

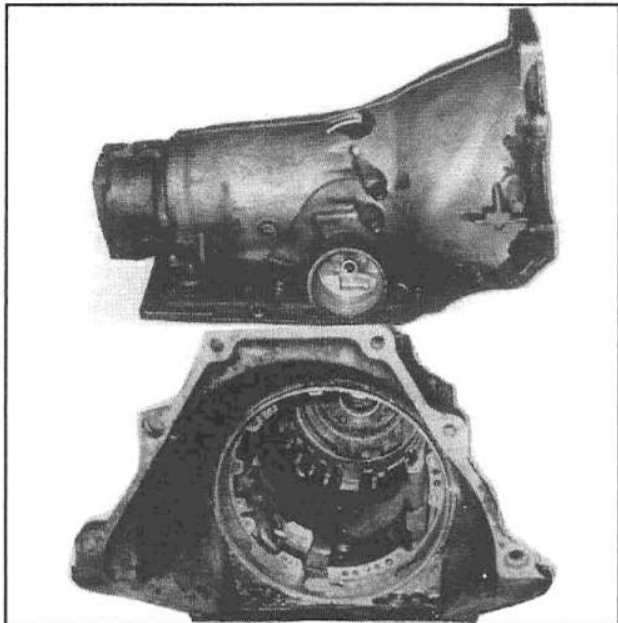
AUTOMATIC TRANSMISSION

Subject	Page	Subject	Page
MAINTENANCE	230	Control Valve Body & Accumulator Assembly	237
Transmission Fluid Check, Drain and Refill	230	Remove	237
Oil Cooler Flushing Procedure	231	Dismantle, Clean and Inspect	237
Oil Cooler (in Radiator) Replacement	232	Assemble	237
Power Control Modul	232	2-4 Servo	238
Down and Up Shift	232	Remove	238
Electrical Components	232	Install	238
Gear Shift Linkage	233	Transmission	239
Remove and Replace	233	Remove	239
Remove	233	Install	239
Install	233		
Speedometer Sender Unit	233	PROBLEM SOLVING & DIAGNOSIS	240
Remove	233	Preliminary Checks	240
Install	233	Fluid Level Check	240
Rear Extension	234	Fluid Leakage Checks	240
Remove	234	Fluid Leakage Conventor Area	241
Install	234	Manual Linkage Check	241
Extension Housing Seal	234	Transmission Operation Checks	242
Remove	234	Test Preparation	242
Install	234	Control Pressure Tests	242
Transmission Sump (Oil Pan)	234	Stall Tests	242
Remove	234	Road Test Procedures	243
Install	234		
MAJOR REPAIRS AND REBUILD	235	SPECIFICATIONS	243
1-2 Accumulator Assembly	235	TORQUE WRENCH SPECIFICATIONS	244
Remove	235		
Install	235		

AUTOMATIC TRANSMISSION

VR and VS commodores use a Hydra-Matic 4L60 Automatic Transmission. Which is a 4 speed including an over drive gear plus reverse transmission.

Transmissions changes are electronically controlled by the Powertrain Control Modul (PCM) which adjusts line pressure to alter shift speed according to engine speed.



A metal identification plate is attached to the transmission as shown in the above illustration.

The VR model codes are:

V6 Vehicles 4HDM
V8 Vehicles 4HBM

MAINTENANCE

Transmission Fluid Check, Drain and Refill

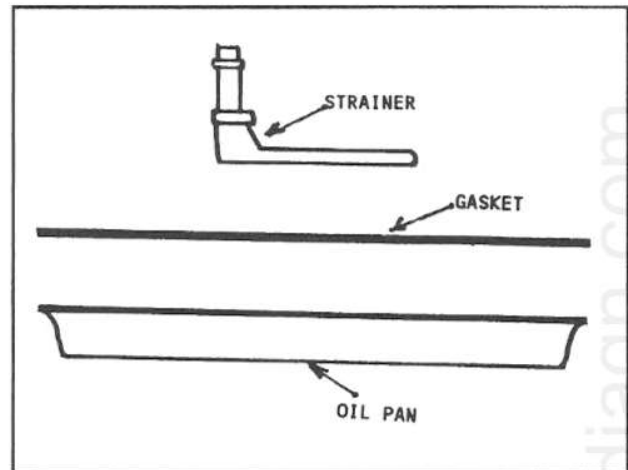
Normal maintenance and lubrication requirements do not necessitate period automatic transmission fluid changes. If a major failure, such as a clutch, band, bearing, etc. has occurred, the transmission will have to be removed for repair and the converter replaced.

Automatic transmission fluid is red coloured when new, after use it turns a light brown. Remove the fluid dipstick to check the colour, if the colour is a dark brown and has a burnt type of odour, the fluid should be drained and refilled with new fluid.

When filling a dry transmission and converter, V6 install 4.8 litres; V8 install 5.0 litres of fluid. Start the engine, shift the selector lever as in Step 5 below, and check and add fluid as required.

Following is the procedure for partial drain and refill due to minor repairs.

1. Place a drain pan under transmission. Loosen and remove the screws at rear of the oil pan. Loosen remaining screws and allow fluid to drain. Remove and clean oil pan and screen, dispose of oil pan gasket.



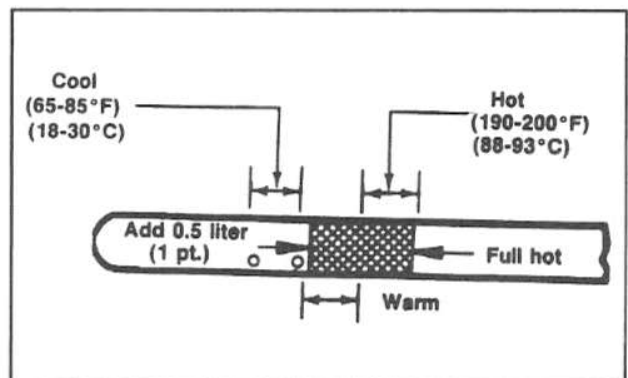
2. Position a new gasket on the oil pan, and install the screen and pan on transmission.

3. Add 3.5 litres of fluid to the transmission through filler tube.

4. Run engine at idle speed until it reaches its normal operating temperature. Do not race the engine.

5. Shift selector lever through all positions then place the lever in 'P'.

6. Switch off engine. Immediately insert the dipstick all the way into the filler tube then withdraw it and check the



AUTOMATIC TRANSMISSION

Page 231

fluid level. This procedure must be completed within 10 seconds of engine switch off.

If required, add fluid to the transmission through the filler tube to raise fluid level to the 'F' (full) mark on the dipstick.

Repeat operations 3 & 4 to recheck fluid level.

Don't Overfill the Transmission.

Incorrect transmission fluid level can have the following effects, although they may be attributable to other malfunctions:-

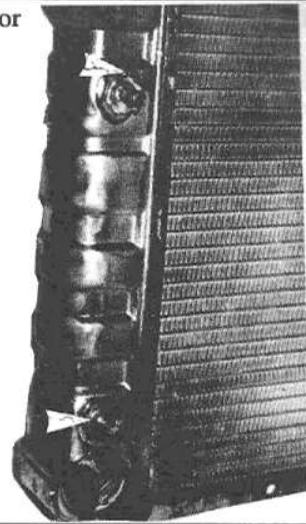
- No drive in "D", "1", "2", "D(overdrive)" or "R".
- Slip and squawk or shudder on full throttle starts in "D", "1", "2" "D(overdrive)" or "R".
- Overheating due to high fluid level during sustained high speeds.

Oil Cooler Flushing Procedure

When a clutch or band failure or other internal trouble has occurred in the transmission, any metal particles or clutch plate or band material that may have been carried into the cooler should be removed from the system by flushing the cooler and lines before the transmission is put back into service. In no case should an automatic transmission having a clutch or band failure or other internal trouble resulting in fluid contamination, be put back into service without first flushing the transmission oil cooler.

