

## SECTION 14: STEERING

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## 1. STEERING SYSTEM

### 1.1 DESCRIPTION

The steering system consists of the steering wheel and column assembly, a vane-type hydraulic pump, reservoir, filter, interconnecting system lines and hoses, integral power steering gear, linkage and steering damper (Fig. 1). The steering linkage includes the pitman arm, drag link, steering arm, tie rod arms and tie rod.

Hydraulic components are added to transmit, increase and regulate steering control forces.

These elements are:

1. Steering stabilizer (damper);
2. A vane type hydraulic pump; and
3. Hydraulic reservoir and hoses.

The steering stabilizer reduces road shocks and vibrations in the system. The steering gearbox is self powered and provides movement with power assistance mainly to the left wheel.

Steering stability and tire wear are influenced by wheels, hubs, tires, air suspension, brakes, front suspension and front end alignment which are all covered in their respective sections in this manual.

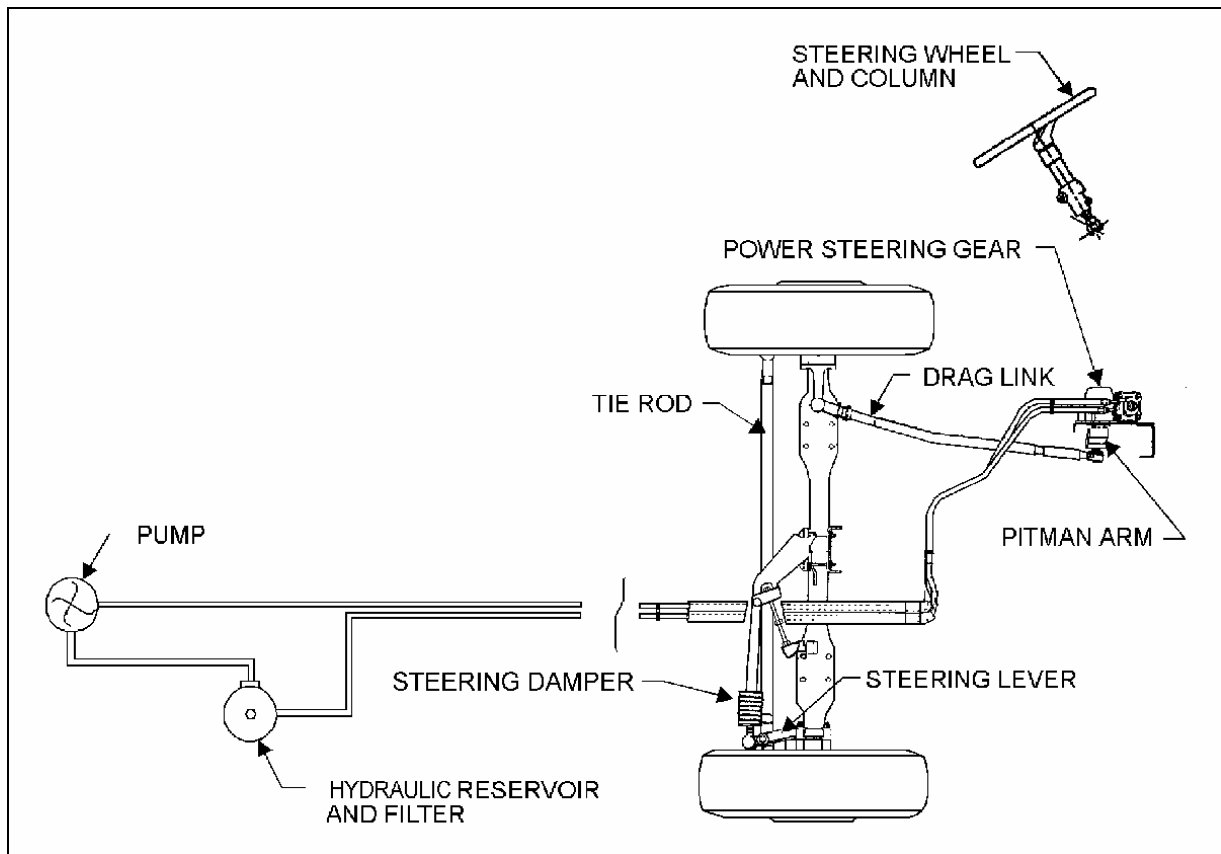


FIGURE 1: STEERING SYSTEM AXLE SETUP

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## 2. POWER STEERING GEAR

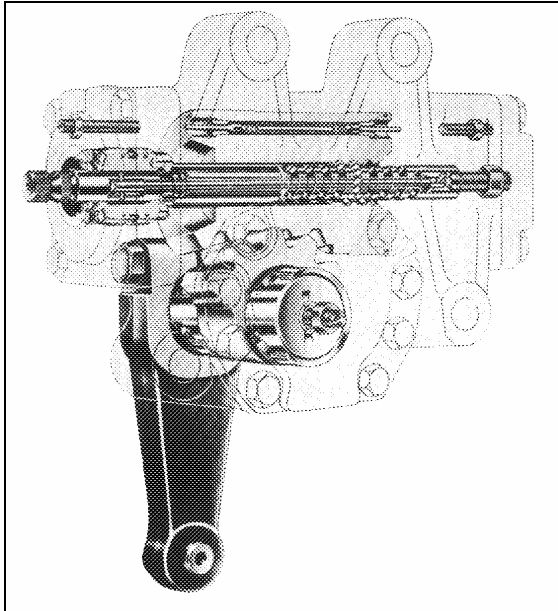


FIGURE 2: POWER STEERING GEAR

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### 2.1 DESCRIPTION

The power steering gear is located in the front lower service compartment (Figs. 2 & 3). The integral power steering gear (TAS 85) incorporates a manual steering mechanism, a hydraulic control valve and a hydraulic power cylinder.

