



Eaton® Transmission

Service Manual

ES(B)O-6X06
June 2024
Rev. 2

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1. General Information

Purpose and Scope of the Manual

This manual is designed to provide detailed information necessary to service and repair Eaton ES(B)O-6X06 transmissions.

How to Use this Manual

Disassembly and assembly instructions in this manual make use of a typical ESO-6106 transmission. Provided illustrations and pictures show parts that may differ from one transmission model to another, according to its application and serial number, but the procedure is the same.

In addition, it is also assumed in the manual that the transmission has been removed from the vehicle and the lubricant has been drained.

The manual has been divided into two main groups as follows:

1. General Information

This section contains information and technical references of the transmission such as Warnings, Precautions and Care in disassembly and assembly, Identification and Designation of Models, Gear Ratios, Tightening Torque and Sealants Specifications, Lubrication and Special Tools.

2. Operation

This section contains information on the transmission operation and functioning: Gear Shift Lever Diagram, Tips for the Driver, Power Flow and Troubleshooting.

3. Disassembly and Assembly

This section contains procedures for disassembling, assembling and adjusting the transmission components. At the beginning of this section, Exploded Views of the transmission are provided with the identification and description of each part, to make easy its visualization during the procedure.

To disassemble and assemble the transmission completely, carefully follow the instructions in this manual in its natural sequence, making use of the text, illustrations and pictures provided. Always observe the precautions and recommendations in the manual.

For more detailed information on product improvement, repair procedures and other subjects related to service, please contact:

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Rua Clark, 2061 - Caixa Postal 304
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NOTE: Eaton reserves the right to make modifications in its products and to change specifications included in this manual at any time without previous notice.

Warnings and Precautions



Before starting a vehicle always be seated in the driver's seat, place the transmission in neutral, set the parking brakes and disengage the clutch.

Before working on a vehicle place the transmission in neutral, set the parking brakes and block the wheels.

Before towing the vehicle, place the transmission in neutral, and lift the rear wheels off the ground, or remove the axle shafts, or disconnect the driveline to avoid damage to the transmission during towing.

The description and specifications contained in this service publication are current at the time of printing.

Eaton Corporation reserves the right to discontinue or modify its models and/or procedures and to change specifications at any time without notice.

Any reference to brand name in this publication is made as an example of the types of tools and materials recommended for use and should not be considered an endorsement. Equivalents may be used.



This symbol is used throughout this manual to call attention to procedures where carelessness or failure to follow specific instructions may result in personal injury and/or component damage.

Departure from the instructions, choice of tools, materials and recommended parts mentioned in this publication may jeopardize the personal safety of the service technician or vehicle operator.

WARNING: Failure to follow indicated procedures creates a high risk of personal injury to the servicing technician.

CAUTION: Failure to follow indicated procedures may cause component damage or malfunction.

NOTE: Additional service information not covered in the service procedures.

TIP: Helpful removal and installation procedures to aid in the service of this unit.

Always use genuine Eaton replacement parts.

Model Designation

All Eaton transmissions are identified by the model designation and serial number. This information is stamped on the identification plate fixed to the transmission case.

ES(B)O - 6X06 A

Eaton Fuller
Sincronizada
Overdrive

— Gear ratio

- Forward speeds

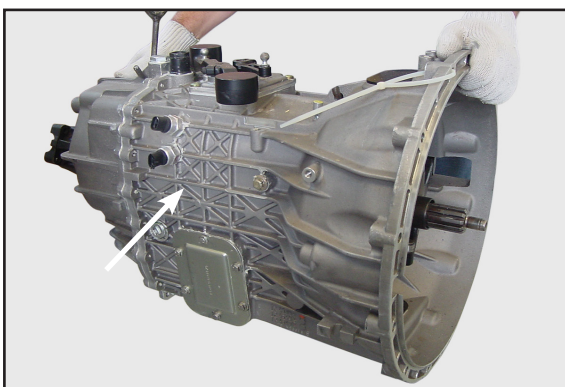
- Design level

- Nominal torque capacity (x100 N.m)

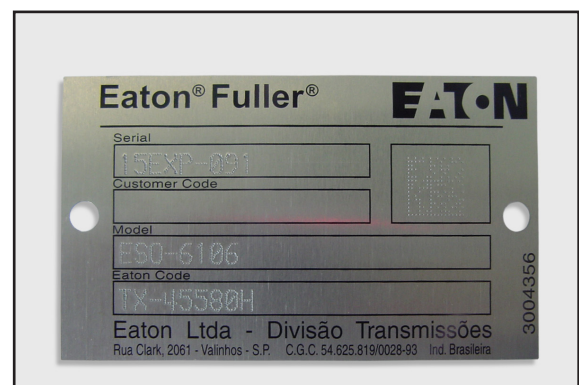


WARNING! Do not remove or destroy the transmission identification plate.

NOTE: When ordering replacement parts or calling for service support, please inform numbers found in the identification plate



5936



5908

		ES(B)O-6106/6206A		ES(B)O-6106/6206B	
Torque	N.m	600		600	
	Lb.ft	442		442	
		Z	Ratio	Z	Ratio
	Input Shaft (I)	29	1.52	29	1.52
	Countershaft (C)	44		44	
1st	Countershaft (C)	12	6.19	12	6.19
	Mainshaft (M)	49		49	
2nd	Countershaft (C)	17	3.39	17	3.39
	Mainshaft (M)	38		38	
3rd	Countershaft (C)	27	2.08	27	2.08
	Mainshaft (M)	37		37	
4th	Countershaft (C)	33	1.33	33	1.33
	Mainshaft (M)	29		29	
5th	Countershaft (C)	Direct	1.00	Direct	1.00
	Mainshaft (M)				
6th	Countershaft (C)	47	0.77	52	0.73
	Mainshaft (M)	24		25	
Reverse	Countershaft (C)	12	5.69	12	5.69
	Reverse Idle Gear (R)	29		29	
	Mainshaft (M)	45		45	

Z = Number of teeth

C = Countershaft

M = Mainshaft

R = Reverse idle gear

I = Input Shaft

Definition and Calculation

Gear ratio of a transmission speed is the relationship between the transmission's output and input speeds, with the said gear shifted. If the gear ratio is greater than 1, it means that the transmission's output speed is slower than the input speed and it is said that there is a reduction in the speed. On the other hand, if the gear ratio is less than 1, the transmission's output speed will be faster than the input speed and, in this case, it is said that there is an overdrive.

The gear ratio is calculated by dividing the number of teeth of the driven gear by the number of teeth of the driving gear of that specific speed and multiplying by the ratio of the input gear set.

Example:

Input gear ratio = $C \div I$ (input gear set) = $44 \div 29 = 1.52$

1st speed ratio = $M \div C$ (1st speed) $\times$ 1,52 (input gear set) = $49 \div 12 \times 1,52 = 6.19$

This means that the 1st speed gear ratio is 6.19:1 or, in other words, with the transmission shifted into the 1st speed, the engine (input shaft) makes 6.19 revolutions for every revolution of the transmission's output shaft. So, in 1st gear, there is a reduction in the output speed.

Lubrication

Proper lubrication procedure is the key to a good and complete maintenance program.

If the oil is not doing its job, or if the oil level is ignored, all the other possible maintenance procedures will not be enough to keep the transmission running or to assure a long transmission life.

Eaton transmissions are designed so that all the internal parts operate in an oil circulating bath, created by the motion of gears and shafts. Thus, all parts are properly lubricated if the following procedures are closely followed:

1. Maintain proper oil level by checking it regularly.
2. Change oil regularly following the maintenance interval chart.
3. Use the recommended grade and type of oil.
4. Buy the oil from a reputable dealer.

Oil change and level check

Periodic transmission oil change eliminates possible bearing failures, ring wear and seizures, since the products from normal wear in service (tiny metal particles), which circulate in the transmission oil, are harmful to these parts.

In addition, the oil changes chemically due to the repeated heating and cooling cycles of a transmission in use.

As a general guide, the following chart provides lubricant oils and maintenance interval recommendation for oil level check and oil change.



CAUTION! Always follow the vehicle manufacturer maintenance recommendation, which prevails over this chart.

	Lubricating Oil	Service Type	Oil Change Interval	Check oil level every
ES(B)O-6X06	• Chevron TGF SAE 80W90 API GL3 (Mineral) Ref. Eaton 300880 • Mobil Mobilube GX SAE 80W90 API GL4 (Mineral)	Regular	120,000 km or 12 months	10,000 km
		Heavy-Duty	60,000 km or 12 months	7,500 km
		Off-Highway	500 hours	50 hours
ESO-6X06	• Chevron Ursa MTF HD SAE 75W80 API GL4 (Synthetic) • Total Gear 9FE 75W80 (Synthetic) • Shell Spirax GXME S6 75W80 (Synthetic)	Regular	400,000 km or 36 months	10,000 km
		Heavy-Duty	180,000 km or 36 months	7,500 km
		Off-Highway	1,000 hours	50 hours

NOTE: Synthetic oils are only approved for transmissions applied to trucks.

NOTE:

- The oil must be changed on the recommended mileage or time interval, whatever occurs first.
- Daily, check the transmission for lubricant oil leaks and make the proper repairs when necessary.

Draining

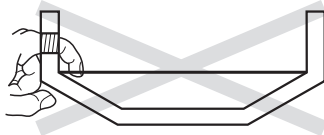
Drain transmission oil while the oil is warm.

To drain oil, remove the magnetic drain plug. Clean the drain plug before reinstalling it.

Refilling



Correct Oil Level



Incorrect Oil Level

6106/02

Oil level check

Before checking oil level, clean case area around filler plug and if necessary, add enough oil to maintain the proper oil level.



CAUTION! Do not mix lubricant of different types and brands, as this may cause incompatibility issues.

Clean case area around oil filler plug, remove the plug and refill the transmission until lubricant level is aligned with the bottom of the filler plug hole.

The amount of oil varies with the position of vehicle related to the ground and the installation angle of transmission. Before refilling, place vehicle on a flat and level surface.

NOTE: Do not add oil above the recommended level.

This will cause the oil to be forced out through the front bearing cover, shift lever housing cover, etc.

The correct application of adhesives (threadlockers) and sealing compounds (sealants) is important to assure a proper assembly and to avoid leakages.

Tightening capscrews, plugs and nuts to the proper torque is important to prevent them from loosening and to avoid oil leakage, assuring a long transmission life. Additionally, apply the recommended adhesive to the threads.



CAUTION! Always use a torque wrench to tighten fastenings to the specified torque.

The following table presents tightening torque and sealant recommendation for the transmission fastening elements and components.

In the table, the item number corresponds to the number of the component in the exploded views included in this manual. Please refer to the exploded views to identify the item in the table.

