DIFFERENTIAL AND DRIVELINE

DESCRIPTION AND OPERATION
FRONT DRIVESHAFTS
Vehicles equipped with either an automatic or manual transmission use an unequal-length drive-shaft system.

The system incorporates two driveshaft assemblies (left and right) that consist of an inner and outer constant velocity (CV) joint and a solid interconnecting shaft (Fig. 1). The right driveshaft is longer than the left due to transaxle packaging and powertrain design.

Fig. 1 Unequal Length Driveshaft System

1 – STUB AXLE
2 – OUTER C/V JOINT
3 – OUTER C/V JOINT BOOT
4 – TUNED RUBBER DAMPER WEIGHT
5 – INTERCONNECTING SHAFT
6 – OUTER C/V JOINT BOOT
7 – STUB AXLE
8 – OUTER C/V JOINT
9 – RIGHT DRIVESHAFT
10 – INNER TRIPOD JOINT BOOT
11 – INNER TRIPOD JOINT
12 – INNER TRIPOD JOINT
13 – INNER TRIPOD JOINT BOOT
14 – INTERCONNECTING SHAFT LEFT DRIVESHAFT
Driveshafts used on both the right and left sides of the vehicle use a tuned rubber damper weight mounted to the interconnecting shaft (Fig. 1). The damper weight applications vary by which side of the vehicle the driveshaft is located on and the transmission application of the vehicle. When replacing a driveshaft, be sure the replacement driveshaft has the same damper weight as the original.

Both driveshaft assemblies use the same type of inner and outer joints. The inner joint of both driveshaft assemblies is a tripod joint, and the outer joint of both driveshaft assemblies is a Rzeppa joint. Both tripod joints and Rzeppa joints are true constant velocity (C/V) joint assemblies. The inner tripod joint allows for the changes in driveshaft length through the jounce and rebound travel of the front suspension.

On vehicles equipped with ABS brakes, the outer C/V joint is equipped with a tone wheel used to determine vehicle speed for ABS brake operation. The inner tripod joint of both driveshafts is splined into the transaxle side gears. The inner tripod joints are retained in the side gears of the transaxle using a snap ring located in the stub shaft of the tripod joint. The outer C/V joint has a stub shaft that is splined into the wheel hub and retained by a single piece steel hub nut (Fig. 2). The hub nut is a locking style; the nut lock, anti-rattle washer, and cotter pin are not necessary.

NOTE: This vehicle does not use a rubber–lip bearing seal as on previous front–wheel–drive cars to prevent contamination of the front wheel bearing. On these vehicles, the face of the outer C/V joint fits deeply into the steering knuckle, using a close outer C/V joint–to–steering knuckle fit. This design deters direct water splash on bearing seal while allowing any water that gets in, to run out the bottom of the steering knuckle bearing bore. It is important to thoroughly clean the outer C/V joint and the wheel bearing area in the steering knuckle before it is assembled after servicing.

**DIAGNOSIS AND TESTING**

**DRIVESHAFT DIAGNOSIS**

**VEHICLE INSPECTION**

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

2. A light film of grease may appear on the right inner tripod joint seal boot; this is considered normal and should not require replacement of the seal boot. The right inner tripod joint seal boot is made of silicone rubber; which will allow the weeping (sweating) of the joint lubricant to pass through it while in operation.

**NOISE AND/OR VIBRATION IN TURNS**

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

1. Damaged outer C/V 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.

2. Noise may also be caused by another component of the vehicle coming in contact with the driveshafts.

**CLUNKING NOISE DURING ACCELERATION**

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

1. A torn seal boot on the inner or outer joint of the driveshaft assembly.

2. A loose or missing clamp on the inner or outer joint of the driveshaft assembly.

3. A damaged or worn driveshaft C/V joint.
SHUDDER OR VIBRATION DURING ACCELERATION

(1) A worn or damaged driveshaft inner tripod joint.
(2) A sticking tripod joint spider assembly (inner tripod joint only).
(3) Improper wheel alignment. See Wheel Alignment in this group for alignment checking and setting procedures and specifications.

VIBRATION AT HIGHWAY SPEEDS

(1) Foreign material (mud, etc.) packed on the backside of the wheel(s).
(2) Out of balance front tires or wheels. See Group 22, Wheels And Tires for the required balancing procedure.
(3) Improper tire and/or wheel runout. See Group 22, Wheels And Tires for the required runout checking procedure.