Force on the steering wheel is transmitted to the steering gear input shaft. The input shaft is connected to the worm shaft by means of a torsion bar. The torsion bar turns with the input shaft, exerting a rotational force on the worm shaft. The worm shaft in turn transmits the force through a ball nut mechanism to axial force on the rack piston. The rack piston resists this force due to its engagement to the sector shaft. With this resistance, the torsion bar is twisted by the input shaft. Pressurized fluid moves the rack piston axially through the cylinder bore, and the rack piston then turns the sector shaft and steers the vehicle.

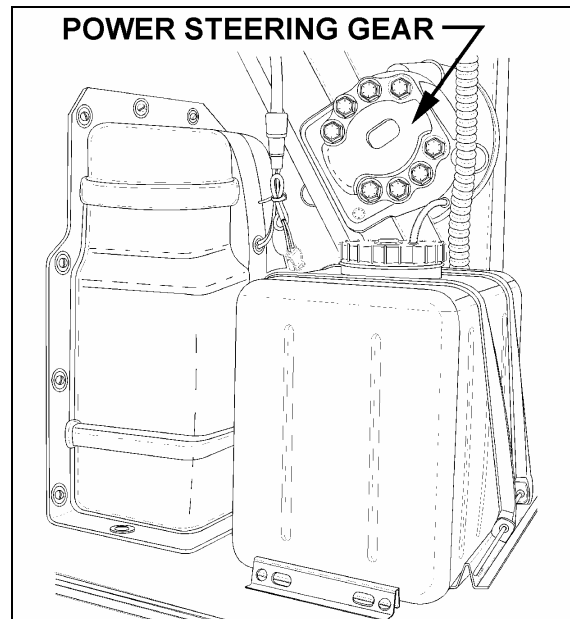


FIGURE 3: FRONT SERVICE COMPARTMENT

If the steered wheels receive a shock load, the shock force is transmitted through the sector shaft to the rack piston and on the worm shaft. This force causes the control valve to send high pressure fluid to the proper cavity to resist the shock force. By hydraulically absorbing the shock, the steering gear prevents kickback at the steering wheel.

The steering gear is equipped with two unloading valves (poppets) at either end of the housing. As the steered wheels approach the axle stop, the corresponding poppet is opened. This reduces heat generated by the pump. The tripped poppet also reduces the load force on the steering linkage. These poppets may be adjusted by the adjusting screw located at bottom of steering gear.

Refer to the "TAS STEERING GEAR SERVICE MANUAL" annexed to this section for the functional aspects and maintenance procedure of the power steering gear.

**Caution:** Before attempting to adjust the poppet valves of the power steering gear, properly set the steering stop screws as outlined in section 10 "FRONT AXLE", under heading "6.4 Turning Angle Adjustment".