1. After installing a new or rebuilt automatic transmission and converter assembly in the vehicle. Do not Con-

Cooler in Radiator



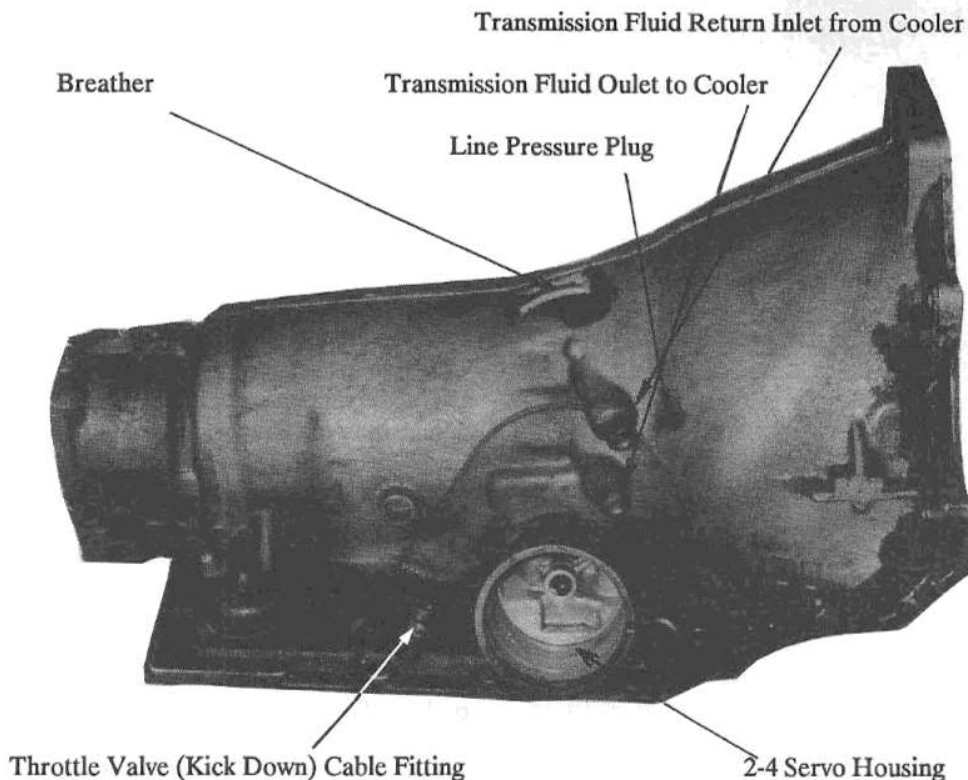
nect Cooler Return Line to the Transmission. Position transmission selector lever in the P (park) position and connect cooler inlet (converter out) line to the transmission. Place a pan under the end of the cooler return line that will hold transmission fluid. Do Not Start the Engine.

2. Install an additional 2 litres more than is required (from specifications) of automatic transmission fluid.

3. Start engine and allow it to run at normal idle speed with the selector lever in P, park position.

4. Allow approx. two litres of transmission fluid to drain into the pan placed under the end of the cooler return line.

Automatic Transmission



5. If fluid does not run clean after draining two litres of it through the cooler, turn off engine and add two additional litres of transmission fluid.

6. Repeat Step 3 to 5 until the transmission fluid flowing out of the cooler return line is clean.

7. If there is no fluid flow or the fluid does not flow freely, turn off the engine and detach both cooler lines from the transmission and cooler.

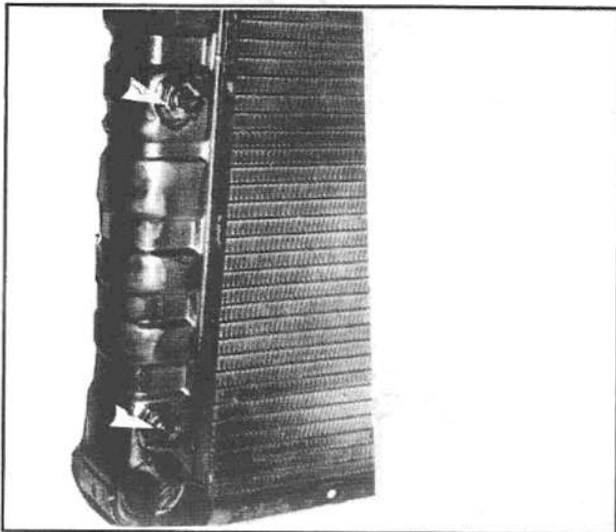
8. Use an air hose with no more than 700 kPa air pressure to reverse flush the cooler lines and the cooler. After reverse flushing, connect both lines at the cooler and the cooler inlet line (converter out) to the transmission.

9. Start the engine and check the fluid flow. If the transmission fluid flows freely, proceed with Steps 3 to 5. If there is no fluid flow, check for pinched cooler lines. If flow is restricted, replace cooler lines and/or the radiator.

10. Turn off the engine, and connect the cooler return line into the transmission. Check the transmission fluid level. Add or remove transmission fluid as required until the proper fluid level is obtained on the dipstick. Don't Overfill the Transmission.

11. Don't attempt to correct cooler or cooler line leaks by closing off the lines.

Oil Cooler (In Radiator) Replacement



When fluid leakage is found at the oil cooler, the entire radiator must be replaced. The oil cooler cannot be removed from the radiator replacement.

Power Control Modul

The Power Control Modul controls and monitors the transmission, similar to the ECM in previous models controlling and monitoring the engine, now the PCM controls and monitors the engine and transmission.

The PCM has a breakdown emergency mode, if the PCM detects certain conditions the transmission will still operate by applying high line pressure. This enables the transmission to be manually operated in R P N 1 2 and in

D or 3 the transmission operates in 3. If this occurs the vehicle should be driven only until the transmission can be repaired.

Down and Up Shift

Correct down and up shift is essential for normal service life of transmission and proper gear shift feel and control. Gear shifts are controlled by the (PCM) Power Control Modul.

The PCM allows for transmission wear by still functioning with pressure variations from 35kPa below upto 70kPa above standard line pressure.

If the transmission is in economy mode the shifts occur less often provided that the accelerator is not more than 80% depressed.

Electrical Components

Transmission Pressure Switch Assembly

Located in the base of the transmission, on lower section of the valve body (held by one bolt) with five pressure switches, flat with a wiring loom connecting to other solenoids and speed sensor.

The five pressure switches have electrical current supplied to them, when open the current is stopped, when closed the current is allowed to flow to earth via the pressure switch.

When there is no pressure fluid:

Reverse Gear switch is open no current (Of the two furthest switches one closest to 3rd gear switch).

1st Gear switch is open no current (2nd closest to electrical plug).

2nd Gear switch is closed with current (Of the two furthest switches the switch away from other switches).

3rd Gear switch is closed with current (3rd closest to electrical plug).

4th Gear switch is open no current (closest to electrical plug).

Fluid Temperature Sensor located in transmission pressure switch near the 5 pin electrical connection. At room temperature of approx 20°C with a 5 volt feed the output should be about 2.50 volts and decreasing voltage as the fluid temperature increases.

Fault codes 58 and 59 are activated if there is trouble with the fluid temperature sensor.

Vehicle Speed Sensor

Located in the left side trans rear extension housing, driven by a toothed rotor. The sensor works on electro magnetic principal and has a 0.5 AC volt output at 100rpm then over 100 AC volts at 8000rpm. Fault code 72 is activated if an intermittent fault in the circuit while vehicle is moving.

Pressure Control Solenoid

Located near the valve body on the right side. This valve replaces 4L60 transmission throttle valve, which alters line pressure. The valve is controlled by different amperage 0 amps to 1.1 amps, 0 amps activates high line pressure,

AUTOMATIC TRANSMISSION

Page 233

while at the other extreme 1.1 amps results in low line pressure. If this circuit malfunctions a Fault Code 73 is displayed.

1-2 Shift Solenoid

This solenoid is located on the rear of the valve body, this valve is either ON or OFF (ON low voltage - OFF high voltage). ON while 1st and 4th gear are active, OFF while 2nd and 3rd gear are active. If there is a malfunction Fault Code 82 will be displayed and the transmission will either have 1st or 4th only or 2nd or 3rd only.

2-3 Shift Solenoid

This solenoid is located on the rear of the valve body, this valve is either ON or OFF (ON low voltage - OFF high voltage). ON while 1st and 2nd gear are active, OFF while 3rd and 4th gear are active. If there is a malfunction Fault Code 81 will be displayed and the transmission will either have 2nd or 3rd only.

3-2 Shift Solenoid

This solenoid is located on front of the valve body, this valve regulates the line pressure so that the shift down from 3rd to 2nd is smooth. If there is a malfunction Fault Code 66 will be displayed and the transmission will only have 3rd gear until fault fixed and a new ignition cycle is carried out.

Torque Converter Clutch

This solenoid is responsible for locking the transmission and flexplate via the torque converter clutch, and is either ON or OFF. When ON that is electrical current earth, the transmission and flexplate are virtually locked with very little loss of power or rpm.

