SUBARU

QUALITY DRIVEN®

SERVICE

CERTIFIED SUBARU TECHNICIAN

Technicians Reference Booklet

Manual Transmissions

Module 201

AUTOMOTIVE Youth Educational Systems YES®

December 2005

MSA5P0268C

Technical Training

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This book is revised with material from New Model Updates 912, 913, 914 and 915.

Manual Transmissions (201)

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Introduction

This Technicians Reference Booklet introduces the Subaru Manual Transmission. It reviews the components and operation, diagnosis, component removal, disassembly, inspection, and reassembly of the transmission. The text and illustrations are derived from and follow the classroom instruction with slide presentations.

This text should be used as a supplement and reinforce classroom and lab instruction.

A list of applicable Service bulletins, important notes, cautions and special tools are given within this booklet. Pages for diagnostic tips and notes are also provided. Technicians work sheets are to be completed during the hands-on lab work segments of the Manual Transmission Module.

Always refer to the appropriate model year Subaru Service Manual, Service Manual Supplements and applicable Service Bulletins on STIS Web site for all up to date specifications and detailed service procedures.

VIN Chart

There are several different manual transmissions used in Subaru vehicles. Consult the VIN chart below as well as the appropriate Subaru Service Manual on STIS Web site to determine the transmission type on which you are working. Different model-year transmissions of the same general type may use different replacement parts.

Vehicle Identification Numbers (VIN)

TYPICAL VIN	4	S	3	B	E	6	3	5	?	2	7	2	0	0	0	0	1
POSITION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

MANUF. I.D. CDE
FHI-FUJI HEAVY IND.
SIA-SUBARU ISUZU AUTO.

LINE TYPE

BODY TYPE

MODEL TYPE

RESTRAINT TYPE

SERIES & ENGINE TYPE

CHECK DIGIT

MODEL YEAR

PLANT OR MANUFACTURER &TRANSMISSION TYPE

SEQUENTIAL PROD. NUM.

1 2 3 MANUFACTURER I.D. CODE

MANUFACTURERS I.D.CODE

	MANUF.	TYPE
3F1 =	FHI	PASSENGER VEHICLE
4S3 =	SIA	PASSENGER VEHICLE

4 LINE TYPE

B	LEGACY
G	IMPREZA
S	FORESTER

5 BODY TYPE

D	IMPREZA SEDAN
E	LEGACY SEDAN
F	IMPREZA SPORT WAGON / FORESTER WAGON
G	IMPREZA SPORT WAGON
H	LEGACY STATION WOAGON & LEGACY OUTBACK

6 SERIES & ENGINE TYPE

ENGINE TYPE

2	2.0 LITER AWD - TURBO
6	2.5 LITER AWD
8	3.0 LITER AWD

7 MODEL TYPE

MODEL TYPE / TRIM LEVEL

3	L (LEGACY / FORESTER)
4	GT - LEGACY
5	GT-LTD S FORESTER / IMPREZA TS
6	OUTBACK
7	OUTBACK-COLD WEATHER / IMPREZA - RS
8	OUTBACK-LTD. (SEDAN), OUTBACK-LTD. (WAGON), IMPREZA OUTBACK
9	OUTBACK (3.0 LITER) / WRX IMPREZA
0	OUTBACK-L.L. BEAN (3.0 LITER)

8 RESTRAINT TYPE

RESTRAINT TYPE

5	MANUAL SEAT BELTS WITH DRIVER AND PASSENGER AIR BAGS
6	MANUAL SEAT BELTS WITH DRIVER AND PASSENGER AIR BAGS AND SIDE AIR BAGS

9 CHECK DIGIT

CHECK DIGIT
INDICATED BY "0" THROUGH "9" OR "X" VARIABLE

10 MODEL YEAR **11 PLANT OR MANUFACTURER & TRANSMISSION TPE**

MODEL YEAR		PLANT OF MANUFACTURER AND TRANSMISSION TYPE		
		SIA	FHI	
2	2002	6	G	FULL-TIME AWD 5MT
3	2003	7	H	FULL-TIME AWD 4AT
4	2004			

12 - 17 SEQUENTIAL PRODUCTION NUMBER

SEQUENTIAL NUMBER

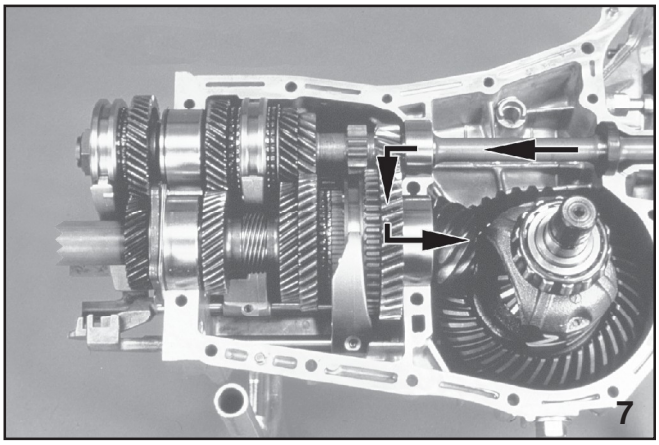
200001 & AFTER LEGACY SEDAN
300001 & AFTER LEGACY STATION WAGON
500001 & AFTER IMPREZA SEDAN
600001 & AFTER LEGACY OUTBACK
700001 & AFTER FORESTER WAGON
800001 & AFTER IMPREZA SPORT WAGON

VIN Chart

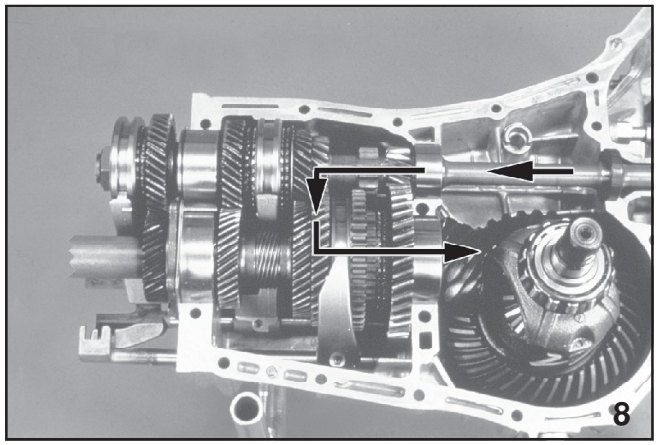
6

Manual Transmissions (201)

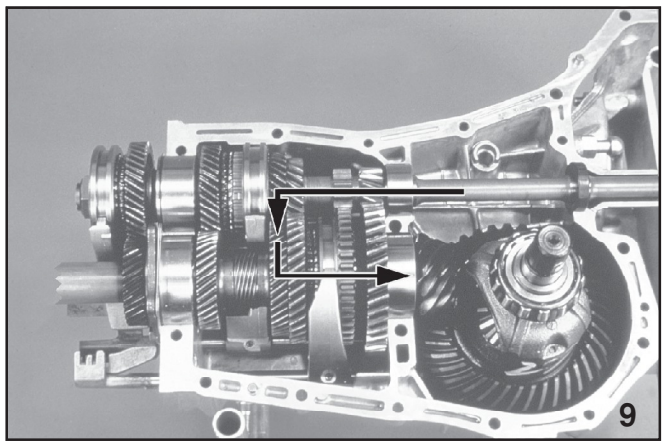
The power passes down the main shaft and across to the output shaft (pinion shaft). This is where the gear selection is made depending on which set of gears are engaged. The center differential compensates for the difference in front and rear axle speeds. It consists of a bevel gear set and a viscous coupling located at the rear of the transmission housing. The center differential, together with a pair of transfer gears, transmits the power from the transmission to the drive pinion shaft (front wheel drive shaft) and the rear drive shaft. The viscous coupling functions as a differential-action-control element.



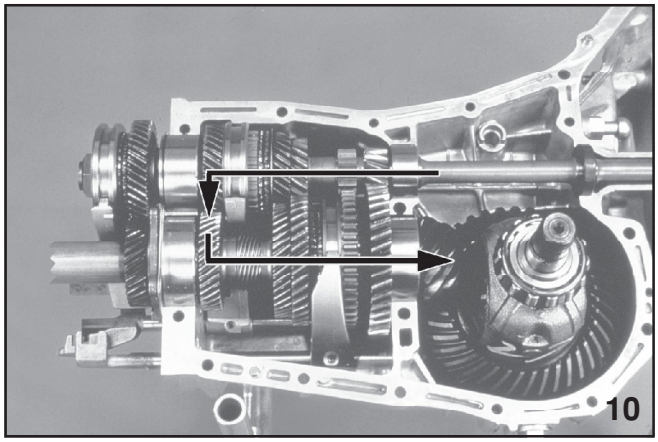
1st Gear



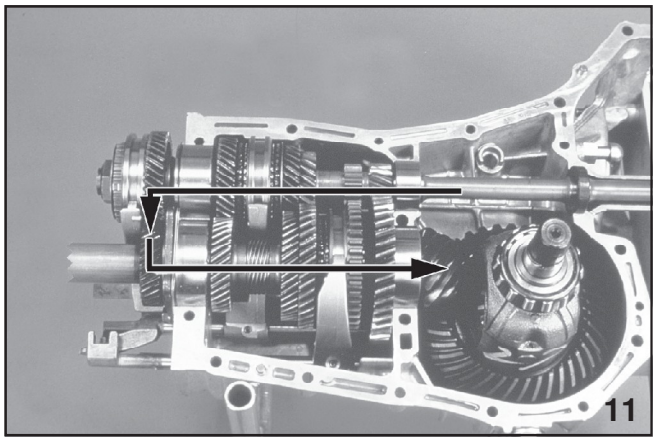
2nd Gear



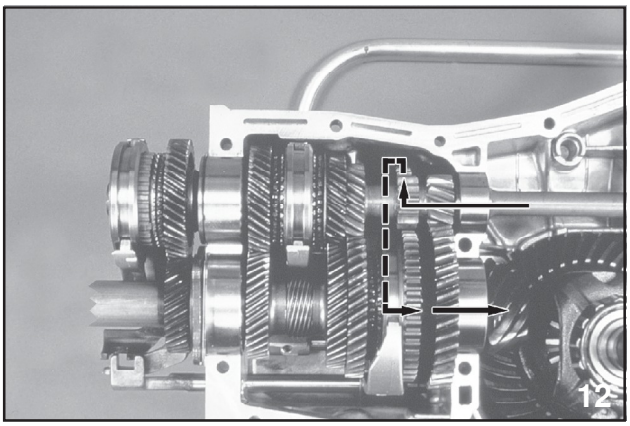
3rd Gear



4th Gear



5th Gear



Reverse

Preliminary Diagnosis

Before removal and disassembly, be sure to verify the customer complaint by making a thorough road test. Identify the probable cause before proceeding.

The following is a partial list of the more common problems that may be encountered in a transmission. For a more complete list, see the troubleshooting chart in the appropriate model year Subaru Service Manual on STIS Web site.

Gears Difficult to Engage

Possible causes: Worn, damaged, or burred spline of synchronizer sleeve; worn or damaged bushings; incorrect contact between synchronizer ring and gear cone.

Grinding Noises When Shifting

Possible causes: Worn or damaged teeth on synchronizer ring or clutch not fully disengaging.

Transmission Jumps Out of Gear

Possible Causes: Loose, worn, or broken engine mounts; worn, damaged, or incorrect shifter fork; worn 1st or 2nd driven gear, needle bearing, or race; worn 3rd or 4th drive gear or bushing; worn reverse idler gear or bushing.

Noises

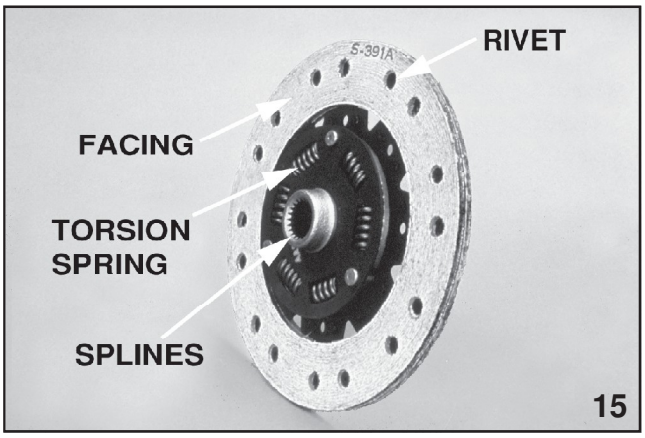
Note when the noise occurs: If it occurs only in one gear, or in all BUT one gear, suspect the components associated with that gear. If the noise occurs only when turning, suspect the differential.

NOTE: IF AN UNUSUAL NOISE IS HEARD WHEN THE VEHICLE IS PARKED WITH ITS ENGINE IDLING AND IF THE NOISE CEASES WHEN THE CLUTCH IS DEPRESSED, IT MAY BE CONSIDERED THAT THE NOISE COMES FROM THE TRANSMISSION.

NOTE: IF THE TROUBLE IS ONLY WEAR OF THE TOOTH SURFACES, MERELY A HIGH ROARING NOISE WILL OCCUR AT HIGH SPEEDS. IF ANY PART IS BROKEN A RHYTHMICAL KNOCKING SOUND WILL BE HEARD EVEN AT LOW SPEEDS.

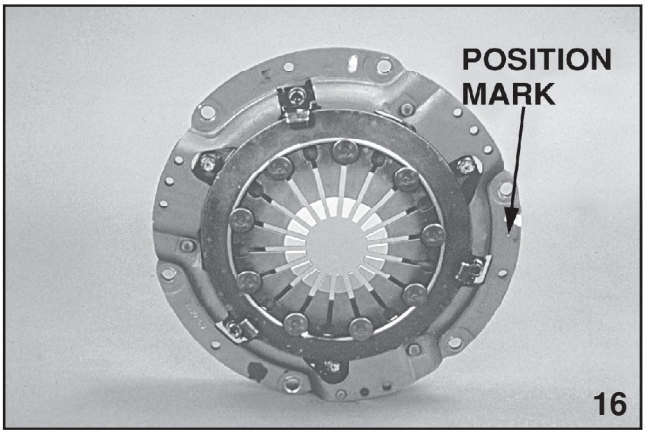
Notes:

Mechanical Operated (Cable Operated Push Type)



Clutch Disc

Inspect the disc for hardened or oil-soaked facing material, worn splines, loose rivets, or torsion spring failure. Measure the depth of the rivet heads, replace the disc if not within specifications. Measure the run out or warpage of the disc with a dial indicator and the proper guide. This is measured at the outer circumference of the facing. Refer to the appropriate model year Subaru Service Manual on STIS Web site.



Clutch Cover

Visually check the clutch cover without disassembling it. Look for loose rivets, a damaged or worn throw out bearing contact area or disc surface, a loose plate strap setting bolt, or a worn spring sliding surface.

(Position mark is "0" mark. Used during installation.)

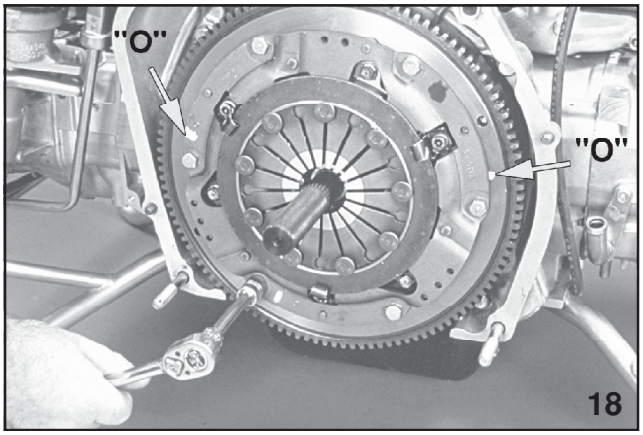
Clutch Release Bearing

Rotate the release bearing while applying pressure in the thrust direction (also radial direction on self- centering bearing). Feel for smoothness of rotation. Also look for wear to the surfaces that contact the release lever and transmission case.

NOTE: THIS IS A SEALED BEARING; DO NOT WASH IT IN SOLVENT. CHECK FOR SIGNS OF LEAKAGE

NOTE: INSURE RELEASE LEVER PIVOT BALL IS LUBRICATED.

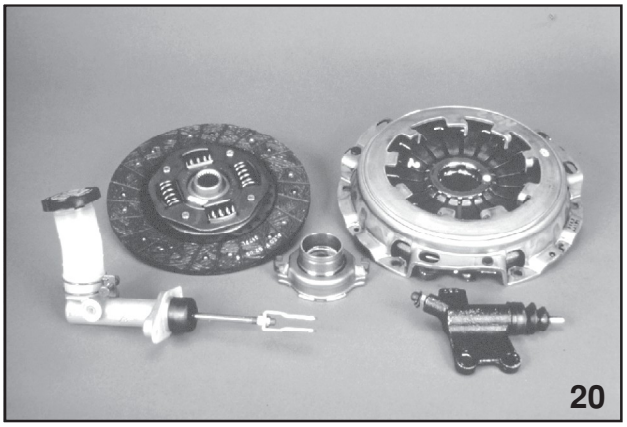
Check the release lever for wear on the pivot or the point of contact with the bearing. Check the contact surface of the flywheel for wear or heat damage. Also check the pilot bearing in the flywheel for smooth rotation. This is also a sealed bearing; do not wash it in solvent.



"O" marks

To install the clutch, place the clutch disc on the disc guide, and position the disc on the flywheel with the word "front" facing the flywheel. Position the cover with the "O" marks on the cover and the flywheel as far apart as possible. Tighten the bolts gradually to draw the cover in evenly. Torque the bolts to specification.

Hydraulic Clutch (Pull Type Legacy and WRX Turbo)



Hydraulic Clutch Components

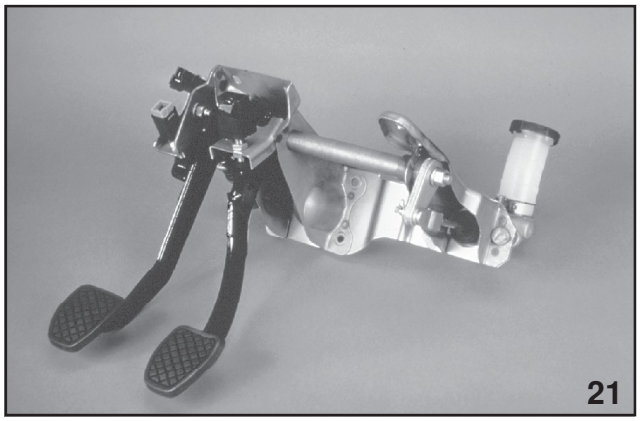
The Subaru hydraulic clutch has been designed for use in our speed/endurance record vehicles and the turbo equipped EJ Series engines. The major advantage, in addition to increased durability and strength, is the self-adjusting feature of the clutch. This eliminates the "free play" adjustment required of the mechanical clutch. The hydraulic clutch, however, does require proper initial linkage adjustment.

Components of the hydraulic clutch are:

- Master cylinder
- Damper assembly
- Operating (slave) cylinder
- Release bearing (pull type)
- Release lever
- Release shaft

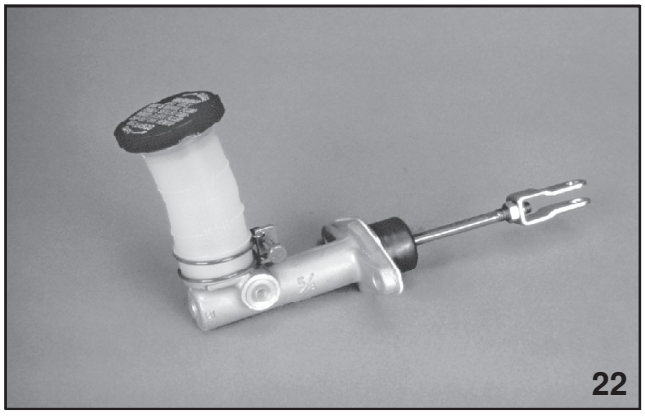
Modified components are:

- Flywheel
- Pressure plate
- Clutch disc
- Pedal mounting platform



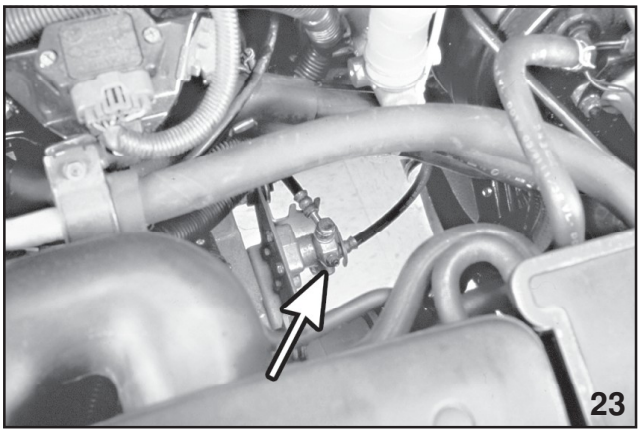
Clutch Pedal Assembly

The hydraulic clutch master cylinder operates similar to the brake master cylinder. It is mounted to the right of the clutch pedal. Pedal input is transmitted by a torque rod to the lever at the end of the master cylinder.