Item	Description	Torque N.m (Lb.ft)	Remarks
Remote Control Tower Assy.			
4	M6x20 Allen screw, external shift and selection levers	9-11 (6-8)	
4	M6x20 Allen screw, pivot bearing	17-20 (13-15)	
5	Cover		Apply Dow Corning 780 sealant onto the contact face
7	M8x1.25 Shift pin	15-19 (11-14)	
9	M8x25 Torx screw	19-26 (14-19)	
Shift Yokes and Rails			
34	M8x18.5 Torx screw	38-44 (28-32)	Apply Loctite 262
53	M14x1.5 Plug	19-26 (14-19)	Apply Loctite 262
Front Case Assy.			
70	Front case		Apply Dow Corning 780 sealant onto the contact face with the rear case
71	M12x1.0 Pivot pin	19-26 (14-19)	Apply Dow Corning 780 sealant onto the thread and contact face*
72	3/4"-14 NPTF Oil fill plug	36-40 (26-29)	Apply Loctite 570 (Eaton E677)
73	1/8"-27 NPTF Breather	6-10 (4-7)	
74	M18x1.5 fpp Reverse speed switch	19-26 (14-19)	Apply Dow Corning 780 sealant onto the thread and contact face*
77	M27x2 Gear select actuator	28-32 (20-23)	Apply Dow Corning 780 sealant onto the thread
80	M6x1.0 Oil intake screw	6-9 (4-6)	
81	M8x25 Capscrew	19-26 (14-19)	Apply Dow Corning 780 sealant onto the contact face*
83	M6x25 Allen screw	11-14 (8-10)	
85	M10x1.5 Cable bracket screw	19-26 (14-19)	
88	M8x25 Screw	19-26 (14-19)	

* Apply sealant onto the contact surface of bolts and plugs with the transmission case.

Item	Description	Torque N.m (Lb.ft)	Remarks
Front Case Assy. (continued)			
89	PTO cover		Apply Dow Corning 780 sealant onto the contact face with the case
90	M10x16 PTO cover screw	29-35 (21-25)	Criss-cross tightening pattern
91	3/4"-14 NPTF Oil drain plug	36-40 (26-29)	Apply Loctite 570 (Eaton E677)
94	M6x1.25 Screw	12-15 (8-11)	
98	M8x16 Bolt	17-19 (13-14)	
99	M8x40 Capscrew	19-26 (14-19)	Apply Dow Corning 780 sealant onto the contact face*
Rear Case Assy.			
110	Rear case		Apply Dow Corning 780 sealant onto the contact face with the front case
113	Shift actuator	28-32 (20-23)	Apply Dow Corning 780 sealant onto the contact face*
115	M8x25 Screw	19-26 (14-19)	Apply Dow Corning 780 sealant onto the contact face*. Criss-cross tightening pattern.
116	M8x40 Capscrew	19-26 (14-19)	Apply Dow Corning 780 sealant onto the contact face*. Criss-cross tightening pattern.
119	Output yoke washer		Apply Dow Corning 780 sealant onto the contact face with the yoke and bolt
120	M16x55 Output yoke bolt	109-122 (80-89)	
121	Neutral switch	19-26 (14-19)	Apply Dow Corning 780 sealant onto the thread and contact face*
123	M8x20 Screw	15-26 (11-19)	
124	Speedometer sensor	14-20 (10-15)	Apply Dow Corning 780 sealant onto the contact face*
125	Reverse idle gear cover		Apply Dow Corning 780 sealant onto the contact face with the case
126	M6x14 Reverse idle gear cover bolt	12-15 (8-11)	

* Aplicar selante na superfície de encosto dos parafusos e bujões com a carcaça da caixa de mudanças.

Recommended threadlocker and sealant

Threadlockers:

- Loctite 262
- Loctite 570 (Eaton E677)

Adhesive and Sealants:

- Dow Corning 780

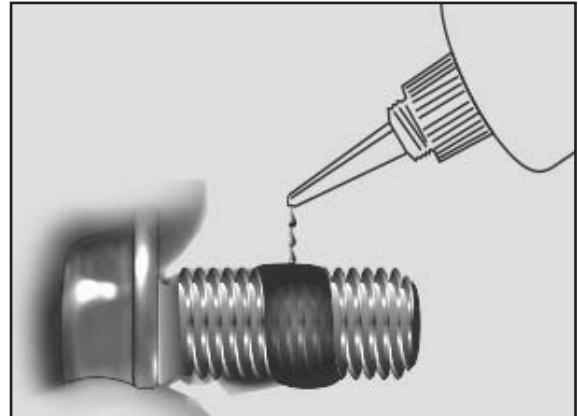
Chemical adhesives can fulfill more than one function:

1. Thread locking, which prevents loose screws by vibration or improper torque.
2. Screw lock and seal, preventing loose screws while ensuring that no lubricant leakage will occur through the holes.
3. Sealing between matching surfaces, replacing gaskets made of other materials and reducing the number of spare parts.

Applying threadlockers onto bolts and plugs

To apply properly:

- Remove all traces of adhesive in the threaded hole. Clean up threads with a tap and remove cutting chips with compressed air.
- Clean the screw and its hole with alcohol. Wait for the alcohol to dry on the screw and apply compressed air into the hole to dry it completely.
- Apply adhesive (threadlocker) on the screw thread in the central area that will be housed into the threaded hole, covering 3 or 4 fully continuous fillets to ensure that no leakage will occur.



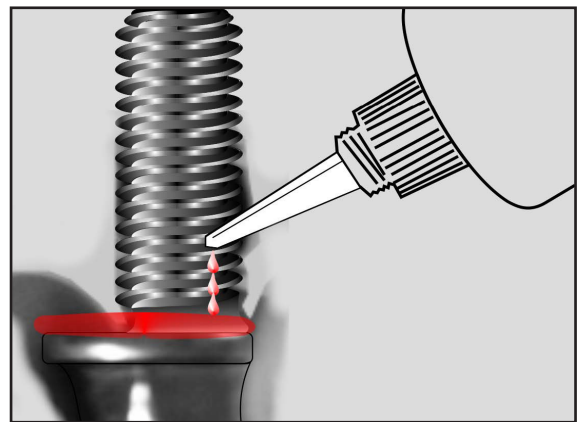
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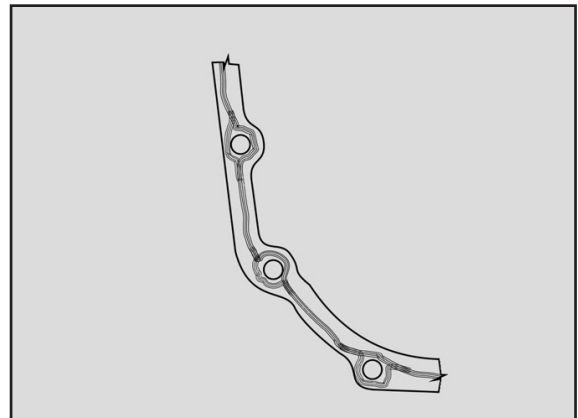
WARNING! Always use safety glasses and hearing protection when using compressed air.

Applying sealant onto the matching surfaces

- The surfaces that will receive the application of sealant or adhesive must be perfectly clean and free of oil or oxidation and must not contain particles that could damage the seal. Thoroughly clean signs of old sealant and dirt from surfaces.
- When recommended, apply sealant onto the bolt and plug contact surface with the transmission case or covers.
- On the contact surface of transmission cases, apply a continuous sealant string along the surface and around the capscrew holes and dowel pins.
- Dow Corning 780 sealant cannot remain exposed to the air for more than 15 minutes; perform the parts assembly within this time.



2106-17



2106-18

Precautions during disassembly and assembly



In order to prevent damage to transmission parts during initial gear movement, it is important when assembling the transmission, to lubricate gear bearings, needle roller bearings, non sealed bearings and all other parts under friction conditions, with the same transmission lubricant oil.

Multi Purpose Grease

Where specified Multi Purpose Grease use a NLGI 2 lithium based grease with dropping point at 177°C minimum.

Cleaning and handling

In order to completely clean the parts, wash them into a bath of solvent (kerosene, for instance), moving every part up and down slowly until all the old lubricant and foreign material have been dissolved.



Care must be taken to avoid skin rashes, fire hazard and vapor inhalation when using solvents.

Non sealed bearings

Immerse the bearings in clean solvent. Move them up and down slowly in order to loosen the deposits. Dry the bearings by means of moisture free compressed air. Repeat the operation until the bearings are thoroughly clean.



Never drive the air jet directly to bearings in order to rotate them in high speed. That can damage bearings.

Synchronizer assemblies

Avoid bad handling of synchronizer assemblies. Either drops or bumps when disassembling or assembling may cause them to lock.

Housings

Clean interior and exterior of cases, covers, etc., thoroughly. Cast parts may be cleaned in weak alkaline solution baths (we recommend a 7% soluble degreasing oil solution). The parts are to remain in the bath for the time it takes to become completely clean. The parts cleaned in alkaline solutions should be rinsed with clean water to remove any alkaline trace after cleaning process.



Care must be taken to avoid vapor inhalation and skin rashes when using alkaline solutions. Every cleaned part must be totally dried at once by means of moisture free compressed-air, or else, by means of a lint free soft cloth, not containing any abrasive material such as metal filings, contaminated oil or polishing compounds.

Inspection

A thorough and careful inspection of each part is very important for the transmission life. The replacement of parts showing either wear or fatigue will avoid future expensive and foreseen failures.

Gears, shafts and synchronizer assemblies

Check carefully gear teeth for wear, pitting, chipping and cracks. If gear teeth show areas where the case hardening is worn through or cracked, the gear should be replaced.

Check shafts for warping and excessive wear or damaged splines.

Cases, covers, etc.

Make sure cases, covers, etc. are completely clean and that mounting surfaces and bearing bores are free from nicks or burrs. Check carefully every part for cracks, excessive wear or for any other condition that may cause oil leak or a future failure.

Needle roller bearings

Check carefully every needle roller for wear, pitting, cracks or spalled areas to determine whether they are suitable for reuse or replacement. After inspection, dip the needle roller bearings in an oil bath and then wrap them in a lint-free cloth or paper, so as to protect them until they are ready for assembling.

Parts replacement

When replacement is necessary, use only genuine Eaton transmission parts to assure continued performance and extended life from the transmission. The use of either non-genuine or remanufactured parts, besides have not the factory's warranty, may lead to severe damage of the unit.

Since the cost of a new part is generally a small fraction of the total cost of downtime and labor, do not reuse a questionable part which could lead to additional repairs and expense soon after assembly.

To aid in determining the reuse or replacement of any transmission part, consideration should also be given to the unit's history, mileage, application, etc.



Oil seals and snap rings

Any oil seal, snap ring, etc. damaged during maintenance, should be replaced by a new one. Replacement of oil seals and snap rings is cheaper when unit is disassembled than a premature overhaul to replace these parts in a future time.

