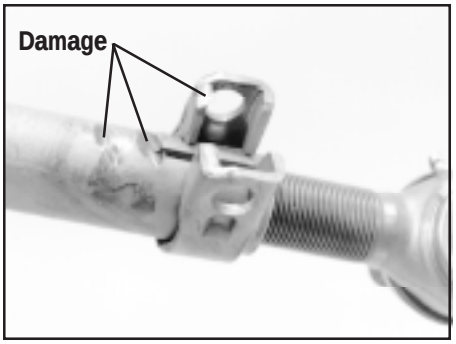
On-Vehicle Inspection

Visual Inspection (Drag Links, Tie Rods, Pitman Arm, Sockets, Seals)

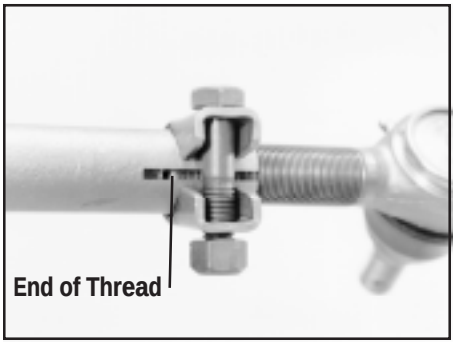


Cracks, breaks or bends

1. Visually inspect linkage components for broken clamps and gouges on tubes (from rubbing parts). Check for a bent steering arm.

Incorrect Components

2. Check manufacturer's specifications to ensure the correct pitman arm and steering arm are installed.



Misadjustments

3. If you can see the end of the socket threads through the slot in the tube the drag link or tie rod must be adjusted or replaced. It's either the wrong size, or the misadjustment was used to compensate for another problem on the vehicle. (e.g. If the toe in was adjusted to compensate for bent tie rod arms.)

   Relocated steering gear (with the use of spacers, etc.)

Grease Zerks

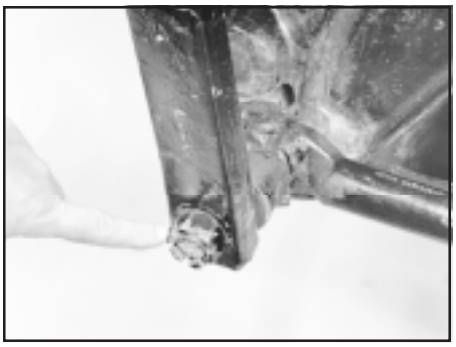
4. Missing or damaged grease zerks must be replaced.

Seal Damage

5. Any form of tear or improper sealing requires seal replacement.

Wear

6. Check for wear on the socket throat, and excessive lash in the socket assembly.



Missing Pins

7. Check socket connections for missing cotter pins.

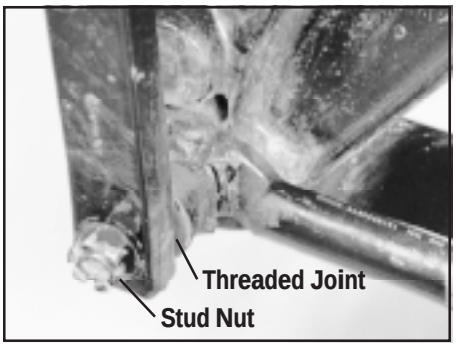
Lash in Sockets

What creates movement in sockets?

In each TRW socket, the compressive force of the spring creates resistive torque by applying a constant load on the bearing and stud.

As wear occurs on the components, the spring creates less resistive torque. With less torque, you no longer have the precise joint needed for optimum steering, but you do still have a safe linkage. When all compression is lost, its time to replace the linkage.

This wear can be caused by impact, lack of lubrication and normal wear.



1. With vehicle engine on, lightly rock the steering wheel while checking for looseness in any threaded joint, or any movement of the stud nut. Any looseness requires repair.

2. With the engine off and wheels straight ahead, push and pull the socket in and out by hand in the direction of the ball stud. If no movement is detected, the socket is safe. Any movement detected by hand requires replacement of the socket.

⚠ WARNING **Do not use a wrench or other object to apply leverage when inspecting sockets. Applying leverage can give skewed results, and damage components. Component damage may ultimately result in loss of steering control.**

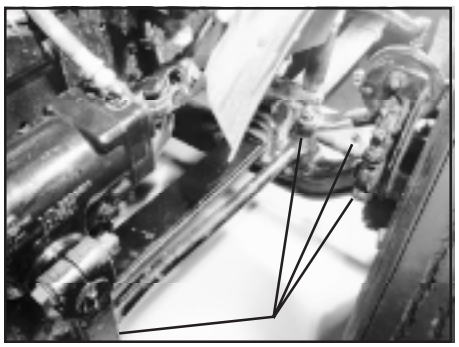
Inspection Station Criteria:

Follow procedures above for inspecting ball sockets. Measure any movement detected by hand with a scale for in and out motion on the ball stud axis.

If movement is 1/8" (3 mm) or more, the vehicle should be taken out of service, and the socket replaced immediately.

If movement is less than 1/8" (3 mm) replacing the socket is strictly a maintenance issue.