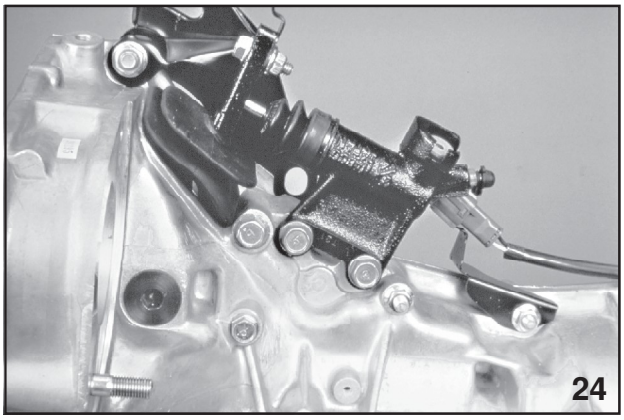
Master Cylinder

The aluminum cylinder body has an internal piston which is operated by the push rod. It uses a cup type seal in the bore of the cylinder body. **The master cylinder is not field serviceable.**



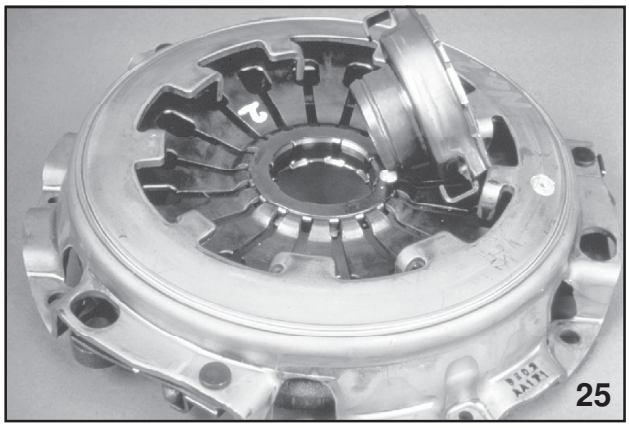
Clutch Damper

A clutch damper is mounted between the master cylinder and the operating cylinder to control the hydraulic noise of the system.



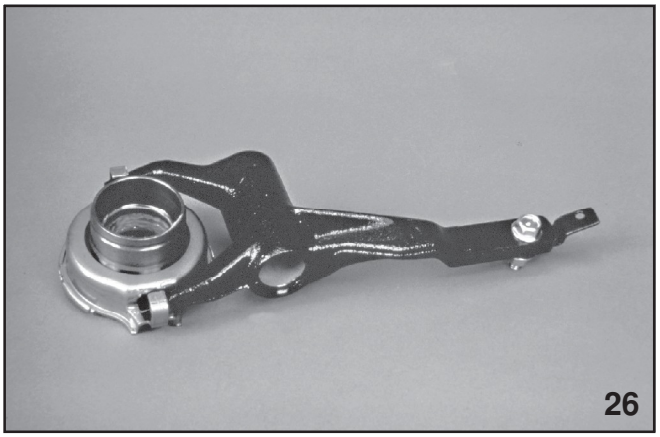
Operating Cylinder

The operating (slave) cylinder is mounted on the transmission. It has a cast iron cylinder body with an internal piston and cup type seal and operates similar to a brake wheel cylinder. It has an air bleed port on top of the cylinder. The bleeding process is similar to a wheel cylinder procedure. The operating cylinder is not field serviceable.



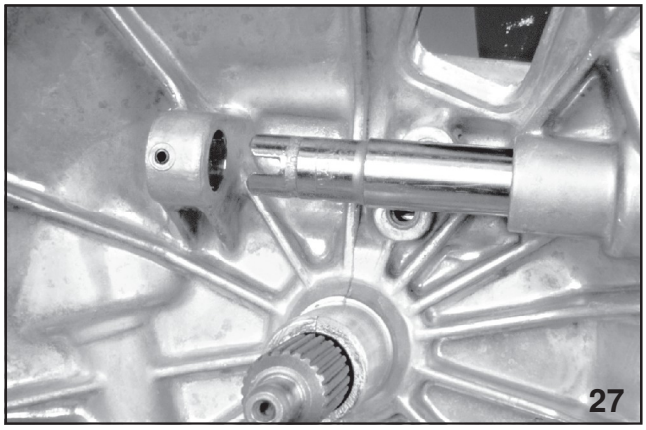
Release Bearing

The constant mesh type release bearing pulls to release the clutch. The release bearing locks into the pressure plate diaphragm springs through the use of a locking wedge collar.



Release Fork (lever)

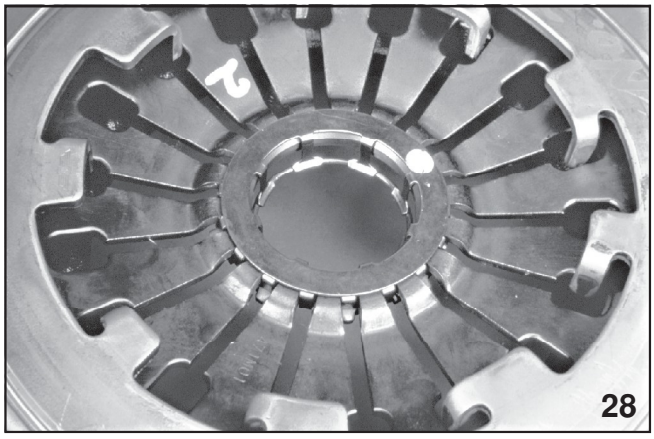
The cast iron release fork (lever) pivots on a shaft. The off-center design of the pivot point provides an increased mechanical advantage which results in less effort required to release the clutch. The release fork pulls the release bearing towards the transaxle to disengage the clutch. The bushing is not field serviceable.



Release Fork Shaft / Spring

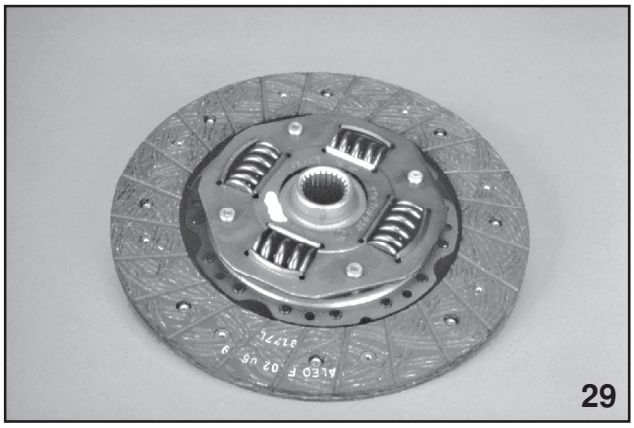
The release fork bushing is mounted to the transmission on a steel shaft. The non-rotating shaft has a split end which aligns with a pin in the transmission case. The shaft is held in place by a plug.

The return assist spring is connected between the transmission case and the release fork.



Clutch Cover (Pressure Plate)

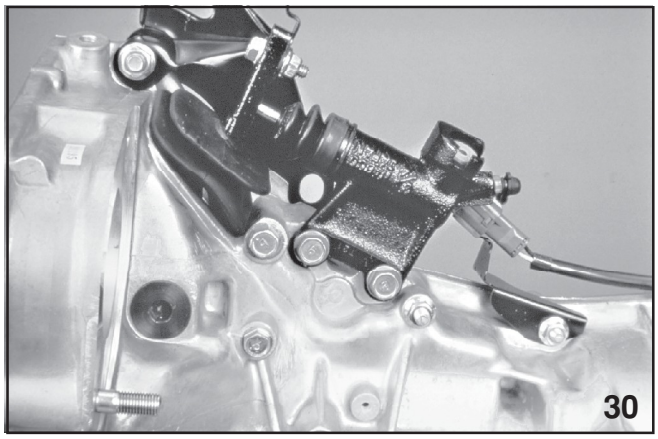
The clutch cover is a diaphragm (Belleville) type spring which is pulled by the release bearing to release pressure from the plate. The cover serves as the fulcrum. A locking wedge collar for the release bearing is an integral part of the clutch cover assembly.



Clutch Disc

The facing is made of non-asbestos material. The hydraulic clutch disc has larger damper springs than the N.A. clutch to withstand the increased turbo engine torque.

The flywheel diameter and thickness have been decreased from the N.A. clutch to provide for cooler operation and faster acceleration.



Clutch Operation

Hydraulic pressure from the master cylinder flows through the damper to extend the operating cylinder piston. The piston pushes on the release fork. As the fork pivots on the shaft it pulls the release bearing which is locked to the pressure plate diaphragm spring. As the diaphragm spring moves outward (away) from the clutch disc, it disengages engine power from the transmission.

Releasing the pressure from the master cylinder allows the operating cylinder piston to retract. This allows the diaphragm spring to move toward the clutch disc, reapplying the pressure to move the pressure plate inward to clamp the clutch disc between the flywheel and the pressure plate. The power flow from the engine through the clutch to the transmission is then restored.

The release fork return spring connected between the fork and the transmission provides constant inward pressure on the fork. This maintains constant outward pressure on the locking wedge collar of the release bearing, preventing release bearing disengagement from the locking wedge collar.

NOTE: WHENEVER THE HYDRAULIC CLUTCH PARTS ARE SERVICED AND/OR REPLACED, PRECISE LINKAGE ADJUSTMENTS MUST BE PERFORMED IN THE PROPER SEQUENCE TO INSURE PROPER CLUTCH OPERATION AND TO AVOID POSSIBLE DAMAGE TO THE CLUTCH COMPONENTS.

Release Bearing / Noise Diagnosis

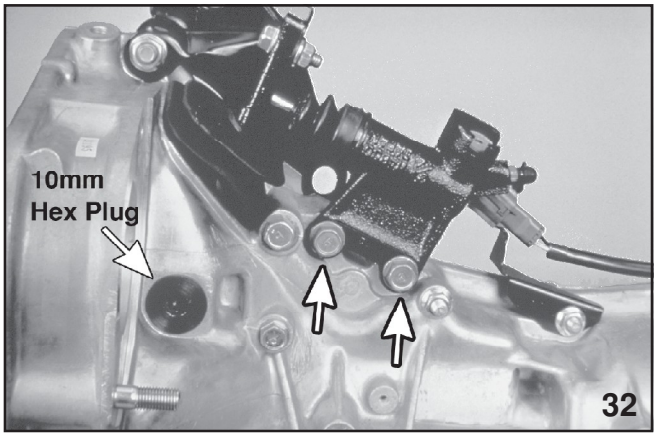
1. Grinding or "Howling"
   - Release Bearing
2. Clutch Pedal Depressed
   - Noise disappears
     - Trans. Bearing
   - Noise increases
     - Pilot Bearing

The fork return spring maintains the release bearing under constant outward pressure against the pressure plate diaphragm spring. And, unlike conventional clutch systems, the bearing always rotates. Thus, a defective release bearing will make a grinding or "howling" noise. The noise will change when the clutch pedal is depressed, and the noise may or may not stop.

If the noise completely stops when the clutch pedal is depressed and the transmission is in "gear" the problem is most likely a transmission bearing. If the noise becomes louder when the clutch pedal is depressed and the transmission is in "gear" it is most likely a defective pilot bearing.

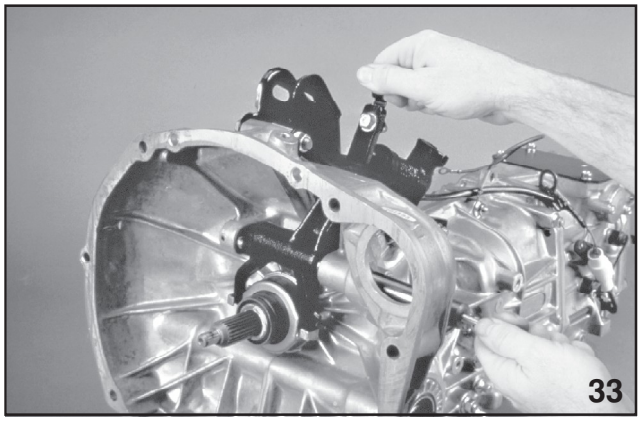
Transmission Removal

<u>NOTE:</u> ALWAYS REFER TO THE APPROPRIATE MY SUBARU SERVICE MANUAL ON STIS WEB SITE FOR DETAILED REMOVAL STEPS. THE FOLLOWING STEPS MUST BE PERFORMED <u>PRIOR</u> TO THE REMOVAL OF A HYDRAULIC CLUTCH EQUIPPED TRANSMISSION (PULL TYPE) FROM THE ENGINE AND VEHICLE OR DAMAGE WILL OCCUR TO CLUTCH ASSEMBLY.



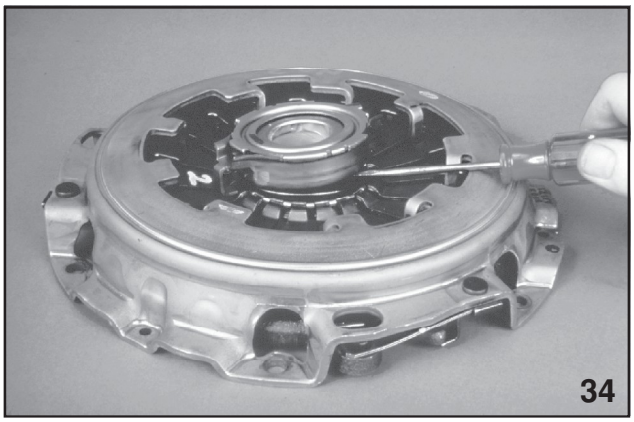
Operating Cylinder Removal

Remove the operating cylinder mounting bolts. Do not disconnect the hydraulic line from the operating cylinder.



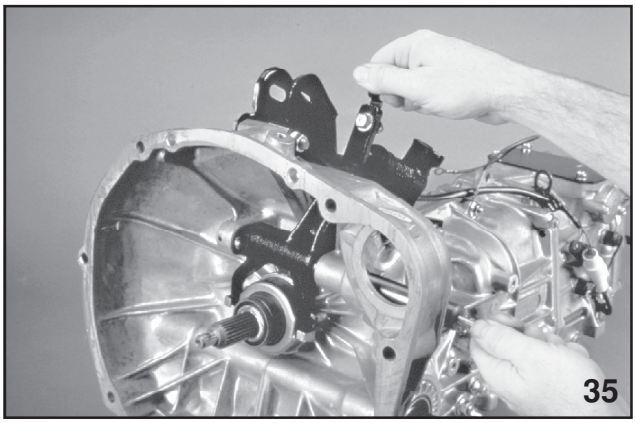
Release Fork Shaft Removal

Use a 10mm hex wrench to remove the plug from the side of the transmission case to access the release fork shaft. Then insert a 6 mm bolt into the release fork shaft and remove the shaft. Pull the release fork up and away from the transmission. This will allow the transmission to be separated from the engine.



Release Bearing Removal

Prior to installing the clutch to the transmission you must remove the release bearing from the pressure plate. Gently pry between the locking wedge collar and the face of the release bearing.



Release Bearing Installation

Install the release bearing over the transmission input shaft bearing retainer. Install the release fork into the release bearing retaining ears. Insert the release fork shaft through the transmission case (slotted end first) through the fork bushing into the transmission case mount. The shaft slot must align with the pin in the case mount. Then use a 10mm hex wrench to install the case plug to lock the fork into the case.

Be sure that the locking wedge collar is properly installed in the pressure plate.

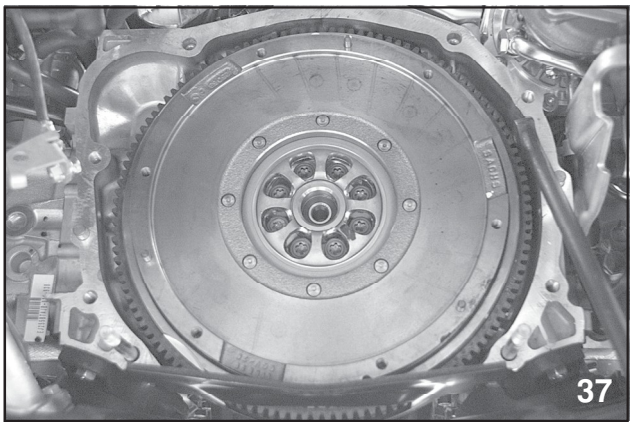
NOTE: ALWAYS REFER TO THE APPROPRIATE MY SERVICE MANUAL ON STIS WEB SITE, FOR THE DETAILED TRANSMISSION INSTALLATION STEPS.

Upon completion of the installation of the transmission to the engine, manually push the fork toward the operating cylinder until a "click" is heard. This forces the release bearing to lock into the wedge collar.

Verify that the bearing is locked into the wedge collar by manually pushing the fork towards the transmission clutch housing. The clutch should operate.

NOTE: THE FORK SHOULD NOT TOUCH THE TRANSMISSION CASE CLUTCH HOUSING AS THIS INDICATES THAT THE BEARING IS NOT LOCKED TO THE PRESSURE PLATE.

Flywheel



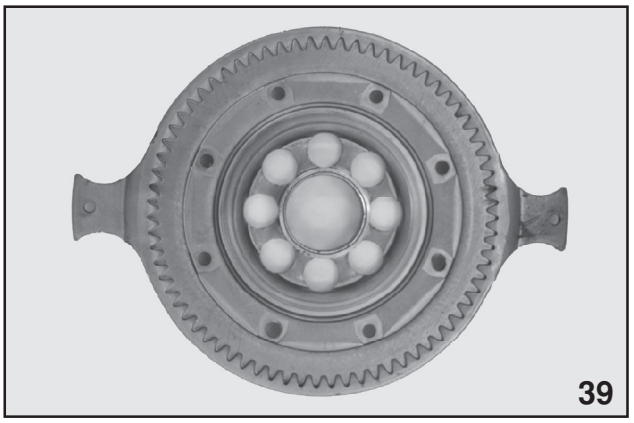
Flywheel Installed

2005MY and later Legacy Turbo vehicles with manual transmission are equipped with a Dual Mass Flywheel. A special tool is required to remove flywheel bolts (J-41510). This flywheel is non serviceable and should not be resurfaced.

The clutch contact surface of the flywheel can move slightly in either direction while the inner mass of the flywheel is stationary.

Cutaway view with springs installed on one side only

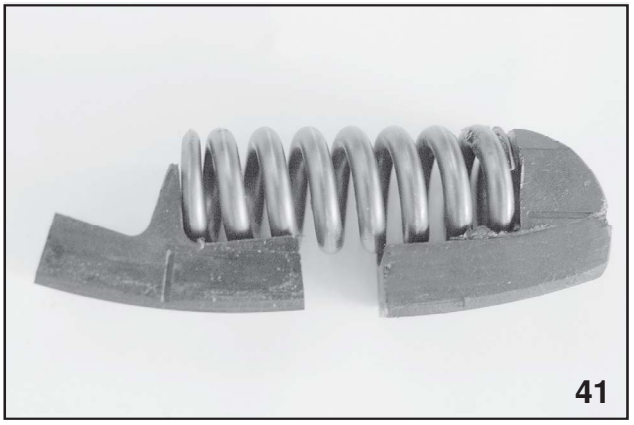
The Dual Mass Flywheel provides a smoother transfer of power from the engine to the clutch assembly by absorbing vibration and shock through a series of springs that are arranged along the circumference of the flywheel.



Actuator

First Mass and Gears

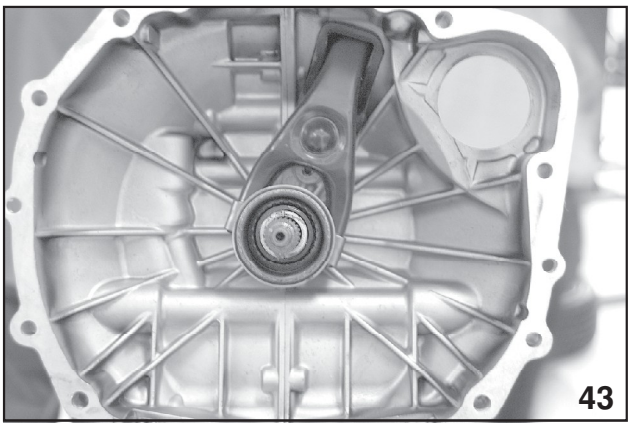
The first mass of the flywheel is connected to the crankshaft and delivers power to the second mass which acts as the contact surface for the clutch plate. The second mass is riveted to an actuator that is supported internally by a set of gears that ride along an internal cut gear of the actuator.



Spring and Spring Carrier

Actuator in contact with Spring Carrier

The actuator power input points will engage with the spring carriers on acceleration or deceleration. The springs will compress as the force to them is increased (On acceleration) and deliver the power to the actuator and finally to the clutch plate.



Release Bearing

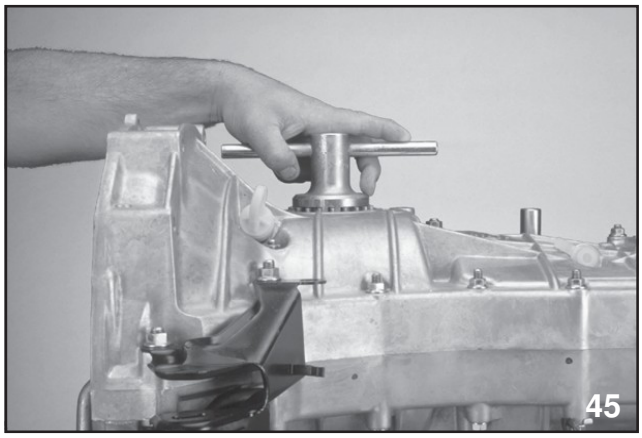
The release bearing is a push type. Consult the Subaru Service Manual on STIS Web site for proper servicing of the release bearing and removal / installation of the transmission.