If there are two malfunction Fault Codes 67 and 69. With code 67 4th gear will should not be possible. Code 69 means the solenoid is ON and this causes low rpm gear changes.

Gear Shift Linkage**Remove**

1. Place selector lever in the 'P' position. Raise vehicle and detach the transmission shift rod from the lower selector lever.

2. Remove the bolt on the bottom of the selector lever, remove transmission control rod and bush from the bottom of the selector lever.

3. Unscrew the gear lever knob.

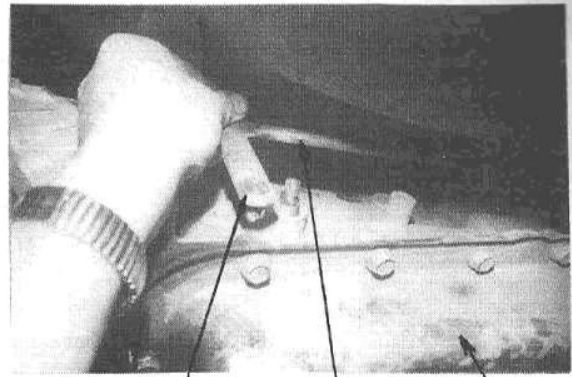
4. Remove the console attaching screws from the front of the console and the two screws from the rear plus the screws in the consol storage compartment. Remove the console.

5. Disconnect the dial indicator light, remove selector housing and lever assembly attaching pop rivets, remove the selector lever and housing.

Install

1. Make sure the bushes are located in the housing and install upper and lower selective levers. Torque the nuts to specification.

Transmission Lever torque specification: 26-30Nm.



Linkage Arm Trans Linkage Shaft Trans Sump
Linkage on left side of transmission

2. Install the selector lever housing and lever assembly, install indicator light, refit console and install indicator assembly.

3. Adjust Gear Shift Lever

(a) Install the control rod bush on the control rod.

(b) Place transmission in "P" position at transmission.

(c) Place consol gearshift lever in "P" position.

(b) Screw trunnion along shifter rod until the trunnion lines up with the bolt hole in the bottom of the gear shift lever.

(c) Install bolt in the selector lever and screw it to the selector rod trunnion. Tighten to specified torque.

Gear Shift Lever Bolt to Rod Trunion torque spec:

18-24Nm

4. Screw the handle onto the selector lever several turns, depress the release button and continue screwing the handle onto the lever until the lever can be moved from the 'Park' position.

5. Screw the handle on a further 2 turns and align the handle into the correct position with the release button facing the front.

8. Lower vehicle and check transmission operation in each selector lever detent position.

Speedometer Sender Unit**Remove**

1. Raise the rear of the vehicle.

2. Remove electrical connector on speedo sender unit.

3. Remove bolt from speedo unit clamp.

4. Remove speedometer sender unit from the extension housing.

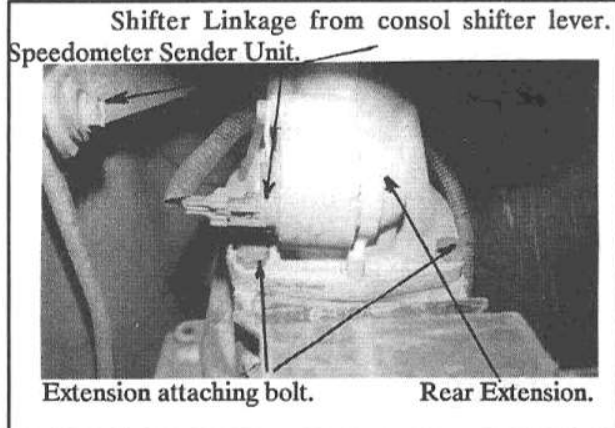
Install

1. Fit a new "O" ring to sender unit and fit unit into transmission rear extension.

2. Install unit clamp and bolt, tighten to specification.

Speedo Sender Unit Bolt torque specification: 8-14Nm

3. Fit electrical wiring loom connection to unit.



4. Lower vehicle.

Rear Extension

Remove

1. Raise back of vehicle. Support rear of transmission.
2. Mark the tail shaft and pinion flange alignment.
3. Remove the tail shaft.
4. Remove the extension seal as described below.

5. Remove speedo sender unit as described above.
6. Remove the extension attaching bolts.
7. Carefully prize the extension away from the transmission case, take not to damage the output shaft and rear seal cavity moulding.

8. Remove the "O" ring seal between the extension and the case.

If the transmission is to be removed, wrap the output shaft in a clean cloth and tie back to transmission, this will stop shaft from falling out.

Install

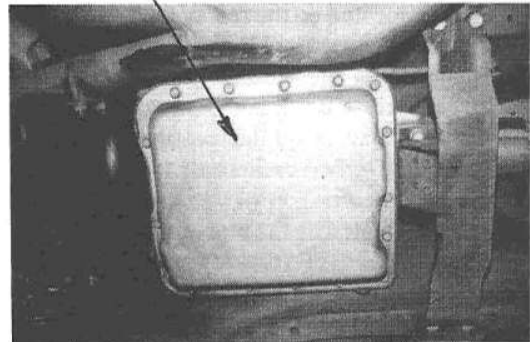
1. Fit a new "O" ring seal between the extension and the case.
2. Carefully install the extension to the transmission case, take not to damage the output shaft and rear seal cavity moulding.

Rear extension seal replacing tool helps drive seal into place.



Transmission Sump

16 Bolts attach sump



Sump Bolt torque 11Nm

3. Install the extension attaching bolts, tighten to specification.

Rear Extension housing attaching bolt torque: 35Nm

4. Replace speedo sender unit as described above.

Speedo Sender Unit Bolt torque specification: 8-14Nm

5. Install a new rear extension seal as described below.
6. Replace the tail shaft.

Extension Housing Seal

Remove

1. Raise back of vehicle.
2. Mark the tail shaft and pinion flange alignment.
3. Remove the tail shaft.
4. Prise seal from housing.

Install

1. Using the seal replacing tool, drive the seal until the seal seats.
2. Install the tail shaft and pinion flange.
3. Lower vehicle.

Transmission Sump (Oil Pan)

Remove

1. Raise vehicle, place a drain pan under the transmission.
2. Loosen and remove the screws at the rear of the oil pan.
3. Loosen the remaining screws and allow the fluid to drain.

CAUTION: The fluid will be very hot if the transmission has just been operated.

4. Remove oil pan securing screws and lower the oil pan carefully, it will still contain a quantity of fluid. Discard this fluid and the oil pan gasket.

Install

1. Clean oil pan, screen and the gasket face of the transmission.

2. Place a new gasket on the oil pan, and install the screen and pan on the transmission.

3. Tighten oil pan bolts to specification.

Transmission Oil Pan (Sump) bolt torque spec: 11Nm

Add 3.5 litres of fluid to the transmission through the filler tube. Run the engine at idle speed until it reaches normal operating temperature. Shift selector lever through all positions then place the lever at 'P'. Switch off the engine. Immediately insert the dipstick all the way into the filler tube then withdraw it and check the fluid level. This Operation Must Be Completed Within 10 Seconds of Engine Switch Off.

If required, add fluid to the transmission through the filler tube to raise the fluid level to the 'F' (full) mark on the dipstick.

