GROUP TAB LOCATOR

3a	Differential & Driveline
6a	Clutch
7a	Cooling
8Ea	Electronic Control Modules
8Ia	Ignition Control
9a	Engine
11a	Exhaust System
14a	Fuel System
21a	Transmission/Transaxle
25a	Emissions Control

Service Manual Comment Forms (Rear of Manual)

DIFFERENTIAL & DRIVELINE

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HALF SHAFT - REAR

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INSTALLATION	2		

HALF SHAFT - REAR

DESCRIPTION

The inner and outer joints of both half shaft assemblies are tripod joints. The tripod joints are true constant velocity (CV) joint assemblies, which allow for the changes in half shaft length through the jounce and rebound travel of the rear suspension.

On vehicles equipped with ABS brakes, the outer CV joint is equipped with a tone wheel used to determine vehicle speed for ABS brake operation.

The inner tripod joint of both half shafts is bolted rear differential assembly's output flanges. The outer CV joint has a stub shaft that is splined into the wheel hub and retained by a steel hub nut.

DIAGNOSIS AND TESTING - HALF SHAFT

VEHICLE INSPECTION

(1) Check for grease in the vicinity of the inboard tripod joint and outboard CV joint; this is a sign of inner or outer joint seal boot or seal boot clamp damage.

NOISE AND/OR VIBRATION IN TURNS

A clicking noise and/or a vibration in turns could be caused by one of the following conditions:

- Damaged outer CV or inner tripod joint seal boot or seal boot clamps. This will result in the loss and/or contamination of the joint grease, resulting in inadequate lubrication of the joint.
- Noise may also be caused by another component of the vehicle coming in contact with the half shafts.

CLUNKING NOISE DURING ACCELERATION

This noise may be a result of one of the following conditions:

- A torn seal boot on the inner or outer joint of the half shaft assembly.
- A loose or missing clamp on the inner or outer joint of the half shaft assembly.
- A damaged or worn half shaft CV joint.

SHUDDER OR VIBRATION DURING ACCELERATION

This problem could be a result of:

- A worn or damaged half shaft inner tripod joint.
- A sticking tripod joint spider assembly (inner tripod joint only).
- Improper wheel alignment. (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE)

VIBRATION AT HIGHWAY SPEEDS

This problem could be a result of:

- Foreign material (mud, etc.) packed on the backside of the wheel(s).
- Out of balance tires or wheels. (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE)
- Improper tire and/or wheel runout. (Refer to 22 - TIRES/WHEELS - DIAGNOSIS AND TESTING)

HALF SHAFT - REAR (Continued)

REMOVAL

(1) Lift vehicle on hoist so that the wheels hang freely.

(2) Remove rear wheel.

(3) Remove cotter pin, nut lock, and spring washer (Fig. 1).

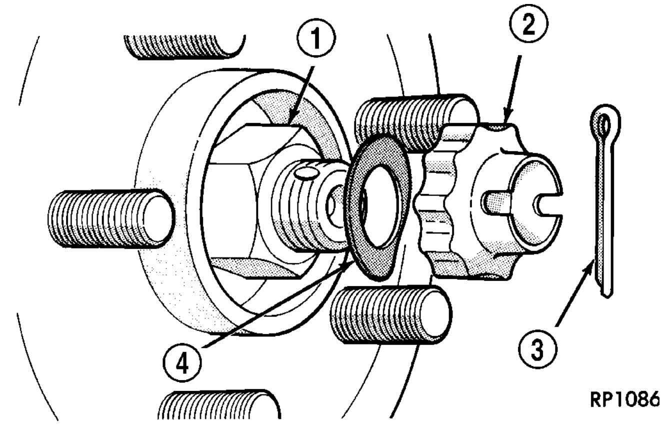

Fig. 1 Cotter Pin, Nut Lock, And Spring Washer

1 - HUB NUT
2 - NUT LOCK
3 - COTTER PIN
4 - SPRING WASHER

(4) Remove hub nut and washer.

CAUTION: The half shaft outer CV joint, when installed, acts as a bolt and secures the hub/bearing assembly. If the vehicle is to be supported or moved on its wheels, install and torque a bolt through the hub. This will ensure that the hub/bearing assembly cannot loosen.

(5) Remove inner half shaft retaining bolts (Fig. 2).

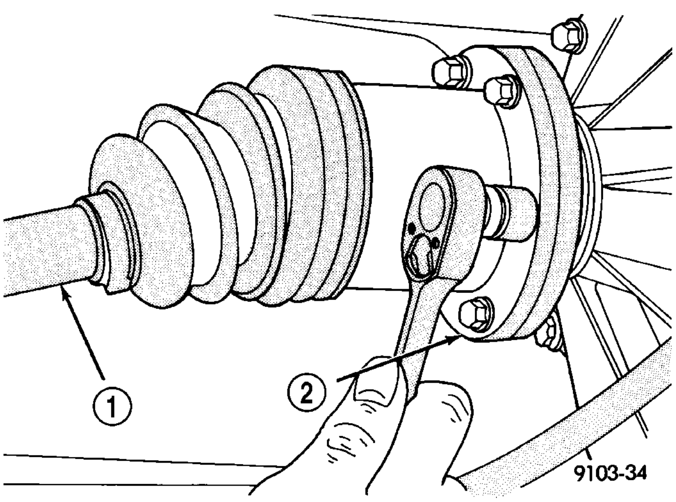

Fig. 2 Inner Half Shaft Bolts

1 - SHAFT
2 - FLANGE

(6) The half shaft is spring loaded. Compress inner half shaft joint slightly and pull downward to clear rear differential output flange. Then pull half shaft assembly outward to remove (Fig. 3).

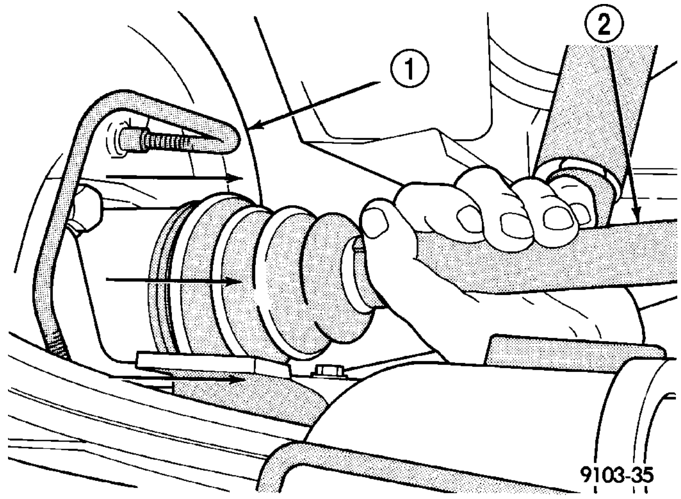

Fig. 3 Half Shaft Removal

1 - BRAKE BACKING PLATE
2 - HALF SHAFT

INSTALLATION

(1) Install the outer CV joint stub shaft through the hub bearing (Fig. 4).

(2) The half shaft is spring loaded. Compress inner half shaft joint slightly and push upward until the inner CV joint flange engages the rear differential output flange.

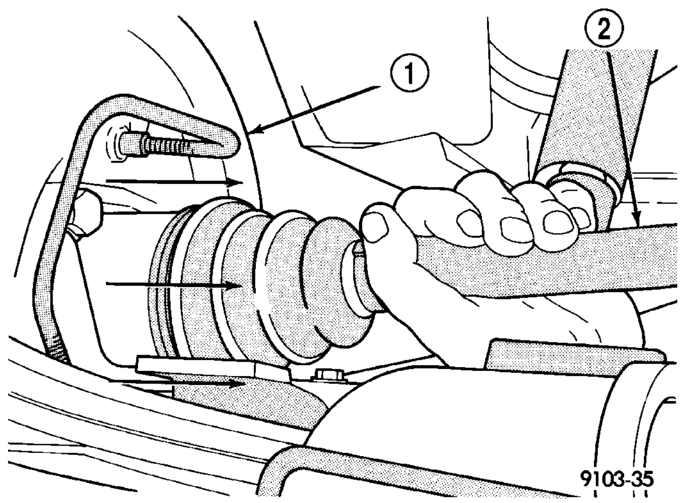

Fig. 4 Half Shaft Installation

1 - BRAKE BACKING PLATE
2 - HALF SHAFT

HALF SHAFT - REAR (Continued)

(3) Install the inner half shaft retaining bolts (Fig. 5). Torque the bolts to 61 N·m (45 ft.lbs.).

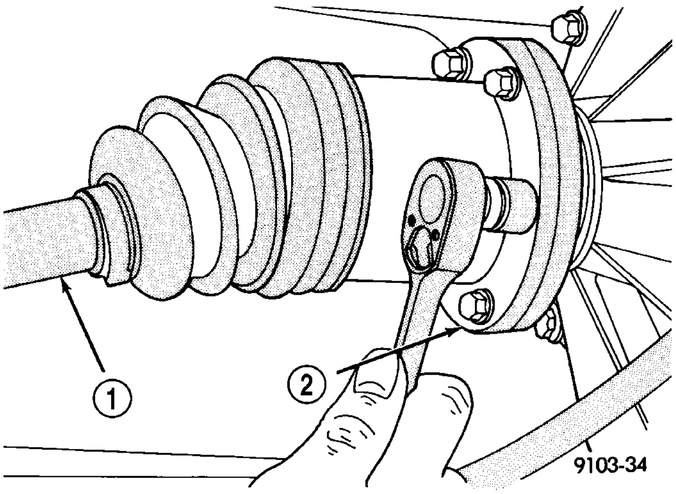

Fig. 5 Inner Half Shaft Bolts

1 - SHAFT
2 - FLANGE

(4) Install the half shaft washer and hub nut. Torque the hub nut to 244 N·m (180 ft.lbs.).

(5) Install the spring washer, nut lock, and a new cotter pin (Fig. 6). Be sure to wrap the cotter pin prongs tightly around the hub nut lock.

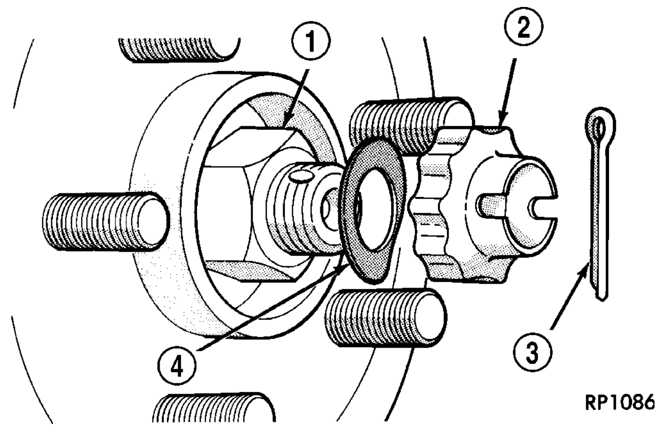

Fig. 6 Cotter Pin, Nut Lock, And Spring Washer

1 - HUB NUT
2 - NUT LOCK
3 - COTTER PIN
4 - SPRING WASHER

(6) Install rear wheel. Torque the lug nuts to 135 N·m (100 ft.lbs.).

SPECIFICATIONS - HALF SHAFT - FRONT

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Nut, Hub	244	180	-
Nuts, Rear Wheel Lug	135	100	-
Bolt, Half Shaft to Output Flange	61	45	-

CV BOOT - INNER/OUTER

REMOVAL

(1) Remove half shaft from vehicle. (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - REMOVAL)

(2) Clamp the half shaft into a suitable vise with protective jaws clamped onto the interconnecting shaft (Fig. 7).

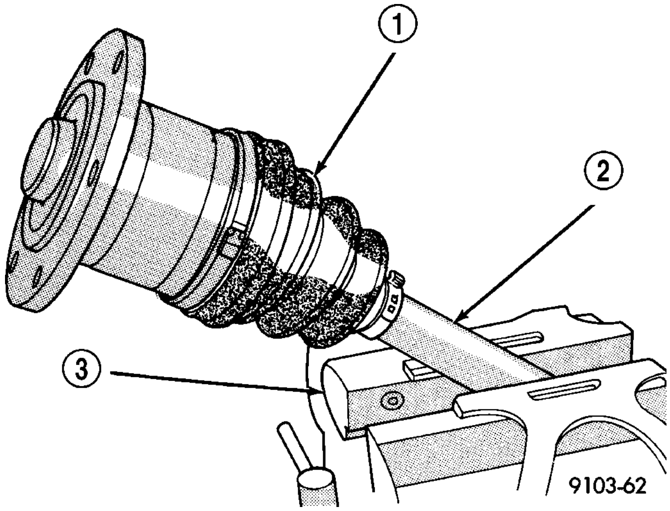

Fig. 7 Clamp Shaft In Soft Jawed Vice

1 - HALF SHAFT BOOT
2 - HALF SHAFT
3 - VISE

(3) Remove the large and small diameter retaining clamps holding the CV boot to the CV joint and the interconnecting shaft (Fig. 8).

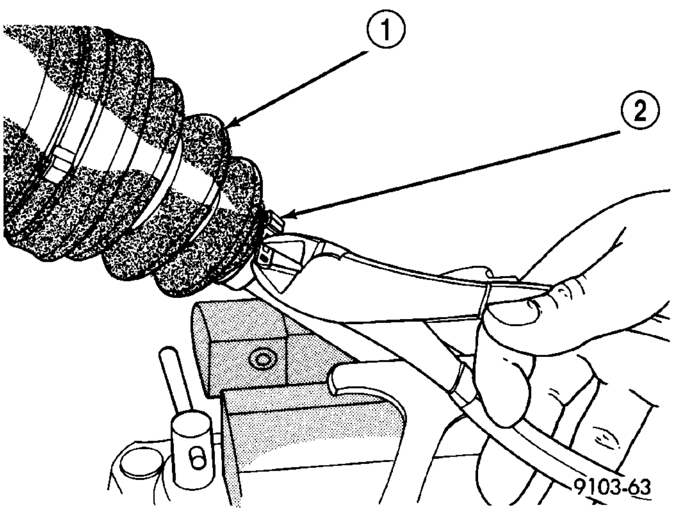

Fig. 8 Remove Boot Clamps

1 - HALF SHAFT BOOT
2 - CLAMP

(4) Pull the boot back from the CV joint (Fig. 9).

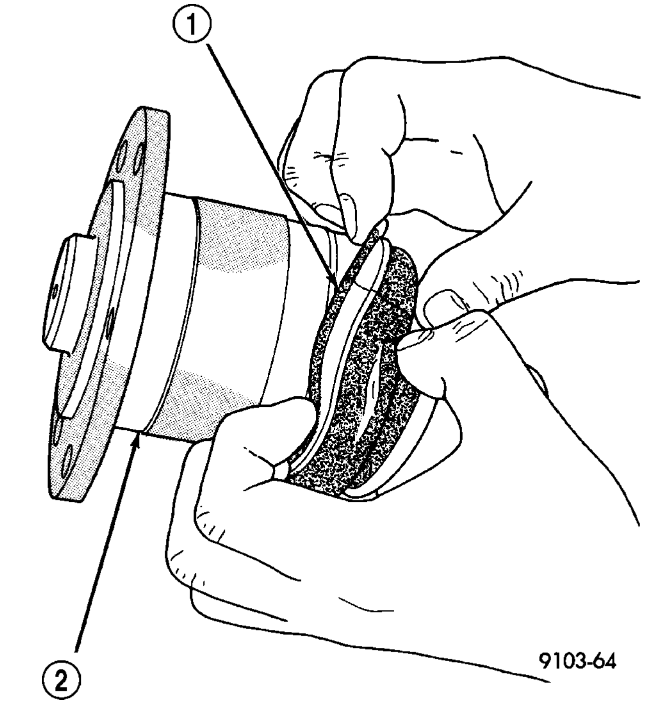

Fig. 9 Pull Back Boot

1 - HALF SHAFT BOOT
2 - HALF SHAFT JOINT

(5) Remove the CV housing from the interconnecting shaft and tripod assembly (Fig. 10).

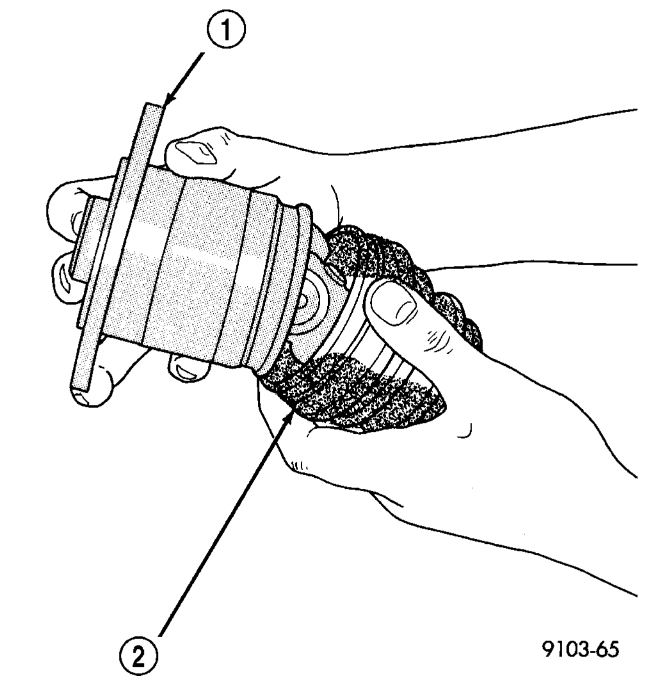

Fig. 10 Remove CV Housing

1 - HALF SHAFT JOINT HOUSING
2 - BOOT

CV BOOT - INNER/OUTER (Continued)

(6) Remove the snap-ring holding the tripod assembly onto the interconnecting shaft (Fig. 11).

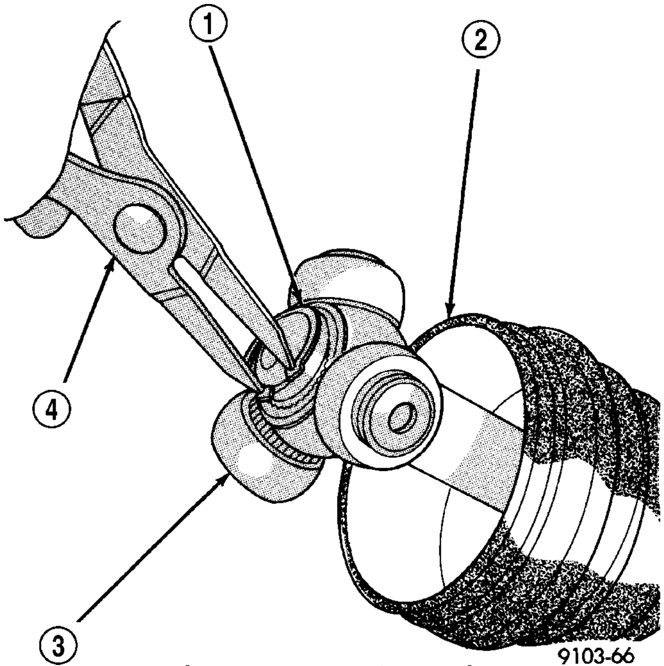

Fig. 11 Remove Snap-Ring

1 - SNAP RING
2 - HALF SHAFT BOOT
3 - TRIPOD ASSEMBLY
4 - SNAP RING PLIERS

(7) Remove the tripod assembly from the interconnecting shaft (Fig. 12).

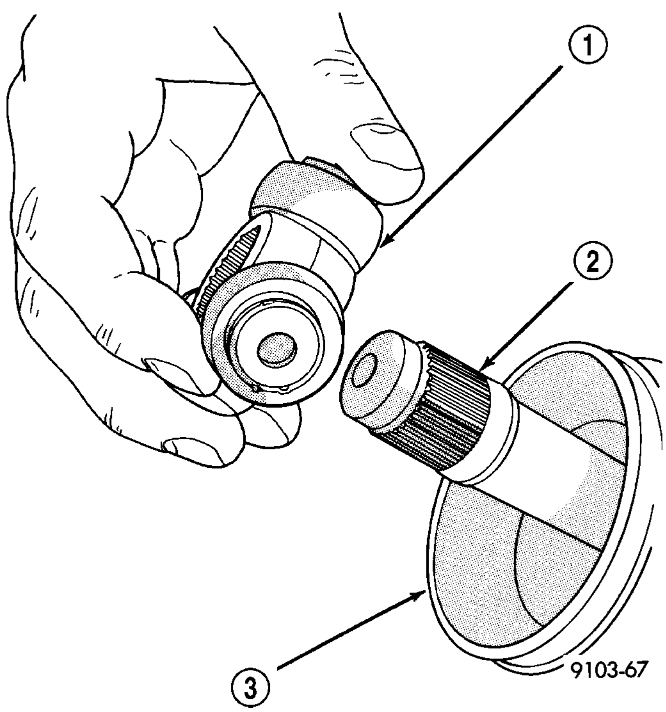

Fig. 12 Slide Tripod Off The Shaft

1 - TRIPOD ASSEMBLY
2 - AXLE SHAFT
3 - HALF SHAFT BOOT

(8) Remove the CV boot from the interconnecting shaft (Fig. 13).

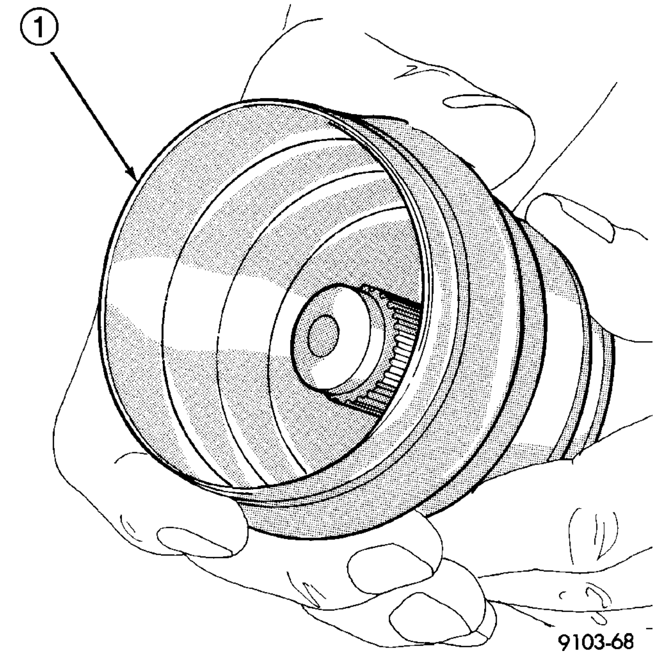

Fig. 13 Remove Boot

1 - HALF SHAFT BOOT

INSTALLATION

(1) Clean the interconnecting shaft and CV joint of any residual grease and dirt.

(2) Slide the new small diameter retaining clamp onto the interconnecting shaft.

(3) Install the CV boot onto the interconnecting shaft (Fig. 14).

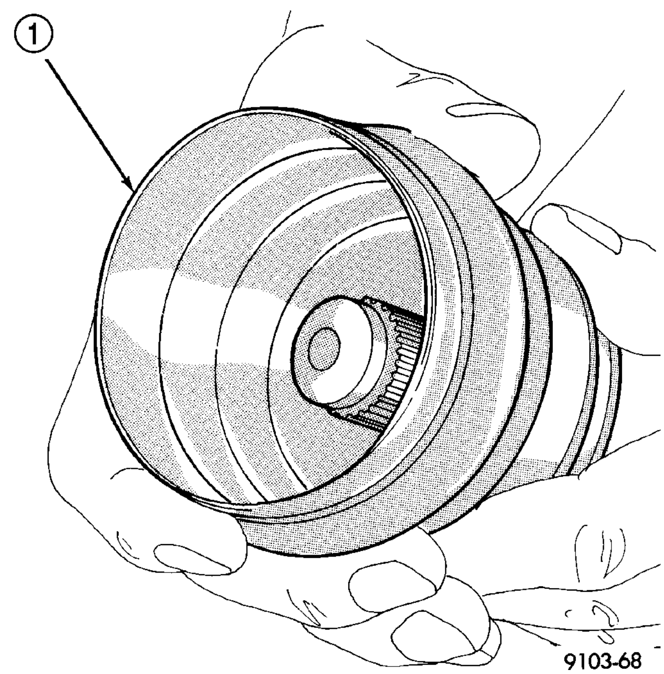

Fig. 14 Install CV Boot Onto Interconnecting Shaft

1 - HALF SHAFT BOOT

CV BOOT - INNER/OUTER (Continued)

(4) Install the tripod assembly onto the interconnecting shaft (Fig. 15).

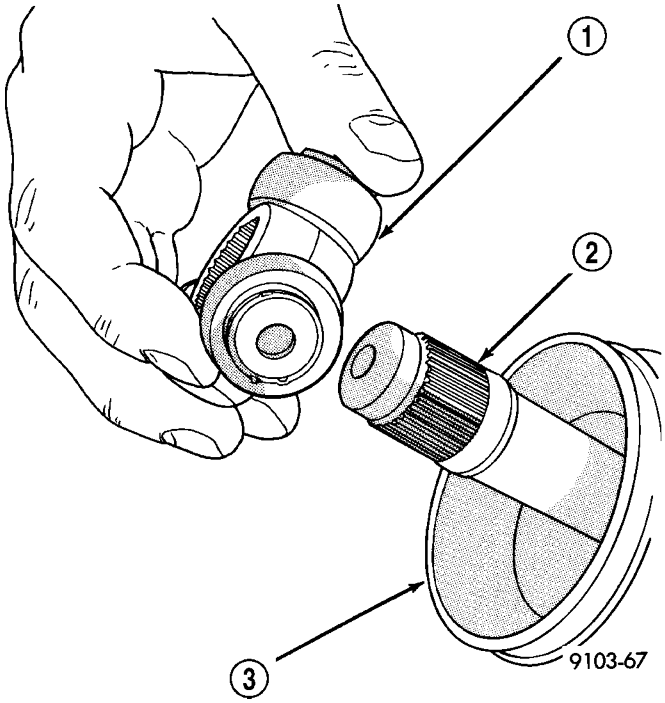

Fig. 15 Slide Tripod Onto The Interconnecting Shaft

1 - TRIPOD ASSEMBLY
2 - AXLE SHAFT
3 - HALF SHAFT BOOT

(5) Install the snap-ring to hold the tripod assembly onto the interconnecting shaft (Fig. 16).

(6) Install the new large diameter retaining clamp onto the CV joint housing.

(7) Distribute 1/2 the amount of grease provided in the seal boot service package (DO NOT USE ANY OTHER TYPE OF GREASE) into tripod housing. Put the remaining amount into the sealing boot.

(8) Install the CV housing onto the interconnecting shaft and tripod assembly (Fig. 17).

(9) Clamp the half shaft into a suitable vise with protective jaws clamped onto the interconnecting shaft.

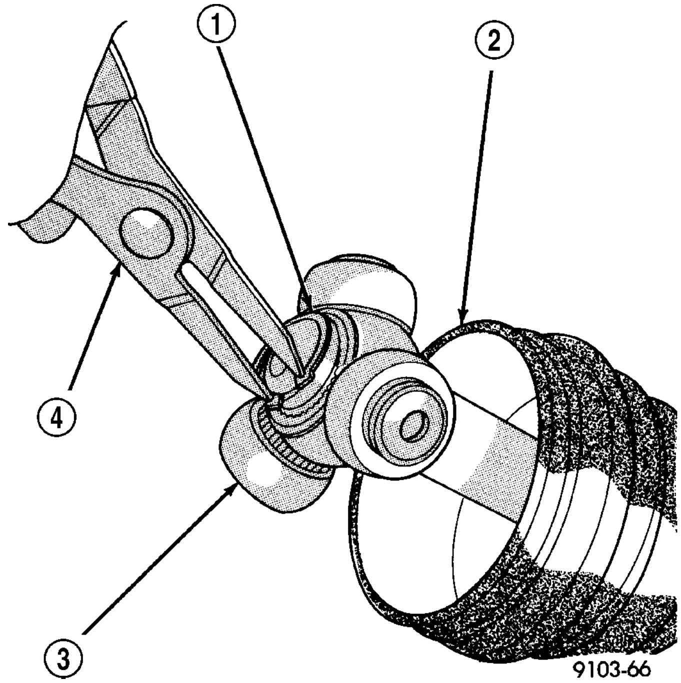

Fig. 16 Install Snap-Ring

1 - SNAP RING
2 - HALF SHAFT BOOT
3 - TRIPOD ASSEMBLY
4 - SNAP RING PLIERS

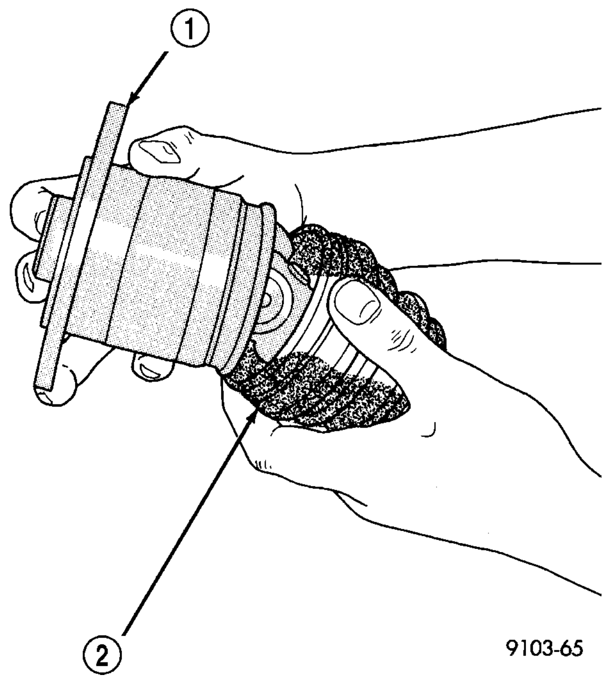

Fig. 17 Install CV Housing

1 - HALF SHAFT JOINT HOUSING
2 - BOOT

CV BOOT - INNER/OUTER (Continued)

(10) Position the CV joint boot on interconnecting shaft so the raised bead on the inside of the small diameter end of the seal boot is in mating groove on interconnecting shaft (Fig. 18).

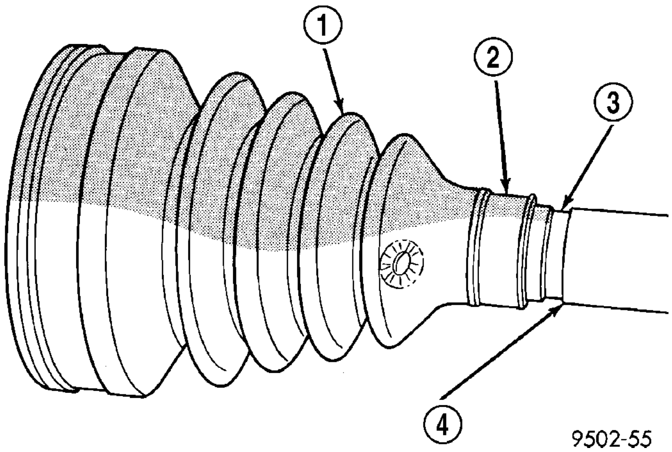

Fig. 18 Sealing Boot Installation on Interconnecting Shaft

1 - SEALING BOOT
2 - RAISED BEAD IN THIS AREA OF SEALING BOOT
3 - GROOVE
4 - INTERCONNECTING SHAFT

(11) Install CV joint seal boot to interconnecting shaft clamp evenly on sealing boot.

(12) Place crimping tool C-4975-A over bridge of clamp (Fig. 19).

(13) Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 20).

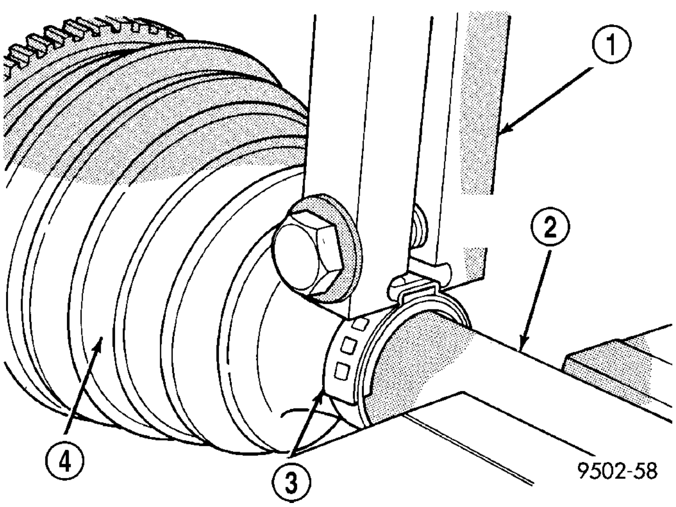

Fig. 19 Crimping Tool Installed on Sealing Boot Clamp - Typical

1 - SPECIAL TOOL C-4975-A
2 - INTERCONNECTING SHAFT
3 - CLAMP
4 - SEALING BOOT

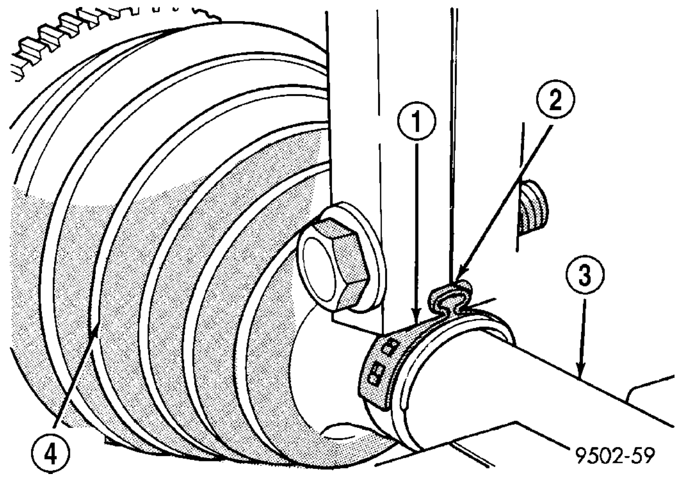

Fig. 20 Sealing Boot Retaining Clamp Installed - Typical

1 - CLAMP
2 - JAWS OF SPECIAL TOOL C-4975-A MUST BE CLOSED COMPLETELY TOGETHER HERE
3 - INTERCONNECTING SHAFT
4 - SEALING BOOT

CAUTION: The boot must not be dimpled, stretched or out of shape in any way. If boot is NOT shaped correctly, equalize pressure in boot and shape it by hand.

(14) Position CV boot into the CV housing retaining groove. Install the boot large diameter retaining clamp evenly onto the boot.

(15) Clamp the CV joint boot to the CV joint, using required procedure for type of boot clamp application.

CV BOOT - INNER/OUTER (Continued)

CRIMP TYPE BOOT CLAMP

If seal boot uses crimp type boot clamp, use the following procedure to install the retaining clamp.

(1) Place crimping tool C-4975-A over bridge of clamp (Fig. 21).

(2) Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 22).

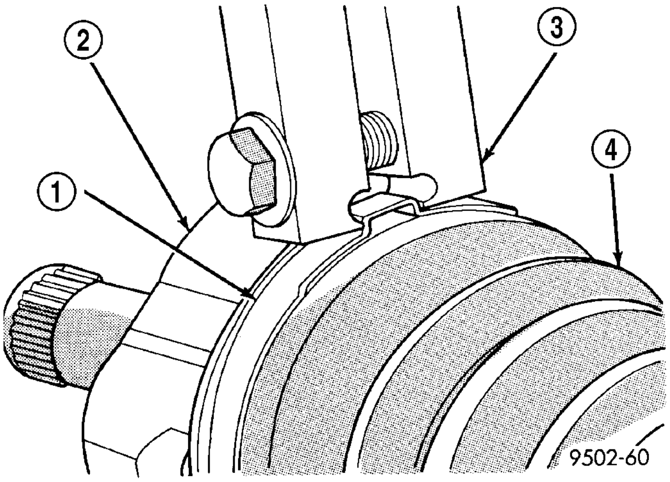

Fig. 21 Crimping Tool Installed on Sealing Boot Clamp - Typical

1 - CLAMP
2 - TRIPOD JOINT HOUSING
3 - SPECIAL TOOL C-4975-A
4 - SEALING BOOT

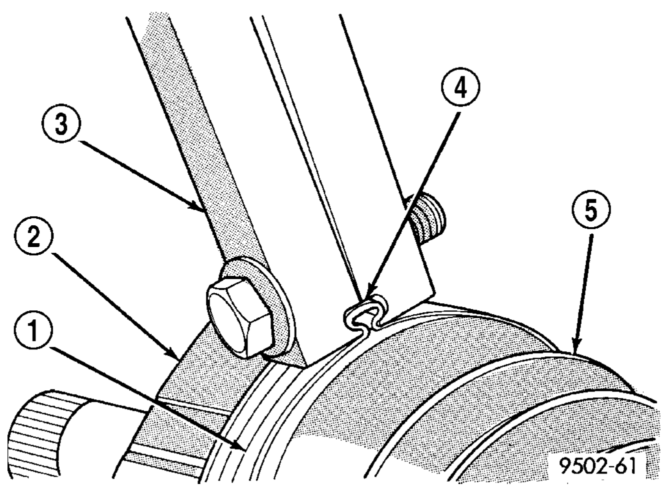

Fig. 22 Sealing Boot Retaining Clamp Installed - Typical

1 - CLAMP
2 - TRIPOD HOUSING
3 - SPECIAL TOOL C-4975-A
4 - JAWS OF SPECIAL TOOL C-4975-A MUST BE CLOSED COMPLETELY TOGETHER HERE
5 - SEALING BOOT

LATCHING TYPE BOOT CLAMP

If seal boot uses low profile latching type boot clamp, use the following procedure to install the retaining clamp.

(1) Place prongs of clamp locking tool in the holes of the clamp (Fig. 23).

(2) Squeeze tool together until top band of clamp is latched behind the two tabs on lower band of clamp (Fig. 24).

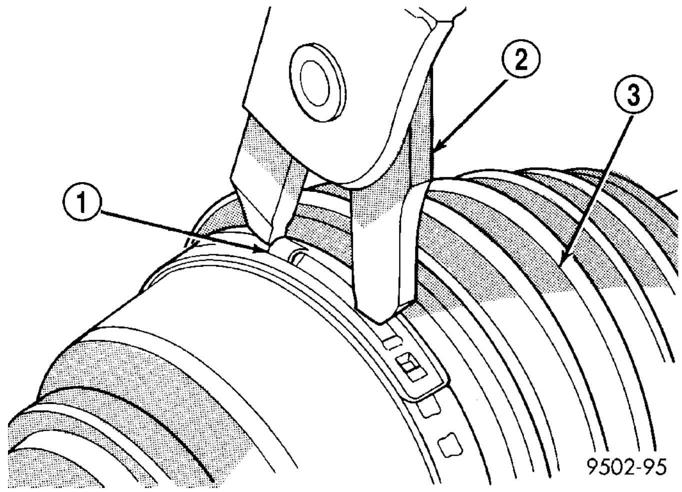

Fig. 23 Clamping Tool Installed on Sealing Boot Clamp

1 - CLAMP
2 - TOOL YA3050, OR EQUIVALENT
3 - SEALING BOOT

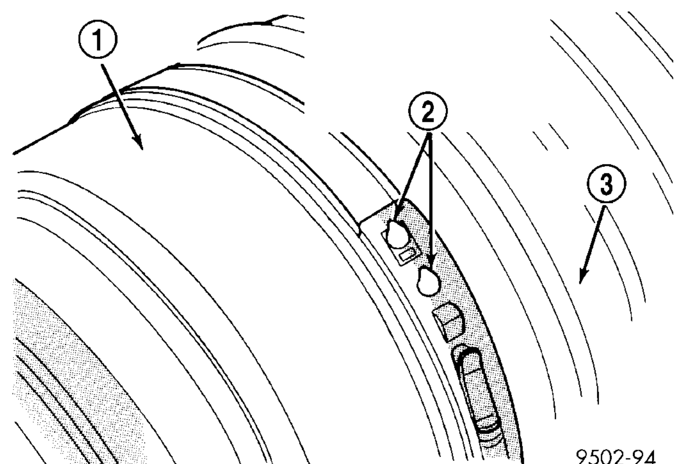

Fig. 24 Sealing Boot Clamp Correctly Installed

1 - INNER TRIPOD JOINT HOUSING
2 - TOP BAND OF CLAMP MUST BE RETAINED BY TABS AS SHOWN HERE TO CORRECTLY LATCH BOOT CLAMP
3 - SEALING BOOT

(16) Install the half shaft into the vehicle. (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - INSTALLATION)

PROPELLER SHAFT

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PROPELLER SHAFT

DESCRIPTION

WARNING: Due to propeller shaft imbalance concerns, the propeller shaft can only be serviced as an assembly.

AWD models utilize a "two-piece" propeller shaft (Fig. 1) to transmit power to the rear driveline module assembly. This two-piece design consists of:

- Front and rear shaft segments.
- Plunging center CV joint
- Center support bearing
- Rubber coupler at driveline module flange

The front shaft segment utilizes a CV joint at the power transfer unit connection, and a plunging CV joint at the center bearing location.

The rear shaft segment utilizes a center support bearing at the forward position, and a rubber coupler at the driveline module flange.

OPERATION

The propeller shaft (Fig. 1) is used to transmit torque from the transaxle power transfer unit (PTU) to the rear driveline module of AWD equipped models.

The propeller shaft front half utilizes a CV joint at the PTU flange, and a plunging CV joint at the center bearing location. These joints are flexible, allowing for torsional movement of the powertrain.

The propeller shaft rear half utilizes a center support bearing, which supports this two-piece assembly. The bearing also stabilizes the rear shaft segment to minimize axle wind-up. The rubber coupler at the driveline module flange dampens out propeller shaft torsional vibrations, as the driveline module it connects to is fastened to the vehicle body.

REMOVAL

CAUTION: Propeller shaft removal is a two-man operation. Never allow propeller shaft to hang while connected to power transfer unit (PTU) or rear driveline module flanges. A helper is required.

(1) Make sure transaxle is in neutral (N). Using chalk, mark propeller shaft flanges at PTU and rear driveline module for installation reference.

(2) Remove six propeller shaft-to-power transfer unit bolts.

(3) Have helper remove three propeller shaft rubber coupler-to-driveline module bolts while he/she supports rear shaft by hand.

(4) Remove center bearing support-to-crossmember bolts, while supporting front shaft with two hands.

(5) Lower propeller shaft assembly to ground, using care not to damage fore and aft flanges (Fig. 1).

INSTALLATION

CAUTION: Propeller shaft installation is a two-man operation. Never allow propeller shaft to hang while connected to power transfer unit (PTU) or rear driveline module flanges. A helper is required.

(1) Make sure transaxle is in Neutral (N) position.

(2) Obtain a helper and lift propeller shaft assembly into position (Fig. 1).

(3) While helper supports front half of shaft level to underbody, align paint marks at driveline module flange and install three propeller shaft rubber coupler-to-rear driveline module bolts by hand. Do not torque at this time.

(4) While helper supports front half of shaft level to underbody, align chalk marks at PTU flange. Install six propeller shaft-to-PTU flange bolts and torque to 30 N·m (22 ft. lbs.). Torque bolts alternately to ensure proper flange mating.

(5) Place center bearing into position. Install and torque center bearing-to-crossmember bolts to 54 N·m (40 ft. lbs.).

(6) Torque propeller shaft rubber coupler-to-rear driveline module assembly to 54 N·m (40 ft. lbs.).

PROPELLER SHAFT (Continued)

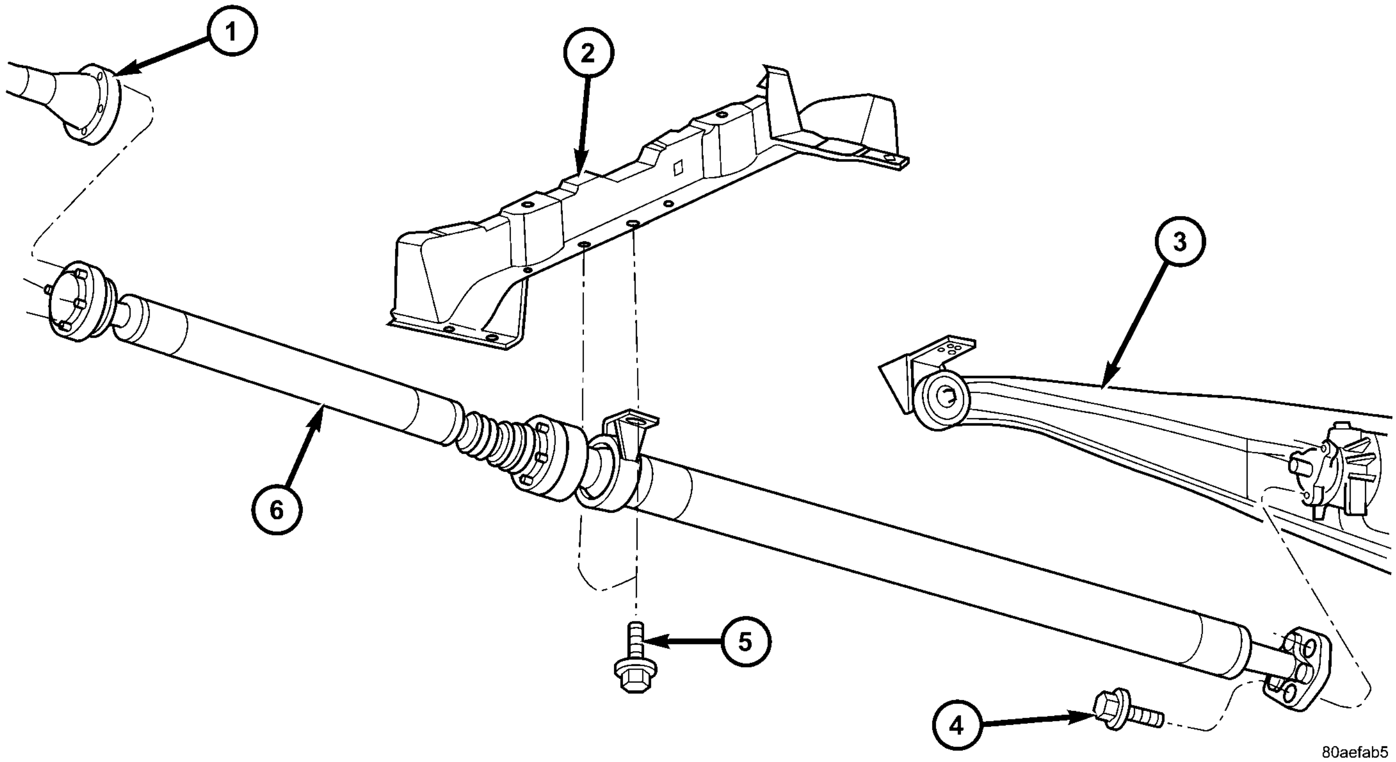

Fig. 1 Propeller Shaft Removal/Installation

1 - PTU FLANGE
2 - CROSSMEMBER
3 - REAR DRIVELINE MODULE
4 - BOLT-PROPELLER SHAFT COUPLER-T0-DRIVELINE MODULE
5 - BOLT-CENTER SUPPORT BEARING-TO-CROSSMEMBER
6 - PROPELLER SHAFT ASSEMBLY

SPECIFICATIONS - PROPELLER SHAFT

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt, Propeller Shaft Front Flange-to-PTU Flange	30	22	—
Bolt, Propeller Shaft Rear Flange-to-Driveline Module Flange	54	40	—
Bolt, Center Support Bearing-to-Body	54	40	—

REAR DRIVELINE MODULE

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REAR DRIVELINE MODULE

DESCRIPTION

The rear driveline module assembly (Fig. 1) consists of four main components:

- Bi-Directional Overrunning Clutch (BOC)
- Viscous Coupling
- Differential Assembly
- Torque Arm

The viscous coupling and bi-directional overrunning clutch are contained within an overrunning clutch housing, which fastens to the differential assembly. The overrunning clutch housing and differential assembly have unique fluid sumps, each requiring their own type and capacity of fluid. The overrunning clutch housing requires Mopar® ATF+4 (Automatic Transmission Fluid—Type 9602) or equivalent. The differential assembly requires Mopar® 80W-90 Gear and Axle Lubricant.

Driveline module service is limited to the following components:

- Differential Assembly (serviced only as assembly)
- Viscous Coupling
- Bi-Directional Overrunning Clutch (BOC)
- Overrunning Clutch Housing
- Seals (Input Flange, Output Flange, Overrunning Clutch Housing O-rings)
- Input Flange/Shield
- Torque Arm
- Vents
- Fasteners

OPERATION

The primary benefits of All Wheel Drive are:

- Superior straight line acceleration, and cornering on all surfaces
- Better traction and handling under adverse conditions, resulting in improved hill climbing ability and safer driving.

The heart of the system is an inter-axle viscous coupling. The vehicle retains predominantly front-wheel drive characteristics, but the All Wheel Drive capability takes effect when the front wheels start to slip. Under normal level road, straight line driving, 100% of the torque is allocated to the front wheels. The viscous coupling controls and distributes torque/power to the rear wheels. The viscous coupling transmits torque to the rear wheels in proportion of the amount of the slippage at the front wheels. Thais variable torque distribution is automatic with no driver inputs required. The coupling is similar to a multi-plate clutch. It consists of a series of closely spaced discs, which are alternately connected to the

REAR DRIVELINE MODULE (Continued)

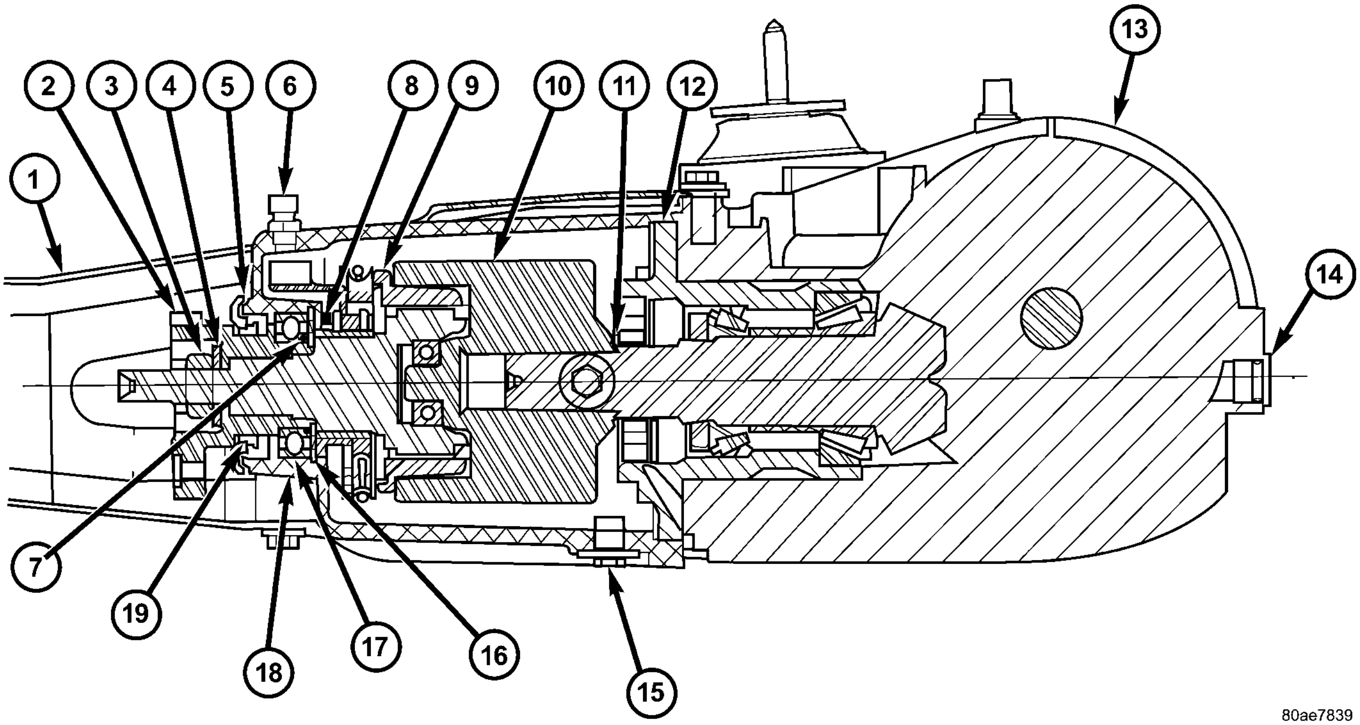


Fig. 1 AWD Driveline Module Assembly

1 - TORQUE ARM	8 - WASHER	15 - PLUG-OVERRUNNING CLUTCH HOUSING DRAIN
2 - INPUT FLANGE	9 - BI-DIRECTIONAL OVERRUNNING CLUTCH (BOC)	16 - SNAP RING
3 - FLANGE NUT	10 - VISCOUS COUPLER	17 - BEARING
4 - WASHER	11 - SHIM (SELECT)	18 - OVERRUNING CLUTCH HOUSING
5 - SHIELD	12 - O-RING	19 - SEAL-INPUT FLANGE
6 - VENT	13 - DIFFERENTIAL ASSEMBLY	
7 - O-RING	14 - PLUG-DIFFERENTIAL FILL	

front and rear drive units. The unit is totally sealed and partially filled with silicone fluid. There is no adjustment, maintenance or fluid checks required during the life of the unit.

The overrunning clutch allows the rear wheels to overrun the front wheels during a rapid front wheel lock braking maneuver. The overrunning action prevents any feed-back of front wheel braking torque to the rear wheels. It also allows the braking system to control the braking behavior as a two wheel drive (2WD) vehicle.

The overrunning clutch housing has a separate oil sump and is filled independently from the differential. The fill plug is located on the side of the overrunning clutch case. When filling the overrunning clutch with lubricant use Mopar® ATF+4 (Automatic Transmission Fluid—Type 9602) or equivalent.

The differential assembly contains a conventional open differential with hypoid ring gear and pinion gear set. The hypoid gears are lubricated by SAE 80W-90 gear lubricant.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - REAR DRIVELINE MODULE NOISE

Different sources can be the cause of noise that the rear driveline module assembly is suspected of making. Refer to the following causes for noise diagnosis.

DRIVELINE MODULE ASSEMBLY NOISE

The most important part of driveline module service is properly identifying the cause of failures and noise complaints. The cause of most driveline module failures is relatively easy to identify. The cause of driveline module noise is more difficult to identify.

If vehicle noise becomes intolerable, an effort should be made to isolate the noise. Many noises that are reported as coming from the driveline module may actually originate at other sources. For example:

- Tires
- Road surfaces
- Wheel bearings

REAR DRIVELINE MODULE (Continued)

- Engine
- Transmission
- Exhaust
- Propeller shaft (vibration)
- Vehicle body (drumming)

Driveline module noises are normally divided into two categories: gear noise or bearing noise. A thorough and careful inspection should be completed to determine the actual source of the noise before replacing the driveline module.

The rubber mounting bushings help to dampen-out driveline module noise when properly installed. Inspect to confirm that no metal contact exists between the driveline module case and the body. The complete isolation of noise to one area requires expertise and experience. Identifying certain types of vehicle noise baffles even the most capable technicians. Often such practices as:

- Increase tire inflation pressure to eliminate tire noise.
- Listen for noise at varying speeds with different driveline load conditions
- Swerving the vehicle from left to right to detect wheel bearing noise.

All driveline module assemblies produce noise to a certain extent. Slight carrier noise that is noticeable only at certain speeds or isolated situations should be considered normal. Carrier noise tends to peak at a variety of vehicle speeds. Noise is **NOT ALWAYS** an indication of a problem within the carrier.

TIRE NOISE

Tire noise is often mistaken for driveline module noise. Tires that are unbalanced, worn unevenly or are worn in a saw-tooth manner are usually noisy. They often produce a noise that appears to originate in the driveline module.

Tire noise changes with different road surfaces, but driveline module noise does not. Inflate all four tires with approximately 20 psi (138 kPa) more than the recommended inflation pressure (for test purposes only). This will alter noise caused by tires, but will not affect noise caused by the differential. Rear axle noise usually ceases when coasting at speeds less than 30 mph (48 km/h); however, tire noise continues, but at a lower frequency, as the speed is reduced.

After test has been completed lower tire pressure back to recommended pressure.

GEAR NOISE (DRIVE PINION AND RING GEAR)

Abnormal gear noise is rare and is usually caused by scoring on the ring gear and drive pinion. Scoring is the result of insufficient or incorrect lubricant in the carrier housing.

Abnormal gear noise can be easily recognized. It produces a cycling tone that will be very pronounced within a given speed range. The noise can occur during one or more of the following drive conditions:

- Drive
- Road load
- Float
- Coast

Abnormal gear noise usually tends to peak within a narrow vehicle speed range or ranges. It is usually more pronounced between 30 to 40 mph (48 to 64 km/h) and 50 to 60 mph (80 to 96 km/h). When objectionable gear noise occurs, note the driving conditions and the speed range.

BEARING NOISE (DRIVE PINION AND DIFFERENTIAL)

Defective bearings produce a rough growl that is constant in pitch and varies with the speed of vehicle. Being aware of this will enable a technician to separate bearing noise from gear noise.

Drive pinion bearing noise that results from defective or damaged bearings can usually be identified by its constant, rough sound. Drive pinion front bearing is usually more pronounced during a coast condition. Drive pinion rear bearing noise is more pronounced during a drive condition. The drive pinion bearings are rotating at a higher rate of speed than either the differential side bearings or the axle shaft bearing.

Differential side bearing noise will usually produce a constant, rough sound. The sound is much lower in frequency than the noise caused by drive pinion bearings.

Bearing noise can best be detected by road testing the vehicle on a smooth road (black top). However, it is easy to mistake tire noise for bearing noise. If a doubt exists, the tire treads should be examined for irregularities that often causes a noise that resembles bearing noise.

ENGINE AND TRANSMISSION NOISE

Sometimes noise that appears to be in the driveline module assembly is actually caused by the engine or the transmission. To identify the true source of the noise, note the approximate vehicle speed and/or RPM when the noise is most noticeable. Stop the vehicle next to a flat brick or cement wall (this will help reflect the sound). Place the transaxle in **NEUTRAL**. Accelerate the engine slowly up through the engine speed that matches the vehicle speed noted when the noise occurred. If the same noise is produced, it usually indicates that the noise is being caused by the engine or transaxle.

DIAGNOSIS AND TESTING - REAR DRIVELINE MODULE OPERATION

Driveline module operation requires relatively straight-forward diagnosis. Refer to the following chart:

DRIVELINE MODULE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
Rear wheels not overrunning	1) Bi-directional overrunning clutch failure	1) Replace overrunning clutch components as required
No AWD in forward or reverse directions, propeller shaft turning	1) Bi-directional overrunning clutch failure	1) Replace overrunning clutch components as required
	2) Viscous coupling failure	2) Replace viscous coupling
	3) Rear differential failure	3) Replace the rear differential assembly
No AWD in forward or reverse directions, propeller shaft not turning	1) Power transfer unit failure.	1) Replace power transfer unit components as necessary
Vibration at all speeds, continuous torque transfer	1) Mis-matched tires, worn tires on front axle.	1) Replace worn or incorrect (mis-matched) tires with same make and size

REMOVAL

(1) Raise vehicle on hoist.

(2) Drain fluid from overrunning clutch housing and/or differential assembly if necessary.

(3) Remove propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT - REMOVAL)

(4) Disconnect left and right rear halfshafts from output flanges (Fig. 2).

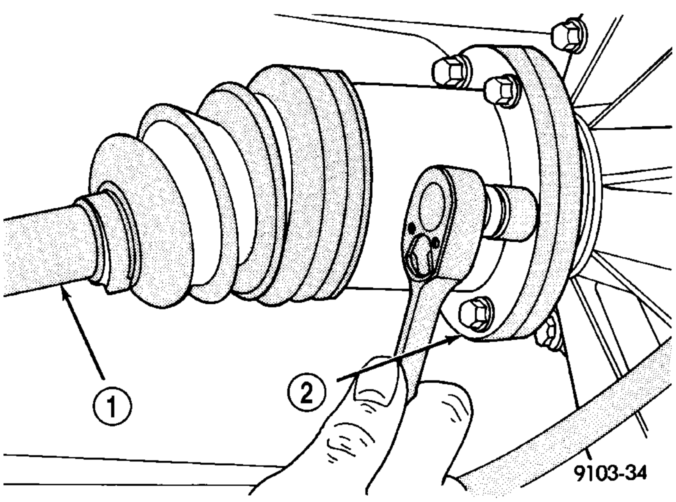


Fig. 2 Half Shaft Mounting Bolts

1 - SHAFT
2 - FLANGE

(5) Remove torque arm mount to body bolts.

(6) Position transmission jack to driveline module assembly and secure assembly to jack.

(7) Remove two driveline module-to-body bolts (Fig. 3).

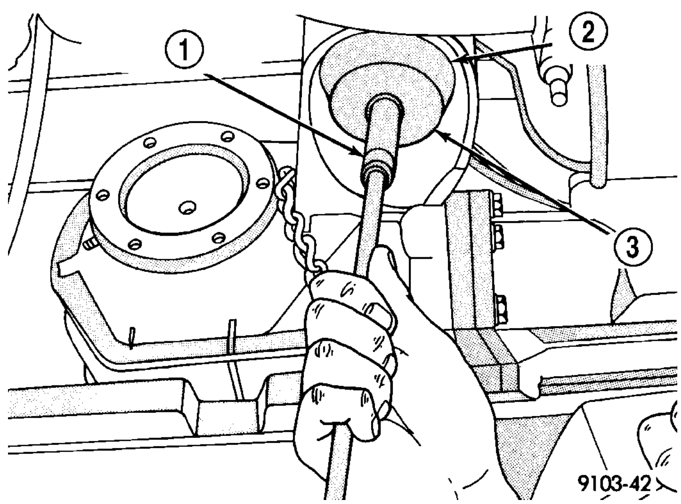


Fig. 3 Rear Drive Line Module Assembly Mounting Bolts

1 - DRIVELINE MODULE RETAINING BOLT (2)
2 - RUBBER ISOLATOR
3 - WASHER

(8) Lower driveline module from vehicle and remove from jack.

REAR DRIVELINE MODULE (Continued)

DISASSEMBLY

WARNING: Differential is only to be serviced as an assembly, and no disassembly is required.

(1) Remove six torque arm-to-differential case bolts and remove torque arm assembly (Fig. 4).

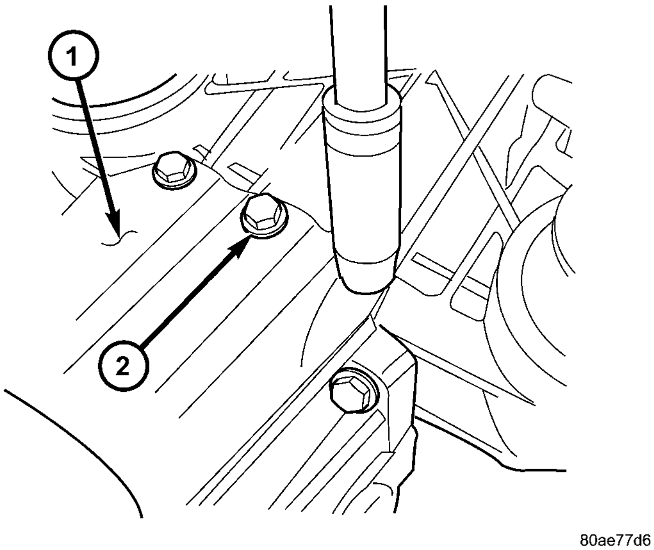


Fig. 4 Torque Arm Fasteners

1 - TORQUE ARM ASSEMBLY
2 - BOLT (SIX)

(2) Remove input flange nut and washer using Tool 6958 and a breaker bar (Fig. 5).

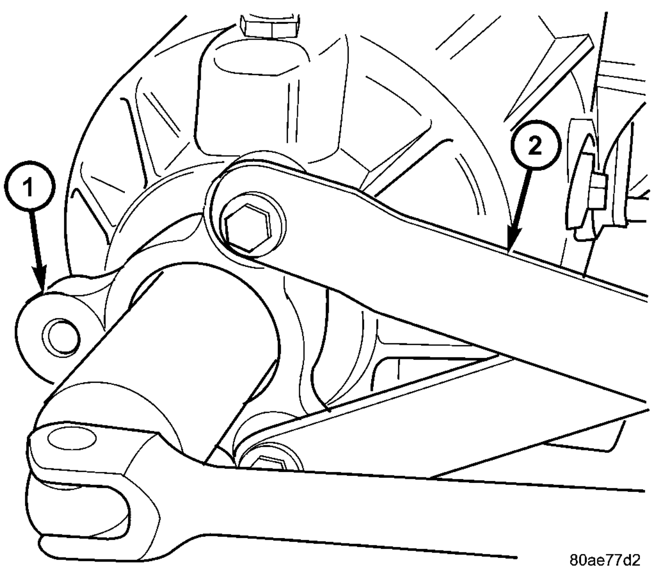


Fig. 5 Input Flange Nut

1 - INPUT FLANGE
2 - TOOL 6958

(3) Remove input flange (Fig. 6).

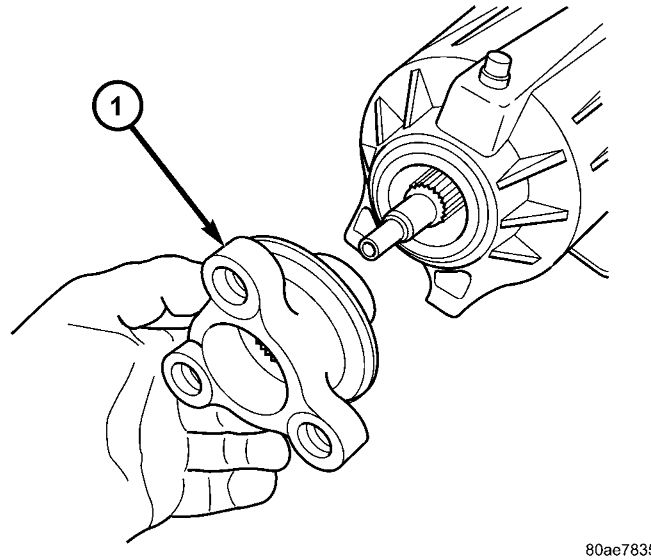


Fig. 6 Input Flange

1 - INPUT FLANGE/SHIELD

(4) Remove input flange seal from overrunning clutch housing using suitable screwdriver (Fig. 7).

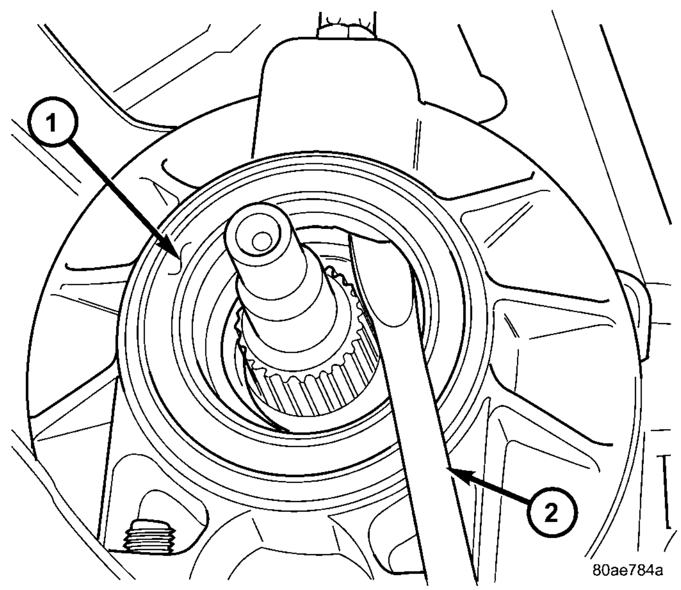


Fig. 7 Input Flange Seal Removal

1 - INPUT FLANGE SEAL
2 - SCREWDRIVER

REAR DRIVELINE MODULE (Continued)

(5) Remove four overrunning clutch housing-to-differential assembly bolts (Fig. 8) and remove housing.

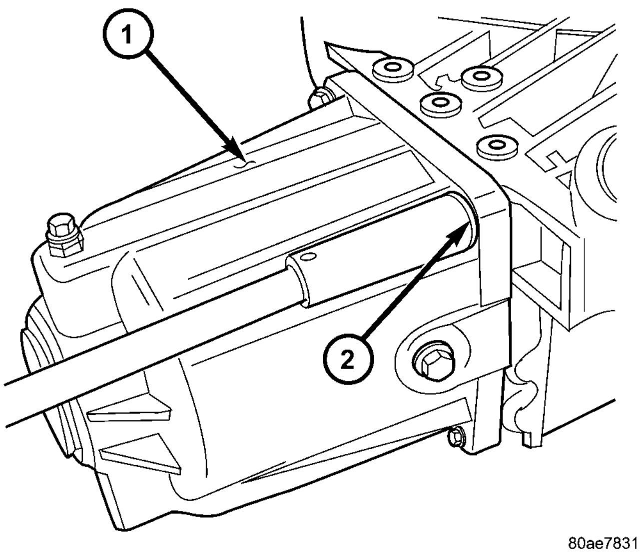


Fig. 8 Overrunning Clutch Housing Bolts

1 - OVERRUNNING CLUTCH HOUSING
2 - BOLT (FOUR)

(6) Remove front bearing snap ring (Fig. 14).

(7) Remove front bearing (Fig. 14).

(8) Remove o-ring and washer from overrunning clutch assembly (Fig. 14).

(9) Remove overrunning clutch assembly from viscous coupler (Fig. 9).

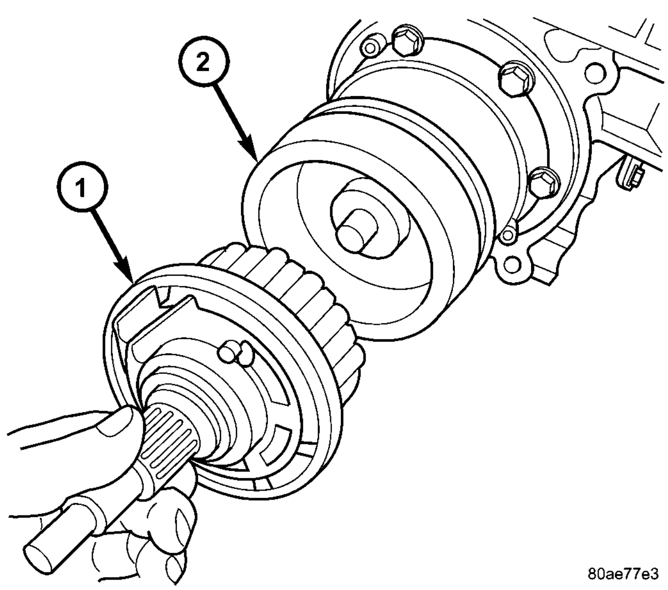


Fig. 9 Overrunning Clutch

1 - OVERRUNNING CLUTCH
2 - VISCOUS COUPLER

(10) Remove viscous coupler from differential pinion shaft (Fig. 10).

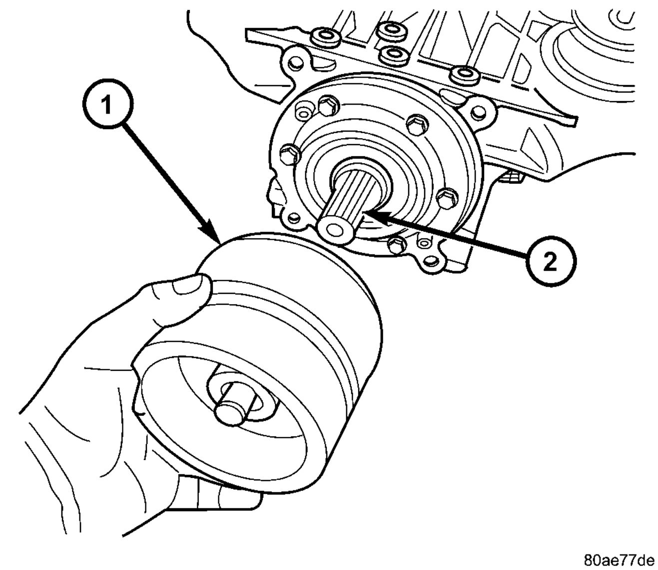


Fig. 10 Viscous Coupler

1 - VISCOUS COUPLER
2 - DIFFERENTIAL PINION

(11) Remove shim (select) from differential pinion gear (Fig. 11).

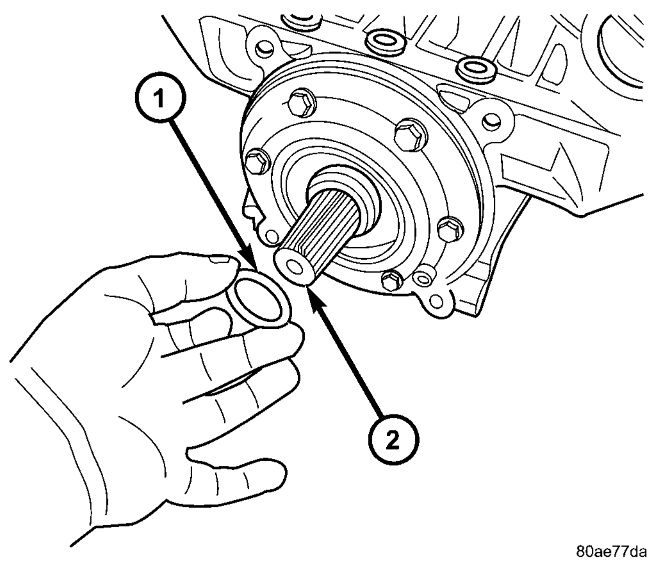


Fig. 11 Shim (Select)

1 - SHIM (SELECT)
2 - DIFFERENTIAL PINION

REAR DRIVELINE MODULE (Continued)

(12) Remove overrunning clutch housing large o-ring from differential assembly (Fig. 14).

(13) Remove output flanges using suitable screwdrivers and wood blocks to protect casting (Fig. 12).

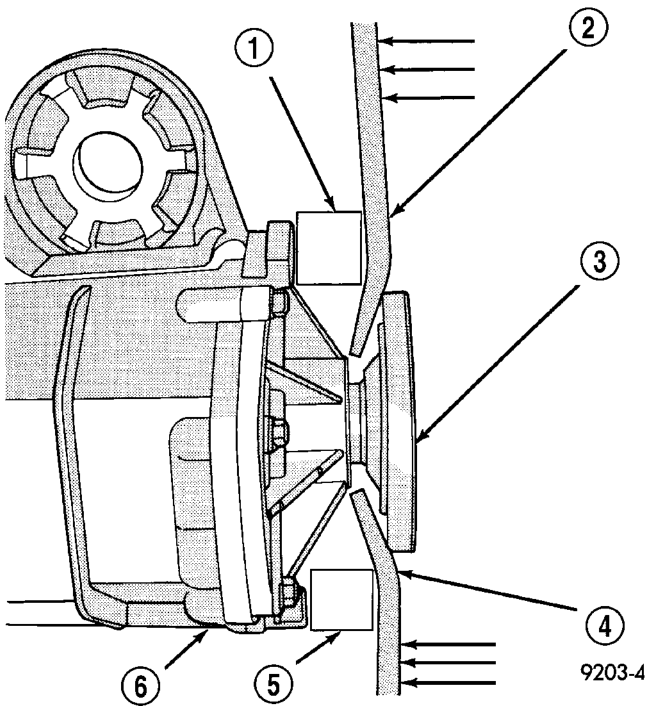


Fig. 12 Output Flange Removal

1 - WOOD BLOCK
2 - PRYBAR
3 - OUTPUT SHAFT
4 - PRYBAR
5 - WOOD BLOCK
6 - DIFFERENTIAL CASE

(14) Remove output flange seals (Fig. 13).

ASSEMBLY

(1) Install output flange seals using tools C4171 and 8493 (Fig. 15).

(2) Install large overrunning clutch housing o-ring to differential assembly (Fig. 14).

(3) Install shim to differential pinion shaft (Fig. 16).

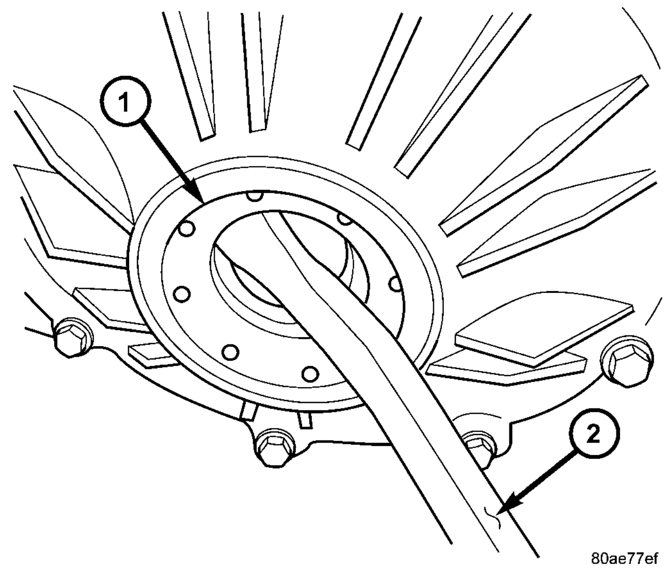


Fig. 13 Output Flange Seal Removal

1 - OUTPUT FLANGE SEAL
2 - SCREWDRIVER

REAR DRIVELINE MODULE (Continued)

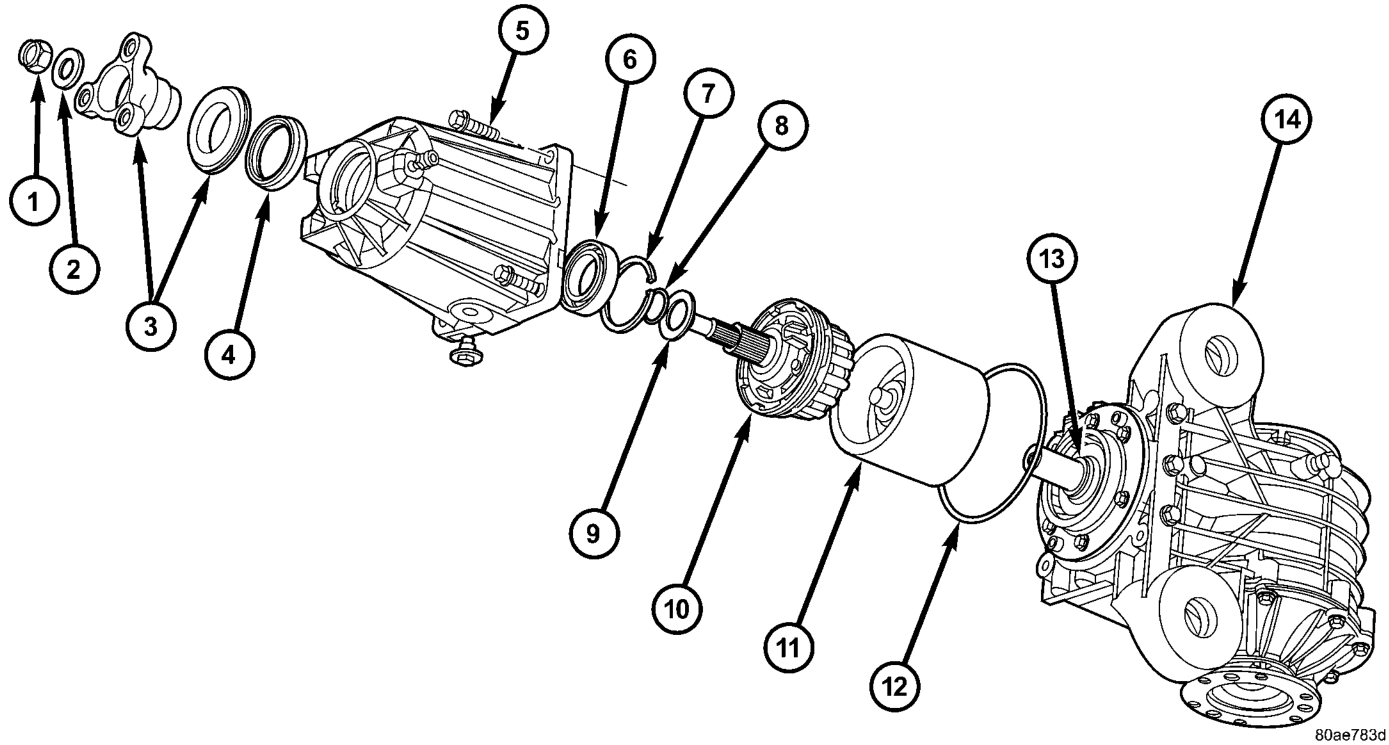


Fig. 14 Drive Line Module

1 - NUT, INPUT FLANGE
2 - WASHER, INPUT FLANGE NUT
3 - INPUT FLANGE/SHIELD
4 - SEAL, INPUT FLANGE
5 - OVERRUNNING CLUTCH HOUSING BOLT
6 - BEARING, FRONT
7 - SNAP RING, BEARING RETAINER
8 - O-RING
9 - WASHER
10 - BI-DIRECTIONAL OVERRUNNING CLUTCH
11 - VISCOUS COUPLER
12 - O-RING, OVERRUNNING CLUTCH HOUSING
13 - SHIM (SELECT)
14 - DIFFERENTIAL ASSEMBLY

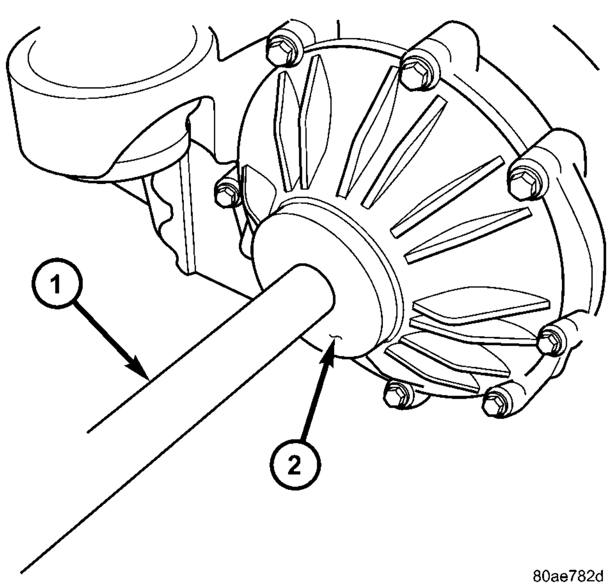


Fig. 15 Output Flange Seal Installation

1 - DRIVER HANDLE C4171
2 - INSTALLER 8493

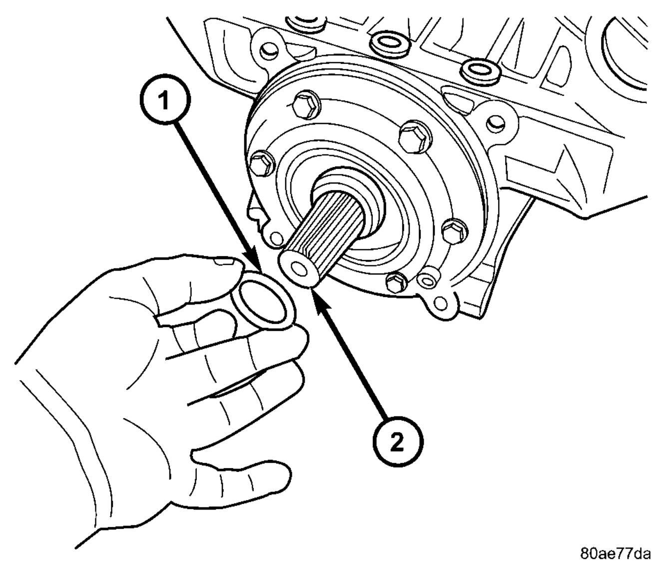


Fig. 16 Shim (Select)

1 - SHIM (SELECT)
2 - DIFFERENTIAL PINION

REAR DRIVELINE MODULE (Continued)

(4) Install viscous coupler to differential pinion shaft (Fig. 17).

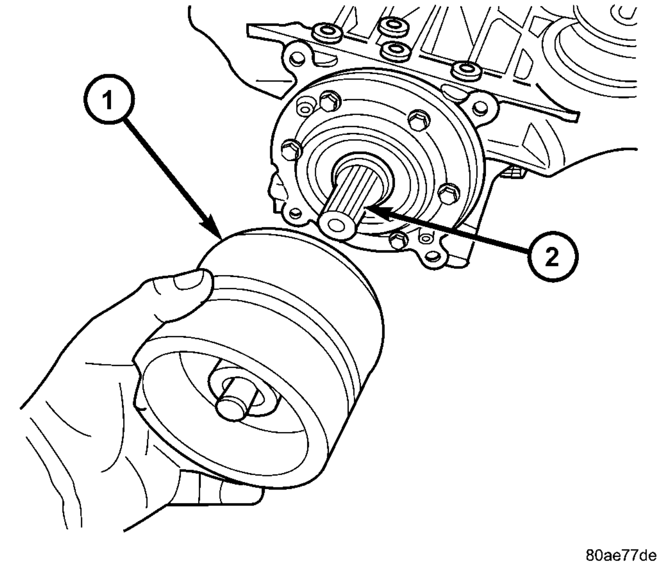


Fig. 17 Viscous Coupler

1 - VISCOUS COUPLER
2 - DIFFERENTIAL PINION

(5) Install overrunning clutch assembly to viscous coupler (Fig. 18).

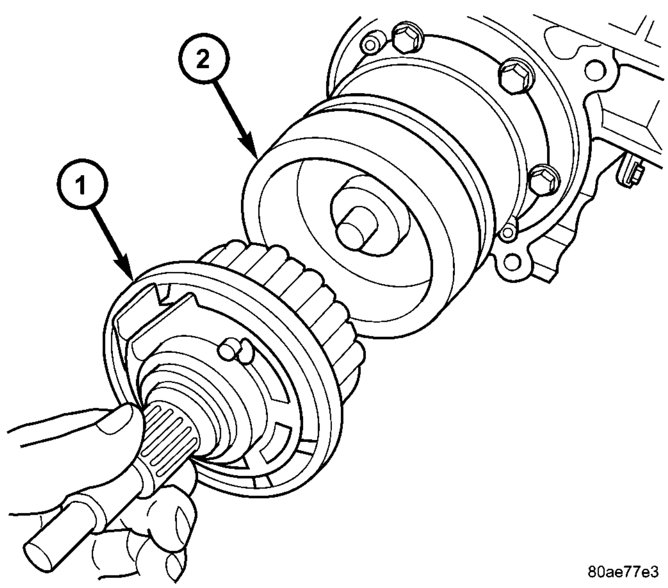


Fig. 18 Overrunning Clutch

1 - OVERRUNNING CLUTCH
2 - VISCOUS COUPLER

(6) Install washer to overrunning clutch (Fig. 14).

(7) Install o-ring to overrunning clutch (Fig. 14).

(8) Align overrunning clutch ground tab to 12 o'clock position (Fig. 19).

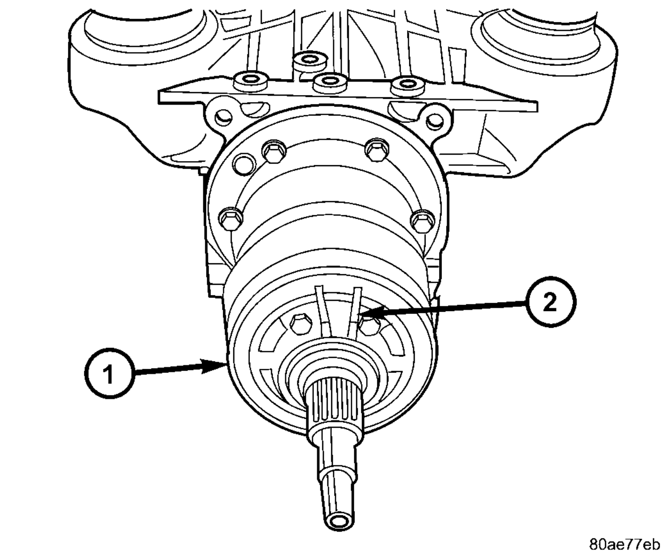


Fig. 19 Grounding Tab at 12 O'clock

1 - OVERRUNNING CLUTCH
2 - GROUND TAB

(9) Install overrunning clutch housing into position, making sure ground tab engages with notch in housing (Fig. 20).

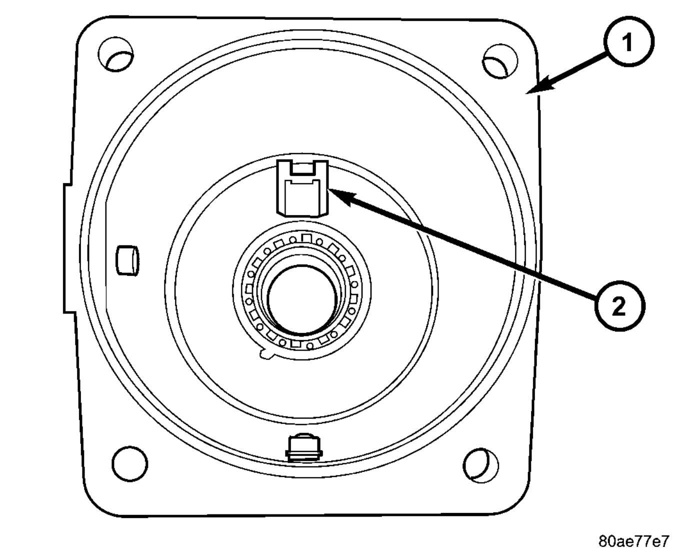


Fig. 20 Overrunning Clutch Housing

1 - OVERRUNNING CLUTCH HOUSING
2 - NOTCH

REAR DRIVELINE MODULE (Continued)

(10) Install and torque overrunning clutch housing-to-differential assembly bolts (Fig. 21) to 60 N·m (44 ft. lbs.).

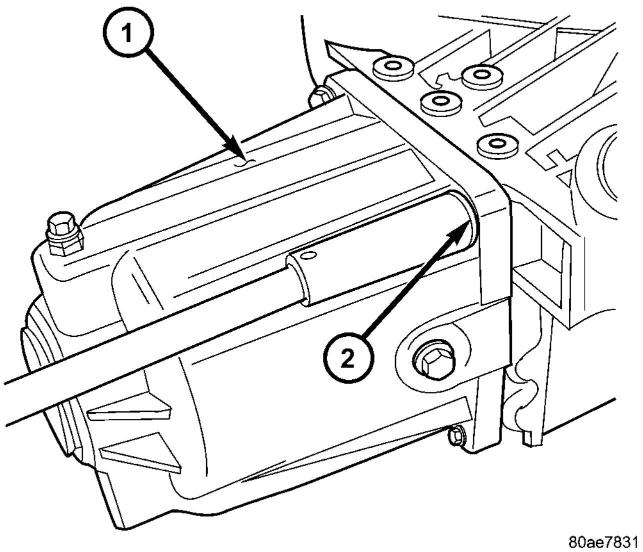


Fig. 21 Overrunning Clutch Housing Bolts

1 - OVERRUNNING CLUTCH HOUSING
2 - BOLT (FOUR)

(11) Install input flange seal using tool 8802 (Fig. 22).

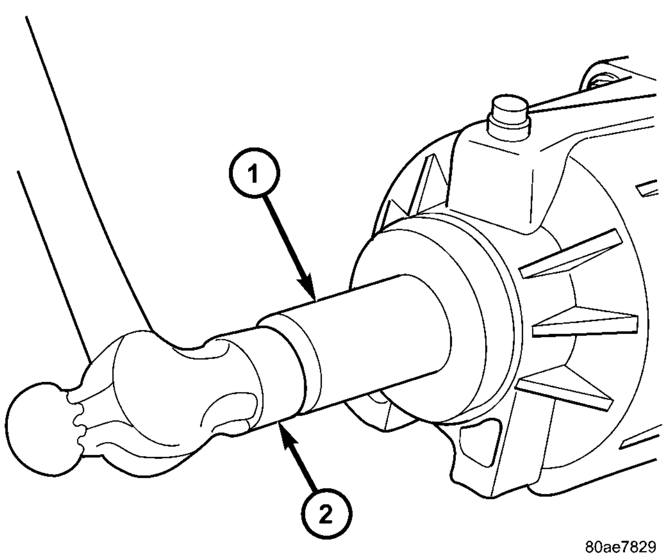


Fig. 22 Input Flange Seal Installation

1 - TOOL 8802
2 - HAMMER

(12) Install flange/shield assembly (Fig. 23).

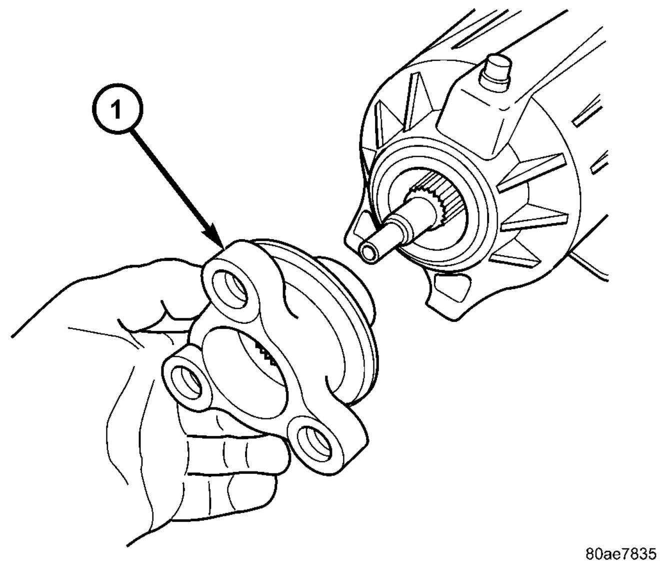


Fig. 23 Input Flange/Shield

1 - INPUT FLANGE/SHIELD

(13) Install input flange washer and nut. Using tool 6958 (Fig. 24), torque nut to 135 N·m (100 ft. lbs.).

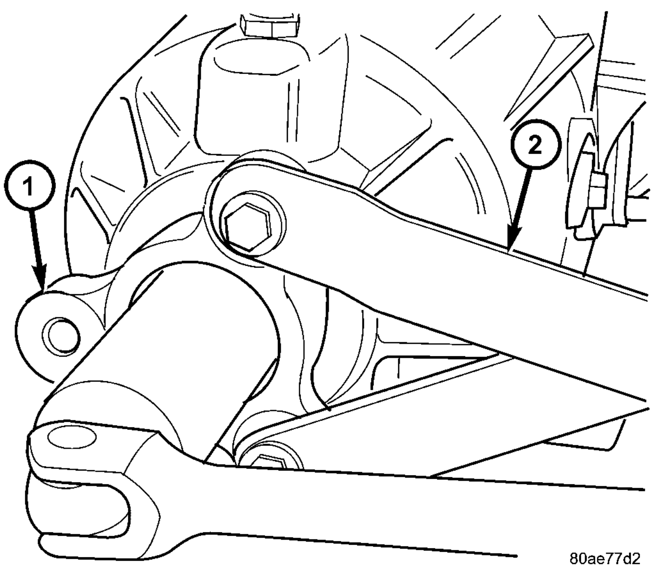


Fig. 24 Input Flange Nut

1 - INPUT FLANGE
2 - TOOL 6958

REAR DRIVELINE MODULE (Continued)

(14) Install torque arm assembly into position. Install and torque torque arm-to-differential assembly bolts (Fig. 25) to 60 N·m (44 ft. lbs.).

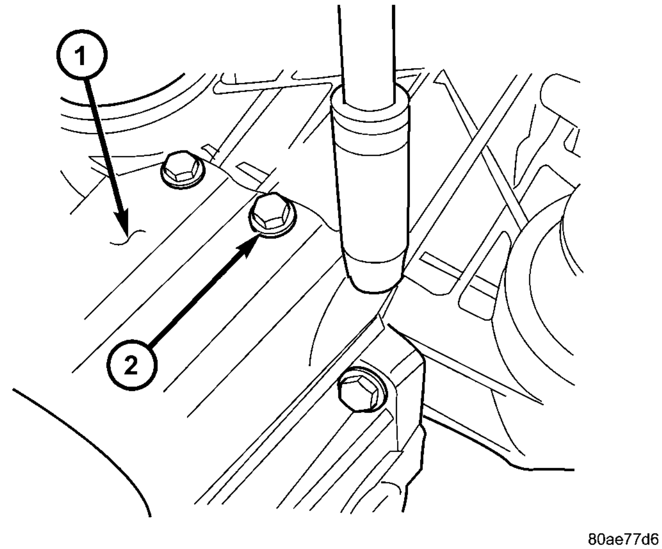


Fig. 25 Torque Arm Fasteners

1 - TORQUE ARM ASSEMBLY
2 - BOLT (SIX)

INSTALLATION

(1) Install rear driveline module assembly to transmission jack and secure.

(2) Raise rear driveline module into position and install and torque mounting bolts (Fig. 26) to 54 N·m (40 ft. lbs.).

(3) Remove transmission jack.

(4) Install and torque torque arm mount-to-body bolts to 54 N·m (40 ft. lbs.).

(5) Install halfshafts to differential output flanges and torque bolts (Fig. 27) to 61 N·m (45 ft. lbs.).

(6) Install propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT - INSTALLATION)

(7) Lower vehicle.

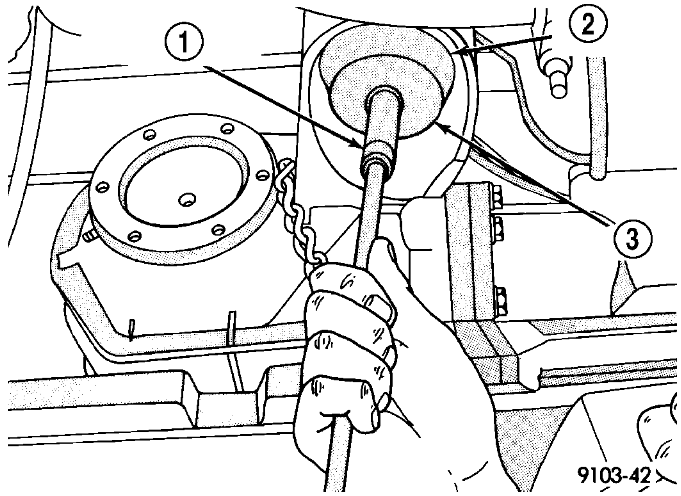


Fig. 26 Rear Drive Line Module Assembly Rear Mounting Bolts

1 - DRIVELINE MODULE RETAINING BOLT (2)
2 - RUBBER ISOLATOR
3 - WASHER

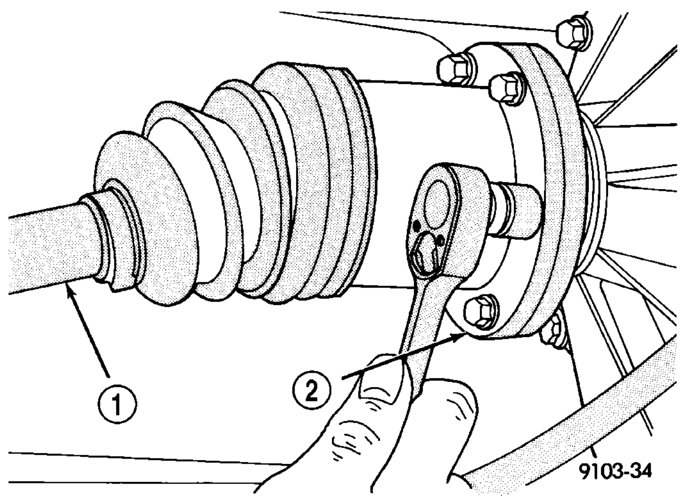


Fig. 27 Half Shaft Mounting Bolts

1 - SHAFT
2 - FLANGE

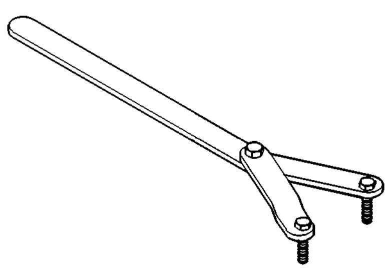
REAR DRIVELINE MODULE (Continued)

SPECIFICATIONS - REAR DRIVELINE MODULE

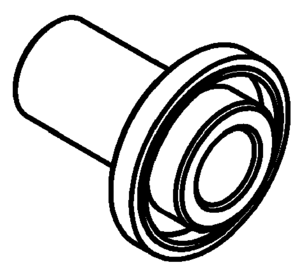
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt, Driveline Module-to-Body	54	40	—
Bolt, Halfshaft-to-Ouput Flange	61	45	—
Bolt, Overrunning Clutch Housing-to-Differential	60	44	—
Bolt, Torque Arm-to-Differential Assembly	60	44	—
Bolt, Torque Arm Mount-to-Body	54	40	—
Nut, Input Flange	135	100	—
Plug, Differential Drain/Fill	35	26	—
Plug, Overrunning Clutch Housing Drain/Fill	30	22	—
Vent, Differential/ Overrunning Clutch Housing	12	—	110

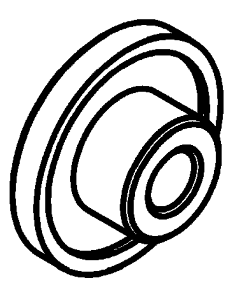
SPECIAL TOOLS



Tool 6958



Tool 8802



Tool 8493

BI-DIRECTIONAL OVERRUNNING CLUTCH

DESCRIPTION

The bi-directional overrunning clutch (BOC) (Fig. 28) works as a mechanical disconnect between the front and rear axles, preventing torque from being transferred from the rear axle to the front. The BOC is a simply an overrunning clutch which works in both clockwise and counter-clockwise rotations. This means that when the output (the rear axle) is rotating faster in one direction than the input (front axle), there is no torque transmission. But when the input speed is equal to the output speed, the unit becomes locked. The BOC provides significant benefits regarding braking stability, handling, and driveline durability. Disconnecting the front and the rear driveline during braking helps to maintain the braking stability of an AWD vehicle. In an ABS/braking event, the locking of the rear wheels must be avoided for stability reasons. Therefore brake systems are designed to lock the front wheels first. Any torque transfer from the rear axle to the front axle disturbs the ABS/braking system and causes potential instabilities on a slippery surface. The BOC de-couples the rear driveline as soon the rear wheels begin to spin faster than the front wheels (front wheels locked) in order to provide increased braking stability. Furthermore the BOC also reduces the likelihood of throttle off over-steer during cornering. In a throttle off maneuver, the BOC once again de-couples the rear driveline forcing all the engine brake torque to the front wheels. This eliminates the chance of lateral slip on the rear axle and increases it on the front. The vehicle will therefore tend to understeer, a situation which is considered easier to manage in most circumstances. During this maneuver, and during the ABS braking event, the BOC does not transmit torque through to the rear wheels. The rear driveline module, with the BOC, will perform the same as a front wheel drive vehicle during these events. The gear ratio offset between the front and rear differentials force the BOC into the overrunning mode most of the time. This allows BOC to significantly reduce the rolling resistance of the vehicle, which improves fuel consumption, allows the downsizing of the driveline components, and prevents the PTU and propshaft joints from overheating.

OPERATION

In order to achieve all-wheel drive operation in reverse, the overrunning clutch locking functional direction must be reversible. The bi-directional overrunning clutch (BOC) changes the operational mode direction depending on the propeller shaft direction. The propeller shaft rotates in the clockwise (when viewed from the front) direction when the vehicle is moving forward, which indexes the BOC to the forward overrunning position. When the vehicle is in reverse, the propeller shaft will rotate counter-clockwise and index the BOC to the reverse overrunning position.

The BOC acts as a mechanical stator. It is active (transmitting torque), or it is not active and in overrunning mode (not transmitting torque). This “all or nothing” approach to torque transfer would cause a sudden application of all available power to the rear wheels, which is not desirable. Therefore it is run in series with a viscous coupler to smooth, dampen, and limit the transmission of torque to the rear axle and to prevent a step style torque input to the rear axle.

BI-DIRECTIONAL OVERRUNNING CLUTCH (Continued)

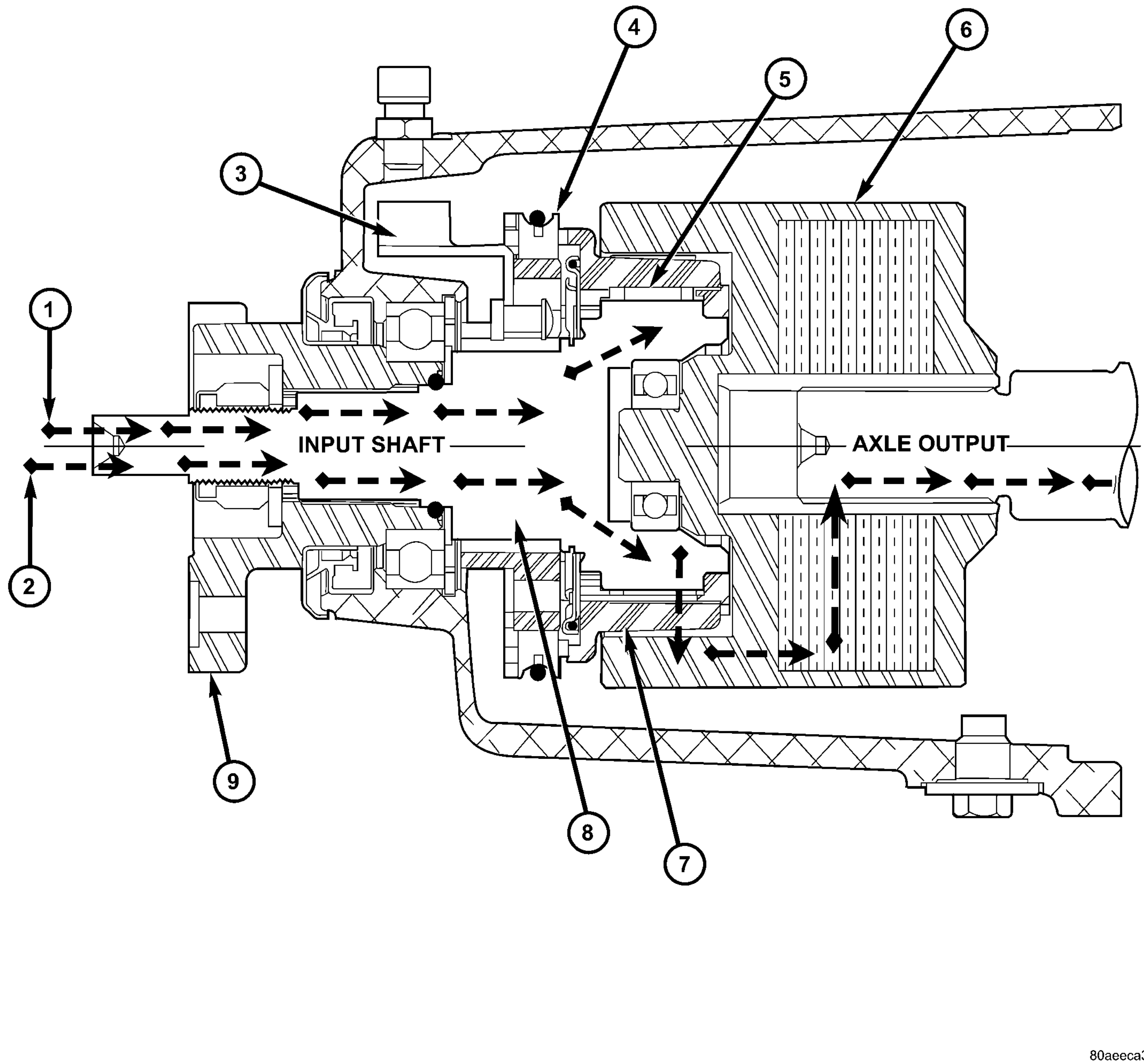


Fig. 28 Bi-directional Overrunning Clutch and Viscous Coupler

1 - POWERFLOW - BOC OVERRUNNING
2 - POWERFLOW - BOC LOCKED
3 - BOC GROUND TAB
4 - FRICTION BRAKE SHOES
5 - BOC ROLLERS
6 - VISCOUS COUPLER
7 - BOC ROLLER CAGE
8 - BOC INPUT SHAFT
9 - INPUT FLANGE

BI-DIRECTIONAL OVERRUNNING CLUTCH (Continued)

STEADY STATE, LOW TO MODERATE SPEED, NO FRONT WHEEL SLIP, FORWARD DIRECTION

During normal driving conditions, (no wheel slip), the inner shaft (front axle) and outer race (viscous coupler) are running at different speeds due to the different gear ratios between the front and rear differentials. In this condition, the outer race is always spinning faster (overdriving between 5-32 rpm) than the inner shaft. When the BOC (Fig. 29) is running under these conditions, at low vehicle speeds the drag shoes and the cage keep the rollers up on the left side (forward side) of the inner shaft flats. This is what is known as “overrunning mode.” Notice that when the clutch is in overrunning mode, the rollers are spinning clockwise and with the outer race, thus no torque is being transferred.

NOTE: Low speed, forward and reverse operation is identical, just in opposite directions. (Fig. 29) shows forward direction in reverse the rollers are on the other side of the flats due to a reversal of the cage force.

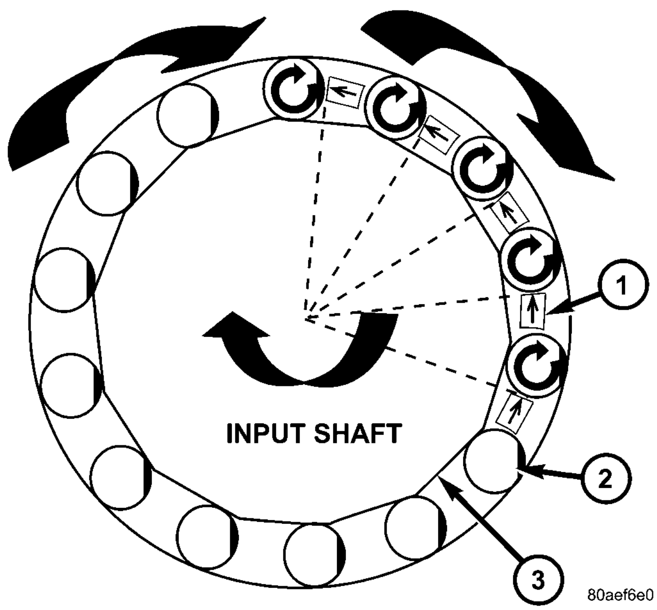


Fig. 29 BOC Operation at Low Speeds With No Front Wheel Slip

1 - CAGE
2 - ROLLER
3 - INPUT SHAFT

TRANSIENT CONDITION (BOC LOCKED), FRONT WHEEL SLIP, FORWARD DIRECTION

When the front wheels lose traction and begin to slip, the propeller shaft and rear axle pinion speed difference decreases to zero. At this point the input shaft (cam) becomes the driving member of the BOC (Fig. 30), compressing the rollers against the outer race. This locks the input shaft with the outer race and transmits torque to the housing of the viscous coupler, that in turn transmits torque to the rear axle pinion. It should also be noted that when the device is locked, the inner shaft and the outer race are rotating at the same speed. The rollers are pinched at this point and will stay locked until a torque reversal (no front wheel slip) occurs. When locked, the viscous coupler slips during the torque transfer and the amount of torque transferred is dependent on the coupling characteristic and the amount of front wheel slip.

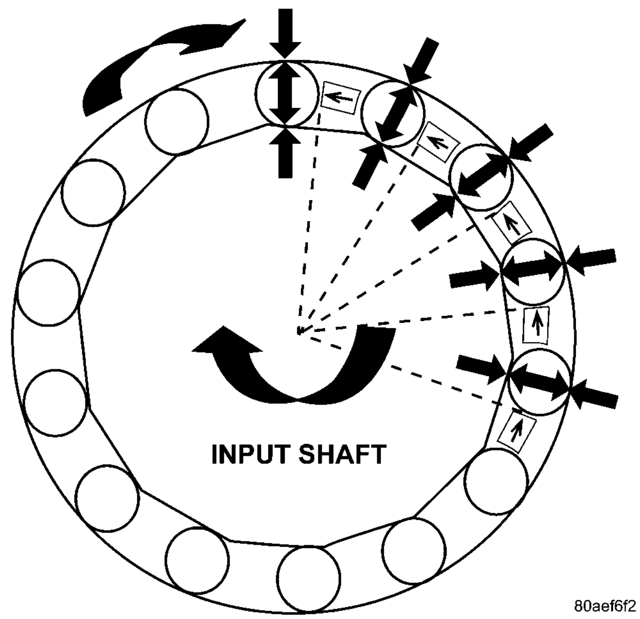


Fig. 30 BOC Operation with Front Wheel Slip

STEADY STATE, HIGH SPEED, NO WHEEL SLIP

The roller cage positions the rollers on the input shaft flats during low and high speed overrunning and during initial BOC lockup. The roller cage is rotating at input shaft (propeller shaft) speed at all times. At low speeds, the friction shoes (Fig. 31) are pressed against the friction ground via the garter spring (Fig. 32), creating a drag force on the roller cage. The drag force positions the cage, which in turn positions the rollers to one side of the flat. The direction of this drag force (position of the roller) is dependent on the input (propeller shaft) rotational direction. Since the rollers are always in contact with the outer race, due to centrifugal forces, the rollers want to follow the outer race due to drag. During overrunning operation, the outer race is rotating faster than the input; causing the rollers to want to traverse the flat from one side to the other. During low speeds, the brake shoes counteract this effect. To

BI-DIRECTIONAL OVERRUNNING CLUTCH (Continued)

avoid excessive wear, the ground shoes are designed to lift off from the friction ground due to centrifugal forces at higher rotational speeds.

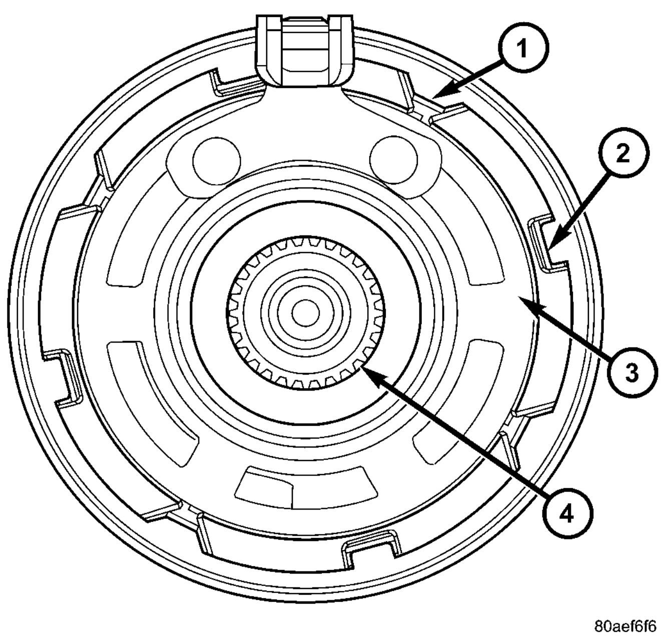


Fig. 31 Front View of BOC

1 - GARTER SPRING
2 - FRICTION BRAKE SHOES
3 - FRICTION GROUND CONNECTED TO GROUND TAB
4 - INPUT SHAFT

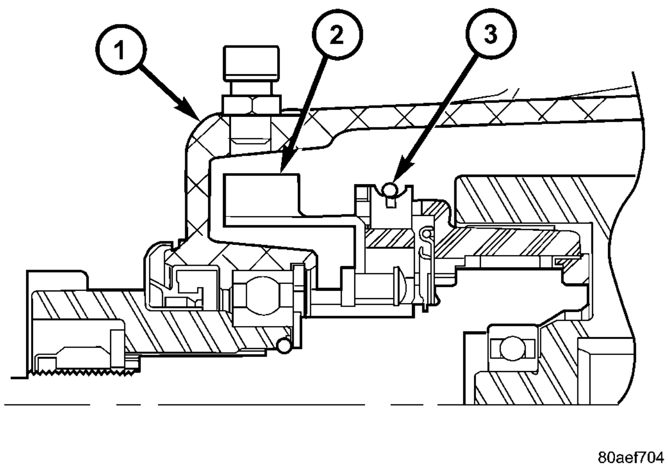


Fig. 32 Location of the Grounding Element

1 - DIFFERENTIAL HOUSING
2 - GROUND TAB
3 - GARTER SPRING

To keep the rollers in the overrunning position and avoid undesired ″high speed lockup″, a high speed latch (Fig. 33) positions the cage before the ground shoes lift off. A further explanation of the high speed effects follows as well. Utilizing only the friction shoes approach means that at high speed the required ground shoe drag torque would cause excessive brake shoe wear or the roller will begin to migrate to the opposite side of the flat due to the drag force of the outer race. This would result in system lock-up. (Fig. 34) shows the BOC as it crosses the speed where the brake shoe force is overcome by the roller drag on the outer race. Notice that the roller is locking up on the opposite side of the flat and the cage supplies no force on the rollers.

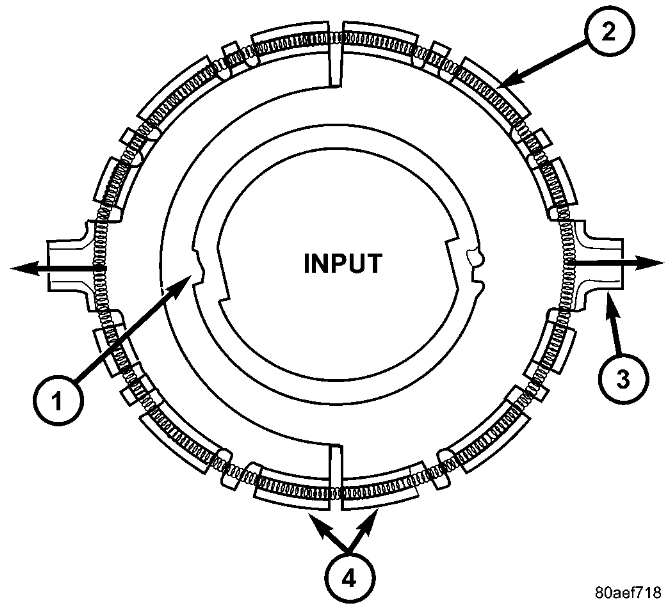


Fig. 33 BOC High Speed Latch (Not Engaged)

1 - TOOTH (TWO PLACES)
2 - GARTER SPRING
3 - TABS AT BOTH ENDS FIT INTO SLOTS IN CAGE
4 - TWO PART DESIGN

This lock-up is not desired, and requires the use of another mechanism to prevent the lock-up. The device that prevents undesired high-speed lock-up is called a ″high speed latch″.

Similar to the friction shoes, the two-piece high-speed latch will separate from each other at high rotational speeds due to centrifugal effects. (Fig. 35) shows the high speed latch engaged. The gap ″x″ increases with speed, eventually locking into one of the slots in the BOC shaft. When the high-speed latch is activated (propeller shaft speed reaches X amount), the cage is partially fixed, and cannot lock on the wrong side of the flat as shown (Fig. 34). The high speed latch is a one way device and does not prevent high-speed lockup in the reverse direction. At high speeds, the BOC provides the same function as low speeds, transferring torque to the viscous coupler only when front wheel slip overcomes the axle ratio offset.

BI-DIRECTIONAL OVERRUNNING CLUTCH (Continued)

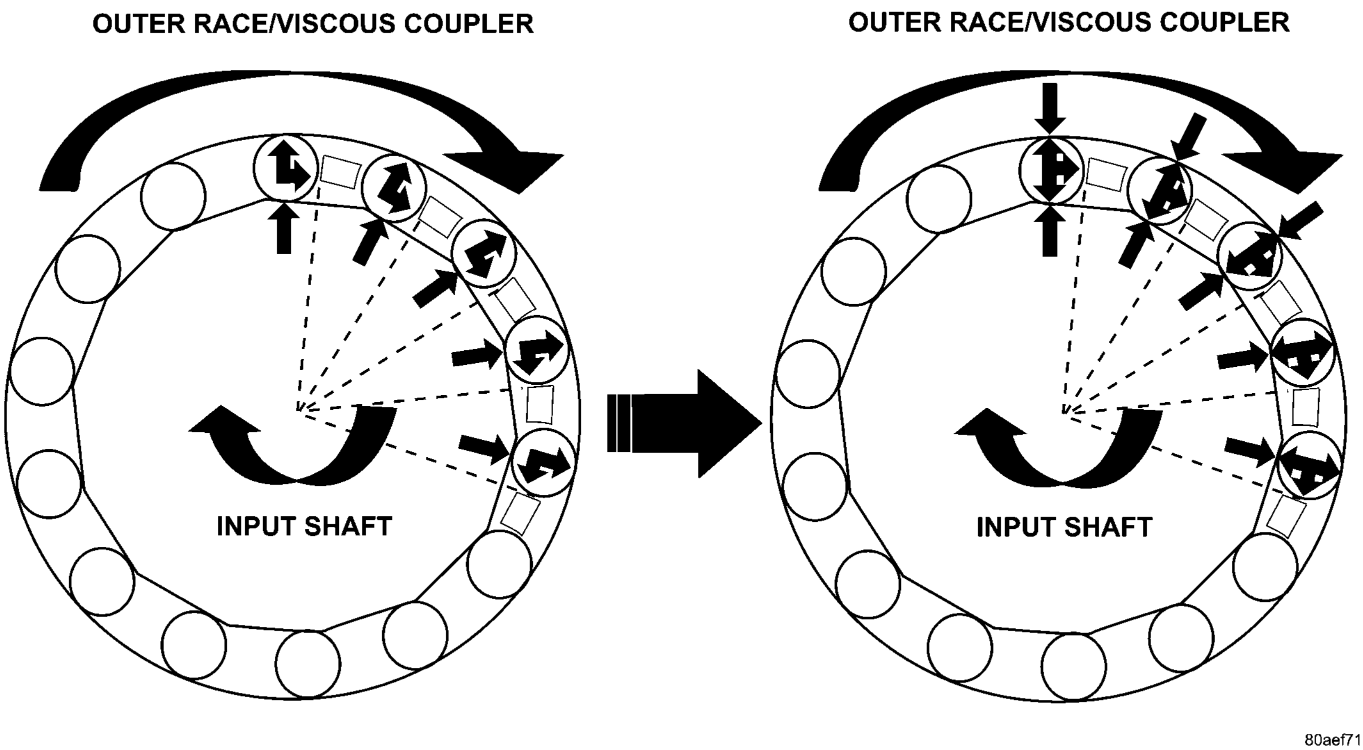


Fig. 34 BOC Operation During High Speed Lock-up Without High Speed Latch

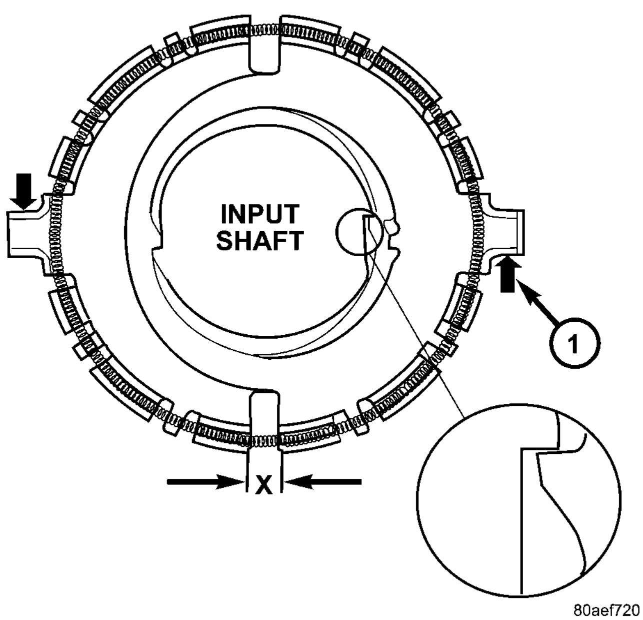


Fig. 35 High Speed Latch Engaged

1 - CAGE FORCE EXERTED BY ROLLERS AT HIGH SPEED

At high speed, the rollers are forced outward to the outer race because of centrifugal force. At high speeds, the friction shoes can no longer prevent lock-up. When the teeth on the high-speed latch engage into the input shaft, it keeps the rollers centered above the flats because the tabs on the latch are locked into the cage. (Fig. 36) shows the roller configuration with the High-Speed Latch engaged.

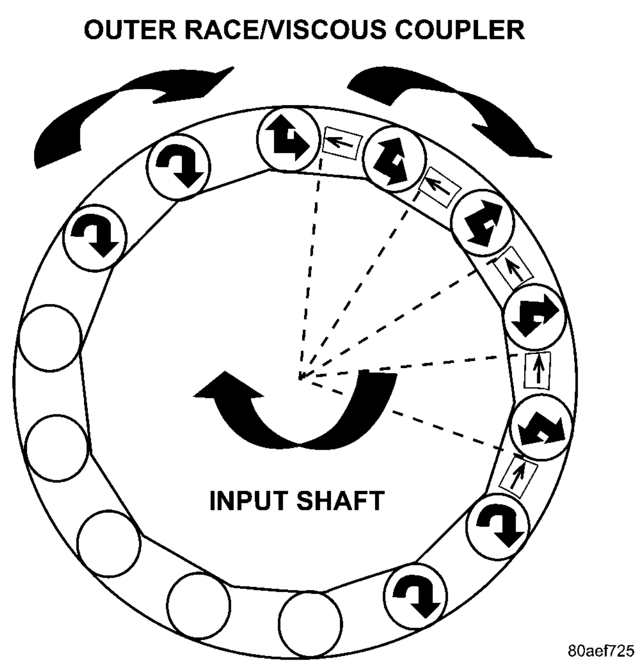


Fig. 36 BOC Operation at High Speed with High Speed Latch

BI-DIRECTIONAL OVERRUNNING CLUTCH (Continued)

On the BOC shaft, the high speed latch teeth lock up in the grooved areas, shown in (Fig. 37), when the turning speed reaches the critical value. (Fig. 37) also shows the outer race/viscous coupler. Notice the surface (outer race) the rollers mate against when transferring torque.

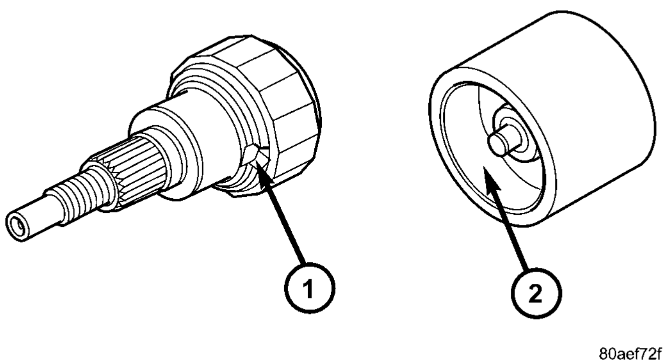


Fig. 37 BOC Input Shaft

1 - GROOVED AREA (2 LOCATIONS)
2 - ROLLER MATING SURFACE

DIFFERENTIAL ASSEMBLY

DESCRIPTION

The differential gear system divides the torque between the axle shafts. It allows the axle shafts to rotate at different speeds when turning corners.

Each differential side gear is splined to an axle shaft. The pinion gears are mounted on a pinion mate shaft and are free to rotate on the shaft. The pinion gear is fitted in a bore in the differential case and is positioned at a right angle to the axle shafts.

OPERATION

In operation, power flow occurs as follows:

- The pinion gear rotates the ring gear
- The ring gear (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The side gears (splined to the axle shafts) rotate the shafts

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 38).

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 39). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

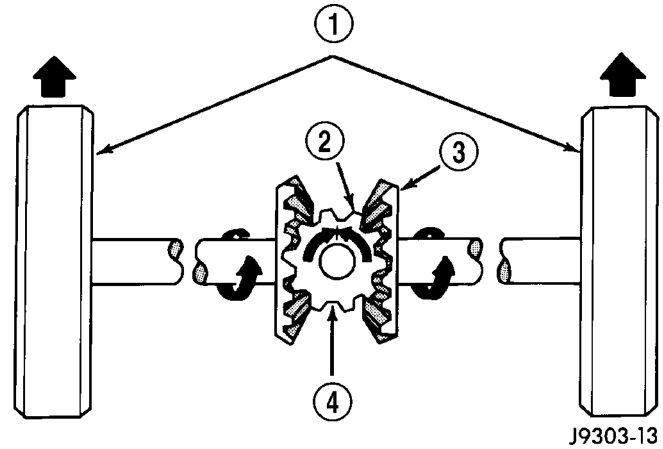


Fig. 38 Differential Operation—Straight Ahead Driving

1 - IN STRAIGHT AHEAD DRIVING EACH WHEEL ROTATES AT 100% OF CASE SPEED
2 - PINION GEAR
3 - SIDE GEAR
4 - PINION GEARS ROTATE WITH CASE

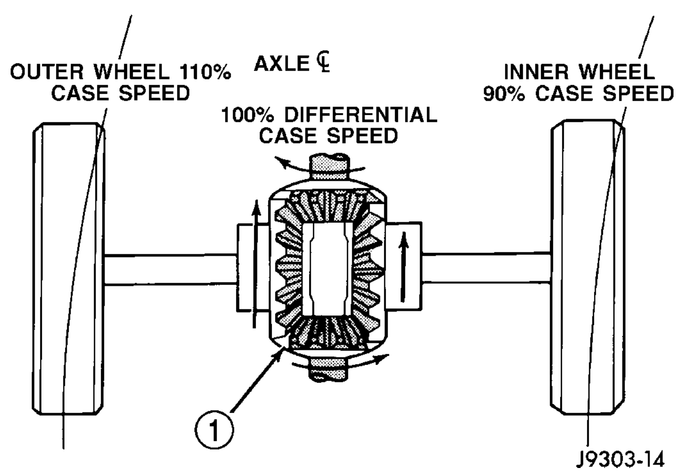


Fig. 39 Differential Operation—On Turns

1 - PINION GEARS ROTATE ON PINION SHAFT

FLUID - DIFFERENTIAL ASSEMBLY

STANDARD PROCEDURE - DIFFERENTIAL ASSEMBLY FLUID CHANGE

The drain plug (Fig. 40) for the differential assembly is located in the bottom of the differential assembly case, toward the rear of the unit.

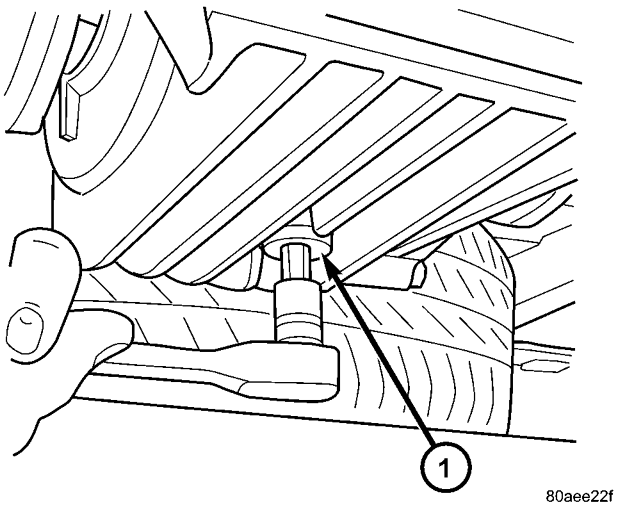


Fig. 40 Differential Drain Plug

1 - DIFFERENTIAL DRAIN PLUG

The fill plug (Fig. 41) for the differential assembly is located on the rear of the assembly case.

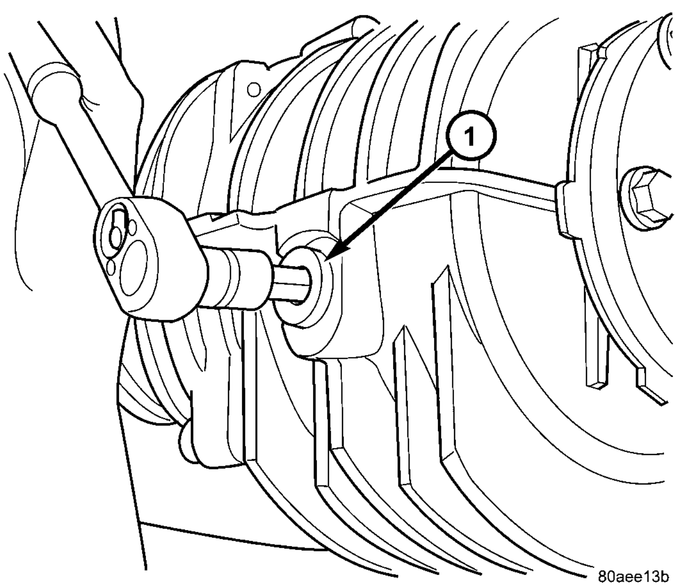


Fig. 41 Differential Fill Plug

1 - DIFFERENTIAL FILL PLUG

The correct fill level is to the bottom of the fill plug hole. Be sure the vehicle is on a level surface, or is hoisted in a level manner, in order to obtain the correct fill level.

(1) Raise the vehicle on a hoist.

(2) Position a drain pan under the differential drain plug (Fig. 40).

(3) Remove the drain plug and allow the fluid to drain into the pan.

(4) Install the drain plug and torque to 35 N·m (26 ft. lbs.).

(5) Re-position the drain pan under the differential fill plug.

(6) Remove the differential fill plug (Fig. 41).

(7) Using a suction gun (Fig. 42) or equivalent, fill the differential assembly with 0.7 L (1.48 pts.) of Mopar® Gear and Axle Lubricant (80W-90).

(8) Install the fill plug and torque to 35 N·m (26 ft. lbs.).

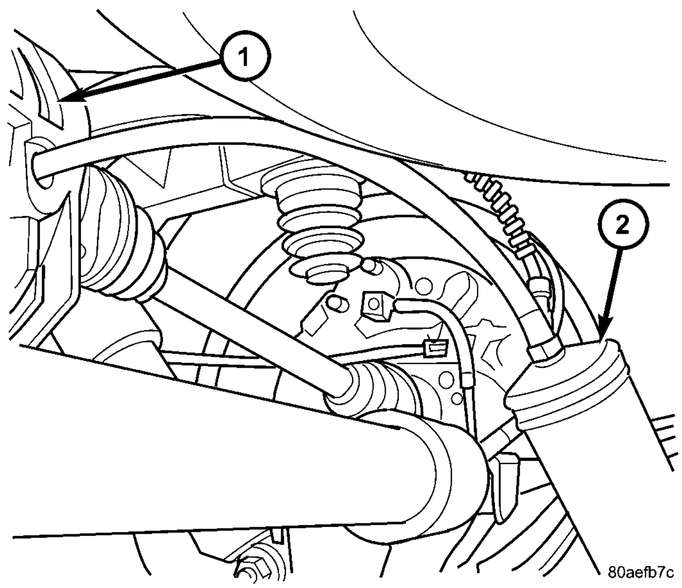


Fig. 42 Filling Differential

1 - DIFFERENTIAL ASSEMBLY
2 - SUCTION GUN

FLUID - OVERRUNNING CLUTCH HOUSING

STANDARD PROCEDURE - OVERRUNNING CLUTCH HOUSING FLUID CHANGE

(1) Raise vehicle on hoist.

(2) Position a drain pan under overrunning clutch housing drain plug.

(3) Remove overrunning clutch housing drain plug and drain fluid (Fig. 43).

(4) Install the drain plug and torque to 30 N·m (22 ft. lbs.).

FLUID - OVERRUNNING CLUTCH HOUSING (Continued)

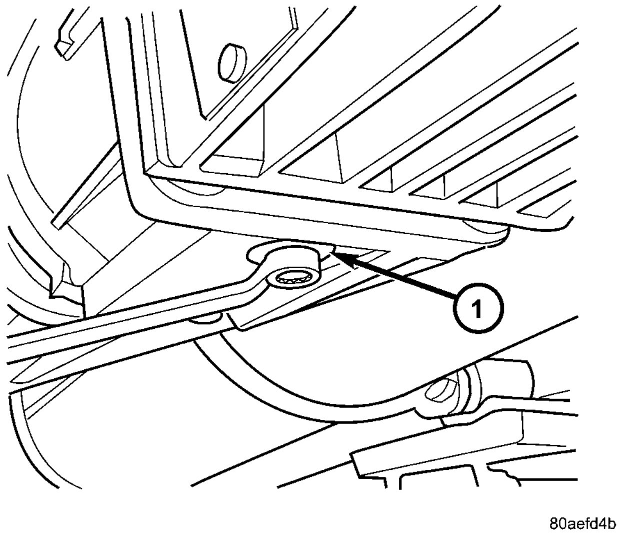


Fig. 43 Overrunning Clutch Case Drain Plug

1 - OVERRUNNING CLUTCH HOUSING DRAIN PLUG

(5) Re-position the drain pan under the overrunning clutch housing fill plug.

(6) Remove fill plug (Fig. 44).

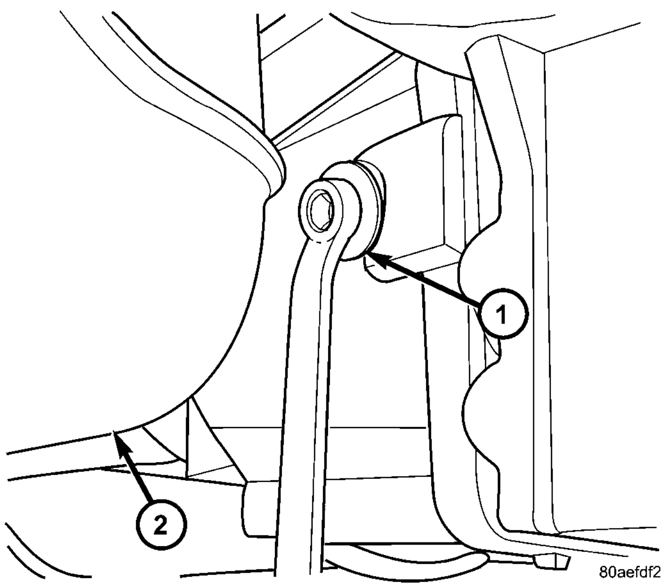


Fig. 44 Overrunning Clutch Housing Fill Plug

1 - OVERRUNNING CLUTCH HOUSING FILL PLUG
2 - FUEL TANK

(7) Using a suction gun (Fig. 45), add 0.58 L (1.22 pts.) of Mopar® ATF+4 (Automatic Transmission Fluid—Type 9602).

(8) Install fill plug and torque to 30 N·m (22 ft. lbs.).

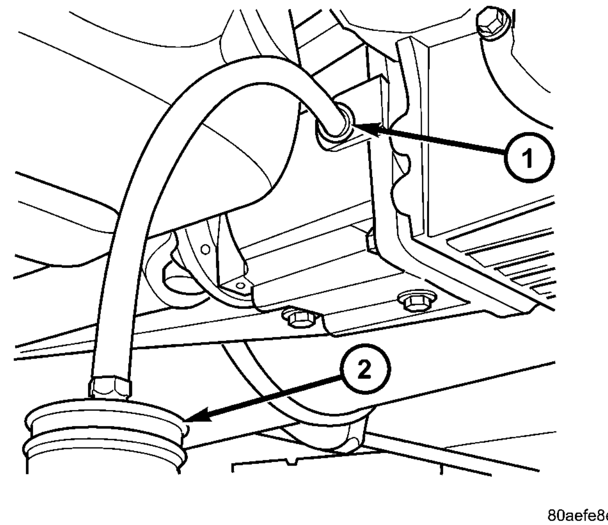


Fig. 45 Filling Overrunning Clutch Case

1 - OVERRUNNING CLUTCH HOUSING FILL HOLE
2 - SUCTION GUN

TORQUE ARM

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove rear driveline module assembly. (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR DRIVELINE MODULE - REMOVAL)

(3) Remove six torque arm-to-differential assembly bolts (Fig. 46). Remove torque arm.

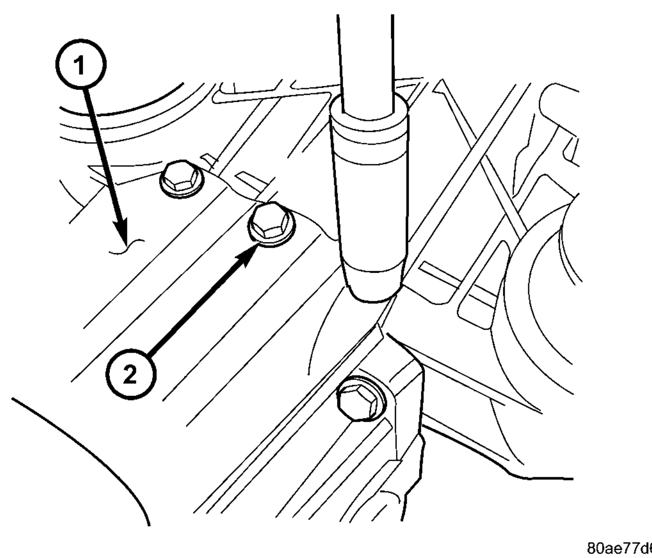


Fig. 46 Torque Arm Fasteners

1 - TORQUE ARM ASSEMBLY
2 - BOLT (SIX)

TORQUE ARM (Continued)

INSTALLATION

(1) Install six torque arm-to-differential assembly bolts (Fig. 46) and torque to 60 N·m (44 ft. lbs.).

(2) Install rear driveline module assembly. (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR DRIVELINE MODULE - INSTALLATION)

(3) Lower vehicle.

INPUT FLANGE SEAL

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT - REMOVAL)

(3) Using tool 6958, remove input flange nut and washer (Fig. 47).

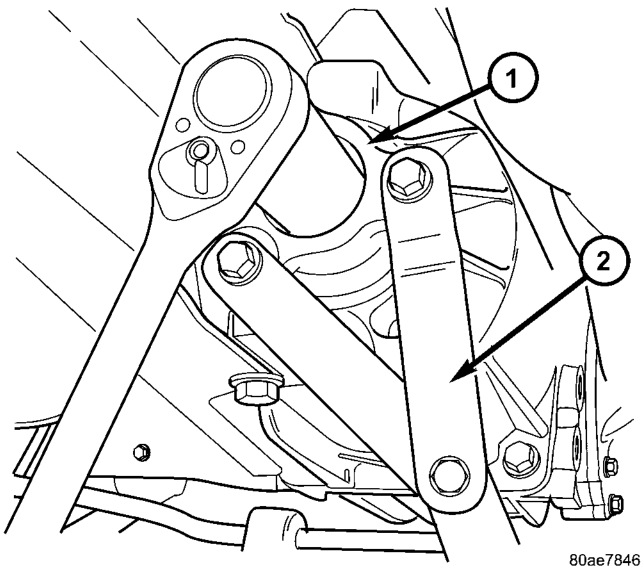


Fig. 47 Input Flange Nut

1 - INPUT FLANGE
2 - TOOL 6958

(4) Remove input flange (Fig. 48).

(5) Using suitable screwdriver, remove input flange seal from overrunning clutch housing (Fig. 49).

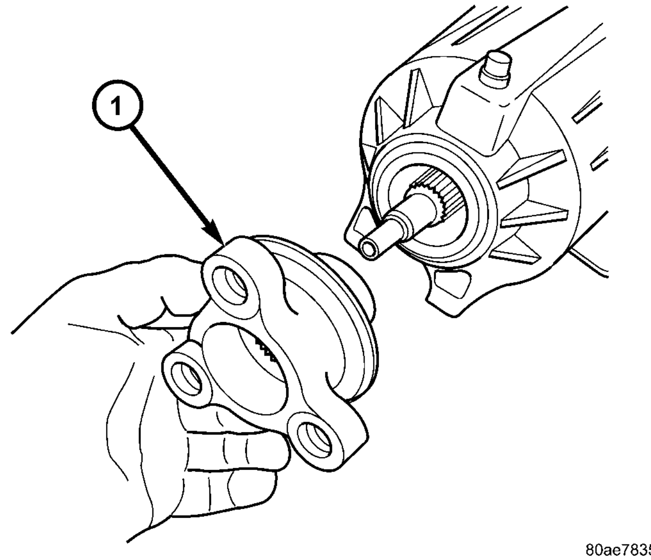


Fig. 48 Input Flange

1 - INPUT FLANGE/SHIELD

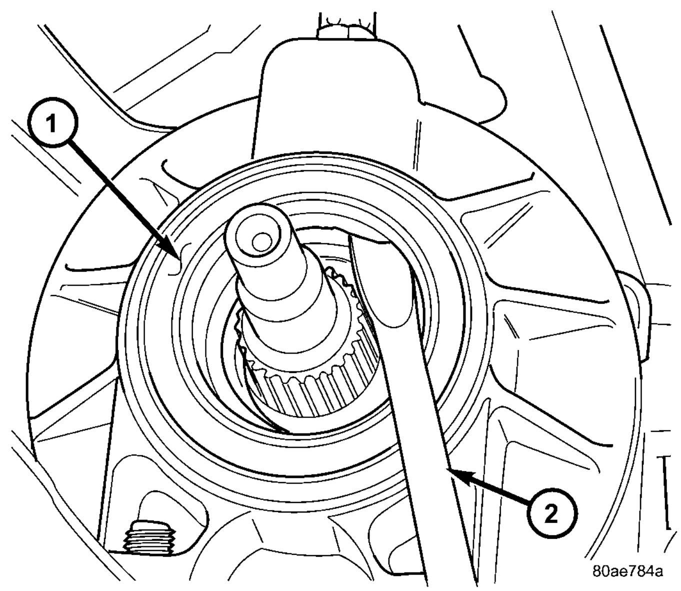


Fig. 49 Input Flange Seal Removal

1 - INPUT FLANGE SEAL
2 - SCREWDRIVER

INPUT FLANGE SEAL (Continued)

INSTALLATION

(1) Using tool 8802, install input flange seal to overrunning clutch case (Fig. 50).

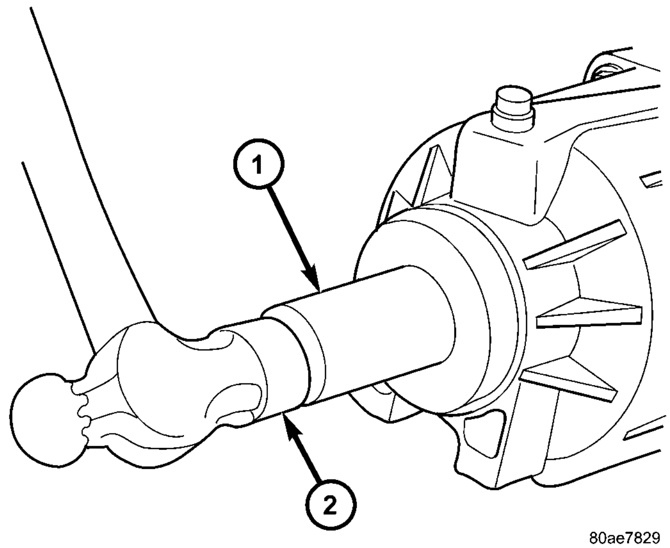


Fig. 50 Input Flange Seal Installation

1 - TOOL 8802
2 - HAMMER

(2) Install input flange (Fig. 51).

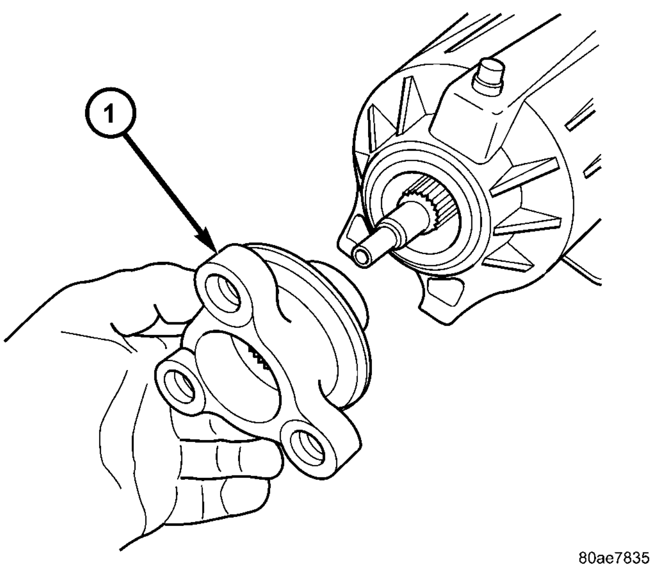


Fig. 51 Input Flange

1 - INPUT FLANGE/SHIELD

(3) Install flange nut and washer. Using tool 6958, torque flange nut to 135 N·m (100 ft. lbs.) (Fig. 52).

(4) Install propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT - INSTALLATION)

(5) Lower vehicle.

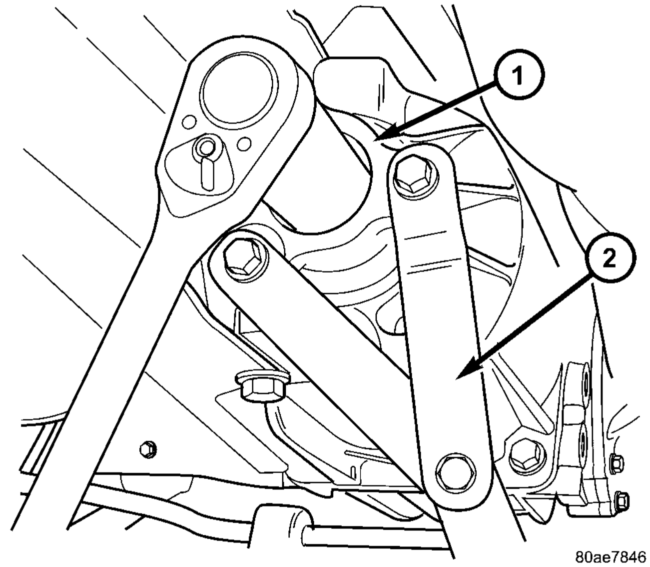


Fig. 52 Input Flange Nut

1 - INPUT FLANGE
2 - TOOL 6958

OUTPUT FLANGE SEAL

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove rear halfshaft inner joint at differential output flange (Fig. 53).

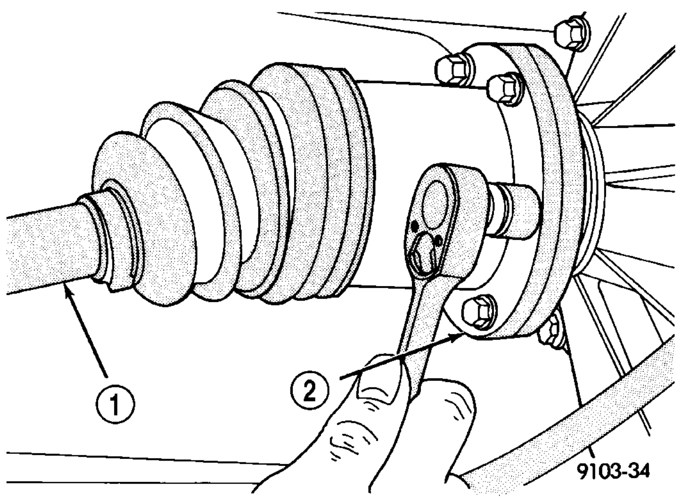


Fig. 53 Inner Half Shaft Bolts

1 - SHAFT
2 - FLANGE

OUTPUT FLANGE SEAL (Continued)

(3) Using two screwdrivers and wood blocks to protect differential housing casting, pry output flange out of differential (Fig. 54).

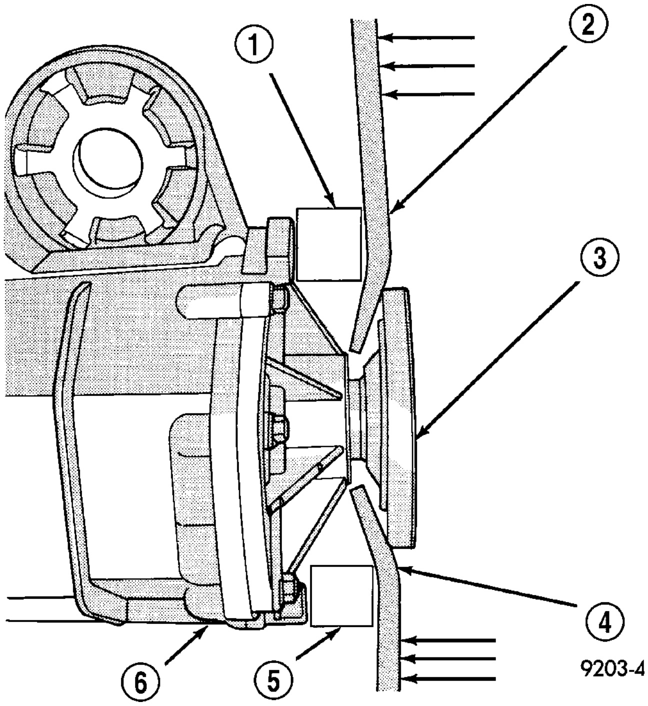


Fig. 54 Output Flange Removal

1 - WOOD BLOCK
2 - PRYBAR
3 - OUTPUT SHAFT
4 - PRYBAR
5 - WOOD BLOCK
6 - DIFFERENTIAL CASE

(4) Use suitable screwdriver to remove output flange seal (Fig. 55).

INSTALLATION

(1) Install output flange seal to differential housing using tool C4171A and 8493 (Fig. 56).

(2) Install ouput flange to differential assembly. Verify that it is seated all the way into position by attempting to pull out by hand.

(3) Install rear halfshaft inner joint to output flange.

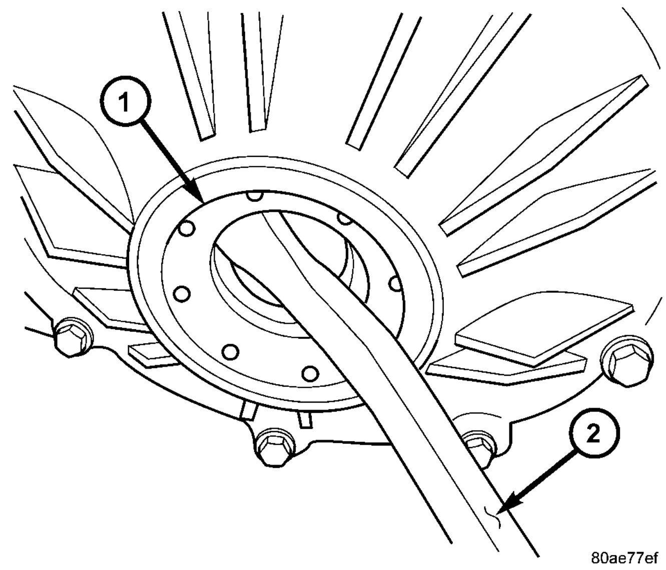


Fig. 55 Output Flange Seal Removal

1 - OUTPUT FLANGE SEAL
2 - SCREWDRIVER

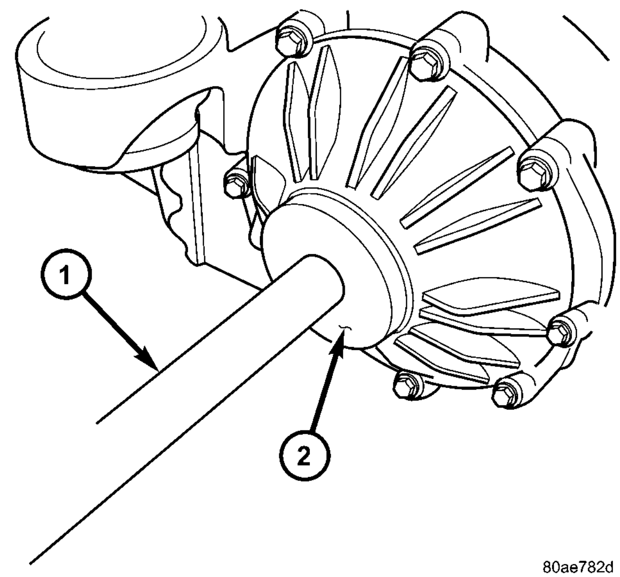


Fig. 56 Output Flange Seal Installation

1 - DRIVER HANDLE C4171
2 - INSTALLER 8493

OUTPUT FLANGE SEAL (Continued)

(4) Install and torque bolts to 61 N·m (45 ft. lbs.) (Fig. 57).

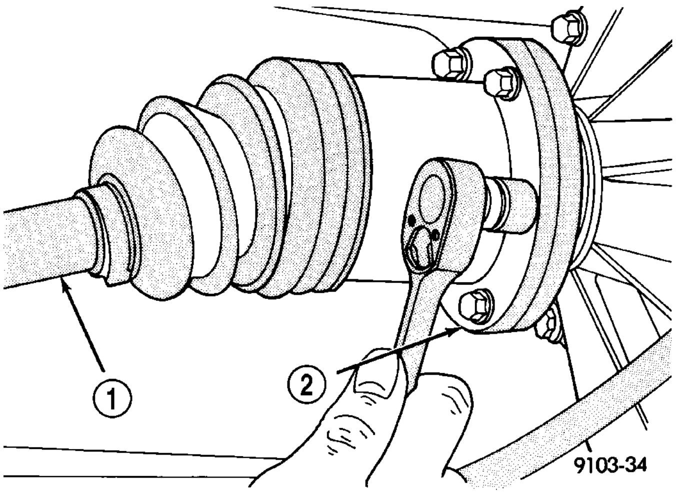


Fig. 57 Inner Half Shaft Bolts

1 - SHAFT
2 - FLANGE

(5) Check differential assembly fluid level and adjust as required. (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR DRIVELINE MODULE/FLUID - STANDARD PROCEDURE)

VISCOUS COUPLER

DESCRIPTION

The heart of the all-wheel drive system is the inter-axle viscous coupling and bi-directional over-running clutch. Under normal driving the vehicle retains predominantly front wheel drive characteristics. The all-wheel drive takes effect when the front wheels start to slip. Under normal level road, straight line driving, 100% of the torque is allocated to the front wheels. The viscous coupler allows more torque to the rear wheels in accordance with the amount of slippage at the front wheels. The variable torque distribution is automatic with no driver inputs required.

OPERATION

The viscous coupler (Fig. 58) is a housing nearly filled with a high viscosity silicone liquid and thin metal plates alternately splined to an inner and outer drum. The viscous coupler provides torque in the following modes:

- Shear mode (normal operation)
- Hump mode (locked mode)

The inner plates are slotted around the radius and the outer plates have holes in them. In the shear mode (normal operation), the plates are evenly spaced and the torque is created by the shearing of the plates through the fluid and 90-100% of the torque is applied to the rear axle. During the shear mode, a fluid flow pattern is created from this design (holes and slots). This fluid flow causes high pressure on each side of each pair of plates and low pressure between each pair of plates.

When a high speed difference (shear) occurs because of loss of traction (one axle spinning faster than the other), the silicone fluid expands as it heats from this shearing. When the silicone expands to fill the viscous coupler completely, this pressure difference is high enough to squeeze each pair of plates together. The resulting hump torque is up to 8 times higher than the shear torque. When the viscous coupler is in the hump mode, it does not lock the axles (undifferentiated 4-Wheel Drive). It controls the amount of slippage while delivering maximum power to the axle having greatest traction. Once the speed difference equalizes the fluid and plates cool down and the viscous coupler goes back to the shear mode.

VISCOUS COUPLER (Continued)

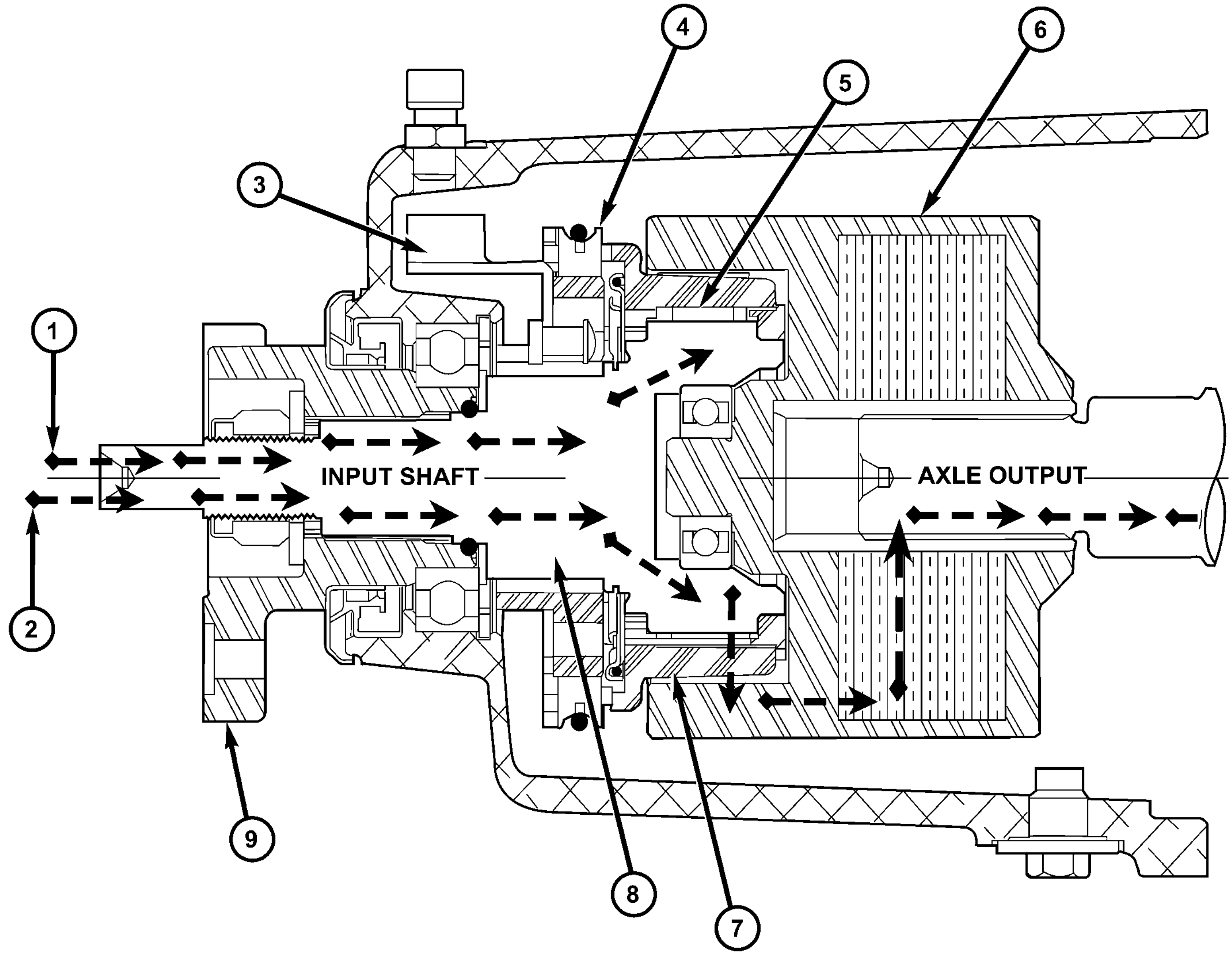


Fig. 58 Bi-directional Overrunning Clutch (BOC) and Viscous Coupler Powerflow

1 - POWERFLOW - BOC OVERRUNNING
2 - POWERFLOW - BOC LOCKED
3 - BOC GROUND TAB
4 - FRICTION BRAKE SHOES
5 - BOC ROLLERS
6 - VISCOUS COUPLER
7 - BOC ROLLER CAGE
8 - BOC INPUT SHAFT
9 - INPUT FLANGE

CLUTCH

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CLUTCH

DESCRIPTION

CLUTCH COMPONENTS

Models equipped with a 2.4L Gas engine utilize a modular clutch assembly (Fig. 1). The modular clutch consists of a single, dry-type clutch disc, a diaphragm style clutch cover, and an integrated flywheel. The clutch cover (pressure plate) is riveted to the flywheel, and therefore can only be serviced as an assembly.

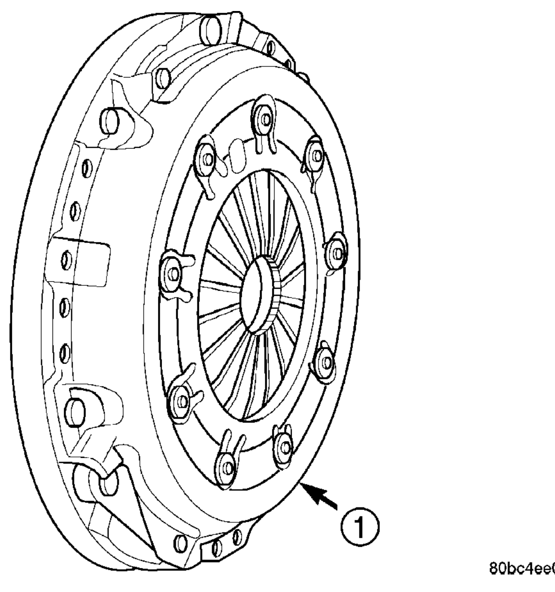


Fig. 1 Modular Clutch Assembly—2.4L Gas Engines

1 - MODULAR CLUTCH ASSEMBLY

CLUTCH (Continued)

Models equipped with the 2.5L Turbo Diesel engine utilize a conventional clutch system (Fig. 2). This system consists of a flywheel, clutch disc, and clutch cover (pressure plate), which is fastened to the flywheel, capturing the clutch disc within. Each component is individually serviceable, however it is **highly recommended that the clutch cover and disc be replaced as a set**.

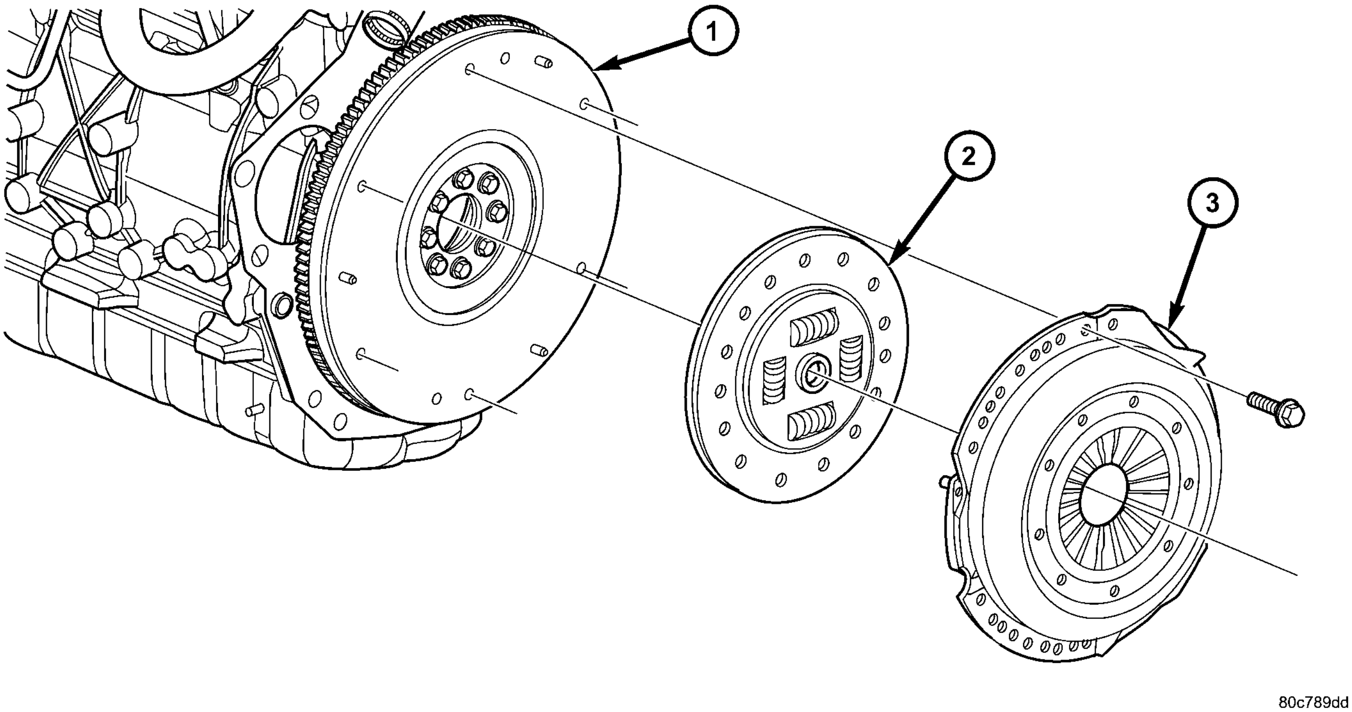


Fig. 2 Clutch Disc and Pressure Plate—2.5L TD Engines

1 - FLYWHEEL
2 - DISC
3 - PRESSURE PLATE

CLUTCH (Continued)

RELEASE SYSTEM

All models utilize a hydraulic clutch release system, conisting of a clutch master cylinder attached to the clutch pedal (Fig. 3), and a slave cylinder fastened to the transaxle which operates the clutch release lever (Fig. 4). When the driver depresses the clutch pedal, the master cylinder pushrod travels through the cylinder bore, displacing fluid through the master cylinder plumbing. This fluid displacement forces the slave cylinder piston to travel, forcing the clutch release bearing into the clutch diaphragm spring via the release lever and leverage (Fig. 5). This releases the clamping force on the clutch disc, allowing the engine crankshaft to rotate independently from the transaxle input shaft.