REMOVAL AND INSTALLATION

DRIVESHAFTS

CAUTION: Boot sealing is vital to retain special lubricants and to prevent foreign contaminants from entering the C/V joint. Mishandling, such as allowing the assemblies to dangle unsupported, or pulling or pushing the ends can cut boots or damage C/V joints. During removal and installation procedures, always support both ends of the driveshaft to prevent damage.

REMOVAL

CAUTION: The driveshaft, when installed, acts as a bolt and secures the front hub/bearing assembly. If vehicle is to be supported or moved on its wheels with a driveshaft removed, install a PROPER-SIZED BOLT AND NUT through front hub. Tighten bolt and nut to 203 N·m (150 ft. lbs.). This will ensure that the hub bearing cannot loosen.

(1) Disconnect battery negative cable.
(2) Place transaxle in gated park.
(3) Raise vehicle on hoist.
(4) Remove wheel and tire assembly (Fig. 3).

(5) Remove the driveshaft to hub and bearing retaining nut (Fig. 4).

(6) If equipped with ABS, disconnect the front wheel speed sensor and secure harness out of the way.
(7) Remove nut and bolt (Fig. 5) retaining ball joint stud into steering knuckle.

NOTE: Use caution when separating ball joint stud from steering knuckle, so ball joint seal does not get damaged.

(8) Separate ball joint stud from steering knuckle by prying down on lower control arm (Fig. 6).

(9) Remove driveshaft from steering knuckle by pulling outward on knuckle while pressing in on driveshaft. Support outer end of driveshaft assembly. If difficulty in separating driveshaft from steering knuckle is encountered, perform the following procedure:

(a) Install Puller, Special Tool 6790 on hub and bearing assembly (Fig. 7), using wheel lug nuts to secure it in place.

(b) Install a wheel lug nut on wheel stud to protect the threads on the stud. Install a flat blade pry tool to keep hub from turning. Using Puller, force the driveshaft outer stub axle from the hub and bearing assembly (Fig. 8).

(c) Pull steering knuckle assembly out and away from outer C/V joint of the driveshaft assembly as shown in (Fig. 5).

NOTE: Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint, driveshaft must be supported.

(10) Support outer end of the driveshaft assembly.

NOTE: Removal of the inner tripod joints is made easier if you apply outward pressure on the joint as you strike the punch with a hammer.
(11) Remove the inner tripod joints from the side gears of the transaxle using a punch to dislodge the inner tripod joint retaining ring from the transaxle side gear. If removing the right side inner tripod joint, position the punch against the inner tripod joint (Fig. 9). Strike the punch sharply with a hammer to dislodge the right inner joint from the side gear. If removing the left side inner tripod joint, position the punch in the groove of the inner tripod joint (Fig. 10). Strike the punch sharply with a hammer to dislodge the left inner tripod joint from the side gear.

(12) Hold inner tripod joint and interconnecting shaft of driveshaft assembly (Fig. 11). Remove inner tripod joint from transaxle by pulling it straight out of transaxle side gear and transaxle oil seal. When removing tripod joint, do not let spline or snap ring drag across sealing lip of the transaxle to tripod joint oil seal. When tripod joint is removed from transaxle, some fluid will leak out.
REMOVAL AND INSTALLATION (Continued)

CAUTION: The driveshaft, when installed, acts as a bolt and secures the front hub/bearing assembly. If vehicle is to be supported or moved on its wheels with a driveshaft removed, install a PROPER-SIZED BOLT AND NUT through front hub. Tighten bolt and nut to 203 N·m (150 ft. lbs.). This will ensure that the hub bearing cannot loosen.

INSTALLATION

(1) Thoroughly clean spline and oil seal sealing surface, on tripod joint. Lightly lubricate oil seal sealing surface on tripod joint with fresh clean transmission lubricant.

(2) Holding driveshaft assembly by tripod joint and interconnecting shaft, install tripod joint into transaxle side gear as far as possible by hand.

(3) Carefully align tripod joint with transaxle side gears. Then grasp driveshaft interconnecting shaft and push tripod joint into transaxle side gear until fully seated. **Test that snap ring is fully engaged with side gear by attempting to remove tripod joint from transaxle by hand. If snap ring is fully engaged with side gear, tripod joint will not be removable by hand.**

(4) Clean all debris and moisture out of steering knuckle (Fig. 12).

