Operation

Drive enters the gearbox via the clutch drive plate splined to the input shaft.

The input shaft is supported by a taper roller bearing at the forward end fitted to the casing and an internal parallel roller bearing at the rear end locating on the output shaft.

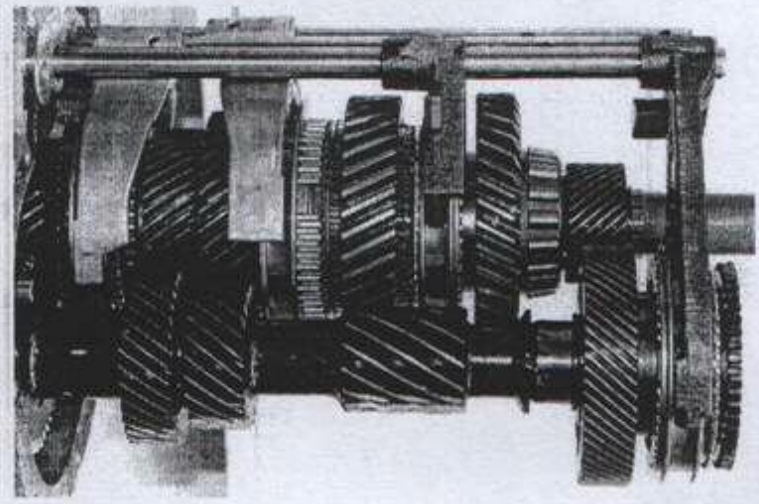
The fixed fourth gear is carried by the input shaft delivering drive to the gearbox for all gear positions.

Drive is transferred to the lay shaft that carries fixed gears for 1st, 2nd, 3rd, 4th and reverse as well as driven 5th speed and the 5th speed syncromesh hub and is supported at each end by taper roller bearings.

The output shaft is supported at the rear end by a taper roller bearing fitted to the casing and the parallel roller bearing fitted to the input shaft at the front end.

It carries 1st, 2nd, 3rd and reverse speed gears, 1st/2nd, 3rd/4th and reverse syncromesh hubs as well as 5th fixed gear.

Reverse idler is supported by a dedicated gear and shaft secured to the main casing by an individual security torx screw that must not be removed unless otherwise instructed.



Shows 2nd Gear Selected

Clutch System

The primary function of the clutch is to couple and uncouple engine power to the transmission upon driver command.

The clutch is a single plate, dry friction clutch disc.

The clutch disc has a splined hub (with integral torsional dampening springs) that attaches the clutch disc to the input shaft.

Engine output is coupled to the input shaft by the friction existing between the clutch disc facings and the flywheel/clutch pressure plate assembly. The extent of this friction is directly related to the composition of the facing material and the magnitude of the clamping force exerted by the clutch pressure plate. These factors limit the amount of torque that can be transmitted without slippage.

The clamping force is obtained from a diaphragm spring contained within the clutch pressure plate assembly.

This force is developed during the attachment of the clutch pressure plate to the flywheel.
The clutch system is disengaged when the clutch pedal is depressed and engaged when the clutch pedal is released. This displacement removes the spring load from the clutch pressure plate and eliminates the coupling friction between the engine and the transmission.

When the clutch pedal is depressed, a cable connected to the clutch release lever, hub and bearing actuates the clutch pressure plate diaphragm spring, releasing pressure on the clutch disc. This eliminates the engagement between the transmission and the engine.

The clutch control system engages and disengages the clutch.

The clutch control system disengages the clutch when the clutch pedal is depressed and engages the clutch when the clutch pedal is released.

Clutch pedal motion is transmitted by the clutch release lever cable to the clutch release lever. The clutch release hub and bearing engages the clutch pressure plate diaphragm spring, releasing the pressure on the clutch disc that in turn disengages the transmission from the engine.

The clutch adjusts automatically to compensate for clutch disc wear.

The clutch linkage is self-adjusting.

The clutch pedal position (CPP) switch prevents the starter motor from engaging unless the clutch pedal is depressed all the way to the floor.

The switch plunger is contacted by the clutch pedal and extends as the clutch pedal is pressed.

The clutch pedal position switch is electrically connected in line with the ignition switch and the starter motor relay coil.

The CPP also turns off the cruise control (where fitted) when the clutch pedal is depressed.

Gearbox Lubrication

Capacities:

Refill	3.6 Litre
Dry	3.8 Litre

Gearbox Fluids and Lubricants:

Gearbox oil specification	Dextron III or Mercon III
Gear linkage grease specification	Dextron III or Mercon III

Final Drive

General

Conventional car differentials are termed as open or free running differentials and are essential if the car is to be able to negotiate a corner.

In any corner the outer wheels must travel a greater distance than the inner wheels within the same amount of time, thus implying the outer wheel rotates at a different speed to the inner.

This ability also limits the traction of both wheels to that of the wheel with the least grip.

There are many variants of differential that have been invented to try and modify this behavioural drawback, these are collectively known as limited slip differentials (LSD for short).

Most work by physically adding a static frictional torque within the differential unit to both wheels, this increases the individual transmittable torque available to the wheel.

There are two main disadvantages to this method, this static preload is there at all times, when in tight corners or slowing down on over run it is not required. In very slippery conditions the effects of this can be quite un-nerving.

Conventional LSD units can also generate enough internal torque resistance under certain conditions to effectively 'lock' the rear wheels together, this causes the rear of the car to slide out, not desirable when pulling away briskly from a junction.

The differential unit used on the MG X Power SV is a speed sensing Hydratrak™ type limited slip differential. This unit works in a unique manner that overcomes these problems as it features no internal preload.

Hydratrak™ Limited Slip Differential

The patented Hydratrak LSD incorporates a cartridge type fluid coupling which progressively and smoothly increases torque transfer to the wheel with slower rotation.

This is in direct response to the reactive speed difference of the opposing, faster rotating wheel, the more one wheel slips, the greater the useful tractive effort on the opposite wheel.

The large torque range available makes the Hydratrak LSD suitable for a wide variety of differential applications in front, rear and inter-axle configurations, with characteristics tuned to suit customer requirements.

Consequently, the correct degree of torque tends to automatically be distributed to each drive wheel as conditions demand, thereby ensuring that near optimum balance between traction, cornering performance, stability and driver feedback is achieved.

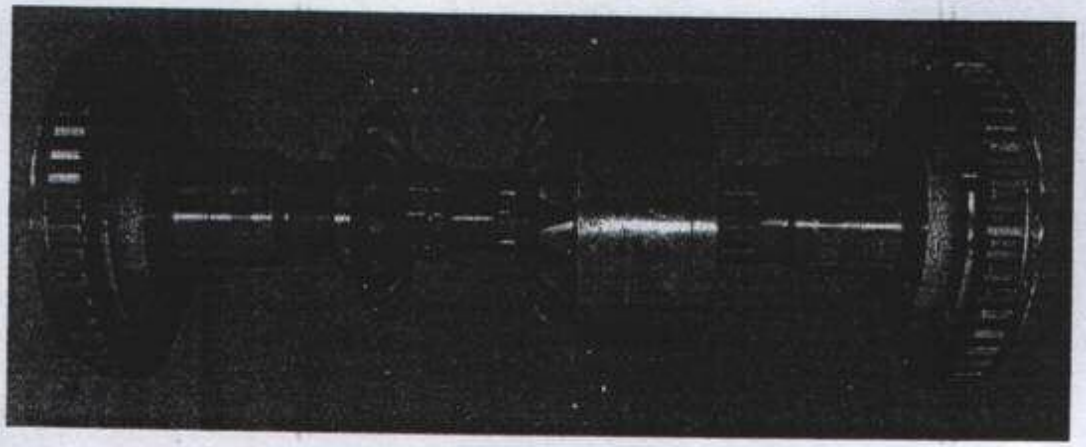
Features and Benefits

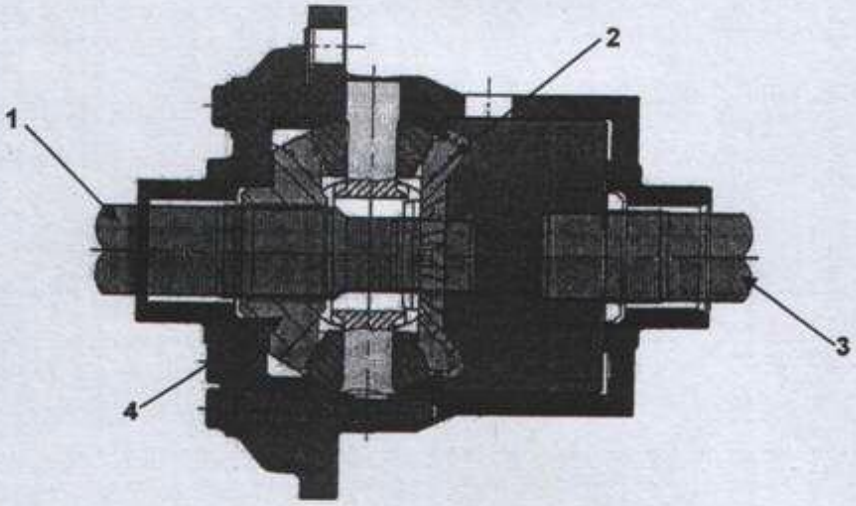
- Speed sensitive
- Progressive build up of torque transfer
- Enhances vehicle stability, traction and cornering feel
- Compatible with Anti Lock Brakes
- Availability of torque transfer tuning (at request of manufacturer)
- No electronics, hydraulics or external controls

The design of the patented Hydratrak LSD is similar to a conventional "open" differential, with the main exception that the Hydratrak coupling replaces the conventional right hand side gear. The coupling unit is a sealed for life, fluid filled cartridge.

Hydratrak™ Operation

The left-hand axle shaft is connected to both the internal hub of the Hydratrak coupling, as well as the left-hand side gear. A series of slots are machined into the hub, with each slot containing a single vane.