Component Removal

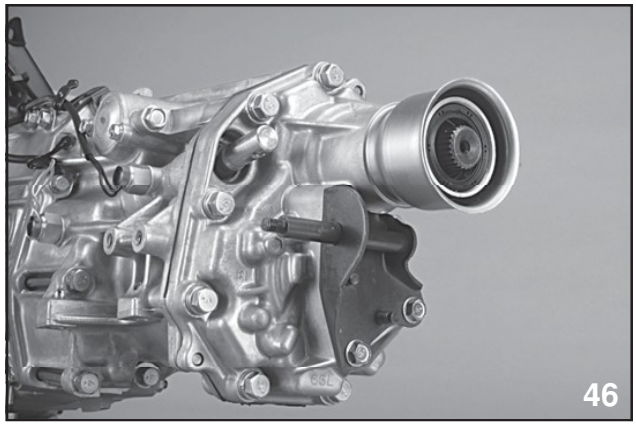
Attach the transmission case to the appropriate special tool stand set (499937100), right-hand side up (nuts on case bolts facing up).

Precautions

- Reduce preload
- Do not lose detent balls
- Remove all case bolts



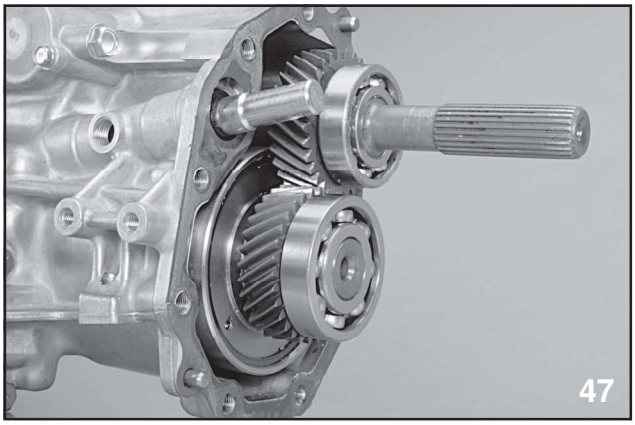
Reducing Preload



Extension Housing

Remove

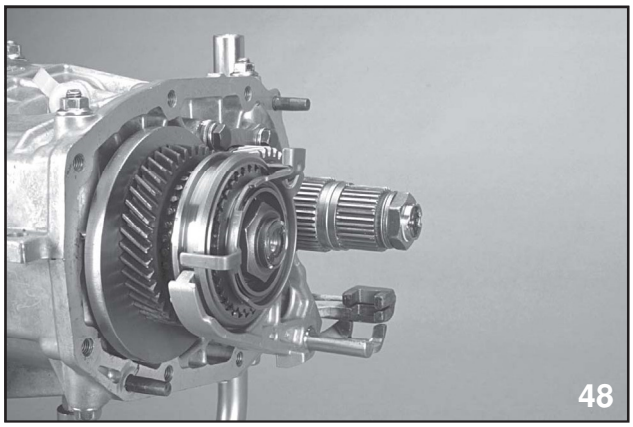
- Extension housing
- Transfer housing, then split cases
- Drive pinion shaft
- Transmission main shaft
- Differential



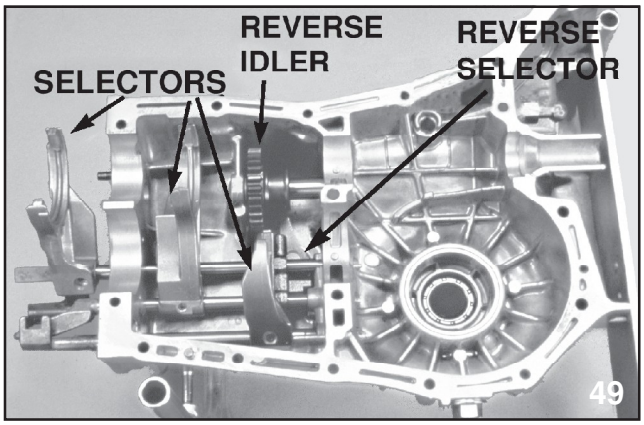
Transfer Gears

Transfer Case Removal

Disconnect the backup light and neutral switch connectors. Remove the transfer case cover bolts and transfer case cover. Then remove the selector arm set screw and the reverse check mechanism.

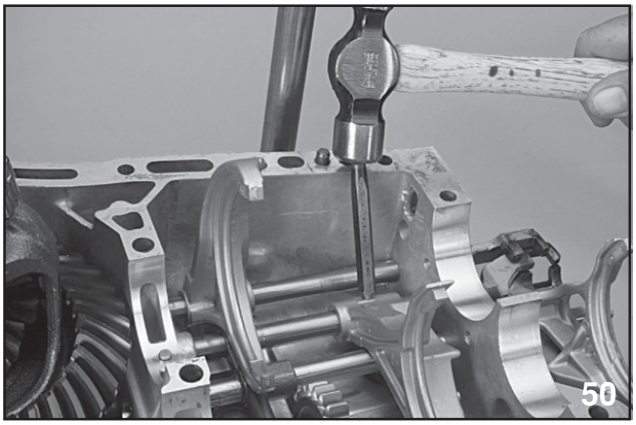


5th / Reverse Synchronizers

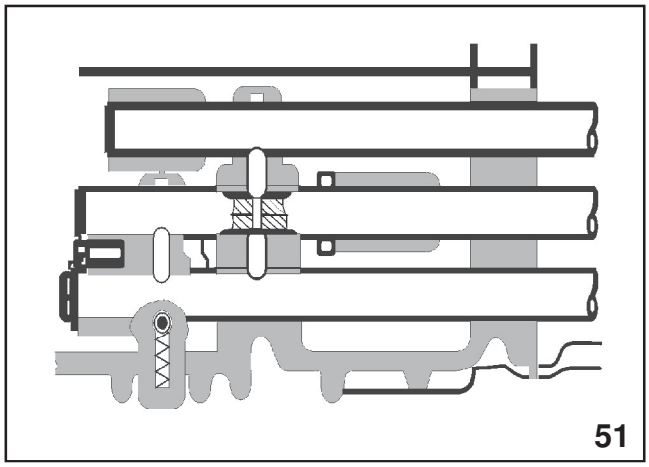


Shifter Forks and Rails

The shifter forks are retained by set screws (bolts) or spring pins. Drive out the pins with the 1-2 shift rail in first gear and the 3-4 rod in neutral; there are recesses in the case that allow room for the pins to come out in these positions.

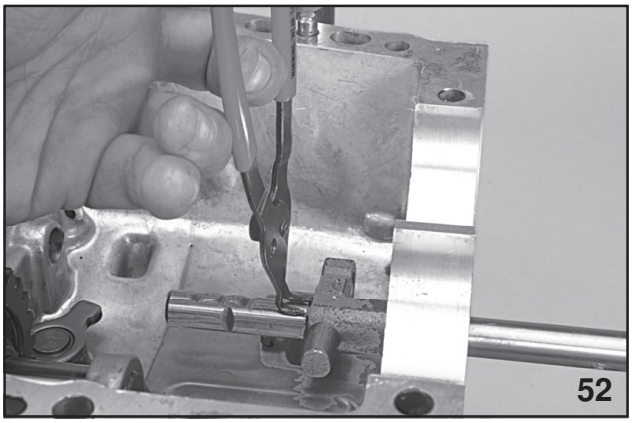


Shift Fork Pin Removal



Shift Rail Interlock Mechanism

When removing a shift rail, keep the remaining rails in the neutral position. The interlock mechanism prevents more than one rail being out of neutral position at a time. Remove the reverse idler gear and washer, pulling out the straight pin. Remove the reverse shifter arm and rod.



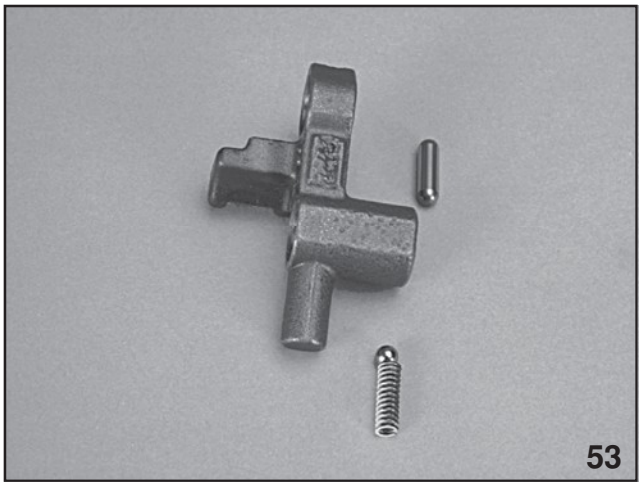
Reverse Shifter Rod

Remove outer snap ring, and pull out reverse shifter rod arm from the reverse fork rod. Then take out the ball, spring and interlock plunger from the rod.

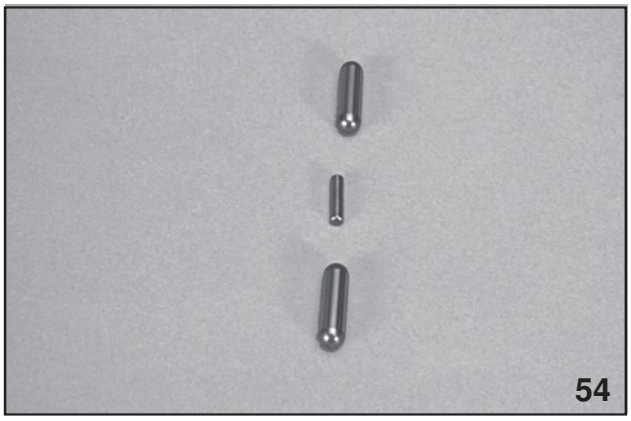
And then remove rod.

When pulling out the reverse shifter rod arm, be careful not to let the ball pop out of the arm.

NOTE: SNAP RING IS DIRECTIONAL. BEVEL SIDE MUST BE TOWARDS INTERLOCK.

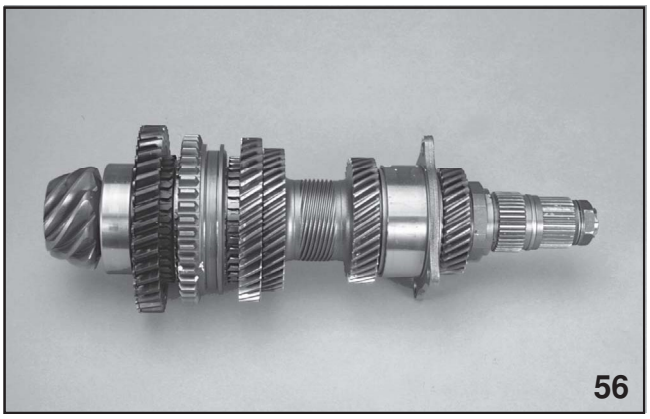


Reverse Fork Rod Arm, Pin ,Ball and Spring

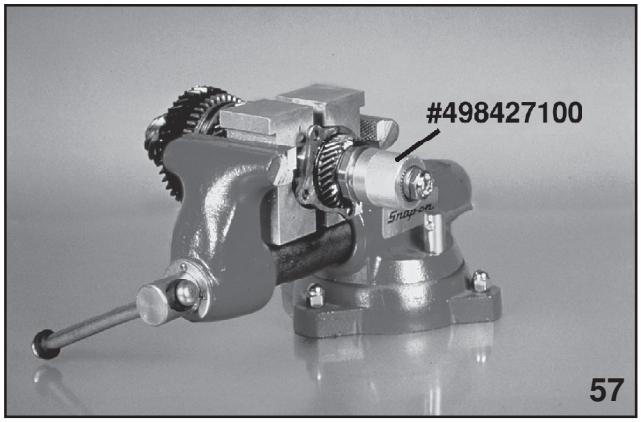


Interlock Plungers and Pin

Drive Pinion Shaft Disassembly

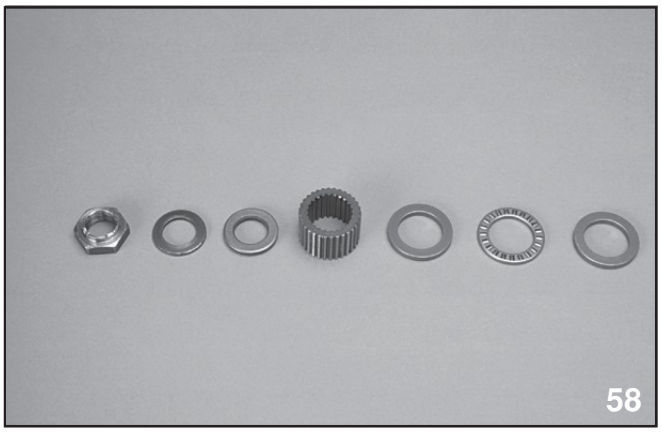


Drive Pinion Shaft Assembly



Remove Pinion Shaft Lock Nut

Remove the lock nut after installing holder **899884100** stopper **498427100** and socket **899988608**.

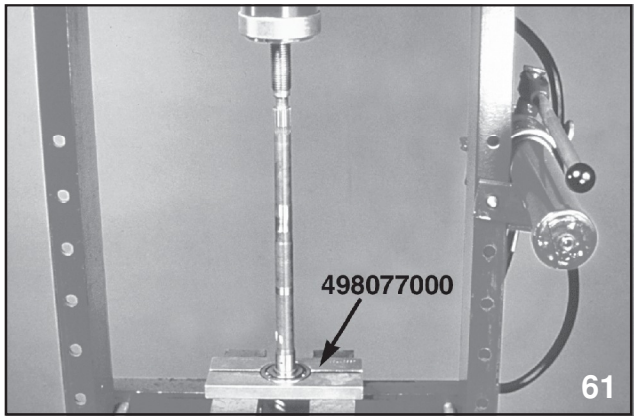


Differential Bevel Gear Sleeve Parts

Withdraw drive pinion from driven shaft. Remove differential bevel gear sleeve, adjusting washer No. 1, adjusting washer No. 2, thrust bearing, needle bearing, drive pinion collar, needle bearing and thrust bearing.

Drive Pinion and Driven Shaft Assembly

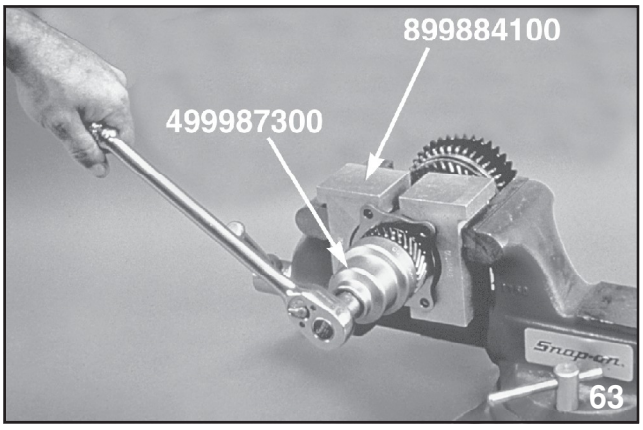
Pinion Shaft Disassembly



Press Pinion Shaft Bearing and Washer

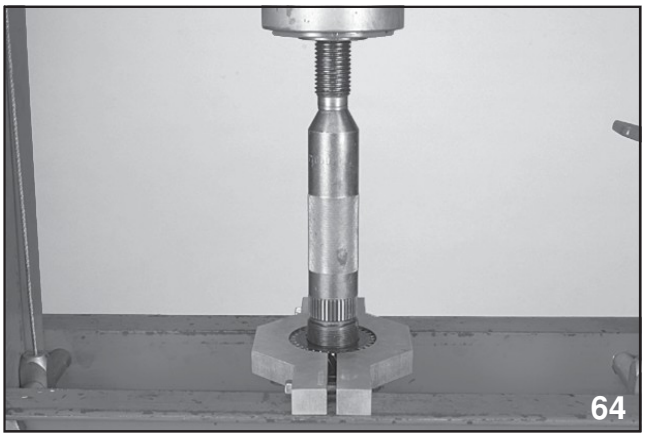
Use the remover 498077000, press the pinion shaft bearing and washer from the pinion shaft.

Driven Shaft Disassembly



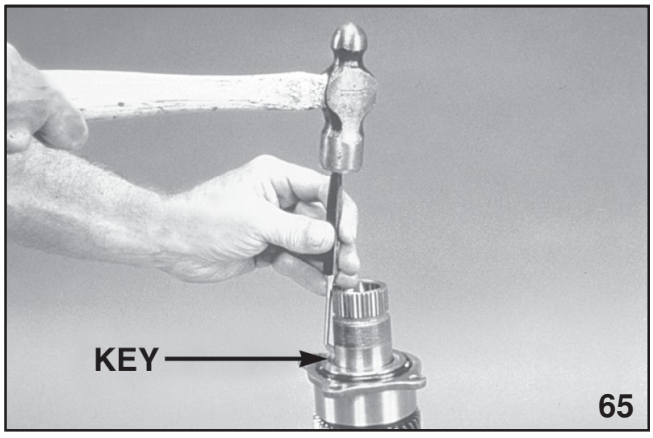
Driven Shaft Lock Nut Removal

Unstake the lock nut, and use the holder **899884100** and the socket wrench **499987300** to remove the lock nut from the driven shaft assembly.



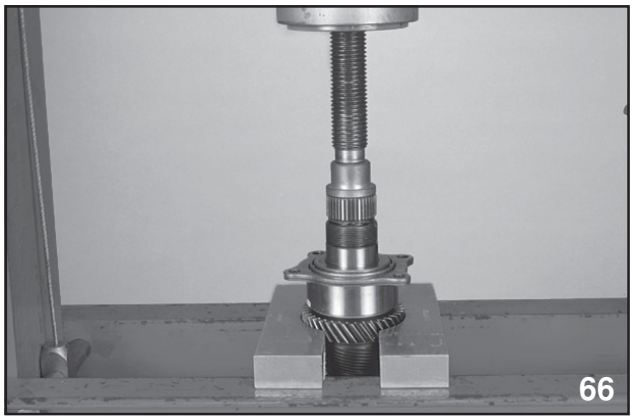
Press 5th Driven Gear

Press 5th driven gear from the driven shaft assembly using the remover **499857000** and press **499757002**.



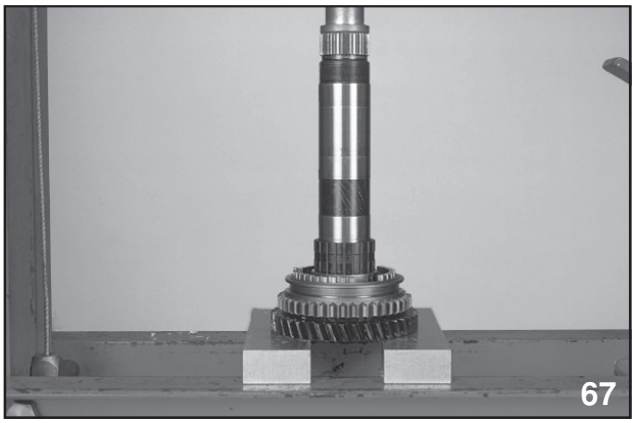
Woodruff Key Removal

Remove the Woodruff key prior to removing the roller bearing and the 3rd-4th gear assembly. Use a drift and a hammer to remove the key. Be careful not to damage the gears, shaft, or bearing.



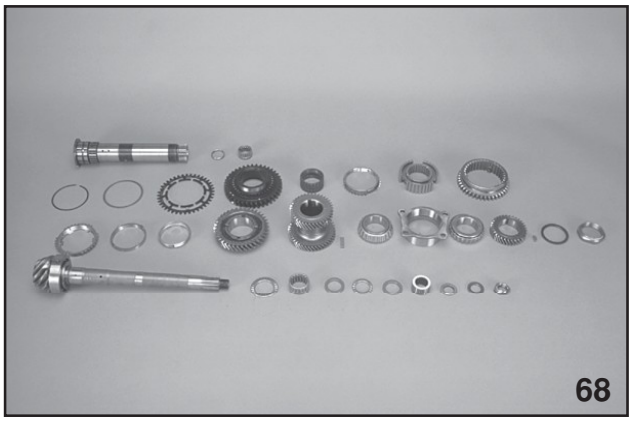
Press Roller Bearing and 3rd-4th Gear Assembly

Press the roller bearing and the 3rd-4th gear assembly using the remover **899714110** and press **499757002**.



Press 1st and Rev Gear Assembly

Prior to removing any of the other driven gear assembly components, the driven shaft key must be removed. Use a hammer and a drift to remove the key. Lift off the 2nd gear assembly, and then press the 1st driven gear, the 2nd gear bushing, the reverse gear, and the 1st-2nd gear synchronizer hub using the remover **899714110** and press **499757002**.