(5) Ensure that front of outer C/V joint, which fits into steering knuckle (Fig. 13), is free of debris and moisture before assembling into steering knuckle.

(6) Slide driveshaft back into front hub. Install steering knuckle onto the ball joint stud (Fig. 14).

**NOTE:** At this point, the outer joint will not seat completely into the front hub. The outer joint will be pulled into hub and seated when the hub nut is installed and torqued.

(7) Install a **NEW** steering knuckle to ball joint stud bolt and nut (Fig. 14). Tighten the nut and bolt to 95 N·m (70 ft. lbs.).
REMOVAL AND INSTALLATION (Continued)

(8) Clean all foreign matter from threads of drive-
shaft outer stub axle. Install hub nut onto the
threads of the stub axle and tighten nut to 244 N·m
(180 ft. lbs.) (Fig. 15).

(9) Install front wheel and tire assembly. Install
front wheel lug nuts (Fig. 16) and tighten to 128 N·m
(95 ft. lbs.).

(10) Check for correct fluid level in transaxle
assembly. Refer to Group 21 Transaxle, for the cor-
rect fluid level checking procedure for the type of
transaxle being checked.

(11) Lower vehicle.

(12) Connect battery negative cable.

DISASSEMBLY AND ASSEMBLY

DRIVESHAFT RECONDITION

NOTE: The only service that is to be performed on
the driveshaft assemblies is the replacement of
the driveshaft seal boots.

If any failure of internal driveshaft components is
diagnosed during a vehicle road test or disassembly
of the driveshaft, the driveshaft will need to be
replaced as an assembly.

NOTE: Lubricant requirements and quantities are
different for inner joints than for outer joints. Use
only the recommended lubricants in the required
quantities when servicing driveshaft assemblies.

See (Fig. 17) for the exploded view of the front
driveshaft components.

INNER TRIPOD JOINT SEAL BOOT

REMOVAL

To remove sealing boot from driveshaft for replace-
ment, the driveshaft assembly must be removed from
the vehicle. See Driveshaft Removal and Installation
in this section for the required driveshaft removal
and replacement procedure.

The inner tripod joints use no internal retention in
the tripod housing to keep the spider assembly in the
housing. Therefore, do not pull on the interconnect-
ning shaft to disengage tripod housing from transmis-
sion stub shaft. Removal in this manner will cause
damage to the inboard joint sealing boots.

(1) Remove the driveshaft requiring boot replace-
ment from the vehicle. See Driveshaft Removal and
Installation in this section for the required driveshaft
removal procedure.

(2) Remove large boot clamp that retains inner tri-
pod joint sealing boot to tripod joint housing (Fig. 18)
and discard. Then remove small clamp that retains
inner tripod joint sealing boot to interconnecting
shaft and discard. Remove the sealing boot from the
tripod housing and slide it down the interconnecting
shaft.
Fig. 17 Driveshaft Assembly Components (Exploded View)

1 – HOUSING ASM, RETAINER &
2 – RING, SPACER
3 – SPIDER, TRIPOTD JOINT
4 – RING, RETAINING
5 – RETAINER, BALL & ROLLER
6 – BALL, TRIPOD JOINT
7 – ROLLER, NEEDLE
8 – CLAMP, SEAL RETAINING
9 – BUSHING, TRIOBAL TRIPOD
10 – SEAL, DRIVE AXLE INBOARD
11 – CLAMP, SEAL RETAINING
12 – SHAFT, AXLE (RH SHOWN, LH SIMILAR)
13 – SEAL, DRIVE AXLE OUTBOARD
14 – CLAMP, SEAL RETAINING
15 – RING, RACE RETAINING
16 – BALL, CHROME ALLOY
17 – RACE, C/V JOINT INNER
18 – CAGE, C/V JOINT
19 – RACE, C/V JOINT OUTER
DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: When removing the spider joint from the tripod joint housing, hold the rollers in place on the spider trunions to prevent the rollers and needle bearings from falling away.

(3) Slide the interconnecting shaft and spider assembly out of the tripod joint housing (Fig. 19).

(4) Remove snap ring that retains spider assembly to interconnecting shaft (Fig. 20). Remove the spider assembly from interconnecting shaft. If spider assembly will not come off interconnecting shaft by hand, it can be removed by tapping spider assembly with a brass drift (Fig. 21). **Do not hit the outer tripod bearings in an attempt to remove spider assembly from interconnecting shaft.**

(5) Slide sealing boot off interconnecting shaft.