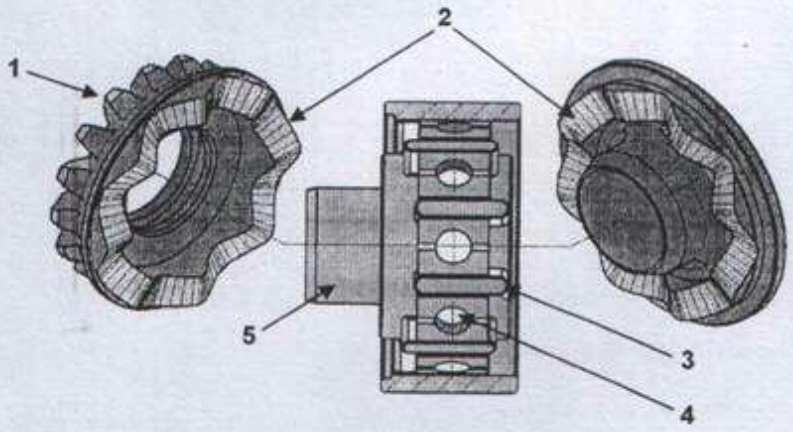




1. Left hand axle shaft
2. Right hand side gear on outer body of Hydratrak coupling
3. Right hand axle shaft
4. Left hand side gear

The right-hand axle shaft is connected to the outer body of the Hydratrak coupling, where the outer body comprises the side gear teeth, as well as the internal cam profiles.

Whenever there is a speed difference between the left and right-hand driving wheels of the vehicle (e.g. during cornering), the hub rotates inside the Hydratrak coupling. This rotation causes the vanes to follow the internal cam profiles.



1. Side gear on outer body
2. Internal cam profile on outer body
3. Vane
4. Fluid chamber
5. Hub

The movement of the vanes transfers the viscous fluid within the Hydratrak coupling through various chambers – this creates hydraulic resistance.
Torque is transferred between the driving wheels due to this hydraulic resistance, rather than by the usual mechanical friction method for conventional LSD's. This hydraulic resistance also increases as the relative wheel slip increases.

Therefore, the Hydratrak LSD increases driving torque to the slower rotating wheel, thereby increasing the useable traction of the vehicle in a progressive, speed sensitive manner – but without the complexity and response time problems of externally controlled systems.

Service Procedures

Background

- Most mechanisms can benefit from a running in schedule during which loads and/or speeds are varied to achieve surface and lubrication improvements as minute asperities of metallic interfacing surfaces are removed through contact.

- The benefit is a longer trouble free life for the mechanism because the running in procedure helps to hold the lubricants temperature to a lower level. Consequently, the viscosity of the oil is maintained at a higher level than would be the case if the mechanism were put on full load and speed without being run in.

- The resulting higher viscosity of the lubricant aids in maintaining surface separation of the wear areas until the minor asperities are diminished and the full bearing capacity of the loaded surfaces is established. The running in schedule helps minimise early generation of wear debris that is excessive, could cause further rapid wear and mechanism failure.

- In particular, the hypoid final drive systems of cars benefit from a running in schedule that assists the gears, bearings and oil seals to attain their full operational capabilities without overheating of the lubricant and its subsequent damaging effect.

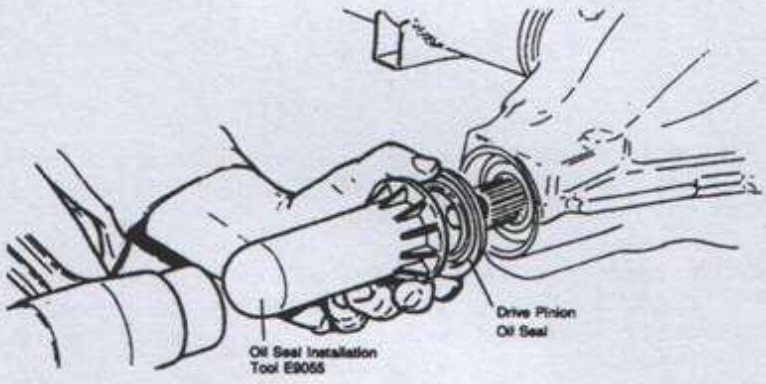
Differential Service Procedures

Pinion Oil Seal Removal

1. Raise the vehicle on a hoist. Disconnect the drive shaft from the drive pinion flange after marking the drive shaft and pinion flange to ensure correct positioning on reassembly.
2. Mark the pinion flange and the pinion nut to establish bearing preload on reassembly.
3. Hold the pinion flange using Tool No. 9980-262028 and remove the self locking nut.
4. Place a drain pan beneath the pinion housing.
5. Mark the ends of a pinion shaft and a pinion flange spline for correct re-alignment during installation.
6. Remove the pinion flange using Tool No. 9980-000070. Under no circumstances should a hammer be used.
7. Remove the pinion oil seal by prying it out with a suitable tool.

Pinion Oil Seal Installation

1. Check the splines on the pinion shaft and pinion flange for burrs and if necessary clean up with fine emery paper. Wipe the flange and shaft clean.
2. Clean the oil seal seat. The lubricant return passage must be clear.
3. Lubricate the seal lips and the outside diameter with oil and install the seal, using Tool No. E9055. Correct seal location is from flush to 0.25 mm below the carrier surface.



4. Align the pinion flange spline mark with the pinion shaft spline mark and install the flange with a smear of lubricant on the splines. Apply a coating of 'Loctite 262' to thread of the pinion nut and tighten until the marks previously made on the pinion flange and the nut are in alignment re-establishing the pinion bearing preload.
5. Install the driveshaft with the marking on the drive shaft and the pinion flange in alignment.

6. Check axle lubricant level and top up if necessary with specified lubricant.

7. Remove the vehicle from the hoist.

Inner Axle Shaft Seal Replacement

Axle Oil Seal Removal

1. Drain lubricant from unit via bottom cover bolt.

2. Remove the half shafts from the assembly.

3. Clean around the seal area ensuring there is no ingress of dirt into the axle shaft needle roller bearing.

4. Carefully remove the seal as the screw adjusters are made from relatively soft aluminium.

Axle Oil Seal Installation

Note:
Before installation of a new seal examine the surface of the axle shafts on which the seal runs and remove any nicks or burrs. Should this surface be irreparable, a new half shaft should be fitted. Examine the housing bore and remove any nicks and burrs.

1. Lubricate the seal lips and the outside diameter and install using Tool No. 5414-0909. The seal is to be seated on the screw adjuster.

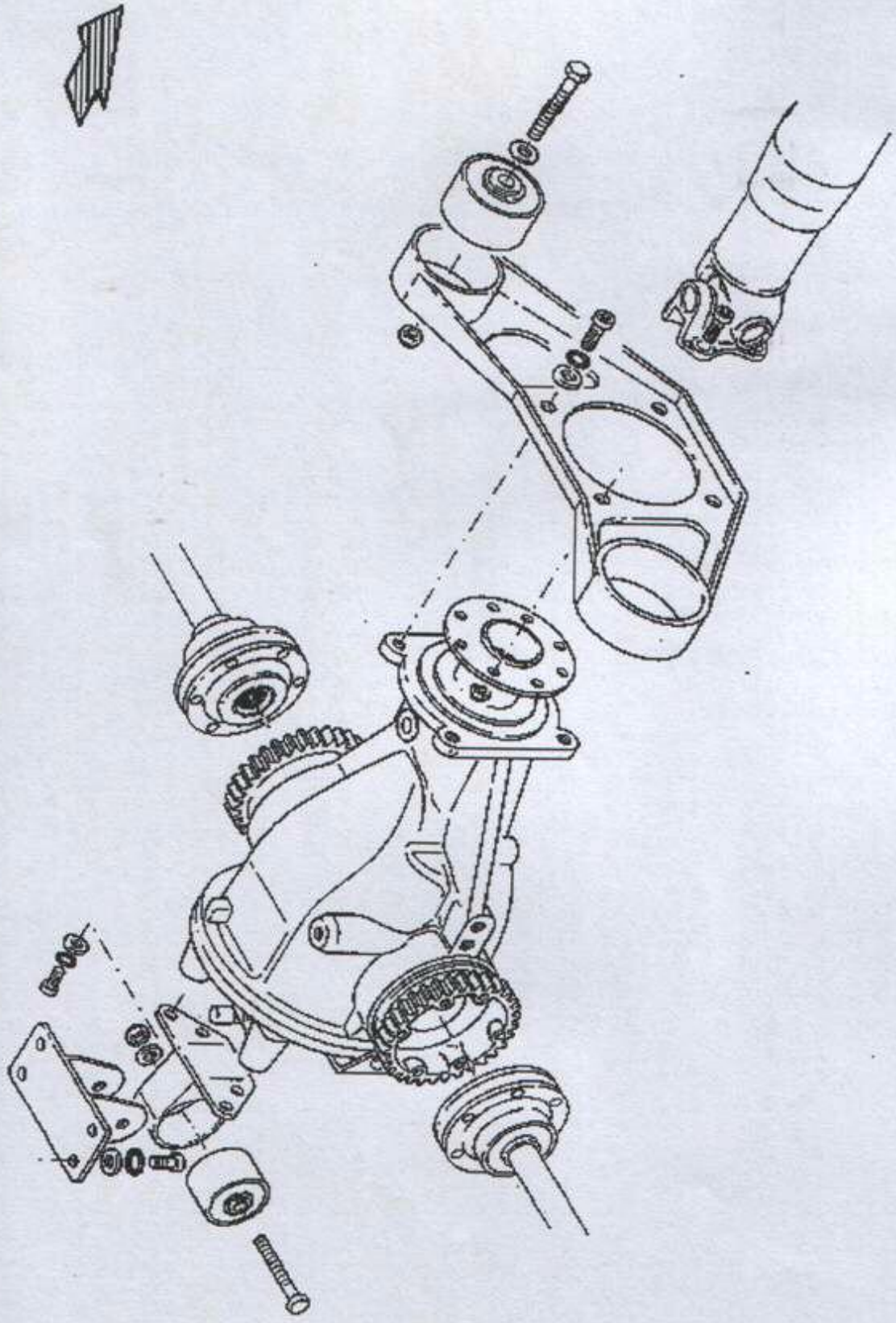
2. Check the retaining rings on the half shafts and replace if damaged. Install the half shafts ensuring that the splines do not come into contact with the seal lips. Ensure the haft shafts are seated correctly and will not pull out easily by hand.