## 2.2 POWER STEERING GEAR REMOVAL

**Warning:** The steering gear weighs approximately 112 lbs (51 kg) dry. Exercise caution when maneuvering.

1. Put a container into place, then disconnect both the inlet and outlet hoses from the power steering gear. Cover fittings to prevent fluid contamination.
2. Mark both the pitman arm and sector shaft with a line, then remove pitman arm. Refer to "11.1 Pitman Arm Removal" procedure.
3. Mark both the steering shaft universal joint yoke and steering gear input shaft with a line, then disconnect universal joint.
4. Unscrew and remove the power steering gear.

## 2.3 POWER STEERING GEAR INSTALLATION

Reverse "Power Steering Gear Removal" procedure paying particular attention to the following:

1. Tighten fasteners as recommended under paragraph 14: "TORQUE SPECIFICATIONS".
2. Bleed air from the system as per step 3, next.

## 3. BLEEDING POWER STEERING HYDRAULIC SYSTEM

To bleed the power steering hydraulic system, refer to the "TAS STEERING GEAR SERVICE MANUAL" annexed to this section, under heading "FILLING AND AIR BLEEDING THE SYSTEM".

## 4. HYDRAULIC PRESSURE TEST

Perform a pressure test as outlined in the "TAS STEERING GEAR SERVICE MANUAL" annexed to this section.

## 5. TROUBLESHOOTING

Perform troubleshooting of the steering gear as outlined in the "TAS STEERING GEAR SERVICE MANUAL", the "TRW - POWER STEERING PUMP SERVICE MANUAL" and the "TRW - CHART YOUR WAY TO EASY STEERING" guide annexed to this section.

## 6. POWER STEERING HYDRAULIC PUMP

### 6.1 DESCRIPTION

The power steering pump is a vane type, gear driven, hydraulic unit which supplies hydraulic pressure for the operation of the steering gear. The pump is mounted on the engine, on the crankshaft pulley's R.H. side.

### 6.2 REMOVAL AND INSTALLATION

The pump is accessible through the engine compartment rear door.

To remove the pump, proceed as follows:

1. Put an empty container directly below pump, then disconnect both the inlet and outlet hoses from the pump. Block fitting cavities to prevent fluid contamination.
2. Remove the two (2) mounting screws, then slowly pry out the pump.
3. Remove and discard gasket.

**Caution:** Inspect the drive coupling thoroughly, and replace if necessary (the drive coupling is a fiber component located between the engine and the pump).

For pump installation, reverse the removal procedure paying particular attention to the following:

**Caution:** Ensure that drive coupling is correctly positioned before reinstalling the pump.

1. Install a new gasket (Prévost P/N 510488).
2. Bleed air from the system as per step 3, "Bleeding Power Steering Hydraulic System".

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### 6.3 MAINTENANCE

Refer to the "TAS STEERING GEAR SERVICE MANUAL" and the "TRW - POWER STEERING PUMP SERVICE MANUAL" annexed to this section.

## 7. STEERING WHEEL

### 7.1 REMOVAL

1. Set the battery master switch located in the main power compartment to the "OFF" position.
2. Using a tool, such as a small flat head screwdriver, pry off the air horn cap.
3. Loosen the small screw in center of cap and the other retaining the black wire, then disconnect the white terminal. Remove horn cap.
4. Loosen and remove the steering wheel nut.
5. Using a suitable puller, remove the steering wheel.

### 7.2 INSTALLATION

To install, reverse the removal procedure. Torque steering wheel nut to 35-45 lbf•ft (47-60 N•m).

## 8. STEERING COLUMN

### 8.1 REMOVAL

To disassemble the steering column from system, refer to Figure 4. The steering column has no lubrication points. The lower steering column U-joint is easily accessible through the front service compartment. The upper steering column U-joint and the steering slip joint are accessible from the front driver's area. To access these joints, proceed as follows:

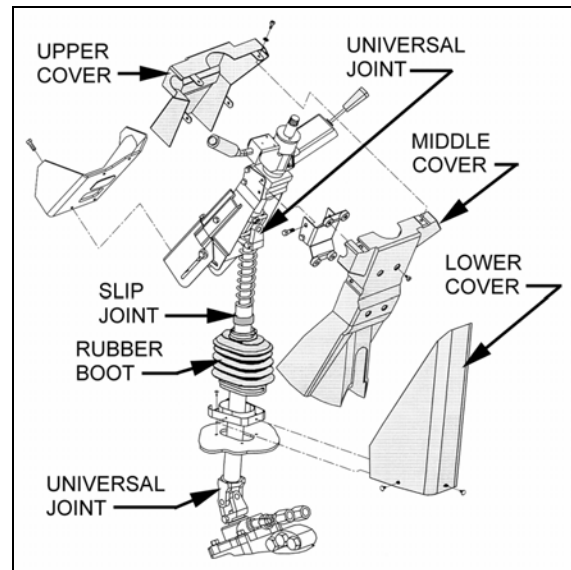


FIGURE 4: STEERING COLUMN

1. From the front driver's compartment area, remove the three plastic fasteners on steering column lower cover. Remove the lower cover (Fig. 4).
2. Unscrew the four retaining screws on steering column middle cover.
3. Unscrew the four retaining screws fixing steering column upper cover to middle cover. Remove the steering column middle and upper covers.
4. Position the steering wheel in order to gain access to the joints.