Loose Connections & Adjustable Areas



Tighten nuts

1. Make sure nuts are tightened at:
   - drag link to pitman arm connection
   - drag link to steering arm connection
   - tie rod to tie rod arm connections
   - clamps at drag link and tie rod adjustable areas

Section 3 On-Vehicle Adjustments

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Adjustable Tie Rod 20

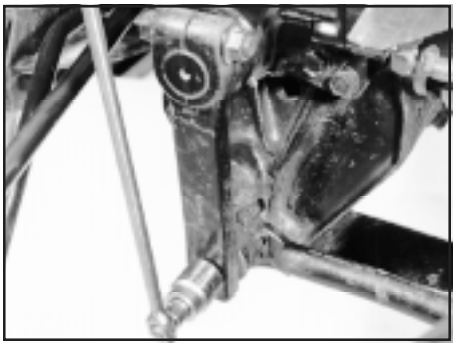
Pitman Arm Timing 26

On-Vehicle Adjustments

Drag Link Adjustment and Centering (one end adjustable)

Position road wheels

1. Position the road wheels straight ahead.



Disconnect drag link

2. Disconnect the drag link at the pitman arm using the appropriate tool.

Center steering gear

3. Make sure the steering gear is on center by aligning the timing marks (housing to output shaft.)

Loosen clamp

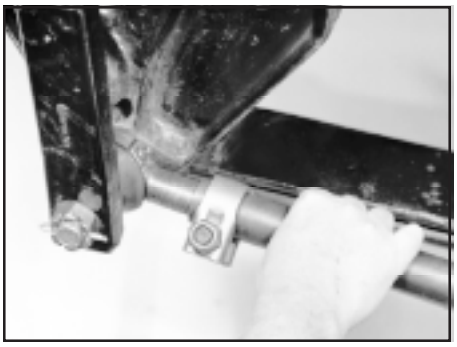
4. Loosen the clamp on the drag link.

Adjust length

5. Adjust drag link length to fit the holes in the pitman arm and axle arm.

Reconnect drag link

6. Torque pitman arm and nut to vehicle manufacturer's specifications, and replace the cotter pin.

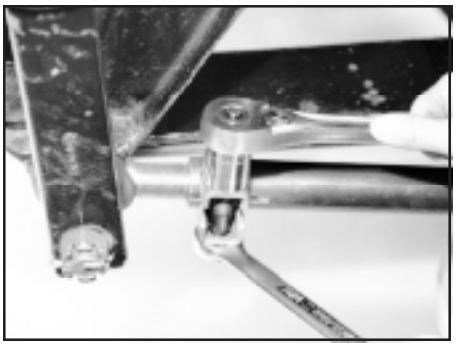


Center drag link tube

7. Grasp the long side of the drag link with both hands. Rotate the drag link away from you as far as it will go, then toward you as far as it will go. Center the drag link between these two points.

Center drag link socket

8. Hold the long side in place. Grasp the short end of the drag link (socket only) and rotate it as far toward you and away from you as it will go. Center the short end between these two points.



Torque clamp

9. With both ends centered, tighten the clamp, and torque to vehicle manufacturer's specifications.

⚠ WARNING **If the clamp is tack-welded, do not remove the tack weld. If the tack weld is removed, clamping force will not be enough to keep the socket threads stationery. Loss of steering control will result.**

NOTE If the clamp is not tack welded, and is a free-to-rotate design, it can be tightened in any position properly.

Lubricate sockets

10. Lubricate sockets through a grease zerk (unless they are "greased for life" sockets) until you can see clean grease purging out of the seal.

NOTE	This purge is necessary to ensure contaminants are removed from socket assemblies.

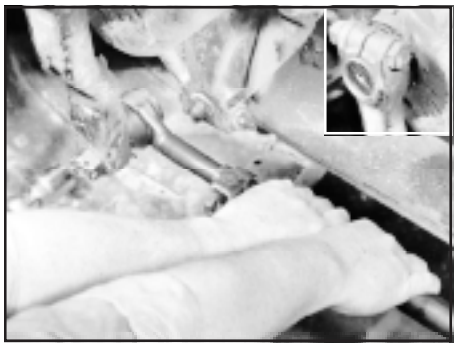
Drag Link Adjustment and Centering (two end adjustable)

Position wheels

1. Position the road wheels straight ahead

Loosen clamps

2. Loosen the clamps on both ends of the drag link.



Center drag link

3. Rotate the center tube of the drag link until the steering gear is on center (align housing timing mark with output shaft timing mark.)

> **⚠ WARNING** **Do not adjust the drag link to a position where you can see the end of the socket thread through the slot in the tube. If the socket thread is visible, corrosion may occur in the tube weakening the components.**

Tighten clamps

4. Tighten the clamps and torque to manufacturer's specifications.

> **⚠ WARNING** **If the clamp is tack-welded, do not remove the tack weld. If the tack weld is removed, clamping force will not be enough to keep the socket threads stationery. Loss of steering control will result.**

> **NOTE** If the clamp is not tack welded, and is a free-to-rotate design, it can be tightened in any position properly.

Lubricate sockets

5. Lubricate sockets through a grease zerk (unless they are "greased for life" sockets) until you can see clean grease purging out of the seal.

NOTE	This purge is necessary to ensure contaminants are removed from socket assemblies.

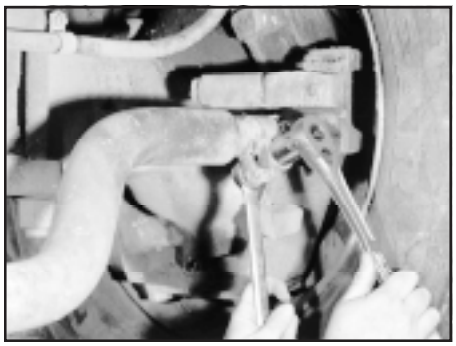
Tie Rod Adjustment and Centering (One end Adjustable: Drop-center)

Position wheels

1. Position the road wheels straight ahead.

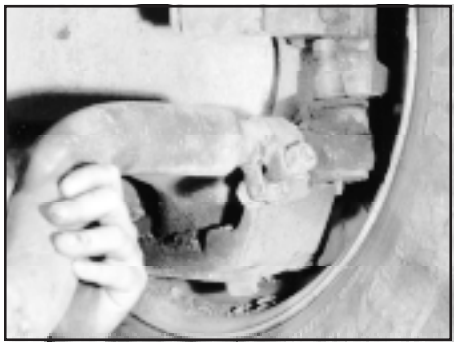
Jack up vehicle

2. Place a jack under the center of the front axle and jack up the front end of the vehicle so the steer axle tires are off the ground.