(6) Thoroughly clean and inspect spider assembly, tripod joint housing, and interconnecting shaft for any signs of excessive wear. **If any parts show signs of excessive wear, the driveshaft assembly will require replacement. Component parts of these driveshaft assemblies are not serviceable.**
INSTALLATION

NOTE: The inner tripod joint sealing boots are made from two different types of material. High-temperature applications use silicone rubber whereas standard temperature applications use Hytrel plastic. The silicone sealing boots are soft and pliable. The Hytrel sealing boots are stiff and rigid. The replacement sealing boot MUST BE the same type of material as the sealing boot that was removed.

(1) Slide inner tripod joint seal boot retaining clamp, onto interconnecting shaft. Then slide the replacement inner tripod joint sealing boot onto interconnecting shaft. Inner tripod joint seal boot MUST be positioned on interconnecting shaft, so the raised bead on the inside of the seal boot is in groove on interconnecting shaft (Fig. 22).

(2) Install spider assembly onto interconnecting shaft with chamfer on spider assembly toward interconnecting shaft (Fig. 23). Spider assembly must be installed on interconnecting shaft far enough to fully install spider retaining snap ring. If spider assembly will not fully install on interconnecting shaft by hand, it can be installed by tapping the spider body with a brass drift (Fig. 24). Do not hit the outer tripod bearings in an attempt to install spider assembly on interconnecting shaft.

(3) Install the spider assembly to interconnecting shaft retaining snap ring into groove on end of interconnecting shaft (Fig. 25). Be sure the snap ring is fully seated into groove on interconnecting shaft.

(4) 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.

(5) Align tripod housing with spider assembly and then slide tripod housing over spider assembly and interconnecting shaft (Fig. 26).

(6) Install inner tripod joint seal boot to interconnecting shaft clamp evenly on sealing boot.
(7) Clamp sealing boot onto interconnecting shaft using crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C-4975-A over bridge of clamp (Fig. 27). Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 28).

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

(8) Position sealing boot into the tripod housing retaining groove. Install seal boot retaining clamp evenly on sealing boot.

CAUTION: The following positioning procedure determines the correct air pressure inside the inner tripod joint assembly prior to clamping the sealing boot to inner tripod joint housing. If this procedure is not done prior to clamping sealing boot to tripod joint housing, boot durability can be adversely affected.
DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: When venting the inner tripod joint assembly, use care so inner tripod sealing boot does not get punctured or, in any other way, damaged. If sealing boot is punctured or damaged while being vented, the sealing boot can not be used.

(9) Insert a trim stick between the tripod joint and the sealing boot to vent inner tripod joint assembly (Fig. 29). When inserting trim stick between tripod housing and sealing boot, ensure trim stick is held flat and firmly against the tripod housing. If this is not done, damage to the sealing boot can occur. If inner tripod joint has a Hytrel (hard plastic) sealing boot, be sure trim stick is inserted between soft rubber insert and tripod housing, and not the hard plastic sealing boot and soft rubber insert.

(10) With trim stick inserted between sealing boot and tripod joint housing, position inner tripod joint on driveshaft until correct sealing boot edge to edge length is obtained for type of sealing boot material being used (Fig. 30) (Fig. 31). Then remove the trim stick.

(11) Clamp tripod joint sealing boot to tripod joint using required procedure for type of boot clamp application. If seal boot uses crimp type boot clamp, clamp sealing boot onto tripod housing using crimpler, Special Tool C-4975-A. Place crimping tool C-4975-A over bridge of clamp (Fig. 32). Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face-to-face (Fig. 33).

(12) If seal boot uses low profile latching type boot clamp, clamp sealing boot onto tripod housing using clamp locking tool, Snap-On® YA3050 (or an equivalent). Place prongs of clamp locking tool in the holes of the clamp (Fig. 34). Squeeze tool together until top band of clamp is latched behind the two tabs on lower band of clamp (Fig. 35).
(13) Install the driveshaft requiring boot replacement back on the vehicle. See Driveshaft Removal and Installation in this section for the required driveshaft installation procedure.

**OUTER C/V JOINT SEAL BOOT**

**REMOVAL**

To remove outer C/V joint sealing boot from a driveshaft for replacement, the driveshaft assembly must be removed from the vehicle. See Driveshaft Removal and Installation in this section for the required driveshaft removal and replacement procedure.