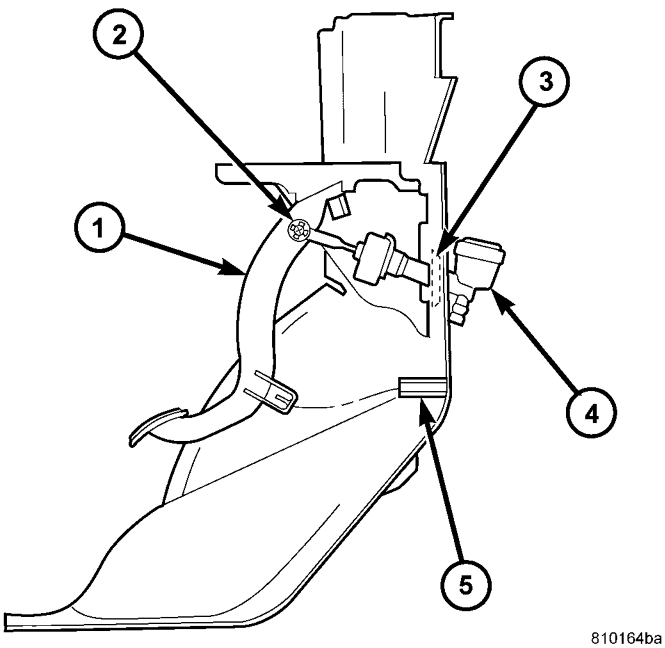


Fig. 3 Clutch Master Cylinder - Typical

1 - CLUTCH PEDAL
2 - BUSHING
3 - GROMMET
4 - MASTER CYLINDER
5 - STOP

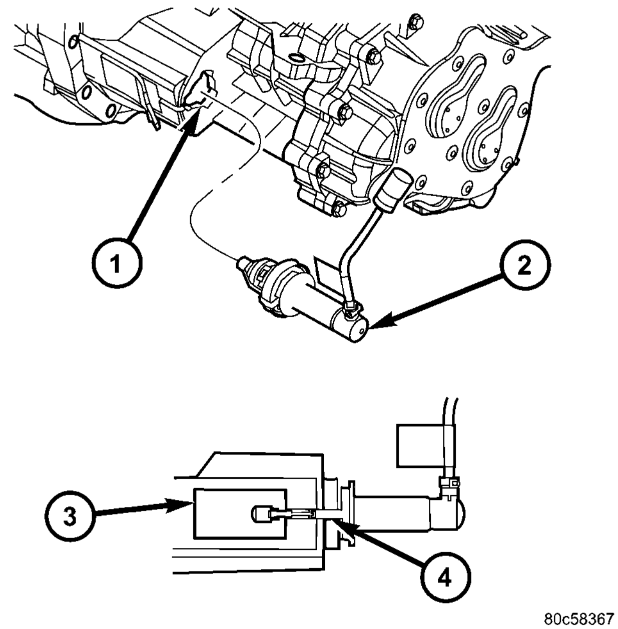


Fig. 4 Slave Cylinder Removal/Installation

1 - MOUNTING HOLE
2 - SLAVE CYLINDER
3 - ACCESS HOLE
4 - NYLON ANTI-ROTATION TAB

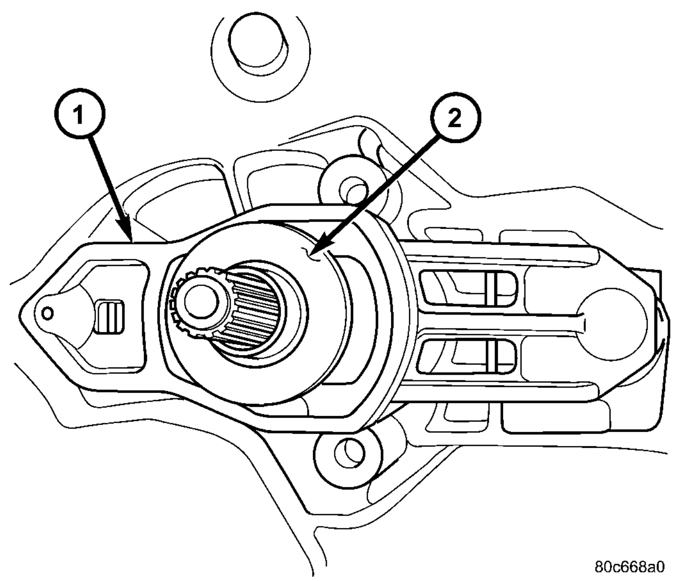


Fig. 5 Release Bearing and Lever

1 - RELEASE LEVER
2 - RELEASE BEARING

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - CLUTCH SYSTEM

Clutch problem diagnosis will generally require a road test to determine the type of fault. Component inspection will then determine the problem after road testing.

Drive the vehicle at normal speeds during road test. Shift the transaxle through all gear ranges and observe clutch action. If chatter, grab, slip, or improper release is experienced, remove and inspect the clutch components. If the problem is noise or hard shifting, further diagnosis may be needed. The transaxle or other driveline components may actually be at fault.

CLUTCH (Continued)

SERVICE DIAGNOSIS - CLUTCH GRAB/CHATTER

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC FACING COVERED WITH OIL OR GREASE	Oil leak at engine rear main or transaxle input shaft seal.	Correct leak and replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
	Too much grease applied to splines of disc and input shaft.	Apply lighter coating of grease to splines.
NO FAULT FOUND WITH CLUTCH COMPONENTS	Problem actually related to suspension or driveline component.	Further diagnosis required. Check engine/transmission mounts, suspension attaching parts and other driveline components as needed.
	Engine related problems.	Check EFI and ignition systems.
PARTIAL ENGAGEMENT OF CLUTCH DISC	Clutch cover, spring, or release fingers bent, distorted (rough handling, improper assembly).	Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
	Clutch disc damaged or distorted.	Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
	Clutch misalignment.	Verify modular clutch pilot plate alignment to crankshaft. Replace the modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD) if the pilot plate is loose or bent.
	Improper transaxle-to-engine installation.	Verify transaxle is properly installed to engine.

SERVICE DIAGNOSIS - CLUTCH SLIPS

CONDITION	POSSIBLE CAUSES	CORRECTION
DISC FACING WORN OUT	Normal wear.	Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
	Driver frequently rides (slips) clutch, results in rapid wear, overheating.	Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
	Insufficient clutch cover diaphragm spring tension	Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
CLUTCH DISC FACING CONTAMINATED WITH OIL OR GREASE	Leak at rear main oil seal or transaxle input shaft seal	Replace leaking seals. Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
	Excessive amount of grease applied to input shaft splines	Apply less grease to input shaft. Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
	Road splash, water entering housing	Seal housing. Inspect clutch assembly.

CLUTCH (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH IS RUNNING PARTIALLY DISENGAGED	Release bearing sticking or binding, does not return to normal running position.	Verify that bearing is actually binding. Then, replace bearing and transmission front bearing retainer if sleeve surface is damaged.
	Clutch pedal not returning to static position.	Inspect pedal assembly for damage and/or obstructions. Replace componnents as necessary.
	Clutch master cylinder or pushrod damaged causing high preload.	Replace clutch master cylinder assembly.
	Slave cylinder binding or stuck.	Replace slave cylinder.
CLUTCH DISC FACINGS HAVE FRACTURED INTO SMALL PIECES	Leak at rear main or transaxle input shaft seal	Replace seal. Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD)..
	Excessive heat from slippage	Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).

SERVICE DIAGNOSIS - IMPROPER CLUTCH RELEASE

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH DISC BINDS ON INPUT SHAFT SPLINES	Clutch disc hub splines damaged during installation	Clean, smooth, and lubricate disc and shaft splines. Replace modular clutch assembly, or clutch disc, and/or input shaft if splines are severely damaged.
	Input shaft splines rough, damaged.	Clean input shaft splines. Then lube.
	Corrosion or rust formations on splines of input shaft and disc	Clean input shaft splines and disc splines, then lube
CLUTCH DISC RUSTED TO FLYWHEEL AND/OR PRESSURE PLATE	Occurs in vehicles stored or not driven for extended period of time. Also occurs after steam cleaning if vehicle is not used for extended period.	Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
CLUTCH WILL NOT DISENGAGE PROPERLY	Disc bent, distorted during transaxle installation	Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
	Clutch cover diaphragm spring damaged during transaxle installation	Replace modular clutch assembly (2.4L Gas) or clutch cover and disc (2.5L TD).
	Release fork bent, loose, or damaged	Replace fork if worn or damaged
	Air in clutch hydraulic circuit.	Allow system to self-bleed or replace hydraulic components.
	Leak in clutch hydraulic circuit.	Replace worn/damaged/leaking hydraulic components.
Clutch pedal requires excessive force (high release load).	Clutch disc is worn.	Replace modular clutch assembly (2.4L models) or clutch cover and disc (2.5L TD models).

CLUTCH (Continued)

SERVICE DIAGNOSIS - CLUTCH PEDAL NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUTCH PEDAL SQUEAKS WHEN DEPRESSED TO FLOOR	Pedal bushings worn out or inadequate lubrication	Replace or lubricate bushings at clutch pedal pivot or master cylinder pushrod.
	Clutch pedal return spring worn out	Lubricate or replace return spring
CLUTCH PEDAL SQUEAKS DURING OPERATION	Clutch release lever pivot stud has inadequate lubrication	Lubricate or replace clutch release lever

DIAGNOSIS AND TESTING - DRIVE PLATE MISALIGNMENT

Common causes of misalignment are:

- Heat warping
- Mounting drive plate on a dirty crankshaft flange
- Incorrect bolt tightening
- Improper seating on the crankshaft shoulder
- Loose crankshaft bolts

Clean the crankshaft flange before mounting the drive plate. Dirt and grease on the flange surface may misalign the flywheel, causing excessive runout. Use new bolts when mounting drive plate to crankshaft. Tighten drive plate bolts to specified torque only. Over-tightening can distort the drive plate hub causing excessive runout.

DIAGNOSIS AND TESTING - CLUTCH COVER AND DISC RUNOUT

Check condition of the clutch cover before installation. A warped cover or diaphragm spring will cause grab and/or incomplete release or engagement. Use care when handling the clutch assembly. Impact can distort the cover, diaphragm spring, and release fingers.

DIAGNOSIS AND TESTING - CLUTCH CHATTER COMPLAINTS

For all clutch chatter complaints, perform the following:

(1) Check for loose, misaligned, or broken engine and transmission mounts. If present, they should be corrected at this time. Test vehicle for chatter. If chatter is gone, there is no need to go any further.

(2) If chatter persists, check hydraulic clutch release system is functioning properly.

(3) Check for loose connections in drivetrain. Correct any problems and determine if clutch chatter complaints have been satisfied. If not:

(a) Remove transaxle.

(b) Check to see if the release bearing is sticky or binding. Replace bearing, if needed.

(c) Check linkage for excessive wear on the pivot stud and fork fingers. Replace all worn parts.

(d) Check clutch assembly for contamination (dirt, oil). Replace clutch assembly, if required.

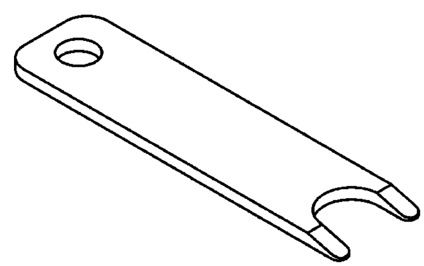
(e) Check to see if the clutch disc hub splines are damaged. Replace with new clutch assembly, if necessary.

(f) Check input shaft splines for damage. Replace, if necessary.

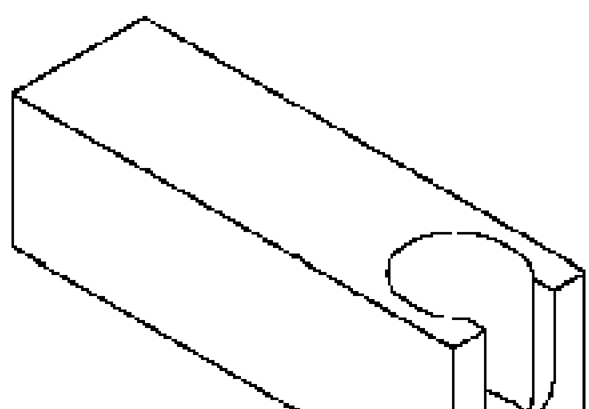
(g) Check for uneven wear on clutch fingers.

(h) Check for broken clutch cover diaphragm spring fingers. Replace with new clutch assembly, if necessary.

SPECIAL TOOLS - T850 TRANSAXLE



Disconnect Tool, 6638A



Remover/Installer, 6891

CLUTCH RELEASE LEVER AND BEARING

REMOVAL

(1) Remove transaxle assembly. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL)

(2) Remove modular clutch assembly from input shaft (2.4L Gas models only).

(3) Grasp clutch release lever and bearing (Fig. 6) with both hands and pull outward using moderate pressure to release lever from pivot ball.

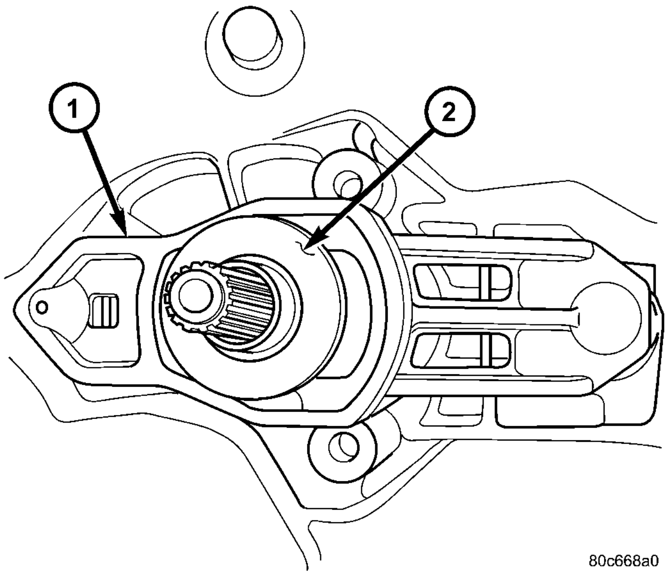


Fig. 6 Release Bearing and Lever

1 - RELEASE LEVER
2 - RELEASE BEARING

(4) Separate release bearing from lever.

NOTE: Remove release lever pivot ball(s) ONLY if replacement is necessary.

(5) Remove pivot ball(s) using slide hammer C-3752 and remover/installer 6891 (Fig. 7).

INSTALLATION

(1) If removed, install **new** release lever pivot ball(s) using slide hammer C-3752 and remover/installer 6891 (Fig. 8) (Fig. 9).

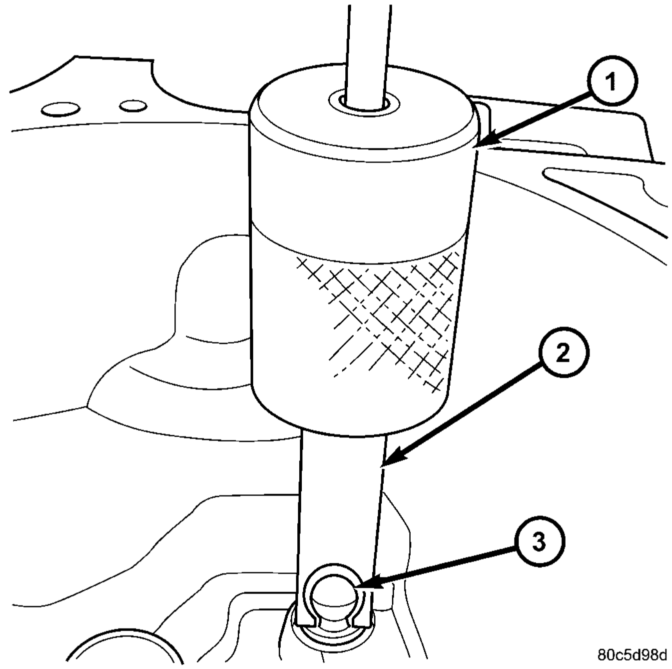


Fig. 7 Pivot Ball Removal/Installation

1 - C-3752 SLIDE HAMMER
2 - REMOVER/INSTALLER 6891
3 - PIVOT BALL

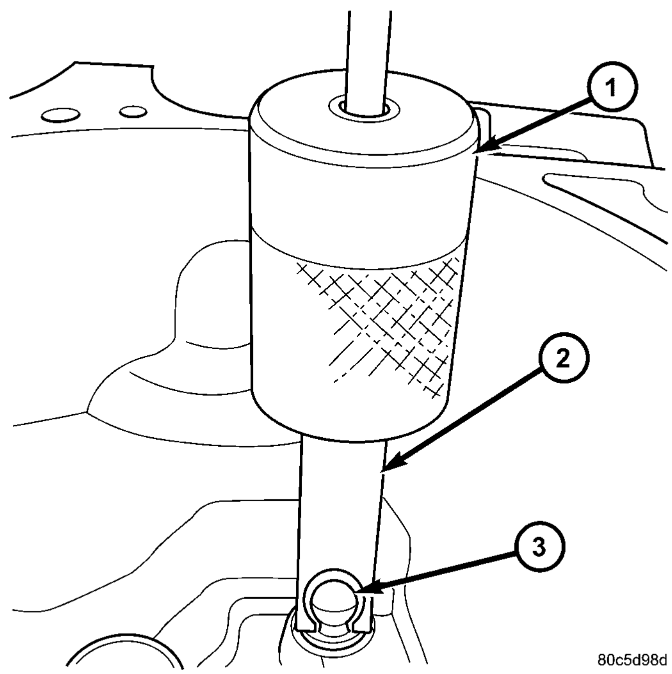


Fig. 8 Pivot Ball Removal/Installation

1 - C-3752 SLIDE HAMMER
2 - REMOVER/INSTALLER 6891
3 - PIVOT BALL

CLUTCH RELEASE LEVER AND BEARING (Continued)

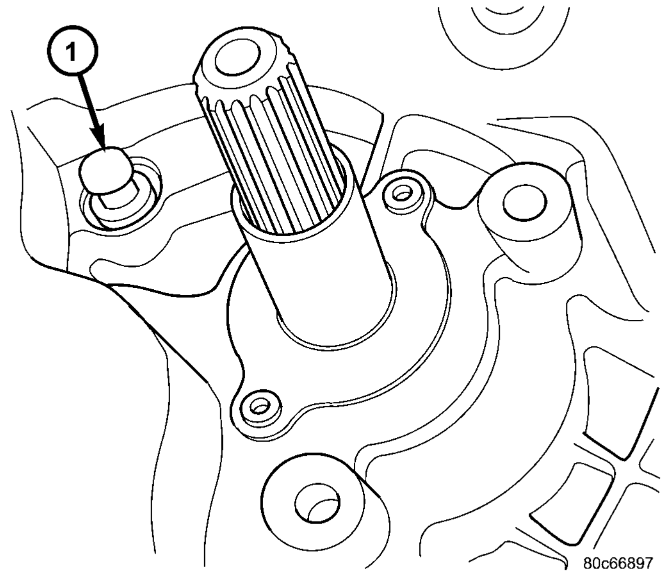


Fig. 9 Pivot Ball Position

1 - PIVOT BALL (1)

(2) Install clutch release bearing to lever. Apply grease to interface points. Make sure release bearing retainers engage lever pocket as shown in (Fig. 10).

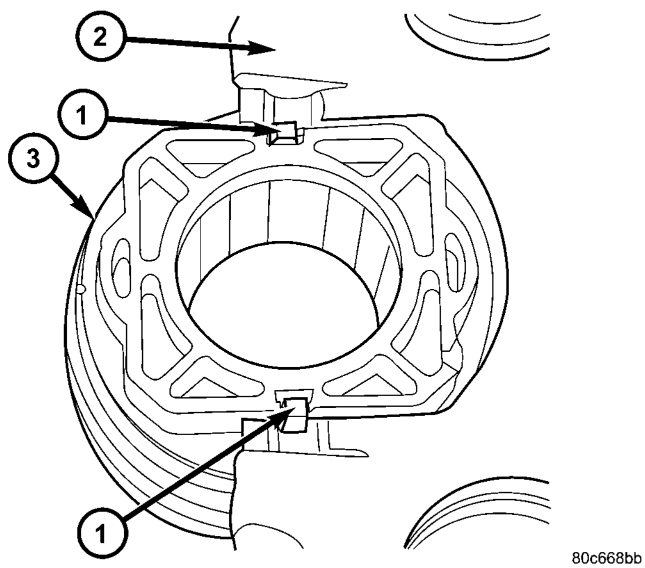


Fig. 10 Release Bearing-to-Lever

1 - RETAINER (2)
2 - RELEASE LEVER
3 - RELEASE BEARING

(3) Apply grease to pivot ball, and on release lever at slave cylinder contact point.

(4) Install clutch release bearing/lever assembly into position by sliding bearing onto input bearing retainer, and using moderate hand pressure to seat release lever to pivot ball(s) (Fig. 11). A "pop" sound should be heard. Verify proper engagement by lightly pulling outward on lever at pivot ball location, and then actuating lever and bearing to ensure proper operation.

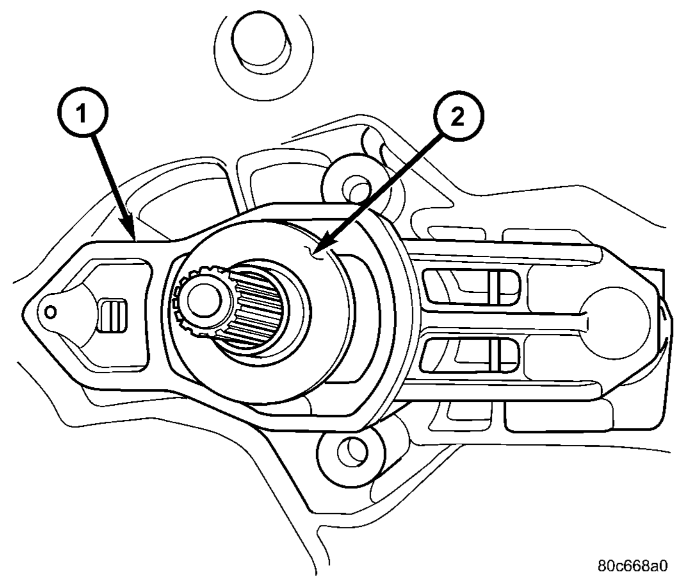


Fig. 11 Release Bearing and Lever

1 - RELEASE LEVER
2 - RELEASE BEARING

MASTER CYLINDER - RHD

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove master cylinder to clutch pedal pin retainer clip. Disengage pushrod from clutch pedal pin (Fig. 13).

(3) Disengage master cylinder grommet from cowl panel.

(4) Remove battery and tray.

(5) **Diesel models:** Remove windshield wiper module assembly. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL)

(6) Discharge Air Conditioning system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE)

(7) Remove suction/discharge line from evaporator junction block.

(8) Using tool 6638A, disconnect clutch hydraulic "quick-connect" fitting (Fig. 12).

(9) Remove clutch master cylinder tubing from retainers in engine compartment.

(10) Remove clutch master cylinder from dash panel/clutch pedal bracket by rotating 45° clockwise and pulling outward towards engine (Fig. 13).

(11) Carefully guide clutch master cylinder and hydraulic plumbing from engine compartment.

MASTER CYLINDER - RHD (Continued)

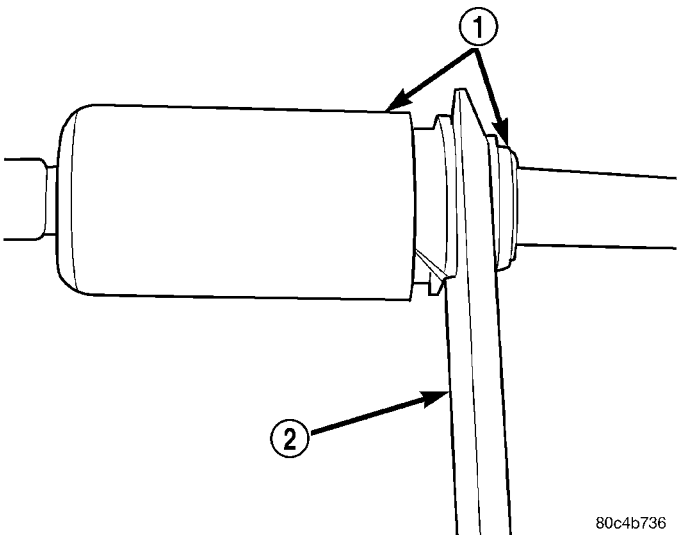


Fig. 12 Disconnect Quick-Connect Using Tool 6638A

1 - QUICK CONNECT FITTING
2 - TOOL 6638A

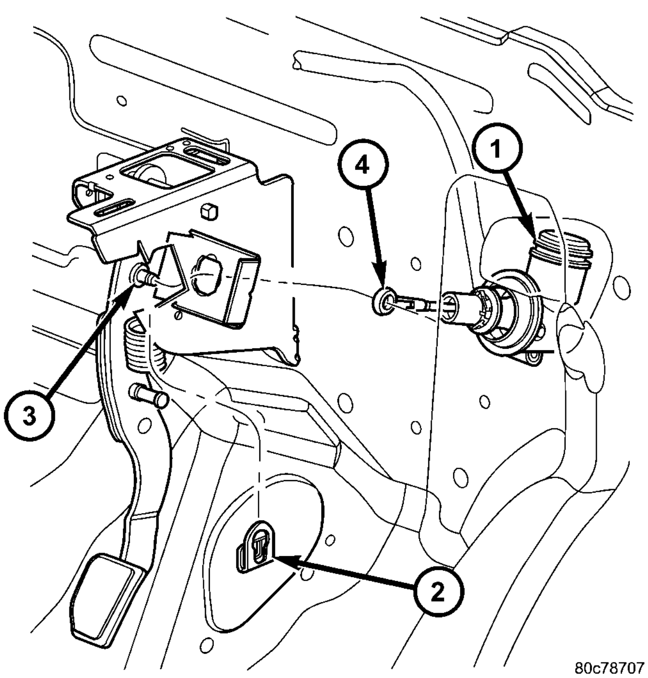


Fig. 13 Clutch Master Cylinder at Pedal Bracket

1 - CLUTCH MASTER CYLINDER
2 - RETAINER CLIP
3 - CLUTCH PEDAL PIN
4 - PUSH ROD

INSTALLATION

(1) Carefully route master cylinder plumbing into engine compartment as removed and position master cylinder to dash panel hole.

(2) Rotate master cylinder 45° clockwise, insert into dash panel hole, engaging clutch pedal bracket. Rotate master cylinder 45° counter-clockwise, securing it to pedal bracket (Fig. 13).

(3) Install and secure grommet to dash panel.

(4) Connect pushrod to clutch pedal pin. Install retainer clip (Fig. 13).

(5) Secure master cylinder plumbing to retainers in engine compartment.

(6) Connect clutch master cylinder plumbing to slave cylinder “quick connect” fitting. An audible “click” should be heard. Verify connection by pulling outward.

(7) Connect A/C suction/discharge line to evaporator junction block.

(8) **Diesel models:** Install wiper module assembly. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION)

(9) Install battery and tray.

(10) Connect battery negative cable

(11) Charge Air Conditioning system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE)

MASTER CYLINDER - LHD

REMOVAL

(1) Disconnect battery cables.

(2) Remove instrument panel lower silencer (Fig. 14).

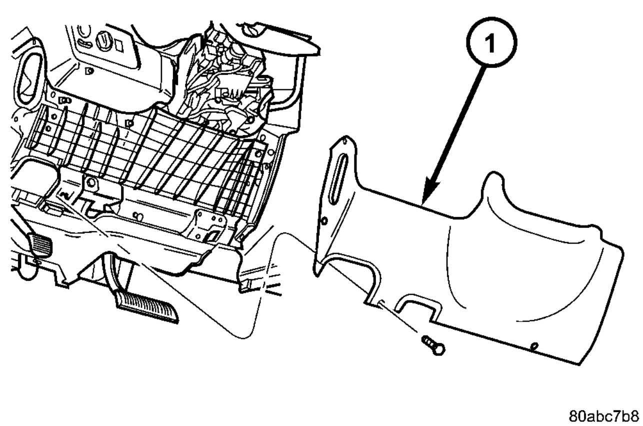


Fig. 14 Instrument Panel Lower Silencer

1 - INSTRUMENT PANEL LOWER SILENCER

MASTER CYLINDER - LHD (Continued)

(3) Remove knee bolster (Fig. 15).

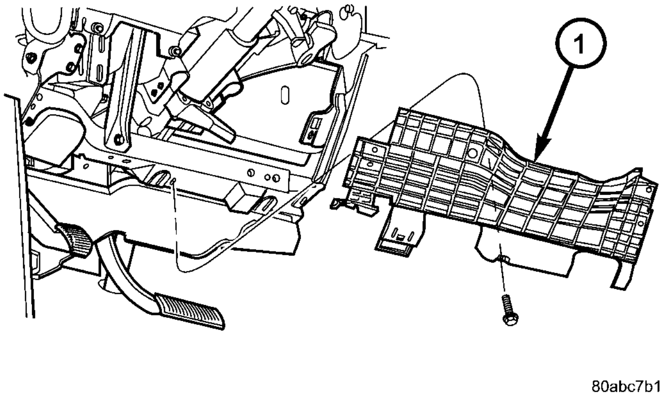


Fig. 15 Knee Bolster

1 - KNEE BOLSTER

(4) Remove clutch master cylinder pushrod retainer clip (Fig. 16).

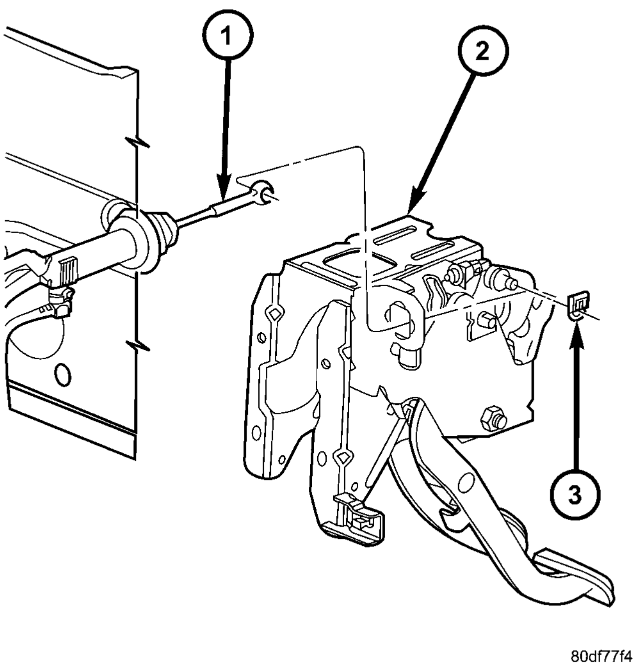


Fig. 16 Master Cylinder Pushrod at Pedal

1 - MASTER CYLINDER PUSHROD
2 - CLUTCH/BRAKE PEDAL ASSEMBLY
3 - PUSHROD RETAINER

(5) Disconnect pushrod from clutch pedal (Fig. 16).
(6) Remove battery shield.
(7) Remove battery.
(8) Remove battery tray.
(9) Remove windshield wiper module assembly (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(10) Using Tool 6638A, disconnect clutch master cylinder "quick connect" fitting (Fig. 17). Disengage plumbing retainer from body stud.

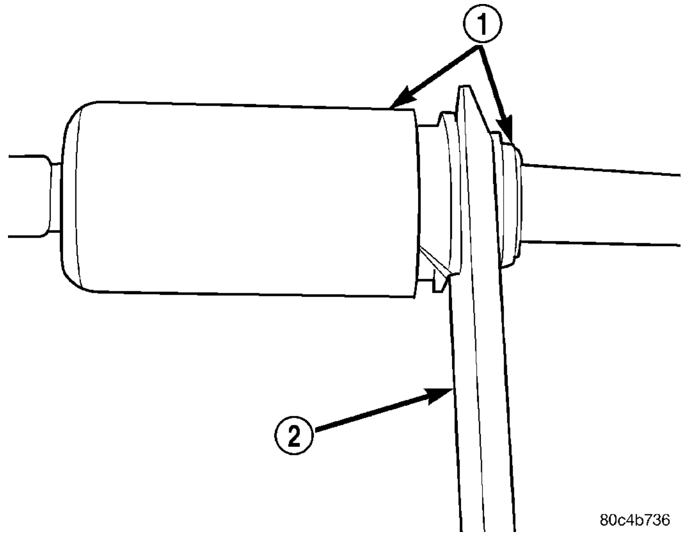


Fig. 17 Disconnect Quick-Connect Using Tool 6638A

1 - QUICK CONNECT FITTING
2 - TOOL 6638A

(11) Remove master cylinder reservoir-to-strut tower nuts (Fig. 18). Reposition reservoir off to side.

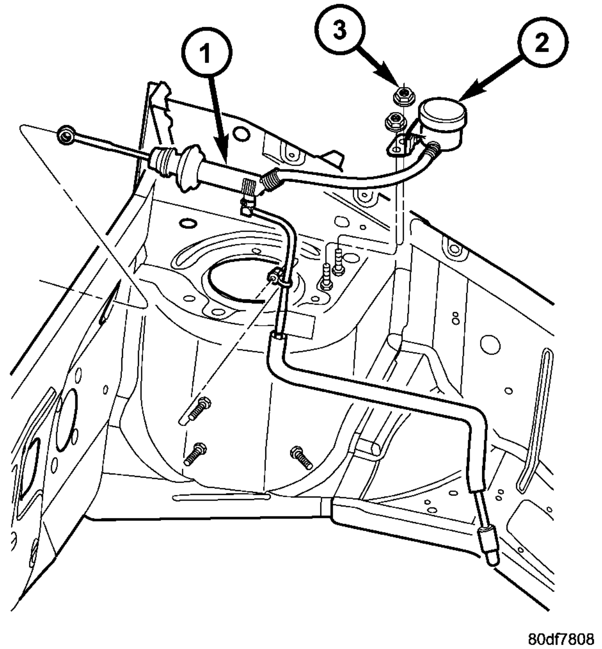


Fig. 18 Clutch Master Cylinder Removal/Installation

1 - CLUTCH MASTER CYLINDER
2 - RESERVOIR
3 - NUT (2)

(12) Remove clutch master cylinder from dash panel by rotating clockwise 45° and removing from dash panel (Fig. 18).

MASTER CYLINDER - LHD (Continued)

(13) Remove master cylinder and plumbing from engine compartment. Use care not to bend or kink plumbing. Note plumbing routing to aid in installation.

INSTALLATION

(1) Install master cylinder into position, while routing plumbing as originally installed.
(2) Insert master cylinder pushrod through dash panel (Fig. 18) and rotate 45° counter-clockwise to secure.
(3) Connect master cylinder plumbing quick-connect fitting. An audible “click” should be heard. Verify connection by pulling outward.
(4) Install master cylinder reservoir onto strut tower. Install and tighten two (2) master cylinder reservoir-to-strut tower nuts to 11 N·m (100 in. lbs.) (Fig. 18).
(5) Install windshield wiper module assembly (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).
(6) Install battery tray.
(7) Install battery.
(8) Install battery shield.
(9) Connect master cylinder pushrod to clutch pedal lever (Fig. 16). Install retainer clip.
(10) Install knee bolster and instrument panel lower silencer (Fig. 15) (Fig. 14).
(11) Connect battery cables.

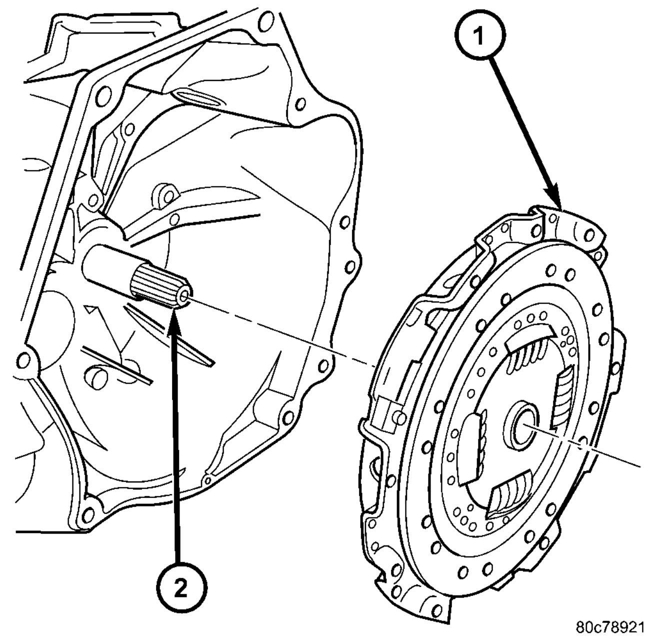


Fig. 19 Modular Clutch Assembly—Typical

1 - MODULAR CLUTCH ASSEMBLY
2 - INPUT SHAFT

MODULAR CLUTCH ASSY - 2.4L GAS

REMOVAL

(1) Remove transaxle from vehicle. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL)
(2) Remove modular clutch assembly from input shaft (Fig. 19).

INSTALLATION

(1) Install modular clutch assembly to transaxle input shaft (Fig. 19).
(2) Install transaxle to vehicle. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - INSTALLATION)

SLAVE CYLINDER

REMOVAL

(1) Raise vehicle on hoist. **Diesel models:** Remove underbody splash shield.
(2) Using Tool 6638A, disconnect hydraulic clutch circuit quick connect fitting.
(3) Remove clutch slave cylinder (Fig. 20) by lifting nylon tab with a small screwdriver, and then depressing cylinder inward towards case and rotating cylinder 60° counter-clockwise.

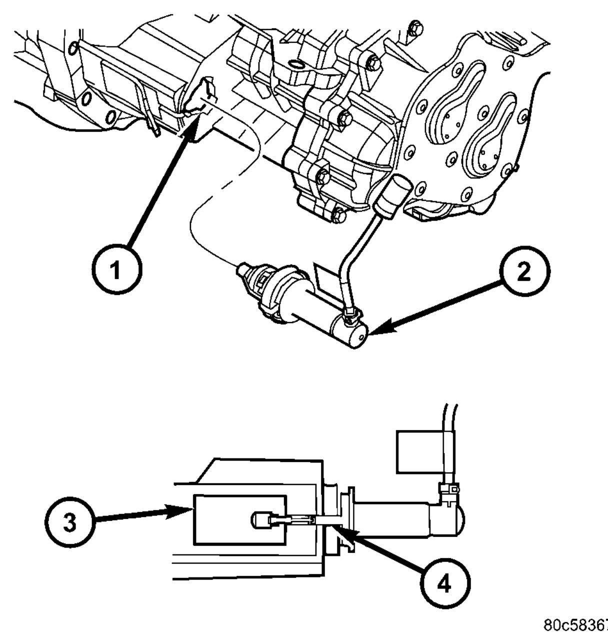


Fig. 20 Slave Cylinder Removal/Installation

1 - MOUNTING HOLE
2 - SLAVE CYLINDER
3 - ACCESS HOLE
4 - NYLON ANTI-ROTATION TAB

SLAVE CYLINDER (Continued)

INSTALLATION

(1) Install clutch slave cylinder into position, noting orientation of different sized lugs. While depressing inward, rotate slave cylinder clockwise until nylon locating tab rests in transaxle case cutout, and the hydraulic tube is vertical (Fig. 20).

(2) Connect "quick-connect" connection until an audible "click" is heard. Verify connection by pulling outward on connection.

(3) **Diesel models:** Install underbody splash shield.

(4) Lower vehicle.

CLUTCH DISC AND PRESSURE PLATE - 2.5L TD

REMOVAL

(1) Remove transaxle assembly. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL)

(2) Remove six (6) clutch pressure plate-to-flywheel bolts. Remove pressure plate and disc from flywheel (Fig. 21).

(3) Inspect flywheel. Resurface/replace as necessary.

(4) Inspect clutch release bearing and lever. Replace as necessary. (Refer to 6 - CLUTCH/CLUTCH RELEASE BEARING - REMOVAL)

INSTALLATION

(1) Install clutch release bearing and lever (if removed). (Refer to 6 - CLUTCH/CLUTCH RELEASE BEARING - INSTALLATION)

(2) Install clutch disc and pressure plate to flywheel (Fig. 21). Install clutch alignment tool, and install and torque pressure plate-to-flywheel bolts to 28 N·m (250 in. lbs.).

(3) Install transaxle assembly. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - INSTALLATION)

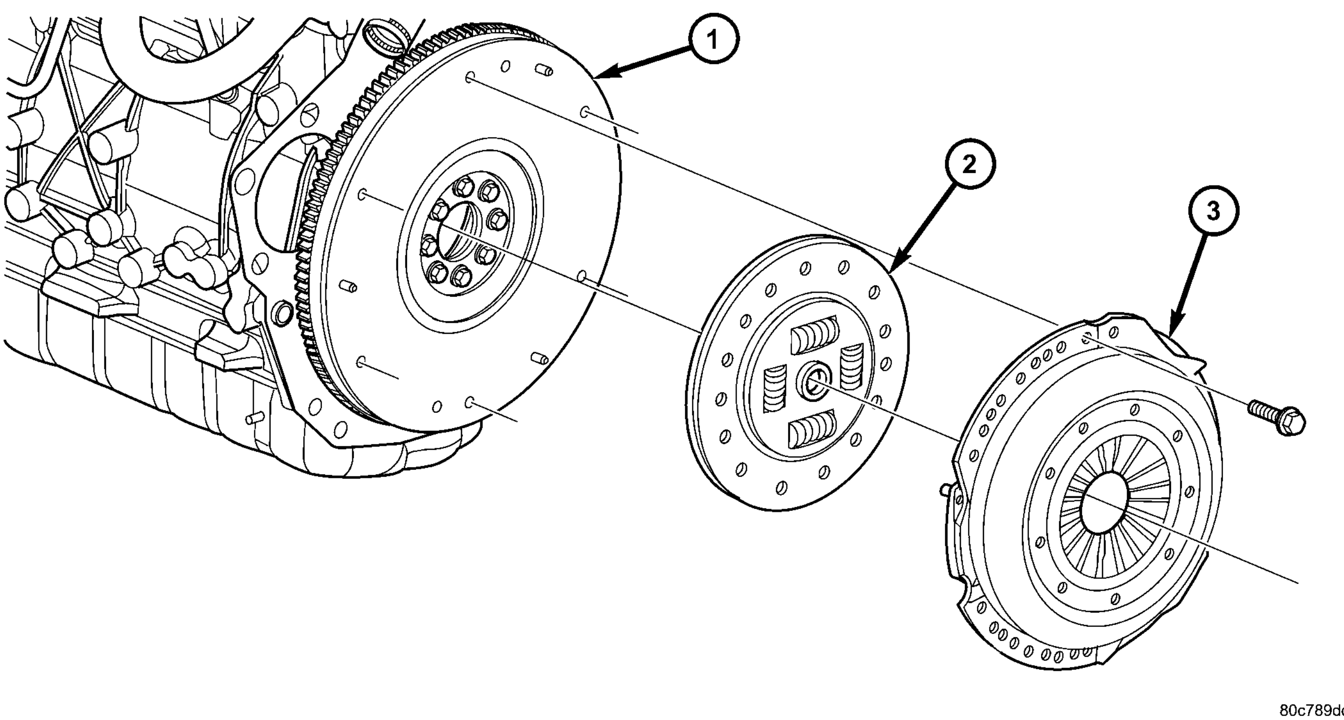


Fig. 21 Clutch Disc and Pressure Plate

1 - FLYWHEEL
2 - DISC
3 - PRESSURE PLATE

FLYWHEEL

REMOVAL

(1) Remove transaxle assembly. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL)

(2) Remove clutch pressure plate and disc. (Refer to 6 - CLUTCH/CLUTCH DISC - REMOVAL)

(3) Remove flywheel assembly (Fig. 22).

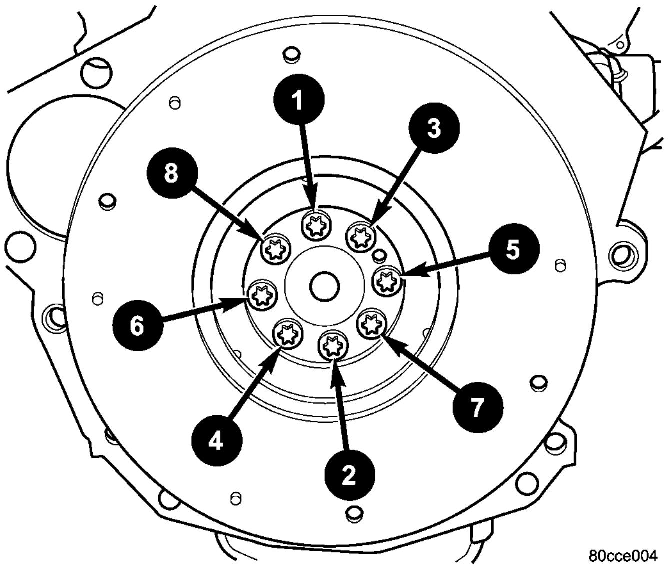


Fig. 22 Flywheel Bolt Torque Sequence

INSTALLATION

(1) Install NEW flywheel-to-crankshaft bolts by hand.

(2) Torque bolts in a criss-cross sequence to 25 N·m (18 ft. lbs.) (Fig. 22).

(3) Torque bolts in a criss-cross sequence an additional 60°.

(4) Install clutch pressure plate and disc. (Refer to 6 - CLUTCH/CLUTCH DISC - INSTALLATION)

(5) Install transaxle assembly. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - INSTALLATION)

CLUTCH PEDAL INTERLOCK SWITCH

REMOVAL

LHD

(1) Disconnect battery negative cable.

(2) Remove instrument panel lower silencer (Fig. 23).

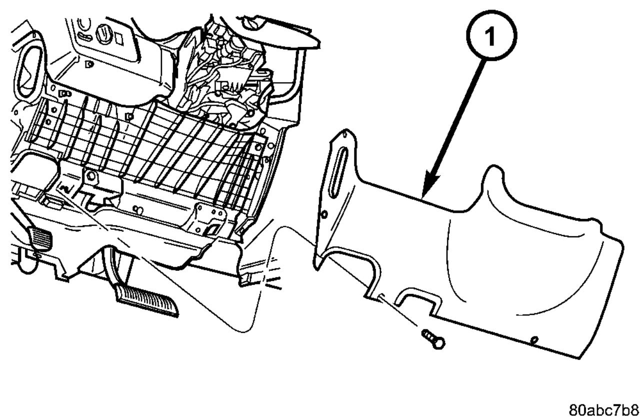


Fig. 23 Instrument Panel Lower Silencer—LHD Shown

1 - INSTRUMENT PANEL LOWER SILENCER

(3) Remove knee bolster (Fig. 24).

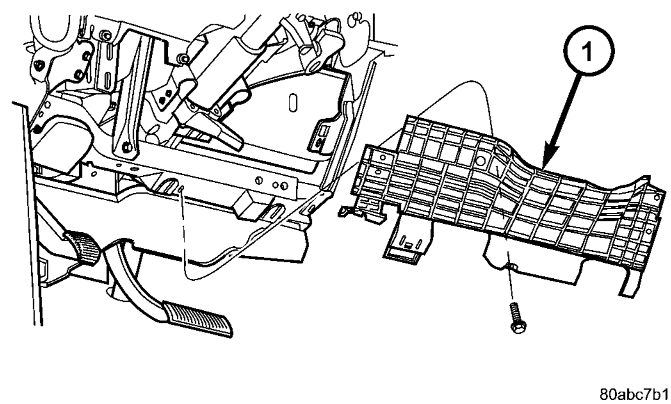


Fig. 24 Knee Bolster—LHD Shown

1 - KNEE BOLSTER

CLUTCH PEDAL INTERLOCK SWITCH (Continued)

(4) Disconnect interlock switch connector (Fig. 25).

(5) Remove interlock switch by depressing four (4) plastic wing tabs, and sliding switch through mounting bracket (Fig. 25). If difficulty is encountered gaining access to and removing interlock switch, removing the upstop switch/bracket assembly (Fig. 25) allows for over-travel of the pedal, giving more room for interlock switch access.

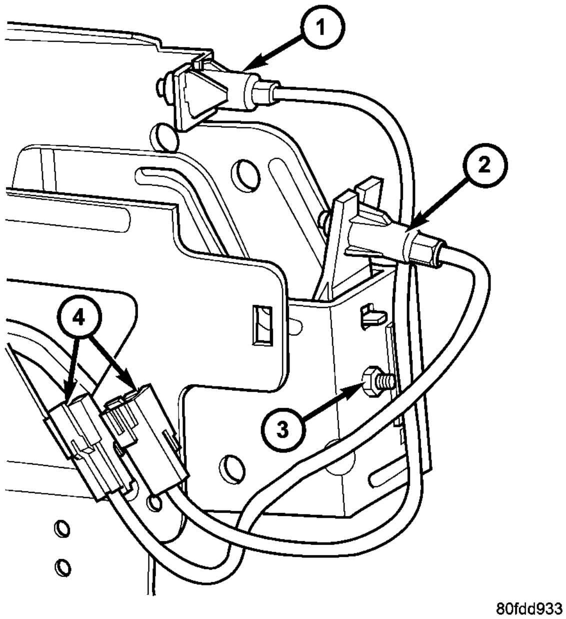


Fig. 25 Interlock/Upstop Switch Location

1 - INTERLOCK SWITCH
2 - UPSTOP SWITCH
3 - RETAINER - UPSTOP BRACKET
4 - CONNECTORS

(6) Remove interlock switch harness from pedal bracket at retainer. Remove switch.

RHD

(1) Disconnect battery negative cable.

(2) Remove instrument panel lower silencer (Fig. 23).

(3) Remove knee bolster (Fig. 24).

(4) Remove master cylinder to clutch pedal pin retainer clip (Fig. 26). Disengage pushrod from clutch pedal pin.

(5) Disconnect interlock and upstop switch connectors.

(6) Disengage master cylinder grommet from dash panel.

(7) Remove clutch master cylinder tubing from retainers in engine compartment.

(8) Remove clutch master cylinder from dash panel/clutch pedal bracket by rotating 45° clockwise and pulling outward towards engine (Fig. 26).

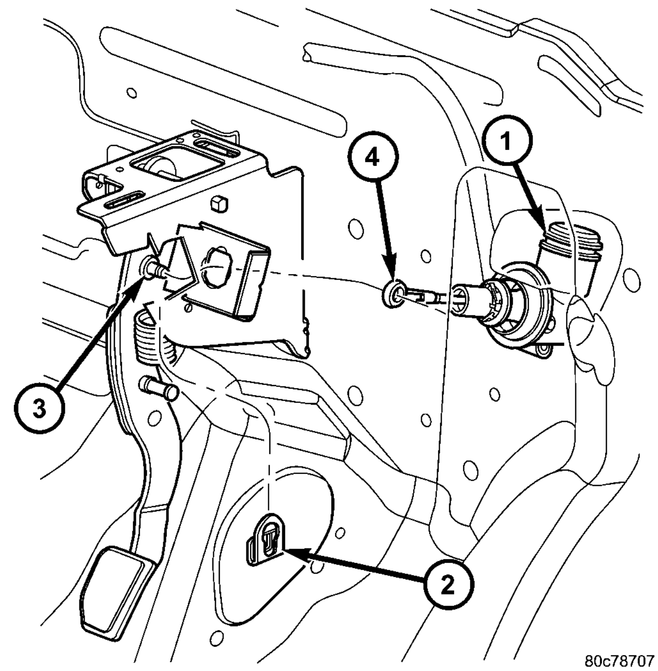


Fig. 26 Clutch Master Cylinder at Pedal Bracket

1 - CLUTCH MASTER CYLINDER
2 - RETAINER CLIP
3 - CLUTCH PEDAL PIN
4 - PUSH ROD

(9) Remove clutch pedal bracket assembly (Fig. 27).

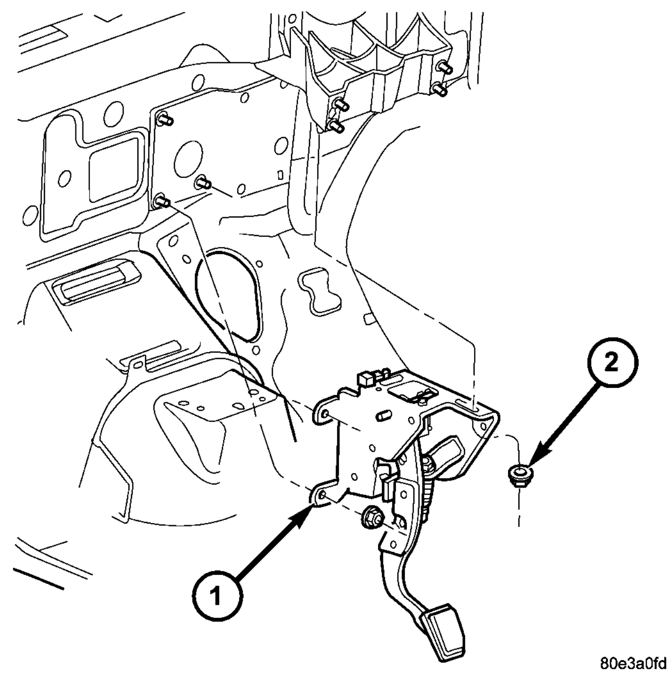


Fig. 27 Clutch Pedal/Bracket Assembly

1 - CLUTCH PEDAL/BRACKET ASSY.
2 - NUT (4)

CLUTCH PEDAL INTERLOCK SWITCH (Continued)

(10) Remove interlock switch harness from pedal bracket at retainer. Remove switch (Fig. 28).

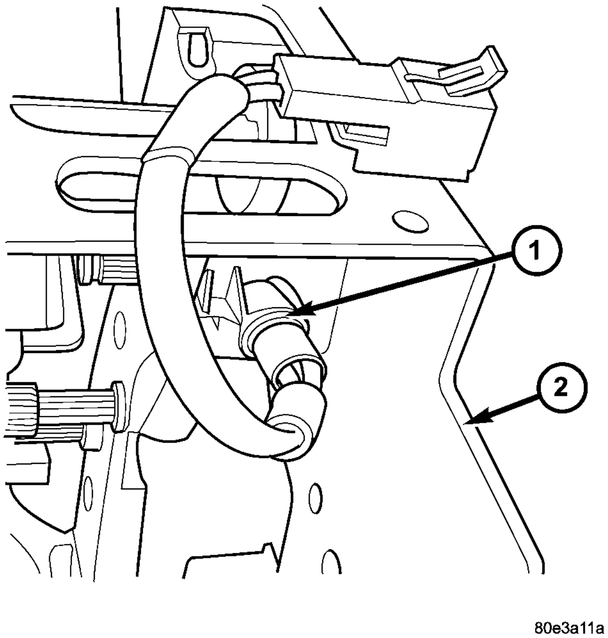


Fig. 28 Clutch Pedal Interlock Switch

1 - CLUTCH INTERLOCK SWITCH
2 - CLUTCH PEDAL/BRACKET ASSY.

INSTALLATION

LHD

(1) Install interlock switch into pedal bracket hole, and secure harness with retainer as shown in (Fig. 28). Make sure switch wing tabs are fully expanded.

(2) Connect interlock switch connector.

(3) Install knee bolster (Fig. 24).

(4) Install instrument panel lower silencer (Fig. 23).

(5) Connect battery negative cable.

(6) Verify function of starter interlock switch. Switch must actuate when pedal is depressed.

RHD

(1) Install interlock switch to pedal bracket assembly as shown in (Fig. 28). Secure connector with retainer to hole in bracket.

(2) Install clutch pedal bracket assembly into position. Install pedal bracket mounting nuts and torque to 28 N·m (250 in. lbs.).

(3) Connect interlock and upstop switch connectors.

(4) Install clutch master cylinder into position and rotate 45° counter-clockwise to secure to pedal bracket (Fig. 26). Secure dash panel grommet and secure hydraulic pluming into dash panel retainers.

(5) Connect master cylinder pushrod to clutch pedal pin and secure with retainer clip (Fig. 26).

(6) Install knee bolster (Fig. 24).

(7) Install instrument panel lower silencer (Fig. 23).

(8) Connect battery negative cable.

(9) Verify function of starter interlock switch. Switch must actuate when pedal is depressed.

CLUTCH PEDAL UPSTOP SWITCH

REMOVAL

LHD

(1) Disconnect battery negative cable.

(2) Remove instrument panel lower silencer (Fig. 29).

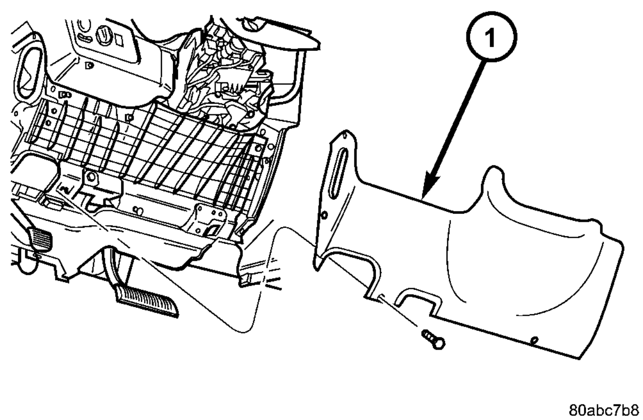


Fig. 29 Instrument Panel Lower Silencer—LHD Shown

1 - INSTRUMENT PANEL LOWER SILENCER

CLUTCH PEDAL UPSTOP SWITCH (Continued)

(3) Remove knee bolster (Fig. 30).

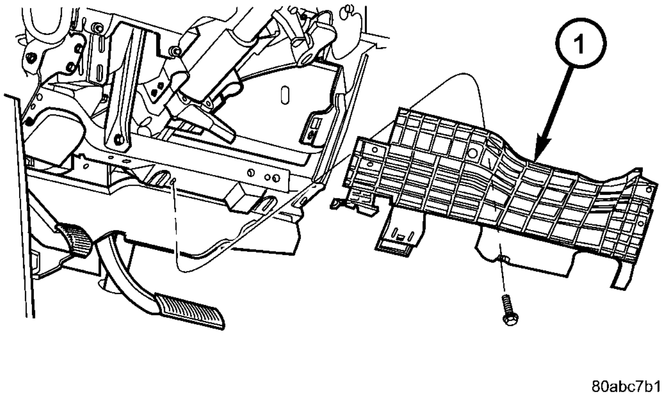


Fig. 30 Knee Bolster—LHD Shown

1 - KNEE BOLSTER

(4) Remove upstop switch by depressing four (4) plastic wing tabs, and sliding switch through mounting bracket. If necessary, remove mounting bracket and remove switch (Fig. 31).

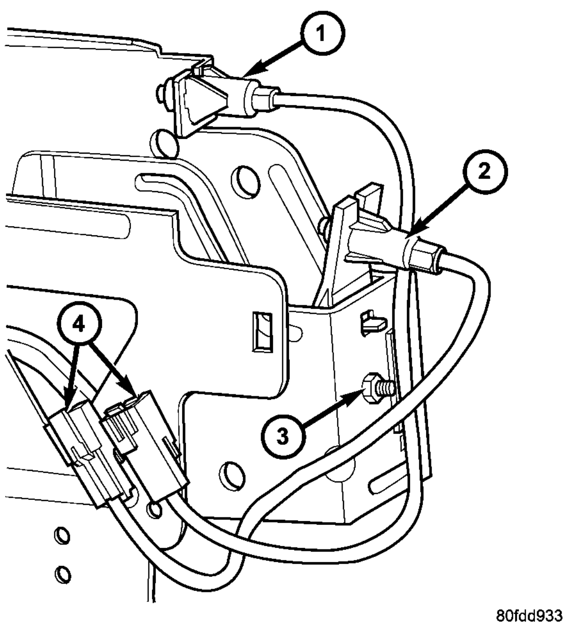


Fig. 31 Interlock/Upstop Switch Location

1 - INTERLOCK SWITCH
2 - UPSTOP SWITCH
3 - RETAINER - UPSTOP BRACKET
4 - CONNECTORS

RHD

(1) Disconnect battery negative cable.

(2) Remove instrument panel lower silencer (Fig. 29).

(3) Remove knee bolster (Fig. 30).

(4) Disconnect upstop switch connector (Fig. 32).

(5) Remove upstop switch/bracket-to-clutch pedal bracket nut. Remove switch (Fig. 32).

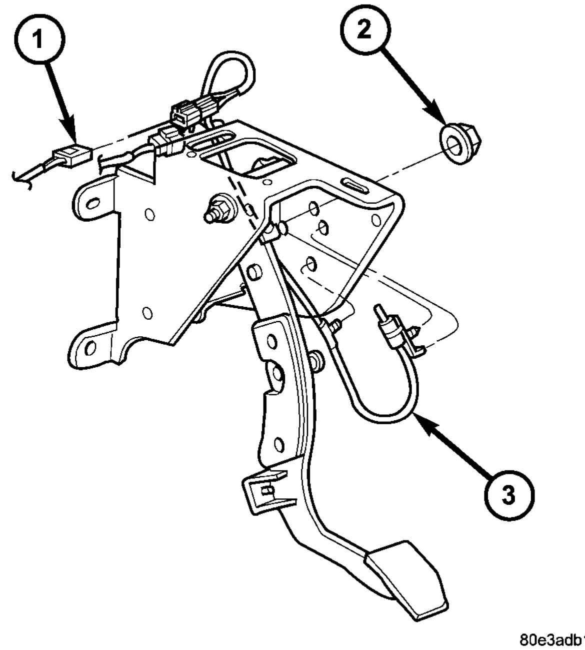


Fig. 32 Clutch Pedal Upstop Switch—RHD

1 - CONNECTOR
2 - NUT
3 - UPSTOP SWITCH/BRACKET

INSTALLATION

LHD

(1) Install upstop switch into bracket (Fig. 31). Ensure switch wing tabs are fully expanded. If removed, re-install bracket and torque to 13 N·m (115 in. lbs.).

(2) Connect upstop switch connector.

(3) Install knee bolster (Fig. 30).

(4) Install instrument panel lower silencer (Fig. 29).

(5) Connect battery negative cable.

RHD

(1) Install switch and bracket assembly. Torque nut to 12 N·m (110 in. lbs.) (Fig. 32).

(2) Connect upstop switch assembly (Fig. 32).

(3) Install knee bolster (Fig. 30).

(4) Install instrument panel lower silencer (Fig. 29).

(5) Connect battery negative cable.

COOLING

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COOLING 2.5L/2.8L TURBO DIESEL

DESCRIPTION - COOLING SYSTEM

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible, maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system. A separate and remotely mounted, pressurized coolant tank using a pressure/vent cap is used.

COOLING SYSTEM COMPONENTS

The cooling system consists of:

- Charge Air Cooler
- Electric Cooling Fans
- A aluminum-core radiator with plastic side tanks
- A separate pressurized coolant tank
- A pressure/vent cap on the coolant tank
- Fan shroud
- Thermostat
- Coolant
- Low coolant warning lamp
- Coolant temperature gauge
- Water pump
- Hoses and hose clamps

DIAGNOSIS AND TESTING

COOLING SYSTEM

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

(1) PROLONGED IDLE, VERY HIGH AMBIENT TEMPERATURE, SLIGHT TAIL WIND AT IDLE, SLOW TRAFFIC, TRAFFIC JAMS, HIGH SPEED OR STEEP GRADES.

- Idle with A/C off when temperature gauge is at end of normal range.

(2) TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

(3) RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt
- Brakes (possibly dragging)
- Changed parts (incorrect water pump)
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to following Cooling System Diagnosis charts.

These charts are to be used as a quick-reference only.

COOLING 2.5L/2.8L TURBO DIESEL (Continued)

COOLING SYSTEM DIAGNOSIS-DIESEL ENGINE

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Diesel engines, due to their inherent efficiency are slower to warm up than gasoline powered engines, and will operate at lower temperatures when the vehicle is unloaded.	1. The low gauge reading may be normal. Refer to thermostats in the manual text for information. See Thermostat Diagnosis-Diesel Engine.
	2. Is the temperature gauge connected to the temperature gauge coolant sensor on the engine?	2. Check, the engine temperature sensor connector in the engine compartment.
	3. Is the temperature gauge operating OK?	3. Check gauge operation. Repair as necessary.
	4. Coolant level low in cold ambient temperatures accompanied with poor heater performance.	4. Check coolant level in the coolant tank. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section for WARNINGS and precautions before removing the pressure cap.
	5. Improper operation of internal heater doors or heater controls.	5. Inspect heater and repair as necessary. Refer to Heating and Air Conditioning for procedures.
TEMPERATURE GAUGE READS HIGH. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM COOLING SYSTEM	1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperature and the air conditioning is on. Higher altitudes could aggravate these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to normal range, determine the cause for the overheating and repair.
	2. Temperature gauge reading incorrectly.	2. Check gauge. Refer to I/P group.
	3. Coolant low in coolant tank and radiator.	3. Check for coolant leaks and repair as necessary.
	4. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered.	4. Tighten cap.
	5. Poor seals at pressure/vent cap.	5. (a) Check condition of cap and cap seals. (b) Check condition of coolant tank filler neck. Make sure it does not leak pressure.

COOLING 2.5L/2.8L TURBO DIESEL (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	6. Freeze point of antifreeze not correct. Mixture may be too rich.	6. Check antifreeze. Adjust antifreeze-to-water ratio as required.
	7. Coolant not flowing through system.	7. Check for coolant flow in coolant tank with engine warm and thermostat open. Coolant should be observed flowing through the tank. If flow is not observed, determine reason for lack of flow and repair as necessary.
	8. Radiator or A/C condenser fins are dirty or clogged.	8. Clean debris from radiator or A/C condenser
	9. Radiator core is corroded or plugged.	9. Have radiator re-cored or replaced.
	10. Aftermarket A/C installed without proper A/C condenser.	10. Install proper A/C condenser.
	11. Dragging Brakes.	11. Check and correct as necessary.
	12. Non-factory bug screen is being used reducing air flow.	12. Only a factory screen should be used.
	13. Thermostat partially or completely shut. This is more prevalent on high mileage vehicles.	13. Check thermostat and replace if necessary.
	14. Cylinder head gasket leaking.	14. Check cylinder head gasket for leaks.
	15. Heater core leaking.	15. Check heater core for leaks. Repair as necessary.
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	1. During cold weather operation, with the heater blower in the high position, the gauge reading may drop slightly. Fluctuation is also influenced by loads, outside temperature and extended idle time with diesel engines.	1. A normal condition. No correction is necessary.
	2. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit.	2. Check operation of gauge and repair as necessary.
	3. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running).	3. A normal condition. No correction needed. Gauge should return to normal range after vehicle is driven.
	4. Gauge reading high after starting a warm-up (hot) engine.	4. A normal condition. No correction needed. Gauge should return to normal after a few minutes of engine operation.

COOLING 2.5L/2.8L TURBO DIESEL (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	5. Coolant level low in the coolant tank (air will build up in the cooling system causing the thermostat to open late).	5. Check and correct coolant leaks.
	6. Cylinder head gasket leaking allowing exhaust gases to enter the cooling system causing the thermostat to open late.	6. (a) Check for cylinder head gasket leaks with a commercially available leak tester. (b) Check for coolant in engine oil. Inspect for white steam emitting from exhaust system. Repair as necessary.
	7. Water pump impeller loose on shaft.	7. Check water pump and replace as necessary.
	8. Loose accessory drive belt (water pump slipping).	8. Check and correct as necessary.
	9. Air leak on the suction side of the water pump allowing air to build up in the cooling system causing the thermostat to open late.	9. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT TANK	1. Pressure relief valve in pressure/ vent cap is defective.	1. Check condition of pressure/vent cap and cap seals.
	2. Head gasket leak or cracked cylinder head.	2. Repair as necessary.
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE IS READING HIGH OR HOT	1. Coolant leaks in radiator, cooling system hoses, water pump, or engine.	1. Pressure test cooling system and repair as necessary.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING	1. Vacuum created in cooling system on engine cool-down is not being relieved through pressure/vent cap.	1. Cap relief valve stuck. Replace if necessary.
NOISY FAN	1. Cooling fan blades loose.	1. Replace cooling fan assembly.
	2. Cooling fan blades striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or A/C condenser.	3. Remove obstructions or clean debris from radiator or A/C condenser.

COOLING 2.5L/2.8L TURBO DIESEL (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or A/C condenser is restricted, obstructed or dirty (insects, leaves, etc.)	1. Remove restriction or clean debris from radiator or A/C condenser.
	2. Engine is overheating (heat may be transferred from radiator to A/C condenser. High Under hood temperatures due to engine overheating may also transfer heat to A/C condenser).	2. Correct overheating condition.
	3. The cooling system is equipped with air seals at the radiator and/or A/C condenser. If these seals are missing or damaged, not enough air flow will be pulled through the radiator and A/C condenser.	3. Check for missing or damaged air seals. Repair as necessary.
INADEQUATE HEATER PERFORMANCE. MAY BE ACCOMPANIED BY LOW GAUGE READING	1. Diesel engines, due to their inherent efficiency are slower to warm up than gasoline powered engines, and will operate at lower temperatures when the vehicle is unloaded.	1. The lower gauge reading may be normal.
	2. Coolant level low.	2. Pressure test cooling system. Repair leaks as necessary.
	3. Obstruction in heater hose fitting at engine.	3. Remove heater hoses and check for obstructions. Repair as necessary.
	4. Heater hose kinked.	4. Locate kinked area. Repair as necessary.
	5. Water pump is not pumping water to heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot the water pump may not be operating correctly. The accessory drive belt may also be slipping causing poor water pump operation.	5. Refer to water pumps in this group. Repair as necessary. If a slipping belt is detected, refer to Engine Accessory Drive Belts in this group. Repair as necessary.
HEAT ODOR	1. Various heat shields are used at certain drive line components. One or more of these shields may be missing.	1. Locate missing shields. Repair or replace as necessary.
	2. Is temperature gauge reading above the normal range?	2. Refer to the previous Temperature Gauge Reads High in these Diagnostic Charts. Repair as necessary.
	3. Is the Cooling fan operating correctly?	3. Refer to Cooling System Fan in this group for diagnosis. Repair as necessary.

COOLING 2.5L/2.8L TURBO DIESEL (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	4. Has undercoating been applied to any unnecessary components?	4. Clean undercoating as necessary.
STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. During wet weather, moisture (snow, ice, or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or air flow to blow it away.	1. Occasional steam emitting from this area is normal. No repair is necessary.
COOLANT ODOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. Refer to Coolant in this group for antifreeze tests. Adjust antifreeze-to-water ratio as necessary.
COOLANT LEVEL CHANGES IN COOLANT TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the HOT and COLD marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures.	1. This a normal condition. No repair necessary.

COOLING SYSTEM LEAK TEST

WARNING: THE WARNING WORDS “DO NOT OPEN HOT” ON THE RADIATOR PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE RADIATOR CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT OR UNDER PRESSURE.

With engine not running, remove pressure/vent cap from the coolant recovery pressure container and wipe the filler neck sealing seat clean. The coolant recovery pressure container should be full.

Attach the Cooling System Tester 7700 or equivalent to the radiator, as shown in (Fig. 1) and apply 104 kPa (15 psi) pressure. If the pressure drops more than 13.8 kPa (2 psi) in 2 minutes, inspect all points for external leaks.

All radiator and heater hoses should be shaken while at 104 kPa (15 psi), since some leaks occur only while driving due to engine movement.

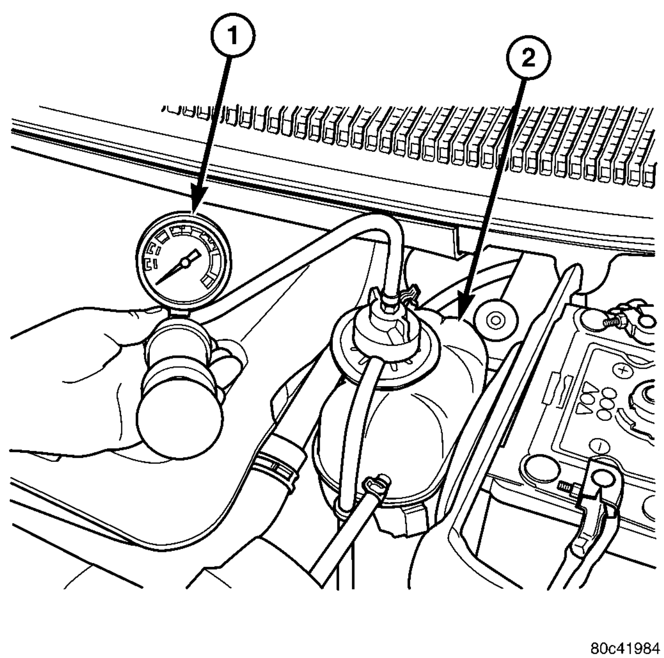

Fig. 1 PRESSURE TESTING COOLING SYSTEM

1 - COOLING SYSTEM PRESSURE TESTER
2 - COOLANT RECOVERY PRESSURE CONTAINER

COOLING 2.5L/2.8L TURBO DIESEL (Continued)

If there are no external leaks, after the gauge dial shows a drop in pressure, detach the tester. Start engine and run until the thermostat opens, allowing the coolant to expand. Reattach the cooling system tester. If the needle on the dial fluctuates it indicates a combustion leak, usually a head gasket leak.

WARNING: WITH TOOL IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

If the needle on the dial does not fluctuate, raise the engine rpm a few times. If an abnormal amount of coolant or steam emits from the tailpipe, it may indicate a coolant leak caused by a faulty head gasket, cracked engine block, or cracked cylinder head.

There may be internal leaks that can be determined by removing the oil dipstick. If water globules appear intermixed with the oil it will indicate an internal leak in the engine. If there is an internal leak, the engine must be disassembled for repair.

COOLING SYSTEM FLOW CHECK

To determine whether coolant is flowing through the cooling system, use the following procedures:

(1) If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If it is hot, coolant is circulating.

WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(2) Remove pressure/vent cap when engine is cold, idle engine until thermostat opens, you should observe coolant flow while looking down in the coolant recovery pressure container. Once flow is detected install the pressure/vent cap.

COOLING SYSTEM AERATION

Low coolant level in a cross flow radiator will equalize in both tanks with engine off. With engine at running and at operating temperature, the high pressure inlet tank runs full and the low pressure outlet tank drops, resulting in cooling system aeration. Aeration will draw air into the water pump resulting in the following:

- High reading shown on the temperature gauge.
- Loss of coolant flow through the heater core.
- Corrosion in the cooling system.
- Water pump seal may run dry, increasing the risk of premature seal failure.
- Combustion gas leaks into the coolant can also cause aeration.

CLEANING

Drain cooling system and refill with clean water. Refer to procedures in this section. Run engine with pressure/vent cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty; fill, run, and drain system again, until water runs clear.

INSPECTION

After performing a cleaning/flush procedure, inspect all hoses, clamps and connections for deterioration and leaks. Inspect radiator and heater core for leaks.

SPECIFICATIONS

COOLING SYSTEM CAPACITY

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Cooling System With Auxiliary Heater	16.6 Liters (17.5 qts.)
Cooling System With Out Auxiliary Heater	13.8 Liters (14.6 qts.)

ACCESSORY DRIVE

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ACCESSORY DRIVE

SPECIFICATIONS

ACCESSORY BELT TENSION

ACCESSORY DRIVE BELT	GAUGE
2.5L/2.8L DIESEL ENGINE	
A/C Compressor/ Generator	Dynamic Tensioner
Power Steering Belt	300 N (67 lbs.)

BELT TENSIONER

REMOVAL

WARNING:: BECAUSE OF HIGH SPRING TENSION, DO NOT ATTEMPT TO DISASSEMBLE THE AUTOMATIC BELT TENSIONER. THE TENSIONER IS SERVICED AS AN ASSEMBLY.

(1) Remove the power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(2) Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(3) Remove the belt tensioner retaining bolt and remove tensioner (Fig. 1).

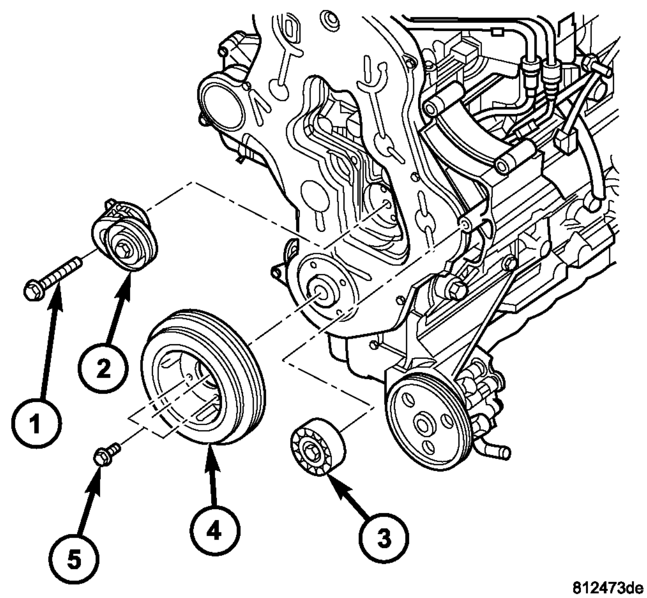

Fig. 1 VIBRATION DAMPER

1 - BELT TENSIONER RETAINING BOLT
2 - BELT TENSIONER
3 - IDLER PULLEY
4 - VIBRATION DAMPER/CRANKSHAFT PULLEY
5 - VIBRATION DAMPER/CRANKSHAFT PULLEY RETAINING BOLTS

BELT TENSIONER (Continued)

INSTALLATION

(1) Install belt tensioner and retaining bolt (Fig. 1). Torque bolt to 55 N·m (40ft. lbs.).

(2) Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(3) Install the power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

IDLER PULLEY

REMOVAL

(1) Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

CAUTION: IDLER PULLEY RETAINING BOLT HAS LEFT HAND THREAD

(2) Remove the idler pulley (Fig. 2).

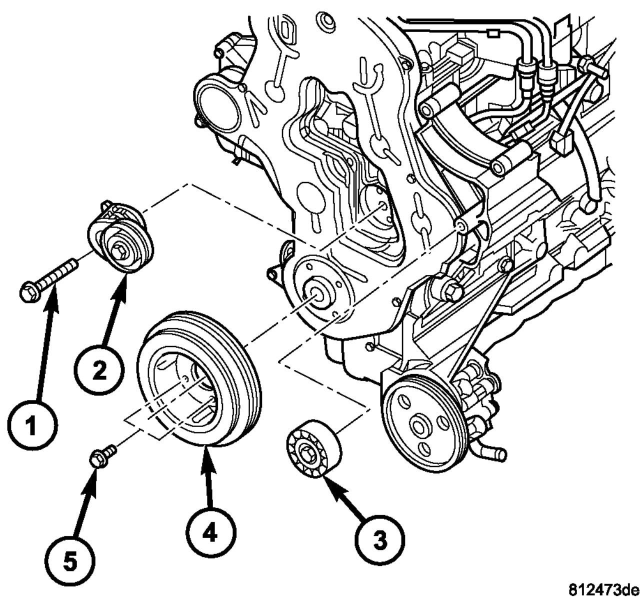

Fig. 2 VIBRATION DAMPER

1 - BELT TENSIONER RETAINING BOLT
2 - BELT TENSIONER
3 - IDLER PULLEY
4 - VIBRATION DAMPER/CRANKSHAFT PULLEY
5 - VIBRATION DAMPER/CRANKSHAFT PULLEY RETAINING BOLTS

INSTALLATION

(1) Install the idler pulley (Fig. 2). Torque retaining bolt to 53 N·m (35 ft. lbs.).

(2) Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(3) Install the power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

DRIVE BELTS

DESCRIPTION

ACCESSORY DRIVE BELT

The accessory drive belt is a serpentine type belt (Fig. 3). Satisfactory performance of these belts depends on belt condition and proper belt tension.

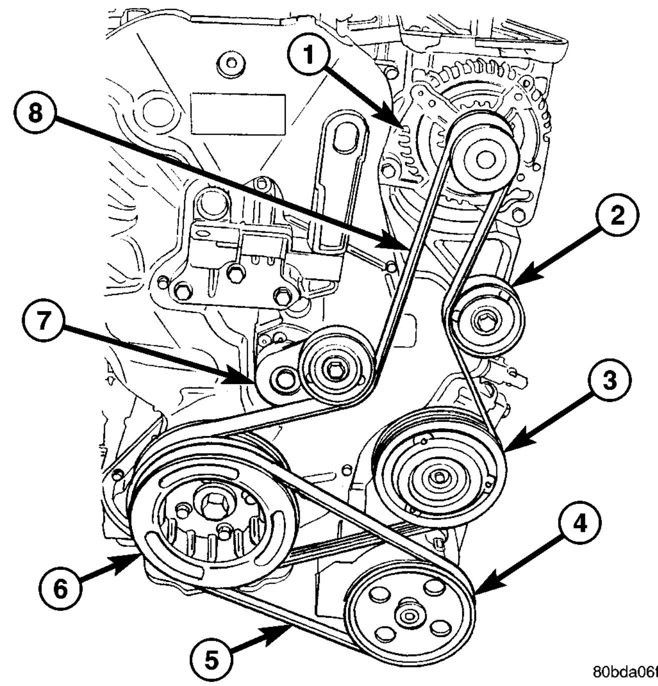

Fig. 3 ACCESSORY DRIVE BELT ROUTING

1 - GENERATOR
2 - IDLER PULLEY
3 - A/C COMPRESSOR CLUTCH
4 - POWER STEERING PUMP PULLEY
5 - POWER STEERING BELT
6 - CRANKSHAFT DAMPER/PULLEY
7 - BELT TENSIONER
8 - ACCESSORY DRIVE BELT

POWER STEERING BELT

The power steering belt is a serpentine type belt (Fig. 3). Satisfactory performance of this belt depends on condition of the belt.

DRIVE BELTS (Continued)

OPERATION

ACCESSORY DRIVE BELT

The accessory drive belts form the link between the engine crankshaft and the engine driven accessories.

POWER STEERING BELT

The power steering belt forms a link between the engine crankshaft and the power steering pump.

DIAGNOSIS AND TESTING

ACCESSORY DRIVE BELT

CONDITION	POSSIBLE CAUSES	CORRECTIONS
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	1. Belt too loose	1. Replace belt (auto-tensioned belts)
	2. Faulty belt tensioner	2. Replace tensioner as necessary
	3. Belt excessively glazed or worn	3. Replace belt
BELT SQUEAL WHEN ACCELERATING ENGINE	1. Belts too loose	1. Check and replace belt tensioner if necessary
	2. Belt glazed	2. Replace belt
BELT SQUEAK AT IDLE	1. Belts too loose	1. Replace belt
	2. Dirt or paint imbedded in belt or pulley	2. Replace belt, clean pulley
	3. Non-uniform belt	3. Replace belt
	4. Misaligned pulleys	4. Align accessories
	5. Non-uniform groove or eccentric pulley	5. Replace pulley
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	1. Broken cord in belt	1. Replace belt
	2. Belt too loose, or too tight	2. Replace belt
	3. Misaligned pulleys	3. Align accessories
	4. Non-uniform groove or eccentric pulley	4. Replace pulley

REMOVAL

ACCESSORY DRIVE BELT

(1) Remove the power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Relieve tension on belt tensioner using a suitable wrench (Fig. 4) and lock tensioner with a drift punch (Fig. 5).

(3) Remove the accessory drive belt.

POWER STEERING BELT

(1) Raise vehicle on hoist.

(2) Remove right front fender inner splash shield.

(3) Install power steering belt remover tool on crankshaft damper (Fig. 6).

(4) Rotate engine clockwise to remove belt (Fig. 7).

DRIVE BELTS (Continued)

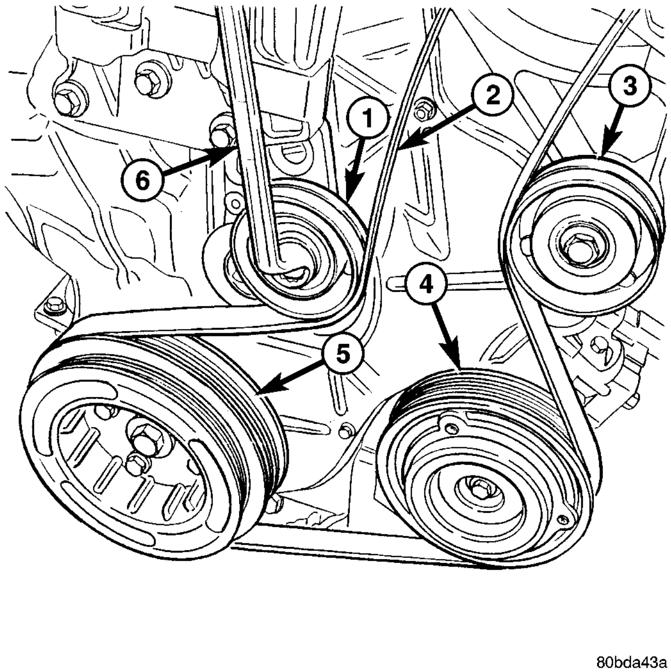

Fig. 4 ACCESSORY DRIVE BELT REMOVAL

1 - BELT TENSIONER
2 - ACCESSORY DRIVE BELT
3 - IDLER PULLEY
4 - A/C COMPRESSOR CLUTCH
5 - CRANKSHAFT DAMPER/PULLEY
6 - WRENCH

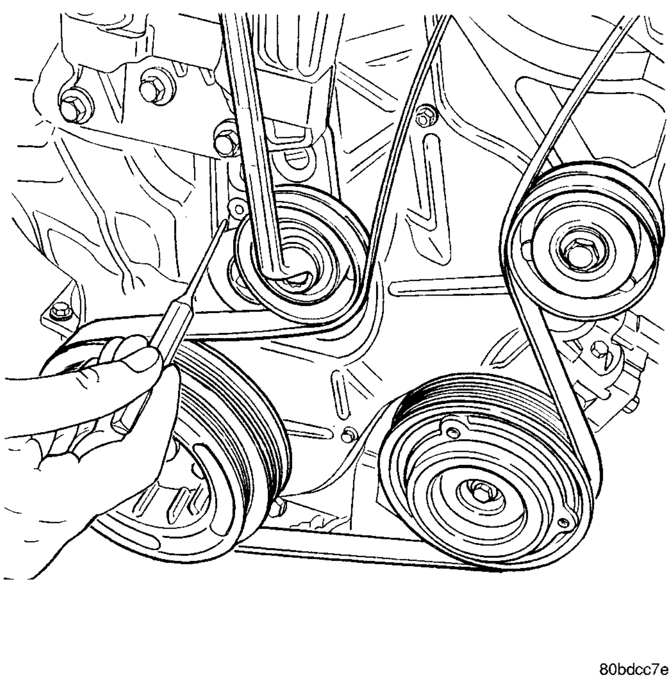

Fig. 5 LOCKING/UNLOCKING BELT TENSIONER

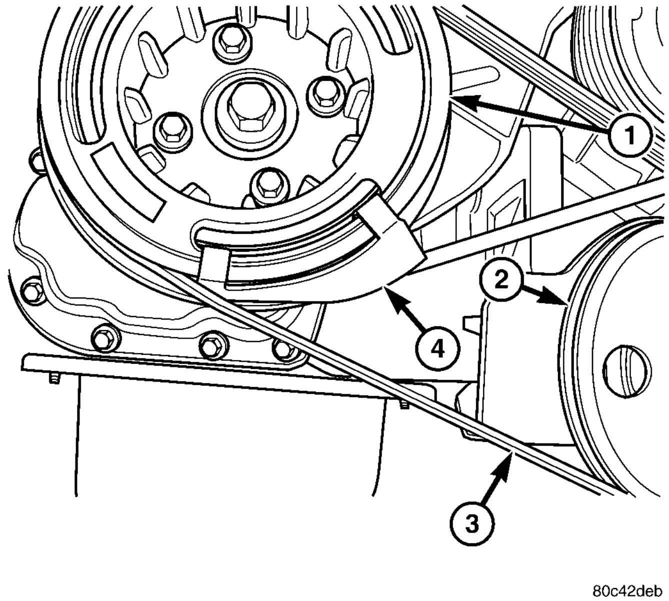

Fig. 6 POWER STEERING BELT REMOVAL TOOL

1 - VIBRATION DAMPER
2 - POWER STEERING PULLEY
3 - POWER STEERING BELT
4 - POWER STEERING BELT REMOVER

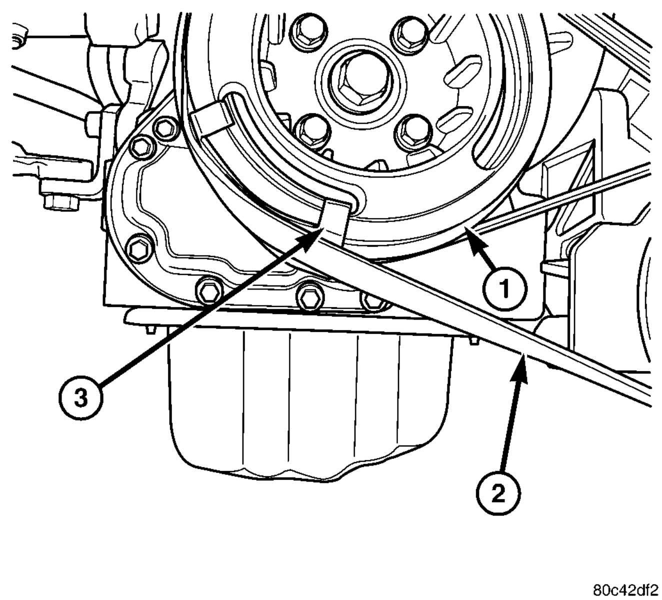

Fig. 7 POWER STEERING BELT REMOVAL

1 - VIBRATION DAMPER
2 - POWER STEERING BELT
3 - POPWER STEERING BELT REMOVER

DRIVE BELTS (Continued)

INSTALLATION

ACCESSORY DRIVE BELT

(1) Install the accessory drive belt in proper position (Fig. 8).

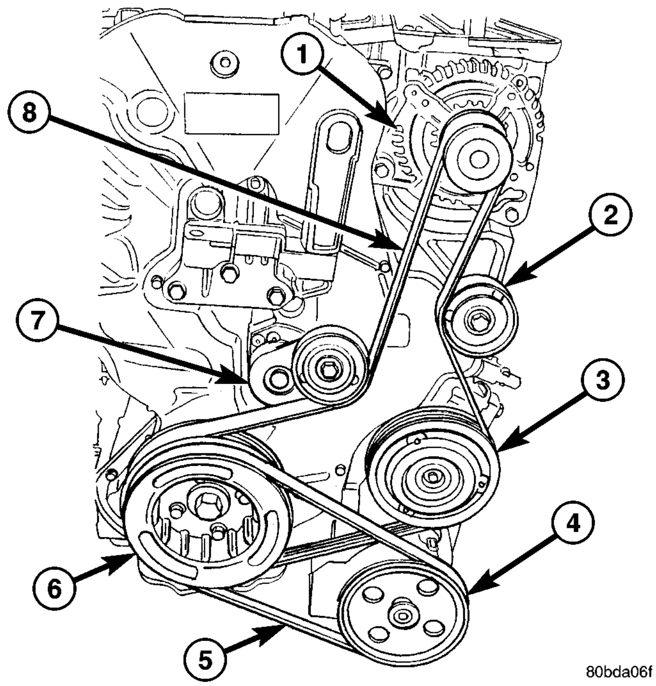

Fig. 8 ACCESSORY DRIVE BELT ROUTING

1 - GENERATOR
2 - IDLER PULLEY
3 - A/C COMPRESSOR CLUTCH
4 - POWER STEERING PUMP PULLEY
5 - POWER STEERING BELT
6 - CRANKSHAFT DAMPER/PULLEY
7 - BELT TENSIONER
8 - ACCESSORY DRIVE BELT

(2) Unlock belt tensioner by removing punch and apply tension to accessory drive belt (Fig. 9).

(3) Install the power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

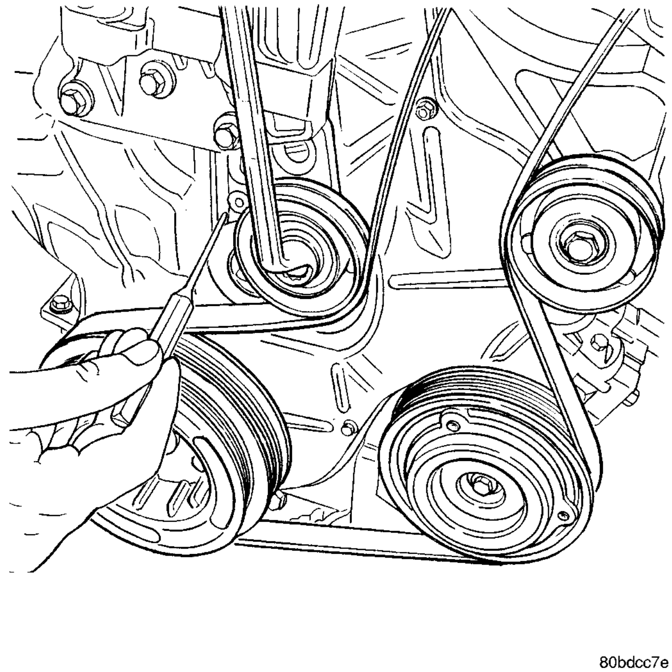

Fig. 9 LOCKING/UNLOCKING BELT TENSIONER

POWER STEERING BELT

(1) Install power steering belt installation tool (Fig. 10).

(2) Install power steering belt on crankshaft and rotate crankshaft clockwise until belt is fully installed on crankshaft (Fig. 10).

(3) Remove installation tool from crankshaft.

(4) Install right front fender inner splash shield.

(5) Lower vehicle from hoist.

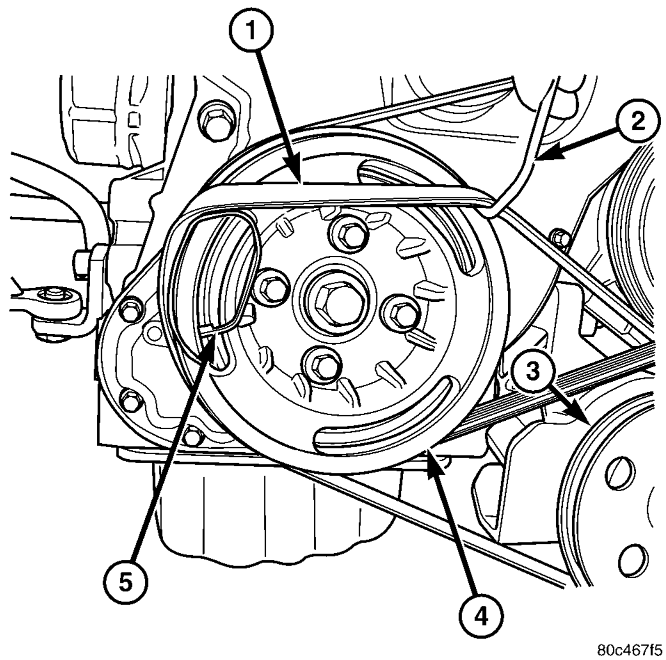

Fig. 10 POWER STEERING BELT INSTALLATION

1 - POWER STEERING BELT
2 - HOLDING HOOK
3 - POWER STEERING PUMP PULLEY
4 - VIBRATION DAMPER
5 - POWER STEERING BELT INSTALLATION TOOL

ENGINE

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COOLANT

DESCRIPTION

Coolant flows through the engine water jackets and cylinder heads absorbing heat produced by the engine during operation. The coolant carries heat to the radiator and heater core. Here it is transferred to ambient air passing through the radiator and heater core fins.

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 ° C (-35 ° F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.**

COOLANT (Continued)

Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 ° C (-90 ° F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

100 Percent Ethylene-Glycol - Should Not Be Used in Chrysler Vehicles

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 ° C (300 ° F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at -22 ° C (-8 ° F).

Propylene-glycol Formulations - Should Not Be Used in Chrysler Vehicles

Propylene-glycol formulations do not meet Chrysler coolant specifications. It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 ° C (-26 ° F). 5 ° C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 ° C (257 ° F) at 96.5 kPa (14 psi), compared to 128 ° C (263 ° F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up in Chrysler vehicles, which are designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/Ethylene-glycol Mixtures - Should Not Be Used in Chrysler Vehicles

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

DIAGNOSIS AND TESTING - COOLANT CONCENTRATION TESTING

Coolant concentration should be checked when any additional coolant was added to system or after a coolant drain, flush and refill. The coolant mixture offers optimum engine cooling and protection against corrosion when mixed to a freeze point of -37°C (-34°F) to -59°C (-50°F). The use of a hydrometer or a refractometer can be used to test coolant concentration.

A hydrometer will test the amount of glycol in a mixture by measuring the specific gravity of the mixture. The higher the concentration of ethylene glycol, the larger the number of balls that will float, and higher the freeze protection (up to a maximum of 60% by volume glycol).

A refractometer will test the amount of glycol in a coolant mixture by measuring the amount a beam of light bends as it passes through the fluid.

Some coolant manufactures use other types of glycols into their coolant formulations. Propylene glycol is the most common new coolant. However, propylene glycol based coolants do not provide the same freezing protection and corrosion protection and is not recommended.

CAUTION: Do not mix types of coolant, corrosion protection will be severely reduced.

STANDARD PROCEDURE

COOLANT SERVICE

For engine coolant recommended service schedule, (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

ADDING ADDITIONAL COOLANT

The pressure/vent cap should not be removed from the coolant recovery pressure container when the engine is hot. When additional coolant is needed to maintain this level, it should be added to the coolant recovery pressure container (Fig. 1). Use only 50/50 mix of ethylene glycol type antifreeze and distilled water. For the recommended antifreeze/coolant type (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).

CAUTION: Do not use well water, or suspect water supply in cooling system. A 50/50 ethylene glycol and distilled water mix is recommended. For the recommended antifreeze/coolant type (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).

COOLANT (Continued)

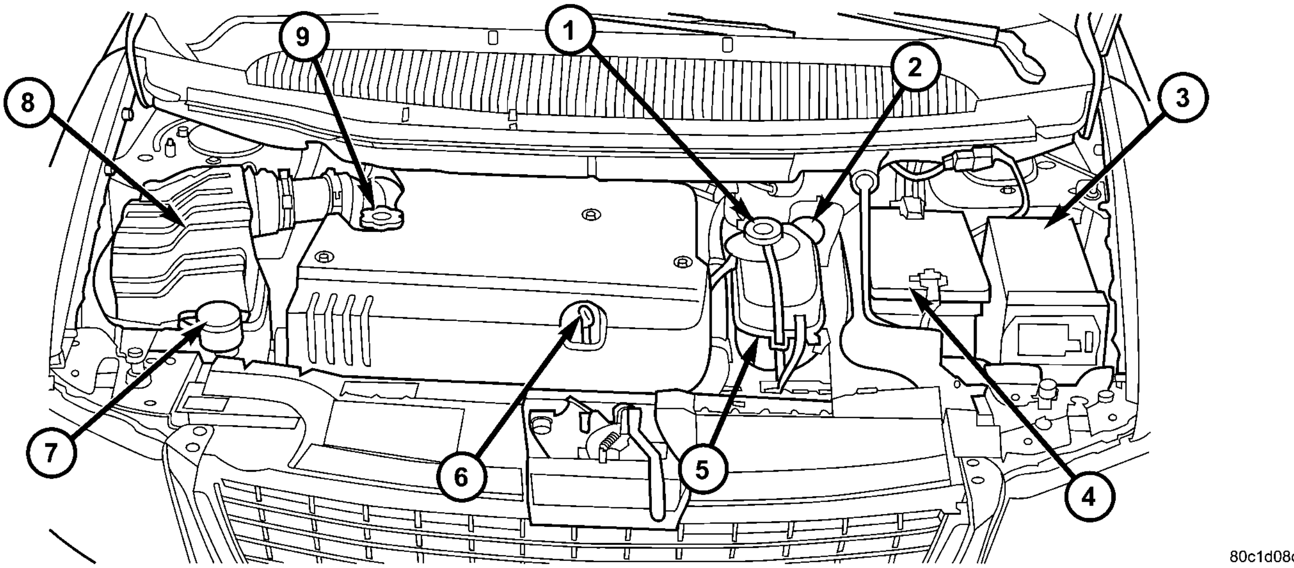

Fig. 1 UNDERHOOD FLUID FILL LOCATIONS

1 - COOLANT PRESSURE/VENT CAP
2 - BRAKE MASTER CYLINDER
3 - INTELLIGENT POWER MODULE
4 - BATTERY
5 - COOLANT RECOVERY PRESSURE CONTAINER
6 - OIL DIPSTICK
7 - WINDSHIELD SOLVENT RESEVOIR
8 - AIR FILTER HOUSING
9 - ENGINE OIL FILL CAP

COOLANT LEVEL CHECK

NOTE: Do not remove pressure/vent cap for routine coolant level inspections.

The coolant reserve system provides a quick visual method for determining the coolant level without removing the pressure/vent cap. **With the engine cold and not running,** simply observe the level of the coolant in the coolant recovery pressure container (Fig. 2). The coolant level should be between the MIN and MAX marks.

COOLING SYSTEM FILLING

(1) Remove pressure vent cap from coolant recovery pressure container.

(2) Loosen air bleed screw on the thermostat housing.

(3) Slowly fill the cooling through the coolant recovery pressure container until a steady stream of coolant comes out of the air bleed.

(4) Tighten the air bleed screw.

(5) Continue filling coolant recovery pressure container until level reaches the full line.

(6) Without installing the pressure/vent cap, start and run engine at idle for a couple minutes.

(7) Recheck coolant level and fill as necessary.

(8) Install pressure/vent cap and drive vehicle for approx. 10 km to reach normal operating temperatures.

(9) Allow vehicle to cool. Check and fill coolant as needed.

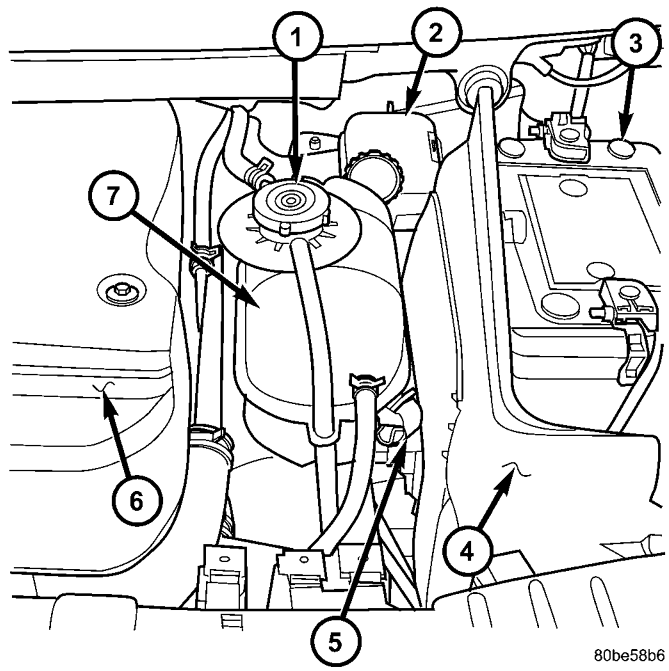

Fig. 2 COOLANT RECOVERY PRESSURE CONTAINER LOCATION

1 - PRESSURE/VENT CAP
2 - BRAKE MASTER CYLINDER
3 - BATTERY
4 - BATTERY SHIELD
5 - COOLANT RECOVERY PRESSURE CONTAINER RETAING CLIP
6 - ENGINE COVER
7 - COOLANT RECOVERY PRESSURE CONTAINER

COOLANT (Continued)

COOLING SYSTEM DRAINING

WARNING: DO NOT REMOVE OR LOOSEN THE COOLANT PRESSURE/VENT CAP, CYLINDER BLOCK DRAIN PLUGS, OR THE DRAINCOCK WHEN THE SYSTEM IS HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(1) **Without removing pressure/vent cap and with system not under pressure**, open the draincock. The draincock is located on the lower right side of radiator (Fig. 3).

(2) After the coolant recovery pressure container is empty, then remove coolant pressure/vent cap.

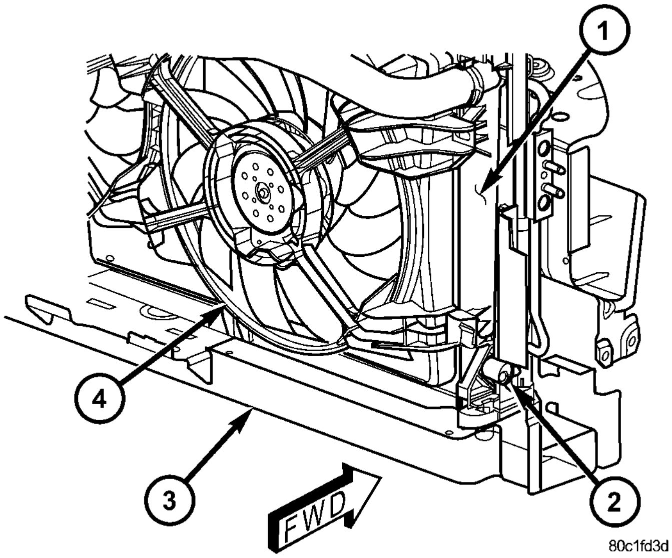

Fig. 3 DRAINCOCK LOCATION

1 - RADIATOR
2 - DRAINCOCK
3 - LOWER RADIATOR SUPPORT
4 - ELECTRIC COOLING FAN

COOLANT RECOVERY PRESS CONTAINER

DESCRIPTION

The coolant recovery pressure container is mounted in the engine compartment next to the battery. The coolant recovery pressure container is made of plastic (Fig. 4).

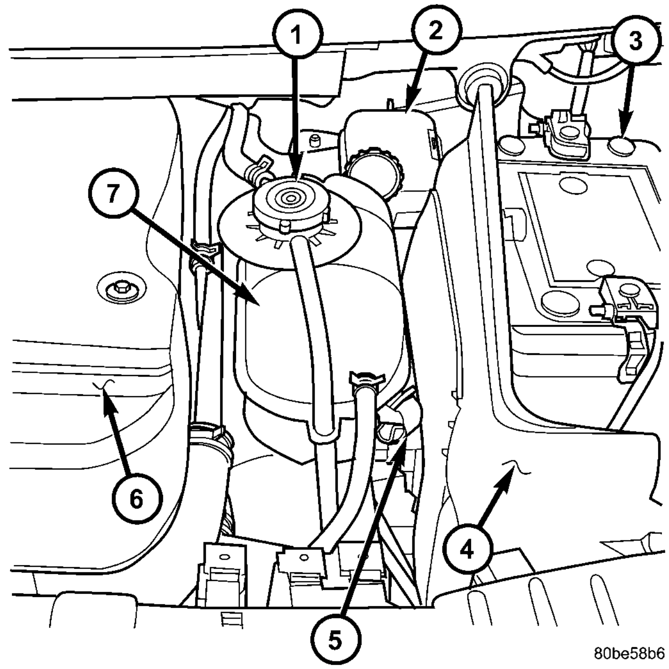

Fig. 4 COOLANT RECOVERY PRESSURE CONTAINER LOCATION

1 - PRESSURE/VENT CAP
2 - BRAKE MASTER CYLINDER
3 - BATTERY
4 - BATTERY SHIELD
5 - COOLANT RECOVERY PRESSURE CONTAINER RETAING CLIP
6 - ENGINE COVER
7 - COOLANT RECOVERY PRESSURE CONTAINER

OPERATION

The coolant recovery pressure container works with the pressure/vent cap to use thermal expansion and contraction of the coolant to keep the coolant free of trapped air. Provides a convenient and safe method for checking coolant level and adjusting level at atmospheric pressure without removing the pressure/vent cap. It also provides some reserve coolant to cover deaeration, evaporation, or boiling losses.

REMOVAL

(1) Drain cooling system below level of coolant recovery pressure bottle. (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE)

(2) Disconnect coolant bypass and overflow hoses from coolant recovery pressure container (Fig. 6).

COOLANT RECOVERY PRESS CONTAINER (Continued)

(3) Unclip the coolant recovery pressure container retaining clip (Fig. 5).

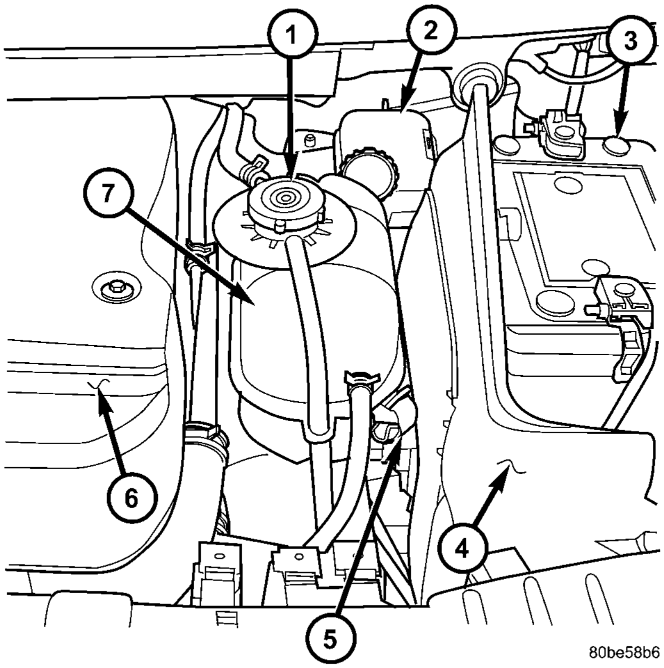

Fig. 5 COOLANT RECOVERY PRESSURE CONTAINER LOCATION

1 - PRESSURE/VENT CAP
2 - BRAKE MASTER CYLINDER
3 - BATTERY
4 - BATTERY SHIELD
5 - COOLANT RECOVERY PRESSURE CONTAINER RETAING CLIP
6 - ENGINE COVER
7 - COOLANT RECOVERY PRESSURE CONTAINER

(4) Raise coolant recovery pressure container from mounting bracket and disconnect coolant hose from bottom of container (Fig. 6).

(5) Remove coolant recovery pressure bottle.

INSTALLATION

(1) Connect coolant hose at bottom of coolant recovery pressure container (Fig. 6) and install in mounting bracket.

(2) Connect coolant recovery pressure container retaining clip (Fig. 5).

(3) Connect coolant bypass and overflow hoses to coolant recovery pressure container.

(4) Refill cooling system. (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE)

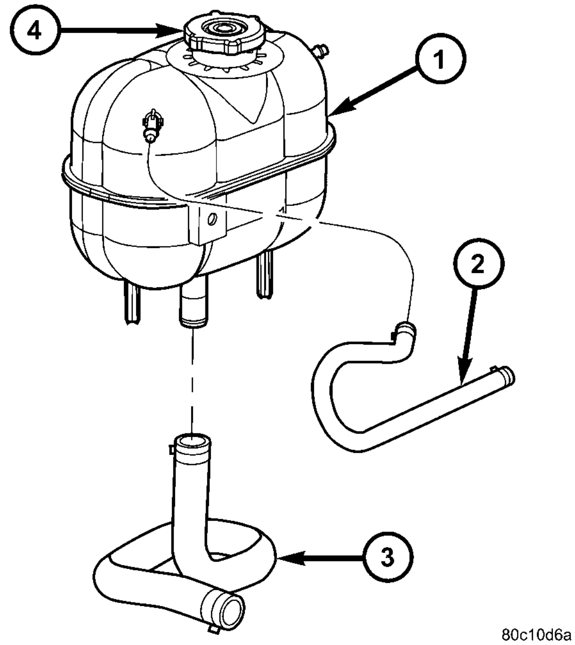

Fig. 6 COOLANT RECOVERY PRESSURE CONTAINER

1 - COOLANT RECOVERY PRESSURE CONTAINER
2 - COOLANT BYPASS HOSE
3 - OUTLET HOSE
4 - PRESSURE/VENT CAP

ENGINE COOLANT TEMP SENSOR

DESCRIPTION

The engine coolant temperature sensor threads into a coolant passage in the cylinder head (Fig. 7). New sensors have sealant applied to the threads.

OPERATION

The coolant temperature (ECT) sensor is a negative temperature coefficient (NTC) thermistor (resistance varies inversely with temperature). This means at cold temperatures its resistance is high so the voltage signal will be high. As coolant temperature increases, resistance decreases and the signal voltage will be low. This allows the sensor to provide an analog voltage signal to the ECM.

ENGINE COOLANT TEMP SENSOR (Continued)

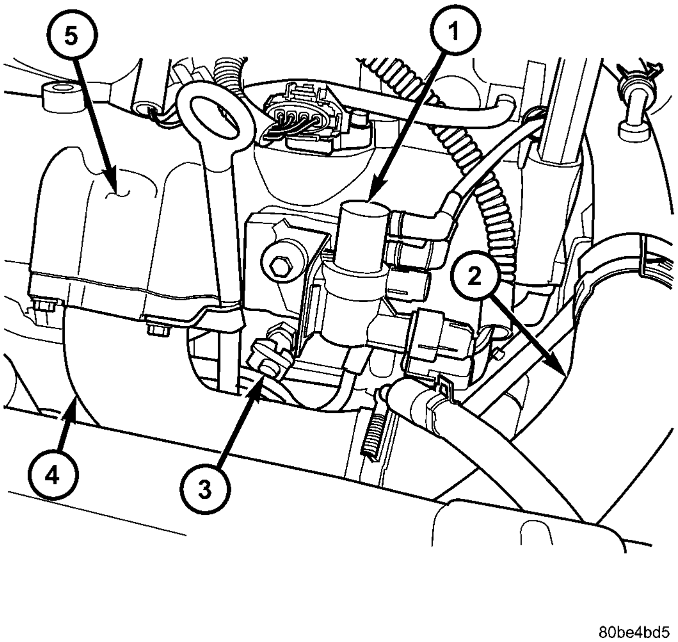

Fig. 7 COOLANT TEMPERATURE SENSOR LOCATION

1 - EGR SOLENOID
2 - UPPER RADIATOR HOSE
3 - COOLANT TEMPERATURE SENSOR
4 - INTAKE MANIFOLD INLET
5 - INTAKE MANIFOLD/CYLINDER HEAD COVER

REMOVAL

WARNING: DO NOT REMOVE OR LOOSEN THE COOLANT PRESSURE/VENT CAP, CYLINDER BLOCK DRAIN PLUGS, OR THE DRAINCOCK WHEN THE SYSTEM IS HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(1) Drain the cooling system. (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE)
(2) Disconnect coolant temperature sensor electrical connector (Fig. 8).
(3) Remove coolant temperature sensor from cylinder head (Fig. 8).

INSTALLATION

(1) Install coolant temperature sensor in cylinder head (Fig. 8).
(2) Connect coolant temperature sensor electrical connector (Fig. 8).
(3) Refill the cooling system. (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE)
(4) Connect the negative battery cable.

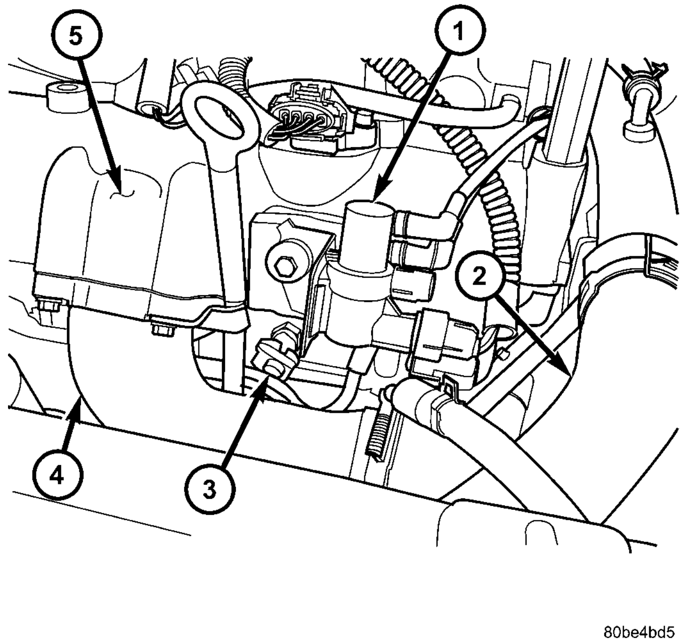

Fig. 8 COOLANT TEMPERATURE SENSOR LOCATION

1 - EGR SOLENOID
2 - UPPER RADIATOR HOSE
3 - COOLANT TEMPERATURE SENSOR
4 - INTAKE MANIFOLD INLET
5 - INTAKE MANIFOLD/CYLINDER HEAD COVER

ENGINE COOLANT THERMOSTAT

DESCRIPTION

A pellet-type thermostat controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator (Fig. 9).

OPERATION

The thermostat starts to open at 88°C (190°F). Above this temperature, coolant is allowed to flow to the radiator. This provides quicker engine warmup and overall temperature control.

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes other problems. These are: longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation. This condensation can result in sludge formation.

ENGINE COOLANT THERMOSTAT (Continued)

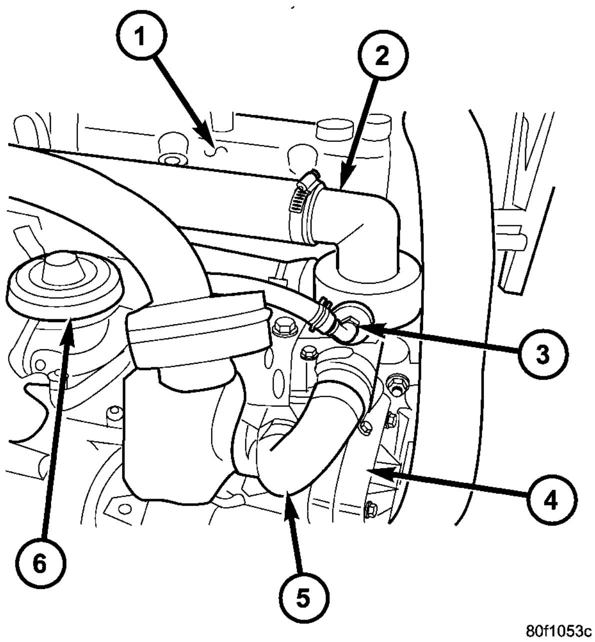

Fig. 9 THERMOSTAT HOUSING

1 - CYLINDER HEAD COVER
2 - THERMOSTAT HOUSING
3 - AIR BLEED
4 - WATER PUMP
5 - WATER PUMP HOUSING TO THERMOSTAT HOUSING BYPASS HOSE
6 - EGR VALVE

REMOVAL

NOTE: The thermostat is not serviced separately. The thermostat and housing must be replaced as an assembly.

(1) Disconnect negative battery cable.

(2) Drain cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(3) Remove front wiper unit to gain access to thermostat housing(Refer to 8 - ELECTRICAL/WIPERS/ WASHERS/WIPER MODULE - REMOVAL).

(4) Disconnect upper radiator hose adapter tube, water pump hose, and EGR hose at thermostat housing.

(5) Remove both thermostat housing attaching bolts and housing (Fig. 10).

INSTALLATION

(1) Install thermostat housing, gasket, and retaining bolts (Fig. 10). Torque bolts to 27.5N·m.

(2) Connect upper radiator hose adapter tube, water pump hose, and EGR cooler hose to thermostat housing.

(3) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

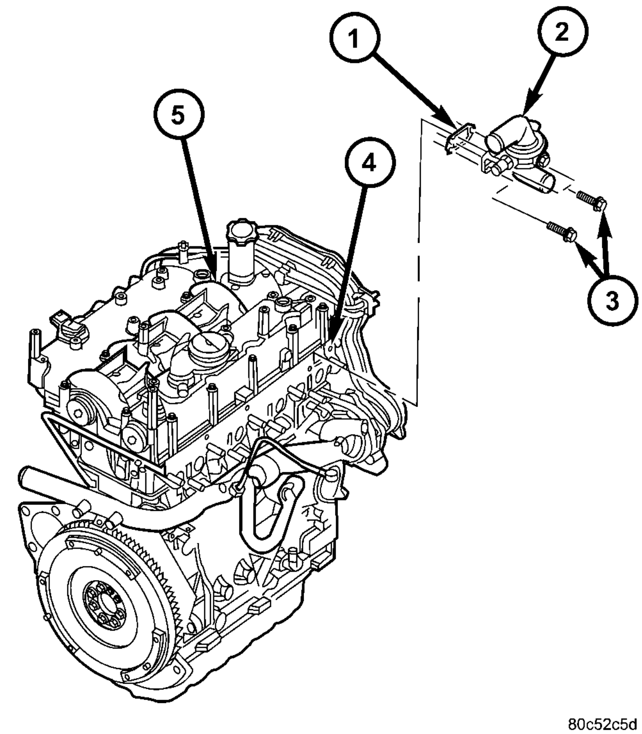

Fig. 10 THERMOSTAT HOUSING ASSEMBLY

1 - THERMOSTAT HOUSING GASKET
2 - THERMOSTAT HOUSING
3 - RETAINING BOLTS
4 - CYLINDER HEAD
5 - CYLINDER HEAD COVER/INTAKE MANIFOLD

(4) Refill cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(5) Connect negative battery cable.

RADIATOR

DESCRIPTION

The radiator is a cross-flow type (horizontal tubes) with design features that provide greater strength along with sufficient heat transfer capabilities to keep the engine satisfactorily cooled. The radiator has plastic side tanks and aluminum cooling tubes.

OPERATION

The radiator functions as a heat exchanger, using air flow across the exterior of the radiator tubes. This heat is then transferred from the coolant and into the passing air.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove radiator upper crossmember support. (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - REMOVAL)

RADIATOR (Continued)

WARNING: DO NOT REMOVE THE CYLINDER BLOCK PLUG OR THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(3) Drain the cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(4) Remove the radiator fans. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL)

(5) Disconnect coolant bypass hose (Fig. 11).

(6) Disconnect upper and lower hoses from the radiator (Fig. 11).

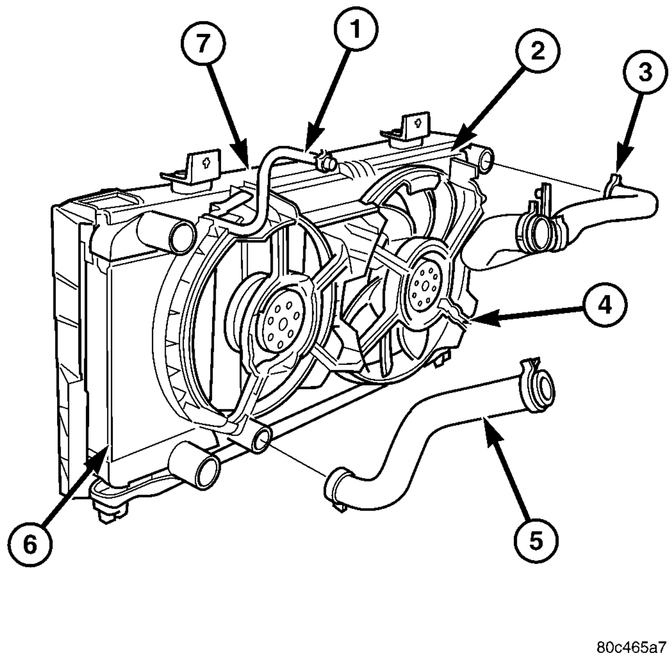

Fig. 11 UPPER AND LOWER RADIATOR HOSES - 2.5L DIESEL SHOWN

1 - COOLANT BYPASS HOSE
2 - RADIATOR ASSEMBLY
3 - UPPER RADIATOR HOSE
4 - COOLING FAN
5 - LOWER RADIATOR HOSE
6 - CHARGE AIR COOLER
7 - RADIATOR BRACKET

(7) Remove the A/C condenser side brackets to radiator attaching screws (Fig. 12). Separate the condenser from the radiator by lifting upward to disengage from lower mounts (Fig. 12). Allow the condenser to rest in front of radiator.

(8) Radiator can now be lifted free from engine compartment. **Care should be taken not to damage radiator cooling fins or water tubes during removal.**

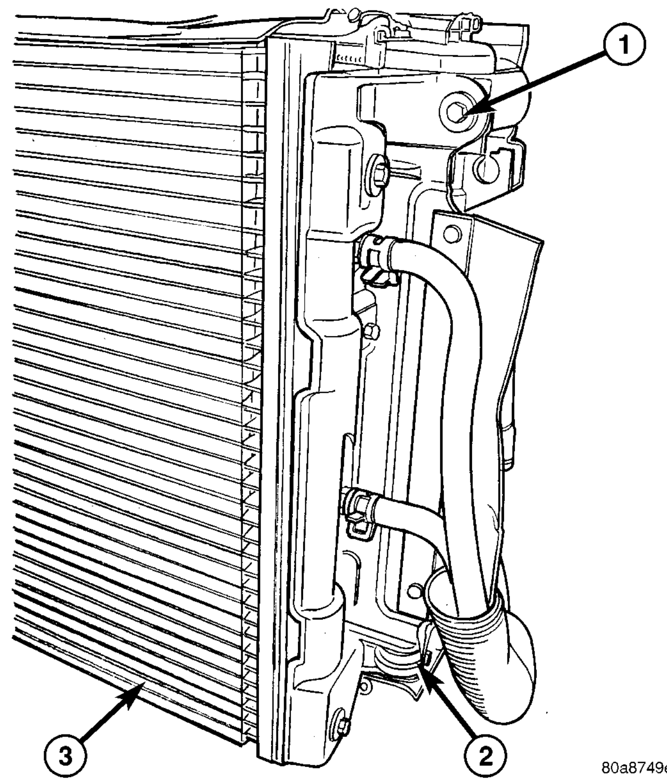

Fig. 12 Radiator to A/C Condenser Mounting (left mount shown, right similar)

1 - SCREW - A/C CONDENSER SIDE BRACKET TO RADIATOR
2 - LOWER MOUNT
3 - A/C CONDENSER

INSTALLATION

(1) **Be sure the air seal is in position before radiator is installed.** Slide radiator down into position. Seat the radiator with the rubber isolators into the mounting holes provided, with a 10 lbs. force.

(2) Position air conditioning condenser onto the radiator lower mounts and install upper screws (Fig. 12). Tighten fasteners to 5 N·m (45 in. lbs.).

(3) Install the radiator upper and lower hoses (Fig. 11).

(4) Connect the coolant bypass hose.

(5) Install the radiator fans. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION)

(6) Install the radiator upper crossmember support. (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - INSTALLATION)

(7) Fill the cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(8) Connect negative cable to battery.

RADIATOR DRAINCOCK

REMOVAL

CAUTION: Use of pliers on draincock is not recommended. Damage may occur to radiator or draincock.

NOTE: It is not necessary to remove draincock during a routine coolant drain.

(1) Drain the cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(2) Open the draincock by turning it counterclockwise until it stops.
(3) Turn the draincock back (clockwise) 1/8 turn.
(4) Pull the draincock (Fig. 13) from the radiator tank.

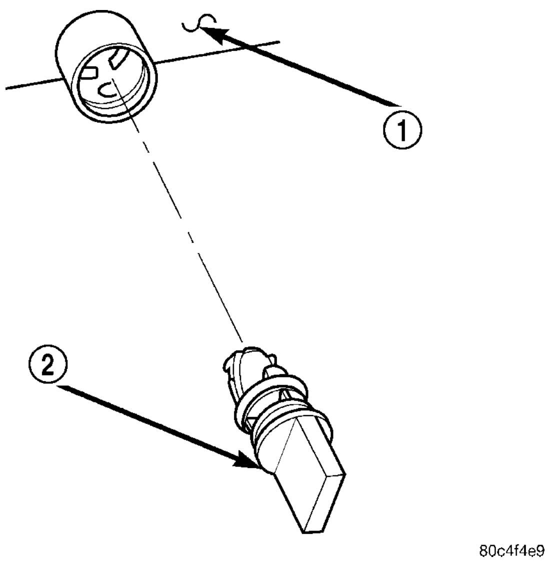

Fig. 13 Draincock

1 - RADIATOR TANK
2 - DRAINCOCK

INSTALLATION

(1) Align draincock stem to radiator tank opening.
(2) Push draincock into the radiator tank opening.
(3) Tighten the draincock by turning clockwise until it stops.
(4) Fill the cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

WATER PUMP

DESCRIPTION

The water pump on the 2.5L CRD diesel has a die cast aluminum housing. It bolts to a aluminum housing which attaches to the engine block (Fig. 14).

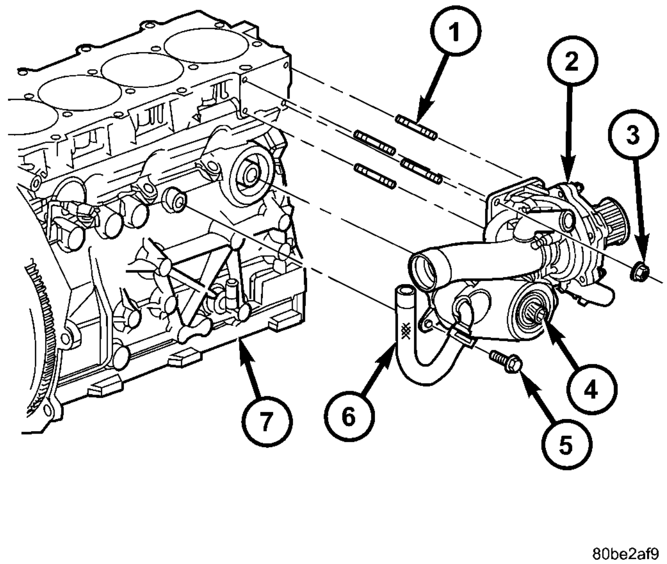

Fig. 14 WATER PUMP

1 - WATER PUMP HOUSING STUDS
2 - WATER PUMP
3 - RETAINING NUTS
4 - OIL COOLER RETAINING STUD
5 - OIL COOLER TO ENGINE BLOCK RETAINING BOLT
6 - OIL COOLER COOLANT HOSE
7 - ENGINE BLOCK

OPERATION

The water pump is used to circulate coolant through the cooling system. The coolant is pumped through the engine block, cylinder head, heater core, EGR cooler, cabin heater, and radiator.

WATER PUMP (Continued)

REMOVAL

REMOVAL - WATER PUMP

(1) Disconnect negative battery cable.

(2) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(3) Remove timing belt inner and outer covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(4) Remove water pump retaining bolts and pump (Fig. 15).

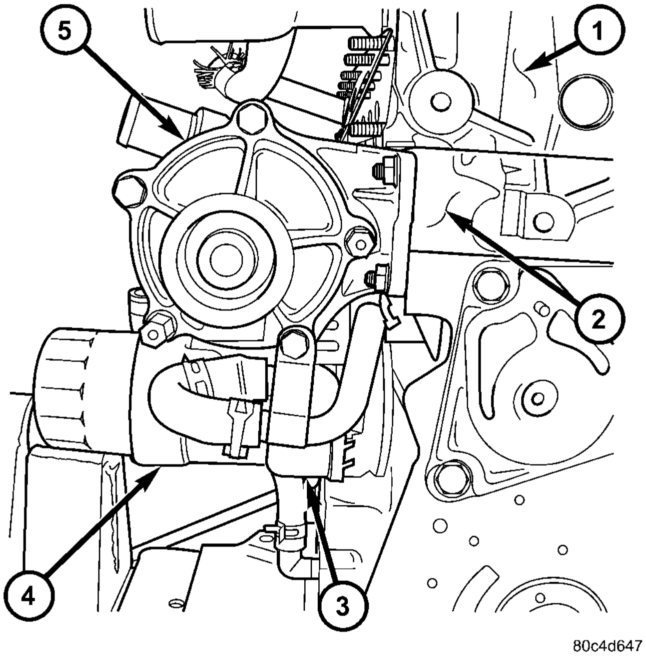

Fig. 15 WATER PUMP LOCATION

1 - CYLINDER HEAD
2 - ENGINE BLOCK
3 - OIL COOLER
4 - OIL FILTER HOUSING
5 - WATER PUMP

REMOVAL - WATER PUMP HOUSING

(1) Disconnect negative battery cable.

(2) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(3) Remove both outer and inner timing belt covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(4) Disconnect water pump housing to thermostat housing bypass hose (Fig. 16).

(5) Remove the water pump housing retaining nuts (Fig. 17).

(6) Remove water pump housing from engine block (Fig. 17).

CLEANING

Clean gasket mating surfaces as necessary.

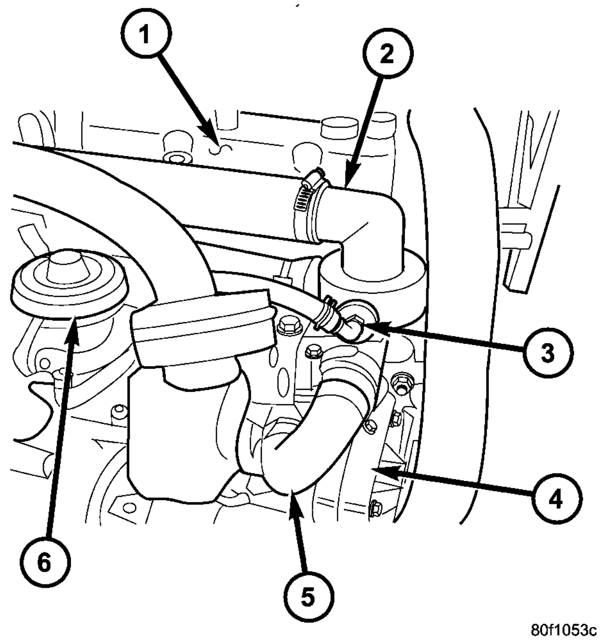

Fig. 16 THERMOSTAT HOUSING LOCATION

1 - CYLINDER HEAD COVER
2 - THERMOSTAT HOUSING
3 - AIR BLEED
4 - WATER PUMP
5 - WATER PUMP HOUSING TO THERMOSTAT HOUSING BYPASS HOSE
6 - EGR VALVE

INSTALLATION

INSTALLATION - WATER PUMP

(1) Clean gasket mating surfaces as necessary.

(2) Place water pump and gasket in place. Install water pump retaining bolts (Fig. 15). Torque bolts to 24.4N·m.

(3) Install both inner and outer timing belt covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(4) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(5) Connect negative battery cable.

INSTALLATION - WATER PUMP HOUSING

(1) Clean mating surfaces of water pump housing and engine block as necessary.

(2) Place new o-ring in groove in water pump housing (Fig. 18).

(3) Be sure lower radiator hose tube o-ring is in place.

(4) Install water pump housing on lower radiator hose tube and push on mounting studs (Fig. 17). Torque retaining nuts to 24.4N·m.

(5) Connect water pump housing to thermostat housing bypass hose (Fig. 16).

WATER PUMP (Continued)

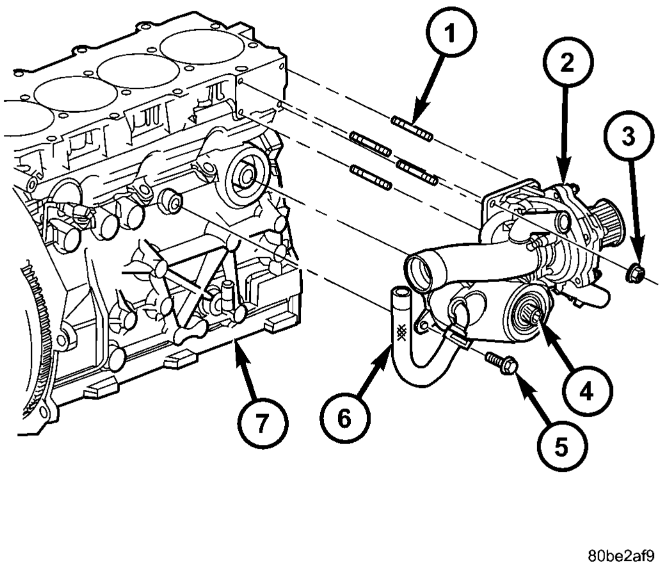

Fig. 17 WATER PUMP ASSEMBLY

1 - WATER PUMP HOUSING STUDS
2 - WATER PUMP
3 - RETAINING NUTS
4 - OIL COOLER RETAINING STUD
5 - OIL COOLER TO ENGINE BLOCK RETAINING BOLT
6 - OIL COOLER COOLANT HOSE
7 - ENGINE BLOCK

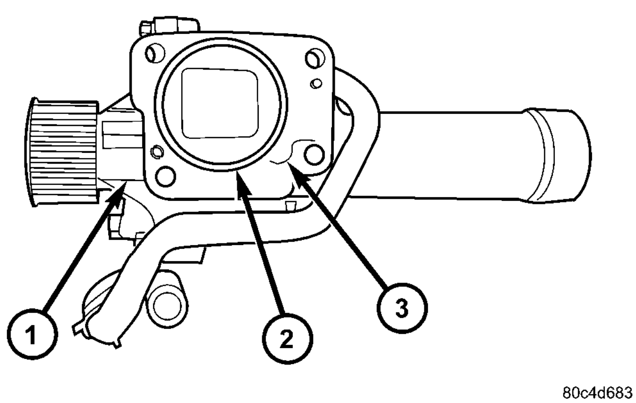

Fig. 18 WATER PUMP HOUSING O-RING

1 - WATER PUMP
2 - WATER PUMP HOUSING O-RING
3 - WATER PUMP HOUSING

(6) Install both inner and outer timing belt covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(7) Refill cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(8) Connect negative battery cable.

RADIATOR PRESSURE CAP

DESCRIPTION

The cooling system pressure cap is located on the coolant pressure container. The cap construction includes; stainless steel swivel top, rubber seals, and retainer, main spring, and a spring loaded valve (Fig. 19).

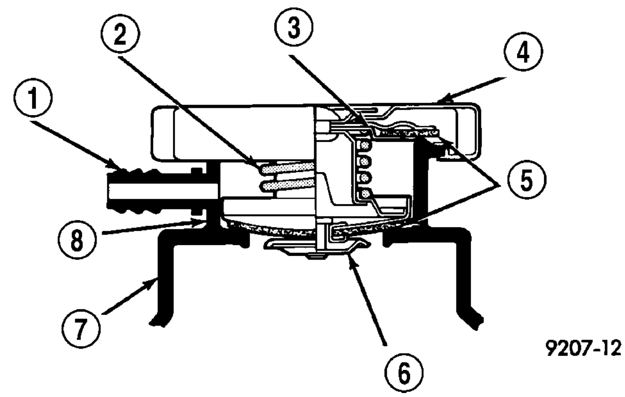

Fig. 19 Cooling System Pressure Cap Filler Neck

1 - OVERFLOW NIPPLE
2 - MAIN SPRING
3 - GASKET RETAINER
4 - STAINLESS-STEEL SWIVEL TOP
5 - RUBBER SEALS
6 - VENT VALVE
7 - PRESSURE BOTTLE
8 - FILLER NECK

OPERATION

The cooling system is equipped with a pressure cap that releases excessive pressure; maintaining a range of 97-124 kPa (14-18 psi).

The cooling system will operate at higher than atmospheric pressure. The higher pressure raises the coolant boiling point thus, allowing increased radiator cooling capacity.

There is also a vent valve in the center of the cap. This valve also opens when coolant is cooling and contracting, allowing the air to return to the coolant pressure container. **If valve is stuck shut, the radiator hoses will be collapsed on cool down. Clean the vent valve (Fig. 19) and inspect coolant recovery hose routing, to ensure proper sealing when boiling point is reached.**

If the gasket is dirty or damaged, a vacuum may not be achieved, resulting is loss of coolant and eventual overheating due to low coolant level in radiator and engine.

RADIATOR PRESSURE CAP (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - COOLING SYSTEM PRESSURE CAP

Dip the pressure cap in water. Clean any deposits off the vent valve or its seat and apply cap to end of the Pressure Cap Test Adaptor that is included with the Cooling System Tester 7700. Working the plunger, bring the pressure to 104 kPa (15 psi) on the gauge. If the pressure cap fails to hold pressure of at least 97 kPa (14 psi), replace the pressure cap.

CAUTION: The Cooling System Tester Tool is very sensitive to small air leaks that will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to the tool. Turn tool upside down and recheck pressure cap to confirm that cap is bad.

If the pressure cap tests properly while positioned on Cooling System Tester (Fig. 20), but will not hold pressure or vacuum when positioned on the filler neck. Inspect the filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly.

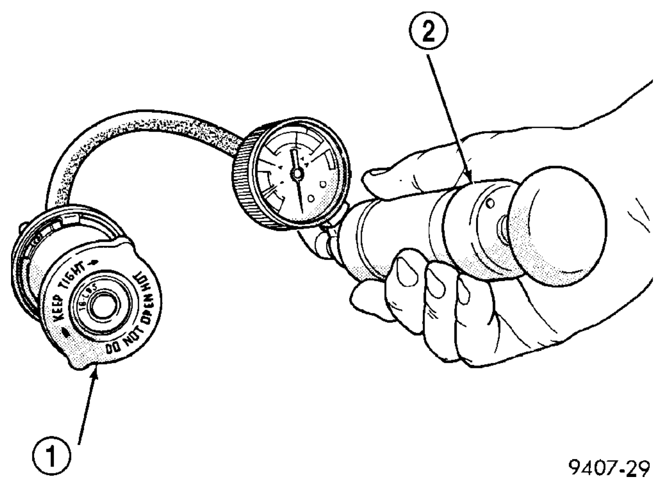

Fig. 20 Testing Cooling System Pressure Cap

1 - PRESSURE CAP
2 - PRESSURE TESTER

DIAGNOSIS AND TESTING - PRESSURE RELIEF TEST

The pressure cap upper gasket (seal) pressure relief can be checked by removing the overflow hose at the radiator filler neck nipple (Fig. 21). Attach the Radiator Pressure Tool to the filler neck nipple and pump air into the radiator. Pressure cap upper gasket should relieve at 69-124 kPa (10-18 psi) and hold pressure at 55 kPa (8 psi) minimum.

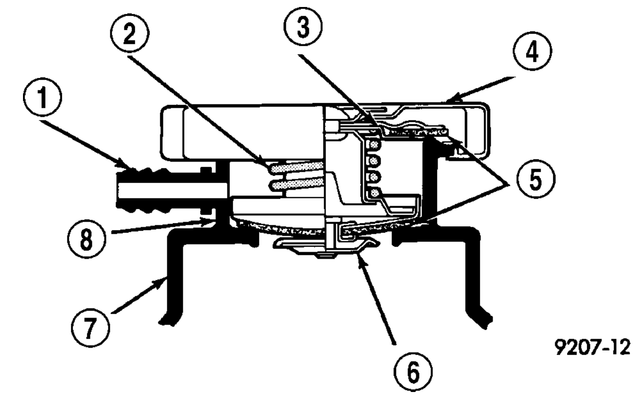

Fig. 21 Radiator Pressure Cap Filler Neck

1 - OVERFLOW NIPPLE
2 - MAIN SPRING
3 - GASKET RETAINER
4 - STAINLESS-STEEL SWIVEL TOP
5 - RUBBER SEALS
6 - VENT VALVE
7 - PRESSURE BOTTLE
8 - FILLER NECK

WARNING: THE WARNING WORDS “DO NOT OPEN HOT” ON THE RADIATOR PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE RADIATOR CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT OR UNDER PRESSURE.

There is no need to remove the radiator cap at any time **except** for the following purposes:

(1) Check and adjust coolant freeze point.
(2) Refill system with new coolant.
(3) Conducting service procedures.
(4) Checking for vacuum leaks.

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE REMOVING CAP. THEN PLACE A SHOP TOWEL OVER THE CAP AND WITHOUT PUSHING DOWN ROTATE COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS TO ESCAPE THROUGH THE OVERFLOW TUBE AND WHEN THE SYSTEM STOPS PUSHING COOLANT AND STEAM INTO THE CRS TANK AND PRESSURE DROPS PUSH DOWN AND REMOVE THE CAP COMPLETELY. SQUEEZING THE RADIATOR INLET HOSE WITH A SHOP TOWEL (TO CHECK PRESSURE) BEFORE AND AFTER TURNING TO THE FIRST STOP IS RECOMMENDED.

CLEANING

Use only a mild soap to clean the pressure cap.

RADIATOR PRESSURE CAP (Continued)

INSPECTION

Hold the cap in your hand, **top side up** (Fig. 21). The vent valve at the bottom of the cap should open. If the rubber gasket has swollen, preventing the valve from opening, replace the cap.

Hold the cleaned cap in your hand, **upside down.** If any light can be seen between vent valve and the rubber gasket, replace the cap. **Do not use a replacement cap that has a spring to hold the vent shut.**

A replacement cap must be of the type designed for coolant reserve systems. This design ensures coolant return to the radiator.

RADIATOR FAN

DESCRIPTION

The dual radiator fans are mounted to the back side of the radiator (Fig. 22). The radiator fan consist of the fan blade, electric motor and a support shroud which are all serviced as an assembly.

OPERATION

RADIATOR FAN OPERATION CHART

FAN OPERATION AS A FUNCTION OF COOLANT TEMPERATURE			
Fan Status	A/C On, High Ambient	A/C ON, Norm Ambient	A/C Off, Norm Ambient
OFF	93°C (200°F)	96°C (205°F)	98°C (208°F)
LOW TO OFF	93°C (200°F)	96°C (205°F)	98°C (208°F)
OFF TO LOW	96°C (205°F)	98°C (208°F)	100°C (212°F)
HI TO LOW	96°C (205°F)	100°C (212°F)	102°C (216°F)
LO TO HIGH	98°C (208°F)	102°C (216°F)	104°C (220°F)

DIAGNOSIS AND TESTING - RADIATOR FAN MOTOR

RADIATOR FAN DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY RADIATOR FAN	1. Fan blade loose.	1. Replace fan assembly. (Refer to 7 - COOLING/ ENGINE/RADIATOR FAN - REMOVAL)
	2. Fan blade striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or A/C condenser.	3. Remove obstructions and/or clean debris.
	4. Electric fan motor defective.	4. Replace fan assembly. (Refer to 7 - COOLING/ ENGINE/RADIATOR FAN - REMOVAL)
ELECTRIC FAN MOTOR DOES NOT OPERATE	1. Fan relay, powertrain control module (PCM), coolant temperature sensor, or wiring defective.	1. (Refer to Appropriate Diagnostic Information) Repair as necessary.
	2. Defective A/C pressure transducer.	2. (Refer to Appropriate Diagnostic Information) Repair as necessary.
ELECTRIC RADIATOR FAN OPERATES ALL THE TIME	1. Fan relay, powertrain control module (PCM), coolant temperature sensor or wiring defective.	1. (Refer to Appropriate Diagnostic Information) Repair as necessary.
	2. Check for low coolant level.	2. Add coolant as necessary.
	3. Defective A/C pressure transducer.	3. (Refer to Appropriate Diagnostic Information) Repair as necessary.

REMOVAL

There are no repairs to be made to the fan or shroud assembly. If the fan is warped, cracked, or otherwise damaged, it must be replaced as an assembly (Fig. 22).

(1) Remove the radiator upper crossmember. (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - REMOVAL)

(2) Disconnect the radiator fan electrical connectors.

(3) Remove radiator fan(s) retaining screw (Fig. 22).

(4) Remove the radiator fan(s) by lifting upward to release from mounts.

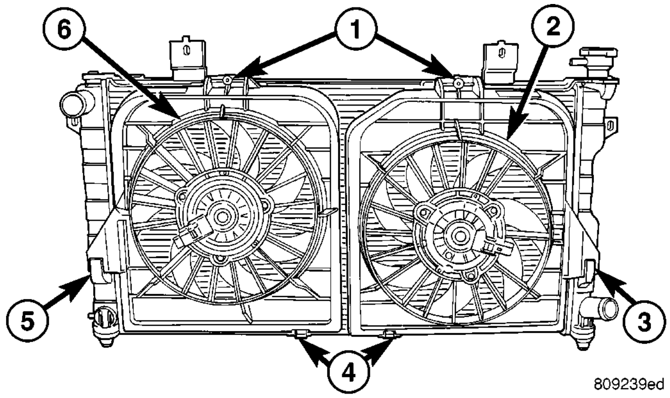

Fig. 22 Radiator Fans

1 - SCREWS - RADIATOR FAN ATTACHING
2 - RADIATOR FAN - RIGHT
3 - MOUNT - RIGHT RADIATOR FAN
4 - CLIPS - RADIATOR FAN LOWER
5 - MOUNT - LEFT RADIATOR FAN
6 - RADIATOR FAN - LEFT

INSTALLATION

(1) Install the radiator fan(s) into mounts and attaching clips on the radiator.

(2) Install radiator fan(s) attaching screws (Fig. 22). Tighten to 5 N·m (45 in. lbs.).

(3) Connect the radiator fan(s) electrical connectors.

(4) Install the radiator upper support crossmember. (Refer to 23 - BODY/EXTERIOR/GRILLE OPENING REINFORCEMENT - INSTALLATION)

(5) Install the upper radiator mounts to the crossmember bolts, if removed. Tighten to 8 N·m (70 in. lbs.).

(6) Install the radiator upper hose to the support clip (2.4L engine).

HOSE CLAMPS

DESCRIPTION - HOSE CLAMPS

The cooling system uses spring type hose clamps. If a spring type clamp replacement is necessary, replace with the original Mopar® equipment spring type clamp.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter (Fig. 23).

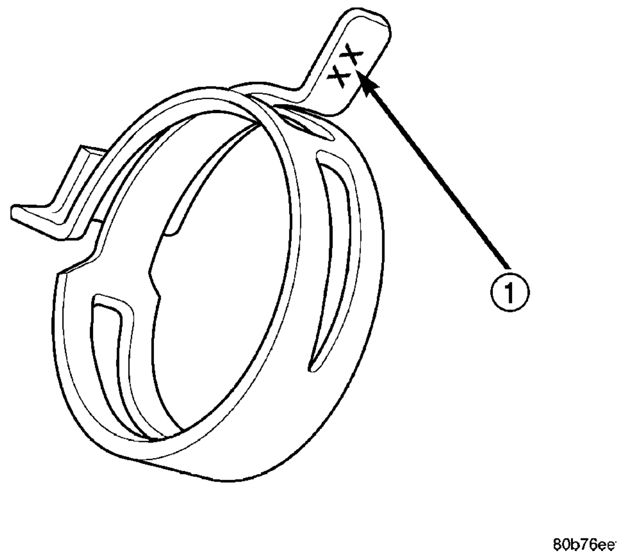

Fig. 23 Spring Clamp Size Location

1 - SPRING CLAMP SIZE LOCATION

OPERATION - HOSE CLAMPS

The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, use Special Tool 6094 or equivalent, constant tension clamp pliers (Fig. 24) to compress the hose clamp.

HOSE CLAMPS (Continued)

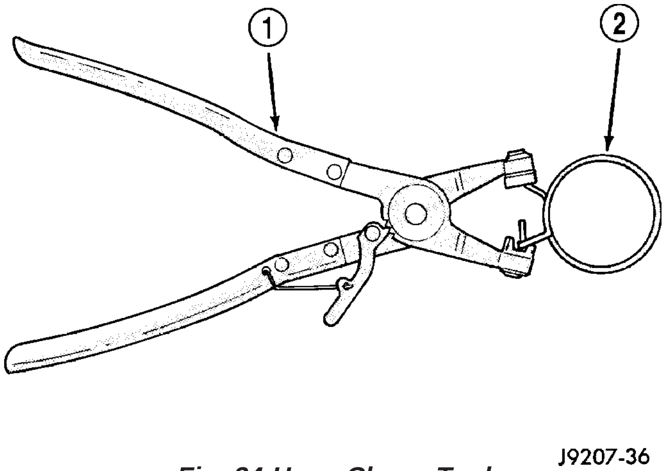

Fig. 24 Hose Clamp Tool

1 - HOSE CLAMP TOOL 6094
2 - HOSE CLAMP

RADIATOR FAN RELAY

DESCRIPTION

The low and high speed fan relays are mounted to the upper radiator support above the charge air cooler (Fig. 25).

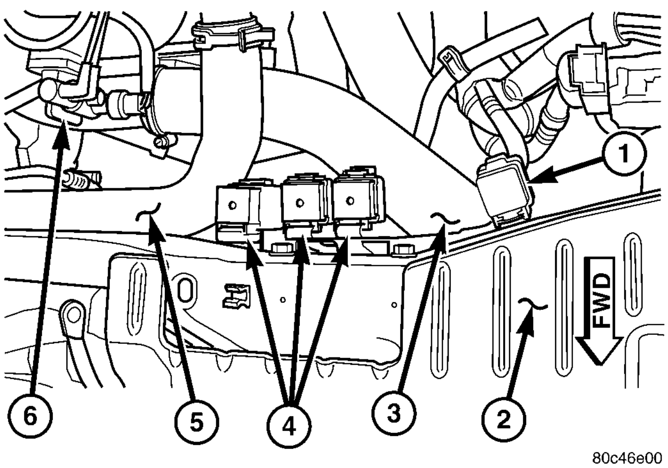

Fig. 25 RELAY LOCATIONS

1 - GLOW PLUG RELAY
2 - UPPER RADIATOR SUPPORT
3 - CHARGE AIR COOLER OUTLET HOSE
4 - RADIATOR FAN RELAYS
5 - UPPER RADIATOR HOSE
6 - EGR SOLENOID

OPERATION

The cooling system uses two fans. Both fans operate at two different speeds, low and high. Depending on engine coolant temperature and A/C system high side pressure, the fans operate at either low or high. The ignition switch supplies voltage to the coil side of the relay. When the ECM grounds the coil side of the relay, the contacts close and the battery supplies power to the fans.

COOLANT SYSTEM HOSES

REMOVAL

REMOVAL - UPPER RADIATOR HOSE

WARNING: THE WARNING WORDS "DO NOT OPEN HOT" ON THE RADIATOR PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE RADIATOR CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT OR UNDER PRESSURE.

(1) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(2) Drain cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).
(3) Remove upper radiator hose (Fig. 26).

REMOVAL - LOWER RADIATOR HOSE

WARNING: THE WARNING WORDS "DO NOT OPEN HOT" ON THE RADIATOR PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE RADIATOR CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT OR UNDER PRESSURE.

(1) Drain cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).
(2) Remove lower radiator hose (Fig. 26).

REMOVAL - COOLANT BYPASS HOSE

WARNING: THE WARNING WORDS "DO NOT OPEN HOT" ON THE RADIATOR PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, THE RADIATOR CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT OR UNDER PRESSURE.

(1) Drain cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).
(2) Remove the coolant bypass hose (Fig. 26).

COOLANT SYSTEM HOSES (Continued)

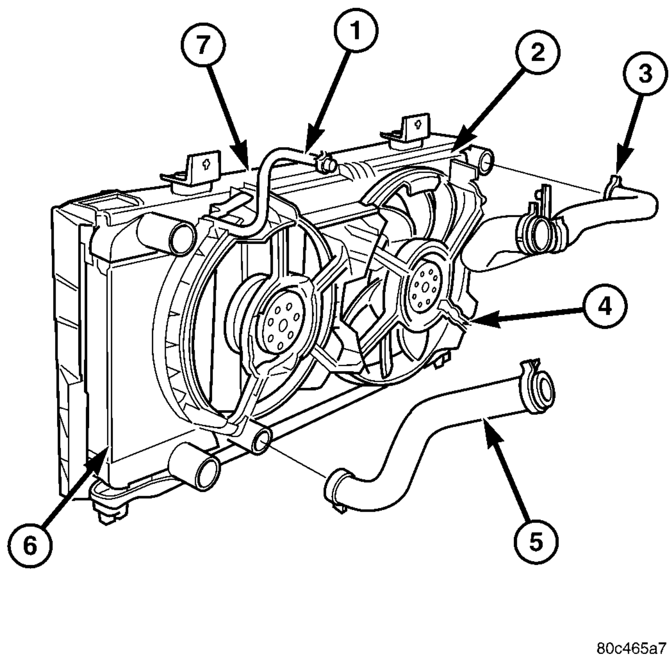

Fig. 26 UPPER AND LOWER RADIATOR HOSES - 2.5L SHOWN

1 - COOLANT BYPASS HOSE
2 - RADIATOR ASSEMBLY
3 - UPPER RADIATOR HOSE
4 - COOLING FAN
5 - LOWER RADIATOR HOSE
6 - CHARGE AIR COOLER
7 - RADIATOR BRACKET

INSTALLATION

INSTALLATION - UPPER RADIATOR HOSE

(1) Install upper radiator hose (Fig. 26).

(2) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(3) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

INSTALLATION - LOWER RADIATOR HOSE

(1) Install lower radiator hose (Fig. 26).

(2) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

INSTALLATION - COOLANT BYPASS HOSE

(1) Install cooling system bypass hose (Fig. 26).

(2) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

ELECTRONIC CONTROL MODULES

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ENGINE CONTROL MODULE

DESCRIPTION

The ECM is located in the left front corner of the engine compartment attached to the radiator support (Fig. 1).

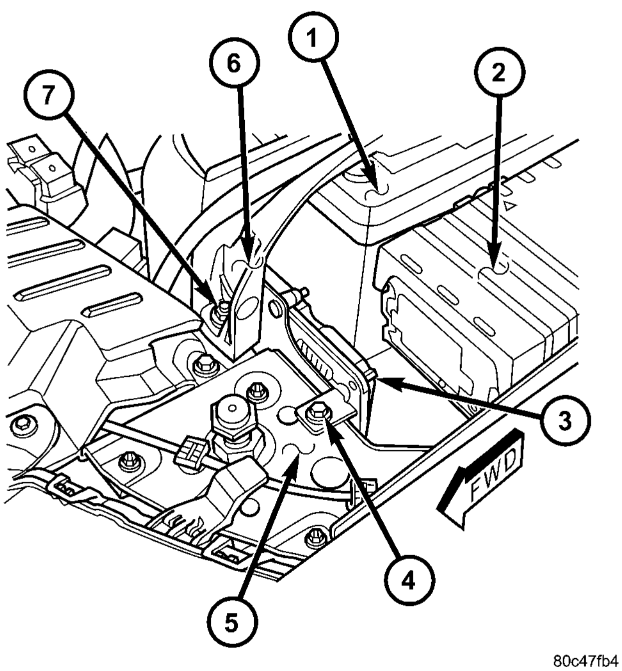

Fig. 1 ENGINE CONTROL MODULE LOCATION-TYPICAL

1 - BATTERY
2 - IPM (INTEGRATED POWER MODULE)
3 - ECM (ENGINE CONTROL MODULE)
4 - RETAINING BOLT
5 - RADIATOR SUPPORT
6 - CLUTCH CABLE BRACKET (LHD)
7 - CLUTCH CABLE BRACKET RETAINING BOLT (LHD)

OPERATION

The ECM has been programmed to monitor different circuits of the diesel fuel injection system. This monitoring is called on-board diagnostics. Certain criteria must be met for a diagnostic trouble code to be entered into the ECM memory. The criteria may be a range of: engine rpm, engine temperature, time or other input signals to the ECM. If all of the criteria for monitoring a system or circuit are met, and a problem is sensed, then a DTC will be stored in the ECM memory. It is possible that a DTC for a monitored circuit may not be entered into the ECM memory, even though a malfunction has occurred. This may happen when the monitoring criteria have not been met. The ECM compares input signal voltages from each input device with specifications (the established high and low limits of the input range) that are programmed into it for that device. If the input voltage is not within the specifications and other trouble code criteria are met, a DTC will be stored in the ECM memory.

ECM OPERATING MODES

As input signals to the ECM change, the ECM adjusts its response to the output devices. For example, the ECM must calculate a different fuel quantity and fuel timing for engine idle condition than it would for a wide open throttle condition. There are several different modes of operation that determine how the ECM responds to the various input signals.

Ignition Switch On (Engine Off)

When the ignition is turned on, the ECM activates the glow plug relay for a time period that is determined by engine coolant temperature, atmospheric temperature and battery voltage.

Engine Start-Up Mode

The ECM uses the engine temperature sensor and the crankshaft position sensor (engine speed) inputs to determine fuel injection quantity.

Normal Driving Modes

Engine idle, warm-up, acceleration, deceleration and wide open throttle modes are controlled based on all of the sensor inputs to the ECM. The ECM uses these sensor inputs to adjust fuel quantity and fuel injector timing.

ENGINE CONTROL MODULE (Continued)

Limp-In Mode

If there is a fault detected with the accelerator pedal position sensor, the ECM will set the engine speed at 1100 RPM.

Overspeed Detection Mode

If the ECM detects engine RPM that exceeds 5200 RPM, the ECM will set a DTC in memory and illuminate the MIL until the DTC is cleared.

After-Run Mode

The ECM transfers RAM information to ROM and performs an Input/Output state check.

MONITORED CIRCUITS

The ECM is able to monitor and identify most driveability related trouble conditions. Some circuits are directly monitored through ECM feedback circuitry. In addition, the ECM monitors the voltage state of some circuits and compares those states with expected values. Other systems are monitored indirectly when the ECM conducts a rationality test to identify problems. Although most subsytems of the engine control module are either directly or indirectly monitored, there may be occasions when diagnostic trouble codes are not immediately identified. For a trouble code to set, a specific set of conditions must occur and unless these conditions occur, a DTC will not set.

DIAGNOSTIC TROUBLE CODES

Each diagnostic trouble code (DTC) is diagnosed by following a specific procedure. The diagnostic test procedure contains step-by-step instruction for determining the cause of the DTC as well as no trouble code problems. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

HARD CODE

A DTC that comes back within one cycle of the ignition key is a hard code. This means that the problem is current every time the ECM/SKIM checks that circuit or function. Procedures in this manual verify if the DTC is a hard code at the beginning of each test. When the fault is not a hard code, an intermittent test must be performed. NOTE: If the DRBIII® displays faults for multiple components (i.e. ECT, VSS, IAT sensors) identify and check the shared circuits for possible problems before continuing (i.e. sensor grounds or 5-volt supply circuits). Refer to the appropriate schematic to identify shared circuits. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

INTERMITTENT CODE

A DTC that is not current every time the ECM/SKIM checks the circuit or function is an intermittent code. Most intermittent DTCs are caused by wiring or connector problems. Problems that come and go like this are the most difficult to diagnose; they must be looked for under specific conditions that cause them. **NOTE: Electromagnetic (radio) interference can cause an intermittent system malfunction.** This interference can interrupt communication between the ignition key transponder and the SKIM. The following checks may assist you in identifying a possible intermittent problem:

- Visually inspect the related wire harness connectors. Look for broken, bent, pushed out or corroded terminals.
- Visually inspect the related wire harness. Look for chafed, pierced or partially broken wire.
- Refer to hotlines or technical service bulletins that may apply.

Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

ECM DIAGNOSTIC TROUBLE CODES

IMPORTANT NOTE: Before replacing the ECM for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most ECM driver/control circuit failures are caused by internal failures to components (i.e. relays and solenoids) and shorted circuits (i.e. sensor pull-ups, drivers and ground circuits). These faults are difficult to detect when a double fault has occurred and only one DTC has set. If the DRBIII® displays faults for multiple components (i.e.VSS, ECT, Batt Temp, etc.) identify and check the shared circuits for possible problems before continuing (i.e. sensor grounds or 5-volt supply circuits). Refer to the appropriate wiring diagrams to identify shared circuits. Refer to the appropriate Diesel Powertrain Diagnostic Manual for more information.

STANDARD PROCEDURE - PCM/ECM/SKIM PROGRAMMING - DIESEL

NOTE: Before replacing the PCM/ECM for a failed driver, control circuit or ground circuit, be sure to check the related component/circuit integrity for failures not detected due to a double fault in the circuit. Most PCM/ECM driver/control circuit failures are caused by internal component failures (i.e. relay and solenoids) and shorted circuits (i.e. pull-ups, drivers and switched circuits). These failures are difficult to detect when a double fault has occurred and only one DTC has set.

ENGINE CONTROL MODULE (Continued)

PCM/SKIM PROGRAMMING

When a PCM (JTEC) and the SKIM are replaced at the same time perform the following steps in order:

(1) Program the new PCM (JTEC)

(2) Program the new SKIM

(3) Replace all ignition keys and program them to the new SKIM.

ECM/SKIM PROGRAMMING

When an ECM (Bosch) and the SKIM are replaced at the same time perform the following steps in order:

(1) Program the new SKIM

(2) Program the new ECM (Bosch)

PROGRAMMING THE ECM (Bosch)

(1) To program the VIN, connect the DRB III® and turn the ignition on.

(2) Select Engine from the main menu. The DRB III® will require the VIN to be entered before continuing.

(3) Select ENTER to update the VIN. The DRB III® will display the updated VIN.

(4) If the engine is equipped with air conditioning, the ECM A/C function must be enabled. Enable the ECM A/C function as follows:

- Using the DRB III® select ENGINE, MISCELLANEOUS, then ENABLE/DISABLE A/C
- Push 1 to enable A/C. DRB III® screen should display A/C Activated.

PROGRAMMING THE PCM (JTEC)

The SKIS Secret Key is an ID code that is unique to each SKIM. This code is programmed and stored in the SKIM, PCM and transponder chip (ignition keys). When replacing the PCM it is necessary to program the secret key into the new PCM using the DRB III®. Perform the following steps to program the secret key into the PCM.

(1) Turn the ignition switch on (transmission in park/neutral).

(2) Use the DRB III® and select THEFT ALARM, SKIM then MISCELLANEOUS.

(3) Select PCM REPLACED (GAS ENGINE).

(4) Enter secured access mode by entering the vehicle four-digit PIN.

(5) Select ENTER to update PCM VIN.

NOTE: If three attempts are made to enter secure access mode using an incorrect PIN, secured access mode will be locked out for one hour. To exit this lockout mode, turn the ignition to the RUN position for one hour then enter the correct PIN. (Ensure all accessories are turned off. Also monitor the battery state and connect a battery charger if necessary).

(6) Press ENTER to transfer the secret key (the SKIM will send the secret key to the PCM).

(7) Press Page Back to get to the Select System menu and select ENGINE, JTEC (diesel only), MISCELLANEOUS, and SRI MEMORY CHECK.

(8) The DRB III® will ask, Is odometer reading between XX and XX? Select the YES or NO button on the DRB III®. If NO is selected, the DRB III® will read, Enter odometer Reading<From I.P. odometer>. Enter the odometer reading from the Instrument Panel and press ENTER.

PROGRAMMING THE SKIM

(1) Turn the ignition switch on (transmission in park/neutral).

(2) Use the DRB III® and select THEFT ALARM, SKIM then MISCELLANEOUS.

(3) Select PCM REPLACED (GAS ENGINE).

(4) Program the vehicle four-digit PIN into SKIM.

(5) Select COUNTRY CODE and enter the correct country.

NOTE: Be sure to enter the correct country code. If the incorrect country code is programmed into SKIM, the SKIM must be replaced.

(6) Select YES to update VIN (the SKIM will learn the VIN from the PCM).

(7) Press ENTER to transfer the secret key (the PCM will send the secret key to the SKIM).

(8) Program ignition keys to SKIM.

NOTE: If the PCM and the SKIM are replaced at the same time, all vehicle keys will need to be replaced and programmed to the new SKIM.

PROGRAMMING IGNITION KEYS TO THE SKIM

(1) Turn the ignition switch on (transmission in park/neutral).

(2) Use the DRB III® and select THEFT ALARM, SKIM then MISCELLANEOUS.

(3) Select PROGRAM IGNITION KEY'S.

(4) Enter secured access mode by entering the vehicle four-digit PIN.

NOTE: A maximum of eight keys can be learned to each SKIM. Once a key is learned to a SKIM it (the key) cannot be transferred to another vehicle.

If ignition key programming is unsuccessful, the DRB III® will display one of the following messages:

Programming Not Attempted - The DRB III® attempts to read the programmed key status and there are no keys programmed into SKIM memory.

ENGINE CONTROL MODULE (Continued)

Programming Key Failed (Possible Used Key From Wrong Vehicle) - SKIM is unable to program key due to one of the following:

- faulty ignition key transponder
- ignition key is programmed to another vehicle.

8 Keys Already Learned, Programming Not Done - SKIM transponder ID memory is full.

(5) Obtain ignition keys to be programmed from customer (8 keys maximum).

(6) Using the DRB III®, erase all ignition keys by selecting MISCELLANEOUS and ERASE ALL CURRENT IGN. KEYS.

(7) Program all ignition keys.

Learned Key In Ignition - Ignition key transponder ID is currently programmed in SKIM memory.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove left front headlamp module (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - REMOVAL).

(3) Remove lower headlamp assembly mounting bolt (Fig. 2).

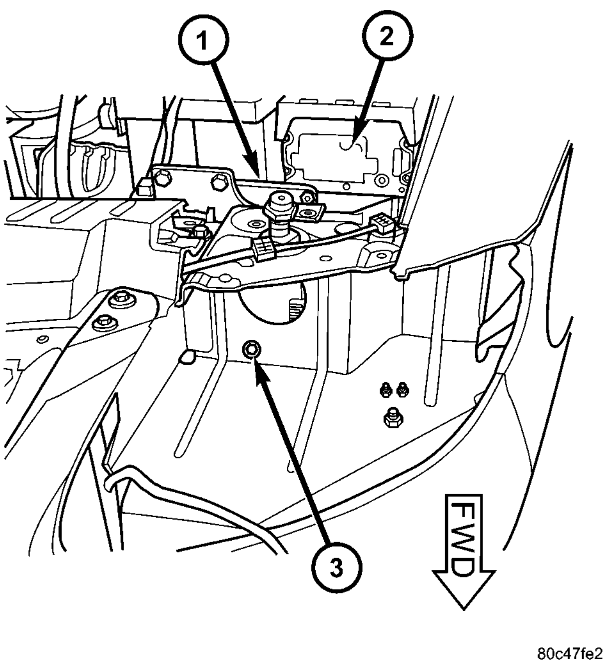

Fig. 2 ENGINE CONTROL MODULE-LOWER MOUNTING BOLT

1 - ENGINE CONTROL MODULE (ECM)
2 - INTEGRATED POWER MODULE
3 - ECM LOWER MOUNTING BOLT

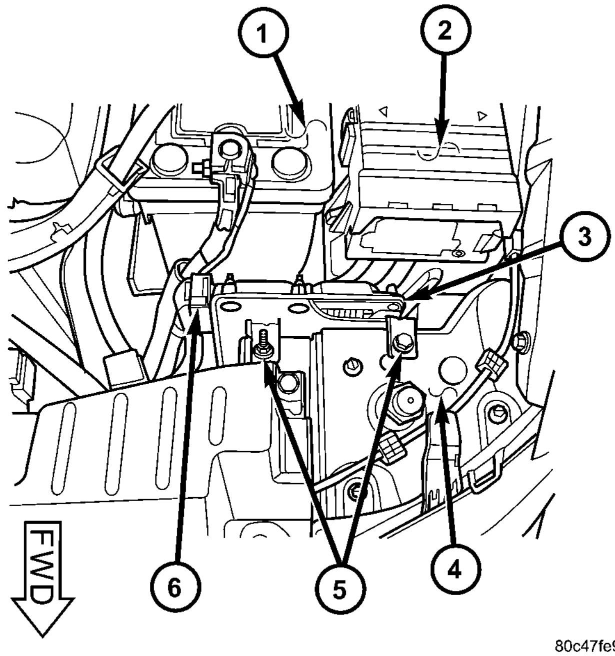

Fig. 3 ENGINE CONTROL MODULE-UPPER MOUNTING BOLTS

1 - BATTERY
2 - INTEGRATED POWER MODULE
3 - ENGINE CONTROL MODULE
4 - RADIATOR SUPPORT
5 - ECM UPPER MOUNTING BOLTS
6 - ECM ELECTRICAL CONNECTORS

(4) Remove ECM upper mounting bolts (Fig. 3).

(5) Lift ECM from radiator support.

(6) Disconnect ECM electrical connectors.

(7) Separate ECM from mounting bracket.

INSTALLATION

(1) Install ECM on mounting bracket.

(2) Connect ECM electrical connectors.

(3) Place ECM and bracket assembly in position on radiator support.

(4) Install upper and lower mounting bolts.

(5) Install left headlamp module (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/HEADLAMP UNIT - INSTALLATION).

(6) Connect negative battery cable.

(7) Program ECM as necessary (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - STANDARD PROCEDURE).

IGNITION CONTROL

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GLOW PLUG

DESCRIPTION

Glow plugs are used to help start a cold or cool engine (Fig. 1). The glow plugs will heat up and glow to heat the combustion chamber of each cylinder. An individual glow plug is used for each cylinder. Each glow plug is threaded into the left side of the cylinder head below the cylinder head cover/intake manifold.

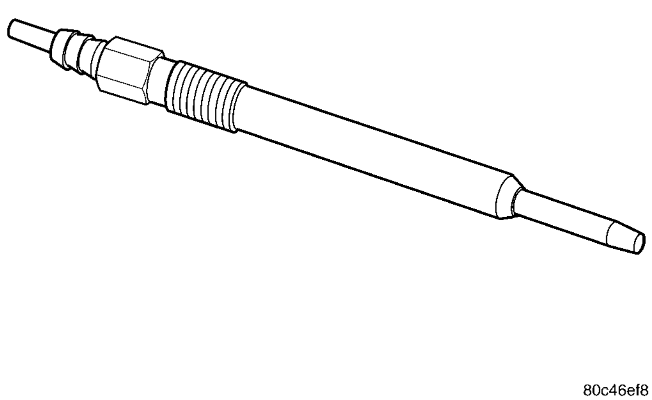

Fig. 1 GLOW PLUG

OPERATION

Each glow plug will momentarily draw approximately 25 amps of electrical current during the initial key “ON” cycle. This is on a cold or cool engine. After heating the current draw will drop to approximately 9–12 amps per plug.

Total momentary cuurent draw for all four glow plugs is approximately 100 amps on a cold engine dropping to a total of approximately 40 amps after the plugs are heated.