Loosen clamp

3. Loosen the clamp on the tie rod tube.

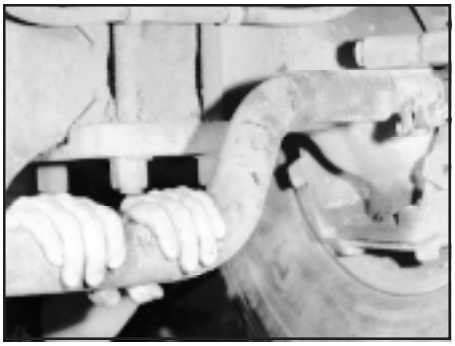


Disconnect tie rod

4. Disconnect the tie rod from the tie rod arm at the adjustable end.

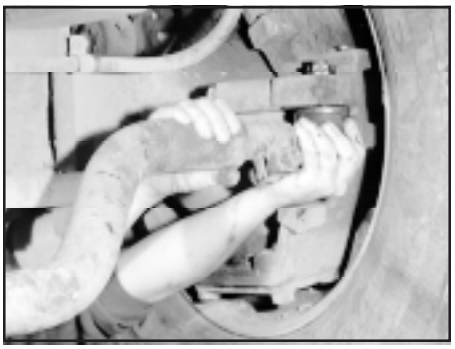
Adjust toe

5. Adjust the socket in one full turn increments. Reinstall the socket end, tighten (don't torque), and check toe in measurement after each full turn adjustment. Repeat as necessary until toe is correct.



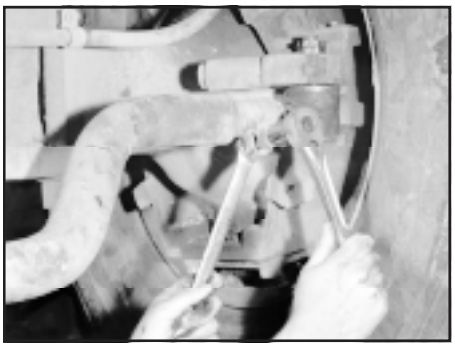
Center tie rod

6. Grasp the long side of the tie rod with both hands. Rotate the tie rod away from you as far as it will go, then toward you as far as it will go. Center the tie rod between these two points.



Center tie rod socket

7. Hold the long side in place. Grasp the short end of the tie rod (socket only) and rotate it as far toward you and away from you as it will go. Center the short end between these two points.



Torque clamp

8. With both ends centered, tighten the clamp, and torque to vehicle manufacturer's specifications.

⚠ WARNING **If the clamp is tack-welded, do not remove the tack weld. If the tack weld is removed, clamping force will not be enough to keep the socket threads stationery. Loss of steering control will result.**

NOTE If the clamp is free-to-rotate, it can be tightened in any position properly, as long as there is enough clearance.

Lubricate sockets

9. Lubricate sockets through a grease zerk (unless they are "greased for life" sockets) until you can see clean grease purging out of the seal.

NOTE This purge is necessary to ensure contaminants are removed from socket assemblies.

Tie Rod Adjustment and Centering
(One end Adjustable: Threaded-sleeve)

Position wheels

1. Position the road wheels straight ahead.

Jack up vehicle

2. Raise the front end of the vehicle so the steer axle tires are off the ground.

Loosen clamp

3. Loosen the clamp on the tie rod tube.

Adjust toe

4. Turn the hex adjuster until the toe is correct.

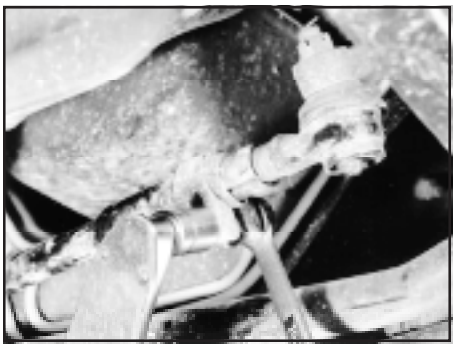
⚠ WARNING **Do not adjust the tie rod to a position where you can see the end of the socket thread through the slot in the tube. If the socket thread is visible, corrosion may occur in the tube weakening the components.**

Center tie rod

5. Grasp the long side of the tie rod with both hands. Rotate the tie rod away from you as far as it will go, then toward you as far as it will go. Center the tie rod between these two points.

Center tie rod socket

6. Hold the long side in place. Grasp the short end of the tie rod (socket only) and rotate it as far toward you and away from you as it will go. Center the short end between these two points.



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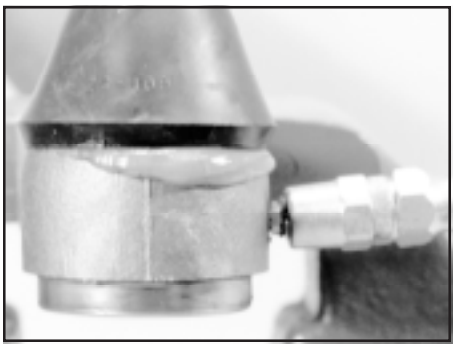

Lubricate sockets

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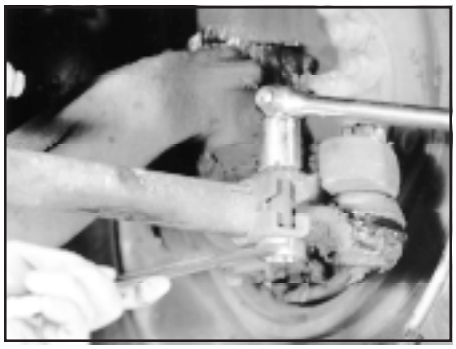
NOTE This purge is necessary to ensure contaminants are removed from socket assemblies.