** Don't overfill the Transmission.*

1. Raise vehicle and remove transmission sump and strainer.

2. Remove the accumulator retaining cover (3) bolts with care as there is a spring behind the cover.

3. Remove cover, spring, and seal.

4. Remove the 1-2 accumulator piston it may be necessary to use air pressure to help remove the piston.

Install

1. Wash with solvent and dry, replace seal with a new seal lubricate the new seal with automatic transmission fluid.

2. Install the 1-2 accumulator piston into position.

3. Install new seal and cleaned springs.

4. Install the cover and three bolts. Tighten cover bolts to specification.

Accumulator Cover Bolts torque spec: 11Nm

6. Replace transmission sump and strainer, tighten sump bolts to specification.

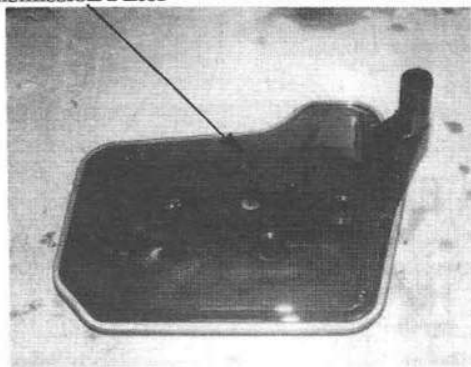
Transmission Sump bolt torque specification: 11Nm

Major Repairs and Rebuild

1-2 Accumulator Assembly

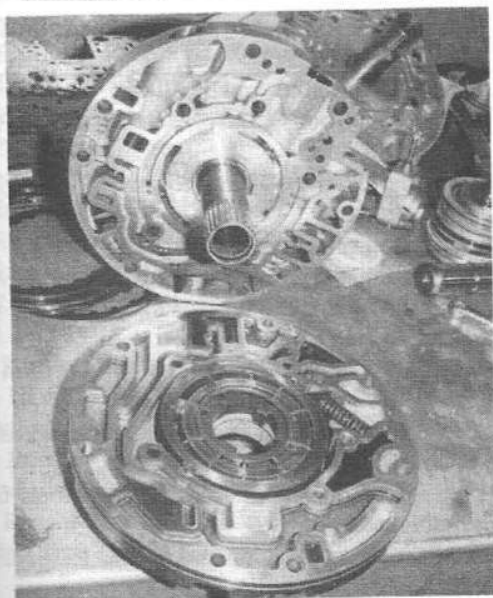
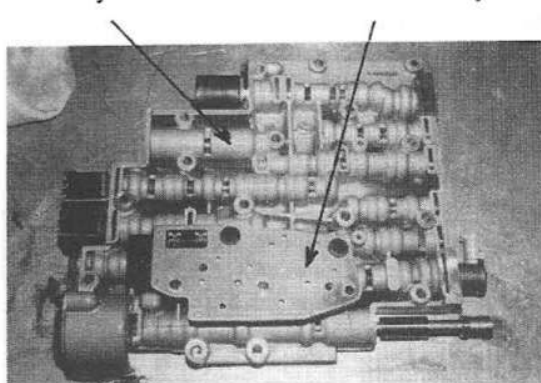
Remove

Transmission Filter

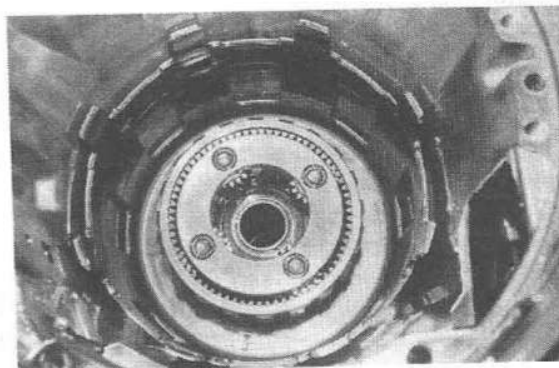


Valve Body

Switch Assembly



Pump split in half



Looking inside transmission at planetary (sun) gear

Auxilliary Valve body Attached by 4 bolts torque to 11Nm



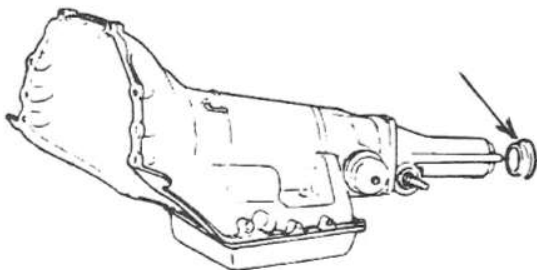
Control Valve Body & 3-4 Accumulator Assembly Remove

1. Raise vehicle and remove transmission sump.
2. Remove electrical loom connections, label and tie back.
3. Remove electrical switches that are connected to the valve body (solenoid).
4. Remove the valve body control switch assembly two bolts, then remove the switch assembly.
5. Remove the torque convert valve control solenoid assembly two bolts, then remove the solenoid assembly.
6. Remove attaching bolts that hold the control valve body into place, lower the control valve body taking care with the manual valve link and 3 ball valves which will also fall down.
7. Remove detent lever and spring from valve body.
8. With the 1-2 accumulator removed access to 3-4 accumulator is gained by removing gaskets and spacer plate, remove with care as there are a spring, seal, pin, piston and 4 check balls involved.

Dismantle, Clean and Rebuild

1. Wash the complete valve body with a solvent based liquid and air dry.

When removing transmission plug rear extension shaft hole to stop fluid draining from transmission



2. Remove the pins from the valves shown in diagrams, with care. Remove the springs and valves, wash with solvent and dry, lubricate with auto trans fluid, replace valves and springs making sure the valves move freely. Fit new valves and springs if reconditioning transmission.

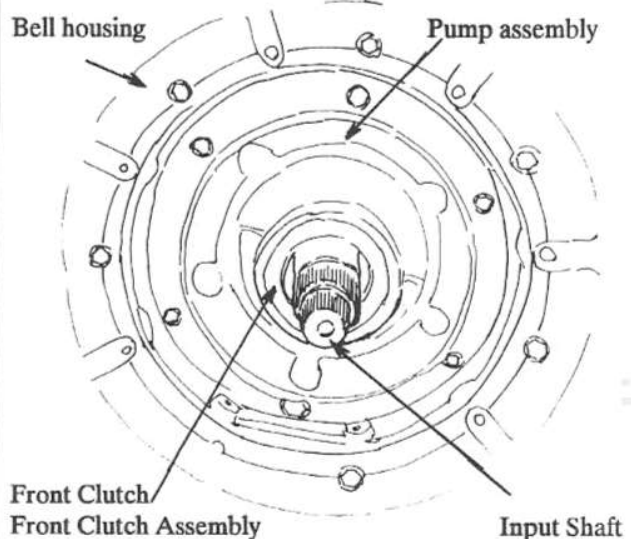
Install

1. Install 3-4 accumulator with care as there are a spring, seal, pin, piston and 4 check balls involved, if petroleum jelly is used on the balls, they will stay in place while installing the assembly. Use new gaskets when installing the accumulator and spacer plate. The gaskets and spacer plate will need to be held in position until the auxiliary valve body and 1-2 accumulator is installed
2. Replace the Auxiliary valve body and 1-2 accumulator, tighten (4) bolts to specification.

Auxiliary Valve Body Bolts torque specification: 11Nm

3. Replace 12 attaching bolts that hold the control valve body into place, lift the control valve body into place as

Input Shaft, Pump Assembly and Front Clutch Assembly



you fit the manual valve link and 3 ball valves.

4. Replace the valve body control switch assembly, then the two bolts.
5. Install detent lever and spring to valve body, tighten bolt to specification.

Detent Lever Bolt torque specification: 22Nm

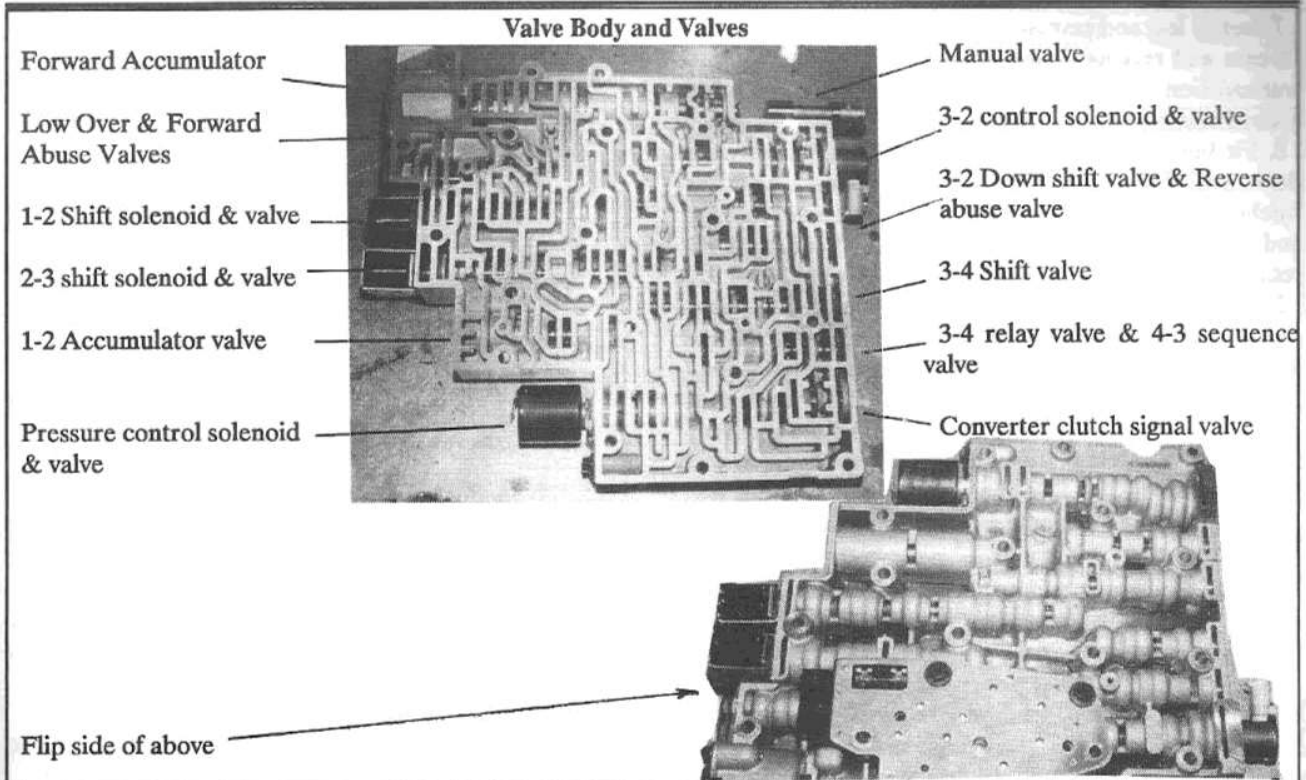
6. Place (3) ball valves in place and install control valve body into transmission, hold in place and install the (12) retaining bolts, tighten to specification.