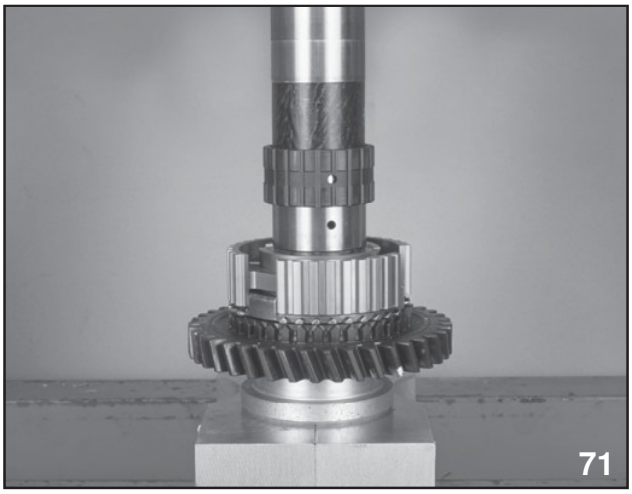
Drive Pinion and Driven Shaft Components

Notes:

Driven Shaft Reassembly

1st Driven Gear Bushing

The driven shaft is placed on top of the installer **499587000** to make sure that 1st driven gear is pressed flush to the driven shaft.



2nd Driven Gear Bushing

Install washer, snap ring and sub gear (if equipped) to 1st driven gear.
Install 1st driven gear, 1st baulk ring, gear and hub assembly onto driven shaft.

NOTE:

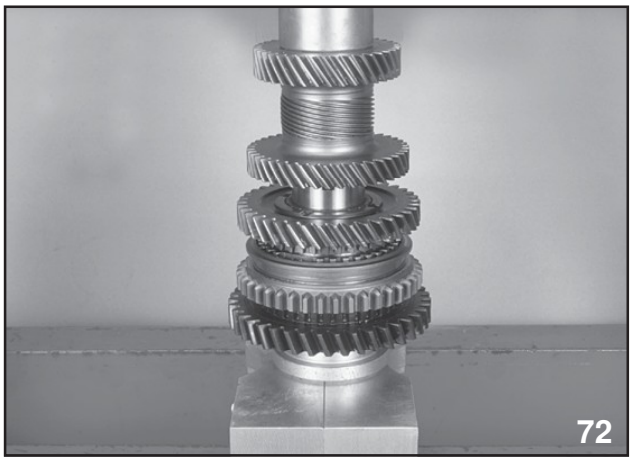
- Take care to install gear and hub assembly in proper direction.
- Align baulk ring and gear & hub assembly with key groove.

Install 2nd driven gear bushing onto driven shaft using **499277200** Installer and **499587000** Installer.

Install 2nd driven gear, inner baulk ring, synchro cone, outer baulk ring and insert onto driven shaft.

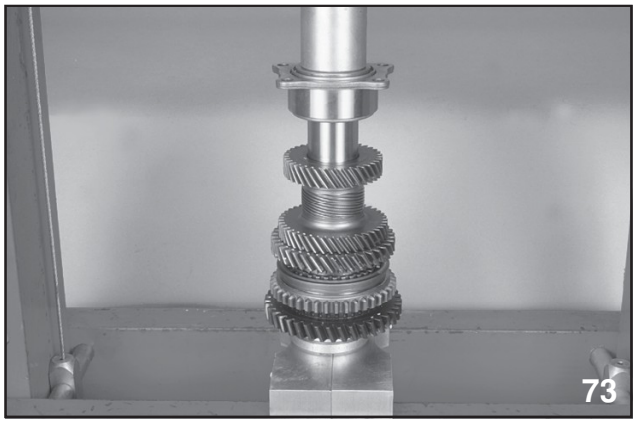
NOTE:

- Place a suitable spacer between the installer 499587000 and the driven shaft to provide clearance between the 1st gear and installer
- When press fitting, align oil holes of shaft and bushing.



3rd-4th Driven Gears

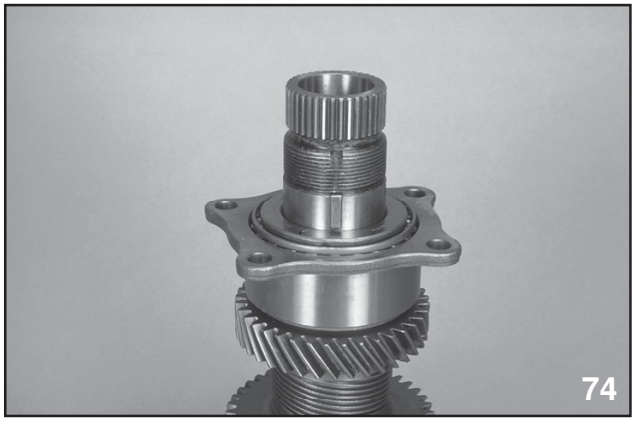
After installing woodruff key on driven shaft, install 3rd-4th driven gear using **499277200** installer.



Pinion Shaft Roller Bearing

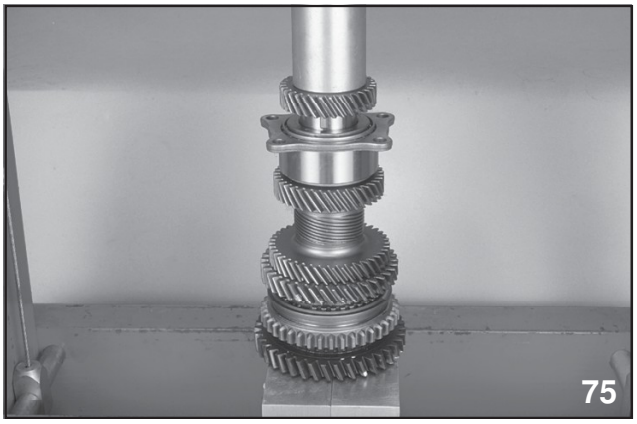
Install the roller bearings and bearing retainer onto driven shaft using **499277200** installer.

Install the lower bearing first. Then place the bearing retainer on the lower bearing. **Finally press on the upper bearing.**



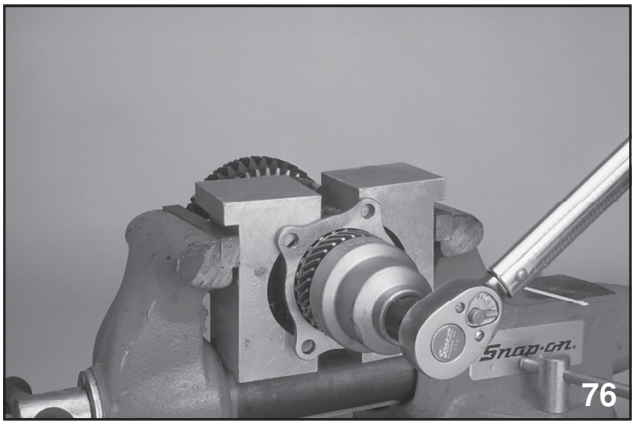
Woodruff Key

Position 5th gear woodruff key in groove on the rear of driven shaft.



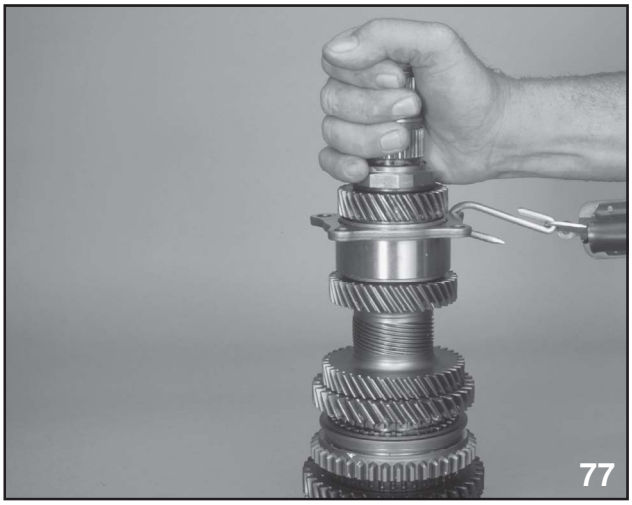
5th Driven Gear

Install and press 5th gear onto driven shaft.



Install Driven Shaft Washer and Lock Nut

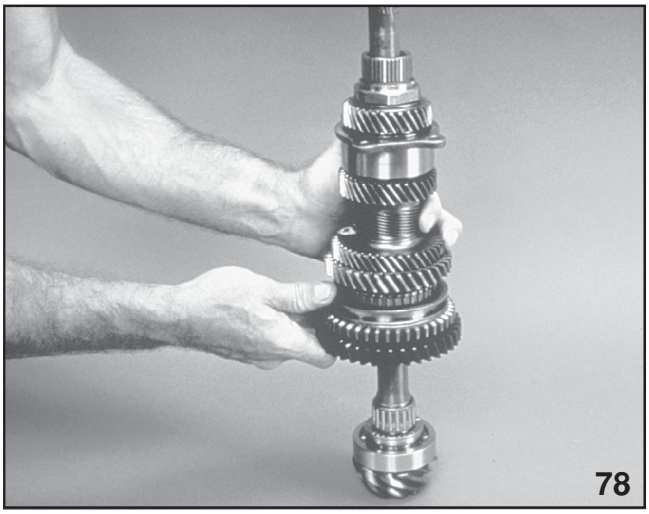
Install a new driven shaft washer and lock nut, and then use the holder **899884100** and the socket wrench **499987300** to torque the lock nut to specification. Stake the lock nut at two points.



Roller Bearing Starting Torque

Use a spring gauge to measure the starting torque of the roller bearing.

NOTE: IF NOT WITHIN SPECS, REPLACE THE ROLLER BEARINGS.

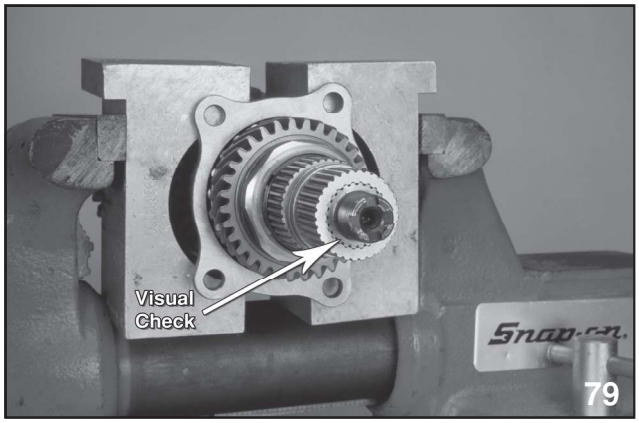


Install Driven Shaft Assembly

Install the bearing on the pinion shaft, and press the washer using the installers and press.

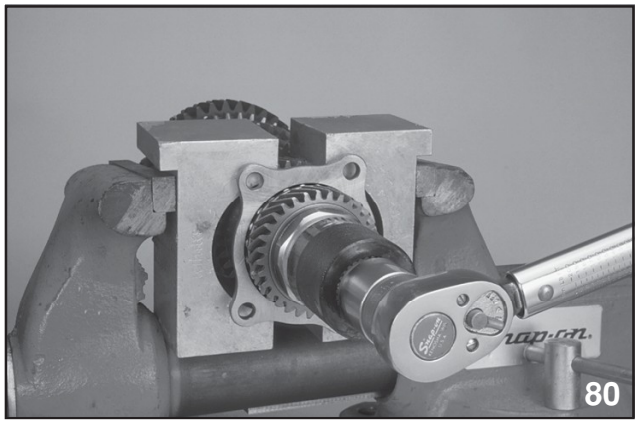
NOTE: THE BEARING IS DIRECTIONAL AND MUST BE INSTALLED WITH THE KNOCK PIN HOLE AWAY FROM THE PINION GEAR.

Then place the thrust bearing on the pinion shaft, and carefully install the driven shaft assembly onto the pinion shaft.



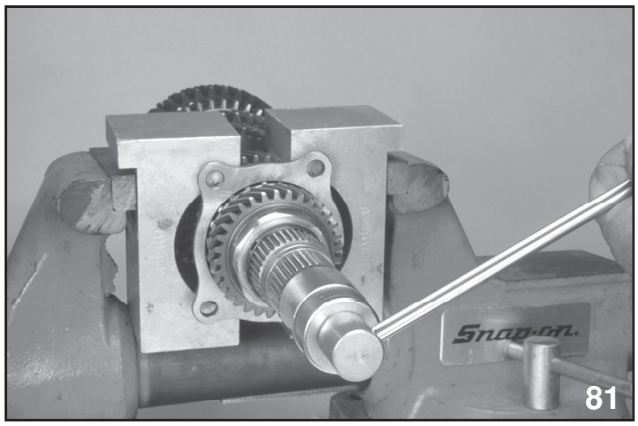
Visual Check / Bearing Preload

With a visual check confirm that the end of the pinion shaft and the differential bevel gear sleeve are flush. If they are not flush, select a adjusting washer No. 2 so that they are flush with a visual check. Install the washer, a new lock washer and new lock nut.



Torque Lock Nut

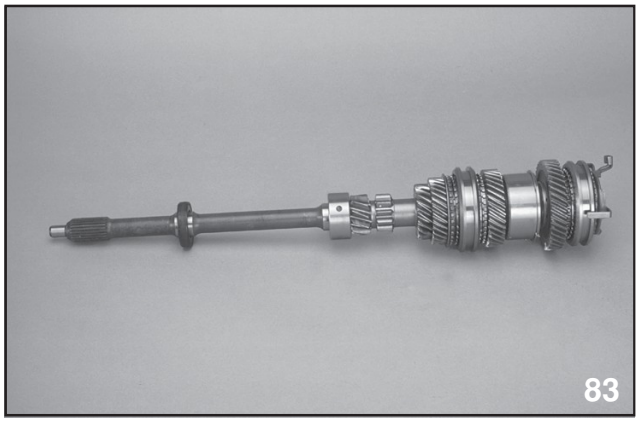
Torque lock nut using **899884100** holder, **498427100** stopper and **899988608** socket tighten lock nut to specified torque.



Lock Nut Starting Torque

After removing the **498427100** stopper, measure the starting torque using a torque wrench. If starting torque is not within specified limit, select a new adjusting washer No. 1 and recheck. If specified torque range cannot be obtained when No. 1 adjusting washer is used, then select a suitable No. 2 adjusting washer. These washers are selective: See appropriate model year Subaru Service Manual on STIS Web site for procedure and tables. Stake lock nut at four places.

Transmission Main Shaft Disassembly

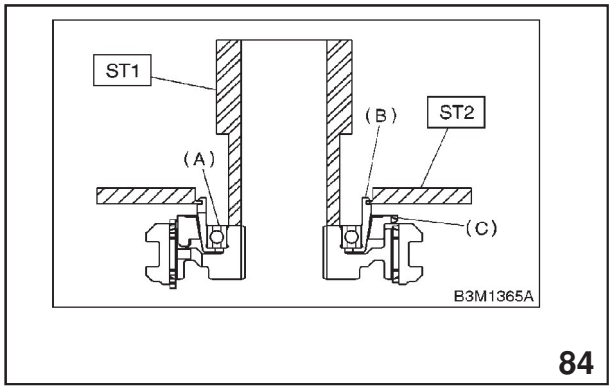


Main Shaft Assembly

Remove lock nut from main shaft assembly using **498937000** holder and **899984103** socket.

Remove 5th-rev. sleeve and hub assembly, baulk ring, 5th drive gear and needle bearing. The following steps apply to 1999 MY and newer. You only need to do this if you are servicing 5th Rev. gear components. Remove snap ring and synchro cone stopper from 5th-rev sleeve and hub assembly.

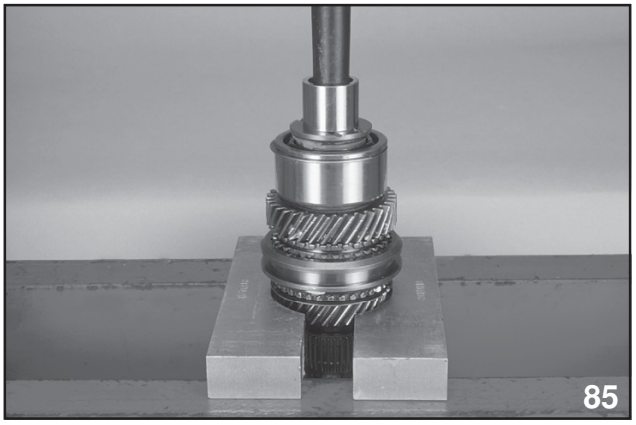
ST1	499757002	SNAP RING PRESS
ST2	498077400	SYNCHRO CONE REMOVER



Removing Synchro Cone and Baulk Ring

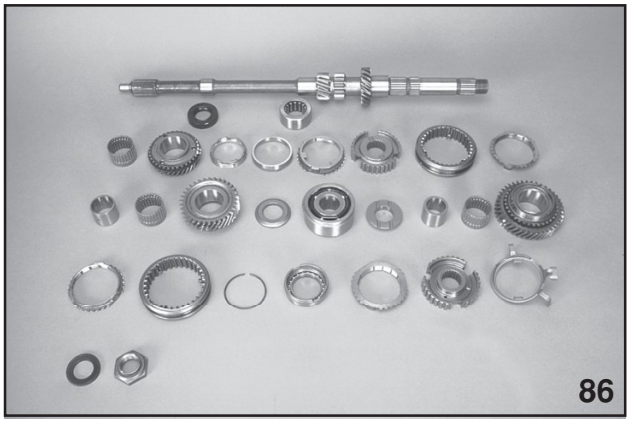
(A) Ball bearing
(B) Synchro cone
(C) Baulk ring

Using ST1, ST2 and a press, remove ball bearing, synchro cone and baulk ring (Rev.)



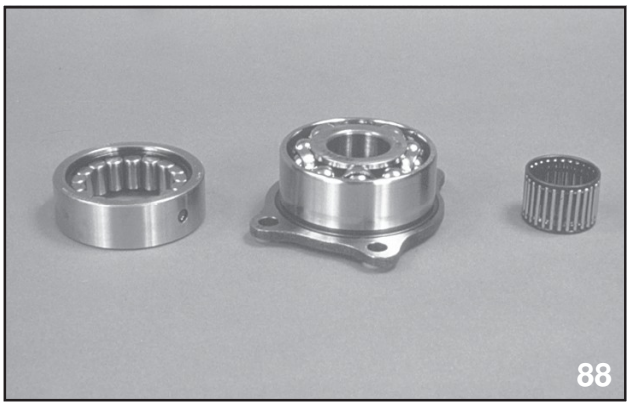
Press Off Components

Press off the components at the 3rd drive gear using retainer **899714110**, and **899864100** Remover.



Main Shaft Components

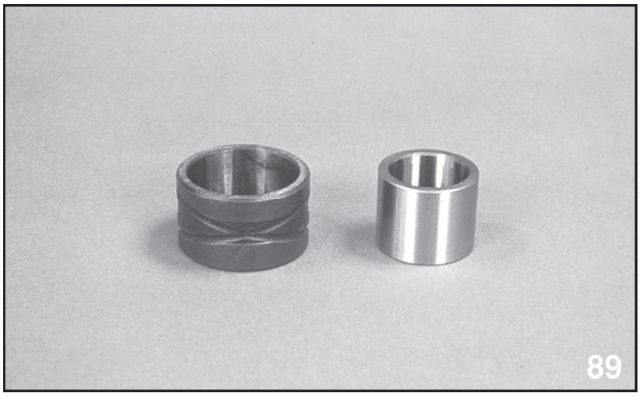
Disassembly & Inspection of Components



Bearings

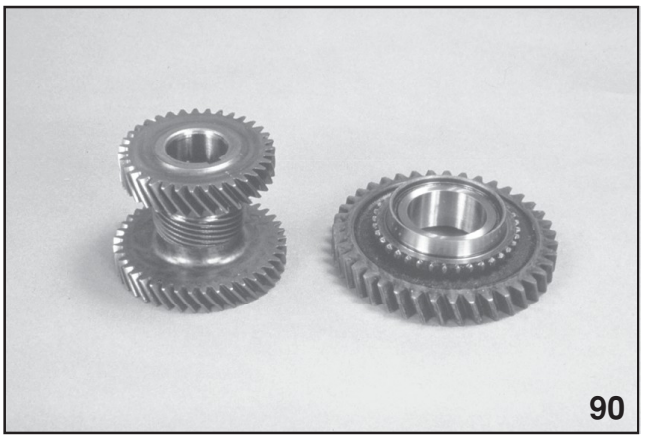
Inspect the parts during the disassembly procedure. Replace or repair as indicated.

Replace the bearings if they are worn, damaged, or do not turn smoothly.



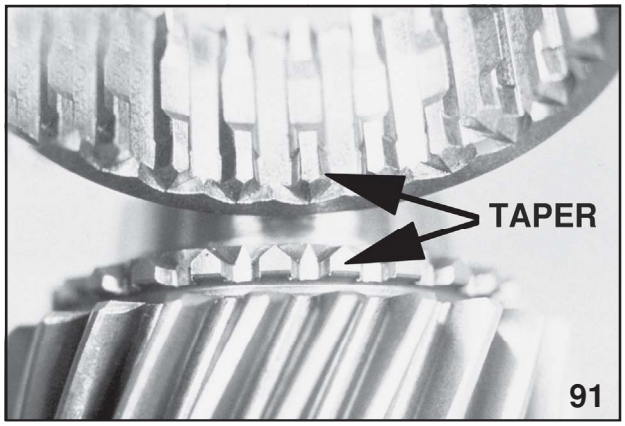
Bushings

Replace the bushings when the sliding surfaces are damaged or abnormally worn.