Electrical operation of the glow plugs is controlled by two glow plug relays. Each glow plug relay controls two glow plugs. Refer to glow plug relays for more information.

GLOW PLUG RELAY

DESCRIPTION

There are two glow plug relays. These relays are located in the Power Distribution Center (PDC) in the engine compartment (Fig. 2).

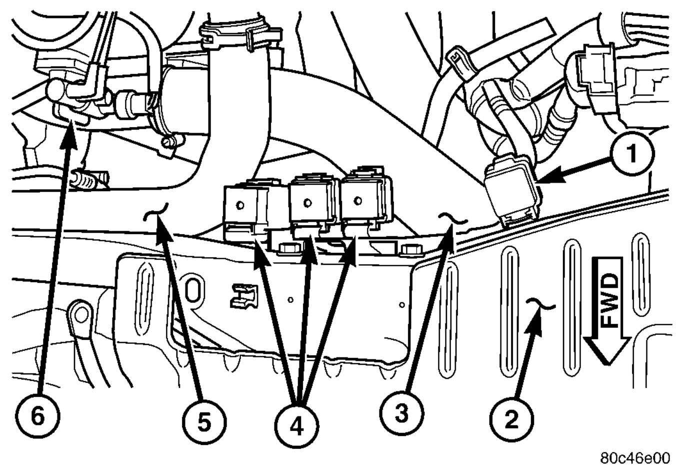

Fig. 2 RELAY LOCATIONS

1 - GLOW PLUG RELAY
2 - RADIATOR SUPPORT
3 - CHARGE AIR COOLER OUTLET HOSE
4 - COOLING FAN RELAY
5 - UPPER RADIATOR HOSE
6 - EGR SOLENOID

OPERATION

When the ignition (key) switch is place in the ON position, a signal is sent to the ECM relating current engine coolant temperature. This signal is sent from the engine coolant temperature sensor.

After receiving this signal, the ECM will determine if, when and for how long of a period the glow plug relays should be activated. This is done before, during and after the engine is started. Whenever the glow plug relays are activated, it will control the 12 volt 100 amp circuit for the operation of the four glow plugs. Each relay control two glow plugs.

GLOW PLUG RELAY (Continued)

The Glow Plug lamp is tied to this circuit. Lamp operation is also controlled by the ECM.

With a cold engine, the glow plug relays and glow plugs may be activated for a maximum time of 200 seconds. Refer to the following Glow Plug Control chart for a temperature/time comparison of the glow plug relay operation.

In this chart, Pre-Heat and Post-Heat times are mentioned. Pre-Heat is the amount of time the glow plug relay control circuit is activated when the ignition (key) is switched ON, without the engine running. Post-Heat is the amount of time the glow plug relay control circuit is activated after the engine is operated. The Glow Plug lamp will not be activated during the post-heat cycle.

Engine Coolant Temperature ″Key ON″	Wait-To Start Lamp ″ON″ (Seconds)	Pre-Heat Cycle (Glow Plugs On Seconds)	Post-Heat Cycle (Seconds)
-30C	20 SEC.	35 SEC.	200 SEC.
-10C	8 SEC.	23 SEC.	180 SEC.
+10C	6 SEC.	21 SEC.	160 SEC.
+30C	5 SEC.	20 SEC.	140 SEC.
+40C	4 SEC.	19 SEC.	70 SEC.
+70C	1 SEC.	16 SEC.	20 SEC.

CAMSHAFT POSITION SENSOR

DESCRIPTION

The camshaft position (CMP) sensor is mounted in the top of cylinder head cover/intake manifold at the rear of the engine. The CMP sensor is a hall effect device (Fig. 3).

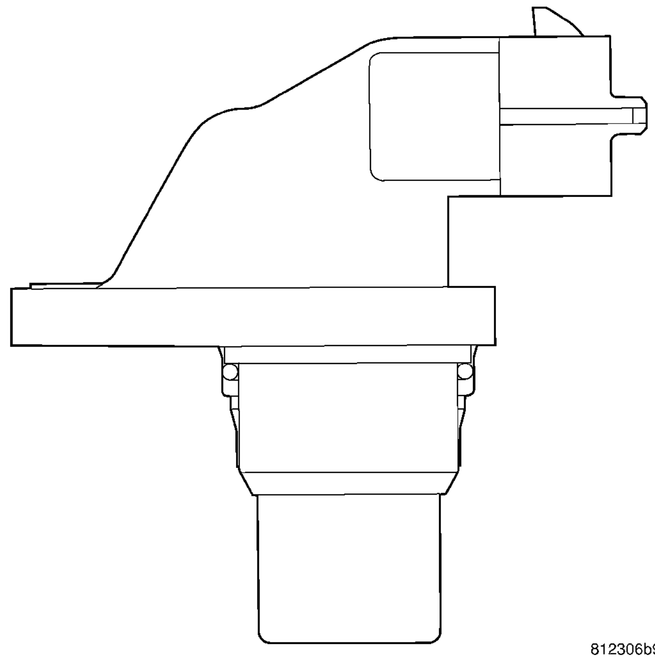

Fig. 3 CAMSHAFT POSITION SENSOR

OPERATION

The CMP sensor is a hall effect switch. A tooth made of a ferromagnetic material is attached to the camshaft. When this tooth passes the CMP sensor an electronic signal is created. This signal is then sent to the engine control module (ECM). This signal is used by the ECM to determine which cylinder has just entered its compression phase.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).

(3) Disconnect camshaft position sensor electrical connector (Fig. 4).

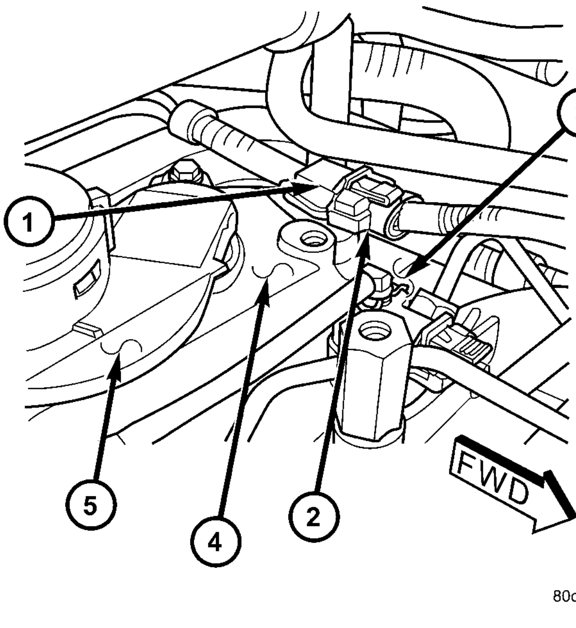

Fig. 4 CAMSHAFT POSITION SENSOR LOCATION

1 - CAMSHAFT POSITION SENSOR
2 - CAMSHAFT POSITION SENSOR ELCTRICAL SENSOR
3 - FUEL INJECTOR
4 - CYLINDER HEAD COVER
5 - OIL SEPARATOR

(4) Remove sensor retaining bolt and remove sensor from cylinder head cover.

CAMSHAFT POSITION SENSOR (Continued)

INSTALLATION

(1) Lubricate O-ring and install sensor in cylinder head cover. Torque retaining bolt to 5.4 N·m.

(2) Connect camshaft position sensor electrical connector.

(3) Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).

(4) Connect negative battery cable.

ENGINE

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ENGINE 2.5L/2.8 TURBO DIESEL

DESCRIPTION

DESCRIPTION - 2.5L/2.8L COMMON RAIL DIESEL ENGINE

The 2.5 Liter (2499cc) and 2.8L (2776cc) four-cylinder "common rail" direct injection engines are very similar in design and operability with a few differences. The 2.5L is the engine of choice for the manual transmission and the 2.8L for the automatic transmission. Both 4 cylinder "common rail" direct injection engines are an in-line overhead valve design. The engines utilize a cast iron cylinder block and an aluminum cylinder head with four valves per cylinder and dual overhead cam shafts. Both engines are turbocharged and intercooled. Differences include a longer crankshaft gear, larger cylinder bore and larger intake ducts in the cylinder head of the 2.8L. (Fig. 1).

DESCRIPTION	SPECIFICATION
Displacement 2.5L	2.5L (2499 cc)
Displacement 2.8L	2.8L (2776cc)
Bore - 2.5L	92.00 mm
Bore - 2.8L	94.00 mm
Stroke 2.5L	94.00 mm
Stroke 2.8L	100.00 mm
Compression Ratio	17.5:1
Vacuum at Idle	700 mm/Hg (27.5 In/Hg)
Belt Tension	Automatic Belt Tensioner
Thermostat Opening	80°C ± 2°C
Generator Rating	Denso 12V-95A
Cooling System Capacity	13.8 Liters W/O Auxiliary Heater 16.6 Liters With Auxiliary Heater
Engine Oil Capacity	6.0L W/Filter Change
Timing System	Belt Driven Overhead Camshafts
Air Intake	Dry Filter With Turbocharger and Charge Air Cooler
Fuel Supply	Vane Pump Incorporated In Injection Pump
Fuel System	Direct Fuel Injection Common Rail System
Combustion Cycle	4 Stroke
Cylinder Compression Difference Between Cylinders	5 Bar
Cooling System	Water Cooling
Injection Pump	Common Rail System
Lubrication	Pressure Lubricated By Rotary Pump
Minimum Oil Pressure (Warm)	0.7 Bar at Idle 2 Bar at 3800 rpm
Engine Rotation	Clockwise Viewed From Front Cover
Transmission 2.5L	MTX
Transmission 2.8L	ATX

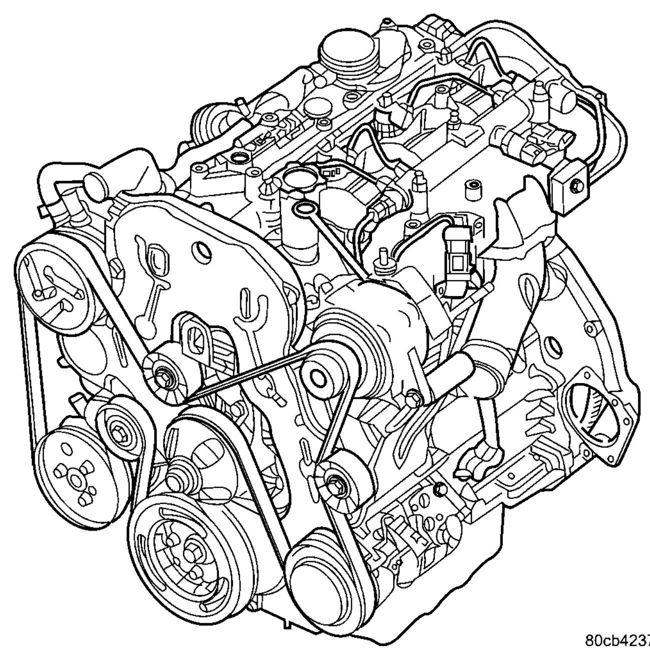


Fig. 1 2.5L/2.8L COMMON RAIL DIESEL ENGINE

DESCRIPTION - ENGINE COVER

The engine cover is a black plastic cover used to cover the top of the engine (Fig. 10). It is used to isolate engine noises.

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

REMOVAL

REMOVAL - 2.5L/2.8L DIESEL ENGINE

(1) Disconnect negative battery cable.

(2) Remove engine cover (Fig. 2). (Refer to 9 - ENGINE - REMOVAL)

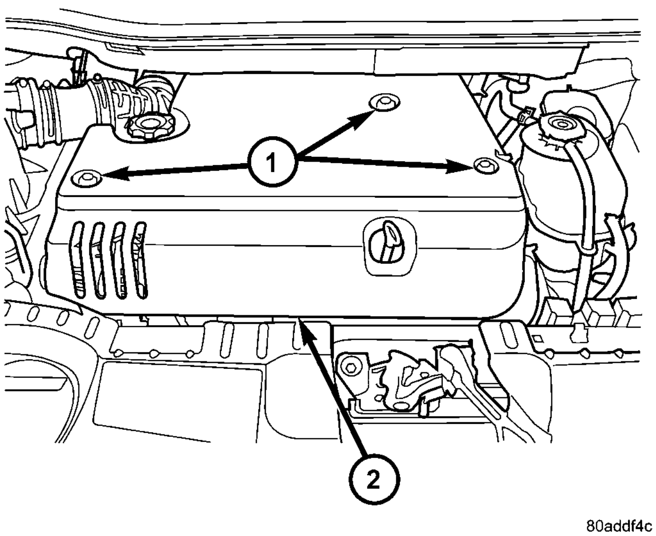


Fig. 2 ENGINE COVER

1 - ENGINE COVER MOUNTING BOLTS
2 - ENGINE COVER

(3) Remove air cleaner housing, MAF sensor, and air intake tube assembly (Fig. 3).

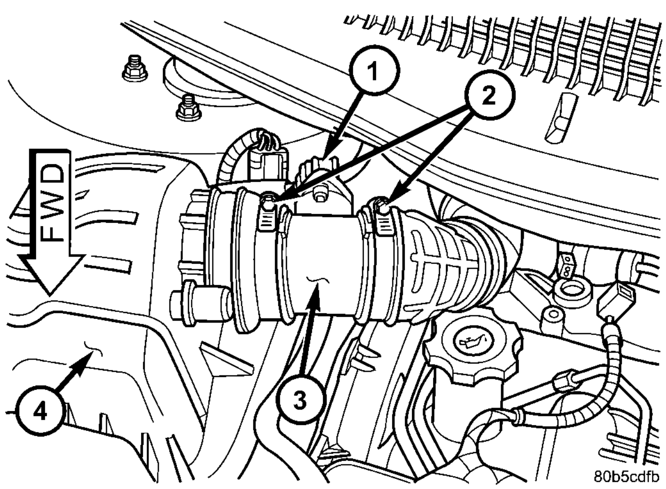


Fig. 3 MASS AIR FLOW (MAF) SENSOR LOCATION

1 - MAF SENSOR ELECTRICAL CONNECTOR
2 - RETAINING CLAMPS
3 - MASS AIR FLOW (MAF) SENSOR
4 - AIR CLEANER HOUSING

(4) Remove coolant pressure tank pressure cap.

(5) Raise vehicle on hoist.

(6) Drain cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(7) Remove lower splash shield.

(8) Remove splash shield side panels.

(9) Remove power steering reservoir hose from power steering pump and drain power steering fluid (Fig. 4).

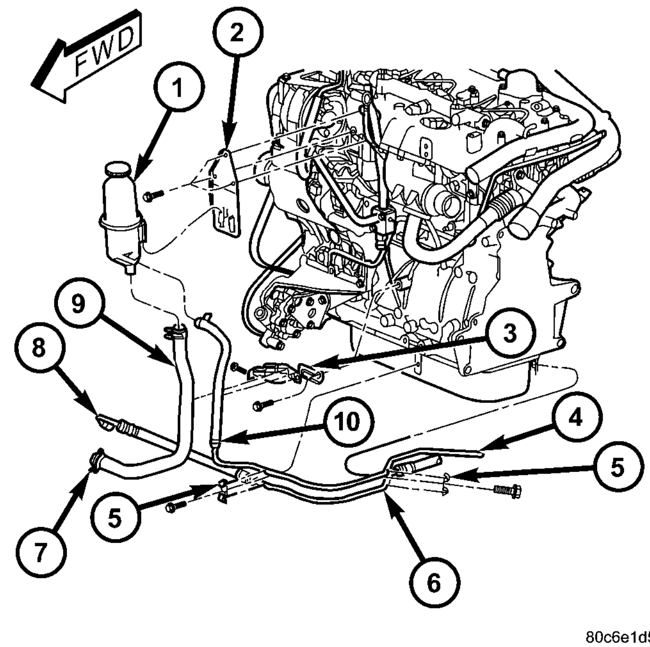


Fig. 4 RESERVOIR AND HOSES - 2.5L DIESEL

1 - POWER STEERING FLUID RESERVOIR
2 - RESERVOIR BRACKET
3 - SUPPLY HOSE BRACKET
4 - RETURN HOSE FROM GEAR
5 - ROUTING CLIP
6 - PRESSURE HOSE TO GEAR
7 - SUPPLY HOSE (PUMP END)
8 - PRESSURE HOSE (PUMP END)
9 - SUPPLY HOSE
10 - RETURN HOSE

(10) Disconnect high pressure power steering line at pump (Fig. 4).

(11) Disconnect power steering pump return hose clamp (Fig. 4).

(12) Remove power steering return line retaining clamp (Fig. 4).

(13) Remove power steering line clamps from oil pan (Fig. 4).

(14) Remove power steering pump reservoir and bracket (Fig. 4).

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

(15) Drain coolant system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(16) Remove coolant pressure tank (Fig. 5).

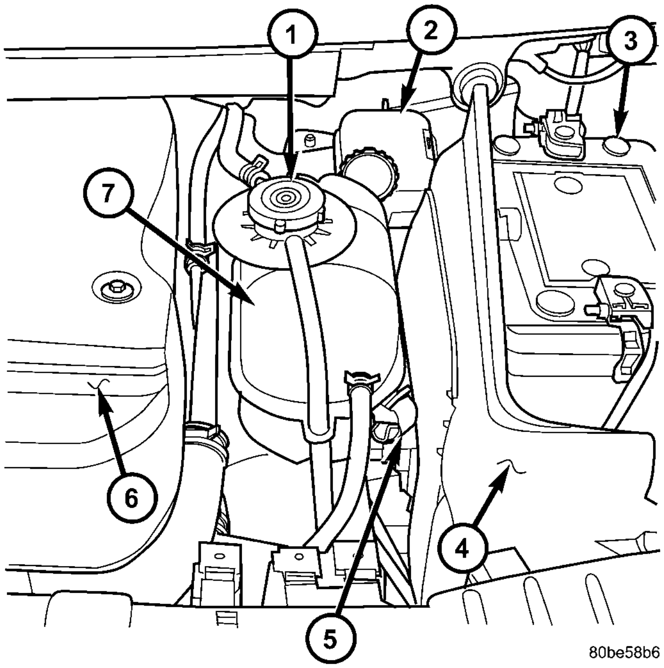


Fig. 5 COOLANT RECOVERY PRESSURE CONTAINER LOCATION

1 - PRESSURE/VENT CAP
2 - BRAKE MASTER CYLINDER
3 - BATTERY
4 - BATTERY SHIELD
5 - COOLANT RECOVERY PRESSURE CONTAINER RETAING CLIP
6 - ENGINE COVER
7 - COOLANT RECOVERY PRESSURE CONTAINER

(17) Remove battery shield.

(18) Remove charge air cooler outlet hose.

(19) Remove charge air cooler inlet hose (Fig. 6).

(20) Disconnect upper radiator hose at engine (Fig. 7).

(21) Disconnect lower radiator hose at engine (Fig. 7).

(22) Disconnect brake booster vacuum supply hose.

(23) Disconnect heater core return hose at engine.

(24) Disconnect EGR solenoid vacuum line at brake booster check valve.

(25) Disconnect fuel injector, cam sensor, boost pressure/intake air temperature sensor, fuel rail high pressure, and EGR solenoid connectors (Fig. 8).

(26) Disconnect generator electrical connectors.

(27) Disconnect coolant temperature sensor and glow plug electrical connectors.

(28) Disconnect high pressure injection pump and A/C compressor electrical connectors.

(29) Disconnect starter electrical connectors.

(30) Disconnect ground wires at engine block.

(31) Raise vehicle on hoist.

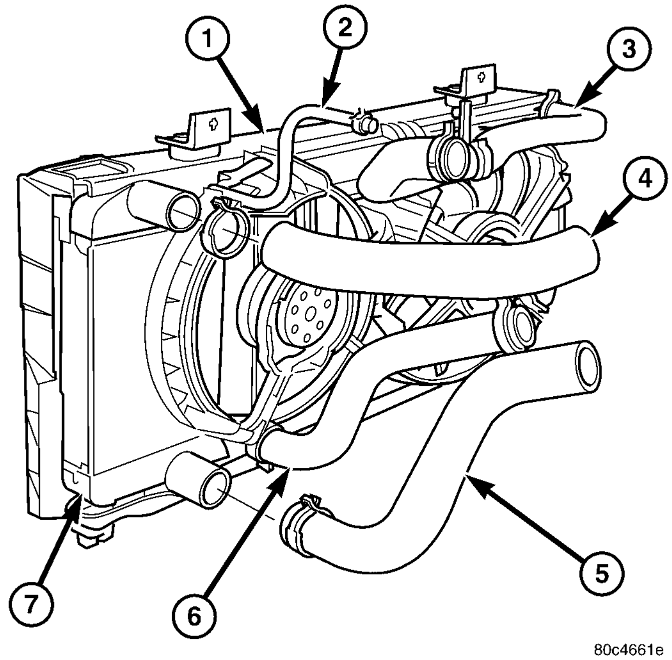


Fig. 6 CHARGE AIR COOLER HOSES

1 - COOLING MODULE
2 - BYPASS HOSE
3 - UPPER RADIATOR HOSE
4 - CHARGE AIR COOLER OULET HOSE
5 - CHARGE AIR COOLER INLET HOSE
6 - LOWER RADIATOR HOSE
7 - CHARGE AIR COOLER

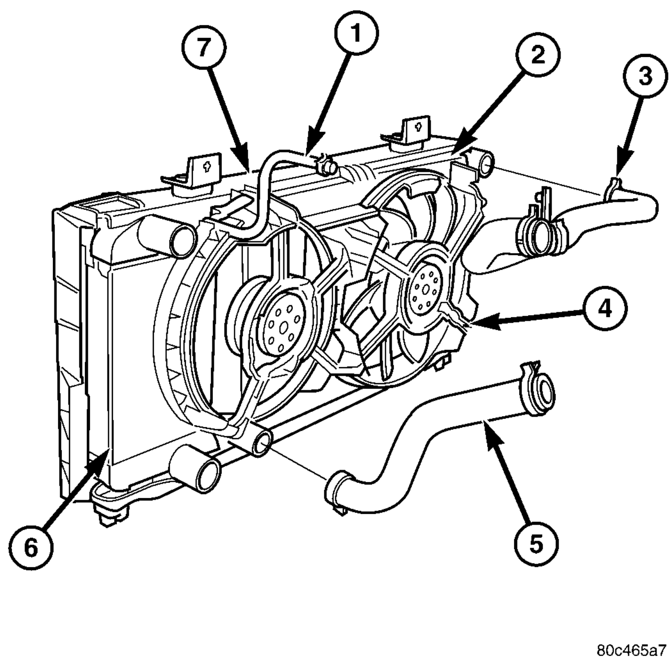


Fig. 7 UPPER AND LOWER RADIATOR HOSES

1 - COOLANT BYPASS HOSE
2 - RADIATOR ASSEMBLY
3 - UPPER RADIATOR HOSE
4 - COOLING FAN
5 - LOWER RADIATOR HOSE
6 - CHARGE AIR COOLER
7 - RADIATOR BRACKET

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

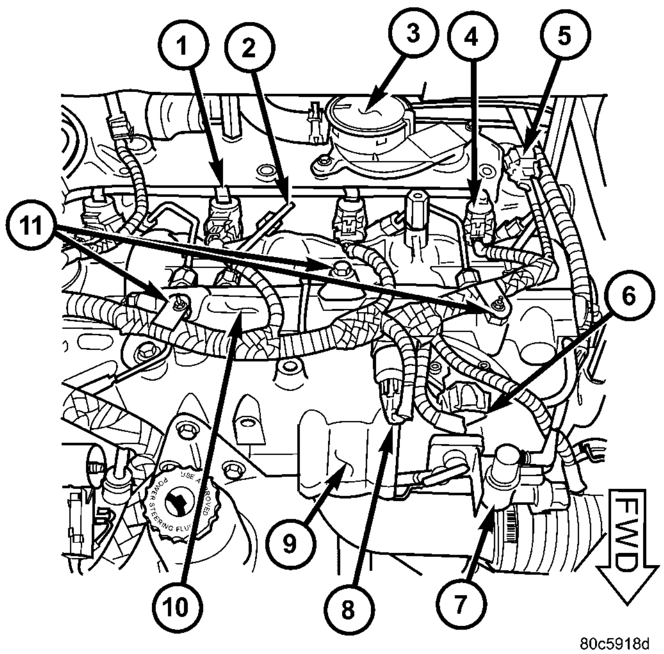


Fig. 8 ENGINE COMPONENT LOCATIONS

1 - FUEL INJECTOR RETURN LINE
2 - FUEL INJECTOR SUPPLY LINE
3 - OIL SEPARATOR
4 - FUEL INJECTOR
5 - CAMSHAFT POSITION SENSOR
6 - BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR
7 - EGR SOLENOID
8 - FUEL PRESSURE SENSOR
9 - CYLINDER HEAD COVER/INTAKE MANIFOL
10 - FUEL RAIL
11 - WIRING HARNESS RETAINING CLIPS

(32) Disconnect oil pressure switch, engine speed sensor, and vehicle speed sensor electrical connector (Fig. 9).

(33) Raise and support vehicle.

(34) Remove front wheels.

(35) Remove the suspension cradle assembly (Refer to 13 - FRAME & BUMPERS/FRAME/ENGINE CRADLE CROSSMEMBER - REMOVAL).

(36) Remove both axle shaft assemblies (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - REMOVAL).

(37) Disconnect the clutch slave cylinder quick disconnect line (RHD only)(Refer to 6 - CLUTCH/SLAVE CYLINDER - REMOVAL).

(38) Disconnect reverse lamp connector.

(39) Disconnect shifter cables at the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/GEAR SHIFT CABLE - REMOVAL).

(40) Disconnect exhaust pipe from the turbocharger downpipe and reposition to right side of vehicle.

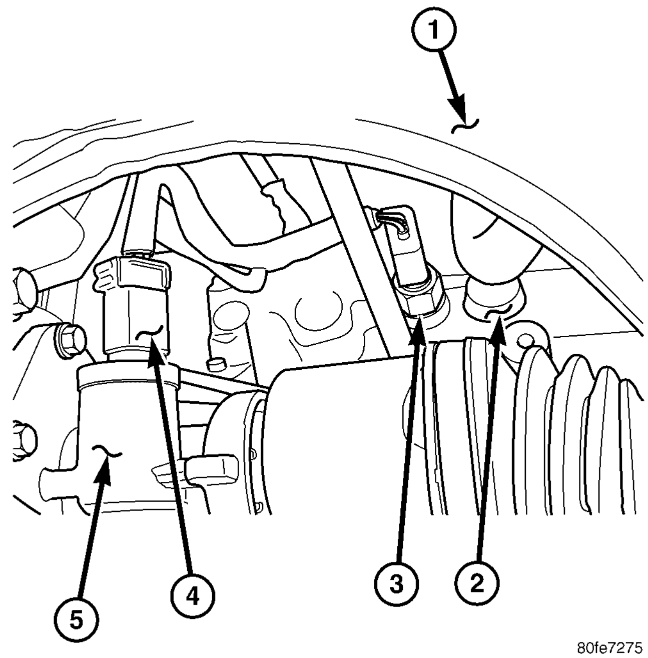


Fig. 9 VIEW-REAR ENGINE

1 - SUSPENSION CRADLE
2 - ENGINE BLOCK
3 - OIL PRESSURE SWITCH
4 - VEHICLE SPEED SENSOR
5 - TRANSMISSION

(41) Disconnect cabin heater coolant line (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/HEATER UNIT - REMOVAL).

(42) Remove front engine mount bracket retaining bolts from lower radiator support

(43) Lower vehicle. Evacuate the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

(44) Disconnect the A/C lines at the A/C compressor.

(45) Raise and support vehicle.

(46) Disconnect the fuel supply and return lines.

(47) Position engine cradle under engine and lower vehicle over cradle.

(48) Remove right engine mount bolts.

(49) Remove left engine mount through bolt.

(50) Carefully raise vehicle, leaving engine and transmission on engine cradle.

(51) Lift engine from engine cradle and dissemble as necessary.

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

REMOVAL - ENGINE COVER

(1) Remove engine cover retaining bolts.

(2) Remove engine cover from engine (Fig. 10).

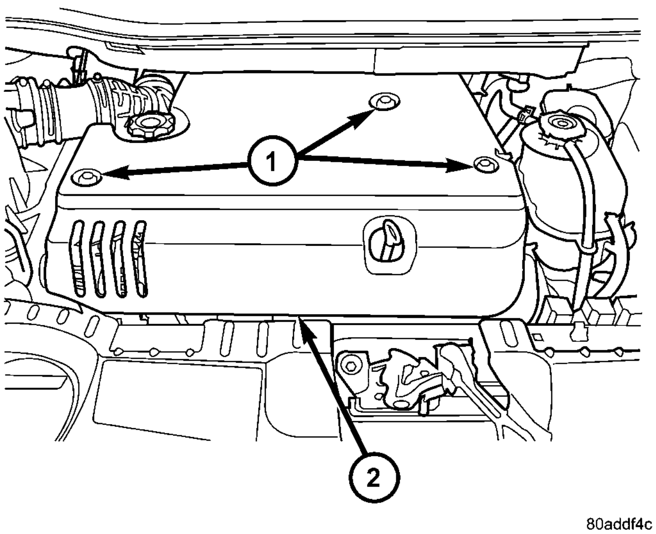


Fig. 10 ENGINE COVER

1 - ENGINE COVER MOUNTING BOLTS
2 - ENGINE COVER

INSTALLATION

INSTALLATION - 2.5L TURBO DIESEL ENGINE

(1) Reassembly engine and transmission assembly and install on engine cradle.

(2) Position engine and cradle assembly under vehicle.

(3) Slowly lower the vehicle down over the engine and cradle assembly.

(4) Install right engine mount bolts. Torque to 54N·m (40 ft. lbs.)

(5) Install left engine mount through bolt. Torque to 75N·m (55 ft. lbs.)

(6) Raise vehicle and engine from engine cradle.

(7) Attach front engine mount bracket to lower radiator support. Torque to 54N·m (40 ft. lbs.)

(8) Connect cabin heater coolant hose.

(9) Connect exhaust pipe to the turbocharger downpipe flange. Torque to 28 N·m (250 in. lbs.)

(10) Connect reverse lamp electrical connector at transmission.

(11) Connect both shifter cables (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/GEAR SHIFT CABLE - INSTALLATION).

(12) Connect the clutch slave cylinder quick disconnect connector (RHD only)(Refer to 6 - CLUTCH/SLAVE CYLINDER - INSTALLATION).

(13) Install engine harness into bracket on transmission.

(14) Lower vehicle.

(15) Connect fuel supply and return lines.

(16) Connect A/C lines to A/C compressor. Torque to 23N·m (17 ft. lbs.)

(17) Route engine wiring harnes to proper location.

(18) Connect engine harness ground cables to engine block

(19) Connect starter solenoid electrical connector and battery positive wire to starter. Torque to 10N·m (90 in. lbs.)

(20) Connect A/C compressor, injection pump, glow plugs, and coolant temperature sensor electrical connectors.

(21) Connect generator electrical connector. Torque to 9N·m (75 in. lbs.)

(22) Connect the fuel injector, fuel pressure sensor, boost pressure/intake air temp sensor, cam sensor, and EGR solenoid electrical connectors (Fig. 8).

(23) Connect EGR solenoid vacuum supply line to brake boost vacuum supply line.

(24) Connect brake booster vacuum supply line.

(25) Connect heater core return hose to coolant pipe.

(26) Connect lower radiator hose to engine (Fig. 7).

(27) Install charger air cooler inlet hose (Fig. 6).

(28) Install charge air cooler outlet hose (Fig. 6).

(29) Connect upper radiator hose to engine (Fig. 7).

(30) Install battery shield.

(31) Install coolant reserve pressure container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - INSTALLATION).

(32) Install power steering reservoir and bracket (Fig. 4).

(33) Raise vehicle

(34) Connect oil pressure sensor, oil temperature sensor, engine speed sensor, and vehicle speed sensor electrical connector (Fig. 9).

(35) Install suspension cradle in vehicle (Refer to 13 - FRAME & BUMPERS/FRAME/ENGINE CRADLE CROSSMEMBER - INSTALLATION).

(36) Install both axle shaft assemblies (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - INSTALLATION).

(37) Connect the power steering supply, pressure, and return lines to power steering pump (Fig. 4).

(38) Install the power steering line brackets on oil pan (Fig. 4).

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

(39) Install lower splash shield and side panels.
(40) Install both front wheel and tire assemblies.
(41) Lower vehicle.
(42) Install air cleaner housing, MAF sensor, and air intake tube assembly (Fig. 3).
(43) Refill transmission to proper level (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/FLUID - STANDARD PROCEDURE).
(44) Refill engine coolant (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).
(45) Fill engine crankcase to proper level, with correct viscosity engine oil.
(46) Connect negative battery cable.
(47) Recharge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).
Perform fuel system air purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).
(48) Install engine cover (Refer to 9 - ENGINE - INSTALLATION) (Fig. 2).

INSTALLATION - ENGINE COVER

(1) Install engine cover on engine.
(2) Install the engine cover mounting bolts (Fig. 10).

SPECIFICATIONS

SPECIFICATIONS - 2.5L COMMON RAIL DIESEL ENGINE

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION
Engine Type	R2516C5
Transmission	MTX
Number of Cylinders	4
Bore	92 mm
Stroke	94 mm
Displacement	2499.5cc
Injection Order	1-3-4-2
Compression Ratio	17.5:1 (± 0.5)
Maximum Power	105kW (143 HP) @ 4000 RPM
Peak Torque	340N·m @ 2000 RPM
Cylinder Compression (Max. Difference Between Cylinders	5 Bar
Minimum Oil Pressure (Warm)	.7 Bar @ Idle 2 Bar @ 3800 RPM

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Front Journal Diameter- Nominal	62.985-63.005 mm	2.479-2.480 in
Front Journal Diameter- minus 0.25	62.735-63.074 mm	2.469-2.471 in.
Front Bearing Diameter- Nominal	63.005-63.034 mm	2.480-2.481 in.
Front Bearing Diameter-minus 0.25	62.775-62.784 mm	2.470-2.471 in
Clearance Between the Journal and Bearing	0.000-0.049 mm	0.000-0.001 in.
Center Journal Diameter- Nominal	63.005-63.020 mm	0.001-0.003 in.
Center Journal Diameter-minus 0.25	62.775-62.770 mm	2.470-2.471
Center Bearing Diameter- Nominal	63.005-63.020 mm	2.480-2.481 in.
Center Bearing Diameter-minus 0.25	62.775-62.770 mm	2.470-2.471 in.
Clearance Between Journal and Bearing	0.008-0.051 mm	0.0003-0.0002 in
Rear Journal Diameter- Nominal	89.980-90.000 mm	3.542-3.543 in
Rear Journal Diameter- minus 0.25	89.730-99.750 mm	3.532-3.927 in.
Rear Bearing Diameter- Nominal	90.045-90.065 mm	3.545-3.546 in.
Rear Bearing Diameter- minus 0.25	89.795-89.815 mm	3.535-3.536 in.

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Clearance Between Journal and Bearing	0.045-0.080 mm	0.001-0.003 in.
Connecting Rod Journal-Nominal	53.940-53.955 mm	2.123-2.124 in.
Connecting Rod Journal- minus 0.25	53.690-53.705 mm	2.113-2.114 in.
Connecting Rod Bearing-Nominal	53.997-54.016 mm	2.125-2.126 in.
Connecting Rod Bearing- minus 0.25	53.727-53.766 mm	2.115-2.116 in.
Clearance Between Journal and Bearing	0.022-0.076 mm	0.0008-0.0029 in.
Crankshaft End Play	0.080-0.280 mm	0.003-0.011 in.
Adjustment	Thrust Washers	Thrust Washers
Thrust Washers Available	2.31-2.36 mm	0.090-0.092 in.
	2.41-2.46 mm	0.094-0.096 in.
	2.51-2.56 mm	0.098-0.100
Carrier with Thrush Washers Installed	27.670-27.820 mm	1.089-1.095 in.

MAIL BEARING CARRIERS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Internal Diameter-Front	67.025-67.050 mm	2.638-2.639 in.
Internal Diameter-Center	66.670-66.690 mm	2.624-2.624 in.
Internal Diameter-Rear	85.985-86.005 mm	3.385-3.386 in.

LINERS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Internal Diameter	091.997-92.015 mm.	3.621-3.622 in.
Protrusion	0.00-0.05 mm	0.00-0.001 in.

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Available Adjustment Shims	0.15 mm	0.005 in.
	0.17 mm	0.006 in.
	0.20 mm	0.007 in.
	0.23 mm	0.009
	0.25 mm	0.0098

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Minimum Thickness	94.95-95.05 mm.	3.738-3.742 in.
Gasket Thickness	1.32 mm ± 0.08, 0 notches	0.0051 in. ± 0.003, 0 notches
	1.42 mm ± 0.08, 1 notch	0.051 in. ± 0.003, 1 notch
	1.52 mm ± 0.08, 2 notches	0.059 in. ± 0.003, 1 notches

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Small end Bearing Internal Diameter	32.035-32.050 mm	1.2612-1.2618 in.
Large End Internal Diameter	53.997-54.016 mm	2.125-2.126 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Skirt Diameter (measured at approximately 10 mm above the bottom of the skirt)	91.912-91.928 mm.	3.618-3.619 in.
Piston Clearance	0.065-0.83 mm	0.002-0.003 in.
Top of Piston to Cylinder Head	0.69-0.83 mm	0.027-0.032 in.

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Protrusion	0.460-0.609 mm Fit Gasket, Number (1.32mm), 0 notches or holes	0.018-0.023 in. Fit Gasket, Number (0.051 in.), 0 notches
	0.610-0.709 mm Fit Gasket, Number (1.42 mm) 1 notch or hole	0.024-0.027 in. Fit Gasket, Number (0.055 in.) 1 notch or hole
	0.710-0.810 mm Fit Gasket, Number (1.52 mm), 2 notches or holes	0.027-0.031 in. Number (0.059 in) 2 notches or holes

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Type	Full Floating	
Pin Diameter	32.004-32.008 mm 32.004-32.010 mm	1.2599-1.2601 in. 1.2599-1.2602 in.
Clearance	0.010-0.020 mm 0.004-0.012 mm	0.0001-0.0004 in. 0.0001-0.0004 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance in Groove		
Top Compression Ring	0.078-0.137 mm	0.003-0.005 in.
Second Compression Ring	0.070-0.110 mm	0.002-0.004 in.
Oil Control (Steel Rails)	0.40-0.080 mm	0.001 - 0.003 in.
Fitted Gap		

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Top Compression Ring	.030-0.45 mm	0.011-0.017 in.
Second Compression Ring	0.035 - 0.050 mm	0.0013 - 0.0019 in.
Oil Ring (Steel Ring)	.025 - 0.50 mm	.0009 - .0019 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Journal Diameter-Front	29.960-29.980 mm	1.179-1.180 in.
Bearing Clearance	0.03-0.08 mm	0.0011-0.0031 in.
Journal Diameter-Center	39.250-39.270 mm	1.545-1.546 in.
Bearing Clearance	0.03-0.08 mm	0.001-0.003 in
Journal Diameter-Rear	39.250-39.270 mm	1.545-1.546 in.
Bearing Clearance	0.03-0.08 mm	0.001-0.003 in.

HYDRAULIC LIFTER

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Outside Diameter	11.994 ± 0.006 mm	0.472 ± 0.0002 in.

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle-Intake	45° 25’-55° 35’ mm	-
Face Angle-Exhaust	45° 25’-45° 35’ mm	-
Intake Valve Opens	15.6° ± 2° A.T.D.C.	-
Intake Valve Closes	64.4° ± 2° A.B.D.C.	-

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Exhaust Valve Opens	66° ± 2° B.B.D.C.	-
Exhaust Valve Closes	32° ± 2° A.T.D.C.	-
Head Diameter-Intake	32.30-32.50 mm	1.271-1.279 in.
Head Diameter-Exhaust	30.80-31.00 mm	1.212-1.220 in.
Head Stand Down-Intake	1.08-1.34 mm	0.042-0.052 in.
Head Stand Down-Exhaust	0.99-1.25 mm	0.038-0.049 in.
Stem Diameter-Intake	5.952-5.970 mm	0.234-0.235 in.
Stem Diameter-Exhaust	5.942-5.960 mm	0.233-0.234 in.
Clearance in Guide-Intake	0.030-0.060 mm	0.001-0.002 in.
Clearance in Guide-Exhaust	0.040-0.070 mm	0.001-0.002 in.

VALVE GUIDE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Inside Diameter	6.00-6.012 mm	0.2362-0.2366 in.
Fitted Height-Intake	14.5-15.0 mm	0.570-0.590 in.
Fitted Height-Exhaust	16.5-17.0 mm	0.649-0.669 in.

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length	45.26 mm	1.781 in.
Fitted Length	38.0 mm	1.496 in.
Load at Fitted Length	182 ± 5-10% Kg	-
Load at Top of Lift	395 ± 5% Kg	-
Number of Coils	8	-

LUBRICATION

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Pressure Relief Valve Opens	6.50 bar	94 psi
Pressure Relief Valve Spring-Free Length	51.5 mm	2.02 in.

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Outer Rotor End Float	0.060-0.160 mm	0.002-0.006 in.
Inner Rotor End Float	0.060-0.160	0.002-0.006 in.
Outer Rotor to Body Diameter Clearance	0.130-0.240 mm	0.005-0.009 in.
Rotor Body to Drive Gear Clearance (pump not fitted)	0.90-1.50 mm	0.035-0.059 in.

SPECIFICATIONS - 2.8L COMMON RAIL DIESEL ENGINE

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION
Engine Type	R2816C5.05A
Transmission	ATX
Number of Cylinders	4
Bore	94 mm
Stroke	100 mm
Displacement	2776cc
Injection Order	1-3-4-2
Compression Ratio	17.5:1 (± 0.5)
Maximum Power	110kW (150 CV) @ 3800 RPM
Peak Torque	360 N·m @ 1800 RPM
Cylinder Compression (Max. Difference Between Cylinders	5 Bar
Minimum Oil Pressure (Warm)	.7 Bar @ Idle 2 Bar @ 3800 RPM

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Front Journal Diameter-Nominal	62.985-63.005 mm	2.479-2.480 in
Front Journal Diameter- minus 0.25	62.735-62.755 mm	2.469-2.470 in.
Front Bearing Diameter-Nominal	63.005-63.034 mm	2.480-2.481 in.
Front Bearing Diameter-minus 0.25	62.755-62.784 mm	2.471-2.478 in
Clearance Between the Journal and Bearing	0.00-0.049 mm	0.000-0.001 in.
Center Journal Diameter-Nominal	63.005-63.020 mm	0.001-0.003 in.
Center Journal Diameter-minus 0.25	62.775-62.770 mm	2.470-2.471
Center Bearing Diameter-Nominal	63.005-63.020 mm	2.480-2.481 in.
Center Bearing Diameter-minus 0.25	62.775-62.770 mm	2.470-2.471 in.
Clearance Between Journal and Bearing	0.008-0.051 mm	0.0003-0.0002 in
Rear Journal Diameter-Nominal	89.980-90.000 mm	3.542-3.543 in
Rear Journal Diameter- minus 0.25	89.730-99.750 mm	3.532-3.927 in.
Rear Bearing Diameter-Nominal	90.045-90.065 mm	3.545-3.546 in.
Rear Bearing Diameter- minus 0.25	89.795-89.815 mm	3.535-3.536 in.
Clearance Between Journal and Bearing	0.045-0.080 mm	0.001-0.003 in.
Connecting Rod Journal-Nominal	53.940-53.955 mm	2.123-2.124 in.
Connecting Rod Journal- minus 0.25	53.690-53.705 mm	2.113-2.114 in.
Connecting Rod Bearing-Nominal	53.997-54.016 mm	2.125-2.126 in.
Connecting Rod Bearing- minus 0.25	53.727-53.766 mm	2.115-2.116 in.
Clearance Between Journal and Bearing	0.022-0.076 mm	0.0008-0.0029 in.
Crankshaft End Play	0.080-0.280 mm	0.003-0.011 in.
Adjustment	Thrust Washers	Thrust Washers
Thrust Washers Available	2.31-2.36 mm	0.090-0.092 in.
	2.41-2.46 mm	0.094-0.096 in.
	2.51-2.56 mm	0.098-0.100
Carrier with Thrush Washers Installed	27.670-27.820 mm	1.089-1.095 in.

MAIL BEARING CARRIERS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Internal Diameter-Front	67.025-67.050 mm	2.638-2.639 in.
Internal Diameter-Center	66.670-66.690 mm	2.624-2.624 in.
Internal Diameter-Rear	85.985-86.005 mm	3.385-3.386 in.

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

LINERS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Internal Diameter	091.997-92.015 mm.	3.621-3.622 in.
Protrusion	0.00-0.05 mm	0.00-0.001 in.
Available Adjustment Shims	0.15 mm	0.005 in.
	0.17 mm	0.006 in.
	0.20 mm	0.007 in.
	0.23 mm	0.009
	0.25 mm	0.0098

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Minimum Thickness	94.95-95.05 mm.	3.738-3.742 in.
Gasket Thickness	1.32 mm ± 0.08, 0 notches	0.0051 in. ± 0.003, 0 notches
	1.42 mm ± 0.08, 1 notch	0.051 in. ± 0.003, 1 notch
	1.52 mm ± 0.08, 2 notches	0.059 in. ± 0.003, 1 notches

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Small end Bearing Internal Diameter	32.035-32.050 mm	1.2612-1.2618 in.
Large End Internal Diameter	53.997-54.016 mm	2.125-2.126 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Skirt Diameter (measured at approximately 10 mm above the bottom of the skirt)	93.912-93.928 mm.	3.6973-3.6979 in.
Piston Clearance	0.010-0.22 mm	0.0003-0.0008 in.
Top of Piston to Cylinder Head	0.69-0.83 mm	0.027-0.032 in.
Piston Protrusion	0.460-0.609 mm Fit Gasket, Number (1.32mm), 0 notches or holes	0.018-0.023 in. Fit Gasket, Number (0.051 in.), 0 notches
	0.610-0.709 Fit Gasket, Number (1.42 mm) 1 notch or hole	0.024-0.027 in. Fit Gasket, Number (0.055 in.) 1 notch or hole
	0.710-0.810 Fit Gasket, Number (1.52 mm), 2 notches or holes	0.027-0.031 in. Number (0.059 in) 2 notches or holes

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Type	Full Floating	
Pin Diameter	32.004-32.010 mm	1.259-1.260 in.
Clearance	0.010-0.020 mm	0.0003-0.0007 in.

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance in Groove		
Top Compression Ring	0.078-0.137 mm	0.003-0.005 in.
Second Compression Ring	0.070-0.110 mm	0.002-0.004 in.
Oil Control (Steel Rails)	0.40-0.080 mm	0.001 - 0.003 in.
Fitted Gap		
Top Compression Ring	.030-0.45 mm	0.011-0.017 in.
Second Compression Ring	0.030 - 0.050 mm	0.0011 - 0.0019 in.
Oil Ring (Steel Ring)	.025 - 0.50 mm	.0009 - .0019 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Journal Diameter-Front	29.960-29.980 mm	1.179-1.180 in.
Bearing Clearance	0.03-0.08 mm	0.001-0.003 in.
Journal Diameter-Center	39.250-39.270 mm	1.545-1.546 in.
Bearing Clearance	0.03-0.08 mm	0.001-0.003 in
Journal Diameter-Rear	39.250-39.270 mm	1.545-1.546 in.
Bearing Clearance	0.03-0.08 mm	0.001-0.003 in.
Camshaft End Play	0.10-0.55mm	0.004-0.021 in.

HYDRAULIC LIFTER

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Outside Diameter	11.994 ± 0.006 mm	0.472 ± 0.0002 in.

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle-Intake	45° 25'-55° 35' mm	-
Face Angle-Exhaust	45° 25'-45° 35' mm	-
Intake Valve Opens	15.6° ± 2° A.T.D.C.	-
Intake Valve Closes	64.4° ± 2° A.B.D.C.	-
Exhaust Valve Opens	66° ± 2° B.B.D.C.	-
Exhaust Valve Closes	32° ± 2° A.T.D.C.	-
Head Diameter-Intake	32.30-32.50 mm	1.271-1.279 in.
Head Diameter-Exhaust	30.80-31.00 mm	1.212-1.220 in.
Head Stand Down-Intake	1.08-1.34 mm	0.042-0.052 in.
Head Stand Down-Exhaust	0.99-1.25 mm	0.038-0.049 in.
Stem Diameter-Intake	5.952-5.970 mm	0.234-0.235 in.
Stem Diameter-Exhaust	5.942-5.960 mm	0.233-0.234 in.
Clearance in Guide-Intake	0.030-0.060 mm	0.001-0.002 in.
Clearance in Guide-Exhaust	0.040-0.070 mm	0.001-0.002 in.

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

VALVE GUIDE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Inside Diameter	6.00-6.012 mm	0.2362-0.2366 in.
Fitted Height-Intake	14.5-15.0 mm	0.570-0.590 in.
Fitted Height-Exhaust	16.5-17.0 mm	0.649-0.669 in.

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length	45.26 mm	1.781 in.
Fitted Length	38.0 mm	1.496 in.
Load at Fitted Length	182 ± 5-10% Kg	-
Load at Top of Lift	395 ± 5% Kg	-
Number of Coils	8	-

LUBRICATION

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Pressure Relief Valve Opens	6.50 bar	94 psi
Pressure Relief Valve Spring-Free Length	51.5 mm	2.02 in.

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Outer Rotor End Float	0.060-0.160 mm	0.002-0.006 in.
Inner Rotor End Float	0.060-0.160	0.002-0.006 in.
Outer Rotor to Body Diameter Clearance	0.130-0.240 mm	0.005-0.009 in.
Rotor Body to Drive Gear Clearance (pump not fitted)	0.90-1.50 mm	0.035-0.059 in.

SPECIFICATIONS - TORQUE

2.5L/2.8L DIESEL TORQUE SPECIFICATIONS

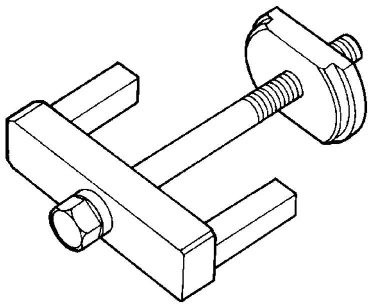
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Oil Pump Bolts	10.8	8	96
Vacuum Pump Bolts	10.8	8	96
Crankshaft Gear Bolts	10.8	8	96
Crankshaft Position Sensor Bolts	10.8	8	96
Flywheel Bolts - 2.5L, Refer to the Service Procedure			
Flex Plate Bolts - 2.8L, Refer to the Service Procedure			
Cylinder Head Bolts - Refer to the Service Procedure			
Reluctor Wheel Bolts	14.6	11	130
Rear Main Bearing Support Bolts	27.5	21	240
Oil Cooler to Engine Block Bolt	38	28	—
Water Pump Housing Nuts	24.4	18	212
Connecting Rod Bolts - Refer to the Service Procedure			
Balance Shaft Bolts	32.4	24	—
Oil Jet Bolts	10.8	8	96
Oil Pan Bolts	11.8	8	96
Crankshaft Hub Bolt	275	202	—

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Front Engine Cover Bolts	11.8	8	96
Transmission to Engine Bolts	83.4	62	—
Cylinder Head Cover / Intake Manifold Bolts	27.5	20	—
Camshaft Access Plugs	80	59	—
Oil Separator Bolts	10.8	8	96
Camshaft Position Sensor Bolt	10.8	8	96
Boost Pressure / Intake Air Temp. Sensor Bolts	5.4	—	48
Accessory Drive Bracket Bolts	47.1	35	—
Vacuum Line Fitting Bolt	56.9	42	—
Rail Pressure Sensor	35	26	—
Fuel Pump Nuts	27.5	21	—
Fuel Line Fittings at Pump	27.5	21	—
Inner Timing Belt Cover Bolts			
8mm	10.8	8	96
10mm	47.1	35	—
Outer Timing Belt Cover Bolts			
3mm	6	—	54
8mm	10.8	8	96
Engine Mount Bracket to Cylinder Head Bolts	47.1	35	—
Intake Inlet Tube Bolts	10.1	8	89
Camshaft Sprocket Bolts	108	80	—
Timing Belt Idler Pulley Bolt	47.1	35	—
Timing Belt Tensioner Bolt	34.7	26	—
Fuel Pump Nut	88.3	65	—
Engine Lift Hook Bolts	32.4	24	—
Thermostat Housing Bolts	27.5	21	—
Turbocharger Oil Feed Line Fitting	24.5	18	217
Exhaust Manifold Nuts (Must recheck each nut after tightening sequence is completed)	36	26.5	—
Exhaust Manifold Heatshield Bolts	27.5	21	—
EGR Valve Nuts	32.4	24	—
EGR Pipe to EGR Bolts	32.4	24	—
Turbocharger Downpipe Nuts	32.4	24	—
Turbocharger Bracket Bolts	47.1	35	—
Vibration Damper to Crankshaft Hub Bolts	27.5	21	—
Crankshaft Support Bolts	44.1	33	—
Turbocharger to Exhaust Manifold Nuts	32.4	24	—

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)

SPECIAL TOOLS



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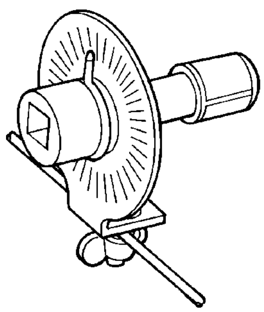
VM.1001 CYLINDER LINER PULLER



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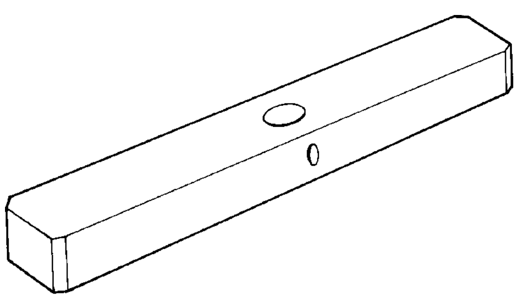
VM.1005 TORQUE ANGLE GAUGE



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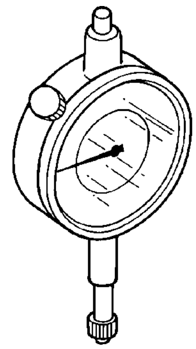
VM.1010 CYLINDER LINER PROTRUSION TOOL



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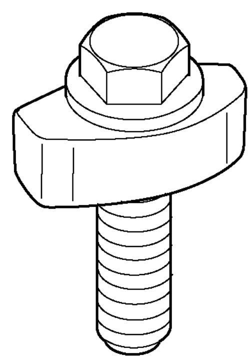
VM.1013 DIAL INDICATOR



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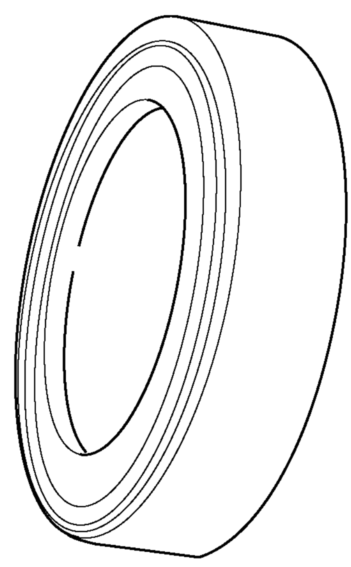
VM.1076 CYLINDER RETAINER



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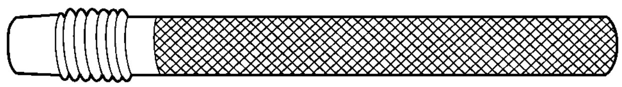
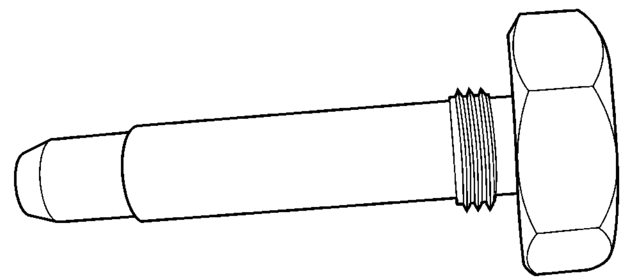
VM.1050 CRANKSHAFT REAR SEAL INSTALLER

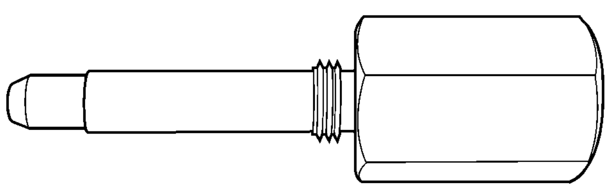
ENGINE 2.5L/2.8 TURBO DIESEL (Continued)



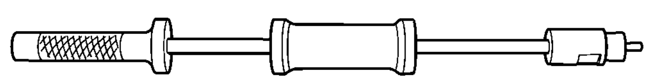
VM.1051 2.5L-TDC ALIGNMENT PIN



VM.1053 EXHAUST CAMSHAFT ALIGNMENT PIN

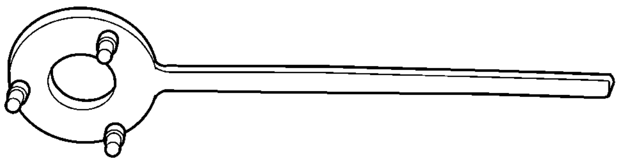


VM.1052 INTAKE CAMSHAFT ALIGNMENT PIN



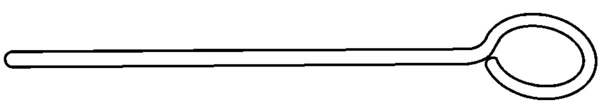
VM.1054 RELIEF VALVE REMOVER/CENTRAL CARRIER PIN REMOVER/INSTALLER

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)



80c13cec

VM.1055 CAMSHAFT/HIGH PRESSURE INJECTION PUMP GEAR HOLDER



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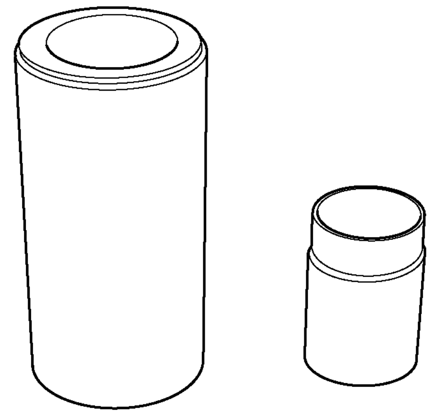
VM.1056 BALANCE SHAFT LOCKING PIN



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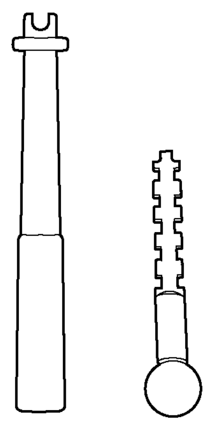
VM.1057 CAMSHAFT OIL SEAL INSTALLER



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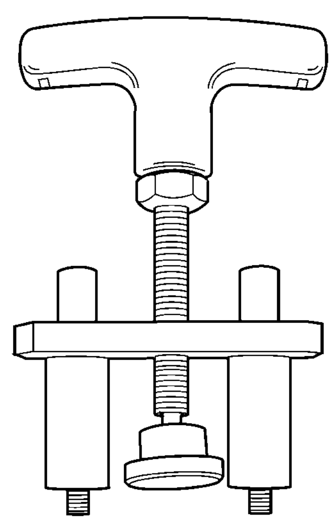
VM.1058 CAMSHAFT OIL SEAL REMOVER



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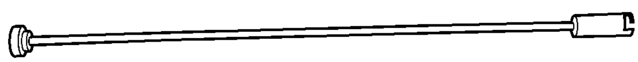
VM.1059 OIL PRESSURE RELIEF VALVE INSTALLER

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)



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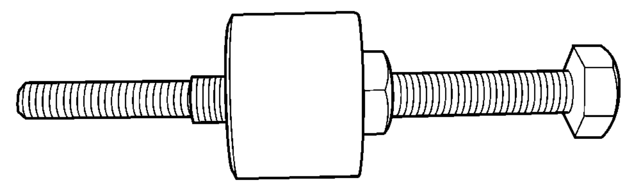
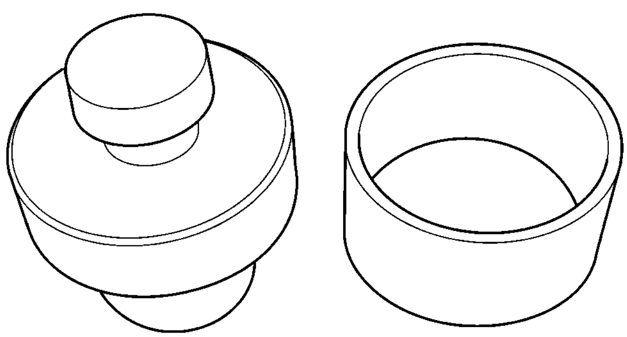
VM.1060 OIL JET REMOVER /INSTALLER



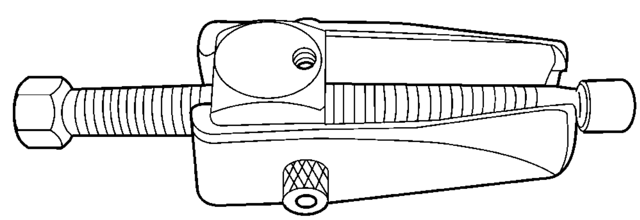
80c17ba4

VM.1062 POWER STEERING PUMP INSTALLER



80c17810

VM.1061 FRONT COVER AND FRONT OIL SEAL INSTALLER



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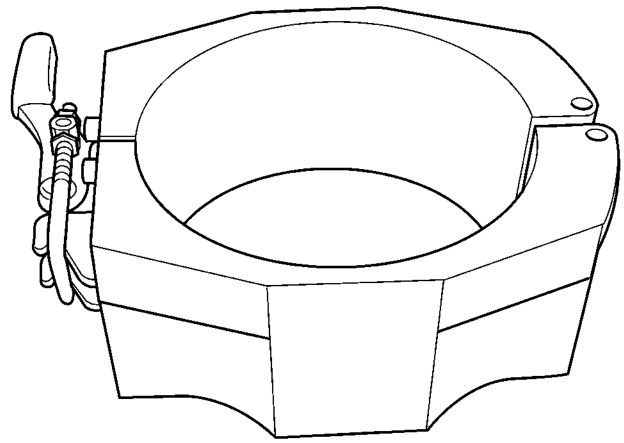
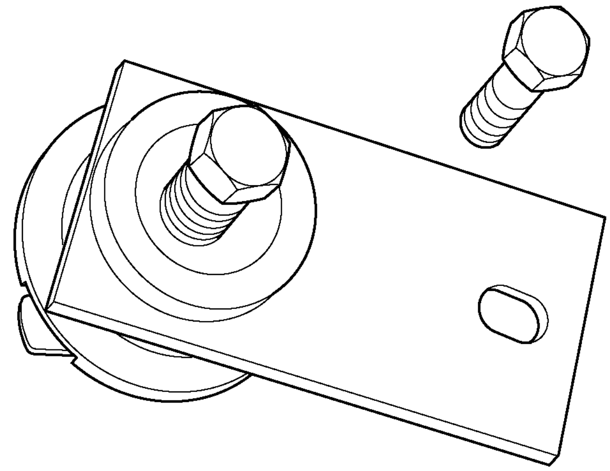
VM.1064 POWER STEERING PUMP GEAR REMOVER

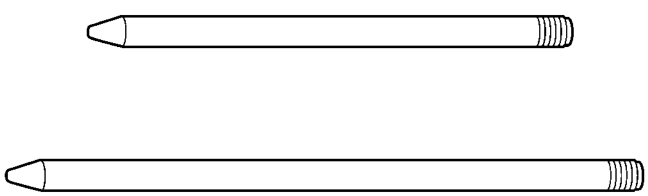
ENGINE 2.5L/2.8 TURBO DIESEL (Continued)



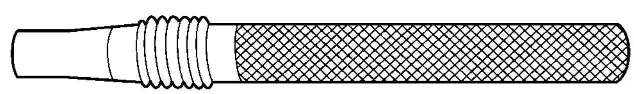
VM.1065 2.5L PISTON RING COMPRESSOR



VM.1067 HIGH PRESSURE PUMP REMOVER

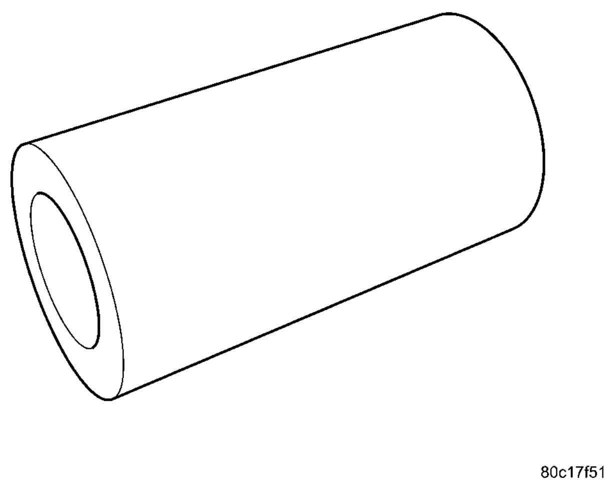


VM.1066 VALVE COVER ALIGNMENT PINS

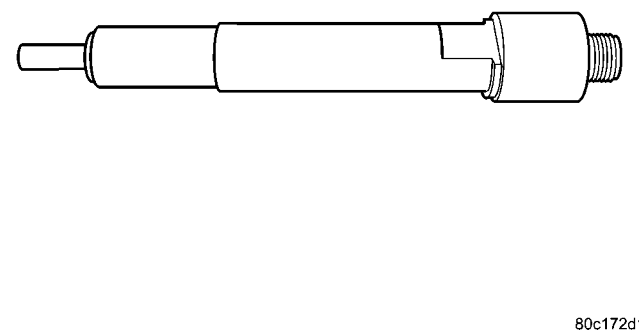


VM.1068 90 DEGREES AFTER TDC ALIGNMENT PIN

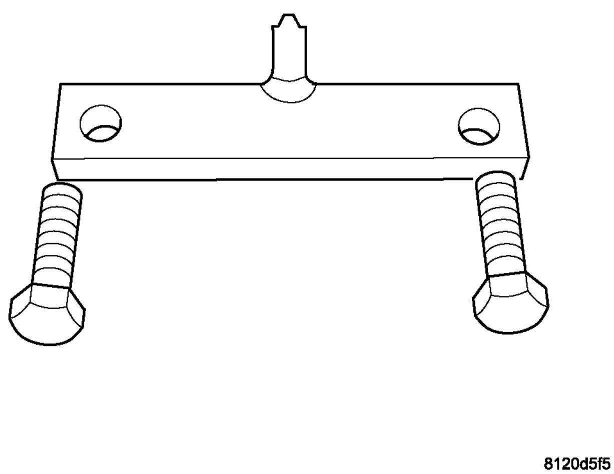
ENGINE 2.5L/2.8 TURBO DIESEL (Continued)



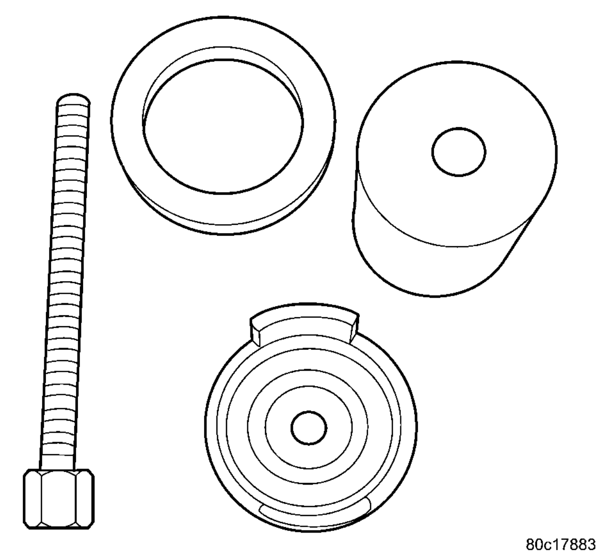
VM.1069 CRANKSHAFT REM/INSTALL SLEEVE



VM.1072 COMPRESSION TESTER ADAPTER

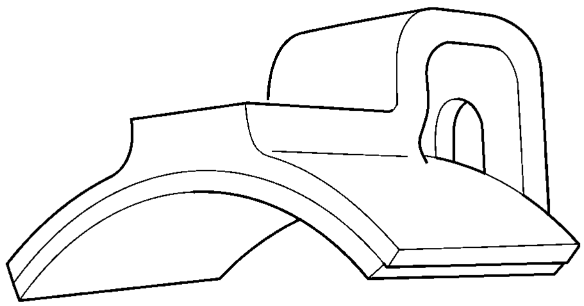


VM.1070 FLYWHEEL LOCKING TOOL



VM.1073 CRANKSHAFT FRONT BEARING REMOVER/INSTALLER

ENGINE 2.5L/2.8 TURBO DIESEL (Continued)



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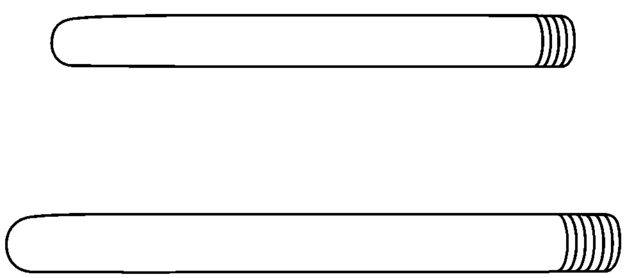
VM.1074 TIMING BELT RETAINER



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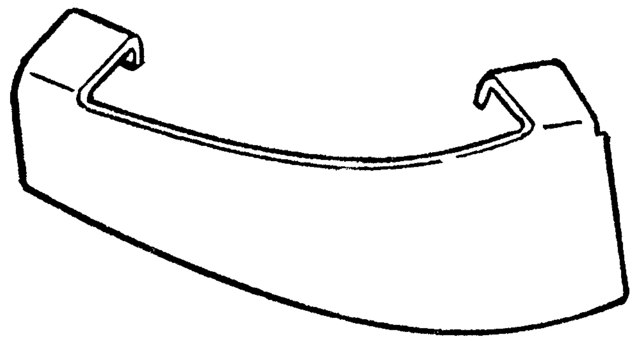
VM.1075 FLYWHEEL ALIGNMENT PINS



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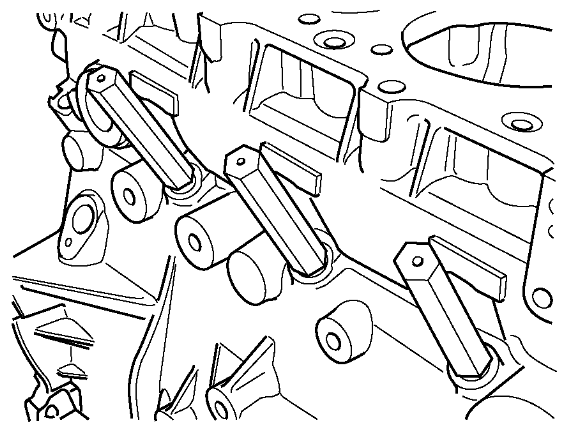
VM.1077 POWER STEERING BELT REMOVER



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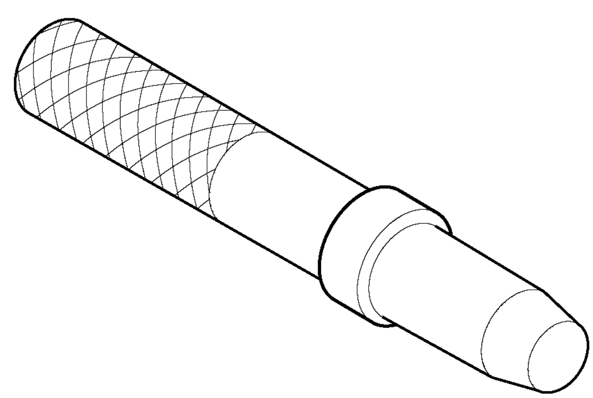
VM.1079 CENTRAL CARRIER ALIGNMENT PINS



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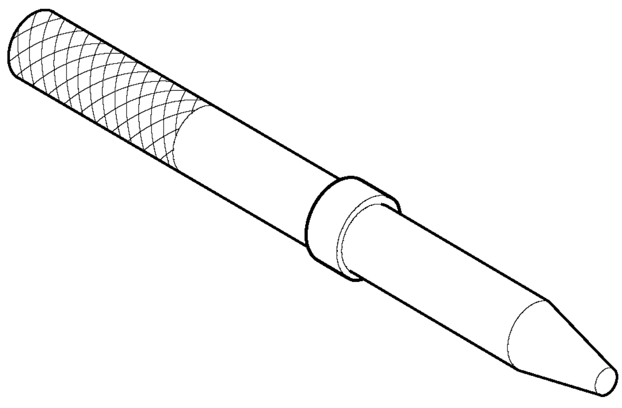
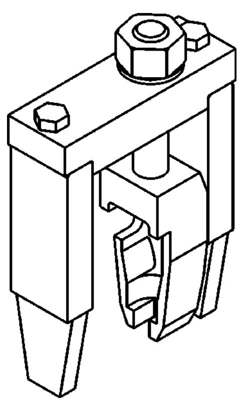
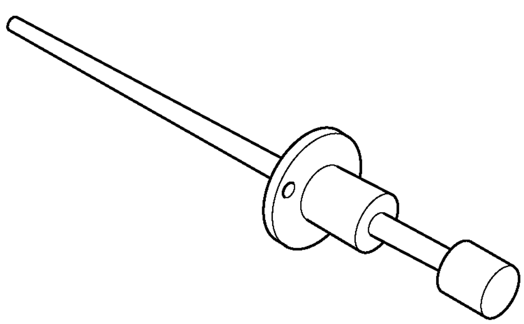
VM.1083 2.8L-TDC LOCATING PIN



VM.1084 2.8L 90 DEGREES AFTER TDC LOCATING PIN



VM.9075 FUEL INJECTOR EXTRACTOR



VM.9095 CRANKSHAFT SUPPORT RETAINER

AIR CLEANER HOUSING

REMOVAL

(1) Disconnect the negative battery cable.

(2) Disconnect the air inlet hose from the air cleaner housing cover (Fig. 11).

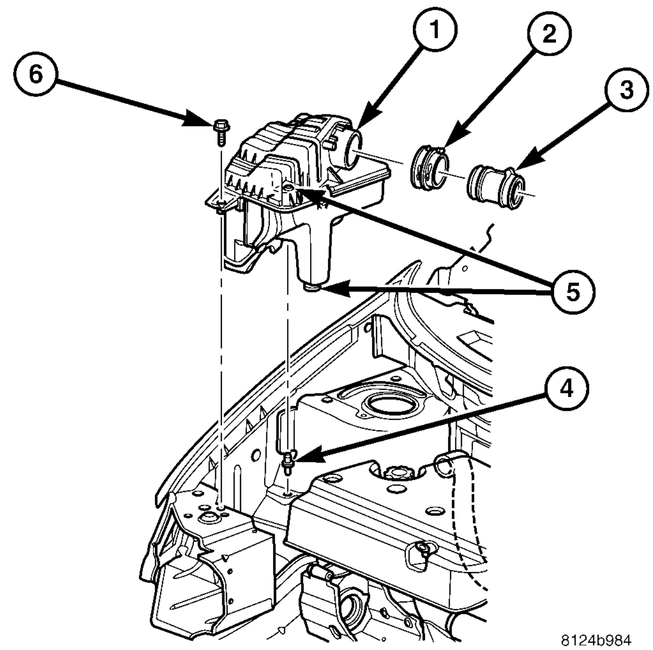


Fig. 11 AIR CLEANER HOUSING

1 - AIR CLEANER HOUSING
2 - AIR DUCT
3 - MASS AIR FLOW SENSOR
4 - LOCATING PIN
5 - LOCATING RINGS
6 - BOLT

(3) Remove the air duct from the air cleaner housing cover.

(4) Remove the bolt for air cleaner housing at upper radiator cross member.

(5) Pull air cleaner housing up and off over the locating pins.

(6) Remove housing from vehicle.

INSTALLATION

(1) Install air cleaner housing into vehicle and onto the locating pins (Fig. 11).

(2) Install bolt to hold housing to the upper radiator cross member.

(3) Install the air inlet duct to the housing.

(4) Connect the air inlet hose to the housing.

(5) Connect the negative battery cable.

CYLINDER HEAD

STANDARD PROCEDURE

STANDARD PROCEDURE - VALVE SERVICE

This procedure is done with the engine cylinder head removed from the block.

DISASSEMBLY

(1) Remove the engine cylinder head from the cylinder block. Refer to cylinder head removal and installation in this section.

(2) Use Valve Spring Compressor Tool and compress each valve spring.

(3) Remove the valve locks, retainers, and springs.

(4) Inspect and remove any burrs on the top of the valve stem, especially around the groove for the locks.

(5) Remove the valves, and place them in a rack in the same order as removed.

VALVE CLEANING

(1) Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

(2) Clean all build-up and gasket material from the engine cylinder head machined gasket surface.

INSPECTION

(1) Inspect for cracks in the combustion chambers and valve ports.

(2) Inspect for cracks on the exhaust seat.

(3) Inspect for cracks in the gasket surface at each coolant passage.

(4) Inspect valves for burned, cracked or warped heads.

(5) Inspect for scuffed or bent valve stems.

(6) Replace valves displaying any damage.

(7) Check valve spring height.

VALVE REFACING

(1) Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

(2) After refacing, a margin of at least 4.52-4.49 mm (.178-.177 inch) must remain (Fig. 12). If the margin is less than 4.49 mm (.177 inch), the valve must be replaced.

VALVE SEAT REFACING

(1) Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.

(2) Use tapered stones to obtain the specified seat width when required.

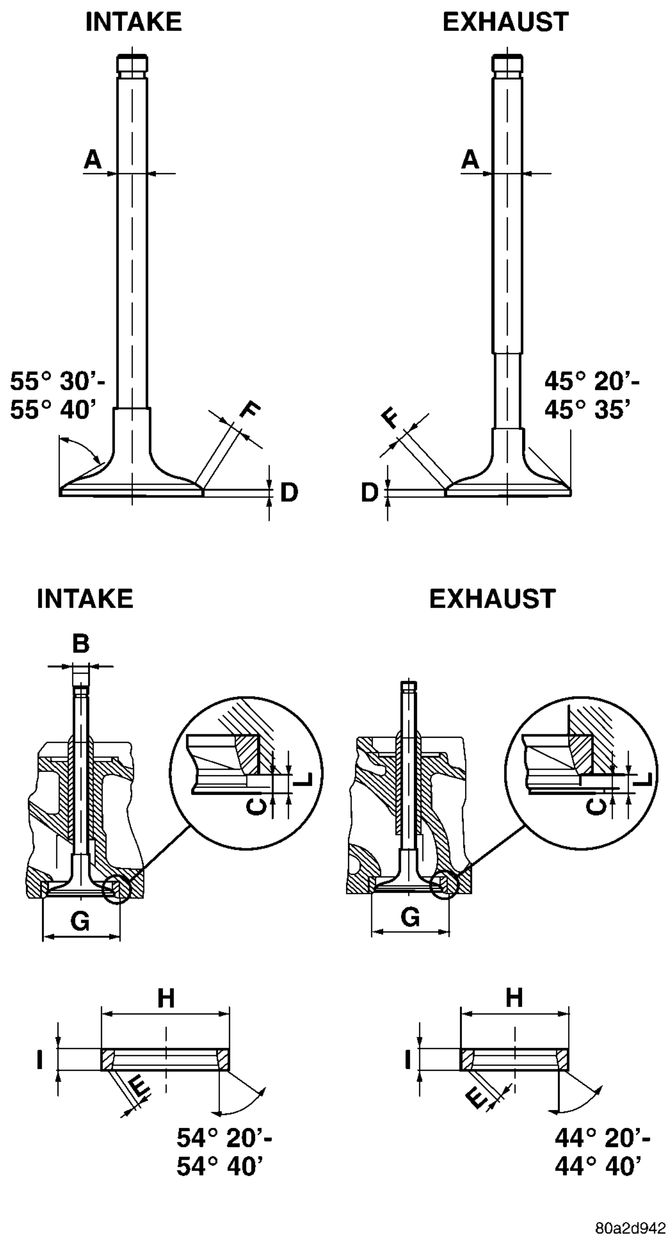


Fig. 12 VALVE SPECS.

MEASUREMENT	INTAKE	EXHAUST
A	7.940-7.960	7.922-7.940
B	8.00-8.015	8.000-8.015
C	1.08-1.34	0.990-1.250
		+0.07
D	2.2 ± 0.08	2.09
		−0.09
E	1.80-2.20	1.65-2.05
F	2.73-3.44	2.45-3.02
G	41.962-41.985	35.964-35.987
H	42.070-42.086	36.050-36.066
I	7.14-7.19	7.00-7.05
L	3.11-3.26	3.10-3.25

CYLINDER HEAD (Continued)

VALVE STAND DOWN

Valve stand down is to maintain the adequate compression ratio.

(1) Invert cylinder head.

(2) Fit each valve to its respective valve guide.

(3) Using a straight edge and feeler gauge, check valve head stand down: Inlet valve head stand down 1.08 to 1.34 mm (.042 to .052 ins.) and exhaust valve stand down .99 to 1.25 mm (.035 to .049 ins.).

(4) If valve head stand down is not in accordance with above, discard original valves, check stand down with new valves and recut valve seat inserts to obtain correct stand down.

VALVE GUIDES

(1) Valve Guides height requirement.

(2) Measurement A (Fig. 13): 16.50 - 17.00 mm. Measurment B : 14.50 - 15.00 mm.

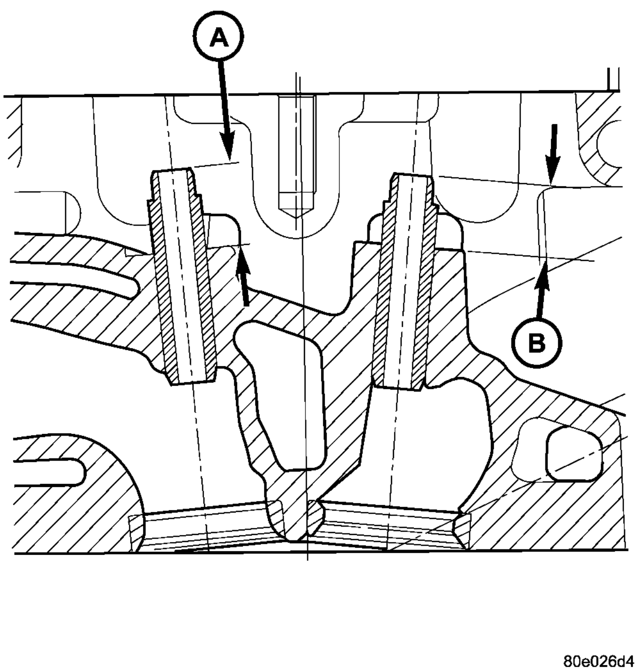


Fig. 13 VALVE GUIDE HEIGHT

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

(1) Measure and record internal diameter of valve guides. Valve guide internal diameter is 8.0 to 8.015 mm (.3149 to .3155 ins.).

(2) Measure valve stems and record diameters. Intake valve stem diameter 7.94 to 7.96 mm (.3125 to .3133 in). Exhaust valve stem diameter 7.92 to 7.94 mm (.3118 to .31215 in).

(3) Subtract diameter of valve stem from internal diameter of its respective valve guide to obtain valve stem clearance in valve guide. Clearance of inlet valve stem in valve guide is .040 to .075 mm (.0015 to .0029 in). Clearance of exhaust valve stem in valve guide is .060 to .093 mm (.0023 to .0036 in).

(4) If valve stem clearance in valve guide exceeds tolerances, new valve guides must be installed.

STANDARD PROCEDURE - MEASURING PISTON PROTRUSION

(1) Use special tool VM.1010 with dial indicator special tool VM.1013 (Fig. 14).

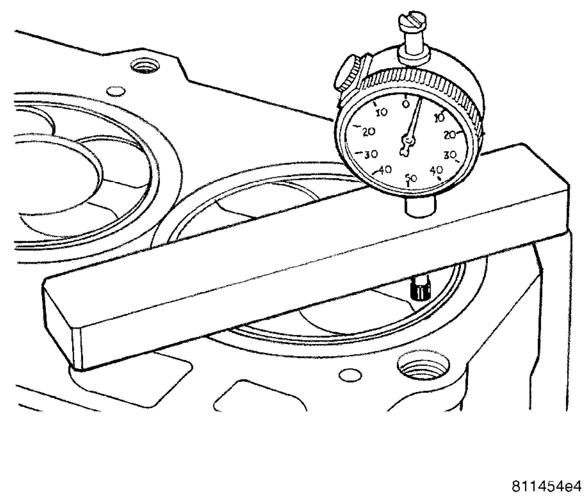


Fig. 14 PISTON PROTRUSION

(2) Bring the piston of cylinder no. 1 exactly to top dead center.

(3) Zero the dial indicator on the cylinder block mating surface.

(4) Setup the dial indicator on the piston crown (above the center of the piston pin) 5mm (1/8 in.) from the edge of the piston and note the measurement (Fig. 14).

(5) Repeat the procedure with the rest of the cylinders.

(6) Establish the thickness of the steel gasket by averaging the four piston potrusion readings.

CYLINDER HEAD (Continued)

Measure Dimension (mm)	0.460-0.609
Cylinder Head Gasket Thickness (mm)	1.32 No Holes or Notches
Piston Clearance (mm)	0.71-0.86
Measure Dimension (mm)	0.610-0.709
Cylinder Head Gasket Thickness (mm)	1.42 1 Hole or Notch
Piston Clearance (mm)	0.711-0.81
Measure Dimension (mm)	0.710-0.810
Cylinder Head Gasket Thickness (mm)	1.52 2 Holes or Notches
Piston Clearance (mm)	0.71-0.81

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(4) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(7) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).

(8) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

CAUTION: Before removing the cylinder head cover/intake manifold or timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(9) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(10) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(11) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(12) Remove cylinder head cover/intake manifold (Fig. 15)(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

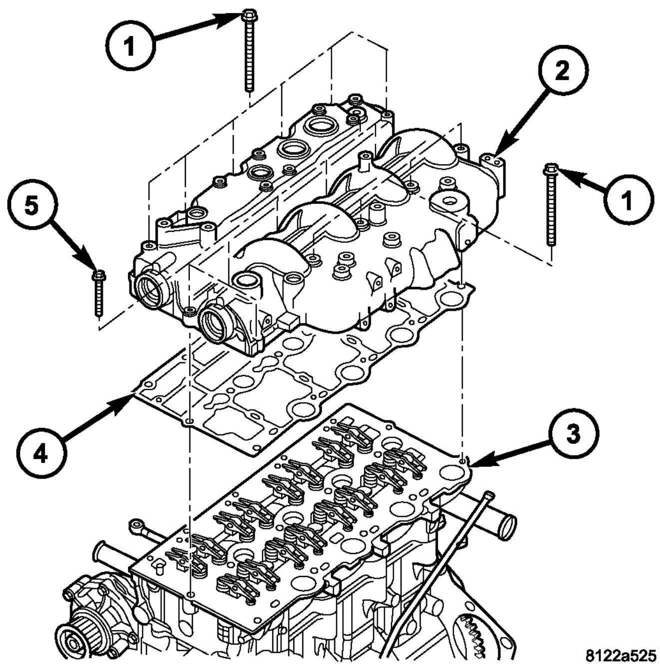


Fig. 15 CYLINDER HEADCOVER/INTAKE MANIFOLD ASSEMBLY

1 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(LONG)
2 - CYLINDER HEAD COVER/INTAKE MANIFOLD
3 - CYLINDER HEAD
4 - CYLINDER HEAD COVER/INTAKE MANIFOLD GASKET
5 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(SHORT)

(13) Remove rocker arm and lifter assemblies from cylinder head.

(14) Remove cylinder head cover/intake manifold gasket from cylinder head (Fig. 15).

(15) Disconnect glow plug and engine coolant temperature electrical connectors.

CYLINDER HEAD (Continued)

(16) Remove coolant recovery pressure container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - REMOVAL).

(17) Remove thermostat housing to upper radiator hose pipe (Fig. 16).

(18) Remove turbocharger outlet to charge air cooler pipe (Fig. 16).

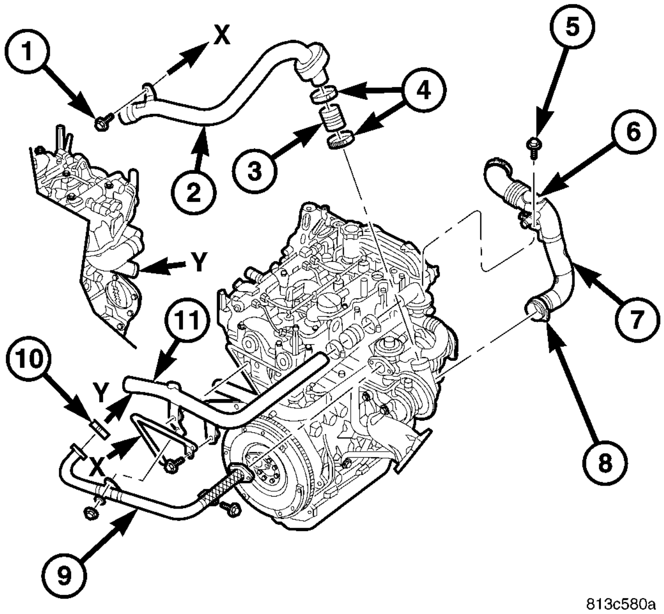


Fig. 16 TURBOCHARGER AND COOLANT PIPES

1 - TURBOCHARGER OUTLET PIPE RETAINING BOLT
2 - TURBOCHARGER OUTLET PIPE
3 - ADAPTOR HOSE
4 - HOSE CLAMPS
5 - TURBOCHARGER INLET PIPE RETAINING BOLT
6 - TURBOCHARGER INLET PIPE
7 - ADAPTOR HOSE
8 - HOSE CLAMPS
9 - EGR VALVE TO INTAKE AIR INLET PIPE
10 - CLAMP
11 - THERMOSTAT HOUSING TO UPPER RADIATOR HOSE PIPE

(19) Remove exhaust manifold heat shield (Fig. 17).

(20) Remove exhaust manifold retaining nuts (Fig. 17).

(21) Slide exhaust manifold and turbocharger off of exhaust manifold studs (Fig. 17).

(22) Remove cylinder head bolts.

(23) Remove cylinder head assembly from engine block (Fig. 18).

CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and exhaust manifold and engine cylinder head mating surfaces. Remove all gasket material and carbon.

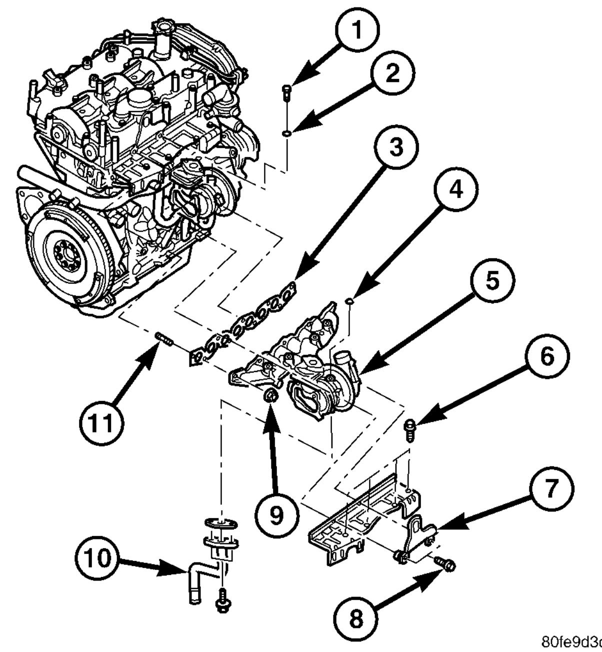


Fig. 17 EXHAUST MANIFOLD AND TURBOCHARGER

1 - TURBOCHARGER OIL SUPPLY BANJO BOLT
2 - COPPER WASHER
3 - EXHAUST MANIFOLD GASKET
4 - COPPER WASHER
5 - TURBOCHARGER
6 - HEAT SHIELD RETAINING BOLT
7 - ENGINE LIFT HOOK
8 - LIFT HOOK RETAINING BOLT
9 - EXHAUST MANIFOLD RETAINING NUT
10 - TURBOCHARGER RETURN HOSE
11 - EXHAUST MANIFOLD STUD

Check to ensure that no coolant or foreign material has fallen into the tappet bore area.

Remove the carbon deposits from the combustion chambers and top of the pistons.

INSPECTION

Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and block mating surfaces.

The minimum cylinder head thickness is 89.95mm (3.541 in.).

INSTALLATION

CAUTION: Piston protrusion must be measured to determine cylinder head gasket thickness if one or more cylinder liners have been replaced (Refer to 9 - ENGINE/CYLINDER HEAD - STANDARD PROCEDURE).

CYLINDER HEAD (Continued)

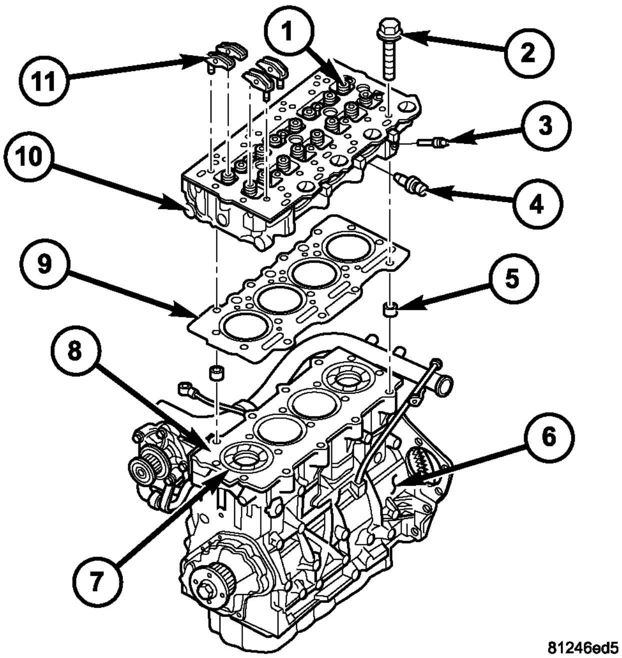


Fig. 18 CYLINDER HEAD ASSEMBLY

1 - VALVE SPRING
2 - CYLINDER HEAD BOLT
3 - GLOW PLUG
4 - COOLANT TEMPERATURE SENSOR
5 - CYLINDER HEAD ALIGNMENT DOWEL
6 - CYLINDER BLOCK
7 - CYLINDER LINER
8 - ENGINE BLOCK DECK
9 - CYLINDER HEAD GASKET
10 - CYLINDER HEAD
11 - ROCKER ARM AND LIFTER ASSEMBLY

NOTE: If cylinder liner(s) have not been removed, the same thickness head gasket that was removed can be used.

(1) Clean and inspect gasket mating surfaces.
(2) Position correct head gasket on engine block.
(3) Place cylinder head on engine block (Fig. 18).

CAUTION: New cylinder head bolts must be used.

(4) Tighten cylinder head bolts following procedure below:

• Lubricate the new cylinder head bolts with engine oil.
• Torque bolts to 30N·m in numerical starting with bolt #1 (Fig. 19).
• Tighten all bolts an additional 75°, starting with bolt #4 then 5-6-7-8-9-10-1-2-3 (Fig. 19).
• Tighten all bolts an additional 50° in numerical order starting with bolt #11 then 12-13-14-15-16-17-18 (Fig. 19).
• Without loosening any bolts tighten all bolts an additional 75° in the following sequence: 4-5-6-7-8-9-10-1-2-3-11-12-13-14-15-16-17-18.

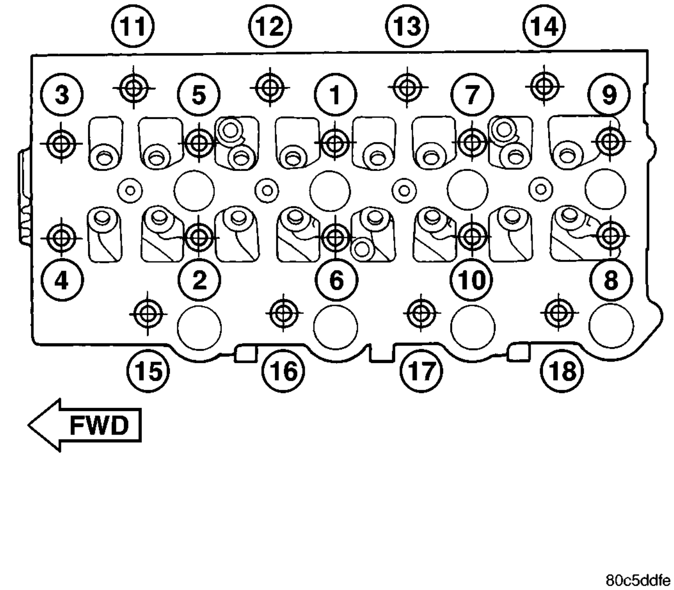


Fig. 19 CYLINDER HEAD TORQUE SEQUENCE

(5) Slide exhaust manifold and turbocharger on exhaust manifold studs (Fig. 20).
(6) Install exhaust manifold retaining nuts. Torque nuts to 32.4N·m.
(7) Install exhaust manifold heat shield (Fig. 20). Torque bolts to 27.5N·m.
(8) Install turbocharger outlet to charge air cooler pipe (Fig. 21).
(9) Install thermostat housing to upper radiator hose pipe (Fig. 21). Install retaining bolt and torque to 47.1N·m.
(10) Install coolant recovery pressure container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - INSTALLATION).
(11) Connect glow plug and coolant temperature sensor electrical connectors.
(12) Install new cylinder head cover/intake manifold gasket.
(13) Install rocker arm and lifter assemblies.**Be sure to put rocker arm and lifter assemblies in same location as removed.**
(14) Install cylinder head cover/intake manifold (Fig. 15)(Refer to 9 - ENGINE/CYLINDER HEAD/ CYLINDER HEAD COVER(S) - INSTALLATION).
(15) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
(16) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
(17) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

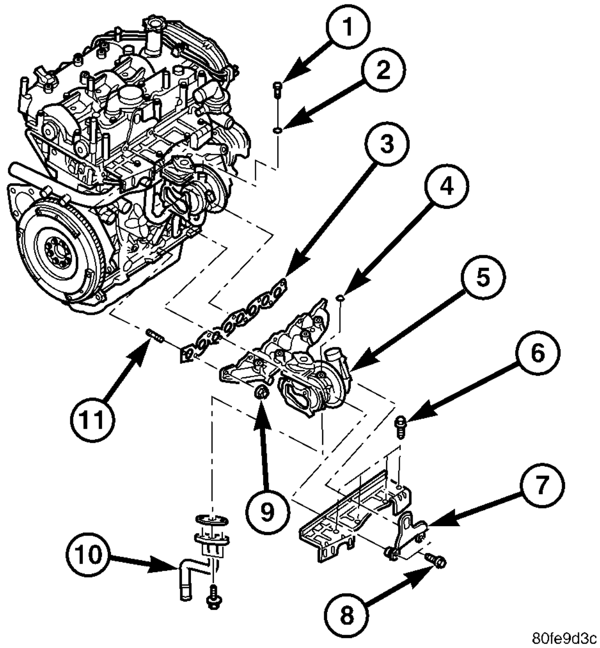


Fig. 20 EXHAUST MANIFOLD AND TURBOCHARGER

1 - TURBOCHARGER OIL SUPPLY BANJO BOLT
2 - COPPER WASHER
3 - EXHAUST MANIFOLD GASKET
4 - COPPER WASHER
5 - TURBOCHARGER
6 - HEAT SHIELD RETAINING BOLT
7 - ENGINE LIFT HOOK
8 - LIFT HOOK RETAINING BOLT
9 - EXHAUST MANIFOLD RETAINING NUT
10 - TURBOCHARGER RETURN HOSE
11 - EXHAUST MANIFOLD STUD

(18) **Remove crankshaft and both camshaft locking pins at this time** (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE) .

(19) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(20) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(21) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(22) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(23) Install air cleaner housing assembly.

(24) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(25) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(26) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(27) Connect negative battery cable.

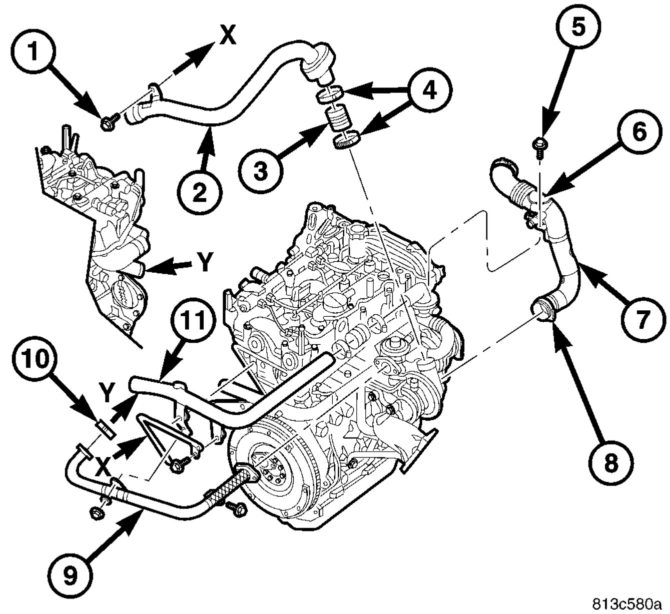


Fig. 21 TURBOCHARGER AND COOLANT PIPES

1 - TURBOCHARGER OUTLET PIPE RETAINING BOLT
2 - TURBOCHARGER OUTLET PIPE
3 - ADAPTOR HOSE
4 - HOSE CLAMPS
5 - TURBOCHARGER INLET PIPE RETAINING BOLT
6 - TURBOCHARGER INLET PIPE
7 - ADAPTOR HOSE
8 - HOSE CLAMPS
9 - EGR VALVE TO INTAKE AIR INLET PIPE
10 - CLAMP
11 - THERMOSTAT HOUSING TO UPPER RADIATOR HOSE PIPE

CAMSHAFT(S)

DESCRIPTION

The camshafts are made of gray cast iron with eight machined lobes and four bearing journals (Fig. 22).

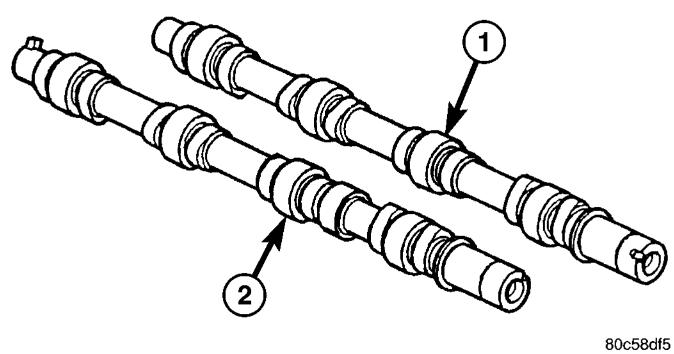


Fig. 22 CAMSHAFTS

1 - INTAKE CAMSHAFT
2 - EXHAUST CAMSHAFT

CAMSHAFT(S) (Continued)

OPERATION

When the camshaft rotates the lobes actuate the hydraulic lifters and rocker arms, forcing downward on the rocker arms which opens the valves.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(4) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(5) Remove air cleaner housing.

(6) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(7) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(8) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).

(9) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

CAUTION: Before removing the cylinder head cover/intake manifold or timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(10) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(11) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(12) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(13) Remove cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(14) With cylinder head cover/intake manifold on work bench, remove plugs at rear of cylinder head cover/intake manifold.

(15) Remove camshaft oil seals (Fig. 23).

(16) Remove snapring and thrust washer from camshaft (Fig. 23).

(17) Slide camshaft through access hole at rear of cylinder head cover/intake manifold.

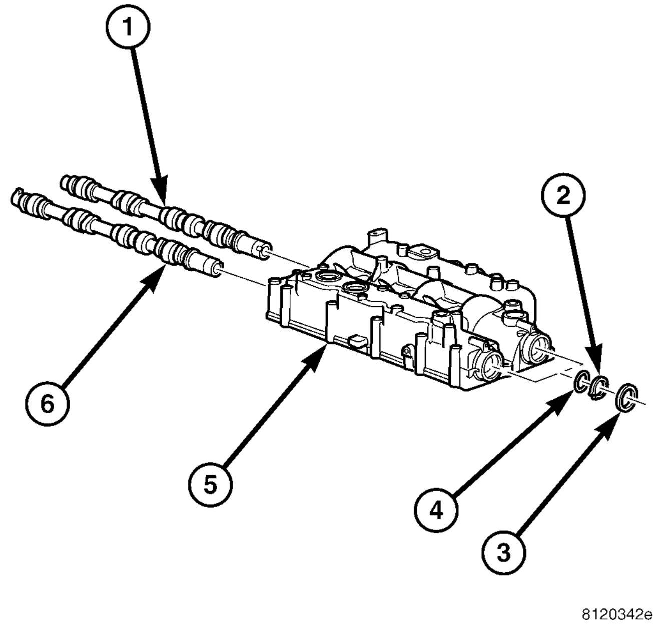


Fig. 23 CAMSHAFT ASSEMBLY

1 - INTAKE CAMSHAFT
2 - SNAPRING
3 - CAMSHAFT OIL SEAL
4 - THRUST WASHER
5 - CYLINDER HEAD COVER/INTAKE MANIFOLD
6 - EXHAUST MANIFOLD

INSTALLATION

(1) Lubricate the camshafts with Mopar® Engine Oil Supplement, or equivalent.

(2) Carefully install camshafts into access holes in rear of cylinder head cover/intake manifold.

(3) Install thrust washer, snap ring, and camshaft oil seal (Fig. 23).

(4) After camshafts are properly installed in cylinder head cover check end play of camshafts with a dial indicator. The end play should be between .10 mm – .55 mm.

NOTE: If the camshaft end play is not within specification, measure thickness of the camshaft spacer. Camshaft spacer thickness should be 2.8 ± .02mm.

(5) Install access hole plugs and gaskets at rear of cylinder head cover/intake manifold. Torque plugs to 80N·m.

(6) Install cylinder head cover/intake manifold on engine block (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(7) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

CAMSHAFT(S) (Continued)

(8) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(9) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(10) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(11) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(12) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(14) Install air cleaner housing.

(15) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(16) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(17) Connect negative battery cable.

CYLINDER HEAD COVER(S)

DESCRIPTION

The cylinder head cover is made of cast aluminum and is also the intake manifold on this engine. The cylinder head cover is equipped with a double breather port and an internal oil return pipe (Fig. 24).

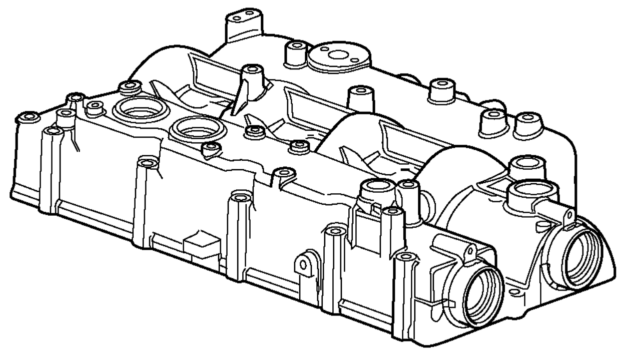


Fig. 24 CYLINDER HEAD COVER/INTAKE MANIFOLD

REMOVAL

REMOVAL

CAUTION: Before removing the cylinder head cover/intake manifold the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(1) Disconnect negative battery cable.

(2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(4) Drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(5) Rotate engine until 90° after TDC is reached. Install both camshaft locking pins and the crankshaft locking pin. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(6) Remove air cleaner housing assembly.

(7) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(8) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(9) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).

(10) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

(11) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(12) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(13) Remove inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(14) Disconnect camshaft position sensor, boost pressure/intake air temperature sensor, EGR solenoid, and fuel pressure sensor electrical connectors (Fig. 25).

(15) Disconnect vacuum lines at EGR solenoid.

(16) Position electrical harness out of way.

(17) Remove fuel injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).

(18) Remove fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL).

CYLINDER HEAD COVER(S) (Continued)

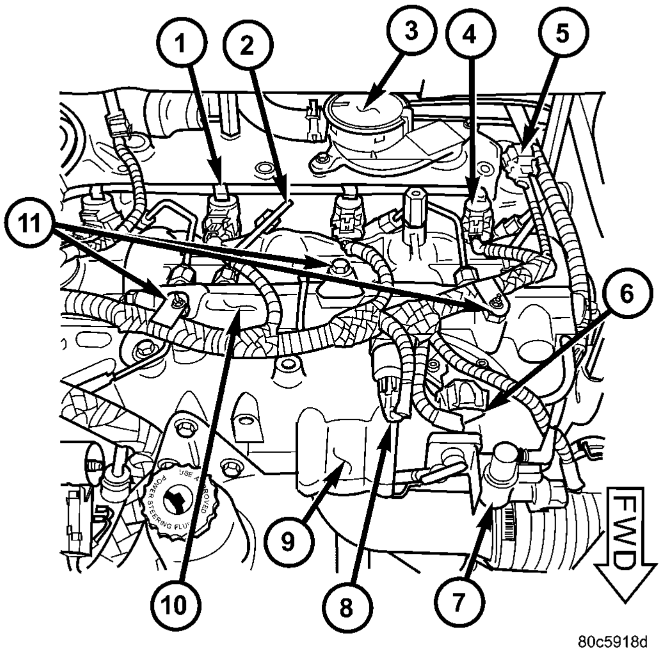


Fig. 25 ENGINE COMPONENT LOCATIONS

1 - FUEL INJECTOR RETURN LINE
2 - FUEL INJECTOR SUPPLY LINE
3 - OIL SEPARATOR
4 - FUEL INJECTOR
5 - CAMSHAFT POSITION SENSOR
6 - BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR
7 - EGR SOLENOID
8 - FUEL PRESSURE SENSOR
9 - CYLINDER HEAD COVER/INTAKE MANIFOL
10 - FUEL RAIL
11 - WIRING HARNESS RETAINING CLIPS

(19) Remove power steering pump reservoir from bracket.

(20) Remove oil dipstick tube retaining bolt at intake manifold inlet.

(21) Disconnect oil separator outlet hose at separator.

(22) Remove turbo inlet tube retaining bolt at intake manifold.

(23) Disconnect EGR tube at intake manifold inlet tube.

(24) Remove cylinder head cover/intake manifold retaining bolts (Fig. 26).

(25) Lift cylinder head cover/intake manifold from cylinder head (Fig. 26).

NOTE: While cleaning the oil return passage in the cylinder head cover, be sure to clean the drain back tube in the cylinder head as well.

(26) Clean the oil return hole in the oil separator access hole with compressed air (Fig. 27).

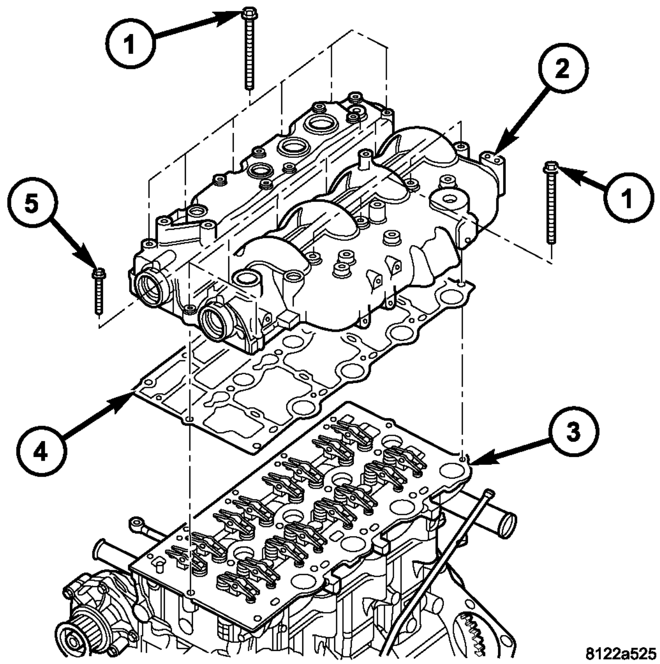


Fig. 26 CYLINDER HEAD COVER/INTAKE MANIFOLD ASSEMBLY

1 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(LONG)
2 - CYLINDER HEAD COVER/INTAKE MANIFOLD
3 - CYLINDER HEAD
4 - CYLINDER HEAD COVER/INTAKE MANIFOLD GASKET
5 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(SHORT)

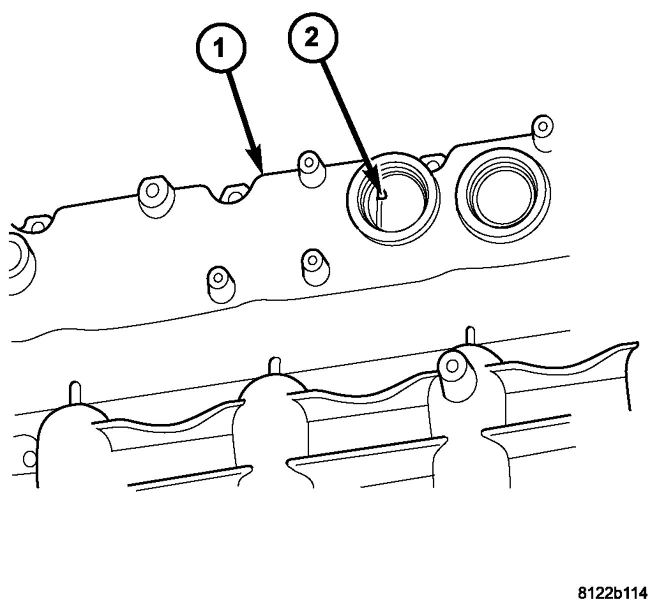


Fig. 27 OIL RETURN PASSAGE

1 - CYLINDER HEAD COVER/INTAKE MANIFOLD
2 - OIL RETURN PASSAGE

CYLINDER HEAD COVER(S) (Continued)

NOTE: When removing rocker arm and lifter assemblies, be sure to keep them in order as they were removed from the cylinder head. Always keep lifters in an upright position when removed from cylinder head.

(27) Remove rocker arm and lifter assemblies from cylinder head (Fig. 28).

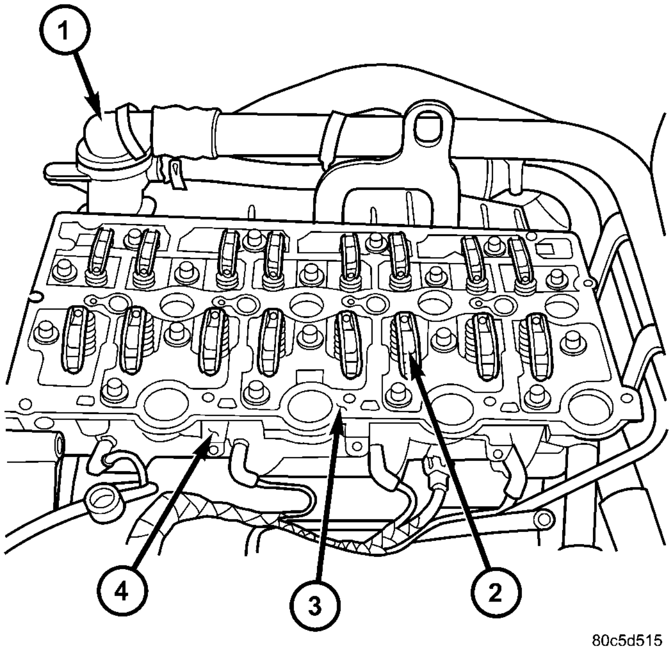


Fig. 28 CYLINDER HEAD COVER/INTAKE MANIFOLD GASKET LOCATION

1 - THERMOSTAT HOUSING
2 - ROCKER ARM AND LIFTER ASSEMBLY
3 - CYLINDER HEAD COVER/INTAKE MANIFOLD
4 - CYLINDER HEAD

(28) Remove cylinder head cover/intake manifold gasket from cylinder head.

REMOVAL

(1) Disconnect the negative battery cable.
(2) Remove the engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Remove the engine oil separator fastener and remove the separator (Fig. 29).
(4) Using compressed air, blow out the oil drain back passage in the cylinder head cover/intake manifold assembly.

NOTE: If the cylinder head cover/intake manifold is removed, be sure to clean the oil drain back tube as well.

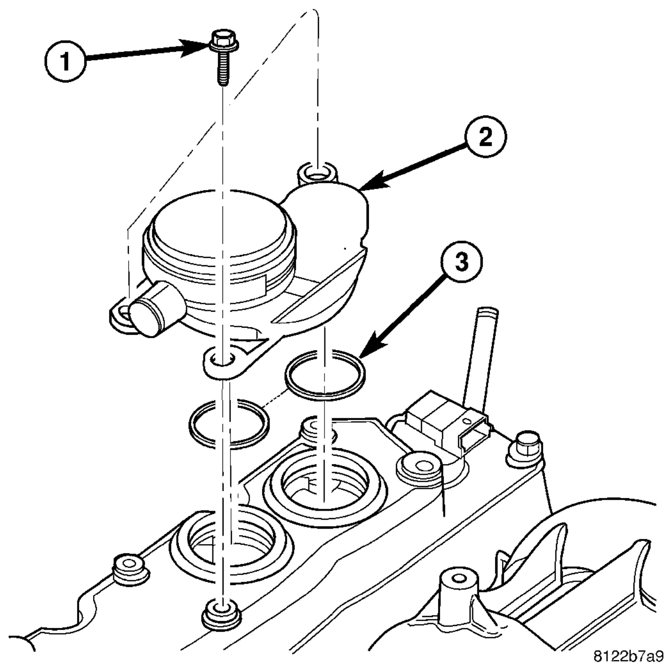


Fig. 29 ENGINE OIL SEPARATOR

1 - SCREW
2 - ENGINE OIL SEPARATOR
3 - O-RINGS

INSTALLATION

INSTALLATION

(1) Clean and inspect sealing surfaces.
(2) Clean and inspect the breather oil return passage in the cylinder head/intake manifold cover (Fig. 27).
(3) Install new gasket on cylinder head.

NOTE: Apply a small amount of grease on each valve stem. This will help hold the rocker arm in position during the cylinder head cover installation.

(4) Install rocker arm and lifter assemblies in cylinder head (Fig. 28).**Be sure to put rocker arm and lifter assemblies in same location as removed.**
(5) Install cylinder head cover/intake manifold alignment studs in cylinder head (Fig. 30).
(6) Install cylinder head cover/intake manifold over alignment stud.

NOTE: Be sure to lubricate cylinder head cover/intake manifold retaining bolts with engine oil before assembly. If new bolts are being installed, DO NOT lubricate before assembly.

(7) Install two cylinder head cover/intake manifold retaining bolts and tighten finger tight.

CYLINDER HEAD COVER(S) (Continued)

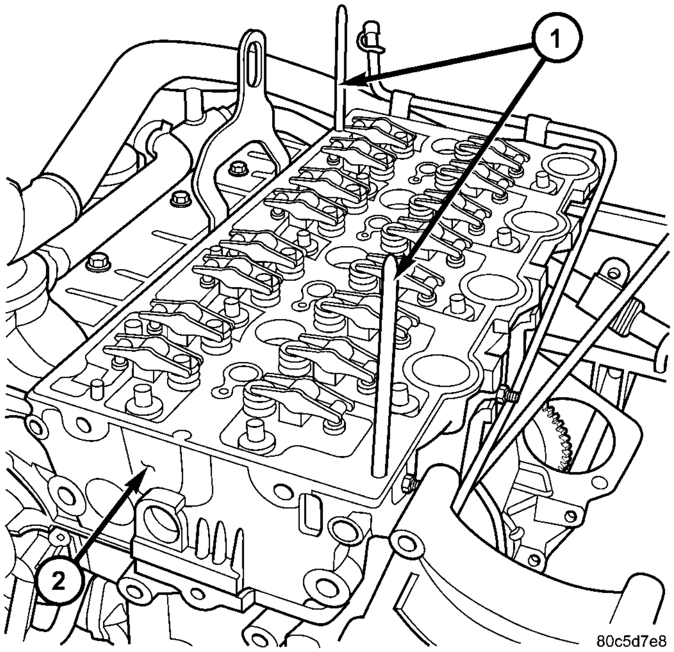


Fig. 30 CYLINDER HEAD COVER/INTAKE MANIFOLD ALIGNMENT STUDS VM.1066

1 - CYLINDER HEAD COVER/INTAKE MANIFOLD ALIGNMENT STUDS VM.1066
2 - CYLINDER HEAD

(8) Remove alignment studs and install remaining retaining bolts (Fig. 26). Tighten retaining bolts finger tight.

(9) Torque cylinder head cover/intake manifold retaining bolts following procedure below.

CYLINDER HEAD COVER/INTAKE MANIFOLD TIGHTENING PROCEDURE

- Coat all bolts being reused with clean engine oil.
- Install the M8x35 bolts into holes 1,2,3,4,5, and 12. Install the M8x85 bolts into holes 6,7,8,9,10,11,13,14,15, and 16. Tighten all bolt **hand tight**.
- Alternate between bolts #11 and #16 to seat cylinder head cover/intake manifold on cylinder head (Fig. 31). Torque bolts to 7 N·m.
- Torque all cylinder head cover/intake manifold retaining bolts to 25 N·m in numerical order starting with #1 and ending with #16 (Fig. 31).

(10) Connect EGR tube at intake manifold inlet tube. Torque clamp to 10.8 N·m.

(11) Install turbo inlet tube retaining bolt at intake manifold. Torque bolt to 27.5 N·m.

(12) Connect oil separator outlet hose at separator.

(13) Install oil dipstick tube retaining bolt at intake manifold inlet. Torque bolt to 10 N·m.

(14) Install power steering pump reservoir in bracket.

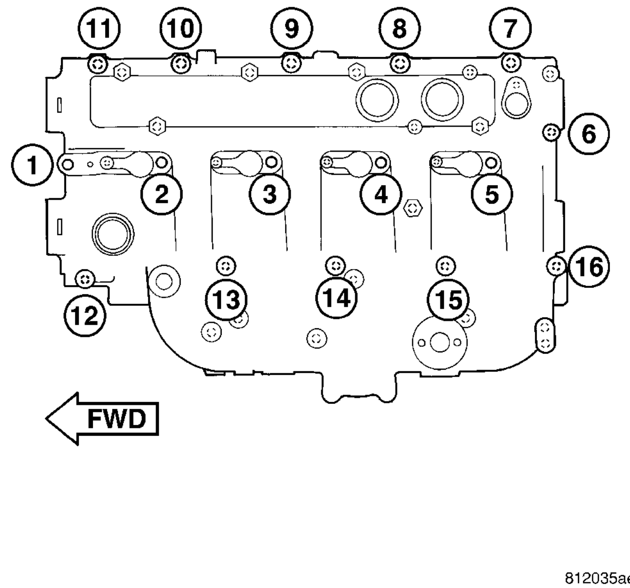


Fig. 31 CYLINDER HEAD COVER/INTAKE MANIFOLD TIGHTENING SEQUENCE

(15) Install fuel rail (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/FUEL RAIL - INSTALLATION).

(16) Install fuel injectors and fuel injector supply lines (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

(17) Connect vacuum lines at EGR solenoid.

(18) Clip wiring harness retainers on studs on fuel rail (Fig. 25).

(19) Connect camshaft position sensor, boost pressure/intake air temperature sensor, EGR solenoid, and fuel pressure sensor electrical connectors (Fig. 25).

(20) Install inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(21) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(22) Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(23) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(24) Install generator (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - INSTALLATION).

(25) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(26) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

CYLINDER HEAD COVER(S) (Continued)

(27) Install air cleaner housing assembly.

(28) Remove crankshaft and both camshaft locking pins (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).

(29) Refill cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(30) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(31) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(32) Connect negative battery cable.

INSTALLATION

NOTE: Using compressed air, blow out the oil return passage in the cylinder head cover/ intake manifold assembly. If the cylinder head cover/intake manifold has been removed, be sure to clean the oil drain back tube as well.

(1) Lubricate the O-rings with clean engine oil and position in the cover (Fig. 29).

(2) Seat the oil separator, being careful not to damage the O-rings (Fig. 29).

(3) Install the retaining fastener and torque the bolt to 10.8 N·m (8 lbs. ft.).

(4) Install the engine cover (Refer to 9 - ENGINE - INSTALLATION).

(5) Connect the negative battery cable.

CAMSHAFT OIL SEAL(S)

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove air cleaner housing assembly.

(3) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

(4) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

WARNING: Before removing the timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(5) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(6) Using VM.1055, remove both camshaft gears (Fig. 32).

(7) Remove both camshaft oil seals.

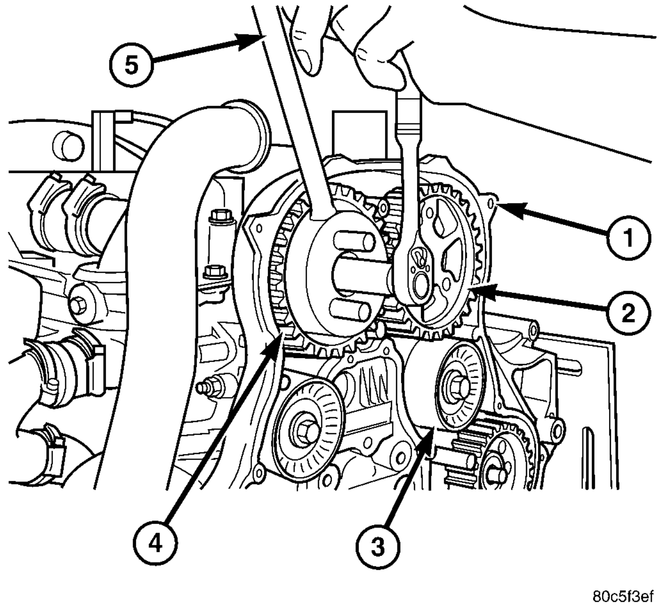


Fig. 32 CAMSHAFT GEAR REMOVAL/INSTALLATION

1 - TIMING BELT INNER COVER
2 - CAMSHAFT SPROCKET
3 - IDLER PULLEYS
4 - CAMSHAFT SPROCKET
5 - VM.1055

INSTALLATION

(1) Install new camshaft oil seal using VM.1057 (Fig. 33).

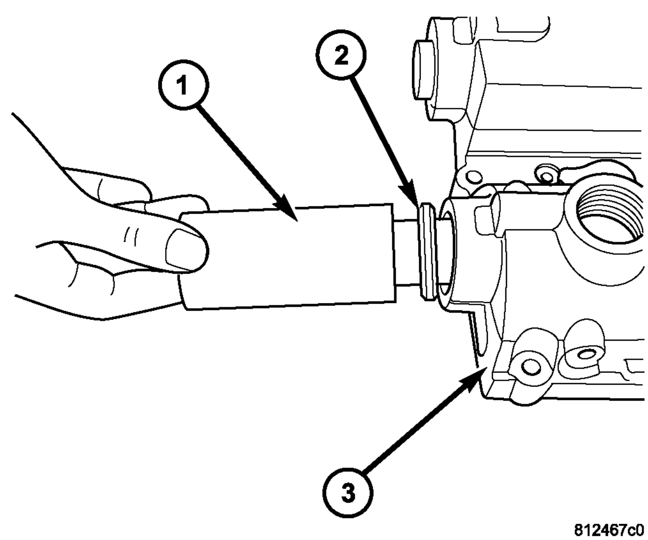


Fig. 33 CAMSHAFT OIL SEAL INSTALLER

1 - VM.1057
2 - CAMSHAFT SEAL
3 - CYLINDER HEAD COVER/INTAKE MANIFOLD

CAMSHAFT OIL SEAL(S) (Continued)

(2) Install camshaft sprockets and tighten retaining bolts finger tight.

(3) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(4) Torque camshaft sprockets to 108 N·m using VM.1055 (Fig. 32).

(5) Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(6) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(7) Install air cleaner housing assembly.

(8) Connect negative battery cable.

ROCKER ARMS

DESCRIPTION

The rocker arms are made of stamped steel (Fig. 34).

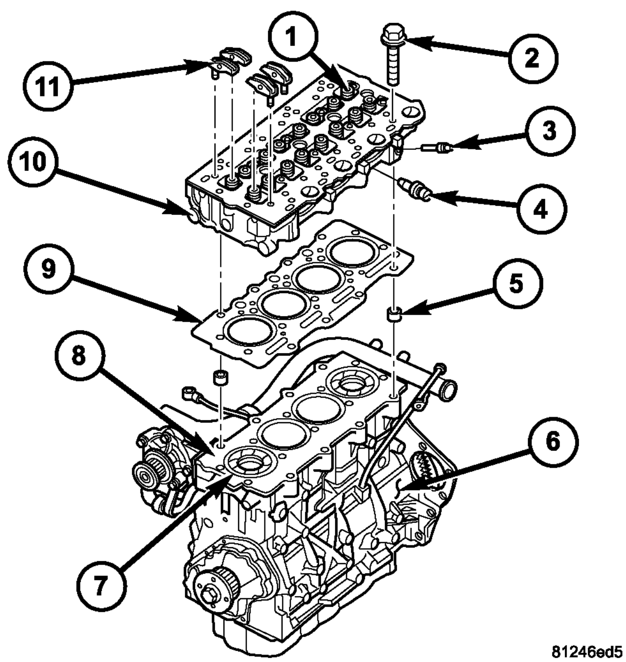


Fig. 34 CYLINDER HEAD ASSEMBLY

1 - VALVE SPRING
2 - CYLINDER HEAD BOLT
3 - GLOW PLUG
4 - COOLANT TEMPERATURE SENSOR
5 - CYLINDER HEAD ALIGNMENT DOWEL
6 - CYLINDER BLOCK
7 - CYLINDER LINER
8 - ENGINE BLOCK DECK
9 - CYLINDER HEAD GASKET
10 - CYLINDER HEAD
11 - ROCKER ARM AND LIFTER ASSEMBLY

OPERATION

The rocker arms are used as a link between the camshaft and valves. As the camshaft rotates the lobes of the camshafts apply downward pressure on the rocker arms. This pressure is then transmitted to the valves which causes the valves to open.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(3) Remove air cleaner housing assembly.

(4) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

(5) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(6) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(7) Remove inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(8) Remove cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(9) Remove rocker arm abd lifter (Fig. 35).

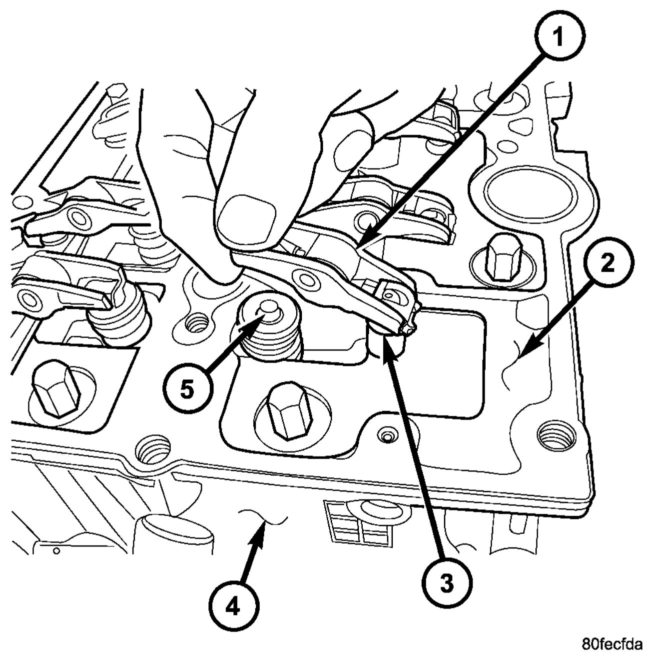


Fig. 35 ROCKER ARM ASSEMBLY

1 - ROCKER ARM ASSEMBLY
2 - CYLINDER HEAD COVER/INTAKE MANIFOLD
3 - HYDRAULIC LIFTER
4 - CYLINDER HEAD
5 - VALVE

ROCKER ARMS (Continued)

INSTALLATION

(1) Clean and inspect gasket sealing surfaces.

(2) Install new gasket on cylinder head.

(3) Lubricate lifter ball end of lifter(s), valve(s), and rocker arm roller(s) with Mopar® Engine Oil Supplement or equivlalent.

(4) Connect rocker arm(s) to lifter and reposition on valve(s) (Fig. 35).

(5) Install cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(6) Install inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(7) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(8) Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(9) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(10) Install air cleaner housing assembly.

(11) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(12) Connect negative battery cable.

HYDRAULIC LIFTERS

DESCRIPTION

Valve lash is controlled by hydraulic tappets located inside the cylinder head, in tappet bores below the camshafts (Fig. 36).

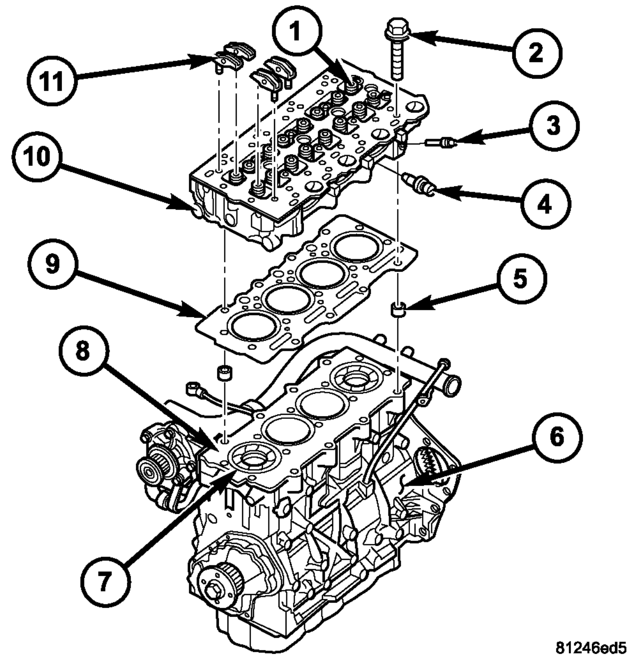


Fig. 36 CYLINDER HEAD ASSEMBLY

1 - VALVE SPRING
2 - CYLINDER HEAD BOLT
3 - GLOW PLUG
4 - COOLANT TEMPERATURE SENSOR
5 - CYLINDER HEAD ALIGNMENT DOWEL
6 - CYLINDER BLOCK
7 - CYLINDER LINER
8 - ENGINE BLOCK DECK
9 - CYLINDER HEAD GASKET
10 - CYLINDER HEAD
11 - ROCKER ARM AND LIFTER ASSEMBLY

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(4) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

(5) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

CAUTION: Before removing the cylinder head cover/intake manifold or the timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(6) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(7) Remove inner timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(8) Remove cylinder head cover/intake manifold (Fig. 37)(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(9) Remove rocker arm and lifter assemblies from lifter bores.

HYDRAULIC LIFTERS (Continued)

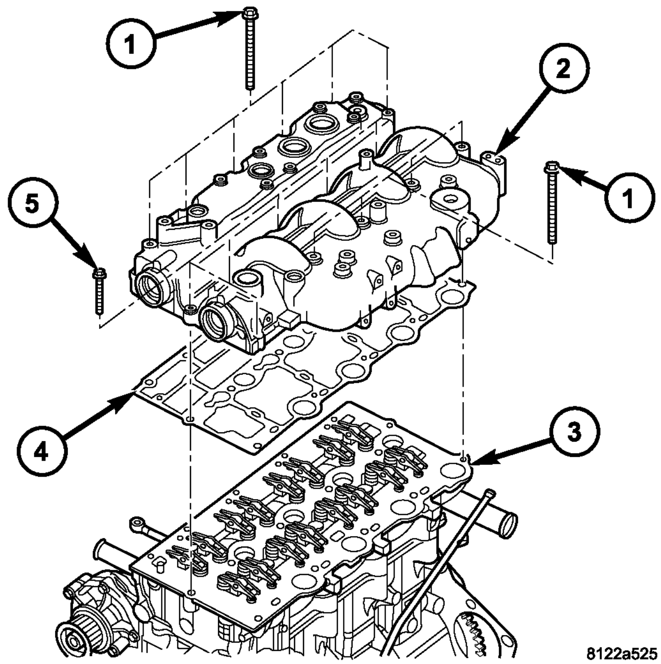


Fig. 37 CYLINDER HEADCOVER/INTAKE MANIFOLD ASSEMBLY

1 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(LONG)
2 - CYLINDER HEAD COVER/INTAKE MANIFOLD
3 - CYLINDER HEAD
4 - CYLINDER HEAD COVER/INTAKE MANIFOLD GASKET
5 - CYLINDER HEAD COVER/INTAKE MANIFOLD BOLTS(SHORT)

INSPECTION

Clean each lifter assembly in cleaning solvent to remove all varnish and sludge deposits. Inspect for indications of scuffing on the side and base of each lifter body.

INSTALLATION

(1) Install rocker arm and lifter assemblies in lifter bores.

(2) Install cylinder head cover/intake manifold (Fig. 37) (Refer to 9 - ENGINE/CYLINDER HEAD/ CYLINDER HEAD COVER(S) - INSTALLATION).

(3) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(4) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(5) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(6) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(7) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(8) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(9) Connect negative battery cable.

ENGINE BLOCK

DESCRIPTION

The 2.5L/2.8L CRD Diesel engine uses a cast iron engine block with wet cast iron cylinder liners (Fig. 38), (Fig. 39).

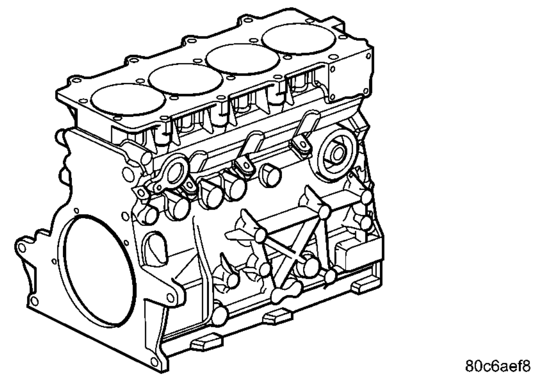


Fig. 38 ENGINE BLOCK 2.5L

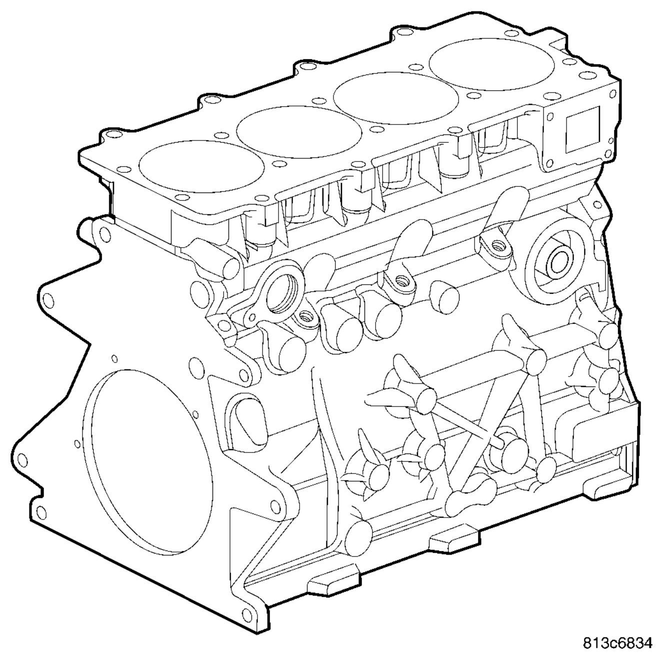


Fig. 39 ENGINE BLOCK 2.8L

CRANKSHAFT

DESCRIPTION

The crankshaft used for the 2.5L is a forged steel design with five main bearing journals (Fig. 40). The crankshaft used for the 2.8L is of the same basic construction and design except the rear alignment pin is shorter (0.12mm) and the rear crankshaft diameter is slightly larger (0.33mm) (Fig. 41). These crankshafts ARE NOT interchangable. The crankshaft is located at the bottom of the engine block and is held in place with three main bearing supports

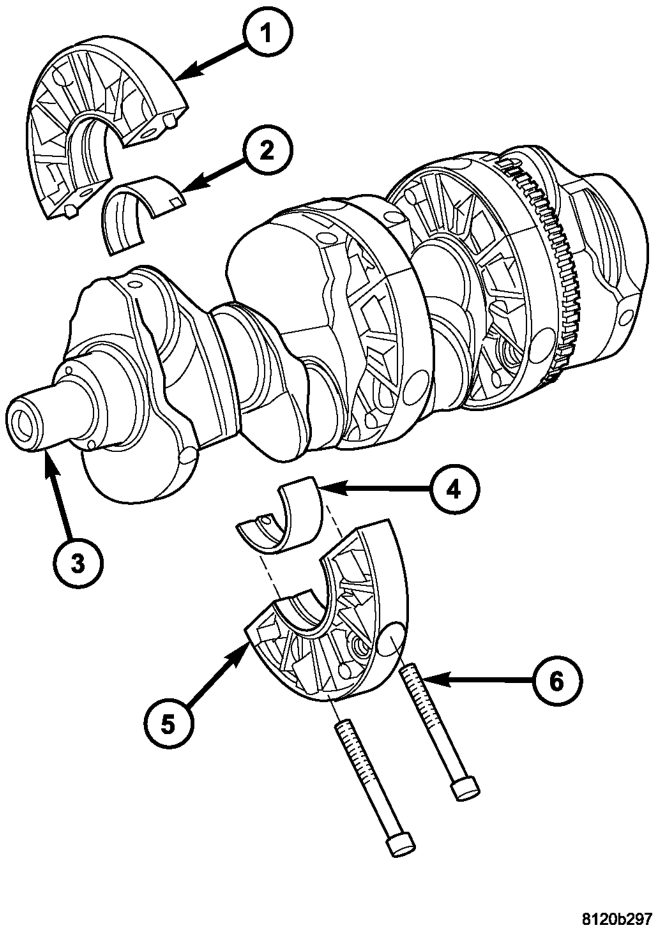


Fig. 40 CRANKSHAFT

1 - CRANKSHAFT SUPPORT HALVE
2 - MAIN BEARING HALVE
3 - CRANKSHAFT
4 - MAIN BEARING HALVE
5 - CRANKSHAFT SUPPORT HALVE
6 - MAIN BEARING SUPPORT BOLTS

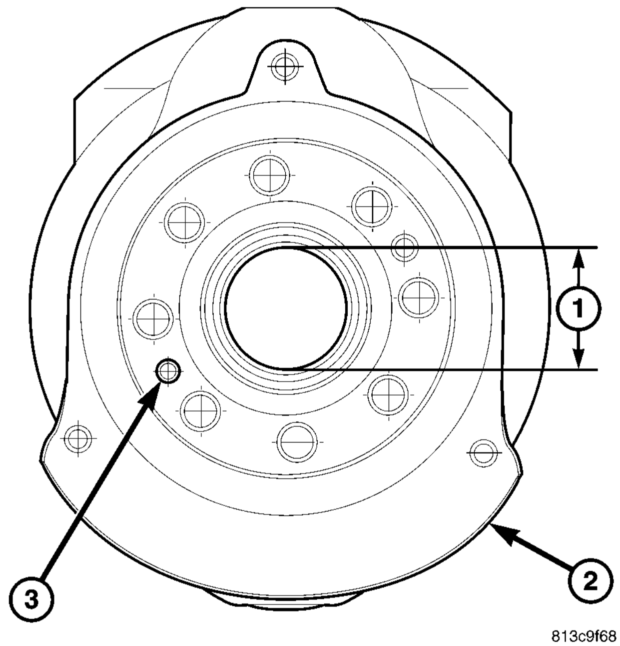


Fig. 41 2.8L CRANKSHAFT END VIEW

1 - DIAMETER
2 - CRANKSHAFT
3 - REAR ALIGNMENT PIN

OPERATION

The crankshaft transfers force generated by combustion within the cylinder bores to the flywheel or flexplate.

STANDARD PROCEDURE - CHECKING CRANKSHAFT END PLAY

NOTE: Checking crankshaft end play is similar for both the 2.5L and the 2.8L.

(1) Mount a dial indicator to a stationary point at rear of engine. Locate the probe perpendicular against the flywheel or flex plate (Fig. 42).

(2) Move the crankshaft all the way to the front of its travel.

(3) Zero the dial indicator.

(4) Move the crankshaft all the way to the rear and read dial indicator. For crankshaft end play clearances (Refer to 9 - ENGINE - SPECIFICATIONS) .

CRANKSHAFT (Continued)

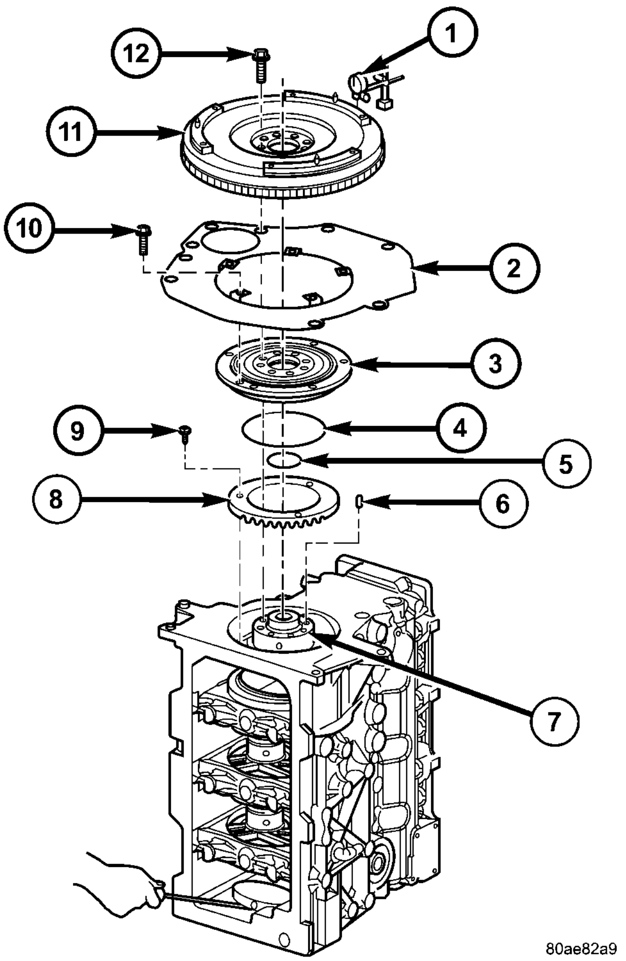


Fig. 42 CHECKING CRANKSHAFT END PLAY

1 - DIAL INDICATOR
2 - ADAPTER PLATE
3 - REAR MAIN BEARING SUPPORT
4 - SEALING RING
5 - SEALING RING
6 - ALIGNMENT PIN
7 - CRANKSHAFT
8 - RELUCTOR WHEEL
9 - RELUCTOR WHEEL RETAINING BOLT
10 - REAR MAIN BEARING SUPPORT RETAINING BOLTS
11 - FLYWHEEL
12 - FLYWHEEL BOLTS

REMOVAL

(1) Remove engine from vehicle (Refer to 9 - ENGINE - REMOVAL).

(2) Mount engine on an engine stand.

(3) Drain engine oil and remove oil filter.

(4) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(5) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(6) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(7) Remove cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(8) Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(9) Remove flywheel (2.5L), Remove flex plate (2.8L).

(10) Remove rear main bearing support/adapter plate retaining bolts and remove adapter plate (Fig. 43).

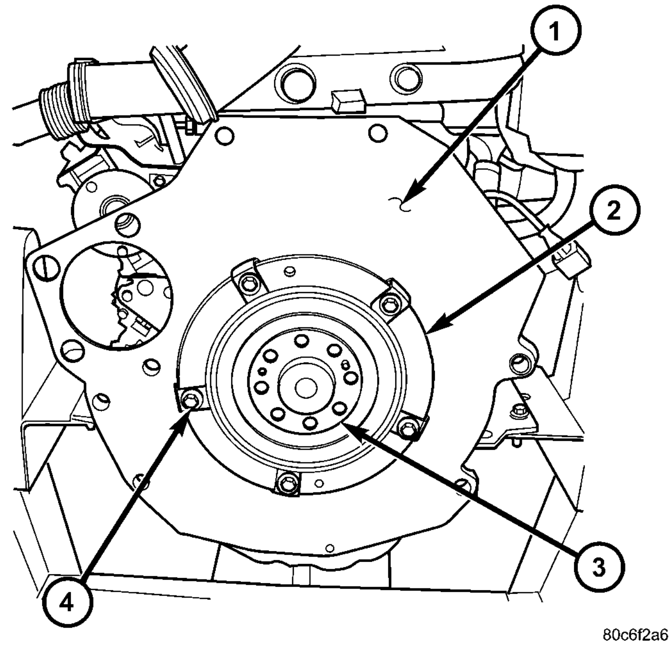


Fig. 43 2.5L REAR MAIN BEARING SUPPORT

1 - ADAPTER PLATE
2 - REAR MAIN BEARING SUPPORT
3 - CRANKSHAFT
4 - REAR MAIN BEARING SUPPORT RETAINING BOLTS

(11) Remove rear main bearing support by threading two retaining bolts in holes provided. Tighten bolts equally to push main bearing support out of block (Fig. 44), (Fig. 45).

CRANKSHAFT (Continued)

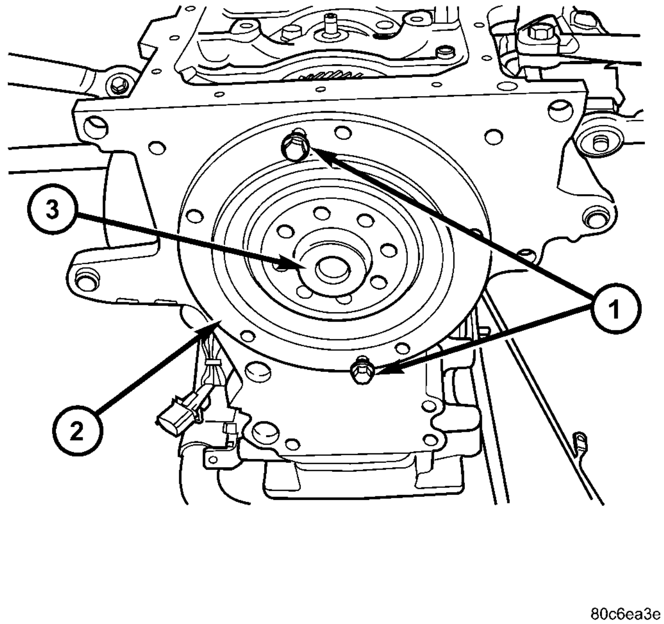


Fig. 44 2.5L REAR MAIN BEARING SUPPORT REMOVAL

1 - BOLTS
2 - REAR MAIN BEARING SUPPORT
3 - CRANKSHAFT

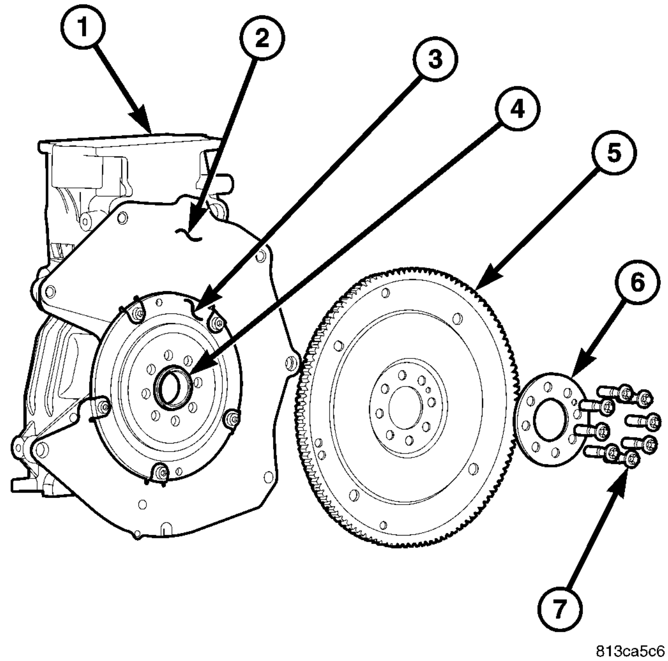


Fig. 45 2.8L REAR MAIN BEARING SUPPORT REMOVAL

1 - ENGINE BLOCK
2 - PLATE
3 - REAR MAIN BEARING SUPPORT
4 - CRANKSHAFT
5 - FLEX PLATE
6 - BACKING PLATE
7 - BOLTS

(12) Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).

(13) Remove crankshaft sprocket.

(14) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(15) Remove oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

(16) Remove balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL).

(17) Remove oil jets (Refer to 9 - ENGINE/LUBRICATION/OIL JET - REMOVAL).

(18) Remove piston and connecting rod assemblies (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - REMOVAL).

(19) Slide special tool VM.1069 on crankshaft (Fig. 46).

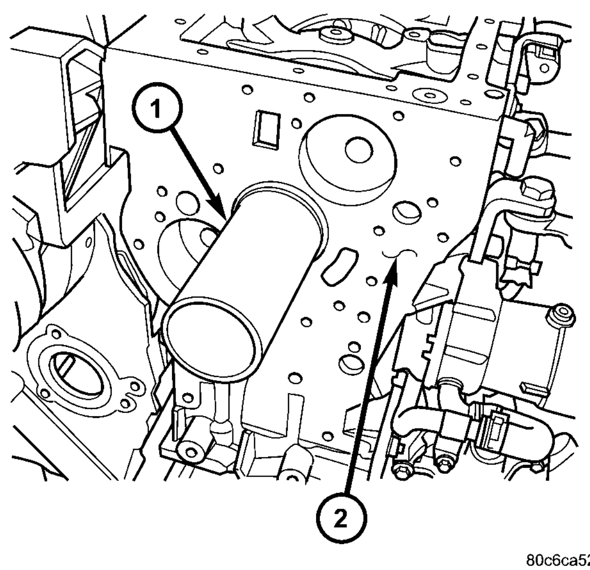


Fig. 46 CRANKSHAFT SLEEVE VM.1069

1 - CRANKSHAFT SLEEVE VM.1069
2 - ENGINE BLOCK

CRANKSHAFT (Continued)

(20) Using special tool VM.1054, remove crankshaft support retainers (Fig. 47).

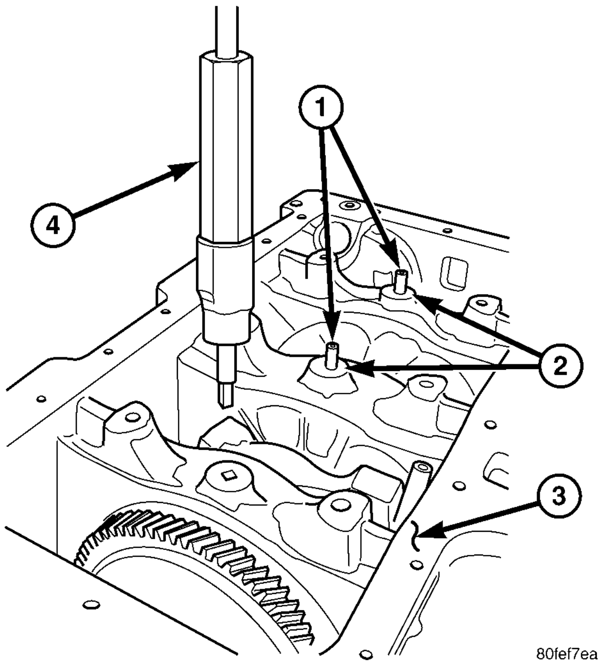


Fig. 47 CRANKSHAFT SUPPORT RETAINERS/ BALANCE SHAFT OIL FEED

1 - CRANKSHAFT SUPPORT RETAINERS/BALANCE SHAFT OIL FEED
2 - O-RINGS (3)
3 - ENGINE BLOCK
4 - CRANKSHAFT SUPPORT RETAINER/BALANCE SHAFT OIL FEED REMOVER - INSTALLER VM.1054

(21) Slide crankshaft out rear of engine block.

INSTALLATION

CAUTION: IT IS CRITICAL THAT BOTH HALVES OF THE CRANKSHAFT SUPPORT ARE ALIGNED PROPERLY WITH THE ENGINE TO SUPPORT ENGINE OIL MANAGEMENT.

NOTE: Before installing crankshaft in engine block, be sure the notches in the crankshaft supports are facing towards the front of the engine.

(1) Install crankshaft in engine block. **Be sure to align oil holes in crankshaft supports and engine block.**

NOTE: There are two identical holes in the crankshaft support. Care must be take to insert the special tool into the correct hole (Fig. 48).

(2) Insert crankshaft alignment dowel into the vacuum pump access hole, through the proper crankshaft support holes, then slide the tool guide flush against the engine block and retain with a vacuum pump retaining bolt (Fig. 48).

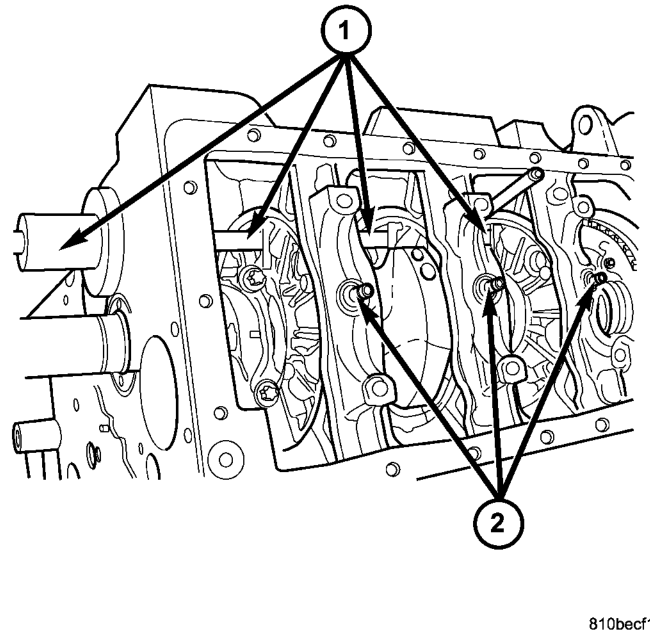


Fig. 48 CRANKSHAFT SUPPORT ALIGNMENT

1 - CRANKSHAFT ALIGNMENT TOOL VM9095
2 - BALANCE SHAFT OIL SUPPLY

NOTE: Before installing the crankshaft support retainers/balance shaft oil supply be sure that special tool VM 1079, alignment pins, and VM 9095 are installed (Fig. 49).

(3) Install crankshaft support retainers using special tool VM 1054. (Fig. 47).

(4) Install crankshaft support retainers O-rings.

(5) Remove special tool VM.1069 from crankshaft (Fig. 46).

(6) Remove special tool VM 9095 from the engine block.

(7) Install crankshaft sprocket.

(8) Install front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).

(9) Install rear main bearing support in engine block. **Be sure to align oil hole in rear main bearing support with hole in block.**

(10) Install adapter plate and retaining bolts (Fig. 43). Torque bolts to 27.5N·m.

CRANKSHAFT (Continued)

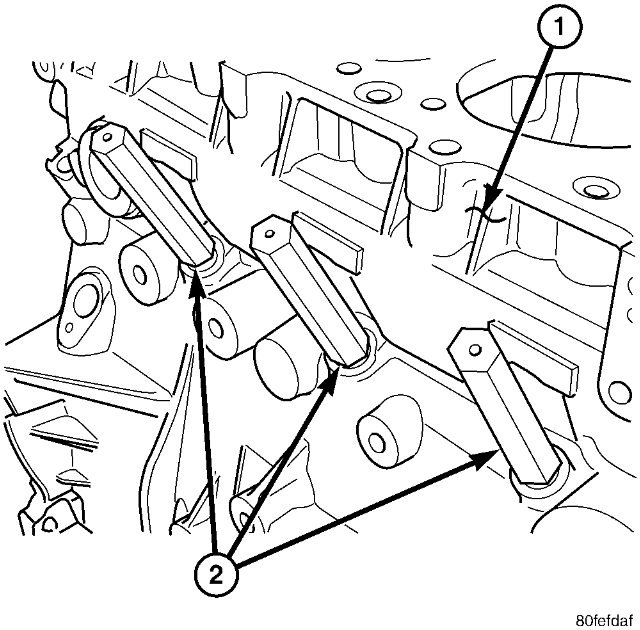


Fig. 49 CRANKSHAFT SUPPORT RETAINERS/ BALANCE SHAFT OIL SUPPLY ALIGNMENT PINS

1 - ENGINE BLOCK
2 - ALIGNMENT PINS VM 1079

(11) Install flywheel (2.5L), Install flex plate (2.8L).

(12) Install piston and connecting rod assemblies (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSTALLATION).

(13) Install oil jets (Refer to 9 - ENGINE/LUBRICATION/OIL JET - INSTALLATION).

(14) Install balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION).

(15) Install oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).

(16) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(17) Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(18) Install cylinder head cover/intake manifold (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(19) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(20) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(21) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(22) Install engine in vehicle.

(23) Fill engine oil with proper oil to correct level.

FLEX PLATE

REMOVAL

(1) Remove the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL).

(2) Paint mark the flex plate to crankshaft relationship.

(3) Remove the flex plate fasteners and fly wheel (Fig. 50).

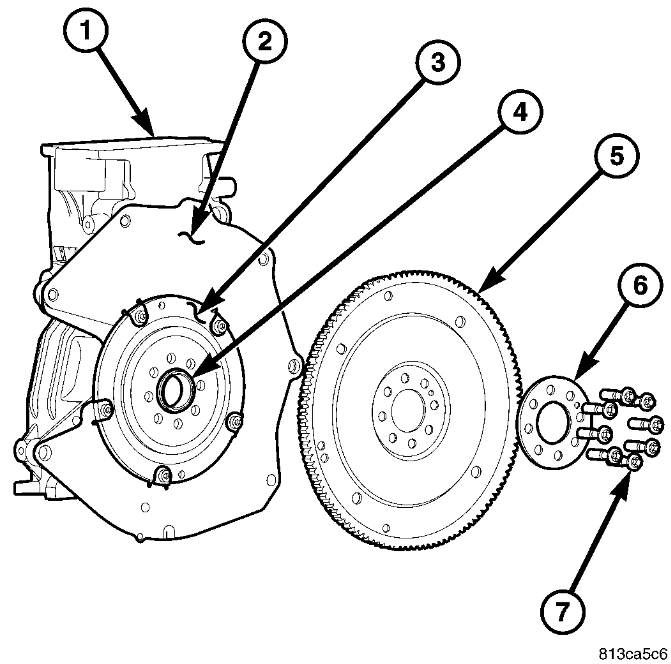


Fig. 50 2.8L REAR MAIN BEARING SUPPORT REMOVAL

1 - ENGINE BLOCK
2 - PLATE
3 - REAR MAIN BEARING SUPPORT
4 - CRANKSHAFT
5 - FLEX PLATE
6 - BACKING PLATE
7 - BOLTS

INSTALLATION

NOTE: Do Not Lubricate new bolts because they are already coated with an anti scuff treatment.

(1) Position the flex plate and install the fasteners hand tight (Fig. 50).

(2) Tighten each fastener to 50 N·m (37 lbs. ft.) following a clockwise cross sequence.

(3) At this point, loosen only one fastener at a time and with a torque wrench set to 25 N·m (19 lbs. ft.) tighten the bolt, then with a torque angle gauge tighten that bolt an additional 60 degrees.

(4) Perform the above procedure for each fastener in a cross sequence.

FLY WHEEL

REMOVAL

(1) Remove the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL).

(2) Paint mark the fly wheel to crankshaft relationship.

(3) Remove the fly wheel fasteners and fly wheel (Fig. 51).

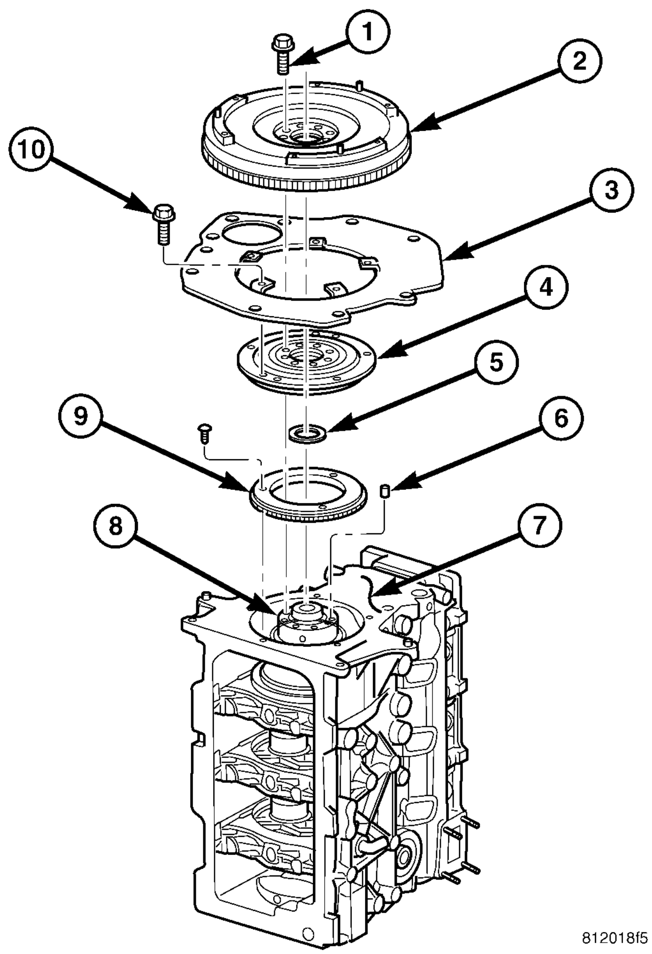


Fig. 51 FLY WHEEL

1 - 60 MM FLY WHEEL BOLTS
2 - FLY WHEEL
3 - TRANSMISSION ADAPTOR PLATE
4 - REAR MAIN BEARING SUPPORT
5 - O-RING
6 - DOWL
7 - ENGINE BLOCK
8 - CRANKSHAFT
9 - RELUCTOR WHEEL
10 - ADAPTOR PLATE BOLT

INSTALLATION

NOTE: Do Not Lubricate new bolts because they are already coated with an anti scuff treatment.

(1) Position the fly wheel and install the fasteners hand tight (Fig. 51).

(2) Tighten each fastener to 50 N·m (37 lbs. ft.) following a clockwise cross sequence.

(3) At this point, loosen only one fastener at a time and with a torque wrench set to 25 N·m (19 lbs. ft.) tighten the bolt, then with a torque angle gauge tighten that bolt an additional 60 degrees.

(4) Perform the above procedure for each fastener in a cross sequence.

CYLINDER LINERS

DESCRIPTION

The cylinder wall liner used on this engine is of the wet design. O-rings are used to seal the liner to the engine block.

REMOVAL

(1) Remove engine from vehicle.

(2) With engine completely disassembled, use special tool VM.1001 to remove liner assembly (Fig. 52).

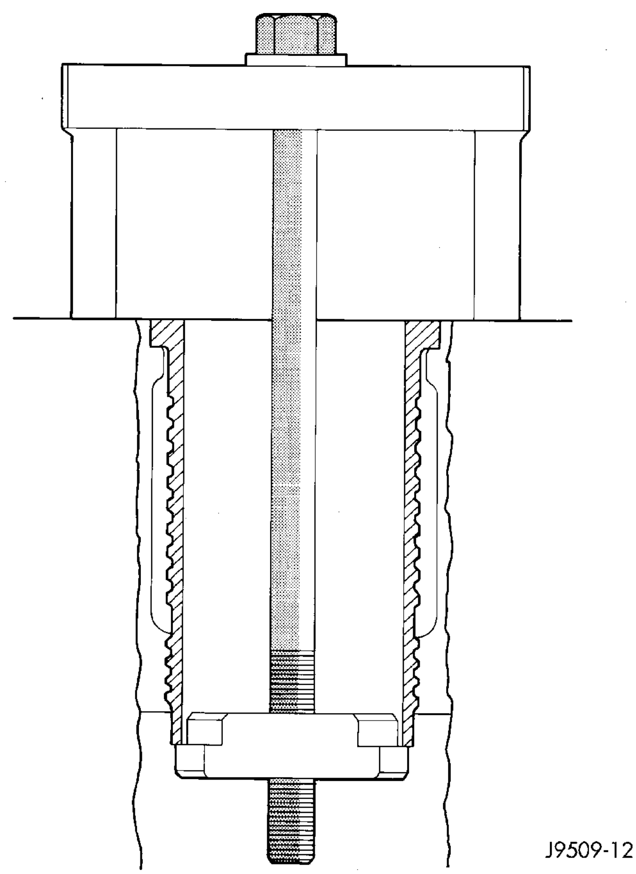


Fig. 52 CYLINDER LINER REMOVER

(3) Tighten bolt on VM.1001 to remove liner from block (Fig. 53).

(4) Remove shims from cylinder liner or cylinder block recess. Keep shims with each cylinder liner.

CYLINDER LINERS (Continued)

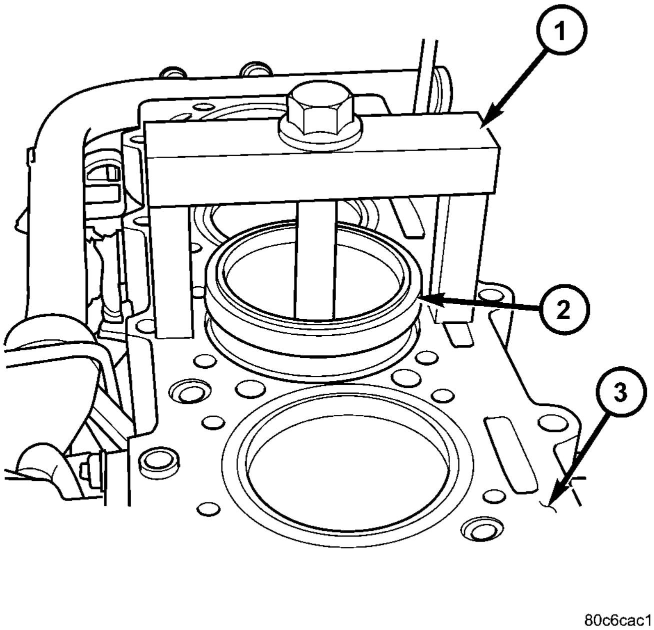


Fig. 53 CYLINDER LINER REMOVAL

1 - SPECIAL TOOL VM.1001
2 - CYLINDER LINER
3 - ENGINE BLOCK

INSPECTION

The cylinder walls should be checked for out-of-round and taper with a dial bore gauge. The cylinder bore out-of-round is 0.100 mm (.0039 in.) maximum and cylinder bore taper is 0.100 mm (.0039 in.) maximum. If the cylinder walls are badly scuffed or scored, new liners should be installed and honed, and new pistons and rings fitted.

Measure the cylinder bore at three levels in directions A and B (Fig. 54). Top measurement should be 10 mm (3/8 in.) down and bottom measurement should be 10 mm (3/8 in.) up from the bottom bore.