3. Check lubricant level, top up as required.

Recommended Lubricants

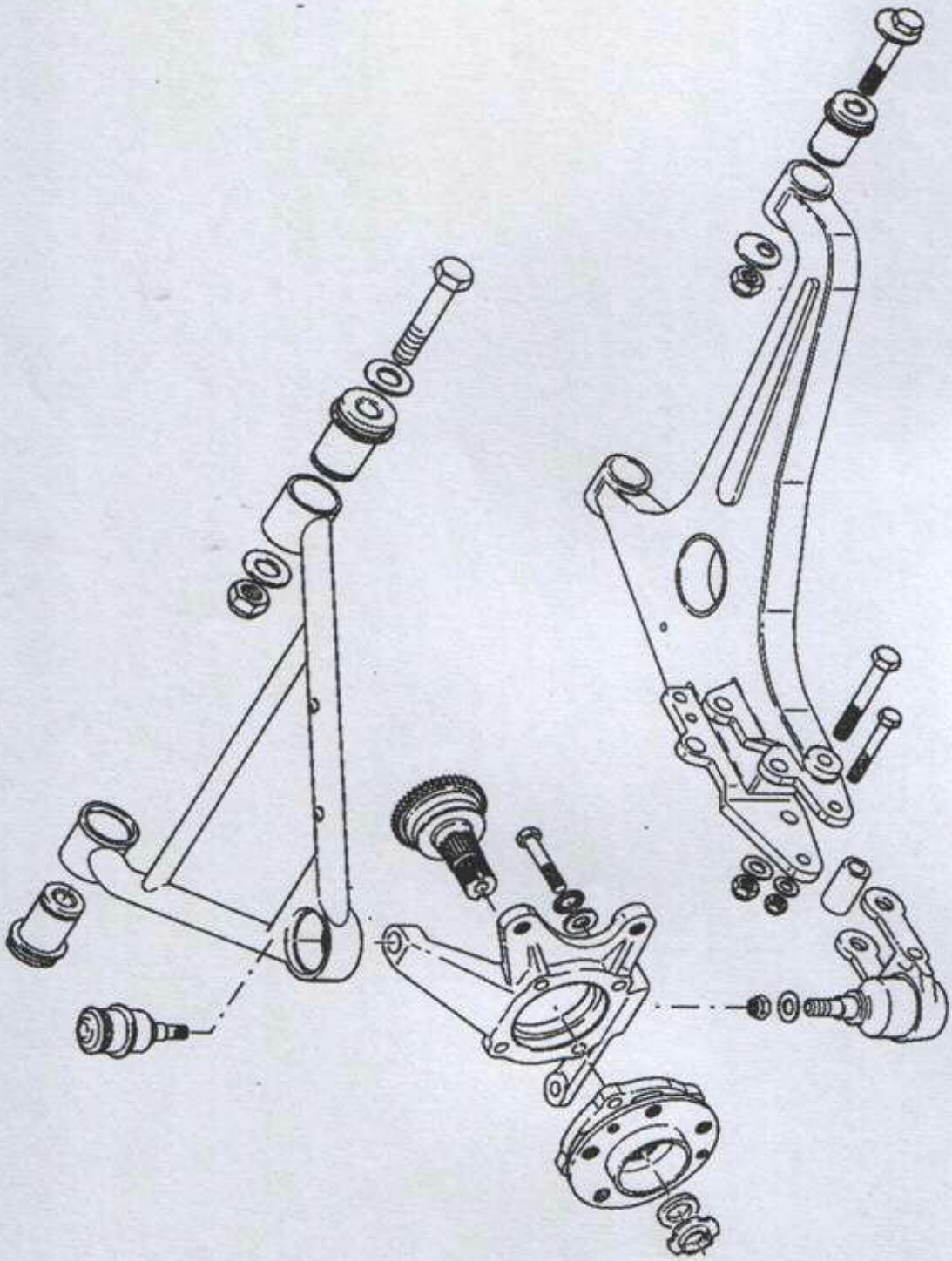
Specification	API GL5 Mobil SHC 80W-140ID or SHC 80W-140 Castrol SAF-XJ
Capacity	1.6 litres