Valve Body bolt torque specification: 11Nm

7. Replace the torque converter solenoid.
8. Install electrical switches that are connected to the valve body control switch assembly.
9. Install electrical loom connections, use labels from earlier during removal.
10. Replace transmission sump and tighten to specification.

AUTOMATIC TRANSMISSION

Page 237



Transmission Sump bolt torque specification: 11Nm
 11. Lower vehicle.

Oil Pump, Input / Output Shaft Assemblies,

1. Remove the oil pump attaching bolts from the front of the transmission.
 2. Remove the oil pump from the input shaft, it will be necessary to use a puller against the input shaft. Take care not to damage the input shaft spline while removing the oil pump.
 3. Take hold of the input shaft and gently remove the "reverse input clutch" and "input clutch assembly", remove thrust washer.
 4. Remove the 2-4 band support pin and remove the band.
 5. Remove the input sun gear.
 6. Place a tool box at the end of the output shaft, as it may tend to fall out, as you remove the input shaft retaining circlip (from the front).
 7. Remove input carrier assembly.
 8. Remove output shaft if it is loose.
 9. Remove thrust bearing, input internal gear and carrier shaft.
 10. Remove the reaction sun gear case and thrust washer.
 11. Remove low and reverse clutch retaining circlip, support spring and clutch gear.
 12. Remove reaction sun gear, thrust washer, low and reverse clutch race, and reaction carrier assembly.
 13. Remove the low and reverse clutch plates.
- * Take note of removal procedure to help in assembly.

14. Remove the reaction internal gear and thrust bearing. The output shaft will now come out if it has not already been removed. Remove the reaction internal gear bearing, case section from trans case.

15. Remove the pawl pivot shaft plug then shaft (a magnet may help). Remove the pawl parking bracket and spring.

16. Remove the low and reverse clutch retaining spring circlip, clutch spring assembly and clutch piston.

Clean and Inspect

1. Wash parts in a solvent solution and air dry.
2. Inspect for any damage and foreign matter caught on components.
3. Check all components for cracks or distortion.

Assemble

1. Fit new low and reverse piston seals, lubricate the seals with transmission fluid.
 2. Install low and reverse piston, clutch spring assembly, clamp spring assembly down to fit retaining circlip then remove clamp.
 3. Replace the pawl pivot shaft, then shaft plug, pawl parking bracket and spring, tighten to specification.
- Parking Linkage Bracket bolt torque spec: 22Nm**
4. Replace the reaction internal gear bearing, case section into trans case, hold with petroleum jelly. Install the reaction internal gear and thrust bearing.
 5. Install the reaction carrier assembly onto thrust bearing.
 6. Install the low and reverse clutch plates in the order they were removed.

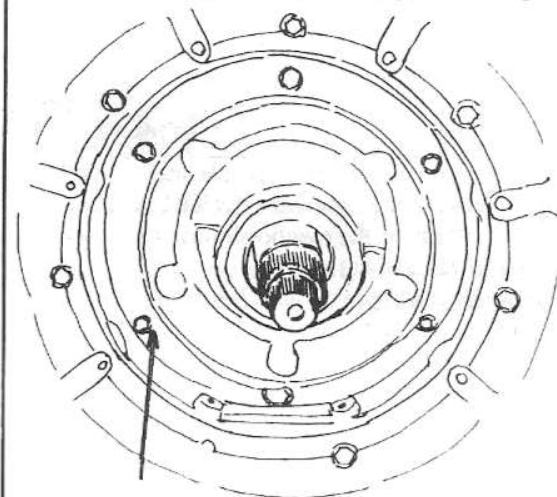
7. Install low and reverse clutch assembly onto support, fit cam and retaining spring circlip, and fit assembly into transmission with hub facing down, align lug with lug groove in case.

8. Fit inner race into roller assembly, twist and push down until fully seated, check that inner race will turn freely. Fit small retaining spring between case and case lug and open notch in low and reverse clutch support. Fit retaining ring into transmission case.

9. Install the reaction sun gear and retaining circlip into reaction carrier, check that gears mesh properly. Fit low and reverse roller clutch race, thrust washer, reaction gear case fitting it over the reaction sun gear. Fit thrust washer into reaction sun shell with prongs locating into grooves.

10. Fit the retaining circlip in input internal gear as you fit the reaction shaft into the internal gear, then fit this assembly into the reaction sun gear, making sure the spline is lined up.

Fit a new "O" ring onto input shaft just below spline.



Oil Pump bolts torque specification: 22Nm

11. Install the thrust bearing onto the reaction shaft, making sure it faces the correct way.

12. Install the output shaft, support the end of the shaft with a tool box or similar so it will not fall out. Install the input carrier and expanding retaining circlip onto the output shaft.

13. Fit input sun gear into input carrier, meshing sun gear into pinion gear.

14. Fit end play adjusting thrust washer and bearing on input shell and shaft. Install reverse input clutch onto input clutch check that lugs align with housing hub.

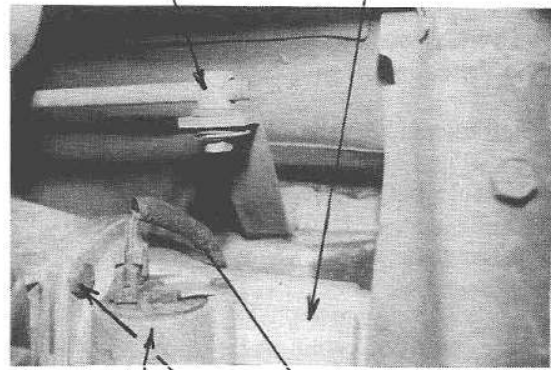
15. Slide reverse input and input clutch assembly with all clutch lugs over internal gear into transmission, making sure that the surface will clear the oil pump when fitted.

16. Fit the anchor pin for 2-4 band and the band into transmission.

17. Install the oil pump with thrust washer after fitting a new gasket and seal to transmission, tighten bolts to specified torque. Make sure the input shaft will turn.

Gear Shift Lever and Adjusting Rod

Transmissionmission Rear Extension



Speedo Sender Unit Wiring Loom
Extension Attaching Bolts

Oil Pump bolts torque specification: 22Nm

18. Check end play of input shaft for specified clearance, if not within specification, rectify by installing different end play adjusting thrust washer in point 14. above.

Input Shaft End Play clearance: 0.13-0.93mm

19. Install the torque converter onto input shaft, after fitting a new "O" ring onto input shaft just below spline.

2-4 Servo

Remove

1. Push the servo cover in and remove the retaining circlip, remove cover and seal.

2. Remove piston assemblies and spring from the transmission.

3. Separate the 4th (small piston) apply piston from the 2nd apply piston.

4. Remove seals from both pistons.

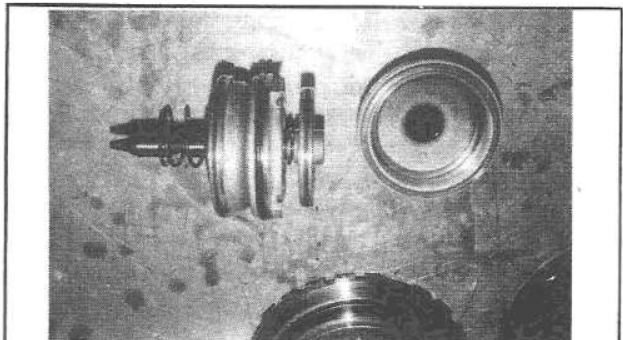
5. Wash with a solvent solution and air dry, check for any faults.