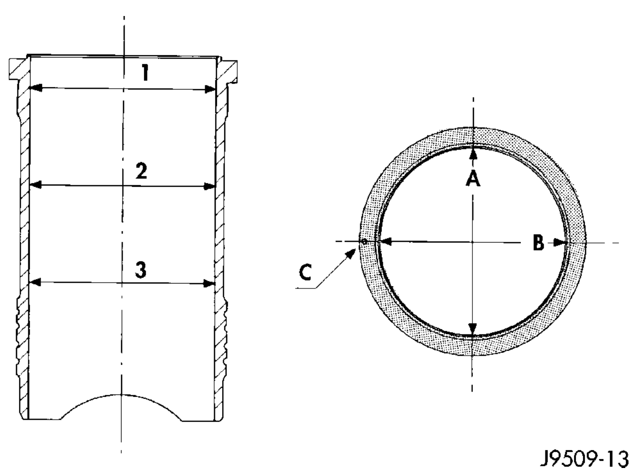


Fig. 54 LINER INSPECTION

INSTALLATION

CAUTION: Cylinder liner O-rings have different diameters. Care should be taken when installing replacement O-rings because they are engine specific.

(1) Carefully clean liner and engine block, and degrease the engine block where it comes into contact with the liners. Install the liners in the engine block as shown, rotating them back and forth by 45° in order to guarantee correct positioning (Fig. 55).

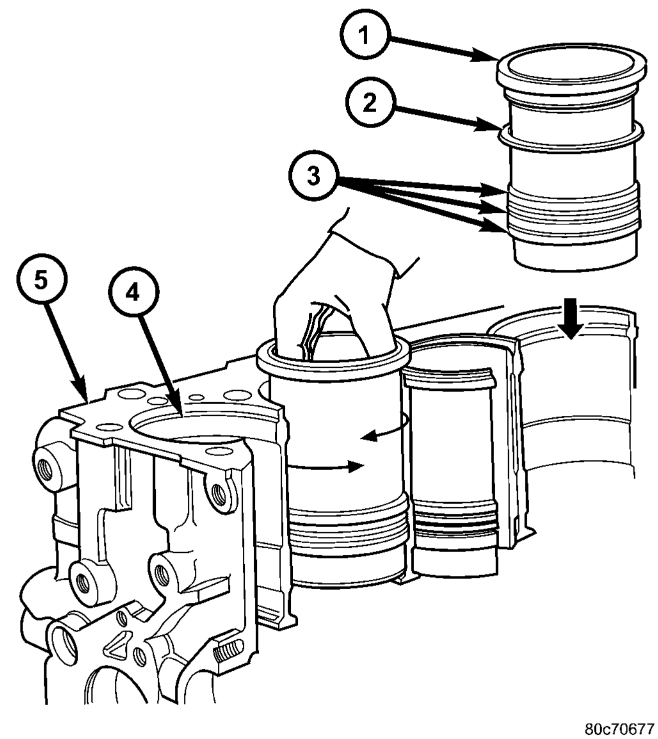


Fig. 55 LINER INSTALLATION

1 - CYLINDER LINER
2 - SHIMS
3 - O-RINGS
4 - BLOCK LEDGE
5 - ENGINE BLOCK

(2) Measure the liner recess relative to block deck with a dial indicator mounted on a special tool VM-1010 A. **All the measurements must be taken on high pressure pump side of engine block.** . Zero dial gauge on block deck.

(3) Move dial gauge to cylinder liner record reading on dial gauge.

(4) Remove liner and special tool.

(5) Then select the correct shim thickness to give proper protrusion (0.00 - 0.05 mm).

(6) Fit the shim and the O-rings onto the liner.

(7) Lubricate the lower liner location in the block.

CYLINDER LINERS (Continued)

(8) Fit the liners in the crankcase making sure that the shim is positioned correctly in the seat. Lock the liners in position using special tool (VM.1076) and bolts (Fig. 56).

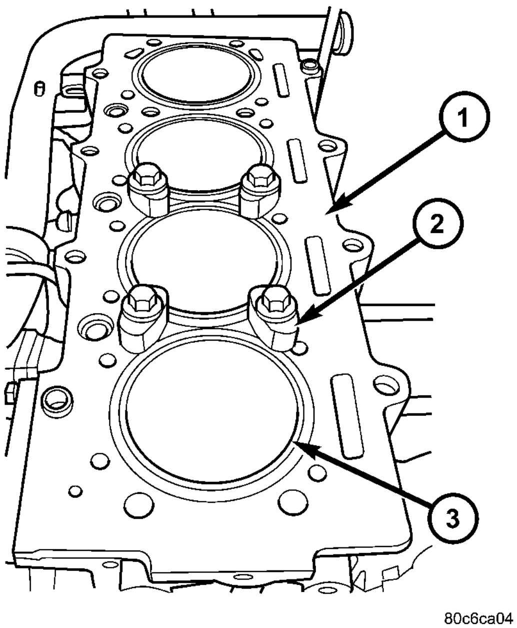


Fig. 56 LINER CLAMP LOCATION

1 - ENGINE BLOCK
2 - LINER RETAINER VM.1076
3 - CYLINDER LINER

(9) Recheck the liner protrusion. It should be 0.00 - 0.05 mm.
(10) Reassemble engine.
(11) Install engine in vehicle.

INTERNAL VACUUM PUMP

DESCRIPTION

The diesel engine uses a internal vacuum pump. This vacuum pump is mounted in the front of the engine block under the engine front cover (Fig. 57). The vacuum pump is driven by a sprocket on the crankshaft.

REMOVAL

(1) Disconnect negative battery cable.
(2) Remove air cleaner housing.
(3) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(4) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

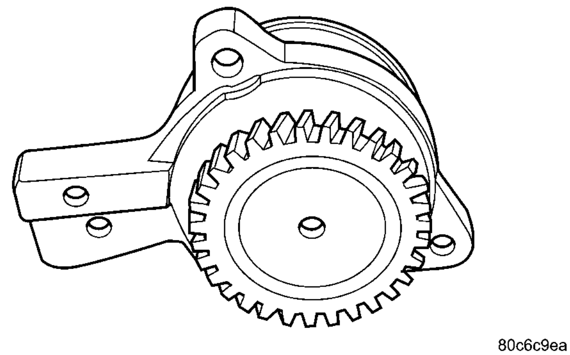


Fig. 57 VACUUM PUMP

(5) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).
(6) Remove vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
(7) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
(8) Remove timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
(9) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

NOTE: Crankshaft hub has LHD thread.

(10) Remove crankshaft hub.
(11) Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).
(12) Remove crankshaft sprocket (Fig. 58).
(13) Remove vacuum pump (Fig. 58).

INSTALLATION

NOTE: Verify the 3 blades on the vacuum pump are in place and correctly assembled. The tapered edge should be on the outer side. Make sure the pump rotates before installation.

(1) Lubricate vacuum pump blades and install in vacuum pump body as shown (Fig. 59).
(2) Install vacuum pump in engine block (Fig. 58). Torque bolts to 10.8N·m.
(3) Install crankshaft sprocket (Fig. 58). Torque bolts to 10.8N·m.
(4) Install front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).
(5) Install front crankshaft hub. Torque bolt to 304N·m.

INTERNAL VACUUM PUMP (Continued)

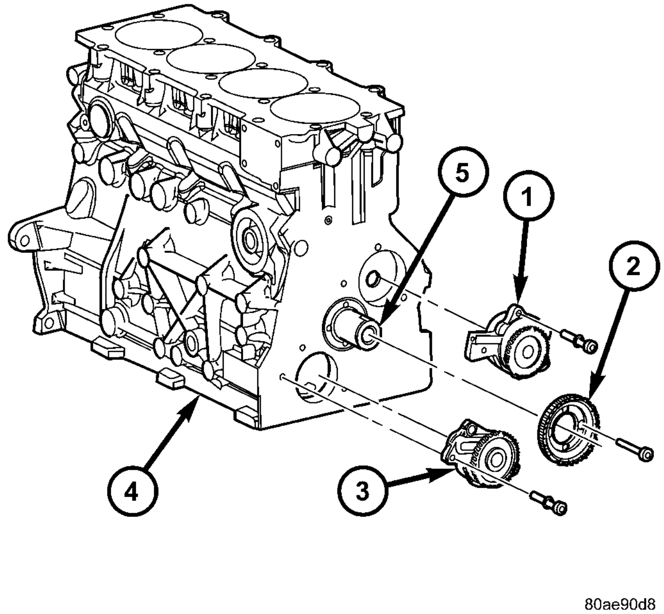


Fig. 58 OIL PUMP AND VACUUM PUMP

1 - VACUUM PUMP
2 - CRANKSHAFT SPROCKET
3 - OIL PUMP
4 - ENGINE BLOCK
5 - CRANKSHAFT

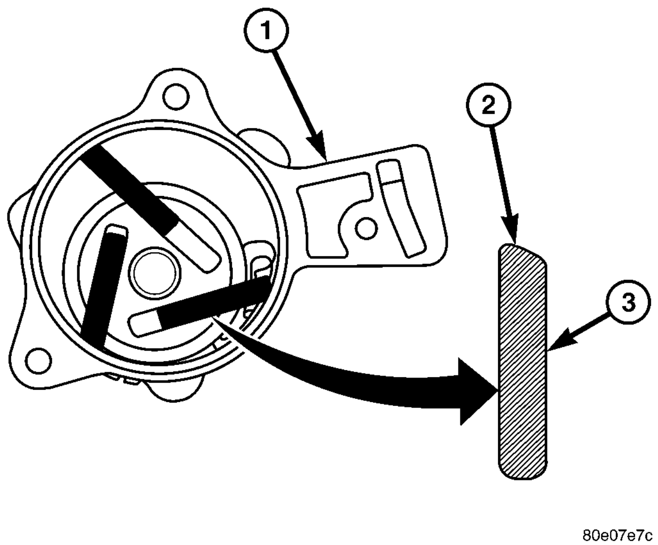


Fig. 59 VACUUM PUMP COMPONENTS

1 - VACUUM PUMP BODY
2 - VACUUM PUMP BLADE TAPERED EDGE
3 - VACUUM PUMP BLADE

(6) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(7) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(8) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(9) Install vibration damper/crankshaft pulley.

(10) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(11) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(12) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Install air cleaner housing.

(14) Connect negative battery cable.

PISTON & CONNECTING ROD

DESCRIPTION

The pistons are of a free floating design. Oil jets in the engine block lubricate and cool the piston and pin assembly. The connecting rods have a pressed in place wrist pin bushing which is lubricated by the oil jets (Fig. 60).

STANDARD PROCEDURE - PISTON RING FITTING

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore (Fig. 61). Check gap with feeler gauge. Top compression ring gap .30 to .45mm (.0118 to .0177 in.). Second compression ring gap .30 to .45mm (.0118 to .0177 in.). Oil control ring gap .25 to .50mm (.0098 to .0196 in.).

(2) If ring gaps exceed dimension given, new rings or cylinder liners must be fitted. Keep piston rings in piston sets.

(3) Check piston ring to groove clearance (Fig. 62). Top compression ring gap .080 to .130mm (.0031 to .0051 in.). Second compression ring gap .070 to .110mm (.0027 to .0043 in.). Oil control ring gap .040 to .080mm (.0015 to .0031 in.).

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).

PISTON & CONNECTING ROD (Continued)

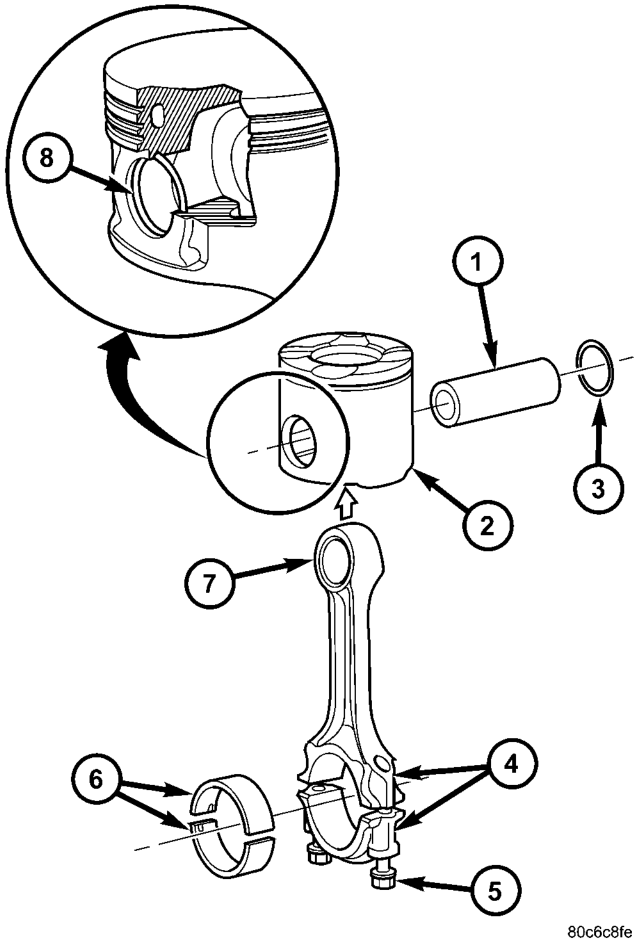


Fig. 60 PISTON AND CONNECTING ROD ASSEMBLY

1 - PISTON PIN
2 - PISTON
3 - SNAP RING
4 - PAINTED CONNECTING ROD ALIGNMENT NUMBERS
5 - CONNECTING ROD BOLT
6 - CONNECTING ROD BEARING
7 - CONNECTING ROD
8 - SNAP RING

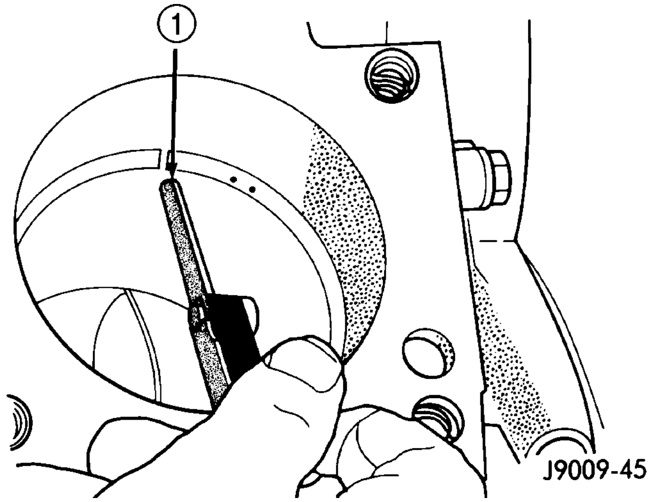


Fig. 61 RING END GAP MEASUREMENT

1 - FEELER GAUGE

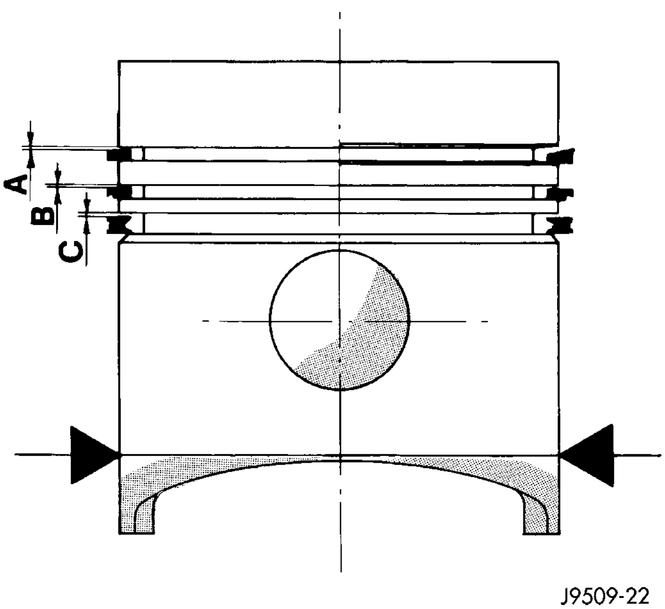


Fig. 62 PISTON RING TO GROOVE CLEARANCE

(3) Raise vehicle on hoist.

(4) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(5) Remove oil pump pickup tube.(Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL)

(6) Remove balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL).

(7) Remove top ridge of cylinder bores with a ridge reamer before removing pistons from cylinder block. **Be sure to keep top of pistons covered during this operation.**

(8) Piston and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

NOTE: Be careful not to nick or scratch crankshaft journals, connecting rod cap can be separated by tapping with a plastic hammer on a clean surface.

(9) After removal, install bearing cap on the mating rod and mark piston and connecting rod with painted matching cylinder number when removed from engine block.

PISTON & CONNECTING ROD (Continued)

PISTON PIN - REMOVAL

(1) Secure connecting rods in a soft jawed vice.

(2) Remove 2 snap rings securing piston pin (Fig. 63).

(3) Push piston pin out of piston and connecting rod (Fig. 63).

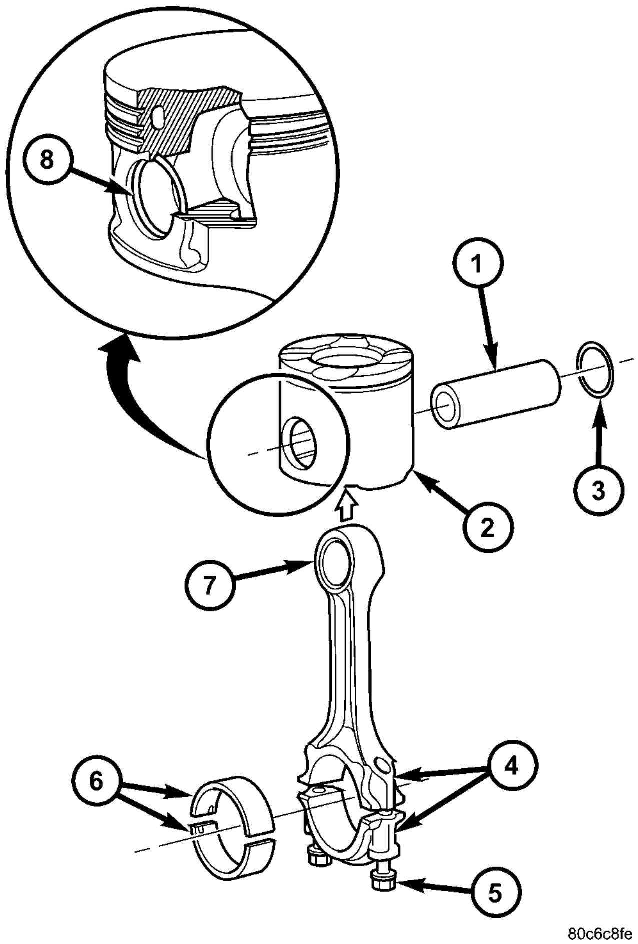


Fig. 63 PISTON AND CONNECTING ROD ASSEMBLY

1 - PISTON PIN
2 - PISTON
3 - SNAP RING
4 - PAINTED CONNECTING ROD ALIGNMENT NUMBERS
5 - CONNECTING ROD BOLT
6 - CONNECTING ROD BEARING
7 - CONNECTING ROD
8 - SNAP RING

PISTON RING - REMOVAL

(1) ID mark on face of top and second piston rings must point toward piston crown.

(2) Using a suitable ring expander, remove top and second piston rings (Fig. 64).

(3) Remove upper oil ring side rail, lower oil ring side rail and then the oil expander from piston.

(4) Carefully clean carbon from piston crowns, skirts and ring grooves ensuring the 4 oil holes in the oil control ring groove are clear.

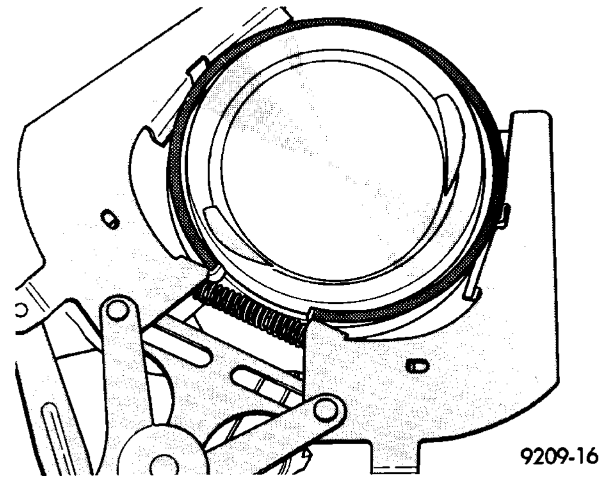


Fig. 64 PISTON RINGS - REMOVAL/INSTALLATION

INSPECTION

PISTONS

(1) Piston Diameter: Size: 91.912-91.928mm (3.6185-3.6192 in.) Maximum wear limit .05mm (.0019 in.).

(2) Check piston pin bores in piston for roundness. Make 3 checks at 120° intervals. Maximum out of roundness .05mm (.0019in.).

(3) The piston diameter should be measured approximately 15 mm (.590 in.) up from the base.

(4) Skirt wear should not exceed 0.1 mm (.00039 in.).

(5) The clearance between the cylinder liner and piston should not exceed 0.065-0.083 mm (.0025-.0032 in.).

CONNECTING RODS

CAUTION: Connecting rod bolts must be replaced when disassembled. When assembling the connecting rod, be sure that the pawl on each of the connecting rod caps is facing the rear (fly wheel) side of the engine (Fig. 65).

NOTE: Do Not lubricate the new connecting rod bolts. They are already coated with a anti scuff treatment.

(1) Assemble bearing shells and bearing caps to their respective connecting rods ensuring that the serrations on the cap and reference marks are aligned (Fig. 65).

(2) Tighten connecting cap bolts to 10 N·m (88 in. lbs.).

(3) Without loosening connecting rod bolts, tighten all bolts to 30N·m (22 ft.lbs.).

(4) Using a torque angle gauge, tighten each bolt an additional 40°.

PISTON & CONNECTING ROD (Continued)

(5) Recheck all bolt tightening with a torque wrench set to 88N·m (65 ft.lbs.).

(6) Check and record internal diameter of crank end of connecting rod.

CAUTION: When changing connecting rods, DO NOT use a stamp to mark the cylinder location. Identify the connecting rods and caps location using a paint marker. All four must have the same weight and the same number. Replacement connecting rods will only be supplied in sets of four (Fig. 65).

Connecting rods are supplied in sets of four since they all must be of the same weight category. Max allowable weight difference is 5 gr.

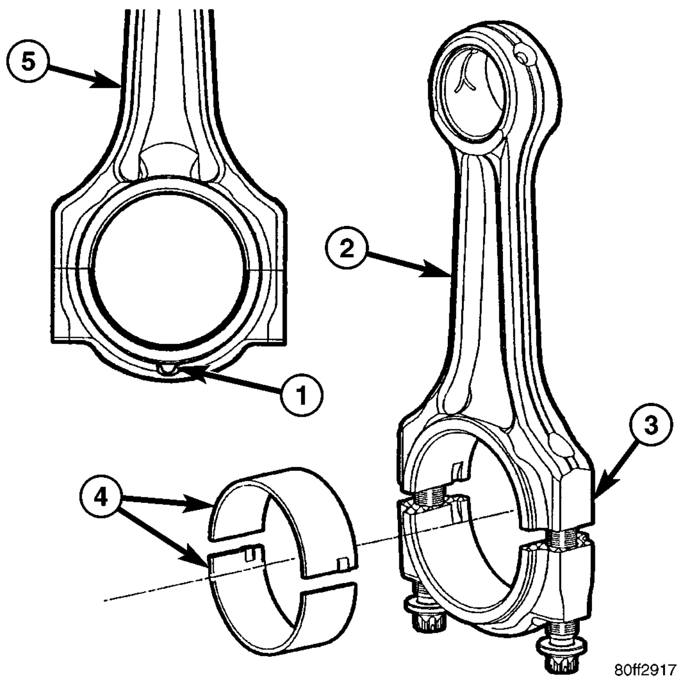


Fig. 65 CONNECTING ROD IDENTIFICATION

1 - CONNECTING ROD PAWL
2 - CONNECTING ROD
3 - PAINTED CYLINDER IDENTIFIER
4 - CONNECTING ROD BEARINGS
5 - CONNECTING ROD

PISTON PINS

(1) Measure the diameter of piston pin in the center and both ends.For specification,(Refer to 9 - ENGINE - SPECIFICATIONS), (Refer to 9 - ENGINE - SPECIFICATIONS)

INSTALLATION

PISTON PIN INSTALLATION

(1) Secure connecting rod in soft jawed vice.

(2) Lubricate piston pin and piston with clean engine oil.

(3) Position piston on connecting rod (Fig. 66).

CAUTION: Ensure arrow on piston crown and the bearing cap numbers on the connecting rod are on the opposite side.

(4) Install piston pin (Fig. 66).

(5) Install clips in piston to retain piston pin (Fig. 66).

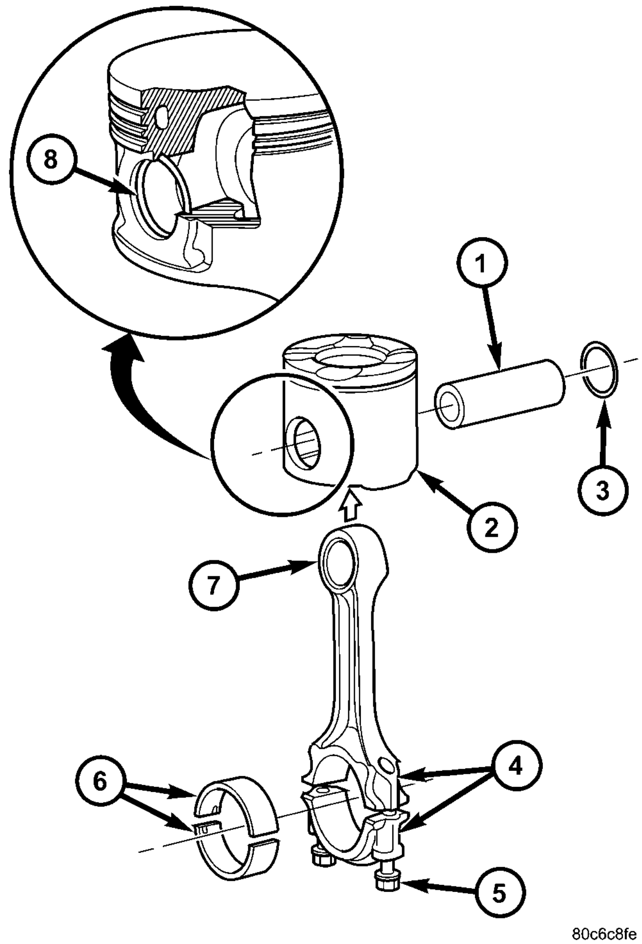


Fig. 66 PISTON AND CONNECTING ROD ASSEMBLY

1 - PISTON PIN
2 - PISTON
3 - SNAP RING
4 - PAINTED CONNECTING ROD ALIGNMENT NUMBERS
5 - CONNECTING ROD BOLT
6 - CONNECTING ROD BEARING
7 - CONNECTING ROD
8 - SNAP RING

(6) Remove connecting rod from vice.

PISTON RINGS - INSTALLATION

(1) Install rings on the pistons using a suitable ring expander (Fig. 67).

(2) Top compression ring is tapered and chromium plated. The second ring is of the scraper type and must be installed with scraping edge facing bottom of the piston. The third is an oil control ring. Ring gaps must be positioned, before inserting piston into the liners, as follows.

PISTON & CONNECTING ROD (Continued)

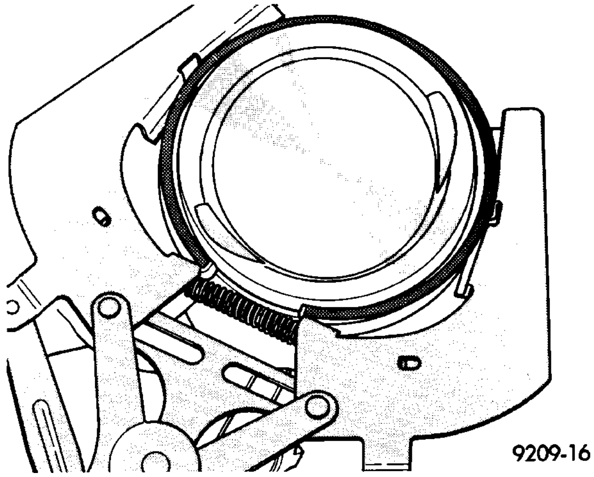


Fig. 67 PISTON RINGS-INSTALLATION

(3) Top ring gap must be positioned at the #3 position (looking at the piston crown from above) (Fig. 68).

(4) Second piston ring gap should be positioned at the #1 position (Fig. 68).

(5) Oil control ring gap should be positioned at the #2 position (Fig. 68).

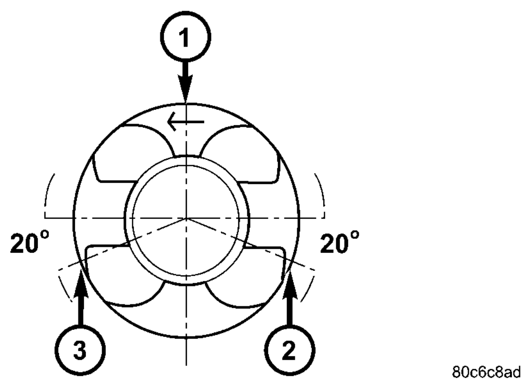


Fig. 68 PISTON RING GAP LOCATION

1 - SECOND COMPRESSION RING GAP POSITION
2 - OIL CONTROL RING GAP POSITION
3 - TOP COMPRESSION RING GAP POSITION

(6) When assembling pistons check that components are installed in the same position as before disassembly, determined by the numbers stamped on the crown of individual pistons. Engine cylinders are numbered starting from gear train end of the engine. **Face arrow on top of piston toward front of engine**. Therefore, the numbers stamped on connecting rod big end should face toward the injection pump side of engine. To insert piston into cylinder use a ring compressor (VM.1065) as shown in (Fig. 69).

INSTALLATION

(1) Before installing pistons, and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap (Fig. 68).

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted together.

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston and tighten (Fig. 69). **Ensure position of rings does not change during this operation**.

NOTE: Be sure arrow on top of piston faces towards front of engine and the connecting rod pawl faces the rear (flywheel) side of the engine.

NOTE: Be careful not to nick crankshaft journals.

(4) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

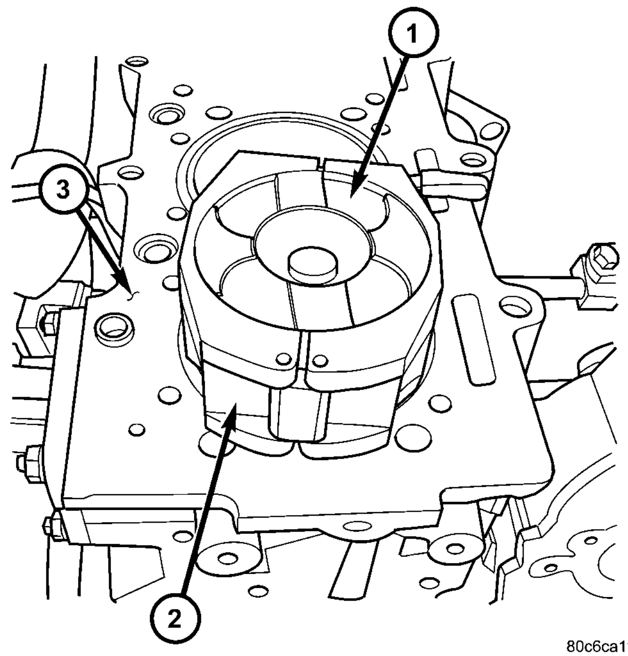


Fig. 69 PISTON INSTALLATION USING VM.1065

1 - PISTON
2 - PISTON RING COMPRESSOR VM.1065
3 - ENGINE BLOCK

(5) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

PISTON & CONNECTING ROD (Continued)

NOTE: Connecting rod bolts must be replaced when disassembled. DO NOT lubricate new connecting rod bolts as they are already coated.

(6) Install connecting rod caps (Fig. 70). Install rod bolts and tighten each bolt to 10N·m (89 lbs. in..). Tighten each bolt again to 30N·m (22 lbs. ft.) plus 40°. Then torque to 88N·m (65 ft.lb).

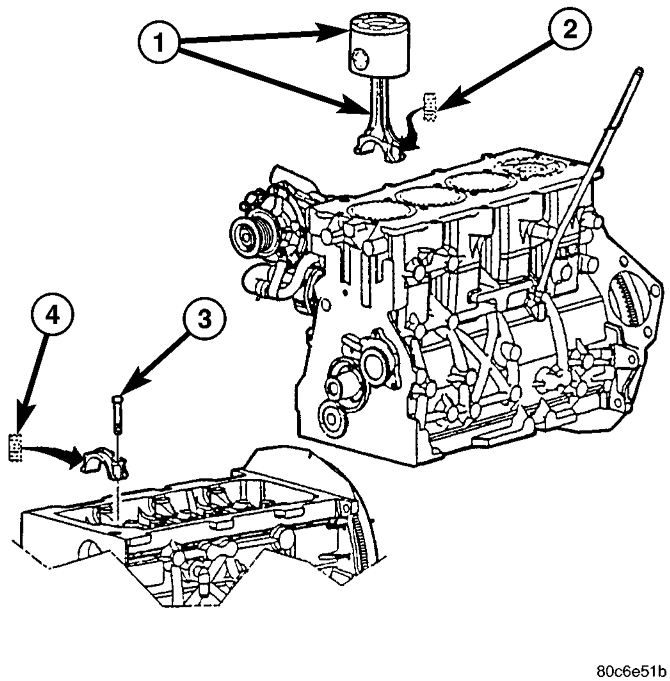


Fig. 70 PISTON AND CONNECTING ROD INSTALLATION

1 - PISTON AND CONNECTING ROD ASSEMBLY
2 - PAINTED CYLINDER IDENTIFIER
3 - CONNECTING ROD BOLT
4 - PAINTED CYLINDER IDENTIFIER

(7) Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(8) Install balance shaft assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION).

(9) Install oil pump pickup tube (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).

(10) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(11) Connect negative battery cable.

CRANKSHAFT OIL SEAL - FRONT

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove air cleaner housing.

(3) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

(4) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(5) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(6) Remove vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(7) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(8) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(9) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

NOTE: Crankshaft hub retaining bolt has LHD thread.

(10) Remove crankshaft hub (Fig. 71).

(11) Remove front engine cover (Fig. 71) (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL) .

(12) With cover on work bench, pry out old seal.

INSTALLATION

CAUTION: Do Not use a hammer to install the crankshaft oil seal.

NOTE: To prevent potential oil leaks, DO NOT touch the front crankshaft inner seal. Always handle the seal from the outer diameter.

(1) Clean engine block and front engine cover sealing surfaces.

(2) Install crankshaft oil seal on VM.1061 (Fig. 72).

(3) Place sleeve for VM.1061 on press bench as shown (Fig. 72).

CRANKSHAFT OIL SEAL - FRONT (Continued)

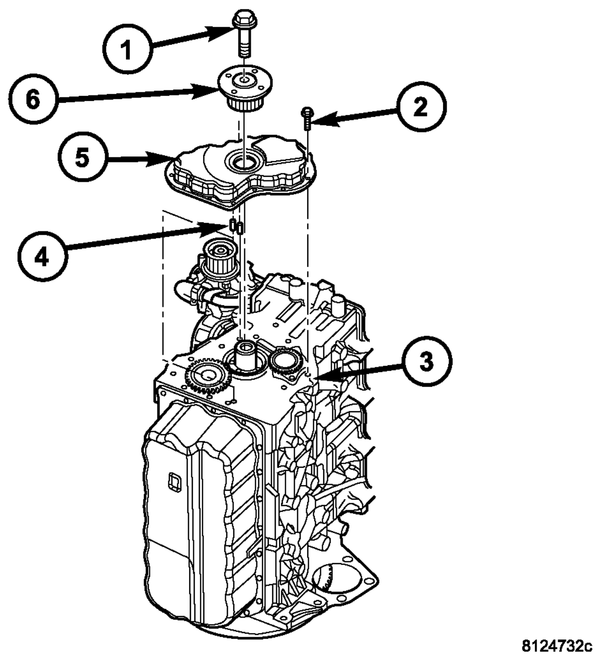


Fig. 71 ENGINE COVER - FRONT

1 - CRANKSHAFT HUB RETAINING BOLT
2 - FRONT ENGINE COVER RETAINING BOLTS
3 - ENGINE BLOCK
4 - FRONT ENGINE COVER ALIGNMENT DOWELS
5 - FRONT ENGINE COVER
6 - CRANKSHAFT HUB

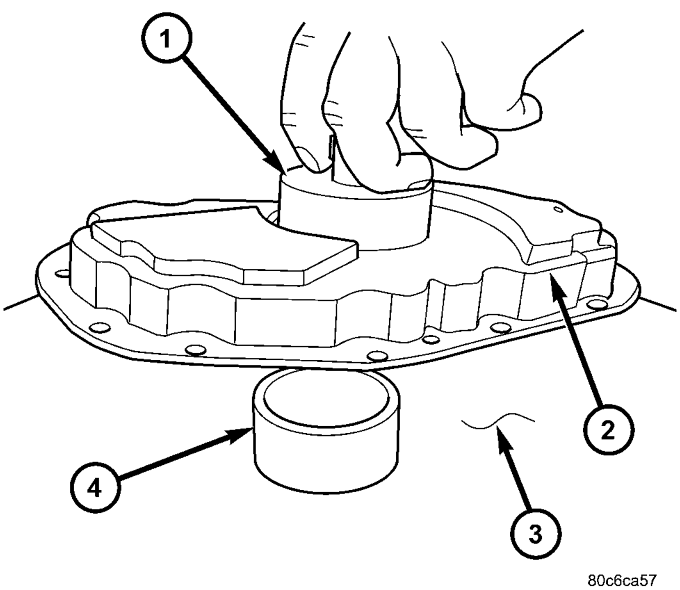


Fig. 72 VM.1061 PLACEMENT

1 - VM.1061
2 - FRONT ENGINE COVER
3 - PRESS BENCH
4 - SLEEVE FROM VM.1061

(4) Press the new seal into front engine cover.

(5) Install front engine cover using VM 1061 as a guide, care must be taken not to damage the seal (Fig. 73).

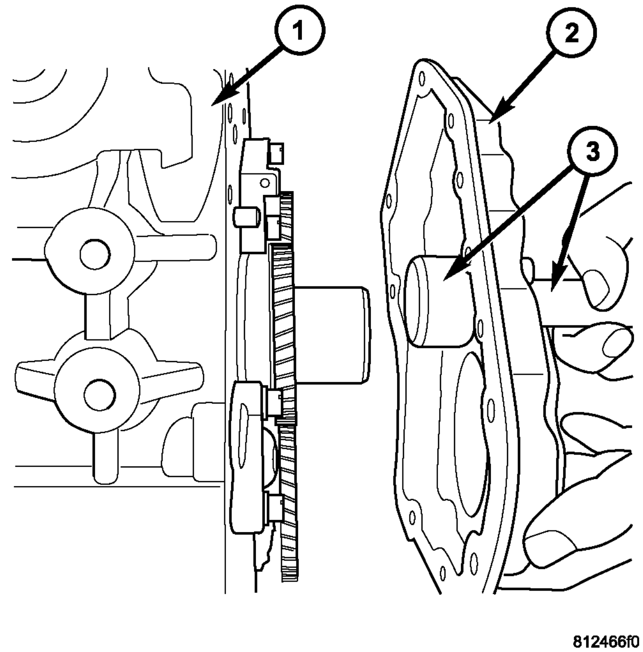


Fig. 73 ENGINE FRONT COVER

1 - ENGINE BLOCK
2 - FRONT ENGINE COVER
3 - VM.1061

(6) Install crankshaft hub and retaining bolt. Torque bolt to 304N·m (224 lbs. ft.).

(7) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(8) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(9) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(10) Install vibration damper/crankshaft pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(11) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(12) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(14) Install air cleaner housing.

(15) Connect negative battery cable.

VIBRATION DAMPER

REMOVAL

(1) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(2) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(3) Remove vibration damper retaining bolts and damper (Fig. 74).

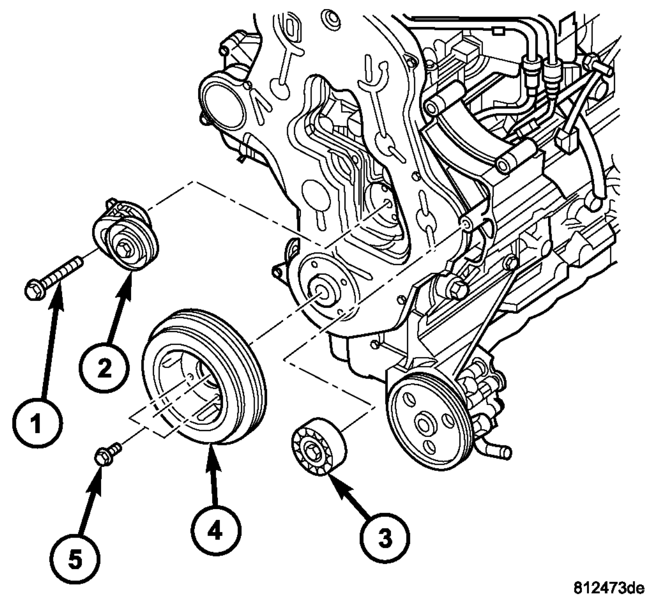


Fig. 74 VIBRATION DAMPER

1 - BELT TENSIONER RETAINING BOLT
2 - BELT TENSIONER
3 - IDLER PULLEY
4 - VIBRATION DAMPER/CRANKSHAFT PULLEY
5 - VIBRATION DAMPER/CRANKSHAFT PULLEY RETAINING BOLTS

INSTALLATION

(1) Install vibration damper and retaining bolts (Fig. 74). Torque bolts to 27.5N·m.

(2) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(3) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

ENGINE COVER - FRONT

DESCRIPTION

The front engine cover on this engine is a stamped steel cover which covers the oil pump and vacuum pump.

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove air cleaner housing.

(3) Support engine and remove right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - REMOVAL).

(4) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(5) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(6) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(7) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

CAUTION: Before removing the cylinder head cover/ intake manifold or timing belt the engine must put at 90° after TDC. Failure to do so could result in valve and/or piston damage during reassembly. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

(8) Remove timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(9) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

NOTE: Crankshaft hub has LHD thread.

(10) Remove crankshaft hub.

(11) Remove front engine cover (Fig. 75).

INSTALLATION

(1) Clean engine block and front engine cover sealing surfaces.

(2) Apply a continous 3mm bead of Silicone Sealer to cover, install within 10 minutes (Fig. 75). Torque bolts to 11.8N·m.

ENGINE COVER - FRONT (Continued)

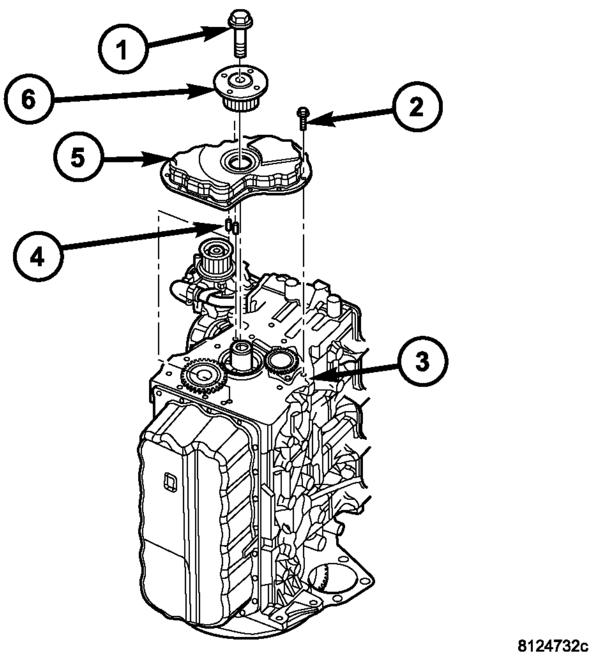


Fig. 75 ENGINE COVER - FRONT

1 - CRANKSHAFT HUB RETAINING BOLT
2 - FRONT ENGINE COVER RETAINING BOLTS
3 - ENGINE BLOCK
4 - FRONT ENGINE COVER ALIGNMENT DOWELS
5 - FRONT ENGINE COVER
6 - CRANKSHAFT HUB

(3) Install crankshaft hub (Fig. 75). Torque bolt to 304N·m.

(4) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(5) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(6) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(7) Install vibration damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(8) Install right engine mount (Refer to 9 - ENGINE/ENGINE MOUNTING/RIGHT MOUNT - INSTALLATION).

(9) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(10) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(11) Install air cleaner housing.

(12) Connect negative battery cable.

CRANKSHAFT MAIN BEARINGS

REMOVAL

NOTE: Refer to crankshaft description for proper identification of the crankshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - DESCRIPTION).

The engine must be removed from vehicle and completely disassembled to replace the front main bearing.

CRANKSHAFT MAIN BEARINGS

(1) With crankshaft assembly removed from engine.

(2) Remove crankshaft supports from crankshaft and remove bearing halves from supports (Fig. 76).

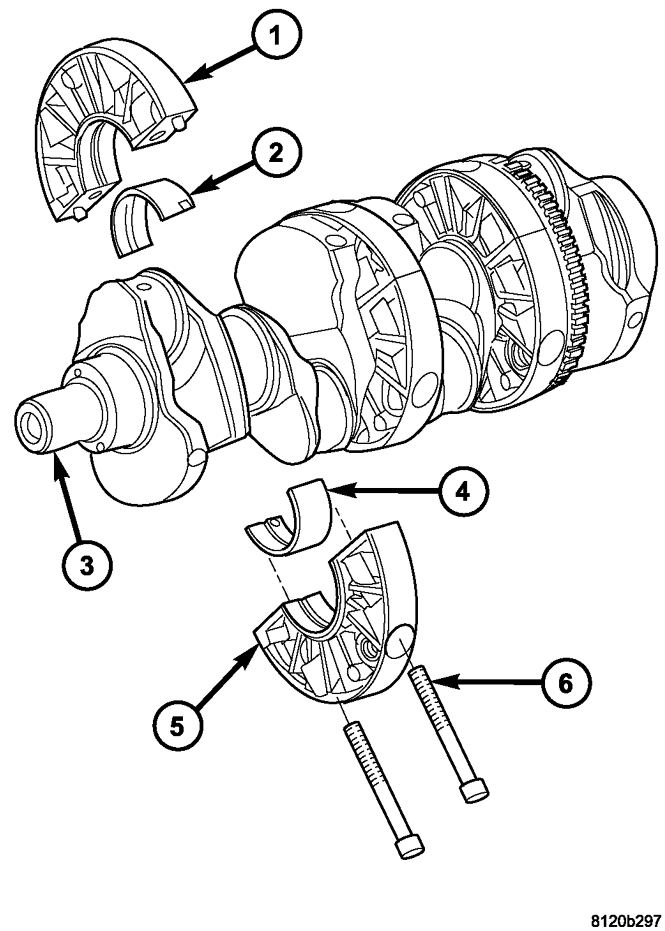


Fig. 76 2.5L CRANKSHAFT

1 - CRANKSHAFT SUPPORT HALVE
2 - MAIN BEARING HALVE
3 - CRANKSHAFT
4 - MAIN BEARING HALVE
5 - CRANKSHAFT SUPPORT HALVE
6 - MAIN BEARING SUPPORT BOLTS

CRANKSHAFT MAIN BEARINGS (Continued)

CRANKSHAFT FRONT MAIN BEARING

(1) Using special tool VM.1073 push front main bearing out of front of engine block (Fig. 77).

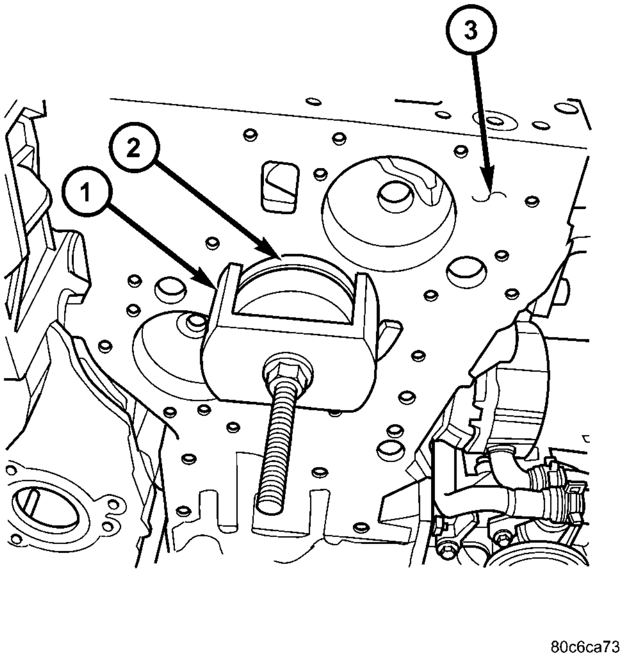


Fig. 77 FRONT MAIN BEARING REMOVAL

1 - VM.1073
2 - FRONT CRANKSHAFT MAIN BEARING
3 - ENGINE BLOCK

INSTALLATION

CRANKSHAFT MAIN BEARINGS

NOTE: Refer to crankshaft description for proper identification of the crankshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - DESCRIPTION).

(1) Install bearing halves in crankshaft supports.

(2) Lubricate crankshaft and main bearings with clean engine oil.

(3) Install crankshaft supports on crankshaft (Fig. 78). Torque bolts to 44.1N·m.

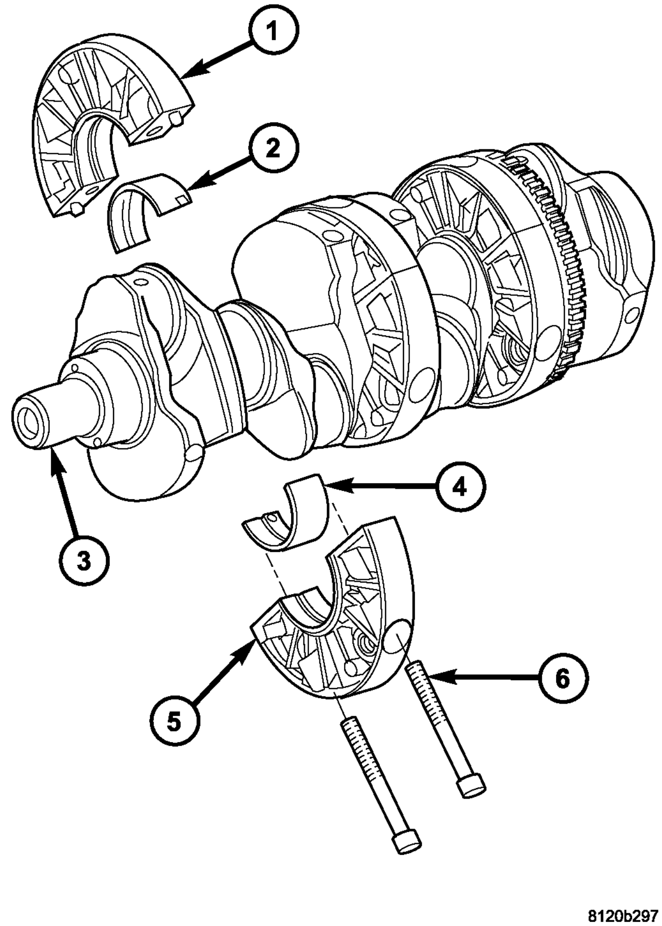


Fig. 78 2.5L CRANKSHAFT

1 - CRANKSHAFT SUPPORT HALVE
2 - MAIN BEARING HALVE
3 - CRANKSHAFT
4 - MAIN BEARING HALVE
5 - CRANKSHAFT SUPPORT HALVE
6 - MAIN BEARING SUPPORT BOLTS

FRONT CRANKSHAFT MAIN BEARING

(1) Using special tool VM.1073, push front crankshaft main bearing in engine block (Fig. 79).

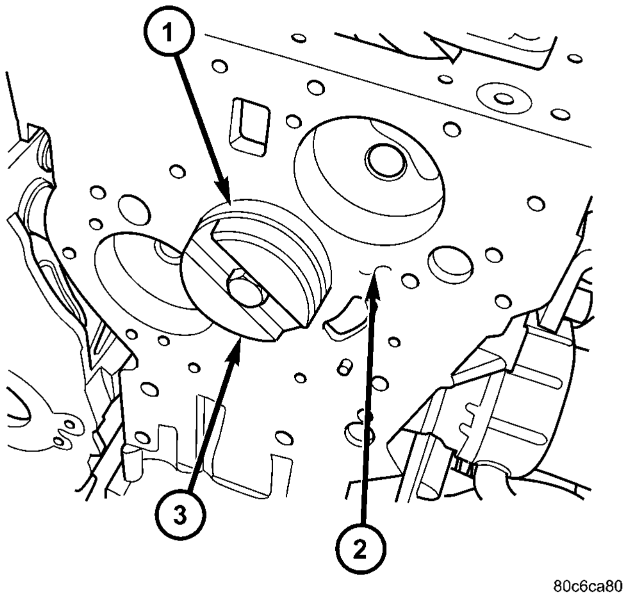


Fig. 79 FRONT MAIN BEARING INSTALLATION

1 - FRONT CRANKSHAFT MAIN BEARING
2 - ENGINE BLOCK
3 - SPECIAL TOOL VM.1073

(2) Be sure oil hole in bearing lines up with oil gallery in engine block (Fig. 80).

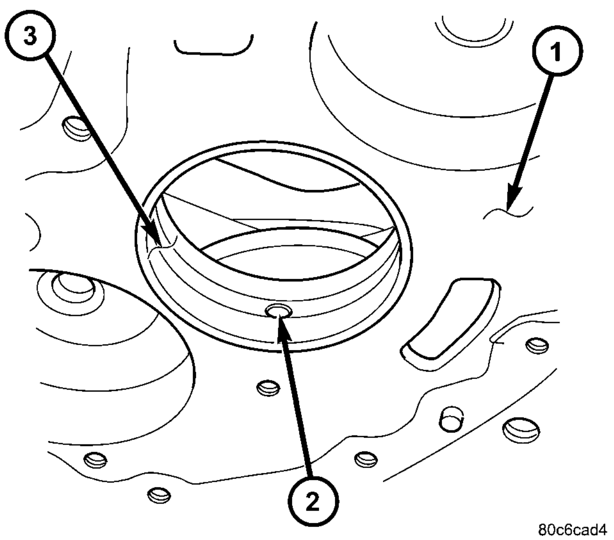


Fig. 80 FRONT MAIN BEARING ALIGNMENT

1 - ENGINE BLOCK
2 - OIL HOLE IN BEARING
3 - FRONT CRANKSHAFT MAIN BEARING

(3) Reassemble engine and install in vehicle.

CRANKSHAFT OIL SEAL - REAR

DESCRIPTION

The rear crankshaft seal consists of two parts that reside in a third part, the rear support assembly. The rear seal is inserted into the rear cup (Fig. 81). These pieces should be assembled WITH OUT removing one from the other. The rear support assembly, once assembled, should not be separated as well, to reduced possibility of damage to the internal rear seal lip (Fig. 82).

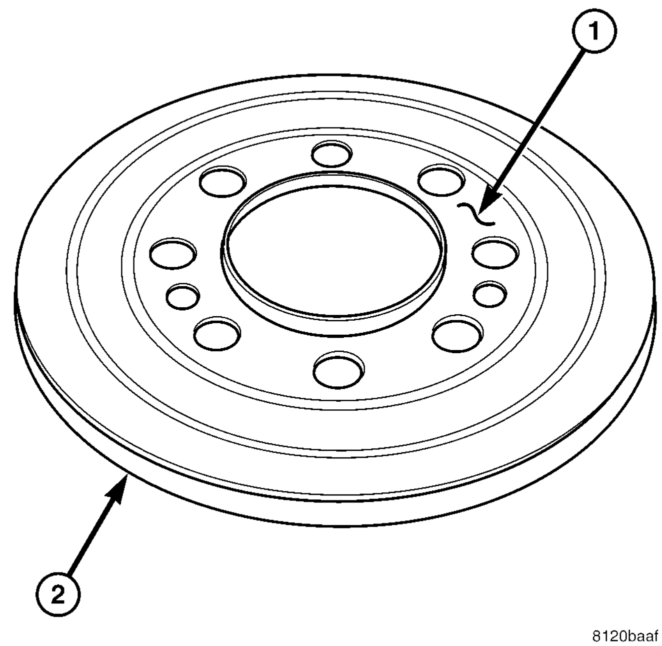


Fig. 81 REAR CRANKSHAFT SEAL ASSEMBLY

1 - REAR SEAL
2 - REAR CUP

REMOVAL

This must be done with either the engine or transmission removed from vehicle.

(1) Remove flywheel assembly.

(2) Pry out old crankshaft oil seal.

INSTALLATION

NOTE: To prevent potential oil leaks, DO NOT touch or separate the rear crankshaft inner seal. Always handle the seal from the outer diameter (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - DESCRIPTION).

CRANKSHAFT OIL SEAL - REAR (Continued)

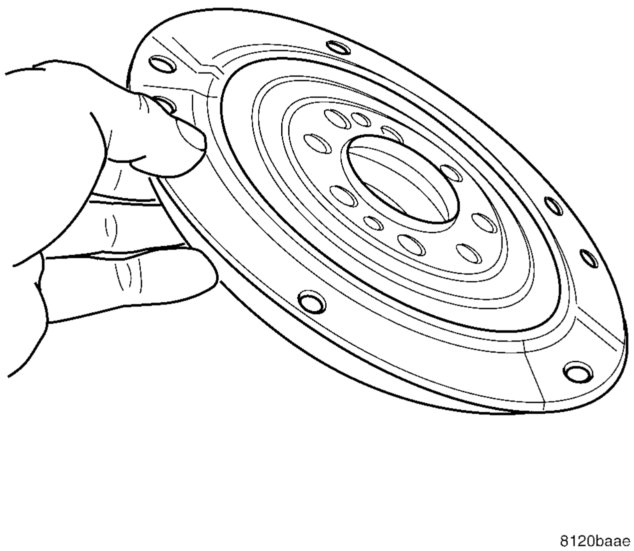


Fig. 82 REAR SUPPORT ASSEMBLY

(1) Using special tool VM.1050, install rear crankshaft oil seal in rear main bearing support (Fig. 83).

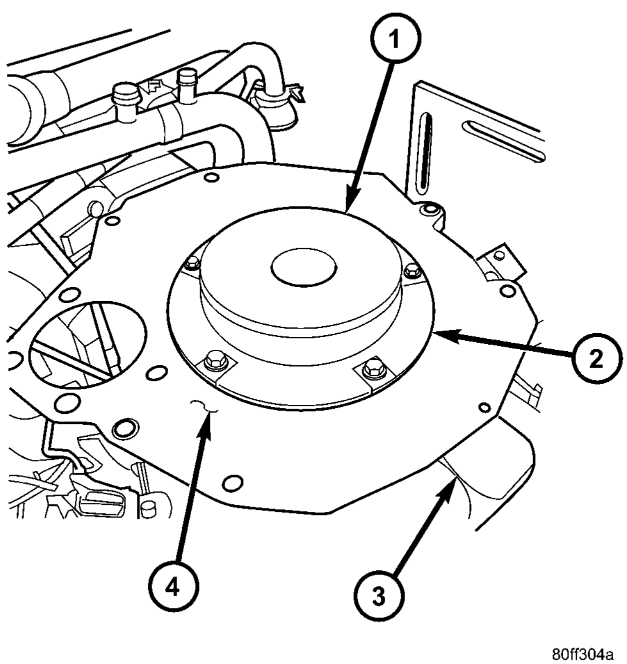


Fig. 83 2.5L REAR CRANKSHAFT OIL SEAL INSTALLATION USING VM.1050

1 - SPECIAL TOOL VM.1050
2 - REAR MAIN BEARING SUPPORT
3 - OIL PAN
4 - ENGINE TO TRANSMISSION ADAPTER PLATE

(2) Install engine or transmission in vehicle.

OIL PAN

REMOVAL

(1) Disconnect negative battery cable.
(2) Raise vehicle on hoist.
(3) Drain engine oil from engine.
(4) Remove all oil pan retaining bolts and oil pan (Fig. 84).

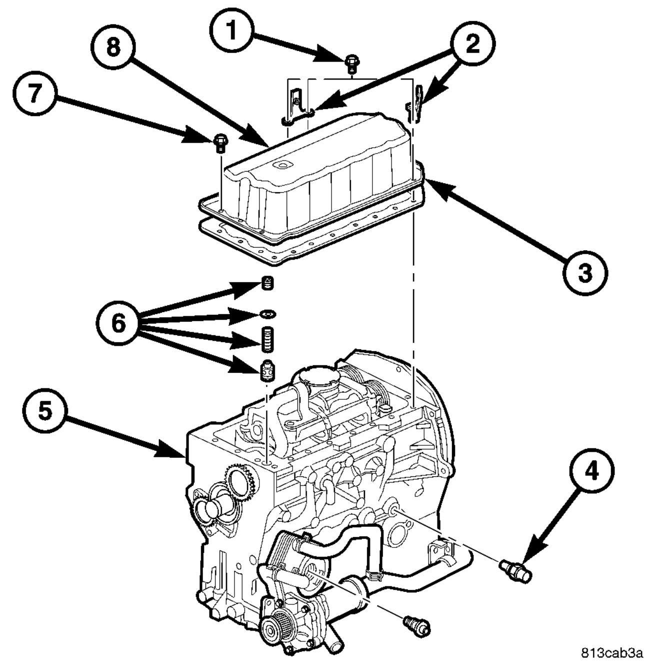


Fig. 84 OIL PAN

1 - OIL PAN RETAINING BOLTS
2 - POWER STEERING LINE BRACKETS
3 - OIL PAN GASKET
4 - OIL PRESSURE SENSOR
5 - ENGINE BLOCK
6 - OIL PRESSURE RELIEF VALVE
7 - OIL PAN RETAINING BOLTS
8 - OIL PAN

INSTALLATION

(1) Clean oil pan and sealing surfaces. Inspect oil pan and engine block.
(2) Install oil pan, gasket, and retaining bolts (Fig. 84).
(3) Be sure power steering line brackets are in proper location (Fig. 84).
(4) Torque oil pan bolts to 11.8N·m.
(5) Lower vehicle.
(6) Refill engine oil to proper level.
(7) Connect negative battery cable.

OIL PUMP

REMOVAL

REMOVAL

(1) Disconnect negative battery cable.
(2) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(3) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(4) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
(5) Remove timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
(6) Remove timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
(7) Remove front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - REMOVAL).
(8) Remove crankshaft sprocket (Fig. 85).
(9) Remove oil pump retaining bolts and remove pump from engine block (Fig. 85).

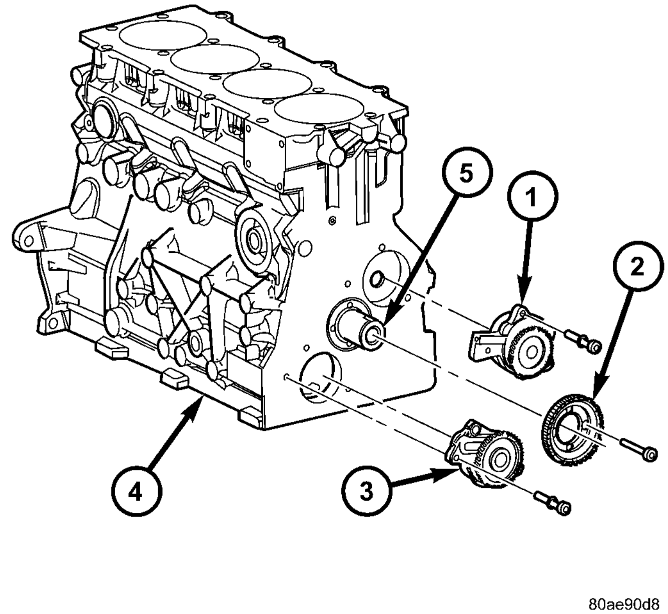


Fig. 85 OIL PUMP AND VACUUM PUMP

1 - VACUUM PUMP
2 - CRANKSHAFT SPROCKET
3 - OIL PUMP
4 - ENGINE BLOCK
5 - CRANKSHAFT

REMOVAL

(1) Disconnect negative battery cable.
(2) Raise vehicle on hoist.
(3) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
(4) Remove oil pump pickup tube retaining bolt and pull pickup tube from engine block (Fig. 86).

INSTALLATION

INSTALLATION

(1) Lubricate oil pump rotor with engine oil.
(2) Install oil pump in bore in engine block (Fig. 85).
(3) Install oil pump retaining bolts (Fig. 85). Torque bolts to 10.8N·m.
(4) Install crankshaft sprocket (Fig. 85). Torque bolts to 10.8N·m.
(5) Install front engine cover (Refer to 9 - ENGINE/ENGINE BLOCK/ENGINE COVER - INSTALLATION).
(6) Install timing belt inner cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
(7) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
(8) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
(9) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(10) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(11) Connect negative battery cable.

OIL PUMP (Continued)

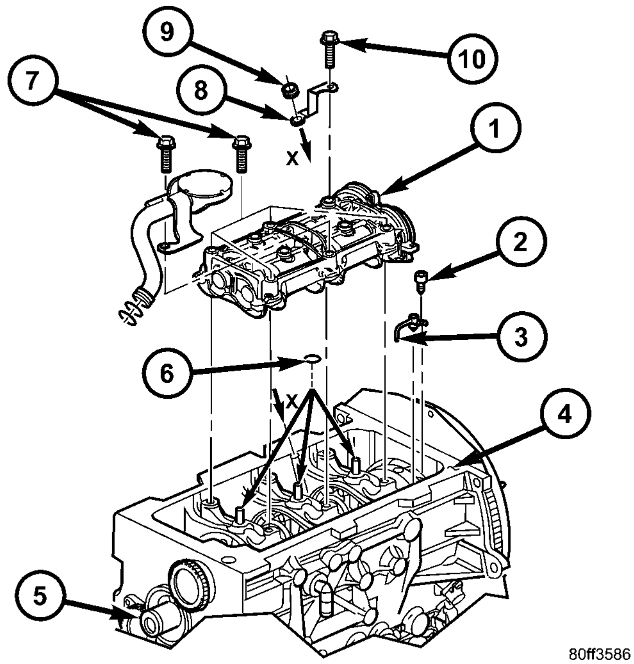


Fig. 86 OIL PUMP PICKUP TUBE ASSEMBLY

1 - BALANCE SHAFT
2 - OIL JET RETAINING BOLT
3 - OIL JET
4 - ENGINE BLOCK
5 - CRANKSHAFT
6 - O- RING(S)
7 - BALANCE SHAFT RETAINING BOLTS
8 - OIL DIPSTICK TUBE RETAINER
9 - RUBBER BUSHING
10 - RETAINING BOLT

INSTALLATION

(1) Lubricate o-ring on oil pump pickup tube with engine oil.

(2) Install pickup tube in engine block and install retaining bolt (Fig. 86). Torque bolt to 32.4N·m.

(3) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(4) Refill engine oil to proper level.

(5) Connect negative battery cable.

NOTE: If a slight oil witness mark is present, retighten the oil pan bolts to 12N·m (106 in.lbs.).

(6) Start engine and inspect for leaks.

OIL PRESSURE SENSOR/ SWITCH

DESCRIPTION

The oil pressure switch is located on the right side of the engine block. The switch screws into the engines main oil gallery (Fig. 87).

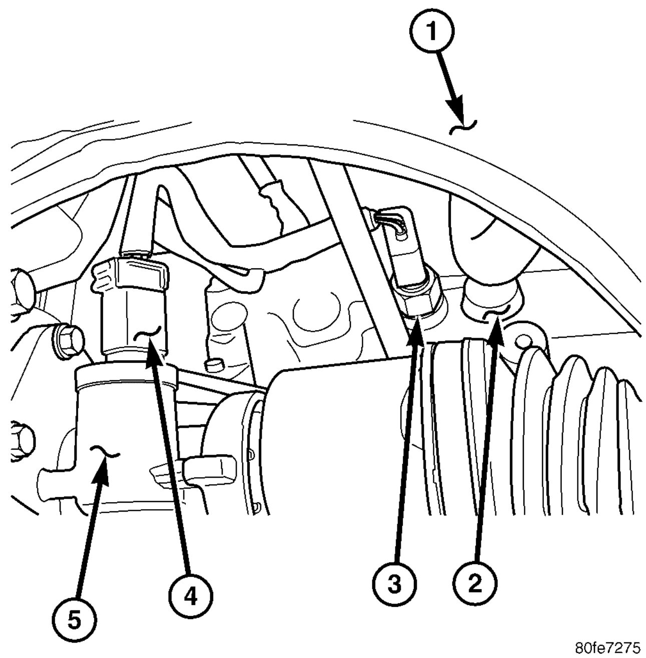


Fig. 87 VIEW-REAR ENGINE

1 - SUSPENSION CRADLE
2 - ENGINE BLOCK
3 - OIL PRESSURE SWITCH
4 - VEHICLE SPEED SENSOR
5 - TRANSMISSION

REMOVAL

(1) Disconnect negative battery cable.

(2) Raise vehicle on hoist.

(3) Disconnect oil pressure switch electrical connector (Fig. 87).

(4) Remove oil pressure switch from engine block.

INSTALLATION

(1) Apply Mopar® Thread Sealant to the switch threads.

(2) Install oil pressure switch in engine block.

(3) Connect oil pressure switch electrical connector (Fig. 87).

(4) Lower vehicle.

(5) Start engine and check for leaks.

(6) Check and adjust oil level as necessary.

OIL PRESSURE RELIEF VALVE

DESCRIPTION

The oil pressure relief valve mounts in the front of the engine block and is used to control oil flow through the engines lubrication system (Fig. 88).

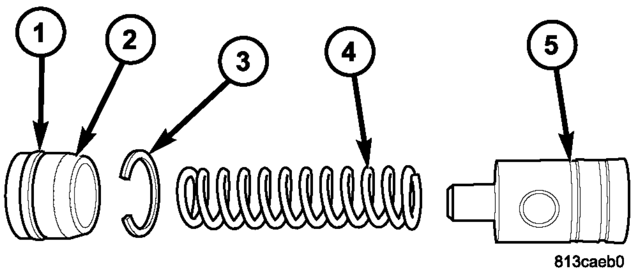


Fig. 88 OIL PRESSURE RELIEF VALVE

1 - O-RING
2 - OIL PRESSURE RELIEF VALVE CAP
3 - CLIP
4 - OIL PRESSURE RELIEF VALVE SPRING
5 - OIL PRESSURE RELIEF VALVE PLUNGER

REMOVAL

(1) Remove engine oil pan (Refer to 9 - ENGINE/ LUBRICATION/OIL PAN - REMOVAL).

(2) Using special tool VM.1054, remove oil pressure relief valve from engine block (Fig. 89).

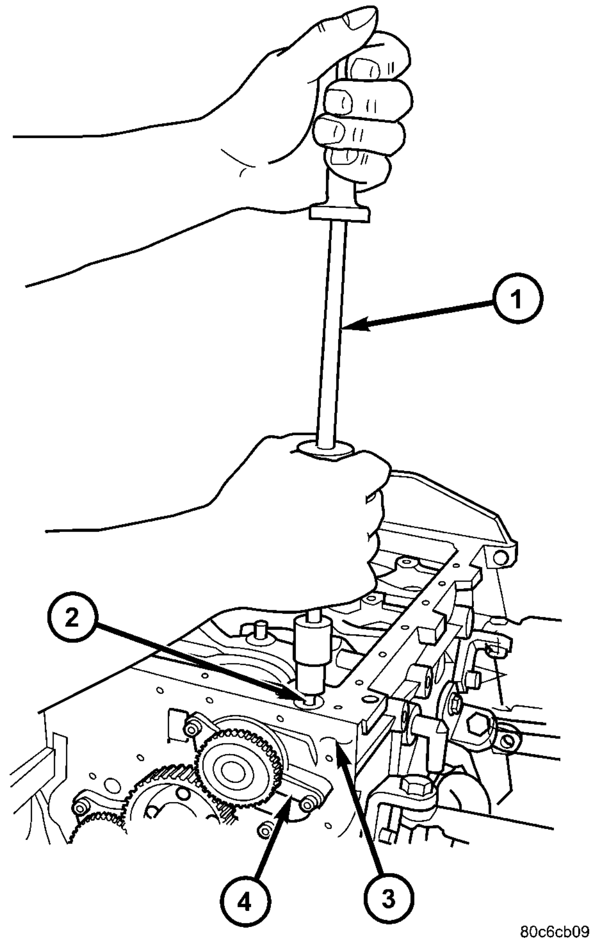


Fig. 89 OIL PRESSURE RELIEF VALVE REMOVAL

1 - VM.1054
2 - OIL PRESSURE RELIEF VALVE
3 - ENGINE BLOCK
4 - OIL PUMP

INSTALLATION

(1) Thoroughly clean all components and relief valve pocket in cylinder block.

(2) Lubricate all oil pressure relief valve components with engine oil.

(3) Install oil pressure relief valve plunger, spring, and cap.

(4) Using special tool VM.1059, push oil pressure relief valve cap in untill flush with engine block (Fig. 90).

(5) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

OIL PRESSURE RELIEF VALVE (Continued)

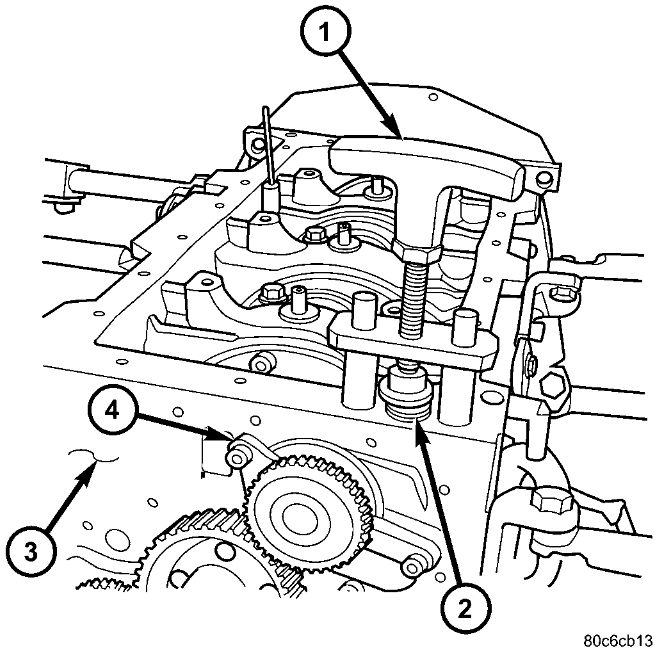


Fig. 90 OIL PRESSURE RELIEF VALVE INSTALLATION

1 - VM.1059
2 - OIL PRESSURE RELIEF VALVE
3 - ENGINE BLOCK
4 - OIL PUMP

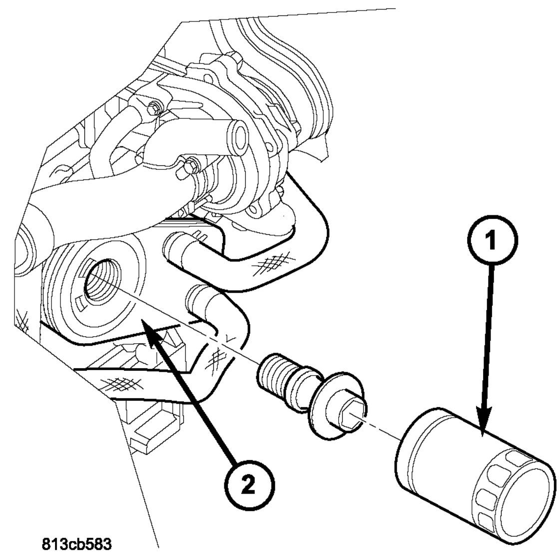


Fig. 91 OIL FILTER

1 - OIL FILTER
2 - ENGINE OIL COOLER

OIL COOLER & LINES

REMOVAL

(1) Drain cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(2) Raise vehicle on hoist.

(3) Remove oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).

(4) Disconnect coolant hoses at cooler (Fig. 92).

(5) Remove oil cooler retaining bolt at engine block (Fig. 92).

(6) Remove oil cooler retaining stud and remove oil cooler from engine block (Fig. 92).

INSTALLATION

(1) Clean oil cooler and engine block sealing surfaces.

(2) Install oil cooler, retaining bolt, and stud (Fig. 92). Torque retaining bolt to 47.1N·m (35 lbs.ft.) and stud to 37.2 N·m (28 lbs.ft.)..

(3) Connect coolant hoses at cooler (Fig. 92).

(4) Install oil filter (Fig. 91)

(5) Lower vehicle.

(6) Refill cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(7) Start engine and check for leaks.

(8) Check and adjust oil level as necessary.

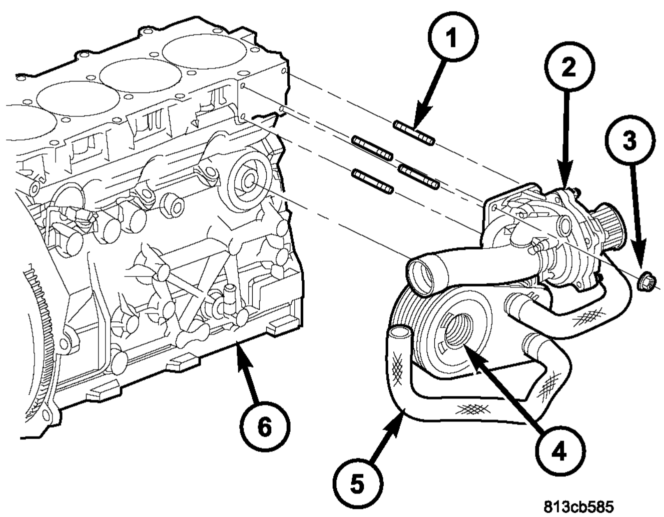


Fig. 92 WATER PUMP AND OIL COOLER ASSEMBLIES

1 - WATER PUMP HOUSING STUDS
2 - WATER PUMP
3 - RETAINING NUTS
4 - OIL COOLER RETAINING STUD
5 - COOLANT HOSE
6 - ENGINE BLOCK

OIL FILTER

DESCRIPTION

The oil filter is a high quality, full flow, disposable style. (Fig. 93).

REMOVAL

NOTE: Capture any residual oil spill while removing filter and wipe any oil that comes in contact with other components

(1) Raise vehicle on hoist.
(2) Twist oil filter counterclockwise with a suitable oil filter wrench to remove. (Fig. 93)

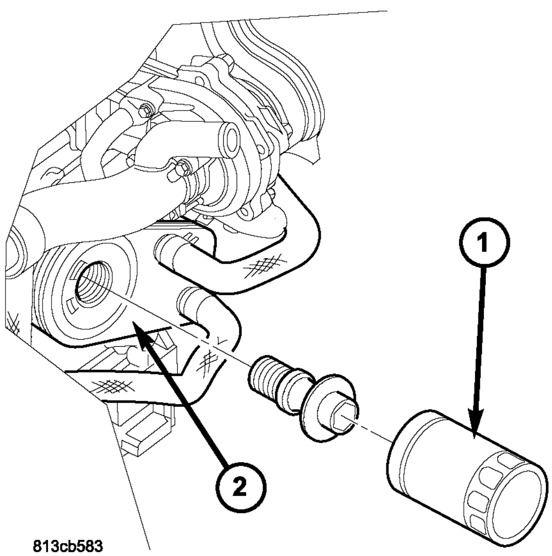


Fig. 93 OIL FILTER

1 - OIL FILTER
2 - ENGINE OIL COOLER

INSTALLATION

(1) Lubracate oil filter seal with clean engine oil.
(2) Turning clockwise, seat the oil filter then tighten the oil filter 1/2 turn more (Fig. 93).
(3) Lower vehicle from hoist.
(4) Start engine and check for leaks.
(5) Check and adjust oil level as necessary.

OIL JET

DESCRIPTION

There are four oil jets installed in the engine block. These oil jets are used to cool and lubricate the piston assemblies (Fig. 94).

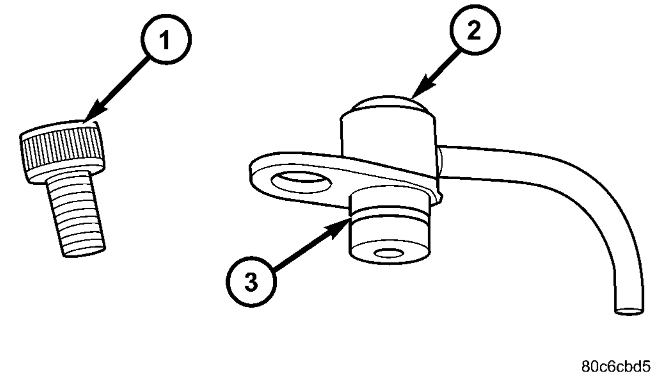


Fig. 94 OIL JET ASSEMBLY

1 - RETAINING BOLT
2 - OIL JET
3 - O-RING

REMOVAL

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage.

NOTE: Remove oil jets Before removing pistons, crankshaft or liners

(1) Disconnect negative battery cable.
(2) Raise vehicle on hoist.
(3) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
(4) Using special tool VM.1060 to hold oil jet. Remove oil jet retaining bolt and remove oil jet from engine block (Fig. 95).

INSTALLATION

CAUTION: Use caution when removing and installaing oil jets. Damage to oil jet nozzle could cause severe engine damage.

NOTE: Carefully install the oil jets After assembling the engine liners, crankshaft and pistons.

(1) Lubricate o-ring on oil jet.
(2) Using special tool VM.1060, install oil jet in engine block (Fig. 95).
(3) Install oil jet retaining bolt. Torque bolt to 10.8N·m.

OIL JET (Continued)

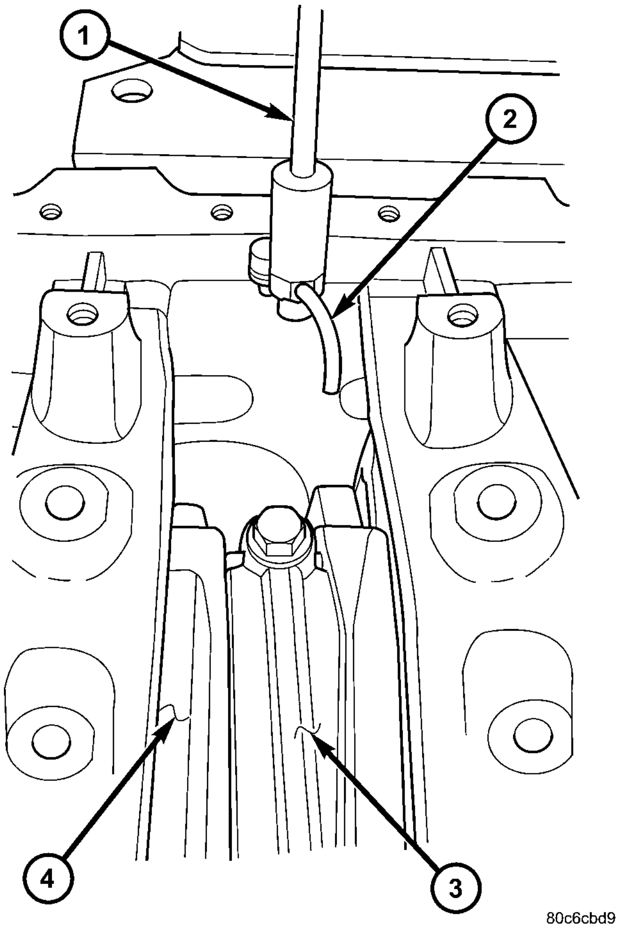


Fig. 95 OIL JET REMOVAL/INSTALLATION

1 - SPECIAL TOOL VM.1060
2 - OIL JET
3 - CONNECTING ROD
4 - CRANKSHAFT

(4) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
(5) Refill engine oil to proper level.
(6) Connect negative battery cable.

INTAKE MANIFOLD

DESCRIPTION

(Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - DESCRIPTION)

REMOVAL

(1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

INSTALLATION

(1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

EXHAUST MANIFOLD

REMOVAL

(1) Remove the battery and tray assembly (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL).
(2) Remove the wiper cowl assembly (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL).
(3) Raise and support the vehicle.
(4) Drain the cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(5) Loosen the clamp retaining the upper charge air tube to the turbocharger (Fig. 96).

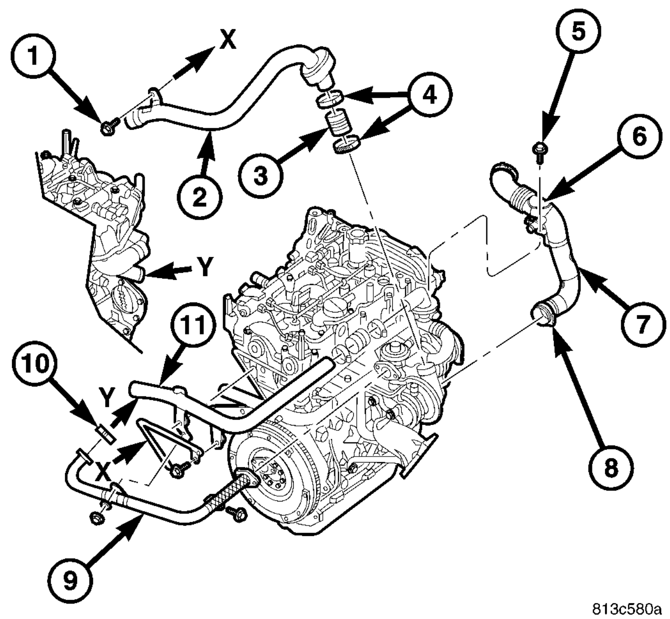


Fig. 96 TURBOCHARGER AND COOLANT PIPES

1 - TURBOCHARGER OUTLET PIPE RETAINING BOLT
2 - TURBOCHARGER OUTLET PIPE
3 - ADAPTOR HOSE
4 - HOSE CLAMPS
5 - TURBOCHARGER INLET PIPE RETAINING BOLT
6 - TURBOCHARGER INLET PIPE
7 - ADAPTOR HOSE
8 - HOSE CLAMPS
9 - EGR VALVE TO INTAKE AIR INLET PIPE
10 - CLAMP
11 - THERMOSTAT HOUSING TO UPPER RADIATOR HOSE PIPE

(6) Lower the vehicle.
(7) Remove the auxiliary heater coolant pipe upper retaining nut.
(8) Remove the coolant recovery pressure container(Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - REMOVAL).
(9) Disconnect the upper radiator hose from the coolant tube.
(10) Remove the coolant tube fasteners and tube.

EXHAUST MANIFOLD (Continued)

(11) Disconnect the charger air inlet at the tube and remove the tube.

(12) Disconnect the EGR cooler coolant hoses.

(13) Disconnect the EGR cooler tube clamp.

(14) Disconnect the EGR vacuum hose.

(15) Remove the engine lift bracket (Fig. 97).

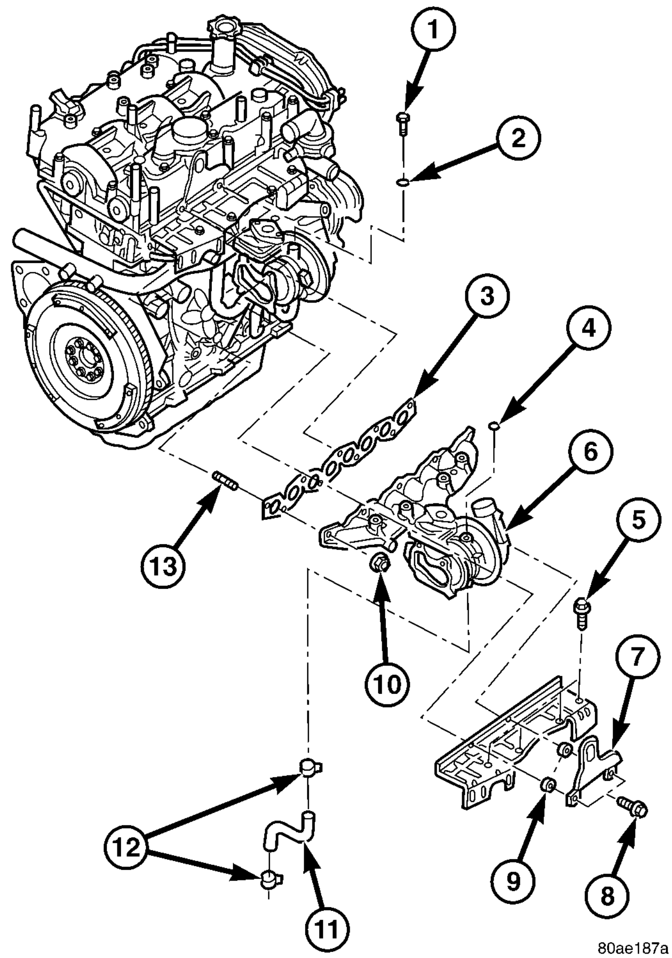


Fig. 97 EXHAUST MANIFOLD AND TURBOCHARGER

1 - TURBOCHARGER OIL SUPPLY BANJO BOLT
2 - COPPER WASHER
3 - EXHAUST MANIFOLD GASKET
4 - COPPER WASHER
5 - EXHAUST MANIFOLD HEAT SHIELD RETAINING BOLT
6 - TURBOCHARGER
7 - ENGINE LIFT HOOK
8 - ENGINE LIFT HOOK RETAINING BOLT
9 - SPACER
10 - EXHAUST MANIFOLD RETAINING NUT
11 - TURBOCHARGER OIL RETURN HOSE
12 - HOSE CLAMPS
13 - EXHAUST MANIFOLD STUDS

(16) Remove the exhaust manifold shields (Fig. 97).

(17) Remove the exhaust manifold upper fasteners (Fig. 97).

(18) Raise and support the vehicle.

(19) Remove the turbocharger (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/ TURBOCHARGER - REMOVAL).

(20) Remove the lower exhaust manifold fasteners and exhaust manifold (Fig. 97).

INSTALLATION

(1) Clean exhaust manifold mating surfaces.

NOTE: The exhaust manifold tightening sequence must be repeated after the original sequence is completed.

(2) Install the exhaust manifold gasket and carefully position the exhaust manifold onto the cylinder head. Tighten the fasteners in a cross pattern working from the inside out to 36 N·m (26.5 lbs. ft.) (Fig. 97).

(3) Install the turbocharger(Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/ TURBOCHARGER - INSTALLATION).

(4) Lower the vehicle

(5) Install the exhaust manifold heat shields. Tighten shield fasteners to 27.5 N·m (21 lbs. ft.) (Fig. 97).

(6) Connect the EGR vacuum hose and cooler hoses.

(7) Connect the EGR Cooler tube.

(8) Install the engine lift bracket (Fig. 97).

(9) Install the charge air tube (Fig. 96).

(10) Install the coolant tube and fasteners (Fig. 96).

(11) Connect the upper radiator to the coolant tube.

(12) Install the coolant reservoir (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESS CONTAINER - INSTALLATION).

(13) Install the auxiliary heater tube fastener. Tighten fastener to 27.5 N·m (21 lbs. ft.).

(14) Raise and support the vehicle.

(15) Connect and tighten the charge air hose to the turbocharger (Fig. 96).

(16) Lower the vehicle.

(17) Install the wiper cowl assembly (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION).

(18) Install the battery and tray assembly (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION).

(19) Start engine and inspect for leaks.

VALVE TIMING

STANDARD PROCEDURE - LOCKING ENGINE 90° AFTER TDC

(1) Disconnect negative battery cable.

(2) Remove starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).

NOTE: Crankshaft hub retaining bolt is left hand thread.

(3) Rotate engine untill notch in hub is in the following position (Fig. 98).

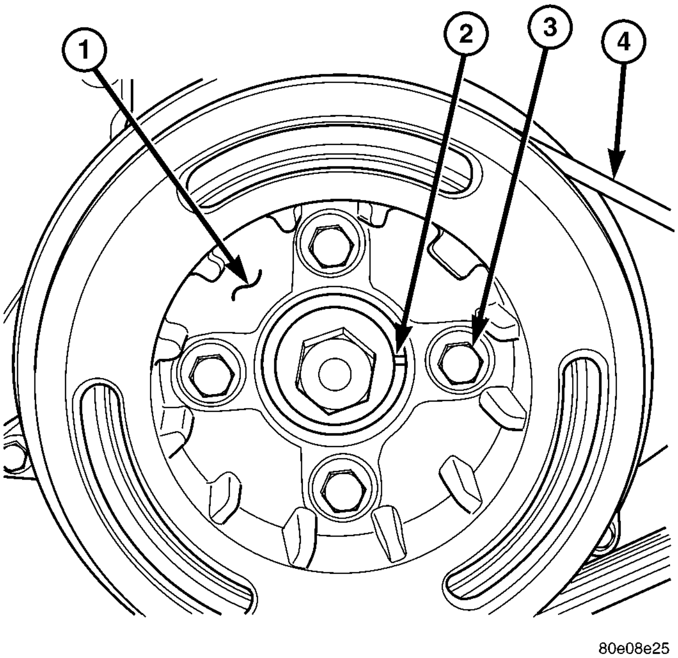


Fig. 98 CRANKSHAFT HUB ALIGNMENT

1 - VIBRATION DAMPER/CRANKSHAFT PULLEY
2 - CRANKSHAFT HUB NOTCH
3 - VIBRATION DAMPER/CRANKSHAFT PULLEY TO CRANKSHAFT HUB BOLTS
4 - ACCESSORY DRIVE BELT

(4) Remove the yellow plastic plug and install special tool VM.1068 in the engine block as shown at this time (Fig. 99). This will lock the engine at 90° after TDC.

(5) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(6) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(7) Remove plug in cylinder head cover/intake manifold and insert VM.1053 to lock exhaust camshaft in position (Fig. 100).

(8) Remove generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).

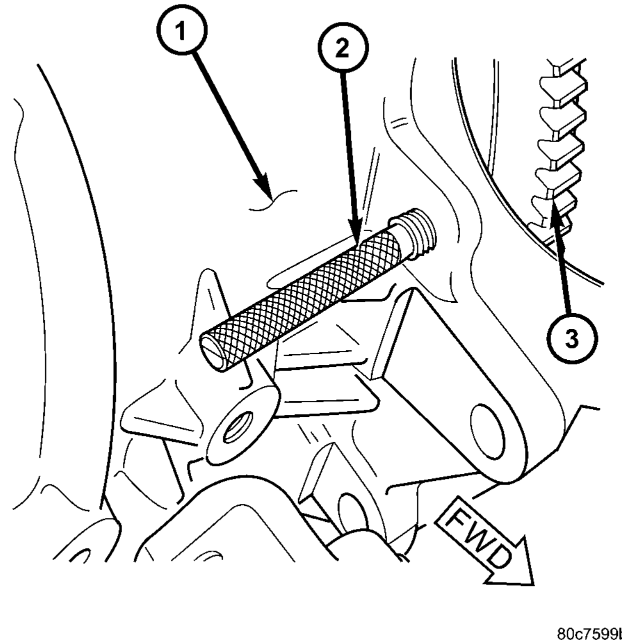


Fig. 99 90 DEGREES AFTER TDC ALIGNMENT PIN LOCATION

1 - ENGINE BLOCK
2 - VM.1051 TDC PIN OR VM.1068 90 DEGREES ATDC PIN
3 - FLYWHEEL

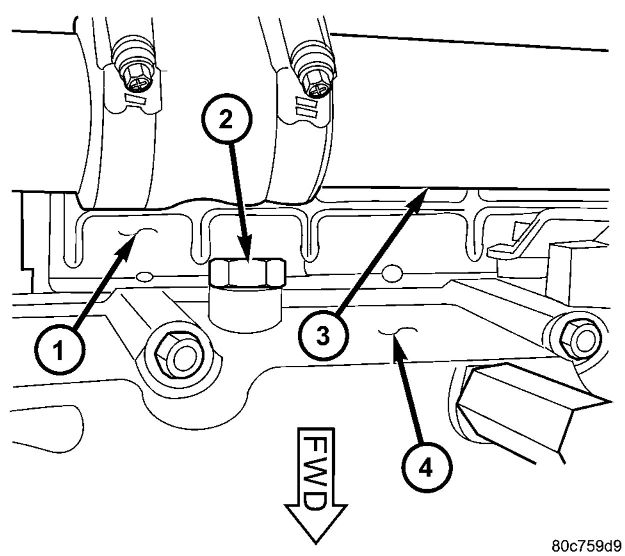


Fig. 100 EXHAUST CAMSHAFT LOCKING PIN VM.1053

1 - EXHAUST MANIFOLD HEAT SHIELD
2 - EXHAUST CAMSHAFT LOCKING PIN VM.1053
3 - COOLANT TUBE FROM THERMOSTAT HOUSING TO UPPER RADIATOR HOSE
4 - CYLINDER HEAD COVER/INTAKE MANIFOLD

VALVE TIMING (Continued)

(9) Remove plug in cylinder head cover/intake manifold and insert VM.1052 to lock intake camshaft in position (Fig. 101).

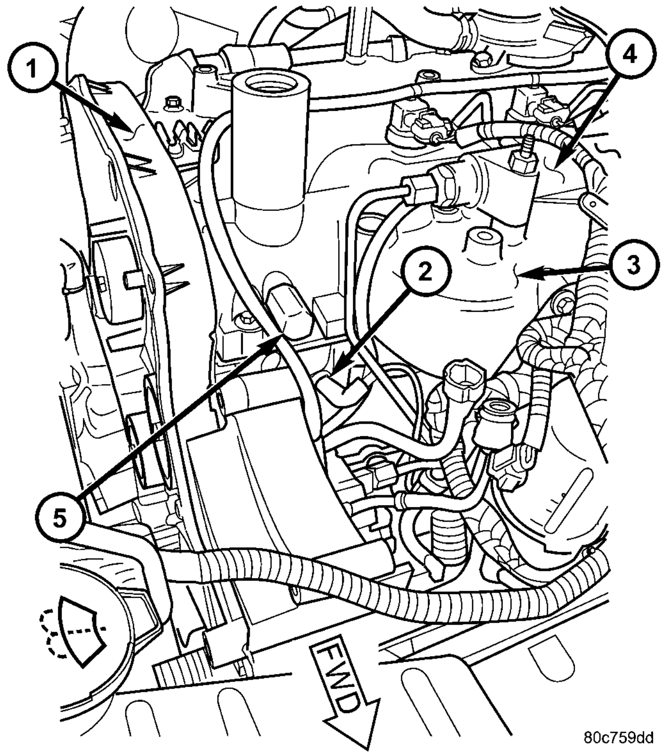


Fig. 101 INTAKE CAMSHAFT LOCKING PIN VM.1052

1 - TIMING BELT INNER COVER
2 - GLOW PLUG ELECTRICAL CONNECTOR
3 - CYLINDER HEAD COVER/INTAKE MANIFOLD
4 - FUEL RAIL
5 - INTAKE CAMSHAFT LOCKING PIN VM.1052

(10) At this point the timing belt can be removed for service.

(11) After engine service is completed and timing belt reinstalled, remove both camshaft locking pins from cylinder head cover/intake manifold.

(12) Install both camshaft access plugs.

(13) Remove 90° after TDC engine locking pin and install the plastic cover.

(14) Install starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).

(15) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(16) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(17) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(18) Connect negative battery cable.

BALANCE SHAFT

DESCRIPTION

The 2.5L/2.8L Common Rail Diesel engine is equipped with two nodular cast iron balance shafts in a cast aluminum carrier. The balance shaft assembly is mounted to the engine block (Fig. 102).

OPERATION

The balance shaft is driven by the crankshaft. The balance shafts are connected by heelical gears. The dual-counter rotating shafts decrease second order vertical shaking forces caused by component movement.

REMOVAL

(1) Disconnect negative battery cable.

(2) Raise vehicle on hoist.

(3) Before installation of the balance shaft assembly, the # 1 cylinder must be brought to TDC. Using special tool VM.1051, roll engine over by hand until tool can be inserted into engine block locking flywheel from turning.

(4) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(5) Remove balance shaft assembly (Fig. 102).

INSTALLATION

(1) Before installation of the balance shaft assembly, the # 1 cylinder must be brought to TDC. Using special tool VM.1051, roll engine over by hand until tool can be inserted into engine block locking flywheel from turning (Fig. 103). Once the # 1 cylinder is brought to TDC, the balance shaft assembly can be installed.

(2) With balance shaft assembly on work bench. Insert special tool VM.1056 into balance shaft assembly (Fig. 104). This will ensure proper balance shaft and crankshaft timing after assembly.

(3) Install balance shaft assembly and retaining bolts (Fig. 102). Torque bolts to 32.4N·m.

(4) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(5) Refill engine oil to proper level.

(6) Connect negative battery cable.

BALANCE SHAFT (Continued)

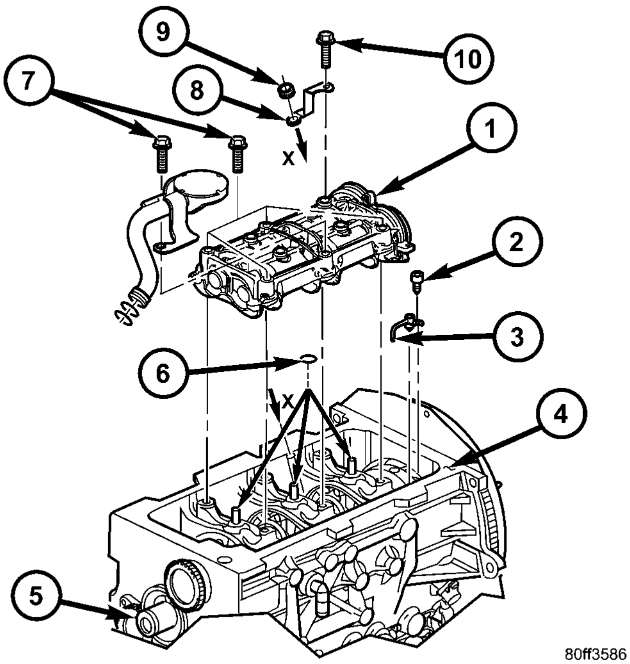


Fig. 102 OIL PUMP PICKUP TUBE ASSEMBLY

1 - BALANCE SHAFT
2 - OIL JET RETAINING BOLT
3 - OIL JET
4 - ENGINE BLOCK
5 - CRANKSHAFT
6 - O- RING(S)
7 - BALANCE SHAFT RETAINING BOLTS
8 - OIL DIPSTICK TUBE RETAINER
9 - RUBBER BUSHING
10 - RETAINING BOLT

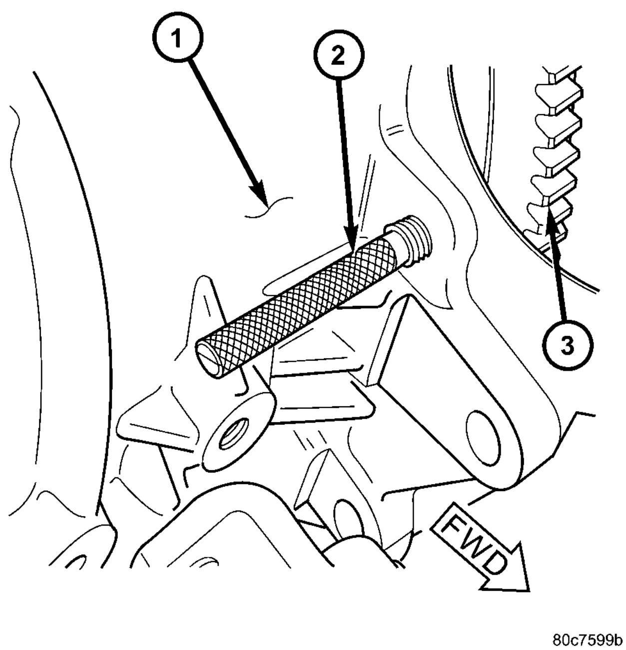


Fig. 103 TDC ALIGNMENT PIN LOCATION

1 - ENGINE BLOCK
2 - VM.1051 TDC PIN OR VM.1068 90 DEGREES ATDC PIN
3 - FLYWHEEL

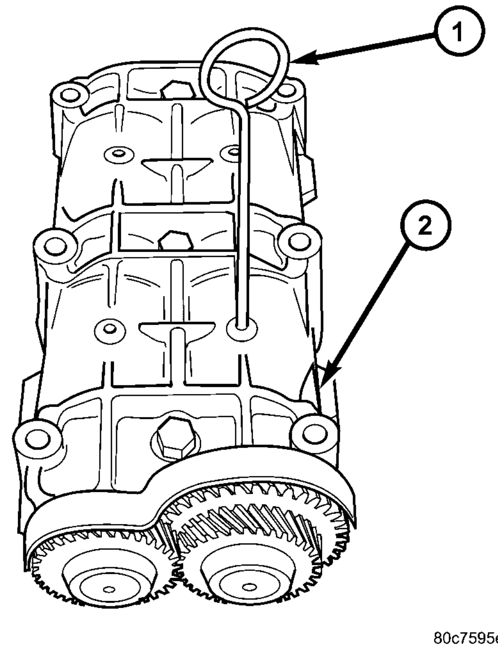


Fig. 104 BALANCE SHAFT ALIGNMENT PIN VM.1056

1 - VM.1056
2 - BALANCE SHAFT ASSEMBLY

TIMING BELT COVER

REMOVAL

REMOVAL - TIMING BELT OUTER COVER

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Remove air cleaner housing.

(4) Support engine and remove right engine mount and bracket.

(5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(7) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(8) Remove timing belt outer cover retaining bolts and remove cover (Fig. 105).

REMOVAL - TIMING BELT INNER COVER

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Remove air cleaner housing.

TIMING BELT COVER (Continued)

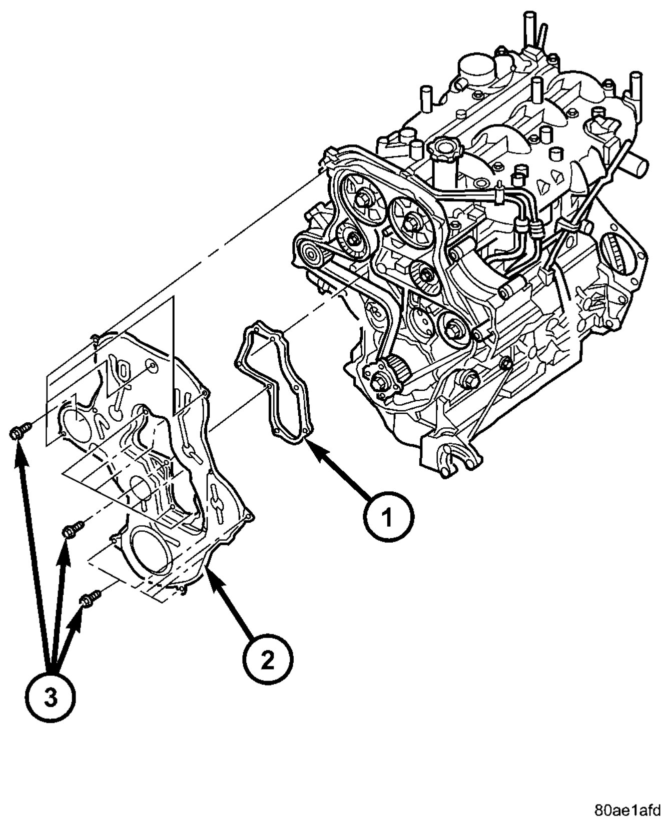


Fig. 105 TIMING BELT COVER (OUTER)

1 - SEAL
2 - TIMING BELT OUTER COVER
3 - RETAINING BOLTS

(4) Support engine and remove right engine mount and bracket.

(5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(7) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(8) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(9) Remove timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(10) Remove timing belt idler pulleys (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT IDLER PULLEY - REMOVAL).

(11) Using special tool VM.1055, remove camshaft sprockets (Fig. 106).

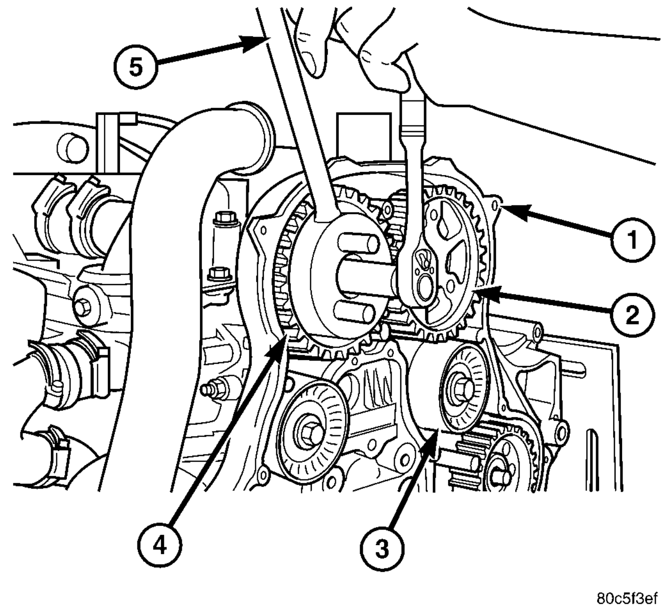


Fig. 106 CAMSHAFT SPROCKET REMOVAL/ INSTALLATION

1 - TIMING BELT INNER COVER
2 - CAMSHAFT SPROCKET
3 - IDLER PULLEYS
4 - CAMSHAFT SPROCKET
5 - VM.1055

(12) Remove timing belt tensioner (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - REMOVAL).

(13) Remove injection pump sprocket (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).

(14) Remove timing belt inner cover retaining bolts and remove cover (Fig. 107).

INSTALLATION

INSTALLATION - TIMING BELT OUTER COVER

(1) Install timing belt outer cover seal and cover (Fig. 105). Torque 3mm bolts to 10.8N·m and 8mm bolts to 10.8N·m.

(2) Install vibration damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(3) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(4) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

TIMING BELT COVER (Continued)

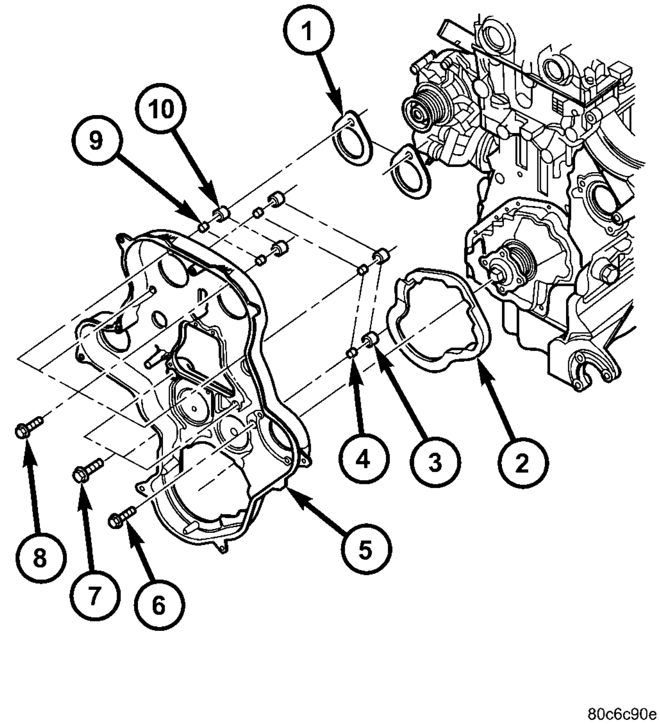


Fig. 107 TIMING BELT COVER - INNER

1 - TIMING BELT COVER TO CYLINDER HEAD COVER GASKET
2 - TIMING BELT COVER TO FRONT ENGINE COVER SEAL
3 - RUBBER GROMMET
4 - BUSHING
5 - TIMING BELT COVER - INNER
6 - RETAINING BOLT
7 - RETAINING BOLT
8 - RETAINING BOLT
9 - BUSHING
10 - RUBBER GROMMET

(5) Install right engine mount.

(6) Install air cleaner housing.

(7) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(8) Connect negative battery cable.

INSTALLATION - TIMING BELT INNER COVER

(1) Install timing belt inner cover to engine front cover seal (Fig. 107).

(2) Install timing belt inner cover to cylinder head cover gaskets (Fig. 107).

(3) Install timing belt inner cover and retaining bolts (Fig. 107). Torque 10mm bolts to 47.1N·m and 8mm bolts to 10.8N·m.

(4) Install injection pump sprocket (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

(5) Install camshaft sprockets (Fig. 106). Torque bolts to 108N·m.

(6) Install timing belt idler pulleys (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT IDLER PULLEY - INSTALLATION).

(7) Install timing belt and tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(8) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(9) Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(10) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(11) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(12) Install right engine mount assembly.

(13) Install air cleaner housing.

(14) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(15) Connect negative battery cable.

TIMING BELT IDLER PULLEY

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Remove air cleaner housing.

(4) Support engine and remove right engine mount.

(5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(7) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(8) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(9) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

NOTE: Idler pulley retaining bolts are LHD thread.

(10) Remove timing belt idler pulleys (Fig. 108).

TIMING BELT IDLER PULLEY (Continued)

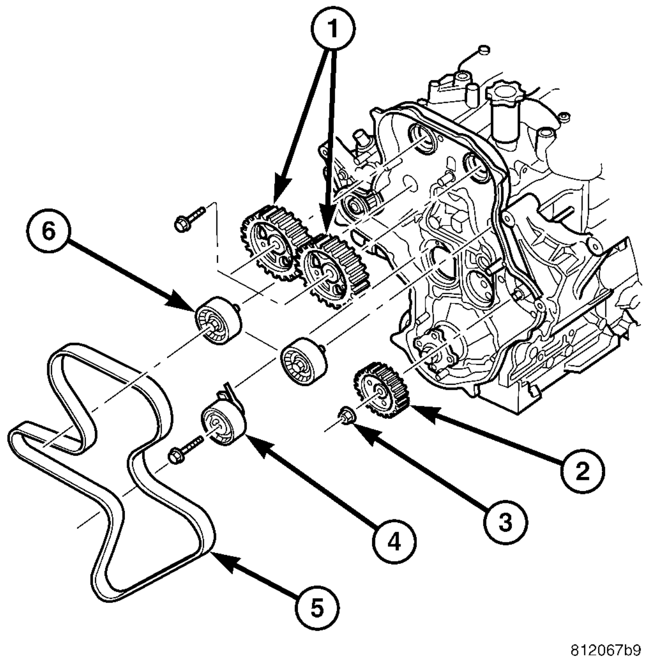


Fig. 108 TIMING BELT AND SPROCKETS

1 - CAMSHAFT SPROCKETS
2 - INJECTION PUMP SPROCKET
3 - INJECTION PUMP SPROCKET RETAINING NUT
4 - TIMING BELT TENSIONER
5 - TIMING BELT
6 - IDLER PULLEY

INSTALLATION

(1) Install timing belt idler pulleys (Fig. 108). Torque bolts to 47.1N·m.

(2) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(3) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(4) Install vibration damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(5) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(6) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(7) Install right engine mount.

(8) Install air cleaner housing.

(9) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(10) Connect negative battery cable.

TIMING BELT TENSIONER & PULLEY

REMOVAL

CAUTION: INSPECT THE TOOTHED BELT, PULLEYS AND BEARINGS FOR DAMAGE, SEIZURE AND LEAKS.

NOTE: DO NOT expose the toothed belt to oil, grease or water contamination. DO NOT clean belt, pulleys or tensioner with solvent. DO NOT crimp the timing belt at a sharp angle. DO NOT install belt with levered tools forcing the belt onto the pulleys.

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Remove air cleaner housing.

(4) Support engine and remove right engine mount.

(5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(7) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(8) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(9) Loosen and remove timing belt tensioner (Fig. 109).

INSTALLATION

CAUTION: INSPECT THE TOOTHED BELT, PULLEYS AND BEARINGS FOR DAMAGE, SEIZURE AND LEAKS.

NOTE: DO NOT expose the toothed belt to oil, grease or water contamination. DO NOT clean belt, pulleys or tensioner with solvent. DO NOT crimp the timing belt at a sharp angle. DO NOT install belt with levered tools forcing the belt onto the pulleys.

(1) Install timing belt tensioner and retaining bolt (Fig. 109).

(2) Adjust timing belt tensioner (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - ADJUSTMENTS).

TIMING BELT TENSIONER & PULLEY (Continued)

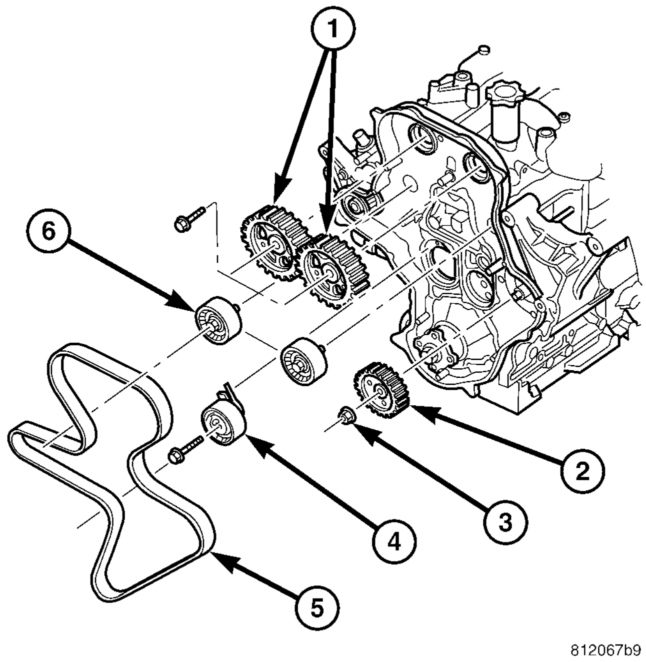


Fig. 109 TIMING BELT AND SPROCKETS

1 - CAMSHAFT SPROCKETS
2 - INJECTION PUMP SPROCKET
3 - INJECTION PUMP SPROCKET RETAINING NUT
4 - TIMING BELT TENSIONER
5 - TIMING BELT
6 - IDLER PULLEY

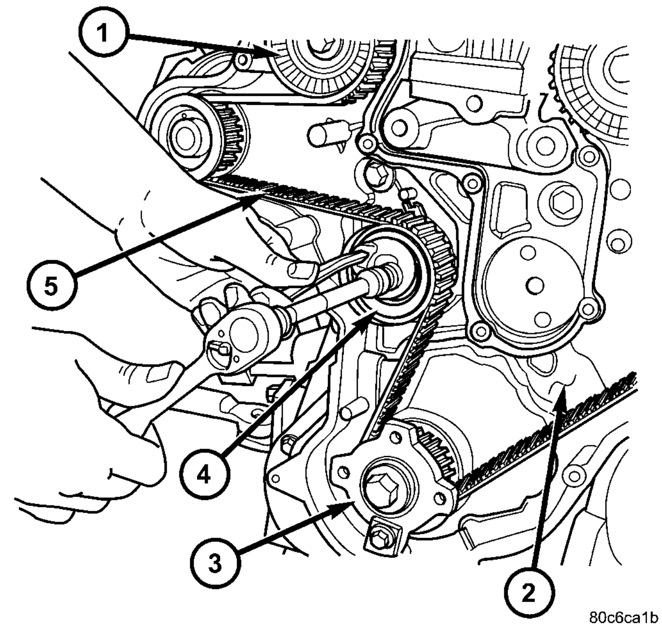


Fig. 110 TIMING BELT TENSIONER ADJUSTMENT

1 - TIMING BELT IDLER PULLEY
2 - ENGINE FRONT COVER
3 - CRANKSHAFT HUB
4 - TIMING BELT TENSIONER
5 - TIMING BELT

(3) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(4) Install vibration damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(5) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(6) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(7) Install right engine mount.

(8) Install air cleaner housing.

(9) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(10) Connect negative battery cable.

ADJUSTMENTS

ADJUSTMENT - TIMING BELT TENSIONER

(1) With timing belt outer cover removed and timing belt installed.

(2) Loosen timing belt tensioner (Fig. 110).

(3) Align timing belt tensioner spring stop with tensioner as shown (Fig. 111) and torque timing belt tensioner retaining bolt to 34.7N·m.

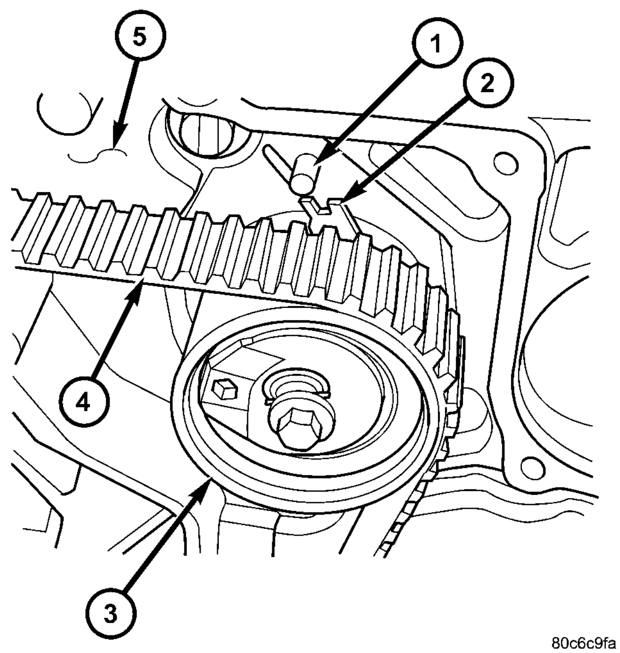


Fig. 111 TIMING BELT TENSIONER ALIGNMENT

1 - TENSIONER SPRING STOP
2 - TIMING BELT TENSIONER
3 - TIMING BELT TENSIONER
4 - TIMING BELT
5 - TIMING BELT INNER COVER

TIMING BELT TENSIONER & PULLEY (Continued)

(4) Rotate engine 2 complete revolution and then recheck tensioner alignment. Readjust tensioner alignment as necessary.

TIMING BELT AND SPROCKETS

REMOVAL

CAUTION: BEFORE REMOVING THE TIMING BELT, THE ENGINE MUST BE PLACED AT 90° ATDC. FAILURE TO DO SO COULD RESULT IN VALVE AND/OR PISTON DAMAGE DURING REASSEMBLY. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE)

CAUTION: INSPECT THE TOOTHED BELT, PULLEYS AND BEARINGS FOR DAMAGE, SEIZURE AND LEAKS.

NOTE: DO NOT expose the toothed belt to oil, grease or water contamination. DO NOT clean belt, pulleys or tensioner with solvent. DO NOT crimp the timing belt at a sharp angle. DO NOT install belt with levered tools forcing the belt onto the pulleys.

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Remove air cleaner housing assembly.
(4) Support engine and remove right engine mount.
(5) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(6) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(7) Remove the generator.
(8) Rotate engine until #1 piston is at TDC, crankshaft notch on the crankshaft hub will be at 12 o'clock.
(9) Looking at the engine from the belt side, rotate the crankshaft 90° clockwise.
(10) Install the 90° alignment pin, VM 1068 into the crankcase threaded hole to lock crankshaft (make sure the crankshaft will not rotate).
(11) Paint mark the crankshaft hub and the oil pump cover. This will assist during assembly.
(12) Remove vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
(13) Remove timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
(14) Remove the intake and exhaust camshaft plugs from the camshaft cover to introduce the camshaft timing pins.

NOTE: If the engine is already timed, install the camshaft alignment pins (intake cam alignment pin, VM 1052, exhaust cam alignment pin, VM 1053).

(15) Loosen timing belt tensioner and remove timing belt (Fig. 112).
(16) Using intake camshaft gear bolt, rotate intake camshaft until the intake alignment hole lines up with the hole in the camshaft cover. Install the intake cam alignment pin VM 1052. Repeat the operation for the exhaust camshaft with alignment pin VM 1053 (Fig. 112).
(17) Using VM 1055 hold the cam gears to remove the bolts.

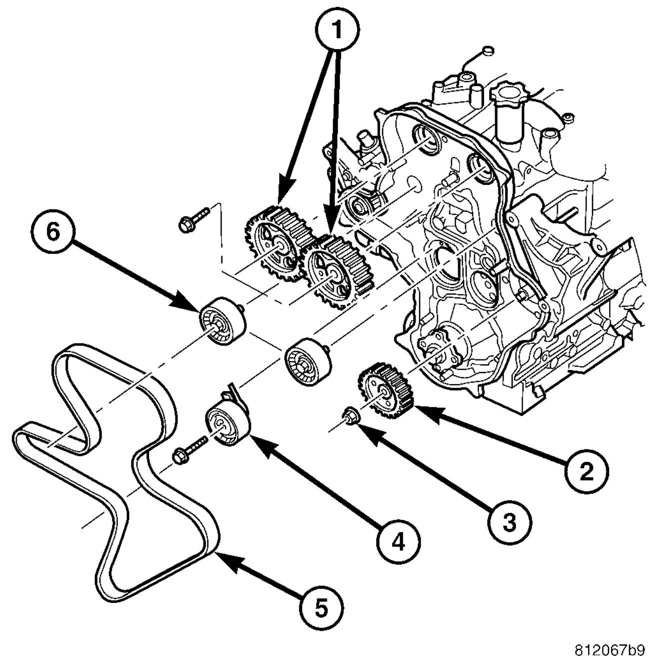


Fig. 112 TIMING BELT AND SPROCKETS

1 - CAMSHAFT SPROCKETS
2 - INJECTION PUMP SPROCKET
3 - INJECTION PUMP SPROCKET RETAINING NUT
4 - TIMING BELT TENSIONER
5 - TIMING BELT
6 - IDLER PULLEY

INSTALLATION

(1) With both camshaft alignment pins still installed and the engine locked at 90° after TDC, install the timing gears finger tight.
(2) Align timing mark on high pressure injection pump sprocket with timing mark on cover (Fig. 113).

TIMING BELT AND SPROCKETS (Continued)

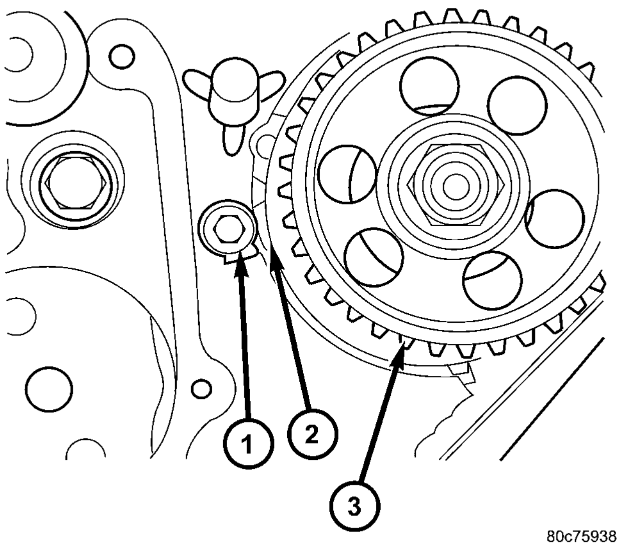


Fig. 113 INJECTION PUMP GEAR TIMING MARKS

1 - TIMING MARK ON COVER
2 - TIMING MARK ON INJECTION PUMP SPROCKET
3 - INJECTION PUMP SPROCKET

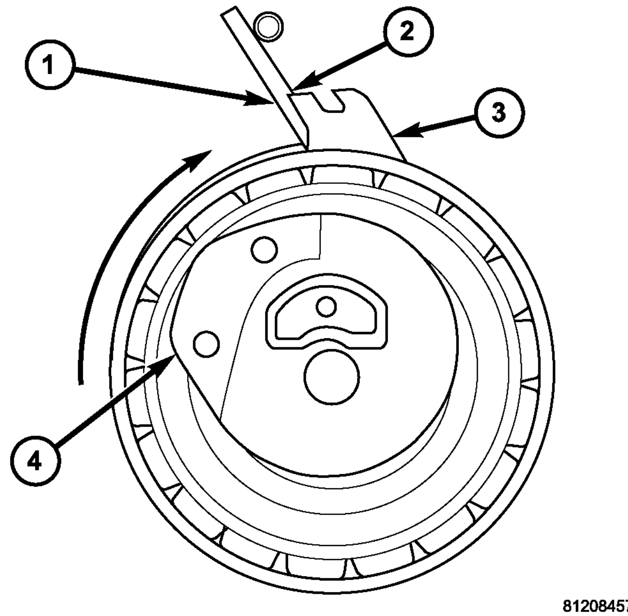


Fig. 114 TIMING BELT TENSIONER ALIGNMENT

1 - TENSIONER SPRING
2 - 1MM ALIGNMENT POINTER OVERLAP
3 - TENSIONER ALIGNMENT POINTER
4 - TENSIONER ASSEMBLY

(3) Install timing belt on crankshaft hub, fix it with VM1074, then around high pressure injection pump, idler pulley, intake camshaft gear, exhaust camshaft gear, idler pulley and water pump gear.

NOTE: To uniform the belt tension, slightly rotate the intake camshaft pulley counterclockwise with VM 1055.

(4) Adjust the timing belt tensioner (turn it clockwise), lining up the tensioner center notch with aluminum cover dowel pin (Fig. 114). Tighten the tensioner bolt to 28N·m (20.5 lbs. ft.).

(5) Torque camshaft gear bolts to 60 N·m (44 lbs.ft.) (pre setting) holding gears with VM 1055.

(6) Remove both camshaft alignment pins from cylinder head cover/intake manifold. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE) .

(7) Torque camshaft gear bolts to 108 N·m (80 lbs.ft.) while holding gears with VM 1055.

(8) Remove 90° ATDC engine locking pin from engine block.

CAUTION: Wait 30 minutes before rotating crankshaft after installing camshaft cover.

(9) Rotate crankshaft 2 times (looking at it from the belt side)

(10) Carefully line up the painted mark on the crankshaft hub and oil pump cover.

CAUTION: IF THE CAMSHAFT ALIGNMENT PINS CAN NOT BE INSTALLED, REPEAT THIS PROCEDURE.

(11) Check that the intake and exhaust cam alignment pins CAN be installed, if so remove them.

(12) Install the intake and exhaust camshaft plugs.

(13) Install timing belt outer cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(14) Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(15) Install the alternator.

(16) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(17) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(18) Install right engine mount.

(19) Install air cleaner housing.

(20) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(21) Connect negative battery cable.

EXHAUST SYSTEM

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EXHAUST SYSTEM AND TURBOCHARGER

DESCRIPTION

The basic exhaust system consists of an engine exhaust manifold, turbocharger, exhaust down pipe, exhaust pipe, exhaust heat shield(s), muffler and exhaust tailpipe

The exhaust system uses a single muffler.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. If the system contacts any body panel, it will transfer objectionable noises originating from the engine to the body.

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screw or bolt threads, corrosion damage and worn, cracked or broken hangers. Replace all components that are badly corroded or damaged. DO NOT attempt to repair.

When replacement is required, use original equipment parts (or equivalent). This will assure proper alignment and provide acceptable exhaust noise levels.

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

SPECIFICATIONS - TORQUE

2.5L DIESEL - TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Nuts, Exhaust Manifold	32.4	24	-
Bolts, Exhaust Manifold Heat shield	27.5	21	-
Bolts, Turbocharger Bracket	47.1	35	-
Nuts, Turbocharger Downpipe	32.4	24	-
Fitting, Turbocharger Oil Feed Line	24.5	18	215
Nuts, Turbocharger to Exhaust Manifold	32.4	24	-

CHARGE AIR COOLER AND PLUMBING

DESCRIPTION

The charge air cooler is located in front of the radiator and cools the super heated air produced by the compression of inlet air by the turbocharger. The cooling of this super heated air maintains engine power and efficiency (Fig. 1).

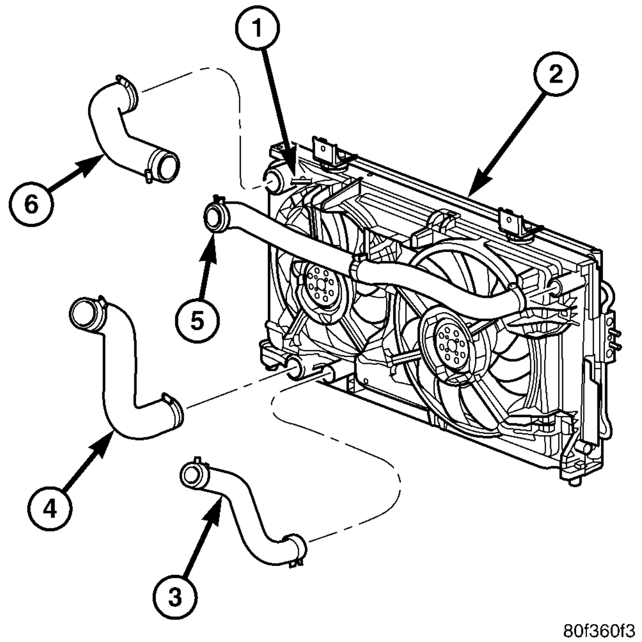

Fig. 1 CHARGE AIR COOLER AND HOSES - 2.5L DIESEL SHOWN

1 - CHARGE AIR COOLER
2 - COOLING MODULE
3 - RADIATOR OUTLET HOSE
4 - CHARGE AIR COOLER TO TURBOCHARGER OUTLET HOSE
5 - RADIATOR INLET HOSE
6 - CHARGE AIR COOLER TO INTAKE MANIFLOD

TURBOCHARGER

DESCRIPTION

CAUTION: The turbocharger is a performance part and must not be tampered with. The wastegate bracket is an integral part of the turbocharger. Tampering with the wastegate components can reduce durability by increasing cylinder pressure and thermal loading due to incorrect inlet and exhaust manifold pressure. Poor fuel economy and failure to meet regulatory emissions laws may result. Increasing the turbocharger boost WILL NOT increase engine power.

The turbocharger is an exhaust-driven supercharger which increases the pressure and density of the air entering the engine. With the increase of air entering the engine, more fuel can be injected into the cylinders, which creates more power during combustion.

The turbocharger assembly consists of four (4) major component systems (Fig. 2) (Fig. 3):
- Turbine section
- Compressor section
- Bearing housing
- Wastegate

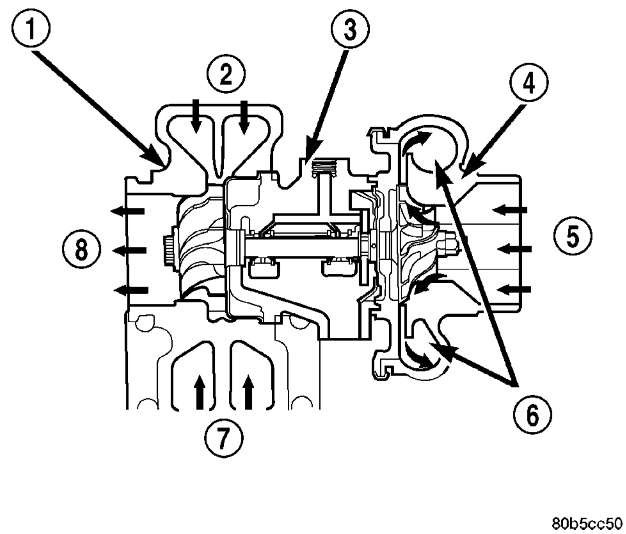

Fig. 2 Turbocharger Operation

1 - TURBINE SECTION
2 - EXHAUST GAS
3 - BEARING HOUSING
4 - COMPRESSOR SECTION
5 - INLET AIR
6 - COMPRESSED AIR TO ENGINE
7 - EXHAUST GAS
8 - EXHAUST GAS TO EXHAUST PIPE

OPERATION

Exhaust gas pressure and energy drive the turbine, which in turn drives a centrifugal compressor that compresses the inlet air, and forces the air into the engine through the charge air cooler and plumbing. Since heat is a by-product of this compression, the air must pass through a charge air cooler to cool the incoming air and maintain power and efficiency.

Increasing air flow to the engine provides:
- Improved engine performance
- Lower exhaust smoke density
- Improved operating economy
- Altitude compensation
- Noise reduction.

TURBOCHARGER (Continued)

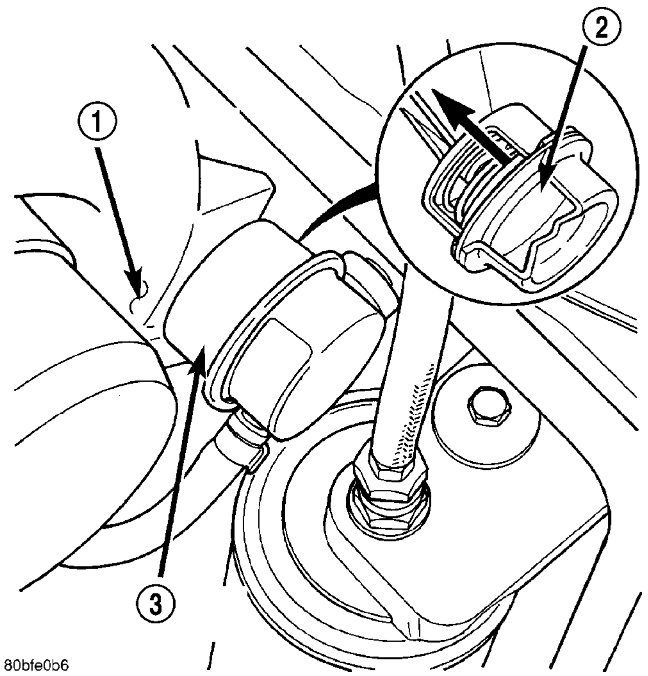

Fig. 3 Turbocharger Wastegate Actuator

1 - TURBOCHARGER
2 - DIAPHRAGM
3 - WASTE GATE ACTUATOR

The turbocharger also uses a wastegate (Fig. 4), which regulates intake manifold air pressure and prevents over boosting at high engine speeds. When the wastegate valve is closed, all of the exhaust gases flow through the turbine wheel. As the intake manifold pressure increases, the wastegate actuator opens the valve, diverting some of the exhaust gases away from the turbine wheel. This limits turbine shaft speed and air output from the impeller.

The turbocharger is lubricated by engine oil that is pressurized, cooled, and filtered. The oil is delivered to the turbocharger by a supply line that is tapped into the block. The oil travels into the bearing housing, where it lubricates the shaft and bearings (Fig. 5). A return pipe at the bottom of the bearing housing, routes the engine oil back to the crankcase.

The most common turbocharger failure is bearing failure related to repeated hot shutdowns with inadequate “cool-down” periods. A sudden engine shut down after prolonged operation will result in the transfer of heat from the turbine section of the turbocharger to the bearing housing. This causes the oil to overheat and break down, which causes bearing and shaft damage the next time the vehicle is started.

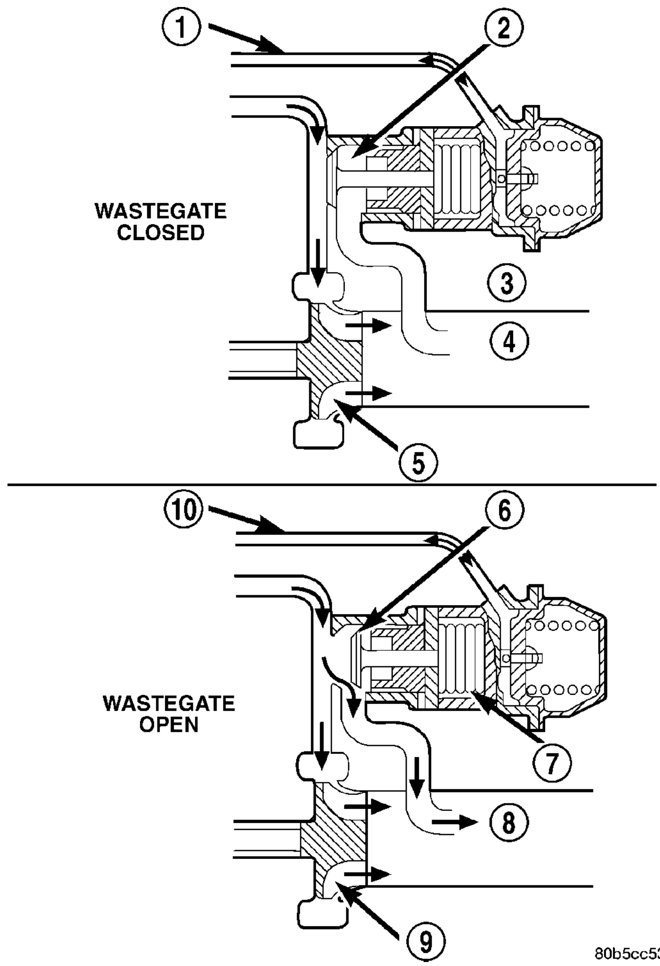

Fig. 4 Wastegate Operation

1 - SIGNAL LINE
2 - EXHAUST BYPASS VALVE
3 - WASTEGATE
4 - EXHAUST
5 - TURBINE
6 - EXHAUST BYPASS VALVE
7 - WASTEGATE
8 - EXHAUST
9 - TURBINE
10 - SIGNAL LINE

Letting the engine idle after extended operation allows the turbine housing to cool to normal operating temperature. The following chart should be used as a guide in determining the amount of engine idle time required to sufficiently cool down the turbocharger before shut down, depending upon the type of driving and the amount of cargo.

TURBOCHARGER (Continued)

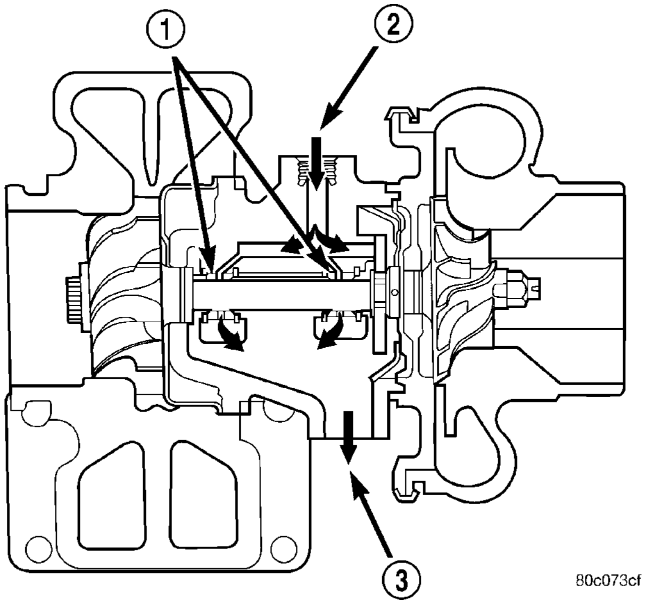

Fig. 5 Turbocharger Oil Supply and Drain

1 - BEARINGS
2 - OIL SUPPLY (FROM ENGINE BLOCK)
3 - OIL RETURN (TO OIL PAN)

TURBOCHARGER "COOL DOWN" CHART			
Driving Condition	Load	Turbo-charger Tempera-ture	Idle Time (in minutes) Before Shut Down
Stop & Go	Empty	Cool	Less than 1
Stop & Go	Medium	Warm	1
Highway Speeds	Medium	Warm	2
City Traffic	Max. GCWR	Warm	3
Highway Speeds	Max. GCWR	Warm	4
Uphill Grade	Max. GCWR	Hot	5

REMOVAL

(1) Remove the battery and tray assembly (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL).

(2) Disconnect the mass air flow (MAF) sensor and the intake air temperature (IAT) sensor wiring harness connectors.

(3) Disconnect the air inlet tube at the breather and remove the air cleaner cover.

(4) Raise and support the vehicle.

(5) Remove the exhaust system.

(6) Remove the lower engine splash shield.

(7) Loosen the turbocharger support bracket and set aside.

(8) Remove the turbocharger flange (Fig. 6)

(9) Remove the auxiliary heater pipe fasteners and position pipe aside.

(10) Disconnect the turbocharger oil supply and return lines at the turbocharger.

(11) Remove the turbocharger to exhaust manifold fasteners (Fig. 6).

(12) Disconnect the turbocharger wastegate actuator vacuum line and remove the turbocharger (Fig. 6).

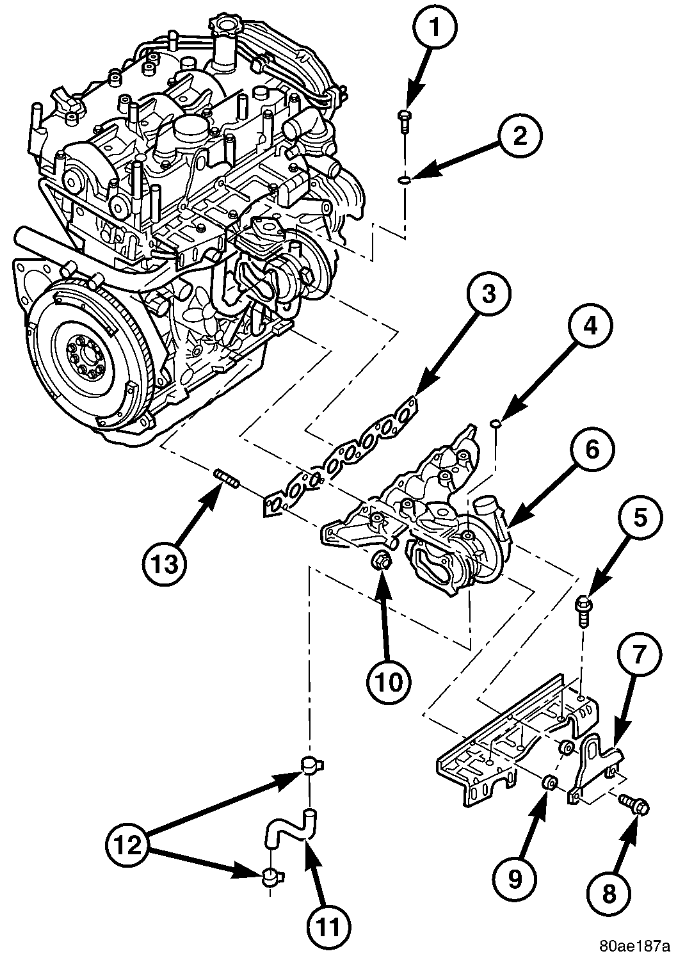

Fig. 6 EXHAUST MANIFOLD AND TURBOCHARGER

1 - TURBOCHARGER OIL SUPPLY BANJO BOLT
2 - COPPER WASHER
3 - EXHAUST MANIFOLD GASKET
4 - COPPER WASHER
5 - EXHAUST MANIFOLD HEAT SHIELD RETAINING BOLT
6 - TURBOCHARGER
7 - ENGINE LIFT HOOK
8 - ENGINE LIFT HOOK RETAINING BOLT
9 - SPACER
10 - EXHAUST MANIFOLD RETAINING NUT
11 - TURBOCHARGER OIL RETURN HOSE
12 - HOSE CLAMPS
13 - EXHAUST MANIFOLD STUDS

TURBOCHARGER (Continued)

CLEANING

All old gaskets should be inspected for any tears or signs of prior leakage. If any gaskets show such indications, they should be replaced with new gaskets. All gasket mating surfaces must be cleaned of old gasket material to produce a smooth and dirt free sealing surface for the new gasket.

INSPECTION

Visually inspect the turbocharger and exhaust manifold gasket surfaces. Replace stripped or eroded mounting studs.

(1) Visually inspect the turbocharger for cracks. The following cracks are NOT acceptable:

- Cracks in the turbine and compressor housing that go completely through.
- Cracks in the mounting flange that are longer than 15 mm (0.6 in.).
- Cracks in the mounting flange that intersect bolt through-holes.
- Two (2) Cracks in the mounting flange that are closer than 6.4 mm (0.25 in.) together.

(2) Visually inspect the impeller and compressor wheel fins for nicks, cracks, or chips. Note: Some impellers may have a factory placed paint mark which, after normal operation, appears to be a crack. Remove this mark with a suitable solvent to verify that it is not a crack.

(3) Visually inspect the turbocharger compressor housing for an impeller rubbing condition (Fig. 7). Replace the turbocharger if the condition exists.

(4) Measure the turbocharger axial end play:

(a) Install a dial indicator as shown in (Fig. 8). Zero the indicator at one end of travel.

(b) Move the impeller shaft fore and aft and record the measurement. Allowable end play is 0.038 mm (0.0015 in.) MIN. and 0.089 mm (0.0035 in.) MAX. If the recorded measurement falls outside these parameters, replace the turbocharger assembly.

(5) Measure the turbocharger bearing radial clearance:

(a) Insert a narrow blade or wire style feeler gauge between the compressor wheel and the housing (Fig. 9).

(b) Gently push the compresser wheel toward the housing and record the clearance.

(c) With the feeler gauge in the same location, gently push the compressor wheel away from the housing and again record the clearance.

(d) Subtract the smaller clearance from the larger clearance. This is the radial bearing clearance.

(e) Allowable radial bearing clearance is 0.326 mm (0.0128 in.) MIN. and 0.496 mm (0.0195 in.) MAX. If the recorded measurement falls outside these specifications, replace the turbocharger assy.

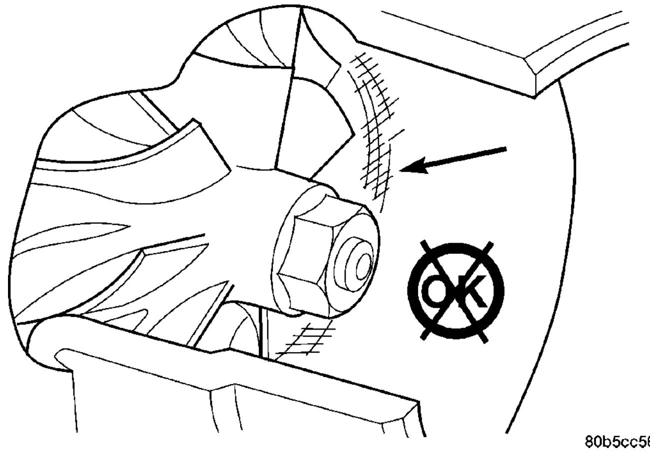

Fig. 7 Inspect Compressor Housing for Impeller Rubbing Condition - Typical

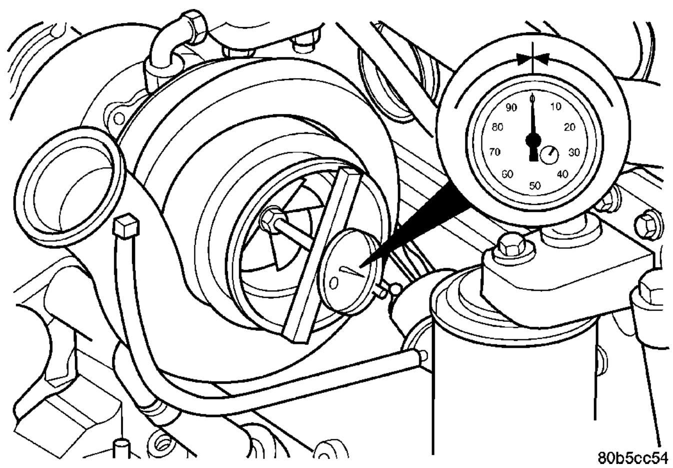

Fig. 8 Measure Turbocharger Axial End Play - Typical

TURBOCHARGER (Continued)

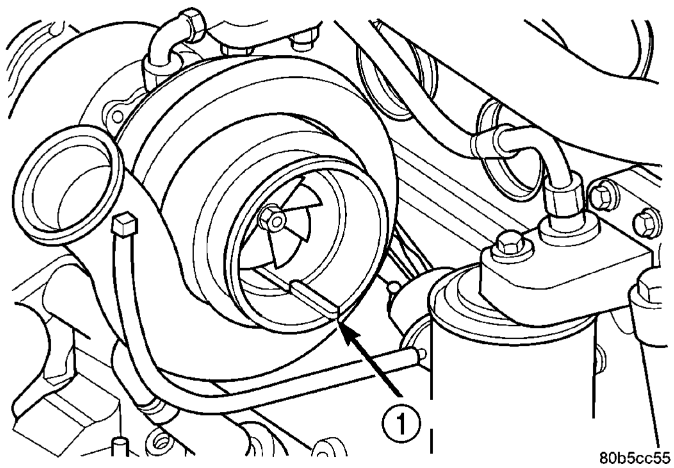

Fig. 9 Measure Turbocharger Bearing Radial Clearance - Typical

1 - FEELER GAUGE

INSTALLATION

(1) Clean all gasket mating surfaces taking care not to damage the sealing surfaces.

(2) Install the turbocharger to the exhaust manifold (Fig. 6). Tighten fasteners to 32.4 N·m (24 lbs. ft.).

(3) Connect the wastegate actuator vacuum line.

(4) Connect the turbocharger oil supply and return lines (Fig. 6). Tighten supply bolt to 24.5 N·m (217 lbs. in.) and return fasteners to 10 N·m (89 lbs. in.)..

(5) Reposition and secure the auxiliary heater pipes to floor board. Tighten bolts to 10.8 N·m (96 lbs. in.).

(6) Install the turbocharger flange (Fig. 6). Tighten fasteners to 32.4 N·m (24 lbs. ft.).

(7) Secure the turbocharger support bracket. Tighten fasteners to 47.1 N·m (35 lbs. ft.).

(8) Connect the exhaust system. Tighten the exhaust manifold to front pipe fasteners to 32 N·m (24 lbs. ft.) and the exhaust support bracket fasteners to 27.5 N·m (21 lbs. ft.).

(9) Install the lower engine splash shield.

(10) Lower the vehicle.

(11) Connect the air inlet hose to the breather and install the air cleaner cover.

(12) Connect the MAF and IAT sensor harness connectors.

(13) Install the battery and tray assembly (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION).

(14) Start engine and inspect for leaks.

HEAT SHIELDS

REMOVAL

(1) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Partially drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(4) Remove thermostat housing to upper radiator hose tube (Fig. 10).

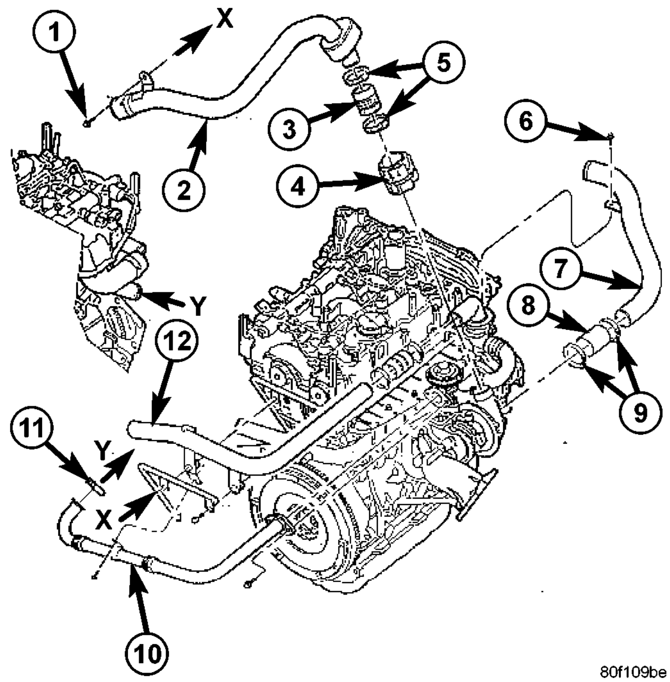

Fig. 10 TURBOCHARGER AND COOLANT PIPES

1 - TURBOCHARGER OUTLET PIPE RETAINING BOLT
2 - TURBOCHARGER OUTLET PIPE
3 - ADAPTER HOSE
4 - HEAT SHIELD
5 - HOSE CLAMPS
6 - TURBOCHARGER INLET PIPE RETAINING BOLT
7 - TURBOCHARGER INLET PIPE
8 - ADAPTER HOSE
9 - HOSE CLAMPS
10 - EGR VALVE TO INTAKE AIR INLET PIPE
11 - CLAMP
12 - THERMOSTAT HOUSING TO UPPER RADIATOR HOSE PIPE

(5) Remove exhaust manifold heat shield retaining bolts and remove shield (Fig. 11).

HEAT SHIELDS (Continued)

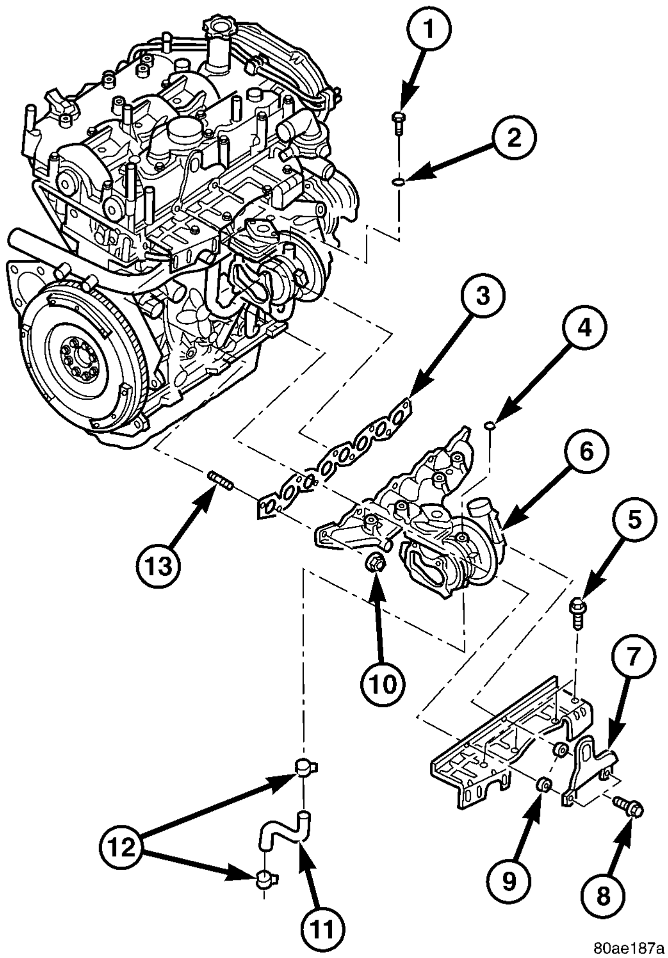

Fig. 11 EXHAUST MANIFOLD AND TURBOCHARGER

1 - TURBOCHARGER OIL SUPPLY BANJO BOLT
2 - COPPER WASHER
3 - EXHAUST MANIFOLD GASKET
4 - COPPER WASHER
5 - EXHAUST MANIFOLD HEAT SHIELD RETAINING BOLT
6 - TURBOCHARGER
7 - ENGINE LIFT HOOK
8 - ENGINE LIFT HOOK RETAINING BOLT
9 - SPACER
10 - EXHAUST MANIFOLD RETAINING NUT
11 - TURBOCHARGER OIL RETURN HOSE
12 - HOSE CLAMPS
13 - EXHAUST MANIFOLD STUDS

INSTALLATION

(1) Reposition exhaust heat shield (Fig. 11).

(2) Install exhaust heat shield retaining bolts (Fig. 11). Torque bolts to 27.5N·m.

(3) Install thermostat housing to upper radiator hose tube (Fig. 10).

(4) Refill cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(5) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(6) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(7) Start the engine and inspect for exhaust leaks. Repair exhaust leaks as necessary.

(8) Check the exhaust system for contact with the body panels. Make the necessary adjustments, if needed.

FUEL SYSTEM

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FUEL SYSTEM 2.5L / 2.8L TURBO DIESEL

DESCRIPTION - DIESEL FUEL DELIVERY SYSTEM

WARNING: HIGH - PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 1600 BAR (23,200 PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH - PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH - PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

The fuel system on the 2.5L OR 2.8L Common Rail Diesel (CRD) Engine uses a high pressure pump and an Electronic Control Module (ECM). (Fig. 1)

The fuel delivery system consists of the:
- Accelerator pedal
- Air cleaner housing/element
- Fuel filter/water separator
- Fuel heater
- Fuel heater relay
- Fuel/Lift pump
- High Pressure Fuel injection pump
- Fuel injectors
- Fuel tank
- Fuel tank filler/vent tube assembly
- Fuel tank filler tube cap
- Fuel tank module containing fuel tank vent valves and a fuel gauge sending unit (fuel level sensor).
- Fuel tubes/lines/hoses
- High-pressure fuel injector lines
- Low-pressure fuel supply lines
- Low-pressure fuel return line
- Overflow valve
- Quick-connect fittings
- Water draining

WARNING - HIGH FUEL SYSTEM PRESSURE

WARNING: HIGH-PRESSURE FUEL LINES DELIVER FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE INJECTORS. THIS MAYBE AS HIGH AS 1600BAR (23,200PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

FUEL SYSTEM 2.5L / 2.8L TURBO DIESEL (Continued)

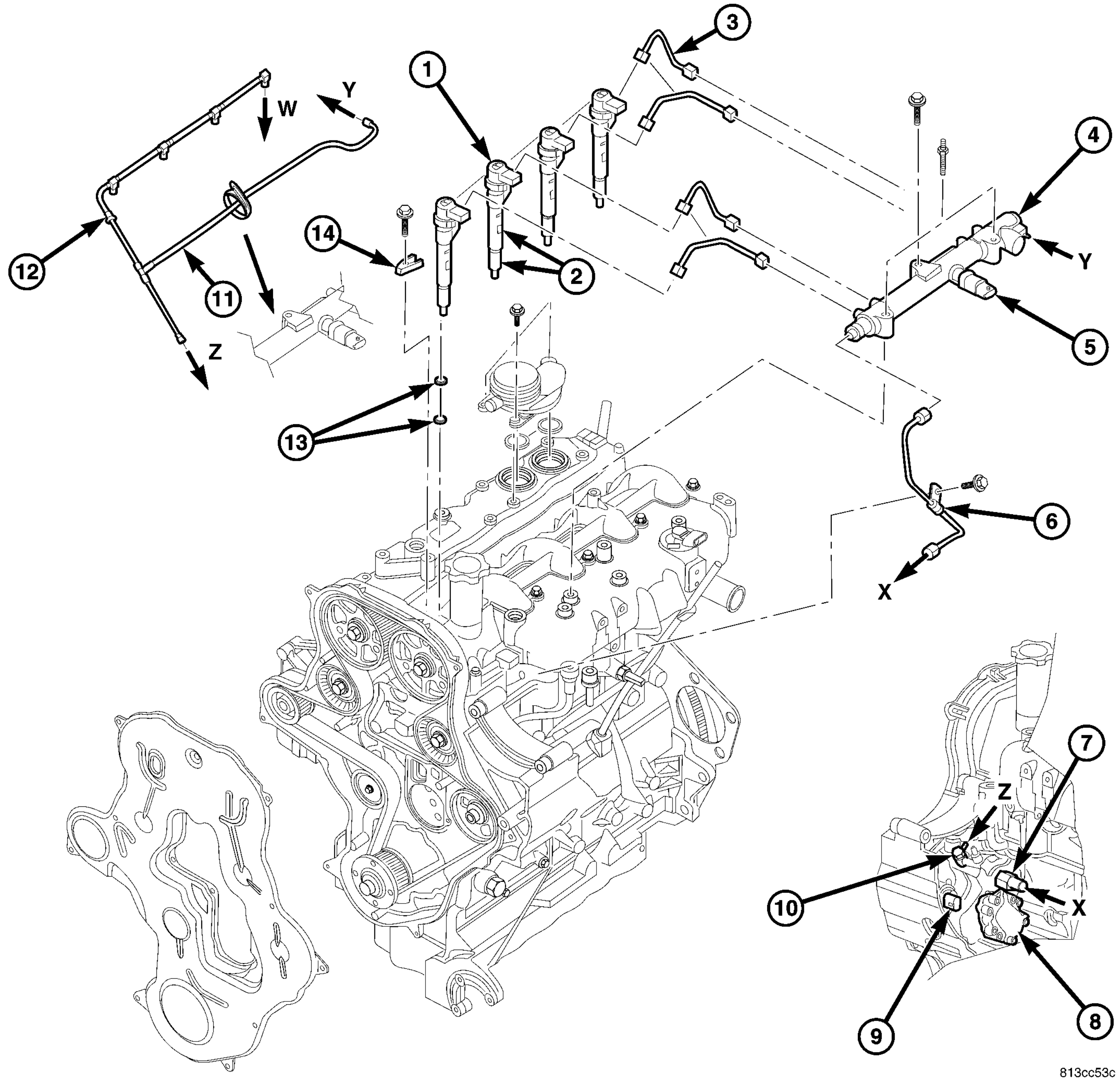

Fig. 1 CRD FUEL SYSTEM

1 - FUEL INJECTOR
2 - INJECTOR LUBRACATION POINT
3 - HIGH PRESSURE FUEL LINE
4 - FUEL RAIL
5 - FUEL RAIL PRESSURE SENSOR
6 - FUEL RAIL SUPPLY LINE
7 - INJECTION PUMP HIGH PRESSURE OUTLET
8 - HIGH PRESSURE INJECTION PUMP
9 - FUEL PRESSURE SOLENOID
10 - INJECTION PUMP FUEL RETURN FITTING
11 - FUEL INJECTOR FUEL RETURN HOSE
12 - FUEL FLOW BACK VALVE
13 - WASHER AND O-RING
14 - FUEL INJECTOR HOLD DOWN

FUEL SYSTEM 2.5L / 2.8L TURBO DIESEL (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - AIR IN FUEL SYSTEM

Air will enter the fuel system whenever fuel supply lines, separator filters, injection pump, high-pressure lines or injectors are removed or disconnected. Air trapped in the fuel system can result in hard starting, a rough running engine, engine misfire, low power, excessive smoke and fuel knock.

Inspect the fuel system from the fuel tank to the injectors for loose connections (Refer to 14 - FUEL SYSTEM - WARNING). Leaking fuel is an indicator of loose connections or defective seals. Air can also enter the fuel system between the fuel tank and the injectors because the lift pump only runs to prime the system. It does not run while the engine is running. Inspect the fuel tank and fuel lines for damage or loose connections that might allow air into the system.

With the DRBIII® connected to the vehicle, select Engine and the select Sensor Display. Page down to view Fuel Pressure Set Point and Actual Fuel Pressure. Start the engine and observe the Fuel Pressure Set Point and the Actual Fuel Pressure. If the Actual Fuel Pressure Oscillates above and below the Fuel Pressure Set Point in a regular cycle, perform the Fuel System Air Purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

If the Actual Fuel Pressure gradually drops below the Fuel Pressure Set Point then spikes well above the Fuel Pressure Set Point, replace the fuel pressure solenoid (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL PRESSURE SOLENOID - REMOVAL), then perform the Fuel System Air Purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

DIAGNOSIS AND TESTING - FUEL SUPPLY RESTRICTIONS

LOW-PRESSURE LINES

Fuel supply line restrictions or a defective fuel/lift pump can cause starting problems and prevent engine from accelerating.

Test all fuel supply lines for restrictions or blockage. Flush or replace as necessary. Purge fuel system of air once a fuel supply line has been replaced (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

HIGH-PRESSURE LINES

CAUTION: High pressure lines cannot contact each other or other components. Do not attempt to weld high-pressure fuel lines or to repair lines that are damaged. High pressure lines must be replaced at each disassembly. Use only recommended lines when replacement of high-pressure fuel line is necessary.

Restricted (kinked or bent) high-pressure lines can cause starting problems, poor engine performance, engine mis-fire and white smoke from exhaust (Refer to 14 - FUEL SYSTEM - WARNING).

DIAGNOSIS AND TESTING - FUEL DELIVERY SYSTEM

NOTE: Air Intrusion is the most common failure of a fuel system. If air intrusion is suspect, perform the Fuel System Air Purge procedure first.(Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

CONDITION	POSSIBLE CAUSES	CORRECTION
No Start/Hard Start/Start and Stall	Contaminated Fuel	Drain, Flush and Refill Fuel System
	Low Fuel Pressure	Check Fuel/Lift Pump Pressure. Refer to Fuel Pump Pressure Test in this section
	Restricted Fuel Filter	Replace Fuel Filter
	Fuel/Lift Pump Relay Inoperative	Test Fuel/Lift Pump Relay, refer to Fuel/Lift Pump Relay in this section.
	Fuel Heater Inoperative	Test Fuel Heater and circuitry. Refer to Fuel Heater in this section.
	Restricted or Leaking Fuel Lines	Inspect/ Replace necessary fuel line(s), perform Fuel System Air Purge
	Stored Diagnostic Trouble Codes	Refer to the appropriate Diagnostic Service Manual

FUEL SYSTEM 2.5L / 2.8L TURBO DIESEL (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Stalls Under Aggressive Maneuvers/Loss Of Fuel Pressure	Restricted or Damaged Fuel Tank Siphon Filter	Replace Fuel Tank Siphon Filter
	Contaminated Fuel	Drain, Flush and Refill Fuel System
	Damaged Fuel Tank	Replace Fuel Tank
	Restricted Fuel Filter	Replace Fuel Filter
	Stored Diagnostic Trouble Codes	Refer to the appropriate Diagnostic Service Manual
Cannot Refill Fuel Tank/ Excessive Pressure in Fuel Tank When Cap Is Removed	Sticking or Damaged Fuel Tank Fill/Vent Valve, Hose or Lines	Inspect, Repair Vent Hose and Lines, Replace Fuel Tank

STANDARD PROCEDURE

STANDARD PROCEDURE - FUEL TRANSFER PUMP PRESSURE TEST

NOTE: Use a shop towel to capture any fuel spillage.

(1) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(2) Connect a fuel pump pressure gauge to the air purge valve (Fig. 2).

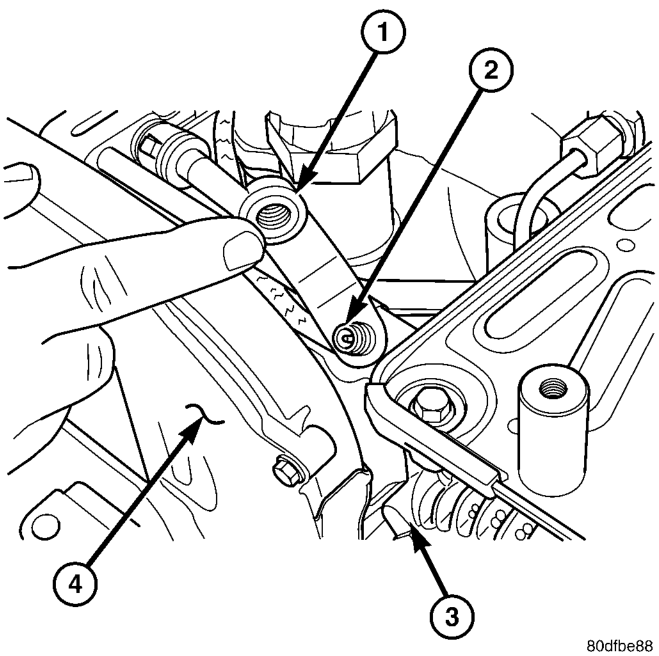

Fig. 2 AIR PURGE VALVE

1 - AIR PURGE VALVE CAP
2 - AIR PURGE VALVE
3 - ALTERNATOR
4 - ENGINE FRONT COVER

(3) Turn ON the ignition (fuel/lift pump should run for approximately 5 seconds).

(4) Observe the fuel pressure gauge, fuel pressure should read between 0.8 -1.2 bar (12 - 17 psi.).

If fuel pressure is outside of specification, review the following list of possible causes:

- Restricted fuel filter.
- Stored DTC's.
- Defective fuel/lift pump relay.
- Defective fuel/lift pump. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TRANSFER PUMP - DIAGNOSIS AND TESTING).
- Open fuel/lift pump relay Ignition positive circuit.
- Open fuel/lift pump ignition positive circuit.
- High resistance, fuel/lift pump ground.