Tie Rod Adjustment and Centering (two end adjustable)

Position wheels

1. Position the road wheels straight ahead



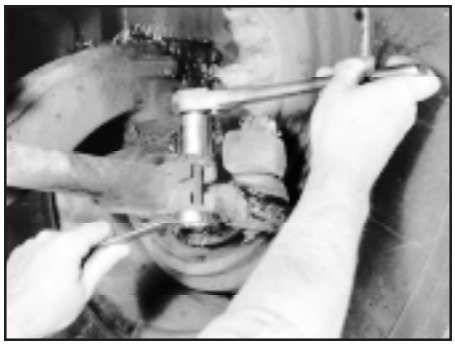
Loosen clamps

2. Loosen the clamps on both ends of the tie rod.

Center tie rod

3. Rotate the center tube of the tie rod until you achieve proper toe-in measurements on the front wheels. (Check vehicle manufacturer's specs.)

⚠ WARNING **Do not adjust the tie rod to a position where you can see the end of the socket thread through the slot in the tube. If the socket thread is visible, corrosion may occur in the tube weakening the components.**

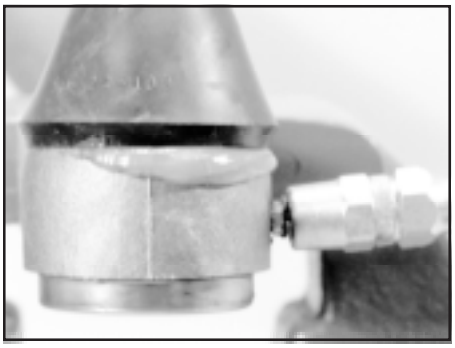


Tighten clamps

4. Tighten the clamps and torque to manufacturer's specifications.

⚠ WARNING **If the clamp is tack-welded, do not remove the tack weld. If the tack weld is removed, clamping force will not be enough to keep the socket threads stationery. Loss of steering control will result.**

NOTE If the clamp is not tack welded, and is a free-to-rotate design, it can be tightened in any position properly.



Lubricate sockets

5. Lubricate sockets through a grease zerk (unless they are "greased for life" sockets) until you can see clean grease purging out of the seal.

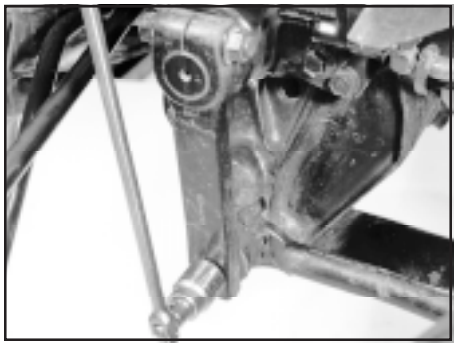
NOTE	This purge is necessary to ensure contaminants are removed from socket assemblies.

Pitman Arm Timing

⚠ WARNING **Don't remove the drag link connection after the pitman arm pinch bolt is removed. Doing so will deform the drag link and cause steering problems.**

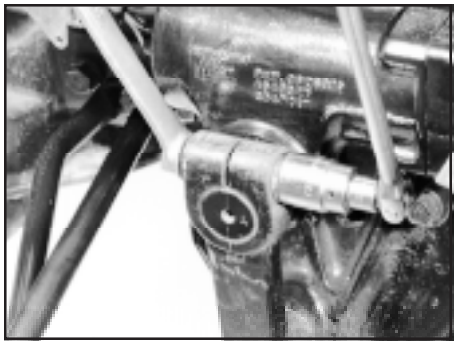
⚠ WARNING **When using a chisel to spread a pinch bolt-type pitman arm boss for assembly or removal from the shaft, maintain a firm grip on the chisel at all times. Failure to do this may result in the chisel flying loose which could cause an injury. Never leave the chisel wedged in the pitman arm boss. If you cannot remove the pitman arm from the shaft with a chisel and your hands, remove the chisel from the arm boss and use a puller only to remove the pitman arm.**

⚠ CAUTION **Do not use a hammer on the pitman arm to remove it from the output shaft as internal damage to the steering gear could result. Be sure there is no spreading wedge left in the pitman arm boss before tightening the pitman arm clamp bolt after assembly on the output shaft.**



Disconnect drag link

1. Disconnect the drag link from the pitman arm using the appropriate tool.



Remove pinch bolt

2. Loosen and remove the pitman arm pinch bolt.

Remove pitman arm

3. Remove the pitman arm using a pitman arm puller.

Inspect splines

4. Check pitman arm internal splines for:

- severe wear, corrosion and fretting
- twisted splines
- missing splines

⚠ WARNING **If twisted or missing splines are found, be sure to inspect all internal steering gear components carefully for signs of impact damage. Follow the procedure in the appropriate steering gear Service Manual.**

Align timing marks

5. Align the timing marks on the pitman arm and steering gear output shaft. Make sure you use the correct timing mark; consult your manufacturer's specifications if in doubt.

Install pitman arm

6. Spread open the split end of the arm just enough to allow the arm to slide onto the output shaft. Push the arm on with hand pressure.