Differential Specialist Notes



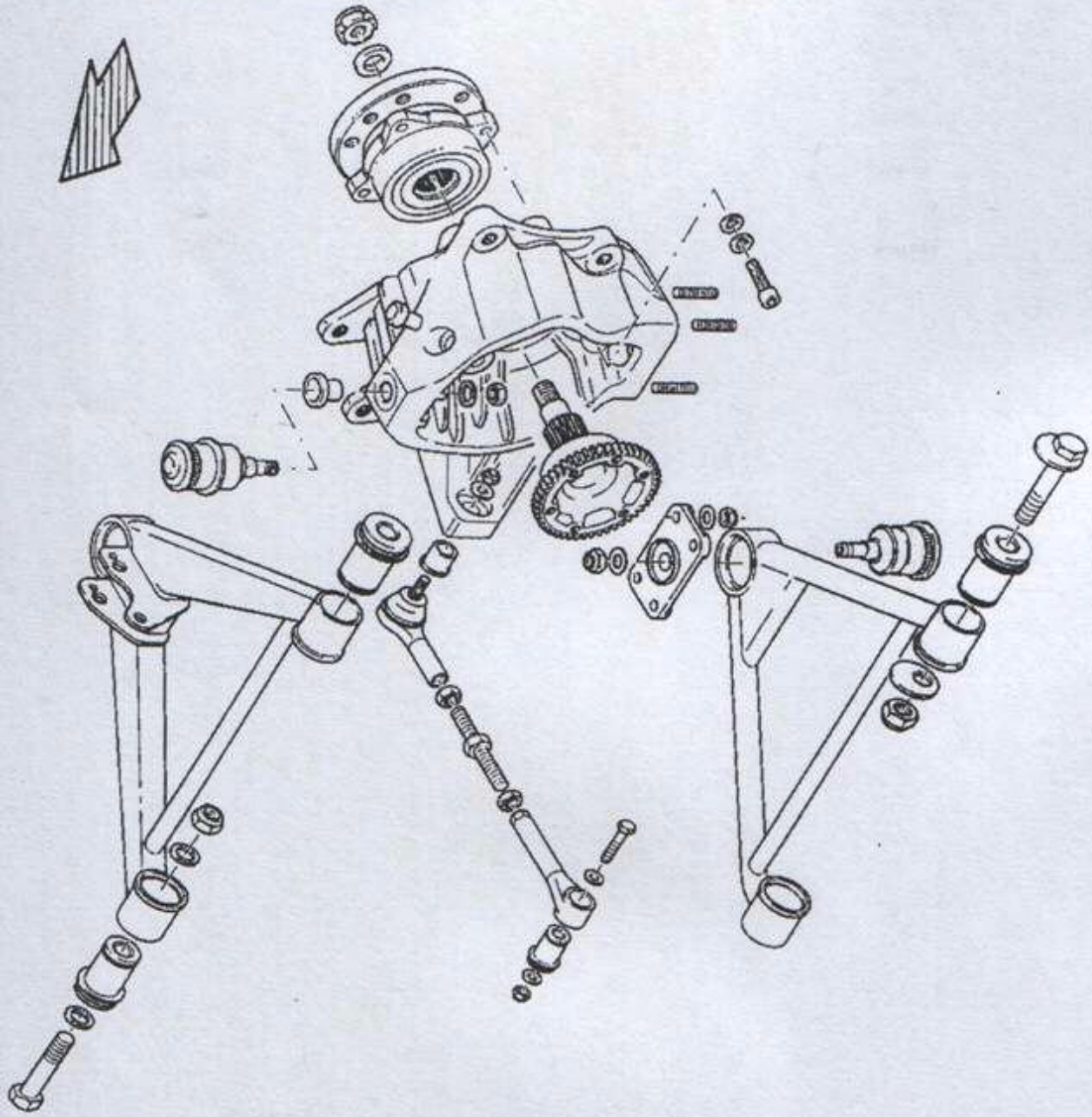
Notes Page

Front Suspension



Notes Page

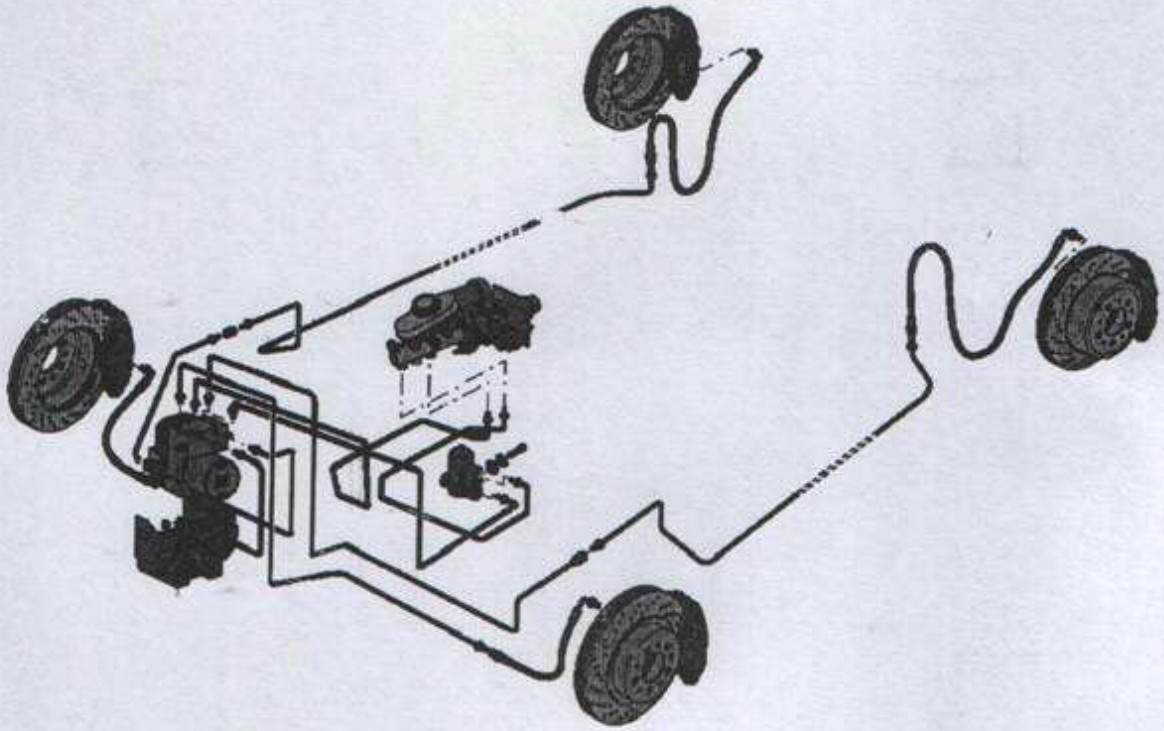
Rear Suspension Specialist Notes



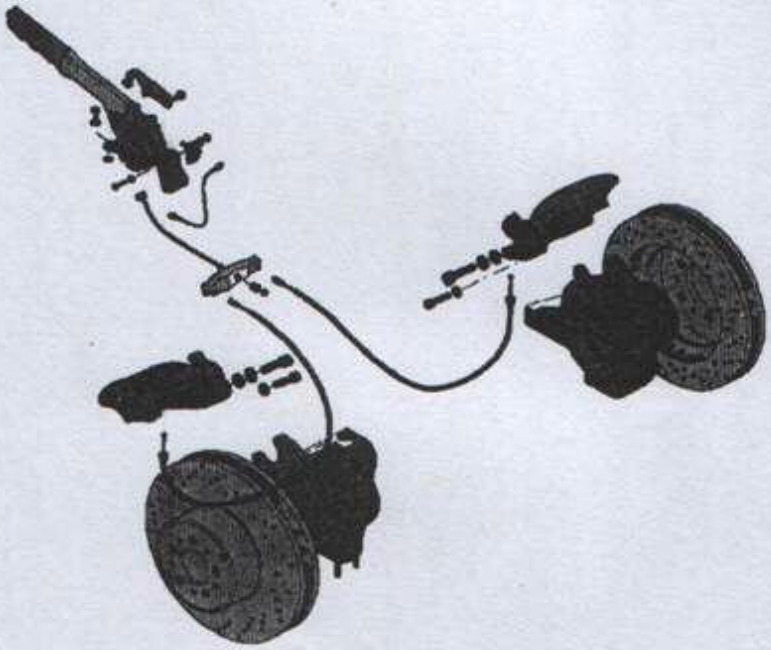
Notes Page

Braking Systems

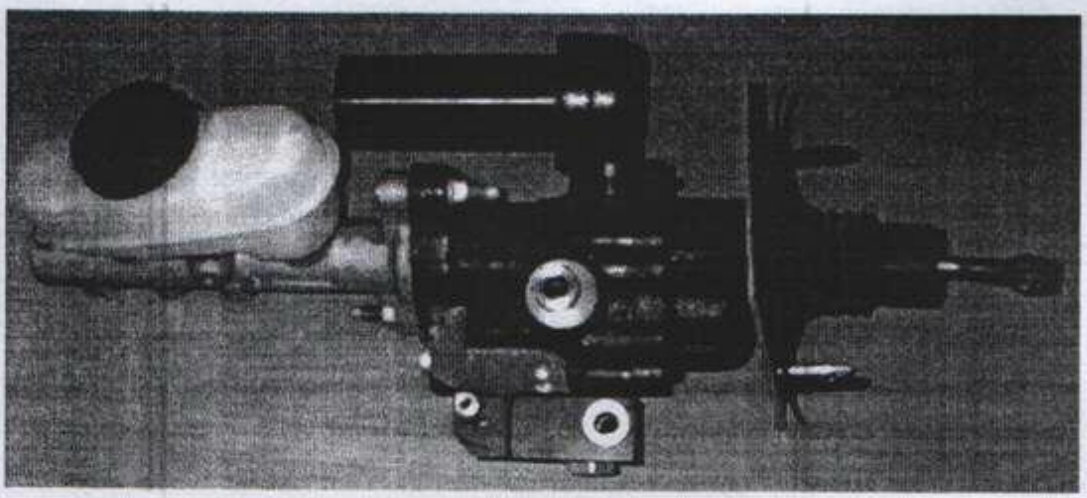
Footbrake Layout

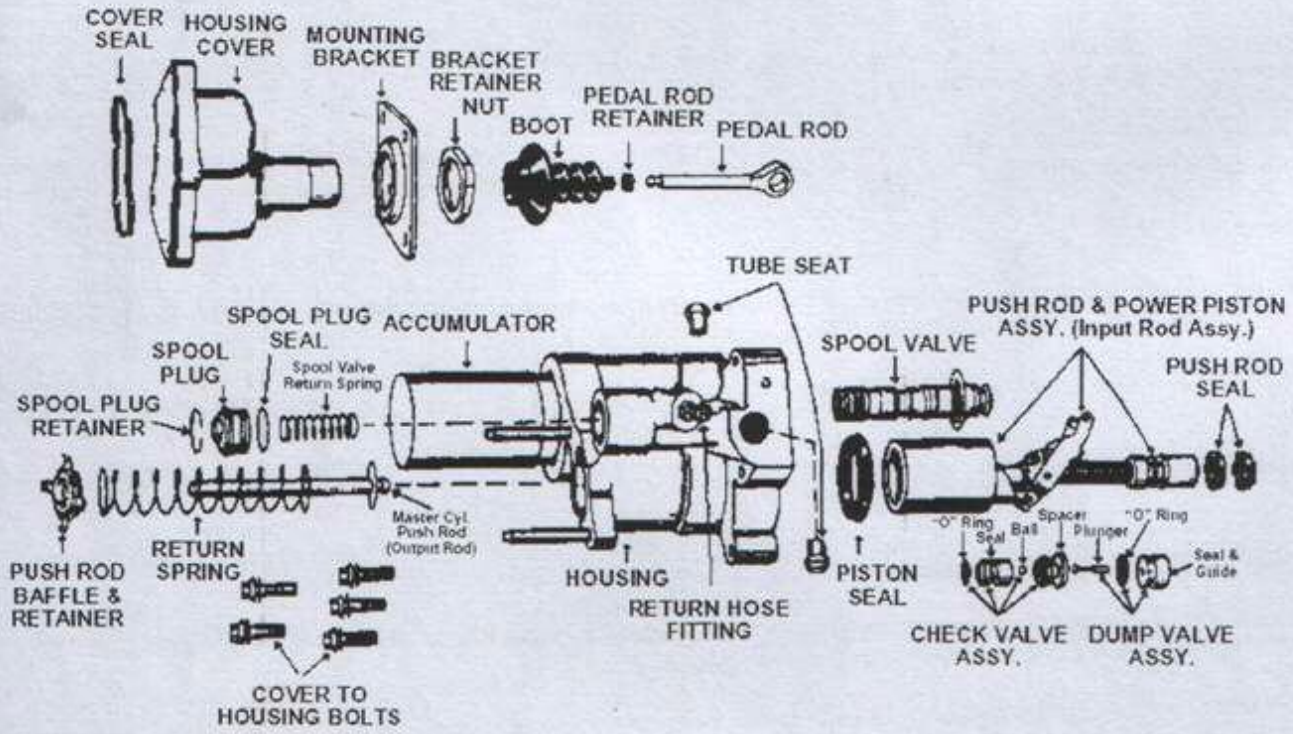


Handbrake Layout



Hydro-Boost Braking System





Invented by Bendix, the hydro-boost system offers many advantages over the vacuum boost assisted systems.

Its compact size has solved some of the design challenges of downsized vehicles, vans and sports vehicles.

The system does not utilize a vacuum source, which makes the use of the system favorable to diesel powered vehicles or turbo-charged applications.

Its boost to the braking system is much higher than that of a vacuum assisted system, so it has a definite advantage when fitted to special applications, such as vehicles fitted with four wheel disc brakes.

The braking system is basically the same, except it is a hydraulic boosted system, instead of a vacuum boost assist.
The system utilizes the power steering pump as a source of pressure to operate the booster.

The master cylinder is fitted to the output rod of the booster.

The three systems that basically make up the hydro-boost system are the applied, release and the reserve system.

Their purpose is as follows:

Applied

When the brake pedal is depressed, the pedal moves the pedal rod and spool valve.

The fluid return to the power steering pump is restricted, forcing fluid into the boost chamber from the pressure port.

An increase in the valve movement restricts fluid flow between the power steering pump and the power steering gear.

The increase of fluid pressure in the boost chamber forces the piston forward, engaging the piston in the master cylinder, applying the brakes.

If power steering assist is required during the braking mode, the power steering pump pressure will rise and the spool valve will shift open, directing an increase in fluid flow to the power steering gear.

Released

When the brake pedal is released, the return spring in the spool valve pushes the valve to its normal released position. The fluid pressure is prevented from entering the boost chamber.

The boost chamber is vented through the spool valve to the pump return port and back to the power steering pump.

Reserve

As a safety system in case of a loss of power steering pump pressure, the system incorporates a reserve system allowing 2-3 brake applications with power assist.

The reserve system consists of a charging valve, accumulator valve and a spring-loaded accumulator. The charging valve incorporates an orifice and a check valve.

Fluid from the power steering pump passes through the orifice in the valve, unseats the ball check valve and enters the accumulator.

The check valve prevents a reversal of the fluid flow. The accumulator valve is a poppet type valve, held closed by the accumulator pressure. If there is no pressure available from the power steering pump, an actuator on the spool valve sleeve opens the accumulator valve.

Fluid pressure can also enter the accumulator from the boost chamber through the accumulator valve, when the boost chamber pressure exceeds the accumulator pressure.

A pressure relief valve vents the accumulator to the pump return port when the pressure in the accumulator exceeds 1600 psi.

Caution:
Even though the engine may not be running, the system can still contain excessive pressure in the accumulator.

The accumulator pressure must be bled off prior to opening the hydraulic system.

This is accomplished by pumping the brake pedal with the engine off.

When replacing a hydro-boost it is strongly recommended that drilling a 1/16 inch hole in the end of the accumulator prior to disposal.

This procedure will release the nitrogen gas; so make certain you wear safety glasses.

When handling a hydro-boost, it should not be carried by the accumulator and definitely not dropped on it.

Do not expose the unit to excessive heat.

The hydro-boost noises may or may not be accompanied by other brake performance symptoms. When they are accompanied by other symptoms, further attention to the system will be necessary.

Troubleshooting Tips

Certain noises will be associated with the operation of the hydro-boost and there is nothing that can be done to prevent them. Identifying the difference between normal and abnormal noises and explaining that to the customer can be a challenge.

Operating noises such as hissing, clunking and clattering are considered normal hydro-boost noises that can occur when the braking system is applied in a manner not associated with everyday driving and braking conditions.

For example, the hydro-boost will emit normal hissing sounds when above-normal brake pedal pressures are applied. This would include pedal effort in the 40 lb. range and higher. The noises are especially noticeable when the brakes are applied in this pressure range with the vehicle not in motion, and the system's operating temperature at an increased level.

Quick releases of the brake pedal with applied pedal pressures in the range of 50-100 lbs. may exhibit clicking, clunking or clattering noises should be considered a normal characteristic. Hissing sounds at or below a pedal pressure range of 20-25 lbs. should be explored.

Caution:
Do not keep the brakes in the applied position with a pedal force of 100 lbs. for longer than 5 seconds at a time.