STANDARD PROCEDURES - DRAINING WATER FROM FUEL FILTER

Refer to Fuel Filter/Water Separator removal/installation for procedures.

STANDARD PROCEDURE - FUEL SYSTEM AIR PURGE

(1) Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).

(2) Remove cap from air purge fitting on the fuel supply line. This fitting is located just behind the alternator next to the engine oil fill tube. (Fig. 3).

(3) Attach a hose of about 1 or 2 meters to this fitting using an appropriate connector to open the valve.

(4) Direct the end of the hose into an appropriate fuel container.

(5) Turn the ignition to the "ON" position, **Do not crank the engine.** Keep key on until about 1 liter of fuel has been pumped into the container. **Make sure the hose remains below the level of fuel in the container while the key is in the ON position.**

FUEL SYSTEM 2.5L / 2.8L TURBO DIESEL (Continued)

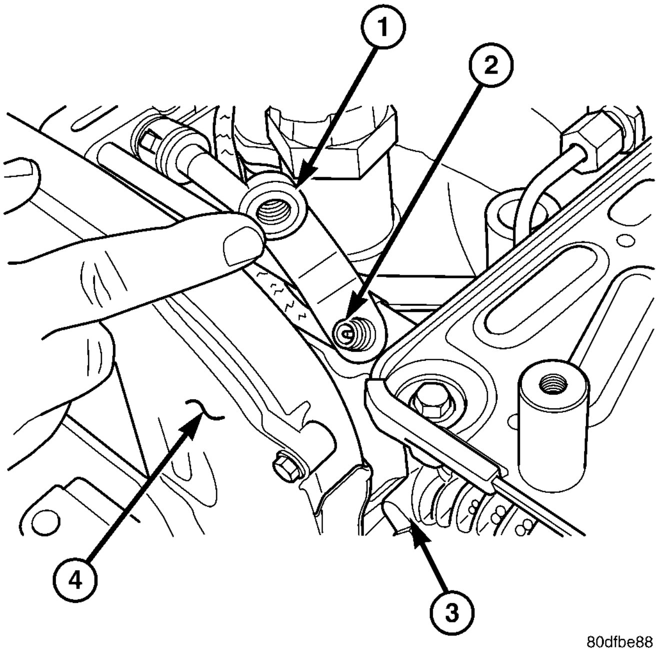

Fig. 3 AIR PURGE VALVE

1 - AIR PURGE VALVE CAP
2 - AIR PURGE VALVE
3 - ALTERNATOR
4 - ENGINE FRONT COVER

NOTE: The fuel pump will only run for 5 seconds. It will be necessary to cycle the key to the OFF then ON position several times to pump approximately 1 liter of fuel.

(6) While keeping end of hose below fuel level in container, turn the ignition "OFF".

(7) Remove hose from air purge fitting and replace cap.

(8) Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).

STANDARD PROCEDURES - CLEANING FUEL SYSTEM COMPONENTS

CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines, fuel rail, and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire. Always wash/clean any fuel system component thoroughly before disassembly and then air dry. DO NOT wire brush injector nozzles when cleaning. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.

SPECIFICATIONS - TORQUE

2.5L/ 2.8L DIESEL - TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Crankshaft Position Sensor Bolt	10.8	8	96
Boost Pressure / Intake Air Temperature Sensor Bolts	5.4	—	48
Fuel Pump Nuts	27.5	21	—
Fuel Line Fittings at Pump	27.5	21	—
Fuel Pump Sprocket Nut	88.3	65	—
Fuel Injector Retaining Bolts	32.4	24	—
High Pressure Fuel Lines	28	20	310
Fuel Rail Bolts	35	26	—
Fuel Rail Pressure Sensor	35	26	

FUEL DELIVERY

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FUEL RAIL

DESCRIPTION

The fuel rail is mounted to the cylinder head cover/ intake manifold (Refer to 14 - FUEL SYSTEM - WARNING) (Fig. 1).

OPERATION

WARNING: HIGH - PRESSURE LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 1600BAR (23,200 PSI.). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH - PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH — PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

The fuel rail stores the fuel for the injectors at high pressure. At the same time, the pressure oscillations which are generated due to the high-pressure pump delivery and the injection of fuel are dampened by the rail volume.

The fuel rail is common to all cylinders, hence it’s name “common rail”. Even when large quantities of fuel are extracted, the fuel rail maintains a constant inner pressure. This ensures that the injection pressure remains constant from the moment the injector opens.

REMOVAL - FUEL RAIL

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Disconnect fuel injector high pressure lines (Refer to 14 - FUEL SYSTEM - WARNING).

FUEL RAIL (Continued)

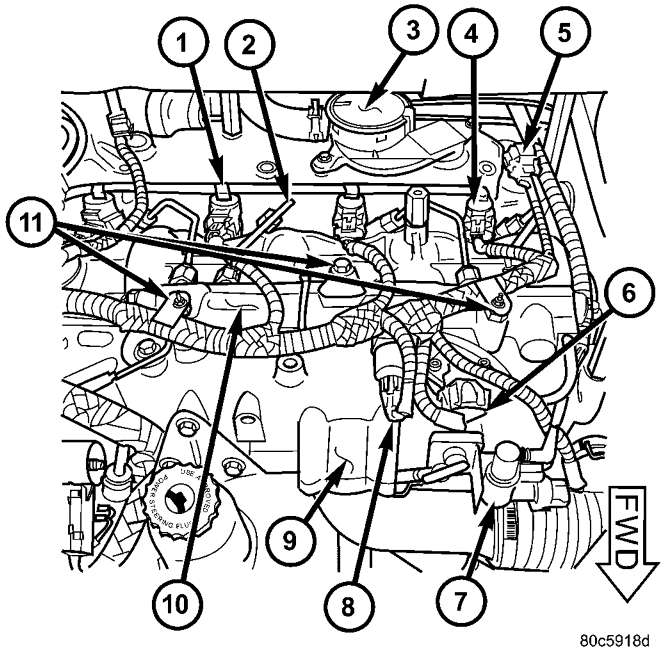

Fig. 1 ENGINE COMPONENT LOCATIONS

1 - FUEL INJECTOR RETURN LINE
2 - FUEL INJECTOR HIGH PRESSURE LINE
3 - OIL SEPARATOR
4 - FUEL INJECTOR
5 - CAMSHAFT POSITION SENSOR
6 - BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR
7 - EGR SOLENOID
8 - FUEL PRESSURE SENSOR
9 - CYLINDER HEAD COVER/INTAKE MANIFOLD
10 - FUEL RAIL
11 - FUEL INJECTOR WIRNING HARNESS RETAINER(S)

(4) Disconnect fuel rail supply line. (Fig. 2)

(5) Disconnect fuel rail return line. (Fig. 2)

(6) Disconnect fuel rail high pressure sensor connector. (Fig. 2)

(7) Remove engine electrical harness retainers from the fuel rail retaining bolts/studs. (Fig. 2)

(8) Remove fuel rail retaining bolts and remove fuel rail (Fig. 2).

INSTALLATION - FUEL RAIL

(1) (Refer to 14 - FUEL SYSTEM - WARNING) Install fuel rail to intake manifold/cylinder head cover (Fig. 2). Torque retaining bolts to 27.5N·m.

(2) Install engine electrical harness retainers from the fuel rail retaining bolts/studs. (Fig. 2)

(3) Connect fuel rail high pressure sensor electrical connector. (Fig. 2)

(4) Connect fuel rail return line. (Fig. 2)

(5) Connect fuel rail supply line. (Fig. 2)

(6) Connect fuel injector high pressure lines. (Fig. 2)

(7) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(8) Connect negative battery cable.

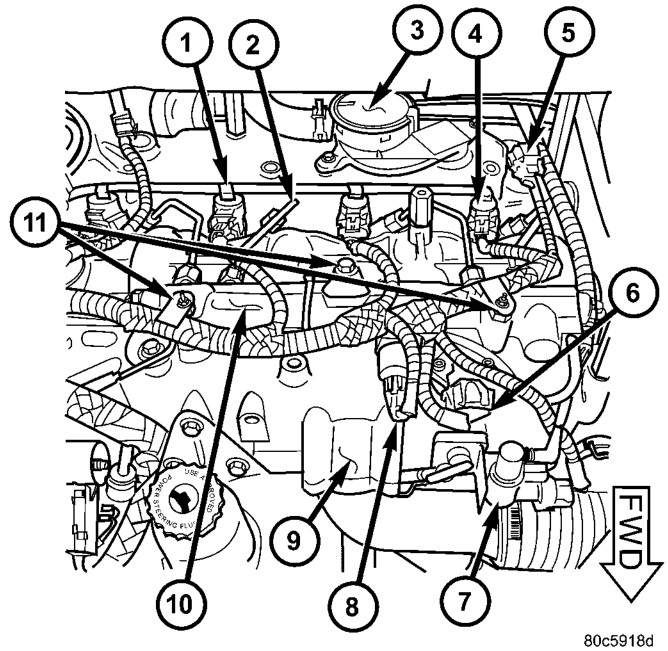

Fig. 2 FUEL RAIL COMPONENTS

1 - FUEL INJECTOR RETURN LINE
2 - FUEL INJECTOR HIGH PRESSURE LINE
3 - OIL SEPARATOR
4 - FUEL INJECTOR
5 - CAMSHAFT POSITION SENSOR
6 - BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR
7 - EGR SOLENOID
8 - FUEL PRESSURE SENSOR
9 - CYLINDER HEAD COVER/INTAKE MANIFOLD
10 - FUEL RAIL
11 - FUEL INJECTOR WIRNING HARNESS RETAINER(S)

FUEL FILTER / WATER SEPARATOR

DESCRIPTION

The fuel filter/water separator assembly is located under the vehicle in front of the rear axle assembly (Fig. 3). The assembly also includes the Fuel Heater and Water-In-Fuel (WIF) sensor.

OPERATION

The fuel filter/water separator protects the fuel injection pump by removing water and contaminants from the fuel. The construction of the filter/separator allows fuel to pass through it, but helps prevent moisture (water) from doing so. Moisture collects at the bottom of the canister.

The recommended fuel filter replacement interval is 20,000 km.

For draining of water from canister, refer to Fuel Filter/Water Separator Removal/Installation section.

A Water-In-Fuel (WIF) sensor is part of the fuel filter bowl assembly. Refer to Water-In-Fuel Sensor Description/Operation.

FUEL FILTER / WATER SEPARATOR (Continued)

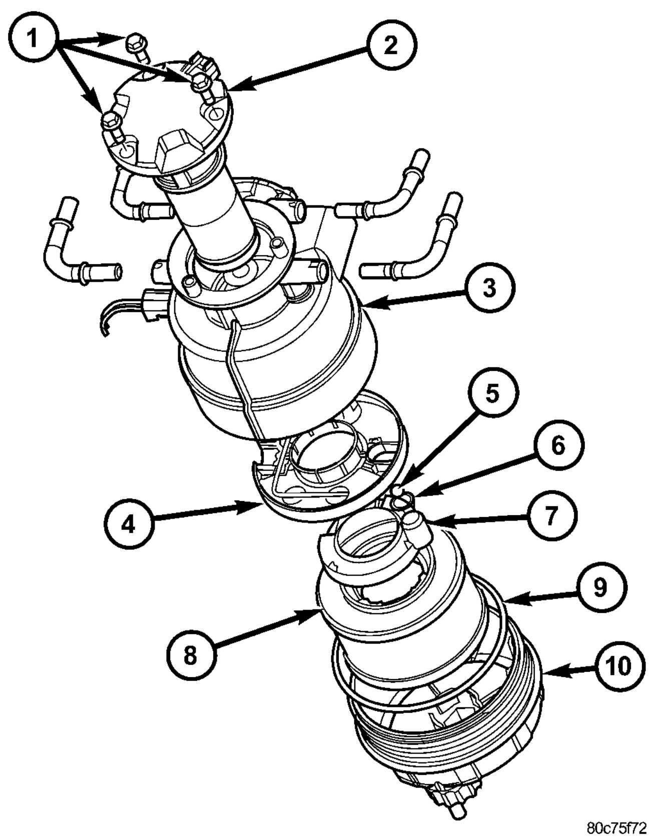

Fig. 3 FUEL FILTER/WATER SEPARATOR

1 - LIFT PUMP RETAINING BOLTS
2 - LIFT PUMP
3 - FUEL FILTER/WATER SEPARATOR HOUSING
4 - FUEL HEATER
5 - CHECK BALL
6 - O-RING
7 - FLOW DIVERTER
8 - FUEL FILTER
9 - O-RING
10 - FUEL FILTER BOWL ASSEMBLY

The fuel heater is installed into the filter/separator housing above the fuel filter. Refer to Fuel Heater Description/Operation.

REMOVAL

REMOVAL - FUEL FILTER

WARNING: NO SPARKS, OPEN FLAMES, OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.
(2) Raise and support the vehicle.
(3) Clean the fuel filter/water separator housing and dry with compressed air.
(4) Connect a drain hose to the fuel filter/water separator drain port and place the other end in a suitable container.
(5) Twist the fuel filter/water separator drain port-counterclockwise and completly drain the housing.
(6) Close the draincock.
(7) Disconnect the water in fuel electrical connector.
(8) Turning counterclockwise, remove the fuel filter and bowl assembly (Fig. 3).

REMOVAL

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.
(2) Raise and support vehicle.
(3) Insert a suitable hose onto the fuel drain port of the fuel filter bowl assembly, turn drain port counterclockwise and drain fuel into a suitable and appropriately marked container (Fig. 4).

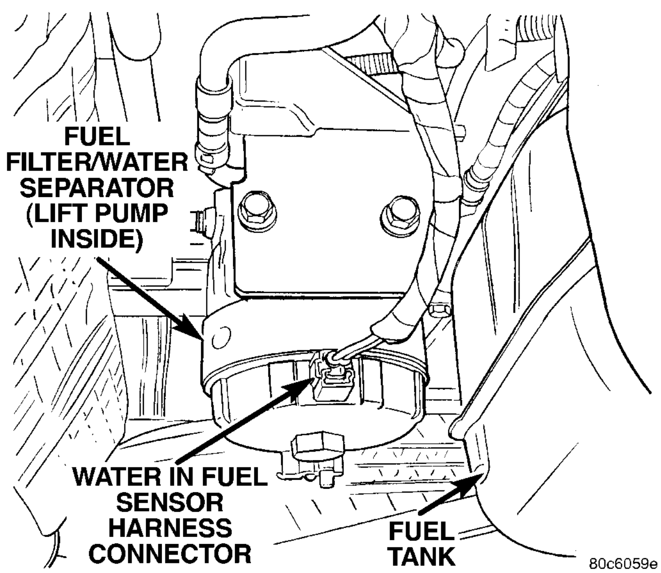

Fig. 4 LIFT PUMP LOCATION

(4) Disconnect fuel supply and return lines at fuel filter/water separator and set aside.
(5) Disconnect fuel filter/water separator electrical connector at bracket.
(6) Remove fuel filter/water separator retaining bracket bolts and remove assembly.

FUEL FILTER / WATER SEPARATOR (Continued)

INSTALLATION

INSTALLATION - FUEL FILTER

WARNING: NO SPARKS, OPEN FLAMES, OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Inspect the new fuel filter bowl assembly O-ring seal for proper positioning and deformities, replace as necessary.

(2) Lubricate the O-ring seal with clean engine oil or diesel fuel.

(3) Position the fuel filter bowl assembly to the fuel filter/water separator (Fig. 3).

(4) Turning clockwise, hand tighten the bowl assembly until both mating surfaces meet, then tighten the bowl assembly to 35N·m (26 lbs. ft.).

(5) Connect the water in fuel electrical connector.

(6) Reconnect negative battery cable.

(7) Perform the fuel system air purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

(8) Start engine and inspect for fuel leaks.

INSTALLATION

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: Assure fuel filter drain port is closed.

(1) Position fuel filter/water separator bracket and tighten retaining bolts (Fig. 4).

(2) Connect fuel filter/water separator electrical connector.

(3) Connect fuel feed and return lines.

(4) Connect negative battery cable.

(5) Perform the fuel system air purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

(6) Start engine and inspect for leaks.

FUEL INJECTION PUMP

DESCRIPTION

A radial-piston pump is used as the high pressure pump for fuel pressure generation (Refer to 14 - FUEL SYSTEM - WARNING) (Fig. 5).

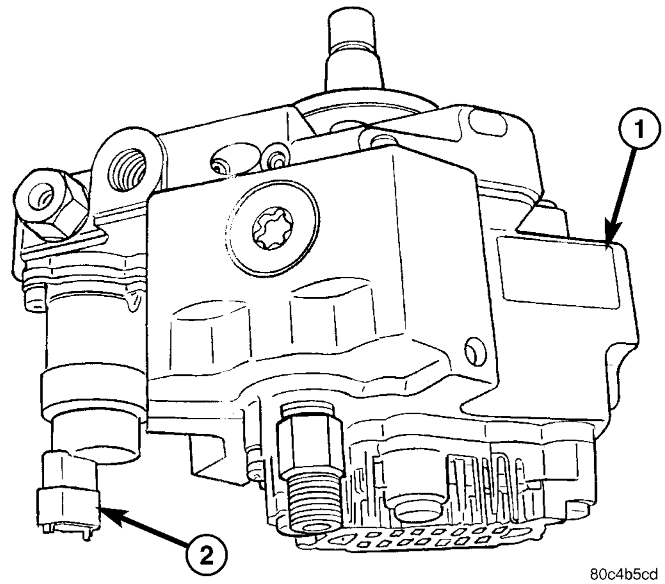

Fig. 5 FUEL INJECTION PUMP

1 - FUEL INJECTION PUMP
2 - INJECTION PUMP PRESSURE SOLENOID

REMOVAL

(1) Disconnect negative battery cable (Refer to 14 - FUEL SYSTEM - WARNING).

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL)

(3) Remove air cleaner housing assembly.

(4) Remove power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(5) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(6) Support engine and remove right engine mount assembly.

(7) Remove outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

FUEL INJECTION PUMP (Continued)

(8) Using special tool VM.1055, remove injection pump sprocket retaining nut (Fig. 6).

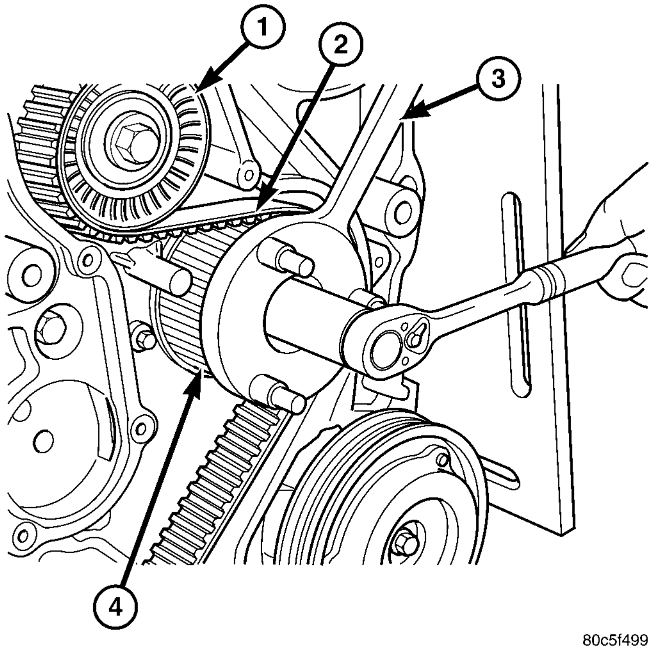

Fig. 6 INJECTION PUMP SPROCKET RETAINING NUT REMOVAL/INSTALLATION

1 - IDLER PULLEY
2 - TIMING BELT
3 - VM.1055
4 - INJECTION PUMP SPROCKET

NOTE: The use of special tool VM.1067 will allow you to remove the injection pump without removing the timing belt from the engine. This will allow you to remove and install the injection pump without altering injection pump timing.

(9) Install feet from VM.1067 in injection pump sprocket as shown (Fig. 7).

(10) Install inner flange of special tool VM.1067 on injection pump sprocket as shown (Fig. 8). Secure flange to feet in injection pump sprocket with allen bolts supplied with tool.

(11) Screw injection pump sprocket holding plate assembly into flange of VM.1067 (Fig. 9) Using LHD threaded bolt supplied, secure holding plate assembly to timing belt inner cover.

(12) Remove generator (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - REMOVAL)

(13) Disconnect fuel supply and return lines at injection pump.

(14) Disconnect fuel pressure solenoid electrical connector at injection pump (Fig. 10).

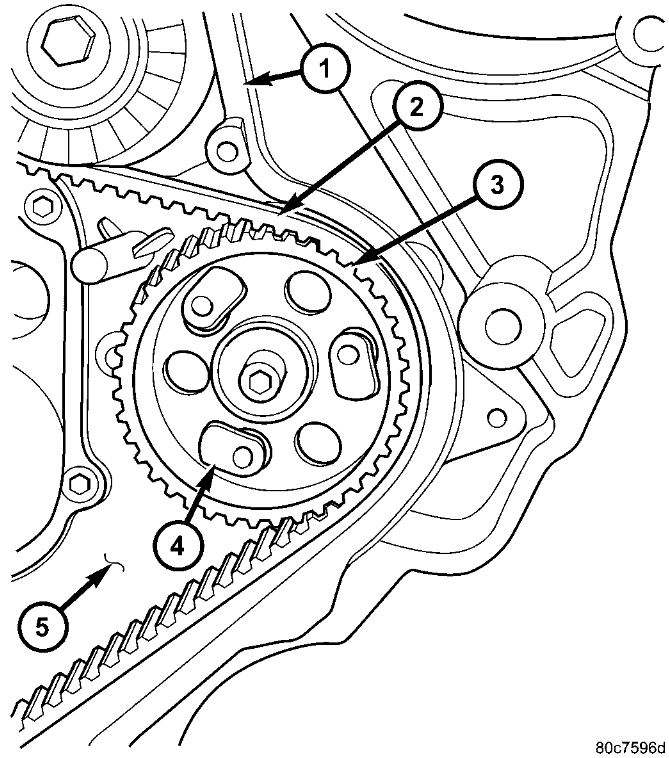

Fig. 7 VM.1067 FEET INSTALLATION

1 - OUTER TIMING BELT SEALING SURFACE
2 - TIMING BELT
3 - TIMING BELT SPROCKET
4 - FEET FOR SPECIAL TOOL VM.1067
5 - INNER TIMING BELT COVER

(15) Remove injection pump retaining nuts (Fig. 10).

(16) While holding injection pump, tighten bolt in center of injection pump holding plate (Fig. 9).This will push the injection pump out of the injection pump sprocket.

INSTALLATION

(1) Loosen bolt in center of injection pump holding plate and slide injection pump through the accessory bracket into the injection pump sprocket (Refer to 14 - FUEL SYSTEM - WARNING).

(2) Install injection pump retaining nuts. Torque nuts to 27.5N·m (Fig. 10).

(3) Unscrew injection pump holding plate (part of VM.1067) from inner timing belt cover and remove (Fig. 9).

(4) Install injection pump sprocket retaining nut to hold sprocket in place.

(5) Remove flange and feet (both part of VM.1067) from injection pump sprocket (Fig. 8) (Fig. 7).

FUEL INJECTION PUMP (Continued)

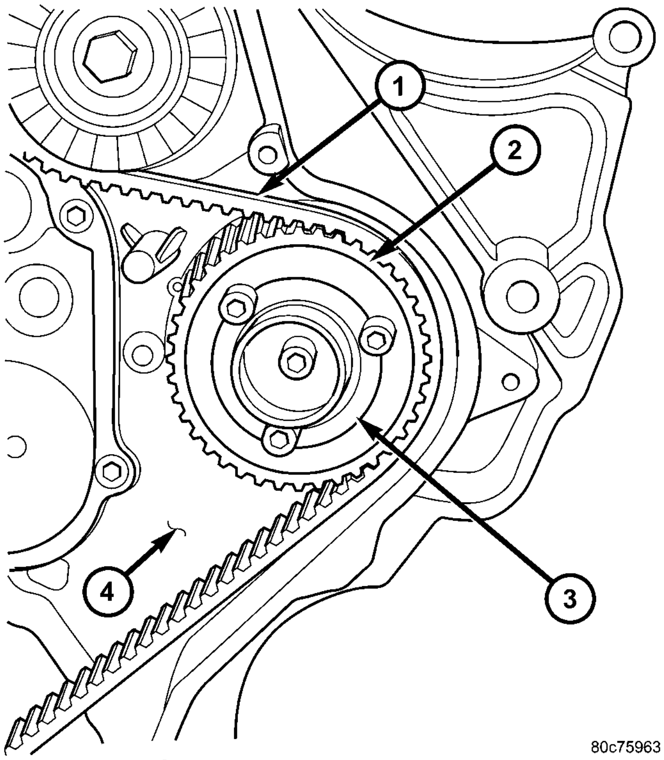

Fig. 8 VM.1067 INSTALLATION

1 - TIMING BELT
2 - INJECTION PUMP SPROCKET
3 - FLANGE OF VM.1067
4 - INNER TIMING BELT COVER

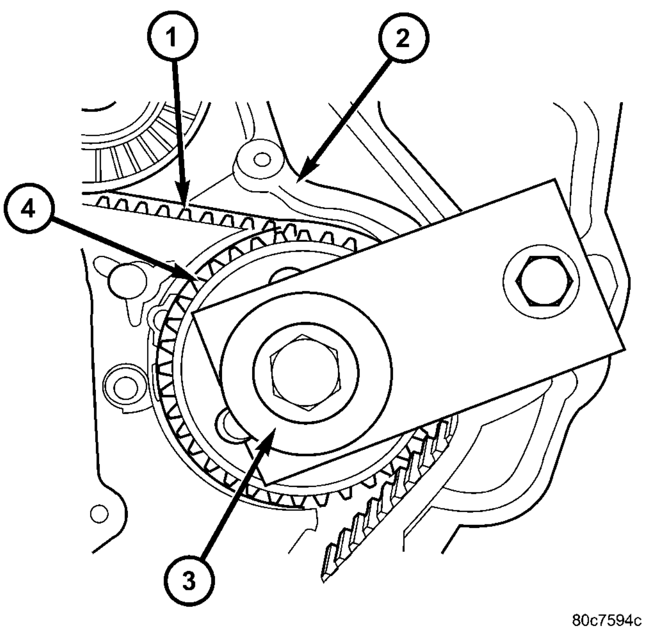

Fig. 9 INJECTION PUMP/GEAR REMOVAL USING VM.1067

1 - TIMING BELT
2 - INNER TIMING BELT COVER
3 - INJECTION PUMP SPROCKET HOLDING PLATE ASSEMBLY PART OF VM.1067
4 - INJECTION PUMP SPROCKET

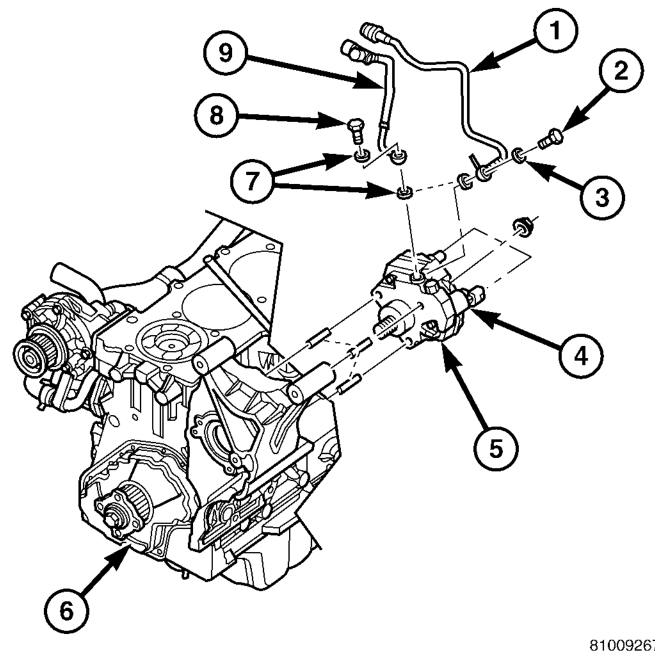

Fig. 10 INJECTION PUMP REMOVAL

1 - FUEL SUPPLY HOSE
2 - BANJO BOLT
3 - WASHER
4 - FUEL PRESSURE SOLENOID
5 - HIGH PRESSURE INJECTION PUMP
6 - INJECTION PUMP GEAR
7 - WASHERS
8 - BANJO BOLT
9 - FUEL RETURN HOSE

(6) Using special tool VM.1055 (Fig. 6), torque injection pump sprocket retaining nut to 88.3N·m.

(7) Connect fuel pressure solenoid electrical connector (Fig. 10).

(8) Connect fuel supply and return lines at injection pump. Tighten bolts to 27.5N·m (20 lbs. ft.). (Fig. 10).

(9) Install generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

(10) Install outer timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(11) Install right engine mount assembly.

(12) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Install power steering belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(14) Install air cleaner housing assembly.

(15) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(16) Connect negative battery cable (Refer to 14 - FUEL SYSTEM - WARNING).

FUEL LINES

DESCRIPTION

DESCRIPTION

NOTE: High pressure fuel lines must be replaced once disassembled.

All fuel lines up to the high pressure pump are considered low-pressure. This includes the fuel lines from the fuel tank to the fuel/lift pump, and the fuel/lift pump to the high pressure pump. The fuel return lines and the fuel drain lines are also considered low-pressure lines. High-pressure lines are used between the high pressure pump and the fuel rail and then from the rail to the fuel injectors (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - DESCRIPTION).

DESCRIPTION - HIGH PRESSURE FUEL LINES

NOTE: High pressure fuel lines must be replaced once disassembled.

(Refer to 14 - FUEL SYSTEM - WARNING). The high-pressure fuel lines are used between the fuel injection pump and the fuel rail, and between the fuel rail and fuel injectors.

OPERATION - HIGH PRESSURE FUEL LINES

WARNING:: HIGH - PRESSURE LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 1600BAR (23,200 PSI.). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH - PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH — PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

CAUTION: The high-pressure fuel lines cannot contact each other or other components. Do not attempt to weld high-pressure fuel lines or to repair lines that are damaged. If lines are ever kinked or bent, they must be replaced. Use only the recommended lines when replacement of high-pressure fuel line is necessary.

High-pressure fuel lines deliver fuel under extremely high pressure from the high pressure pump to the fuel injectors (Refer to 14 - FUEL SYSTEM - WARNING). The lines expand and contract from the high-pressure fuel pulses generated during the injection process. All high-pressure fuel lines are of the same length and inside diameter. Correct high-pressure fuel line usage and installation is critical to smooth engine operation.

DIAGNOSIS AND TESTING - HIGH PRESSURE FUEL LINES

Review the high pressure fuel system warning before beginning service.(Refer to 14 - FUEL SYSTEM - WARNING). High-pressure fuel line leaks can cause starting problems and poor engine performance.

WARNING: DUE TO EXTREME FUEL PRESSURES, USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. DO NOT GET YOUR HAND NEAR A SUSPECTED LEAK. INSPECT FOR HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. HIGH FUEL INJECTION PRESSURE CAN CAUSE PERSONAL INJURY IF CONTACT IS MADE WITH THE SKIN.

NOTE: Fuel Injector high pressure fuel lines must be replaced when ever they are removed for service.

Place the cardboard over the suspected high-pressure fuel line(s). Move you hands away from the area. Start the engine. TURN THE ENGINE OFF. Inspect the cardboard for fuel spray (Fig. 11). If a high-pressure line connection is leaking, counterhold and tighten the connection to specification. Re-test as indicated in the pervious steps. Replace damaged, restricted or leaking high-pressure fuel lines with the correct replacement line and perform the Fuel System Air Purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

FUEL LINES (Continued)

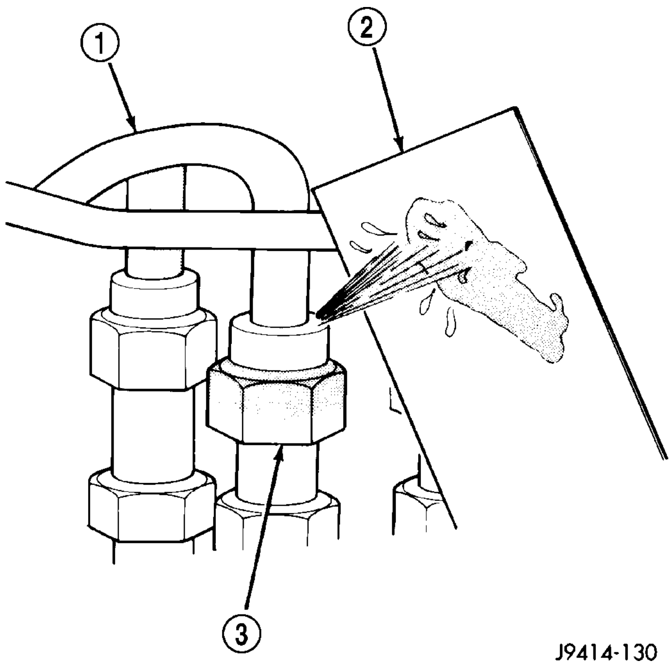

Fig. 11 Typical Test for Leaks with Cardboard

1 - HIGH-PRESSURE LINE
2 - CARDBOARD
3 - FITTING

CAUTION: The high-pressure fuel lines cannot contact each other or other components. Do not attempt to weld high-pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacing high-pressure fuel line(s).

FUEL/LIFT PUMP RELAY

DESCRIPTION

The fuel/lift pump relay is located in the Integrated Power Module (IPM). This micro-relay operates the same as a conventional relay except the terminal orientation and current capacity is different, and the relay case is smaller.

OPERATION

Fused battery positive voltage is supplied to the fuel/lift pump relay at all times through the Integrated Power Module (IPM). Fused ignition positive voltage is supplied to the fuel/lift pump relay through the IPM. The fuel/lift pump is grounded to the chassis. When the ignition switch is in the Run or Start position, the ECM grounds the lift pump relay control circuit for 5 seconds. This closes the relay contacts and supplys power to the fuel/lift pump motor. The fuel/lift pump will only operate on inital key On.

FUEL/LIFT PUMP

DESCRIPTION

The fuel/lift pump is located under the vehicle in front of the rear axle assembly (Fig. 12). The 12–volt electric vane-type pump is operated and controlled by the Engine Control Module (ECM).

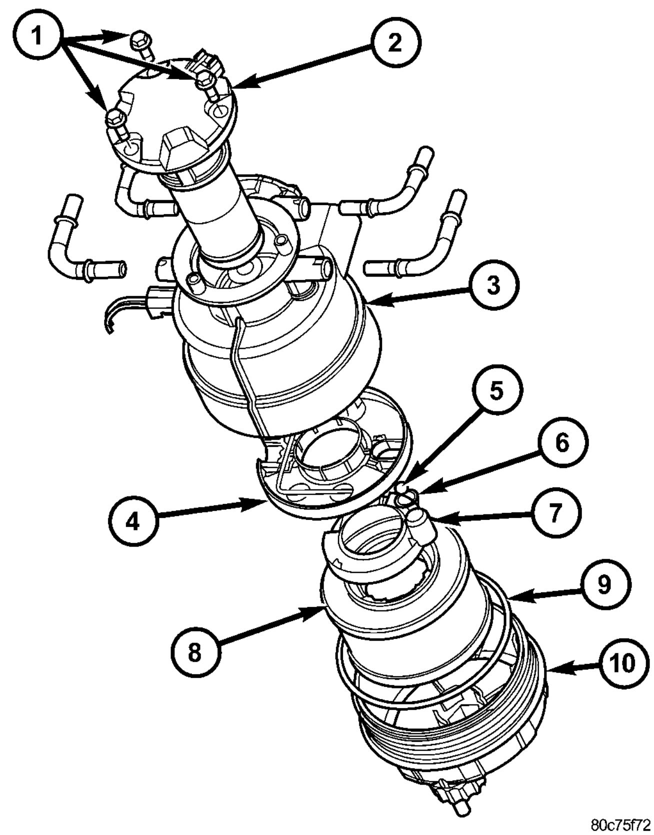

Fig. 12 FUEL TRANSFER(LIFT) PUMP LOCATION

1 - LIFT PUMP RETAINING BOLTS
2 - LIFT PUMP
3 - FUEL FILTER/WATER SEPARATOR HOUSING
4 - FUEL HEATER
5 - CHECK BALL
6 - O-RING
7 - FLOW DIVERTER
8 - FUEL FILTER
9 - O-RING
10 - FUEL FILTER BOWL ASSEMBLY

FUEL/LIFT PUMP (Continued)

OPERATION

The purpose of the fuel/lift pump is to supply low-pressure fuel: **from** the fuel tank, **through** the fuel filter/water separator and **to** the high pressure pump.

Fused battery positive voltage is supplied to the fuel/lift pump relay at all times through the Integrated Control Module. Fused ignition positive voltage is supplied to the fuel/lift pump relay by the ECM. When the ignition key is turned to the Run or Start position, the ECM grounds the relay control circuit for 5 seconds, which closes the relay contacts and allows fuel pump operation.

With the ignition "ON" and fuel transfer pump running, the low-pressure fuel pressure should be 12-17 psi.

DIAGNOSIS AND TESTING - FUEL/LIFT PUMP

CONDITION	POSSIBLE CAUSES	CORRECTION
Fuel/Lift Pump Inoperative	Stored DTC's	Refer to the appropriate diagnostic manual
	Open or shorted fused ignition switch output circuit.	Test and repair circuit as required
	Open or shorted fused battery voltage circuit to fuel/lift pump relay.	Test and repair circuit as required.
	Open or shorted fuel/lift pump relay output circuit.	Test and repair circuit as required.
	Open or high resistance, fuel/lift pump ground circuit.	Test and repair circuit as required.
	Defective fuel/lift pump relay	Test and replace relay as required.
	Defective fuel/lift pump	Replace fuel/lift pump

REMOVAL

(1) The fuel pump is serviced as part of the fuel filter/water separator assembly. Refer to (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - REMOVAL).

INSTALLATION

(1) The fuel pump is serviced as an assembly along with the fuel filter/water separator. Refer to (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - INSTALLATION).

WATER IN FUEL SENSOR

DESCRIPTION

The WIF sensor is located in the bowl assembly of the fuel filter/water separator.

OPERATION

The sensor sends an input to the Engine Control Module (ECM) when it senses water in the fuel filter/water separator. As the water level in the filter/separator increases, the resistance across the WIF sensor decreases. This decrease in resistance is sent as a signal to the ECM and compared to a high water standard value. Once the value reaches 30 to 40 kilohms, the ECM will activate the water-in-fuel warning lamp. This all takes place when the ignition key is initially put in the ON position.

REMOVAL

The Water in Fuel Sensor is part of the fuel filter bowl assembly. Refer to fuel filter replacement for removal procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - REMOVAL)

INSTALLATION

The Water in Fuel Sensor is part of the fuel filter bowl assembly. Refer to fuel filter installation for procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - INSTALLATION).

FUEL HEATER RELAY

DESCRIPTION

The fuel heater relay is located in the Integrated Power Module (IPM). This micro-relay operates the same as a conventional relay except the terminal orientation and current capacity is different, and the relay case is smaller.

OPERATION

The fuel heater relay is a electromechanical devise that switches battery voltage to the fuel heater when the ECM grounds the relay coil. The fuel heater relay can not be repaired, and if faulty or damaged, must be replaced.

FUEL HEATER

DESCRIPTION

The fuel heater is incorporated within the Fuel Filter/Water Separator, which is located under the vehicle in front of the rear axle assembly. It's purpose is to keep the fuel at a suitable temperature range to improve cold starting, cold driveability and cold exhaust emissions.

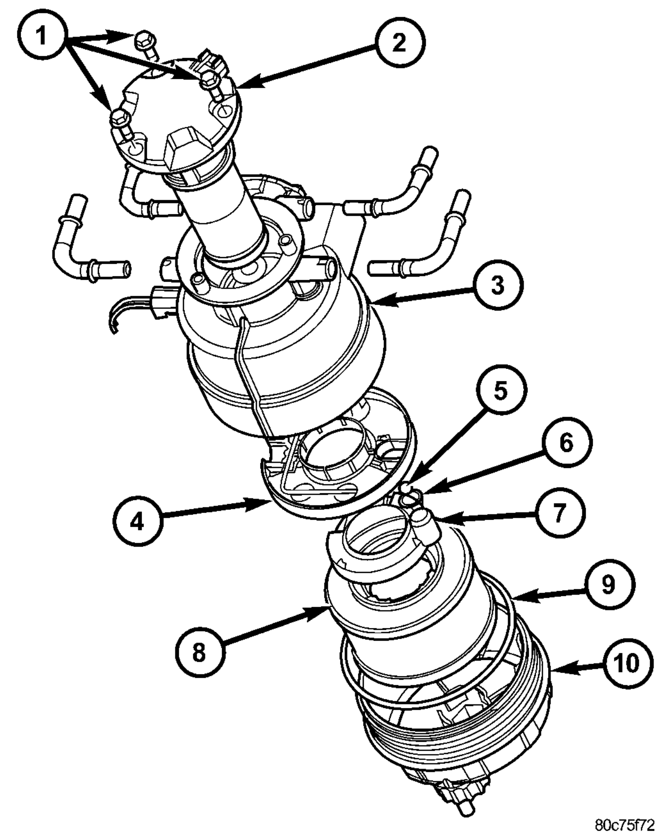

Fig. 13 FUEL FILTER/WATER SEPARATOR

1 - FUEL/LIFT PUMP RETAINING BOLTS
2 - FUEL/LIFT PUMP
3 - FUEL FILTER/WATER SEPARATOR HOUSING
4 - FUEL HEATER
5 - CHECK BALL
6 - O-RING
7 - FLOW DIVERTER
8 - FUEL FILTER
9 - O-RING
10 - FUEL FILTER BOWL ASSEMBLY

OPERATION

Fused battery positive voltage is supplied to the fuel heater relay at all times through the Integrated Power Module (IPM). Fused ignition positive voltage is supplied to the fuel heater relay through the IPM. The fuel heater is grounded through the ECM. When the ignition switch is in Run or Start position, the fuel heater relay contacts close and supply power to the fuel heater. The fuel heater acts as a thermister (resistance varies with temperature). If the fuel temperature is 8°C (46°F) or below the heater turns on until the temperature of the fuel reaches 25°C (76°F) at which time the heater turns off. (Fig. 13).

FUEL HEATER (Continued)

DIAGNOSIS AND TESTING - FUEL HEATER

The fuel heater element only operates between 8°C (46°F) and 24°C (76°F).

CONDITION	POSSIBLE CAUSES	CORRECTION
Fuel Heater Inoperative	Open or shorted battery positive circuit to fuel heater relay.	Test and repair circuit as required.
	Open or shorted ignition positive voltage circuit to fuel heater relay.	Test and repair circuit as required.
	Open or shorted fuel heater relay ground circuit.	Test and repair circuit as required.
	Open or shorted fuel heater relay output circuit.	Test and repair circuit as required.
	Faulty fuel heater relay	Test and replace as necessary.
	Faulty fuel heater	Test and replace as necessary.
	Faulty ECM	Test and replace as necessary.

REMOVAL

(1) The Fuel Heater is part of the Fuel Filter/Water Separator. Refer to the Fuel Filter/Water Separator Replacement Procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - REMOVAL).

INSTALLATION

(1) The Fuel Heater is part of the Fuel Filer/Water Separator. Refer to the Fuel Filter/Water Separator Installation Procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - INSTALLATION).

FUEL INJECTION

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FUEL INJECTION

STANDARD PROCEDURE - TESTING FUEL INJECTORS

NOTE: The fuel pump pressure must be between 0.8 and 1.2 bar (13–17 psi), and engine must be at operating temperature, engine coolant 88°C (190°F).

(1) (Refer to 14 - FUEL SYSTEM - WARNING). Run engine until operating temperature is obtained.

(2) Turn Off the ignition.

(3) Disconnect the fuel injector fuel return hose at the return hose tee directly behind the generator, next to the air purge fitting, leaving the return hose to the high pressure injection pump connected to the pump (Fig. 1).

(4) Block off fuel return line to high pressure injection pump.

(5) Connect a hose to the return hose tee and place it in a suitable container.

(6) Start the engine and measure the return fuel for 1 minute at idle.

NOTE: If the quantity of fuel is above 100ml. it means one or more of the fuel injectors has a problem.

(7) If the measured quantity is above 100ml, disconnect each individual injector and measure the quantity of return fuel into the container.

NOTE: Make sure to block off the fuel return hose at each individual fuel injector before taking a measurement.

(8) Replace the fuel injector that has a return rate above 25ml. for one minute at idle(Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).

(9) If the test does not give a positive result, disconnect the fuel return line at the fuel rail. If fuel is present, replace the fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL).

FUEL INJECTION (Continued)

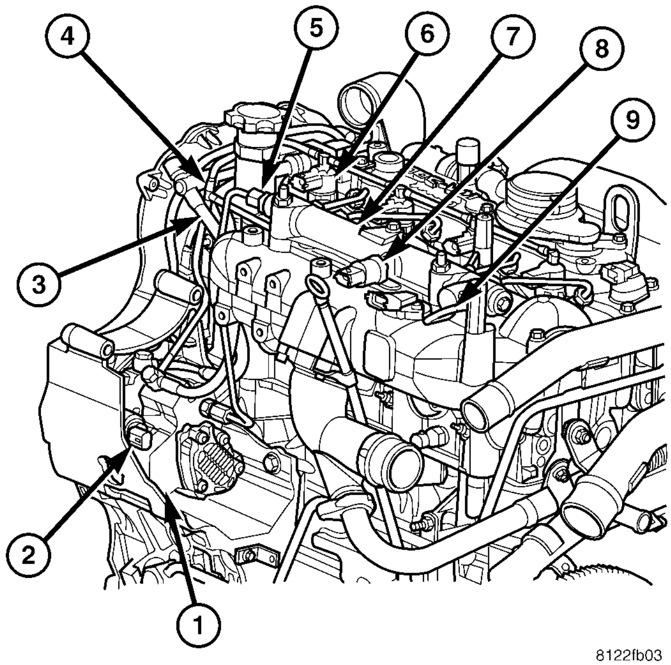

Fig. 1 DIESEL FUEL SYSTEM COMPONENTS

1 - HIGH PRESSURE FUEL INJECTION PUMP
2 - FUEL PRESSURE SOLENOID
3 - AIR PURGE FITTING
4 - FUEL INJECTOR FUEL RETURN HOSE TEE
5 - HIGH PRESSURE FUEL SUPPLY LINE
6 - FUEL INJECTOR
7 - FUEL RAIL
8 - FUEL RAIL PRESSURE SENSOR
9 - FUEL RAIL RETURN LINE

(10) Perform the fuel system air purge procedure after replacing any components (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

FUEL PRESSURE SOLENOID

DESCRIPTION

The fuel pressure solenoid controls the low pressure fuel supply to the high pressure injection pump. The readings along with the Fuel Pressure Sensor readings are used by the ECM to determine and maintain the appropriate fuel system pressure under all driving conditions (Fig. 2).

REMOVAL

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Lift up on the power steering pump reservoir, and remove it from it's mounting. Place the reservoir aside.

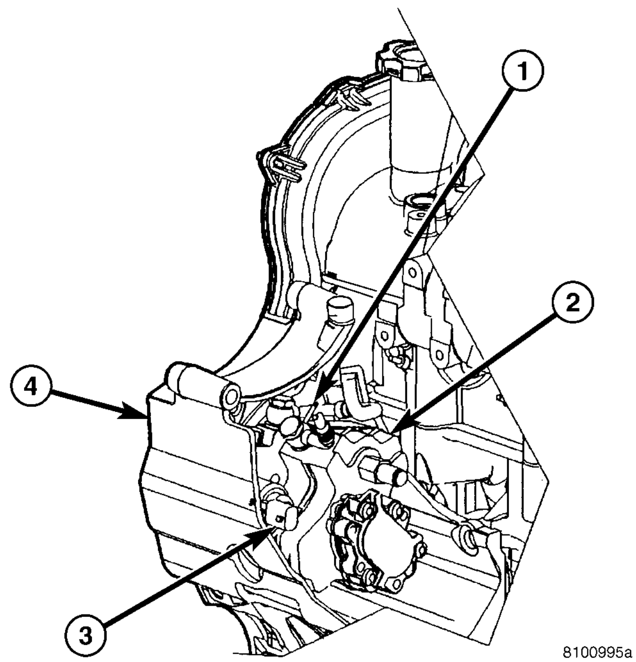

Fig. 2 FUEL PRESSURE SOLENOID

1 - FUEL RETURN LINE
2 - HIGH PRESSURE FUEL INJECTION PUMP
3 - FUEL PRESSURE SOLENOID
4 - ACCESSORY BRACKET

(4) (Refer to 14 - FUEL SYSTEM - WARNING). Thoroughly clean the high pressure fuel injection pump around the area of the fuel pressure solenoid and use compressed air to dry (Fig. 2).
(5) Disconnect the fuel pressure solenoid electrical connector (Refer to 14 - FUEL SYSTEM - WARNING).
(6) Remove the screw attaching the solenoid to the pump (Refer to 14 - FUEL SYSTEM - WARNING).
(7) Grab the fuel pressure solenoid, twist, and pull back to remove the solenoid from the pump (Refer to 14 - FUEL SYSTEM - WARNING).

NOTE: DO NOT use mechanical implements to remove dirt and debris from the injection pump bores or mating surfaces.

(8) Use a clean, lint free cloth to remove any debris from the bores and mating surfaces of the injection pump.

FUEL PRESSURE SOLENOID (Continued)

INSTALLATION

(1) Inspect O-rings on the new pressure solenoid for any damage and ensure that the O-rings are seated properly (Refer to 14 - FUEL SYSTEM - WARNING).

(2) Coat both O-rings with clean engine oil or diesel fuel.

NOTE: If pressure solenoid is pressed in at an angle, the O-rins may be damaged, resulting in fuel leakage or high pressure injection pump malfunction.

(3) Position the new pressure solenoid horizontally into the high pressure injection pump, twist slightly while pressing into pump. Ensure the mating surfaces of both components are flush (Fig. 2).

(4) Install the pressure solenoid retaining screws by hand and tighten in 2 phases. 3 - 4Nm (27 - 35lbs.in.) then 6 - 7Nm (53 - 62 lbs.in.).

(5) Connect the pressure solenoid electrical connector.

(6) Install the power steering reservoir into it's mounting bracket.

(7) Connect the negative battery cable.

(8) Perform the Fuel System Air Purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

FUEL INJECTOR

DESCRIPTION

FUEL INJECTOR

WARNING: HIGH - PRESSURE FUEL LINE DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 1600BAR (23,200PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH - PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH - PRESSURE LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

(Refer to 14 - FUEL SYSTEM - WARNING) There are individual fuel injectors for all four cylinders. These fuel injectors are used to spray fuel into the combustion chamber (Fig. 3).

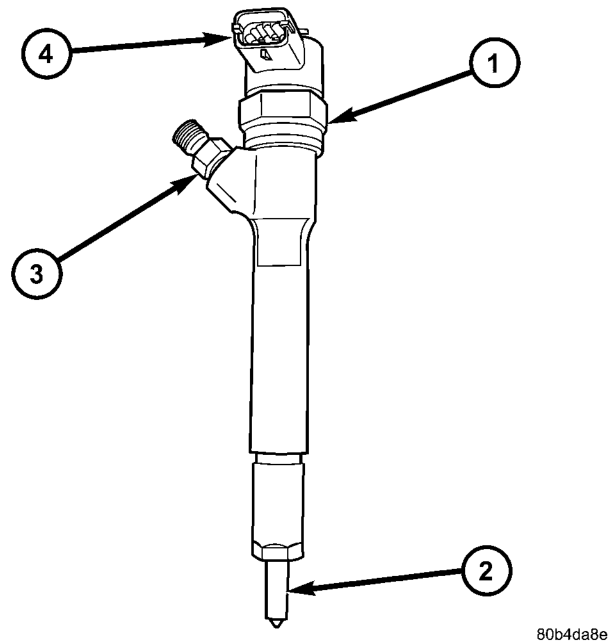

Fig. 3 FUEL INJECTOR

1 - FUEL INJECTOR
2 - NOZZLE
3 - FUEL INLET FITTING
4 - ELECTRICAL CONNECTION

OPERATION

(Refer to 14 - FUEL SYSTEM - WARNING) The injector operation can be subdivided into four operating states with the engine running and the high-pressure pump generating pressure:

- Injector closed (with high pressure applied)
- Injector opens (start of injection)
- Injector opened fully
- Injector closes (end of injection)

Injector closed (with high pressure applied)

With the injector closed (at-rest state), the solenoid valve is not energized and is therefore closed. With the bleed orifice closed, the valve spring forces the armature's ball onto the bleed-orifice seat. The rail's high pressure build up in the valve control chamber, and the same pressure is also present in the nozzle's chamber volume. The rail pressure applied at the control plunger's end face, together with the force of the nozzle spring, maintain the nozzle in the closed position against the opening forces applied to its pressure stage (Fig. 4).

FUEL INJECTOR (Continued)

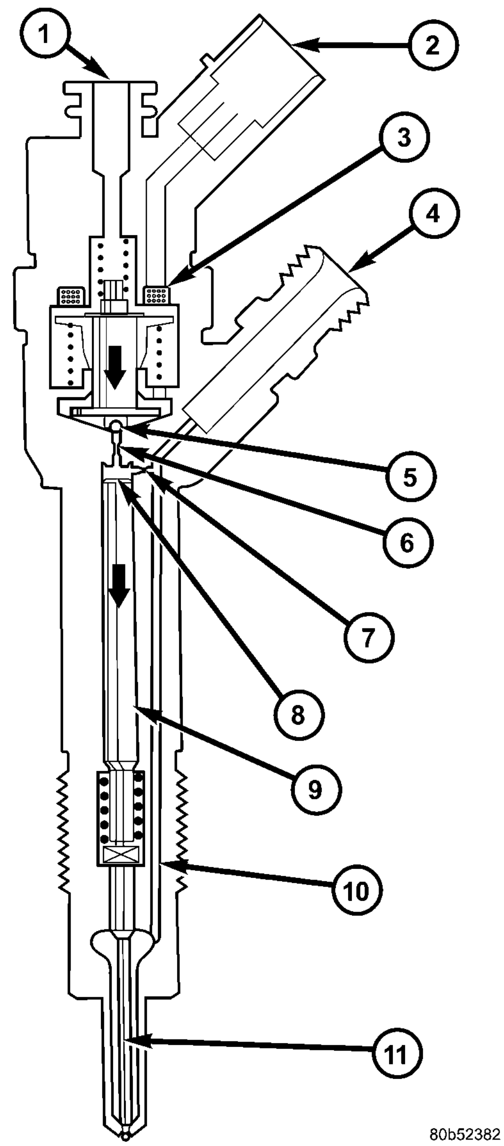

Fig. 4 INJECTOR COMPONENTS

1 - INJECTOR CLOSED (AT-REST STATUS)
2 - ELECTRICAL CONNECTION
3 - TRIGGERING ELEMENT (SOLENOID VALVE)
4 - FUEL INLET (HIGH PRESSURE) FROM THE RAIL
5 - VALVE BALL
6 - BLEED ORIFICE
7 - FEED ORIFICE
8 - VALVE CONTROL CHAMBER
9 - VALVE CONTROL PLUNGER
10 - FEED PASSAGE TO THE NOZZLE
11 - NOZZLE NEEDLE

Injector opens (start of injection)

The solenoid valve is energized with the pickup current which serves to ensure that it open quickly. The force exerted by the triggered solenoid now exceeds that of the valve spring and the armature opens the bleed orifice. Almost immediately, the high-level pick-up current is reduced to the lower holding current required for the electromagnet. This is possible due to the magnetic circuit's air gap now being smaller. When the bleed orifice opens, fuel can flow from the valve control chamber into the cavity situated above it, and from there via the fuel return to the tank. The bleed orifice prevents complete pressure balance, and the pressure in the valve control chamber sinks as a result. This leads to the pressure in the valve-control chamber being lower than that in the nozzle's chamber volume which is still at the same pressure level as the rail. The reduced pressure in the valve-control chamber causes a reduction in the force exerted on the control plunger, the nozzle needle opens as a result, and injection starts (Fig. 4).

Injector opens fully

The control plunger reaches its upper stop where it remains supported by a cushion of fuel which is generated by the flow of fuel between the bleed and feed orifices. The injector nozzle has now opened fully, and the fuel is injected into the combustion chamber at a pressure almost equal to that in the fuel rail (Fig. 4).

Injector closes (end of injection)

As soon as the solenoid valve is no longer triggered, the valve spring forces the armature downwards and the ball closes the bleed orifice. The armature is a 2–piece design. Here, although the armature plate is guided by a driver shoulder in its downward movement, it can "overspring" with the return spring so that it exerts no downwards-acting forces on the armature and the ball. The closing of the bleed orifice lead to pressure build up in the control chamber via the input from the feed orifice. This pressure is the same as that in the rail and exerts an increased force on the control plunger through its end face. This force, together with that of the spring, now exceeds the force exerted by the chamber volume and the nozzle needle closes. Injection ceases as soon as the nozzle needle comes up against its bottom stop again (Fig. 4).

FUEL INJECTOR (Continued)

STANDARD PROCEDURE - INJECTOR BORE CLEANING

(1) Screw the injector nozzle bore plug onto the threaded extention.

(2) Seat the plug into the injector nozzle bore and remove threaded extention (Fig. 5).

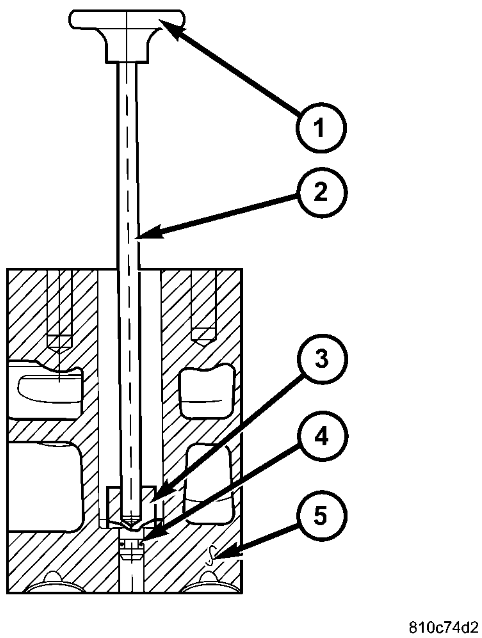

Fig. 5 FUEL INJECTOR PLUG AND EXTENTION

1 - HANDLE
2 - THREADED EXTENTION
3 - PLUG
4 - O-RING
5 - CYLINDER HEAD

(3) Using the abrasive blade roller, clean the injector bore (Fig. 6).

NOTE: Before blowing the debris out of the bore, insert the threaded extention onto the the plug and press down to prevent debris from entering the combustion chamber.

(4) Install the threaded extention onto the bore plug and press down while blowing the material away from the injector seat (Fig. 5).

NOTE: Do Not apply antiseize compound near the fuel injector nozzle.

NOTE: Repeated mounting of the return fuel hose retaining ring is not permitted

(5) Carefully clean and lubracate the injector body with antiseize compound before installation (Fig. 7).

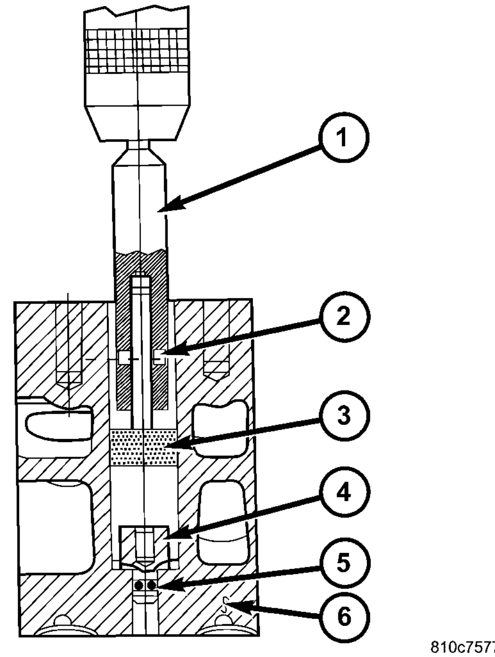

Fig. 6 CYLINDER HEAD INJECTOR BORE CLEANING

1 - EXTENTION
2 - DOWEL
3 - ABRASIVE BLADE ROLLER
4 - PLUG
5 - O-RING
6 - CYLINDER HEAD

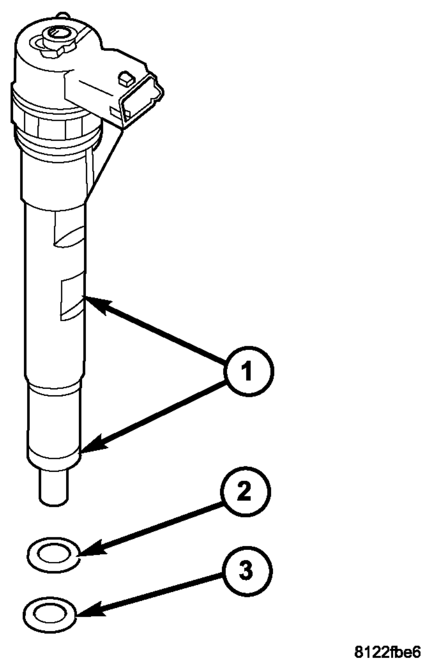

Fig. 7 FUEL INJECTOR

1 - LUBRACATION POINTS
2 - WASHER
3 - SEAL

FUEL INJECTOR (Continued)

REMOVAL

NOTE: Repeated mounting of the fuel return line and retaining clip is not permitted.

(1) Disconnect negative battery cable (Refer to 14 - FUEL SYSTEM - WARNING).

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL) (Refer to 9 - ENGINE COVER - REMOVAL).

(3) Disconnect injector electrical connector.

NOTE: DO NOT use a brush to clean around injector nozzle. The Injector may become restricted with debris.

(4) Remove fuel return line from injector (Fig. 8).

(5) Counterhold and remove fuel injector high pressure line from the injector.

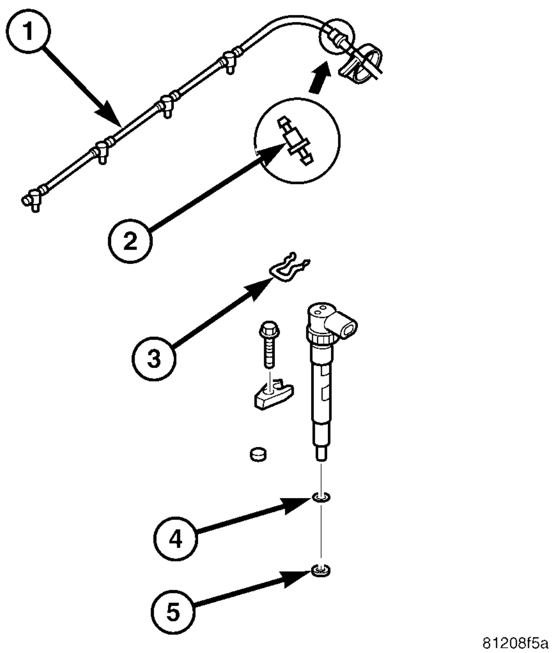

Fig. 8 FUEL INJECTOR AND COMPONENTS

1 - FUEL RETURN LINE
2 - ONE WAY VALVE
3 - RETAINING RING
4 - WASHER
5 - O-RING

(6) Remove fuel injector retaining bolt and retainer (Fig. 8).

(7) Remove fuel injector from cylinder head (Fig. 8).

CAUTION: If the fuel injectors will not come out of the cylinder head perform the following steps to prevent damaging other components.

(8) Assemble and install Injector extractor special tool VM9075 on to injector and cylinder head (Fig. 9).

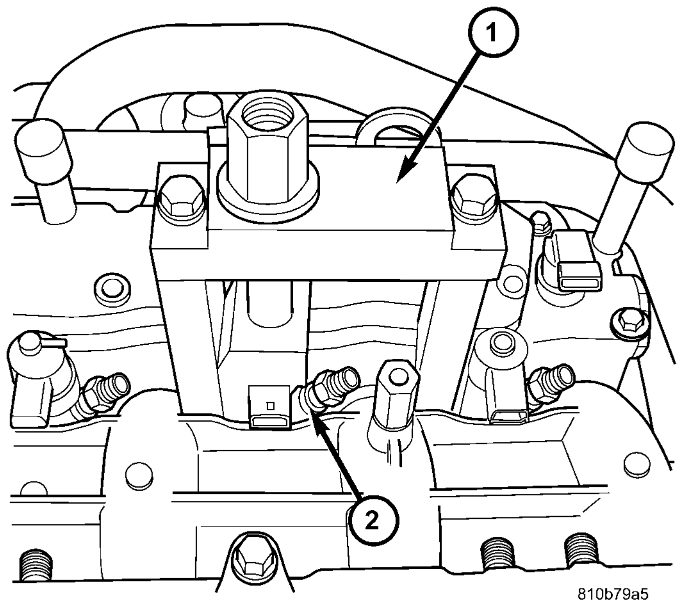

Fig. 9 FUEL INJECTOR EXTRACTOR

1 - VM9075
2 - FUEL INJECTOR

(9) Tighten injector extractor center nut until fuel injector is extracted (Fig. 10).

NOTE: If the injector is still hard to remove, leave the tool in place with tension on the injector and liberally spray the injector seat with antiseize lubricant.

(10) Thoroughly clean cylinder head fuel injector bore (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).

INSTALLATION

WARNING: (Refer to 14 - FUEL SYSTEM - WARNING).

NOTE: Lightly lubricate injector body with antiseize compound and install fuel injector in cylinder head. Be sure the copper washer is installed on end of injector before installing in cylinder head.

NOTE: DO NOT use a brush to clean around injector nozzle. DO NOT lubricate area around injector nozzle. The Injector may become restricted with debris.

FUEL INJECTOR (Continued)

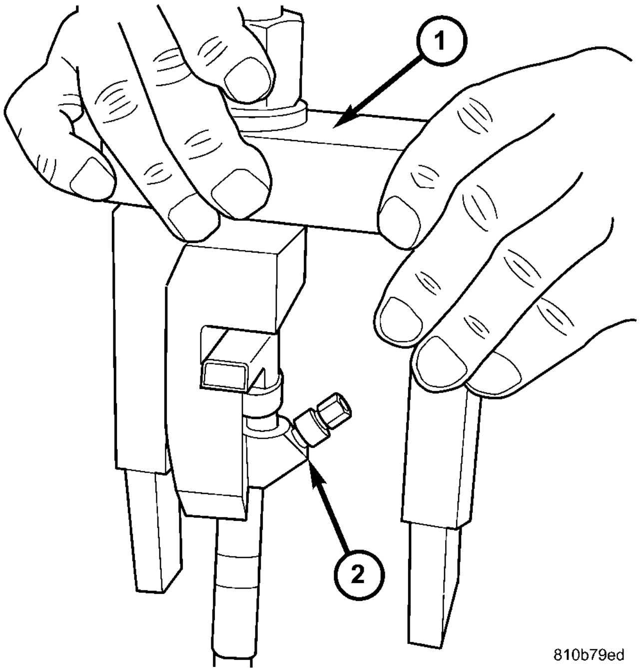

Fig. 10 SPECIAL TOOL VM9075

1 - VM9075
2 - FUEL INJECTOR

(1) Install fuel injector with new seals.

(2) Install fuel injector retainer and bolt (Fig. 8). Torque bolt to 32.4 N·m.

(3) Install fuel injector high pressure line, counterhold and tighten to 20 N·m (177 lbs. in.)..

NOTE: Repeated mounting of the return line and clip is not permitted.

(4) Install fuel return line to injector (Fig. 8).

(5) Connect fuel injector electrical connector.

(6) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(7) Connect negative battery cable (Refer to 14 - FUEL SYSTEM - WARNING).

ACCELERATOR PEDAL POSITION SENSOR

DESCRIPTION

The accelerator pedal position sensor mounts to the accelerator pedal bracket (Fig. 11).

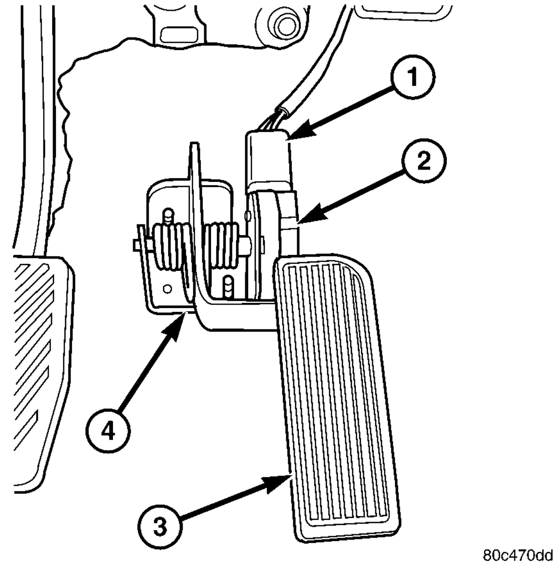

Fig. 11 ACCELERATOR PEDAL POSITION SENSOR LOCATION (TYPICAL)

1 - ACCELERATOR PEDAL POSITION SENSOR ELECTRICAL CONNECTOR
2 - ACCELERATOR PEDAL POSITION SENSOR
3 - ACCELERATOR PEDAL
4 - ACCELERATOR PEDAL MOUNTING BRACKET

OPERATION

The accelerator pedal position sensor contains a low idle switch and a potentiometer that are operated by the accelerator pedal. As the accelerator pedal is depressed, the low idle switch opens and the potentiometer provides a variable voltage signal to the engine control module directly proportional to accelerator pedal position. When the pedal is fully depressed, the voltage signal is high.

REMOVAL - PEDAL POSITION SENSOR (LHD)

(1) Disconnect negative battery cable.

(2) Disconnect pedal position sensor electrical connector (Fig. 11).

(3) Remove 2 pedal position sensor retaining nuts (Fig. 11).

(4) Remove pedal position sensor from vehicle.

INSTALLATION - PEDAL POSITION SENSOR (LHD)

(1) Position pedal position sensor in vehicle.

(2) Install pedal position sensor retaining nuts (Fig. 11).

(3) Connect pedal position sensor electrical connector (Fig. 11).

(4) Connect negative battery cable.

BOOST PRESSURE SENSOR

DESCRIPTION

The boost pressure/ intake air temperature sensor is mounted to the top of the intake manifold. The sensor allows the ECM to monitor air pressure within the intake manifold. This sensor is also used to monitor the intake air temperature (Fig. 12).

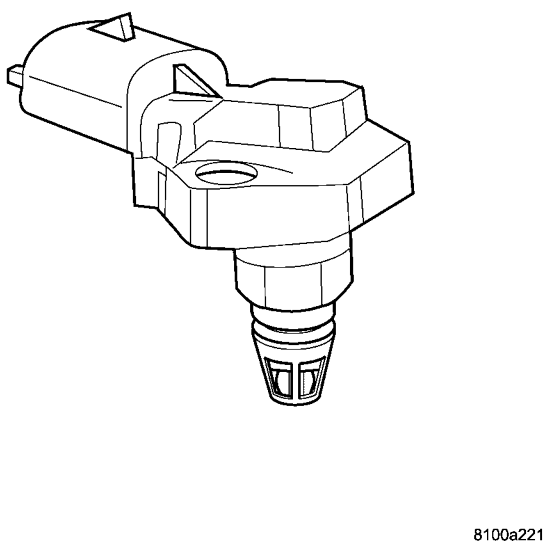

Fig. 12 BOOST PRESSURE SENSOR / INTAKE AIR TEMPERATURE SENSOR

OPERATION

When the intake manifold pressure is low sensor voltage output is 0.25-1.8 volts at the ECM. When the intake manifold pressure is high due to turbo boost, sensor voltage output is 2.0-4.7 volts. The sensor receives a 5-volts reference from the ECM. Sensor ground is also provides by the ECM. The ECM uses boost pressure combined with intake air temerature to determine the volume of air entering the engine.

DIAGNOSIS AND TESTING - BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR

If the boost pressure sensor fails, the ECM records a DTC into memory and continues to operate the engine in one of the three limp-in modes. When the ECM is operating in this mode, a loss of power will be present, as if the turbocharger was not operating. The best method for diagnosing faults with the boost pressure sensor is with the DRB III® scan tool. Refer to the Diesel Powertrain Diagnostic Manual for more information.

Refer to On-Board Diagnostics in Emissions Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

INTAKE AIR TEMPERATURE SENSOR

DESCRIPTION

The boost pressure sensor/intake air temperature sensor is located in the top of the intake manifold (Fig. 13). The intake air temperature sensor is used to measure the intake air temperature. The intake air temperture sensor is a dual purpose sensor. It is also used as a boost pressure sensor.

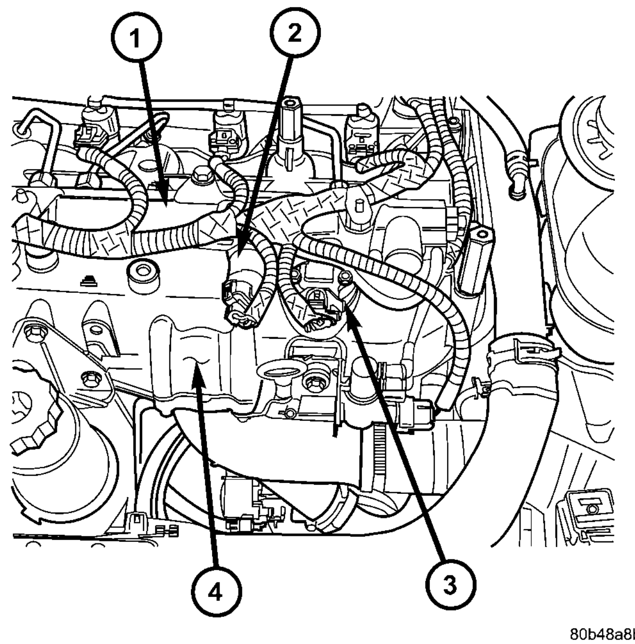

Fig. 13 BOOST PRESSURE SENSOR/INTAKE AIR TEMPERATURE SENSOR LOCATION

1 - FUEL RAIL
2 - FUEL PRESSURE SENSOR
3 - BOOST PRESSURE/INTAKE AIR TEMPERATURE SENSOR
4 - CYLINDER HEAD COVER/INTAKE MANIFOLD

OPERATION

The intake air temperature sensor is a negative temperature coefficient (NTC) thermistor (resistance varies inversly with temperature). This means at cold air temperature its resistance is high, so the voltage signal will be high. As intake air temperature increases, sensor resistance decreases and the signal voltage will be low. This allows the sensor to provide an analog voltage signal (0.2-4.8 volts) to the ECM.

INTAKE AIR TEMPERATURE SENSOR (Continued)

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove engine cover retaining bolts and cover- (Refer to 9 - ENGINE - REMOVAL).

(3) Disconnect intake air temperature electrical connector.

(4) Remove intake air temperature sensor retaining screws and sensor (Fig. 13).

INSTALLATION

(1) Install intake air temperature sensor and retaining bolts (Fig. 13). Torque to 5.4 N·m.

(2) Connect intake air temperature sensor.

(3) Install engine cover and retaining bolts (Refer to 9 - ENGINE - INSTALLATION).

CRANKSHAFT POSITION SENSOR

DESCRIPTION

The crankshaft position sensor is mounted in the right rear of the engine block below the turbocharger (Fig. 14). This sensor is used to detect engine speed.

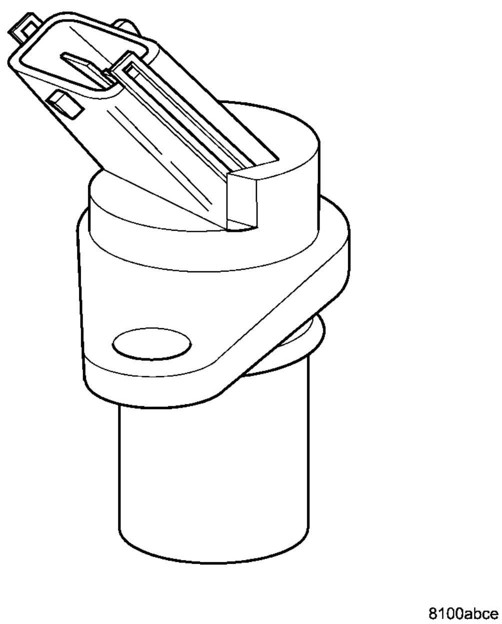

Fig. 14 CRANKSHAFT POSITION SENSOR

OPERATION

The crankshaft position sensor is a magnetic pickup type sensor that generates an A/C signal. The sensor contains a permanent magnet and a coil of wire. The sensor generates an A/C signal each time a notch in the reluctor wheel on the crankshaft passes across the permanent magnet. The ECM calculates engine speed based on the frequency of the A/C signal.

MASS AIR FLOW (MAF) SENSOR

DESCRIPTION

The Mass Air Flow (MAF) Sensor is mounted inline in the air intake between the air filter and the turbocharger (Fig. 15).

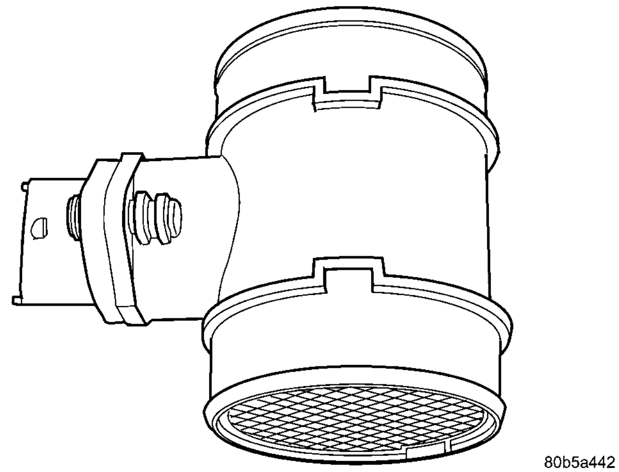

Fig. 15 MASS AIR FLOW (MAF) SENSOR

OPERATION

The ECM uses the mass air flow (MAF) sensor to measure air density. The MAF sensor contains a ceramic element. A signal voltage is provided to the element. As engine speed increases, airflow across the ceramic element increases. Changes in air flow and air density cause the temperature of the ceramic element to fluxuate. The ceramic element changes resistance respectively to changes in temperature. The change in resistance varies the signal voltage output to the ECM. The ECM/PCM relay supplies battery power the to MAF sensor. Ground is provided by the ECM. The MAF sensor signal is provided to the ECM.

REMOVAL

(1) Disconnect negative battery cable.

(2) Disconnect MAF sensor electrical connector (Fig. 16).

(3) Loosen MAF sensor retaining clamps (Fig. 16).

(4) Remove MAF sensor from airduct (Fig. 16).

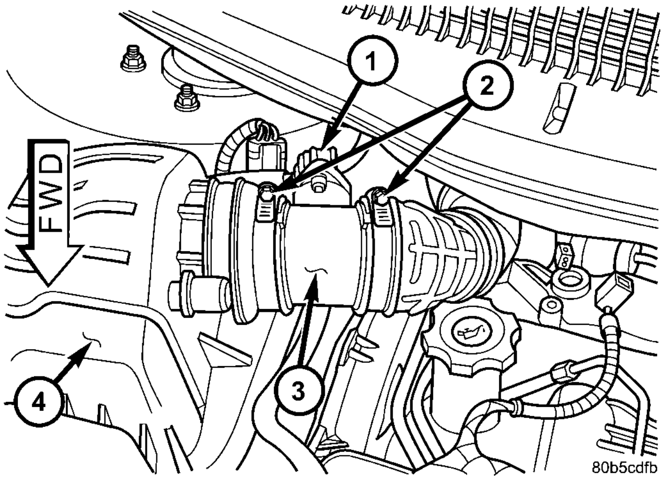

Fig. 16 MASS AIR FLOW (MAF) SENSOR LOCATION

1 - MAF SENSOR ELECTRICAL CONNECTOR
2 - RETAINING CLAMPS
3 - MASS AIR FLOW (MAF) SENSOR
4 - AIR CLEANER HOUSING

INSTALLATION

(1) Install MAF sensor in airduct (Fig. 16).

(2) Tighten retaining clamps (Fig. 16).

(3) Connect MAF sensor electrical connector (Fig. 16).

(4) Connect negative battery cable.

TRANSMISSION/TRANSAXLE

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POWER TRANSFER UNIT

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POWER TRANSFER UNIT

DESCRIPTION

The Power Transfer Unit (P.T.U.) is attached to a modified automatic transaxle case where the right half shaft extension housing would normally be located.

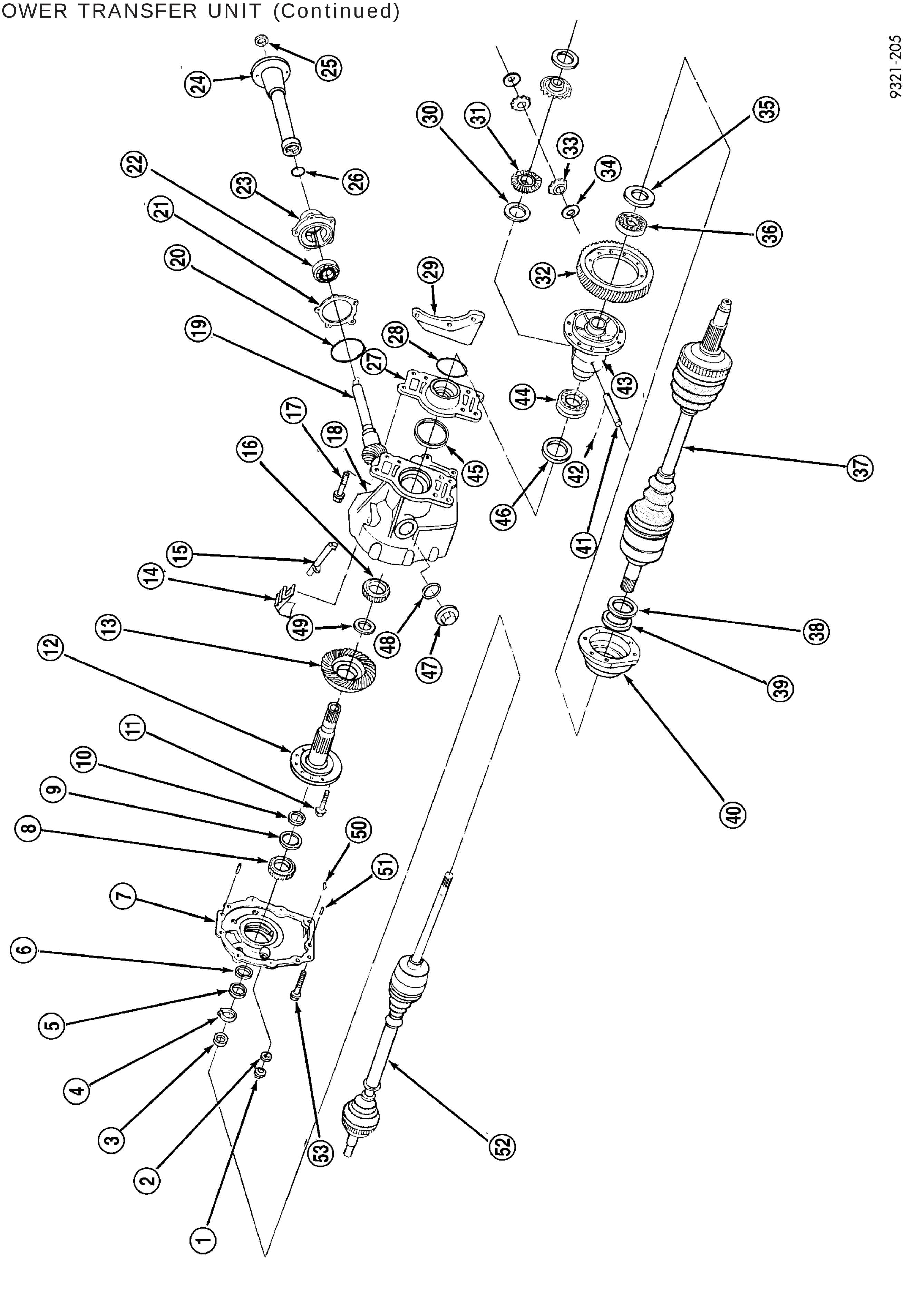
The Power Transfer Unit is sealed from the transaxle and has its own oil sump. The Unit uses Mopar® SAE 80W-90 Gear and Axle Lubricant (MS-9020) and holds 1.15 liters (1.22 quarts).

Service of the Power Transfer Unit is limited to:

- Fluid Change
- Seals
- Gaskets
- One ball bearing
- Output flange

If the ring gear and pinion, any tapered roller bearings, case, covers, or pinion carrier fail the entire unit must be replaced.

POWER TRANSFER UNIT (Continued)



Power Transfer Unit Components

POWER TRANSFER UNIT (Continued)

1 - PLUG
2 - WASHER FLAT
3 - SEAL RING
4 - SNAP RING
5 - BALL BEARING
6 - SEAL RING
7 - COVER-PTU CASE END
8 - TAPERED ROLLER BEARING
9 - SEAL RING
10 - SEAL RING
11 - HEX HEAD SCREW
12 - SHAFT-PTU INPUT
13 - GEAR-PTU RING
14 - TROUGH-PTU (RT.)
15 - TROUGH-PTU (LT.)
16 - TAPERED ROLLER BEARING
17 - HEX HEAD SCREW
18 - CASE-PTU
19 - PINION-PTU
20 - O-RING
21 - SHIM
22 - TAPERED ROLLER BEARING
23 - COVER-PTU CASE REAR
24 - FLANGE TUBE-PTU-OUTPUT ASSY.
25 - LOCK NUT-HEX FLANGE
26 - O- RING
27 - RETAINER PLATE
28 - O-RING
29 - BRACKET
30 - THRUST WASHER
31 - SIDE GEAR-DIFFERENTIAL
32 - FINAL DRIVE GEAR
33 - PINION DIFFERENTIAL
34 - WASHER DIFFERENTIAL PINION
35 - SHIM
36 - TAPERED ROLLER BEARING
37 - SHAFT ASSY. FRONT L.H.
38 - SEAL RING
39 - OIL WIPER
40 - RETAINER DIFFERENTIAL BEARING
41 - SHAFT DIFFERENTIAL PINION
42 - PIN
43 - CASE DIFFERENTIAL
44 - TAPERED ROLLER BEARING CONE
45 - SEAL RING
46 - SEAL RING
47 - PLUG
48 - O-RING
49 - SHIM
50 - MAGNET
51 - DOWEL
52 - SHAFT ASSY. FRONT R.H.
53 - HEX HEAD SCREW

OPERATION

The Transfer Unit provides the power to the rear wheels through a hypoid ring gear and pinion set.

DIAGNOSIS AND TESTING

SEAL IDENTIFICATION

For accurate seal diagnosis, repair seal name and location is critical. Refer to (Fig. 1), (Fig. 2), (Fig. 3) and (Fig. 4) for correct seal name and location.

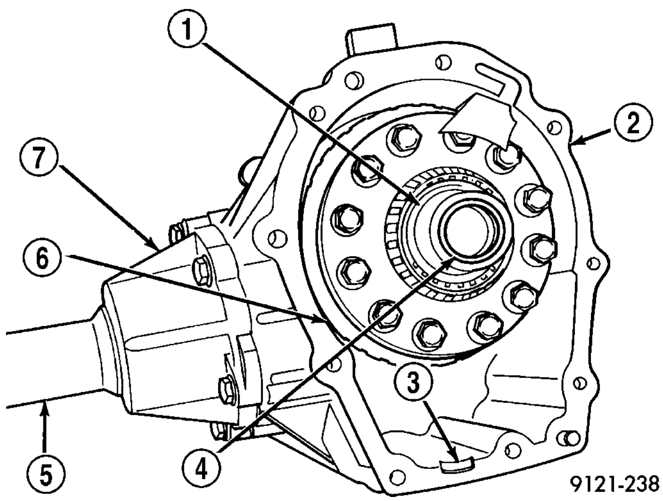


Fig. 1 Seal

1 - INPUT SHAFT
2 - P.T.U. CASE
3 - MAGNET
4 - INPUT SHAFT END SEAL
5 - OUTPUT SHAFT
6 - RING GEAR
7 - REAR COVER

FLUID LEAK DIAGNOSIS

When diagnosing fluid leaks on the Power Transfer Unit two weep holes are provided to diagnose certain seal leaks. These holes are located on the bottom side of the assembly (Fig. 5).

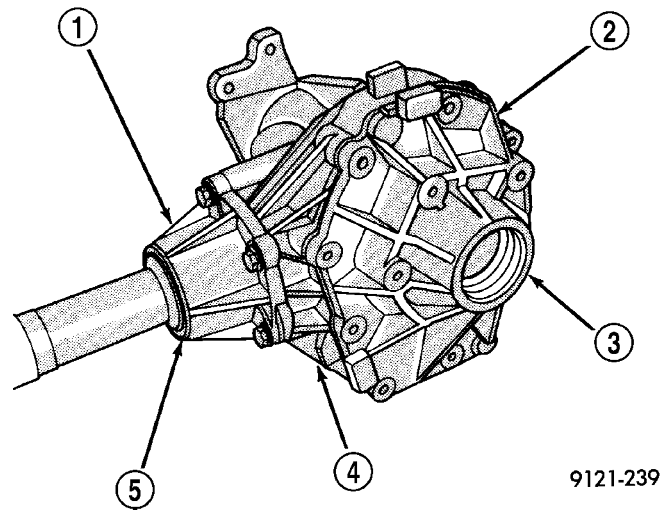


Fig. 2 Seal Location

1 - REAR COVER
2 - END COVER
3 - OUTER HALFSHAFT SEAL
4 - P.T.U. CASE
5 - P.T.U. OUTPUT SEAL

If fluid leak is detected from either weep hole, seal replacement is necessary. **Do not attempt to repair the leak by sealing weep holes,** they must be kept clear of sealants for proper seal operation.

If fluid is leaking from weep hole A (Fig. 5) the type of fluid leaking will determine which seal needs to be replaced. If the fluid leaking is red in color (transmission fluid) this indicates that the Transmission differential carrier seal should be replaced. If the fluid leaking is light brown (gear lube) this indicates that the Power Transfer Unit input seal should be replaced. For replacement of these seals refer to Power Transfer Unit Service Procedures.

If fluid is leaking from weep hole B (Fig. 5) the type of fluid leaking will determine which seal is

POWER TRANSFER UNIT (Continued)

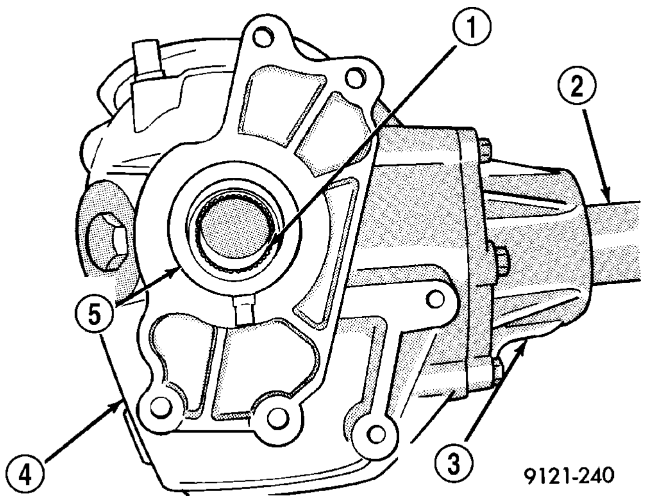


Fig. 3 Seal Location

1 - INPUT SHAFT
2 - OUTPUT SHAFT
3 - REAR COVER
4 - P.T.U. CASE
5 - INPUT SHAFT SEAL

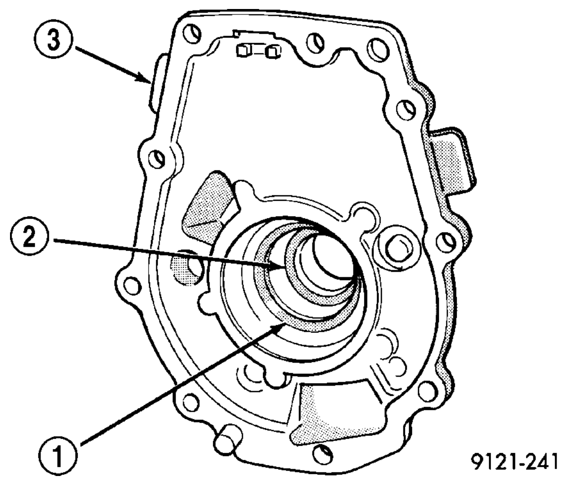


Fig. 4 Seal Location

1 - P.T.U. INPUT SHAFT COVER SEAL
2 - HALF SHAFT INNER SEAL
3 - INSIDE VIEW OF P.T.U. END COVER

leaking. If the fluid leaking is red in color (transmission fluid) this indicates that the input shaft end seal should be replaced. If the fluid leaking is light brown (gear lube) this indicates that the half shaft inner seal and P.T.U. input shaft cover seal should be replaced. For replacement of these seals refer to Power Transfer Unit Service Procedures.

Before condemning any seal or gasket be sure that the rear rocker arm cover on the engine is not the cause of the oil leak. Oil leaking from the rocker arm cover is easily mistaken for a leaking Power Transfer Unit.

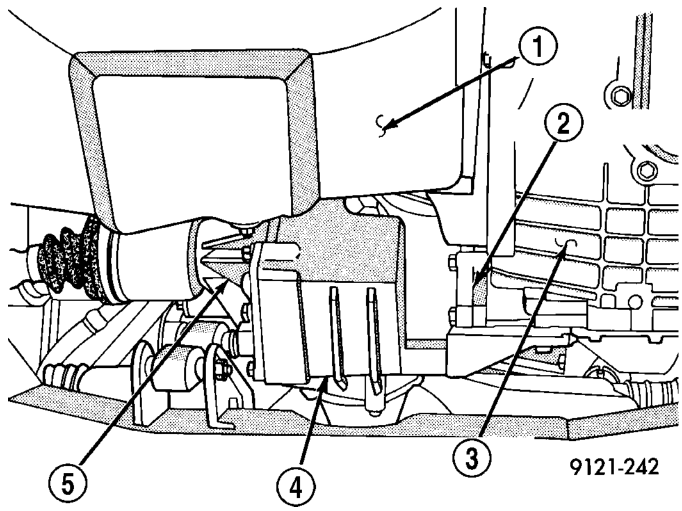


Fig. 5 Weep Hole Locations

1 - ENGINE OIL PAN
2 - WEEP HOLE “A”
3 - TRANSAXLE CASE
4 - P.T.U.
5 - WEEP HOLE “B”

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUID LEVEL INSPECTION

(1) Raise vehicle on hoist.
(2) Remove PTU inspection plug (Fig. 6).

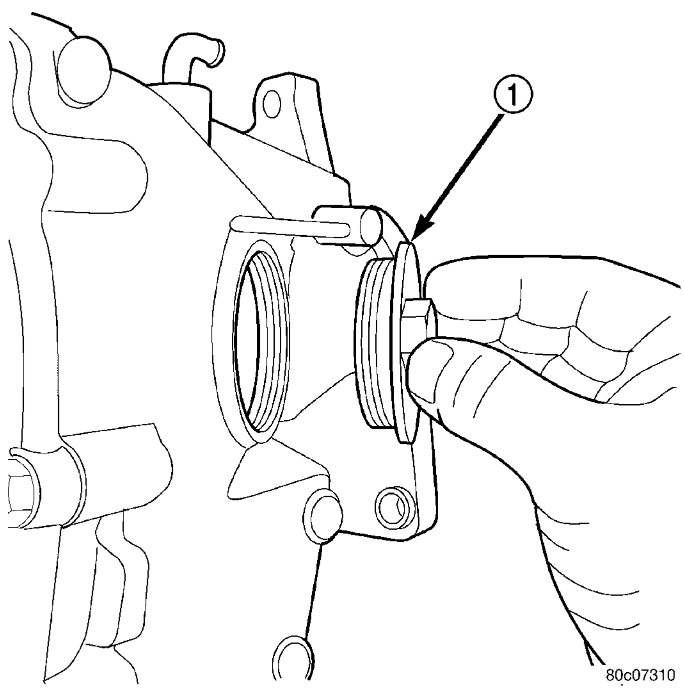


Fig. 6 Inspection Plug

1 - INSPECTION PLUG

POWER TRANSFER UNIT (Continued)

(3) Fluid level should be within 3/16” from bottom of inspection hole. Add Mopar® Gear and Axle Lubricant 80W-90 as necessary with suitable suction gun (Fig. 7).

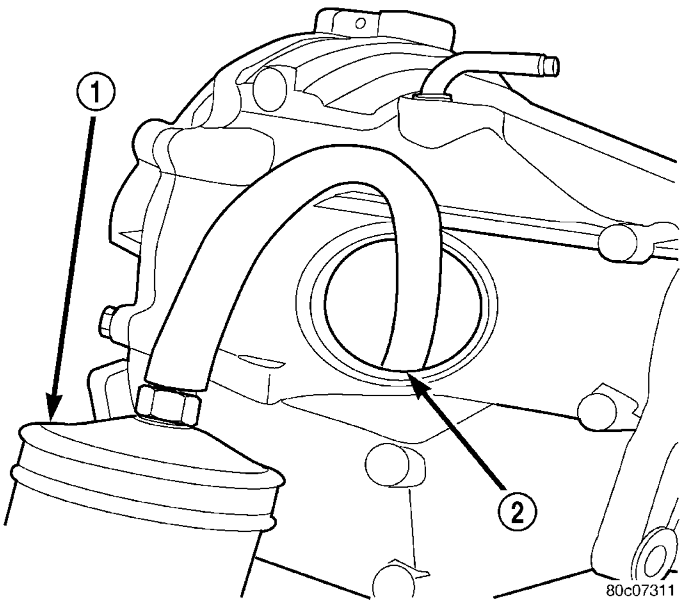


Fig. 7 Removing/Adding PTU Fluid

1 - SUCTION GUN
2 - INSPECTION HOLE

(4) Install inspection plug and torque to 20 N·m (180 in. lbs.) torque.

(5) Lower vehicle.

STANDARD PROCEDURE - PTU FLUID CHANGE

NOTE: PTU Fluid should be changed upon servicing the unit, or at the unit’s regular scheduled interval. (Refer to LUBRICATION & MAINTENANCE/ MAINTENANCE SCHEDULES - DESCRIPTION)

(1) Raise vehicle on hoist.

(2) Remove PTU inspection plug (Fig. 8).

(3) Using suitable suction gun, draw fluid from PTU. Make sure hose contacts bottom of case to ensure all fluid is removed.

(4) Add 1.15 liters (1.22 quarts) of Mopar® Gear and Axle Lubricant 80W-90 with suction gun (Fig. 9).

(5) Install inspection plug and torque to 20 N·m (180 in. lbs.) torque.

(6) Lower vehicle.

REMOVAL

(1) Raise vehicle and remove front wheels.

CAUTION: A certain amount of oil will drain out of the transaxle when the drive shaft is removed.

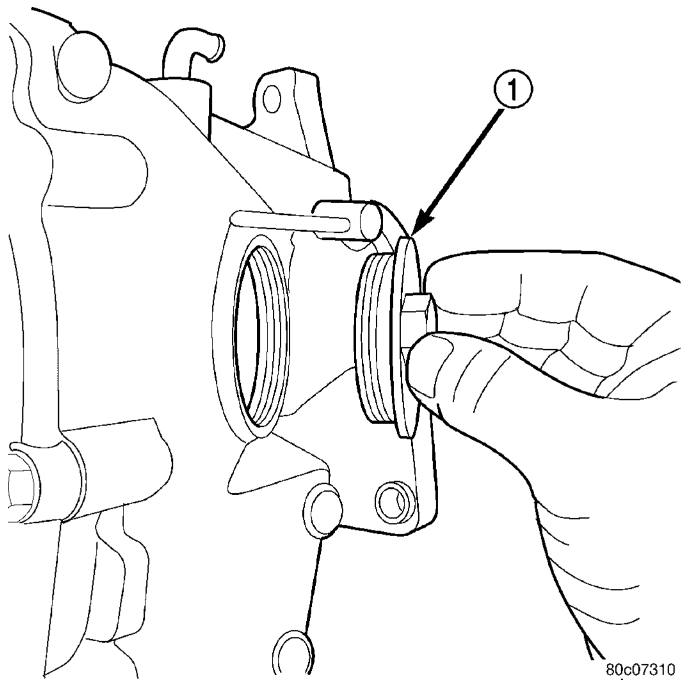


Fig. 8 Inspection Plug

1 - INSPECTION PLUG

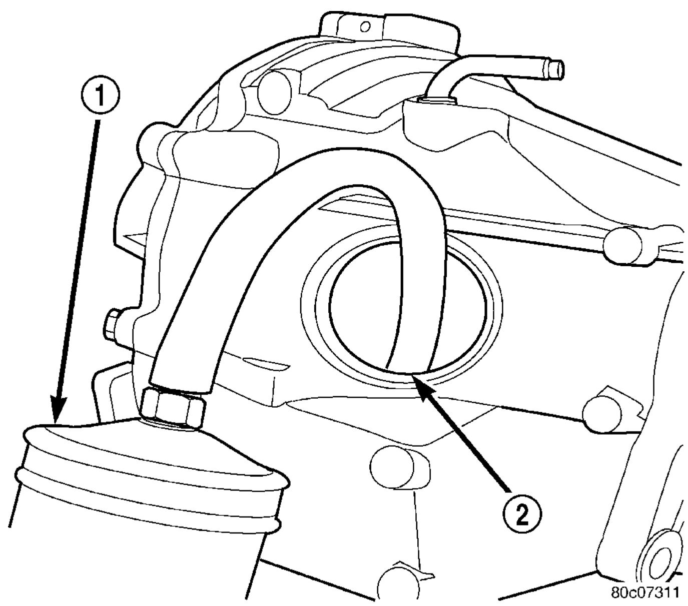


Fig. 9 Adding Fluid to PTU

1 - SUCTION GUN
2 - INSPECTION HOLE

(2) Remove right front drive shaft. Install a plug into the right driveshaft seal hole. (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - REMOVAL)

(3) Mark propeller shaft front flange.

CAUTION: Do not let propeller shaft to hang freely. Damage to the shaft will occur.

POWER TRANSFER UNIT (Continued)

(4) Remove propeller shaft assembly (Fig. 10). (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT - REMOVAL)

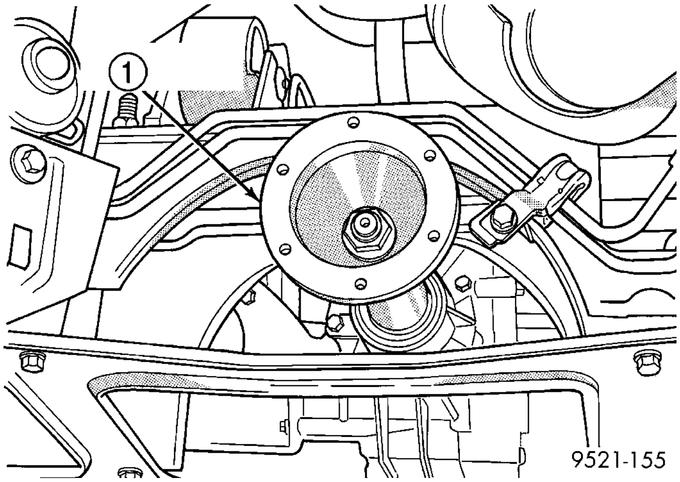


Fig. 10 Driveshaft Flange

1 - DRIVESHAFT FLANGE

(5) Remove cradle plate (Fig. 11).

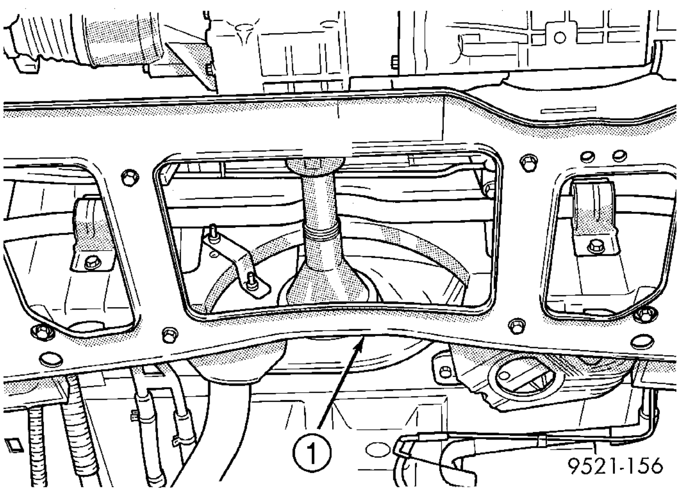


Fig. 11 Cradle Plate

1 - CRADLE PLATE

(6) Remove the Power Transfer Unit mounting bracket bolts at the rear of the unit (Fig. 12).

(7) Remove the right outboard support bracket and bolts near the right axle shaft.

(8) Remove the four mounting bolts for the P.T.U. (Fig. 13)and (Fig. 14).

(9) Remove P.T.U. assembly from vehicle.

INSTALLATION

(1) To install, reverse removal procedure. Check transaxle fluid and P.T.U. fluid and fill to level.

(2) Refer to the Specifications section for the proper torque specifications.

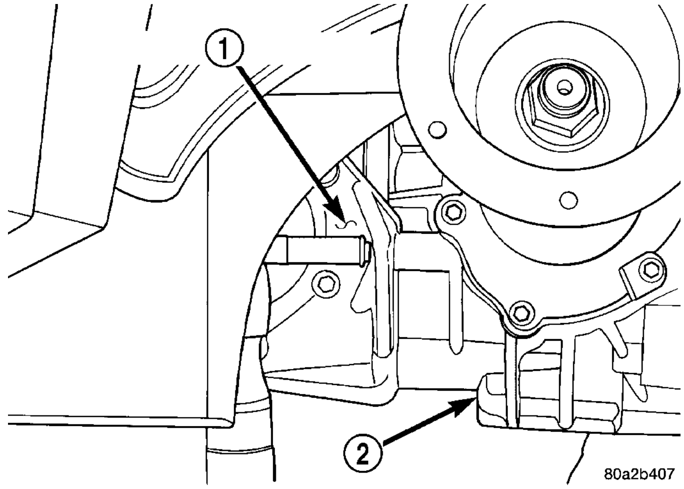


Fig. 12 Remove Rear P.T.U Bracket Bolts

1 - P.T.U. MOUNT BRACKET
2 - P.T.U.

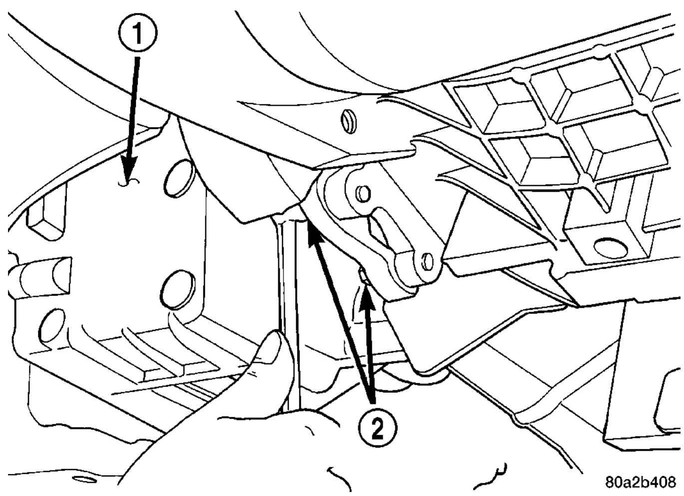


Fig. 13 P.T.U. Lower Mounting Bolts

1 - P.T.U.
2 - P.T.U. MOUNTING BOLTS

ADJUSTMENTS

OUTPUT FLANGE SHIM SELECTION

This procedure is used when the output flange is replaced. Replacement of the output flange requires installation of the correct size shim to maintain bearing preload. **The shim must protrude from the new output flange the same distance that the original shim protruded from the original flange.**

(1) Stand the original output flange on end with shim side pointing up.

(2) Place original shim into groove in top of flange.

(3) Place a straight edge across the shim.

POWER TRANSFER UNIT (Continued)

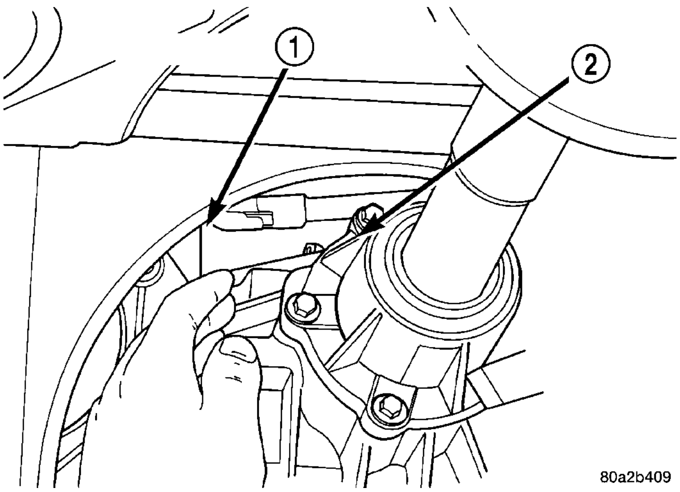


Fig. 14 P.T.U. Upper Mounting Bolts

1 - P.T.U. UPPER MOUNTING BOLTS
2 - P.T.U.

(4) Using feeler gauge, measure the distance between the straight edge and the top of the flange (Fig. 15). Record this measurement.

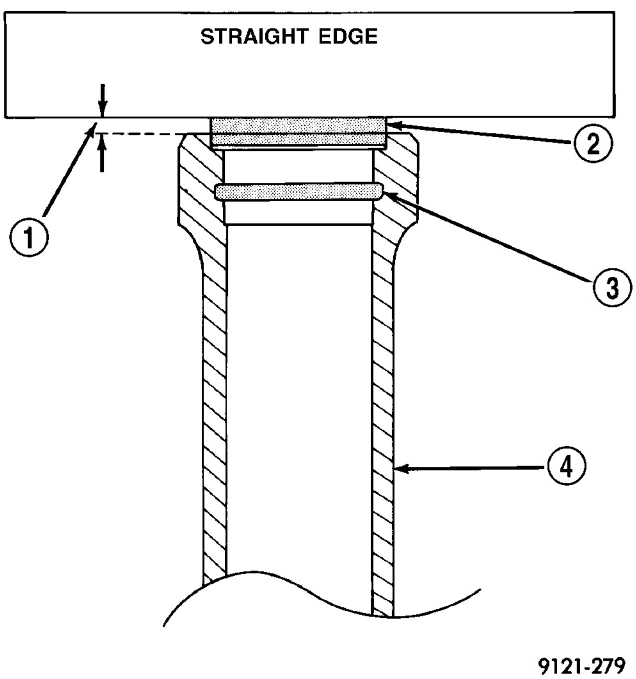


Fig. 15 Output Flange Shim Measurement

1 - MEASURE THIS DIMENSION
2 - SHIM
3 - O-RING
4 - OUTPUT FLANGE

(5) Repeat steps Step 1 through Step 4using the **new flange and the original shim.** Record this measurement.

(6) If measurements are not equal, use a new shim that protrudes from new output flange. Make sure it protrudes the same amount.

(7) For Example: The original shim protrudes 0.075 inch from the original output flange. Place the **original shim** into the new output flange. The protrusion of the shim in the new flange is 0.085 inch. This indicates that a 0.010 inch thinner shim is required to maintain the original protrusion.

(8) Install output flange and torque flange nut to 244 N·m (180 ft. lbs.).

(9) Check the turning torque of the pinion before installing the rear cover into the P.T.U. The turning torque should be between 2.0 N·m and 2.5 N·m (17 in. lbs. and 22 in. lbs.).

SPECIFICATIONS

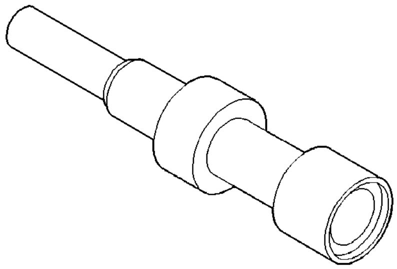
TORQUE

DESCRIPTION	TORQUE
End Cover	28 N·m (250 in. lbs.)
Fill Plug	27 N·m (240 in. lbs.)
Flange Nut	162 N·m (120 ft. lbs.)
Inspection Plug	20 N·m (180 in. lbs.)
Rear Cover	28 N·m (250 in. lbs.)
Ring Gear	94 N·m (70 ft. lbs.)

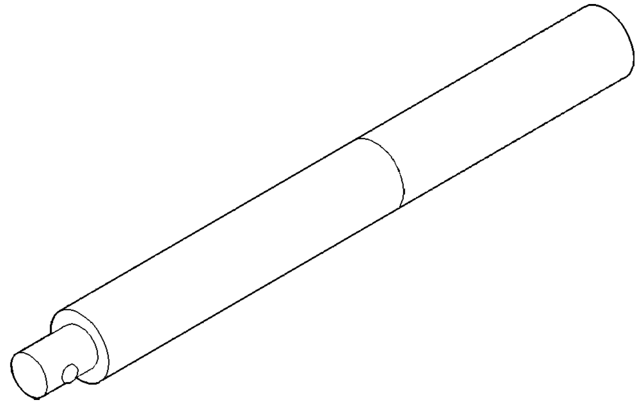
POWER TRANSFER UNIT (Continued)

SPECIAL TOOLS

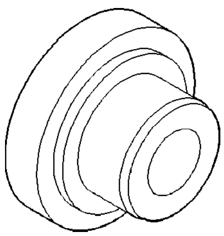
SDP POWER TRANSFER UNIT



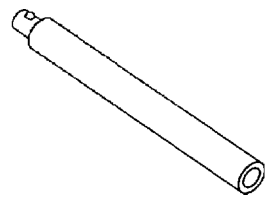
5049-a Seal Puller



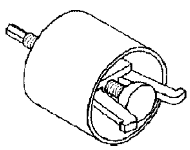
C-4171 Handle



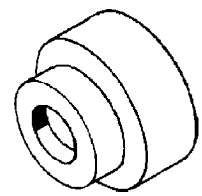
5065 Bearing Installer



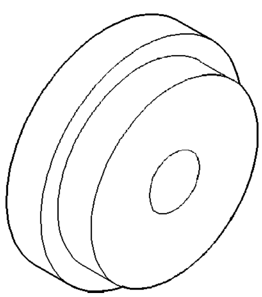
C-4171-2 Handle



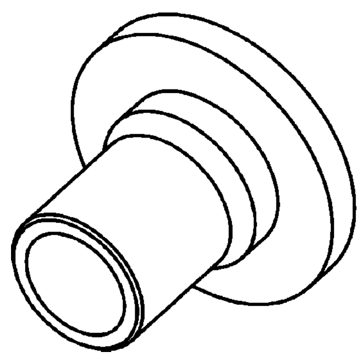
6514 Bearing Remover



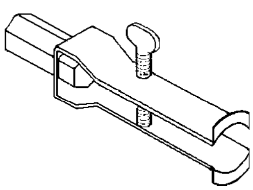
C-4657 Seal Installer



6522 Bearing Remover

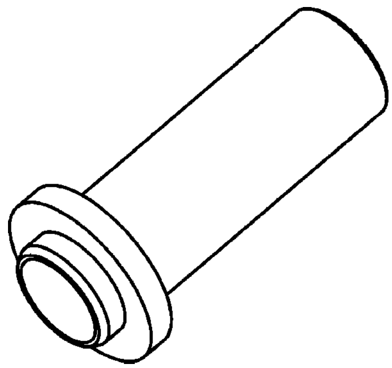


MD998200 Intaller

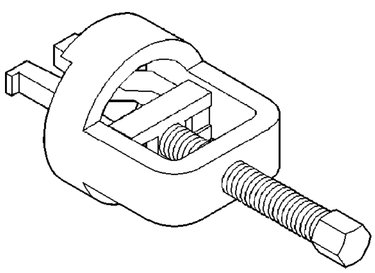


7794-a Bearing Remover

POWER TRANSFER UNIT (Continued)



MD998334 Seal Installer



MD998346 Bearing Puller

DIFFERENTIAL CARRIER SEAL

REMOVAL

NOTE: The Power Transfer Unit must be removed from the vehicle to replace this seal.

(1) Remove PTU from transaxle. (Refer to 21 - TRANSMISSION/TRANSAXLE/POWER TRANSFER UNIT - REMOVAL)

(2) Use a pry bar to remove seal from retainer plate (Fig. 16). Be careful not to damage seal journal when removing seal.

INSTALLATION

(1) Using a large socket, carefully install new seal. The spring side of the seal must face the transaxle differential.

(2) Install the PTU to the transaxle. (Refer to 21 - TRANSMISSION/TRANSAXLE/POWER TRANSFER UNIT - INSTALLATION)

(3) Check PTU fluid level. (Refer to 21 - TRANSMISSION/TRANSAXLE/POWER TRANSFER UNIT - STANDARD PROCEDURE)

END COVER BALL BEARING

REMOVAL

The end cover ball bearing can be removed and installed without removing the Power Transfer Unit from the vehicle. When replacing the bearing the output seal must be removed to gain access to the bearing.

(1) Raise vehicle on hoist.

(2) Remove right front half shaft from vehicle.

(3) Remove output seal with a hammer and chisel (Fig. 17).

(4) Remove bearing retaining snap ring (Fig. 18).

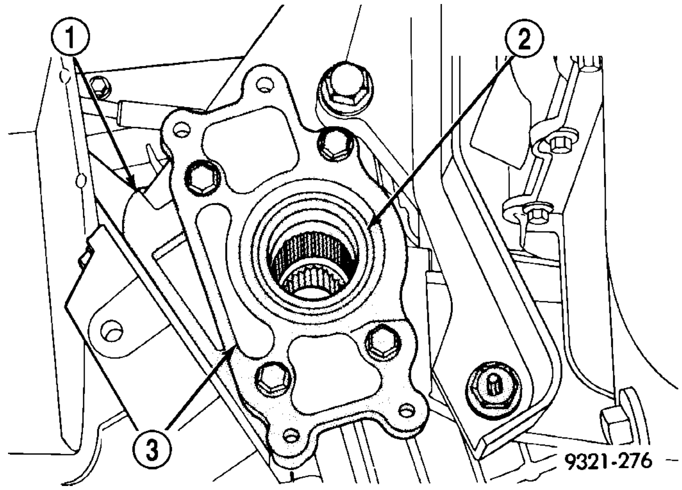


Fig. 16 Transaxle Differential Carrier Seal

1 - TRANSAXLE CASE
2 - DIFFERENTIAL CARRIER SEAL
3 - RETAINER PLATE

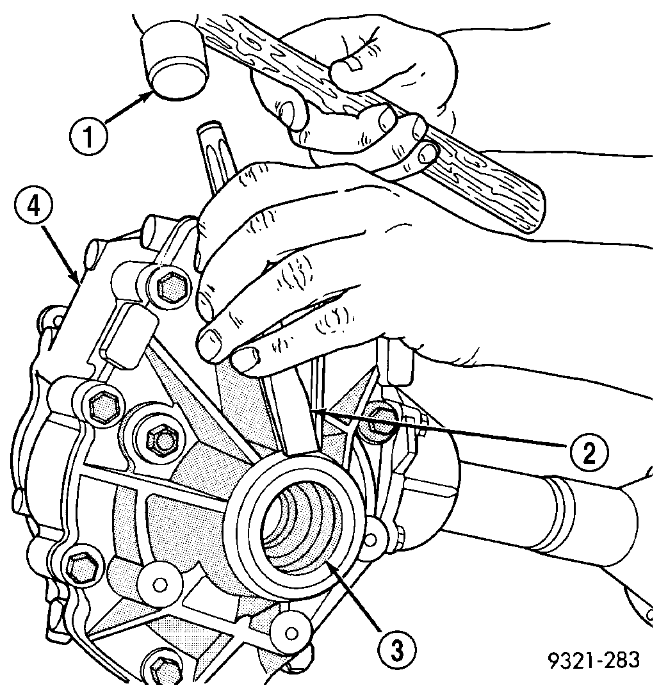


Fig. 17 Output Seal Removal

1 - HAMMER
2 - CHISEL
3 - SEAL
4 - POWER TRANSFER UNIT

END COVER BALL BEARING (Continued)

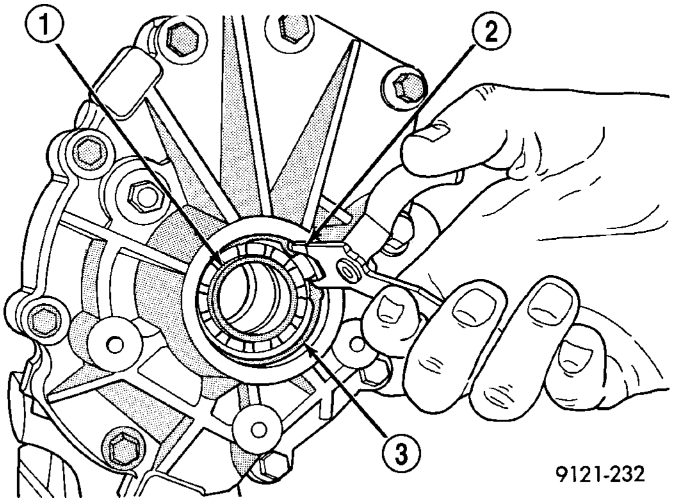


Fig. 18 Bearing Snap Ring

1 - BEARING
2 - SNAP RING PLIERS
3 - BEARING SNAP RING

(5) Use bearing puller MD998346 to remove bearing (Fig. 19).

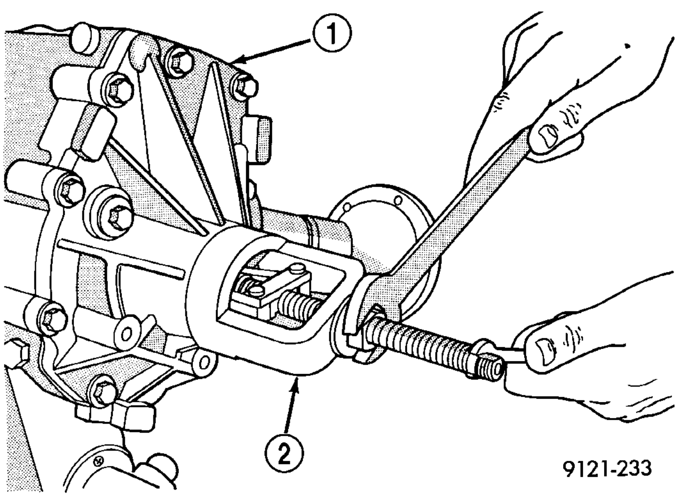


Fig. 19 Bearing Removal

1 - P.T.U. END COVER
2 - SPECIAL TOOL MD998346

INSTALLATION

The end cover ball bearing can be removed and installed without removing the Power Transfer Unit from the vehicle. When replacing the bearing the output seal must be removed to gain access to the bearing.

CAUTION: When installing bearing, position the bearing in place by hand square to the bore. Otherwise, bearing and/or housing damage may occur upon installation.

(1) Use installer MD998200 and driver handle C-4171 to install bearing (Fig. 20) into the housing.

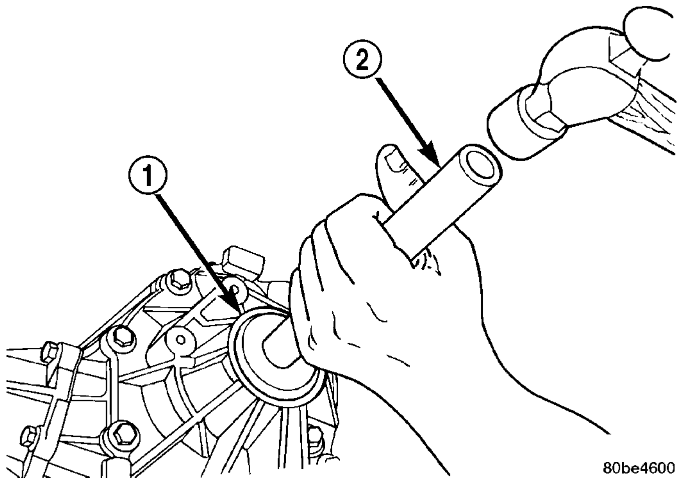


Fig. 20 Bearing Installation

1 - SPECIAL TOOL MD998200
2 - SPECIAL C-4171

(2) Install bearing retaining snap ring.

CAUTION: When installing bearing retaining snap ring, be sure to index the snap ring so that the snap ring does not cover bearing oil passage.

(3) Install new outer half shaft seal using MD998334 seal installer (Fig. 21). **Do not reuse the old seal.**

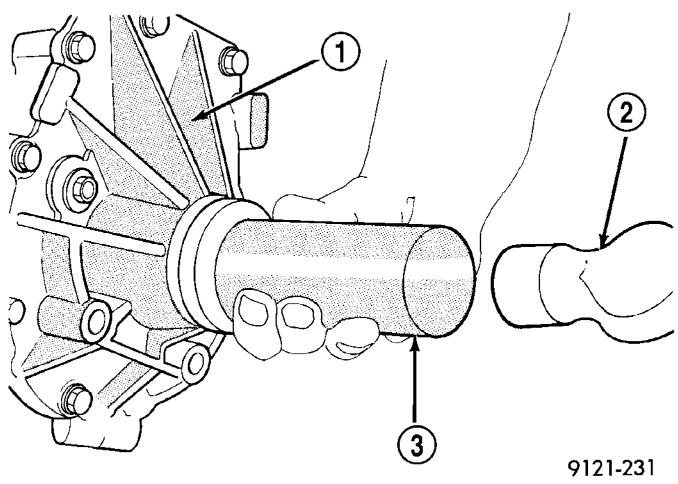


Fig. 21 Installing New Seal

1 - P.T.U. END COVER
2 - HAMMER
3 - SPECIAL TOOL MD998334

(4) Reinstall right front half shaft.
(5) Check and fill fluids as required.

END COVER SEAL

REMOVAL

The Power Transfer Unit must be removed from the vehicle to perform this operation. (Refer to 21 - TRANSMISSION/TRANSAXLE/POWER TRANSFER UNIT - REMOVAL)

(1) Remove P.T.U. end cover bolts (Fig. 22).

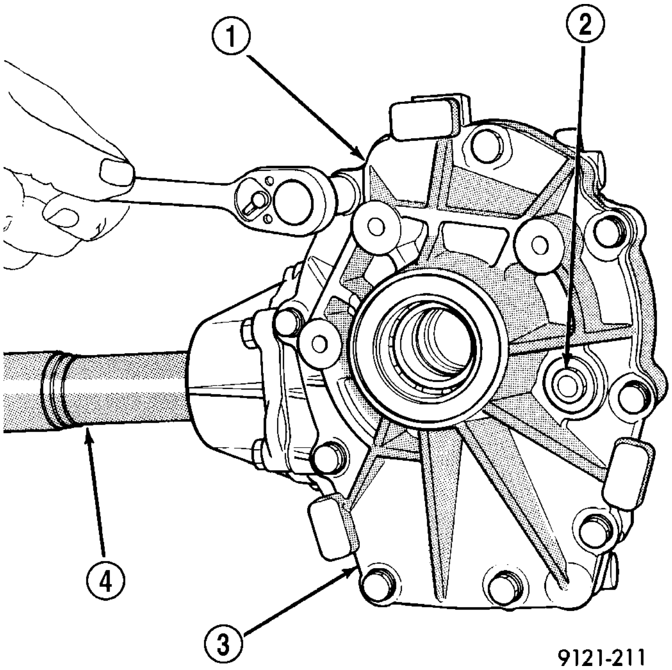


Fig. 22 P.T.U. End Cover Bolts

1 - POWER TRANSFER UNIT
2 - FILL PLUG
3 - END COVER
4 - OUTPUT SHAFT

(2) Gently tap on end cover ears with a hammer to separate end cover from the case (Fig. 23).

(3) Clean and inspect sealer surfaces.

INSTALLATION

(1) Reinstall cover and tighten bolts to 28 N·m (250 in. lbs.) in the sequence shown in (Fig. 24). Retighten first bolt after all others are tight.

CAUTION: When end cover is installed be careful not to damage the P.T.U. Input Shaft Cover Seal.

(2) Reinstall P.T.U. into vehicle.

(3) Check and fill fluids as required.

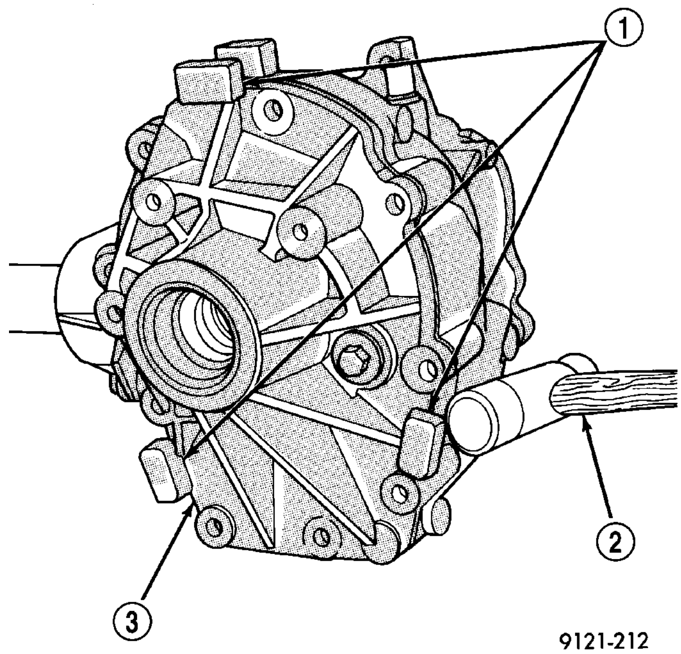


Fig. 23 End Cover Removal

1 - END COVER EARS
2 - HAMMER
3 - POWER TRANSFER UNIT

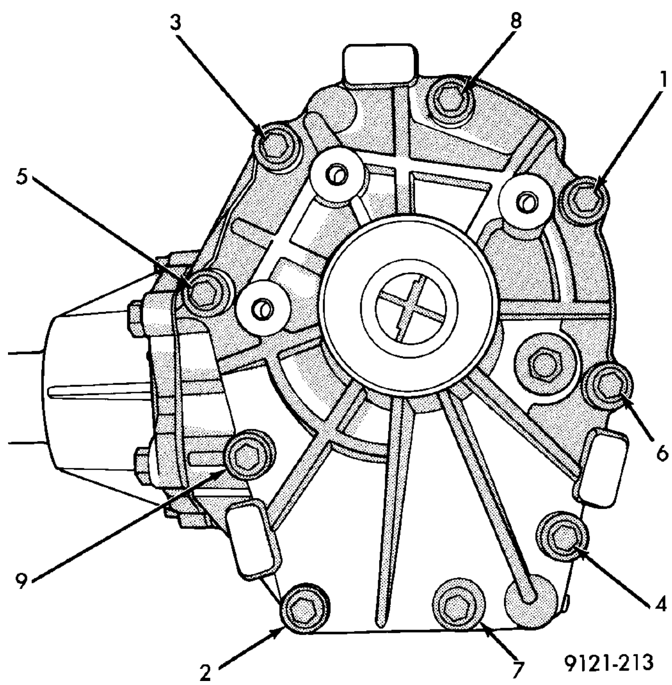


Fig. 24 Bolt Tightening Sequence

HALF SHAFT INNER SEAL

REMOVAL

The power transfer unit half shaft inner seal is the smaller of the two seals located on the inside of the end cover.

(1) Remove power transfer unit from the vehicle.

(2) Remove end cover bolts (Fig. 25).

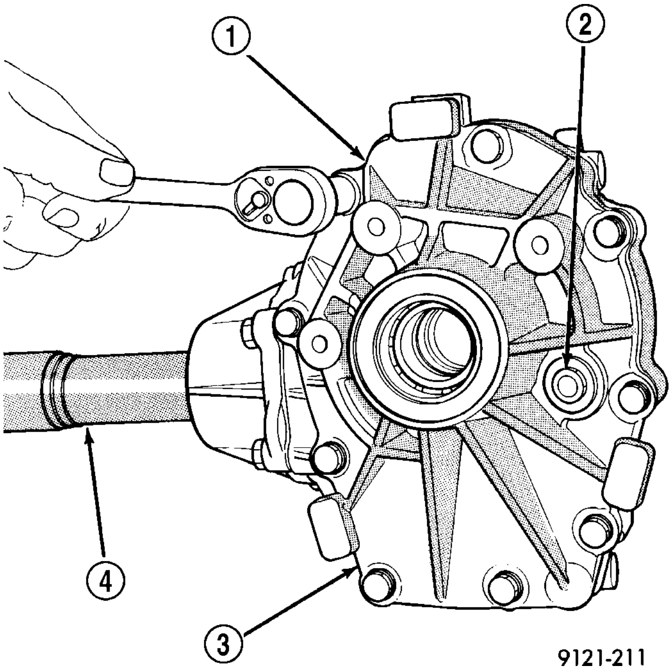


Fig. 25 End Cover Bolts

1 - POWER TRANSFER UNIT
2 - FILL PLUG
3 - END COVER
4 - OUTPUT SHAFT

(3) Tap on end cover ears to separate cover from case (Fig. 26).

(4) Drive seal out with a hammer and small chisel (Fig. 27).

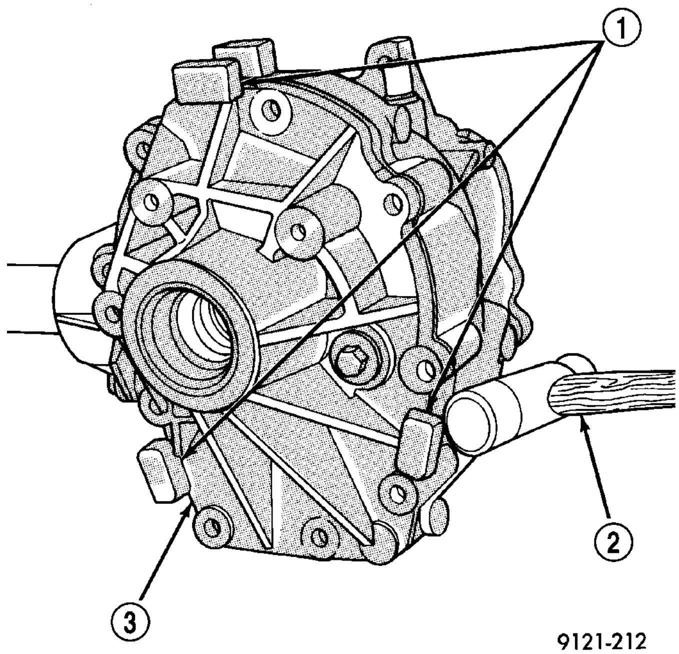


Fig. 26 End Cover Removal

1 - END COVER EARS
2 - HAMMER
3 - POWER TRANSFER UNIT

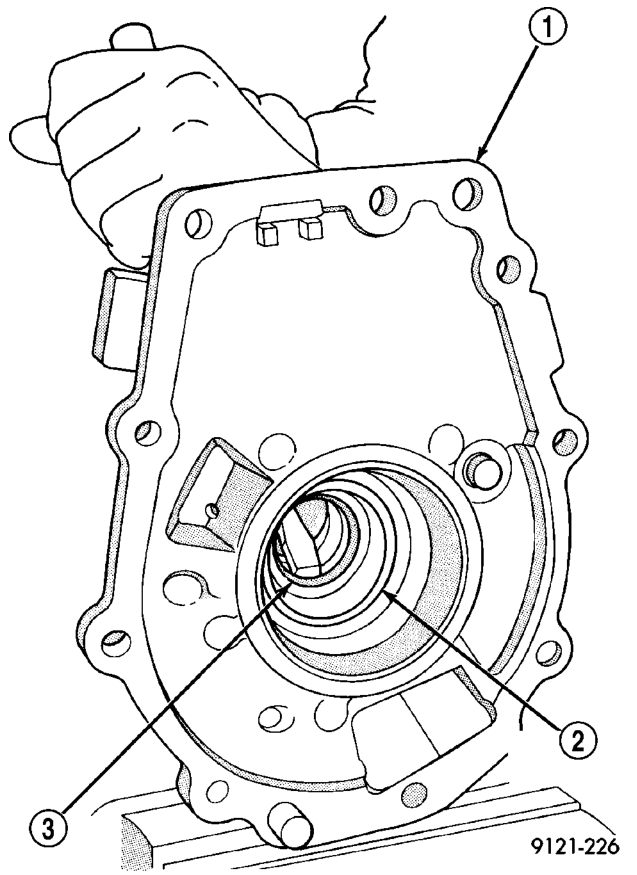


Fig. 27 Seal Removal

1 - END COVER
2 - END COVER SEAL
3 - AXLE SHAFT SEAL

HALF SHAFT INNER SEAL (Continued)

INSTALLATION

The power transfer unit half shaft inner seal is the smaller of the two seals located on the inside of the end cover.

(1) Clean and inspect seal area.

(2) Install seal with a 1 1/16 inch socket (Fig. 28). The seal must be installed with the spring side of the seal facing end cover ball bearing. The seal will bottom against a machined shoulder in the cover.

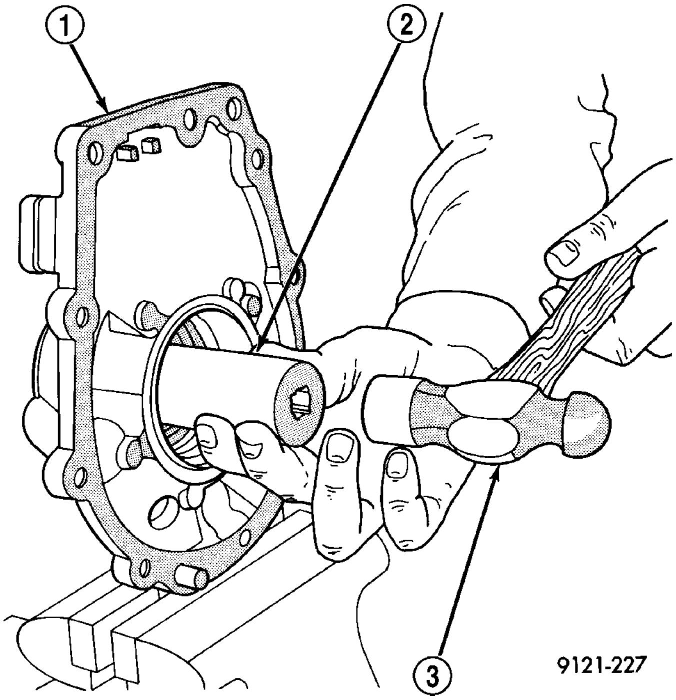


Fig. 28 Seal Installation

1 - END COVER
2 - SOCKET
3 - HAMMER

(3) Clean sealing surfaces of the end cover and P.T.U. case. Apply a bead of Mopar® Gasket Maker, Loctite Gasket Eliminator No. 518 or equivalent.

(4) Place end cover onto P.T.U. case and install bolts. Tighten bolts to 28 N·m (250 in. lbs.) in the sequence shown in (Fig. 29). Retighten first bolt after all other bolts are tight.

(5) Reinstall P.T.U. assembly.

(6) Check and fill fluids as required.

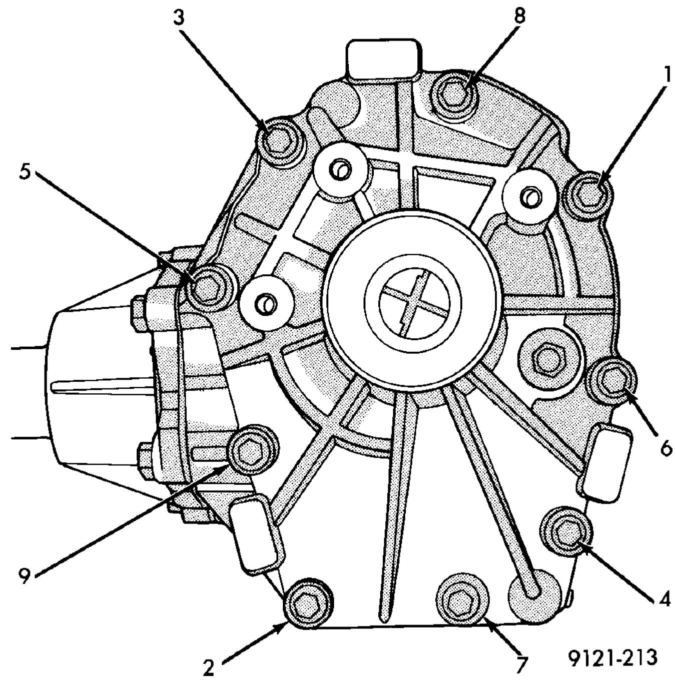


Fig. 29 Bolt Tightening Sequence

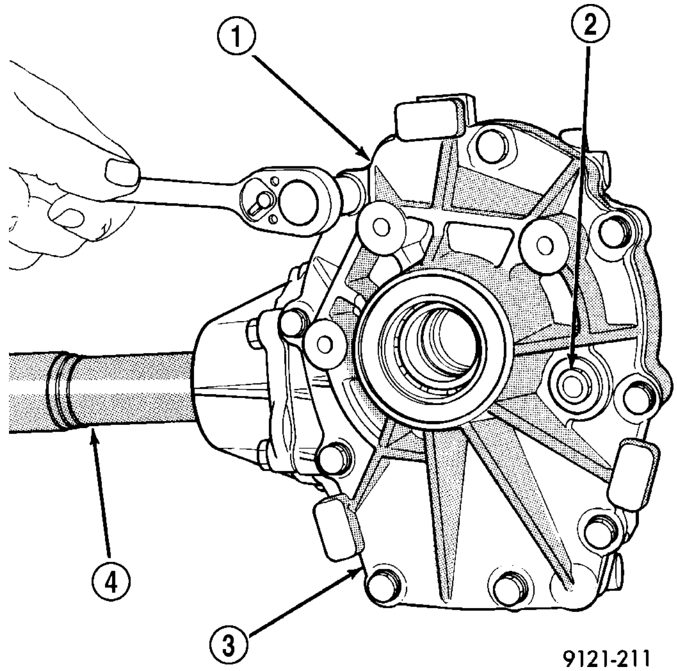


Fig. 30 P.T.U. End Cover Bolts

1 - POWER TRANSFER UNIT
2 - FILL PLUG
3 - END COVER
4 - OUTPUT SHAFT

INPUT SHAFT COVER SEAL

REMOVAL

The power transfer unit input shaft cover seal is the larger of the two seals located on the inside of the end cover. The differential bearing cup must be removed to service this seal.

(1) Remove P.T.U. end cover bolts (Fig. 30).

INPUT SHAFT COVER SEAL (Continued)

(2) Gently tap on end cover ears to separate cover from case (Fig. 31).

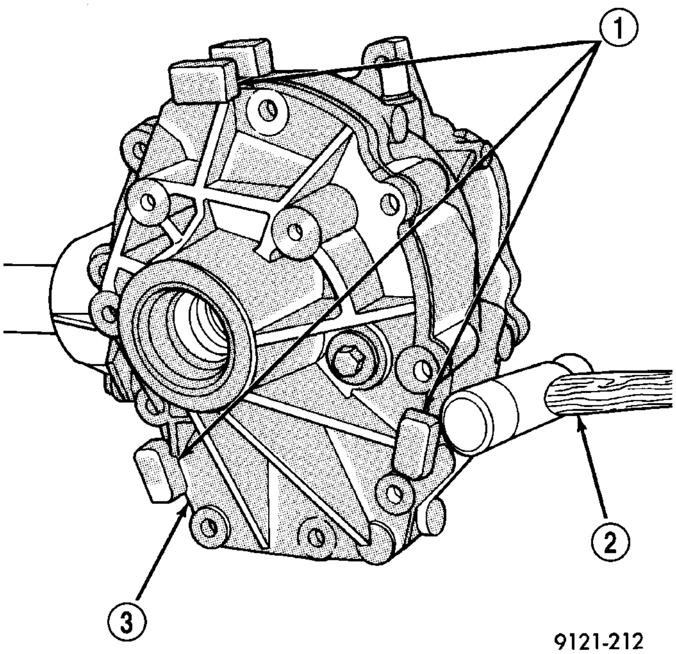


Fig. 31 End Cover Removal

1 - END COVER EARS
2 - HAMMER
3 - POWER TRANSFER UNIT

(3) Use special tool No. 6514 and remove the differential bearing race located in the end cover (Fig. 32). The race must be removed to gain access to the seal.

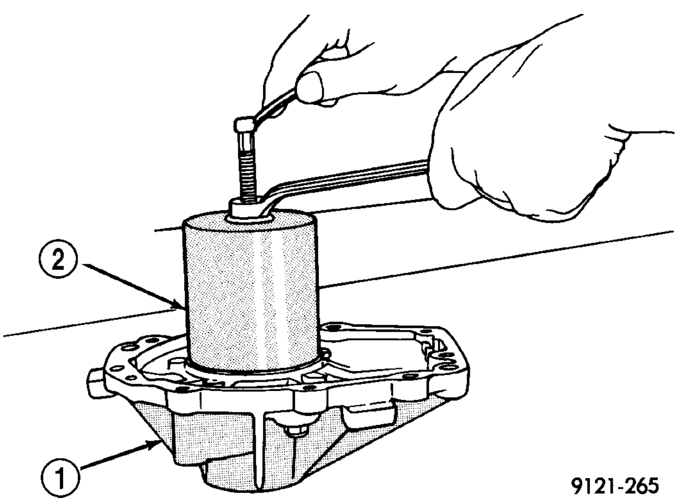


Fig. 32 Bearing Race Removal

1 - END COVER
2 - SPECIAL TOOL
No. 6514

(4) Use special tool No. 7794-A to remove seal (Fig. 33).

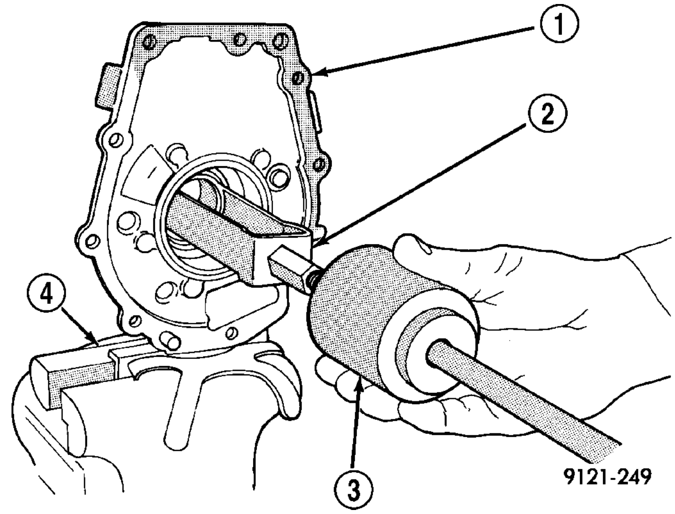


Fig. 33 Seal Removal

1 - END COVER
2 - SPECIAL TOOL
7794–A
3 - SLIDE HAMMER
4 - SOFT JAW VICE

INSTALLATION

The power transfer unit input shaft cover seal is the larger of the two seals located on the inside of the end cover. The differential bearing cup must be removed to service this seal.

(1) Clean and inspect seal area.

(2) Use special tool No. MD998803 and install seal (Fig. 34). When installing seal the spring side of the seal must face toward the special tool.

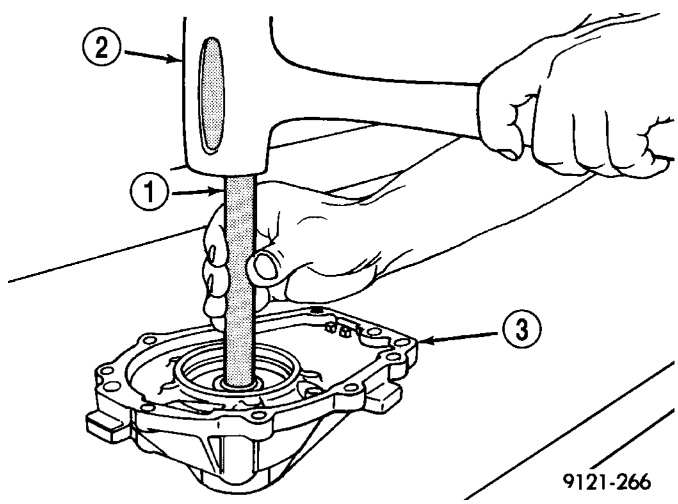


Fig. 34 Seal Installation

1 - SPECIAL TOOL
No. MD998803
2 - HAMMER
3 - END COVER

INPUT SHAFT COVER SEAL (Continued)

(3) Reinstall the original bearing race and shim using special tool No. 6522 (Fig. 35) and (Fig. 36).

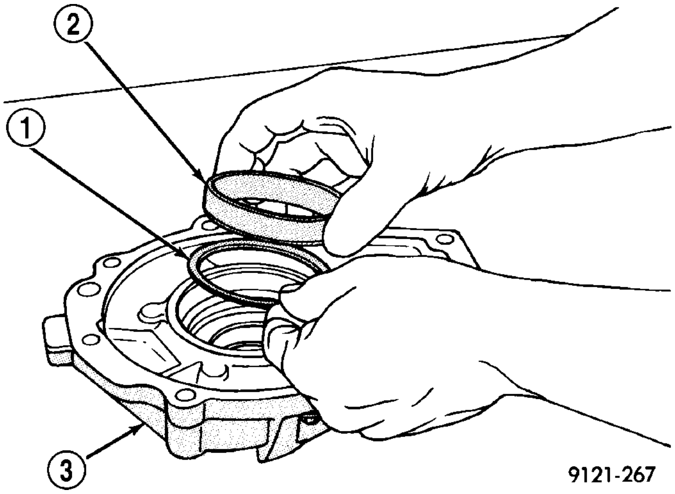


Fig. 35 Bearing Shim and Race

1 - SHIM
2 - BEARING RACE
3 - END COVER

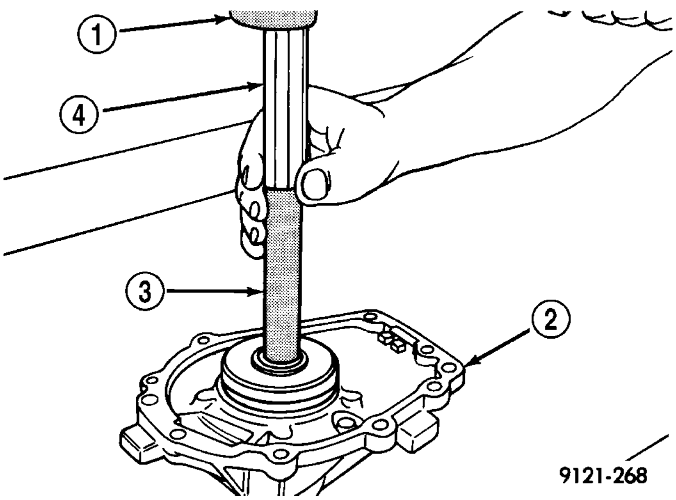


Fig. 36 Installing Bearing Race

1 - HAMMER
2 - END COVER
3 - SPECIAL TOOL
No. 6522
4 - HANDLE
4171

CAUTION: The original shim must be installed behind the bearing cup to maintain proper bearing preload.

(4) Apply Mopar® Gasket Maker, Loctite Gasket Eliminator No. 518 or equivalent to sealing surfaces of end cover.

(5) Place end cover onto P.T.U. case and install bolts. Tighten bolts to 28 N·m (250 in. lbs.) in the sequence shown in (Fig. 37). Retighten first bolt after all others are tight.

CAUTION: When end cover is installed be careful not to damage the P.T.U. Input Shaft Cover Seal.

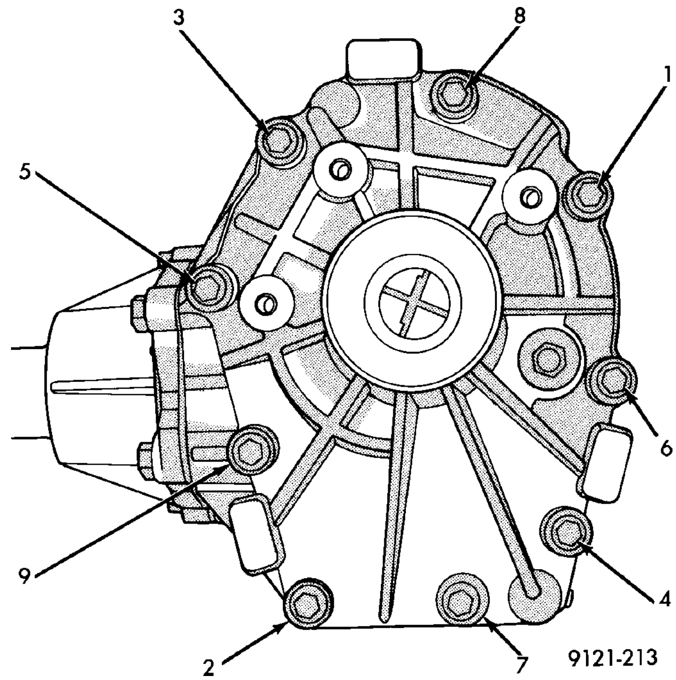


Fig. 37 Bolt Tightening Sequence

(6) Reinstall P.T.U. assembly into vehicle.

(7) Check and fill fluids as required.

INPUT SHAFT END SEAL

REMOVAL

The input shaft end seal is located on the end of the input shaft.

(1) Remove power transfer unit from the vehicle.

(2) Remove end cover bolts (Fig. 38).

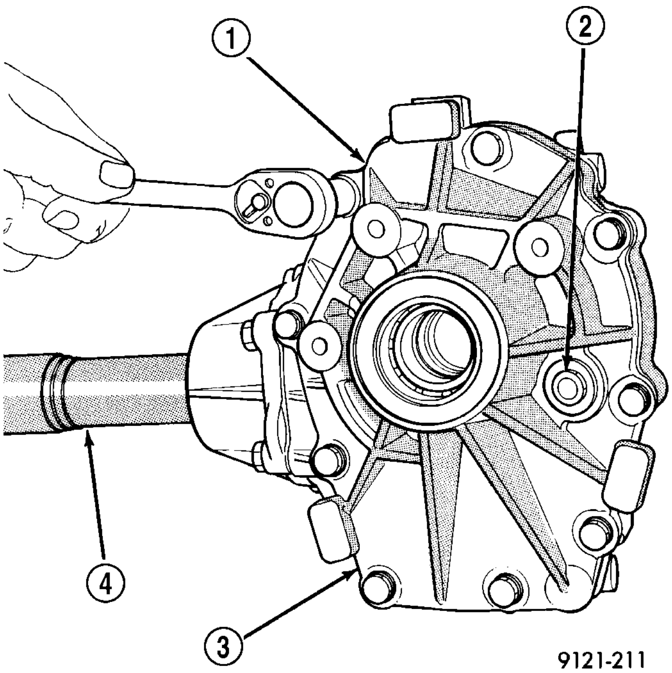


Fig. 38 End Cover Bolts

1 - POWER TRANSFER UNIT
2 - FILL PLUG
3 - END COVER
4 - OUTPUT SHAFT

(3) Tap on end cover ears to separate end cover from case (Fig. 39).

(4) Pry out seal with a pry bar (Fig. 40).

INSTALLATION

The input shaft end seal is located on the end of the input shaft.

(1) Clean and inspect seal area.

(2) Remove input shaft from housing and stand on soft block of wood. Install input shaft end seal with seal installer 5065 and handle C-4171.

(3) Lubricate seal lip after installing seal into input shaft.

(4) Clean sealing surfaces of the end cover and P.T.U. case. Apply a bead of Mopar® Gasket Maker, Loctite Gasket Eliminator No. 518 or equivalent.

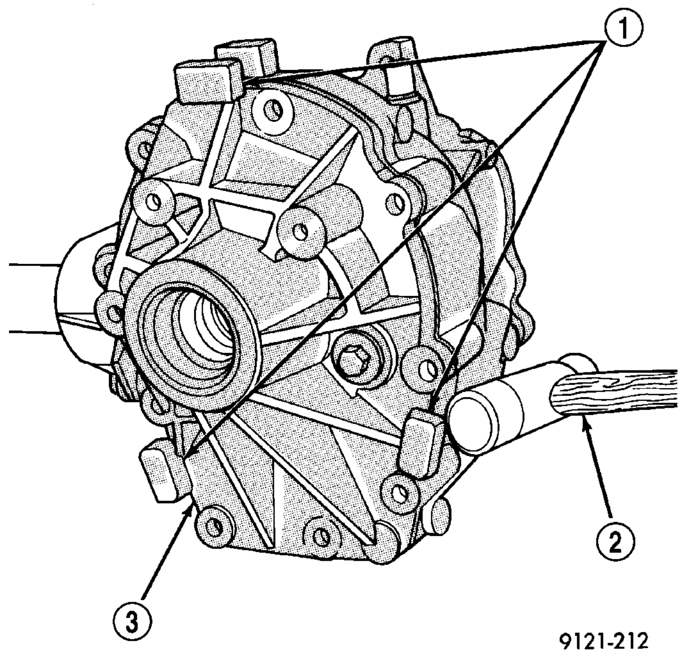


Fig. 39 Side Cover Removal

1 - END COVER EARS
2 - HAMMER
3 - POWER TRANSFER UNIT

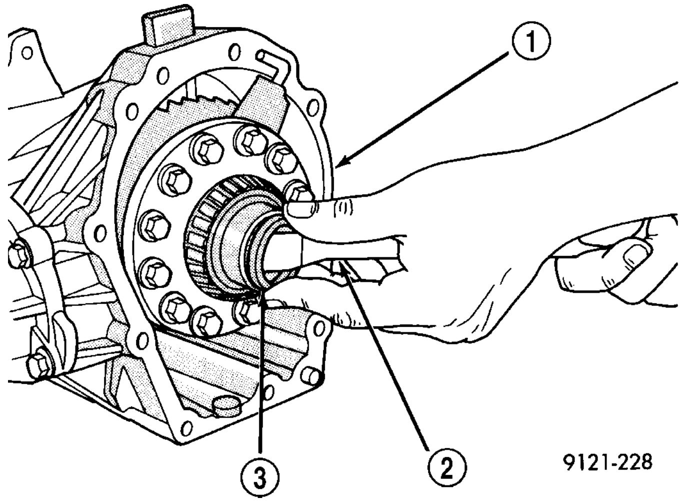


Fig. 40 Seal Removal

1 - POWER TRANSFER UNIT
2 - PRYBAR
3 - SEAL

INPUT SHAFT END SEAL (Continued)

(5) Place end cover onto P.T.U. case and install bolts. Tighten bolts to 28 N·m (250 in. lbs.) in the sequence shown in (Fig. 41). Retighten first bolt after all others are tight.

CAUTION: When end cover is installed be careful not to damage the P.T.U. Input Shaft Cover Seal.

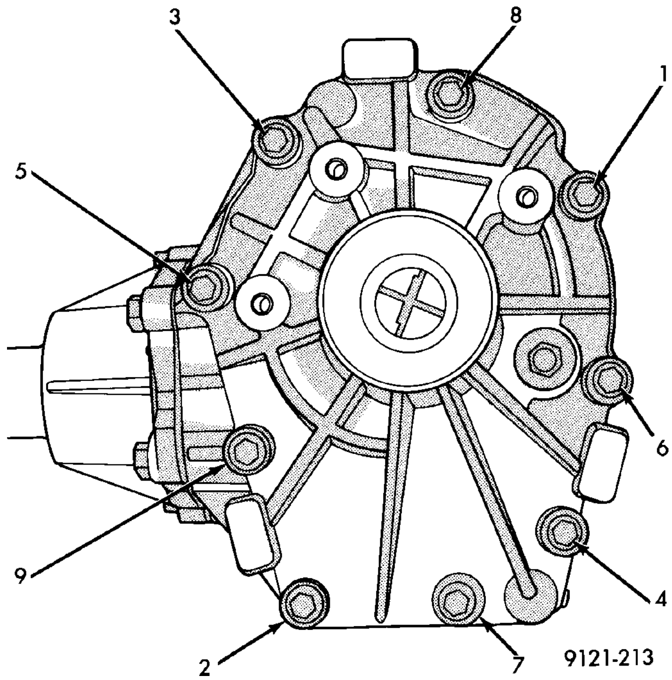


Fig. 41 Bolt Tightening Sequence

(6) Reinstall P.T.U. assembly.
(7) Check and fill fluids as required.

INPUT SHAFT SEAL

REMOVAL

The Power Transfer Unit must be removed from the vehicle to service this seal. Refer to Power Transfer Unit Removal in this section for procedures.

(1) Remove P.T.U. end cover bolts (Fig. 42).

(2) Gently tap on end cover ears to separate cover from case (Fig. 43).

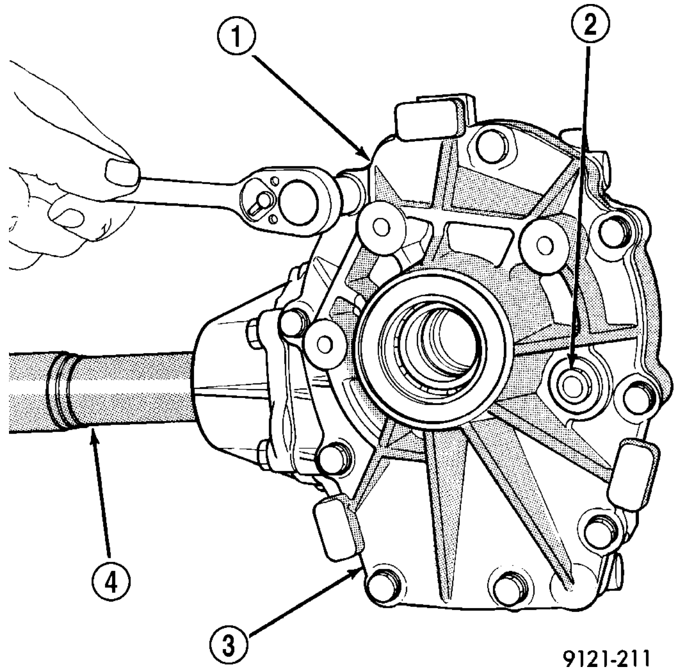


Fig. 42 P.T.U. End Cover Bolts

1 - POWER TRANSFER UNIT
2 - FILL PLUG
3 - END COVER
4 - OUTPUT SHAFT

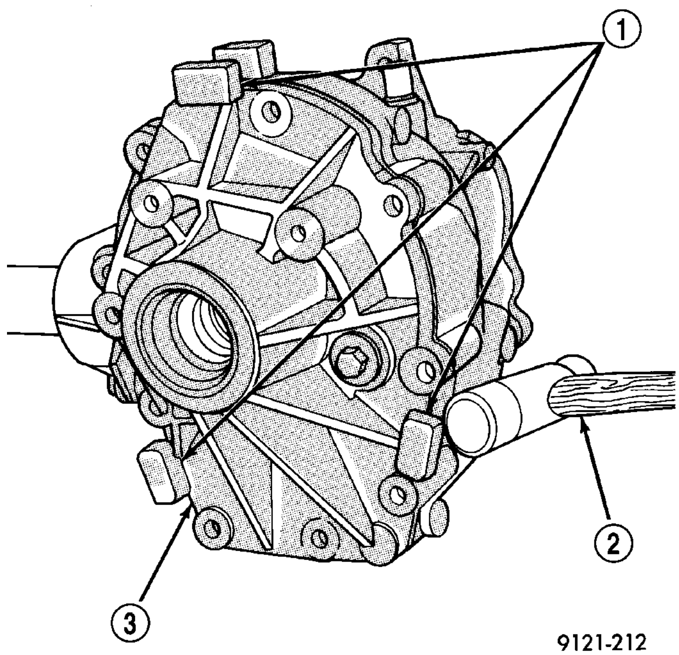


Fig. 43 End Cover Removal

1 - END COVER EARS
2 - HAMMER
3 - POWER TRANSFER UNIT

INPUT SHAFT SEAL (Continued)

(3) Remove ring gear oil trough (Fig. 44).

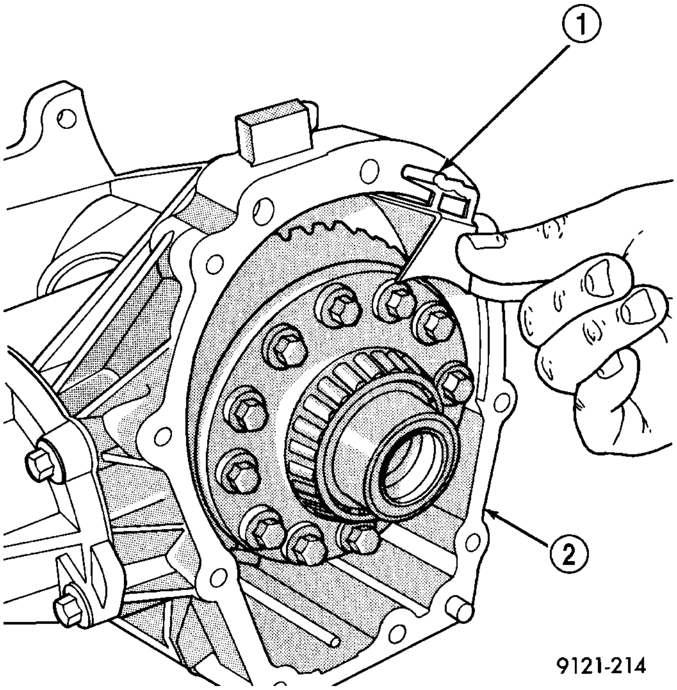


Fig. 44 Oil Trough

1 - OIL TROUGH
2 - POWER TRANSFER UNIT

(4) Remove input shaft and ring gear from case (Fig. 45).

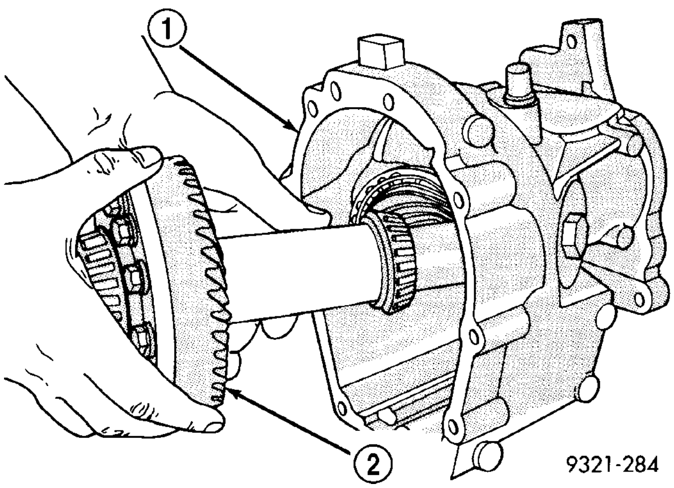


Fig. 45 Input Shaft and Ring Gear Removal

1 - POWER TRANSFER UNIT
2 - RING GEAR

(5) Use Special Tool No. 7794-A (seal puller) to remove seal (Fig. 46).

INSTALLATION

The Power Transfer Unit must be removed from the vehicle to service this seal. Refer to Power Transfer Unit Removal in this section for procedures.

(1) Clean and inspect seal area.

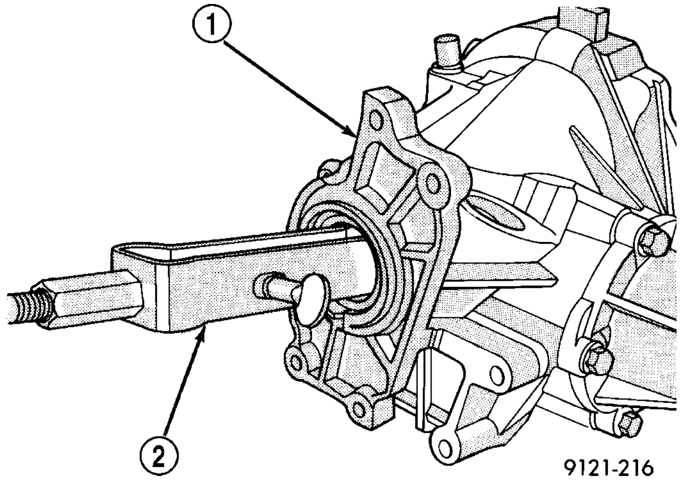


Fig. 46 Seal Removal

1 - POWER TRANSFER UNIT
2 - SPECIAL TOOL 7794–A

(2) Lay housing on bench and install new seal with seal driver C-4657 and handle C-4171 (Fig. 47). The seal must be installed with the spring side facing towards the ring gear. Drive the seal in until it bottoms against the case shoulder.

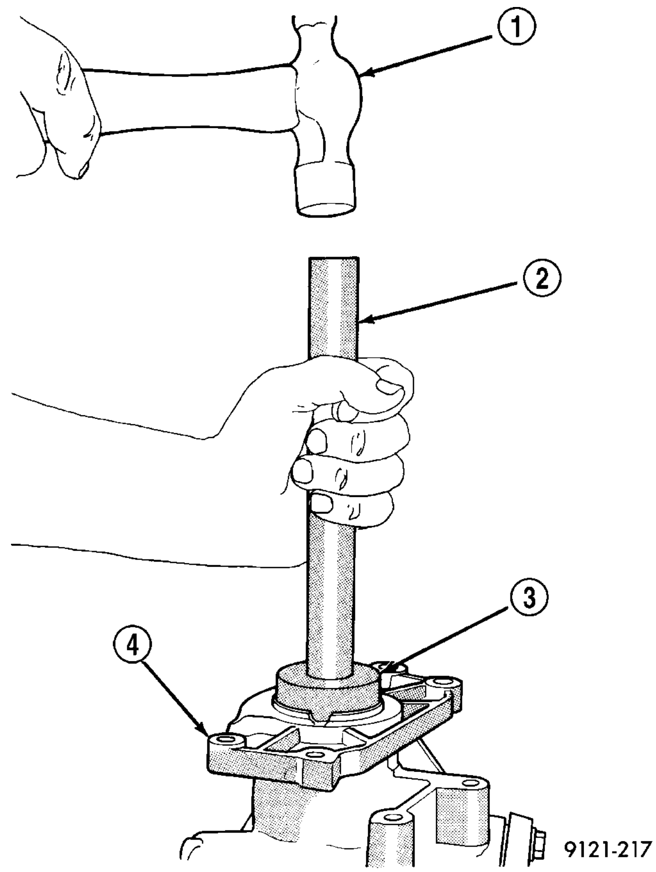


Fig. 47 Seal Installation

1 - HAMMER
2 - SPECIAL TOOL C-4171
3 - SPECIAL TOOL C-4657
4 - POWER TRANSFER UNIT

INPUT SHAFT SEAL (Continued)

(3) Install input shaft.
(4) Install oil trough.
(5) Apply Mopar® Gasket Maker or equivalent to sealing surfaces of end cover and reinstall. Tighten bolts to 28 N·m (250 in. lbs.)

CAUTION: When end cover is installed be careful not to damage the P.T.U. Input Shaft Cover Seal.