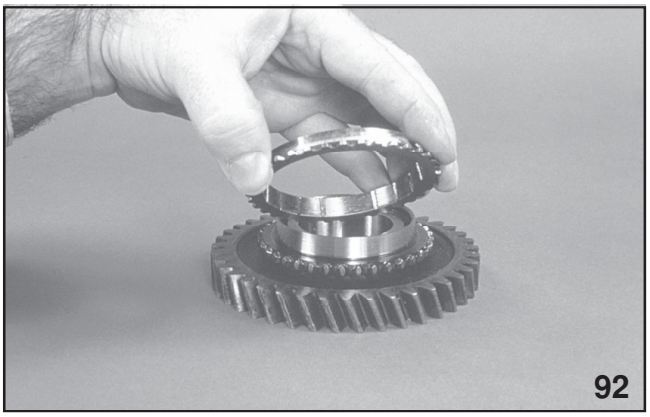
Gears

Replace the gears if the tooth surfaces are damaged or excessively worn. Replace if the cone is rough or damaged or if the inner bearing surface is damaged. The 3rd and 4th gears must be replaced as a set.

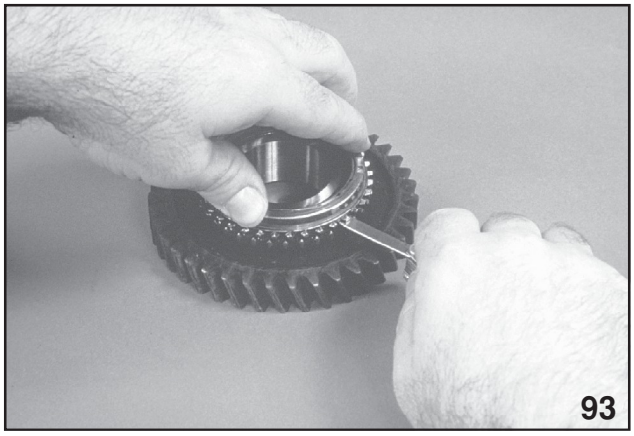


Inspect Gear Teeth & Couplers

Replace the couplers (sleeves) or gears if the tapers are worn; they help prevent popping out of gear.

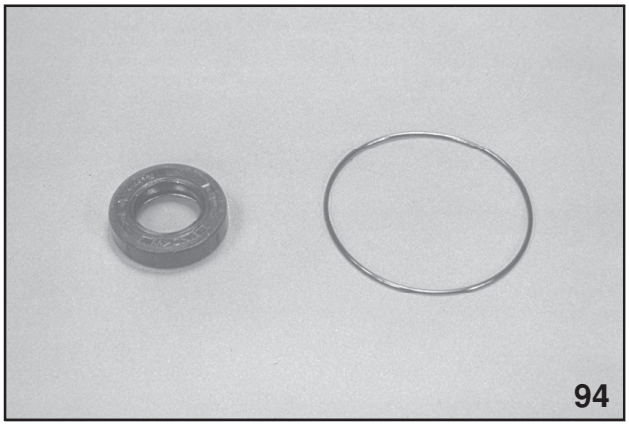


Synchronizer Ring



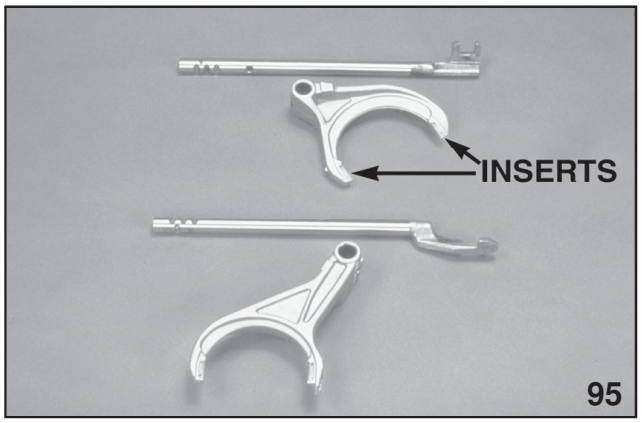
Synchronizer Ring Wear

Replace the synchronizer ring when the inner surface is worn, the contact surface of the synchronizer insert is scored or abnormally worn, or if the gap between the faces of the ring and gear is less than specification when the ring is pressed against the cone. (Minimum clearance .020")



Oil Seals & O-rings

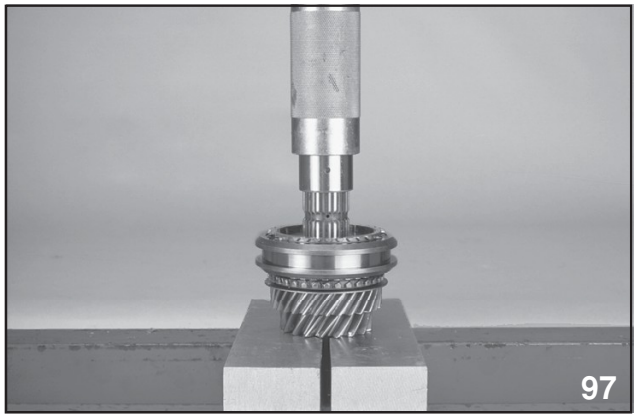
Replace all Oil Seals and O-rings.



Shift Forks and Rails

Replace the shift forks and rails when they are damaged or if the nylon inserts on the forks are worn or missing.

Transmission Main Shaft Reassembly

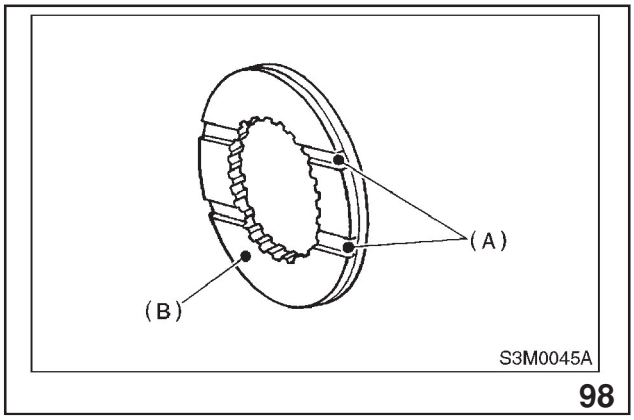


4th Gear Bearing Race

Install 3rd drive gear, outer baulk ring, synchro cone, inner baulk ring, sleeve and hub assembly for 3rd gear needle bearing on transmission main shaft.

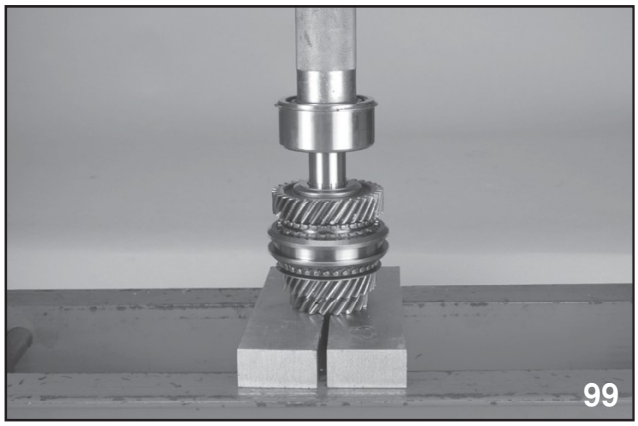
NOTE: ALIGN GROOVE IN BAULK RING WITH SHIFTING INSERT. SLEEVE HAS LUBRICATION HOLE. PROPERLY ALIGN WITH PASSAGE IN SHAFT.

Install 4th needle bearing race onto transmission main shaft using **899714110** remover and **499877000** installer and press.



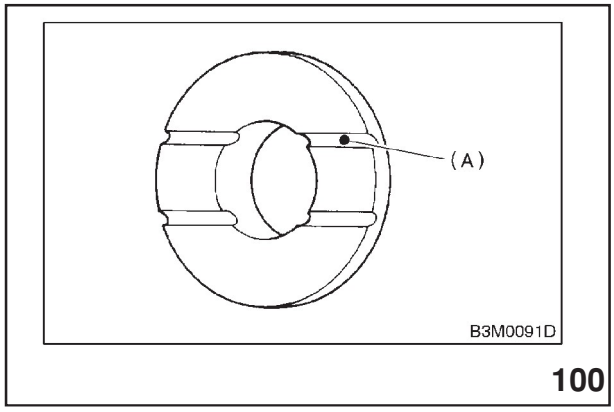
4th Gear Thrust Washer

(A) Groove
(B) 4th gear side



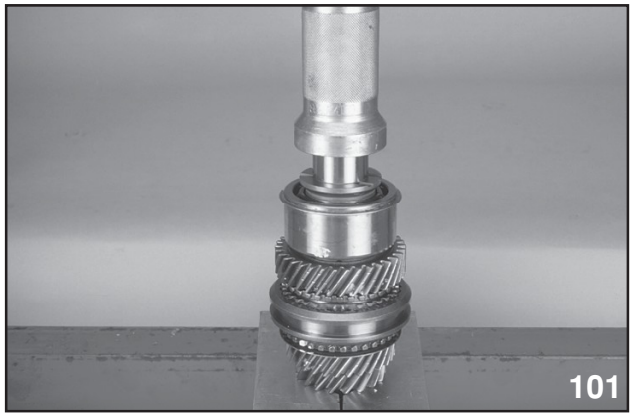
Ball Bearing Pressing

Install baulk ring, needle bearing, 4th drive gear and 4th gear thrust washer on main shaft. Install ball bearing onto rear section of main shaft and press.



5th Gear Thrust Washer Detail

(A) Face this surface to 5th gear side.

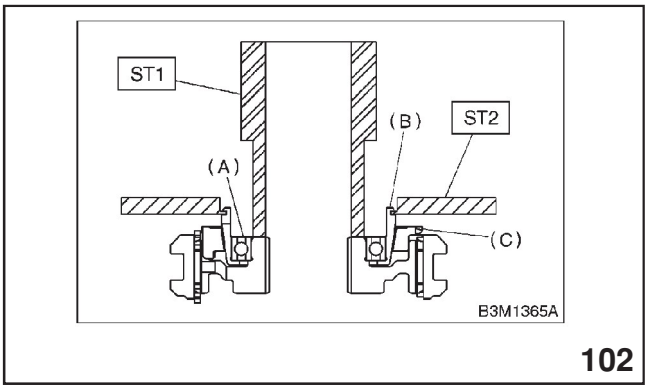


5th Gear Thrust Washer

Install 5th gear thrust washer and 5th needle bearing race on main shaft and press.

NOTE: THE FOLLOWING STEPS ONLY APPLY TO REASSEMBLY OF 1999 MY AND NEWER REVERSE BAULK RING AND SYNCHRO CONE.

ST 499757002 INSTALLER



Installing Reverse Baulk Ring and Synchro Cone

(A) Baulk ring
(B) Synchro cone
(C) Ball bearing

Install bearing onto synchro cone.

Install baulk ring and synchro cone onto 5th-Rev sleeve and hub assembly using ST and a press.

NOTE:

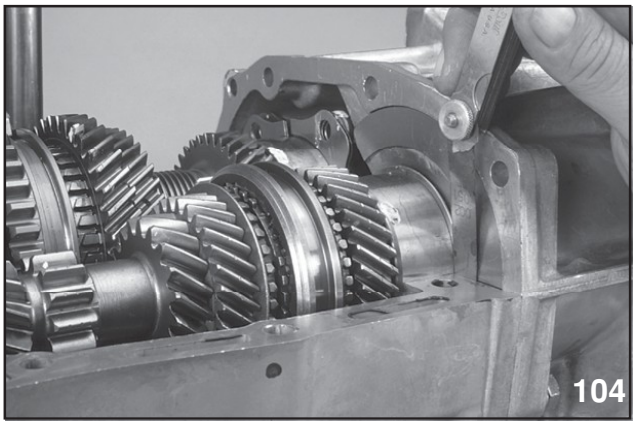
- Use new ball bearing.
- After press fitting, make sure synchro cone rotates freely.

Install synchro cone stopper and snap ring to 5th-Rev sleeve and hub assembly.

Main Shaft

Install the remaining parts to the rear section of transmission main shaft including a new washer and nut.

Mount the shaft in a vise using transmission main shaft holder **498937000**. Torque the nut to specification using socket wrench **499987003**. Stake the nut at two places.

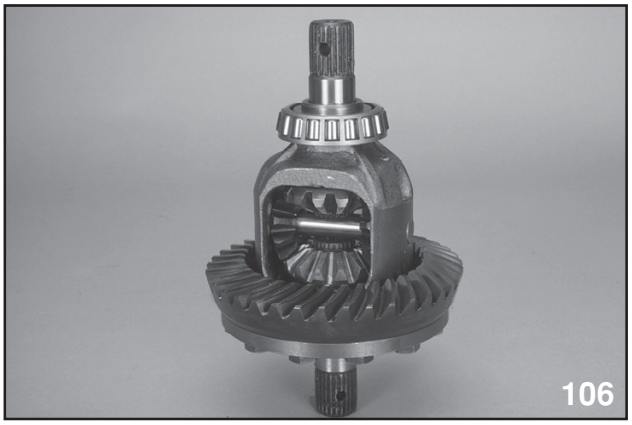


Main shaft End Play Clearance

With a feeler gauge, measure the clearance by placing the feeler blade between the snap ring and the main case. This dimension should be 0-.008 in (0-0.2mm).

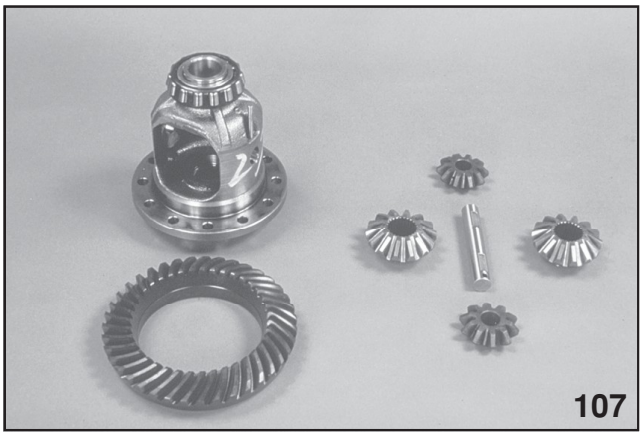
NOTE: THIS PROCEDURE DIFFERS FROM THE METHOD SHOWN IN THE SUBARU SERVICE MANUAL ON STIS WEB SITE.

Differential Disassembly and Reassembly



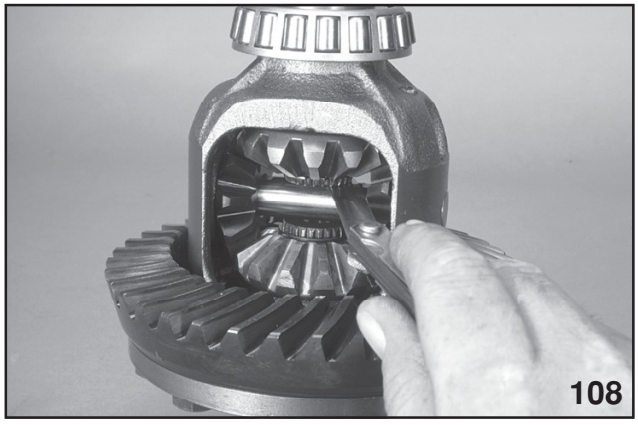
Differential Assembly

Mark the axle shafts for reassembly in the same location, remove the snap rings, and then remove the axle shafts. Unbolt the crown (ring) gear and remove it. Drive out the pinion shaft pin toward the crown gear side, and remove the pinion shaft, pinion gears, and washers.



Differential Components

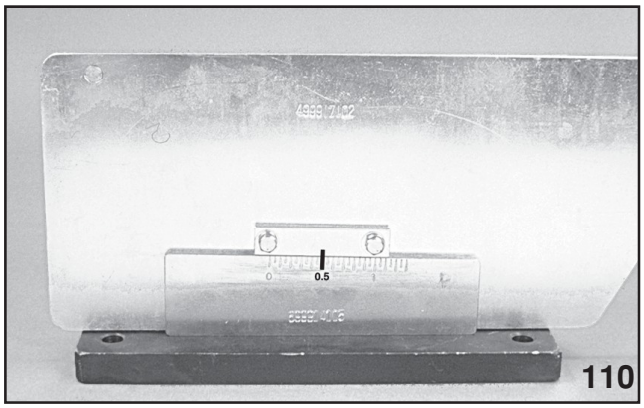
Inspect the parts for wear or damage. After reassembly, make sure that both washers are the same thickness. Align the hole in the pinion shaft with the hole in the differential case, and then install the pin from the crown gear side. Measure the backlash between the bevel side gears and pinion gears, and choose the proper selective washers to adjust the backlash to specification.



Axle Shaft Clearance

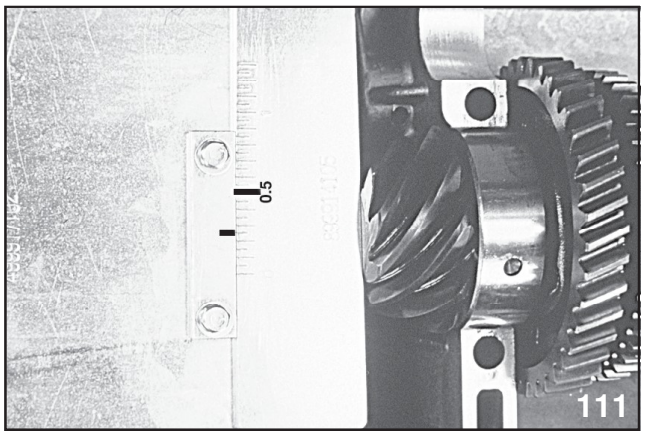
Measure the end play of the axle shafts. Replace the selective snap ring(s) if not with in specifications. (0 to .008")

Pinion Depth Shim Selection



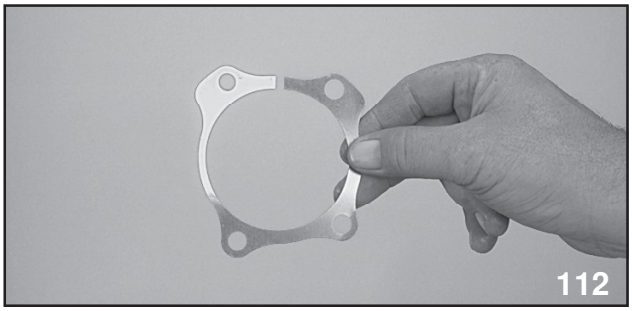
Adjustment of Drive Pinion Shim Gauge

To calibrate gauge assembly: Loosen the two bolts, place the gauge on a flat surface, align the red centering marks, and tighten the bolts.



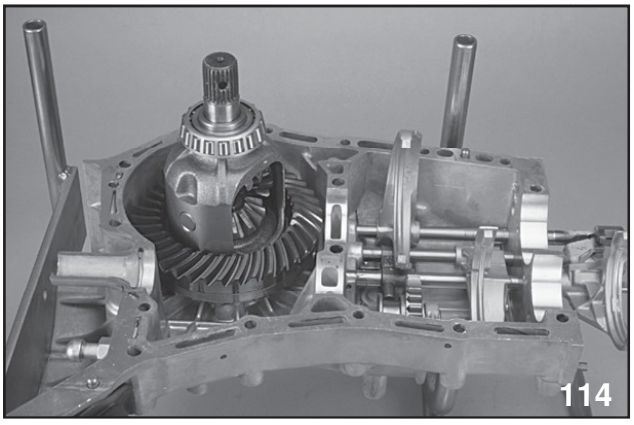
Using Pinion Setting Gauge Assembly

Place the assembled drive pinion without shims into the right-hand transmission case, and tighten the bearing holder bolts to specifications. Put the gauge assembly in place, and slide the plate until it is snug between the gauge and the pinion. Read the measurement from the lines that line up, and add or subtract the number on the end of the pinion to get the thickness of the shim required. If there are no marks on shaft, then read directly off gauge.