(1) Remove driveshaft assembly requiring boot replacement from vehicle. See Driveshaft Removal and Installation in this section for the required driveshaft removal procedure.
DISASSEMBLY AND ASSEMBLY (Continued)

(2) Remove large boot clamp retaining C/V joint sealing boot to C/V joint housing (Fig. 36) and discard. Remove small clamp that retains outer C/V joint sealing boot to interconnecting shaft and discard. Remove sealing boot from outer C/V joint housing and slide it down interconnecting shaft.

(3) Wipe away grease to expose outer C/V joint and interconnecting shaft.

(4) Remove outer C/V joint from interconnecting shaft using the following procedure: Support interconnecting shaft in a vise equipped with protective caps on jaws of vise to prevent damage to interconnecting shaft. Then, using a soft-faced hammer, sharply hit the end of the C/V joint housing to dislodge housing from internal circlip on interconnecting shaft (Fig. 37). Then slide outer C/V joint off end of interconnecting shaft, joint may have to be tapped off shaft using a soft-faced hammer.

(5) Remove large circlip (Fig. 38) from the interconnecting shaft before attempting to remove outer C/V joint sealing boot.

(6) Slide failed sealing boot off interconnecting shaft.

(7) Thoroughly clean and inspect outer C/V joint assembly and interconnecting joint for any signs of excessive wear. If any parts show signs of excessive wear, the driveshaft assembly will require replacement. Component parts of these driveshaft assemblies are not serviceable.

INSTALLATION

(1) Slide new sealing boot to interconnecting shaft retaining clamp onto interconnecting shaft. Slide the outer C/V joint assembly sealing boot onto the interconnecting shaft (Fig. 39). Seal boot MUST be positioned on interconnecting shaft so the raised bead on the inside of the seal boot is in groove on interconnecting shaft.

(2) Align splines on interconnecting shaft with splines on cross of outer C/V joint assembly and start outer C/V joint onto interconnecting shaft.

(3) Install outer C/V joint assembly onto interconnecting shaft by using a soft-faced hammer and tapping end of stub axle (with nut installed) until outer C/V joint is fully seated on interconnecting shaft (Fig. 40).
(4) Outer C/V joint assembly must be installed on interconnecting shaft until cross of outer C/V joint assembly is seated against circlip on interconnecting shaft (Fig. 41).

(5) Distribute 1/2 the amount of grease provided in seal boot service package (DO NOT USE ANY OTHER TYPE OF GREASE) into outer C/V joint assembly housing. Put the remaining amount into the sealing boot.

(6) Install outer C/V joint sealing boot to interconnecting shaft clamp evenly on sealing boot.

(7) Clamp sealing boot onto interconnecting shaft using crimer, Special Tool C-4975-A and the following procedure. Place crimping tool C-4975-A over bridge of clamp (Fig. 42). Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 43).
CAUTION: Seal must not be dimpled, stretched, or out-of-shape in any way. If seal is NOT shaped correctly, equalize pressure in seal and shape it by hand.

(8) Position outer C/V joint sealing boot into its retaining groove on outer C/V joint housing. Install sealing boot to outer C/V joint retaining clamp evenly on sealing boot.

(9) Clamp sealing boot onto outer C/V joint housing using Crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C-4975-A over bridge of clamp (Fig. 44). Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 45).

(10) Install the driveshaft requiring boot replacement back on the vehicle. See Driveshaft Removal and Installation in this section for the required driveshaft installation procedure.
SPECIFICATIONS

TORQUE

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>TORQUE</th>
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<tbody>
<tr>
<td>Driveshaft-to-Hub/Bearing</td>
<td></td>
</tr>
<tr>
<td>Nut</td>
<td>244 N·m (180 ft. lbs.)</td>
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<tr>
<td>Knuckle-to-Ball Joint</td>
<td></td>
</tr>
<tr>
<td>Bolt/Nut</td>
<td>95 N·m (70 ft. lbs.)</td>
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<tr>
<td>Wheel/Tire-to-Hub/Bearing</td>
<td></td>
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<tr>
<td>Lug Nuts</td>
<td>128 N·m (95 ft. lbs.)</td>
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SPECIAL TOOLS

DRIVESHAFT

Boot Clamp Installer C-4975A

Puller 6790