Torque pinch bolt

7. Install the pinch bolt and torque to manufacturer's specifications.

Connect drag link

8. Reconnect the drag link. Torque the nut and replace the cotter pin.

Section 4 Replacement

Seals 30

Socket Ends 36

Grease Zerk 38

Assembly 39

Replacement

Seals

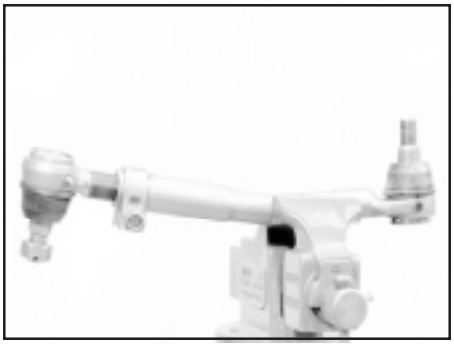
Boot Seal

TOOL REQUIRED: A section of tubing with the inside diameter as close to the outside diameter of the boot seal (middle section) as possible.

The inside corner of the tube should be radiused (rounded) or chamfered (angled) so it will not cut the rubber during the press-on operation.

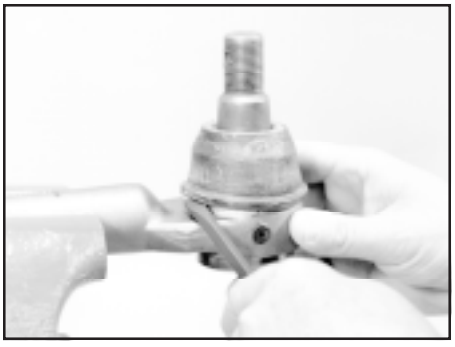
Disconnect drag link or tie rod

1. Disconnect drag link or tie rod from the axle arm or pitman arm.



Remove assembly

2. Remove the entire drag link assembly, leaving the socket ends in position so the assembly can be easily reinstalled.



Remove seal

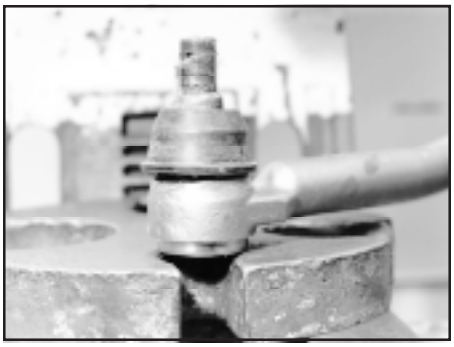
3. Press or tap on the flanged foot portion of the seal to remove it from the socket assembly. If you use a screwdriver to loosen the seal, be careful not to damage the sealing face of the socket forging.

Clean socket area

4. Wipe off all grease and foreign material from around the ball stud and socket throat. Do not use any type of cleanser to remove the grease.

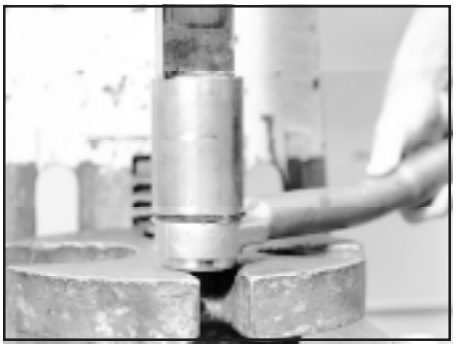
Apply clean grease

5. Using **#2 NLGI extreme pressure, lithium-based, moly-filled, heavy duty grease**, grease the socket throat and stud ball. Then fill the new boot seal 3/4 full with the same grease.



Place assembly in a vise

6. Position the socket assembly in a large vise, or on a press so that the ball stud is perpendicular to the socket stem.



Install new seal

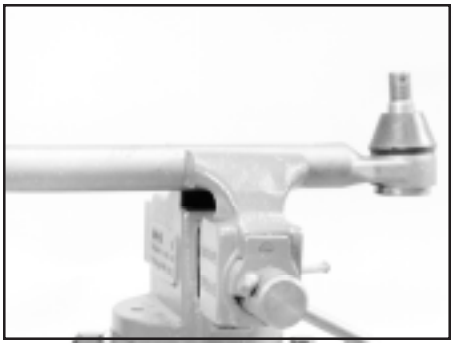
7. Press on the new boot seal using the tool described on page 30. The seal is in place when the flanged portion is seated on the machined section (sealing face) of the socket forging.

⚠ CAUTION **DO NOT over-press the seal; over-pressing could cause it to deform and seal improperly. DO NOT use a screwdriver, chisel, punch, etc. on the flanged foot of the seal for installation.**

Reinstall drag link or tie rod

8. Reconnect the drag link or tie rod to its connection points, and tighten to vehicle manufacturer's specifications. Replace the cotter pin.

Sliding Seal



Disconnect drag link or tie rod

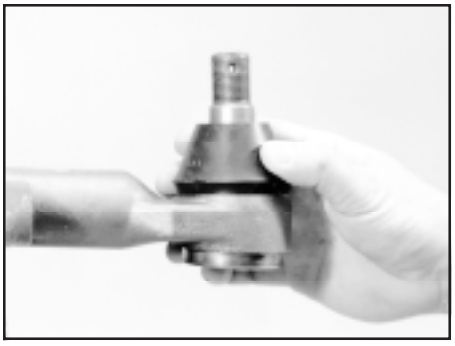
1. Disconnect drag link or tie rod from the axle arm or pitman arm.

Remove seal

2. Remove the old seal by sliding it off the ball stud.

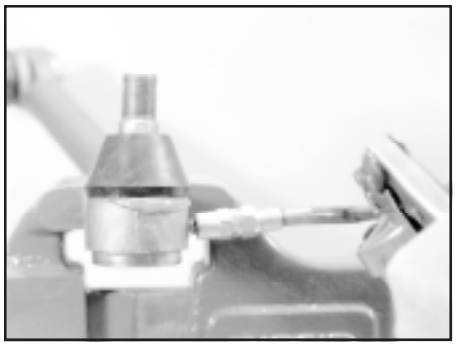
Clean socket area

3. Wipe off all grease and foreign material from around the ball stud and socket throat with a clean cloth. Don't use any type of chemical cleanser to remove the grease.