Install

1. Fit new seals to both pistons and assemble the pistons together.

2. Install pistons and spring (spring first) into transmission.

3. Fit new seal to cover and install, push to allow retaining spring circlip to be fitted.



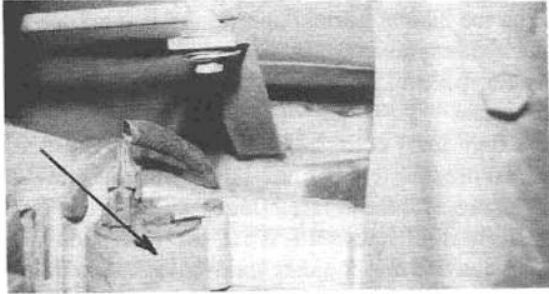
AUTOMATIC TRANSMISSION

Page 239

Transmission**Remove**

1. Detach earth lead from battery.

Remove the speedometer sender unit from the extension housing.



2. Raise vehicle, if work is to be carried out on the transmission or torque converter when removed from the vehicle, drain transmission fluid.
3. Remove the tail shaft and place a rag plug into rear of transmission to stop oil leakage.
4. Remove rear mounting to extension housing bolts.
5. Remove the speedometer sender unit from the extension housing.
6. Detach the fluid cooler lines from the case. Plug the cooler line connections.
7. Detach the manual linkage rod from the transmission control lever.
8. Remove the cover plate from the front of the converter housing, disconnect the neutral start switch wiring, remove the converter to flywheel attaching nuts.
9. Place a transmission jack to support the transmission and secure the transmission to the jack with a safety chain.
10. Remove the cross member to body bracket attaching nuts and lower the crossmember.
11. Remove the exhaust system bracket.
12. Remove the converter housing to engine attaching bolts. Remove the filler tube.

Install the converter housing to the engine attaching bolts.

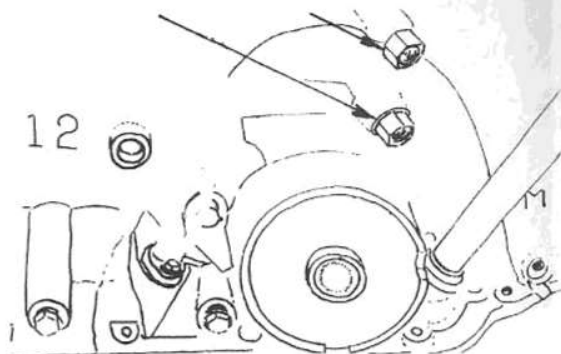
Converter Attaching Bolt Holes



13. Hold the converter firmly against the transmission, move the transmission to the rear and lower. Secure the converter to prevent it becoming disengaged from the

transmission and remove the assembly from under the vehicle.

Connect fluid cooling lines to the transmission case
Fluid Inlet Fluid Outlet

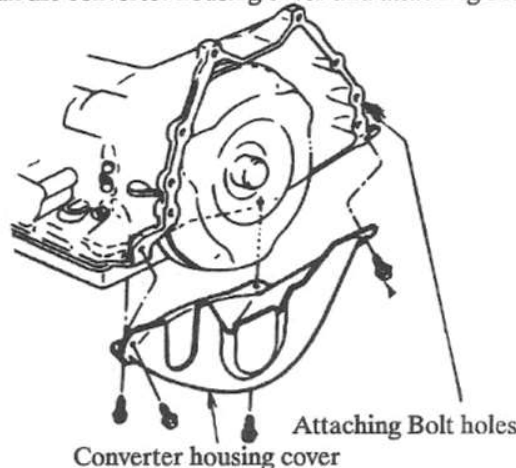
**Install**

1. With the converter properly installed on the transmission, position it on the jack and secure with a safety chain.
2. Raise the transmission into position, install the filler tube. Install the converter housing to the engine attaching bolts. Remove safety chain.
3. Connect fluid cooling lines to the transmission case leaving the unions loose.
4. Loosely assemble the exhaust system bracket to the exhaust pipe flange.
5. Locate the crossmember and mounting and install the crossmember to body bracket nuts.
6. Align the exhaust system bracket, lower the transmission and install the extension housing to mounting bolts.

Extension Housing bolts to Engine torque spec:

40-45Nm

Install the converter housing cover and attaching bolts

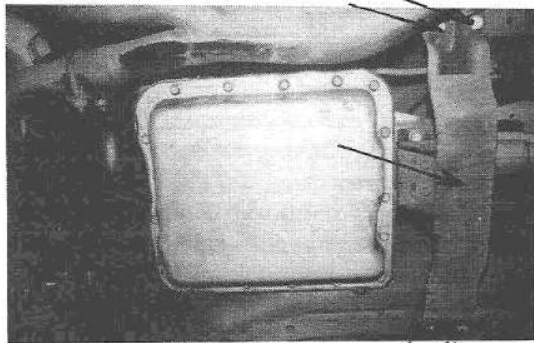


7. Remove jack, tighten exhaust bracket to pipe flange nuts, tighten the fluid cooler lines to case unions.

Fluid Cooler Lines to Trans torque spec: 22-24Nm

8. Install the flexplate to converter attaching nuts. Install the converter housing cover.

Locate the crossmember and mounting and install the crossmember to body bracket nuts.



Torque Converter to Flexiplate bolt torque spec:

40-45Nm

Converter Housing Cover bolt torque spec: 9-12Nm

9. Align the mating marks and install the tail/drive shaft. Lower vehicle and connect down shift cable and check adjustment.

10. Reconnect the battery, check fluid level and check the operation of the transmission controls.

PROBLEM SOLVING AND DIAGNOSIS

Preliminary Checks

When diagnosing transmission problems, first refer to the diagnosis guide for detailed information of the items that could be causing the problem. The following preliminary checks should be made in the order listed.

Check fluid level, check fluid for a burnt clutch plate odour. Check the manual linkage adjustment. Check the accelerator pedal height and down shift linkage.

Check the throttle linkage to make sure of wide open throttle operation, check the engine for proper operation.

Fluid Level Check

Make sure that the vehicle is standing level. Run engine at normal idle speed until the fluid reaches its normal operating temperature.

Clean all dirt from the transmission fluid dipstick cap before removing the dipstick from the filler tube. Remove the dipstick, wipe it clean, and place it to one side.

Shift the selector lever through all positions then place the lever at 'P'. Switch off engine. Immediately insert the dipstick all the way into the filler tube then withdraw it and check the fluid level. This Operation Must Be Completed Within 10 Seconds of Engine Switch Off.

If required, add fluid to the transmission through filler tube to raise the fluid level to the 'F' (full) mark on the dipstick. Recheck fluid level. Don't Overfill the Transmission.

If it is required to check fluid level when the transmission is cold, when the level should be on 'Add' mark, otherwise it will be too high at normal operating temperature when the fluid has expanded.

Recheck the level when the gearbox is at normal running temperature.

If the fluid level is too high this will cause the fluid to become more aerated. Aerated fluid will cause low control pressure, and the aerated fluid may be forced out the vent. Low fluid level can effect the operation of the transmission and may indicate fluid leaks that could cause transmission damage.

Incorrect transmission fluid level can also have the following effects, although they may be attributable to other malfunctions:-

- No drive in 'D', '1', '2' or 'R'.
- Slip and squawk or shudder on full throttle starts in 'D', '1', '2', or 'R'.
- Overheating due to high fluid level during sustained high speeds.

Fluid Leakage Checks

Check speedometer transducer installation at the transmission. Leakage at the oil pan gasket often can be stopped by tightening the attaching bolts to the proper torque. If required, replace gasket. Check fluid filler tube connection at the transmission. If the filler tube O-ring seal is leaking, replace seal.

The transmission fluid is water cooled; check fluid lines and fittings between the transmission and the cooler in the radiator tank for looseness, wear or damage. If leakage can't be stopped by tightening a fitting, replace defective parts.

Check engine coolant in radiator. If transmission fluid is present in coolant, the cooler in the radiator tank is probably leaking.