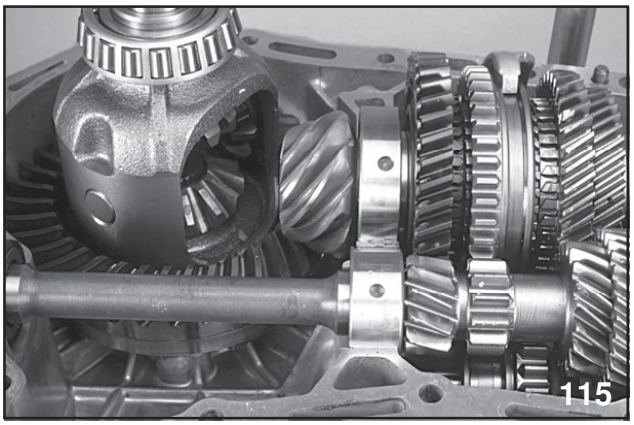
Drive Pinion Shim

Transmission Reassembly

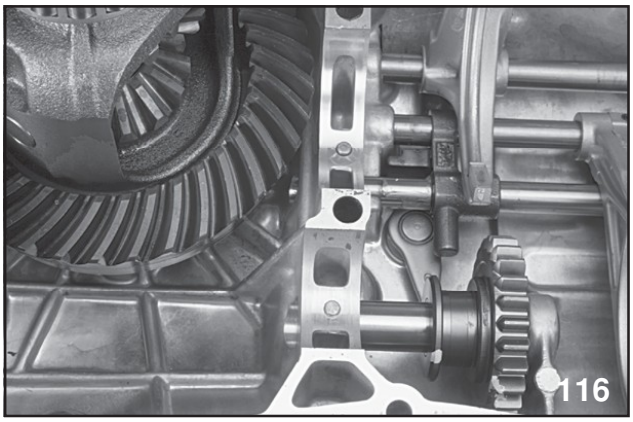


Install Differential Assembly

Install the shifter forks and rods. Coat the interlock plungers with grease if necessary to prevent their falling out. Set each rod to neutral while installing the next rod. Install the shifter detent balls, springs, and plugs. Install the differential assembly.

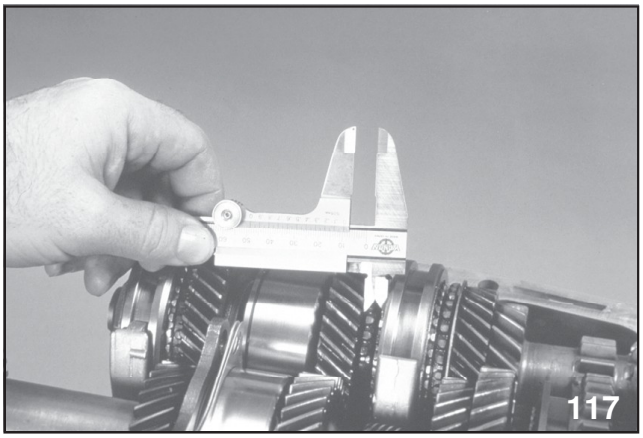


Knock Pin Bearing Holes



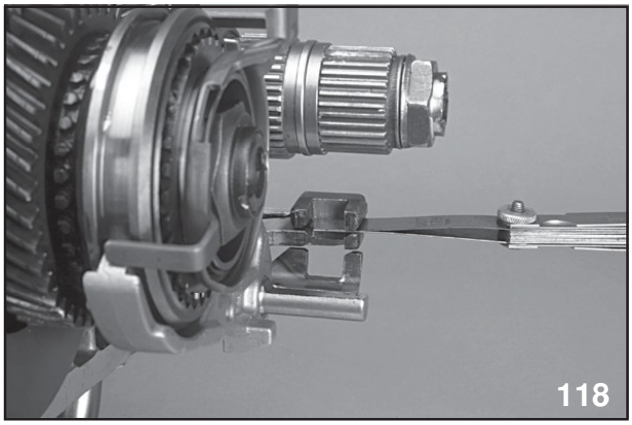
Knock Pins

Install the drive pinion shaft with shims and main shaft into the case. Make sure that the pinion bearing and main shaft bearing are correctly fitted to the knock pin in the case.



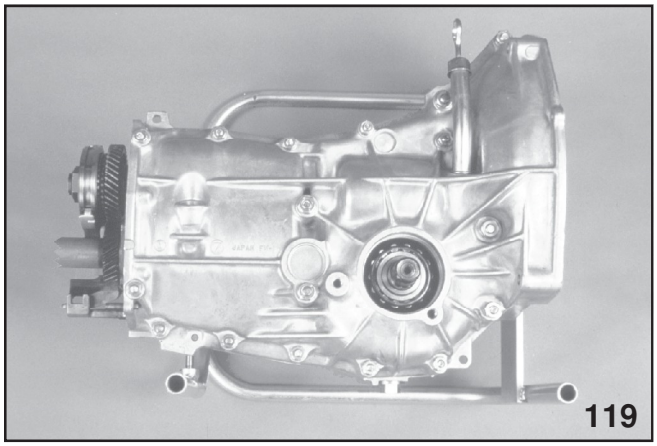
Measure Shifter Fork Centering

The shifter forks are selective. Measure between the coupler (sleeve) and each gear face. Use the table in the appropriate model year Subaru Service Manual on STIS Web site to select the proper forks.



Measure Shift Rod End Clearance

Measure the clearance between the rod ends. Replace the forks or rods if they are not within specification.

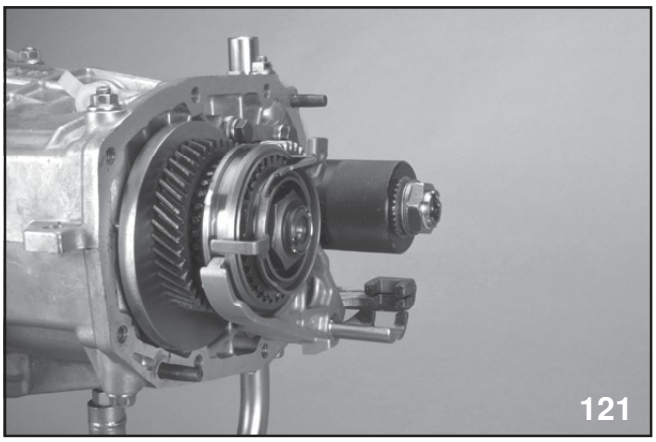


Transmission Case Reassembled

Apply a light coat of Prussian Blue to several of the crown gear teeth.

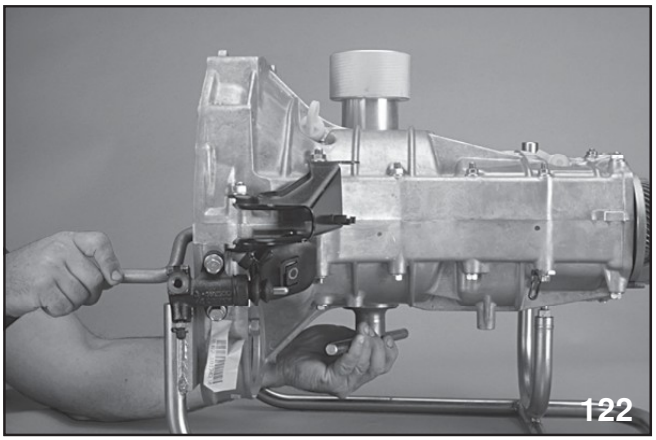
Reassemble the transmission case using a non-hardening sealer. Insert the bolts from the bottom, and torque the bolts in the proper sequence. Torque the bolts for the drive pinion bearing retainer to proper specification.

Hypoid Gear Adjustments



Locking the Driven Shaft

Install 498427100 Stopper onto the end of the drive pinion shaft.



Hypoid Gear Clearance Adjustment

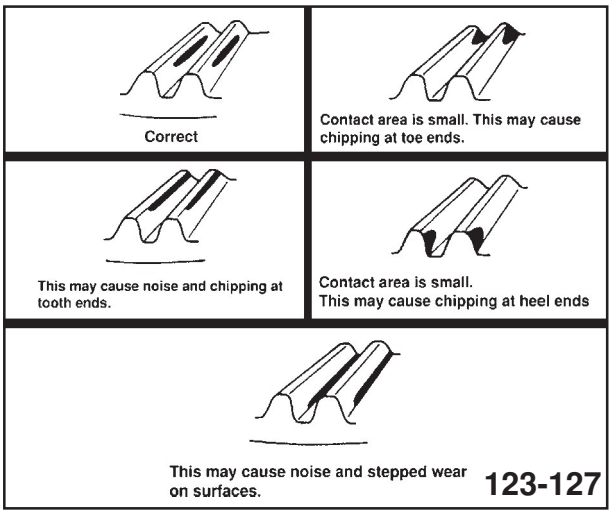
Adjust the backlash with weight **399780104**, wrench **499787000**, and handle **499927100**. Place the transmission right-hand-side up, and place the weight on the top bearing cup. Shift into 5th gear. Screw in the bottom retainer assembly, without an O-ring, while turning the input shaft with the handle. Stop when you feel a slight resistance. Do this procedure several times to be sure the setting is correct.

Remove the weight, and then screw in the upper retainer, without an O-ring, stopping when a slight resistance is felt.

NOTE: AT THIS POINT, THE BACKLASH BETWEEN THE HYPOID GEAR AND DRIVE PINION SHAFT IS ZERO STATE. (LASH)

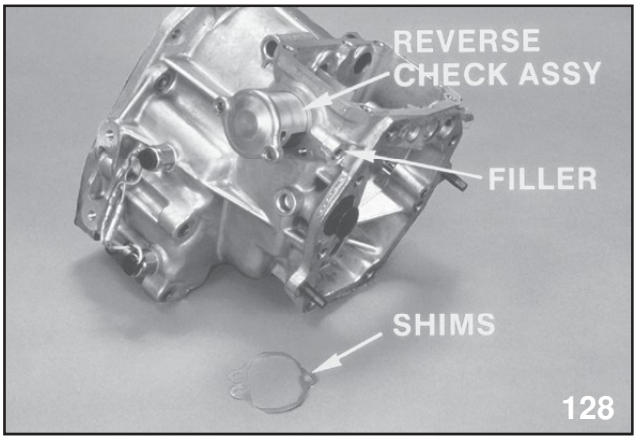
Back off the bottom retainer by 1 and 1/2 notches of the lock plate. Next, turn in the top retainer the same amount plus an additional 1/2 to 1 notch. Temporarily tighten the lock plates. Turn the handle several dozen times, tapping lightly around the retainer with a plastic mallet.

Check the backlash with a dial gauge, inserting the probe through the drain plug hole and placing stem of dial indicator on drive side of ring gear. Repeat the above procedure if backlash is out of specification.



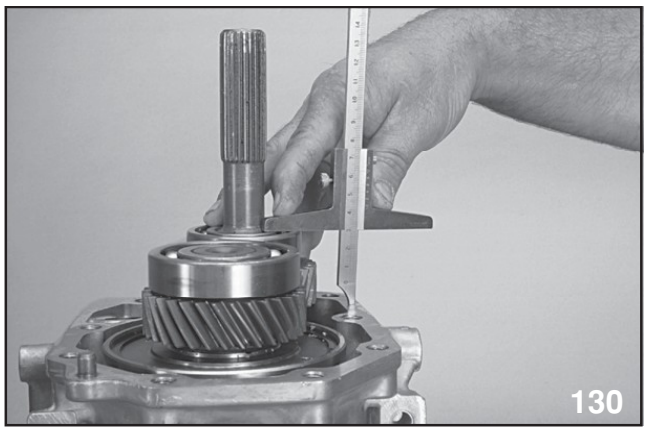
Hypoid Gear Tooth Contact Patterns

Check the Prussian Blue tooth contact pattern. With the backlash and contact pattern correct, mark the positions of the axle shaft oil seal retainers. Back off one retainer at a time (counting turns) until oil ring groove is exposed. Install a new O-ring, and then bring the retainer back to original position.



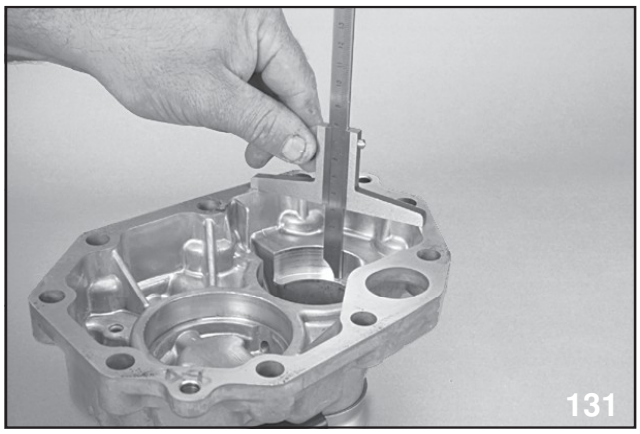
Install Transfer Case & Extension Assembly

Transfer Case and Extension Case Assembly



Height "W"

Measure height "W" between transfer case and ball bearing on the transfer driven gear.



Depth "X"

Measure depth "X".

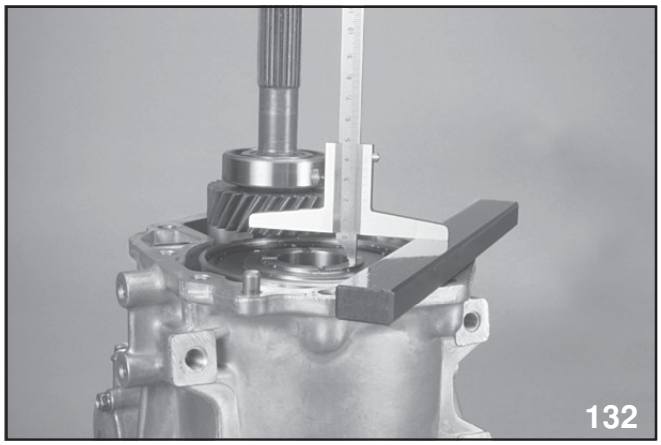
NOTE: MEASURE WITH BEARING CONE AND THRUST WASHER REMOVED.

Calculate space "t" using the following equation: t = X - W - (0.2 to 0.3 mm) (0.008 to 0.012 in)

Standard clearance between thrust washer and roller bearing:

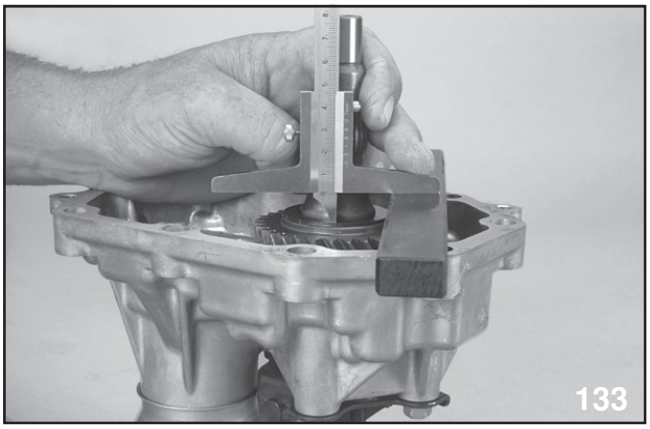
0.2 - 0.3 mm T (0.008 - 0.012 in T)

Select suitable thrust washer.



Depth "S"

Fit thrust washers on transfer drive shaft. Measure depth "S' between transfer case and center differential.



Depth "T"

Measure depth "T" between extension case and transfer drive gear.

Calculate space "U" using the following equation: U = S - T - (.15 to .35 mm)

Select suitable thrust washer

Standard clearance:

0.15 - 0.35 mm (0.0059 - 0.0138 in)

Fit thrust washer on center differential.

Apply proper amount of liquid gasket to the transfer case mating surface.

Install extension assembly into transfer case.

Center Differential

The center differential operation is unchanged and is now non-serviceable, except for the supporting bearings.

1999 and Later Center Differential Assembly

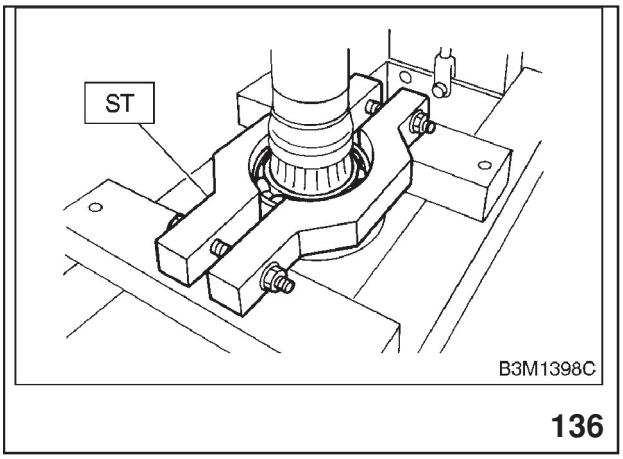
DISASSEMBLY

NOTE: DO NOT DISASSEMBLE CENTER DIFFERENTIAL BECAUSE IT IS A NON- SERVICEABLE PART.

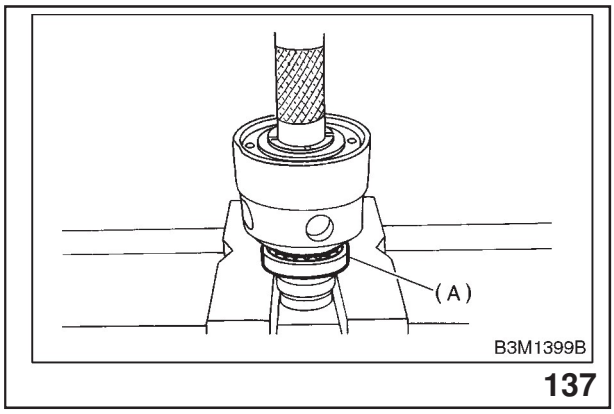
Remove ball bearing using ST.

NOTE:
Do not reuse ball bearing. Prepare a new ball bearing.

ST 498077300 Center Differential bearing remover



Removing Ball Bearing



Installing Ball Bearing

(A) Ball bearing

Assembly

Install ball bearing to center differential assembly.

Inspection

1) Bearings

Replace bearings in the following cases:

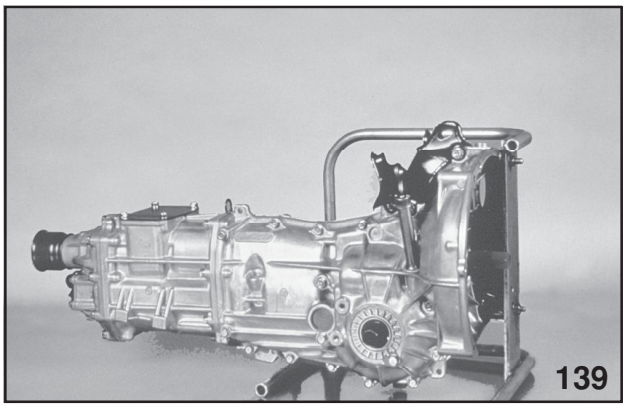
- Broken or rusty bearings
- Worn or damaged
- Bearings that fail to turn smoothly or make abnormal noise when turned after gear oil lubrication.
- Bearings having other defects

2) Center differential

Replace center differential assembly in the following case:

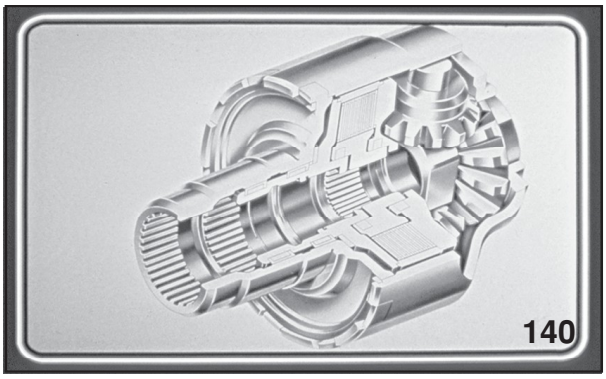
- Worn or damaged

Viscous Full-time 4WD Transmission



Viscous Full-time 4WD Transmission

The length and size of the transmission have been increased to match the 2.2L engine. The gears/synchronizers have also been increased in size to improve shift characteristics for the Legacy. This transmission uses the FT4WD design center differential, with a viscous coupling used in place of the center differential locking mechanism.



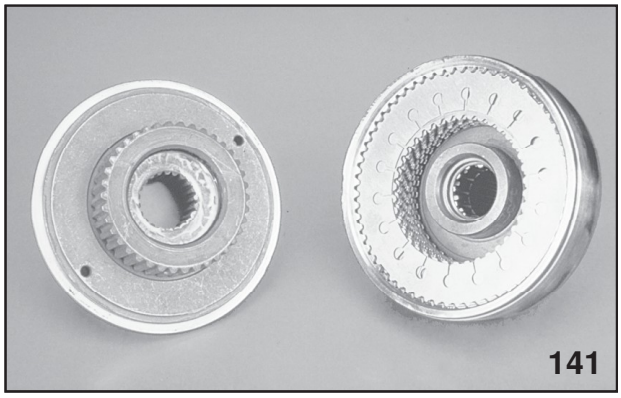
Viscous Coupling

The viscous coupling provides improved driving stability on slick driving surfaces by automatically optimizing the drive torque from the front to the rear wheels.

Operating similar to a limited slip differential, the coupling transfers torque to the non-spinning front or rear wheels. It also absorbs the difference in rotating speeds between the front and rear wheels during turning which prevents torque bind.

An additional advantage of the viscous coupling is the removal of the DIFF LOCK switch (found on XT, XT6 and L-Series models) which is not required because the viscous coupling replaces the function of the DIFF LOCK. The viscous coupling automatically distributes torque to the wheels with the most traction.