### 9. TURNING ANGLE ADJUSTMENT

The maximum turning angle is set through two (2) steering stop screws installed on the axle center. Steering stop screws are factory adjusted to accommodate the chassis design, and therefore, do not require adjustment on new vehicles. However, these should be checked and adjusted if necessary, any time a steering system component is repaired, disassembled or adjusted. Refer to section 10 "FRONT AXLE" under heading "6.4 TURNING ANGLE ADJUSTMENT".

**Caution:** To prevent the steering damper from interfering with the adjustment of turning angles, make sure its fixing bracket is at correct location on the axle (refer to "12.2 Steering Stabilizer Cylinder (Damper)").

### Hydraulic Stop

**Caution:** Reduce or shut off the power steering hydraulic pressure before the boss on the axle touches the stop screw. If not, the components of the front axle will be damaged (refer to "TAS STEERING GEAR SERVICE MANUAL" annexed to this section, under heading "POPPET RESETTING").

**Caution:** Never maintain the relief pressure for more than 5 seconds, since damage to the power steering pump may occur.

## 10. STEERING LINKAGE ADJUSTMENT

The steering linkage includes the pitman arm, drag link, steering arm, tie rod arms and tie rod.

Perform lubrication according to "GKN PARTS AND SERVICE MANUAL NO. 1604 Issue A - GKN AXLES LIMITED" annexed to section 10 "FRONT AXLE".

Drag link ends are provided with grease fittings. Under normal conditions, these should be serviced every 6,250 miles (10 000 km). Refer to section 24 "LUBRICATION".

Steering linkage pivot points should be checked each time they are lubricated. Looseness can be visually detected while rotating the steering wheel in both directions. Replace defective parts.

**Caution:** Front wheel alignment should be checked and adjusted if necessary, any time a component of the steering system is repaired, disassembled or adjusted. Refer to section 10 "FRONT AXLE" under heading 6. "FRONT WHEEL ALIGNMENT".

## 11. PITMAN ARM

### 11.1 REMOVAL

1. Remove cotter pin, nut and washers from drag link ball stud at pitman arm.
2. Disconnect drag link from pitman arm, using jaw style pullers (pressure screw type).

**Warning:** Always wear approved eye protection when operating pullers.

**Caution:** Do not drive (hammer in) pitman arm on or off pitman shaft as this can damage the steering gear.

**Caution:** Heating of components to aid in disassembly is not allowed because it has a detrimental effect on axle components and steering linkages.

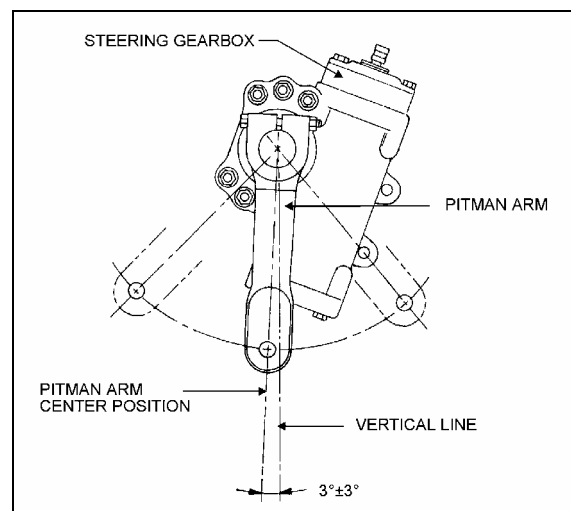


FIGURE 5: PITMAN ARM ADJUSTMENT

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3. Remove pitman arm clamp bolt nut, washer and bolt.
4. Check the radial position of the pitman arm in relation to the sector shaft prior to removal of pitman arm.
5. Add reference marks to the arm and shaft if necessary to ensure correct alignment at reassembly.
6. Remove pitman arm. A chisel will help you loosen the pitman arm. Use a puller if you cannot remove the pitman arm manually.