Chatter and Pedal Vibration

- Check power steering belt tension
- Check power steering fluid level
- System contamination
- Defective hydro-boost

Brakes Grab

- Check power steering belt tension
- Flush power steering system while pumping brakes
- Defective hydro-boost

Noise

- Low power steering fluid level
- Aerated fluid
- Internal restriction
- Check power steering belt tension

No Reserve Assist

- No reserve assist indicates accumulator leakage

Excessive Pedal Effort

- Check power steering belt tension
- Check power steering fluid level
- Defective hydro-boost
- Internal restriction
- Low power steering pump pressure

Slow Pedal Return

- Check for restriction in return line between hydro-boost and pump reservoir
- Incorrectly connected return line
- Defective hydro-boost
- Binding in linkage

Brakes Self-Apply

- Return line not connected properly
- Restriction in return line, or kink in hose between booster and pump
- Defective hydro-boost

The brakes can also be applied manually if the reserve system is depleted.

Any leakage goes directly back to the power steering pump reservoir.

Hydro-Boost Unit

Removal

Warning:

The power brake booster must never be carried by the accumulator and should never be dropped on the accumulator.

Check the snap ring on the accumulator for correct seating before the power brake booster is used. The accumulator contains high-pressure nitrogen gas and can be dangerous if mishandled.

Warning:

If the accumulator is to be disposed of, it must not be exposed to excessive heat.

Before discarding the accumulator, drill a 1.6-mm (1/16-inch) diameter hole in the end of the accumulator can to relieve the gas pressure.

Always wear safety glasses when performing this operation.

1. With the engine off, depress the brake pedal several times to discharge the accumulator.
2. Disconnect the battery ground cable.
3. Disconnect the fluid level sensor connector.
4. Disconnect the brake tubes.
5. Disconnect the power steering return line hose.
6. Disconnect the power steering pressure lines.
7. Remove the self-locking pin.
8. Remove the stoplight switch and the brake booster push rod from the brake pedal pin.
9. Remove the power brake booster nuts.
10. Remove the power brake booster nut.
11. Remove the booster.

Installation

1. Follow the removal procedure in reverse order.
2. Install new Teflon® seals on the power steering pressure fittings.
3. Bleed Hydro-Boost.

Hydro-Boost Bleeding

Note:

The Hydro-Boost power brake booster is generally self-bleeding, and the following procedure will normally bleed the air from the power brake booster.

Normal operation of the vehicle will further remove any additional trapped air.

1. Fill the power steering oil reservoir.
2. Remove the Powertrain Control Module (PCM) fuse to prevent the engine from starting.
3. Crank the engine for several seconds.
4. Check the fluid level in the power steering oil reservoir and add if necessary. Install the Powertrain Control Module (PCM) fuse.
5. Start the engine.
6. With the engine running, turn the steering wheel from stop to stop twice.
7. Switch off engine.
8. Operate the brake pedal several times to discharge the accumulator.
9. Repeat steps 5 and 6.

If foaming occurs, stop the engine and allow the foam to dissipate and repeat steps 5 and 6 as required, until all the air is removed from the system (when the foaming stops).

Master Cylinder Priming

Warning:

Brake fluid contains polyglycol ethers and polyglycols.

Avoid contact with eyes. If brake fluid contacts eyes, flush eyes with running water for 15 minutes.

Wash hands thoroughly after skin contact.

Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

Caution:

Do not allow the brake master cylinder reservoir to run dry during the bleeding operation.

Keep the brake master cylinder reservoir filled with the specified brake fluid.

Never reuse the brake fluid that has been drained from the hydraulic system.

Caution:

Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

Note:

When any part of the hydraulic system has been disconnected for repair or installation of new components, air can enter the system and cause spongy brake pedal action.

This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

Caution:

Use only bleed screws on the engine side of the brake master cylinder.

The hydro-boost bleed screw, located near the dash on the hydro-booster casting, is for the booster cavity filled with power steering fluid, not brake fluid.

1. Connect a clear waste line to the bleed screw closet to the booster first and the other end in a container partially filled with recommended brake fluid.

2. Open the bleed screw, have an assistant push the brake pedal down slowly through full travel, close the bleed screw, then return brake pedal slowly to full released position. Wait five seconds, and repeat operation until air bubbles cease to appear.

3. Repeat Step 2 for bleed screw farthest from hydro-booster.

Anti-Lock Brake System Hydraulic Control Unit (HCU) Bleeding

Note:

This procedure only needs to be performed if the anti-lock brake hydraulic control unit (HCU) has been installed new or if the HCU lines have been opened.

Clean all dirt from and remove the brake master cylinder filler cap, and fill the brake master cylinder reservoir with the specified brake fluid.

1. Connect a clear waste line to the RH rear bleeder screw and the other end in a container partially filled with recommended brake fluid.
2. Loosen the RH rear bleed screw until a stream of brake fluid comes out. Whilst the assistant maintains pressure on the brake pedal, tighten the RH rear bleed screw.
3. Repeat until clear, bubble-free fluid comes out.
4. Refill the brake master cylinder reservoir as necessary.
5. Tighten the RH rear bleed screw, and disconnect the waste line.
6. Repeat Steps 1, 2 and 3 for the LH rear bleed screw, the RH front disc brake caliper bleed screw, and the LH front disc brake caliper bleed screw.
7. Connect the scan tool DCL cable adapter into the vehicle data link connector (DLC) under the dash, and follow the scan tool instructions.
8. Repeat the system bleed procedure as outlined in Steps 2 through 6.

Caliper Bleeding

Note:

It is not necessary to do a complete brake system bleed if only the disc brake caliper was disconnected.

1. Attach a rubber drain tube to the disc brake caliper bleeder screw, and submerge the free end of the tube in a container partially filled with clean brake fluid.
2. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.
3. Loosen the disc brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the disc brake caliper bleeder screw.
4. Repeat until clear, bubble-free fluid comes out.
5. Refill the brake master cylinder reservoir as necessary.
6. Tighten the disc brake caliper bleeder screw. Refer to Specifications.

Handbrake

The parking brake system is an auto-adjust system. The spring in the parking brake control continuously adjusts the cable tension in the system.

Handbrake Cable Tension Release

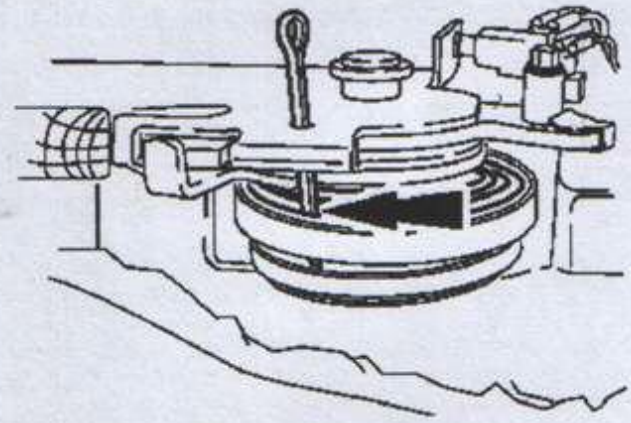
Caution:
If any component in the parking brake system requires repair the cable tension must be released.

Place the parking brake lever in the released position.

Remove the console.

Pull the parking brake cable and equalizer rearward compressing the lever spring.

Insert a steel pin through hole in the lever to the ratchet wheel.



Caution:
Do not remove the steel pin until the parking brake cable and equalizer/rear cable and conduits are connected to the parking brake lever.

Pin removal releases the tension in the ratchet wheel causing the spring to unwind and release tension.

Anti Lock Brakes Principles of Operation

The anti-lock brake control module receives wheel speed readings from each anti-lock brake sensor and processes this information to determine if an ABS event is necessary.

The anti-lock brake sensor electrically senses each tooth of the anti-lock brake sensor indicators as it passes through the anti-lock brake sensor's magnetic field.

The anti-lock brake control module continuously monitors and compares the rotational speed of each wheel and, when it detects an impending wheel lock, modulates brake pressure to the appropriate brake caliper.

This is accomplished by triggering the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel returns to normal speed, the anti-lock brake control module returns the solenoid valves to their normal position, and normal (base) braking resumes.

The anti-lock brake control module is self-monitoring.

When the ignition switch is turned to the RUN position, the anti-lock brake control module will do a preliminary electrical check, and at approximately 12 km/h (8 mph) the pump motor is turned on for approximately one half-second.

During all phases of operation the anti-lock brake control module (after the vehicle is in motion) checks for correct operation of the anti-lock brake sensors.

Any malfunction of the ABS will cause the ABS to shut off and ABS warning indicator to illuminate; normal power assisted braking, however, remains.

The ABS control module has the ability to store multiple DTCs in memory.

The traction control system controls wheelspin by modulating the engine torque. This is achieved by communicating to the powertrain control module (PCM) and by applying, then releasing, the appropriate brake to restore traction when one or both drive wheels lose traction and begin to spin during acceleration.

Depressing the traction control switch can disable the traction control system.

The traction control system will reset and return to normal traction assist when the ignition switch is cycled or when the traction control switch is depressed again.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical and electrical damage.
3. If the concern remains after the inspection, connect the scan tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the scan tool menu.
4. NO RESP/NOT EQUIP for the anti-lock brake control module, go to Pinpoint Test A.
5. SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the anti-lock brake control module.
6. If the DTCs retrieved are related to the concern, go to the Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index to continue diagnostics.
7. If no DTCs related to the concern are retrieved, proceed to Symptom Chart to continue diagnostics.

Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index

Note:

If a wheel speed signal fault or a pump motor fault is detected, the yellow ABS warning indicator cannot be reset with the key OFF and key ON method.

The vehicle must be driven over 12 km/h (8 mph) for the anti-lock brake control module to do a re-check of the system before the yellow ABS warning indicator is turned OFF.