(6) Reinstall P.T.U. assembly into vehicle.
(7) Check and fill fluids as required.

OUTER HALF SHAFT SEAL

REMOVAL

The outer half shaft seal is located on the outside of the end cover. The P.T.U. does not have to be removed to replace this seal.
(1) Lift vehicle on hoist.
(2) Remove right front half shaft from vehicle.
(3) Remove seal with a chisel and hammer (Fig. 48).

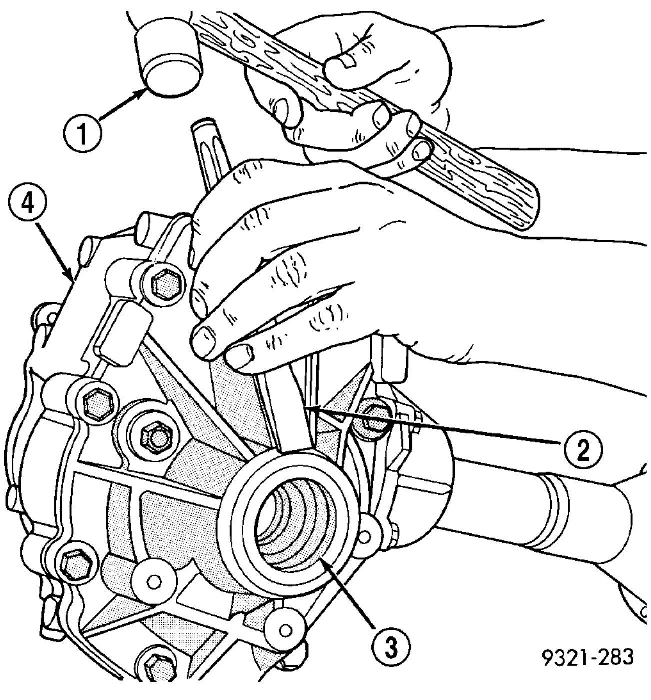


Fig. 48 Seal Removal

1 - HAMMER
2 - CHISEL
3 - SEAL
4 - POWER TRANSFER UNIT

INSTALLATION

The outer half shaft seal is located on the outside of the end cover. The P.T.U. does not have to be removed to replace this seal.
(1) Clean and inspect seal area.
(2) Install new seal with seal installer MD998334 (Fig. 49).

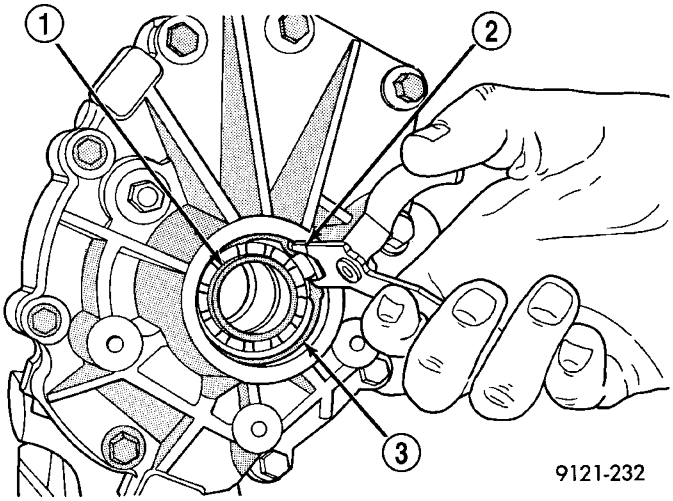


Fig. 49 Seal Installation

1 - BEARING
2 - SNAP RING PLIERS
3 - BEARING SNAP RING

(3) Reinstall right front half shaft.
(4) Check and fill fluids as required.

REAR COVER O-RING

REMOVAL

(1) Raise vehicle on hoist.
(2) Remove rear cover retaining bolts (Fig. 50).

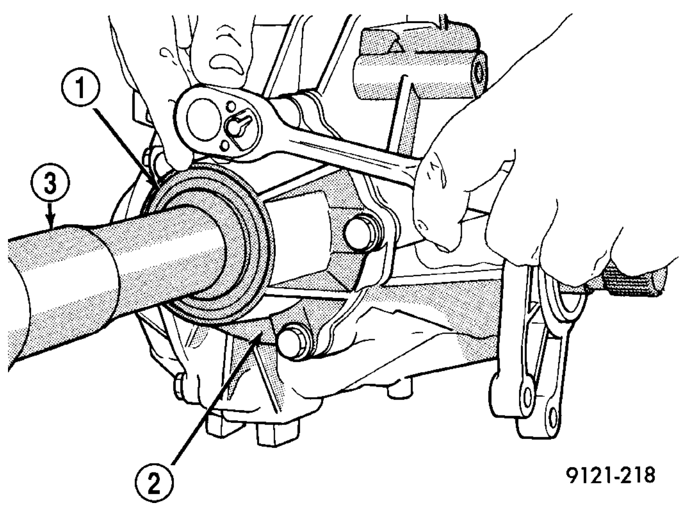


Fig. 50 Rear Cover Bolts

1 - OUTPUT FLANGE SEAL
2 - REAR COVER
3 - OUTPUT SHAFT

REAR COVER O-RING (Continued)

(3) Index rear cover to the case for later reassembly (Fig. 51).

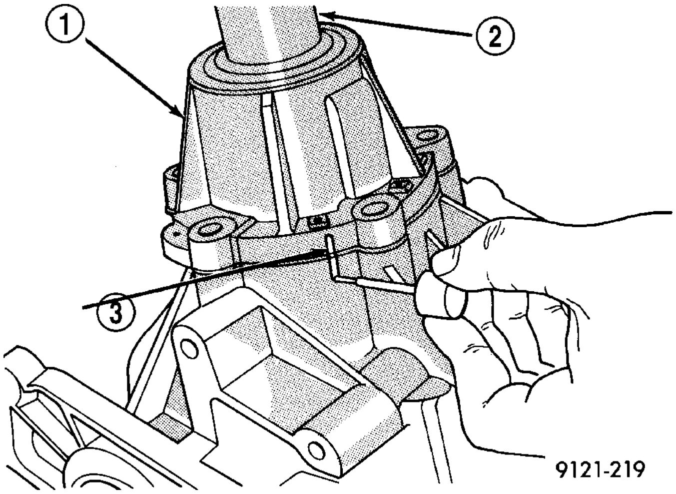


Fig. 51 Mark Rear Cover

1 - REAR COVER
2 - OUTPUT SHAFT
3 - PAINT MARK

(4) Pull rear cover out of the P.T.U. case (Fig. 52).

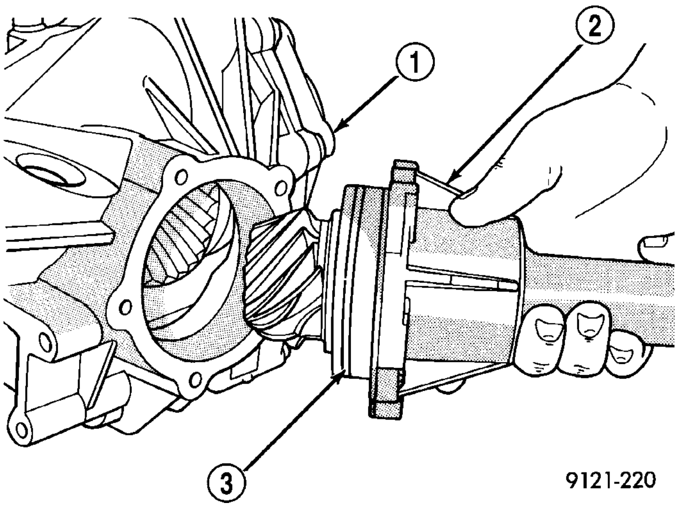


Fig. 52 Rear Cover Removal

1 - POWER TRANSFER UNIT ASSEMBLY
2 - REAR COVER
3 - O-RING

(5) Remove rear cover O-Ring (Fig. 53).

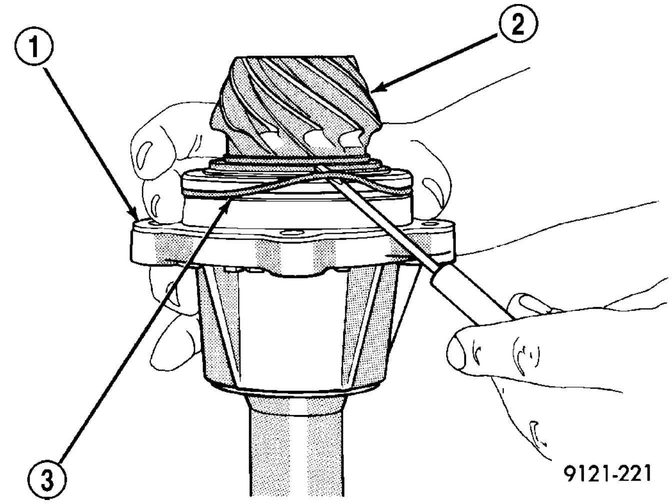


Fig. 53 O-Ring Removal

1 - REAR COVER
2 - PINION GEAR
3 - O-RING

INSTALLATION

(1) To install, reverse removal procedure.

T850 MANUAL TRANSAXLE

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T850 MANUAL TRANSAXLE

DESCRIPTION

The NV T850 5-speed transaxle (Fig. 1) is a constant-mesh manual transaxle that is synchronized in all gear ranges, including reverse.

The transaxle consists of three major sub-assemblies: the input shaft, intermediate shaft, and differential assembly. The transaxle shift system consists of a mechanical shift cover, rails, forks, and cables. The unique design of this shift system provides a higher mechanical advantage, resulting in less friction and lower shift cable loads for smoother, more positive operation.

T850 MANUAL TRANSAXLE (Continued)

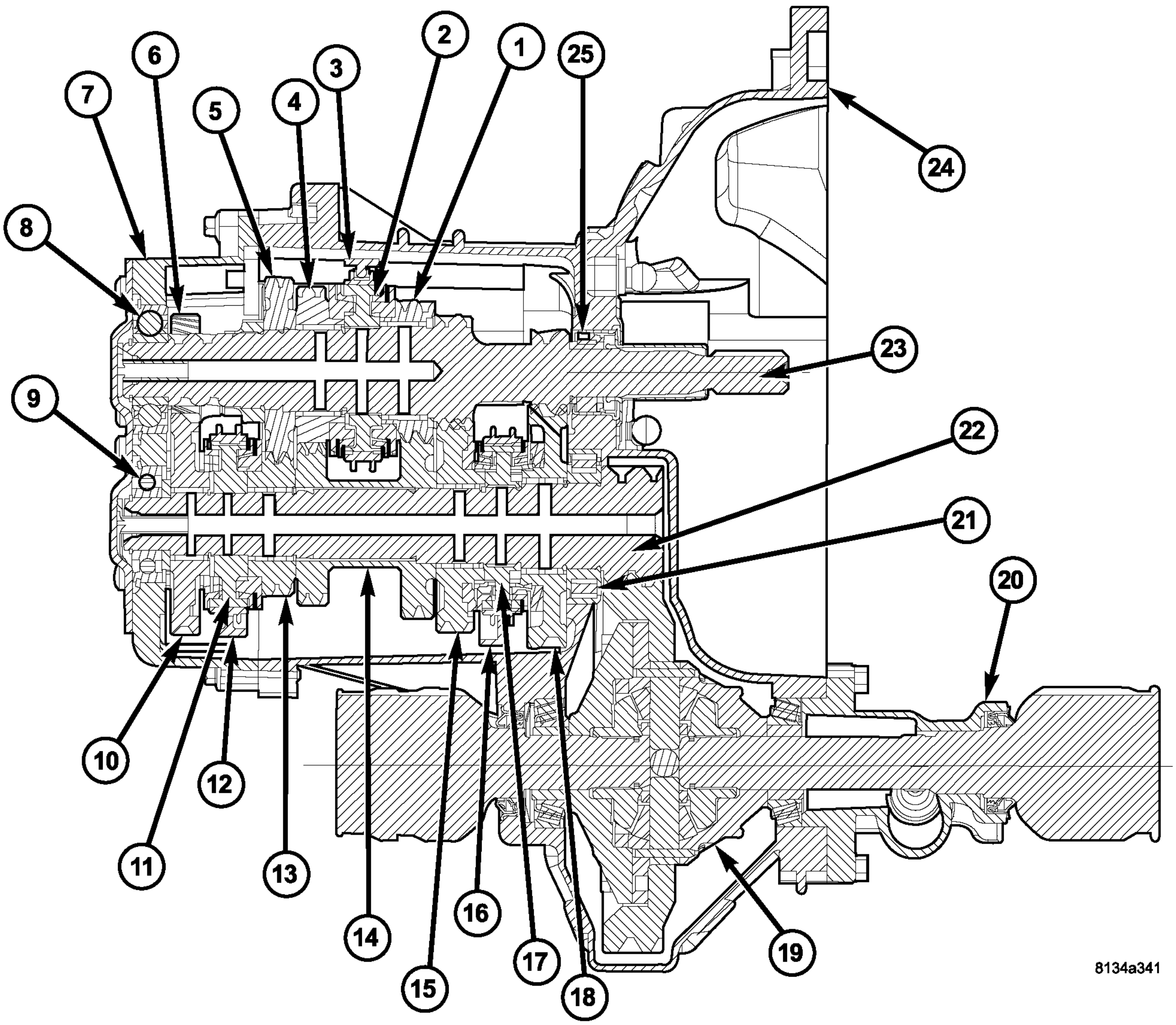


Fig. 1 NV T850 Transaxle

1 - 3RD GEAR (SPEED)
2 - 3/4 SYNCHRONIZER
3 - 3/4 SHIFT FORK
4 - 4TH GEAR (SPEED)
5 - 5TH GEAR (INPUT)
6 - REVERSE IDLER GEAR
7 - END COVER, REAR
8 - INPUT SHAFT BEARING (SEALED BALL)
9 - INTERMEDIATE SHAFT BEARING (SEALED BALL)
10 - REVERSE GEAR
11 - 5/R SYNCHRONIZER
12 - 5/R SHIFT FORK
13 - 5TH GEAR (SPEED)
14 - 3/4 CLUSTER GEAR
15 - 2ND GEAR (SPEED)
16 - 1/2 SHIFT FORK
17 - 1/2 SYNCHRONIZER
18 - 1ST GEAR (SPEED)
19 - DIFFERENTIAL ASSEMBLY
20 - EXTENSION HOUSING
21 - INTERMEDIATE SHAFT BEARING (CAGED ROLLER)
22 - INTERMEDIATE SHAFT
23 - INPUT SHAFT
24 - CASE
25 - INPUT SHAFT BEARING (ROLLER)

T850 MANUAL TRANSAXLE (Continued)

The NV T850 transaxle is available with the 2.4L Gas and 2.5L Turbo Diesel engine options. Unique gearing tailored to the performance characteristics of each engine provides optimum driveability, gradability, and acceleration. The gear ratios are as follows:

GEAR	RATIO
1st	3.65
2nd	2.05
3rd	1.37
4th	0.97
5th	0.76
Reverse	3.47
Final Drive Ratio	3.77
Overall Top Gear	2.85

TRANSAXLE IDENTIFICATION

NOTE: Since transaxles use unique gear ratios for each of the two engine applications, it is imperative that the transaxle is properly identified, and the correct transaxle assembly number is used when ordering service parts.

The transaxle model, assembly part number, build date, and final drive ratio (FDR) can be found on a metal tag fastened to the transaxle case on the bellhousing (Fig. 2). A barcode label is also glued to the transaxle bellhousing, and it too includes the transaxle part number.

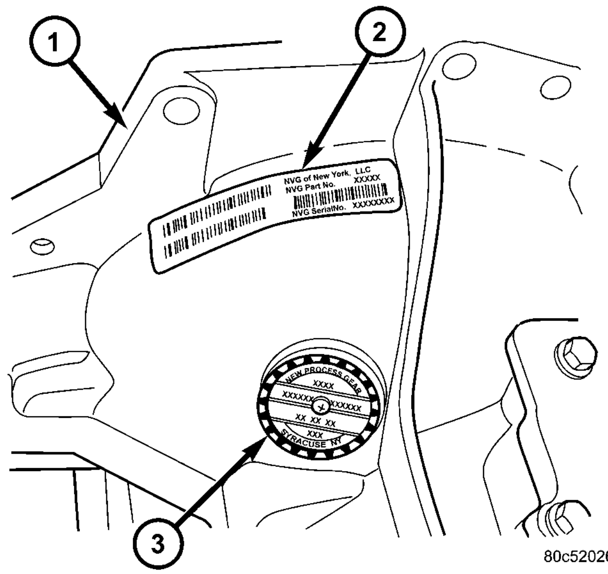


Fig. 2 T850 Transaxle Identification

1 - TRANSAXLE BELLHOUSING
2 - BARCODE LABEL
3 - I.D. TAG

T850 MANUAL TRANSAXLE (Continued)

OPERATION

NEUTRAL

Engine power is transmitted to the tinput shaft. Engine power is transmitted to the input shaft via the clutch assembly and the input shaft turns. Since no synchronizers are engaged on either the input or intermediate shafts, power is not transmitted to the intermediate shaft and the differential does not turn (Fig. 3).

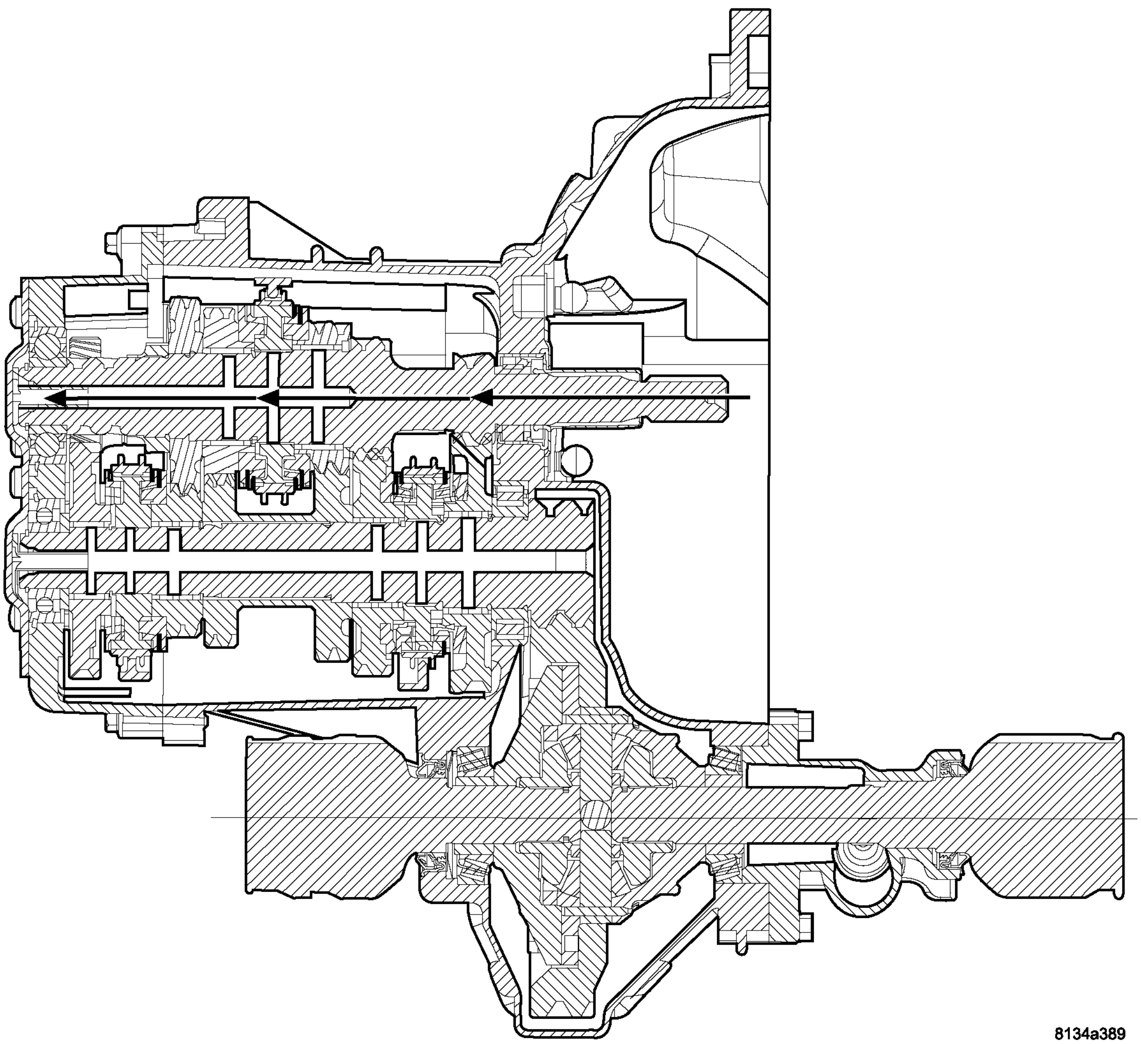


Fig. 3 Neutral Gear Operation

T850 MANUAL TRANSAXLE (Continued)

1ST GEAR

Engine power is transmitted to the input shaft via the clutch assembly and the input shaft turns. The input shaft first gear is integral to the input shaft, and is in constant mesh with the intermediate shaft first speed gear. Because of this constant mesh, the intermediate shaft first speed gear freewheels until first gear is selected. As the gearshift lever is moved to the first gear position, the 1-2 fork moves the 1-2 synchronizer sleeve towards first gear on the intermediate shaft. The synchronizer sleeve engages the first gear clutch teeth, fixing the gear to the intermediate shaft, and allowing power to transmit through the intermediate shaft to the differential (Fig. 4).

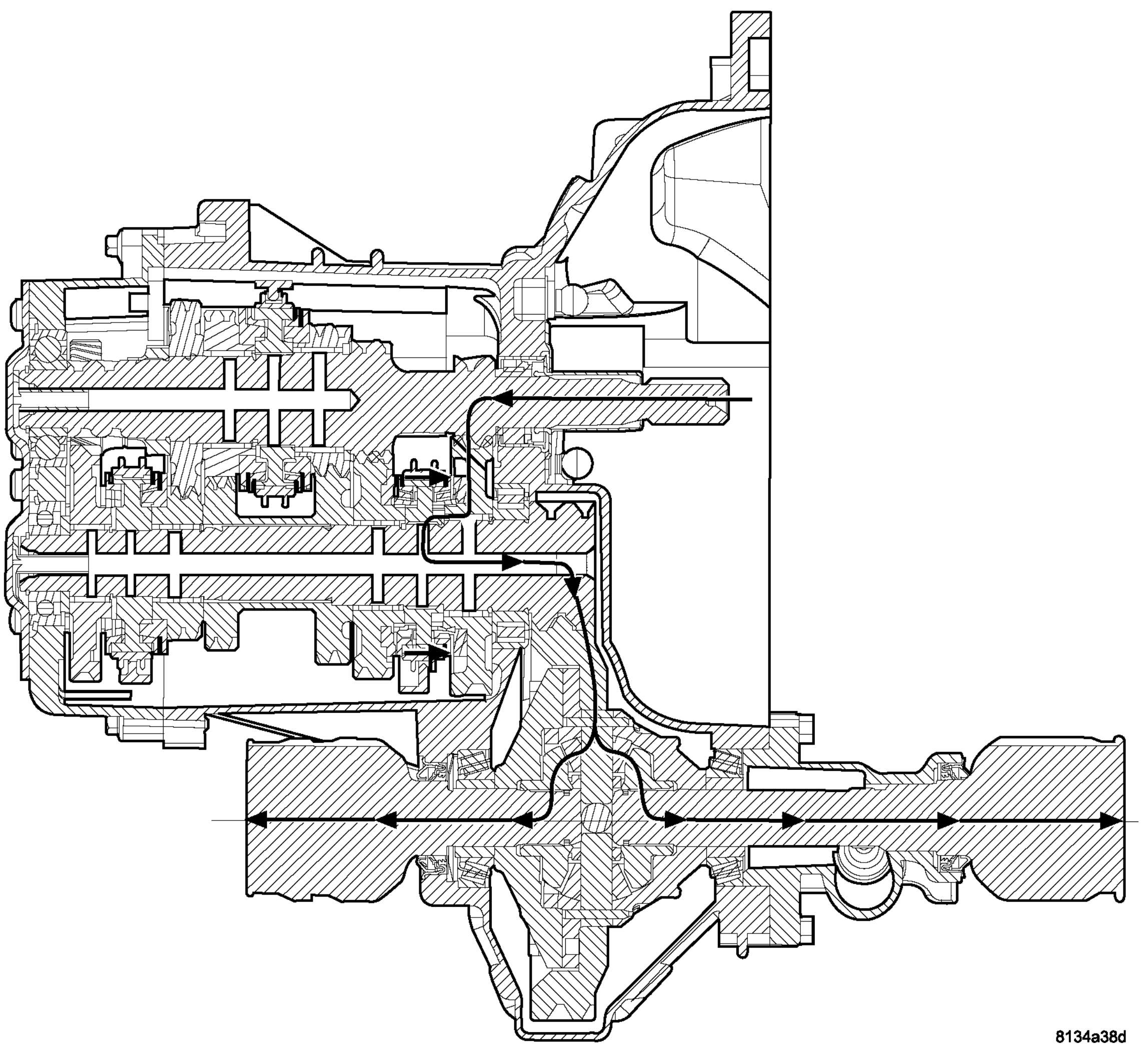


Fig. 4 1st Gear Operation

T850 MANUAL TRANSAXLE (Continued)

2ND GEAR

Engine power is transmitted to the input shaft via the clutch assembly and the input shaft turns. The input shaft second gear is integral to the input shaft, and is in constant mesh with the intermediate shaft second speed gear. Because of this constant mesh, the intermediate shaft second speed gear freewheels until second gear is selected. As the gearshift lever is moved to the second gear position, the 1-2 fork moves the 1-2 synchronizer sleeve towards second gear on the intermediate shaft. The synchronizer sleeve engages the second gear clutch teeth, fixing the gear to the intermediate shaft, and allowing power to transmit through the intermediate shaft to the differential (Fig. 5).

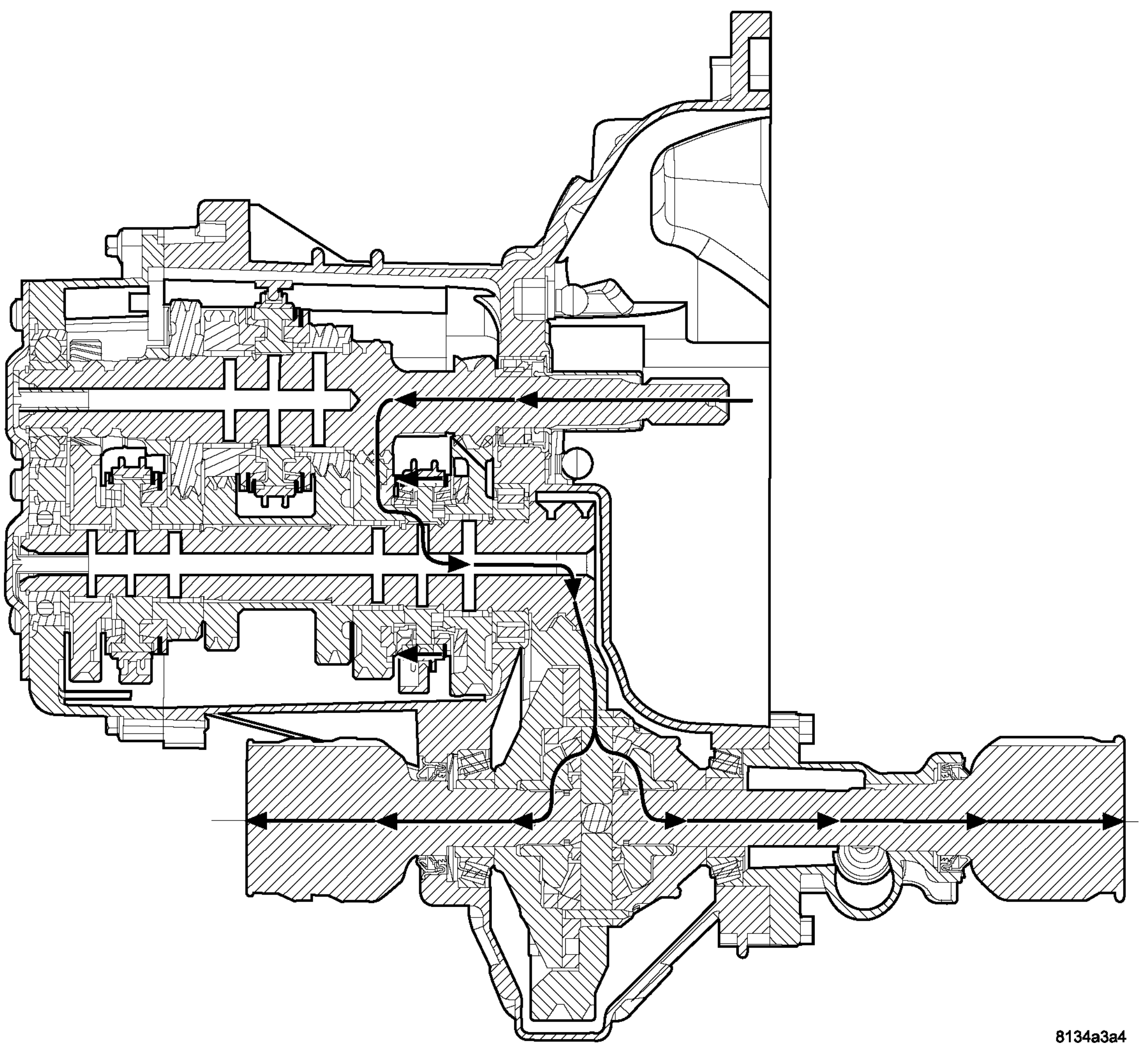


Fig. 5 2nd Gear Operation

T850 MANUAL TRANSAXLE (Continued)

3RD GEAR

Engine power is transmitted to the input shaft via the clutch assembly and the input shaft turns. The input shaft third speed gear is in constant mesh with the intermediate shaft 3-4 cluster gear, which is fixed to the intermediate shaft. Because of this constant mesh, the input shaft third speed gear freewheels until third gear is selected. As the gearshift lever is moved to the third gear position, the 3-4 fork moves the 3-4 synchronizer sleeve towards third gear on the input shaft. The synchronizer sleeve engages the third gear clutch teeth, fixing the gear to the input shaft, and allowing power to transmit through the intermediate shaft to the differential (Fig. 6).

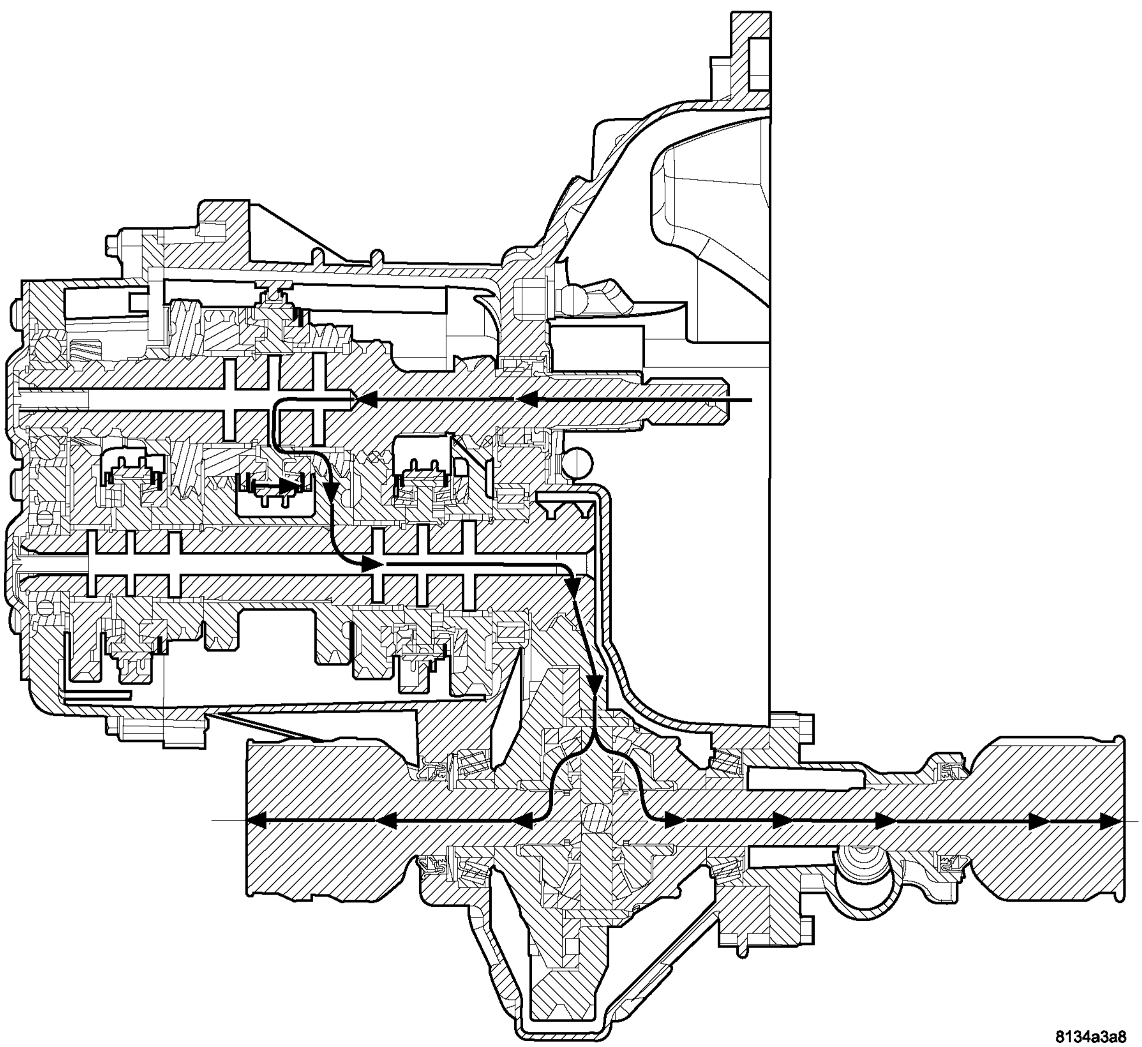


Fig. 6 3rd Gear Operation

T850 MANUAL TRANSAXLE (Continued)

4TH GEAR

Engine power is transmitted to the input shaft via the clutch assembly and the input shaft turns. The input shaft fourth speed gear is in constant mesh with the intermediate shaft 3-4 cluster gear, which is fixed to the intermediate shaft. Because of this constant mesh, the input shaft fourth speed gear freewheels until fourth gear is selected. As the gearshift lever is moved to the fourth gear position, the 3-4 fork moves the 3-4 synchronizer sleeve towards fourth gear on the input shaft. The synchronizer sleeve engages the fourth gear clutch teeth, fixing the gear to the input shaft, and allowing power to transmit through the intermediate shaft to the differential (Fig. 7).

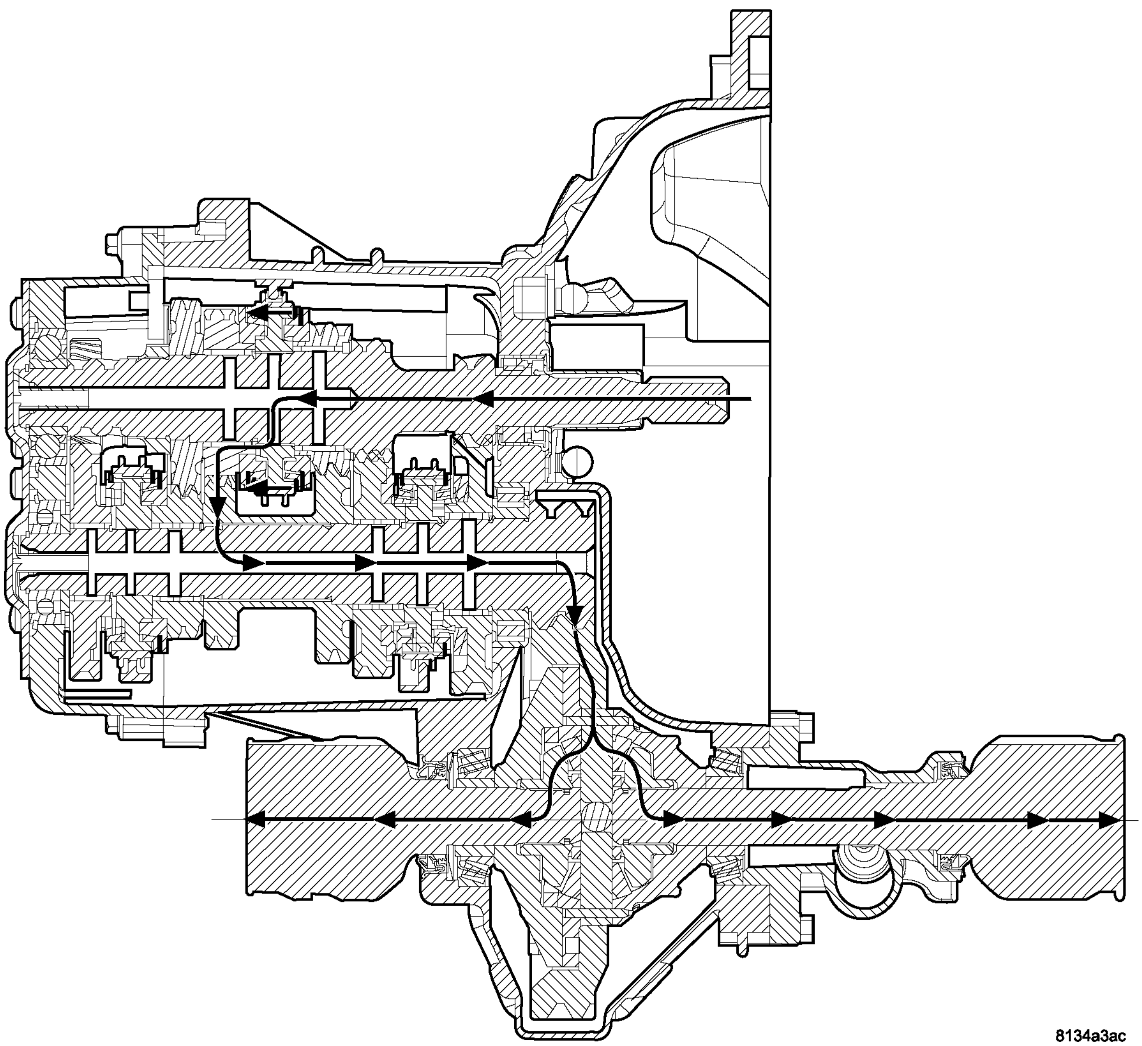


Fig. 7 4th Gear Operation

T850 MANUAL TRANSAXLE (Continued)

5TH GEAR

Engine power is transmitted to the input shaft via the clutch assembly and the input shaft turns. The input shaft fifth gear is pressed on to the input shaft, and is in constant mesh with the intermediate shaft fifth speed gear. Because of this constant mesh, the intermediate shaft fifth speed gear freewheels until fifth gear is selected. As the gearshift lever is moved to the fifth gear position, the 5-R fork moves the 5-R synchronizer sleeve towards the intermediate shaft fifth speed gear. The synchronizer sleeve engages the fifth gear clutch teeth, fixing the gear to the input shaft, and allowing power to transmit through the intermediate shaft to the differential (Fig. 8).

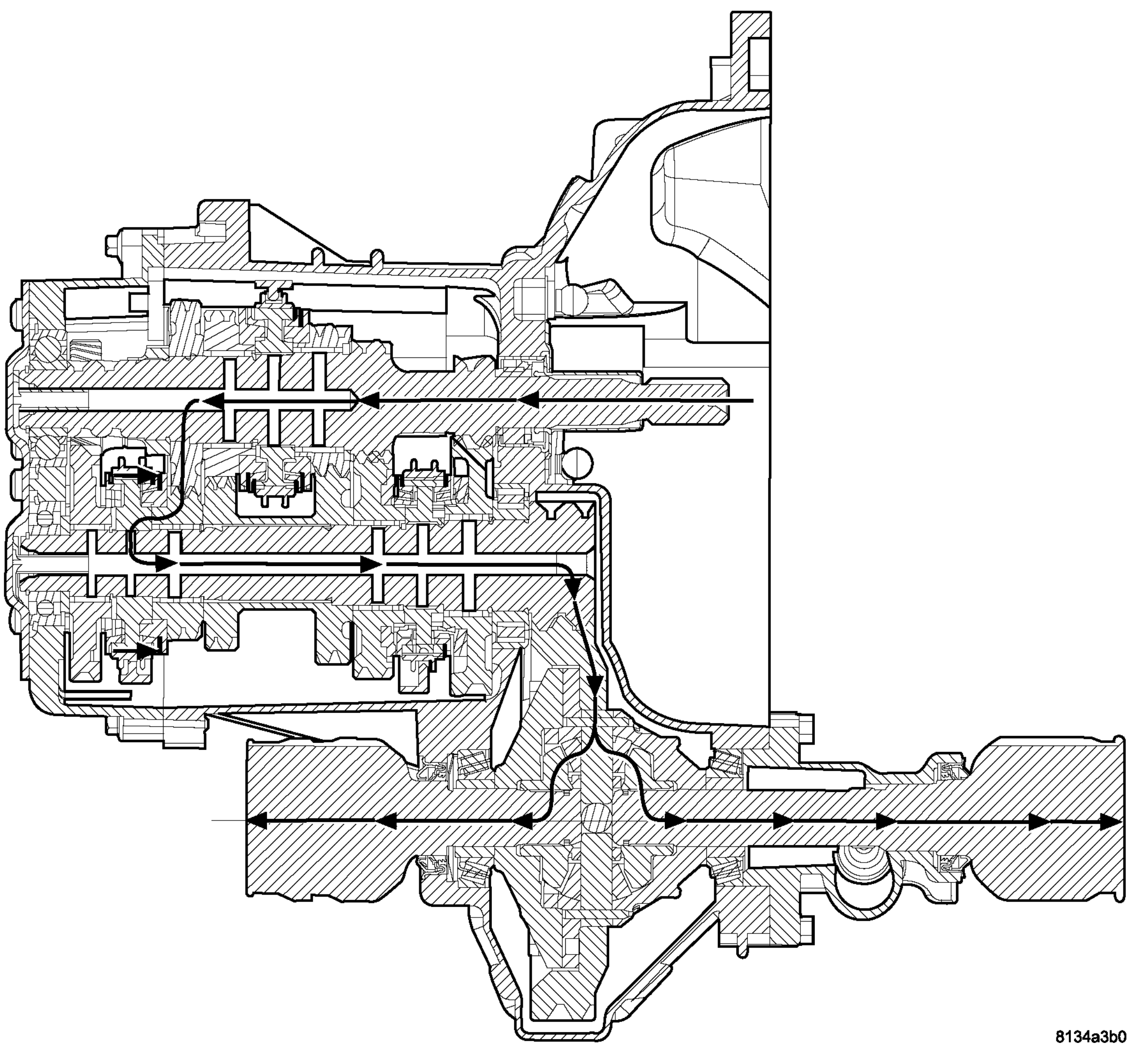


Fig. 8 5th Gear Operation

T850 MANUAL TRANSAXLE (Continued)

REVERSE GEAR

Engine power is transmitted to the input shaft via the clutch assembly and the input shaft turns. The input shaft reverse gear is integral to the input shaft, and is in constant mesh with the reverse idler gear. The reverse idler gear, which reverses the rotation of the intermediate shaft, is in constant mesh with the intermediate shaft reverse gear. Because of this constant mesh, the intermediate shaft reverse gear freewheels until reverse gear is selected. As the gearshift lever is moved to the reverse gear position, the 5-R fork moves the 5-R synchronizer sleeve towards the intermediate shaft reverse gear. The synchronizer sleeve engages the reverse gear clutch teeth, fixing the gear to the intermediate shaft, and allowing power to transmit through the intermediate shaft to the differential (in reverse) (Fig. 9).

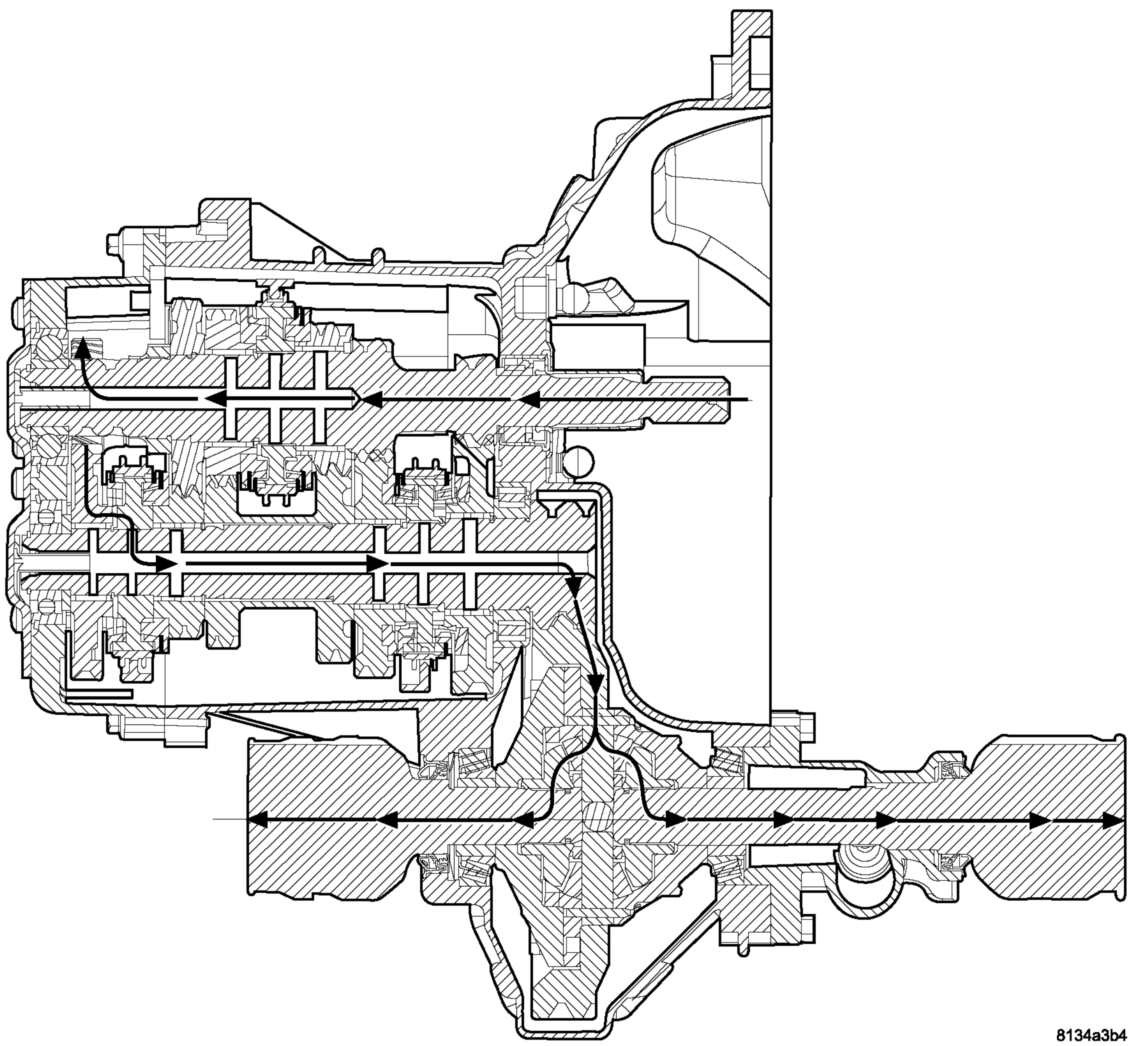


Fig. 9 Reverse Gear Operation

T850 MANUAL TRANSAXLE (Continued)

DIAGNOSIS AND TESTING - COMMON PROBLEM CAUSES

The majority of transaxle malfunctions are a result of:

- Insufficient lubrication
- Incorrect lubricant
- Misassembled or damaged internal components
- Improper operation

HARD SHIFTING

Hard shifting may be caused by a misadjusted crossover cable. If hard shifting is accompanied by gear clash, synchronizer clutch and stop rings or gear teeth may be worn or damaged.

Hard shifting may also be caused by a binding or broken shift cover mechanism. Remove shift cover and verify smooth operation. Replace as necessary.

Misassembled synchronizer components also cause shifting problems. Incorrectly installed synchronizer sleeves, keys, balls, or springs can cause shift problems.

NOISY OPERATION

Transaxle noise is most often a result of worn or damaged components. Chipped, broken gear or synchronizer teeth, and brinnelled, spalled bearings all cause noise.

Abnormal wear and damage to the internal components is frequently the end result of insufficient lubricant.

SLIPS OUT OF GEAR

Transaxle disengagement may be caused by misaligned or damaged shift components, or worn teeth on the drive gears or synchronizer components. Incorrect assembly also causes gear disengagement. Check for missing snap rings.

LOW LUBRICANT LEVEL

Insufficient transaxle lubricant is usually the result of leaks, or inaccurate fluid level check or refill method. Leakage is evident by the presence of oil around the leak point. If leakage is not evident, the condition is probably the result of an underfill.

If air–powered lubrication equipment is used to fill a transaxle, be sure the equipment is properly calibrated. Equipment out of calibration can lead to an underfill condition.

CLUTCH PROBLEMS

Worn, damaged, or misaligned clutch components can cause difficult shifting, gear clash, and noise.

A worn or damaged clutch disc, pressure plate, or release bearing can cause hard shifting and gear clash.

REMOVAL

REMOVAL - 2.4L GAS

(1) Raise hood.

(2) Disconnect gearshift cables from shift levers/cover assembly (Fig. 10).

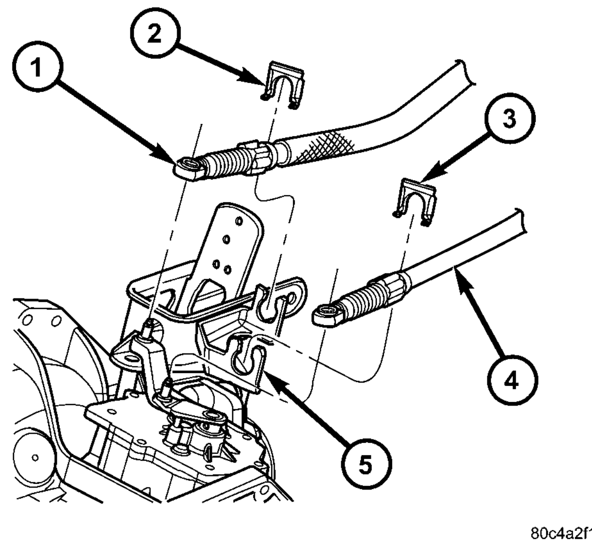


Fig. 10 Gearshift Cables at Transaxle

1 - SELECTOR CABLE
2 - CABLE RETAINER
3 - CABLE RETAINER
4 - CROSSOVER CABLE
5 - MOUNT BRACKET

(3) Remove gearshift cable retaining clips from mounting bracket (Fig. 10). Remove cables and secure out of way.

T850 MANUAL TRANSAXLE (Continued)

(4) Remove three (3) right engine mount bracket-to-transaxle bolts (Fig. 11).

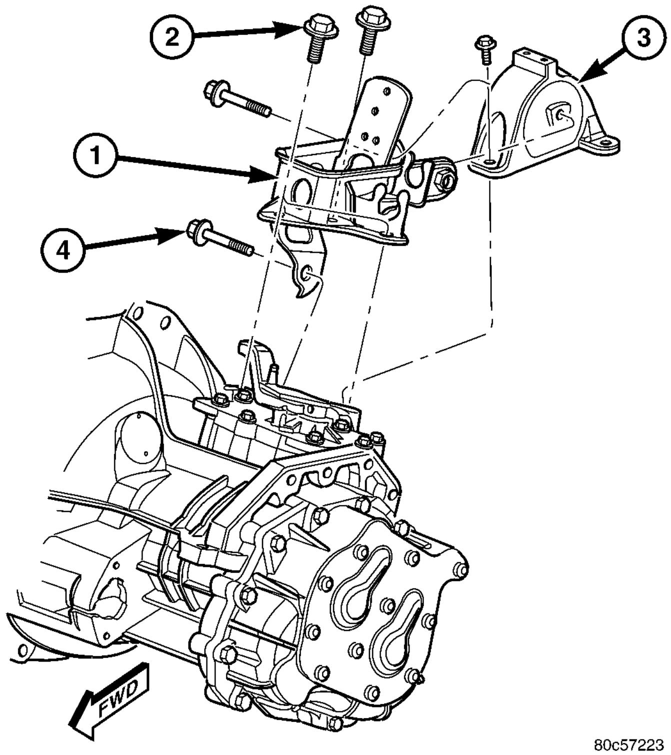


Fig. 11 Transaxle Right Mount and Bracket

1 - MOUNT BRACKET
2 - BOLT (3)
3 - MOUNT
4 - BOLT (1)

(5) Raise vehicle on hoist.

(6) Remove front wheel/tires and halfshafts.

(7) Drain transaxle fluid into suitable container.

(8) Remove front harness retainer and secure harness out of way.

(9) Using Tool 6638A, disconnect clutch hydraulic circuit quick connect (located on slave cylinder tube). Remove clutch slave cylinder by depressing towards case and rotating counter-clockwise 60°, while lifting anti-rotation tab out of case slot with screwdriver (Fig. 12).

(10) Remove engine left mount bracket.

(11) Remove starter motor (Fig. 13).

(12) Disconnect back-up lamp switch connector.

(13) Remove structural collar.

(14) Remove modular clutch assembly-to-drive plate bolts.

(15) Position screw jack and wood block to engine oil pan.

(16) Remove transmission upper mount through-bolt from left frame rail.

(17) Lower engine/transaxle assembly on screw jack.

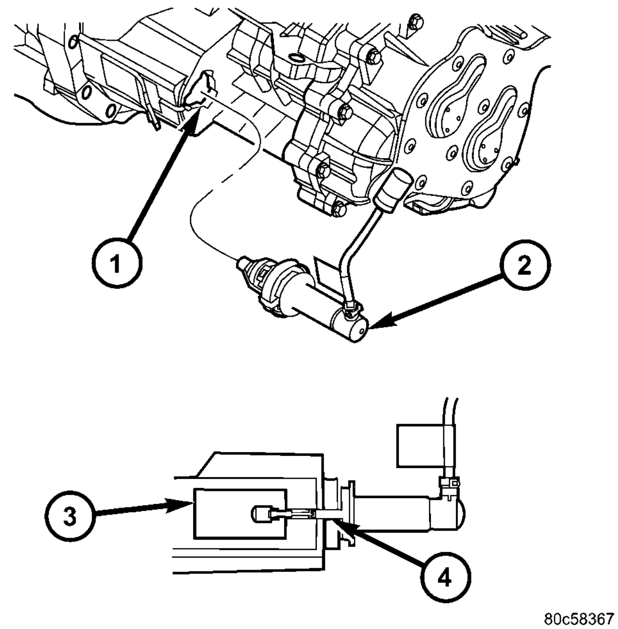


Fig. 12 Slave Cylinder Removal/Installation

1 - MOUNTING HOLE
2 - SLAVE CYLINDER
3 - ACCESS HOLE
4 - NYLON ANTI-ROTATION TAB

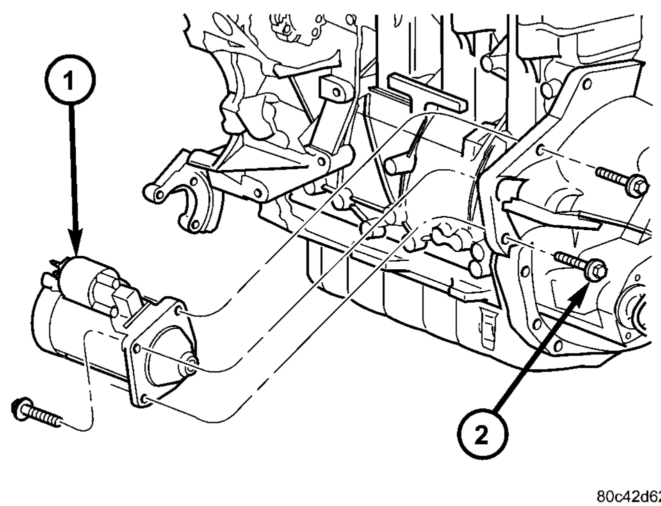


Fig. 13 Starter Motor Removal/Installation

1 - STARTER MOTOR
2 - BOLT (3)

T850 MANUAL TRANSAXLE (Continued)

(18) Remove four (4) upper mount-to-transaxle bolts and remove mount (Fig. 14).

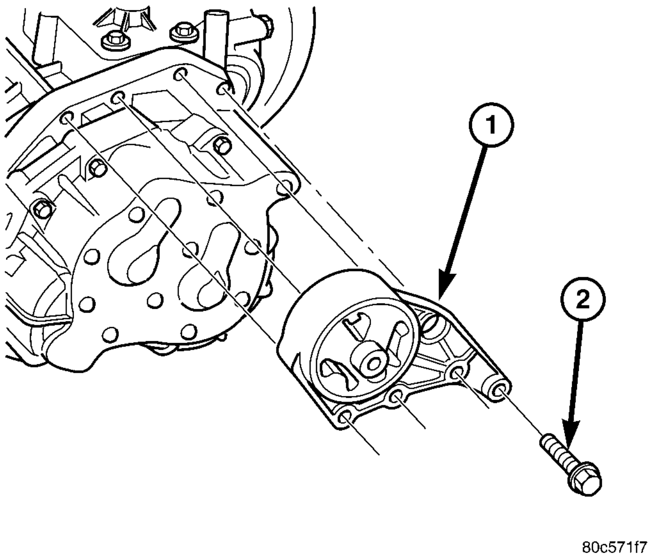


Fig. 14 Transaxle Upper Mount

1 - MOUNT
2 - BOLT (4)

(19) Obtain helper and transmission jack. Secure transaxle to transmission jack and remove transaxle-to-engine bolts.

(20) Remove transaxle from engine.

(21) Inspect modular clutch assembly, clutch release components, and engine drive plate.

REMOVAL - 2.5L TD

(1) Raise hood.

(2) Disconnect both battery cables.

(3) Remove battery thermal shield (Fig. 15).

(4) Remove battery hold down bolt, clamp, and battery (Fig. 16).

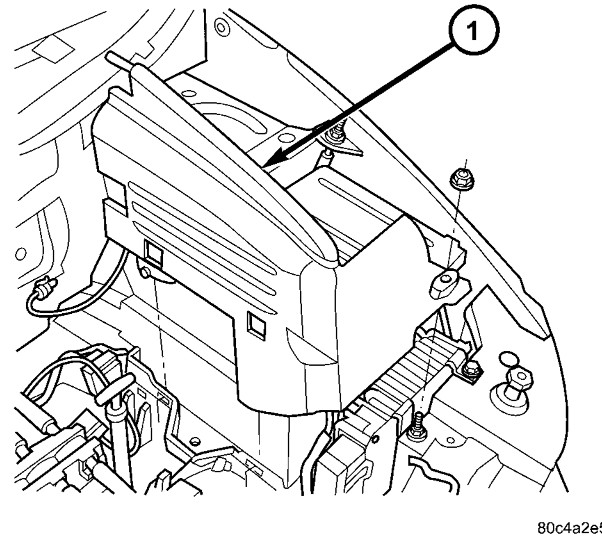


Fig. 15 Battery Thermal Shield

1 - BATTERY THERMAL SHIELD

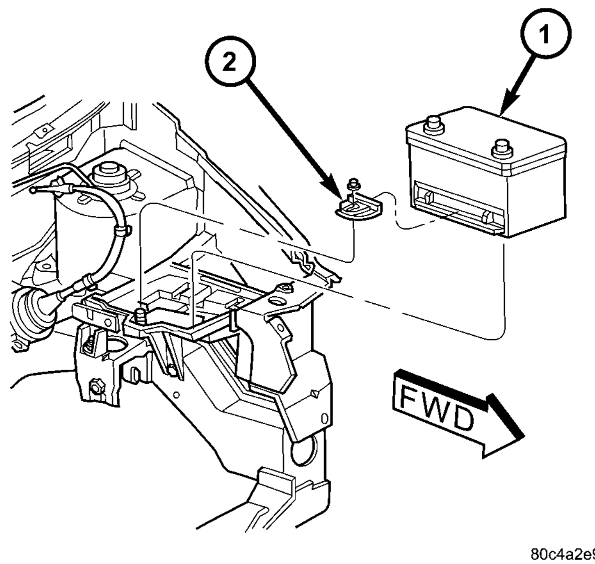


Fig. 16 Battery and Hold-Down Clamp

1 - BATTERY
2 - HOLD-DOWN CLAMP

T850 MANUAL TRANSAXLE (Continued)

(5) Remove battery tray (Fig. 17). Disconnect battery temperature sensor.

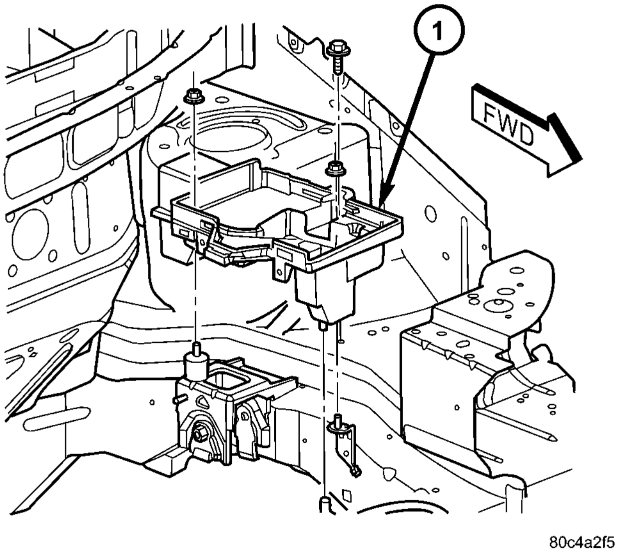


Fig. 17 Battery Tray

1 - BATTERY TRAY

(6) Remove coolant recovery bottle from bracket.

(7) Remove coolant recovery bottle mounting bracket (Fig. 18).

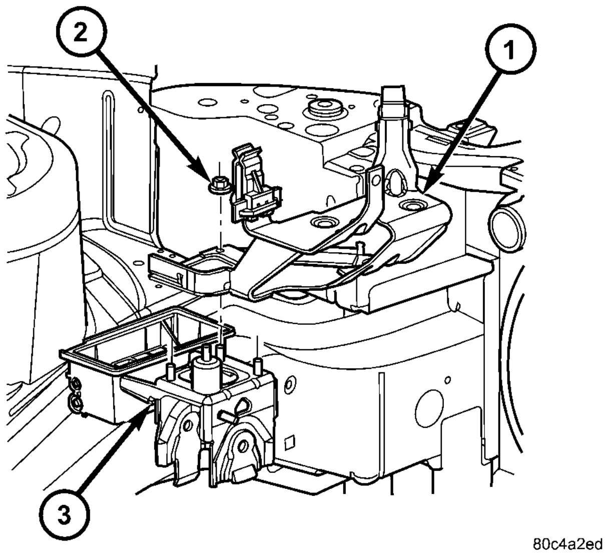


Fig. 18 Coolant Recovery Bottle Bracket

1 - COOLANT RECOVERY BOTTLE BRACKET
2 - NUT
3 - MOUNT BRACKET

(8) Disconnect gearshift cables from shift levers/cover assembly (Fig. 19).

(9) Remove gearshift cable retaining clips from mounting bracket (Fig. 19). Remove cables and secure out of way.

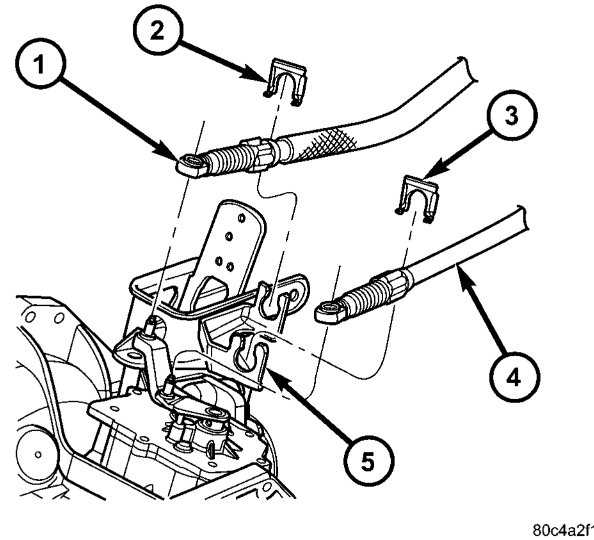


Fig. 19 Gearshift Cables at Transaxle

1 - SELECTOR CABLE
2 - CABLE RETAINER
3 - CABLE RETAINER
4 - CROSSOVER CABLE
5 - MOUNT BRACKET

(10) Remove three (3) right engine mount bracket-to-transaxle bolts (Fig. 20).

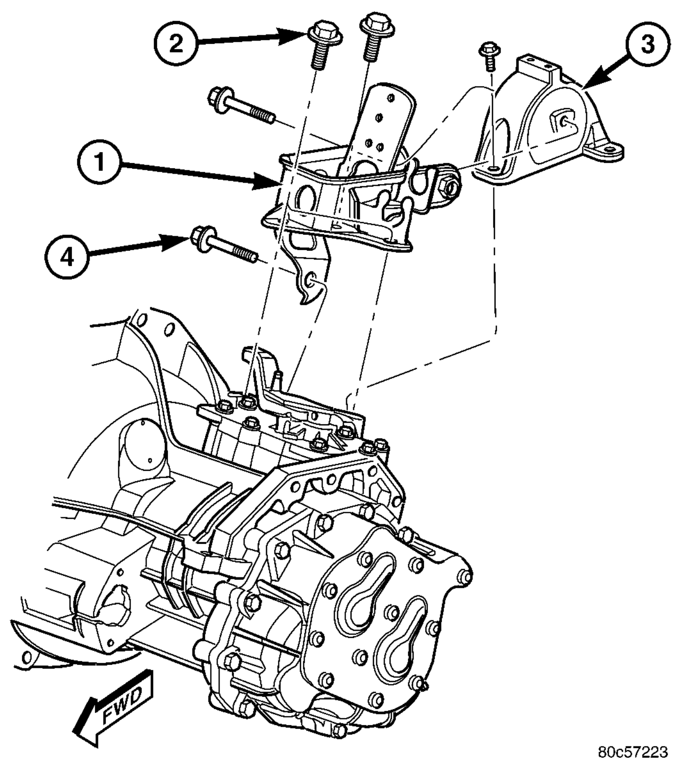


Fig. 20 Transaxle Right Mount and Bracket

1 - MOUNT BRACKET
2 - BOLT (3)
3 - MOUNT
4 - BOLT (1)

T850 MANUAL TRANSAXLE (Continued)

(11) Raise vehicle on hoist.

(12) Remove front wheel/tires and halfshafts.

(13) Remove underbody splash shield.

(14) Drain transaxle fluid into suitable container.

(15) Remove front harness retainer and secure harness out of way.

(16) Using Tool 6638A, disconnect clutch hydraulic circuit quick connect (located on slave cylinder tube). Remove clutch slave cylinder by depressing towards case and rotating counter-clockwise 60°, while lifting anti-rotation tab out of case slot with screwdriver (Fig. 21).

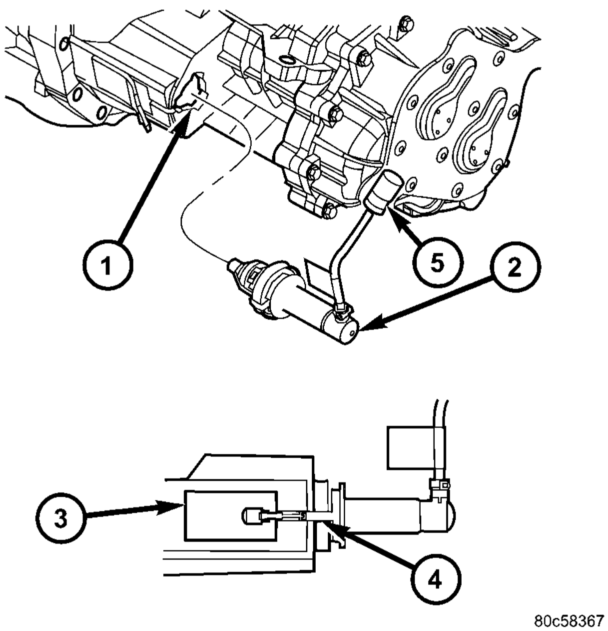


Fig. 21 Slave Cylinder Removal/Installation

1 - MOUNTING HOLE
2 - SLAVE CYLINDER
3 - ACCESS HOLE
4 - NYLON ANTI-ROTATION TAB
5 - QUICK CONNECT

(17) Remove engine left mount bracket (Fig. 22).

(18) Remove starter motor (Fig. 23).

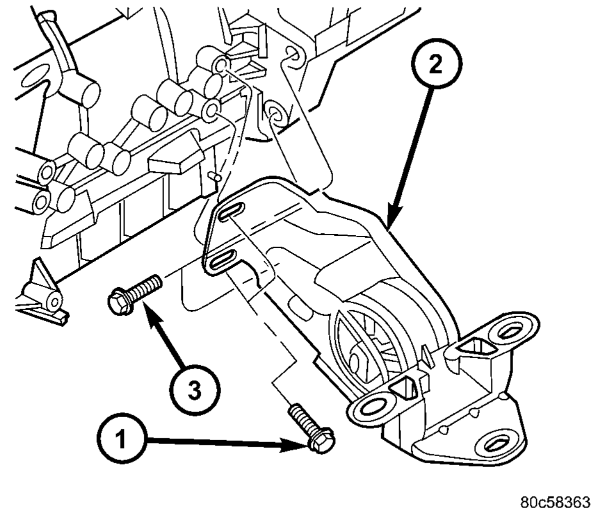


Fig. 22 Left Mount Bracket Removal/Installation

1 - BOLT (2)
2 - MOUNT BRACKET
3 - BOLT (2)

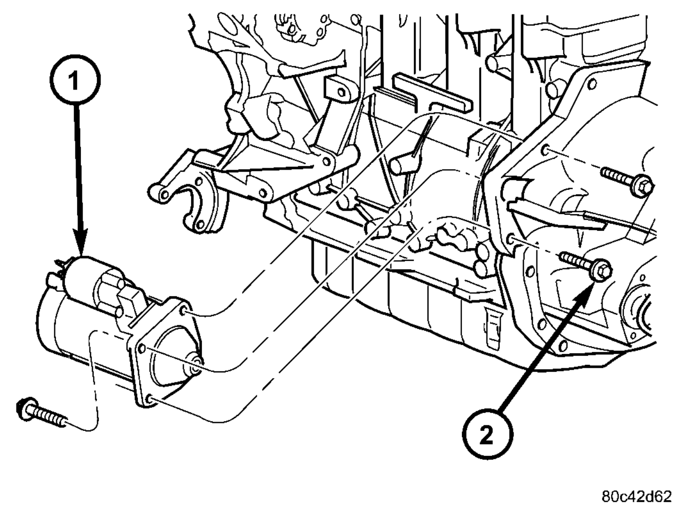


Fig. 23 Starter Motor Removal/Installation

1 - STARTER MOTOR
2 - BOLT (3)

T850 MANUAL TRANSAXLE (Continued)

(19) Disconnect back-up lamp switch connector.

(20) Position screw jack and wood block to engine oil pan.

(21) Remove transmission upper mount through-bolt from left frame rail.

(22) Lower engine/transaxle assembly on screw jack.

(23) Remove four (4) upper mount-to-transaxle bolts and remove mount (Fig. 24).

(24) Obtain helper and transmission jack. Secure transaxle to transmission jack and remove transaxle-to-engine bolts.

(25) Remove transaxle from engine (Fig. 25).

(26) Inspect clutch, clutch release components, and flywheel.

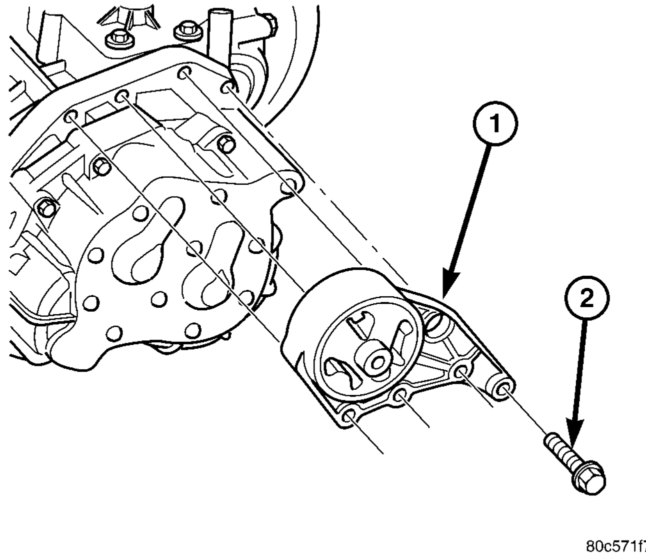


Fig. 24 Transaxle Upper Mount

1 - MOUNT
2 - BOLT (4)

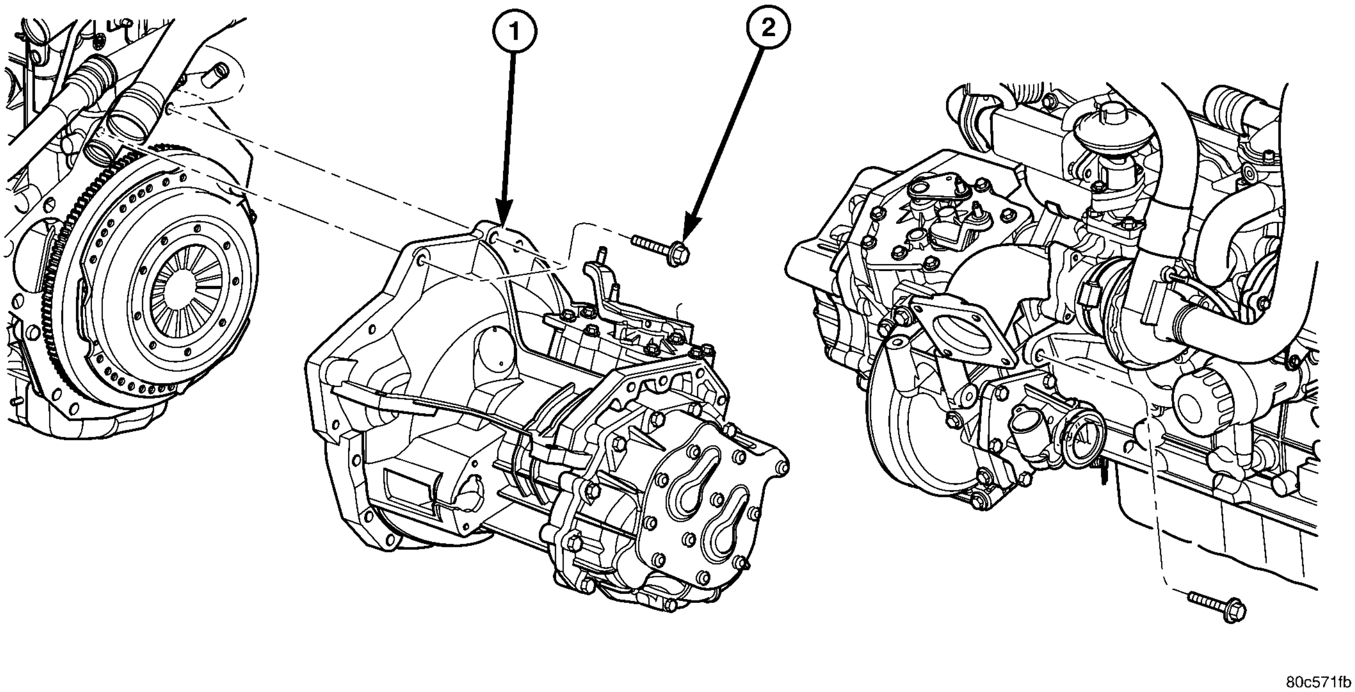


Fig. 25 Transaxle Removal/Installation

1 - TRANSAXLE
2 - BOLT

T850 MANUAL TRANSAXLE (Continued)

DISASSEMBLY

(1) Remove clutch release lever and bearing (Fig. 26). Inspect release lever pivot balls and replace if necessary (Fig. 27). Use slide hammer C-3752 and remover/installer 6891 (Fig. 28) if pivot ball replacement is necessary.

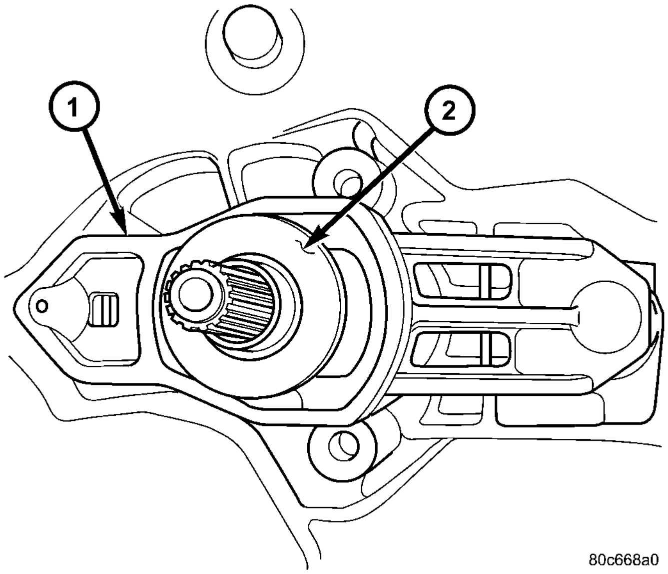


Fig. 26 Release Bearing and Lever

1 - RELEASE LEVER
2 - RELEASE BEARING

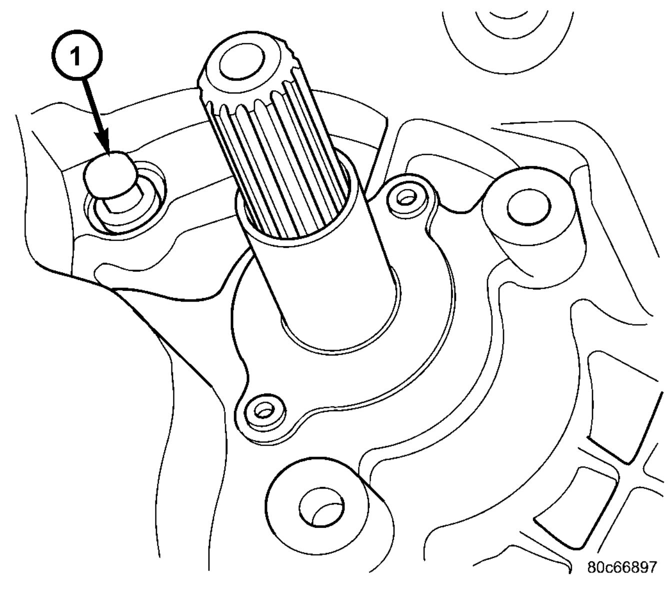


Fig. 27 Pivot Ball Orientation

1 - PIVOT BALL (1)

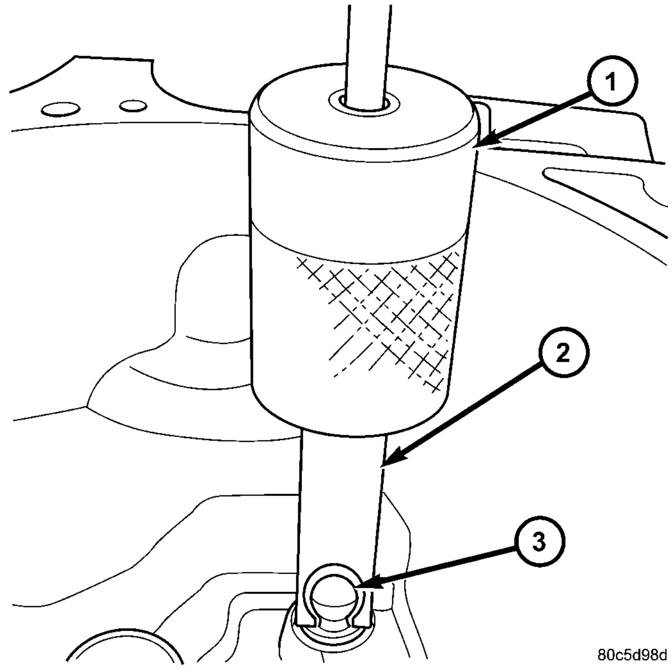


Fig. 28 Pivot Ball Removal/Installation

1 - C-3752 SLIDE HAMMER
2 - REMOVER/INSTALLER 6891
3 - PIVOT BALL

(2) Remove input shaft bearing retainer (Fig. 29).

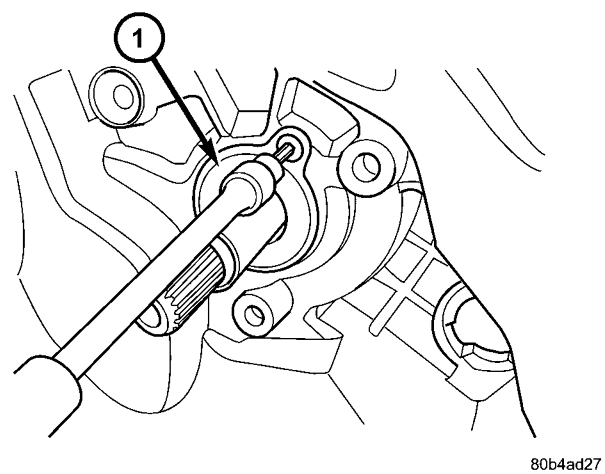


Fig. 29 Input Bearing Retainer

1 - INPUT BEARING RETAINER

NOTE: Place transaxle in neutral before shift cover removal. It may be necessary to remove selector lever from cover to gain access to and remove one fastener.

T850 MANUAL TRANSAXLE (Continued)

(3) Remove shift cover-to-case bolts and remove shift cover assembly (Fig. 30).

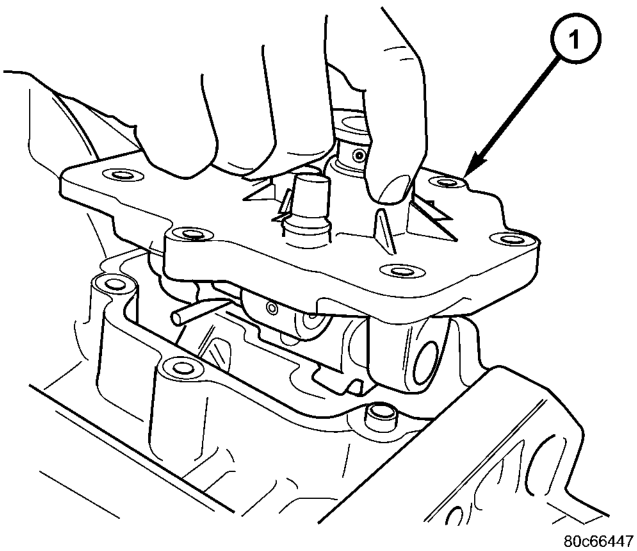


Fig. 30 Shift Cover Removal/Installation

1 - SHIFT COVER ASSEMBLY

(4) Using a suitable screwdriver, remove and discard extension housing axle oil seal (Fig. 31).

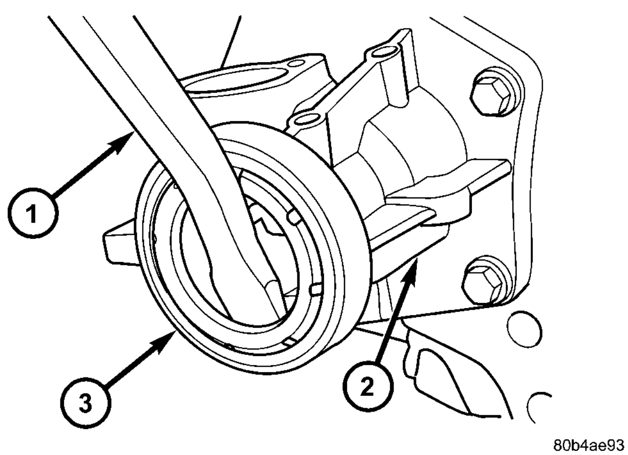


Fig. 31 Extension Housing Seal

1 - SCREWDRIVER
2 - EXTENSION HOUSING
3 - SEAL - DISCARD UPON REMOVAL

(5) Remove extension housing-to-case and differential cover bolts (Fig. 32).

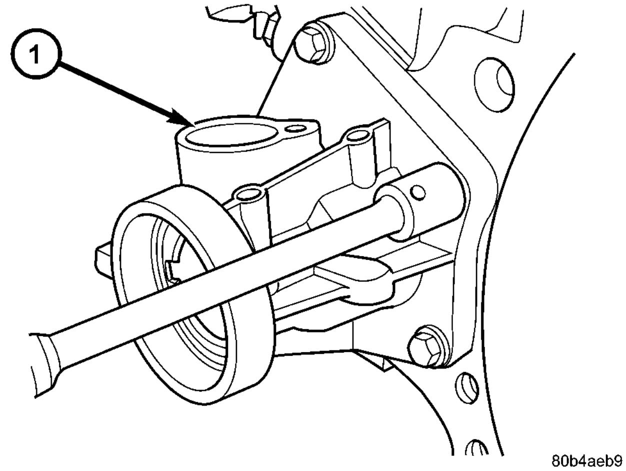


Fig. 32 Extension Housing-to-Case Bolts

1 - EXTENSION HOUSING

(6) Place transaxle with bellhousing surface down.
(7) Remove backup lamp switch (Fig. 33).

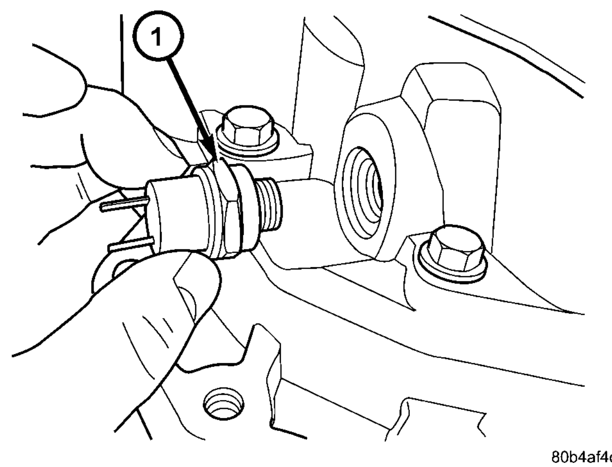


Fig. 33 Back-Up Lamp Switch — Typical

1 - BACK-UP LAMP SWITCH

T850 MANUAL TRANSAXLE (Continued)

(8) Remove end plate (Fig. 34).

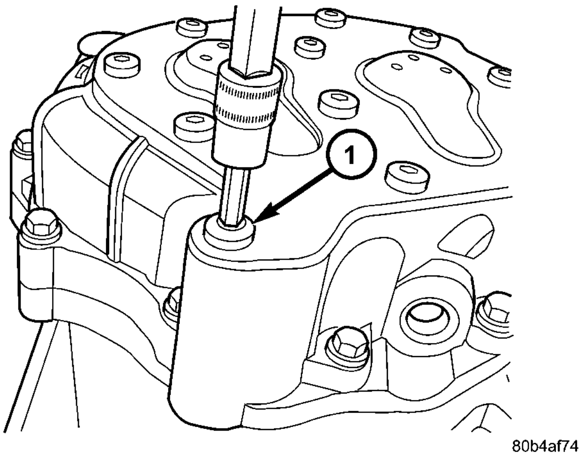


Fig. 34 End Plate Bolts

1 - BOLT (11)

(9) Set up lifting bar (tool 8489) as shown in (Fig. 35).

(10) Lift up on bar (input shaft bearing side) and remove input shaft bearing snap ring.

(11) Lift up on bar (intermediate shaft side) and remove intermediate shaft bearing snap ring.

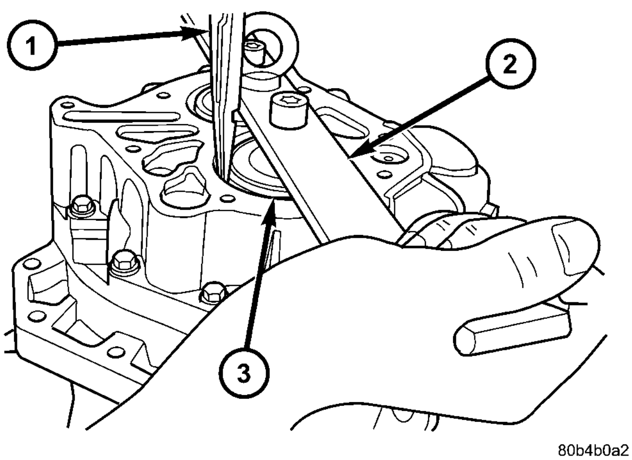


Fig. 35 Input Bearing Snap Ring

1 - SNAP RING PLIERS
2 - LIFTING BAR 8489
3 - SNAP RING

(12) Remove lifting bar 8489.

(13) Remove end cover-to-case bolts (12) (Fig. 36).

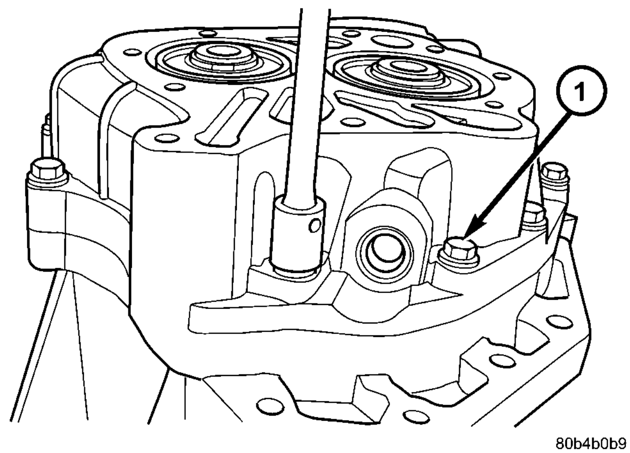


Fig. 36 End Cover Bolts

1 - BOLT (12)

(14) Remove end cover from transaxle (Fig. 37).

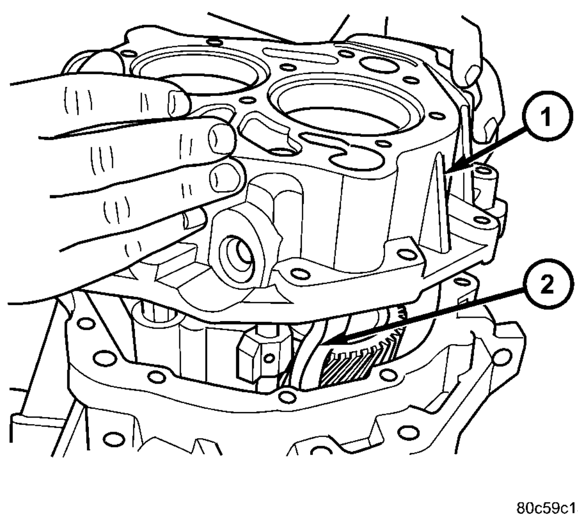


Fig. 37 End Cover Removal/Installation

1 - END COVER
2 - OIL TROUGH

T850 MANUAL TRANSAXLE (Continued)

(15) Remove 3/4 shift rail bushing from end cover using slide hammer C-3752 and remover 6786 (Fig. 38).

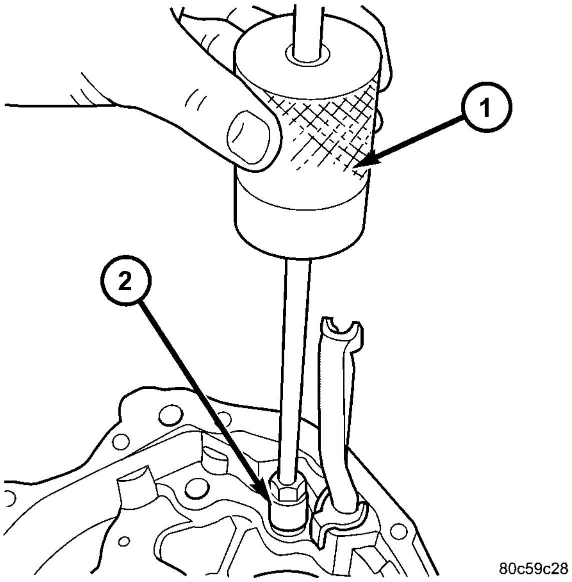


Fig. 38 3/4 Shift Rail Bushing Removal

1 - SLIDE HAMMER C-3752
2 - REMOVER 6786

(16) Remove intermediate shaft bearing snap ring (Fig. 39).

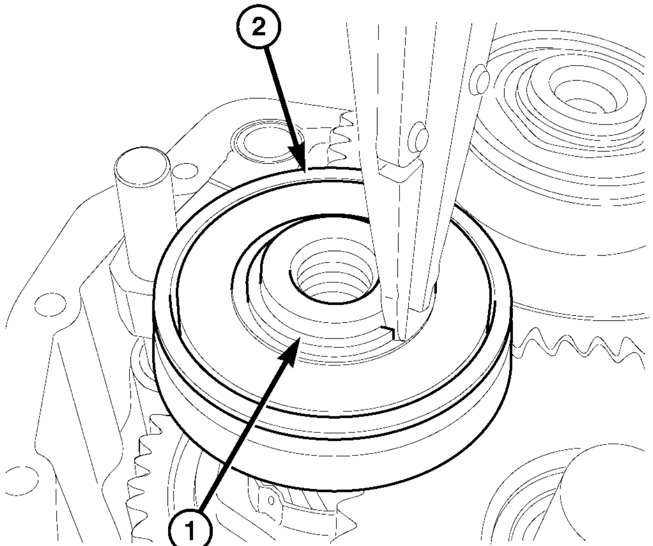


Fig. 39 Intermediate Shaft Bearing Snap RIng

1 - SNAP RING
2 - INTERMEDIATE SHAFT BEARING

(17) Remove intermediate shaft bearing using Puller 1026 (Fig. 40).

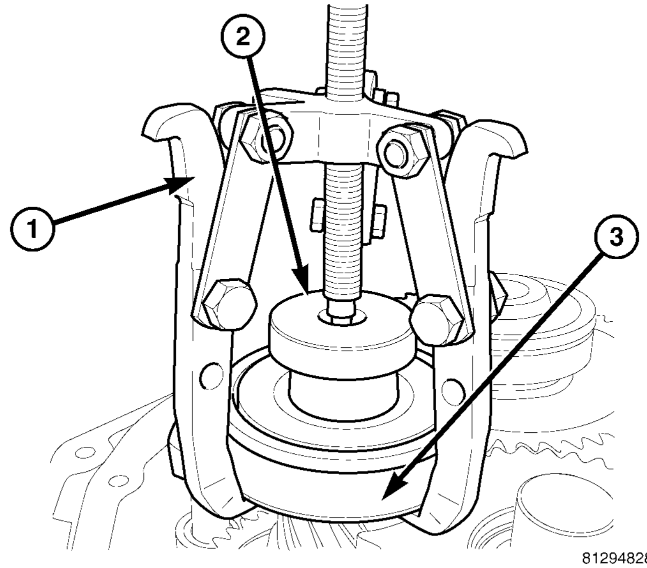


Fig. 40 Intermediate Shaft Bearing Removal

1 - PULLER 1026
2 - ADAPTER
3 - INTERMEDIATE SHAFT BEARING

(18) Remove reverse idler outer washer (Fig. 41).

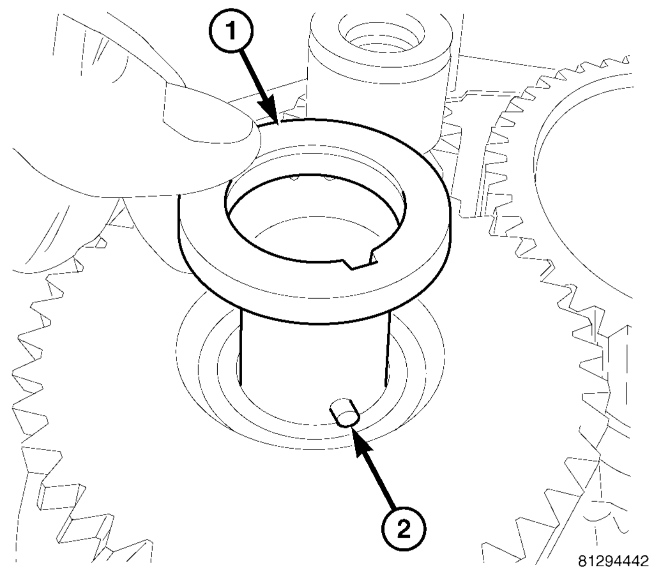


Fig. 41 Outer Washer Removal/Installation

1 - OUTER WASHER
2 - PIN

T850 MANUAL TRANSAXLE (Continued)

(19) Remove reverse idler gear (Fig. 42).

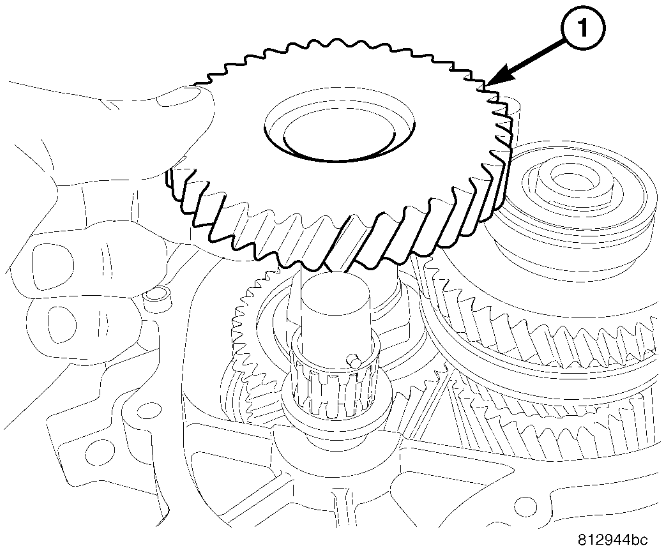


Fig. 42 Reverse Idler Gear Removal/Installation

1 - REVERSE IDLER GEAR

(20) Remove reverse idler needle bearing (Fig. 43).

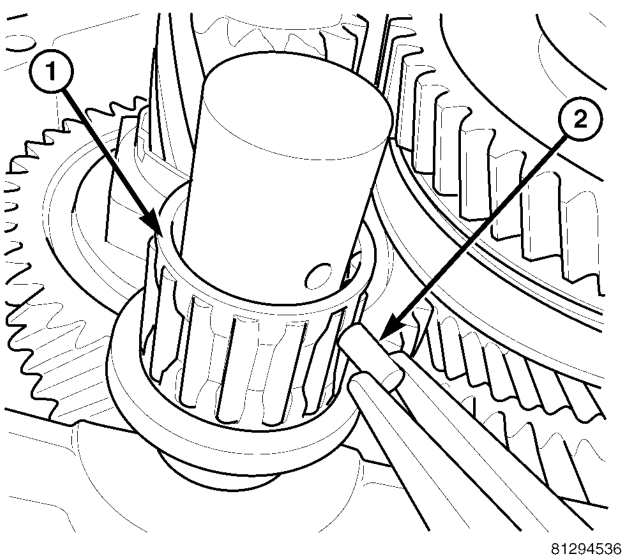


Fig. 43 Outer Pin and Needle Bearing

1 - PIN (2)
2 - BEARING

(21) Remove inner washer and pin (Fig. 44) (Fig. 45).

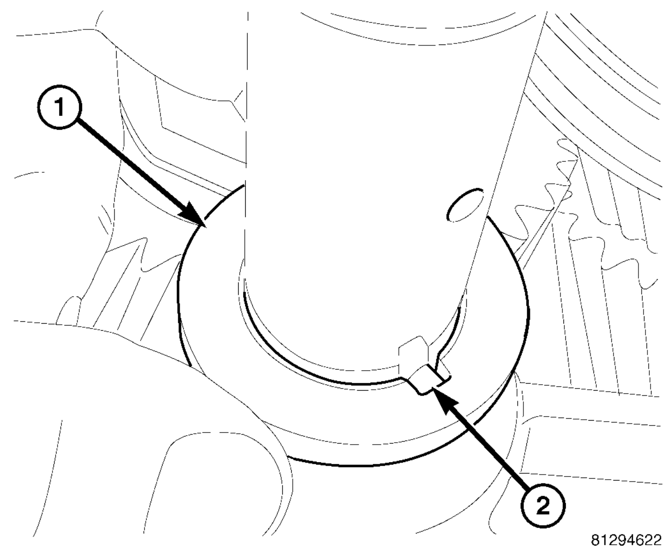


Fig. 44 Inner Washer Removal/Installation

1 - WASHER
2 - PIN

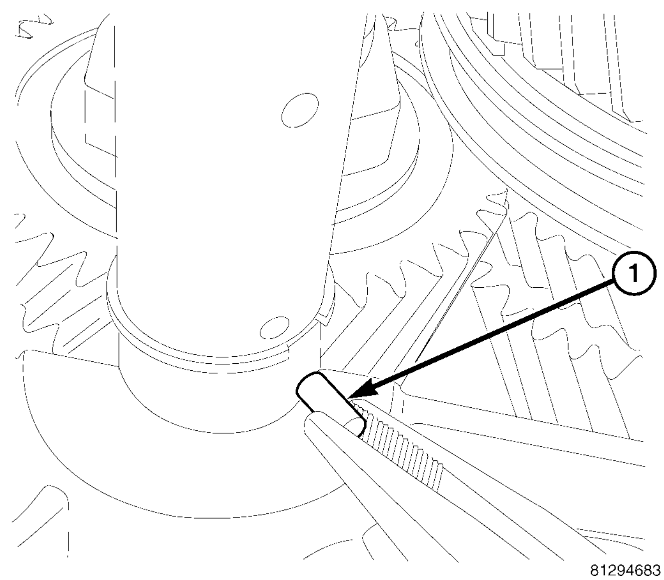


Fig. 45 Inner Pin Removal/Installation

1- PIN (2)

T850 MANUAL TRANSAXLE (Continued)

(22) Remove reverse idler shaft (Fig. 46).

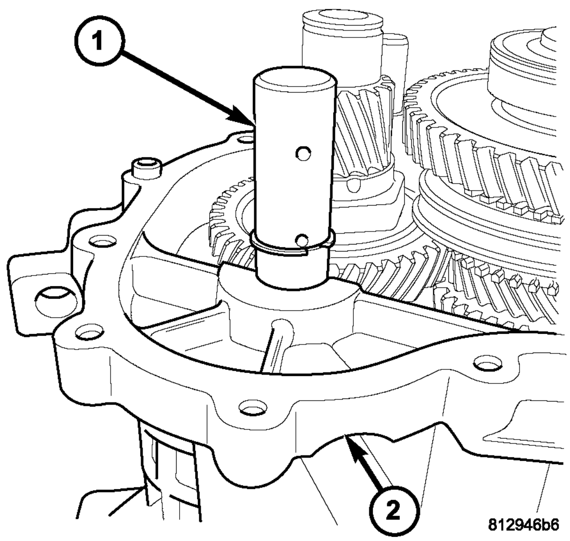


Fig. 46 Reverse Shaft Removal/Installation

1 - SHAFT (w/SNAP RING)
2 - BOLT

(23) Remove 1-2/5-R shift rail (Fig. 47).

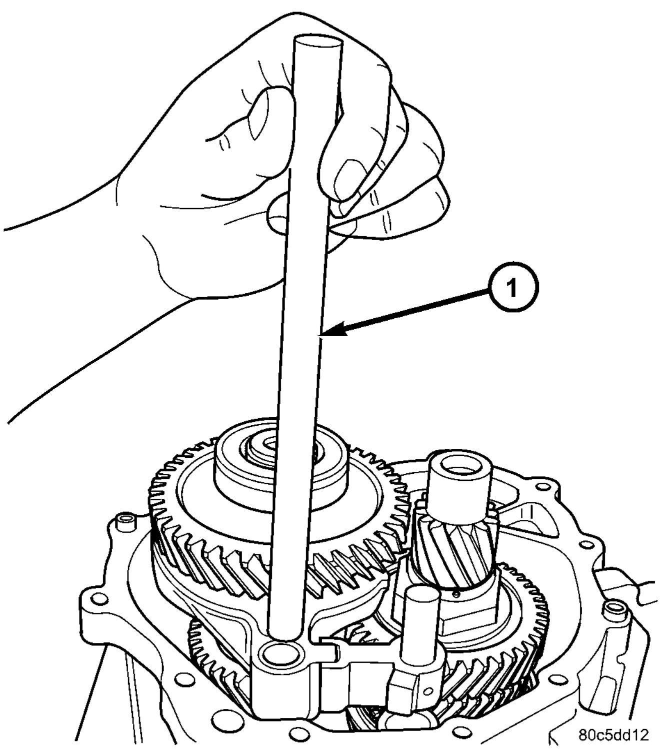


Fig. 47 1/2-5/R Shift Rail Removal/Installation

1 - 1/2-5/R SHIFT RAIL

(24) Install lifting bar 8489.

(25) Lift geartrain (w/reverse idler gear assy.) out of transaxle and install on fixture 8487 (Fig. 48).

(26) Remove remaining shift rail and forks from geartrain (Fig. 48).

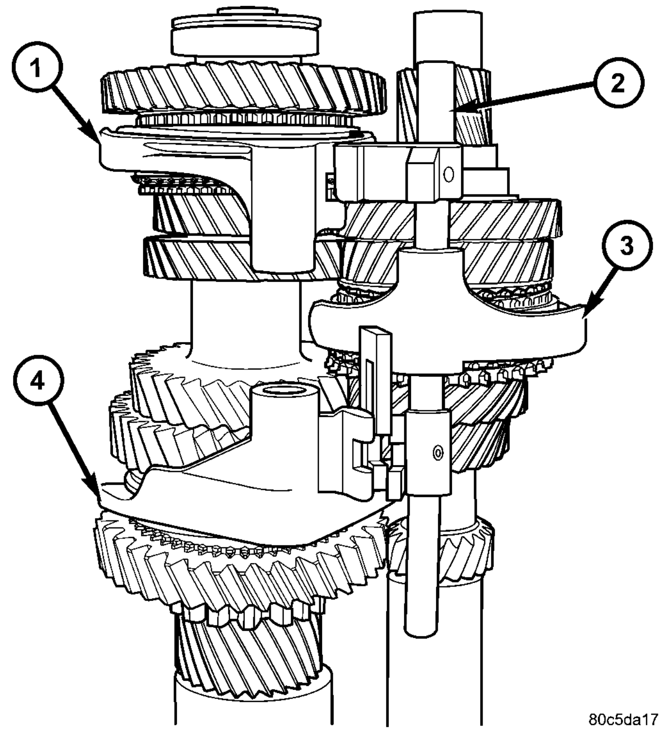


Fig. 48 Shift Fork/Rail Orientation

1 - 5/R FORK
2 - 3/4 RAIL ASSEMBLY
3 - 3/4 FORK
4 - 1/2 FORK

(27) Remove lifting bar from geartrain.

NOTE: At this point, differential bearing turning torque should be measured to ensure proper shim selection upon reassembly.

(28) Reinstall and torque extension housing and measure differential turning torque. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/DIFFERENTIAL - ADJUSTMENTS)

T850 MANUAL TRANSAXLE (Continued)

(29) Remove impact blocker (if equipped) (Fig. 49).

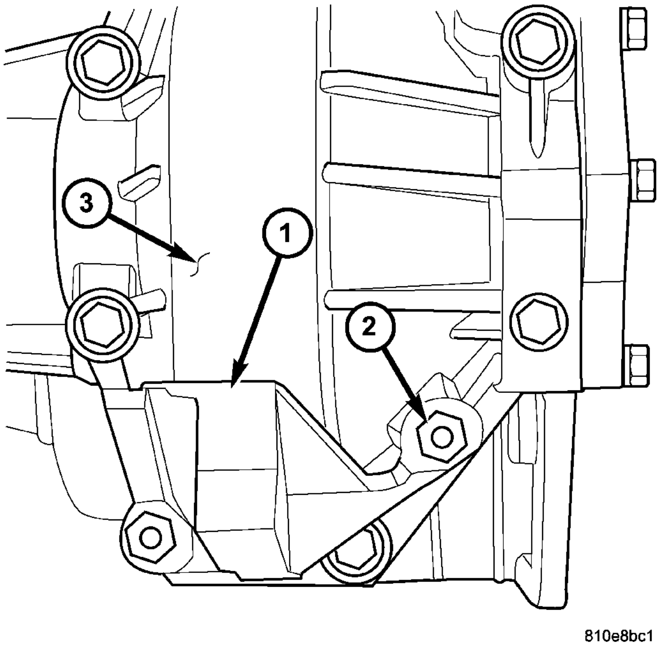


Fig. 49 Impact Blocker (SRT-4 Models)

1 - IMPACT BLOCKER (SRT-4 Models)
2 - NUT (2)
3 - DIFFERENTIAL COVER

(30) Remove differential cover bolts.

(31) Remove differential cover. If necessary, use a soft tipped hammer to aid in removal.

(32) Remove extension housing.

(33) Remove differential assembly. Note orientation of shim, oil slinger, and differential side bearing races (Fig. 50).

(34) Remove differential chip collector magnet and clean (Fig. 51). **Magnet is adhered with RTV, and may require force to remove.**

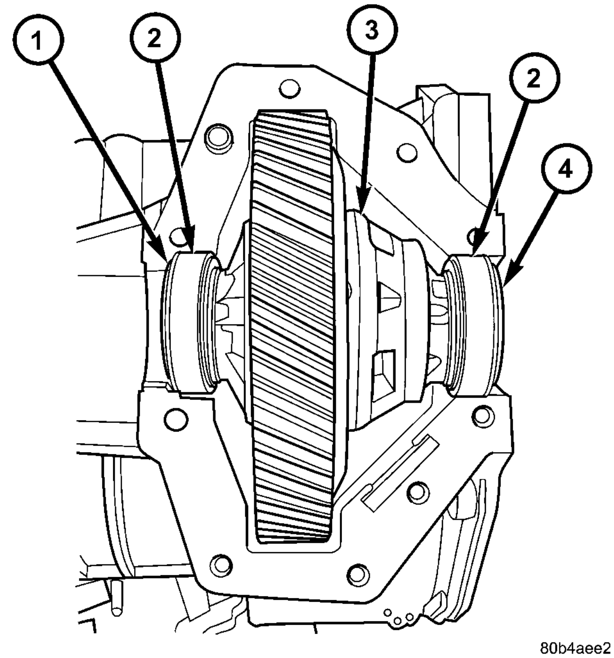


Fig. 50 Differential Shim/Slinger Orientation

1 - SLINGER
2 - BEARING RACE
3 - DIFFERENTIAL ASSEMBLY
4 - SHIM (SELECT)

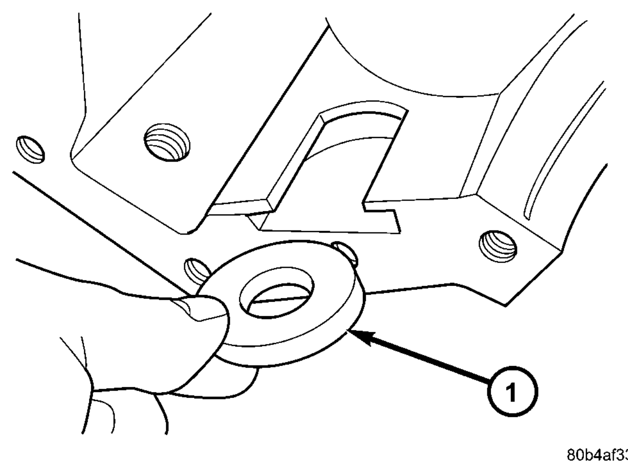


Fig. 51 Differential Magnet

1 - MAGNET

T850 MANUAL TRANSAXLE (Continued)

(35) Remove intermediate shaft bearing race with puller 8472 (Fig. 52).

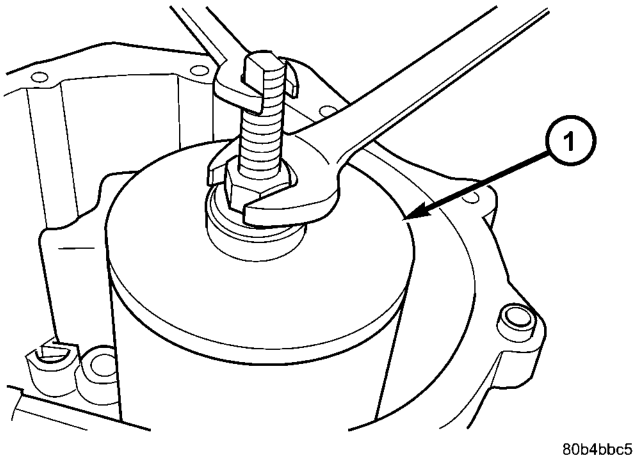


Fig. 52 Intermediate Shaft Bearing Race Removal

1 - REMOVER 8472

(36) Remove shift rail bushing from case with remover 6786 and slide hammer C-3752 (Fig. 53).

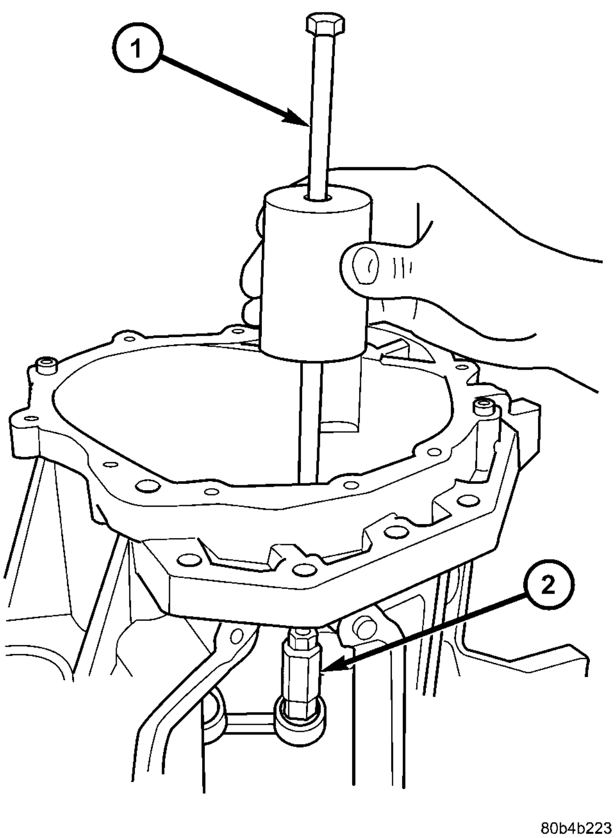


Fig. 53 Shift Rail Bushing Removal

1 - SLIDE HAMMER C-3752
2 - REMOVER 6786

(37) Remove input shaft bearing using an arbor press and tool 8474 (Fig. 54).

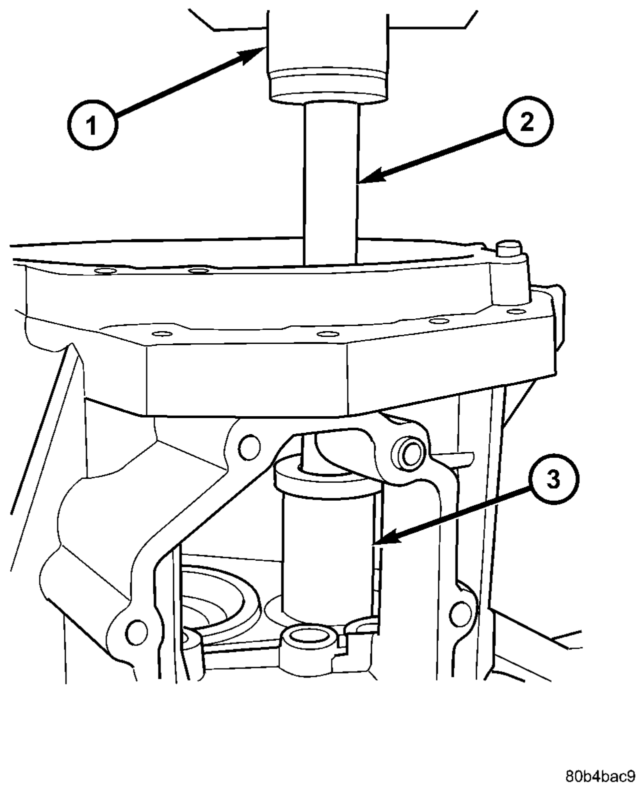


Fig. 54 Input Shaft Bearing Removal

1 - ARBOR PRESS
2 - DRIVER HANDLE C-4171
3 - REMOVER/INSTALLER 8474

T850 MANUAL TRANSAXLE (Continued)

ASSEMBLY

NOTE: When assembling this transaxle, always use NEW snap rings.

NOTE: Before assembling transaxle, differential turning torque must be measured and adjusted. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/DIFFERENTIAL - ADJUSTMENTS). Differential turning torque must be measured with geartrain out of case.

(1) Install input shaft bearing using an arbor press and remover/installer 8474 (Fig. 55).

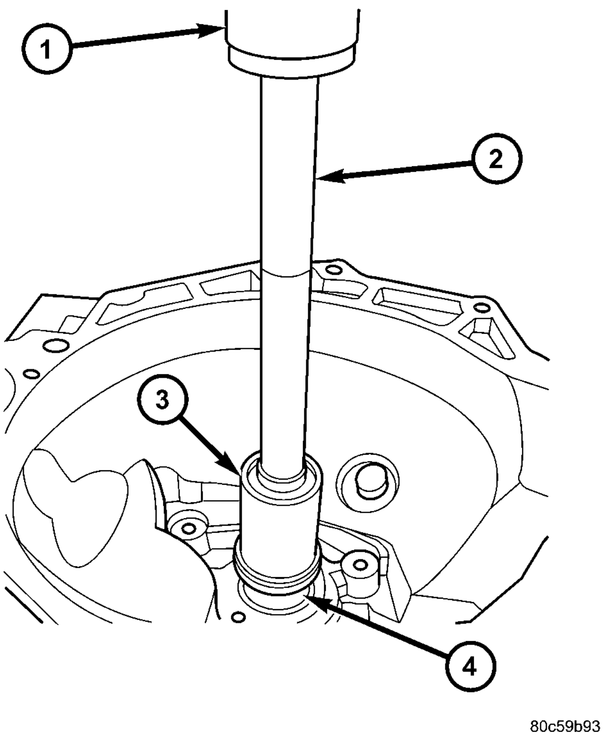


Fig. 55 Input Shaft Bearing Installation

1 - ARBOR PRESS
2 - C-4171 DRIVER HANDLE
3 - REMOVER/INSTALLER 8474
4 - INPUT SHAFT BEARING

(2) Install shift shaft bushing to case using installer 8475 (Fig. 56).

(3) Install intermediate shaft bearing race to case with an arbor press, driver handle C-4171, and installer 8471 (Fig. 57). Press until installer 8471 bottoms on transaxle case.

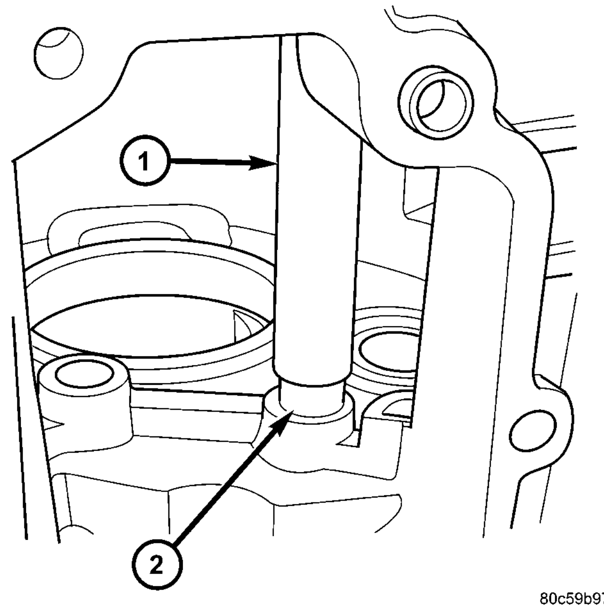


Fig. 56 Shift Shaft Bushing Installation

1 - INSTALLER 8475
2 - SHIFT SHAFT BUSHING

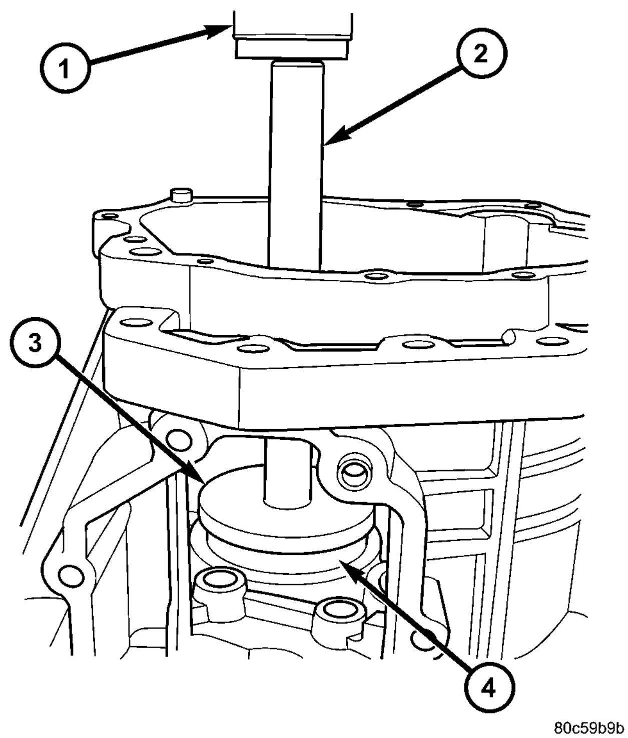


Fig. 57 Install Intermediate Shaft Bearing Race

1 - ARBOR PRESS
2 - DRIVER HANDLE C-4171
3 - INSTALLER 8471
4 - INTERMEDIATE SHAFT BEARING RACE

T850 MANUAL TRANSAXLE (Continued)

NOTE: If input shaft assembly was not disassembled, it is necessary to remove input shaft sealed ball bearing before assembling transaxle. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/INPUT SHAFT - DISASSEMBLY)

(4) Install assembled input and intermediate shafts to fixture 8487 (Fig. 58).

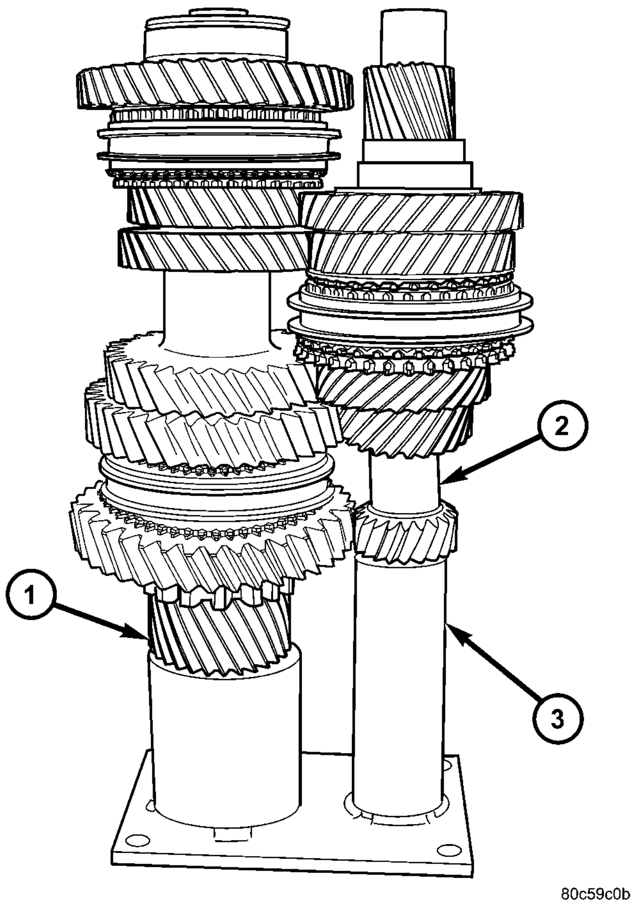


Fig. 58 Install Geartrain to Fixture 8487

1 - INTERMEDIATE SHAFT
2 - INPUT SHAFT
2 - FIXTURE 8487

(5) Install shift forks and 3/4 rail assembly to geartrain as shown in (Fig. 59).

NOTE: Before installing geartrain, make sure that input shaft sealed roller bearing is not installed, otherwise reverse idler assembly installation will be difficult. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/INPUT SHAFT - DISASSEMBLY)

(6) Install lifting bar 8489 to geartrain. Install geartrain to case. **When installing geartrain to case, use care not to damage bearing surfaces.**

(7) Remove lifting bar 8489 from geartrain.

(8) Install shift 1/2-5/R rail as shown in (Fig. 60).

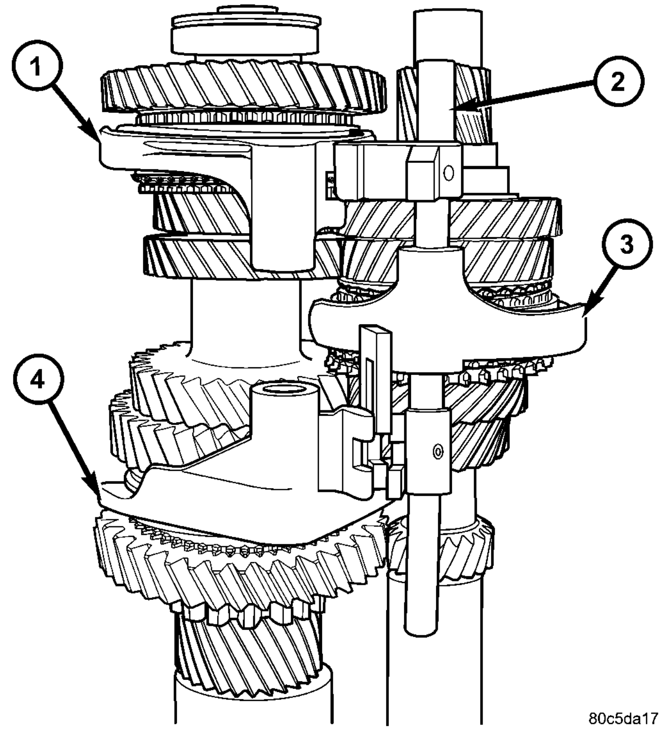


Fig. 59 Shift Fork/Rail Orientation

1 - 5/R FORK
2 - 3/4 RAIL ASSEMBLY
3 - 3/4 FORK
4 - 1/2 FORK

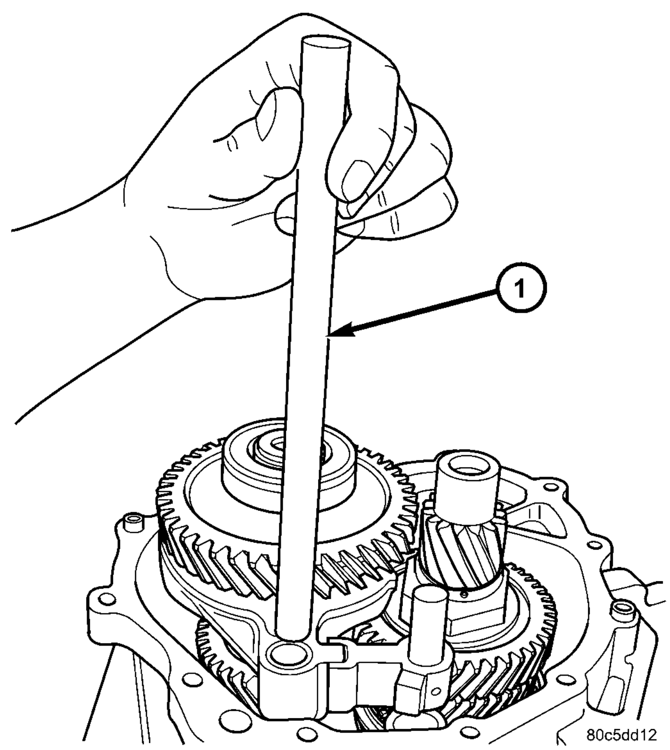


Fig. 60 Shift Rail Installation

1 - 1/2-5/R SHIFT RAIL

T850 MANUAL TRANSAXLE (Continued)

(9) Install reverse idler shaft into position (Fig. 61). Install and torque shaft-to-case bolt to 54 N·m (40 ft. lbs.).

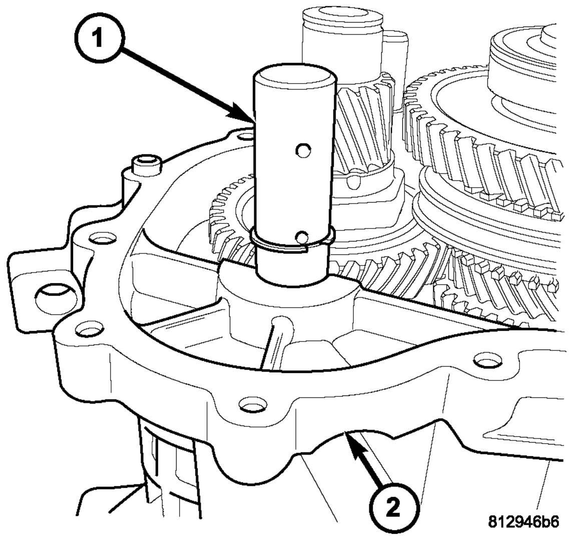


Fig. 61 Reverse Shaft Removal/Installation

1 - SHAFT (w/SNAP RING)
2 - BOLT

(10) Install inner pin (Fig. 62).

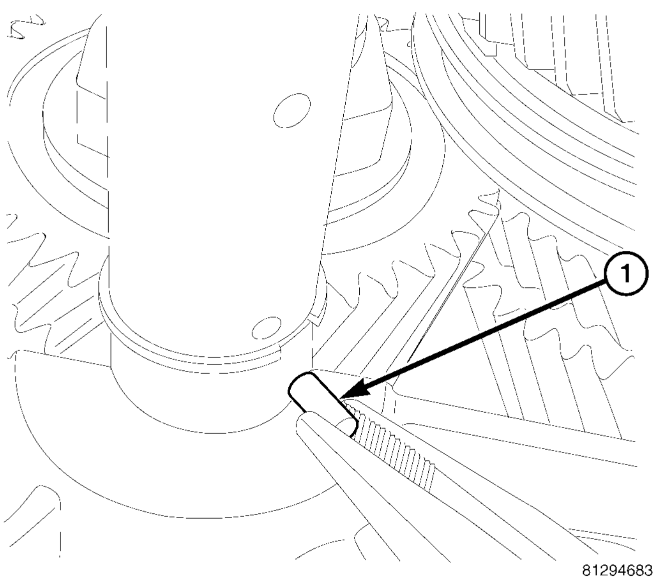


Fig. 62 Inner Pin Removal/Installation

1- PIN (2)

(11) Install inner washer (Fig. 63).

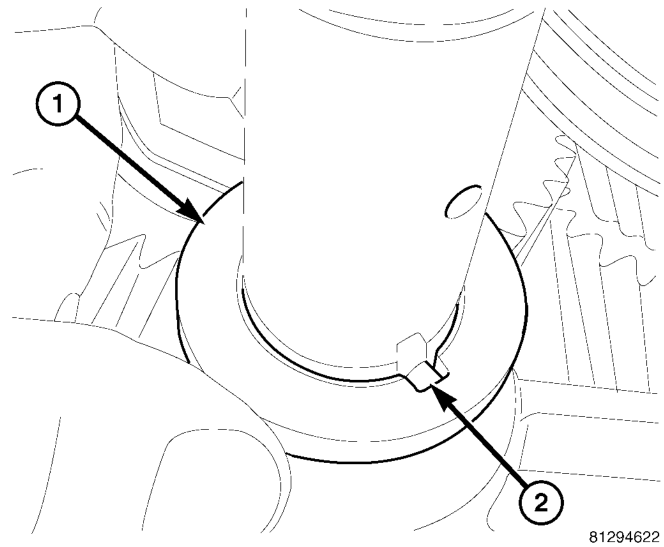


Fig. 63 Inner Washer Removal/Installation

1 - WASHER
2 - PIN

(12) Install needle bearing and outer pin (Fig. 64)

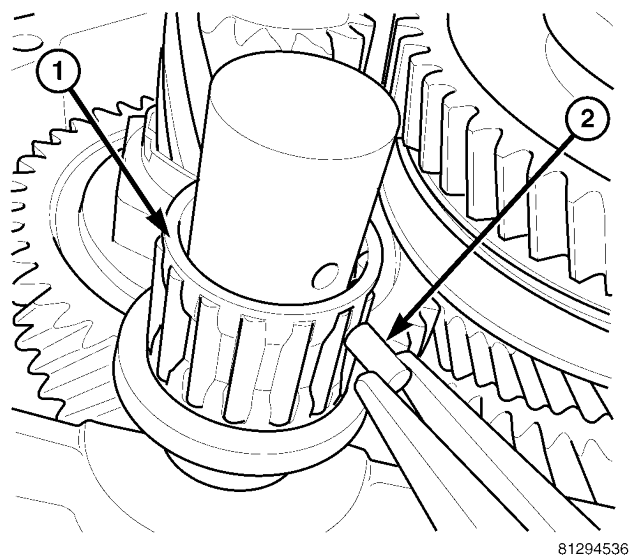


Fig. 64 Outer Pin and Needle Bearing

1 - PIN (2)
2 - BEARING

T850 MANUAL TRANSAXLE (Continued)

(13) Install reverse idler gear (Fig. 65).

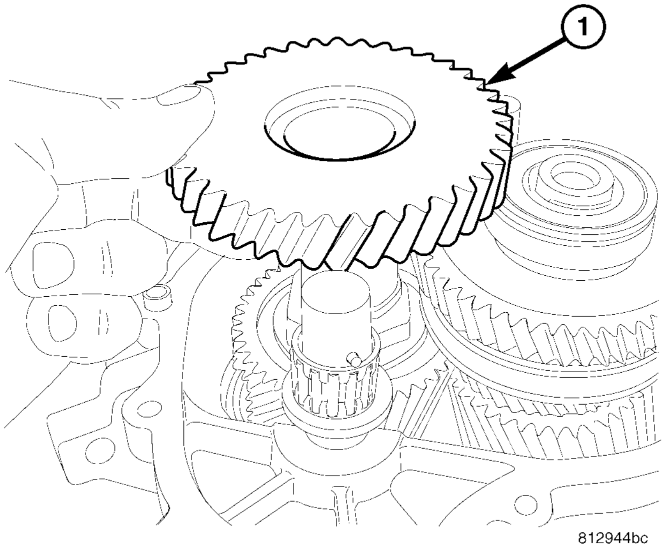


Fig. 65 Reverse Idler Gear Removal/Installation

1 - REVERSE IDLER GEAR

(14) Install outer washer (Fig. 66).

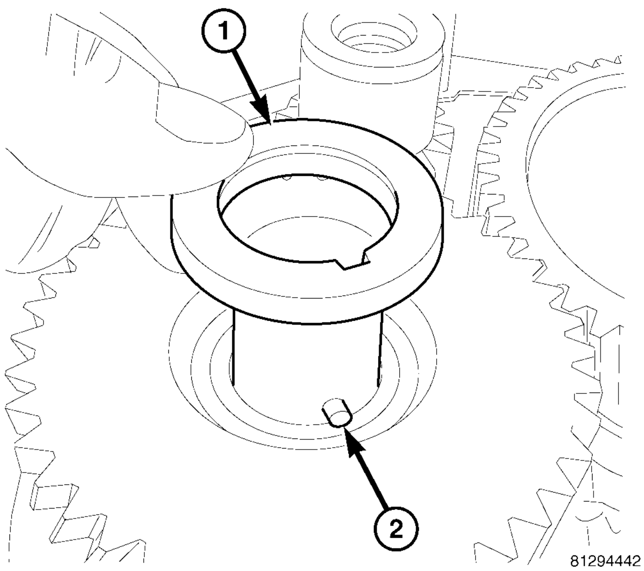


Fig. 66 Outer Washer Removal/Installation

1 - OUTER WASHER
2 - PIN

(15) Install input shaft sealed roller bearing using installer 8482 (Fig. 67).

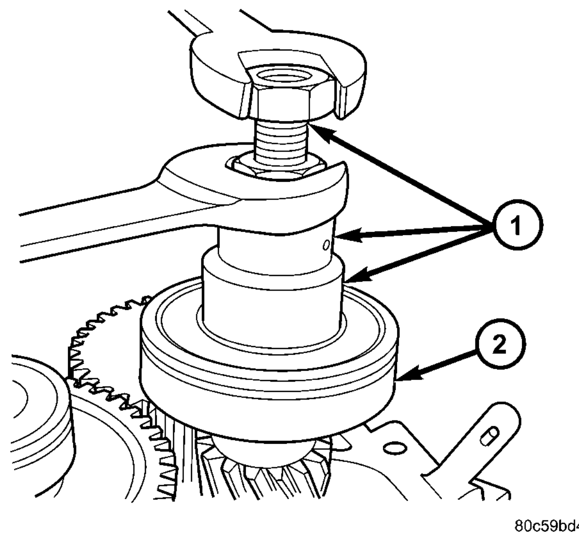


Fig. 67 Install Input Shaft Sealed Roller Bearing

1 - INSTALLER 8482
2 - SEALED ROLLER BEARING

(16) Install **new** input shaft bearing snap ring (Fig. 68).

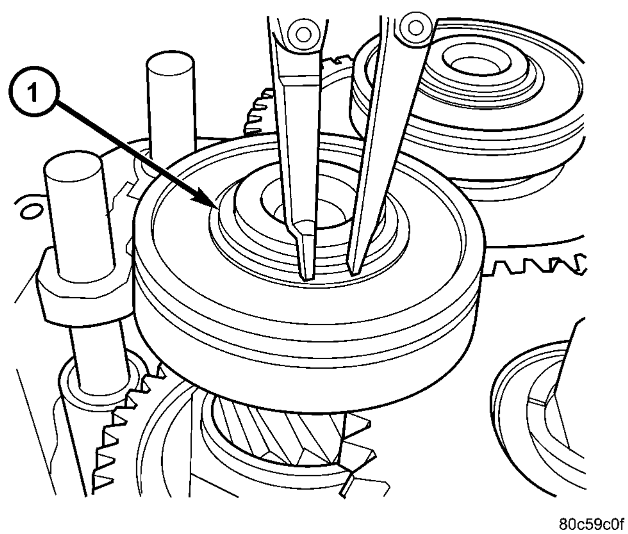


Fig. 68 Input Shaft Bearing Snap Ring

1 - SNAP RING

T850 MANUAL TRANSAXLE (Continued)

(17) Install shift rail bushing to end cover using installer 8475 (Fig. 69).

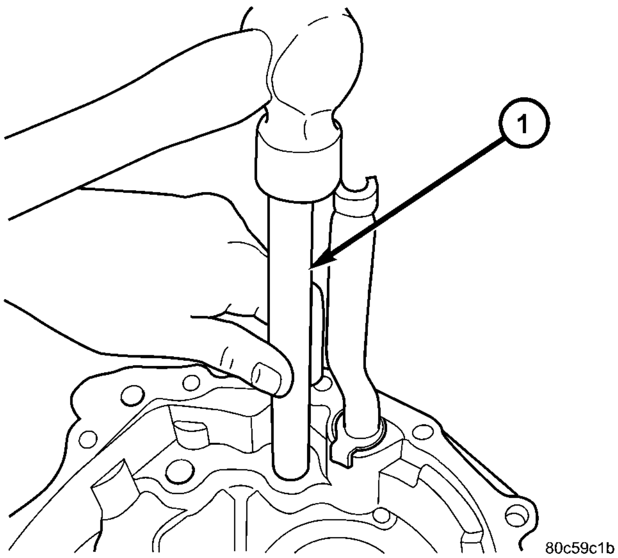


Fig. 69 Shift Rail Bushing Installation

1 - INSTALLER 8475

(18) Apply a 1 mm (0.04 in.) bead of Mopar® Gasket Maker to transaxle end cover and install to transaxle case (Fig. 70). **While installing end cover, be sure to guide oil trough into pocket (Fig. 71).** Torque end cover-to-case bolts to 28 N·m (250 in. lbs.) (Fig. 72).

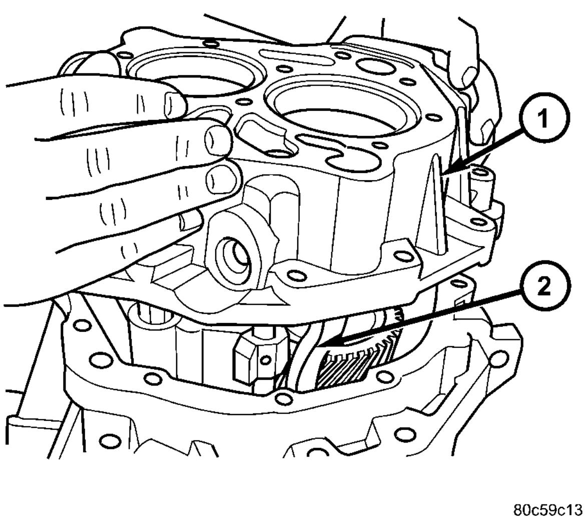


Fig. 70 End Cover Removal/Installation

1 - END COVER
2 - OIL TROUGH

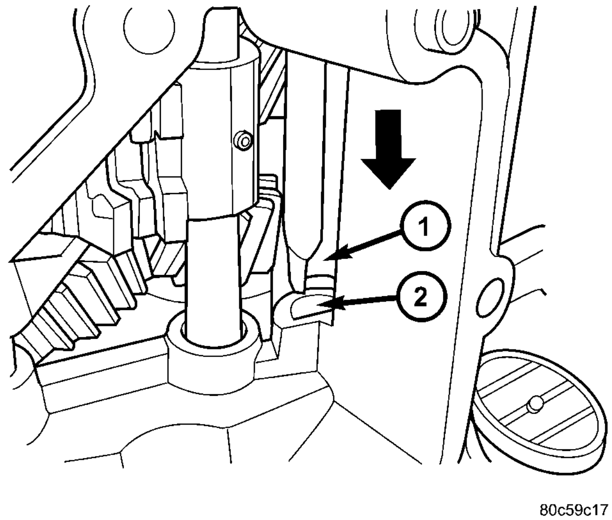


Fig. 71 Oil Trough Pocket

1 - OIL TROUGH
2 - POCKET

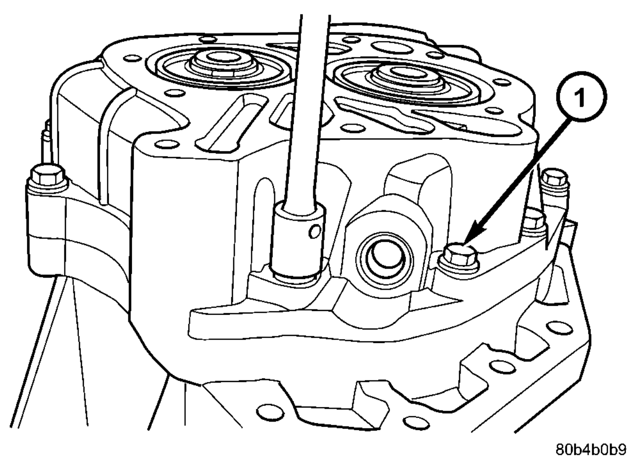


Fig. 72 End Cover Bolts

1 - BOLT (12)

T850 MANUAL TRANSAXLE (Continued)

(19) Install lifting bar 8489 to geartrain.

(20) Lift up on bar (input shaft side) and install input shaft bearing snap ring (Fig. 73).

(21) Lift up on bar (intermediate shaft side) and install intermediate shaft bearing snap ring.

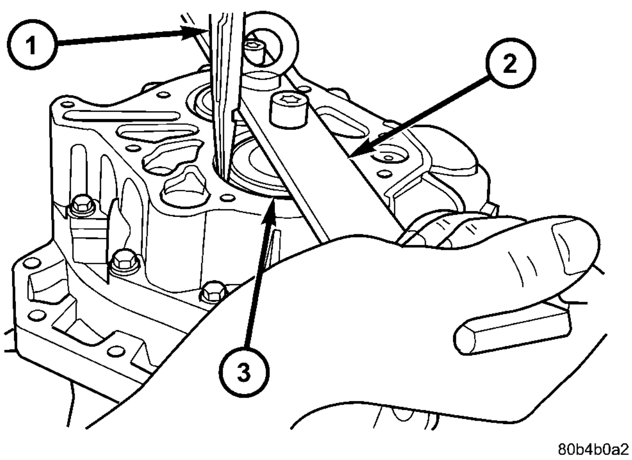


Fig. 73 Input Bearing Snap Ring

1 - SNAP RING PLIERS
2 - LIFTING BAR 8489
3 - SNAP RING

(22) Remove lifting bar 8489.

(23) Install a bead of Mopar® Gear Lube RTV to end plate and immediately install to case. Install and torque bolts to 28 N·m (250 in. lbs.) (Fig. 74).

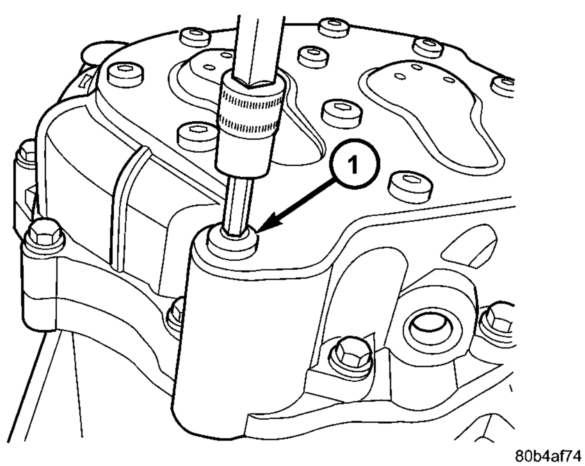


Fig. 74 End Cover Bolts

1 - BOLT (11)

(24) Install back up lamp switch. Use Tool 8827 and torque to 23 N·m (17 ft. lbs.) (Fig. 75).

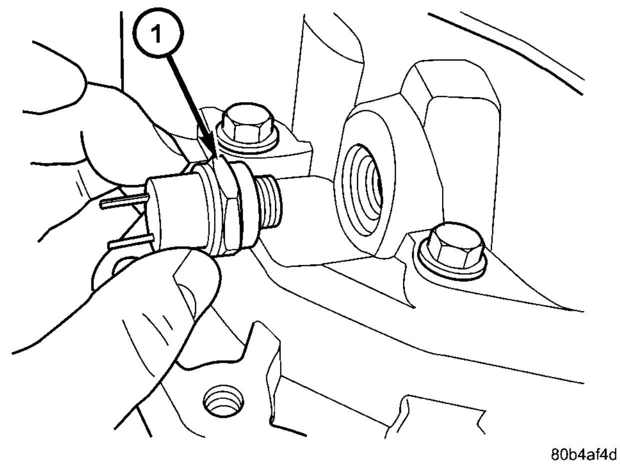


Fig. 75 Back-Up Lamp Switch — Typical

1 - BACK-UP LAMP SWITCH

(25) Roll transaxle assembly on side.

(26) Install differential chip collector magnet (Fig. 76). Retain to case with a dab of Mopar® Gear Lube RTV.

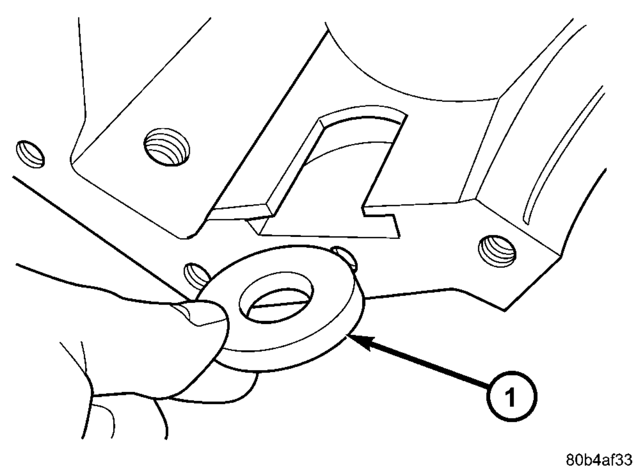


Fig. 76 Differential Magnet

1 - MAGNET

T850 MANUAL TRANSAXLE (Continued)

(27) Install differential assembly with bearing races and select shim (Fig. 77). Shim selection was determined before transaxle assembly (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/DIFFERENTIAL - ADJUSTMENTS).

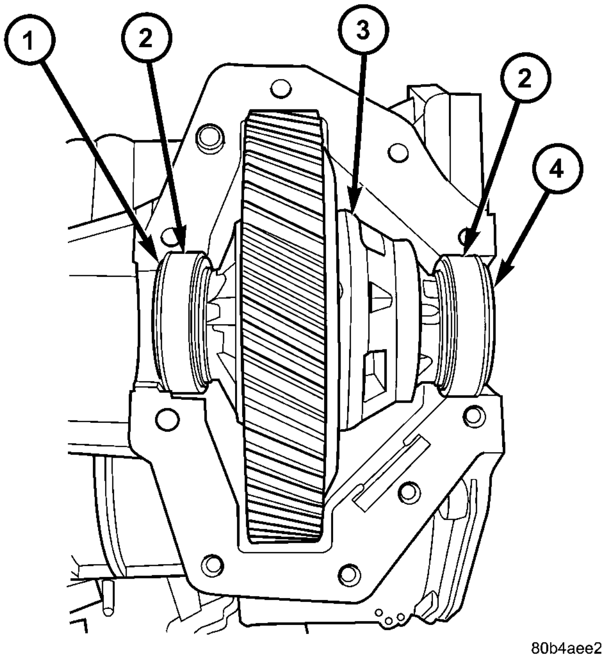


Fig. 77 Differential Shim/Slinger Orientation

1 - SLINGER
2 - BEARING RACE
3 - DIFFERENTIAL ASSEMBLY
4 - SHIM (SELECT)

(28) Install a 1 mm (0.04 in.) bead of Mopar® Gasket Maker to differential cover and install to case. Torque differential cover-to-case bolts to 54 N·m (40 ft. lbs.).

(29) Install a 1 mm (0.04 in.) bead of Mopar® Gasket Maker to extension housing. Install extension housing to differential cover and case and torque bolts to 28 N·m (250 in. lbs.) (Fig. 78).

(30) Install both axle **new** output shaft seals using driver handle C-4171 and installer 8476 (Fig. 79) (Fig. 80).

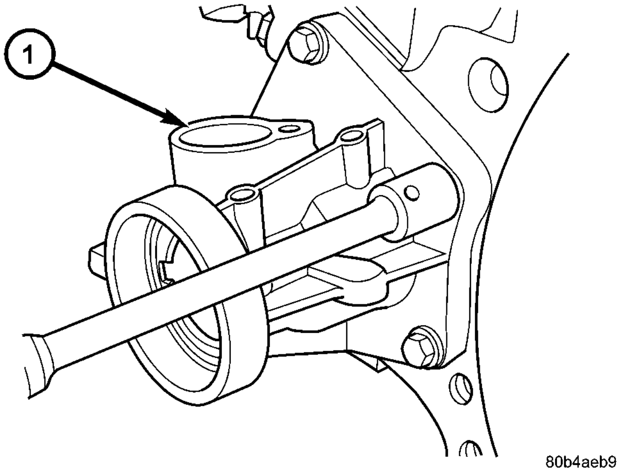


Fig. 78 Extension Housing-to-Case Bolts

1 - EXTENSION HOUSING

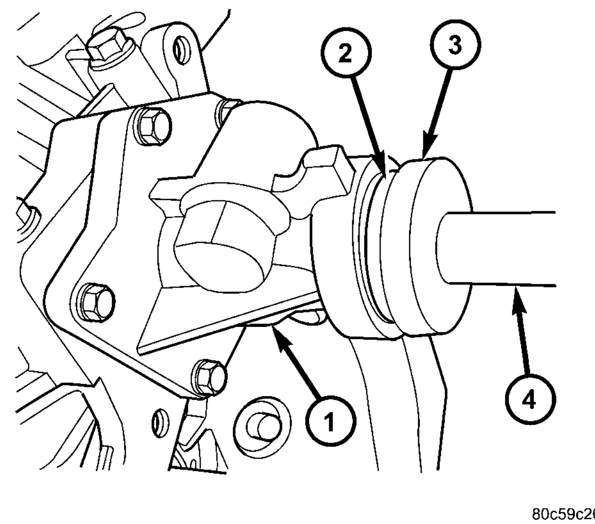


Fig. 79 Axle Seal Installation (Extension Housing Side)

1 - EXTENSION HOUSING
2 - SEAL
3 - INSTALLER 8476
4 - DRIVER HANDLE C-4171

T850 MANUAL TRANSAXLE (Continued)

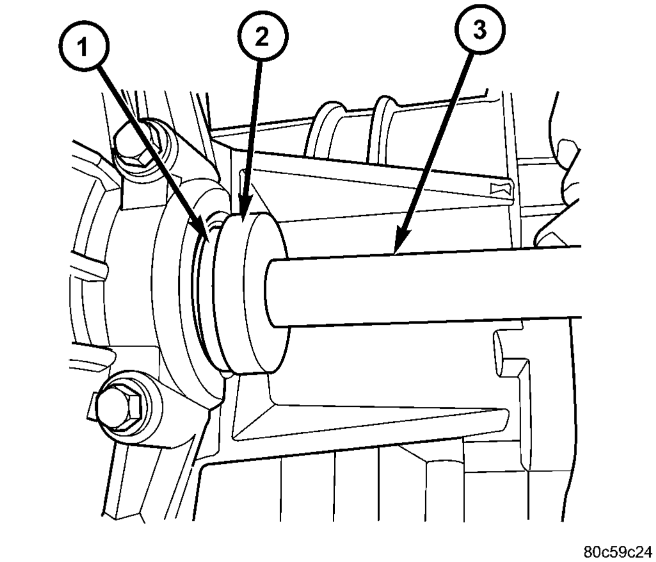


Fig. 80 Axle Seal Installation—Typical

1 - SEAL
2 - INSTALLER 8476
3 - DRIVER HANDLE C-4171

(31) Install impact blocker (If Equipped) (Fig. 81).

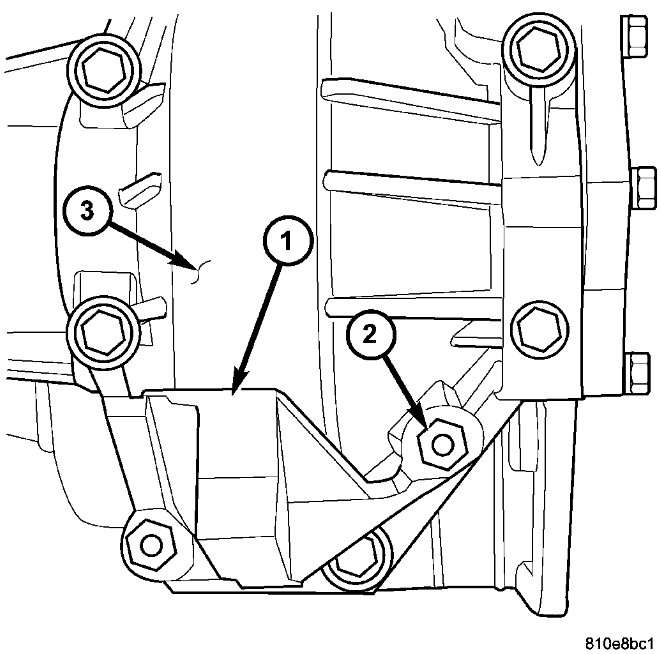


Fig. 81 Impact Blocker (SRT-4 Models)

1 - IMPACT BLOCKER (SRT-4 Models)
2 - NUT (2)
3 - DIFFERENTIAL COVER

(32) Apply a 1 mm (0.04 in.) bead of Mopar® Gasket Maker to shift cover assembly. Place shift cover and transaxle geartrain into neutral and install shift cover (Fig. 82) and torque bolts to 28 N·m (250 in. lbs.).

(33) Reinstall shift selector lever if previously removed.

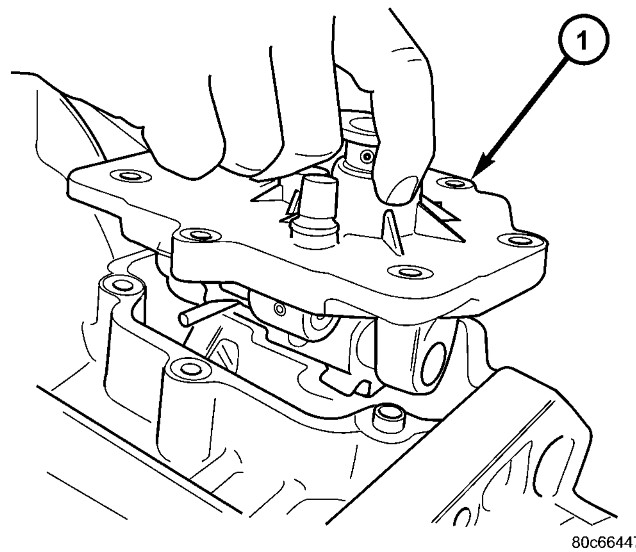


Fig. 82 Shift Cover Removal/Installation

1 - SHIFT COVER ASSEMBLY

(34) Install input shaft bearing retainer (Fig. 83). Torque bolts to 12 N·m (105 in. lbs.).

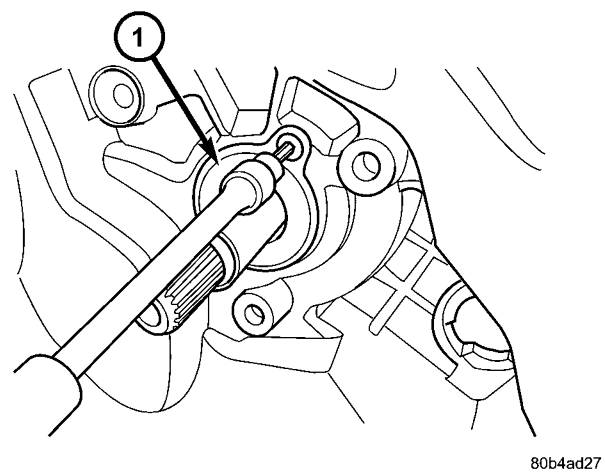


Fig. 83 Input Bearing Retainer

1 - INPUT BEARING RETAINER

T850 MANUAL TRANSAXLE (Continued)

(35) If previously removed, install clutch release lever pivot ball(s) using slide hammer C-3752 and remover/installer 6891 (Fig. 84) (Fig. 85).

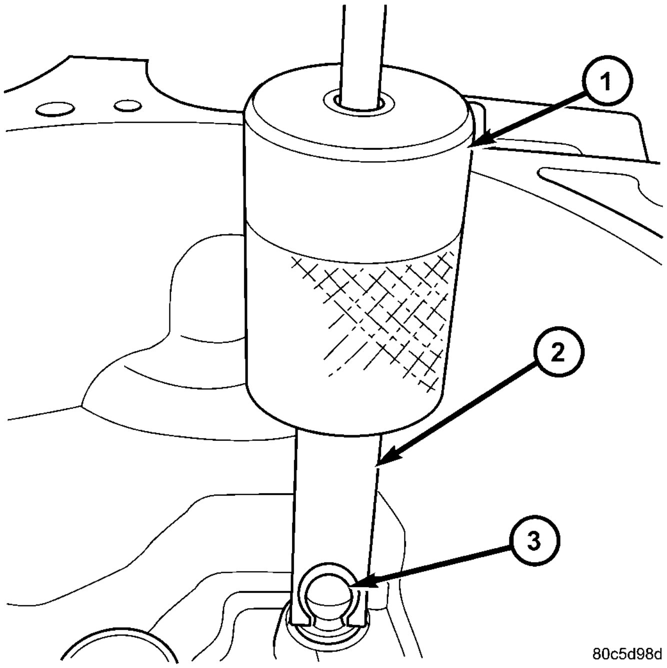


Fig. 84 Pivot Ball Removal/Installation

1 - C-3752 SLIDE HAMMER
2 - REMOVER/INSTALLER 6891
3 - PIVOT BALL

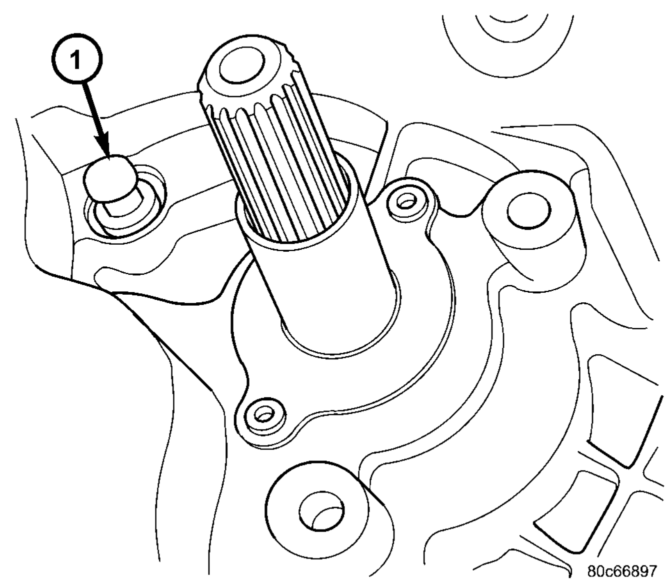


Fig. 85 Pivot Ball Position

1 - PIVOT BALL (1)

(36) Install clutch release bearing to lever. Apply grease to interface (contact) points. Make sure release bearing retainers engage lever pocket as shown in (Fig. 86).

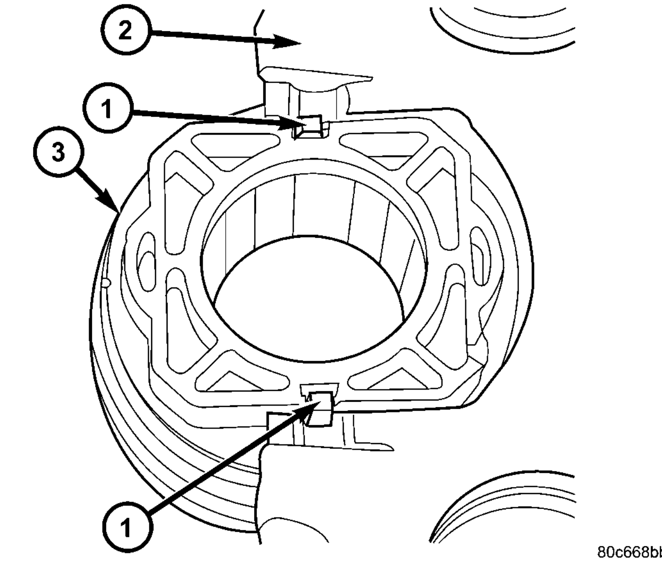


Fig. 86 Release Bearing-to-Lever

1 - RETAINER (2)
2 - RELEASE LEVER
3 - RELEASE BEARING

(37) Apply grease to pivot ball(s), and on release lever at slave cylinder contact point.

(38) Install clutch release bearing/lever assembly into position by sliding bearing onto input bearing retainer, and using moderate hand pressure to seat release lever to pivot ball (Fig. 87). A “pop” sound should be heard. Verify proper engagement by lightly pulling outward on lever at pivot ball location, and then actuating lever and bearing to ensure proper operation.

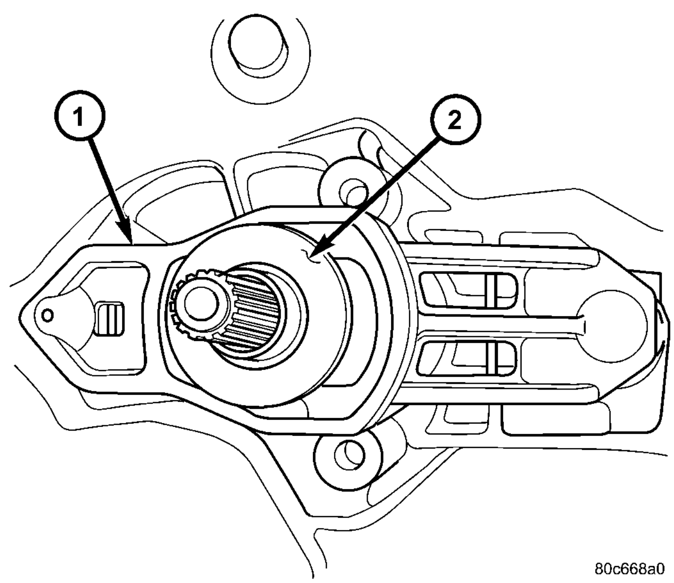


Fig. 87 Release Bearing and Lever

1 - RELEASE LEVER
2 - RELEASE BEARING

T850 MANUAL TRANSAXLE (Continued)

INSTALLATION

INSTALLATION - 2.4L GAS

(1) Install modular clutch assembly to transaxle. Assemble transaxle to engine.

(2) Install and torque transaxle-to-engine bolts to 95 N·m (70 ft. lbs.).

(3) Raise transaxle/engine assembly into position and install upper mount through-bolt. Torque through-bolt to 75 N·m (55 ft. lbs.).

(4) Remove screw jack.

(5) Install and torque modular clutch assembly-to-drive plate bolts to 88 N·m (65 ft. lbs.)

(6) Install structural collar.

(7) Connect back-up lamp switch connector.

(8) Install starter motor into position (Fig. 88). Install and torque bolts to 54 N·m (40 ft. lbs.).

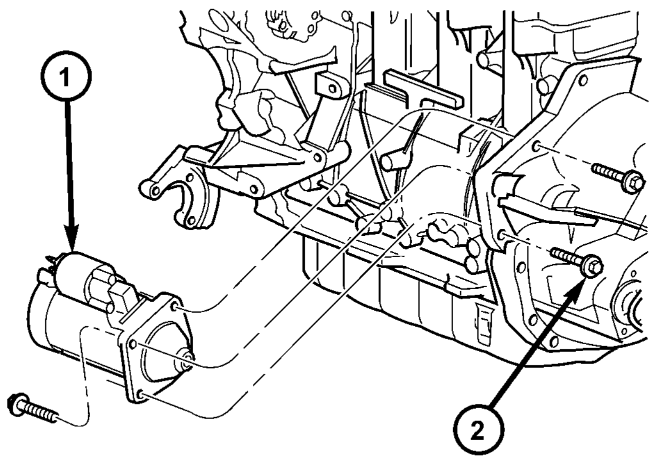


Fig. 88 Starter Motor Removal/Installation

1 - STARTER MOTOR
2 - BOLT (3)

(9) Install engine front mount bracket. Install and torque bracket-to-transaxle bolts to 102 N·m (75 ft. lbs.). Install and torque bracket-to-engine bolts to 68 N·m (50 ft. lbs.). Torque through-bolt and nut to 68 N·m (50 ft. lbs.).

(10) Install clutch slave cylinder into position, noting orientation of different sized lugs (Fig. 89). While depressing inward, rotate slave cylinder clockwise 60®° into position until nylon locating tab rests within transaxle case cutout, and hydraulic tube is vertical. Connect “quick-connect” connection until an audible “click” is heard. Verify connection by pulling outward on connection.

(11) Install halfshafts and front wheel/tire assemblies. (Refer to 3 - DIFFERENTIAL & DRIVELINE/ HALF SHAFT - INSTALLATION)

(12) Lower vehicle.

(13) Install right mount bracket to transaxle (Fig. 90).

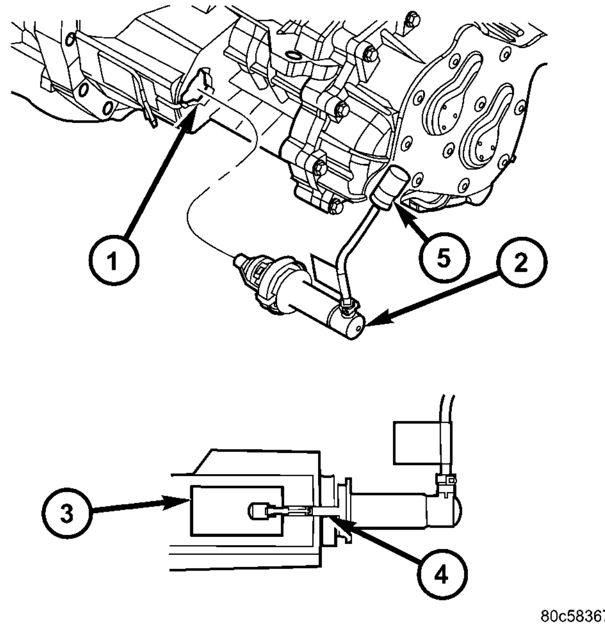


Fig. 89 Slave Cylinder Removal/Installation

1 - MOUNTING HOLE
2 - SLAVE CYLINDER
3 - ACCESS HOLE
4 - NYLON ANTI-ROTATION TAB
5 - QUICK CONNECT

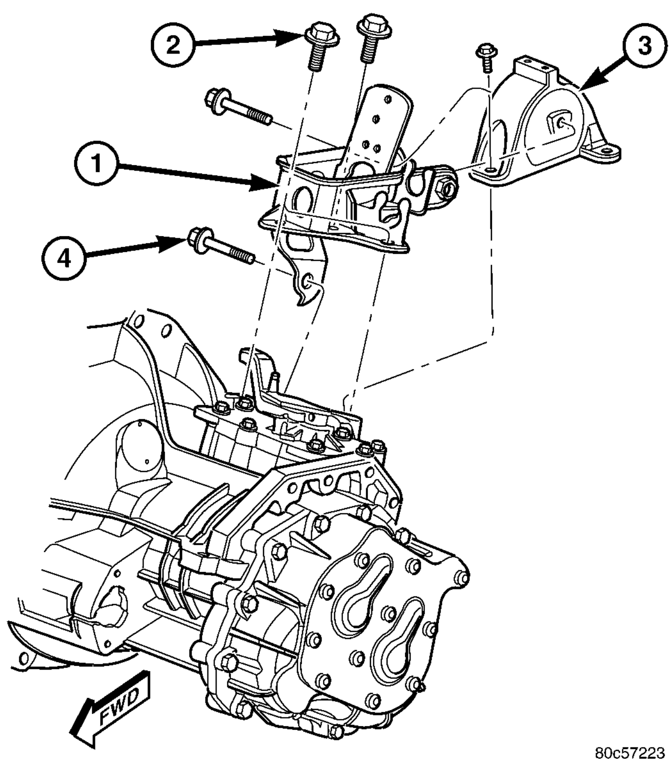


Fig. 90 Transaxle Right Mount and Bracket

1 - MOUNT BRACKET
2 - BOLT (3)
3 - MOUNT
4 - BOLT (1)

T850 MANUAL TRANSAXLE (Continued)

(14) Connect gearshift cables to shift levers/cover assembly (Fig. 91). Install cables into position at mount bracket and secure with retaining clips.

(15) Connect battery cables.

(16) Check transaxle fluid and engine coolant levels. Adjust if necessary. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/FLUID - STANDARD PROCEDURE)

INSTALLATION - 2.5L TD

(1) Assemble transaxle to engine, while aligning transaxle input shaft to clutch disc splines.