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### 11.2 INSTALLATION

1. Position pitman arm on sector gear shaft with reference marks aligned. Ensure that the clamp bolt groove matches.
2. Install bolt, washer and nut. Tighten nut to 280-300 lbf•ft (380-410 N•m).
3. Connect drag link to pitman arm while ensuring that rubber stabilizer is in place on the rod end. Install washers. Tighten nut to 160-300 lbf•ft (220-410 N•m). Afterwards, install a new cotter pin.

### 11.3 ADJUSTMENT

1. Disconnect the drag link from pitman arm. Center steering wheel by dividing the total number of steering wheel turns in two. Scribe a reference mark on steering gearbox at the center previously determined.
2. Using a protractor, check the angle of the pitman arm (refer to Fig. 5 for details).
3. The pitman arm should be adjusted to an angle of  $3^{\circ} \pm 3^{\circ}$  in relation with the vertical axis (towards rear of vehicle). If not, unscrew and remove bolt, nut and washer. Remove the pitman arm according to the procedure outlined under previous heading "*Pitman arm removal*". Adjust to the proper angle.
4. When adjustment is achieved, replace bolt, nut and washer, and torque to 280-300 lbf•ft (380-410 N•m).

## 12. MAINTENANCE

The power steering system requires little maintenance. However, the system should be kept clean to ensure maximum operating performance and troublefree service. Periodic inspections should also be made to check for leakage and all parts for damage or distortion. Insure all fasteners are tight (see "*14. SPECIFICATIONS*" for recommended tightening torques.

When the slightest evidence of dirt, sludge or water is discovered in the system, disconnect fluid

lines at the power steering gear to drain the system. Drain and refill the system with "*Dexron-III* or *Dexron-III*" automatic transmission oil.

Air in the hydraulic system will cause spongy action and noisy operation. When a hose has been disconnected or when fluid has been lost for any reason, the system must be bled. Bleed system as outlined under heading 3: "*BLEEDING POWER STEERING HYDRAULIC SYSTEM*".

**Warning:** Do not operate the pump without fluid in the power steering fluid reservoir.

If the steering linkage between the steering gear and the two front wheels is not properly adjusted, or if it is bent, twisted or worn, the steering of the vehicle will be seriously impaired. Whenever a steering linkage part is repaired, replaced or adjusted, steering geometry and front wheel alignment must be checked and necessary corrections made. Refer to section 10 "*FRONT AXLE*" under heading 6: "*FRONT WHEEL ALIGNMENT*".

At regular lubrication intervals, the steering linkage should be thoroughly inspected for worn or loose components.

After the vehicle has been operated continually and high mileage figures have been reached, overhaul of the various steering units will be required. General overhaul procedure normally requires removal of the entire assembly, cleaning and inspection of all parts and final assembly. Careful inspection of all parts during overhaul is very important and must not be neglected.

Lubrication fittings must all be cleaned before applying lubricant. Moreover, always be sure the equipment used in applying lubricant is clean. Every precaution should be taken to prevent entry of dirt, grit, lint or other foreign matter into lubricant containers. Replace fittings that have become broken or damaged. Lubrication intervals, as well as the recommended lubricants for the steering components, are given in the "*LUBRICATION AND SERVICING SCHEDULE*" in Section 24 of this manual. The intervals given in the schedule are recommended for normal service. More frequent intervals may be required under severe operating conditions.



## 12.1 POWER STEERING RESERVOIR AND FILTER

The power steering reservoir is located on R.H. side of engine compartment, on front wall and accessible through the engine compartment R.H. side door. (Fig. 6).

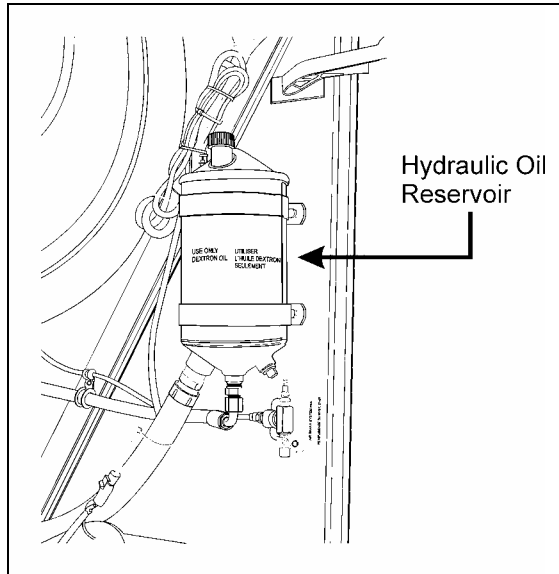


FIGURE 6: ENGINE COMPARTMENT R.H. SIDE DOOR

At regular intervals, fluid level should be checked in the reservoir and filter assembly. Furthermore, the oil filter cartridge element in the power steering reservoir should be replaced every 50,000 miles (80 000 km) or once a year, whichever comes first.