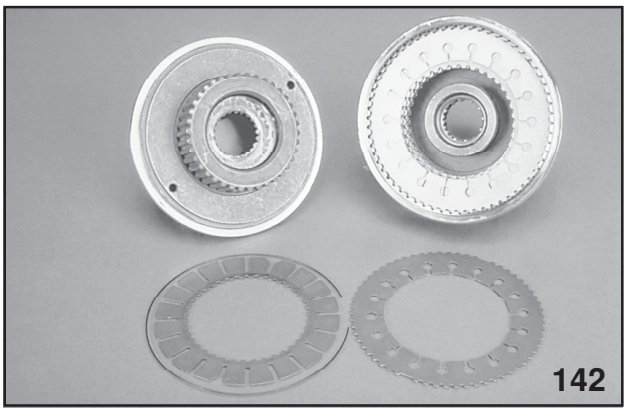
NOTES: WHEN TOWING A VEHICLE WITH A VISCOUS COUPLING, ALL FOUR WHEELS MUST CONTACT THE GROUND OR THE VEHICLE MUST BE HAULED ON A FLAT BED TRUCK (ALL WHEELS OFF THE GROUND).



Viscous Coupling Components

The two main components of the viscous coupling. The housing and the hub. They are designed similar to an AT clutch pack. The inner plates are splined internally to the hub and provide output to the rear wheels. The outer plates are splined to the housing and provide output to the front wheels.

A spacer ring maintains the proper spacing between the outer plates while allowing axial movement of the inner plates. The sealed unit uses silicone oil to transmit torque from the housing to the hub through the plates.



Viscous Coupling Plates

Viscous coupling operation

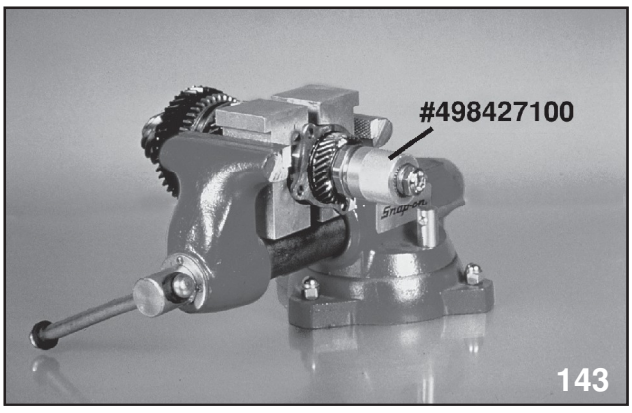
The plates shear (cut) through the silicone oil as they rotate. This causes increased oil temperature which expands the oil. As the oil expands, it creates a shearing force which is transmitted to the plates. This causes torque to be transmitted between the hub and the housing.

NOTE: THE GREATER THE DIFFERENCE OF THE ROTATIONAL SPEED BETWEEN THE HOUSING AND THE HUB, THE GREATER THE TORQUE TRANSFER.

During normal driving conditions when there is no speed difference between the front and the rear wheels, the center differential **delivers a 50/50 torque ratio** (F/R). The viscous coupling does not control the action of the differential because the inner and the outer plates are rotating at the same speed.

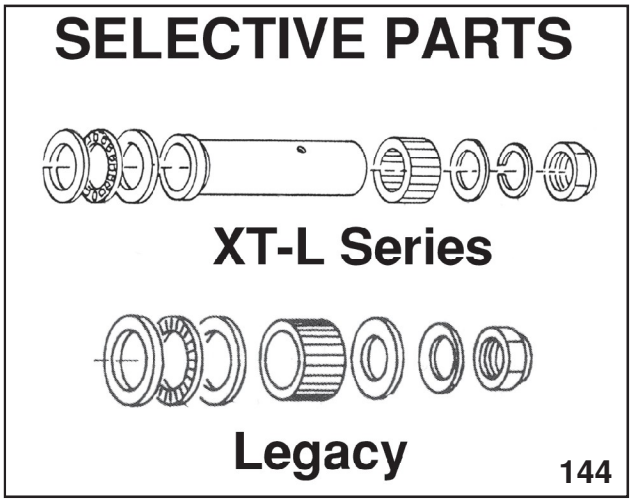
During limited traction driving conditions when there is a rotational difference between one or more wheels there is a different rotating speed between the housing and the hub. Thus the inner and outer plates are rotating at different speeds. This produces the viscous shearing force between the inner and the outer plates. At this time, the torque is proportionately delivered to the non-spinning wheels.

The viscous coupling is non-serviceable and must be replaced as a unit.



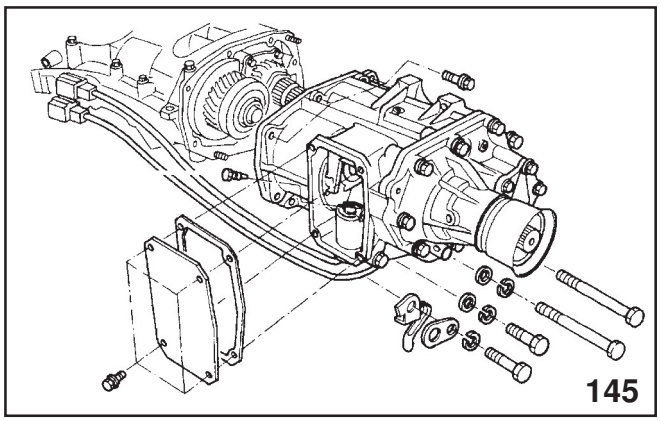
Legacy Pinion Shaft

Disassembly/reassembly procedures for the main case are similar to the previous MY full-time 4WD transmission. The transfer case procedures have been revised due to the viscous coupling center differential. Although disassembly of the drive pinion assembly is similar to the previous MY transmission, you must use stopper **498427100** to remove the pinion shaft lock nut.



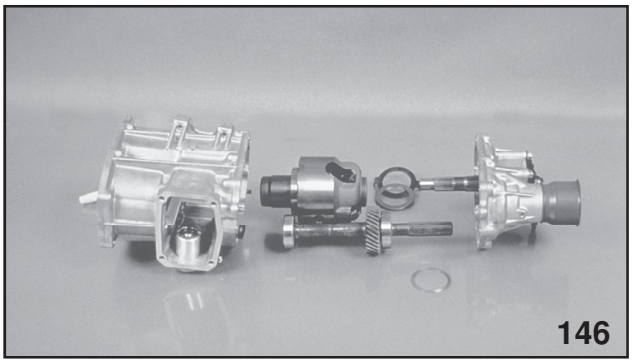
Thrust Bearing Preload / Selective Parts

The selective parts for the drive pinion shaft are different from the previous MY full-time 4WD transmission. See Subaru Service Manual on STIS Web site for selective parts charts and information.



Transfer Case Removal

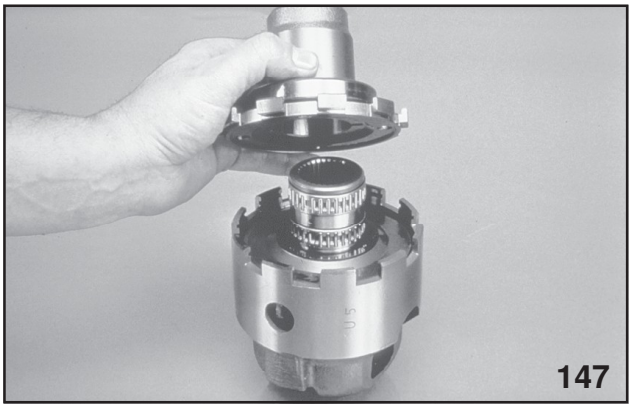
Disconnect the backup light and neutral switch connectors. Remove the transfer case cover bolts and transfer case cover. Then remove the selector arm set screw and the reverse check mechanism.



Transfer Case and Extension Housing

Remove the extension housing bolts and separate the extension housing from the transfer case. Remove the center differential and transfer driven shaft from the transfer case. Then remove the transfer drive shaft from the extension housing. Be sure to remove the thrust washers from the extension housing.

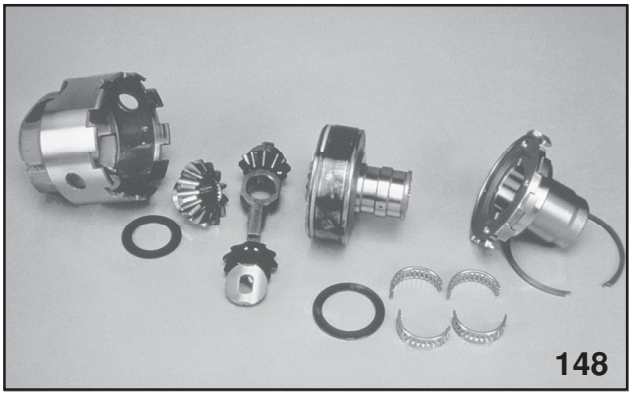
NOTE: THE TRANSFER CASE AND EXTENSION HOUSING CAN BE REMOVED FROM THE MAIN CASE WITHOUT DISASSEMBLY OF THE MAIN CASE COMPONENTS.



Center Differential Disassembly

Remove the snap ring, the differential cover with ball bearing, and the split needle bearings.

NOTE: THE SPLIT NEEDLE BEARINGS MUST BE INSTALLED IN EXACTLY THE SAME POSITIONS WHEN THE CENTER DIFFERENTIAL IS REASSEMBLED.

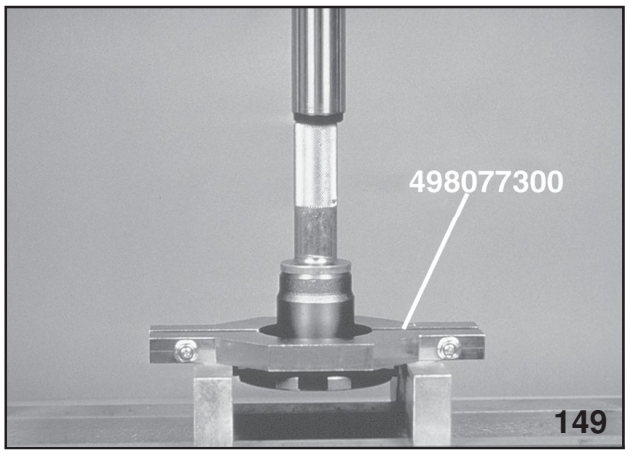


Viscous Coupling Removal

Carefully remove the viscous coupling from the differential case.

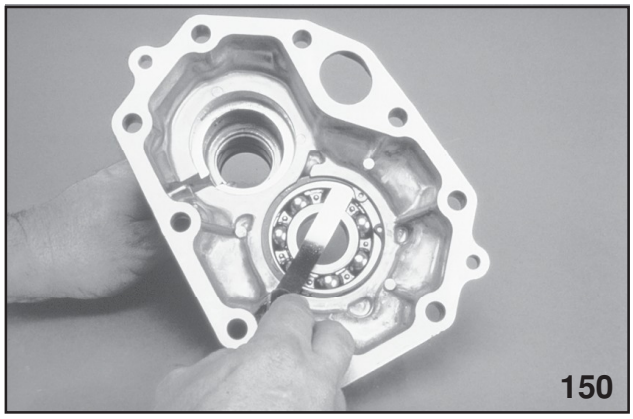
NOTE: ADJUSTING WASHER ON VISCOUS COUPLING IS DIRECTIONAL.

Remove the pinion shaft, pinion bevel gears and retainers, bevel gear, and thrust washer.



Ball Bearing Removal

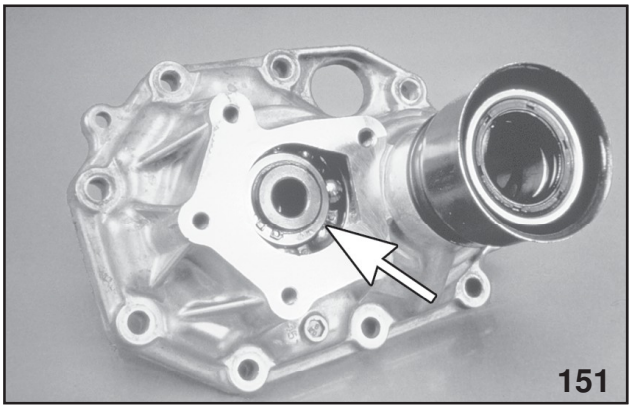
Use remover 498077300 and a press to remove the center differential cover ball bearing. Do not reuse the ball bearing.



Measuring Bearing End-Play

The transfer drive shaft bearing end-play is determined by a selective snap ring which is available in three sizes. Refer to model year Subaru Service Manual on STIS web site. Snap Ring (Inner 72) chart.

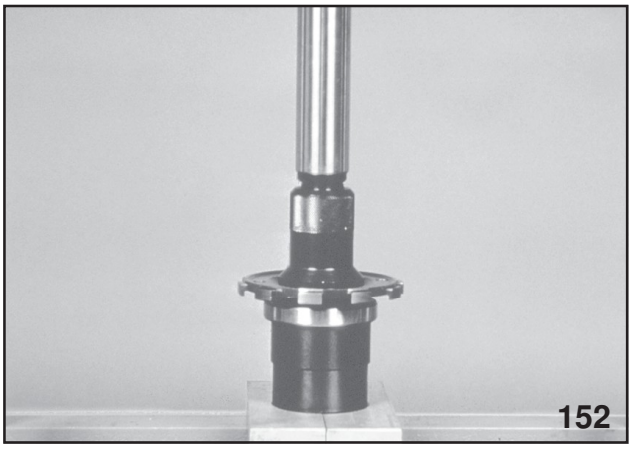
Install the inner ball bearing into the extension housing and then install the selective snap ring (72 mm). Use a feeler gauge to measure the clearance between the snap ring and the bearing outer race. The desired clearance is 0.0 - 0.15 mm (0.0 -0.0059 in).



Measuring Outer Snap Ring Clearance

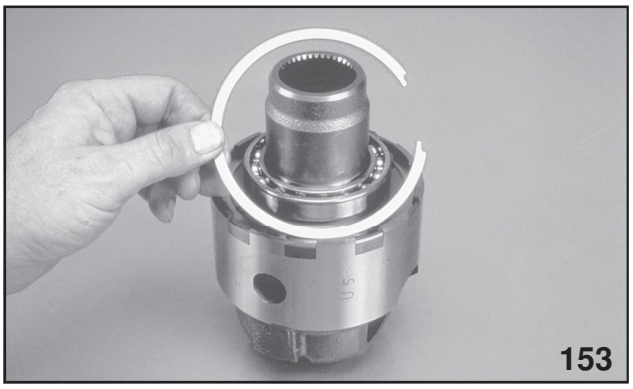
Press the transfer drive shaft into the ball bearing and install the outer selective snap ring to the transfer drive shaft. Refer to model year Subaru Service Manual on STIS web site. Snap Ring (Outer - 30) chart for choice of three sizes of snap rings.

Use a feeler gauge to measure the clearance between the snap ring and the bearing inner race. The desired clearance is: 0.0 - 0.15 mm (0.0 -0.0059 in).



Install Center Differential Ball Bearing

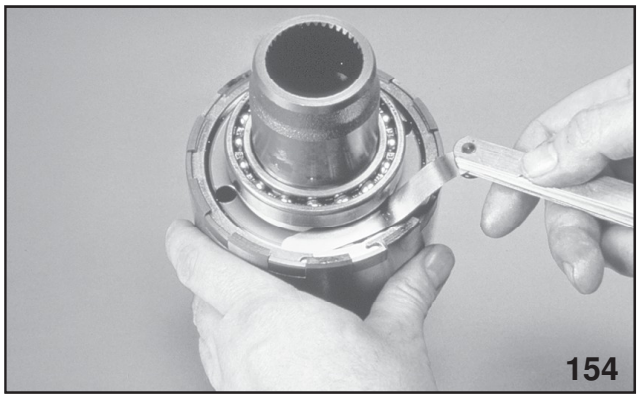
Use a press and an appropriate press tools to install the center differential cover ball bearing. Always press against the inner bearing race when installing the center differential ball bearing.



Center Differential Housing Snap Ring Clearance

NOTE: IT IS EASIER TO PERFORM THIS PROCEDURE BEFORE REASSEMBLY OF THE CENTER DIFFERENTIAL COMPONENTS.

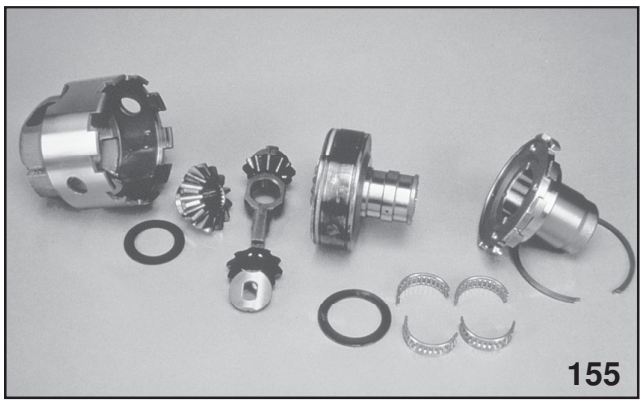
The clearance is determined by a selective snap ring which is available in three sizes. Refer to Model Year Subaru Service Manual on STIS web site. Snap Ring (Inner 110) chart. Always install a new selective snap ring.



Measuring Snap Ring Clearance

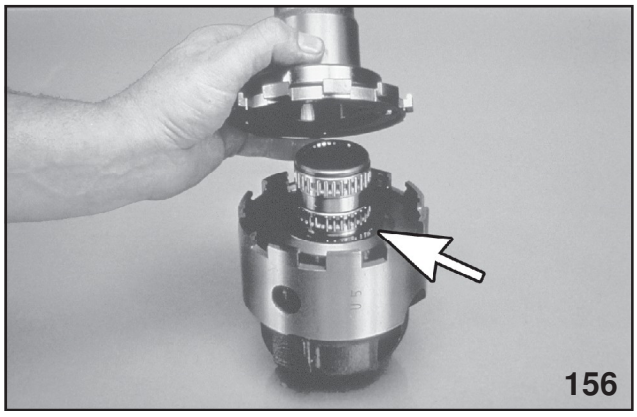
Use a feeler gauge to measure the clearance between the snap ring and the center differential cover. The desired clearance is: 0.0 - 0.15 mm (0.0 - 0.0059 in).

NOTE: INSTALL THE THICKEST SNAP RING POSSIBLE WHICH ALLOWS THE DESIRED CLEARANCE.



Reassemble Center Differential

Install the center differential components into the case in the reverse order of disassembly. Install the bevel gear thrust washer (nonselective). This washer is directional, the chamfered edge faces the bevel gear. Then install the bevel gear, pinion shaft, pinion gears and retainers (no adjustment), and the viscous coupling.

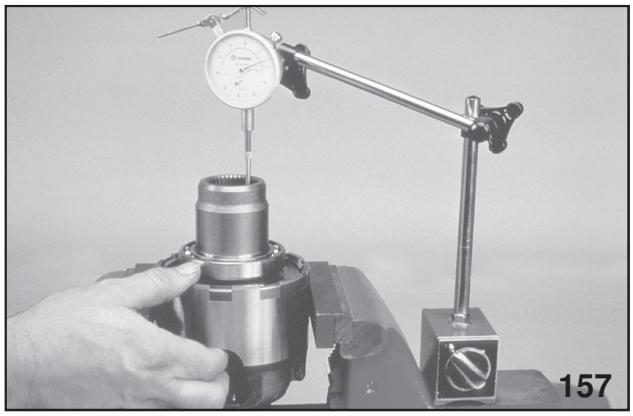


Reassemble Center Differential Adjusting Washer

Then install the original backlash adjusting washer (selective), split needle bearings, center differential cover, and a new selective snap ring (110 mm).

NOTE: THE ORIGINAL BACKLASH WASHER MUST BE INSTALLED DRY TO OBTAIN AN ACCURATE BACKLASH MEASUREMENT. THE WASHER IS ALSO DIRECTIONAL. THE CHAMFERED SIDE MUST FACE THE VISCOUS COUPLING.

NOTE: THE SPLIT NEEDLE BEARINGS MUST BE REINSTALLED TO THE EXACT SAME POSITIONS AS WHEN THE CENTER DIFFERENTIAL WAS DISASSEMBLED. THE NEEDLE BEARINGS ARE A MATCHED SET AND MUST BE REPLACED AS A SET.

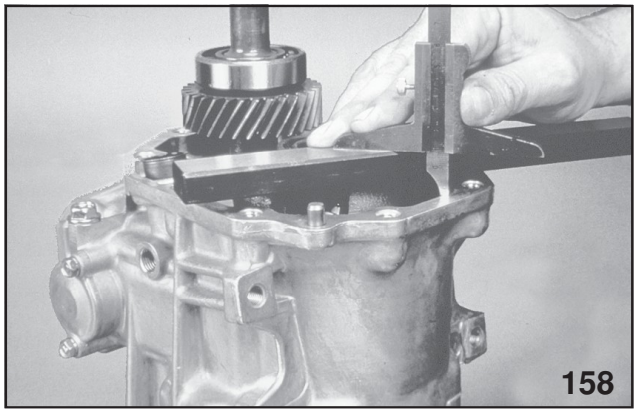


Backlash Adjustment

Support the center differential in a vise or press blocks. Set up a dial indicator and measure the axial backlash (up and down movement of the pinion shaft). The desired clearance is: 0.62 - 0.86 mm (0.024 - 0.034 in).

Be sure to measure the backlash at three points as you rotate the center differential assembly. Use the largest reading to select the proper backlash adjusting washer. A thinner washer will increase the backlash, a thicker washer will decrease the backlash. Refer to model year, Subaru Service Manual on STIS Web site. Adjusting washer (45 x 62 x t) chart. Be sure to re-measure the backlash after installing a new adjusting washer.