An oil leakage through a worn seal may result in failures of other more expensive components of the transmission. The sealing elements should be handled carefully, particularly during assembly. Cuts, scratches or rolled up seal lips decrease the sealing efficiency.

NOTE: *When assembling the transmission, apply petroleum jelly onto oil seal lips.*

Special Tools

Throughout this manual, several transmission maintenance procedures are performed using special tools specifically recommended for this purpose.

These special tools are required for properly servicing the transmission and its use will prevent damages to the transmission and its components.

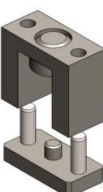
In addition, the use of these tools is important to prevent personal injuries and to preserve the safety of the mechanic.

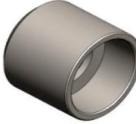
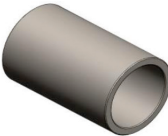


WARNING! Following the disassembly and assembly instructions and using the recommended special tools in this manual are important to prevent personal injuries and/or damage to the transmission and its components.

Special tools can be ordered directly from the approved manufacturer:

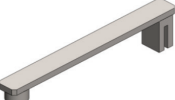
Especifer Industria e Comércio de Ferramentas Ltda.
 Av. Horst Frederico João Heer, 1945 - Galpão B
 Europark Comercial - CEP 13348-578
 Indaiatuba, São Paulo - Brazil
 Phone: +55 19 3936-9797
www.especifer.com.br

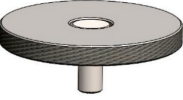
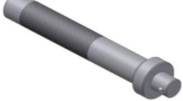
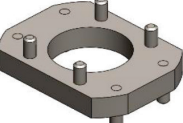
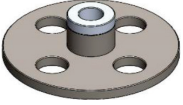
Ref. #	Tool	Description
EEA-17004		Installer, input shaft and countershaft bearings
EEA-17006		Long driver
EEA-17023		Installer, clutch release fork bushing
EEA-17024		Installer, clutch release fork rollers

Ref. #	Tool	Description
EEA-17025		Installer, clutch release fork shaft-bearing assembly
EEA-17026		Installer, pocket bearing
EEA-17027		Installer, mainshaft rear bearing
EEA-17028		Installer, mainshaft rear bearing cup (use with EEA-17501)

Ref. #	Tool	Description
EEA-17029		Installer, countershaft gears
EEA-17031		Installer, input shaft bearing cup (use with EEA-17501)
EEA-17032		Installer, countershaft bearing cups (use with EEA-17501)
EEA-17033		Installer, rear case oil seal (use with EEA-17501)
EEA-17103		Puller spindle
EEA-17107		Puller, bearing cups (use with EEA-17144)
EEA-17110		Front and rear seal puller. Optional device, used to remove seals to analyze leak complaints. For its use, see document Q-PR-54009-U.
EEA-17125		Impact slide hammer
EEA-17128		Puller, input shaft bearing cone

Ref. #	Tool	Description
EEA-17129		Puller, pocket bearing (use with EEA-17103)
EEA-17131		Puller, mainshaft bearing and gear
EEA-17132		Puller, countershaft 4th speed gear
EEA-17133		Puller, countershaft 3rd speed gear
EEA-17134		Puller, countershaft bearings (use with EEA-17103)
EEA-17135		Puller support, mainshaft rear bearing cup (use with EEA-17136)
EEA-17136		Puller, bearing cups
EEA-17137		Puller adapter, countershaft bearing cup (use with EEA-17136)
EEA-17138		Puller adapter, mainshaft bearing cup (use with EEA-17136)
EEA-17139		Puller, bearing cups

Ref. #	Tool	Description
EEA-17140		Puller, main shift rail (use with EEA-17125)
EEA-17141		Puller adapter, re- verse idle gear shaft (use with EEA-17142)
EEA-17142		Puller, reverse idle gear shaft
EEA-17144		Puller beam and spindle (center bolt), puller for bearing cups (use with EEA- 17107)
EEA-17200		Stand, transmission
EEA-17203		Stand mounting plate, transmission (use with EEA-17200)
EEA-17402		Jig, control cable adjustment
EEA-17403		Device, countershaft end play measurement
EEA-17404		Lever, end play measurement

Ref. #	Tool	Description
EEA-17405		Dial indicator base
EEA-17406		Support, mainshaft end play measurement
EEA-17501		Driver
EEA-17503		Device to block mainshaft
EEA-17504		Device to block mainshaft (use with EEA-17503)
EEA-17505		Support for workbench, disassembly and assembly of transmission shafts assembly
EEA-17506		Support for workbench

Gear Shift Lever Pattern and Tips to the Driver

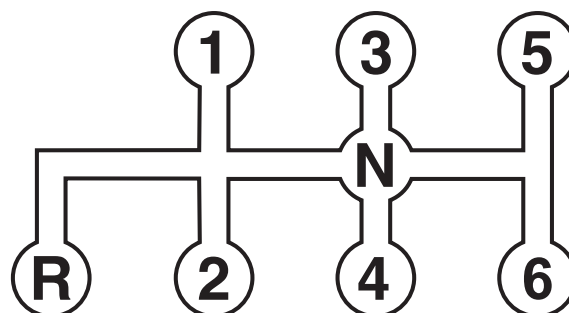
2. Operation

Gear Shift Lever Pattern

ES(B)O-6X06 transmissions have six forward synchronized speeds and one reverse speed.

To shift into speeds, follow the shift pattern shown in the diagram.

An interlocking device prevents from accidental transmission shifting from 1st to reverse gear. To shift into the reverse gear, put shift lever at the position, push it down and complete the shifting.



ESO-6106/6206/03

Tips for the Driver

Always use the clutch to change gears. The incorrect use of the clutch may cause premature failures of the synchronizer assembly.

Always select a starting gear that will provide sufficient power (torque) for the vehicle's working condition (terrain and load).

Never slam or jerk the gear shift lever to complete gear shifting.

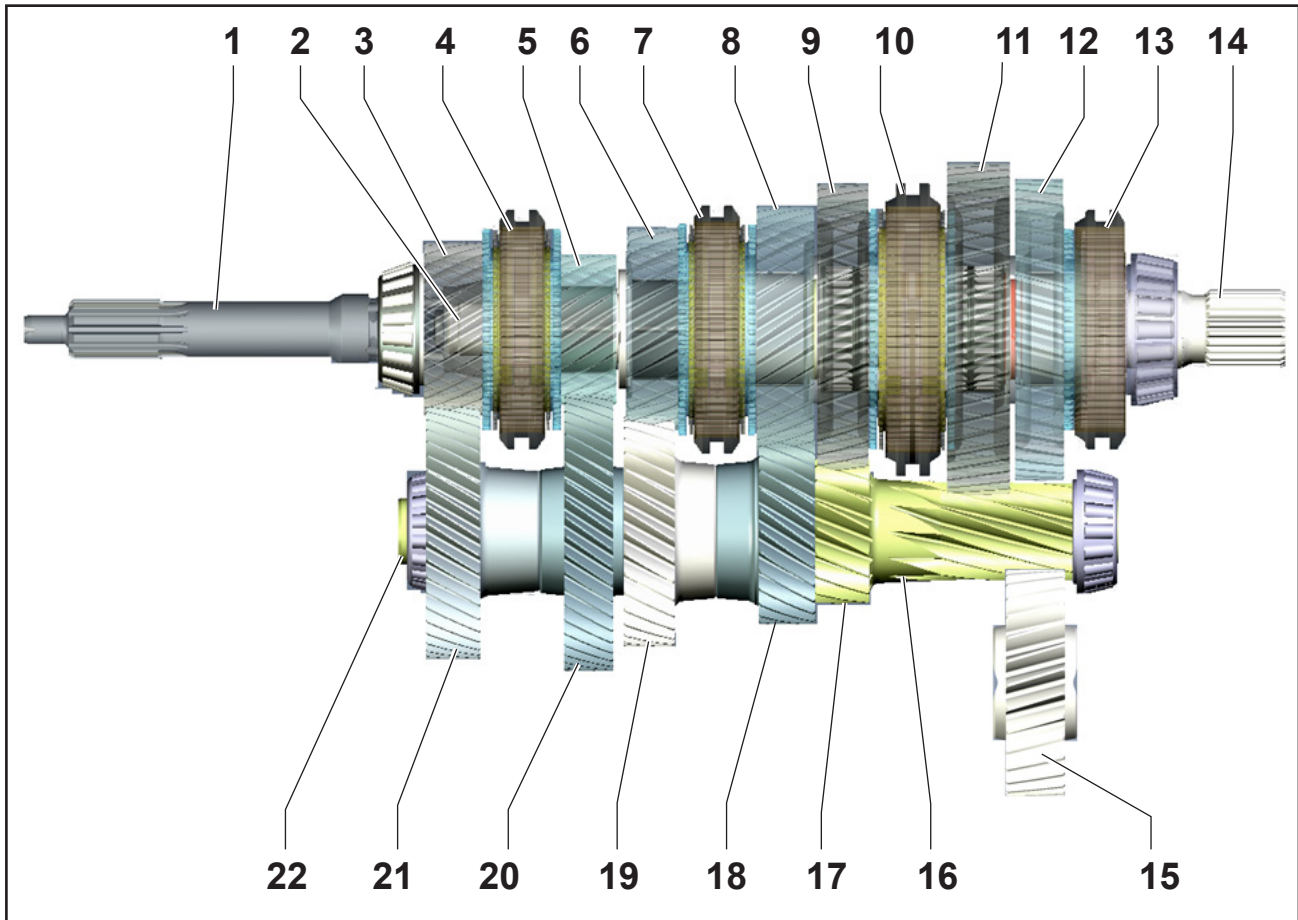
Never leave the shift lever in the neutral position when going downhill.

Power Flow

The transmission must efficiently transfer the engine's power or torque to the vehicle's driveline.

It is essential to know what takes place in the transmission during torque transfer when troubleshooting or making repairs.