### 12.1.1 Oil Level Check Procedure

1. Stop engine. Open engine compartment R.H. side door (Fig. 7).
2. Unscrew and remove the dipstick located on top of reservoir and wipe with a clean rag.
3. Insert dipstick in reservoir. Remove it again to check fluid level.
4. Adjust level to "FULL" mark using proper dipstick side depending on fluid temperature, use "Dexron-IIIE or Dexron-III" automatic transmission oil.
5. Reinsert and tighten the dipstick.

### 12.1.2 Filter Replacement

1. Unscrew and remove the cover nut located on top of the power steering reservoir.
2. Remove the reservoir cover and the gasket.
3. Remove the retaining spring and finally the filter cartridge element.

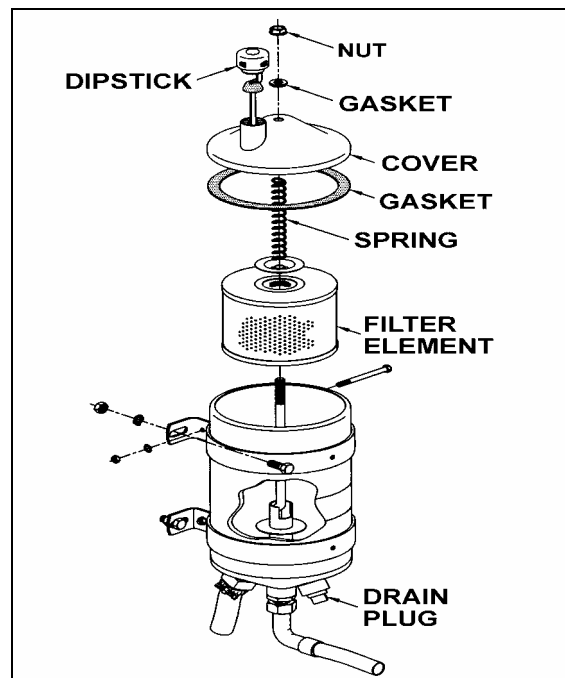


FIGURE 7: POWER STEERING FLUID RESERVOIR

## 12.2 STEERING STABILIZER CYLINDER (DAMPER)

The steering damper is located on R.H. side, at back of front axle (Fig.8).

The cylinder is nonadjustable and non-repairable. Check for oil leaks or lack of resistance. Disconnect the cylinder from axle, then carefully attempt to extend and collapse it manually.

The rod end (ball joint) is provided with a grease fitting. Under normal conditions, it should be serviced every 6,250 miles (10 000 km) or twice a year, whichever comes first. Good quality lithium-base grease NLGI No. 1 and 2 are recommended (refer to section 24 "LUBRICATION"). Check the ball joint for wear, and replace if necessary.

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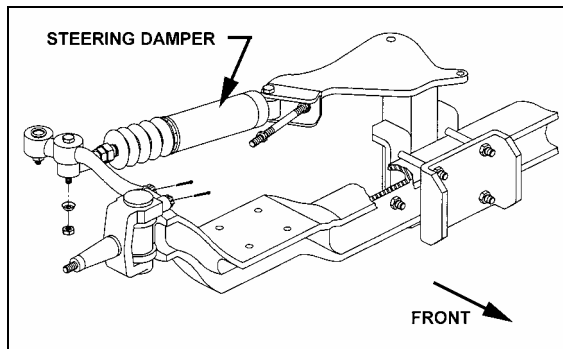


FIGURE 8: STEERING STABILIZER (DAMPER)

### 12.3 DRAG LINK

Lubricate the fittings every 6,250 miles (10 000 km) or twice a year, whichever comes first. Good quality lithium-base grease NLGI No. 1 and 2 are recommended (refer to section 24 "LUBRICATION").

### 12.4 POWER STEERING HYDRAULIC PUMP

For maintenance of the power steering hydraulic pump, refer to the "TRW - POWER STEERING PUMP SERVICE MANUAL" annexed to this section.