NOTE: THE BEVEL GEAR PROTRUDES FROM THE DIFFERENTIAL CASE. BE CAREFUL TO SUPPORT THE DIFFERENTIAL CASE SO THAT THE BEVEL GEAR CAN HANG FREELY AND IS FREE TO ROTATE.

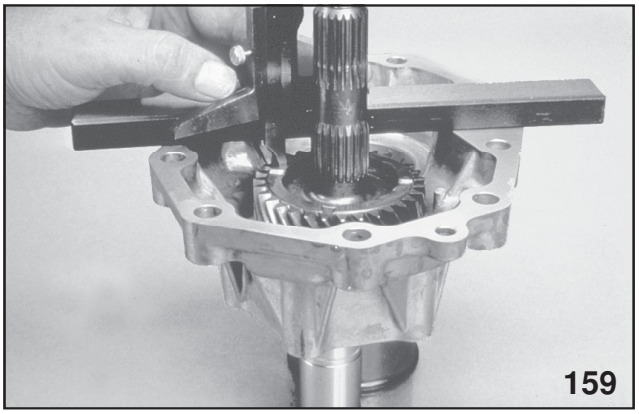


Measuring Height "A"

To measure the center differential end-play, first install the center differential and the transfer driven shaft into the transfer case.

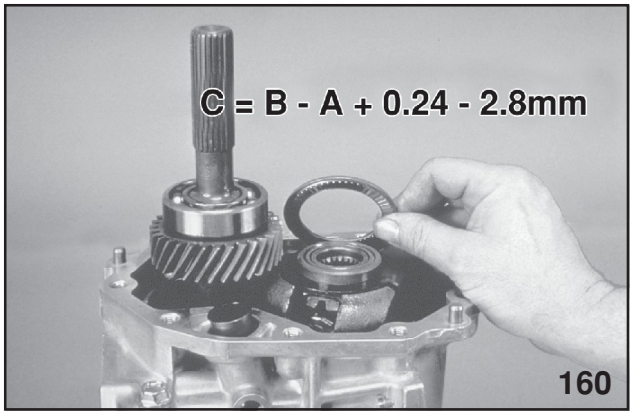
TIP: ALIGN THE SPLINES OF THE CENTER DIFFERENTIAL WITH THE PINION SHAFT AND THE TRANSFER DRIVEN SHAFT BEFORE INSTALLATION OF THE CENTER DIFFERENTIAL TO THE TRANSFER CASE. THIS WILL EASE THE FINAL ASSEMBLY OF THE TRANSFER CASE AND EXTENSION HOUSING.

Measure height "A" from the differential thrust surface to the transfer case mating surface. The washer and bearing should not be installed.



Measuring Depth "B"

Measure depth "B" from the extension housing mating surface to transfer drive shaft gear face.



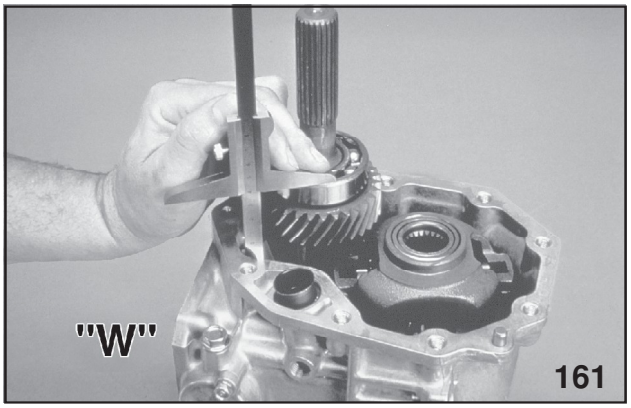
Calculate End-Play "C"

Use the formula:

C = B - A + 0.24 mm (0.010 in) - 2.8 mm (0.110 in)

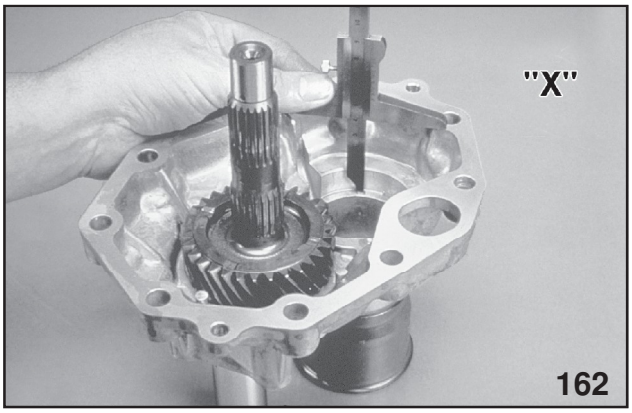
Standard gasket thickness = 0.24 mm (0.010 in) Standard thrust bearing thickness = 2.8 mm (0.110 in)

The desired clearance is: 0.35 - 0.55 mm (0.014 0.022 in). Refer to model year, Subaru Service Manual on STIS Web site. Space "C" Center differential washer chart. Select and install the proper selective washer from the five available sizes. Be sure to position the washer with the tabs as shown in the Subaru Service Manual.



Measuring Height "W"

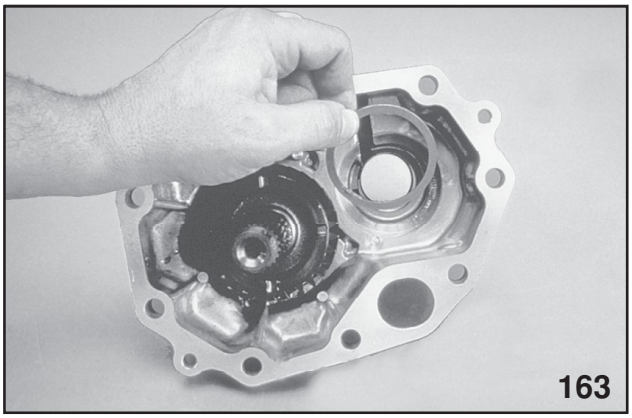
The transfer driven gear thrust clearance is height "W". Measure from the transfer case mating surface to the transfer driven gear outer bearing race.



Measuring Depth "X"

Measure depth "X" from the extension housing mating surface to the transfer driven gear bearing seat.

NOTE: SELECTIVE SHIM SHOULD BE REMOVED WHEN PERFORMING THE ABOVE MEASUREMENT.



Calculate Clearance "Y"

Use the formula:

Y = X - W + 0.24 mm (0.010 in)

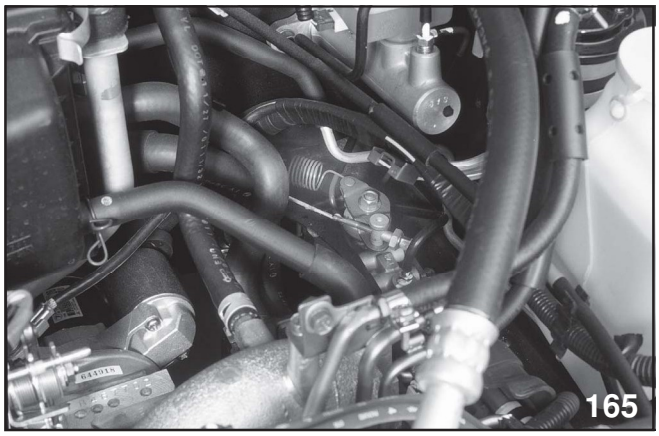
Standard gasket thickness = 0.24 mm (0.010 in)

The desired clearance is: 0.05 - 0.30 mm (0.002 0.012 in). Refer to model year, Subaru Service Manual on STIS Web site. Space "Y" Thrust washer (52 x 61 x t) chart. Select and install the proper selective shim in the transfer driven shaft bearing seat. Use petroleum jelly to hold the shim in position.

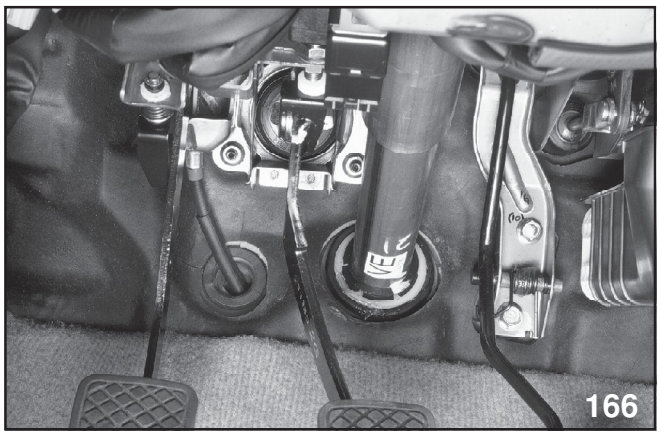
Install the thrust bearing with the roller side surface facing the differential washer. Carefully install the extension housing to the transfer case. Torque the bolts, install the selector arm set screw, and reinstall the transfer case in the reverse order of disassembly.

Forester Hill Holder

Starting with the 2003MY Forester 5 speed manual transmission model is equipped with a hill holder. The hill holder activates with the clutch and brake pedal pushed when the vehicle is at about a 3 degree incline. Releasing the brake and holding the clutch will trap the brake pressure in the left front and right rear wheels.



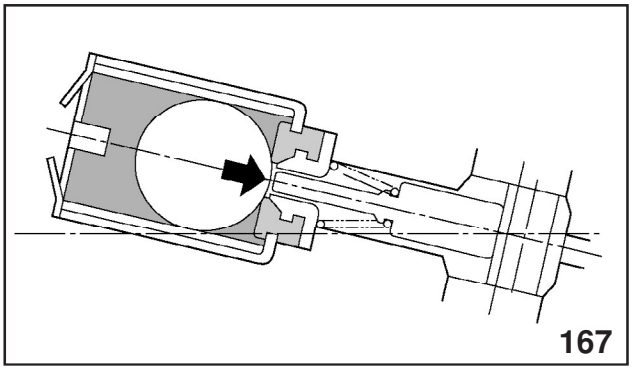
PHV (Pressure Hold Valve)



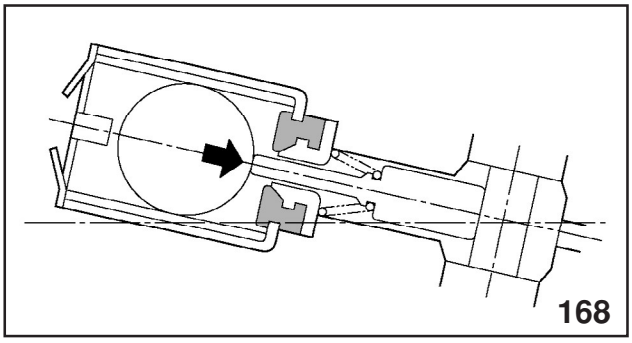
Clutch Pedal

Operation of the pressure control valve (PHV) is accomplished by means of a cable connected to the clutch pedal and routed through the bulk head to the PHV. The end of the cable at the PHV is adjustable.

If the vehicle does not hold on the described incline tighten the adjustment. If the hill holder releases later than the clutch loosen the adjustment. If the hill holder releases too soon tighten the adjustment.



Clutch Pedal In



Clutch Pedal Out

Notes and Cautions

Disassembly

Reduce the preload on the carrier bearings before splitting the case.

Be sure all 17 bolts are removed before attempting to split the case.

Wrap vinyl tape around the axle drive shaft splines before removing the shafts, to protect the oil seals.

Mark the right and left differential roller bearing outer races for reinstallation on the same side.

Shift Rails

Late model 4WD and turbo 5-speed FWD have pins holding the shift forks. Others have set screws (bolts).

When removing or installing a shift rail, keep all others in the neutral position.

Inspection

A deep blue color and a burnt smell indicates overheating and a lack of lubrication.

All gears but 1st and 2nd must be bought in sets. 3rd and 4th gears must be bought in a set.

If the main shaft is replaced, 3rd gear must also be replaced.

Replace all O-rings and seals.

Components

Use a press and the proper holders to remove and replace parts on shafts.

If a roller bearing is pressed off a shaft, replace it.

Position the open ends of synchronizer springs 120 degrees apart on reassembly.

Align the ring grooves on the synchronizer coupling sleeve with the inserts.

Differential

Measure the backlash between the bevel gears and the pinion on reassembly.

Measure the clearance between the axle shafts and case.

Torque the ring gear bolts in opposite pairs.

Do not fold the oil seal lips when installing the differential assembly.

Reassembly & Adjustments

Apply gear oil to the nylon inserts on the shifter forks.

Select the proper shifter fork to center the coupling sleeves in the synchronizer mechanism (late model only).

Use liquid gasket on mating surfaces of the case halves.

Insert the case bolts from the left hand side of the case, tighten in the prescribed sequence.

Adjust the hypoid gear backlash with oil seal retainers without O-rings; then replace the O-rings.

Check the backlash with a dial gauge.

Check the tooth contact pattern with Prussian Blue.

Adjust the neutral position with shims and plate in the reverse check mechanism.

Assemble the clutch to the flywheel with the “O” marks as far apart as possible.

Full-time 4WD Disassembly

Do not damage the needle or thrust bearings during removal of the pinion shaft.

Prior to pressing the roller bearing and the 3rd-4th gear assembly, you must remove the woodruff key. Use a drift and a hammer to knock out the key. Be careful to not damage the gears, shaft, or bearing.

Prior to removing 1st and reverse gears from the driven gear assembly, the driven shaft key must be removed. Use a hammer and a drift to remove the key.

Full-time 4WD Reassembly and Adjustments

Assembly of the pinion shaft is the reverse process of disassembly. Be sure to follow all of the steps and special cautions as listed in the Subaru Service Manual on STIS Web site.

Place a cloth between the press base and the driven shaft assembly to avoid damage to the driven shaft while pressing driven shaft components.

Stake the driven shaft lock nut at two points. Use a spring balance to measure the starting torque of the roller bearing.

The pinion shaft bearing is directional and must be installed with the knock pin hole away from the pinion.

Carefully install the driven shaft assembly onto the pinion shaft to avoid damage to the needle bearings.

Be careful to install the drive pinion spacer in the proper direction.

Measure starting torque after tightening the pinion shaft lock nut to the specified torque. If the starting torque is not within specifications, select a new spacer and/or sleeve and repeat the procedure.

Refer to the Subaru Service Manual on STIS Web site, charts for selection of the proper spacer and/or sleeve. There are seven sleeves and three spacers.

Stake the pinion shaft lock nut at four points.

Full-time 4WD Center Differential

Use stopper **498427000** to rotate the pinion shaft when adjusting the differential bearing preload and backlash .

The split needle bearings must be installed in exactly the same position when the center differential is assembled.

Use a dial gauge to measure the differential backlash. Refer to the Subaru Service Manual on STIS Web site differential bevel washer chart to select the proper bevel washer. Always consult the appropriate Subaru Service Manual on STIS Web site for proper adjustment of the differential lock cable.

Viscous Full-time 4WD Transmission

When towing a vehicle with a viscous coupling, **all** four wheels must contact the ground or the vehicle must be hauled on a flat bed truck (**all** wheels off the ground).

The transfer case and extension housing can be removed from the main case without disassembly of the main case components.

The split needle bearings must be installed in exactly the same positions when the center differential is reassembled.

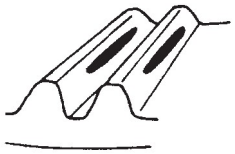
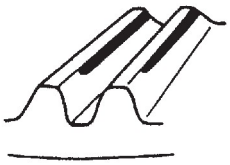
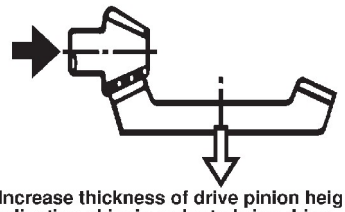
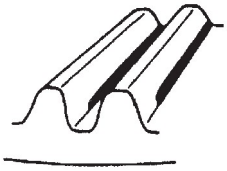
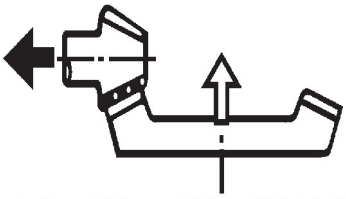
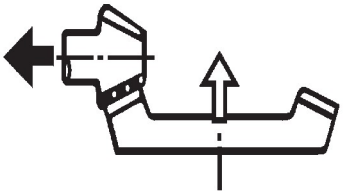
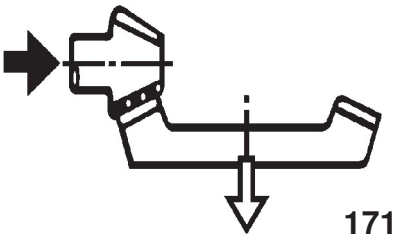
It is easier to determine the center differential snap ring clearance before reassembly of the center differential components.

Install the thickest snap ring possible which allows the desired clearance for the center differential cover. Always install a new selective Snap Ring (110 mm).

The original backlash washer must be installed dry to obtain an accurate backlash measurement. The washer is also directional. The chamfered side must face the viscous coupling.

The split needle bearings must be reinstalled to the exact same positions as when the center differential was disassembled. The needle bearings are a matched set and must be replaced as a set.

Chart for tooth contact

Checking item	Contact pattern	Corrective action
Correct tooth contact Tooth contact pattern slightly shifted toward toe under no-load rotation. (When loaded, contact pattern moves toward heel.)	 Correct	
Face contact Backlash is too large.	 This may cause noise and chipping at tooth ends.	 Increase thickness of drive pinion height adjusting shim in order to bring drive pinion close to crown gear.
Flank contact Backlash is too small.	 This may cause noise and stepped wear on surfaces.	 Reduce thickness of drive pinion height adjusting shim in order to move drive pinion away from crown gear.
Toe contact (Inside end contact)	 Contact area is small. This may cause chipping at toe ends.	Adjust as for flank contact. 
Heel contact (Outside end contact)	Contact area is small. This may cause chipping at heel ends 	Adjust as for face contact.  171

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Slide Sequence

Slide Sequence

Tool List

Tool Number	Description
398527700	Oil Seal Bearing Race Pin
399780104	Preload Weight
498077000	Bearing Press Blocks
498077300	Center Differential Bearing Remover
498077400	Synchronizer Cone Remover
498247001	Magnetic Base for Dial Indicator
498255400	Magnet Base Plate
498427100	Stopper
498447100	Differential Side Seal Installer
498517000	Drive Pinion Bearing Replacer
498787100	Main Shaft Stopper
498937000	Transmission Main Shaft Holder
499277200	Bushing Installer
499747100	Clutch Disc Guide
499757002	Snap Ring Press
499785500	Backlash Wrench
499787000	Differential Side Bearing Retainer Wrench
499827000	Speedometer oil Seal Press
499857000	5th Driven Gear Remover
499877000	4-5 Race Installer
499917500	Drive Pinion Gauge Assembly
499927100	Trans Hand Crank
499937100	Trans Stand Set
499987003	Socket
499987300	Pinion Nut Socket
898938600	Main Shaft Holder
899524100	Differential Bearing Puller Set
899580100	Bearing Installer
899714110	Retainer
899754110	Main Shaft Press Tool
899858600	Retainer
899874100	Bushing Installer
899884100	Pinion Shaft Holder
899904100	Straight Pin Remover
899988608	Pinion Shaft Socket

Continued on next page

Tool List

Tool Number	Description
J-25070	Heat Gun
J-26900-7	Dial Caliper
SOA626215	Accent Ball Installer
SOA629389	Drive Pinion Installer
J-41510	Bell Housing Bolt Torx Bit

Manual Transmissions (201)

Service Bulletins

No.	Date	Title	Subject
03-45-90	01-22-90	Clutch cable adjustment (Revised procedure)	
03-46-90	04-03-90	First gear disengagement	
03-47-91	05-15-91	Clutch pedal assist spring falling off	
01-143-96	12-23-96	Recommended sealants and adhesives	
03-48-99	07-14-99	First gear popping out	
03-49-02	11-01-02	Popping out of reverse	
03-51-02R	05-01-03	Cold clutch judder (Revised bulletin)	
03-52-03R	07-15-03	Clutch pedal sticking (Revised)	
03-53-04	08-20-04	Transmission rear cross member	

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Tech TIPS

Date	Subject
07/95	Inspection of clutch free play during PDI
05/96	Outback gear ratios
10/96	Where's the hill holder?
11/96	Inspection of clutch free play during PDI
01/97	97 Legacy rear differential crossmember bracket noise and vibration
04/97	Rear differential modifications
07/97	All Subaru models with stepped and flat flywheels
07/97	Additional parts information on differential modifications
07/97	Identifying 1997 Subaru Legacy propeller shafts
10/97	'97 Legacy rear differential crossmember bracket noise & vibration
04/98	Rear differential vent oil leakage
09/98	M/T case boss wear
10/98	5MT popping out of first gear
02/99	Shifter rattle
03/99	All 1999 manual transmission vehicles
06/99	Transmission/rear differential gear ratios
01/00	Popping out of fifth gear
04/00	1999/2000MY manual transmission popping out of 1st gear
11/00	2001MY Outback H6-3.0 VDC precautions
8/02	Use of correct fluids
9-10/02	Parts supersession 2002MY Outback & Impreza first driven gear
05/03	Transmission popping out of 3rd gear


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SUBARU
TECHNICIAN


AUTOMOTIVE
Youth
Educational
Systems
YES
PROUD PARTNER