The cooler can be further checked for leaks by disconnecting the lines at the cooler fitting and apply 500 kPa maximum air pressure to the fittings. The radiator cap must be removed when making this check to relieve the pressure on the exterior side of the cooler. If the cooler is leaking and will not hold this pressure the radiator must be replaced. The cooler can't be replaced separately.

Leakage in the extension housing area may be caused by a worn extension housing bush, seal, drive shaft yoke or the housing to case gasket.

If leakage is found at the manual lever shaft, replace seals that are leaking.

The pressure port plug on the left of the case must also be inspected.

Fluid leakage from the converter housing may be caused by engine oil leaking past the rear main bearing or from

oil gallery plugs. Be sure to determine the exact cause of the leak.

Fluid Leakage Converter Area

In diagnosing and correcting fluid leaks in the front pump and converter area, use the following operations to assist in locating the exact cause of leakage.

Leakage at the front of the transmission, as evidenced by fluid around the converter housing, may have several sources. By observing it is possible in many instances to pinpoint the source of the leak before removing the transmission from the vehicle. The paths which the fluid takes to reach the bottom of the converter housing are as shown.

Fluid leaking from front seal lip will tend to move along the drive hub and onto the back of the impeller housing. In the case of a total seal failure, fluid leakage past the lip of the seal will be deposited on the inside of the converter housing only, near the outside diameter of the housing.

Fluid leakage from the outside diameter of the seal and front pump body will follow the same path as leaks from the pump seal or may run down the face of the front pump.

Fluid that leaks past the front pump to case bolts will be deposited on the inside of the converter housing only. Fluid will only be deposited on the converter housing only. Fluid will not be deposited on the back of the converter.

Leakage by the front pump to case and O-ring seal may cause fluid to be deposited on the inside lower part of the converter housing.

Engine leaks sometimes diagnosed as front pump seal leaks. The following areas of possible leakage should also be checked to determine if engine oil leakage is causing the problem:

- * Leakage at the rocker cover may allow oil to flow over the converter housing or seep down between the converter housing and cylinder block causing oil to be present in or at the bottom of the converter housing.

- * Oil gallery plug leaks will allow oil to flow down the rear face of the block to the bottom of the converter housing.

- * Leakage from the crankshaft seal will work back to the flywheel, and then into the converter housing.

Fluid leakage from other areas, forward of the transmission could cause fluid to be present around the converter housing due to blow-back or road draft.

The following operation should be used to determine the cause of leakage before any repairs are made:

- * Remove transmission dipstick and note the colour of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transmission.

Since road draft may cause leaking rocker cover oil to be present on the transmission, this leakage, if present, should be eliminated before performing work on the transmission.

- * Remove converter lower housing cover. Clean off any fluid from the top and bottom of the converter housing,

front of the transmission case, and rear face of the engine and engine oil pan. Clean the converter area by washing with suitable non-flammable solvent, and blow dry with compressed air.

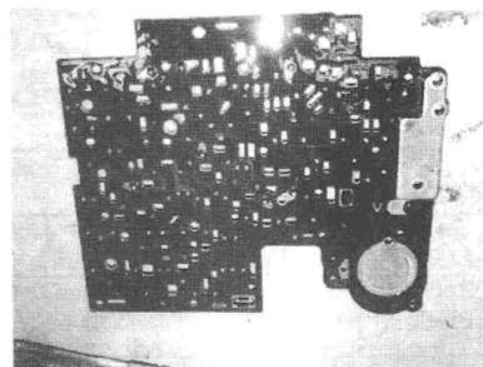
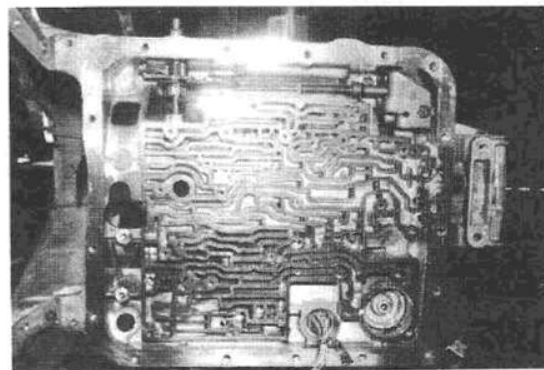
- * Wash out the converter and front of the flywheel. Blow all washed areas dry with compressed air.

- * Run engine until transmission reaches its normal operating temperature. Observe the back of the block and top of the converter housing for evidence of fluid leakage. Raise car and run engine at fast idle, then at engine idle, occasionally shifting to drive and reverse ranges to increase pressures within the transmission. Observe the front of the flywheel, back of the block (in as far as possible), and inside the converter housing. Run engine until fluid leakage is evident and the probable source of leakage can be determined.

Manual Linkage Check

Correct manual linkage adjustment is necessary to position the manual valve for proper fluid pressure direction to the different transmission components. Improperly adjusted manual linkage may cause subsequent transmission failure.

Base of transmission with valve body removed



Gasket which is located between base of transmission and valve body

Transmission Operation Checks-**Test Preparation**

When testing the transmission, the transmission and engine must be at normal operating temperature.

Check transmission fluid level, check manual linkage adjustment, check down shift cable adjustment. Attach a tachometer to the engine and also a pressure gauge to the control pressure outlet at the transmission. Firmly apply parking brake and start engine.

Control Pressure Tests

The test results of the following checks should agree with the specifications given below. When performing control pressures tests, make certain that the service brake pedal is held in the applied position and that the park brake is applied. Do not run this test for any longer than 2 minutes otherwise damage may occur to transmission.

Line pressure readings are performed by having the TECH1 at PCS Control. Increase the PCS amp reading by 0.10 amps for each pressure reading, hand and foot brake applied.

The automatic transmission fluid level must be at the correct level. check the pressure with the pressure shown below.

Park, neutral at 1500 r.p.m. approx 65°C	
PCS Amp	Line Pressure kPa
0.02	1172-1310
0.10	1138-1275
0.20	1103-1241
0.30	1069-1206
0.40	1020-1158
0.50	965-1103
0.60	896-1000
0.70	758-896
0.80	620-793
0.90	448-620
0.98	379-448

Solenoid Ohms Resistance Chart at 200C				
Solenoid Shift	Wire Colour	Terminal	Large Round Connector Pin	Resistance
1-2	Red Lt Green	A	E	20-40
		B	A	
2-3	Red Yellow	A	E	20-40
		B	B	
3-2	Red White	A	E	9-14
		B	S	
Press	Purple Lt Blue	A	C	3.5-4.6
		B	D	
TCC	Red Black	A	E	20-40
		B	T	

Test No.1 Control Pressure Check at Engine Idle

At engine idle rpm, check transmission control pressure at all lever positions. Pressure should agree with Table 1.

Idle pressure too low

Check down shift cable adjustment and revise as required. Low pressure may also be due to excessive leakage in the oil pump, case and control valve body, a sticking control pressure regulator valve or an incorrectly adjusted valve body throttle cam bracket.

Idle pressure too high

Check the down shift cable adjustment for excessive pullout, sticking or non-return of the down shift cam through cam bracket.

Test No.2 - Stall Test Control Pressure and Engine Speed

The pressure and speed tests are carried out simultaneously. Ensure that the park and service brakes are firmly applied during these tests.

The stall test is made in D, 1, 2 and R at full throttle. Pressures and speeds should agree with the specifications.

While making this test, do not hold the throttle open for more than five seconds at a time. Then move the selector lever to Neutral and run engine at 100 rpm for about 15 seconds to cool converter before making the next test. If the engine speed recorded by the tachometer exceeds the maximum limits specified, release the accelerator immediately because clutch or band slippage is indicated.

Stall speed too high

A higher stall speed than that specified indicates that the converter is not receiving its required fluid supply or that slip is occurring, depending on transmission selector lever position. Excessive engine rpm only in D, 2 or 1, indicates forward clutch slippage. Excessive engine rpm only in D indicates gear train one way clutch slippage.

Stall speed too low

When stall test speeds are low and the engine is properly tuned, converter stator clutch problems are indicated. A road test must be performed to determine the exact cause of trouble. If stall test speeds are 300 to 400 rpm below the specified values, and the car cruises properly but has very poor acceleration, the converter stator clutch is slipping.

If the stall test speeds are 300 to 400 rpm below the specified values, and the car drags at cruising speeds and acceleration is poor, the stator clutch could have been installed backwards.

Remove converter and examine stator clutch by replacing with converter that operates correctly and retest.