## 13. DRIVING TIPS

In order to maximize power steering pump service life, do not attempt to turn the steering wheel when the vehicle is stationary, and especially when service brakes are applied (wheel locking will oppose the effect of steering geometry which tends to make the front wheels rotate in opposite directions).

Persisting in turning, or maintaining the steering wheel with an extra effort, could make the hydraulic system work at the relief pressure, and consequently, cause the hydraulic fluid to become overheated.

**Caution:** Never maintain the hydraulic system at the relief pressure for longer than 5/10 seconds to avoid damaging the power steering pump.

**Note:** Unequal or low tire pressure, oversize tires, and vehicle overloading are some of the causes that may increase steering effort.

14. TORQUE SPECIFICATIONS

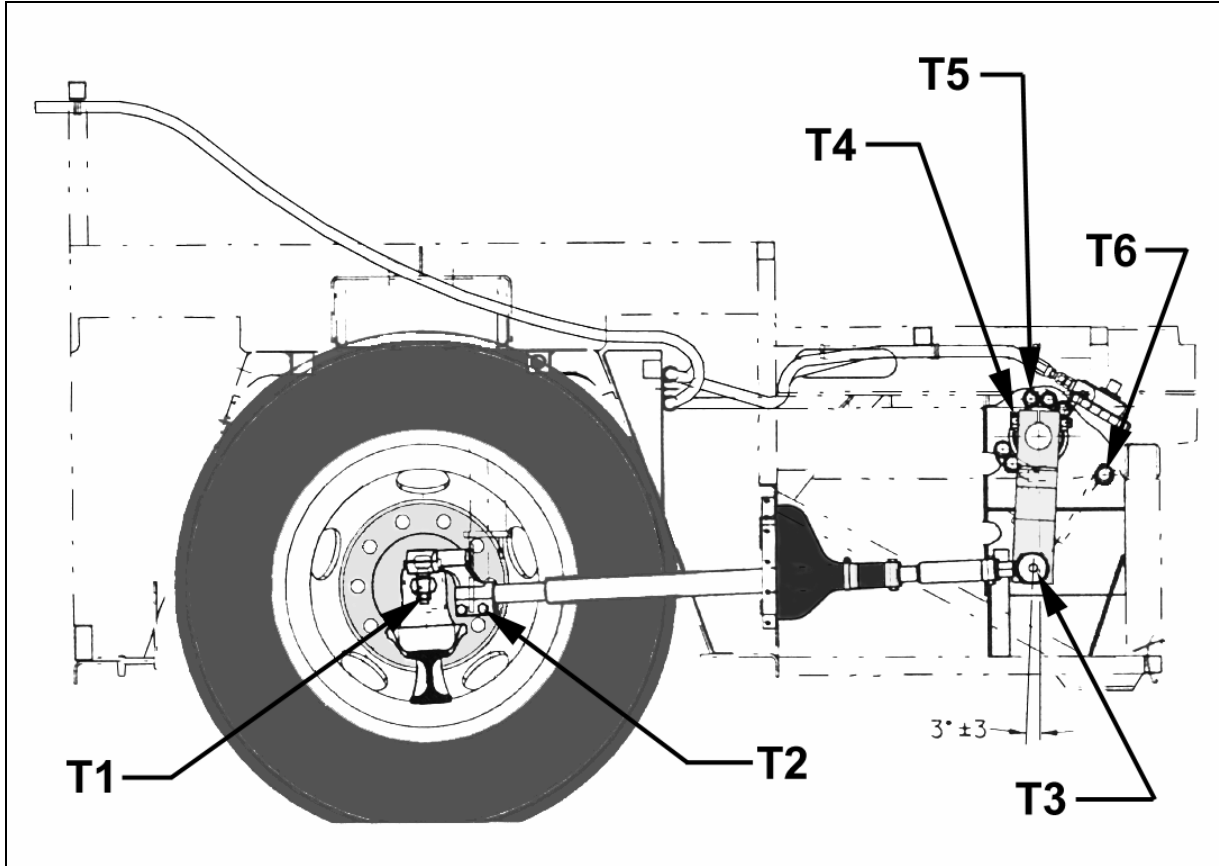


FIGURE 9 : DRAG LINK COMPONENTS

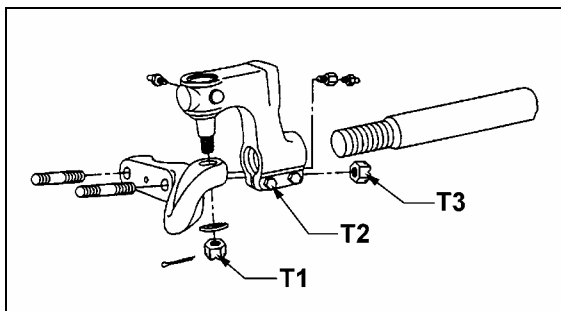


FIGURE 10 : TIE ROD END

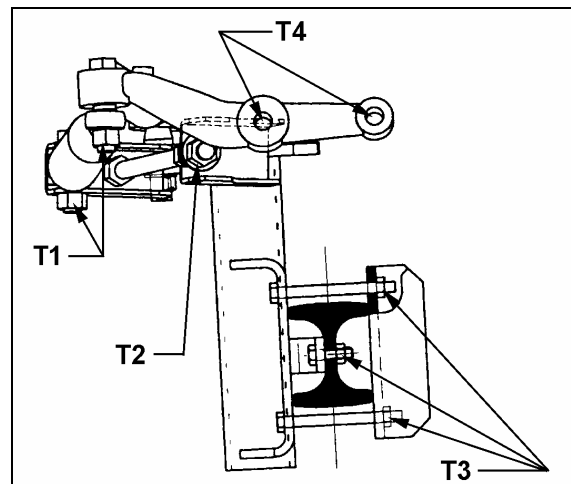


FIGURE 11 : FRONT AXLE COMPONENTS

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<b>DRY TORQUES</b>			
<b>Description</b>	<b>Reference</b>	<b>lbf•ft</b>	<b>N•m</b>
Drag Link End Stud Nut (on steering arm)	Fig. 9, T1	160-300	220-410
Drag Link End Pinch Bolt Nuts	Fig. 9, T2	50-65	70-90
Drag Link End Stud Nut (on pitman arm)	Fig. 9, T3	160-300	220-410
Pitman Arm Mounting Bolt	Fig. 9, T4	280-300	380-410
Steering Gear Fixing Bolts (6)	Fig. 9, T5	290-310	395-420
Steering Gear Fixing Bolt	Fig. 9, T6	490-510	665-695
Tie Rod End Screw Pin Nut	Fig. 10, T1	100-175	135-240