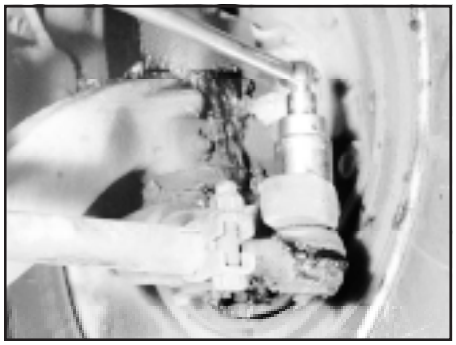
Install new seal

4. Slide the new seal over the ball stud until it seats on the shell.



Apply clean grease

5. Wipe off all foreign material from around the grease fitting. Apply #2 NLGI extreme pressure, lithium-based, moly-filled heavy duty grease through the fitting until it can be seen extruding past the seal.

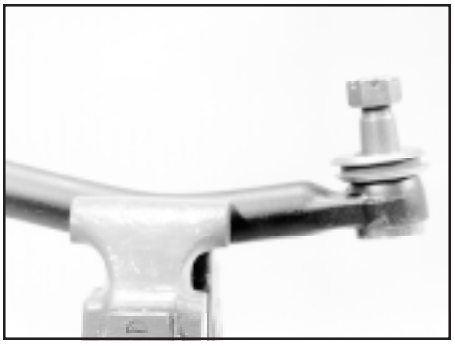


Reinstall assembly

6. Reinstall the assembly and torque connections to vehicle manufacturer's specifications.

Anti-Tilt Seal

⚠ CAUTION **This seal kit should be used only for replacement of identical 8000 series 2-piece anti-tilt seals. Use of these components on any other configuration of socket and seal assembly could cause lash or lost motion while steering, and damage components.**



Disconnect linkage

1. Disconnect the drag link or tie rod from the arm.

Remove seal and plate(s)

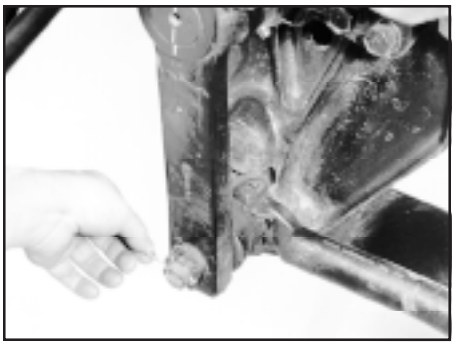
2. Remove and discard the anti-tilt seal and wear plate(s).

Clean socket area

3. Wipe off all grease and foreign material from around the ball stud and socket throat. Do not use any type of cleanser to remove the grease.

Assemble seal and plate(s)

4. Assemble the parts from the kit as shown.

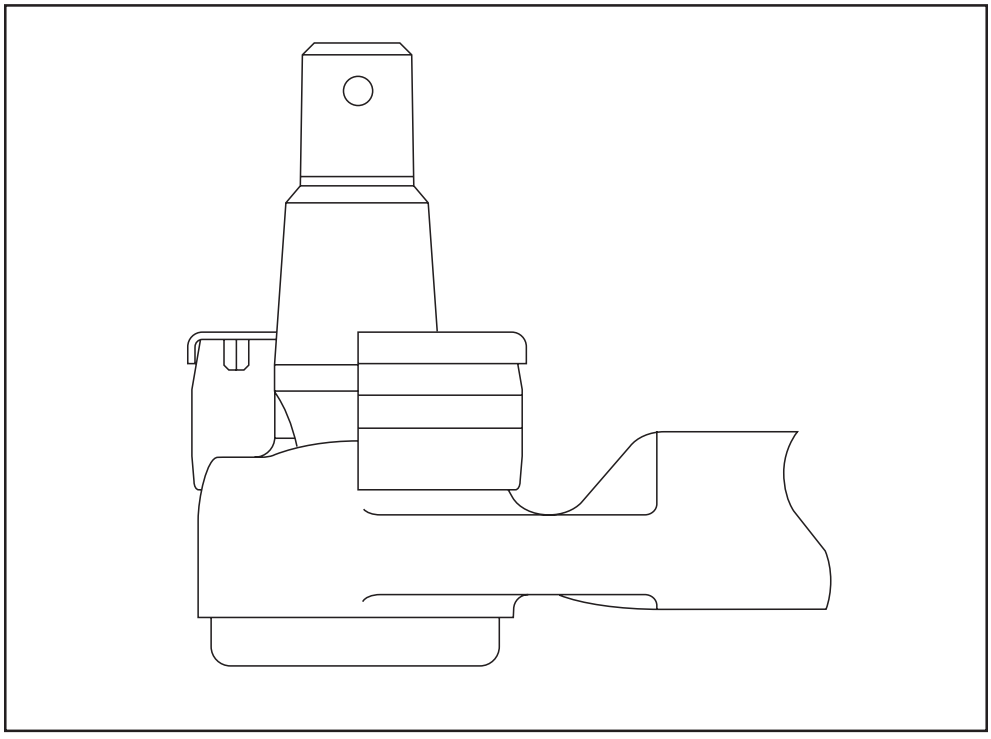


Reinstall linkage

5. Reconnect the drag link or tie rod to the arm and tighten to vehicle manufacturer's specifications.

Grease socket

6. Grease the socket through the lube fitting using EP chassis lube NLGI Grade 3.



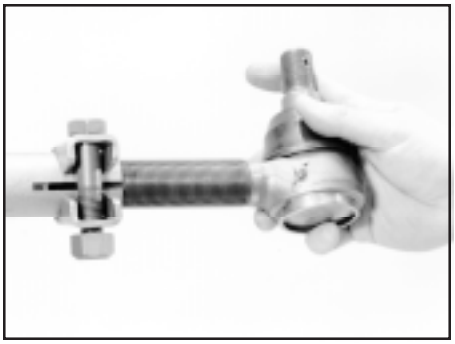
Socket End

Loosen clamp

1. Loosen the clamp (or jam nut.)

Disconnect socket

2. Disconnect the socket from the arm.



Remove socket

3. Unscrew the socket from the tube. Use a pipe wrench if necessary, being careful not to deform the tube.

Install new socket

4. Screw the new socket into the tube.

Adjustment procedure

5. Use adjustment and centering procedures for the type of assembly you're working on. You'll find the procedures in the On Vehicle Adjustments section of this manual.