Gears and Synchronizers Identification

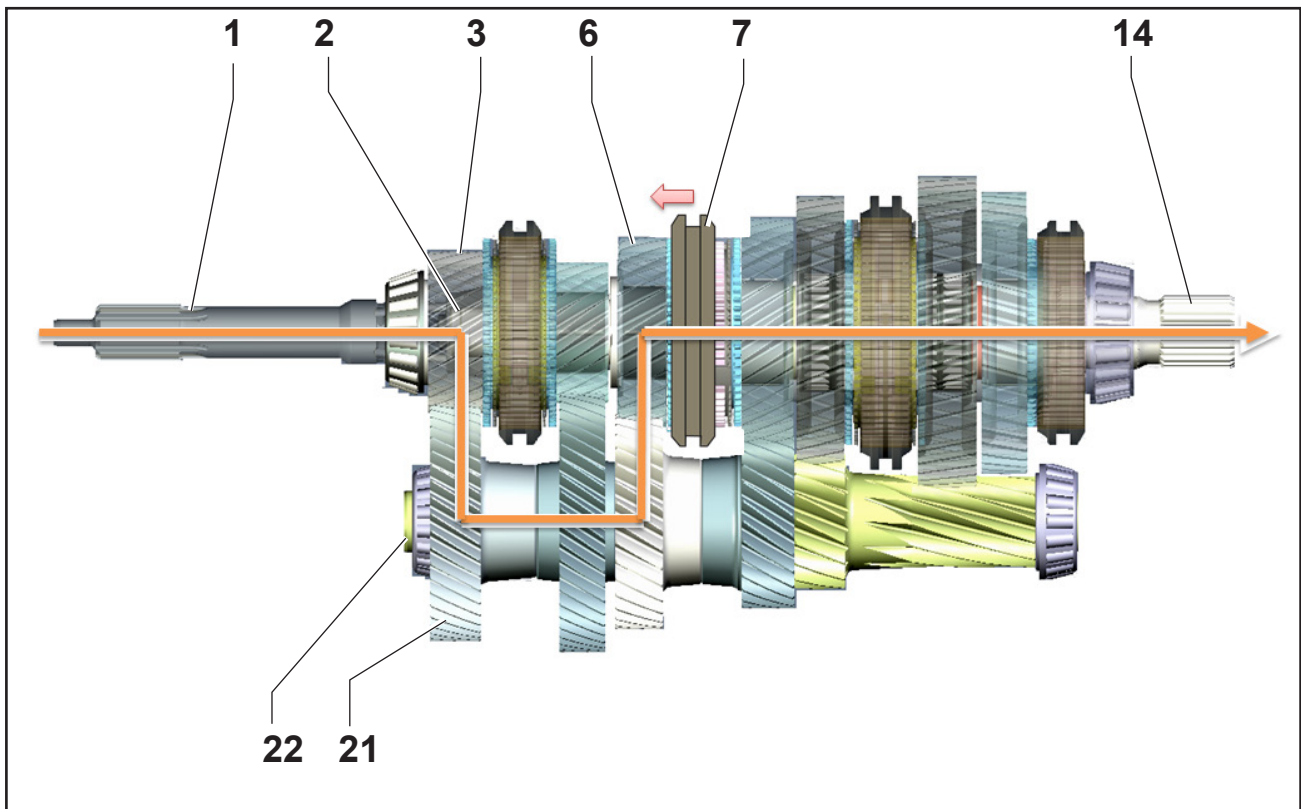


ESO-6106/6206/fluxo

- | | |
|--------------------------------------|---|
| 1. Input shaft | 12. Mainshaft reverse speed gear |
| 2. Mainshaft "pocket" bearing cone | 13. Reverse speed sliding clutch |
| 3. Input shaft drive gear | 14. Mainshaft |
| 4. 5th/6th speed synchronizer assy. | 15. Reverse Idle gear |
| 5. Mainshaft 6th speed gear | 16. Countershaft 1st/reverse speed gear |
| 6. Mainshaft 4th speed gear | 17. Countershaft 2nd speed gear |
| 7. 3rd/4th speed synchronizer assy. | 18. Countershaft 3rd speed gear |
| 8. Mainshaft 3rd speed gear | 19. Countershaft 4th speed gear |
| 9. Mainshaft 2nd speed gear | 20. Countershaft 6th speed gear |
| 10. 1st/2nd speed synchronizer assy. | 21. Countershaft driven gear |
| 11. Mainshaft 1st speed gear | 22. Countershaft |

How the transmission works

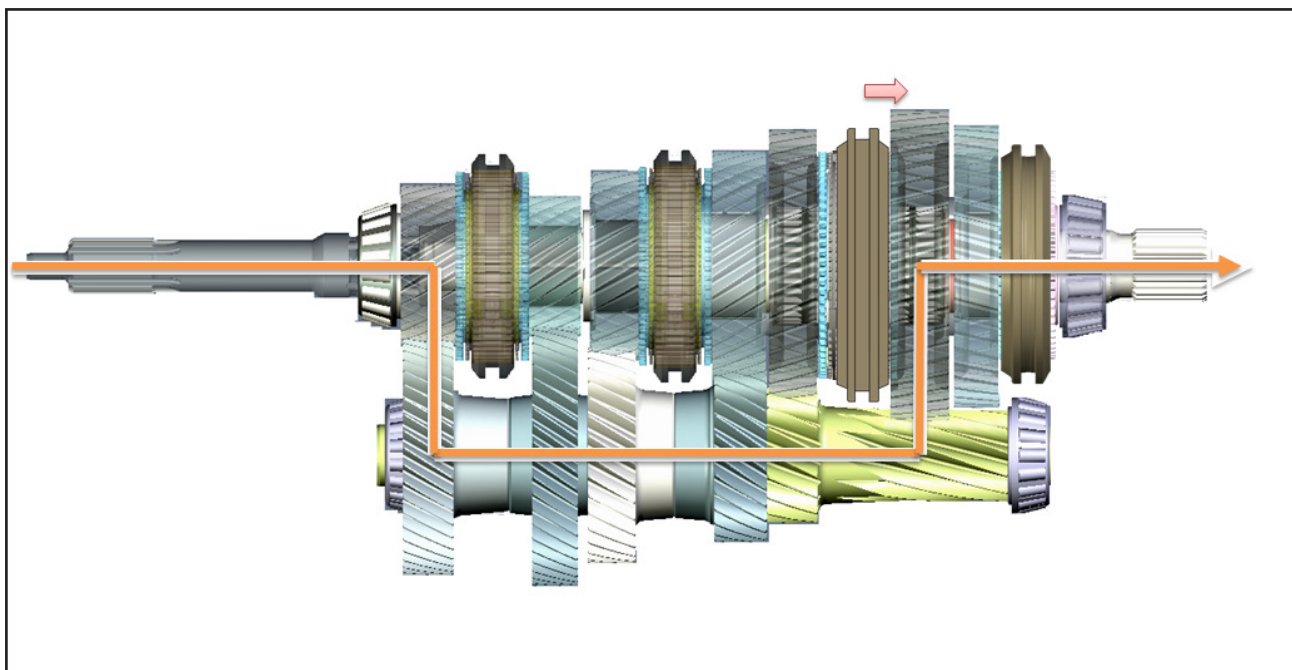
1. Torque from the engine is transferred, through the clutch, to the transmission's input shaft (1). The direction of the rotation is the same as of the engine, always clockwise.
2. From the input shaft (1), the torque is transferred to the countershaft driven gear (21) through the input shaft drive gear (3), performing the first reduction in the transmission. All gears on the countershaft (22) rotate attached to this shaft at the same speed and the direction of the rotation is counterclockwise.
3. The input shaft (1) rotates apart from the mainshaft (14) in order to transmit power to the countershaft (22) independently of the mainshaft. Between these two shafts there is a conical bearing (2) known as "pocket", installed on the mainshaft end and supported on the input shaft, what allows both shafts to rotate at different rotation speeds.
4. The torque along the countershaft (22) is transmitted to all the gears of the mainshaft (14), assembled on needle roller bearings. Each gear on the mainshaft rotates at a different speed, according to the gear ratio of that specific shifted speed (see Gear Ratio table in the General Information section).
5. When a forward speed is shifted (the example in the figure shows the 4th speed), the torque is transferred to the mainshaft (14) by the corresponding gear (6) of that shifted speed, through the synchronizer (7) spline that is actuating. At this point, the second reduction occurs inside the transmission. In the forward speeds, the direction of rotation of the main axis is always clockwise.



ESO-6106/6206/fluxo4

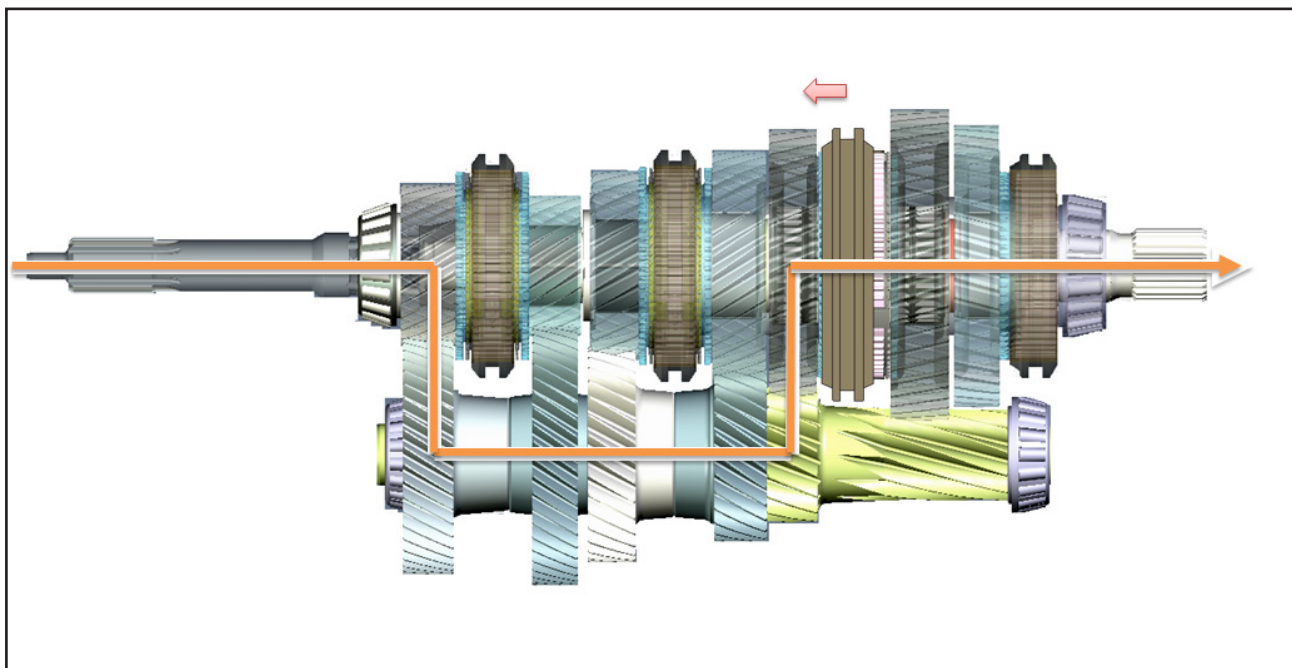
- | | |
|------------------------------------|-------------------------------------|
| 1. Input shaft | 7. 3rd/4th speed synchronizer assy. |
| 2. Mainshaft "pocket" bearing cone | 14. Mainshaft |
| 3. Input shaft drive gear | 21. Countershaft driven gear |
| 6. Mainshaft 4th speed gear | 22. Countershaft |