(2) Install and torque transaxle-to-engine bolts to 95 N·m (70 ft. lbs.) (Fig. 92).

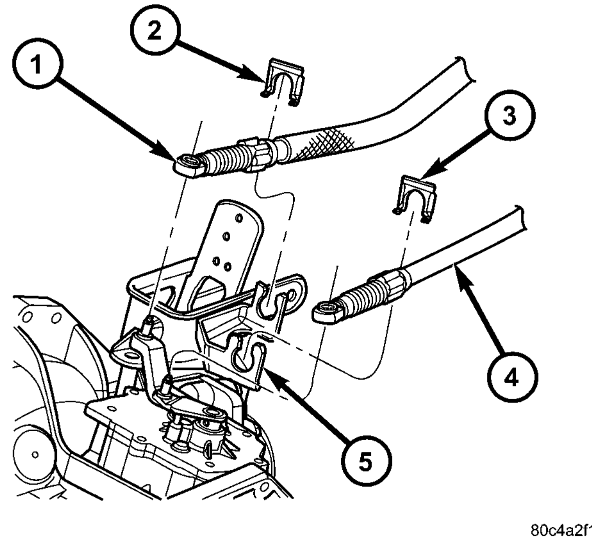


Fig. 91 Gearshift Cables at Transaxle

1 - SELECTOR CABLE
2 - CABLE RETAINER
3 - CABLE RETAINER
4 - CROSSOVER CABLE
5 - MOUNT BRACKET

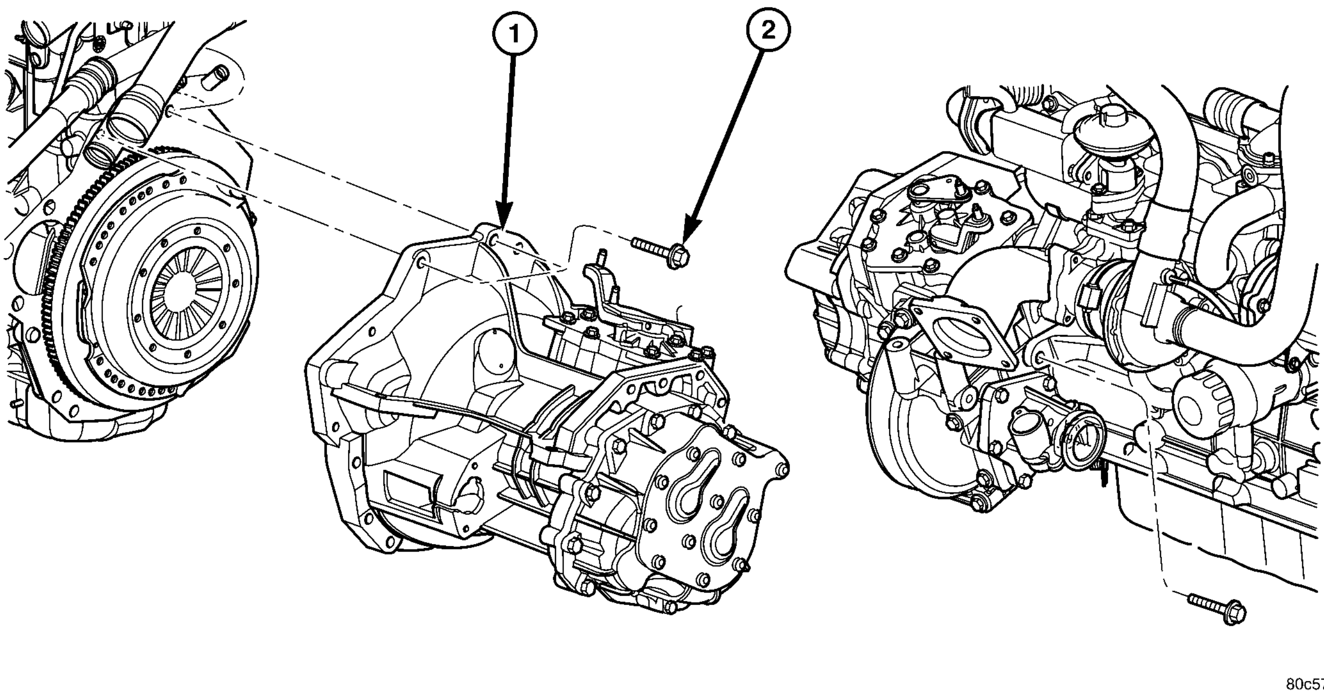


Fig. 92 Transaxle Removal/Installation

1 - TRANSAXLE
2 - BOLT

T850 MANUAL TRANSAXLE (Continued)

(3) Install transaxle upper mount (Fig. 93). Install and torque four (4) mount-to-transaxle bolts to 54 N·m (40 ft. lbs.).

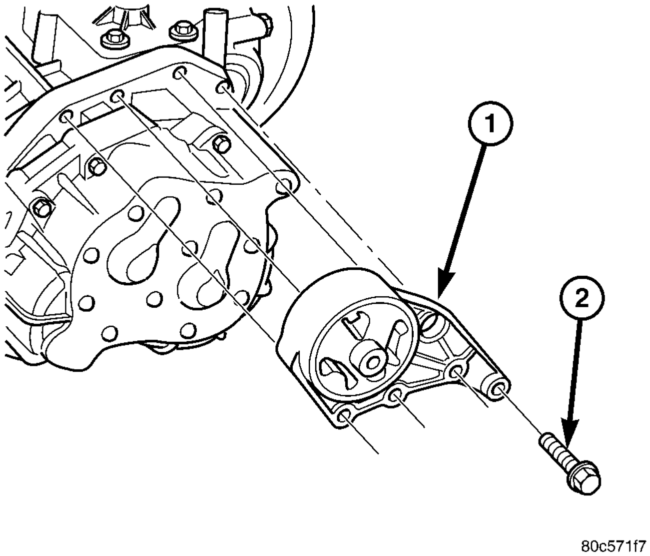


Fig. 93 Transaxle Upper Mount

1 - MOUNT
2 - BOLT (4)

(4) Raise transaxle/engine assembly into position and install upper mount through-bolt. Torque through-bolt to 75 N·m (55 ft. lbs.).

(5) Remove screw jack.

(6) Connect back-up lamp switch connector.

(7) Install starter motor into position (Fig. 94). Install and torque bolts to 54 N·m (40 ft. lbs.).

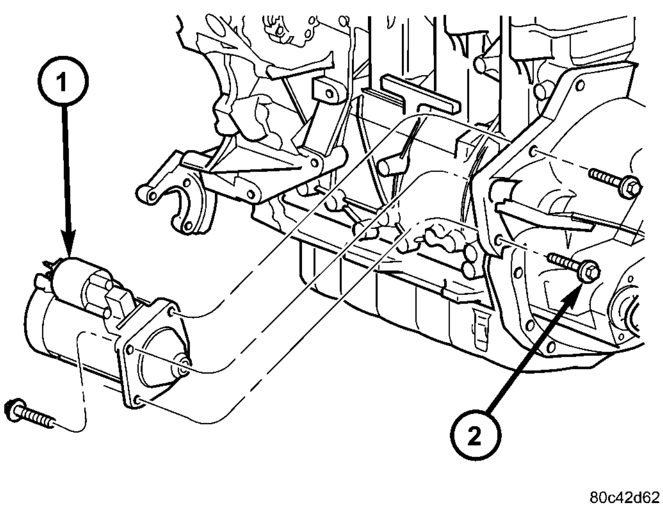


Fig. 94 Starter Motor Removal/Installation

1 - STARTER MOTOR
2 - BOLT (3)

(8) Install engine front mount bracket. Install and torque bracket-to-transaxle bolts to 102 N·m (75 ft. lbs.). Install and torque bracket-to-engine bolts to 68 N·m (50 ft. lbs.). Torque through-bolt and nut to 68 N·m (50 ft. lbs.).

(9) Install clutch slave cylinder into position, noting orientation of different sized lugs (Fig. 95). While depressing inward, rotate slave cylinder clockwise 60° into position until nylon locating tab rests within transaxle case cutout, and hydraulic tube is vertical. Connect “quick-connect” connection until an audible “click” is heard. Verify connection by pulling outward on connection.

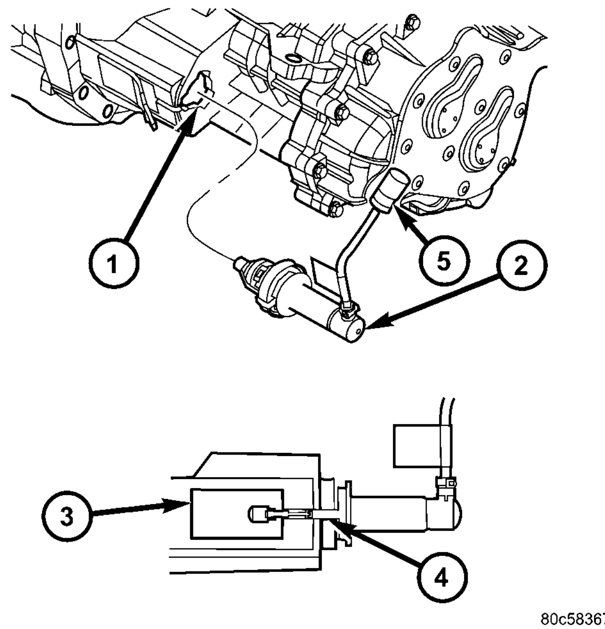


Fig. 95 Slave Cylinder Removal/Installation

1 - MOUNTING HOLE
2 - SLAVE CYLINDER
3 - ACCESS HOLE
4 - NYLON ANTI-ROTATION TAB
5 - QUICK CONNECT

(10) Install underbody splash panel.

(11) Install halfshafts and front wheel/tire assemblies. (Refer to 3 - DIFFERENTIAL & DRIVELINE/ HALF SHAFT - INSTALLATION)

(12) Lower vehicle.

T850 MANUAL TRANSAXLE (Continued)

(13) Install right mount bracket to transaxle (Fig. 96).

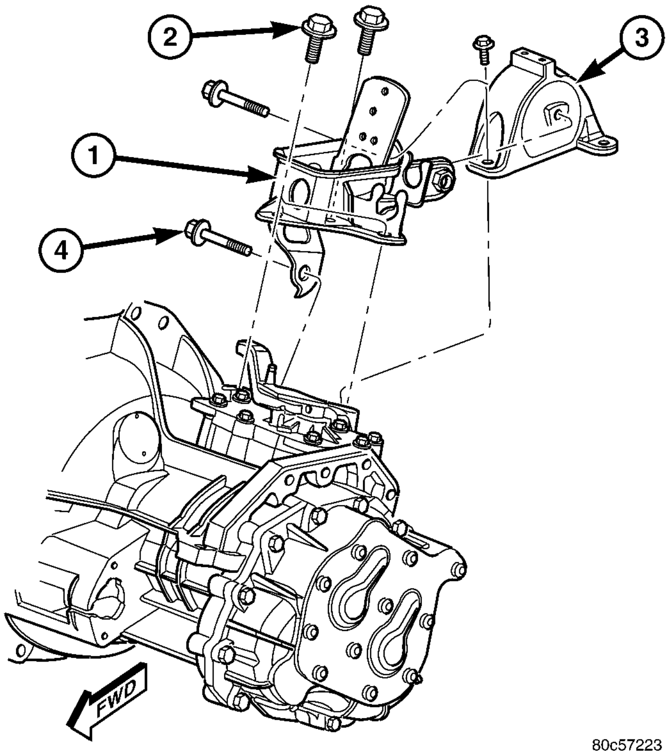


Fig. 96 Transaxle Right Mount and Bracket

1 - MOUNT BRACKET
2 - BOLT (3)
3 - MOUNT
4 - BOLT (1)

(14) Connect gearshift cables to shift levers/cover assembly (Fig. 97). Install cables into position at mount bracket and secure with retaining clips.

(15) Install coolant recovery bottle bracket (Fig. 98).

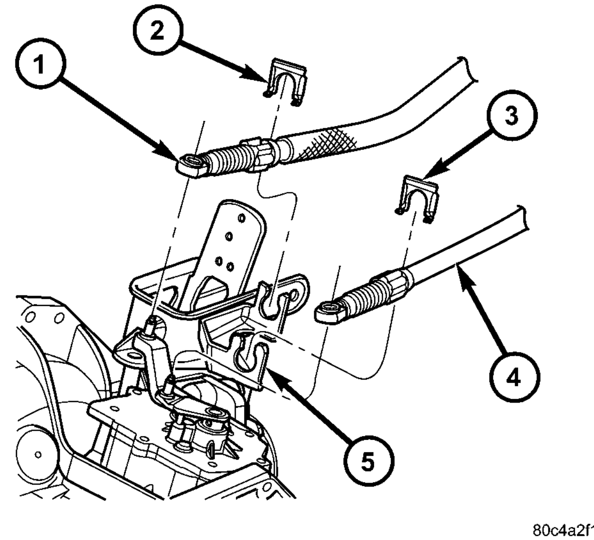


Fig. 97 Gearshift Cables at Transaxle

1 - SELECTOR CABLE
2 - CABLE RETAINER
3 - CABLE RETAINER
4 - CROSSOVER CABLE
5 - MOUNT BRACKET

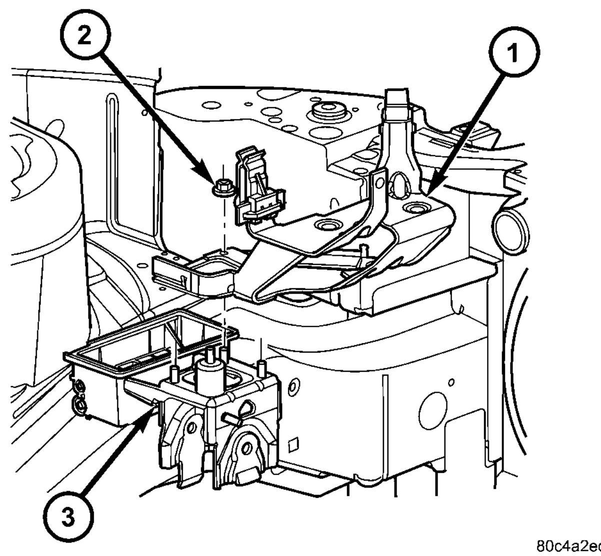


Fig. 98 Coolant Recovery Bottle Bracket

1 - COOLANT RECOVERY BOTTLE BRACKET
2 - NUT
3 - MOUNT BRACKET

T850 MANUAL TRANSAXLE (Continued)

(16) Install coolant recovery bottle to bracket.

(17) Connect battery temperature sensor and install battery tray (Fig. 99).

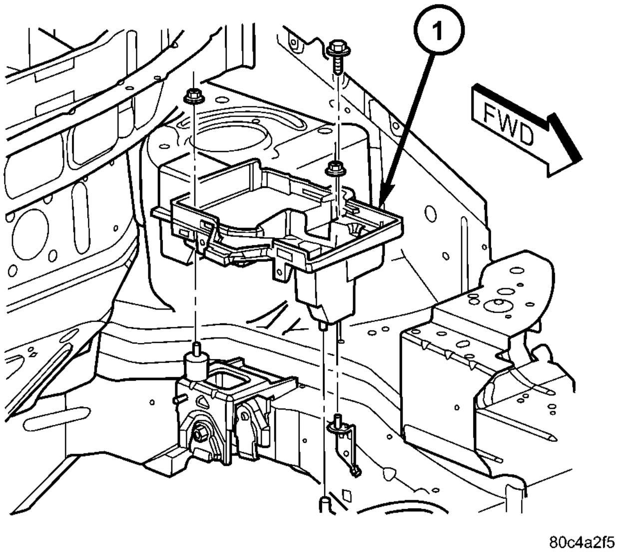


Fig. 99 Battery Tray

1 - BATTERY TRAY

(18) Install battery, hold-down clamp and nut (Fig. 100).

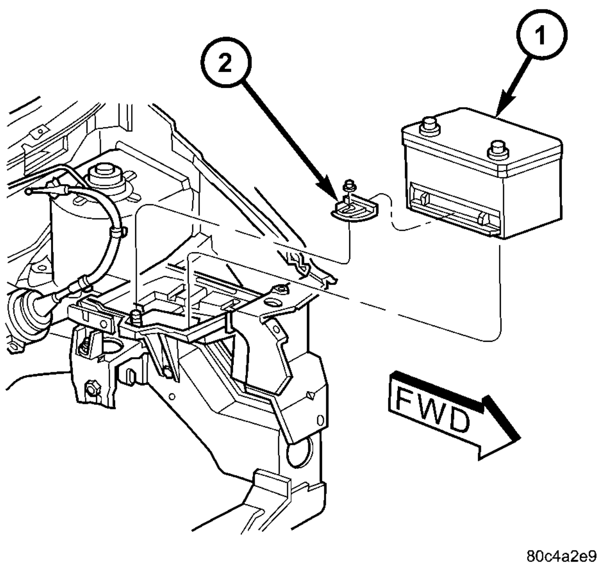


Fig. 100 Battery and Hold-Down Clamp

1 - BATTERY
2 - HOLD-DOWN CLAMP

(19) Install battery thermal shield and clutch cable eyelet (Fig. 101).

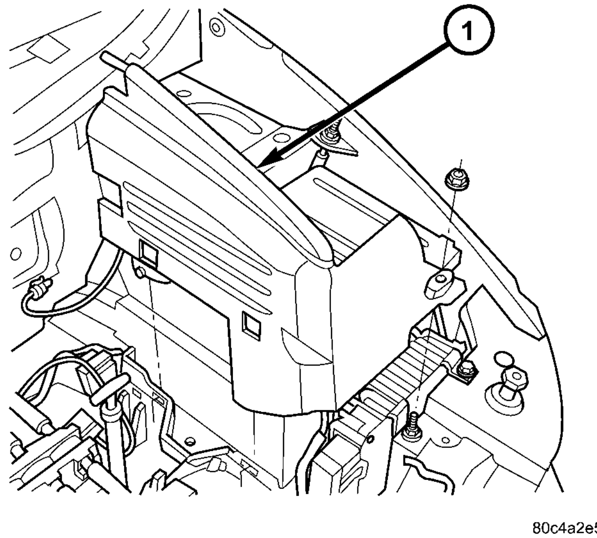


Fig. 101 Battery Thermal Shield

1 - BATTERY THERMAL SHIELD

(20) Connect battery cables.

(21) Check transaxle fluid and engine coolant levels. Adjust if necessary. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/FLUID - STANDARD PROCEDURE)

T850 MANUAL TRANSAXLE (Continued)

SPECIFICATIONS - T850 MANUAL TRANSAXLE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Transaxle Type	Constant-mesh, fully synchronized 5-speed with integral differential
Lubrication Method	Splash oil collected in case passage and oil trough and distributed to mainshafts via gravity
Fluid Type	ATF+4 (Automatic Transmission Fluid—Type 9602)

GEAR RATIOS

GEAR	RATIO
1st	3.65
2nd	2.05
3rd	1.37
4th	0.97
5th	0.76
Reverse	3.47
Final Drive Ratio	3.77
Overall Top Gear	2.85

INPUT SHAFT

BLOCKER RING WEAR GAP	
3rd Gear	0.856-1.539 mm (0.0338-0.0606 in.)
4th Gear	0.762-1.631 mm (0.030-0.064 in.)
GEAR END PLAY	
3rd Gear	0.099-0.505 mm (0.004-0.020 in.)
4th Gear	0.048-0.457 mm (0.002-0.018 in.)

INTERMEDIATE SHAFT

BLOCKER RING WEAR GAP	
1st Gear	0.66-1.84 mm (0.026-0.072 in.)
2nd Gear	0.66-1.84 mm (0.026-0.072 in.)
5th Gear	0.86-1.54 mm (0.034-0.061 in.)
Reverse	0.77-1.63 mm (0.030-0.064 in.)
GEAR END PLAY	
1st Gear	0.091-0.828 mm (0.004-0.033 in.)
2nd Gear	0.051-0.787 mm (0.002-0.031 in.)
5th Gear	0.102-0.762 mm (0.004-0.030 in.)
Reverse	0.066-0.805 mm (0.003-0.0317 in.)

T850 MANUAL TRANSAXLE (Continued)

DIFFERENTIAL

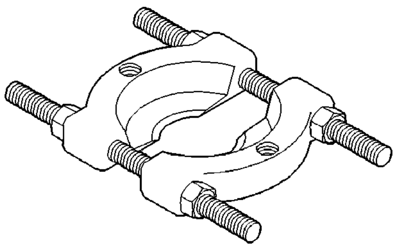
DESCRIPTION	METRIC	STANDARD
Differential Turning Torque	2.3-3.4 N·m	20-30 in. lbs.
Side Gear End Play (each side)	0.025-0.152 mm	0.001-0.006 in.

TORQUE SPECIFICATIONS

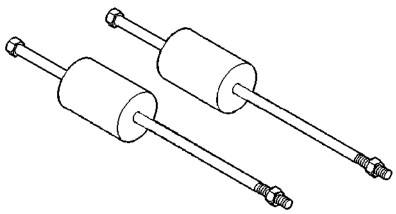
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt, Differential Cover-to-Case	54	40	—
Bolt, End Cover-to-Case	28	—	250
Bolt, End Cover Plate-to-Cover	28	—	250
Bolt, Extension Housing-to-Case	28	—	250
Bolt, Reverse Idler Shaft-to-Case	54	40	—
Bolt, Ring Gear-to-Differential Case	95	70	—
Bolt, Shift Cover-to-Case	28	—	250
Nut, 5th Gear-to-Input Shaft	262	193	—
Plug, Drain	23	17	—
Screw, Input Bearing Retainer	12	—	105
Switch, Back-Up Lamp	23	17	—
Vent	7	—	60

T850 MANUAL TRANSAXLE (Continued)

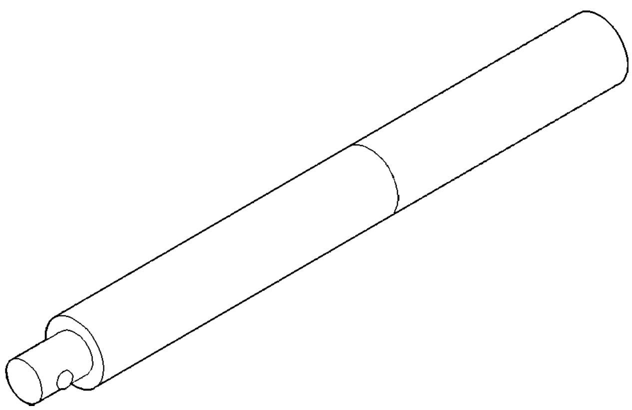
SPECIAL TOOLS - T850 TRANSAXLE



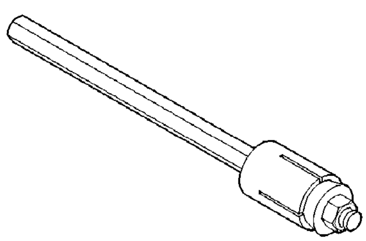
Bearing Splitter, P-334



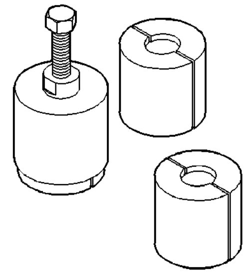
Slide Hammer, C-3752



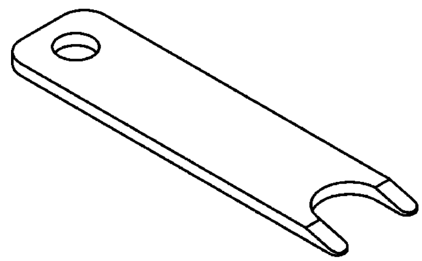
Universal Handle, C-4171



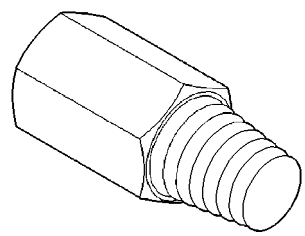
Torque Tool, C-4995



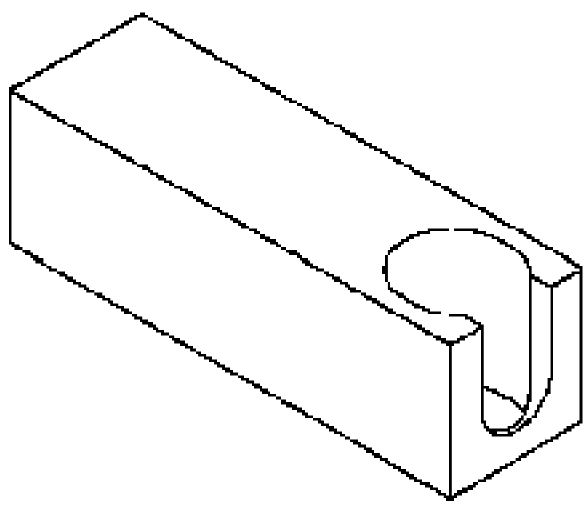
Puller Set, 5048



Disconnect Tool, 6638A

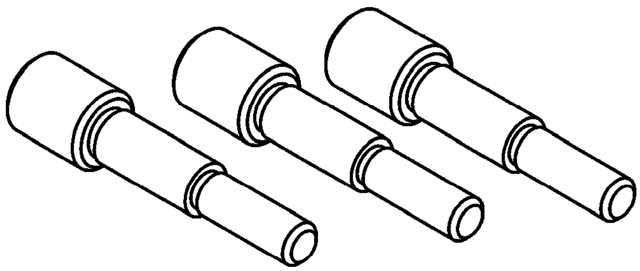


Remover, 6786

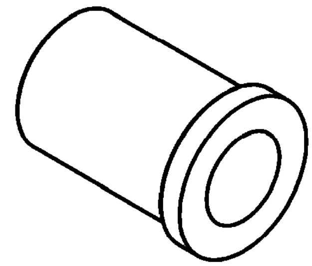


Remover/Installer, 6891

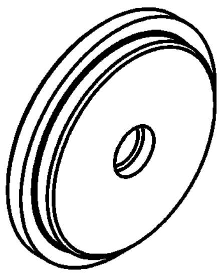
T850 MANUAL TRANSAXLE (Continued)



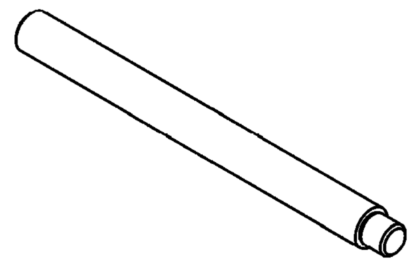
Alignment Pins, 8470



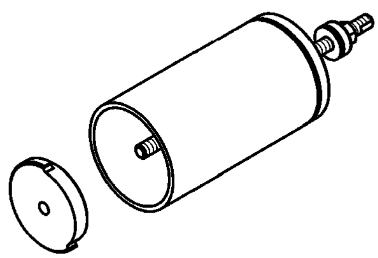
Remover/Installer, 8474



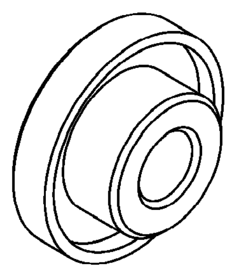
Installer, 8471



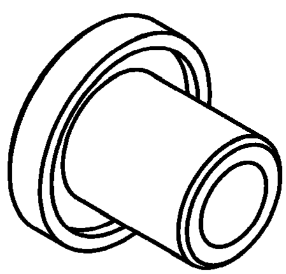
Installer, 8475



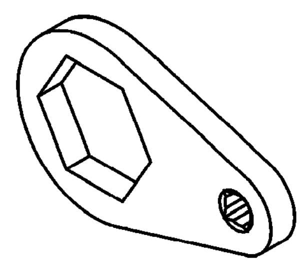
Race Remover, 8472



Installer, 8476

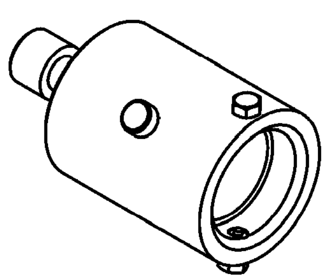


Bearing Installer, 8473

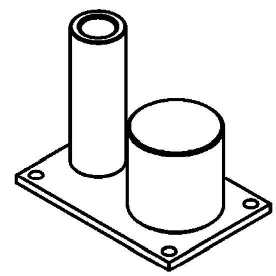


Wrench, 8478

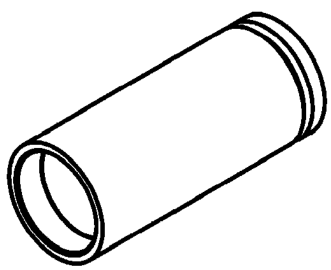
T850 MANUAL TRANSAXLE (Continued)



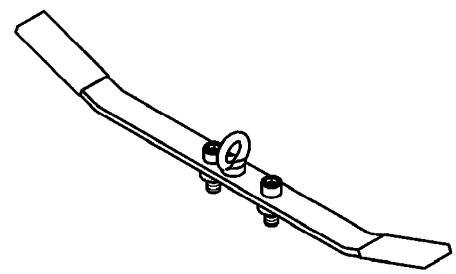
Stake Tool, 8479



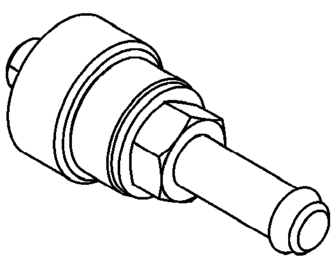
Fixture, 8487



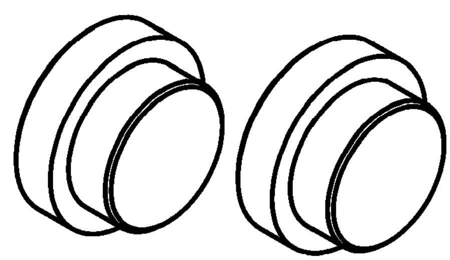
Installer, 8481



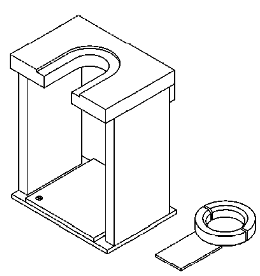
Lifting Bar, 8489



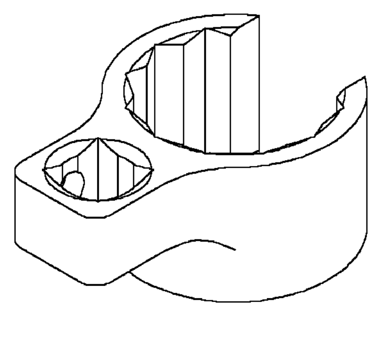
Bearing Installer, 8482



Thrust Buttons, 8491



Fixture, 8483



Wrench, 8827

AXLE SEALS

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove one or both front halfshaft assemblies. (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - REMOVAL)

(3) Using a suitable screwdriver, remove one or both axle seals (Fig. 102).

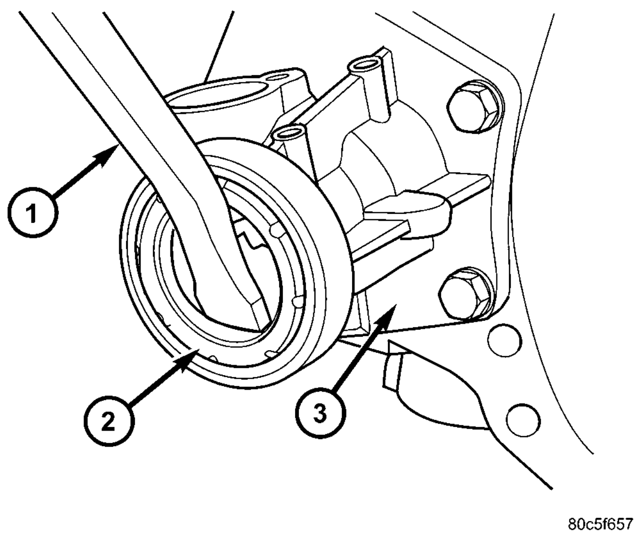


Fig. 102 Axle Seal Removal (Extension Housing Side Shown)

1 - SCREWDRIVER
2 - AXLE SEAL
3 - EXTENSION HOUSING

INSTALLATION

(1) Using driver handle C-4171 and installer 8476, install axle seals into position (Fig. 103) (Fig. 104).

(2) Install one or both front halfshaft assemblies. (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - INSTALLATION)

(3) Check transaxle fluid level and adjust if necessary. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/FLUID - STANDARD PROCEDURE)

(4) Lower vehicle.

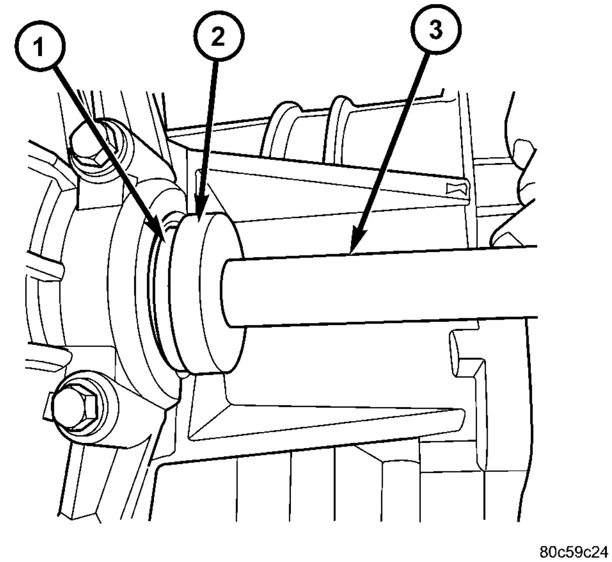


Fig. 103 Axle Seal Installation

1 - SEAL
2 - INSTALLER 8476
3 - DRIVER HANDLE C-4171

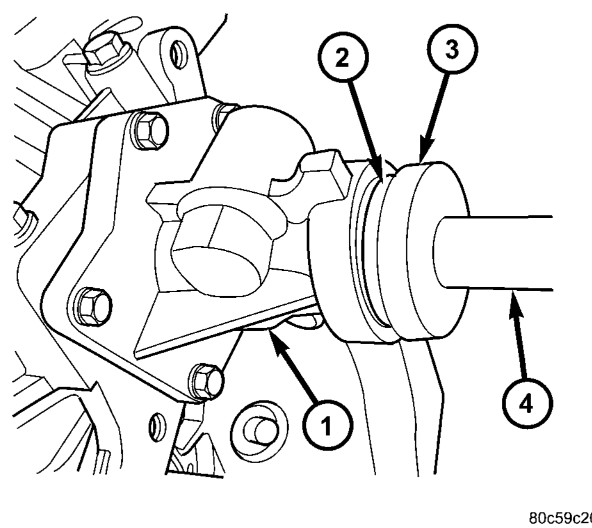


Fig. 104 Axle Seal Installation (Extension Housing Side)

1 - EXTENSION HOUSING
2 - SEAL
3 - INSTALLER 8476
4 - DRIVER HANDLE C-4171

BACK-UP LAMP SWITCH

REMOVAL

(1) Raise vehicle on hoist.
(2) Disconnect back-up lamp switch connector.
(3) Remove back-up lamp switch (Fig. 105).

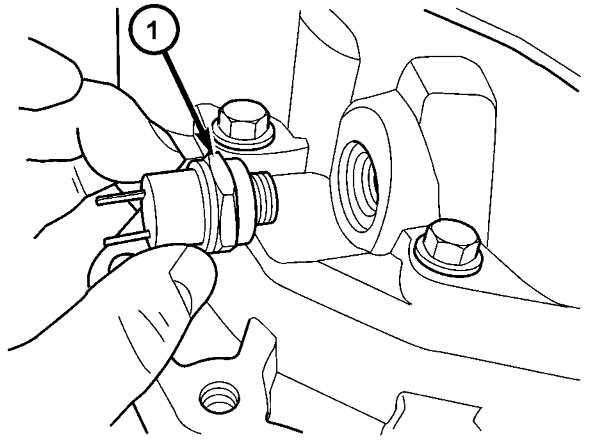


Fig. 105 Back-Up Lamp Switch

1 - BACK-UP LAMP SWITCH

INSTALLATION

(1) Install back-up lamp switch (Fig. 105) and torque to 23 N·m (17 ft. lbs.) using Tool 8827.
(2) Connect back-up lamp switch connector.
(3) Lower vehicle.

DIFFERENTIAL

DESCRIPTION

The T850 differential is a conventional open design. It consists of a ring gear and a two-piece differential case. The differential case contains the pinion and side gears, three floating pinion shafts, and a pinion shaft retaining ring (Fig. 106). The differential case is supported in the transaxle by tapered roller bearings.

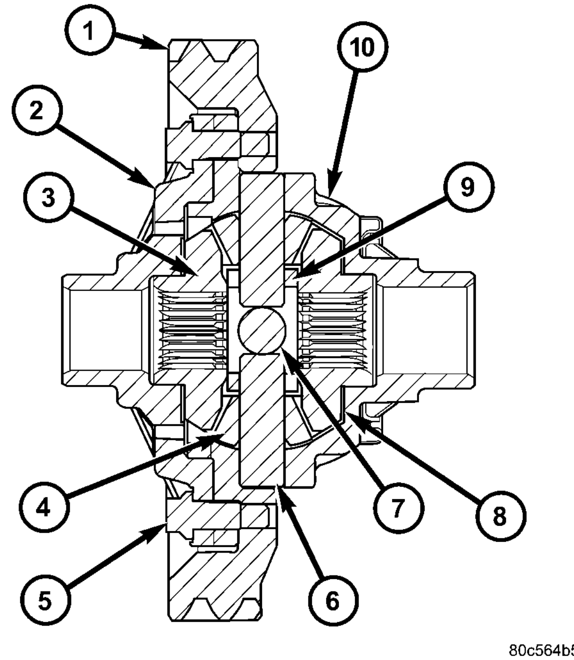


Fig. 106 Differential Assembly

1 - RING GEAR
2 - SUPPORT PLATE
3 - SIDE GEAR (2)
4 - PINION GEAR (4)
5 - BOLT (12)
6 - PINION SHAFT (2-SHORT)
7 - PINION SHAFT (1-LONG)
8 - THRUST WASHER (2)
9 - RETAINING RING
10 - DIFFERENTIAL CASE

OPERATION

The differential assembly is driven by the intermediate shaft via the ring gear. The ring gear drives the differential case, and the case drives the halfshafts through the differential gears. The differential pinion and side gears are supported in the case by pinion shafts and thrust washers. Differential pinion and side gears make it possible for front wheels to rotate at different speeds while cornering.

DIFFERENTIAL (Continued)

DISASSEMBLY

(1) Remove differential side bearings:

(a) Install button 8491-1 to differential case (Fig. 107).

(b) Set up Tool 5048 (5048-1, -4, -6) as shown in (Fig. 108).

(c) Remove differential side bearing (Fig. 109). Same procedure/tools work for both sides.

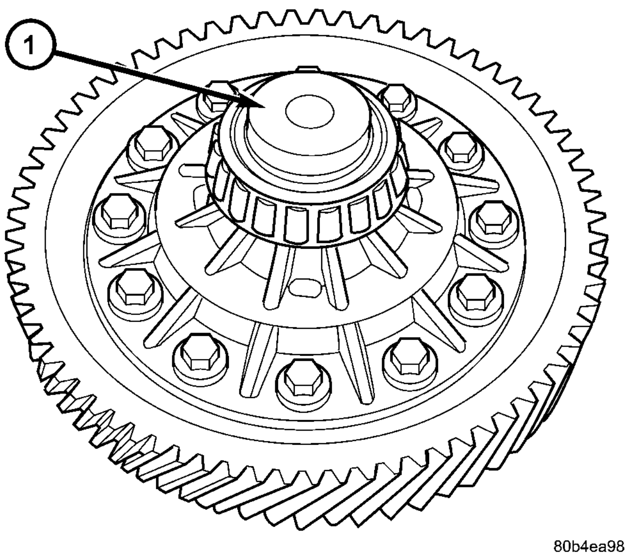


Fig. 107 Tool 8491

1 - TOOL 8491

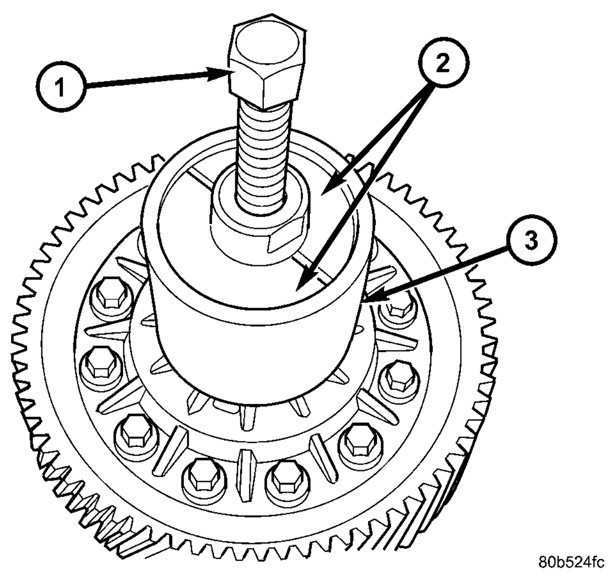


Fig. 108 Puller 5048

1 - 5048-1 FORCING SCREW
2 - 5048-4 COLLETS
3 - 5048-6 SLEEVE

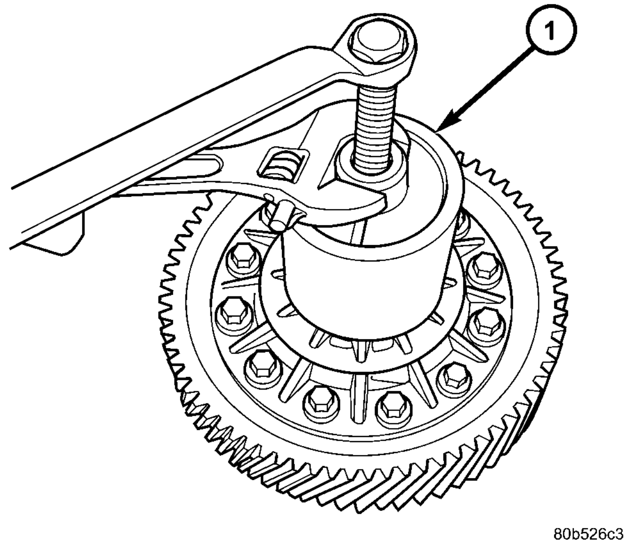


Fig. 109 Differential Side Bearing Removal

1 - TOOL 5048

(2) Remove ring gear-to-case bolts (Fig. 110) and remove ring gear.

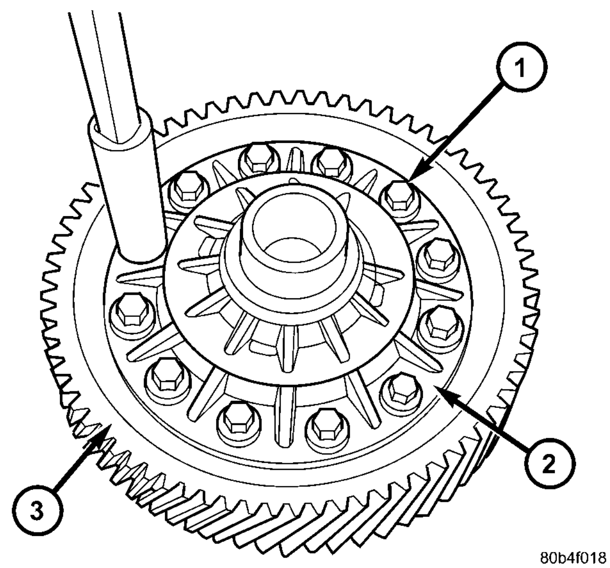


Fig. 110 Ring Gear-to-Differential Case Bolts

1 - BOLT (12)
2 - DIFFERENTIAL SUPPORT
3 - RING GEAR

DIFFERENTIAL (Continued)

(3) Using three ring gear bolts as forcing screws (Fig. 111), separate differential support from case (Fig. 112).

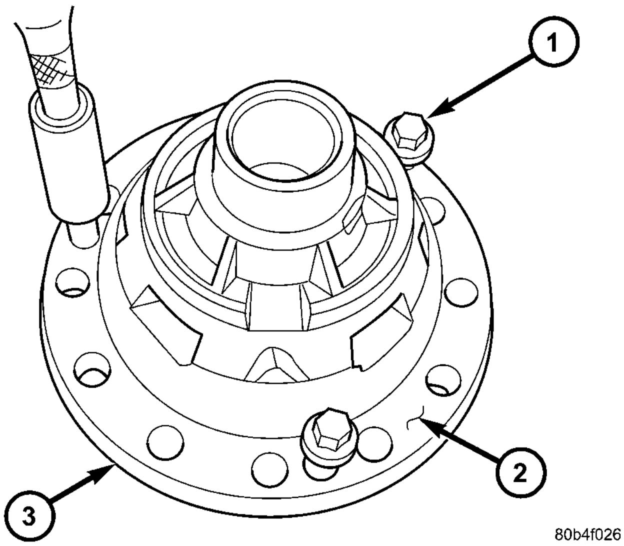


Fig. 111 Separate Differential Case Halves

1 - BOLT (3)
2 - DIFFERENTIAL CASE
3 - DIFFERENTIAL SUPPORT

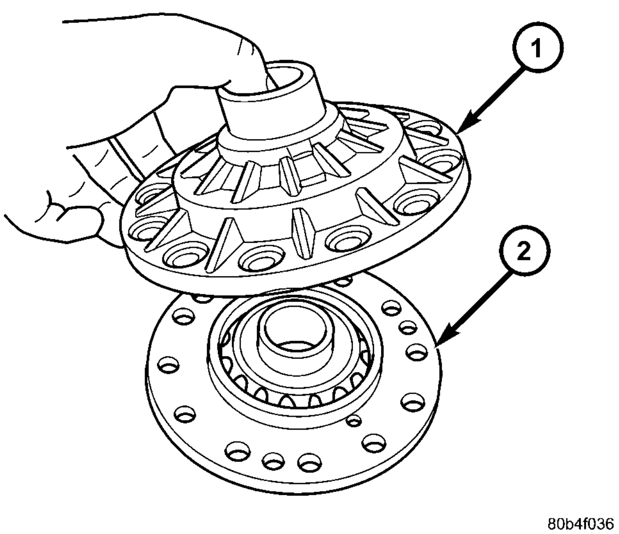


Fig. 112 Differential Support Plate

1 - DIFFERENTIAL SUPPORT PLATE
2 - DIFFERENTIAL CASE

(4) Remove side gear thrust washer (Fig. 113).

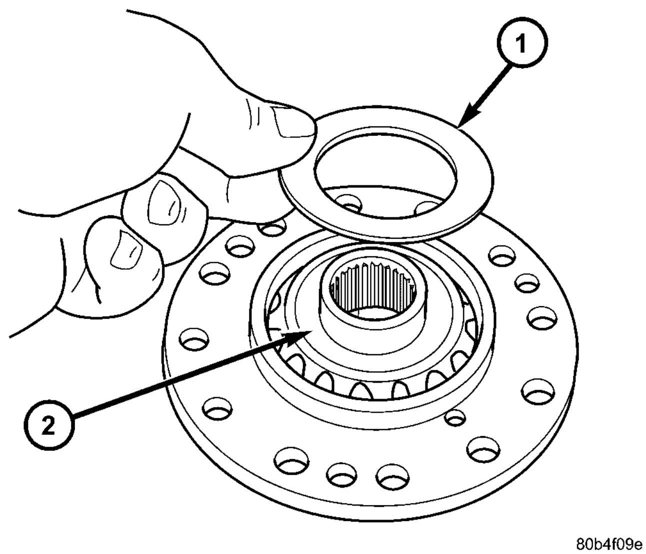


Fig. 113 Side Gear Thrust Washer

1 - SIDE GEAR THRUST WASHER
2 - DIFFERENTIAL SIDE GEAR

(5) Remove side gear (Fig. 114).

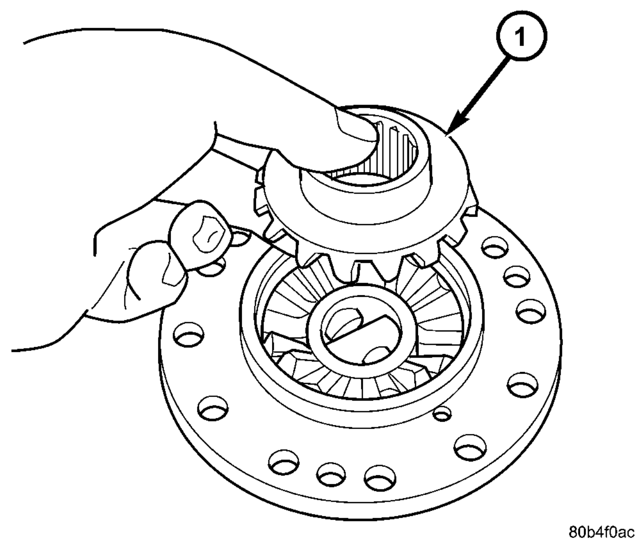


Fig. 114 Differential Side Gear

1 - DIFFERENTIAL SIDE GEAR

DIFFERENTIAL (Continued)

(6) Remove long pinion shaft (Fig. 115).

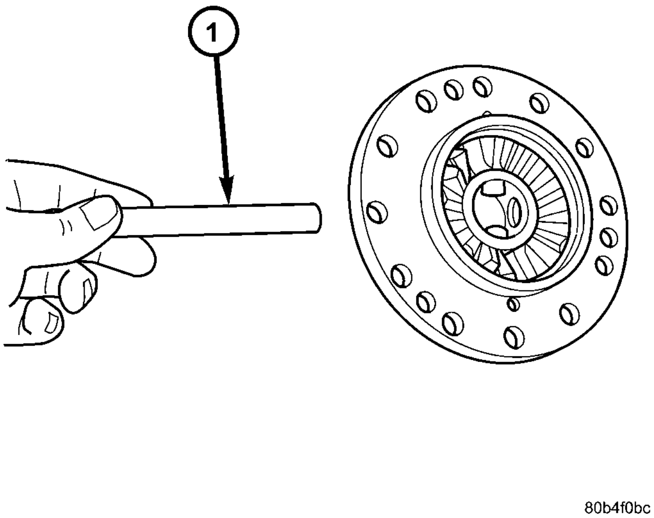


Fig. 115 Long Pinion Shaft

1 - PINION SHAFT (LONG)

(7) Remove both short pinion shafts (Fig. 116).

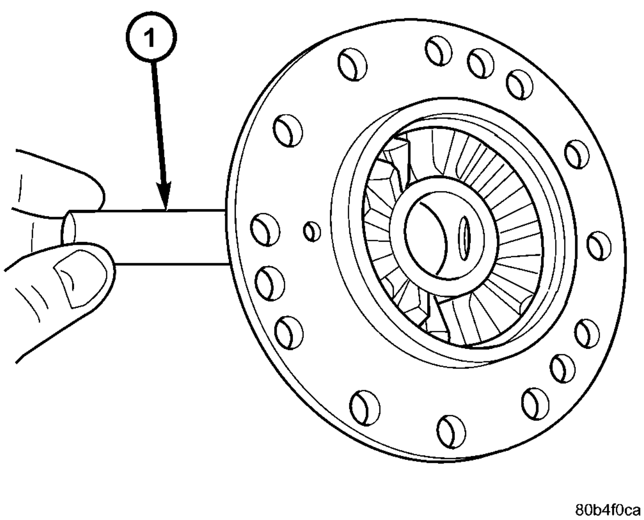


Fig. 116 Short Pinion Shaft (2)

1 - PINION SHAFT (SHORT (2))

(8) Remove pinion shaft retainer (Fig. 117).

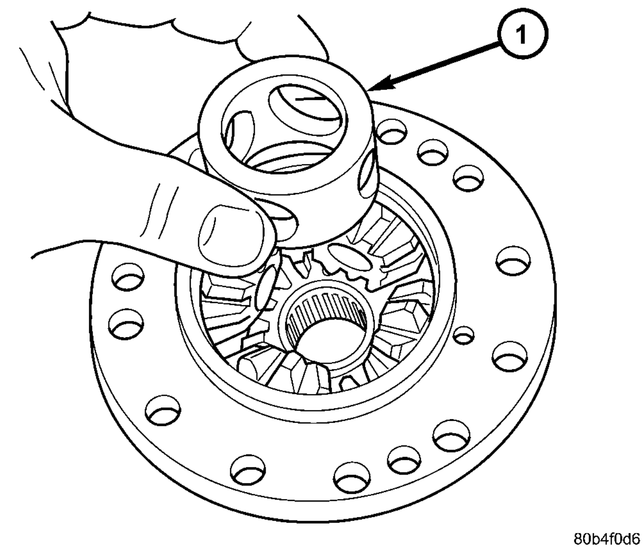


Fig. 117 Pinion Shaft Retaining Ring

1 - RETAINING RING

(9) Remove four pinion gears and thrust washers (Fig. 118).

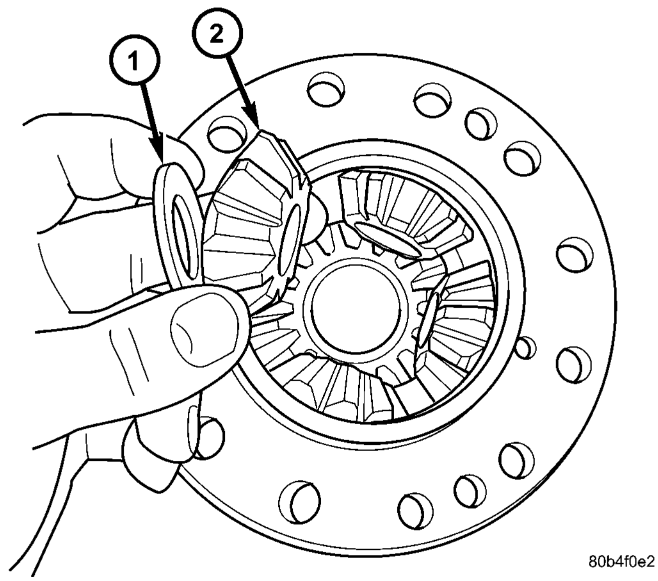


Fig. 118 Pinion Gear and Thrust Washer

1 - THRUST WASHER (4)
2 - PINION GEAR (4)

DIFFERENTIAL (Continued)

(10) Remove side gear (Fig. 119).

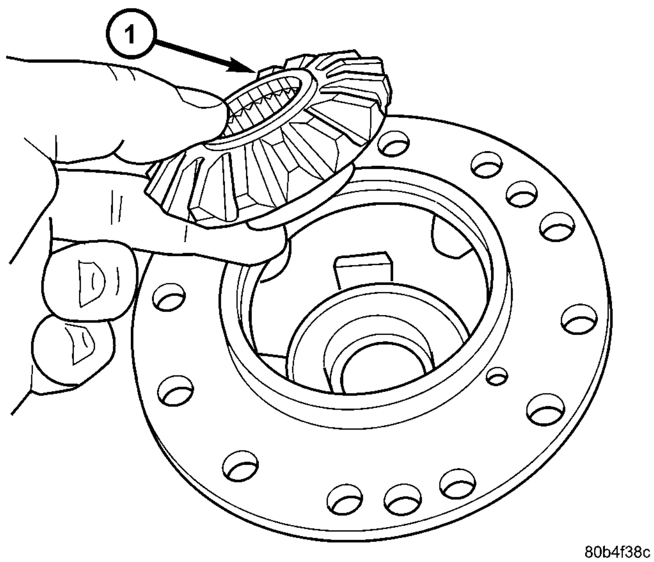


Fig. 119 Differential Side Gear

1 - DIFFERENTIAL SIDE GEAR

(11) Remove side gear thrust washer (Fig. 120).

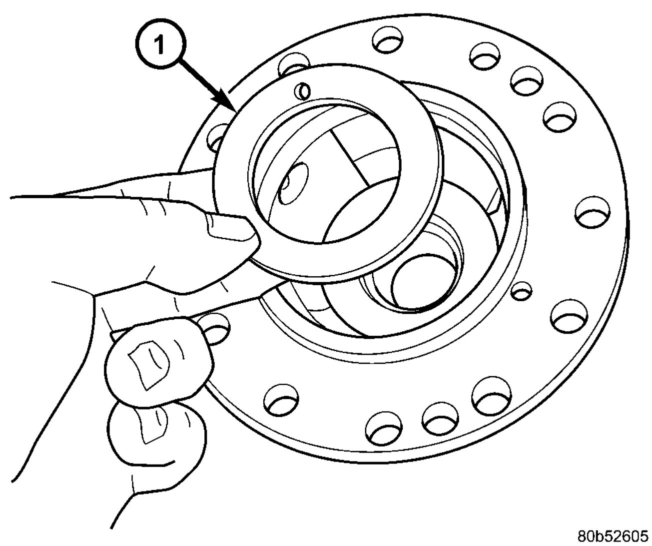


Fig. 120 Side Gear Thrust Washer

1 - SIDE GEAR THRUST WASHER

ASSEMBLY

(1) Install side gear thrust washer (Fig. 121).

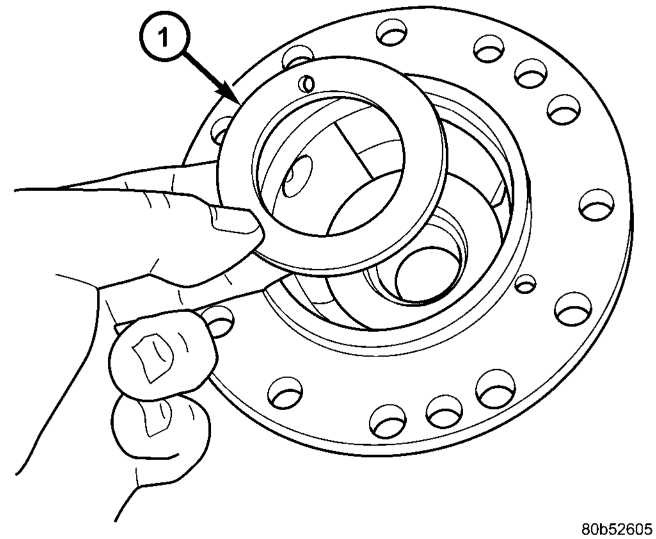


Fig. 121 Side Gear Thrust Washer

1 - SIDE GEAR THRUST WASHER

(2) Install differential side gear (Fig. 122).

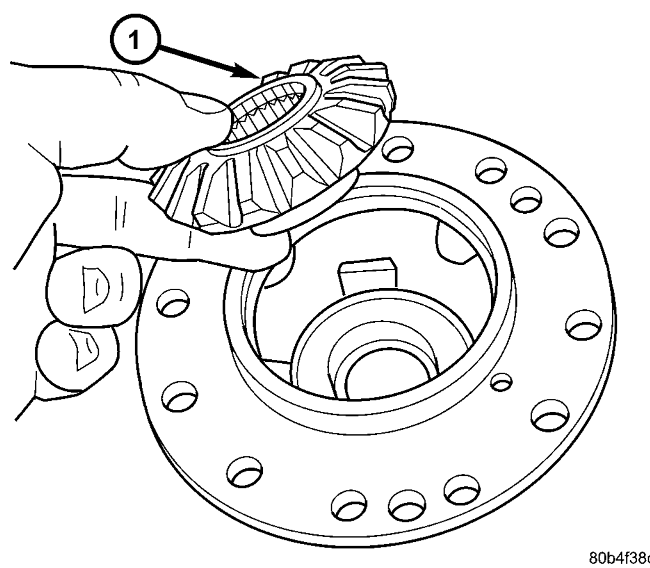


Fig. 122 Differential Side Gear

1 - DIFFERENTIAL SIDE GEAR

DIFFERENTIAL (Continued)

(3) Install four (4) pinion gears and thrust washers (Fig. 123).

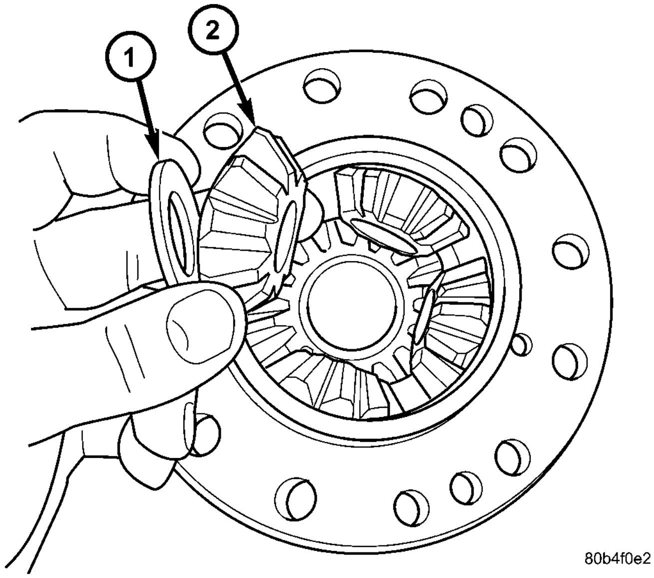


Fig. 123 Pinion Gear and Thrust Washer

1 - THRUST WASHER (4)
2 - PINION GEAR (4)

(4) Install pinion shaft retaining ring (Fig. 124).

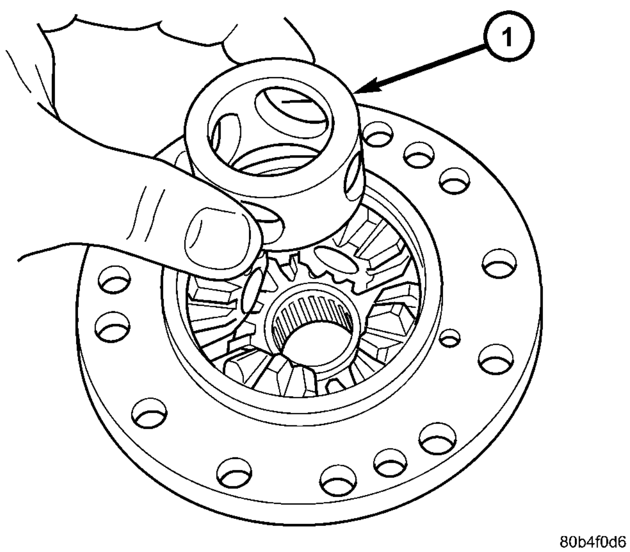


Fig. 124 Pinion Shaft Retaining Ring

1 - RETAINING RING

(5) Install two (2) short pinion shafts (Fig. 125).

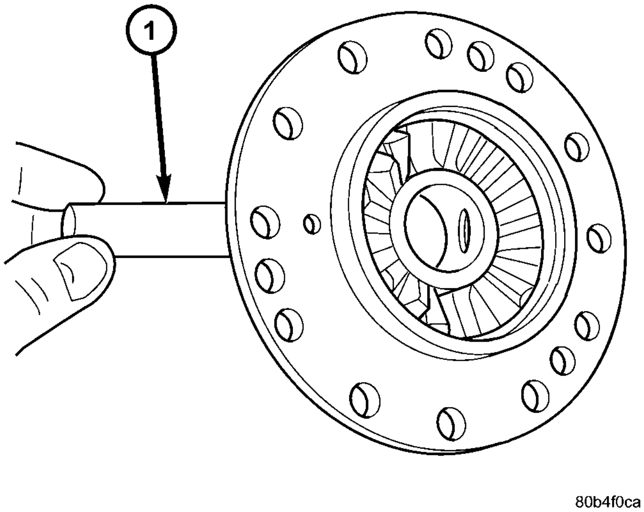


Fig. 125 Short Pinion Shaft (2)

1 - PINION SHAFT (SHORT (2))

(6) Install one (1) long pinion shaft (Fig. 126).

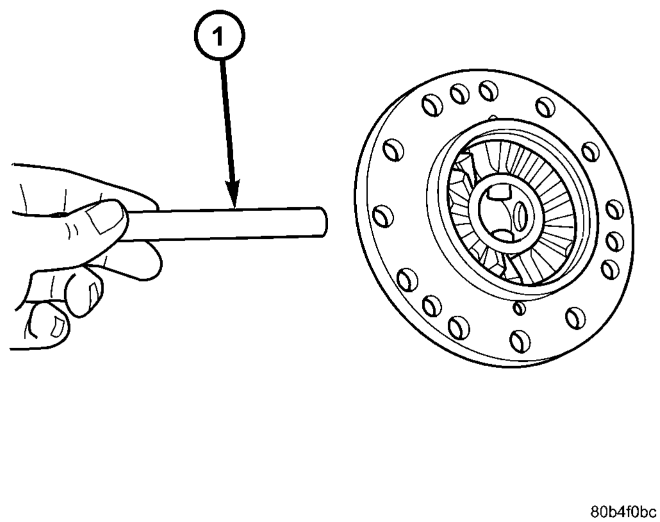


Fig. 126 Long Pinion Shaft

1 - PINION SHAFT (LONG)

DIFFERENTIAL (Continued)

(7) Install differential side gear.

(8) Install side gear thrust washer (Fig. 127).

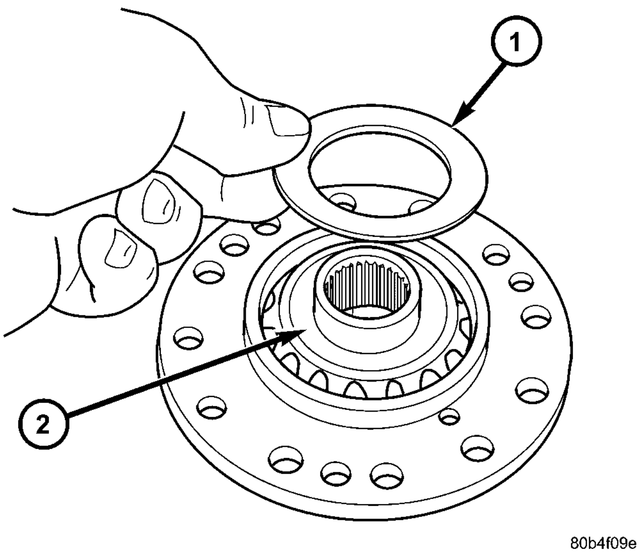


Fig. 127 Side Gear Thrust Washer

1 - SIDE GEAR THRUST WASHER
2 - DIFFERENTIAL SIDE GEAR

(9) Install differential support plate. Align support plate to differential case with alignment pins 8470 (Fig. 128).

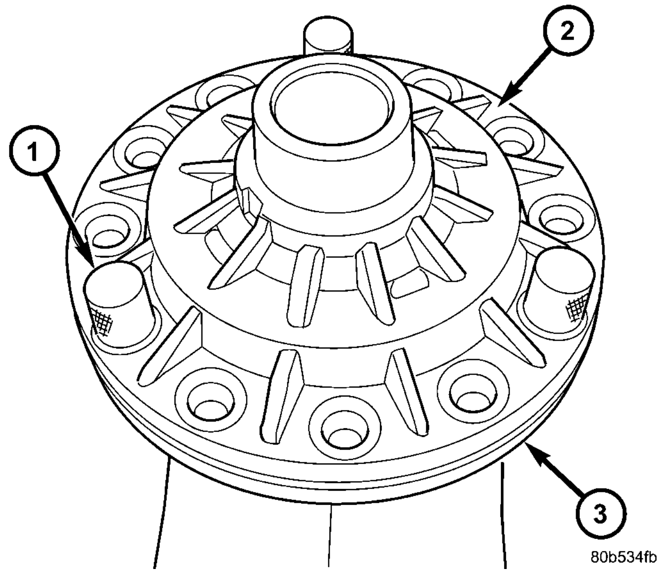


Fig. 128 Align Differential Support to Case

1 - ALIGNMENT PIN 8470
2 - DIFFERENTIAL SUPPORT PLATE
3 - DIFFERENTIAL CASE

(10) Install thrust buttons 8491 to both bearing journals and press halves together using an arbor press (Fig. 129).

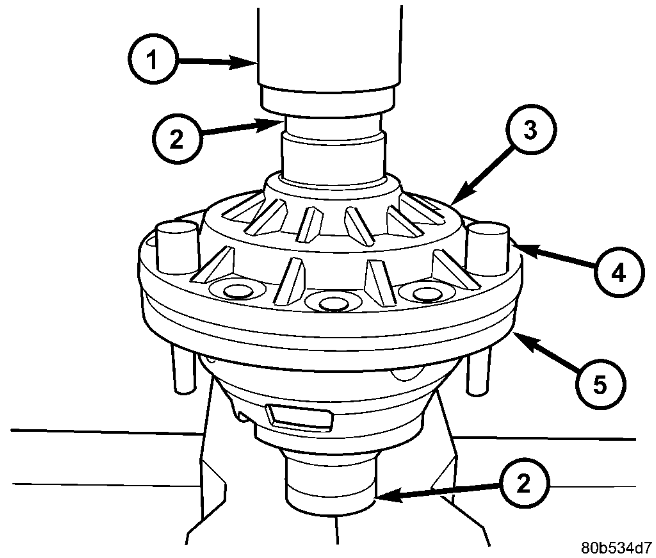


Fig. 129 Installing Differential Support

1 - ARBOR PRESS
2 - BUTTON 8491
3 - DIFFERENTIAL SUPPORT PLATE
4 - ALIGNMENT PIN 8470
5 - DIFFERENTIAL CASE

DIFFERENTIAL (Continued)

(11) Install ring gear into position, start three ring gear-to-differential case bolts by hand (120° apart), and install alignment pins 8470 (Fig. 130).

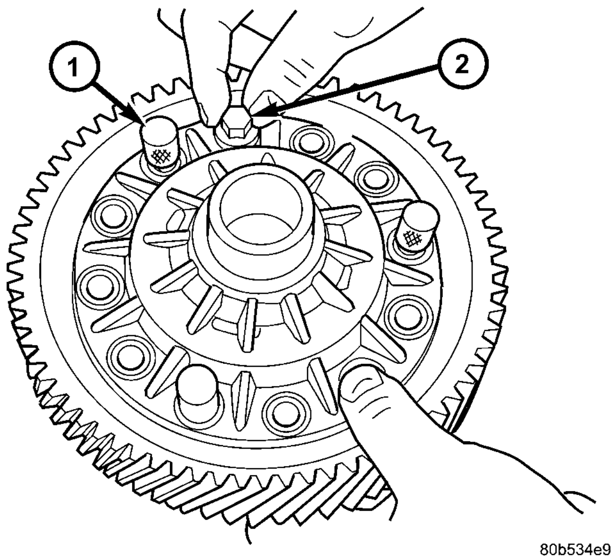


Fig. 130 Ring Gear Alignment/Installation

1 - ALIGNMENT PIN 8470
2 - BOLT

(12) Torque three ring gear bolts to draw ring gear into position. Remove alignment pins, install remaining ring gear-to-differential case bolts and torque to 95 N·m (70 ft. lbs.) (Fig. 131).

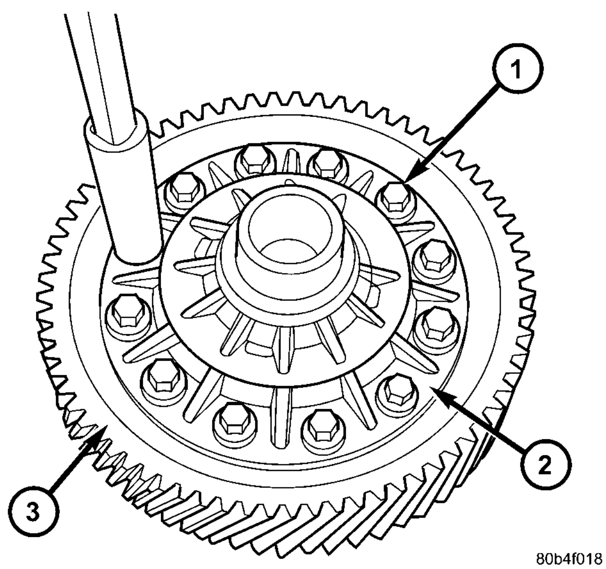


Fig. 131 Ring Gear-to-Differential Case Bolts

1 - BOLT (12)
2 - DIFFERENTIAL SUPPORT
3 - RING GEAR

(13) Install tapered roller bearings using installer 8473 and an arbor press (Fig. 132). Insert button 8491 on opposite journal to protect journal and/or bearing during press operation. Repeat the same operation on opposite side.

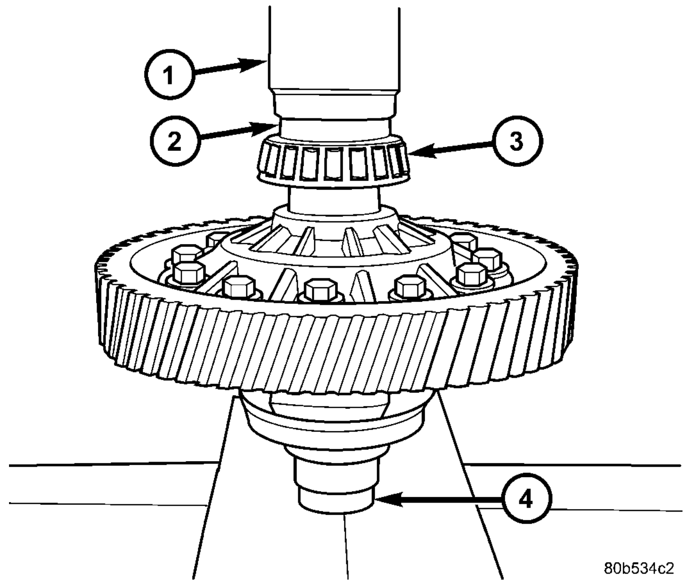


Fig. 132 Differential Side Bearing Installation

1 - ARBOR PRESS
2 - INSTALLER 8473
3 - BEARING
4 - BUTTON 8491

(14) Measure and verify differential side gear end play. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/DIFFERENTIAL - ADJUSTMENTS).

DIFFERENTIAL (Continued)

ADJUSTMENTS

ADJUSTMENT - DIFFERENTIAL TURNING TORQUE

NOTE: Differential turning torque should only be measured with the geartrain out of the transaxle. If measurement is taken with transaxle assembled, an inaccurate measurement will result.

NOTE: All differential cover-to-case bolts and extension housing-to-case bolts must be installed and torqued to obtain accurate measurement.

(1) If transaxle is assembled, remove geartrain and leave differential in place. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - DISASSEMBLY)

(2) Install differential cover and torque differential cover-to-case bolts to 54 N·m (40 ft. lbs.).

(3) Install extension housing and torque extension housing-to-case bolts to 28 N·m (250 in. lbs.).

(4) Place transaxle on work bench so axle centerline is parallel to the ground.

(5) Install turning torque tool C-4995 to differential at side opposite extension housing.

(6) Using an in. lb./N·m dial indicator, rotate differential case multiple times and record measurement (Fig. 133). Differential turning torque should be within 2.3-3.4 N·m (20-30 in. lbs.). Refer to shim chart for proper shim selection. If turning torque measured is less than 2.3 N·m (20 in. lbs.), install a thicker shim. If turning torque measured is greater than 3.4 N·m (30 in. lbs.), install a thinner shim.

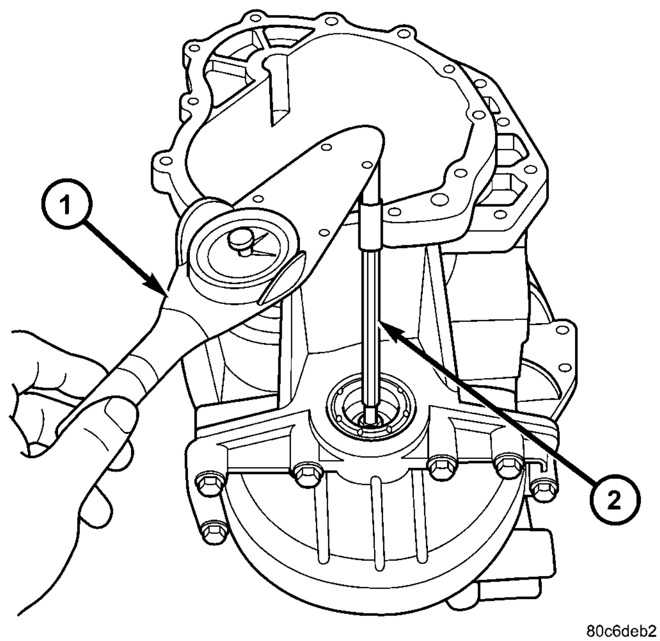


Fig. 133 Differential Turning Torque Measurement

1 - DIAL TORQUE WRENCH
2 - TOOL C-4995

DIFFERENTIAL (Continued)

DIFFERENTIAL BEARING SHIM CHART

PART NUMBER	SHIM THICKNESS	
	METRIC (MM)	STANDARD (STD)
4659242	0.50	0.0197
4659243	0.54	0.0213
4659247	0.58	0.0228
4659248	0.62	0.0244
4659249	0.66	0.0260
4659250	0.70	0.0276
4659251	0.74	0.0291
4659252	0.78	0.0307
4659253	0.82	0.0322
4659254	0.86	0.0339
4659255	0.90	0.0354
4659256	0.94	0.0370
4659257	0.98	0.0386
4659258	1.02	0.0402
4659259	1.06	0.0418
4659260	1.10	0.0434
4659261	1.14	0.0449
4659262	1.18	0.0465
4659263	1.22	0.0481
4659264	1.26	0.0497
4659265	1.30	0.0512
4659266	1.34	0.0528
4659267	1.38	0.0544
4659268	1.42	0.0560
4659269	1.46	0.0575
4659270	1.50	0.0591
4659271	1.54	0.0607
4659272	1.58	0.0623
4659273	1.62	0.0638
4659274	1.66	0.0654
4659275	1.70	0.0670
4659276	1.74	0.0690
4659277	1.78	0.0701
4659278	1.82	0.0716
4659279	1.86	0.0732
4659280	1.90	0.0748
4659281	1.94	0.0763
4659282	1.98	0.0779
4659283	2.02	0.0795
4659284	2.06	0.0811

DIFFERENTIAL (Continued)

ADJUSTMENT - DIFFERENTIAL SIDE GEAR END PLAY

Measure side gear end play: Insert feeler gauges 180° apart between differential side gear and thrust washer as shown in (Fig. 134). Measurement taken here applies to both sides. Side gear end play should be between 0.025-0.152 mm (0.001-0.006 in.). If clearance is greater than 0.152 mm (0.006 in.), install a thicker thrust washer (both sides). If clearance is less than 0.025 mm (0.001), install a thinner thrust washer (both sides). Refer to (Fig. 135) for available side gear shim thicknesses.

If end play measurement indicates a thrust washer change is necessary, the differential must be disassembled. (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/DIFFERENTIAL - DISASSEMBLY)

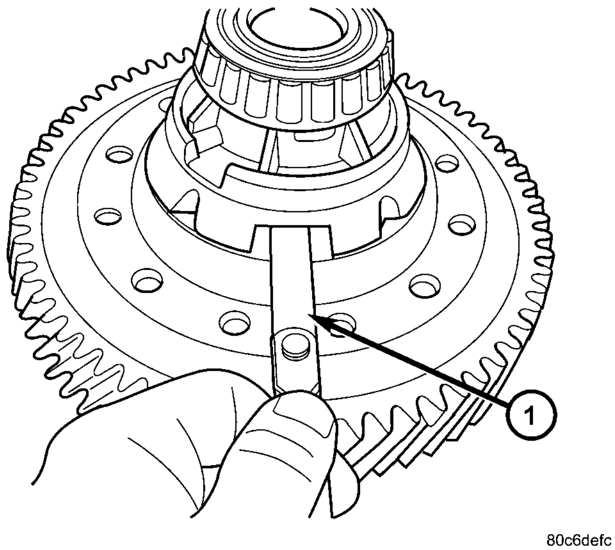


Fig. 134 Side Gear End Play Measurement

1 - FEELER GAUGE

FLUID

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUID LEVEL CHECK

NOTE: For proper fluid level check intervals, (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION)

The fluid required in this transaxle is Mopar® ATF+4. Use of substitute fluids may result in improper transaxle operation and/or failure.

(1) Raise vehicle on hoist.

(2) Remove transaxle fill plug (Fig. 136).

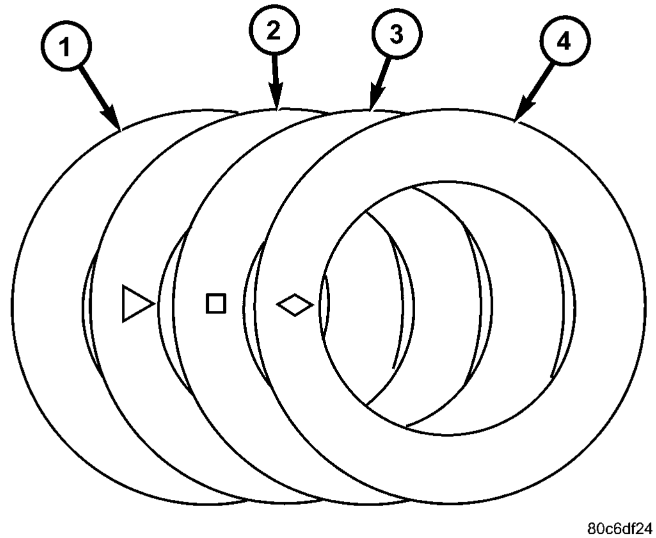


Fig. 135 Available Side Gear Thrust Washers

1 - (PLAIN) 0.79-0.84 mm (0.031-0.033 in.)
2 - (TRIANGLE) 0.91-0.97 mm (0.036-0.038 in.)
3 - (SQUARE) 1.04-1.10 mm (0.041-0.043 in.)
4 - (DIAMOND) 1.17-1.22 mm (0.046-0.048 in.)

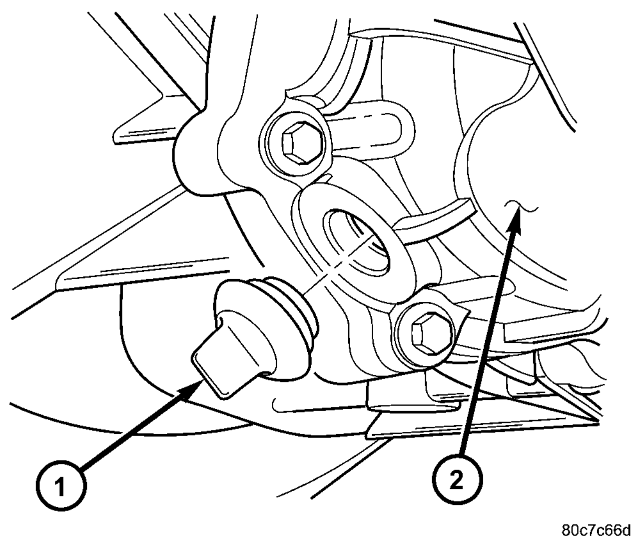


Fig. 136 Transaxle Fill Plug

1 - FILL PLUG
2 - END COVER

(3) Inspect fluid level. Fluid should be within 3/16" below fill hole. Add Mopar® ATF+4 as neccessary.

(4) Install fill plug, ensuring it is properly seated.

(5) Lower vehicle.

FLUID (Continued)

STANDARD PROCEDURE - FLUID DRAIN AND FILL

NOTE: For proper fluid change intervals, (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION)

The fluid required in this transaxle is Mopar® ATF+4. Use of substitute fluids may result in improper transaxle operation and/or failure.

FLUID DRAIN

(1) Raise vehicle on hoist.

(2) Remove transaxle drain plug (Fig. 137) and drain fluid into suitable container.

(3) Install drain plug and torque to 23 N·m (17 ft. lbs.).

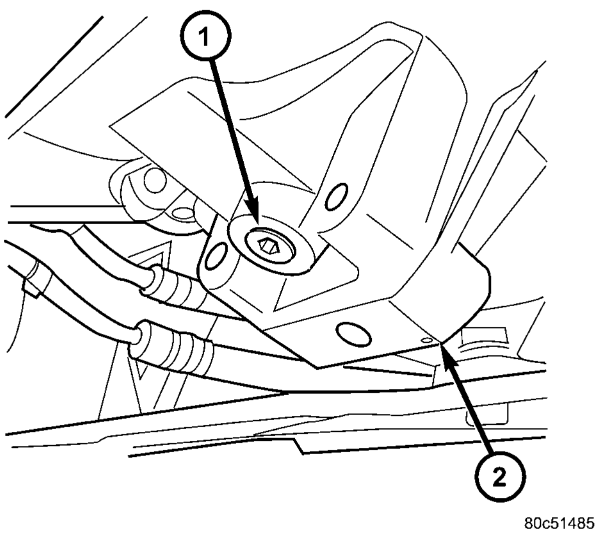


Fig. 137 Transaxle Drain Plug

1 - TRANSAXLE DRAIN PLUG
2 - DIFFERENTIAL COVER

FLUID FILL

(1) Remove transaxle fill plug (Fig. 138).

(2) Add 2.4-2.7L (2.5-2.9 qts.) of Mopar® ATF+4 until fluid is within 3/16” below fill hole.

(3) Install fill plug, ensuring it is properly seated.

(4) Lower vehicle.

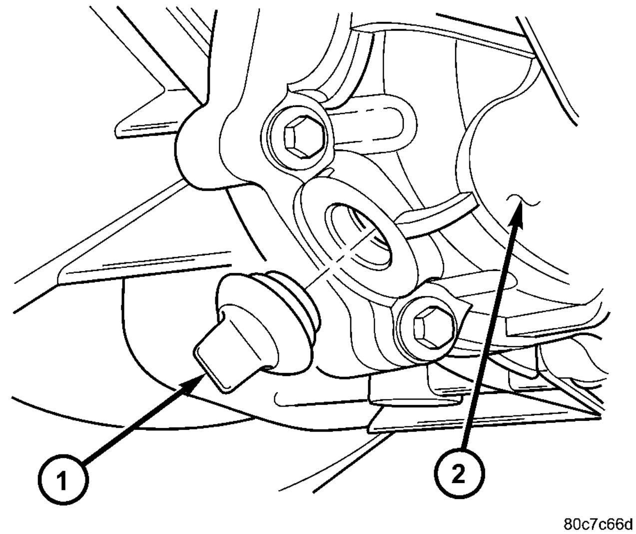


Fig. 138 Transaxle Fill Plug

1 - FILL PLUG
2 - END COVER

GEARSHIFT BOOT

REMOVAL

(1) Remove gearshift knob by pushing down and rotating ¼-turn clockwise (Fig. 139).

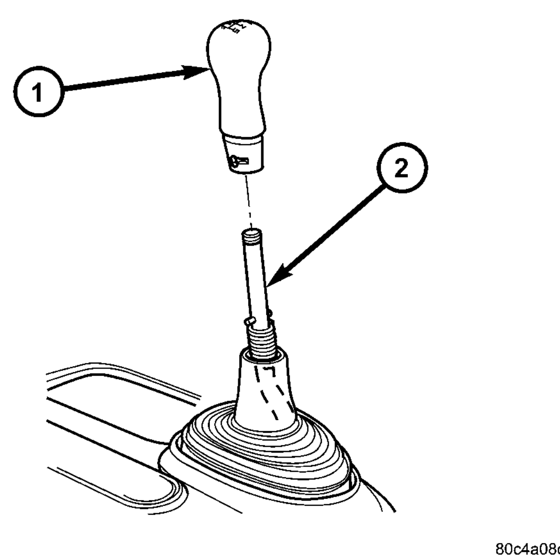


Fig. 139 Gearshift Knob Removal/Installation

1 - GEARSHIFT KNOB
2 - GEARSHIFT LEVER

(2) Remove gearshift boot from center console by disengaging three (3) retaining clips (Fig. 140).

GEARSHIFT BOOT (Continued)

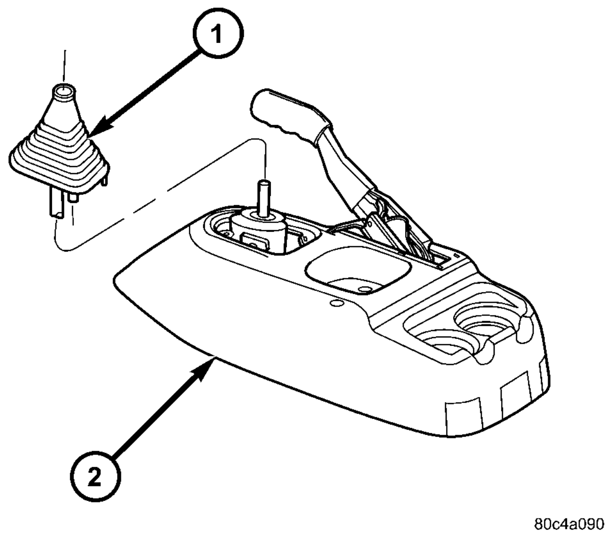


Fig. 140 Gearshift Boot Removal/Installation

1 - GEARSHIFT BOOT
2 - CENTER CONSOLE

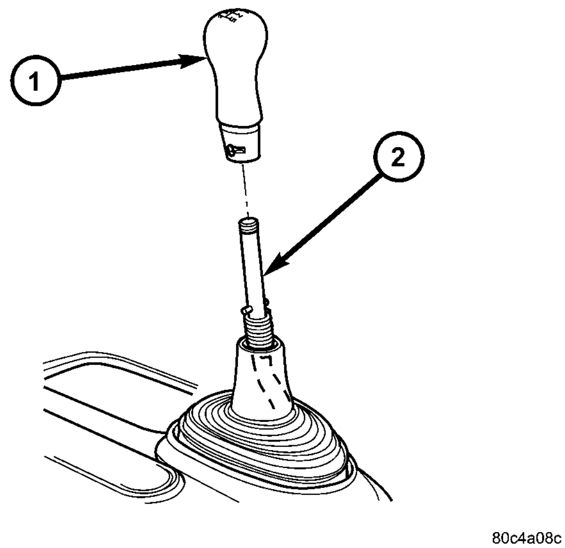


Fig. 141 Gearshift Knob Removal/Installation

1 - GEARSHIFT KNOB
2 - GEARSHIFT LEVER

INSTALLATION

(1) Install gearshift boot to console and secure with three (3) retaining clips (Fig. 140).

(2) Install gearshift knob (Fig. 139). Orient shift pattern ¼-turn clockwise, press down, and rotate ¼-turn counter-clockwise.

(3) Secure gearshift boot to base of knob.

GEARSHIFT CABLE - CROSSOVER

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove gearshift knob by pushing down and rotating ¼-turn clock-wise (Fig. 141).

(3) Remove gearshift boot from center console by disengaging at three (3) retaining clips (Fig. 142).

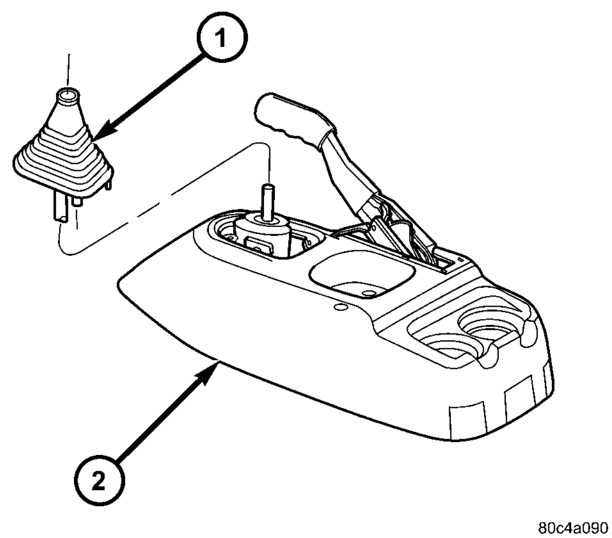


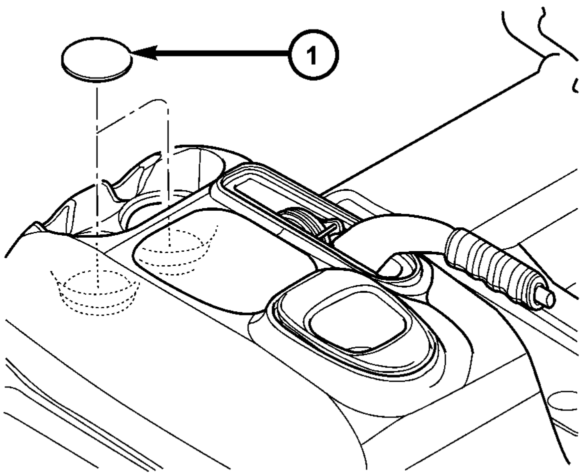
Fig. 142 Gearshift Boot Removal/Installation

1 - GEARSHIFT BOOT
2 - CENTER CONSOLE

GEARSHIFT CABLE - CROSSOVER (Continued)

(4) Apply park brake to allow park brake handle to clear center console upon removal.

(5) Remove two (2) cupholder bottom plugs (Fig. 143).

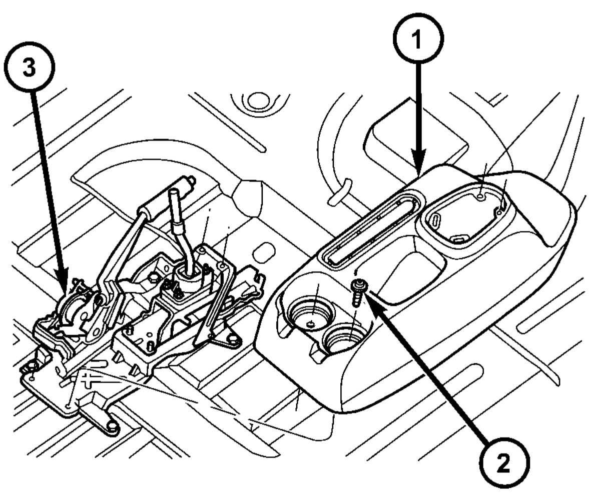


80c4a09d

Fig. 143 Cup Holder Plugs

1 - CUPHOLDER PLUG (2)

(6) Remove four (4) center console-to-gearshift mechanism screws. Remove console assembly (Fig. 144).

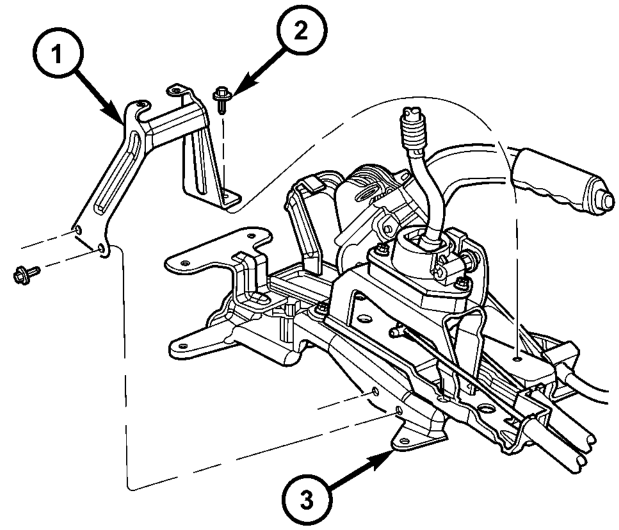


80c4a0a5

Fig. 144 Center Console Removal/Installation (LHD Shown — RHD Typical)

1 - CENTER CONSOLE
2 - SCREW (4)
3 - GEARSHIFT MECHANISM

(7) Remove center console support bracket (Fig. 145).

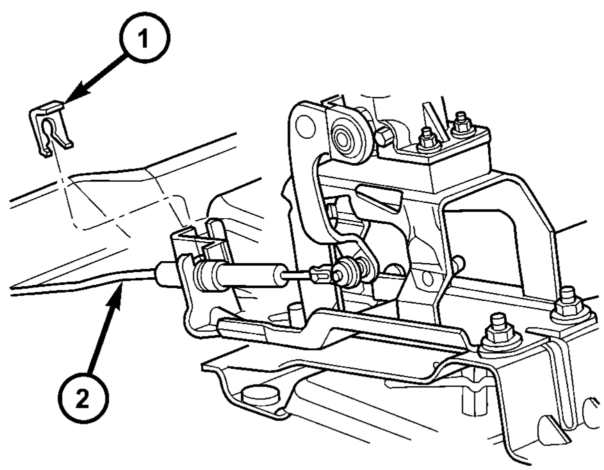


80c4a181

Fig. 145 Center Console Support Bracket

1 - BRACKET
2 - SCREW
3 - GEARSHIFT MECHANISM

(8) Remove crossover cable retainer clip (Fig. 146).



80c4a0ac

Fig. 146 Crossover Cable Retainer Clip

1 - RETAINER CLIP
2 - CROSSOVER CABLE

GEARSHIFT CABLE - CROSSOVER (Continued)

(9) Remove crossover cable from gearshift mechanism (Fig. 147).

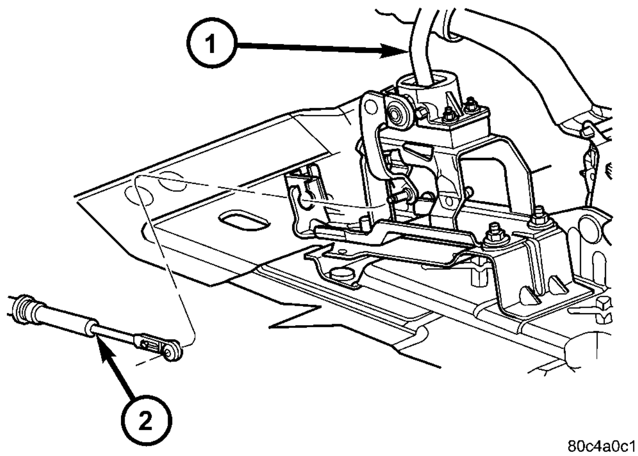


Fig. 147 Crossover Cable at Gearshift Mechanism

1 - GEARSHIFT MECHANISM
2 - CROSSOVER CABLE

(10) **2.4L Gas equipped models goto Step 15. 2.5L TD models:** Remove battery thermal shield (Fig. 148).

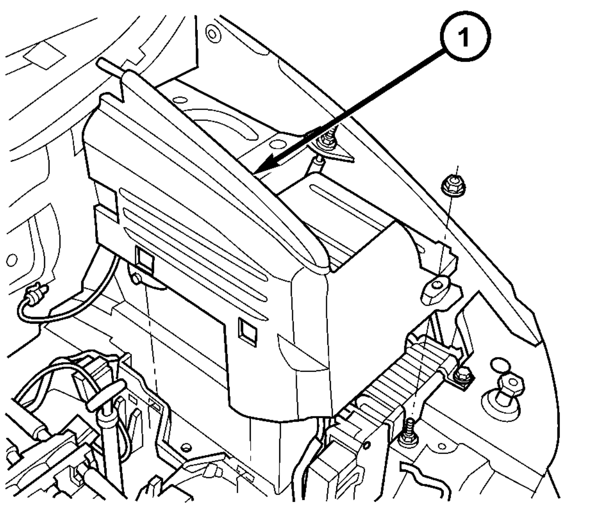


Fig. 148 Battery Thermal Shield

1 - BATTERY THERMAL SHIELD

(11) Remove battery hold down nut, clamp, and battery (Fig. 149).

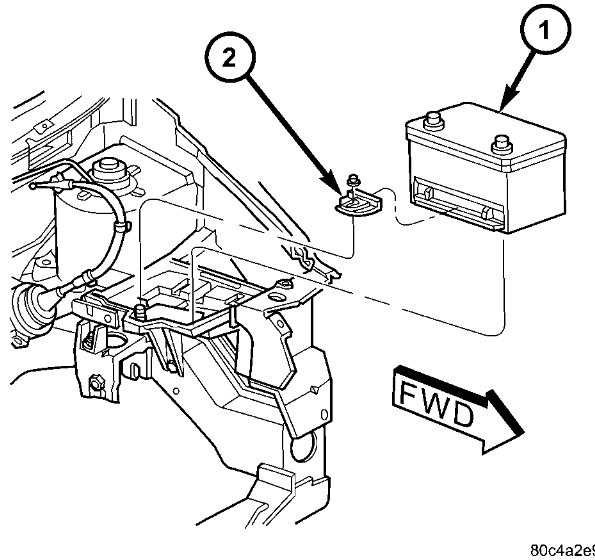


Fig. 149 Battery and Hold-Down Clamp

1 - BATTERY
2 - HOLD-DOWN CLAMP

(12) Remove battery tray (Fig. 150). Disconnect battery temperature sensor.

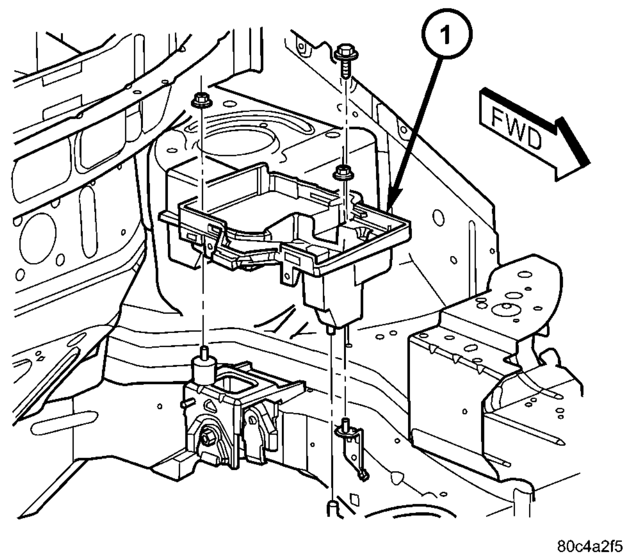


Fig. 150 Battery Tray

1 - BATTERY TRAY

GEARSHIFT CABLE - CROSSOVER (Continued)

(13) Remove coolant recovery bottle from bracket.

(14) Remove coolant recovery bottle mounting bracket (Fig. 151).

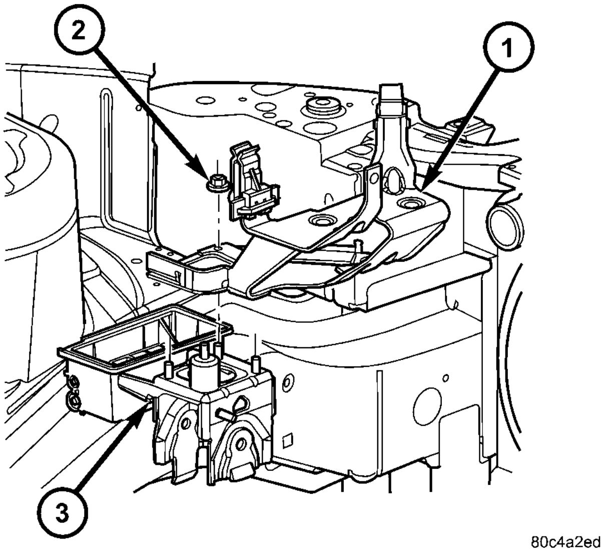


Fig. 151 Coolant Recovery Bottle Bracket

1 - COOLANT RECOVERY BOTTLE BRACKET
2 - NUT
3 - MOUNT BRACKET

(15) Disconnect crossover cable from transaxle crossover lever (Fig. 152).

(16) Remove crossover cable retainer clip and disengage cable from mount bracket (Fig. 152).

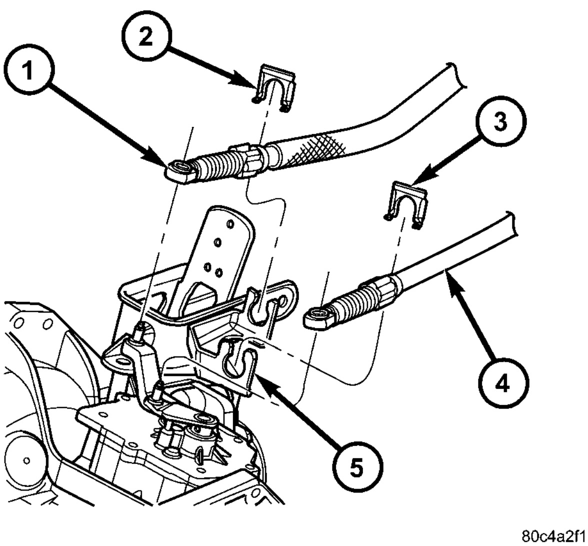


Fig. 152 Gearshift Cables at Transaxle

1 - SELECTOR CABLE
2 - CABLE RETAINER
3 - CABLE RETAINER
4 - CROSSOVER CABLE
5 - MOUNT BRACKET

(17) Raise vehicle on hoist.

(18) Remove crossover cable from engine compartment, then remove cable from passenger compartment through opening in floor pan.

INSTALLATION

(1) From underneath vehicle, install gearshift crossover cable into passenger compartment through floor pan hole. Install remainder of cable into position in engine compartment.

(2) Lower vehicle.

(3) Install crossover cable to mount bracket and secure with retainer clip (Fig. 153).

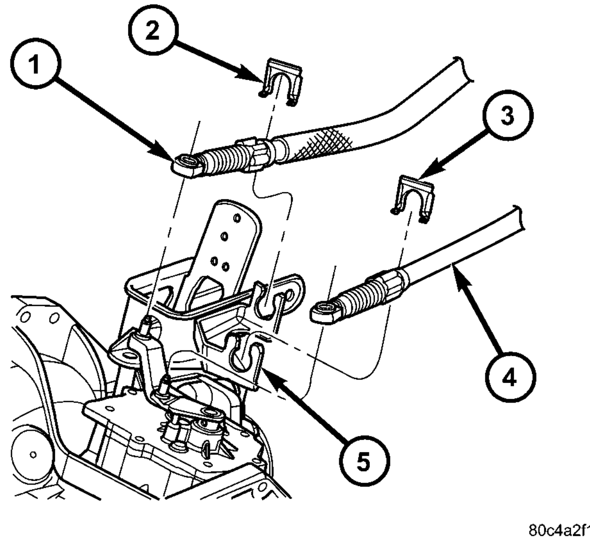


Fig. 153 Gearshift Cables at Transaxle

1 - SELECTOR CABLE
2 - CABLE RETAINER
3 - CABLE RETAINER
4 - CROSSOVER CABLE
5 - MOUNT BRACKET

(4) Install cable to transaxle crossover lever (Fig. 153).

GEARSHIFT CABLE - CROSSOVER (Continued)

(5) **2.4L Gas models goto Step 10. 2.5L TD Models:** Install coolant recovery bottle bracket (Fig. 154).

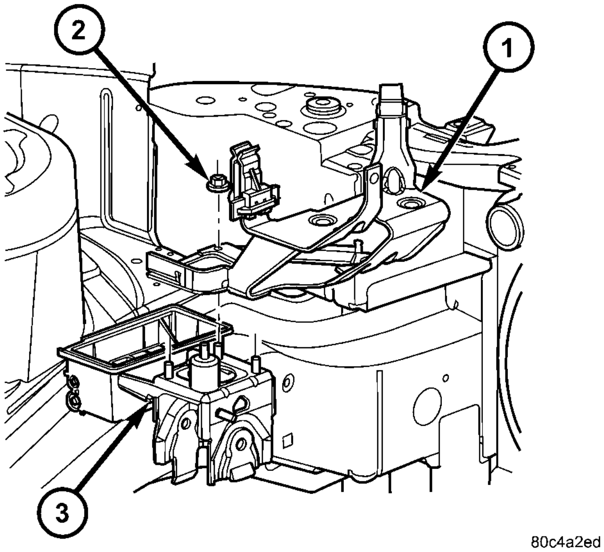


Fig. 154 Coolant Recovery Bottle Bracket

1 - COOLANT RECOVERY BOTTLE BRACKET
2 - NUT
3 - MOUNT BRACKET

(6) Install coolant recovery bottle to bracket.

(7) Connect battery temperature sensor to battery tray. Install battery tray into position (Fig. 155).

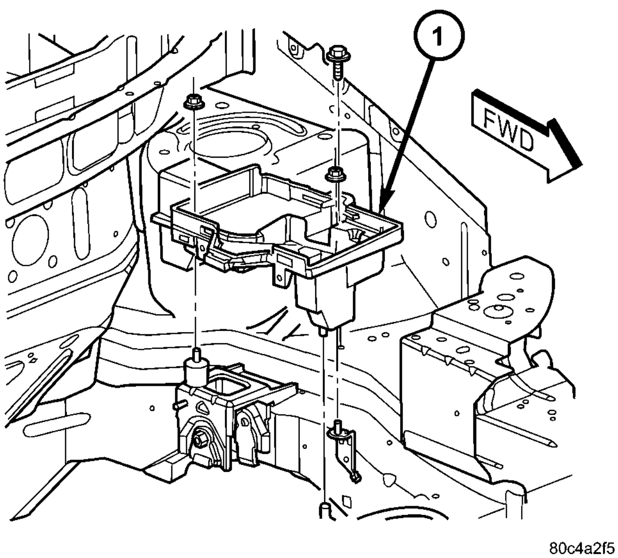


Fig. 155 Battery Tray

1 - BATTERY TRAY

(8) Install battery, hold-down clamp, and nut (Fig. 156).

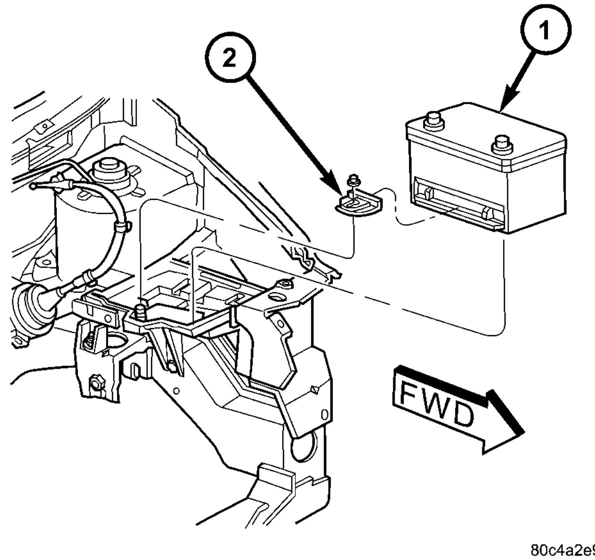


Fig. 156 Battery and Hold-Down Clamp

1 - BATTERY
2 - HOLD-DOWN CLAMP

(9) Install battery thermal shield (Fig. 157).

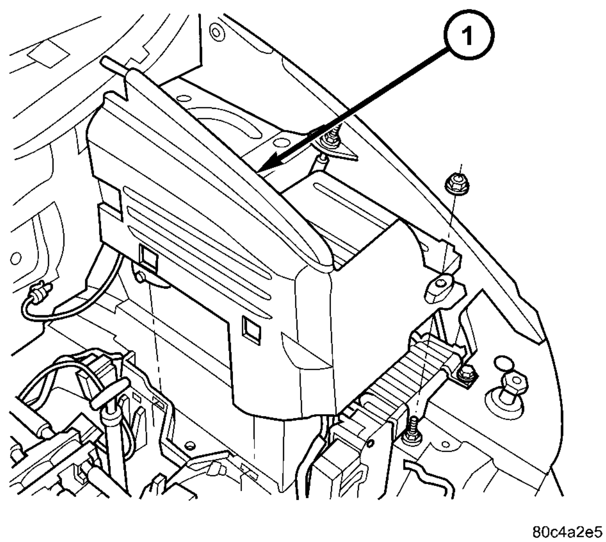


Fig. 157 Battery Thermal Shield

1 - BATTERY THERMAL SHIELD

GEARSHIFT CABLE - CROSSOVER (Continued)

(10) Install crossover cable to gearshift mechanism (Fig. 158). Install retainer clip (Fig. 159).

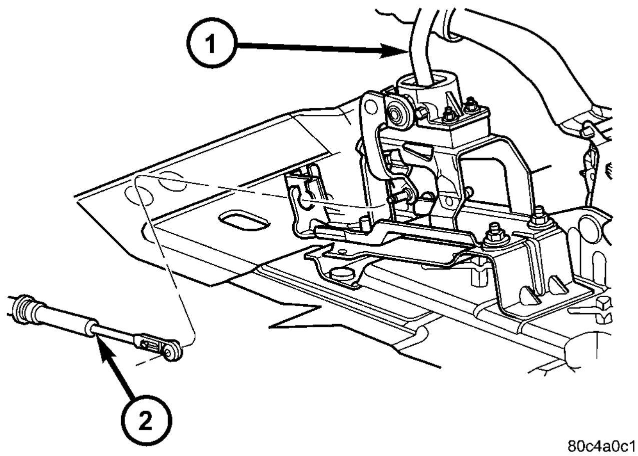


Fig. 158 Crossover Cable at Gearshift Mechanism

1 - GEARSHIFT MECHANISM
2 - CROSSOVER CABLE

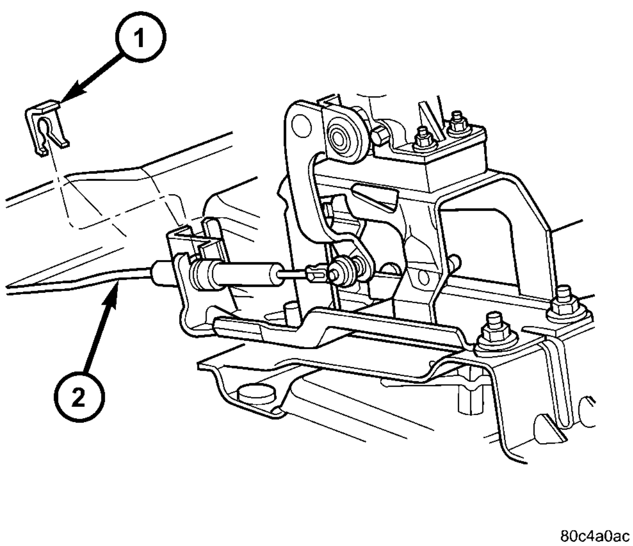


Fig. 159 Crossover Cable Retainer Clip

1 - RETAINER CLIP
2 - CROSSOVER CABLE

(11) Adjust crossover cable (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL/GEAR SHIFT CABLE - ADJUSTMENTS).

(12) Install center console support bracket (Fig. 160). Torque support bracket-to-gearshift mechanism screws to 12 N·m (108 in. lbs.).

(13) Install center console assembly (Fig. 161). Install and torque center console-to-gearshift mechanism screws to 5 N·m (45 in. lbs.).

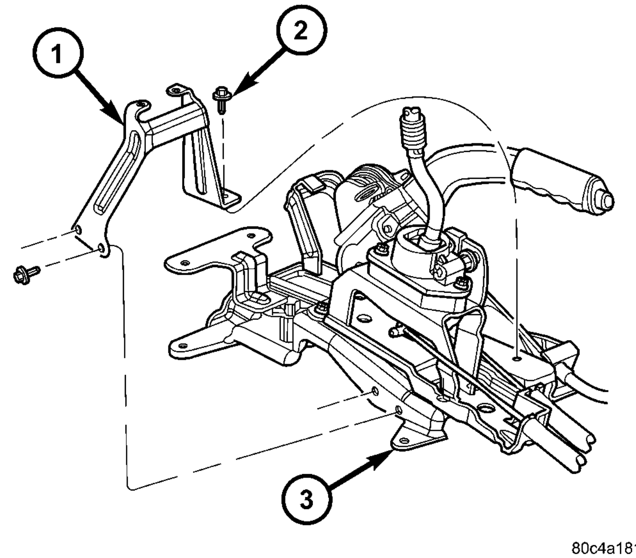


Fig. 160 Center Console Support Bracket

1 - BRACKET
2 - SCREW
3 - GEARSHIFT MECHANISM

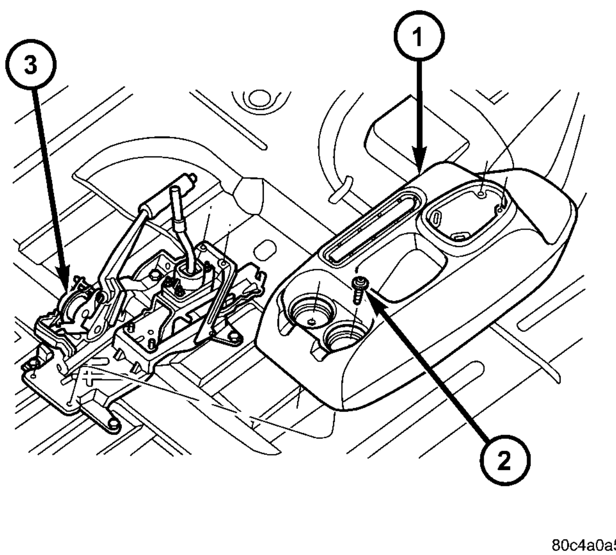


Fig. 161 Center Console Removal/Installation (LHD Shown — RHD Typical)

1 - CENTER CONSOLE
2 - SCREW (4)
3 - GEARSHIFT MECHANISM

GEARSHIFT CABLE - CROSSOVER (Continued)

(14) Install cupholder plugs (Fig. 162).

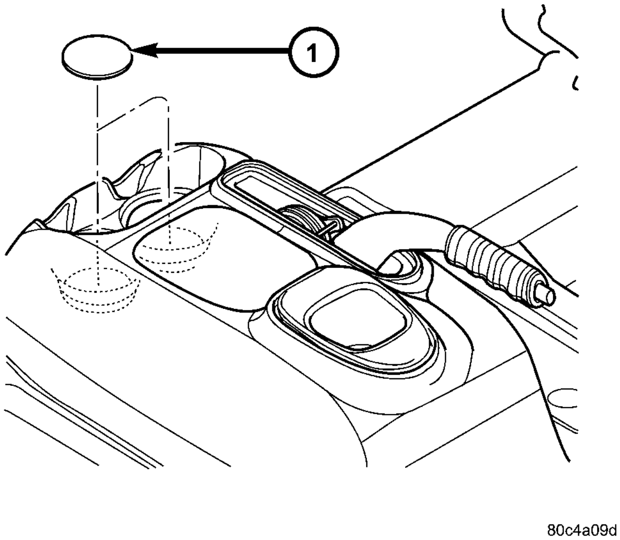


Fig. 162 Cup Holder Plugs

1 - CUPHOLDER PLUG (2)

(15) Install gearshift boot to console (Fig. 163). Secure with three (3) retainer clips.

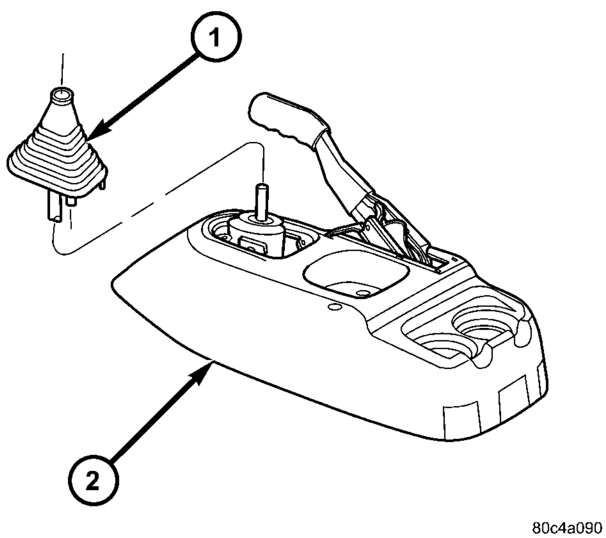


Fig. 163 Gearshift Boot Removal/Installation

1 - GEARSHIFT BOOT
2 - CENTER CONSOLE

(16) Install gearshift knob to gearshift lever (Fig. 164). Orient shift pattern ¼-turn clockwise, push down and rotate ¼-turn counter-clockwise and release. Secure boot to knob.

(17) Connect battery negative cable.

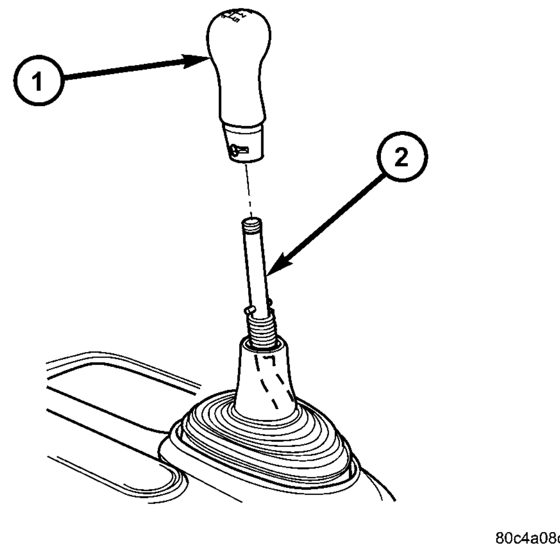


Fig. 164 Gearshift Knob Removal/Installation

1 - GEARSHIFT KNOB
2 - GEARSHIFT LEVER

ADJUSTMENTS

ADJUSTMENT

(1) Disconnect battery negative cable.

(2) Remove gearshift knob by pushing down and rotating ¼-turn clock-wise (Fig. 165).

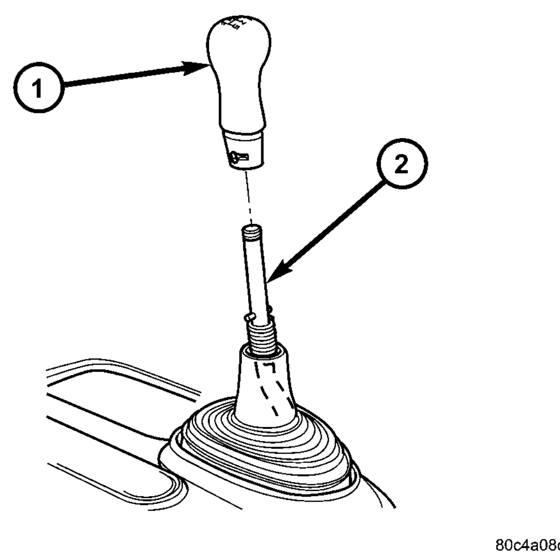


Fig. 165 Gearshift Knob Removal/Installation

1 - GEARSHIFT KNOB
2 - GEARSHIFT LEVER

GEARSHIFT CABLE - CROSSOVER (Continued)

(3) Remove gearshift boot from center console by disengaging at three (3) retaining clips (Fig. 166).

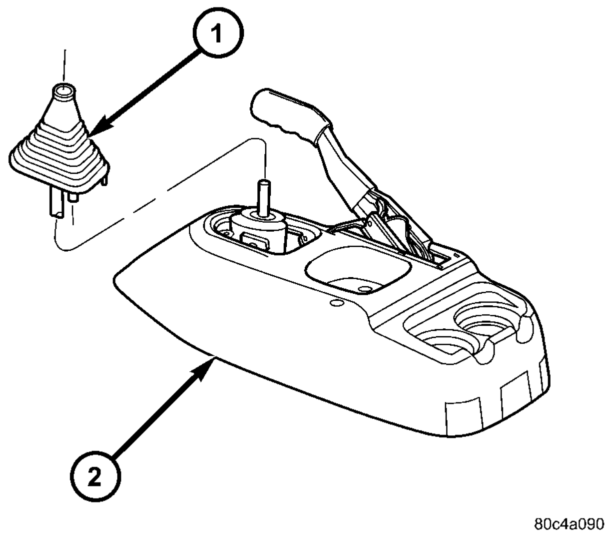


Fig. 166 Gearshift Boot Removal/Installation

1 - GEARSHIFT BOOT
2 - CENTER CONSOLE

(4) Apply park brake to allow park brake handle to clear center console upon removal.

(5) Remove two (2) cupholder bottom plugs (Fig. 167).

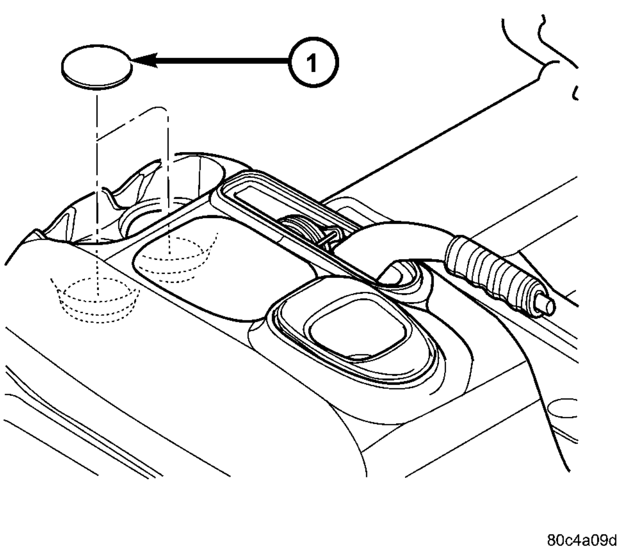


Fig. 167 Cup Holder Plugs

1 - CUPHOLDER PLUG (2)

(6) Remove four (4) center console-to-gearshift mechanism screws. Remove console assembly (Fig. 168).

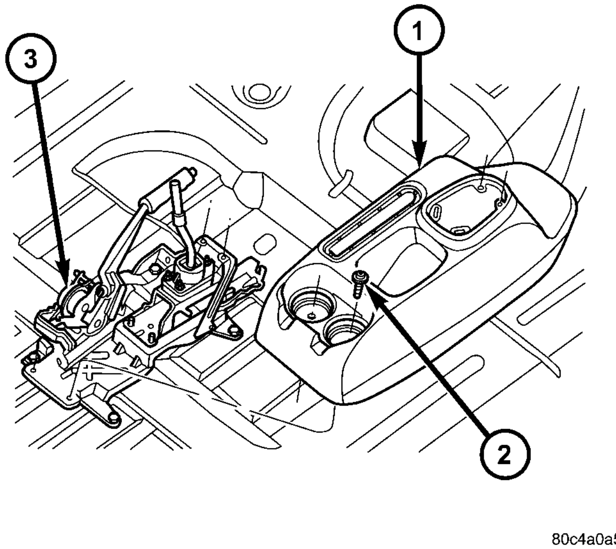


Fig. 168 Center Console Removal/Installation (LHD Shown — RHD Typical)

1 - CENTER CONSOLE
2 - SCREW (4)
3 - GEARSHIFT MECHANISM

(7) Loosen crossover cable adjustment screw (Fig. 169).

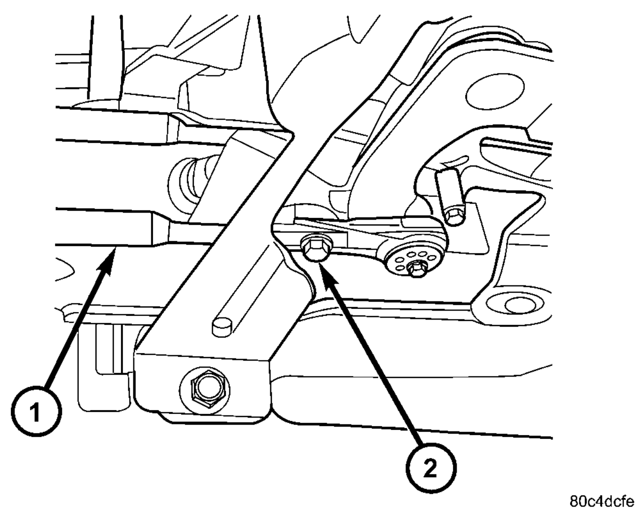


Fig. 169 Crossover Cable Adjustment Screw

1 - CROSSOVER CABLE
2 - ADJUSTMENT SCREW

GEARSHIFT CABLE - CROSSOVER (Continued)

(8) Rock gearshift lever back and forth between 1–2 and 5–R planes. Release lever, allowing shifter spring to return lever to the neutral position in the 3–4 plane. Place gearshift lever in the 3rd gear position.

(9) Torque crossover lever adjustment screw to 8 N·m (70 in. lbs.). **No load should be applied to the shifter lever in any direction (hands off) while tightening screw.**

(10) Verify gearshift lever travel through all gear ranges with engine off (not running).

(11) Install center console assembly (Fig. 168). Install and torque center console-to-gearshift mechanism screws to 5 N·m (45 in. lbs.).

(12) Install cupholder plugs (Fig. 167).

(13) Install gearshift boot to console (Fig. 166). Secure boot to console with three (3) retainer clips.

(14) Install gearshift knob to gearshift lever (Fig. 165). Orient shift pattern on knob ¼-turn clockwise, push down and rotate ¼-turn counter-clockwise and release. Secure boot to knob.

(15) Connect battery negative cable.

GEARSHIFT CABLE - SELECTOR

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove gearshift knob by pushing down and rotating ¼-turn clock-wise (Fig. 170).

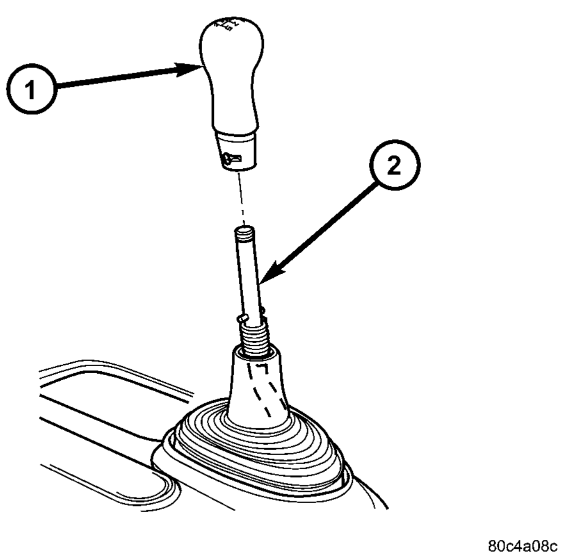


Fig. 170 Gearshift Knob Removal/Installation

1 - GEARSHIFT KNOB
2 - GEARSHIFT LEVER

(3) Remove gearshift boot from center console by disengaging at three (3) retaining clips (Fig. 171).

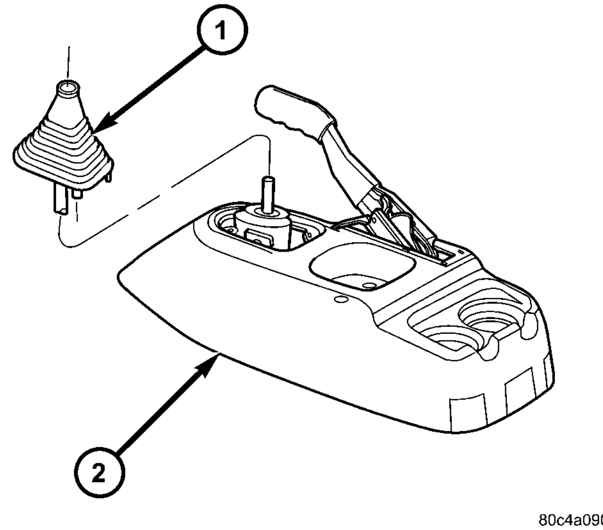


Fig. 171 Gearshift Boot Removal/Installation

1 - GEARSHIFT BOOT
2 - CENTER CONSOLE

(4) Apply park brake to allow park brake handle to clear center console upon removal.

(5) Remove two (2) cupholder bottom plugs (Fig. 172).

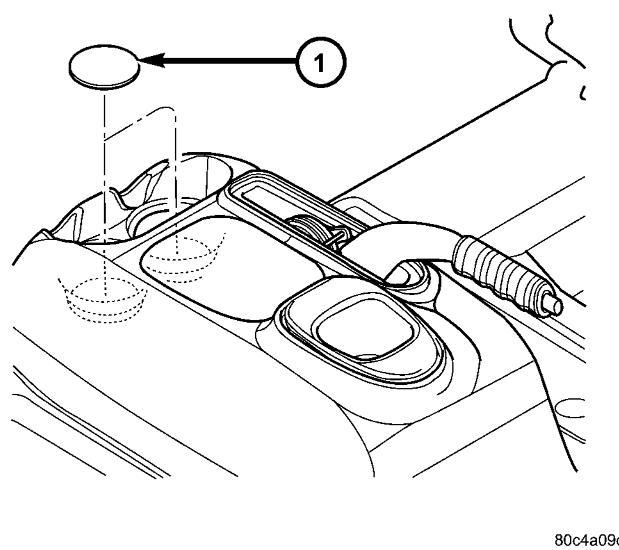


Fig. 172 Cup Holder Plugs

1 - CUPHOLDER PLUG (2)

GEARSHIFT CABLE - SELECTOR (Continued)

(6) Remove four (4) center console-to-gearshift mechanism screws. Remove console assembly (Fig. 173).

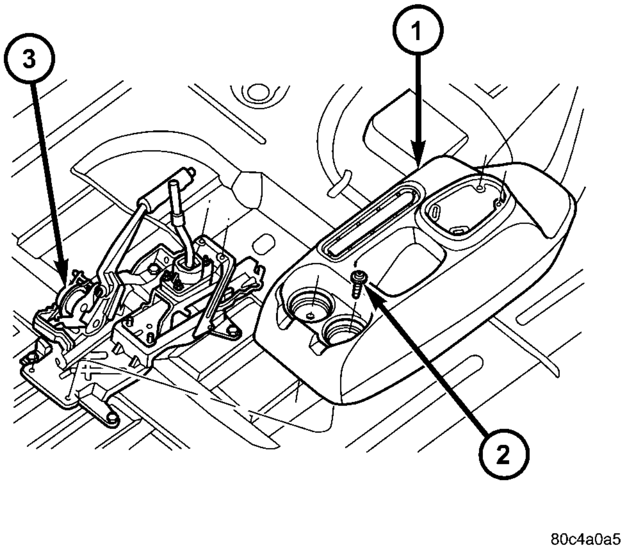


Fig. 173 Center Console Removal/Installation (LHD Shown — RHD Typical)

1 - CENTER CONSOLE
2 - SCREW (4)
3 - GEARSHIFT MECHANISM

(7) Remove center console support bracket (Fig. 174).

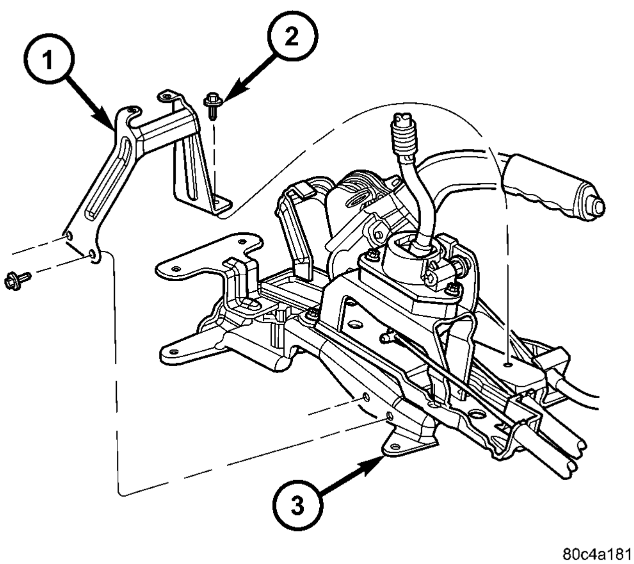


Fig. 174 Center Console Support Bracket

1 - BRACKET
2 - SCREW
3 - GEARSHIFT MECHANISM

(8) Remove selector cable retainer clip (Fig. 175).

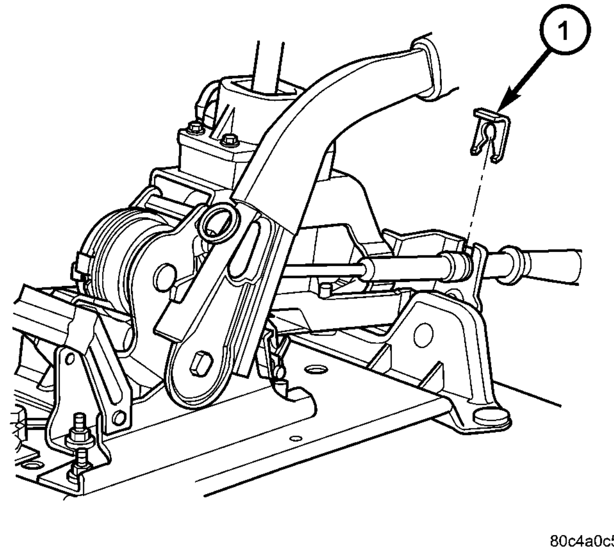


Fig. 175 Selector Cable Retainer Clip

1 - RETAINER CLIP

(9) Remove selector cable from gearshift mechanism (Fig. 176).

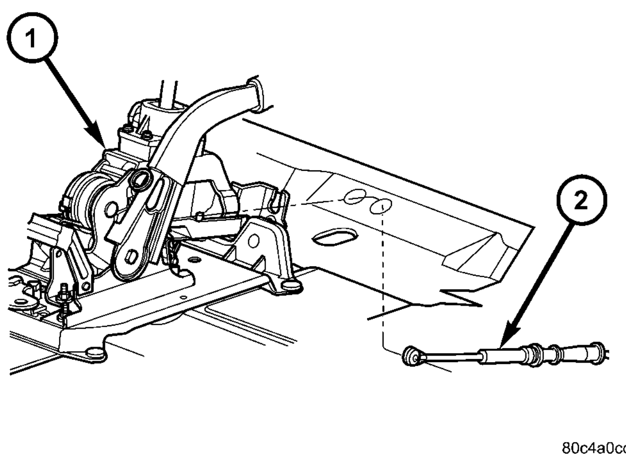


Fig. 176 Selector Cable at Gearshift Mechanism

1 - GEARSHIFT MECHANISM
2 - SELECTOR CABLE

GEARSHIFT CABLE - SELECTOR (Continued)

(10) **2.4L Gas models goto Step 15. 2.5L TD Models:** Remove battery thermal shield (Fig. 177).

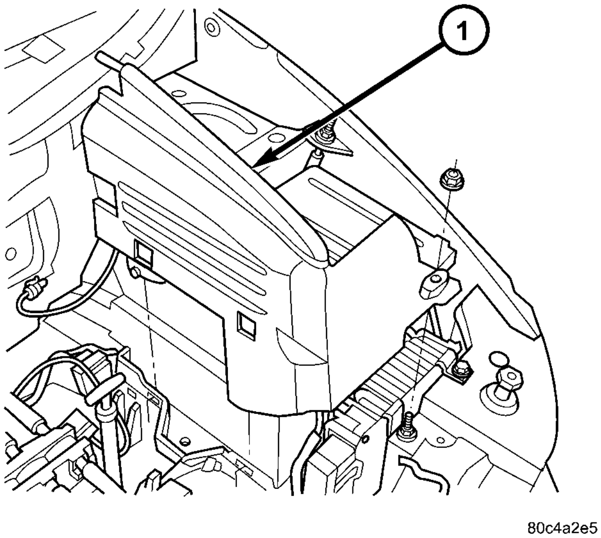


Fig. 177 Battery Thermal Shield

1 - BATTERY THERMAL SHIELD

(11) Remove battery hold down nut, clamp, and battery (Fig. 178).

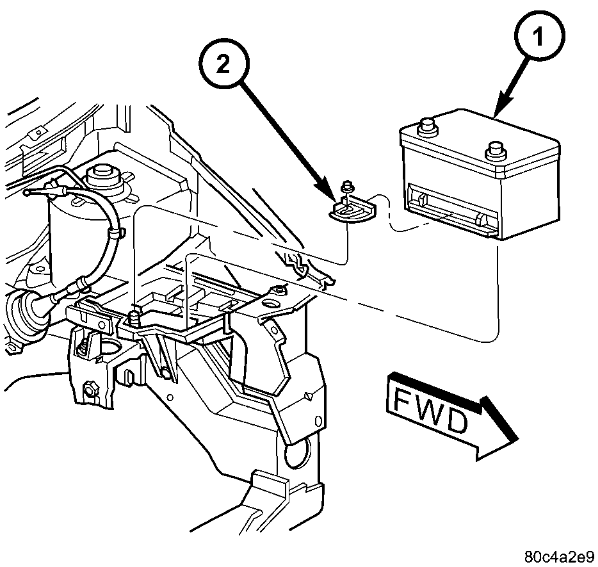


Fig. 178 Battery and Hold-Down Clamp

1 - BATTERY
2 - HOLD-DOWN CLAMP

(12) Remove battery tray (Fig. 179). Disconnect battery temperature sensor.

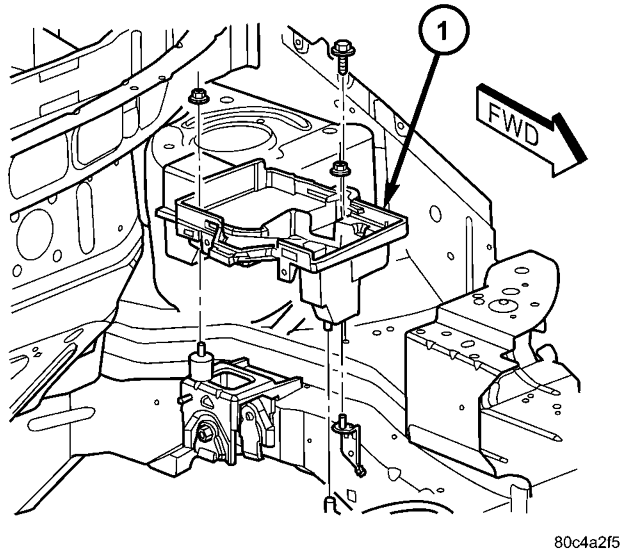


Fig. 179 Battery Tray

1 - BATTERY TRAY

(13) Remove coolant recovery bottle from bracket.

(14) Remove coolant recovery bottle mounting bracket (Fig. 180).

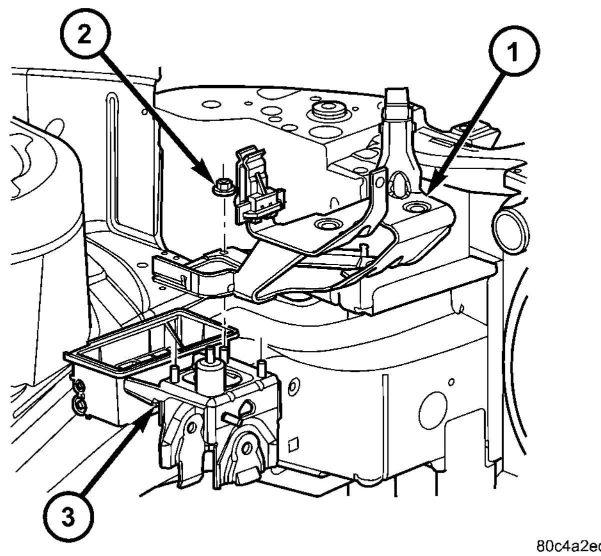


Fig. 180 Coolant Recovery Bottle Bracket

1 - COOLANT RECOVERY BOTTLE BRACKET
2 - NUT
3 - MOUNT BRACKET

GEARSHIFT CABLE - SELECTOR (Continued)

(15) Disconnect crossover cable from transaxle crossover lever (Fig. 181).

(16) Remove crossover cable retainer clip and disengage cable from mount bracket (Fig. 181).

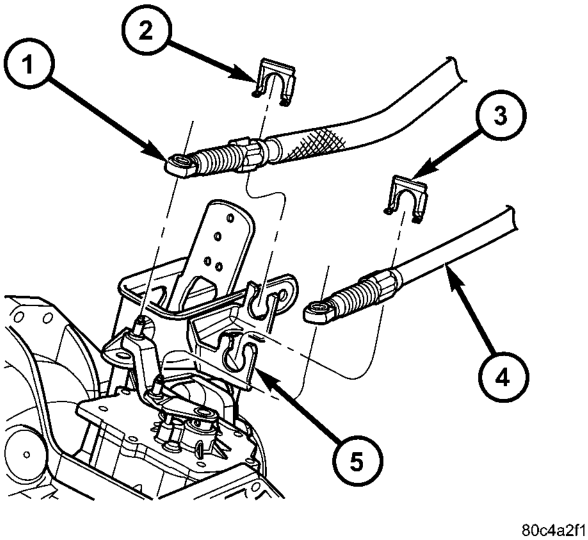


Fig. 181 Gearshift Cables at Transaxle

1 - SELECTOR CABLE
2 - CABLE RETAINER
3 - CABLE RETAINER
4 - CROSSOVER CABLE
5 - MOUNT BRACKET

(17) Raise vehicle on hoist.

(18) Remove selector cable from engine compartment, then remove cable from passenger compartment through opening in floor pan.

INSTALLATION

(1) From underneath vehicle, install gearshift selector cable into passenger compartment through floor pan hole. Install remainder of cable into position in engine compartment.

(2) Lower vehicle.

(3) Install selector cable to mount bracket and secure with retainer clip (Fig. 182).

(4) Install cable to transaxle selector lever (Fig. 182).

(5) **2.4L Gas models goto Step 10. 2.5L TD models:** Install coolant recovery bottle bracket (Fig. 183).

(6) Install coolant recovery bottle to bracket.

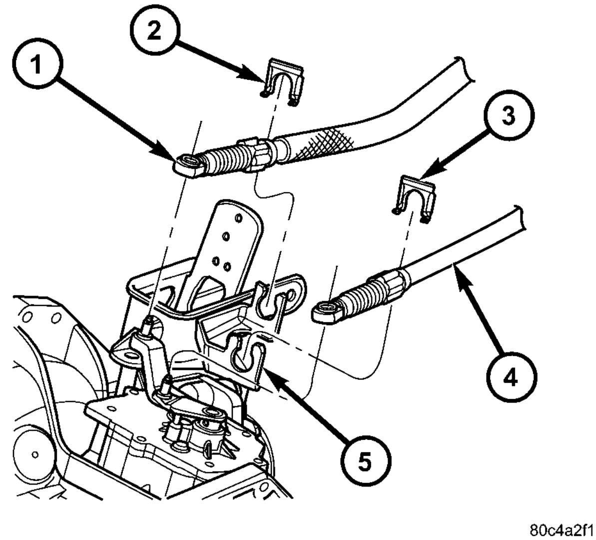


Fig. 182 Gearshift Cables at Transaxle

1 - SELECTOR CABLE
2 - CABLE RETAINER
3 - CABLE RETAINER
4 - CROSSOVER CABLE
5 - MOUNT BRACKET

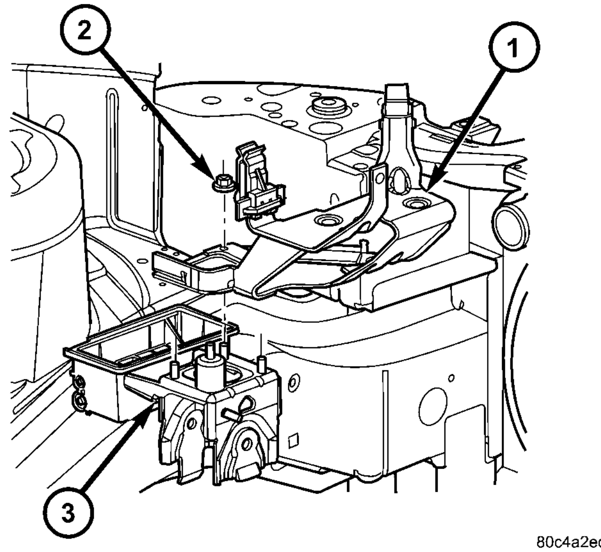


Fig. 183 Coolant Recovery Bottle Bracket

1 - COOLANT RECOVERY BOTTLE BRACKET
2 - NUT
3 - MOUNT BRACKET

GEARSHIFT CABLE - SELECTOR (Continued)

(7) Connect battery temperature sensor to battery tray. Install battery tray into position (Fig. 184).

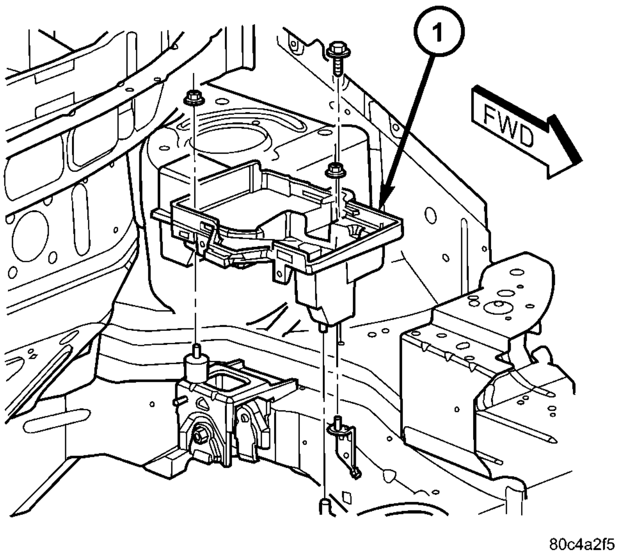


Fig. 184 Battery Tray

1 - BATTERY TRAY

(8) Install battery, hold-down clamp, and nut (Fig. 185).

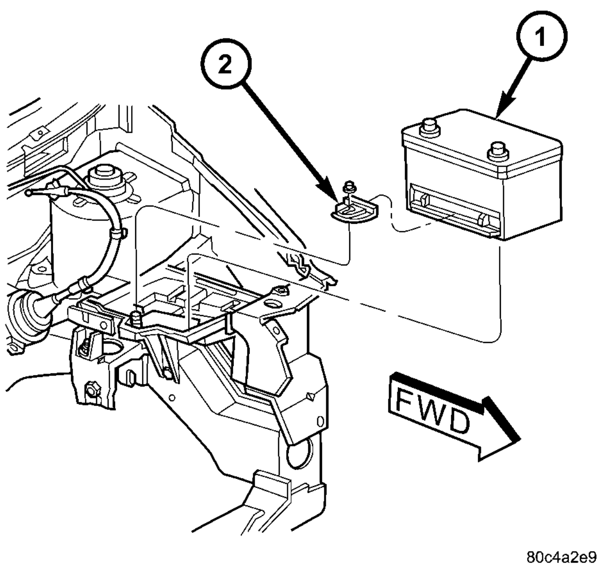


Fig. 185 Battery and Hold-Down Clamp

1 - BATTERY
2 - HOLD-DOWN CLAMP

(9) Install battery thermal shield (Fig. 186).

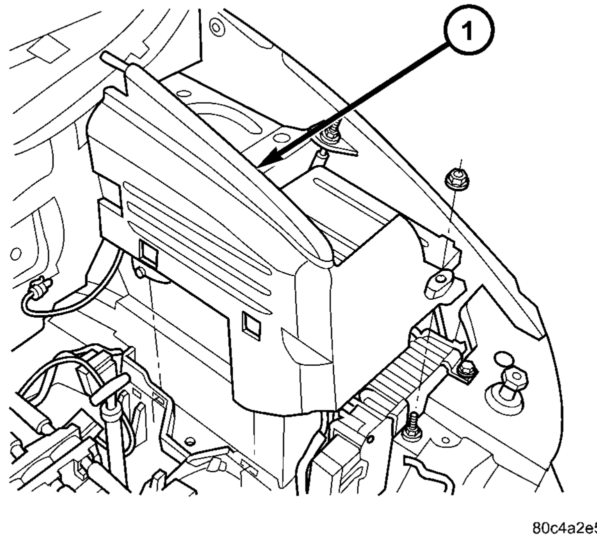


Fig. 186 Battery Thermal Shield

1 - BATTERY THERMAL SHIELD

(10) Install selector cable to gearshift mechanism (Fig. 187). Install retainer clip (Fig. 188).

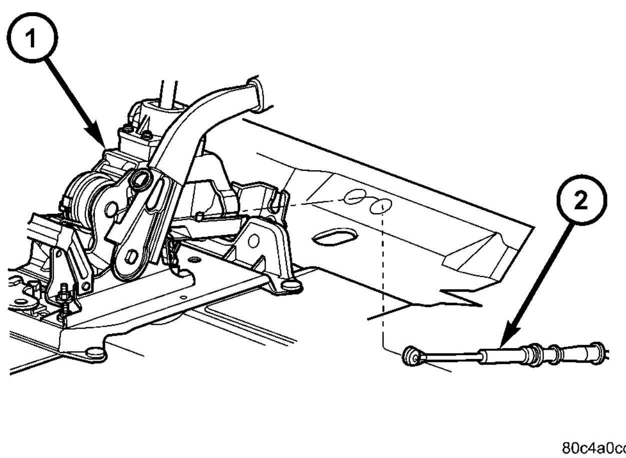


Fig. 187 Selector Cable at Gearshift Mechanism

1 - GEARSHIFT MECHANISM
2 - SELECTOR CABLE

GEARSHIFT CABLE - SELECTOR (Continued)

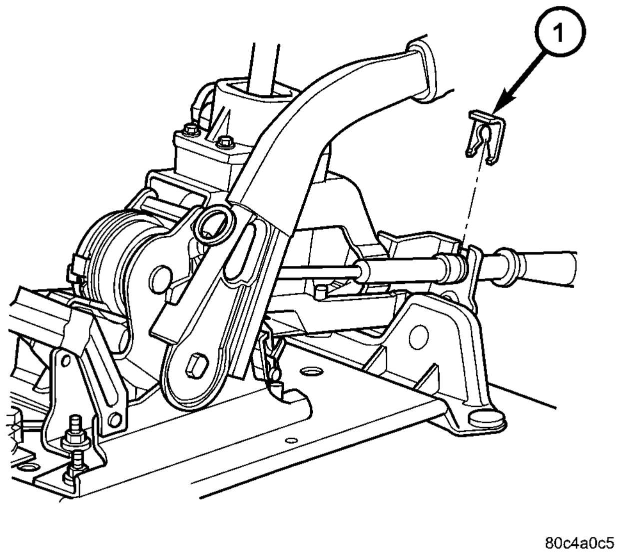


Fig. 188 Selector Cable Retainer Clip

1 - RETAINER CLIP

(11) Install center console support bracket (Fig. 189). Torque support bracket-to-gearshift mechanism screws to 12 N·m (108 in. lbs.).

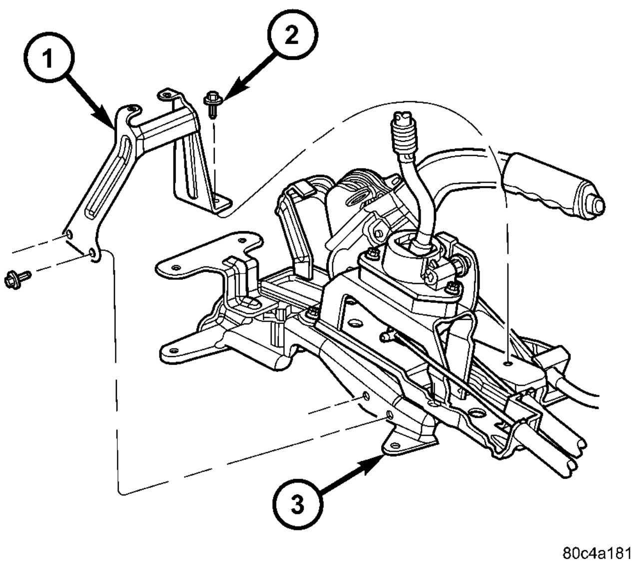


Fig. 189 Center Console Support Bracket

1 - BRACKET
2 - SCREW
3 - GEARSHIFT MECHANISM

(12) Install center console assembly (Fig. 190). Install and torque center console-to-gearshift mechanism screws to 5 N·m (45 in. lbs.).

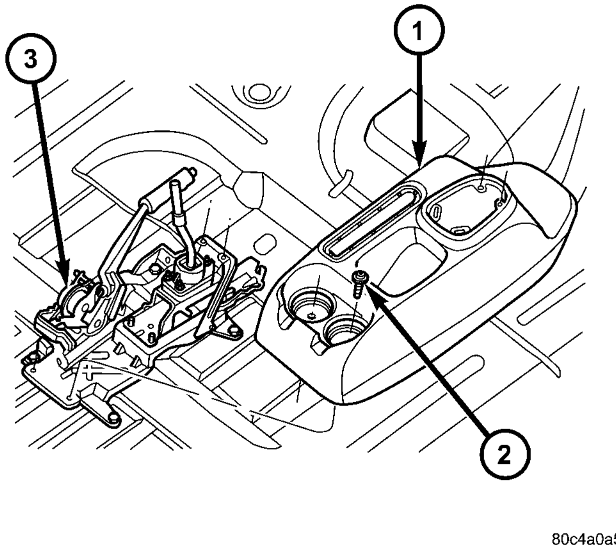


Fig. 190 Center Console Removal/Installation (LHD Shown — RHD Typical)

1 - CENTER CONSOLE
2 - SCREW (4)
3 - GEARSHIFT MECHANISM

(13) Install cupholder plugs (Fig. 191).

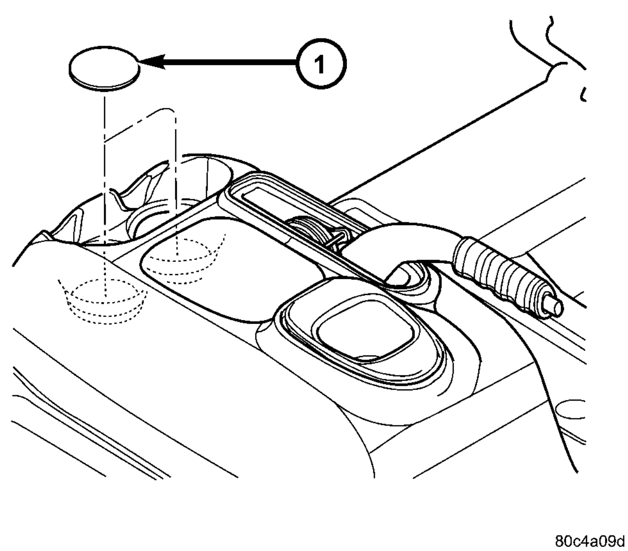


Fig. 191 Cup Holder Plugs

1 - CUPHOLDER PLUG (2)

GEARSHIFT CABLE - SELECTOR (Continued)

(14) Install gearshift boot to console (Fig. 192). Secure with three (3) retainer clips.

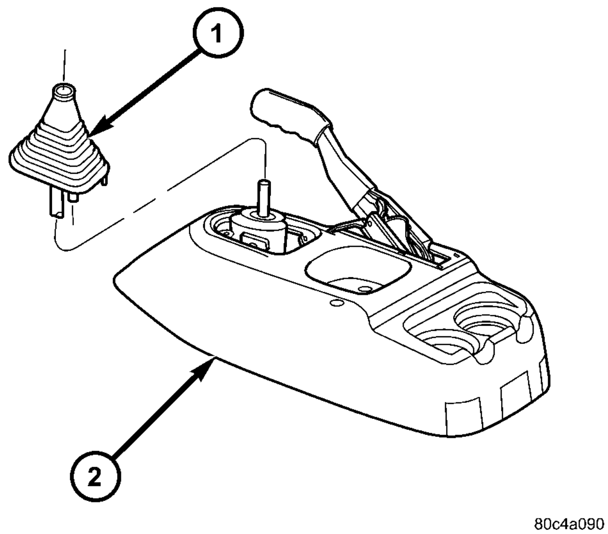


Fig. 192 Gearshift Boot Removal/Installation

1 - GEARSHIFT BOOT
2 - CENTER CONSOLE

(15) Install gearshift knob to gearshift lever (Fig. 193). Orient shift pattern ¼-turn clockwise, push down and rotate ¼-turn counter-clockwise and release. Secure boot to knob.

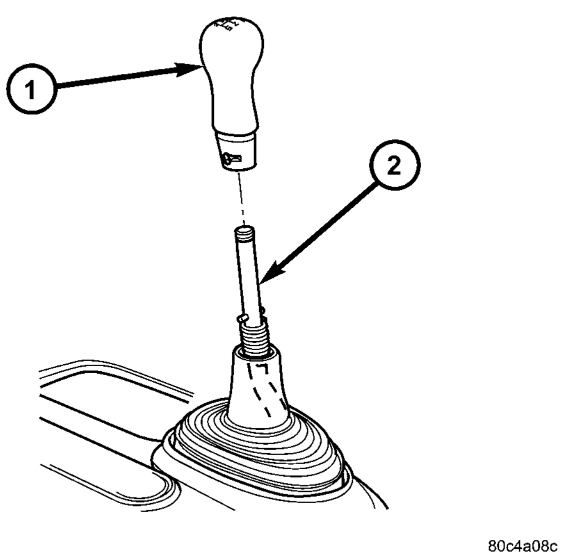


Fig. 193 Gearshift Knob Removal/Installation

1 - GEARSHIFT KNOB
2 - GEARSHIFT LEVER

(16) Connect battery negative cable.

GEARSHIFT KNOB

REMOVAL

(1) Separate gearshift boot from base of knob.
(2) Remove gearshift knob by pushing down and rotating ¼-turn clockwise (Fig. 194).

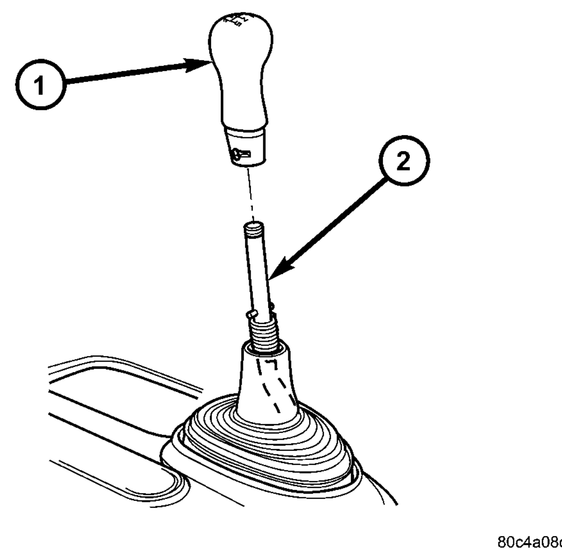


Fig. 194 Gearshift Knob Removal/Installation

1 - GEARSHIFT KNOB
2 - GEARSHIFT LEVER

INSTALLATION

(1) Install gearshift knob pattern ¼-turn clockwise, press down, and rotate ¼-turn counter clockwise (Fig. 194).
(2) Secure gearshift boot to base of knob.

GEARSHIFT MECHANISM

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove gearshift knob by pushing down and rotating ¼ turn clock-wise (Fig. 195).

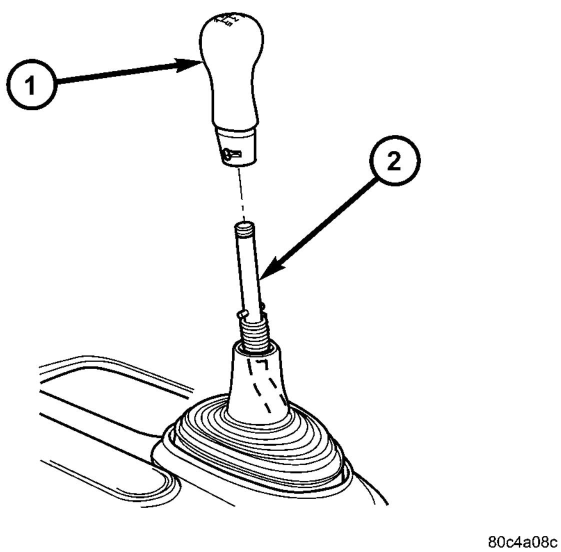


Fig. 195 Gearshift Knob Removal/Installation

1 - GEARSHIFT KNOB
2 - GEARSHIFT LEVER

(3) Remove gearshift boot from center console by disengaging at three (3) retaining clips (Fig. 196).

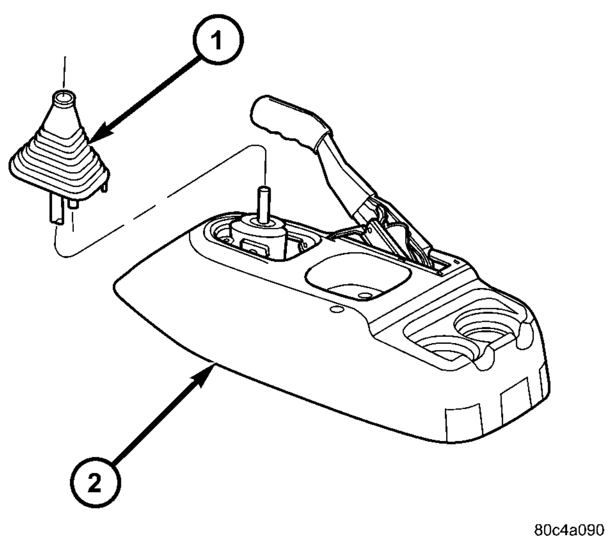


Fig. 196 Gearshift Boot Removal/Installation

1 - GEARSHIFT BOOT
2 - CENTER CONSOLE

(4) Apply park brake to allow park brake handle to clear center console upon removal.

(5) Remove two (2) cupholder bottom plugs (Fig. 197).

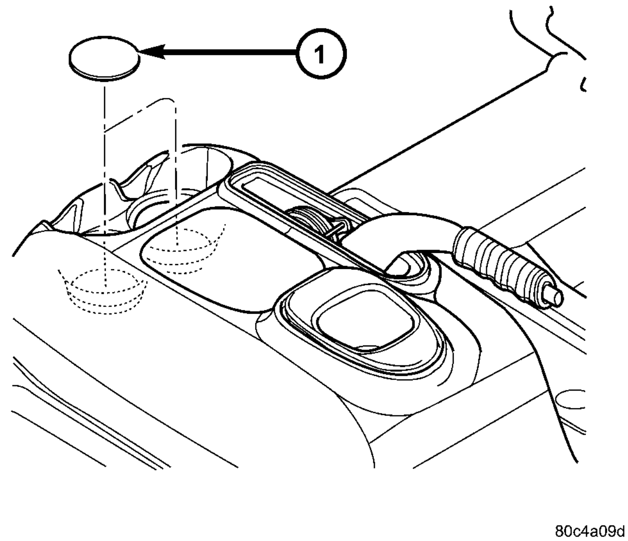


Fig. 197 Cup Holder Plugs

1 - CUPHOLDER PLUG (2)

(6) Remove four (4) center console-to-gearshift mechanism screws. Remove console assembly (Fig. 198).

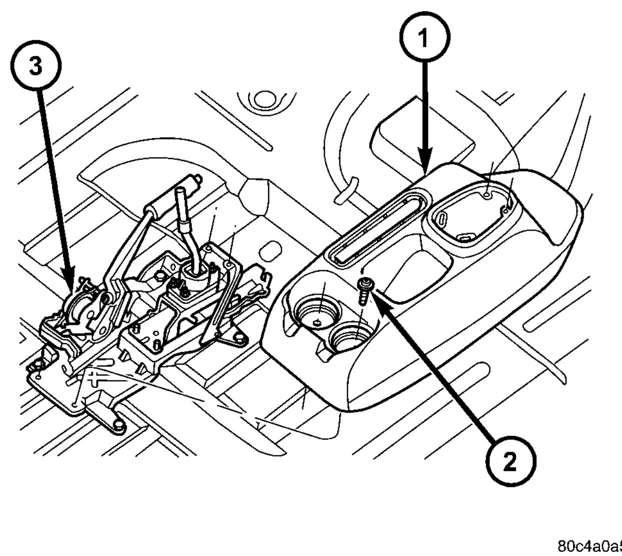


Fig. 198 Center Console Removal/Installation (LHD Shown — RHD Typical)

1 - CENTER CONSOLE
2 - SCREW (4)
3 - GEARSHIFT MECHANISM

GEARSHIFT MECHANISM (Continued)

(7) Remove center console support bracket (Fig. 199).

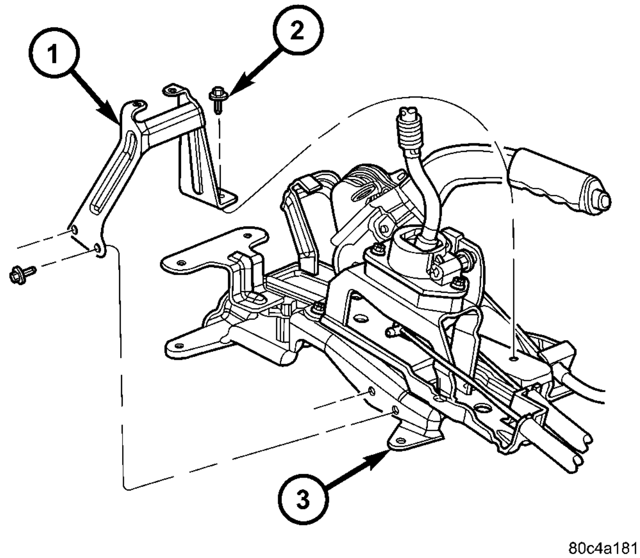


Fig. 199 Center Console Support Bracket

1 - BRACKET
2 - SCREW
3 - GEARSHIFT MECHANISM

(8) Remove crossover cable retainer clip (Fig. 200).

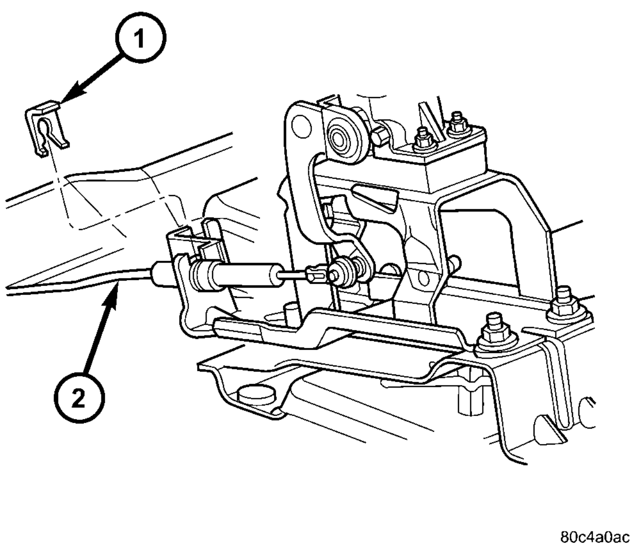


Fig. 200 Crossover Cable Retainer Clip

1 - RETAINER CLIP
2 - CROSSOVER CABLE

(9) Remove crossover cable from gearshift mechanism (Fig. 201).

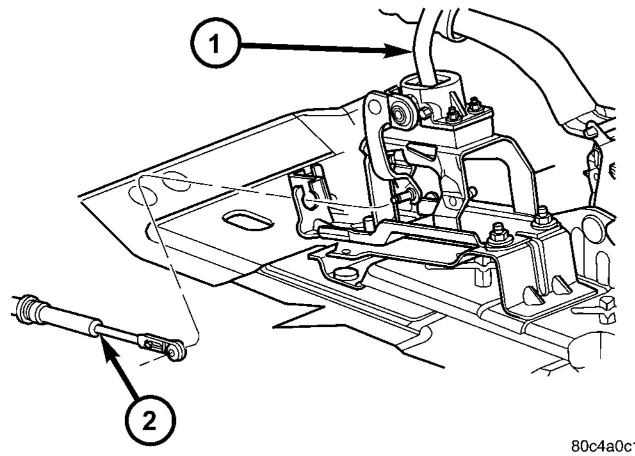


Fig. 201 Crossover Cable at Gearshift Mechanism

1 - GEARSHIFT MECHANISM
2 - CROSSOVER CABLE

(10) Remove selector cable retainer clip (Fig. 202).

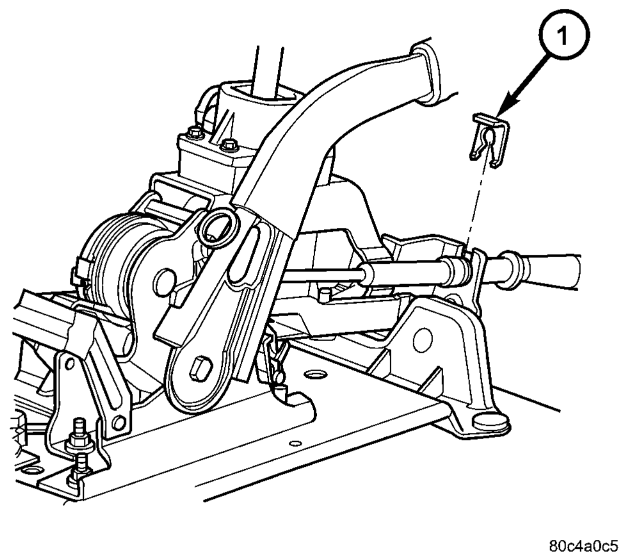


Fig. 202 Selector Cable Retainer Clip

1 - RETAINER CLIP

GEARSHIFT MECHANISM (Continued)

(11) Remove selector cable from gearshift mechanism (Fig. 203).