Torque nut

6. Torque the clamp nut to vehicle manufacturer's specifications.

Grease Zerk

NOTE Before replacing the grease zerk, check for lash in the socket. Replace the entire socket if necessary.

Clean area

1. Clean the area around the damaged grease zerk thoroughly.

Remove zerk

2. Unscrew the grease zerk and remove. If the grease zerk is broken off and cannot be unscrewed, use an E-Z Out.

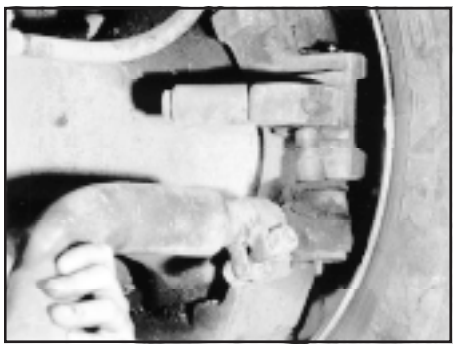
Replace zerk

3. Screw in a new zerk of the appropriate type, size and angle. Torque to manufacturer's specifications.

Check direction of angle

4. If the grease zerk is angled, make sure it is angled in the proper direction. Consult manufacturer's specifications if necessary.

Assembly
Tie Rod

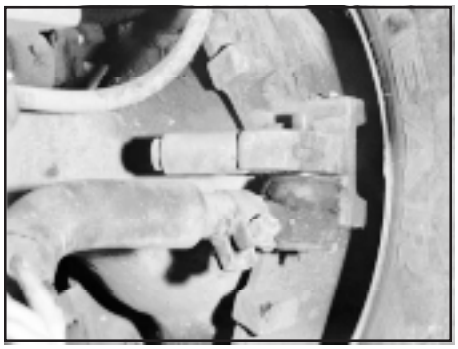


Remove ends

1. Remove both ends of the tie rod from the tie rod arms using the appropriate tool.

Clean area

2. Clean the tapered hole in the tie rod arm with a clean cloth.



Check size of stud

3. Push each stud of the new tie rod into the tie rod arm. Check to make sure the threads on the stud extend down into the tapered hole.

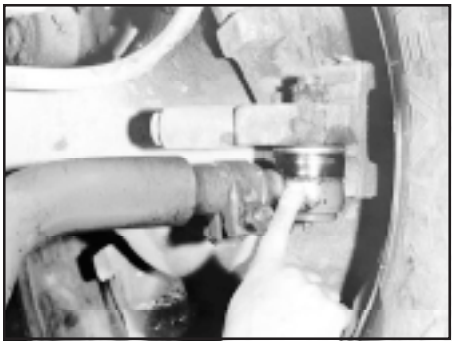
⚠ CAUTION **If the threads stop flush with or above the hole, the sockets are the wrong size. Do not install the wrong size sockets.**

Install new linkage

4. Install the new assembly, torque the ball stud nuts to vehicle manufacturer's specifications, and install cotter pins.

Center Tie Rod

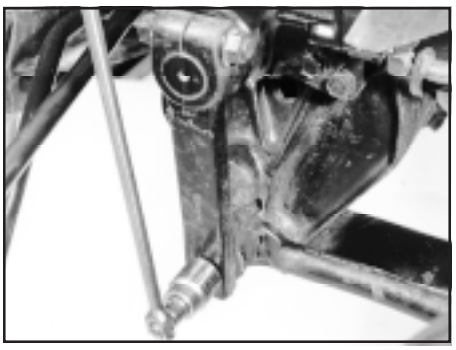
5. Center the tie rod using the appropriate procedure for the type of tie rod installed. You'll find the procedures in the On Vehicle Adjustments section of this manual.



Check for worn taper in tie rod arm

6. With vehicle engine on, lightly rock the steering wheel while checking for looseness and movement of the stud nut. Any looseness requires replacement of the tie rod arms.

Drag Link

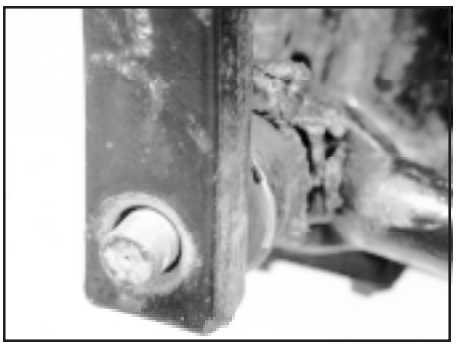


Remove ends

1. Remove both ends of the drag link from the steering arm and pitman arm using the appropriate tool.

Clean area

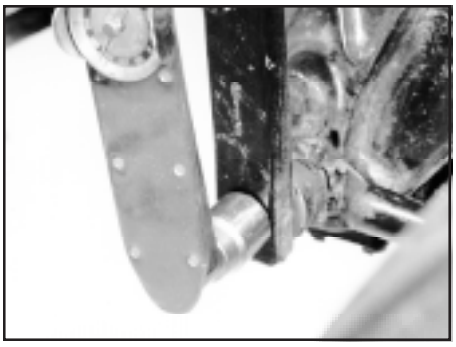
2. Clean the tapered holes in the steering arm and pitman arm with a clean cloth.