1st Speed



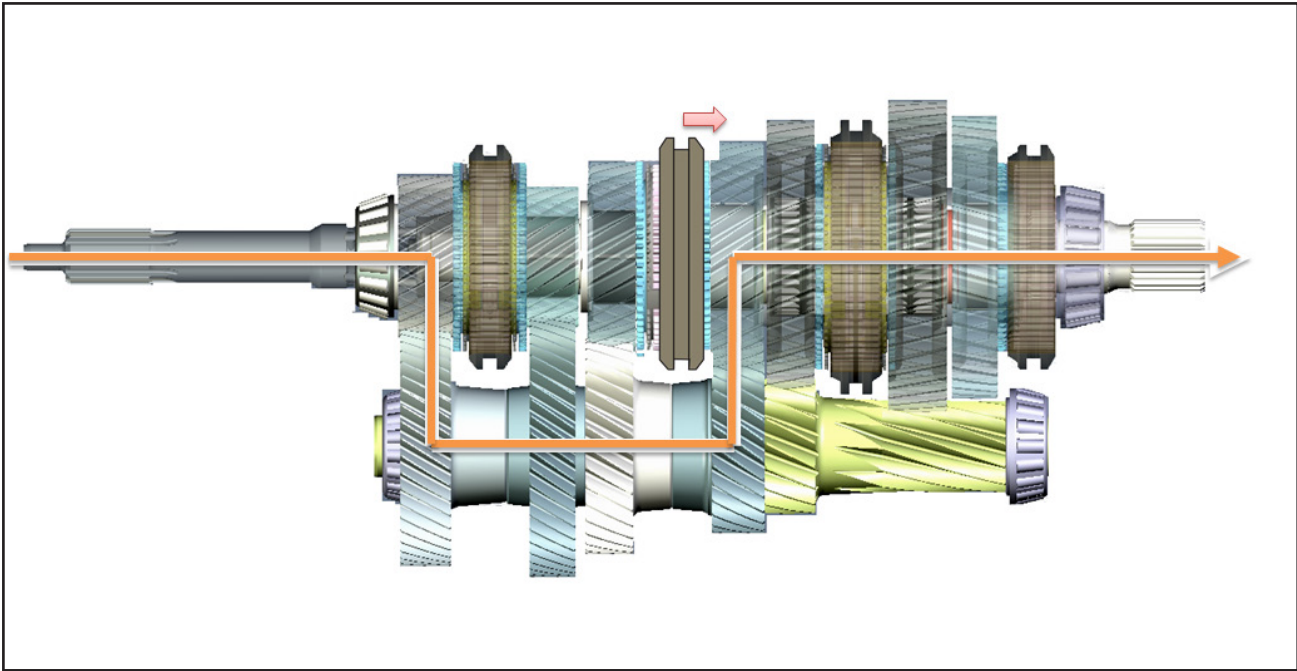
ESO-6106/6206/fluxo1

2nd Speed



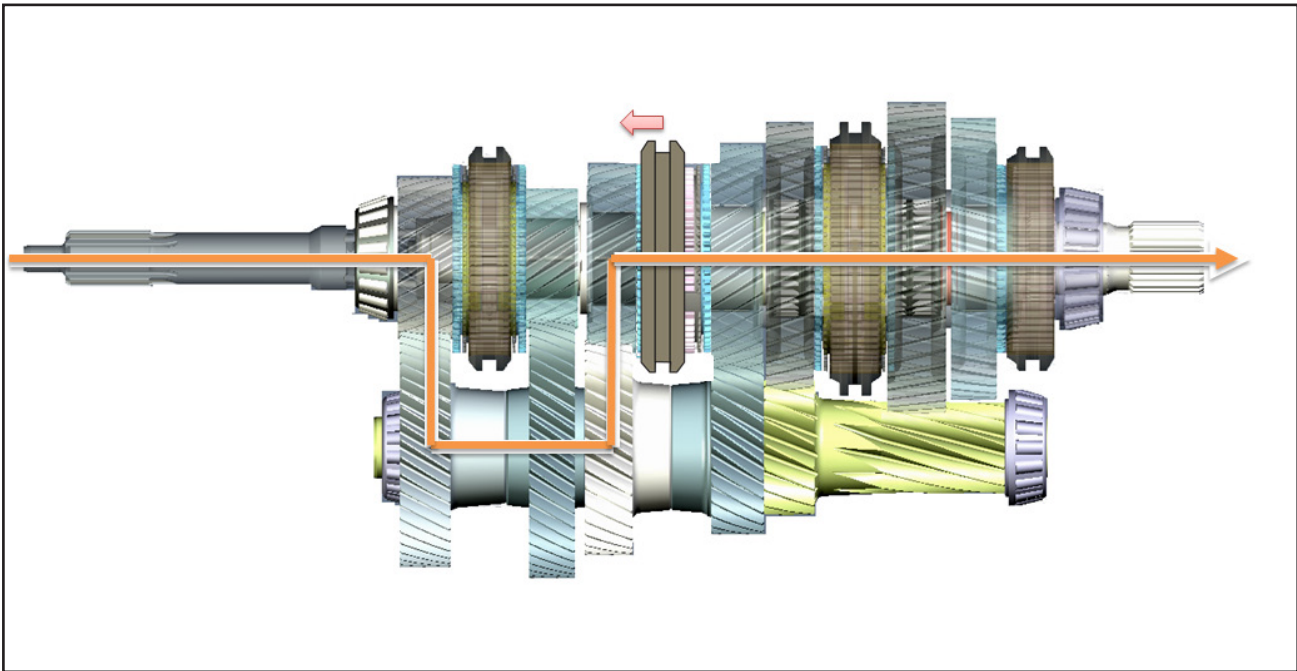
ESO-6106/6206/fluxo2

3rd Speed



ESO-6106/6206/fluxo3

4th Speed

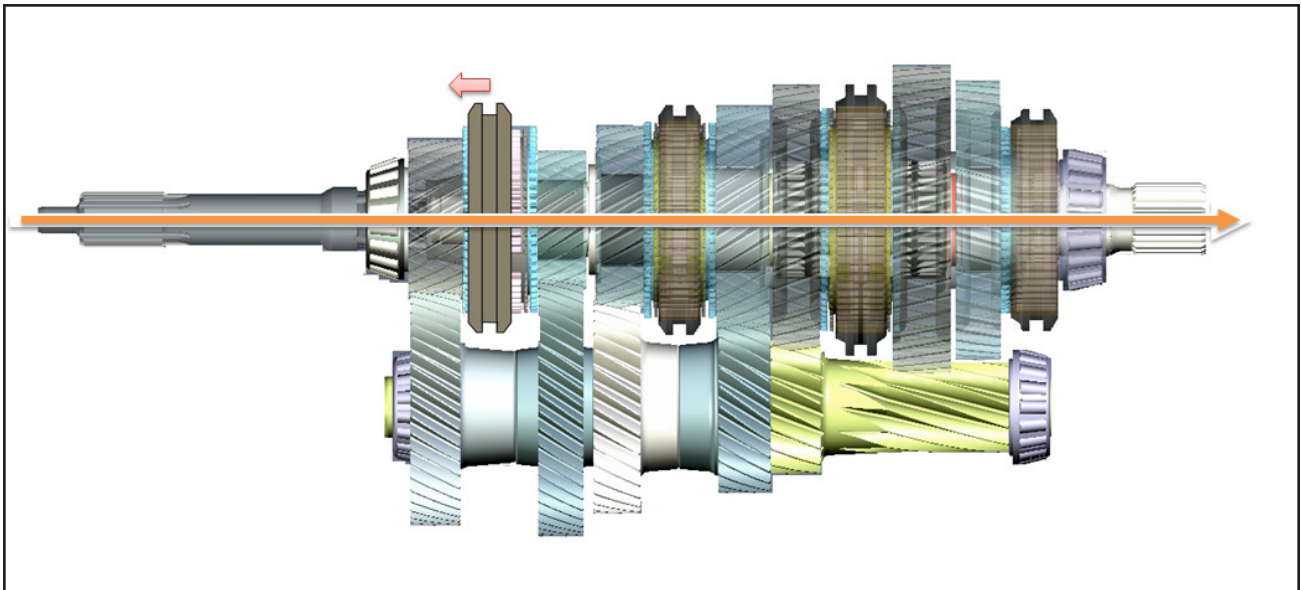


ESO-6106/6206/fluxo4

5th Speed

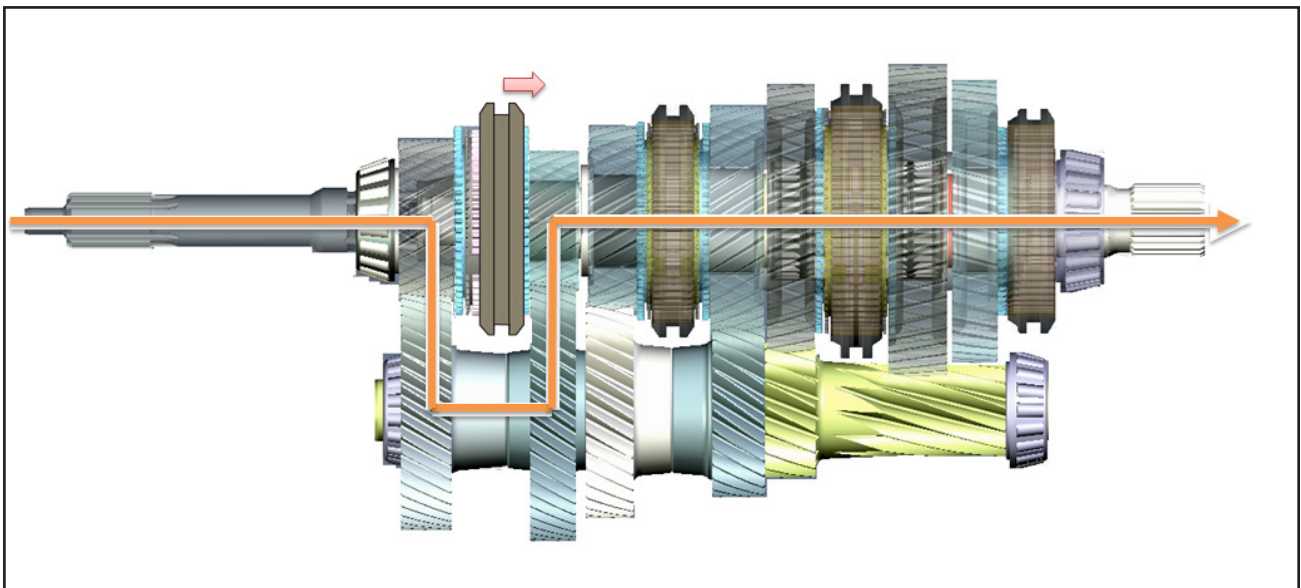
The 5th speed in this transmission is a direct drive speed. This designation is due to the fact that in this speed the input shaft, although it drives the countershaft together, transfers the engine torque directly to the mainshaft, without any gear reduction.