DTC	Source	Description	Action
B1318	Battery voltage low	ABS/TC	Go to Pinpoint test C
B1342	ECU defective	ABS/TC	Install new ABS control module & repeat self test
B1484	Brake pedal input open circuit	ABS/TC	Go to Pinpoint test D
B1596	Repair continuous codes	ABS/TC	Repair the DTC's retreived
C1095	ABS hydraulic pump motor circuit failure	ABS/TC	Go to Pinpoint test E
C1145	RHF ABS sensor input circuit failure	ABS/TC	Go to Pinpoint test F
C1155	LHF ABS sensor input circuit failure	ABS/TC	Go to Pinpoint test F
C1165	RHR ABS sensor input circuit failure	ABS/TC	Go to Pinpoint test F
C1175	LHR ABS sensor input circuit failure	ABS/TC	Go to Pinpoint test F
C1222	Anti lock brake sensor mismatch	ABS/TC	Go to Pinpoint test G
C1233	LHF ABS sensor input signal missing	ABS/TC	Go to Pinpoint test H
C1234	RHF ABS sensor input signal missing	ABS/TC	Go to Pinpoint test H
C1235	RHR ABS sensor input signal missing	ABS/TC	Go to Pinpoint test H
C1236	LHR ABS sensor input signal missing	ABS/TC	Go to Pinpoint test H
C1266	ABS valve power relay circuit failure	ABS/TC	Install new ABS control module & repeat self test
C1805	Mismatched PCM or ABS control module	ABS/TC	Clear the DTCs. Retrieve ABS Control Module DTCs. If DTC C1805 is retrieved, check the PCM and ABS Control Module is for the correct vehicle. Install a new PCM or anti-lock brake control module as necessary. Clear the DTCs. Repeat the self-test.
U1009	SCP (J1850) invalid or missing data for engine torque	ABS/TC	Carry out PCM self test
U1027	SCP (J1850) invalid or missing data for engine speed (rpm)	ABS/TC	Carry out PCM self test
U1059	SCP (J1850) invalid or missing data for transmission	ABS/TC	Carry out PCM self test
U1083	SCP (J1850) invalid or missing data for engine systems	ABS/TC	Carry out PCM self test
U1262	SCP (J1850) Bus communications failure	ABS/TC	Check communication socket and wiring

Pinpoint Tests

Pinpoint Test A: No Communication With The Anti-Lock Brake Control Module

Check (LB/PK) for an open circuit

Measure the voltage between anti-lock brake control module C141 Pin 8, (LB/PK), harness side and ground.

Is the voltage greater than 10 volts?

No

Repair the circuit.

Repeat the self-test.

Yes

Check the anti-lock brake control module grounds

Measure the resistance between anti-lock brake control module C141 Pin 12, (BK), harness side and ground; and between anti-lock brake control module C141 Pin 15, (BK/WH), harness side and ground.

Are the resistances less than 5 ohms?

Yes

Install a new anti-lock brake control module.

Repeat the self-test.

No

Repair the circuit in question.

Repeat the self-test.

Pinpoint Test B: Unable To Enter Self-Test

Check the communications to the anti-lock brake control module.

Does the scan tool communicate with the anti-lock brake control module?

Yes

Install a new anti-lock brake control module.

Repeat the self-test.

No

Refer to Pinpoint test A

Pinpoint test C: DTC B1318, Battery Voltage Low

Check that battery is fully charged

Check the voltage to the anti-lock brake control module

Measure the voltage between anti-lock brake control module C141 pin 8, (LB/PK), harness side and ground.

Is the voltage greater than 10 volts?

No

Repair the circuit.

Clear the DTCs.

Repeat the self-test.

Yes

Check the anti-lock brake control module grounds

Measure the resistance between anti-lock brake control module C141 pin 12, (BK), harness side and ground and between anti-lock brake control module C141 pin 15, (BK/WH), harness side and ground.

Are the resistances less than 5 ohms?

Yes

Install a new anti-lock brake control module.

Repeat the self-test.

No

Repair the circuit in question.

Clear the DTCs.

Repeat the self-test.

Pinpoint Test D: DTC B1484, Brake Pedal Input Open Circuit

Check the stop lamps for correct operation

Operate the brake pedal while checking the stop lamps.

Do the stop lamps illuminate?

No

Check bulbs and switch operation

Yes

Measure the voltage between anti-lock brake control module C141 Pin 6 (LG), harness side and ground, while depressing and releasing the brake pedal.

Is the voltage greater than 10 volts with the brake pedal depressed and zero volts with the brake pedal released?

Yes

Install a new anti-lock brake control module;

Repeat the self-test.

No

Repair relevant circuits (LG) and (RD/LG) as necessary.

Clear the DTCs.

Repeat the self-test.

Pinpoint Test E: DTC C1095, ABS Hydraulic Pump Motor Failure

Check the pump motor for continuous operation.

Is the pump motor running continuously?

Yes

Install a new anti-lock brake control module;

Repeat the self-test.

No

Measure the voltage between anti-lock brake control module C141 pin 13, (YE/LG), harness side, and ground.

Is the voltage greater than 10 volts?

No

Repair the circuit.

Clear the DTCs.

Repeat the self-test.

Yes

Measure the resistance between anti-lock brake control module C141 pin 12, (BK), harness side and ground.

Is the resistance less than 5 ohms?

No

Repair the circuit. Clear the DTCs. Repeat the self-test.

Yes

Connect a 30 Amp fused heavy jumper wire between the positive battery post and pump motor connector pin 1 (component side); and momentarily connect a heavy jumper between negative battery post and pump motor connector pin 2 (component side).

Does the pump motor operate?

Yes

Install a new anti-lock brake control module;

Repeat the self-test.

No

Install a new Hydraulic Control Unit.

Clear the DTCs.
Repeat the self-test.

Pinpoint Test F: DTC C1145 (RHF), C1155 (LHF), C1165 (RHR), C1175 (LHR), Anti-Lock Brake Sensor Input Circuit Failure

Check the suspect anti-lock brake sensor circuit for short to power

Measure the voltage between anti-lock brake control module C141 Pins, harness side and ground as follows:

DTC Code	Module Pin Number	Wiring Colour
C1145 (RHF)	4	YE/RD
C1155 (LHF)	20	TN/OG
C1165 (RHR)	1	TN/LG
C1175 (LHR)	22	OG

Is any voltage present?

Yes

Repair the circuit in question.

Clear the DTCs.

Repeat the self-test.

No

Check the suspect anti-lock brake sensor circuit for short to ground

Measure the resistance between anti-lock brake control module C141 Pins, harness side and ground as follows:

DTC Code	Module Pin Number	Wiring Colour
C1145 (RHF)	4	YE/RD
C1155 (LHF)	20	TN/OG
C1165 (RHR)	1	TN/LG
C1175 (LHR)	22	OG

Is the resistance greater than 10,000 ohms?

Yes

Check the suspect anti-lock brake sensor circuit for an open circuit

Measure the resistance between anti-lock brake control module C141 Pins, harness side and suspect anti-lock brake sensor, harness side as follows:

DTC Code	ABS Modulator Pin No	ABS Sensor Pin No	Wiring Colour
C1145 (RHF)	4	1	YE/RD
C1145 (RHF)	5	2	YE/BK
C1155 (LHF)	20	1	TN/OG
C1155 (LHF)	21	2	TN/BK
C1165 (RHR)	1	2	TN/LG
C1165 (RHR)	3	1	BN
C1175 (LHR)	22	2	OG
C1175 (LHR)	23	1	GY/BK

Are the resistances less than 5 ohms?

Yes

Check the anti-lock brake sensor

Measure the resistance between suspect anti-lock brake sensor pin 1 (component side) and suspect anti-lock brake sensor pin 2 (component side).

Is the resistance between 1280 and 1920 (front) or 1830 and 2760 (rear) ohms?

Yes

Install a new anti-lock brake control module;

Repeat the self-test.

No

Install a new anti-lock brake sensor

Clear the DTC's.

Repeat the self-test.

No

Repair the circuit in question.

Clear the DTCs.

Repeat the self-test.

No

Check the suspect anti-lock brake sensor for a short to ground

Suspect anti-lock brake sensor

Measure the resistance between suspect anti-lock brake sensor Pin 1 (component side) and ground is the resistance greater than 10,000 ohms?

Yes

If RHF repair (YE/RD) and (YE/BK), wiring as necessary.

If LHF repair (TN/OG) and (TN/BK), wiring as necessary.

If RHR repair (TN/LG) and (BN), wiring as necessary.

If LHR repair (OG) and (GY/BK), wiring as necessary.

Clear the DTCs.

Repeat the self-test.

No

Install a new anti-lock brake sensor.

Pinpoint Test G: DTC C1222, Anti-Lock Brake Sensor Mismatch

Check the vehicle components

Check for correct wheel and tyre size, front-to-rear and side-to-side.

Check for excessive wheel bearing play.

Check the anti-lock brake sensor indicator for a bent sensor ring or missing teeth.

Are all the above OK?

No

Repair as necessary.

Clear the DTCs.

Repeat the self-test.

Yes

Clear the DTCs

Carry out road test ensuring the vehicle speed exceeds 24 km/h (15 mph).

Retrieve DTCs

Is DTC C1222 retrieved?

Yes

Install a new anti-lock brake control module.

Repeat the self-test.

No

If another DTC is retrieved, refer to the Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) index.

If no DTCs are retrieved, system is OK.

Pinpoint Test H: DTC C1233 (LHF), C1234 (RHF), C1235 (RHR), C1236 (LHR), Anti-Lock Brake Sensor Input Signal Missing

Check the suspect anti-lock brake sensor

Check the suspect anti-lock brake sensor mounting.

Check the suspect anti-lock brake sensor for excessive dirt build up, obstructions, and damage.

Is the suspect anti-lock brake sensor and mounting OK?

No

Repair as necessary.

Clear the DTCs.

Repeat the self-test.

Yes

Check the suspect anti-lock brake sensor indicator

Check the suspect anti-lock brake sensor indicator for corrosion, nicks, bridged teeth, damaged teeth, correct mounting, and alignment with the anti-lock brake sensor.

Check the air gap and bearing play.

Is the suspect anti-lock brake sensor indicator OK?

No

Install a new anti-lock brake sensor indicator.

Clear the DTCs.

Repeat the self-test.

Yes

Check the anti-lock brake sensor output

Clear the DTCs

Have an assistant monitor the anti-lock brake control module wheel speed input signals whilst driving at various speeds.

Note:

The vehicle must be driven 16 km (10 miles) during this test step.

Are the anti-lock brake control module speed input signals approximately the same at all times?

Yes

Install a new anti-lock brake control module.

Repeat the self-test.

No

Install a new anti-lock brake sensor.

Clear the DTCs.

Repeat the self-test.

Pinpoint Test I: The Yellow Abs Warning Indicator Does Not Self-Check

Check the abs warning indicator circuitry

Depress and release the shorting bar connector internal to the anti-lock brake control module C141, harness side, while checking the yellow ABS warning indicator in the instrument cluster.

Does the yellow ABS indicator illuminate with the shorting bar released and OFF with the shorting bar depressed?

Yes

Install a new anti-lock brake control module.

Test the system for normal operation.

No

Carry out instrument pack self test.