Tie Rod End Pinch bolt Nuts	Fig. 10, T2	65-75	90-100
Lower Lever Stud Nuts	Fig.10, T3	190-275	260-375
Steering Stabilizer (damper) Fixing Nuts	Fig. 11, T1	100-120	135-165
Retaining Rod Support Fixing Nuts	Fig. 11, T2	150-200	205-275
Steering Damper Mounting Support Nuts	Fig. 11, T3	65-70	90-95
Steering Top Lever Nuts	Fig. 11, T4	150-200	205-275

**15. SPECIFICATIONS**

**Power Steering Gear**

Make .....TRW  
 Model ..... TAS 85  
 Supplier number ..... TAS85040  
 Prevost number .....660927  
 F.E.W. .... 18,000 lbs (8 200 kg)  
 Pressure rating .....2,175 psi (150 Bar)  
 Gear ratio .....23.3:1  
 Minimum pump flow for 1.5 hwt/sec ..... 3.5 gpm (13.2 lpm)

**Power Steering Pump**

Make .....TRW  
 Type .....PS Series  
 Relief valve setting .....2,175 psi (14 990 kPa)  
 Controlled flow rate .....4.23 gpm (16 lpm)  
 Inlet port .....1 1/4 NPT  
 Outlet port .....3/4-16 straight thread SAE O' ring boss conn.  
 Supplier number .....PS251615L10200  
 Prevost number .....661009  
 Gasket - Supplier number .....23516100  
 Gasket - Prevost number .....510488

**Power Steering Reservoir**

Make .....Nelson Muffler  
 Oil capacity .....4 US qts (3.7 liters)  
 Supplier number .....91410A  
 Prevost number .....660982  
 Make .....Nelson Muffler  
 Element filter - Supplier number .....83804 E  
 Element filter - Prevost number .....660987

**Steering Stabilizer Cylinder (Damper)**

Make .....Gabriel  
 Extended length .....32.73±0.12"  
 Collapsed length.....20.26±0.12"  
 Stroke.....12.47±0.12"  
 Supplier number .....651535  
 Prevost number .....660979  
 Dust cap - Prevost number .....660980