The coupling teeth of the pilot shaft mesh with the coupling teeth of the 5th speed synchronizer which, in turn, transfers the torque to the mainshaft. Everything happens as if it were a single shaft.



ESO-6106/6206/fluxo5

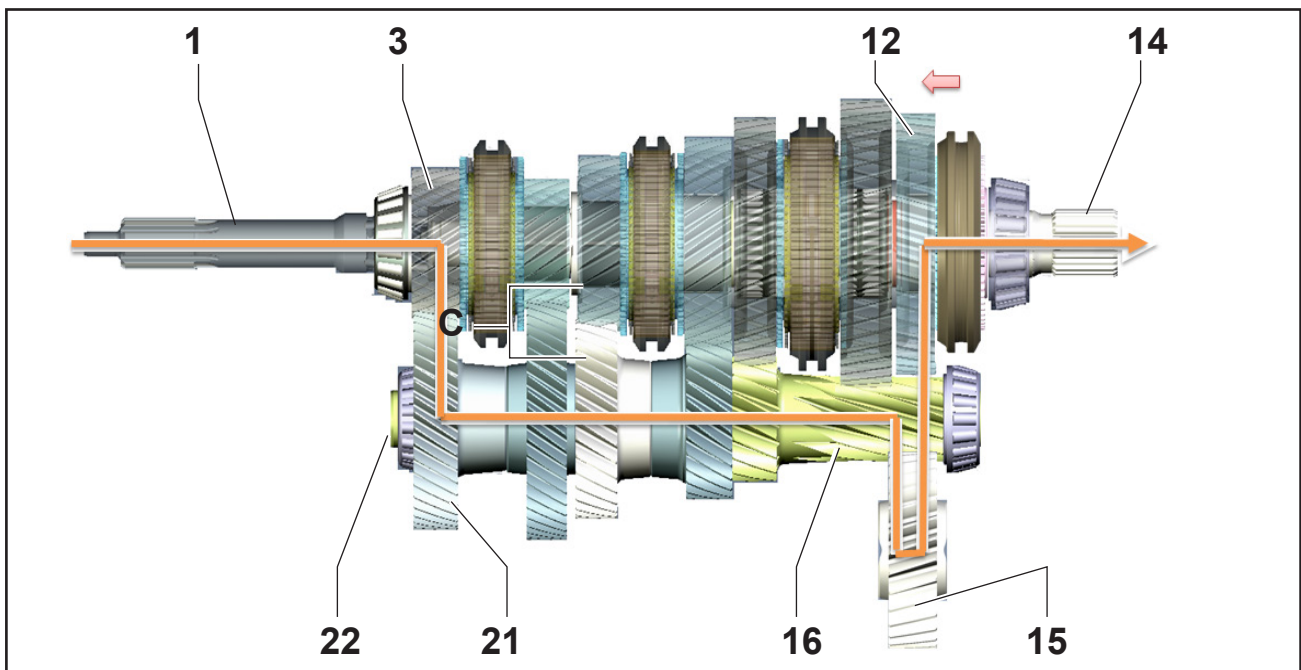
6th Speed



ESO-6106/6206/fluxo6

Reverse Speed

1. When the reverse speed gear is shifted, the torque is transferred from the input shaft (1) to the countershaft (22) performing the first reduction (3 and 21 gear set) of the reverse speed.
2. After that, the torque is transferred from countershaft (22), through the countershaft gear (16) to the reverse idle gear (15), performing the second reduction (16 and 15 gear set) of this speed, and finally, the torque is transferred from the reverse idle gear (15) to the mainshaft reverse gear (12), performing the third reduction (12 and 15 gear set) of the reverse speed.
3. As a result of the reverse idle gear (15) in this engagement, the rotation of the mainshaft (14) in the reverse speed is counterclockwise. This way, the rotation to the wheels is inverted and the vehicle can go backward.



ESO-6106/6206/fluxo-re

- | | |
|----------------------------------|---|
| 1. Input shaft | 15. Reverse Idle gear |
| 3. Input shaft drive gear | 16. Countershaft 1st/reverse speed gear |
| 12. Mainshaft reverse speed gear | 21. Countershaft driven gear |
| 14. Mainshaft | 22. Countershaft |

The following chart presents some transmission malfunctions with their most common causes and possible solutions.

Problem	Probable cause	Possible solution	Reference
Transmission noise when in neutral	Incorrect idle speed adjustment	Adjust idle speed	Instructions on vehicle's manual
	Improper or damaged clutch disc	Replace disc	Instructions on vehicle's manual
	Loose or damaged engine or transmission mounts	Replace and/or tighten mounts	Instructions on vehicle's manual
	Worn or damaged yoke	Replace yoke	Instructions on vehicle's manual
	Warped or unbalanced drive shaft	Repair or replace drive shaft	Requires specific procedure
	Low lubricant level	Fill with recommended oil to the proper level	Recommended lubricant
	Contaminated lubricant	Drain and clean transmission and refill with recommended oil	Recommended lubricant
	Worn or damaged gears and/or bearings	Replace damaged parts	Instructions on this manual
	Misalignment due to loose tightening capscrews	Retighten capscrews	Instructions on this manual
Transmission noise with shifted gears	Improper or damaged clutch disc	Replace disc	Instructions on vehicle's manual
	Low lubricant level	Fill with recommended oil to the proper level	Recommended lubricant

Problem	Probable cause	Possible solution	Reference
Transmission noise with shifted gears (continued)	Worn or damaged flywheel bushing or bearing	Replace damaged parts	Instructions on vehicle's manual
	Vibration from other vehicle components (drive shaft, mounts, yoke)	Verify and repair as per vehicle's manual	Instructions on vehicle's manual
	Misalignment between engine and transmission	Realign	Instructions on vehicle's manual
	Worn or damaged gears and/or bearings	Replace damaged parts	Instructions on this manual
	Warped main shaft or countershaft	Replace warped shaft	Instructions on this manual
Hard shifting	Malfunction of clutch (not releasing)	Verify and adjust clutch driving system	Instructions on vehicle's manual
	Wrong adjustment of clutch pedal	Adjust pedal stroke	Instructions on vehicle's manual
	Worn or damaged flywheel bushing or bearing	Replace damaged parts	Instructions on vehicle's manual
	Improper lubricant	Drain and refill with recommended oil	Recommended lubricant
	Low lubricant level	Fill with recommended oil to the proper level	Recommended lubricant
	Worn or damaged gear shift lever components	Replace damaged parts	Gear shift lever housing

Problem	Probable cause	Possible solution	Reference
Hard shifting (continued)	Worn or damaged synchronizer rings	Replace rings	Synchronizer assemblies
	Excessively worn or damaged synchronizer assemblies (keys, sleeve or hub)	Replace synchronizer assemblies	Synchronizer assemblies
	Improper adjustment of synchronizer assemblies sleeve or hub	Readjust synchr assemblies	Synchronizer assemblies
	Worn or damaged shifting system components (yokes, nylon pads, bars, shift blocks)	Replace damaged parts	Instructions on this manual
	Improper end play on mainshaft or countershaft	Adjust end play	Mainshaft and countershaft end play adjustment
Gear shift rubbing	Malfunction of clutch (not releasing)	Verify and adjust clutch driving system	Instructions on vehicle's manual
	Wrong adjustment of clutch pedal stroke	Adjust pedal stroke	Instructions on vehicle's manual
	Malfunction of clutch driving gsystem	Verify and adjust system	Instructions on vehicle's manual
	Worn or damaged flywheel bushing or bearing	Replace damaged parts	Instructions on vehicle's manual
	Incorrect idle speed adjustment	Adjust idle speed	Instructions on vehicle's manual

Problem	Probable cause	Possible solution	Reference
Gear shift rubbing (continued)	Worn or damaged synchronizer rings	Replace rings	Synchronizer assemblies
	Worn or damaged gear clutching teeth	Replace gear	Instructions on this manual
	Worn shift yokes nylon pads	Replace nylon pads	Shift bars
Transmission slips out of gears	Misalignment between engine and transmission	Realign	Instructions on vehicle's manual
	Incomplete gear shifting	Shift gear properly	Instructions on this manual
	Excessive vibration on gear shift lever due to loose or damaged engine or transmission mounts	Replace and/or tighten mounts	Instructions on vehicle's manual
	Gear shift lever console out of position, forcing the lever	Adjust console	Instructions on vehicle's manual
	Worn or damaged synchronizer assemblies	Replace synchronizer assemblies	Synchronizer assemblies
	Excessive axial clearance on main shaft gears	Adjust clearance	Mainshaft end play adjustment
	Worn or damaged clutching gear teeth	Replace gear	Instructions on this manual
	Worn or damaged shifting system (gear shifting lever housing, yokes, bars, etc.)	Replace damaged parts	Instructions on this manual

Problem	Probable cause	Possible solution	Reference
Oil leak	Lubricant above proper level	Correct to proper level	Recommended lubricant
	Clogged breather	Verify and unclog breather	
	Worn or damaged oil seals	Replace damaged seals	Instructions on this manual
	Housing capscrews not properly tightened or lack of sealant	Reassemble with proper sealant and tightening torque	Instructions on this manual
	Cracked housing or covers	Replace or repair damaged parts	Requires specific procedure
	Warped or damaged mounting surfaces of housings and covers	Replace or repair damaged parts	Requires specific procedure
Bearings failures	Low lubricant level	Fill with recommended oil to the proper level	Recommended lubricant
	Contaminated or not recommended lubricant	Drain and clean transmission and refill with recommended oil	Recommended lubricant
	Improper assembly of transmission components	Reassemble transmission	Instructions on this manual
	Improper end play on mainshaft or countershaft	Adjust end play countershaft end play	Mainshaft and adjustment
	Bearings were not lubricated prior to assembly	Replace damaged parts. Reassemble following right procedure	Instructions on this manual
Double shifting	Double gear shifting interlock system assembled improperly	Reassemble system	Instructions on this manual

3. Disassembly and Assembly



The section "General Information" contains important information and specifications to be used when servicing the transmission.

When disassembling, inspect all components for wear or any other damage.

During disassembly and assembly, replace any part when required.