Pinpoint Test J: Spongy Brake Pedal With No Warning Indicator

Check the vehicle components

Check the brake pedal and power booster/brake master cylinder for correct attachment.

Are the components OK?

No

Repair as necessary.

Test the system for normal operation.

Yes

Bleed the brake system.

Check for spongy brake pedal.

Is the brake pedal spongy?

Yes

Install a new Hydraulic Control Unit.

Test the system for normal operation.

No

The brake system is OK.

Test the system for normal operation.

Pinpoint Test K: Poor Vehicle Stability During Anti-Lock Brake Operation

Bleed the brake system.

Road test vehicle for poor stability during anti lock brake operation.

Does the vehicle feel unstable?

No

The brake system is OK.

Test the system for normal operation.

Yes

Check the ABS valves operation

Lift the vehicle and rotate all the wheels to make sure they rotate freely (the vehicle must be in neutral).

Note:

Trigger must be depressed twice. Each depress runs the pump motor for two seconds.

Trigger the anti-lock brake control module active command PMP MOTOR ON for four seconds.

Apply moderate brake pedal effort.

Have an assistant attempt to rotate the LHF wheel while the pump motor is running.

Does the LHF wheel rotate?

Repeat for ALL wheels

Yes

Install a new HCU.

Test the system for normal operation.

No

Check the LHF ABS valve release

Apply moderate brake pedal effort.

Trigger the anti-lock brake control module active command LHF INLET and LHF OUTLET.

Note:

Trigger must be depressed twice. Each depress runs the pump motor for two seconds.

Have an assistant rotate the LF wheel immediately after depressing trigger.

Does the LHF wheel rotate?

Yes

Repeat for ALL wheels

No

Check for DTC's

Carry out the anti-lock brake control module self-test.

Are any DTCs retrieved?

Yes

Refer to the Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index.

No

Install a new HCU.

Test the system for normal operation.

Pinpoint Test L: The Traction Control is Inoperative or Does Not Operate Correctly

Check the traction control switch circuitry

Measure the voltage between instrument pack Pin 9 (GY), harness side and ground, while depressing and releasing the traction control switch.

Is the voltage greater than 10 volts with the traction control switch depressed and zero volts with the traction control switch released?

Yes

Install a new instrument cluster.

Test the system for normal operation.

No

Measure the resistance between instrument pack Pin 9 (GY), harness side and traction control switch Pin 4, (GY), harness side.

Is the resistance less than 5 ohms?

No

Repair the circuit.

Test the system for normal operation.

Yes

Measure the voltage between traction control switch Pin 3, (PK/BK), harness side and ground.

Is the voltage greater than 10 volts?

Yes

Install a new traction control switch.

Test the system for normal operation.

No

Repair the circuit.

Test the system for normal operation.

Pinpoint Test M: The Traction Control Indicator is Inoperative - Traction Control Switch

Measure the resistance between instrument pack Pin 8, (BK/LB), harness side and traction control switch Pin 5, (BK/LB), harness side; and between instrument pack Pin 8, (BK/LB), harness side and ground.

Is the resistance less than 5 ohms between the instrument pack and traction control switch and greater than 10,000 ohms between instrument cluster and ground?

No

Repair relevant wiring as necessary.

Yes

Measure the voltage between traction control switch Pin 3, (PK/BK), harness side and ground.

Is the voltage greater than 10 volts?

No

Repair the circuit.

Test the system for normal operation.

Yes

Check the traction control switch indicator

Momentarily connect a fused (10A) jumper wire between instrument cluster Pin 8, (BK/LB), harness side and ground, while observing the traction control switch indicator.

Does the traction control switch indicator illuminate?

Yes

Install a new instrument pack.

Test the system for normal operation.

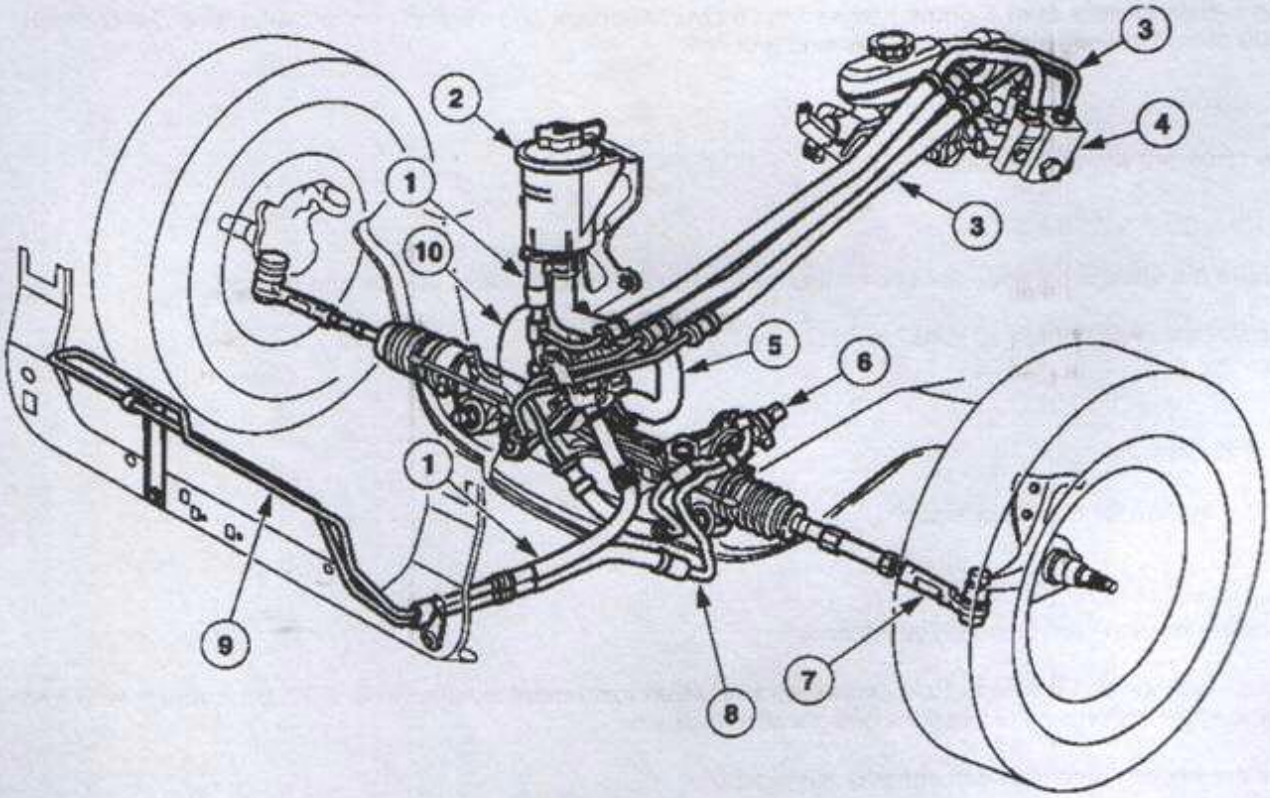
No

Install a new traction control switch.

Test the system for normal operation.

Steering System

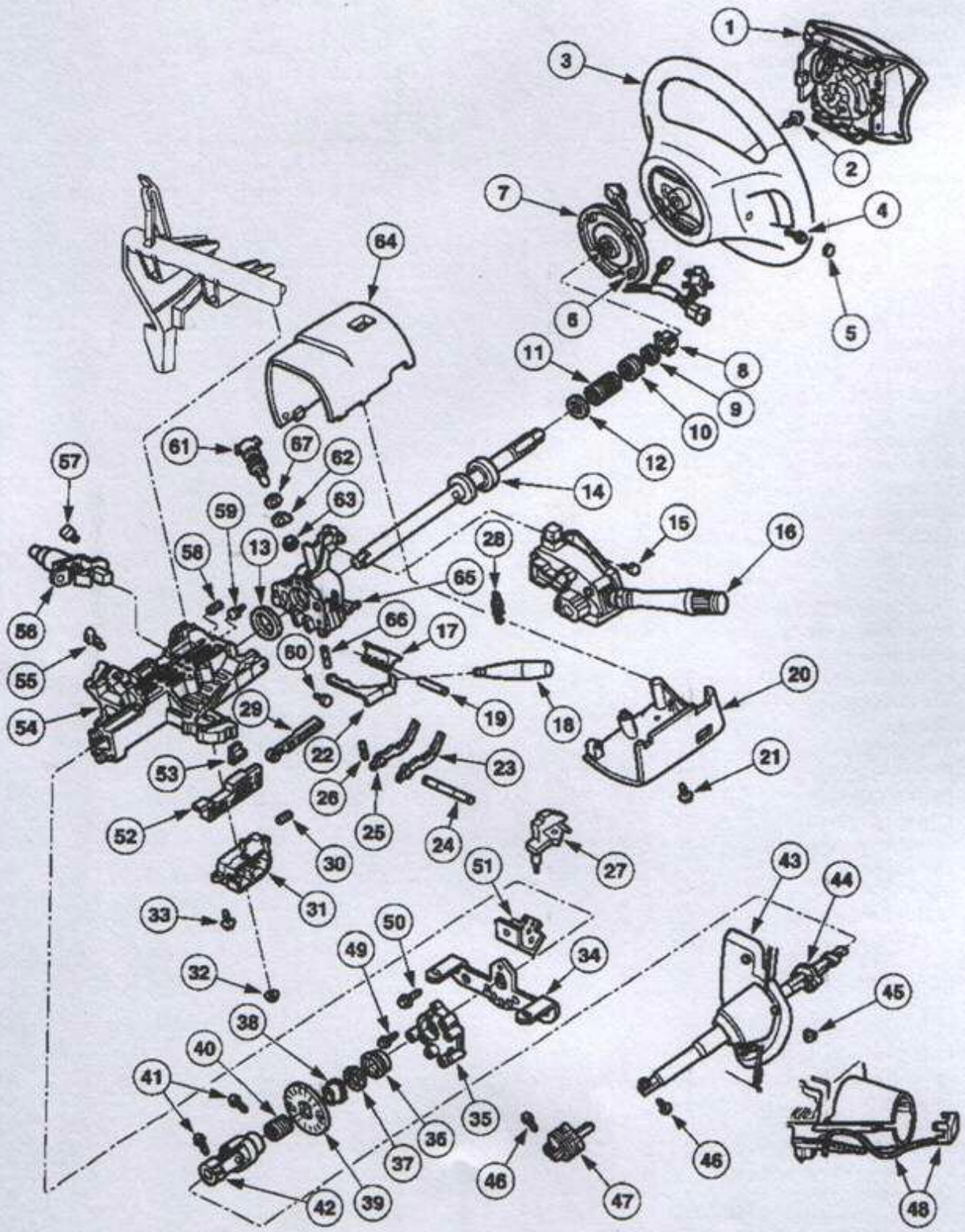
Layout



LHD shown RHD similar

1. Power steering return hose
2. Power steering pump reservoir
3. Power steering hose
4. Hydroboost unit
5. Power steering reservoir pump hose
6. Steering gear
7. Tie-rod end
8. Power steering return hose
9. Power steering fluid cooler
10. Power steering pump