Below standard acceleration in top gear above 50 km/h combined with a substantially reduced maximum speed, indicates that stator one-way clutch has locked in the engaged condition. This condition will also be indicated by the transmission overheating, although the stall speed will remain as specified. Renew converter.

*** The torque converter is a sealed unit without a drain plug. The unit must not be dismantled. If a converter is unsatisfactory in any way then it must be replaced.**

Stall pressure too low

A stall pressure below specification may be caused by:- Low fluid level, down shift cable adjustment, sticking primary regulator-modulator or throttle valve, oil tubes

incorrectly installed, missing or incorrectly tightened valve body screws, missing or broken sealing rings, faulty governor valve or worn pump.

Stall Pressure too high

A stall pressure above specification may be caused by:-
Primary regulator-modulator or throttle valve sticking, or by missing or incorrectly tightened valve body screws.

Test No. 3

Control Pressure After Cut Back

This test requires that the vehicle be driven on the road or on a dynamometer. Accelerate the vehicle with full throttle. During acceleration the control pressure should be suddenly reduced by modulator valve operation to the valve shown in specifications.

Control pressure after cut back too low

Low pressure may be caused by incorrect down shift cable adjustment or faulty regulator valve operation.

Control pressure after cut back too high

High control pressure may be caused by incorrect down shift cable adjustments, faulty governor, modulator valve or regulator valve operation.

With the transmission down shift cable adjustments, faulty governor, modulator valve or regulator valve operation.

Transmission should be in 3rd gear and road speed over 50 km/h the transmission should shift to 2nd gear when the selector lever is moved from D to 2 to 1. The transmission will down shift from 2nd or 3rd to 1st gear when 1 is selected below approx 30 km/h. This check will determine if the governor pressure and shift control valves are functioning properly.

Road Test Procedures

Test 1

Check that the starter only operates with the selector in 'P' and 'N' and that the reversing light only operates in 'R'.

Test 2

Apply brakes and, engine idling, select N-D, N-1, N-2, N-R. Transmission engagement should be felt in each position selected.

Test 3

Examine converter stall speed with transmission in '1' after connecting a tachometer to the engine and applying the hand brake. Allow engine and transmission to reach normal operating temperature and then momentarily depress kick-down position, noting the tachometer reading. Don't stall for more than five seconds, otherwise the transmission will overheat. Check for slip or clutch squawks. Refer to Table 1.

Test 4

With transmission at normal operating temperature, select 'D', release the brakes and accelerate with minimum throttle opening checking for 1st to 2nd and 2nd to 3rd changes. At minimum throttle openings the changes may be difficult to detect. To confirm that the transmis-

sion is in third gear, select '2' when a 3rd to 2nd change should be felt.

Test 5

* At 70 km/h in 3rd gear, depress the accelerator to the 'kick-down' position where transmission should change to 2nd.

* At 30 km/h in 3rd gear, depress accelerator to full throttle position. The transmission should change to 1st gear.

Test 6

* Stop vehicle, re-start using full throttle acceleration. Check change speeds for 1st to 2nd and 2nd to 3rd: refer shift speed chart in specifications.

* At 65 km/h in 3rd gear, release accelerator and '1'. Check for 3rd to 2nd change and engine braking. Check that the 2nd to 1st change occurs below 30 km/h and for engine braking.

Test 7

Stop vehicle with '1' still engaged, release brakes, using full throttle accelerate to 30 km/h (20 mph)). Check for slip and clutch squawk, and no upward changes.

Test 8

Stop and select 'R'. Release brakes, using full throttle if possible. Check slip or clutch squawk.

Test 9

Stop vehicle facing downhill with brakes and select 'P'. Release brakes and check that the parking pawl holds the vehicle. Apply brakes before disengaging the parking pawl. Repeat with vehicle facing uphill.

Upshift speed chart in economy mode, 50%-100% Acceleration

MODEL	HBD(V8)	Km/h
1-2	minimum Throttle	45-58
2-3	minimum Throttle	84-108
3-4	minimum Throttle	185

MODEL	HDD (V6)	Km/h
1-2	minimum Throttle	45-61
2-3	minimum Throttle	85-114
3-4	minimum Throttle	205

SPECIFICATIONS

Type:	Turbo Hydra Matic 700-R4 also called Hydra-Matic 4L60 E
Code	V6 engine - HDD, V8 engine - HBD
Special Features	Torque converter clutch overdrive
Gear Ratios:	
Reverse (R)	2.29
Overdrive (OD)	0.7:1
Drive (D)	1.0:1
Second (2)	1.63:1
First (1)	3.06:1

Torque Converter:

Number of elements 3 plus torque converter clutch
 Cooling type Liquid
 Nominal dia V6 engine 245mm, V8 engine 298mm
 Lubricant: Capacity, refill
 V6 engine 4.8 litres (total capacity 7.9 litres)
 V8 engine 5.0 litres (total capacity 10.6 litres)
 Type recommended Dexron Type 11E

Clutches and Bands:**2-4 Band:**

Type Steel band composition lined
 Operation Servo
 Adjustment Selective fit apply pin:
 65.82-66.12mm - 1 groove
 67.23-67.53mm - 2 grooves
 68.64-68.94mm - no groove

Reverse Input Clutch

Type Multiple wet disc
 Clutch plate, number & thickness:
 Steel 4, 1.892-2.045mm
 Composition 4, 1.730-1.880mm
 Belleville 1, 2.210-2.311mm
 Backing plate 1, selective
 Backing plate, thickness & identification:
 7.249-7.409mm 2
 6.519-6.678mm 3
 5.787-5.947mm 4

Backing plate travel 1.02-1.94mm

Forward Clutch:

Type Multiple wet disc
 Clutch plates, number & thickness:
 Steel 5, 2.29mm
 Composition 5, 1.78mm
 Apply plate 1, 4.30mm
 Waved Steel 1, 1.79mm
 Backing plate 1, selective
 Backing plate, thickness & identification:
 6.92-7.07mm A
 6.38-6.48mm B
 5.79-5.89mm C
 5.20-5.30mm D
 4.61-4.71mm E

Backing plate travel: 0.75-1.60mm

Overrun Clutch:

Type Multiple wet disc
 Clutch plates, thickness & identification:
 Steel 2, 2.248-2.4mm
 Composition 2, 2.03mm
3-4 Clutch:
 Type Multiple wet disc
 Clutch plates, number & thickness:
 Steel 5, 2.71mm
 Composition 6, 2.03mm
 Flat apply plate 1, 5.60mm
 Flat steel (same spline configuration as apply plate)
 1, 1.78mm

Backing plate 1, selective

Backing plate, selective thickness & identification:

5.88-5.68mm A

4.99-4.76mm B

4.10-3.90mm C

Backing plate travel 0.90-2.10mm

Low and reverse clutch:

Type Multiple wet disc

Clutch plates, number & thickness:

Steel 5, 1.75mm

Composition 5, 2.25mm

Waved 1, 2.43mm

Selective 1, selective

Selective plate, thickness & identification:

1.684-1.829mm No identification

1.168-1.314mm 0

2.198-2.344mm 1

Clutch support, thickness & identification:

6.655-6.909mm No identification

Clearances:

Transmission end play

0.13-0.92mm

Pinion gears end play(all) 0.20-0.60mm

Torque converter end play:

V6 engines 0-0.5mm

V8 engines 0-0.6mm

TORQUE WRENCH SPECIFICATIONS

Nm

1-2 Accumulator Cover to Case (short)	11
1-2 Accumulator Cover to Case (long)	11
Auxiliary Valve Body to Case (All)	11
Auxiliary Valve Body Accumulator	11
Manual Detent Spring To Valve Body	22
Oil Passage Cover to Case	11
T.C.C. Solenoid Assembly to pump	11
Transmission Oil Pan to Case	11
4th Clutch Pressure Switch	11
Over Temperature Switch Bracket	11
Park Pawl Bracket to Case	22
Oil pump Cover to Body	22
Oil pump Assembly to Case	22
Rear Case Extension to Case	34
Manual Shaft to inside Detent Lever Nut	31
Line Pressure Plug	11
Oil Cooler Pipe Connector	22-24
Oil Cooler Hose Clamps	0.5-1.5
Transmission to Engine-V6 & V8	40-45
Torque Converter to Flex Plate-V6 & V8	40-45
Beaming Brace to Converter Housing Bolts-V6	40-60
Beaming Brace to Engine Oil Pan Bolts-V6	8-12
Converter Housing Cover-V8	9-12