CAUTION: *Whenever you use a vise to secure transmission components during service, for example shafts, gears, etc., protect the jaws with an aluminum angle or other soft material to prevent damage to the part.*

During assembly, lubricate the following parts using the same lubricant specified for the transmission:

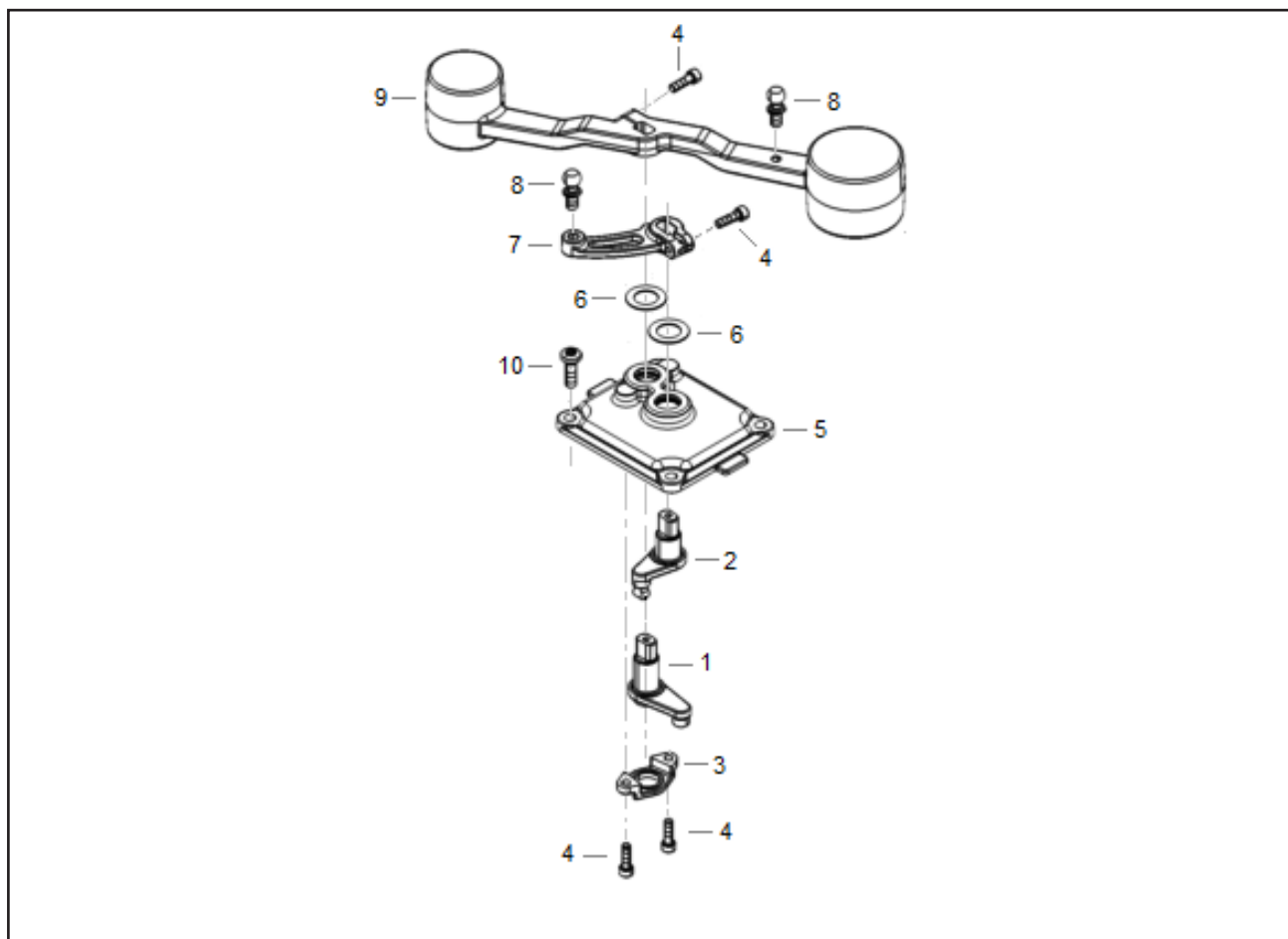
- Mainshaft gears and reverse idle gear bores, faces and cones;
- Contact surfaces of synchronizer rings, cones and friction surfaces;
- Needle bearings and conical bearings;
- Thrust surfaces, bearing bushings.

During assembly, constantly check the transmission (horizontally) to ensure that gears and synchronizers are rotating smoothly and freely.

Apply grease MS-9C onto following parts of the control tower:

- Bushings, inner levers, pivot balls of external shift levers, pivot pins.

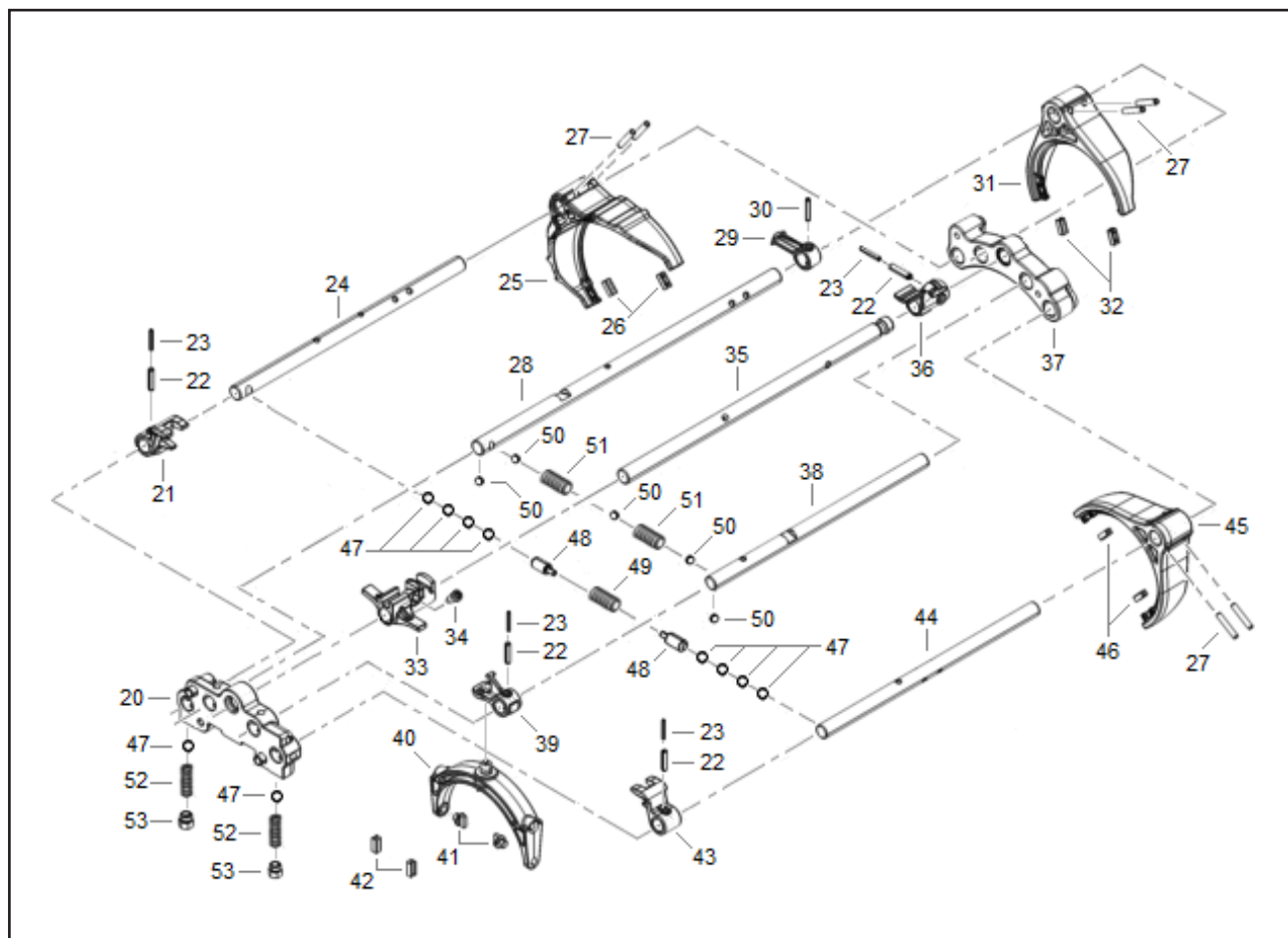
Apply petroleum jelly onto oil seal lips.

Remote Control Tower


ESO4X061A

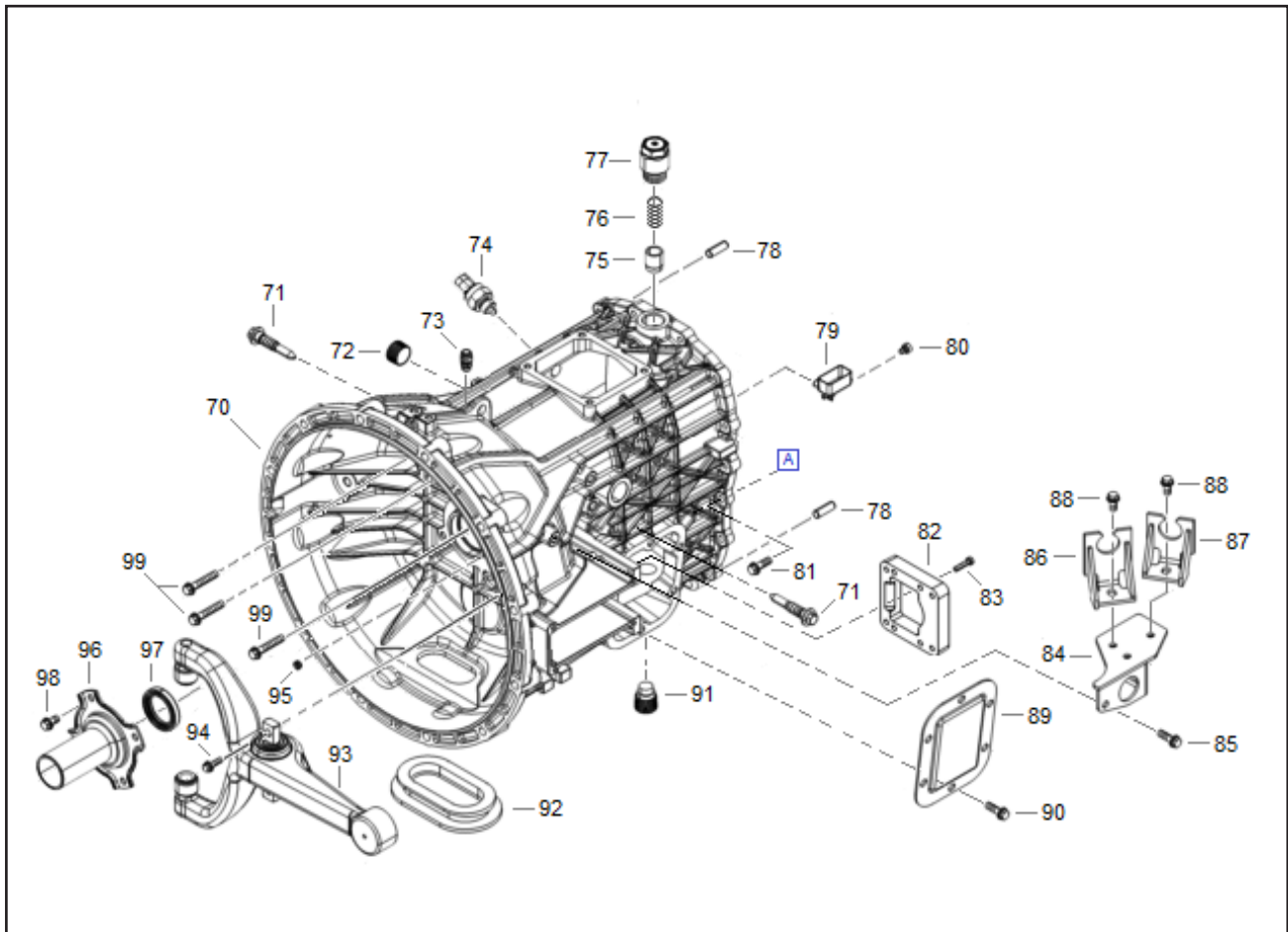
- | | | |
|--------------------------|-----------------------------|-------------------------|
| 1. Inner shift lever | 5. Control tower cover | 9. External shift lever |
| 2. Inner selection lever | 6. Thrust washer | 10. M8x25 Torx screw |
| 3. Pivot bearing | 7. External selection lever | |
| 4. M6x20 Allen screw | 8. Shift pin | |