Steering Column Components



1. Driver air bag module
2. Steering wheel bolt
3. Steering wheel
4. Air bag module retaining screws
5. Steering wheel spoke cover
6. Lock tabs
7. Clockspring
8. Turn indicator cancel cam
9. Snap ring
10. Bearing spring
11. Upper bearing sleeve
12. Upper bearing (small)
13. Lower bearing (large)
14. Shaft assembly
15. Screw
16. Multi-function switch
17. Lock cam
18. Tilt wheel handle
19. Lock cam pivot pin
20. Lower shroud
21. Shroud retaining screws
22. Release lever
23. Lock actuator lever (RH)
24. Lock actuator lever pin
25. Lock actuator lever (LH)
26. Lock lever spring
27. Wiring shield
28. Lock lever spring return
29. Lock lever upper actuator
30. Lock spring (shaft)
31. Ignition switch
32. Steering column mounting lower nuts
33. Screw
34. Mounting bracket
35. Bearing retaining
36. Bearing sleeve
37. Lower bearing
38. Lower bearing tolerance ring
39. Sensor ring
40. Bearing spring
41. Bolt Å flange yoke
42. Coupling
43. Tube boot
44. Intermediate shaft
45. Nut
46. Bolt
47. Intermediate shaft coupling
48. Ignition key warning switch terminal
49. Bearing housing retaining screw
50. Screw
51. Wire connector bracket
52. Lock lever lower actuator
53. Lock pawl
54. Actuator housing
55. Lock actuator cover
56. Ignition/shifter interlock cable
57. Screw
58. Position spring
59. Tilt flange bumper
60. Tilt pivot screws
61. Ignition switch lock cylinder
62. Lock housing bearing
63. Lock gear
64. Upper shroud
65. Lock cylinder housing
66. Lock actuator lever pin
67. Bearing retainer

The body of the steering column is made of magnesium die castings. The steering column is attached to a support that is an integral part of the instrument panel.

The lower attachments of the steering column are through a bracket that bends during collapse. The upper attachments are through plastic shear modules that separate from the main casting during collapse.

A clip and washer are attached to the shear modules to reduce steering column shake and to assist in installation of the steering column.

Note:

All fasteners are important because they can affect the performance of vital parts and systems. Incorrect installation of the fasteners can result in major repair expenses.

They must be installed new with fasteners of the same part number if installation becomes necessary. Do not install a new part of lesser quality or substitute a design.

Torque values must be used as specified during assembly to make sure these parts function correctly.

Power Assisted Steering Diagnosis

Inspection and Verification

Caution:
Do not hold the steering wheel at the stops for an extended amount of time. Damage to the power steering pump will result.

Note:

Make the following preliminary checks before repairing the steering system:

1. Verify the customer concern by operating the steering system.
2. Inspect tyres and tyre pressures
3. Verify that all tyres are sized to specification.
4. Check the tyres for damage or uneven wear.
5. Carry out power assisted steering belt and tensioner check
6. Fluid Level Check
   Verify that the power steering fluid level is within the appropriate indicated range.
7. Air Bleeding
   Verify that there is no air in the power steering system. Run the engine (6007) until it reaches normal operating temperature. Turn the steering wheel to the left and right several times without hitting the stops. If any air bubbles are present, refer to «Purging—CII Power Steering Pump» or «Purging—CIII Power Steering Pump» in this section.
8. External Leak Check
   With the ignition switch at OFF, wipe off the power steering pump, power steering hoses, power steering fluid cooler and steering gear.
   With the engine running, turn the steering wheel from stop-to-stop several times. Do not hold steering wheel at stops. Check for leaks. Repair as necessary if leaks are observed.
9. Turning Effort Check
   Refer to Turning Effort Test under Component Tests in this section.
10. Visually inspect for obvious signs of mechanical damage
11. If an obvious cause for an observed or reported malfunction is found, correct the cause (if possible) before proceeding to the next step.
12. If the fault is not visually evident, determine the symptom and proceed to the following symptom chart.

Steering System Symptom Definitions

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.

Drift/pull may be induced by conditions external to the vehicle (i.e., wind, road camber).

Excessive Steering Wheel Play

Excessive steering wheel play is a condition in which there is too much steering wheel movement before the wheels move. A small amount of steering wheel free play is considered normal.

Feedback

Feedback is a roughness felt in the steering wheel when the vehicle is driven over rough pavement.

Hard Steering or Lack of Assist

Hard steering or lack of assist is experienced when the steering wheel effort exceeds specifications. Hard steering can remain constant through the full turn or occur near the end of a turn. It is important to know the difference between hard steering/lack of assist and binding.

Hard steering or lack of assist can result from either hydraulic or mechanical conditions. It is extremely important to know if this concern occurs during driving, during very heavy or static parking manoeuvres.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tyre interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel.

Poor Self Centre/Sticky Steering

Poor self centre and sticky steering is used to describe the poor return of the steering wheel to centre after a turn or the steering correction is completed.

Shimmy

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tyre/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph), and can begin or be amplified when the tyre contacts pot holes or irregularities in the road surface.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Component Tests

Steering Linkage

1. With the parking brake applied, perform the following:
2. Have an assistant rotate the steering wheel back and forth 360 degrees and watch for relative motion of the ball joints in the tie-rod end ball sockets.
3. Watch for loose steering gear mounting.
4. Another method is to raise the front wheels off the ground, grasp the wheel at the front and rear and watch for excessive play or binding in the joints while trying to steer the wheels.
5. Install new steering components as necessary.

Turning Effort Test

Note:
Make sure that the front wheels are properly aligned and the tyre pressure is correct before checking the effort.

1. Park the vehicle on dry concrete and set the parking brake.
2. Insert a thermometer into the power steering pump reservoir.

Caution:
Do not hold the steering wheel against the stops for more than three to five seconds at a time. Damage to the power steering pump will occur.

3. Idle the engine for two to three minutes. Turn the steering wheel from stop-to-stop several times to warm the fluid to 50-60°C (122-140°F).
4. With the engine running, attach a spring scale to the rim of the steering wheel.
5. Measure the pull required to turn the steering wheel one complete revolution in each direction. The reading should not exceed 2.27 kg (5lbs)

Pump Flow and Pressure Test

Warning:
Do not touch the flowmeter during the test procedure, or severe burns and serious injury may occur.

Caution:
Make sure that the connection point will not interfere with any of the engine accessory drive components or drive belts.

1. Install a power assisted pressure test kit at the high pressure port of the power steering pump. Make sure the gate valve is fully open.
2. On some vehicles, the power steering pump high pressure port is inaccessible and the special tool should then be installed either at the steering gear or at a point in the high pressure line between the power steering pump and the steering gear.
3. Place a dial thermometer in the power steering pump reservoir.
4. Check the power steering fluid level. If necessary, add power steering fluid.

5. Install a digital tachometer.

Caution:
Do not hold the steering wheel against the stops for more than three to five seconds at a time. Damage to the power steering pump will occur.

6. Start the engine. Place the transmission in neutral. Set the parking brake. Raise the power steering fluid temperature to 74-80°C (165-175°F) by rotating the steering wheel fully to the left and right several times.

7. Set the engine speed to 1500 rpm. Record the flow rate and pressure readings.

8. If the flow rate is below the flow rate specification, a new power steering pump may need to be installed. Continue with the test procedure.

9. If the pressure reading is above the maximum pressure specification, then check power steering hoses for kinks and restrictions.

10. Partially close the gate valve to obtain 750 psi. Set the engine speed at idle. Record the flow rate.

11. If the flow is less than the specified flow rate, then install a new power steering pump.

Caution:
Do not allow the gate valve to remain closed for more than 5 seconds.

12. Completely close and partially open the gate valve 3 times. Record the pressure relief valve actuation pressure reading.

13. If the pressure does not meet the relief pressure specification, install a new power steering pump.

14. Set engine speed to 1500 rpm. Record the flow rate.

15. If the flow rate varies more than 3.785 liters/minute (1 gallon/minute) from the initial flow rate reading, install a new power steering pump.

Caution:
Do not hold the steering wheel against the stops for more than three to five seconds at a time. Damage to the power steering pump will occur.

16. Set the engine speed at idle. Turn (or have an assistant turn) the steering wheel to the left and right stops. Record flow rate and pressure readings at the stops.

17. The pressure reading at both stops should be nearly the same as the maximum pump relief pressure.

18. The flow rate should drop below 1.9 litres/minute (0.5 gallons/minute).

19. If the pressure does not reach the maximum pump relief pressure or the flow rate does not drop below the specified value, excessive internal leakage is occurring. Install a new steering gear as necessary.

20. Turn (or have an assistant turn) the steering wheel slightly in both directions and release quickly while watching the pressure gauge.

21. The pressure reading should move from the normal back pressure reading and snap back as the steering wheel is released.

22. If the pressure returns slowly or sticks, the rotary valve in the steering gear is sticking or the steering column is binding. Check the steering column and linkages before servicing the steering gear.

Tie-Rod Articulation Torque

Note:
This check may be done with the steering gear on or off the vehicle.

1. Disconnect the tie-rod end from the front hub assembly.
2. Move the tie-rod back and forth three times.
3. Hook the spring balance gauge over the track rod end or the threaded portion of the front wheel tie-rod and measure the force required to move the front wheel tie-rod. The reading should be between 1 to 4.5 kg (2 – 10 lbs) after initial breakaway.
4. If the force required to move the front wheel tie-rod does not meet the specifications, install a new front wheel tie-rod.

Steering Gear Valve

1. With the vehicle in motion, place the transmission in NEUTRAL and turn the engine OFF.
2. If the vehicle does not pull with the engine OFF, install a new steering gear.
3. If the vehicle pulls with the engine OFF, cross-switch the front wheels.
4. If the vehicle pulls to the opposite side, cross-switch the front and rear wheels on the same side.
5. If the vehicle pull direction does not change, check the front suspension components, wheel alignment and frame alignment.