Check size of stud

3. Push each stud of the new drag link into the holes. Check to make sure the threads on the stud extend down into the tapered hole in both the steering arm and pitman arm.

⚠ CAUTION **If the threads stop flush with or above the hole, the sockets are the wrong size. Do not install the wrong size sockets.**

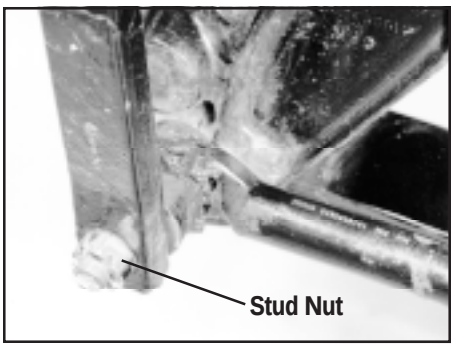


Install new drag link

4. Install the new assembly, torque the ball stud nuts to vehicle manufacturer's specifications, and install cotter pins.

Center Tie Rod

5. Center the drag link using the appropriate procedure for the type of drag link installed. You'll find the procedures in the On Vehicle Adjustments section of this manual.



Check for worn taper in connections

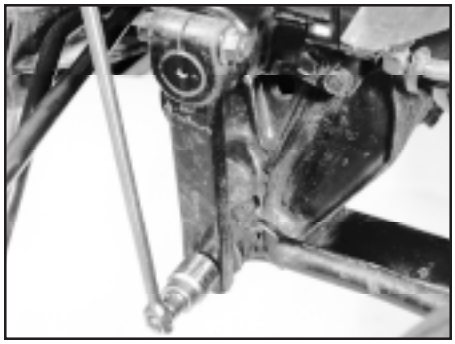
6. With vehicle engine on, lightly rock the steering wheel while checking for looseness and movement of the stud nuts. Any looseness requires replacement of the steering arm or pitman arm.

Pitman Arm

⚠ WARNING **Don't remove the drag link connection after the pitman arm pinch bolt is removed. Doing so will deform the drag link and cause steering problems.**

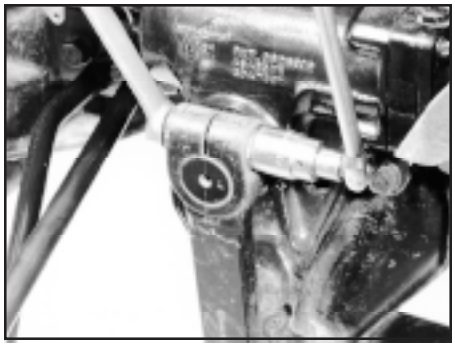
⚠ WARNING **When using a chisel to spread a pinch bolt-type pitman arm boss for assembly or removal from the shaft, maintain a firm grip on the chisel at all times. Failure to do this may result in the chisel flying loose which could cause an injury. Never leave the chisel wedged in the pitman arm boss. If you cannot remove the pitman arm from the shaft with a chisel and your hands, remove the chisel from the arm boss and use a puller only to remove the pitman arm.**

⚠ CAUTION **Do not use a hammer on the pitman arm to remove it from the output shaft as internal damage to the steering gear could result. Be sure there is no spreading wedge left in the pitman arm boss before tightening the pitman arm clamp bolt after assembly on the output shaft.**



Disconnect drag link

1. Disconnect the drag link from the pitman arm using the appropriate tool.



Remove pinch bolt

2. Loosen and remove the pitman arm pinch bolt.

Remove pitman arm

3. Remove the pitman arm using a pitman arm puller.

Inspect splines

4. Check pitman arm internal splines for:

- severe wear, corrosion and fretting
- twisted splines
- missing splines

⚠ WARNING **If twisted or missing splines are found, be sure to inspect all internal steering gear components carefully for signs of impact damage. Follow the procedure in the appropriate steering gear Service Manual.**

Align timing marks

5. Align the timing marks on the new pitman arm and steering gear output shaft. Make sure you use the correct timing mark; consult your manufacturer's specifications if in doubt.

Install pitman arm

6. Spread open the split end of the arm just enough to allow the arm to slide onto the output shaft. Push the arm on with hand pressure.

Torque pinch bolt

7. Install the pinch bolt and torque to manufacturer's specifications.

Connect drag link

8. Reconnect the drag link. Torque the nut and replace the cotter pin.

Section 5 Maintenance

General Lubrication Guidelines 47

Maintenance

TRW Ball sockets should be lubricated with **#2 NLGI extreme pressure, lithium-based, moly-filled, heavy duty grease**, at regular intervals recommended by the vehicle manufacturer. General guidelines for lubrication are listed below, but each owner has the ultimate responsibility for making sure the sockets are lubricated appropriately for the vocation of the vehicle.

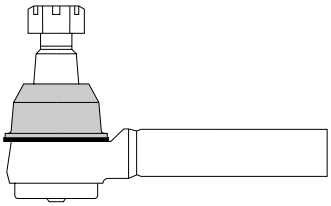
Lubrication Guidelines (on-highway vehicles only)

With Boot Seal

Severe Service - Lubricate socket every oil change or 10,000 miles, whichever comes first.

Normal Service - Lubricate socket every-other oil change or 20,000 miles, whichever comes first.

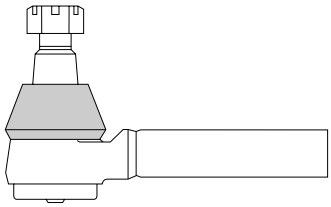
Flush with grease until you see clean grease.



With Sliding Seal

Normal Service - Lubricate socket every oil change or more frequently when the vehicle is subjected to harsh environments.

Flush with grease until you see clean grease.



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