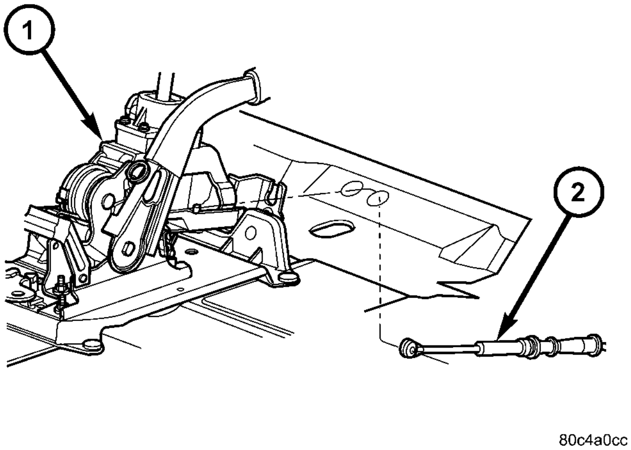


Fig. 203 Selector Cable at Gearshift Mechanism

1 - GEARSHIFT MECHANISM
2 - SELECTOR CABLE

(12) Remove four (4) gearshift mechanism-to-park brake bracket nuts. Remove gearshift mechanism from bracket (Fig. 204).

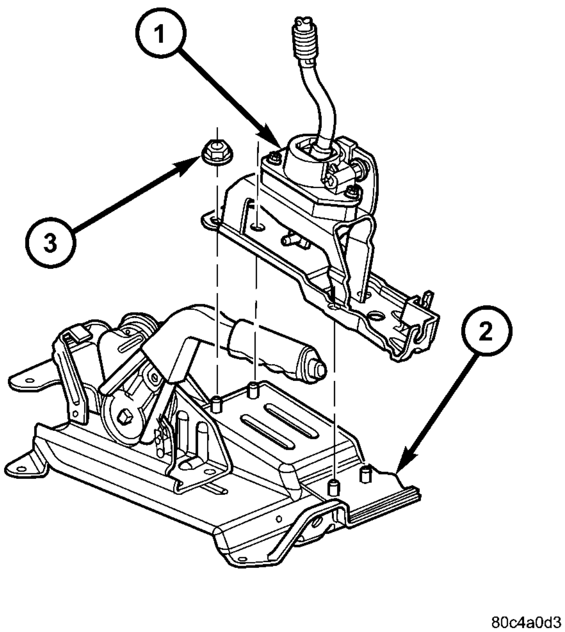


Fig. 204 Gearshift Mechanism Removal/Installation (RHD Shown — LHD Typical)

1 - GEARSHIFT MECHANISM
2 - PARK BRAKE BRACKET
3 - NUT (4)

INSTALLATION

(1) Install gearshift mechanism to park brake bracket (Fig. 205). Install and torque nuts to 12 N·m (108 in. lbs.).

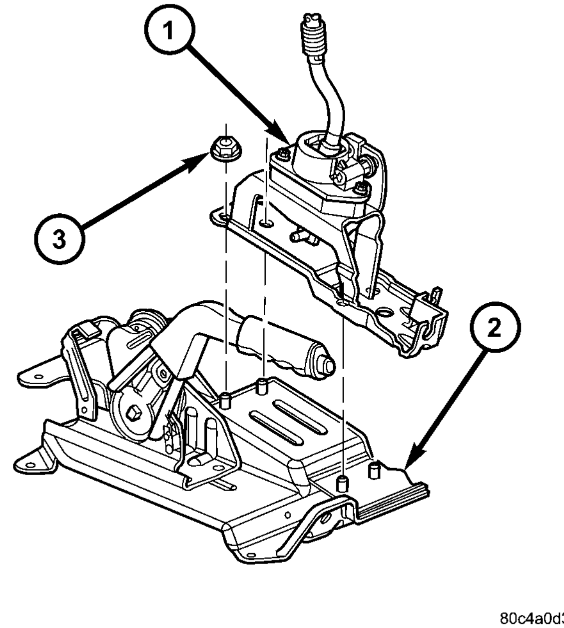


Fig. 205 Gearshift Mechanism Removal/Installation (RHD Shown — LHD Typical)

1 - GEARSHIFT MECHANISM
2 - PARK BRAKE BRACKET
3 - NUT (4)

(2) Install selector cable to gearshift mechanism (Fig. 206). Install retainer clip (Fig. 207).

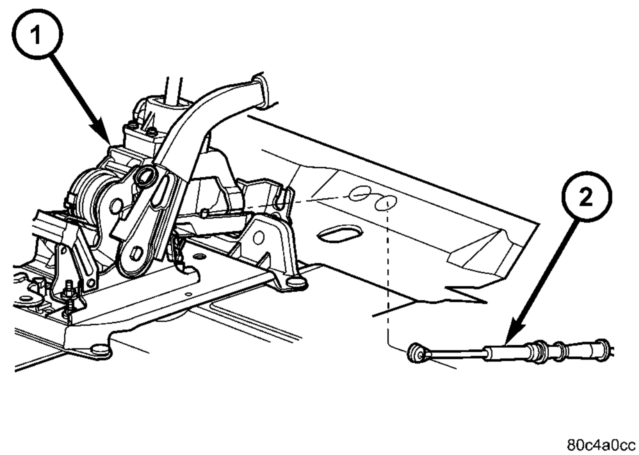


Fig. 206 Selector Cable at Gearshift Mechanism

1 - GEARSHIFT MECHANISM
2 - SELECTOR CABLE

GEARSHIFT MECHANISM (Continued)

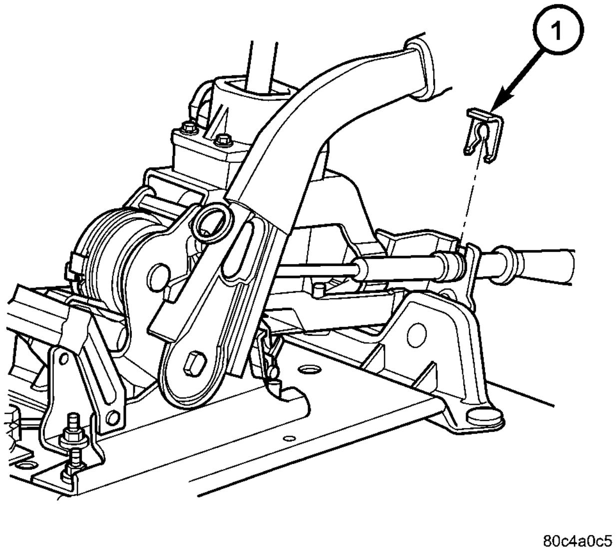


Fig. 207 Selector Cable Retainer Clip

1 - RETAINER CLIP

(3) Install crossover cable to gearshift mechanism (Fig. 208). Install retainer clip (Fig. 209).

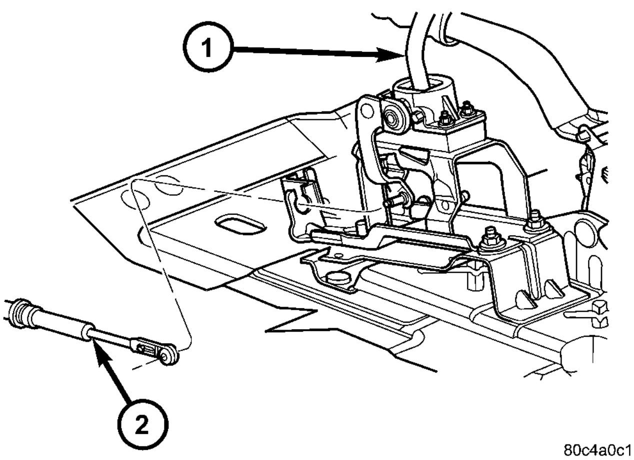


Fig. 208 Crossover Cable at Gearshift Mechanism

1 - GEARSHIFT MECHANISM
2 - CROSSOVER CABLE

(4) Adjust crossover cable.

(5) Install center console support bracket (Fig. 210). Torque support bracket-to-gearshift mechanism screws to 12 N·m (108 in. lbs.).

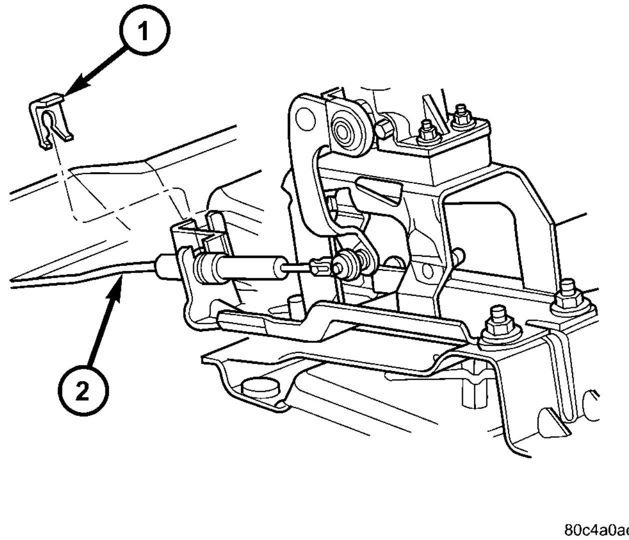


Fig. 209 Crossover Cable Retainer Clip

1 - RETAINER CLIP
2 - CROSSOVER CABLE

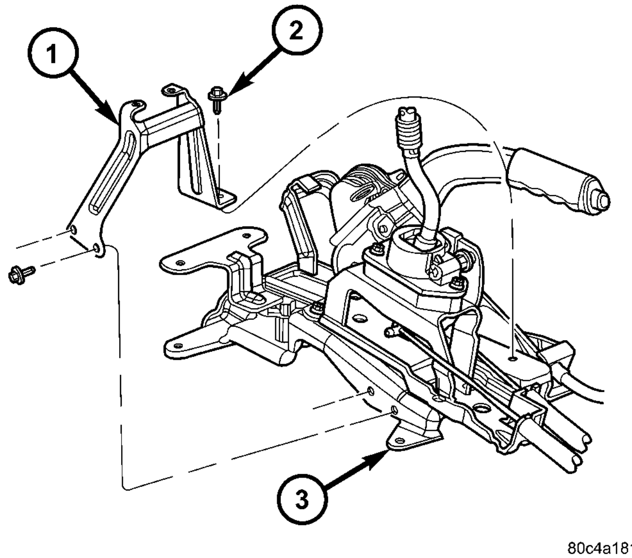
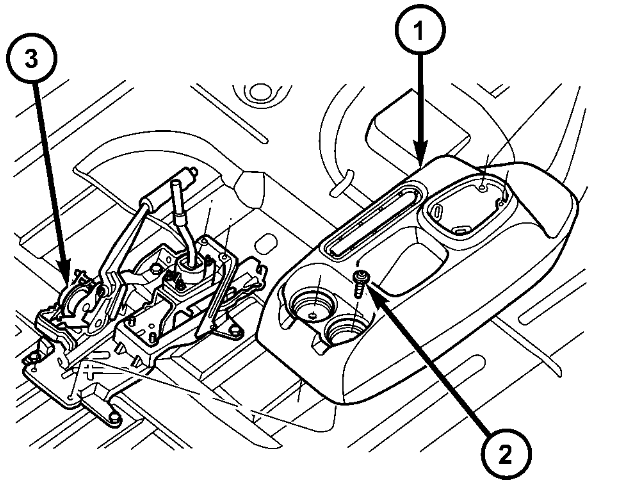


Fig. 210 Center Console Support Bracket

1 - BRACKET
2 - SCREW
3 - GEARSHIFT MECHANISM

GEARSHIFT MECHANISM (Continued)

(6) Install center console assembly (Fig. 211). Install and torque center console-to-gearshift mechanism screws to 5 N·m (45 in. lbs.).

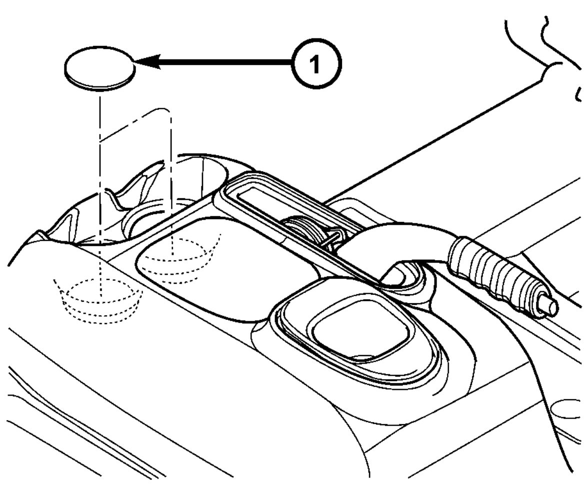


80c4a0a5

Fig. 211 Center Console Removal/Installation (LHD Shown — RHD Typical)

1 - CENTER CONSOLE
2 - SCREW (4)
3 - GEARSHIFT MECHANISM

(7) Install cupholder plugs (Fig. 212).

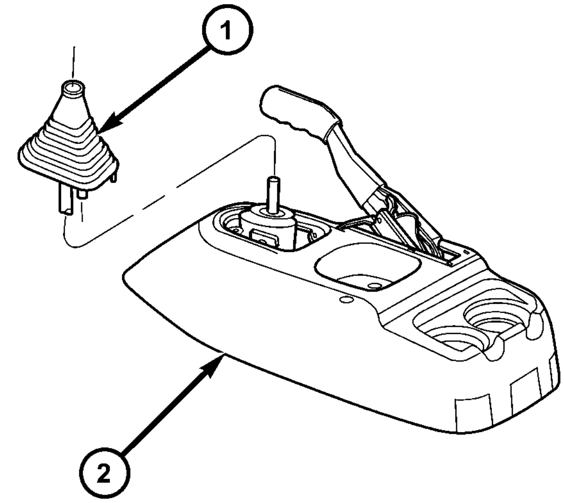


80c4a09d

Fig. 212 Cup Holder Plugs

1 - CUPHOLDER PLUG (2)

(8) Install gearshift boot to console (Fig. 213). Secure with three (3) retainer clips.



80c4a090

Fig. 213 Gearshift Boot Removal/Installation

1 - GEARSHIFT BOOT
2 - CENTER CONSOLE

(9) Install gearshift knob to gearshift lever (Fig. 214). Orient shift pattern ¼-turn clockwise, push down and rotate ¼-turn counter-clockwise and release. Secure boot to knob.

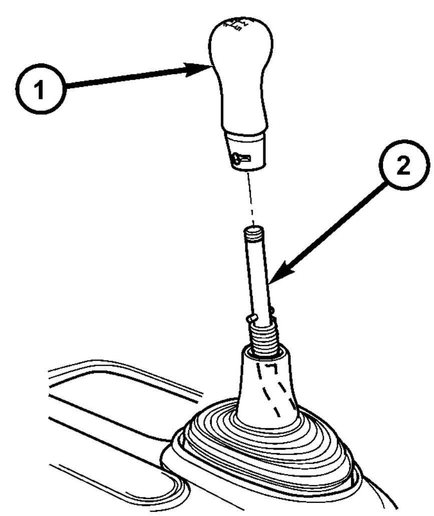


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Fig. 214 Gearshift Knob Removal/Installation

1 - GEARSHIFT KNOB
2 - GEARSHIFT LEVER

(10) Connect battery negative cable.

INPUT SHAFT

DESCRIPTION

The input shaft assembly (Fig. 215) is part of the transaxle geartrain, is driven by the clutch assembly, and consists of the following components:

- Input Shaft
- 3rd Speed Gear
- 4th Speed Gear
- 3/4 Synchronizer
- 5th Input Gear

The input shaft meshes with the intermediate shaft, and is supported by a needle bearing at the front of the transaxle, and a sealed roller bearing at the rear of the transaxle.

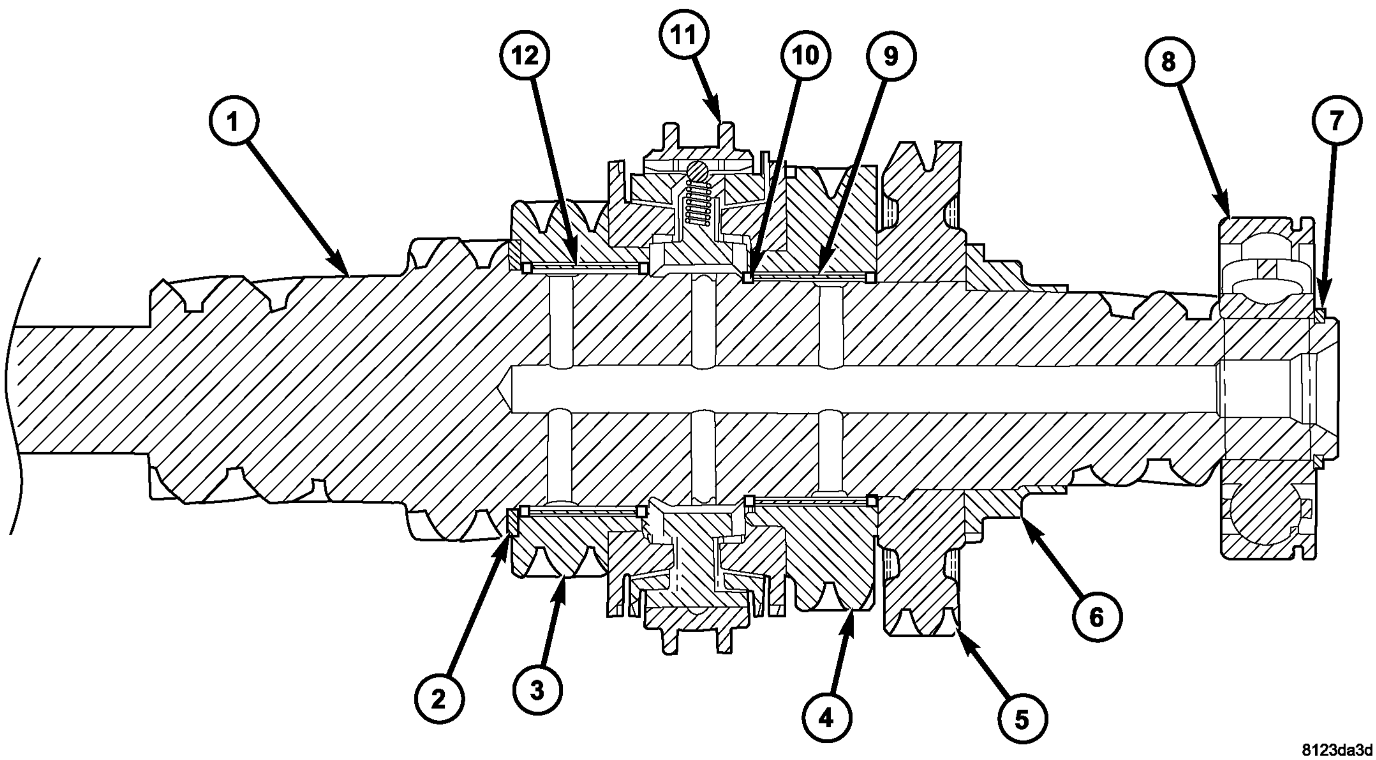

Fig. 215 Input Shaft Assembly

1 - INPUT SHAFT
2 - THRUST WASHER
3 - 3RD GEAR
4 - 4TH GEAR
5 - 5TH GEAR
6 - 5TH GEAR NUT
7 - SNAP RING
8 - INPUT BEARING (SEALED)
9 - NEEDLE BEARING
10 - SNAP RING
11 - 3/4 SYNCHRONIZER
12 - NEEDLE BEARING

INPUT SHAFT (Continued)

DISASSEMBLY

NOTE: When servicing the input shaft assembly, all snap rings which are removed MUST be replaced with new snap rings upon reassembly. The 5th gear nut must be replaced also.

(1) Invert input shaft assembly and place in fixture 8487.

(2) Remove input bearing snap ring (Fig. 216).

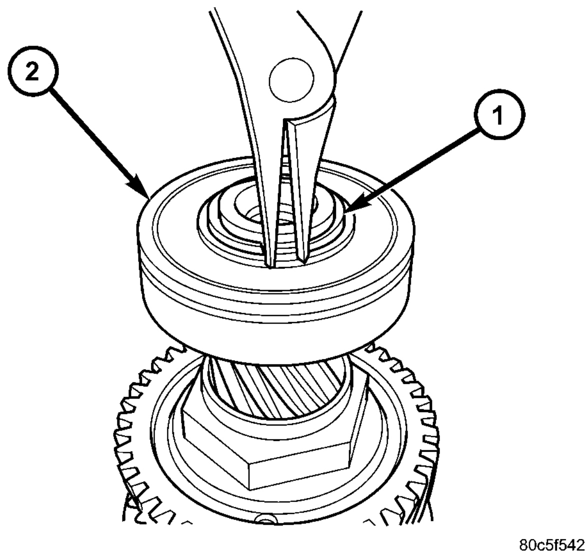

Fig. 216 Input Bearing Snap Ring Removal

1 - SNAP RING
2 - INPUT BEARING

(3) Remove input bearing. Place input shaft assembly onto arbor press table, with the input bearing supported by bearing splitter (Fig. 217). Using adapter 8486-4, press bearing off of shaft, while helper supports shaft to prevent dropping.

(4) Place input shaft assembly back into fixture 8487. Secure fixture to bench with fasteners, or secure to bench vise.

NOTE: 5th gear nut is staked to the shaft. If necessary, grind stake area to ease removal, but use care not to contact gear.

(5) Remove 5th gear nut with wrench 8478 (Fig. 218). Discard nut and use a new one upon assembly.

(6) Remove 5th gear with arbor press and bearing splitter.

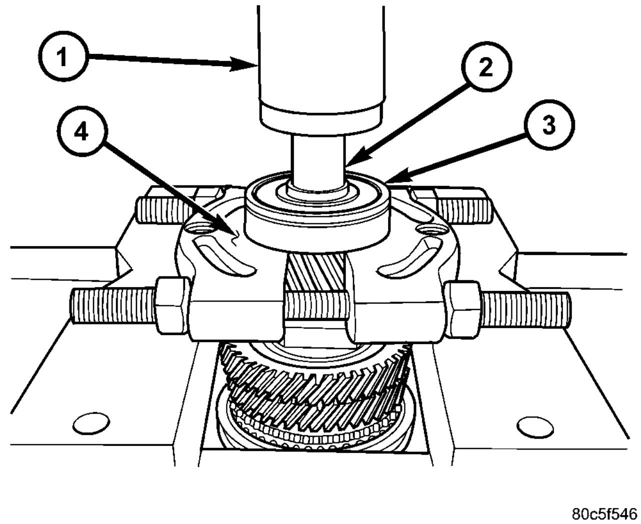

Fig. 217 Input Bearing Removal

1 - ARBOR PRESS RAM
2 - ADAPTER 8486-4
3 - INPUT BEARING
4 - BEARING SPLITTER

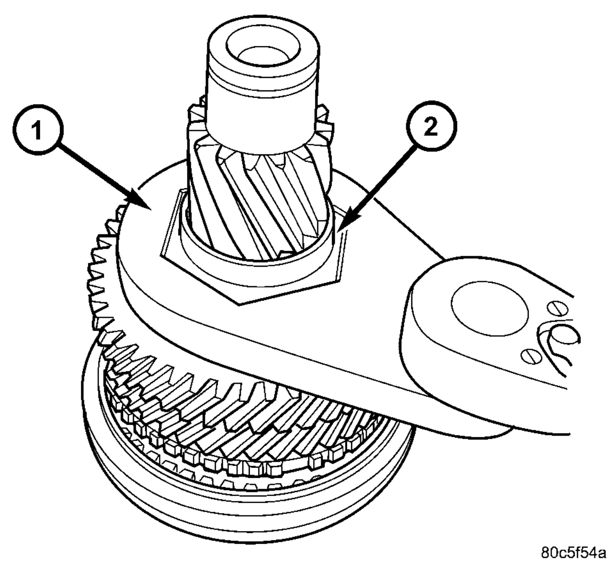

Fig. 218 5th Gear Nut Removal/Installation

1 - WRENCH 8478
2 - 5TH GEAR NUT

INPUT SHAFT (Continued)

(7) Remove 4th gear and needle bearing (Fig. 219) (Fig. 220).

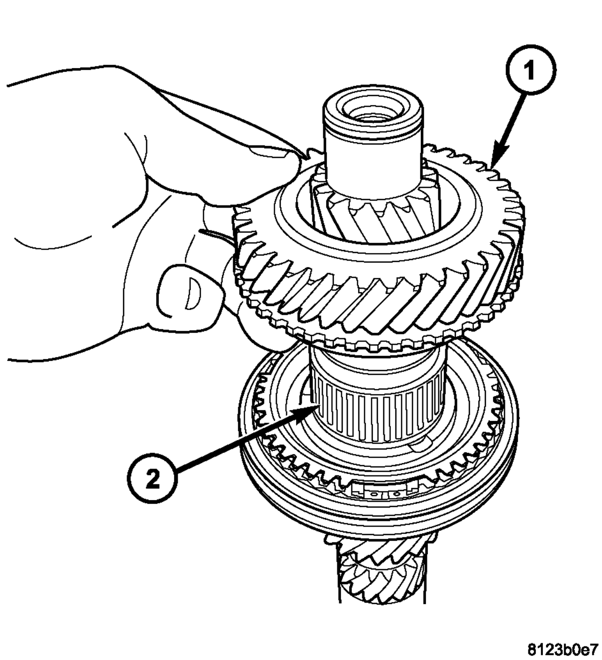

Fig. 219 4th Gear Removal/Installation

1 - 4TH GEAR
2 - NEEDLE BEARING

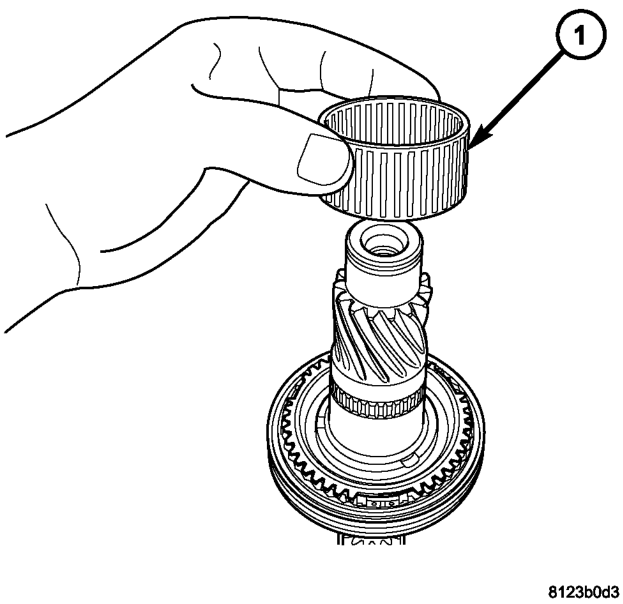

Fig. 220 4th Gear Needle Bearing Removal/ Installation

1 - 4TH GEAR NEEDLE BEARING

(8) Remove 4th gear blocker ring (Fig. 221).

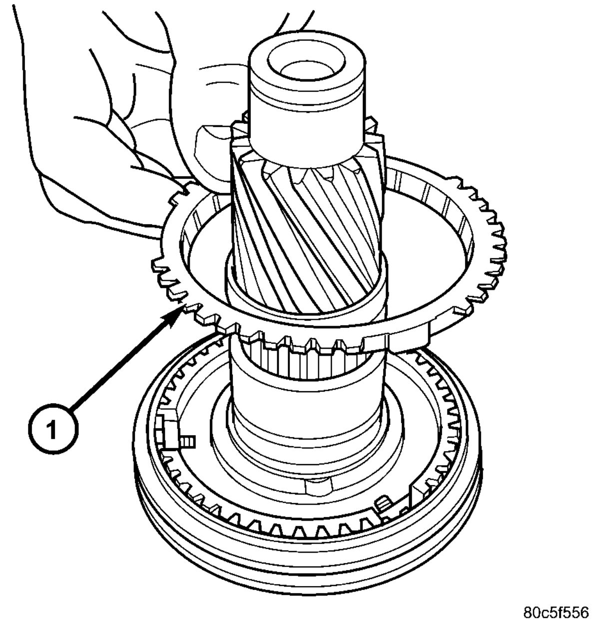

Fig. 221 4th Gear Blocker Ring

1 - 4th GEAR BLOCKER RING

(9) Remove 3/4 synchronizer snap ring (Fig. 222). Discard and replace with new snap ring upon assembly.

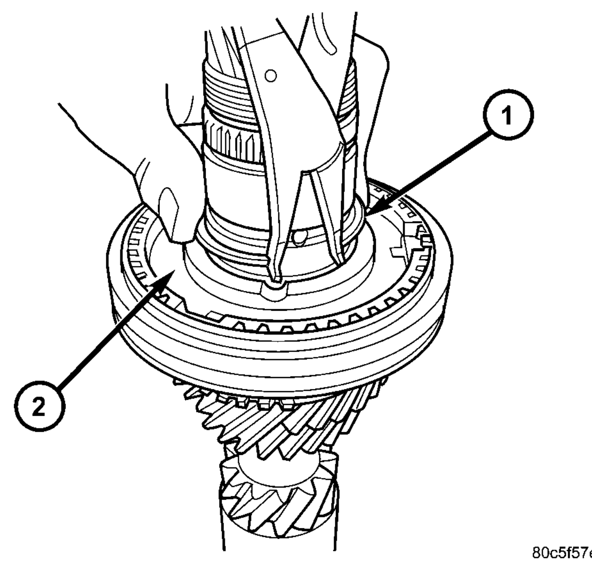

Fig. 222 3/4 Synchro Snap Ring

1 - SNAP RING
2 - 3/4 SYNCHRONIZER

INPUT SHAFT (Continued)

(10) Remove 3/4 synchronizer (Fig. 223).

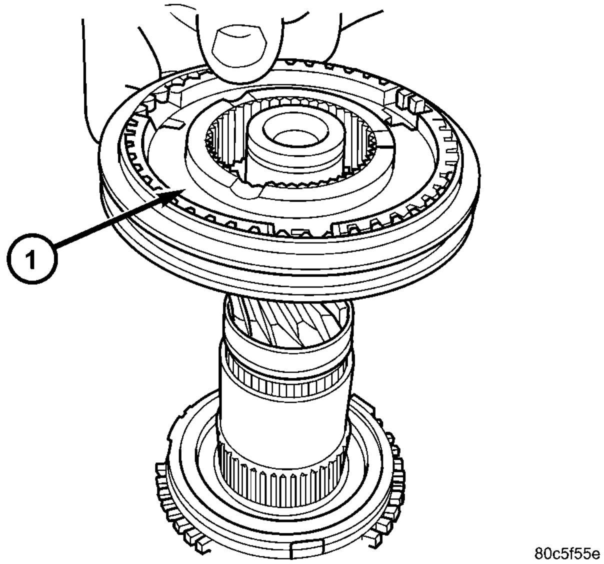

Fig. 223 3/4 Synchro Assembly

1 - 3/4 SYNCHRONIZER

(11) Remove 3rd gear blocker ring (Fig. 224).

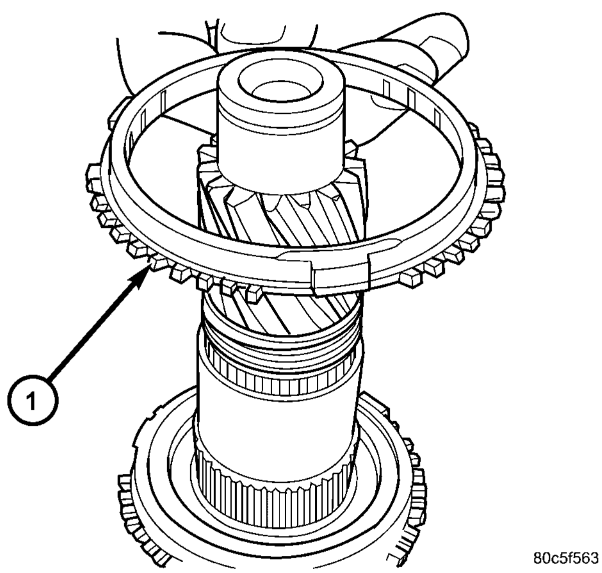

Fig. 224 3rd Gear Blocker Ring

1 - 3RD GEAR BLOCKER RING

(12) Remove 3rd gear and needle bearing (Fig. 225) (Fig. 226).

(13) Inspect third gear thrust washer for signs of excessive wear. To replace, drive off of input shaft with suitable drift and hammer.

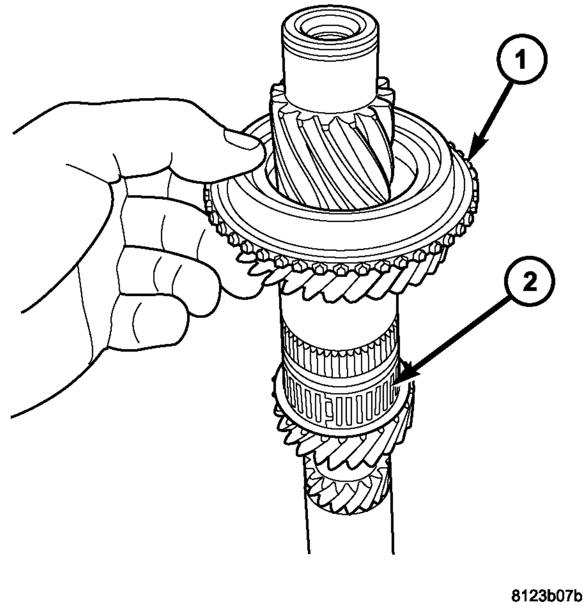

Fig. 225 3rd Gear Removal/Installation

1 - 3RD GEAR
2 - NEEDLE BEARING

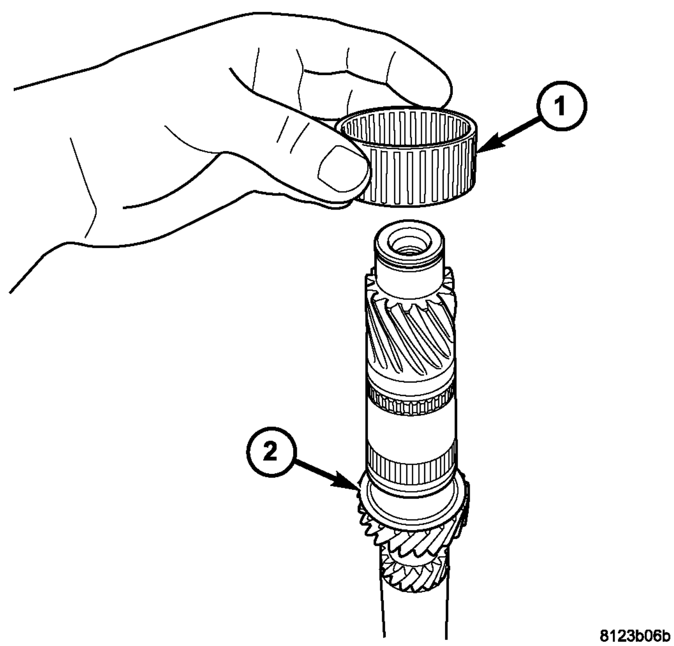

Fig. 226 3rd Gear Needle Bearing Removal/ Installation

1 - 3RD GEAR NEEDLE BEARING
2 - THRUST WASHER

INPUT SHAFT (Continued)

ASSEMBLY

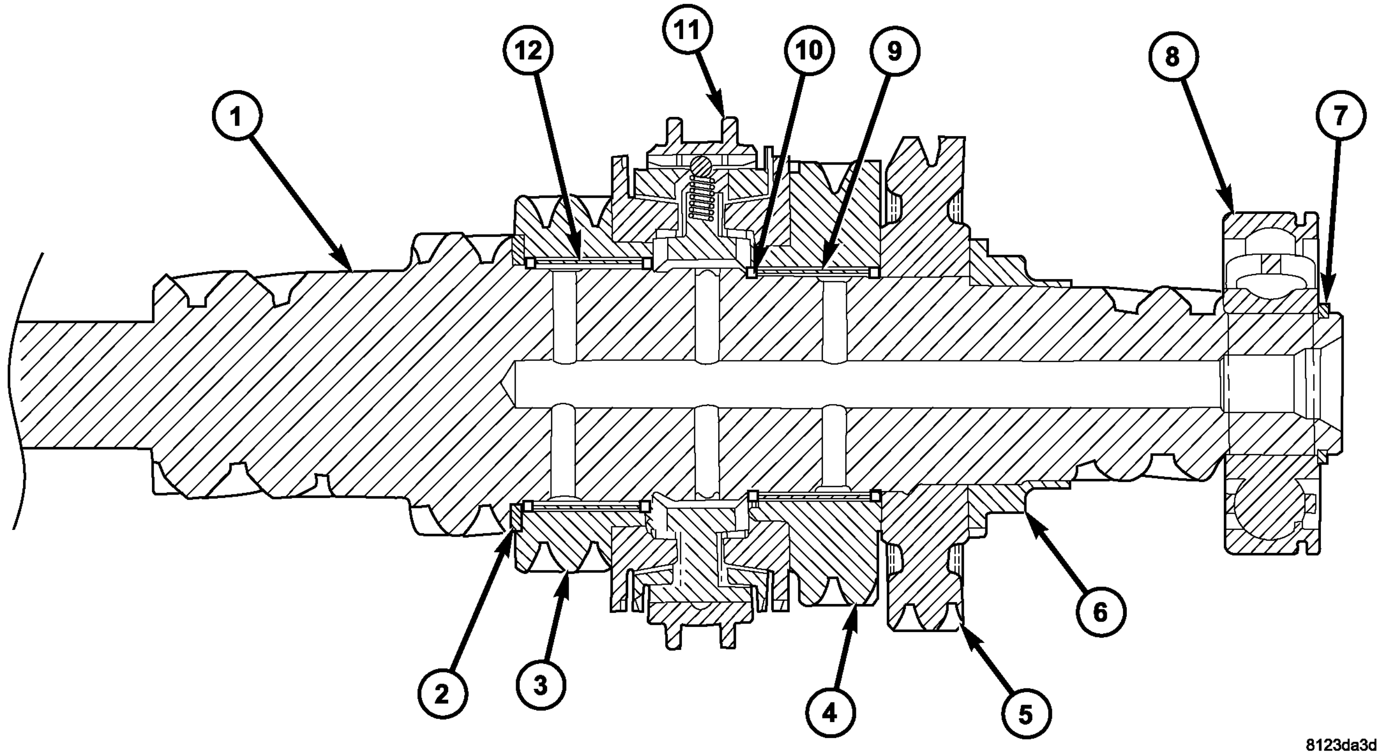

Fig. 227 Input Shaft Assembly

1 - INPUT SHAFT
2 - THRUST WASHER
3 - 3RD GEAR
4 - 4TH GEAR
5 - 5TH GEAR
6 - 5TH GEAR NUT
7 - SNAP RING
8 - INPUT BEARING (SEALED)
9 - NEEDLE BEARING
10 - SNAP RING
11 - 3/4 SYNCHRONIZER
12 - NEEDLE BEARING

NOTE: When servicing the input shaft assembly, all snap rings MUST be replaced with new ones upon assembly. 5th gear nut must also be replaced.

NOTE: When installing 3/4 synchronizer hub to shaft, make sure to align oil slots on synchronizer hub face with oil hole in the shaft splined hub journal.

NOTE: Refer to (Fig. 227) for input shaft assembly reference.

(1) Install input shaft into fixture 8487.
(2) Install thrust washer if removed upon disassembly.
(3) Install 3rd gear and needle bearing (Fig. 228) (Fig. 229).

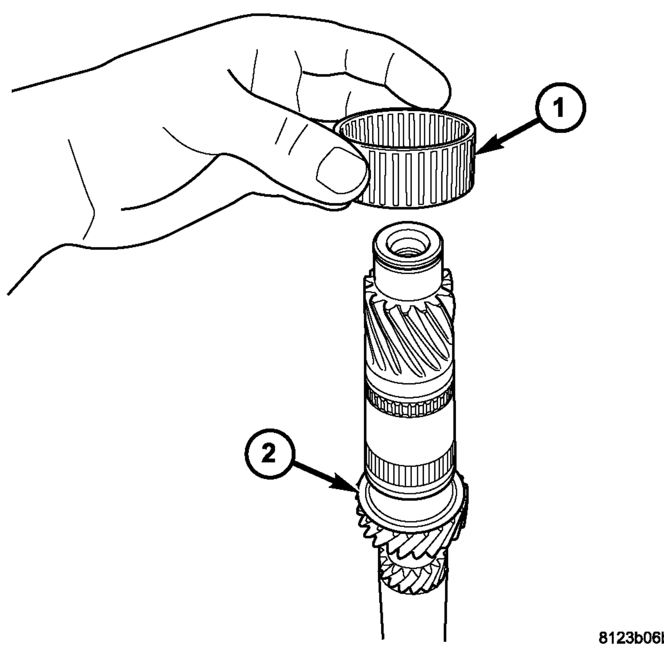

Fig. 228 3rd Gear Needle Bearing Removal/Installation

1 - 3RD GEAR NEEDLE BEARING
2 - THRUST WASHER

INPUT SHAFT (Continued)

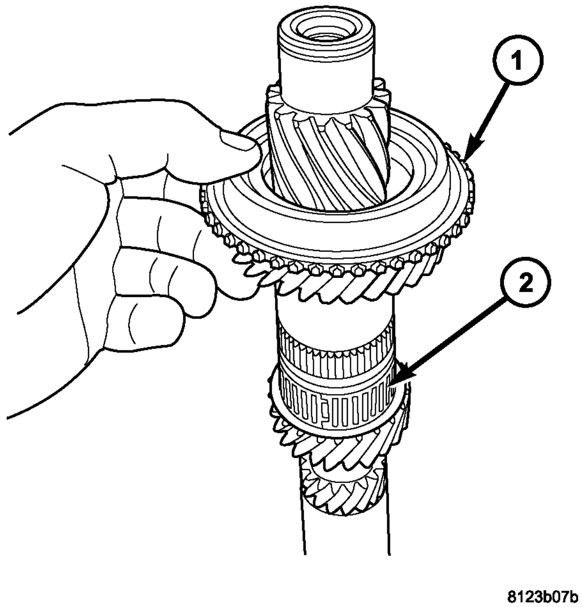

Fig. 229 3rd Gear Removal/Installation

1 - 3RD GEAR
2 - NEEDLE BEARING

(4) Install 3rd gear blocker ring (Fig. 230).

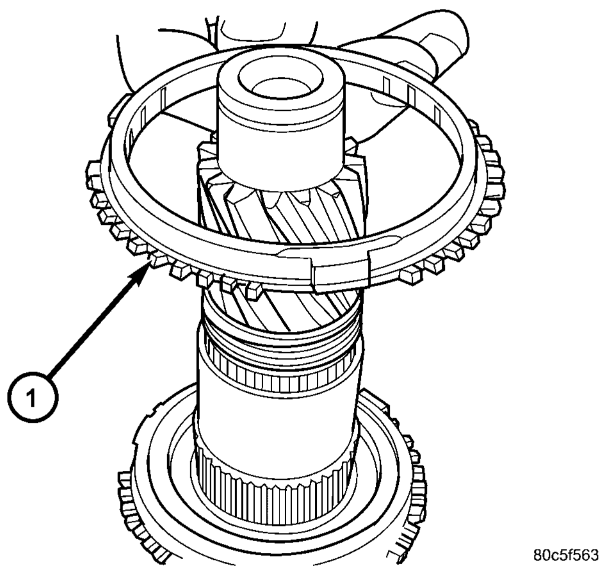

Fig. 230 3rd Gear Blocker Ring

1 - 3RD GEAR BLOCKER RING

(5) Install 3/4 synchronizer (Fig. 231). **When installing 3/4 synchronizer hub to shaft, make sure to align oil slots on synchronizer hub face with oil hole in the shaft splined hub journal.**

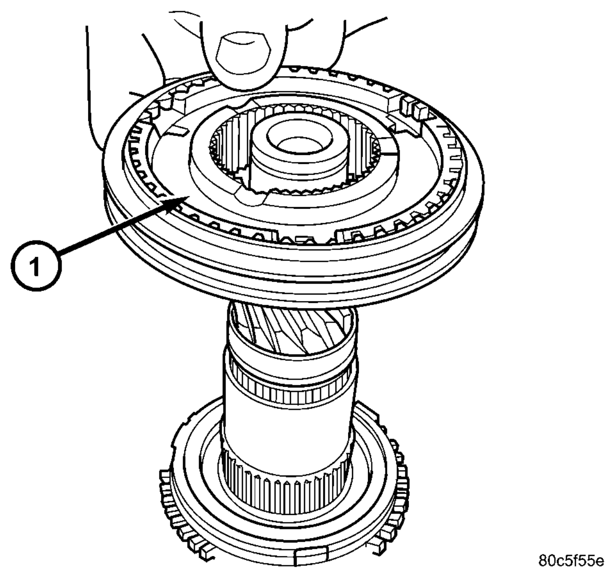

Fig. 231 3/4 Synchro Assembly

1 - 3/4 SYNCHRONIZER

(6) Install **NEW** 3/4 synchronizer snap ring (Fig. 232).

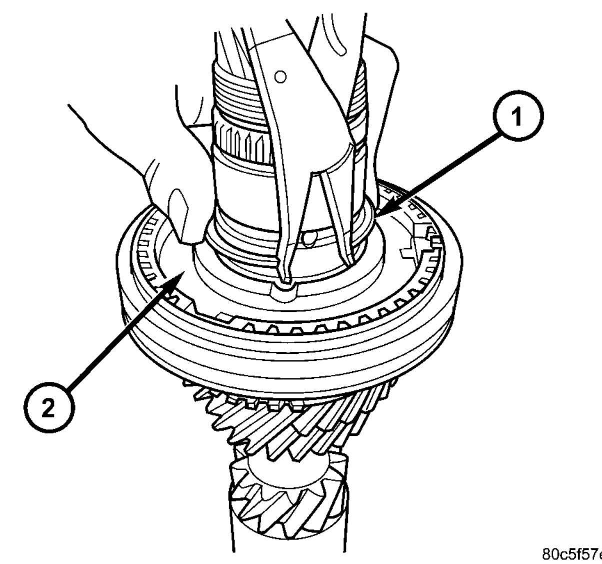

Fig. 232 3/4 Synchro Snap Ring

1 - SNAP RING
2 - 3/4 SYNCHRONIZER

INPUT SHAFT (Continued)

(7) Install 4th gear blocker ring (Fig. 233).

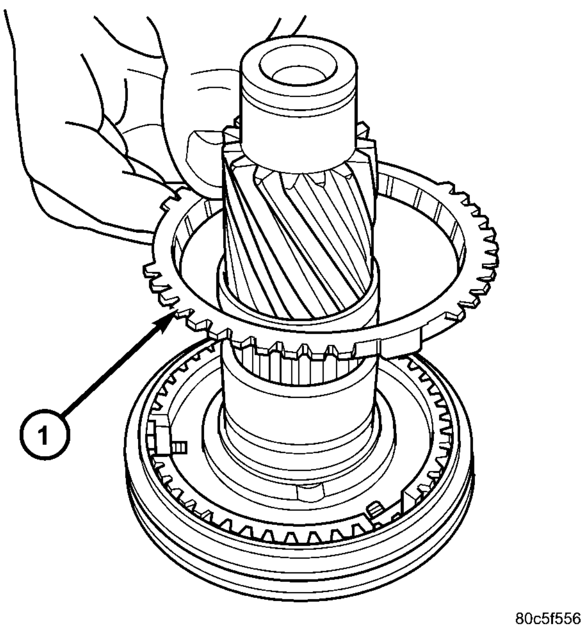

Fig. 233 4th Gear Blocker Ring

1 - 4th GEAR BLOCKER RING

(8) Install 4th gear and needle bearing (Fig. 234) (Fig. 235).

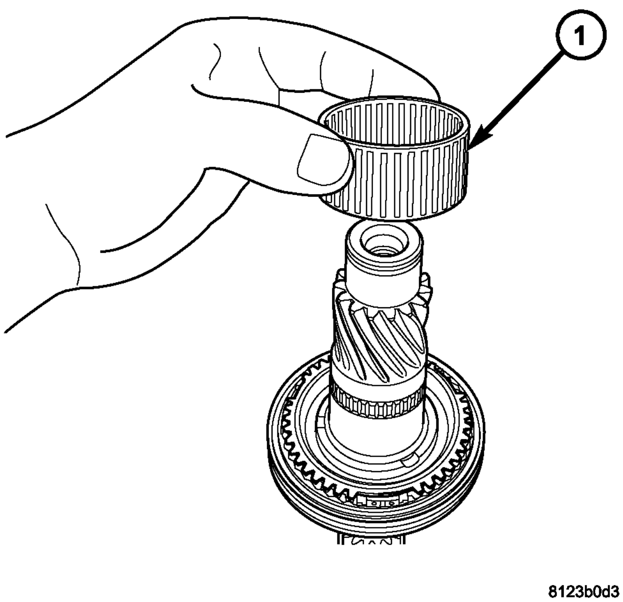

Fig. 234 4th Gear Needle Bearing Removal/ Installation

1 - 4TH GEAR NEEDLE BEARING

(9) Install 5th gear and press into position using installer 8481 (Fig. 236).

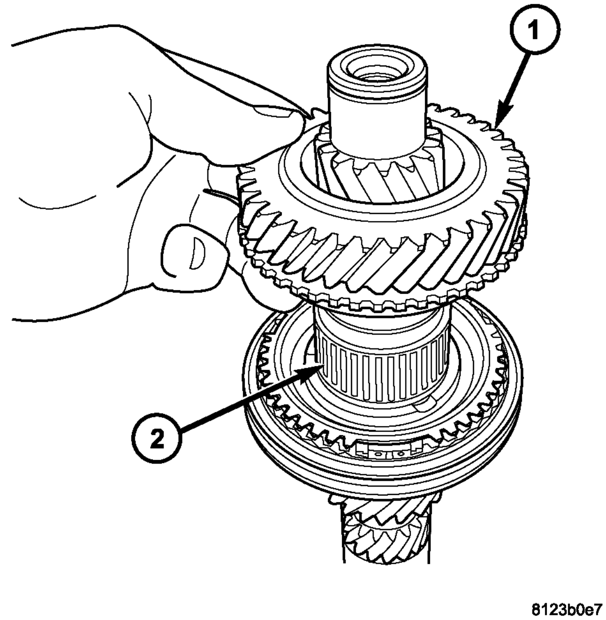

Fig. 235 4th Gear Removal/Installation

1 - 4TH GEAR
2 - NEEDLE BEARING

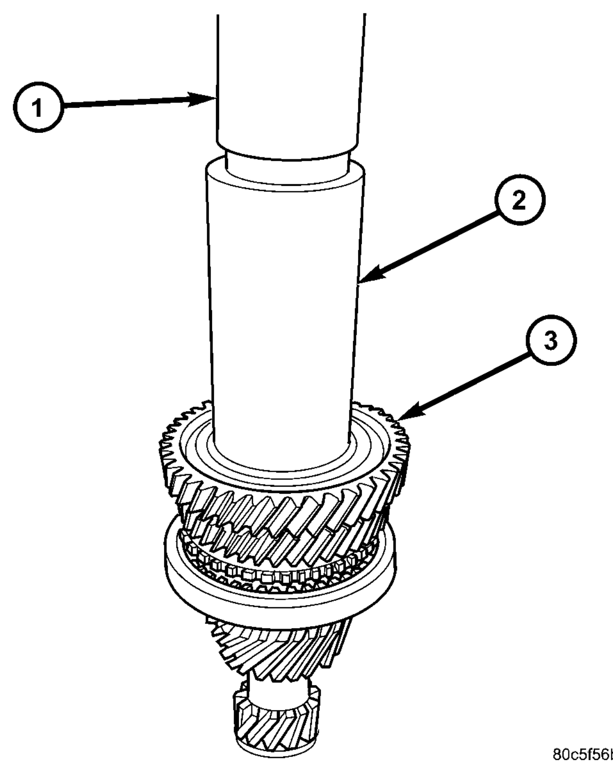

Fig. 236 5th Gear Installation

1 - ARBOR PRESS RAM
2 - INSTALLER 8481
3 - 5TH GEAR

INPUT SHAFT (Continued)

(10) Install **NEW** 5th gear nut and torque to 262 N·m (193 ft. lbs.) using wrench 8478 (Fig. 237).

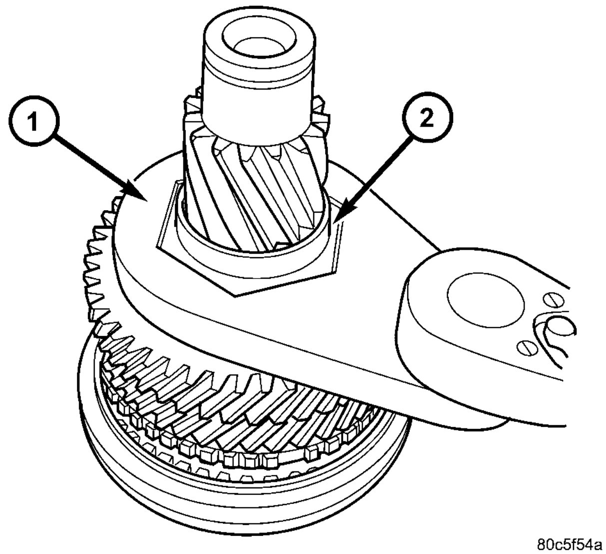

Fig. 237 5th Gear Nut Removal/Installation

1 - WRENCH 8478
2 - 5TH GEAR NUT

(11) Stake 5th Gear nut in four (4) places as follows:

(a) Install staking tool 8479 to 5th gear nut.

(b) Tighten upper thumb screw by hand (Fig. 238).

(c) Tighten two (2) side thumb screws by hand.

(d) Tighten both staking screws until they bottom on tool body (Fig. 239).

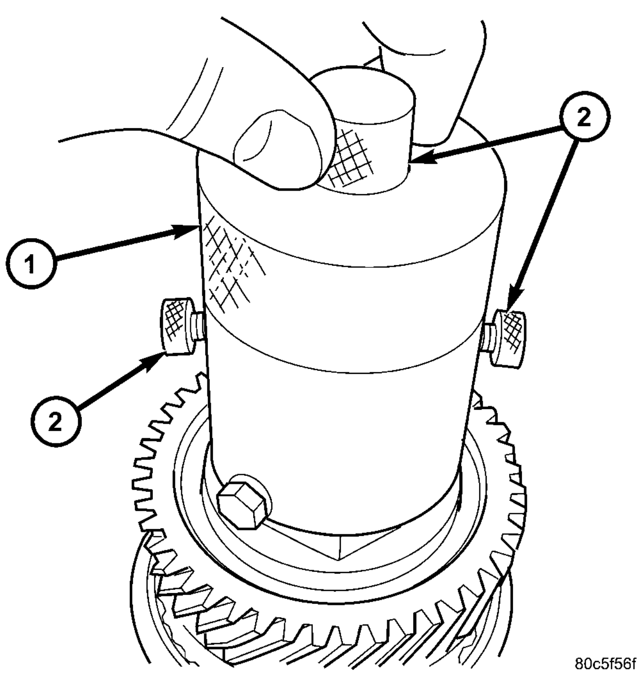

Fig. 238 Staking Tool Set-Up

1 - STAKING TOOL 8479
2 - THUMB SCREWS (3)

(e) Loosen staking screws and thumb screws. Remove tool and visually inspect stake (Fig. 240).

(f) Remove tool, rotate 90°, and repeat process to stake in four (4) places.

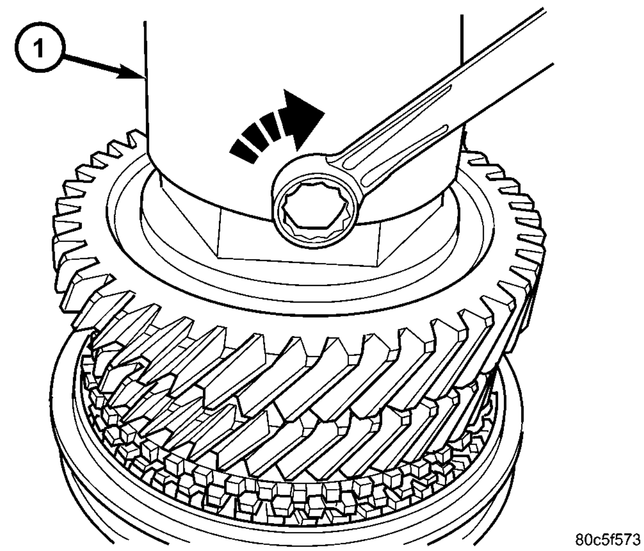

Fig. 239 Tighten Stake Screws

1 - STAKING TOOL 8479

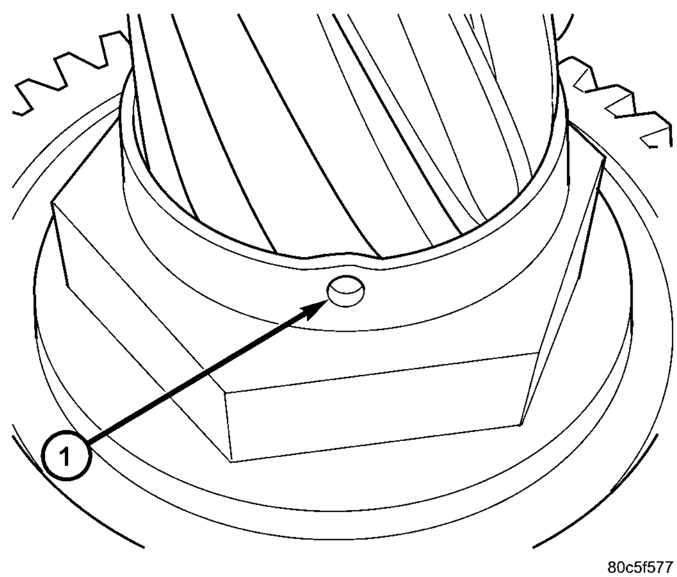

Fig. 240 5th Gear Nut Stake (Four Places)

1 - STAKE

NOTE: The input shaft sealed roller bearing and snap ring do not get installed until transaxle assembly to facilitate installation of the reverse idler gear mechanism.

INTERMEDIATE SHAFT

DESCRIPTION

The intermediate shaft assembly (Fig. 241) is part of the transaxle geartrain, meshes with and is driven by the input shaft, drives the differential via an integrated pinion gear, and consists of the following components:

- Intermediate Shaft
- 1st Speed Gear
- 2nd Speed Gear
- 3/4 Cluster Gear
- 5th Speed Gear
- Reverse Gear
- 1/2 Synchronizer
- 5/R Synchronizer

The intermediate shaft is supported by a caged roller bearing at the front of the transaxle, and a sealed roller bearing at the rear of the transaxle.

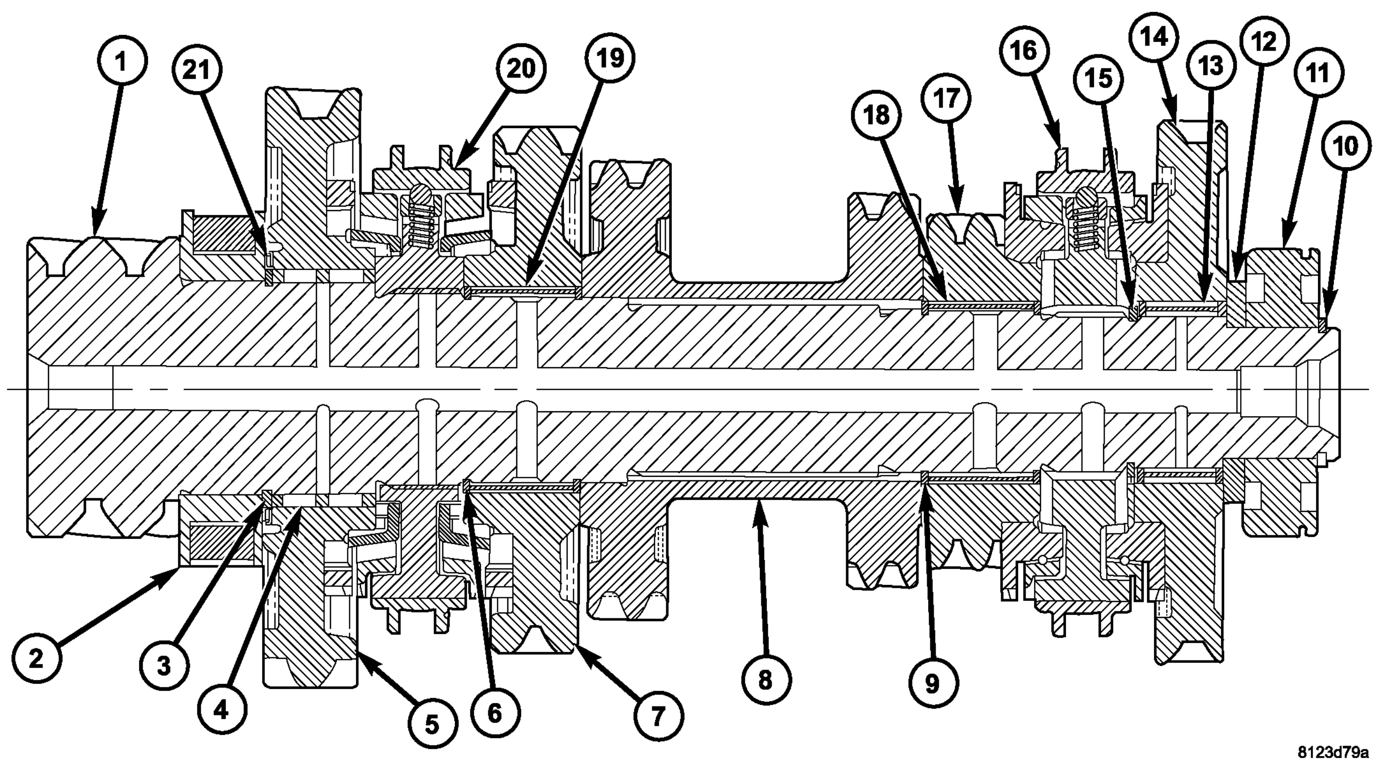

Fig. 241 Intermediate Shaft Assembly

1 - INTERMEDIATE SHAFT
2 - ROLLER BEARING
3 - SNAP RING
4 - NEEDLE BEARING
5 - 1ST SPEED GEAR
6 - SNAP RING
7 - 2ND SPEED GEAR
8 - 3/4 CLUSTER GEAR
9 - SNAP RING
10 - SNAP RING
11 - SEALED ROLLER BEARING
12 - THRUST WASHER
13 - NEEDLE BEARING
14 - REVERSE GEAR
15 - SNAP RING
16 - 5/R SYNCHRO
17 - 5TH SPEED GEAR
18 - NEEDLE BEARING
19 - NEEDLE BEARING
20 - 1/2 SYNCHRO
21 - THRUST BEARING

INTERMEDIATE SHAFT (Continued)

DISASSEMBLY

CAUTION: Do not re-use snap rings when servicing the intermediate shaft assembly. Discard upon disassembly and install new ones provided with available snap ring service kit.

(1) Install intermediate shaft assembly to arbor press table with bearing splitter P-334 under the reverse gear.

(2) Install 8486-4 button to intermediate shaft. Using arbor press ram, press reverse gear and intermediate roller bearing off of shaft, while holding remaining assembly with hand (Fig. 242).

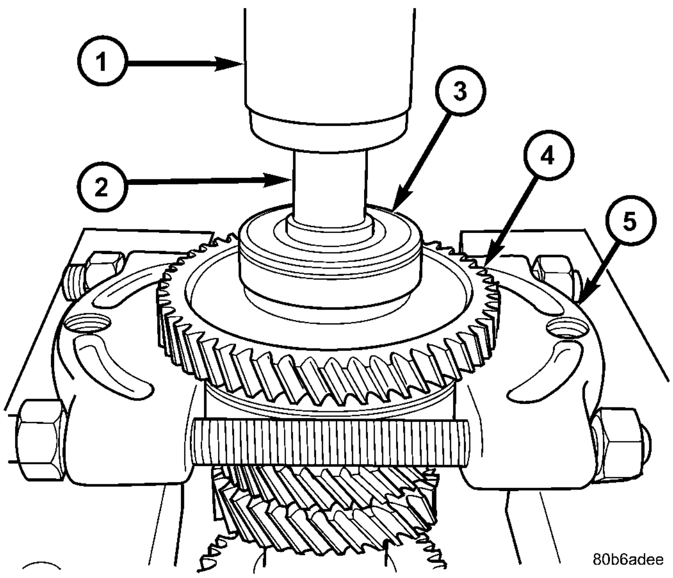

Fig. 242 Bearing and Reverse Gear Removal

1 - ARBOR PRESS RAM
2 - ADAPTER
3 - SEALED ROLLER BEARING
4 - REVERSE GEAR
5 - BEARING SPLITTER P-334

(3) Remove reverse gear blocker ring.
(4) Remove reverse gear needle bearing (Fig. 243).
(5) Remove 5/R synchro snap ring (Fig. 244).

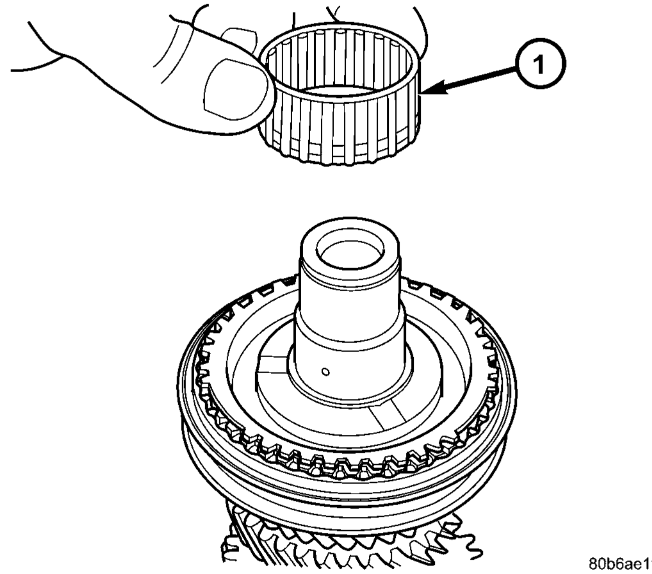

Fig. 243 Reverse Gear Needle Bearing

1 - NEEDLE BEARING

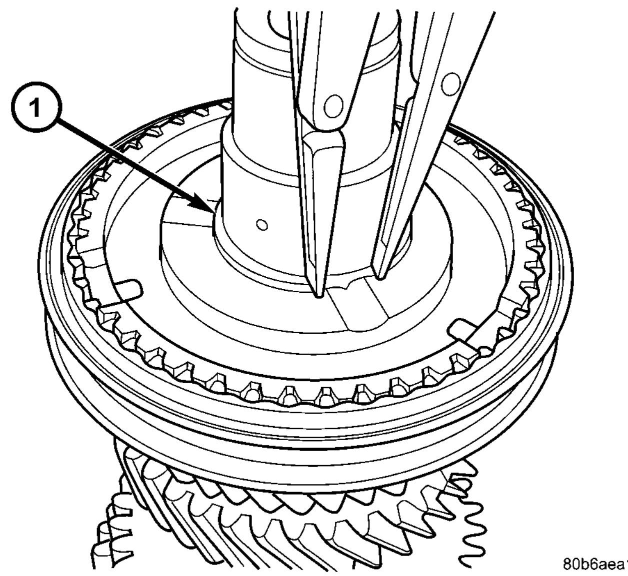

Fig. 244 5/R Synchro Snap Ring

1 - SNAP RING

INTERMEDIATE SHAFT (Continued)

(6) Remove 5/R synchro (Fig. 245).

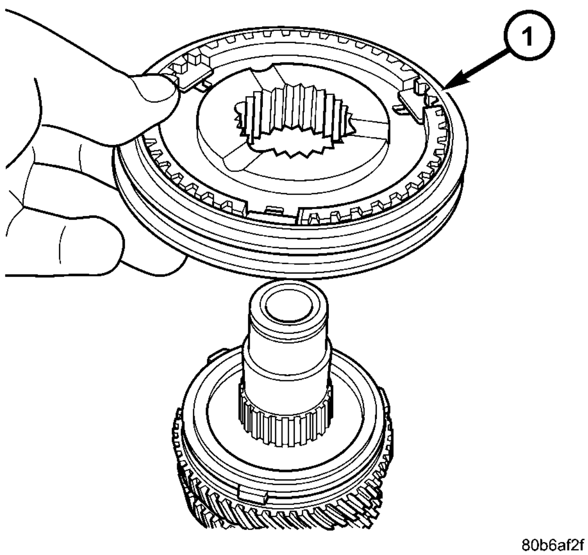

Fig. 245 5/R Synchronizer

1 - 5/R SYNCHRO ASSEMBLY

(7) Remove 5th gear blocker ring (Fig. 246).

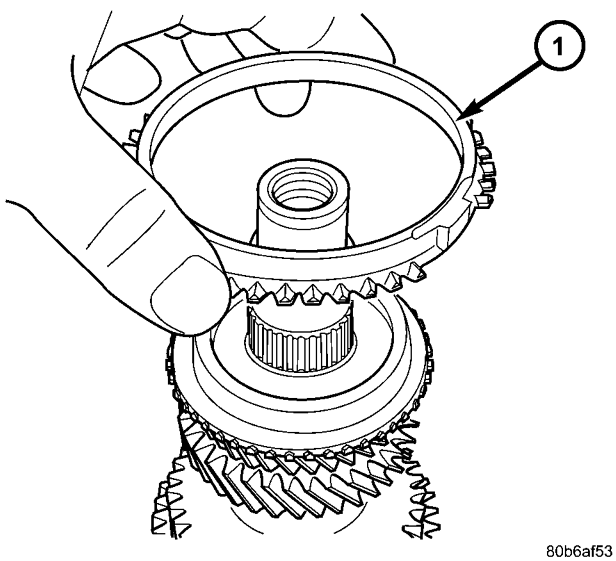

Fig. 246 5th Gear Blocker Ring

1 - 5th GEAR BLOCKER RING

(8) Remove 5th gear and needle bearing (Fig. 247) (Fig. 248).

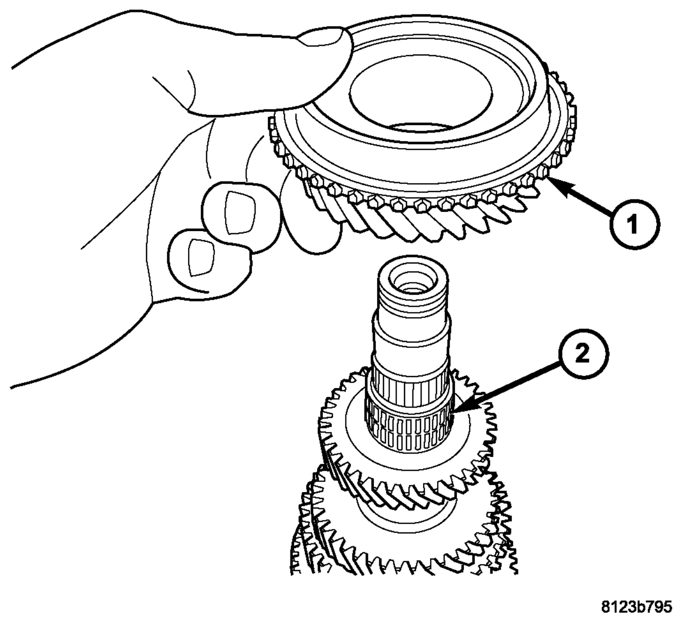

Fig. 247 5th Gear Removal/Installation

1 - 5TH GEAR
2 - NEEDLE BEARING

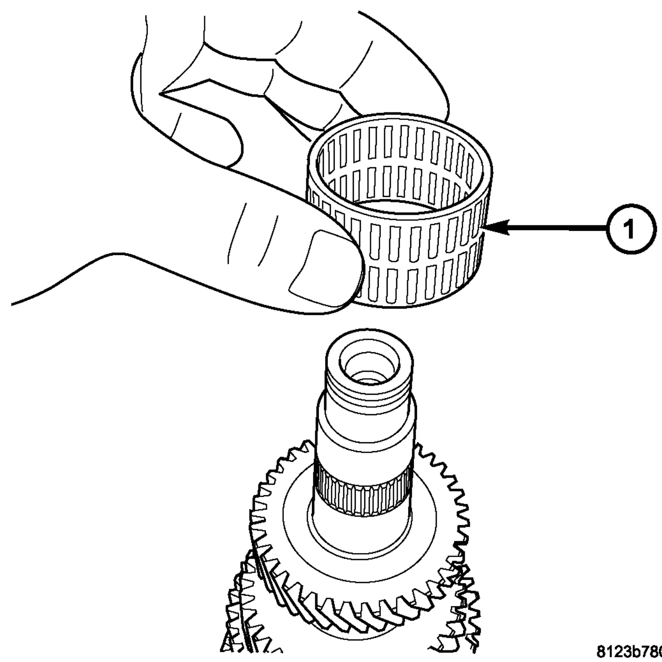

Fig. 248 5th Gear Needle Bearing Removal/ Installation

1 - 5TH GEAR NEEDLE BEARING

INTERMEDIATE SHAFT (Continued)

(9) Remove 3/4 cluster gear snap ring (Fig. 249).

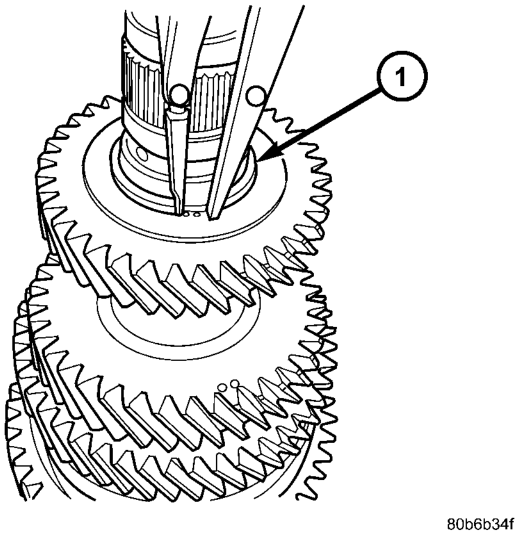

Fig. 249 3/4 Cluster Gear Snap Ring

1 - SNAP RING

(10) Install shaft assembly into fixture 8483, with split collar 8483-3 oriented chamfer side up (Fig. 250). Place 8483-2 into position with chamfer side up (Fig. 251).

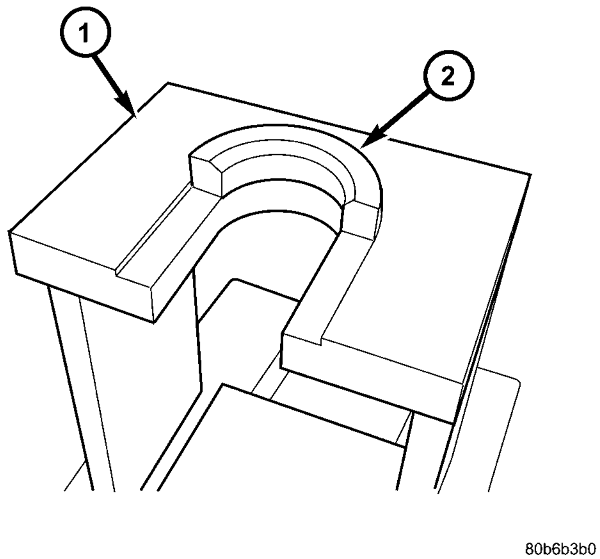

Fig. 250 Fixture 8483

1 - FIXTURE 8483
2 - COLLAR 8483-3

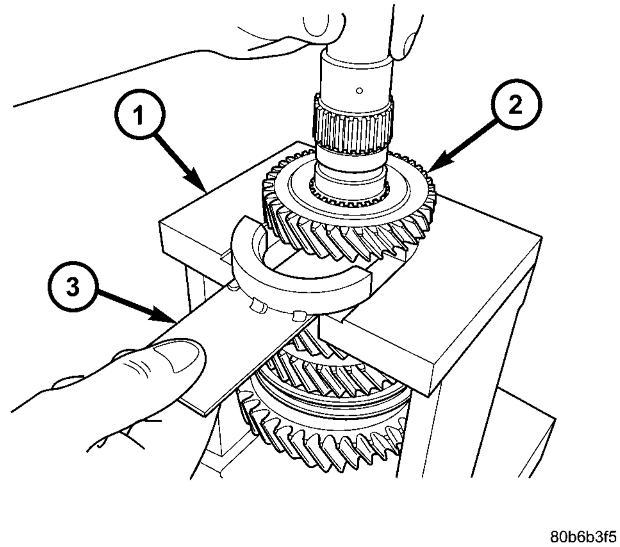

Fig. 251 Loading Intermediate Shaft

1 - FIXTURE 8483
2 - 3/4 CLUSTER GEAR
3 - COLLAR 8483-2

(11) Using an arbor press, press intermediate shaft out of 3/4 cluster gear (Fig. 252).

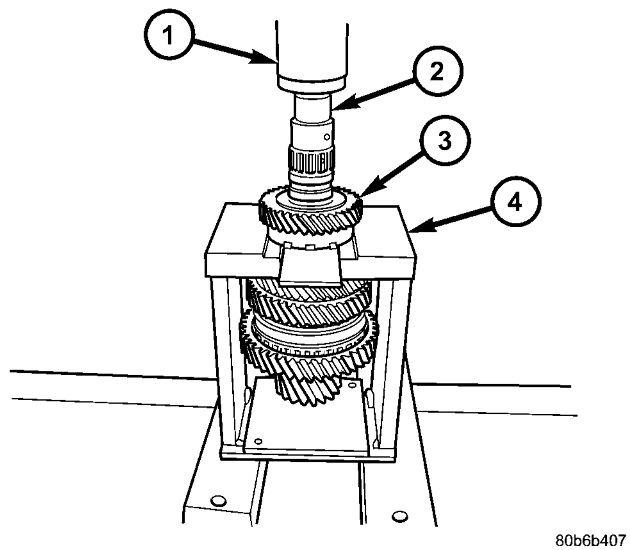

Fig. 252 Press Intermediate Shaft Out of 3/4 Cluster Gear

1 - ARBOR PRESS RAM
2 - INTERMEDIATE SHAFT
3 - 3/4 CLUSTER GEAR
4 - FIXTURE 8483

INTERMEDIATE SHAFT (Continued)

(12) Remove intermediate shaft from fixture and remove 3/4 cluster gear from shaft (Fig. 253).

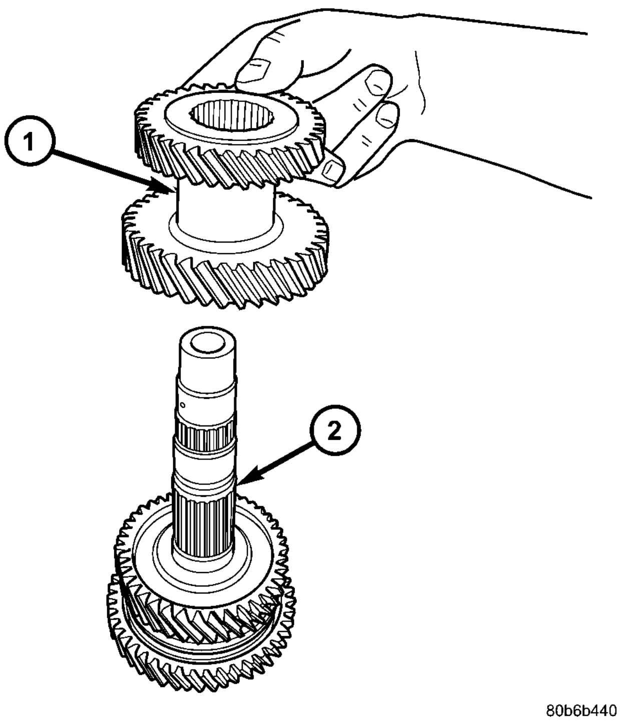

Fig. 253 3/4 Cluster Gear

1 - 3/4 CLUSTER GEAR
2 - INTERMEDIATE SHAFT

(13) Remove 2nd gear and needle bearing (Fig. 254) (Fig. 255).

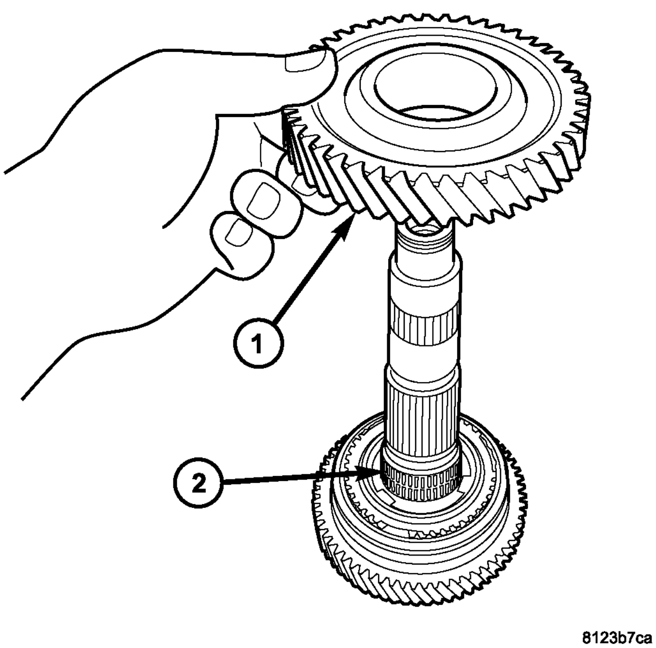

Fig. 254 2nd Gear Removal/Installation

1 - 2ND GEAR
2 - NEEDLE BEARING

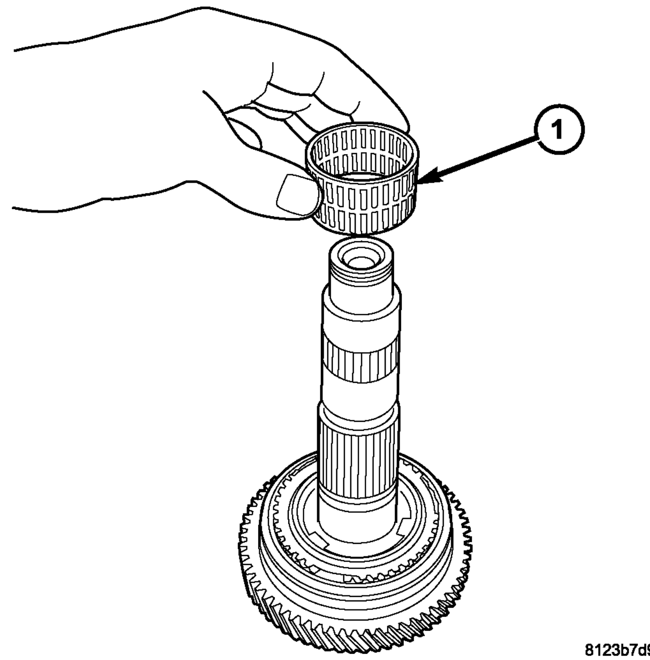

Fig. 255 2nd Gear Needle Bearing Removal/ Installation

1 - NEEDLE BEARING

(14) Remove 2nd gear reactor ring (Fig. 256).

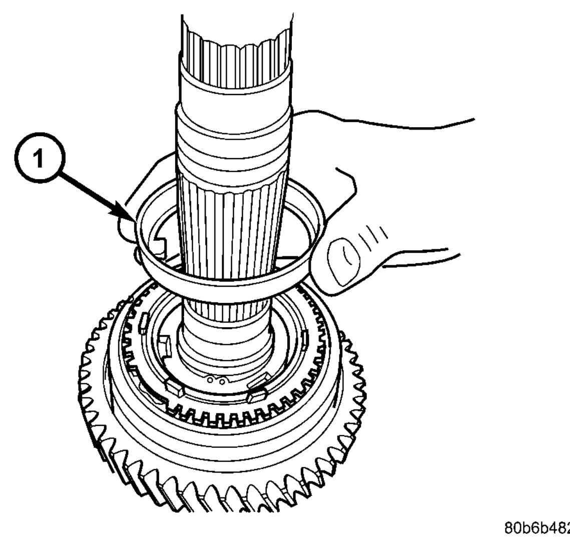

Fig. 256 2nd Gear Reactor Ring

1 - 2ND GEAR REACTOR RING

INTERMEDIATE SHAFT (Continued)

(15) Remove 2nd gear friction cone (Fig. 257).

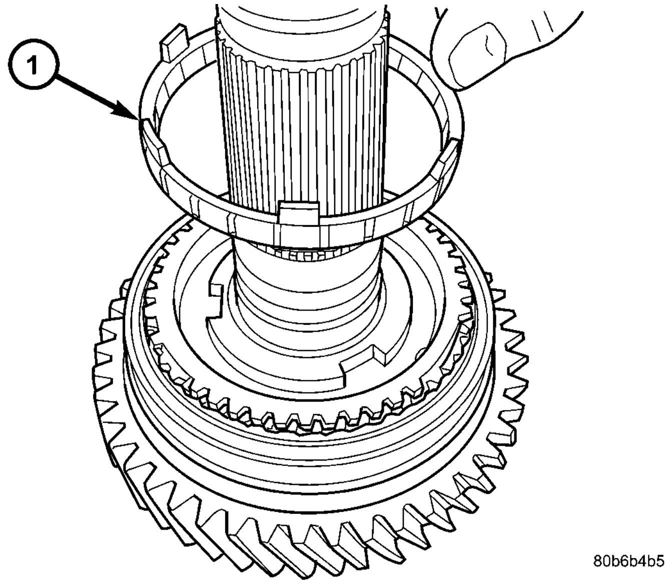

Fig. 257 2nd Gear Friction Cone

1 - 2ND GEAR FRICTION CONE

(16) Remove 2nd Gear outer blocker ring (Fig. 258).

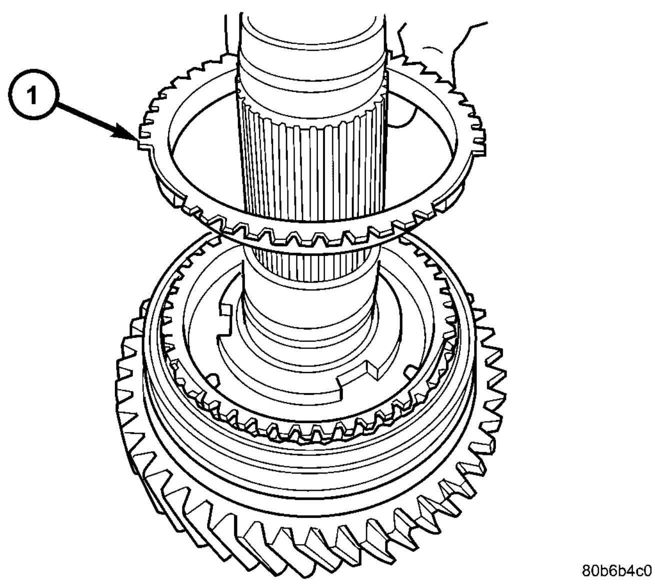

Fig. 258 2nd Gear Outer Blocker Ring

1 - 2ND GEAR BLOCKER RING

(17) Remove 1/2 synchro snap ring (Fig. 259).

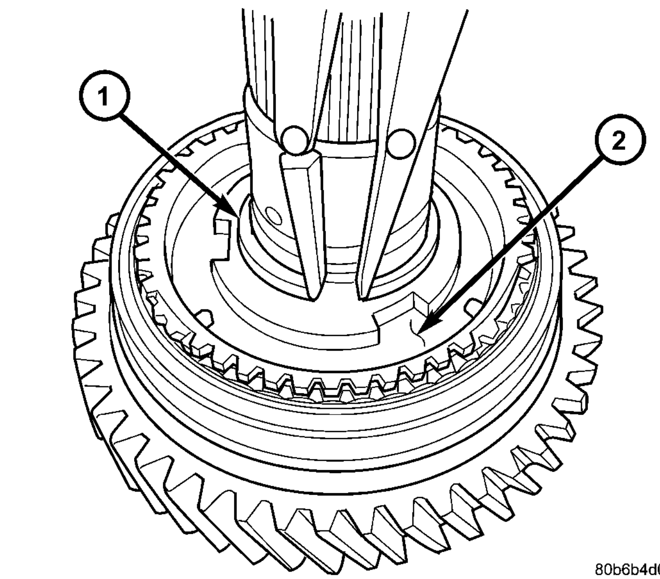

Fig. 259 1/2 Synchro Snap Ring

1 - SNAP RING
2 - 1/2 SYNCHRO HUB

(18) Remove 1/2 synchro from shaft (Fig. 260).

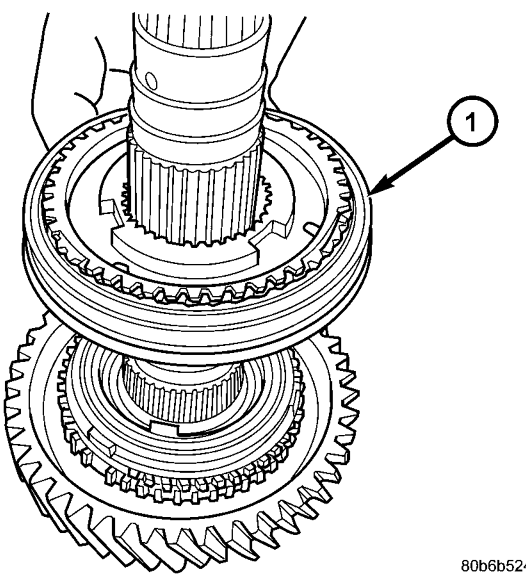

Fig. 260 1/2 Synchronizer

1 - 1/2 SYNCHRONIZER

INTERMEDIATE SHAFT (Continued)

(19) Remove 1st gear blocker ring (Fig. 261).

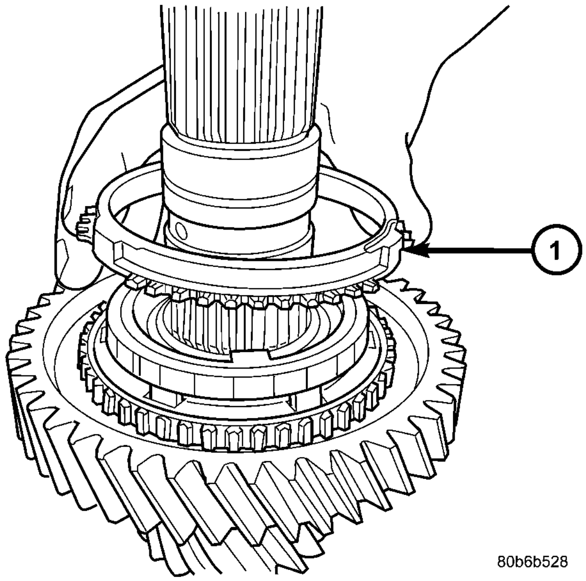

Fig. 261 1st Gear Blocker Ring

1 - 1ST GEAR BLOCKER RING

(20) Remove 1st gear friction cone (Fig. 262).

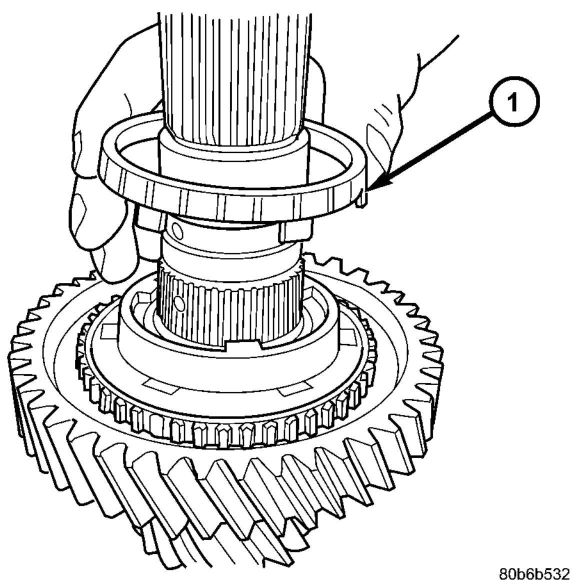

Fig. 262 1st Gear Friction Cone

1 - 1ST GEAR FRICTION CONE

(21) Remove 1st gear reactor ring (Fig. 263).

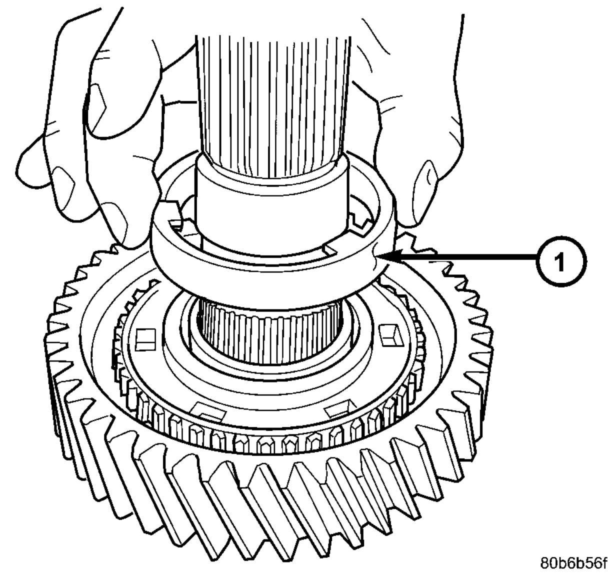

Fig. 263 1st Gear Reactor Ring

1 - 1ST GEAR REACTOR RING

(22) Remove 1st gear from shaft (Fig. 264).

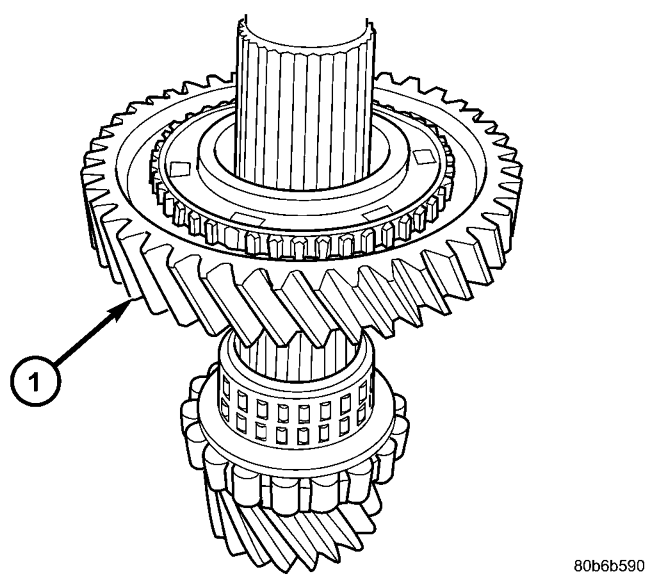

Fig. 264 1st Gear Removal

1 - 1ST GEAR

INTERMEDIATE SHAFT (Continued)

(23) Remove 1st gear needle bearing (Fig. 265).

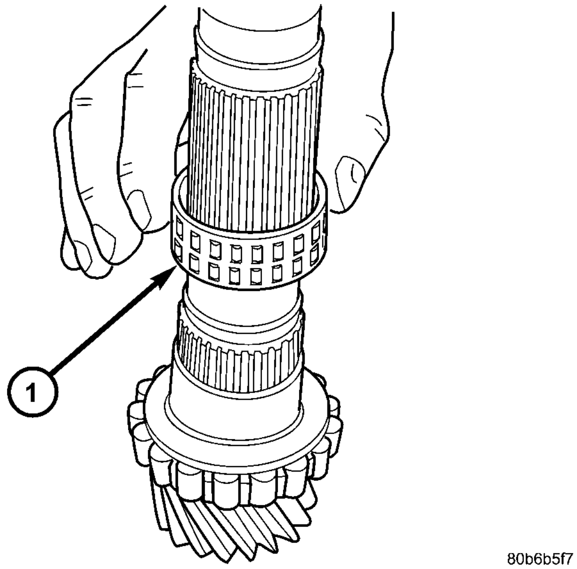

Fig. 265 1st Gear Needle Bearing

1 - 1ST GEAR NEEDLE BEARING

(24) Remove first gear thrust bearing (Fig. 266).

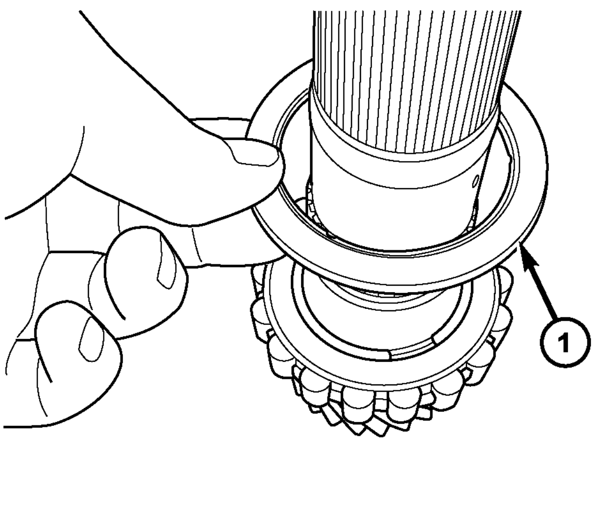

Fig. 266 1st Gear Thrust Bearing Removal/ Installation

1 - THRUST BEARING

(25) Remove intermediate shaft roller bearing snap ring (Fig. 267).

(26) Press intermediate shaft out of roller bearing supported by bearing splitter P-334 (Fig. 268). **Roller bearing is not re-usable once removed. It is necessary to install a new roller bearing upon re-assembly.**

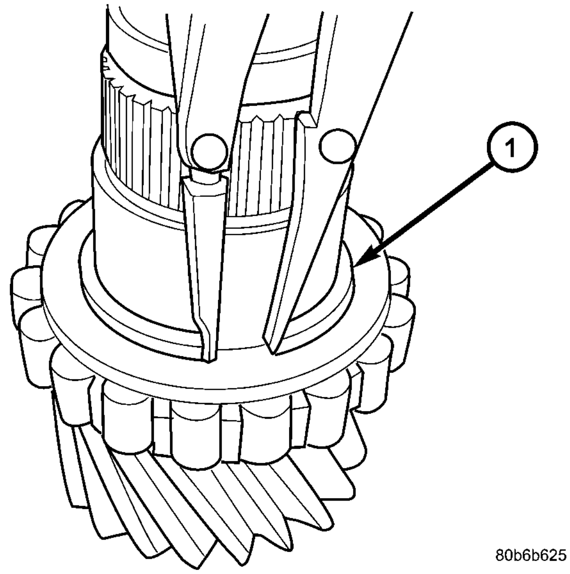

Fig. 267 Intermediate Shaft Roller Bearing Snap Ring

1 - SNAP RING

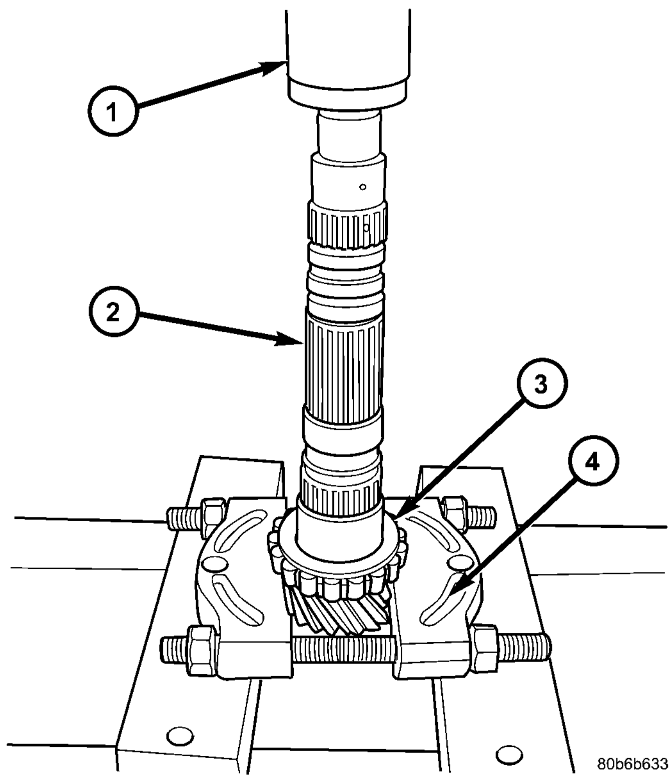

Fig. 268 Intermediate Shaft Roller Bearing Removal

1 - ARBOR PRESS RAM
2 - INTERMEDIATE SHAFT
3 - ROLLER BEARING
4 - BEARING SPLITTER P-334

INTERMEDIATE SHAFT (Continued)

ASSEMBLY

NOTE: Do not re-use snap rings when servicing the intermediate shaft assembly. Discard snap rings and install new ones provided with available snap ring service kit.

NOTE: When installing 1/2 & 5/R synchronizers, make sure to align oil slots on synchronizer hub face with oil hold in the shaft splined hub journal.

NOTE: Refer to (Fig. 269) for intermediate shaft assembly reference.

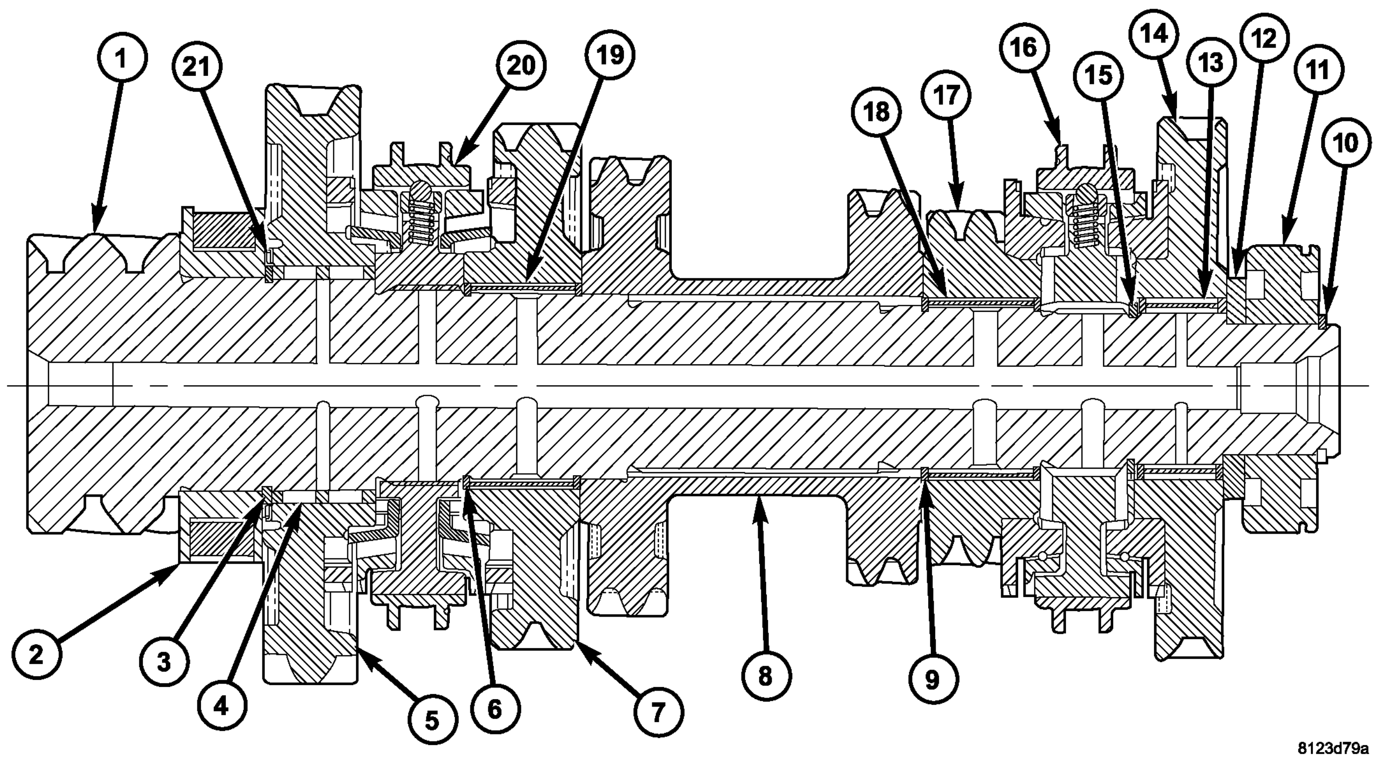

Fig. 269 Intermediate Shaft Assembly

1 - INTERMEDIATE SHAFT
2 - ROLLER BEARING
3 - SNAP RING
4 - NEEDLE BEARING
5 - 1ST SPEED GEAR
6 - SNAP RING
7 - 2ND SPEED GEAR
8 - 3/4 CLUSTER GEAR
9 - SNAP RING
10 - SNAP RING
11 - SEALED ROLLER BEARING
12 - THRUST WASHER
13 - NEEDLE BEARING
14 - REVERSE GEAR
15 - SNAP RING
16 - 5/R SYNCHRO
17 - 5TH SPEED GEAR
18 - NEEDLE BEARING
19 - NEEDLE BEARING
20 - 1/2 SYNCHRO
21 - THRUST BEARING

INTERMEDIATE SHAFT (Continued)

(1) Press intermediate shaft into NEW roller bearing with arbor press (Fig. 270).

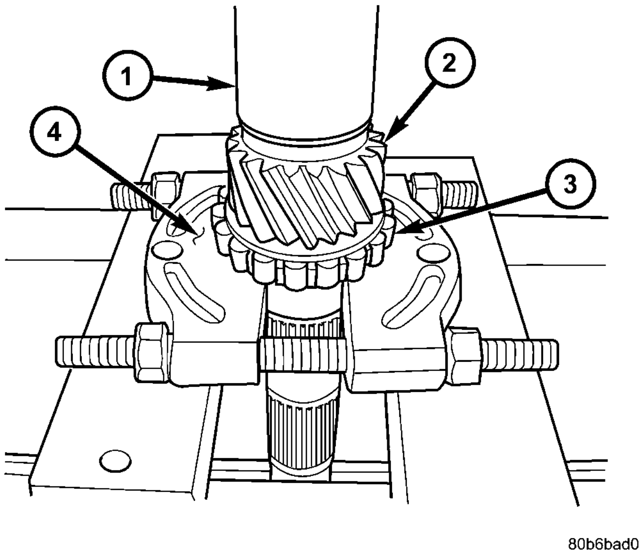

Fig. 270 Intermediate Shaft Bearing Installation

1 - ARBOR PRESS
2 - INTERMEDIATE SHAFT
3 - CAGED ROLLER BEARING
4 - BEARING SPLITTER

(2) Install intermediate shaft roller bearing snap ring (Fig. 271).

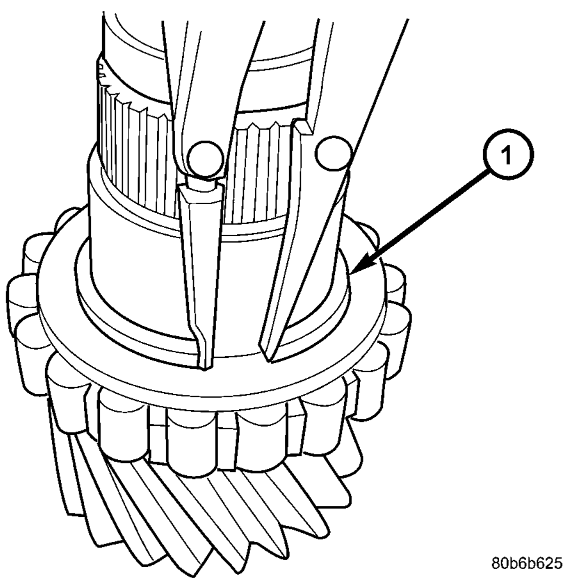

Fig. 271 Intermediate Shaft Roller Bearing Snap Ring

1 - SNAP RING

(3) Install 1st gear thrust bearing (Fig. 272). Blue markings on bearing should face down towards output gear.

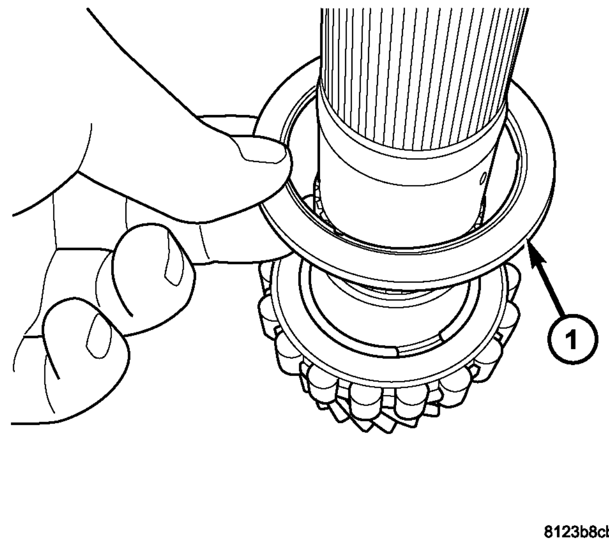

Fig. 272 1st Gear Thrust Bearing Removal/ Installation

1 - THRUST BEARING

(4) Install 1st gear needle bearing to intermediate shaft (Fig. 273).

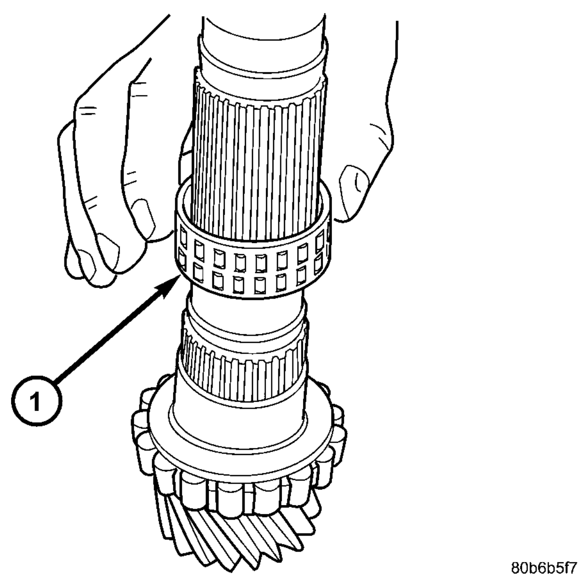

Fig. 273 1st Gear Needle Bearing

1 - 1ST GEAR NEEDLE BEARING

INTERMEDIATE SHAFT (Continued)

(5) Install 1st gear to intermediate shaft (Fig. 274).

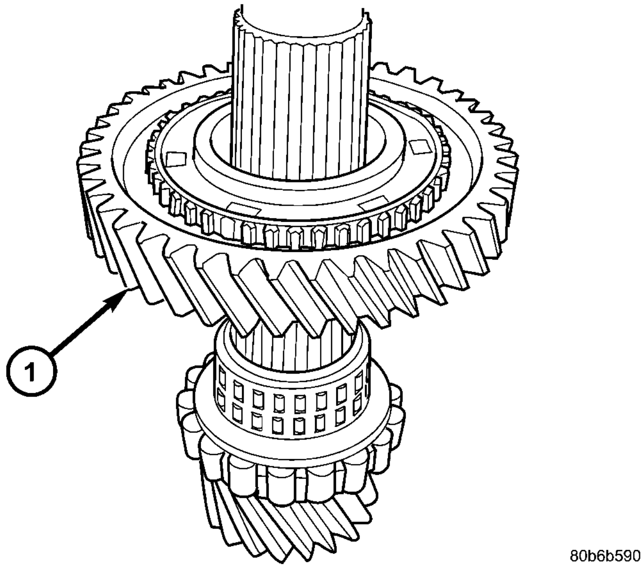

Fig. 274 1st Gear Installation

1 - 1ST GEAR

(6) Install 1/2 synchro to fixture 8483. Insert 1st gear blocker ring, friction cone, and reactor ring as shown in (Fig. 275).

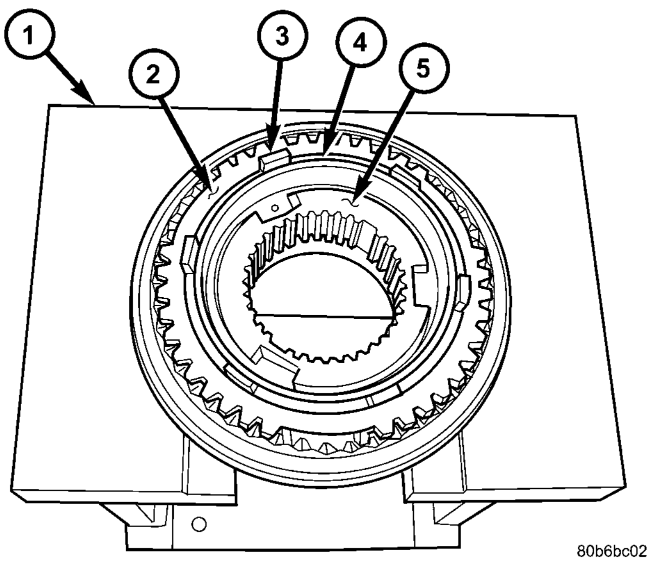

Fig. 275 1/2 Synchro on Fixture 8483

1 - FIXTURE 8483
2 - 1ST GEAR BLOCKER RING
3 - 1ST GEAR FRICTION CONE
4 - 1ST GEAR REACTOR RING
5 - 1/2 SYNCHRONIZER

(7) Install intermediate shaft to synchro assembly on fixture (Fig. 276). **When installing 1/2 synchronizer, make sure to align oil slots on synchronizer hub face with oil hole in the shaft splined hub journal.** Line up friction cone and reactor ring tabs to gear slots. Remove shaft assembly from fixture.

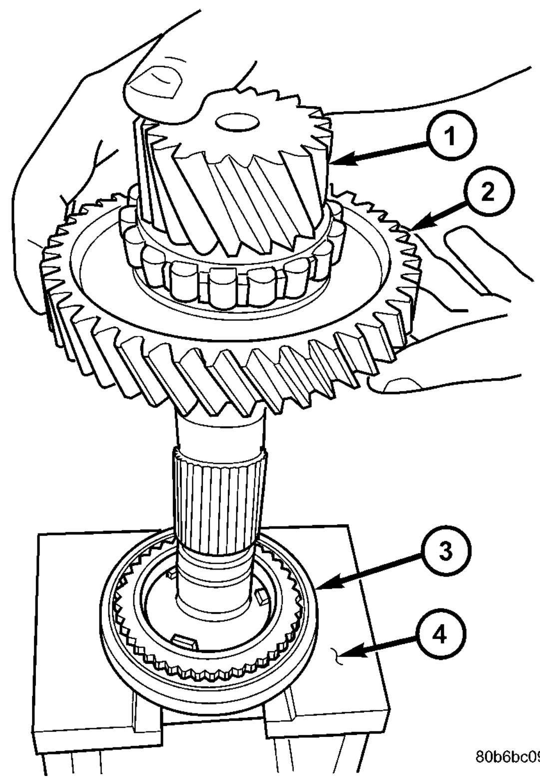

Fig. 276 Install 1/2 Synchro to Intermediate Shaft

1 - INTERMEDIATE SHAFT
2 - 1ST GEAR
3 - 1/2 SYNCHRO ASSEMBLY
4 - FIXTURE 8483

INTERMEDIATE SHAFT (Continued)

(8) Install **NEW** 1/2 synchro snap ring (Fig. 277).

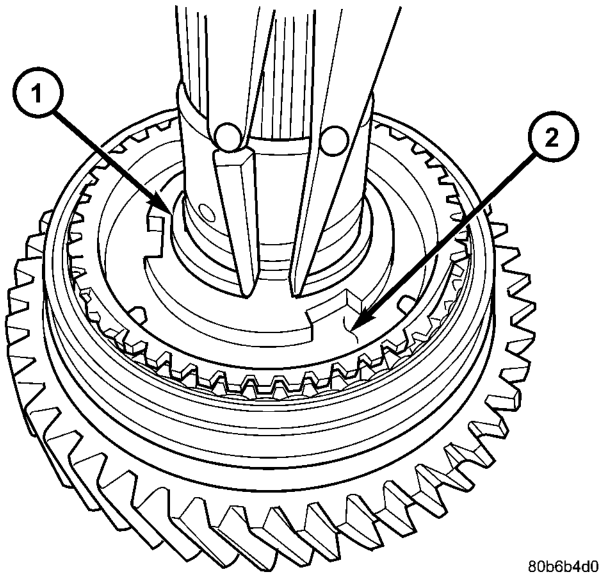

Fig. 277 1/2 Synchro Snap Ring

1 - SNAP RING
2 - 1/2 SYNCHRO HUB

(9) Install 2nd gear blocker ring (Fig. 278).

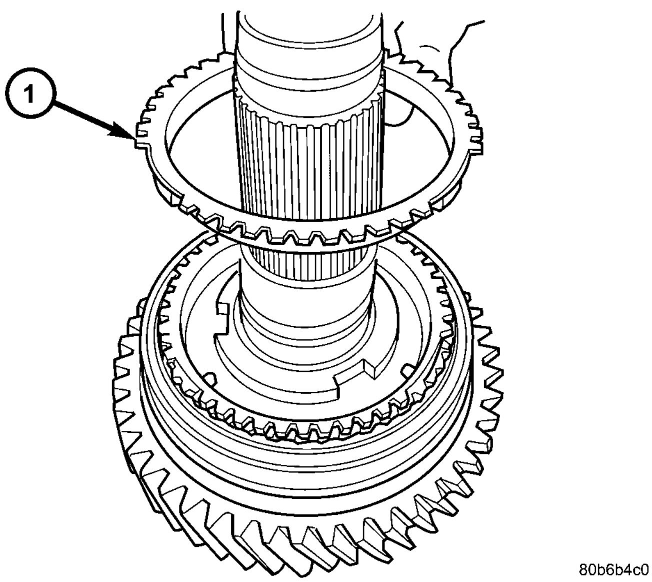

Fig. 278 2nd Gear Blocker Ring

1 - 2ND GEAR BLOCKER RING

(10) Install 2nd gear friction cone (Fig. 279).

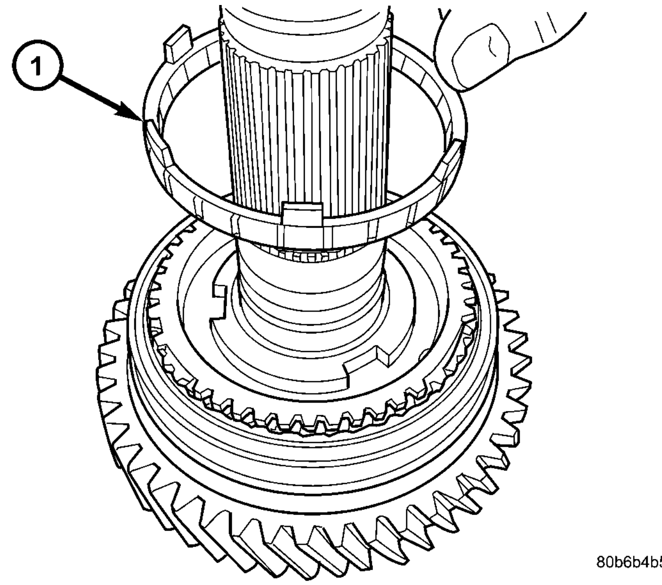

Fig. 279 2nd Gear Friction Cone

1 - 2ND GEAR FRICTION CONE

(11) Install 2nd gear reactor ring (Fig. 280).

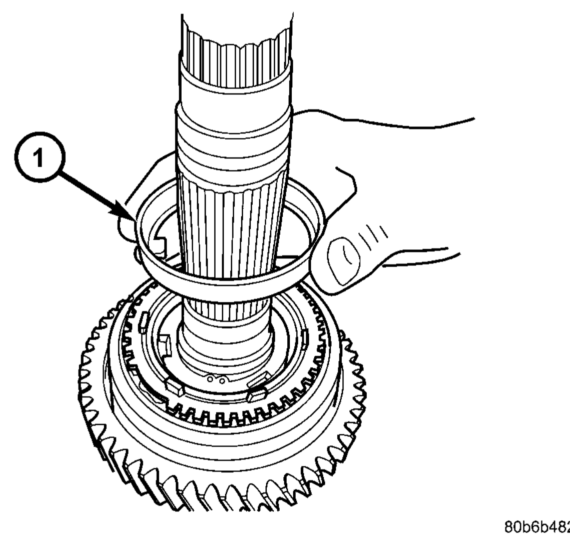

Fig. 280 2nd Gear Reactor Ring

1 - 2ND GEAR REACTOR RING

INTERMEDIATE SHAFT (Continued)

(12) Install 2nd gear and needle bearing to intermediate shaft (Fig. 281) (Fig. 282).

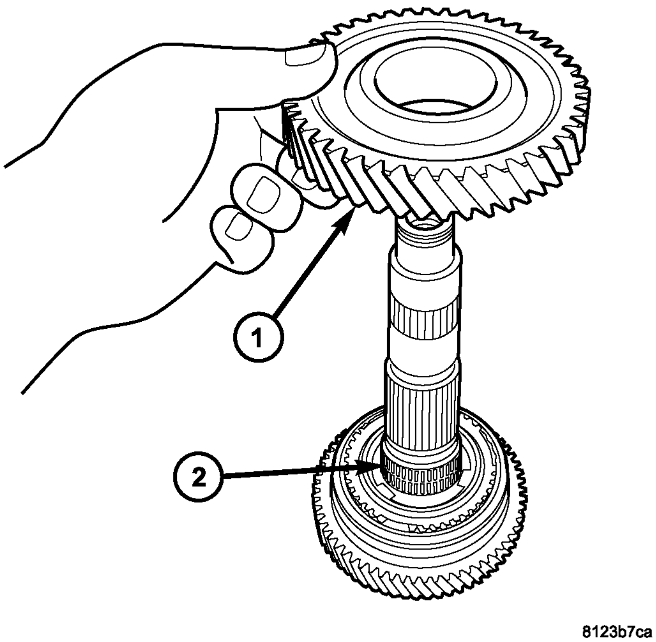

Fig. 281 2nd Gear Removal/Installation

1 - 2ND GEAR
2 - NEEDLE BEARING

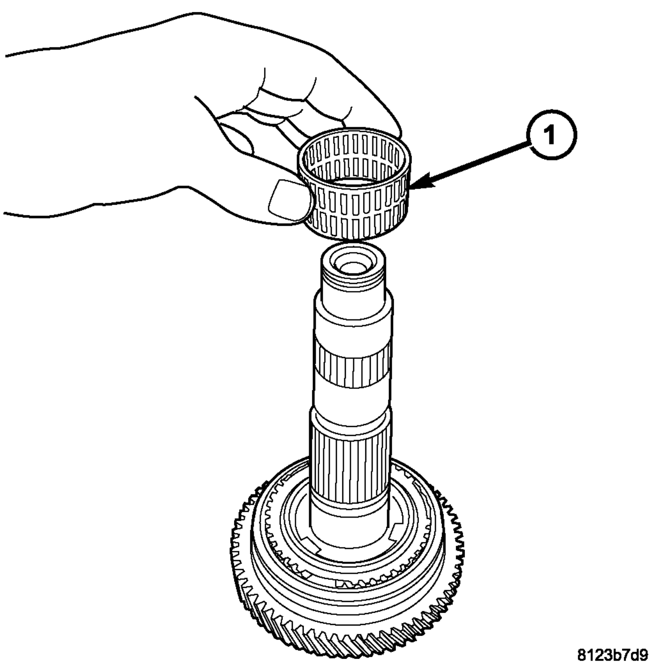

Fig. 282 2nd Gear Needle Bearing Removal/ Installation

1 - NEEDLE BEARING

(13) Press 3/4 cluster gear onto intermediate shaft using cup 8481 (Fig. 283).

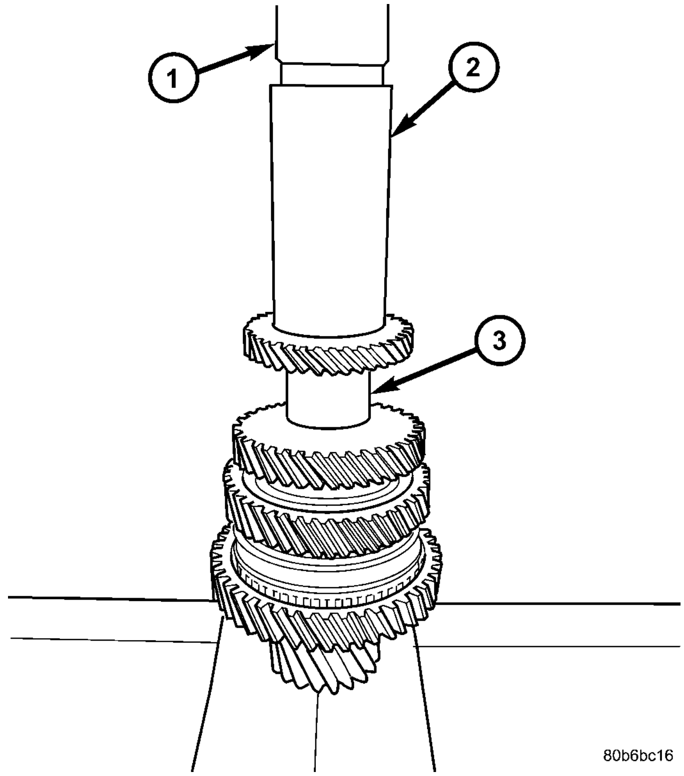

Fig. 283 Install 3/4 Cluster Gear using Tool 8481

1 - ARBOR PRESS
2 - INSTALLER 8481
3 - 3/4 CLUSTER GEAR

(14) Install **NEW** 3/4 cluster gear snap ring (Fig. 284).

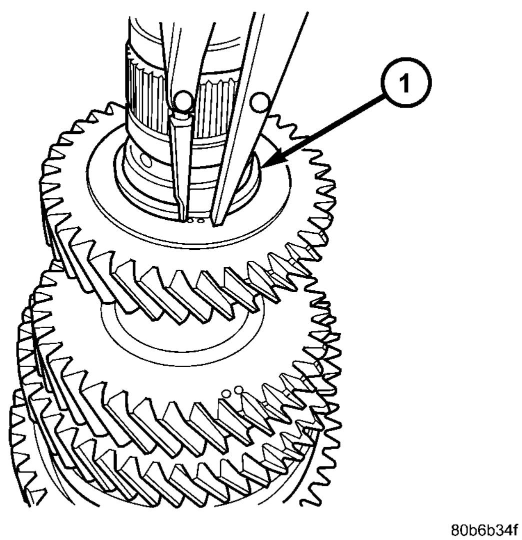

Fig. 284 3/4 Cluster Gear Snap Ring

1 - SNAP RING

INTERMEDIATE SHAFT (Continued)

(15) Install 5th gear and needle bearing to intermediate shaft (Fig. 285) (Fig. 286).

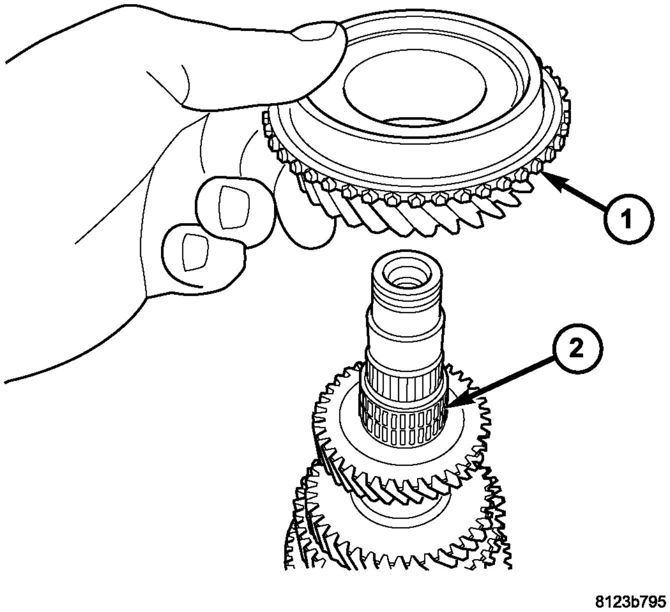

Fig. 285 5th Gear Removal/Installation

1 - 5TH GEAR
2 - NEEDLE BEARING

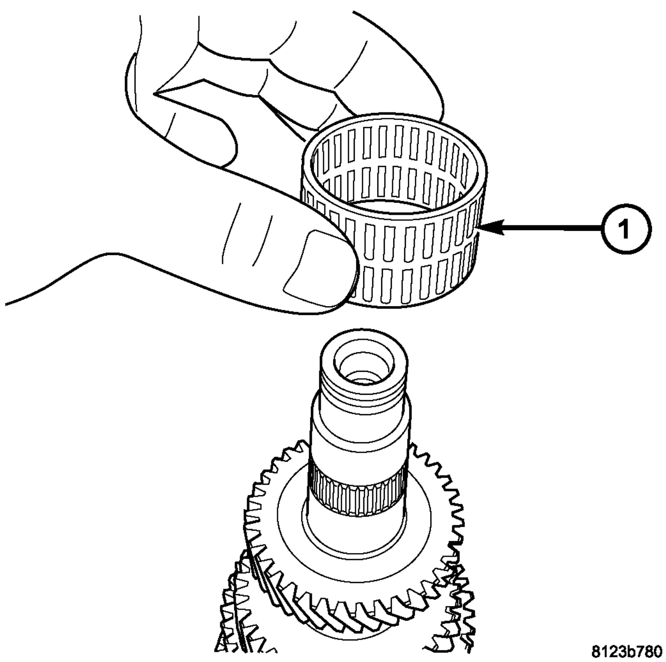

Fig. 286 5th Gear Needle Bearing Removal/ Installation

1 - 5TH GEAR NEEDLE BEARING

(16) Install 5th gear blocker ring to synchronizer (Fig. 287).

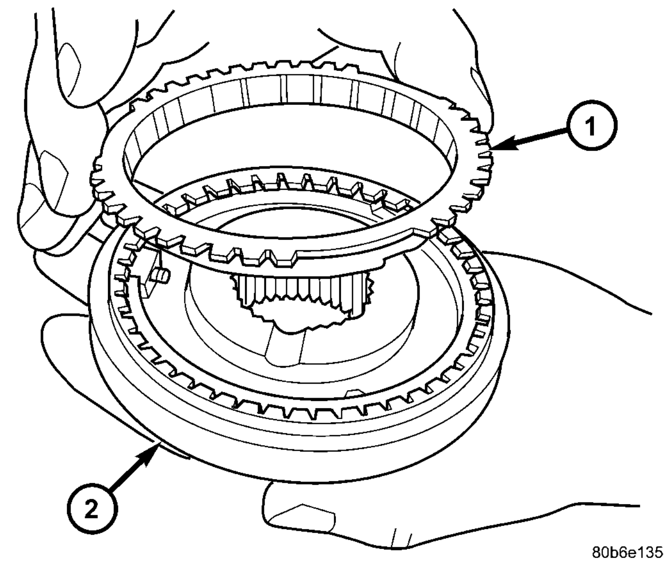

Fig. 287 5th Gear Blocker Ring to Synchro

1 - 5th GEAR BLOCKER RING
2 - 5/R SYNCHRONIZER

(17) Install 5th gear synchronizer assembly to intermediate shaft (Fig. 288). **When installing 5/R synchronizer, make sure to align oil slots on synchronizer hub face with oil hole in the shaft splined hub journal.**

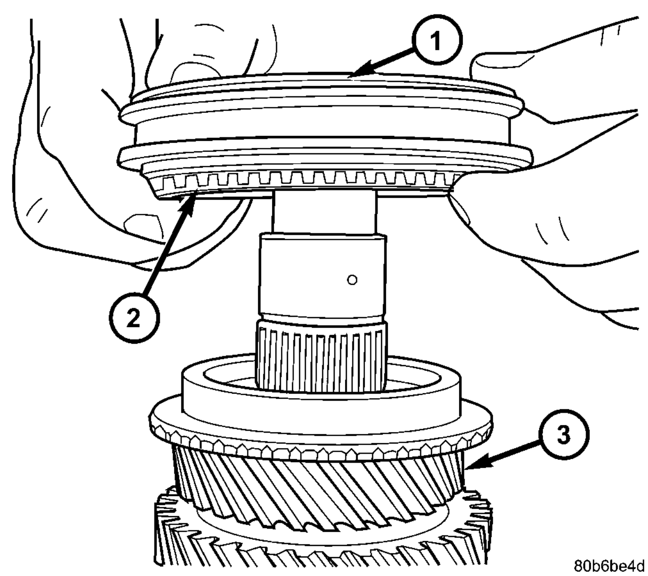

Fig. 288 Install 5/R Synchro and 5th Blocker Ring to 5th Gear

1 - 5/R SYNCHRONIZER
2 - 5TH GEAR BLOCKER RING
3 - 5TH GEAR

INTERMEDIATE SHAFT (Continued)

(18) Install **NEW** 5/R synchro snap ring (Fig. 289).

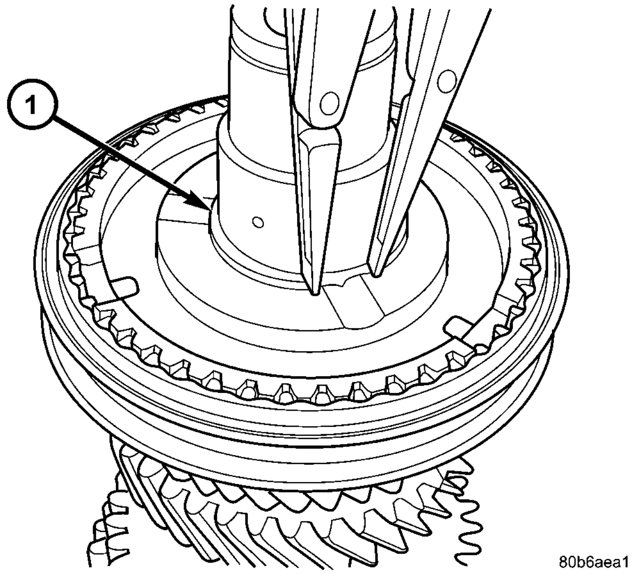

Fig. 289 5/R Synchro Snap Ring

1 - SNAP RING

(19) Install reverse gear blocker ring (Fig. 290).

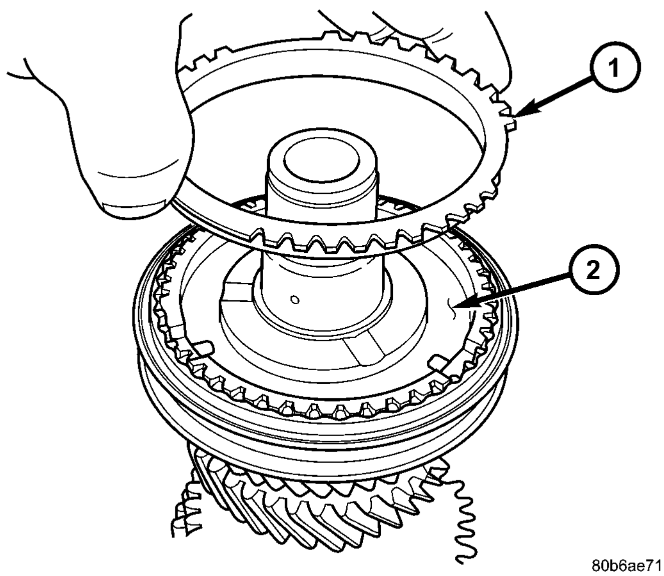

Fig. 290 Reverse Gear Blocker Ring

1 - REVERSE BLOCKER RING
2 - 5/R SYNCHRONIZER

(20) Install reverse gear needle bearing (Fig. 291).

(21) Install reverse gear to intermediate shaft.

(22) Install intermediate shaft sealed roller bearing and thrust washer using installer 8482 (Fig. 292).

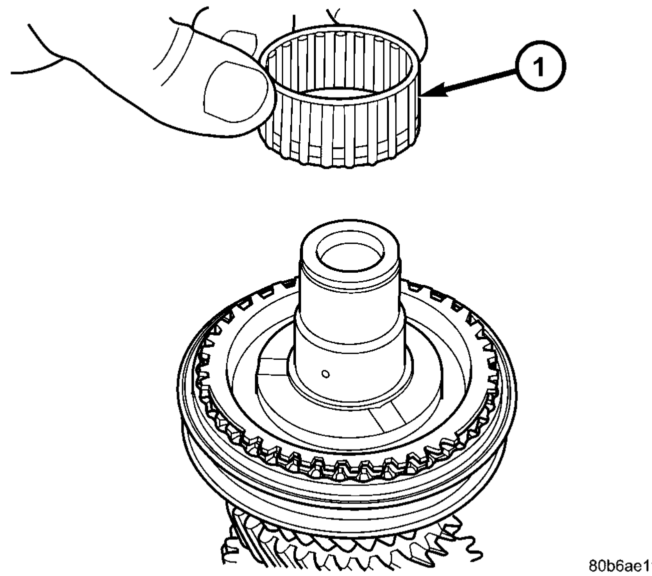

Fig. 291 Reverse Gear Needle Bearing

1 - NEEDLE BEARING

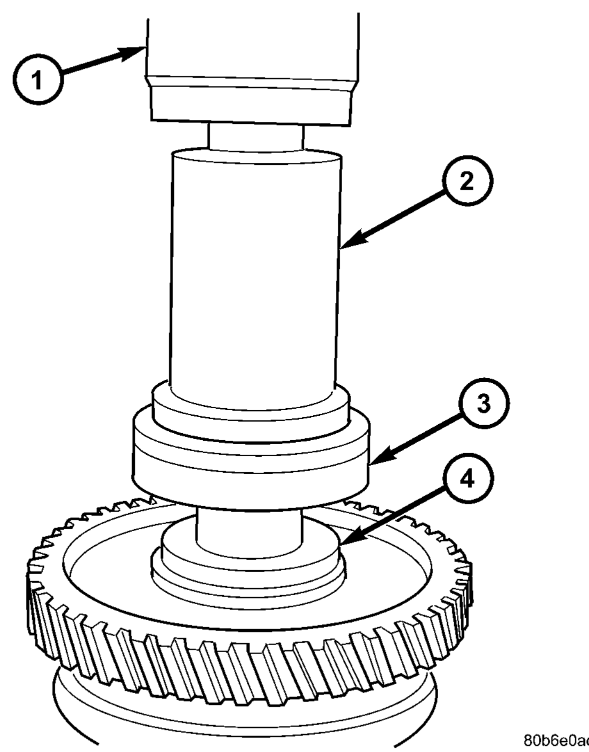

Fig. 292 Sealed Roller Bearing Installatiion

1 - ARBOR PRESS
2 - REMOVER/INSTALLER 8482
3 - SEALED ROLLER BEARING
4 - THRUST WASHER

INTERMEDIATE SHAFT (Continued)

(23) Install **NEW** intermediate shaft sealed bearing snap ring (Fig. 293).

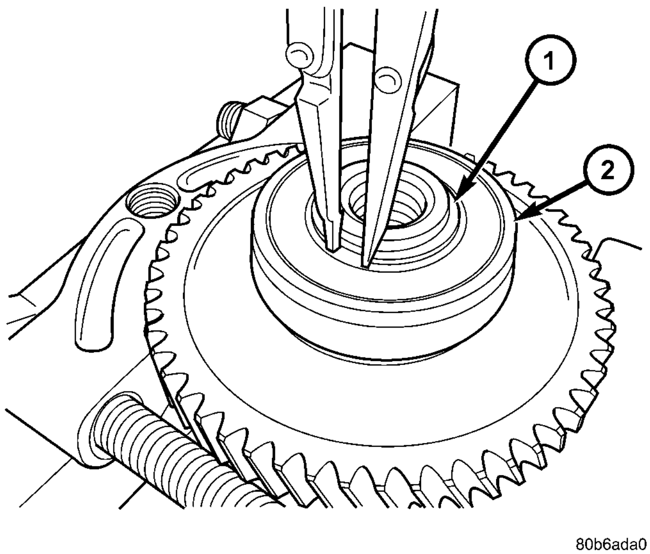

Fig. 293 Intermediate Shaft Bearing Snap Ring

1 - SNAP RING
2 - BEARING

SHIFT COVER

DESCRIPTION

The shift cover assembly (Fig. 294) (Fig. 295) is operated by the gearshift crossover and selector cables, and operates the shift fork/shaft system. It consists of crossover and selector lever mechanisms, transaxle vent, a main shift selector shaft, and the 5-R blockout mechanism. The shift cover is only serviced as an assembly.

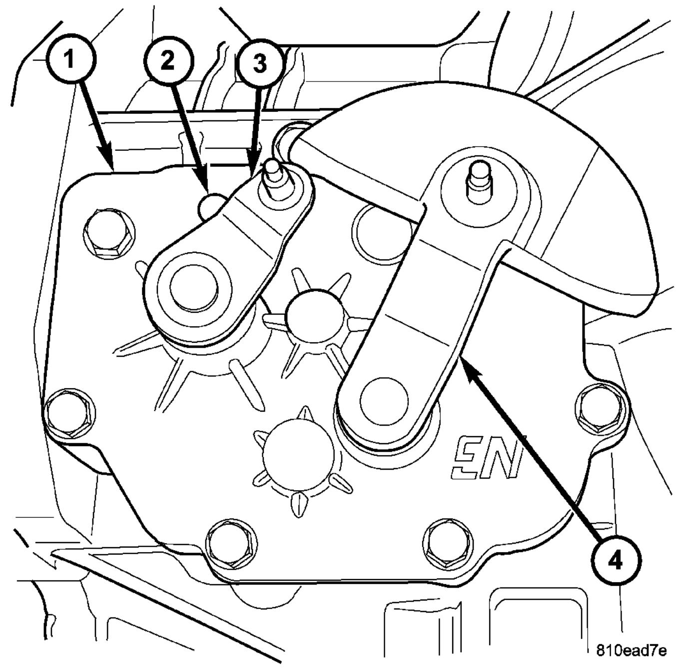

Fig. 294 Shift Lever Identification

1 - SHIFT COVER ASSEMBLY
2 - VENT
3 - CROSSOVER LEVER
4 - SELECTOR LEVER

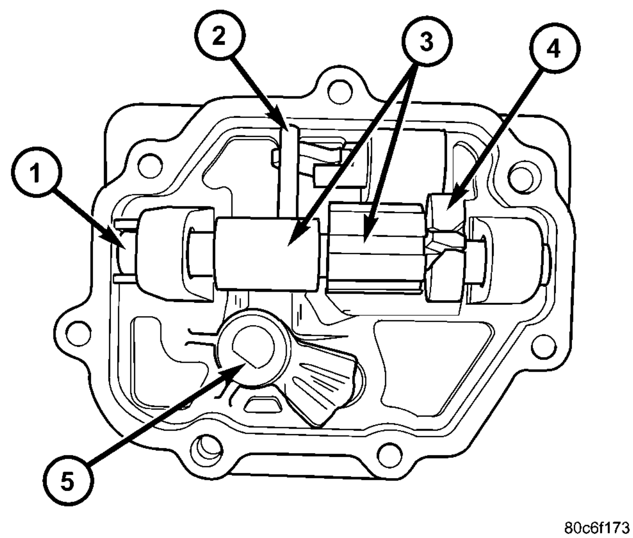

Fig. 295 Shift Cover Assembly Components

1 - SHAFT
2 - 5-R BLOCKOUT PIN/CAM
3 - SHIFT SELECTOR
4 - SHIFT BLOCKER
5 - SELECTOR LEVER/DETENT

SHIFT FORK AND SHAFT

DESCRIPTION

The T850 utilizes a unique shift fork and shaft arrangement consisting of three shift forks and two shafts as shown in (Fig. 296). This system is operated by the shift cover assembly, which combined with a unique gearshift cable design, offers a higher mechanical advantage over traditional shift systems. This arrangement results in less friction and lower shift cable loads for smoother, more positive operation. The shift fork assemblies are constructed of brass, float about the shafts with the aid of needle bearings, and are serviced only as fork/bearing assemblies.

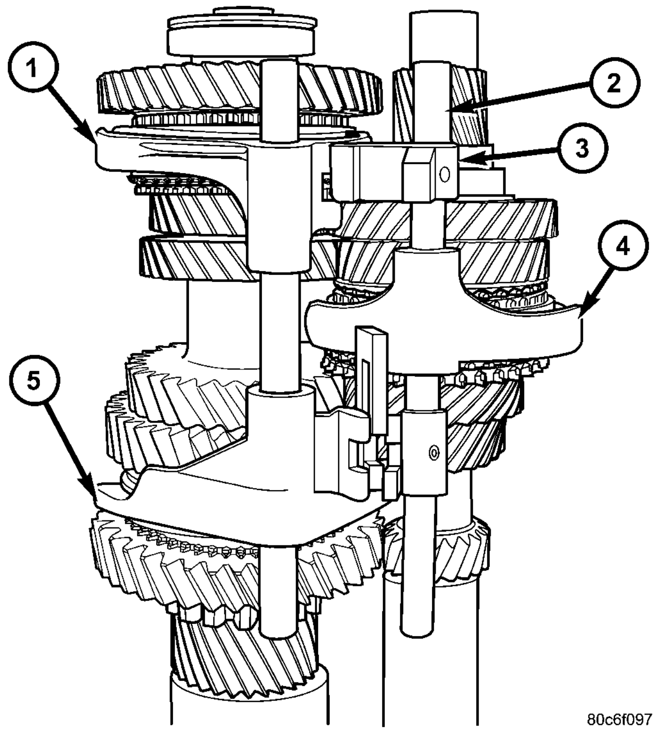

Fig. 296 Shift Fork/Shaft Components

1 - 5/R FORK
2 - SHAFT/LINK ASSEMBLY
3 - LINK
4 - 3/4 FORK
5 - 1/2 FORK

SYNCHRONIZER

DESCRIPTION

The T850 transaxle uses two styles of synchronizer assemblies; a conventional single-cone style is used for the 5th/Reverse and 3rd/4th applications (Fig. 297), and a dual-cone style for the 1st/2nd gear application (Fig. 298).

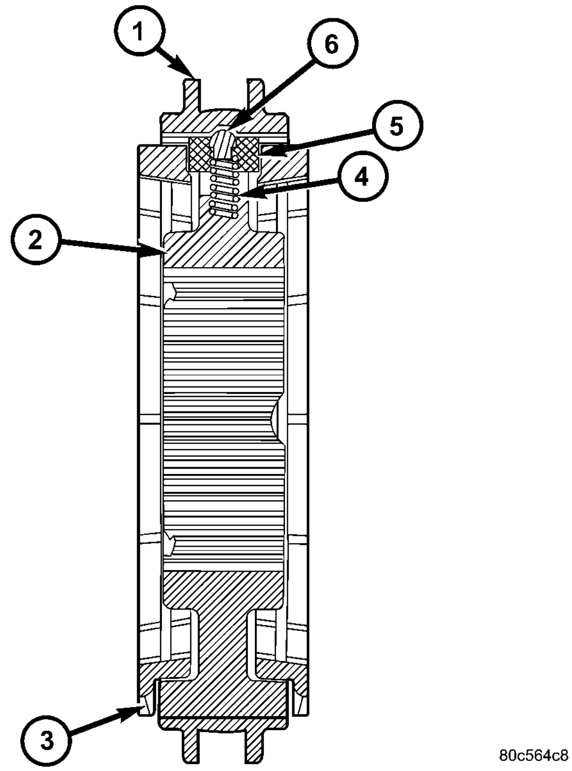

Fig. 297 3/4-5/R Synchronizer Assembly

1 - SLEEVE
2 - HUB
3 - BLOCKER RING (2)
4 - SPRING (3)
5 - KEY (3)
6 - BALL (3)

DISASSEMBLY

Place synchronizer in a clean shop towel and wrap. Press on inner hub. Carefully open up shop towel and remove springs, balls, keys, hub, and sleeve.

CLEANING

CLEAN

Do not attempt to clean the blocking rings in solvent. The friction material will become contaminated. Place synchronizer components in a suitable holder and clean with solvent. Air dry.

INSPECTION

INSPECT

Proper inspection of components involve:

- Teeth, for wear, scuffed, nicked, burred, or broken teeth
- Keys, for wear or distortion
- Balls and springs, for distortion, cracks, or wear

If any of these conditions exist in these components, replace as necessary.

SYNCHRONIZER (Continued)

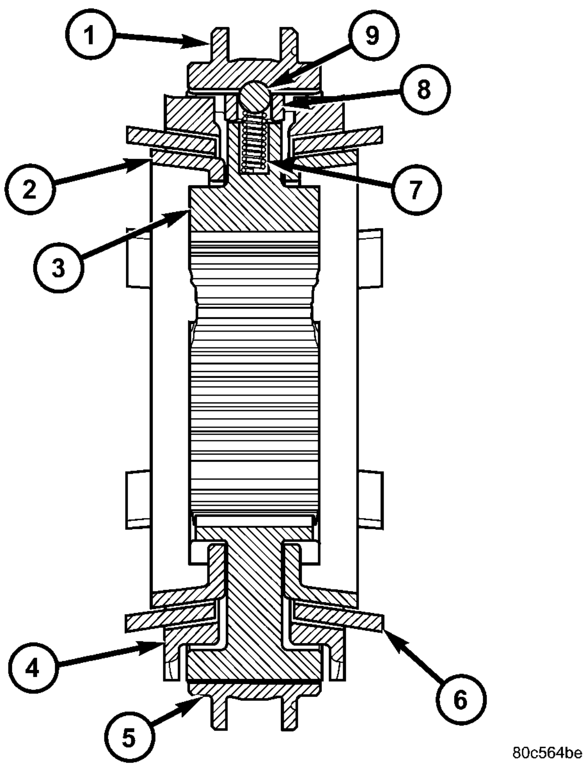

Fig. 298 1/2 Synchronizer Assembly

1 - SLEEVE
2 - REACTOR RING (2)
3 - HUB
4 - BLOCKER RING (2)
5 - SLEEVE
6 - FRICTION CONE (2)
7 - SPRING (3)
8 - KEY (3)
9 - BALL (3)

ASSEMBLY

(1) Position synchronizer hub onto work bench. Hub is non-directional.
(2) Install springs into hub slot.
(3) Insert key into hub and spring.
(4) Apply petroleum jelly to the hole in the key. Insert balls into each key.
(5) Slide sleeve over the hub and depress balls as you carefully slip the sleeve into position.

VEHICLE SPEED SENSOR

REMOVAL

(1) Raise vehicle on hoist.
(2) Disconnect the speed sensor connector (Fig. 299).

CAUTION: Clean area around speed sensor before removing to prevent dirt from entering the transaxle during speed sensor removal.

(3) Remove speed sensor retaining bolt (Fig. 299).

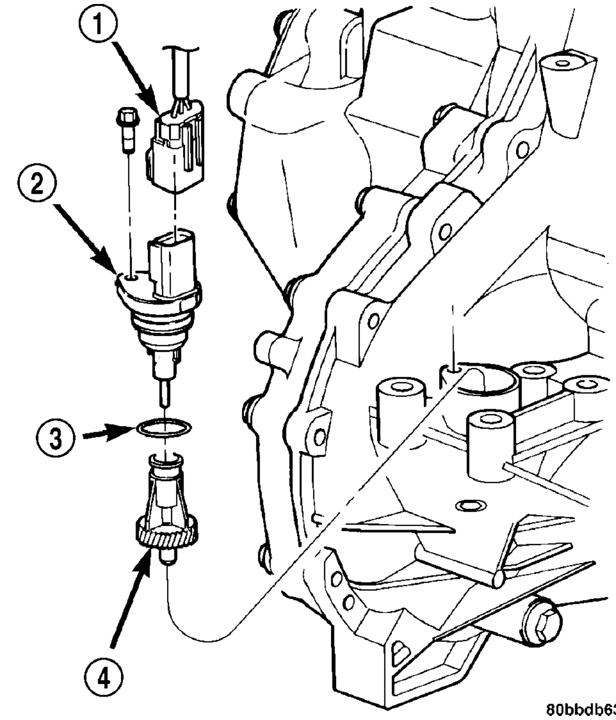

Fig. 299 Speed Sensor and Pinion Removal/ Installation—Typical

1 - CONNECTOR
2 - SENSOR
3 - O-RING
4 - GEAR

(4) Remove speed sensor from transaxle.

CAUTION: Carefully remove vehicle speed sensor so that sensor drive gear does not fall into transaxle. Should sensor drive gear fall into the transaxle during sensor removal, drive gear must be reattached to sensor.

(5) Remove speed sensor drive gear from speed sensor.

INSTALLATION

(1) Install pinion gear to speed sensor (Fig. 299).
(2) Using a NEW o-ring, install the speed sensor to the transaxle (Fig. 299).
(3) Install the bolt and torque to 7 N·m (60 in. lbs.).
(4) Connect speed sensor connector (Fig. 299).
(5) Lower vehicle and road test to verify proper speedometer operation.

EMISSIONS CONTROL

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EMISSIONS CONTROL 2.5L/2.8L TURBO DIESEL

DESCRIPTION

The 2.5L/2.8L diesel Engine Control Module (ECM) controls many different circuits in the fuel injection pump and engine systems. If the ECM senses a problem with a monitored circuit that indicates an actual problem, a Diagnostic Trouble Code (DTC) will be stored in the ECM's memory, and eventually may illuminate the MIL (Malfunction Indicator Lamp) constantly while the key is on. If the problem is repaired, or is intermittent, the ECM will erase the DTC after 40 warm-up cycles without the fault detected. A warm-up cycle consists of starting the vehicle when the engine is cold, then the engine is warmed up to a certain temperature, and finally, the engine temperature falls to ambient temperature, when the key is turned off.

Certain criteria must be met for a DTC to be entered into ECM memory. The criteria may be a specific range of engine rpm, engine or fuel temperature and/or input voltage to the ECM. A DTC indicates that the ECM has identified an abnormal signal in a circuit or the system.

There are several operating conditions that the ECM does not monitor and set a DTC for. Refer to the following Monitored Circuits and Non–Monitored Circuits in this section.

ECM MONITORED SYSTEMS

The ECM can detect certain problems in the electrical system.

Open or Shorted Circuit – The ECM will not distinguish between an open or a short to ground, however the ECM can determine if there is excessive current on a circuit, such as a short to voltage or a decrease in component resistance.

Output Device Current Flow – The ECM senses whether the output devices are electrically connected.

If there is a problem with the circuit, the ECM senses whether the circuit is open, shorted to ground (–), or shorted to (+) voltage.

Fuel Pressure: High fuel pressure is controlled by the fuel injection pump, fuel pressure solenoid, and fuel pressure sensor. The ECM uses inputs from the sensor and solenoid to calculate and determine if a high fuel pressure problem exists.

Fuel Injector Malfunctions: The ECM can determine if a fuel injector has an electrical problem. The fuel injectors on the diesel engine are **controlled** by the ECM.

ECM NON–MONITORED SYSTEMS

The ECM does not monitor the following circuits, systems or conditions that could have malfunctions that result in driveability problems. A DTC will not be displayed for these conditions.

Cylinder Compression: The ECM cannot detect uneven, low, or high engine cylinder compression.

Exhaust System: The ECM cannot detect a plugged, restricted or leaking exhaust system.

Vacuum Assist: Leaks or restrictions in the vacuum circuits of the Exhaust Gas Recirculation System (EGR) are not monitored by the ECM.

ECM System Ground: The ECM cannot determine a poor system ground. However, a DTC may be generated as a result of this condition.

ECM/PCM Connector Engagement: The ECM cannot determine spread or damaged connector pins. However, a DTC may be generated as a result of this condition.

HIGH AND LOW LIMITS

The ECM compares input signals from each input device. There are high and low limits that are programmed into the ECM for that device. If the inputs are not within specifications and other DTC criteria are met, a DTC will be stored in memory. Other DTC criteria might include engine rpm limits or input voltages from other sensors or switches. The other inputs might have to be sensed by the ECM when it senses a high or low input voltage from the control system device in question.

EMISSIONS CONTROL 2.5L/2.8L TURBO DIESEL (Continued)

SPECIFICATIONS - TORQUE

2.5L / 2.8L DIESEL - TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
EGR Pipe to EGR Bolts	32.4	24	—
EGR Pipe to Exhaust Manifold	27.5	21	—
EGR Valve Nuts	32.4	24	—

EXHAUST GAS RECIRCULATION

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DESCRIPTION	3
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EXHAUST GAS RECIRCULATION

DESCRIPTION

The EGR system reduces oxides of nitrogen (NOx) in the engine exhaust. This is accomplished by allowing a predetermined amount of hot exhaust gas to recirculate and dilute the incoming charge air.

A malfunctioning EGR system can cause engine stumble, sags, or hesitation, rough idle, engine stalling and poor driveability.

OPERATION

The system consists of:

- An EGR valve assembly. The valve is located on the rear of the engine above the exhaust manifold.
- An EGR solenoid. The EGR solenoid controls the “on time” of the EGR valve.
- The ECM operates the EGR solenoid. The ECM is located in the left front corner of the engine compartment, in front of the battery.
- An EGR tube connects a passage in the EGR valve to the intake manifold.
- The vacuum pump supplies vacuum for the EGR solenoid and the EGR valve. This pump also supplies vacuum for operation of the power brake booster and the heating and air conditioning system. The pump is located internally in the front of the engine block and is driven by the crankshaft gear.
- Vacuum lines and hoses connect the various components.

When the ECM supplies a variable ground signal to the EGR solenoid, EGR system operation starts to occur. The ECM will monitor and determine when to supply and remove this variable ground signal. This will depend on inputs from the engine coolant temperature, throttle position and engine speed sensors.

When the variable ground signal is supplied to the EGR solenoid, vacuum from the vacuum pump will be allowed to pass through the EGR solenoid and on to the EGR valve with a connecting hose.

Exhaust gas recirculation will begin in this order when:

- The ECM determines that EGR system operation is necessary.
- The engine is running to operate the vacuum pump.
- A variable ground signal is supplied to the EGR solenoid.
- Variable vacuum passes through the EGR solenoid to the EGR valve.
- The inlet seat (poppet valve) at the bottom of the EGR valve opens to recirculate exhaust gas back into the intake manifold.

The EGR system will be shut down by the ECM after 60 seconds of continuous engine idling to improve idle quality.

VALVE

DESCRIPTION

The EGR system consists of (Fig. 1):

- EGR valve
- EGR tube
- Vacuum hoses
- EGR solenoid

OPERATION

The EGR system reduces oxides of nitrogen (NOx) in engine exhaust. Formation of NOx increases proportionally with combustion temperature. To reduce the emission of these oxides, the cylinder temperature must be lowered. The system allows a predetermined amount of hot exhaust gas to recirculate and dilute the incoming charge air. The diluted air mixture reduces peak flame temperature during combustion.

VALVE (Continued)

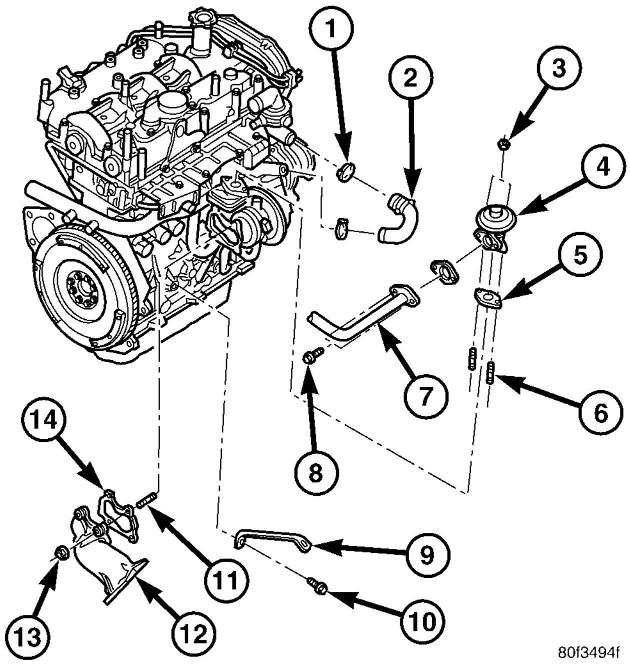

Fig. 1 EGR and TURBOCHARGER COMPONENTS

1 - HOSE CLAMP
2 - COOLANT HOSE
3 - EGR VALVE RETAINING NUT
4 - EGR VALVE
5 - EGR GASKET
6 - EGR VALVE RETAINING STUDS
7 - EGR TUBE
8 - EXHAUST PIPE RETAINING BOLT (2)
9 - TURBOCHARGER BRACKET
10 - BRACKET RETAINING NUT
11 - TURBOCHARGER DOWN PIPE STUD
12 - TURBOCHARGER DOWN PIPE
13 - DOWN PIPE RETAINING NUT
14 - DOWN PIPE GASKET

REMOVAL

(1) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(2) Remove front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - REMOVAL).

(3) Disconnect EGR valve vacuum line.

(4) Remove EGR pipe to EGR valve retaining bolts (Fig. 1).

(5) Remove EGR valve retaining nuts (Fig. 1) and EGR valve.

INSTALLATION

(1) Clean gasket mating surfaces.

(2) Install EGR valve (Fig. 1). Torque nuts to 32.4N·m.

(3) Connect EGR pipe to EGR valve (Fig. 1). Torque bolts to 32.4N·m

(4) Connect EGR vacuum line.

(5) Install front wiper unit (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MODULE - INSTALLATION).

(6) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

ON-BOARD DIAGNOSTICS

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ON-BOARD DIAGNOSTICS
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ON-BOARD DIAGNOSTICS

DESCRIPTION - DIAGNOSTIC TROUBLE CODES

On the following pages, a list of DTC's is provided for the 2.5L diesel engine. A DTC indicates that the ECM has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but most likely will not identify the failed component directly. Refer to the appropriate diagnostic manual for more information on diagnosis of trouble codes.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored DTC can be displayed through the use of the DRB III® scan tool. The DRB III® connects to the data link connector. The data link connector is located under the instrument panel, left of the steering column

ERASING TROUBLE CODES

After the problem has been repaired, use the DRB III® scan tool to erase a DTC.

ENGINE CONTROL MODULE (ECM) - DRBIII® CODES

Generic Scan Tool Code	DRB III® Scan Tool Display
P0100	Mass Air Flow Sensor Plausibility Mass Air Flow Sensor Plausibility Positive Area Mass Air Flow Sensor Signal Voltage Too High Mass Air Flow Sensor Signal Voltage Too Low Mass Air Flow Sensor Supply Voltage Too High Or Low
P0105	Barometric Pressure Circuit Signal Voltage To High Barometric Pressure Circuit Signal Voltage To Low
P0110	Intake Air Temperature Sensor Circuit Signal Too High Intake Air Temperature Sensor Circuit Signal Too Low
P0115	Engine Coolant Temperature Sensor Circuit Voltage To Low Engine Coolant Temperature Sensor Circuit Voltage To High
P0190	Fuel Pressure Sensor Circuit MALF Signal Voltage Too High Fuel Pressure Sensor Circuit MALF Signal Voltage Too Low Fuel Pressure Sensor Supply Voltage Too High or Low
P0195	Oil Temperature Sensor Circuit MALF Signal Voltage Too High Oil Temperature Sensor Circuit MALF Signal Voltage Too Low
P0201	Cylinder 1 Injector Circuit Current Decrease Cylinder 1 Injector Circuit Load Drop Cylinder 1 Injector Circuit Overcurrent High Side Cylinder 1 Injector Circuit Overcurrent Low Side

ON-BOARD DIAGNOSTICS (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
P0202	Cylinder 2 Injector Circuit Current Decrease Cylinder 2 Injector Circuit Load Drop Cylinder 2 Injector Circuit Overcurrent High Side Cylinder 2 Injector Circuit Overcurrent Low Side
P0203	Cylinder 3 Injector Circuit Current Decrease Cylinder 3 Injector Circuit Load Drop Cylinder 3 Injector Circuit Overcurrent High Side Cylinder 3 Injector Circuit Overcurrent Low Side
P0204	Cylinder 4 Injector Circuit Current Decrease Cylinder 4 Injector Circuit Load Drop Cylinder 4 Injector Circuit Overcurrent High Side Cylinder 4 Injector Circuit Overcurrent Low Side
P0235	Boost Pressure Sensor Plausibility Boost Pressure Sensor Signal Voltage Too Low Boost Pressure Sensor Signal Voltage Too High Boost Pressure Sensor Signal Voltage Too High Or Low
P0335	CKP Position Sensor Circuit Overspeed Recognition
P0340	CMP/CKP Position Sensor Circuit CMP/CKP Sync. Failure CMP/CKP Position Sensor Circuit Dynamic Plausibility CMP/CKP Position Sensor Circuit CMP Dynamic Plausibility CMP/CKP Position Sensor Circuit CMP Signal Frequency Too High CMP/CKP Position Sensor Circuit CKP Static Plausibility
P0380	Glow Plug Circuit A Open Circuit Glow Plug Circuit A Short Circuit
P0403	EGR Solenoid Circuit Open Circuit EGR Solenoid Circuit Short Circuit
P0480	Fan 1 Control Circuit Open Circuit Fan 1 Control Circuit Short Circuit
P0481	Fan 2 Control Circuit Open Circuit Fan 2 Control Circuit Short Circuit
P0500	Vehicle Speed Sensor Frequency Too High Vehicle Speed Sensor Frequency High Level Duration Vehicle Speed Sensor Plausibility Vehicle Speed Sensor Signal Voltage Too High
P0514	Battery Temperature Sensor Circuit Signal Voltage Too High Battery Temperature Sensor Circuit Signal Voltage Too Low

ON-BOARD DIAGNOSTICS (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
P0520	Oil Pressure Sensor Circuit MALF Signal Voltage Too High Oil Pressure Sensor Circuit MALF Signal Voltage Too Low Oil Pressure Sensor Circuit MALF Signal Voltage Too Low or High Oil Pressure Sensor Circuit MALF Supply Voltage Too Low or High Oil Pressure Sensor Circuit MALF Supply Voltage Plausibility
P0530	A/C Pressure Sensor Circuit Plausibility A/C Pressure Sensor Circuit Signal Voltage Too High A/C Pressure Sensor Circuit Signal Voltage Too Low A/C Pressure Sensor Circuit Supply Voltage Too High Or Low
P0560	System Voltage Too High System Voltage Too Low
P0579	Speed Control Switch Signal Circuit Voltage Too High Speed Control Switch Signal Circuit Voltage Too Low Speed Control Switch Signal Circuit Voltage Plausibility
P0606	ECM Error Gate Array - Communication ECM Error Gate Array - Communication Not Verified ECM Error Gate Array - Quantity Stop ECM Error Recovery - Has Occurred ECM Error Redundant Overrun Monitoring
P0615	Starter Relay Circuit Short Circuit
P0620	Generator Field Control MALF Open Circuit Generator Field Control MALF Short Circuit Generator Field Control MALF BatteryVoltage Too High Generator Field Control MALF BatteryVoltage Too Low Generator Field Control MALF Charging Volts Too Low Generator Field Control MALF Unstable Current Generator Field Control MALF Battery Voltage deviation Too High Generator Field Control MALF Battery Voltage deviation Too Low
P0627	Fuel Lift Pump Relay Control Circuit Open Circuit Fuel Lift Pump Relay Control Circuit Short Circuit
P0641	Sensor Reference Voltage A CKT Voltage Too High Sensor Reference Voltage A CKT Voltage Too Low
P0645	A/C Clutch Relay Circuit Open Circuit A/C Clutch Relay Circuit Short Circuit
P0651	Sensor Reference Voltage B CKT Voltage Too Low Sensor Reference Voltage B CKT Voltage Too High
P0685	ECM/PCM Relay Control Circuit Shuts Off Too Early ECM/PCM Relay Control Circuit Shuts Off Too Late

ON-BOARD DIAGNOSTICS (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
P0703	Brake Switch Signal Circuits Plausibility After Initalization Brake Switch Signal Circuits Plausibility With Redundant Contact
P0833	Clutch Pedal Plausibility
P1130	Fuel Rail Pressure Malfunction Pressure Too High-Shut Off Fuel Rail Pressure Malfunction Pressure Too Low Fuel Rail Pressure Malfunction Solenoid Open Fuel Rail Pressure Malfunction Leakage Detected
P1131	Fuel Pressure Solenoid Open Circuit Fuel Pressure Solenoid Short Circuit Fuel Pressure Solenoid Plausibility in After-run
P1206	Calculated Injector Voltage Too Low Calculated Injector Voltage Too High
P1511	Battery Sense Line 1 Voltage Too High Battery Sense Line 1 Voltage Too Low
P1601	Capacitor Voltage 1 Voltage Too High Capacitor Voltage 1 Voltage Too Low
P1605	Ignition Switch Plausibility
1606	After Run Shut-Off Error - Zero Quantity After Run Shut-Off Error - Injection Powerstage
P1610	Voltage Regulator Signal Voltage Too High Voltage Regulator Signal Voltage Too Low
P1651	MIL/Diagnostic Lamp via J1850 Bus In Frame Response Error MIL/Diagnostic Lamp via J1850 Bus Status Error
1652	J1850 Communication Bus Short to Voltage J1850 Communication Bus Short to Ground J1850 Communication Bus Transmit Buffer Overrun J1850 Communication Bus SPI Error J1850 Communication Bus Receive Timeout J1850 Communication Bus Unauthorized Reset
P1680	EEPROM Plausibility Checksum Error EEPROM Plausibility Code Word Incorrect Or Missing EEPROM Plausibility Communication Error EEPROM Plausibility Variation Number Error EEPROM Plausibility VIN Checksum Error EEPROM Plausibility Write Error

ON-BOARD DIAGNOSTICS (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
P1685	SKIM System Invalid Key Code Received SKIM System Invalid Secret Key In EEPROM SKIM System Key Communication Timed Out SKIM System Write Access To EEPROM Failure
P1696	EEPROM Communication Error EEPROM Communication Not Verified EEPROM Quanity Stop EEPROM Recovery Occured EEPROM Redundant Overrun Monitoring
P1703	Brake Switch Signal CKTS Plaus. With Redundant Contact After Initialization
P2120	Acc. Pedal Position Sensor 1 CKT Plausibility Acc. Pedal Position Sensor 1 CKT Plausibility With Brake Switch Acc. Pedal Position Sensor 1 CKT Plausibility With Low Idle Switch Acc. Pedal Position Sensor 1 CKT Plausibility With Potentiometer Acc. Pedal Position Sensor 1 CKT Signal Voltage Too High Acc. Pedal Position Sensor 1 CKT Signal Voltage Too Low Acc. Pedal Position Sensor 1 CKT Signal Voltage Too High or Low

SERVICE MANUAL COMMENTS

What errors(s) have you found?

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In order for us to assist you, please include as much details as possible when reporting an error

Comments / Suggestions

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☐ **Dealership Technician**
Dealer Code: ____________

Retail Customer ☐

Manual Title, Year, Number and Page: ____

____

Your Name: ____

Address: ____

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