Shift Yokes and Rails



ESO-6106/6206/explo2

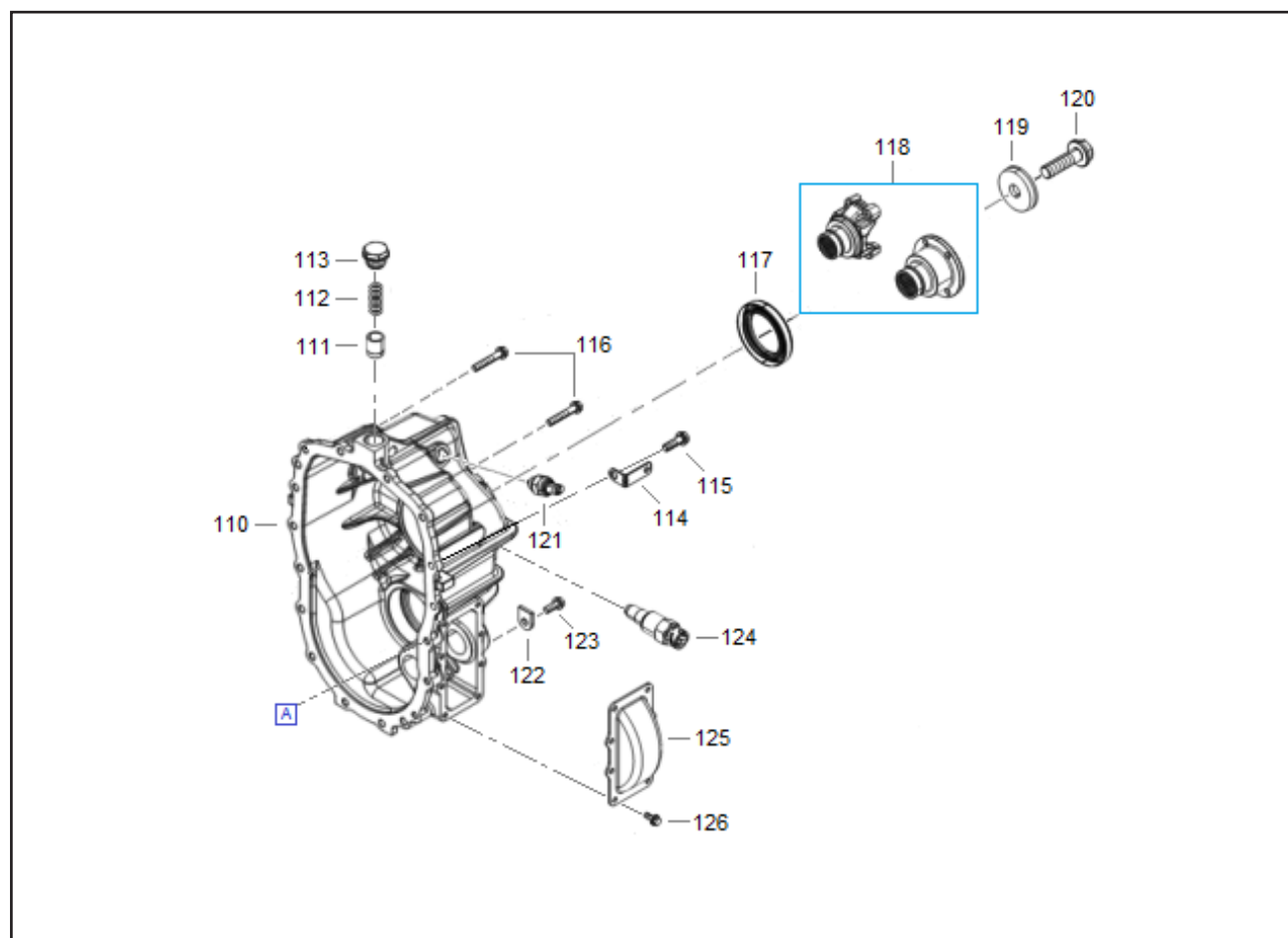
- | | | |
|--|--|--|
| 20. Shift rail front support | 31. Reverse speed shift yoke
(includes #32) | 42. Shift yoke pad |
| 21. 1st/2nd Shift block | 32. Shift yoke pad | 43. 3rd/4th Shift block |
| 22. Roll pin | 33. Shift selector block | 44. 3rd/4th Shift rail |
| 23. Roll pin | 34. M8x18.5 Torx screw | 45. 3rd/4th Shift yoke
(includes #46) |
| 24. 1st/2nd Shift rail | 35. Main shift rail | 46. Shift yoke pad |
| 25. 1st/2nd Shift yoke
(includes #26) | 36. Shift lug | 47. Ball |
| 26. Shift yoke pad | 37. Shift rail rear support | 48. Locker pin |
| 27. Roll pin | 38. 5th/6th Shift rail | 49. Spring |
| 28. Reverse speed shift rail | 39. 5th/6th Shift block | 50. Ball |
| 29. Reverse speed switch actuator | 40. 5th/6th Shift yoke | 51. Spring |
| 30. Roll pin | 41. Pivot support | 52. Spring |
| | | 53. Plug |

Front Case


ESO-6106/6206/explo3

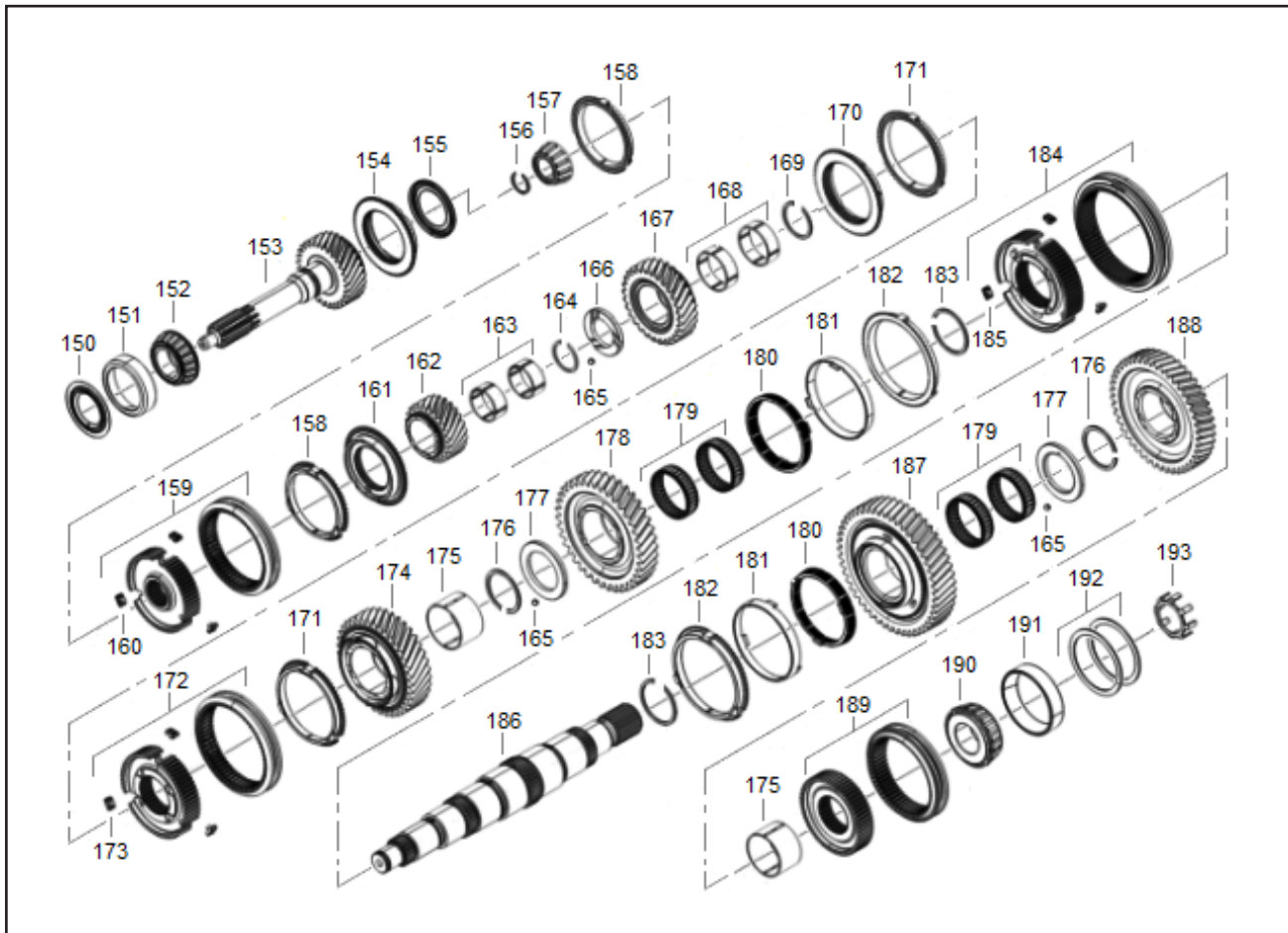
70. Front case	80. M6x1.0 - 6g Screw	90. M10x16 Screw
71. Pivot pin	81. Capscrew	91. Oil drain plug
72. Oil fill plug	82. Adapter plate	92. Inspection cover
73. Breather	83. M6x25 Allen screw	93. Clutch release fork
74. Reverse switch	84. Cable bracket	94. M6x1.25 - 6g Screw
75. Actuator	85. M10x25 Screw	95. Plug
76. Spring	86. Selection cable bracket	96. Clutch release bearing sleeve
77. Gear select actuator plug	87. Shift cable bracket	97. Oil seal
78. Dowel pin	88. M8x16 Screw	98. M8x16 Bolt
79. Oil intake	89. PTO cover	99. M8x40 Capscrew

Rear Case



ESO-6106/6206/explo4

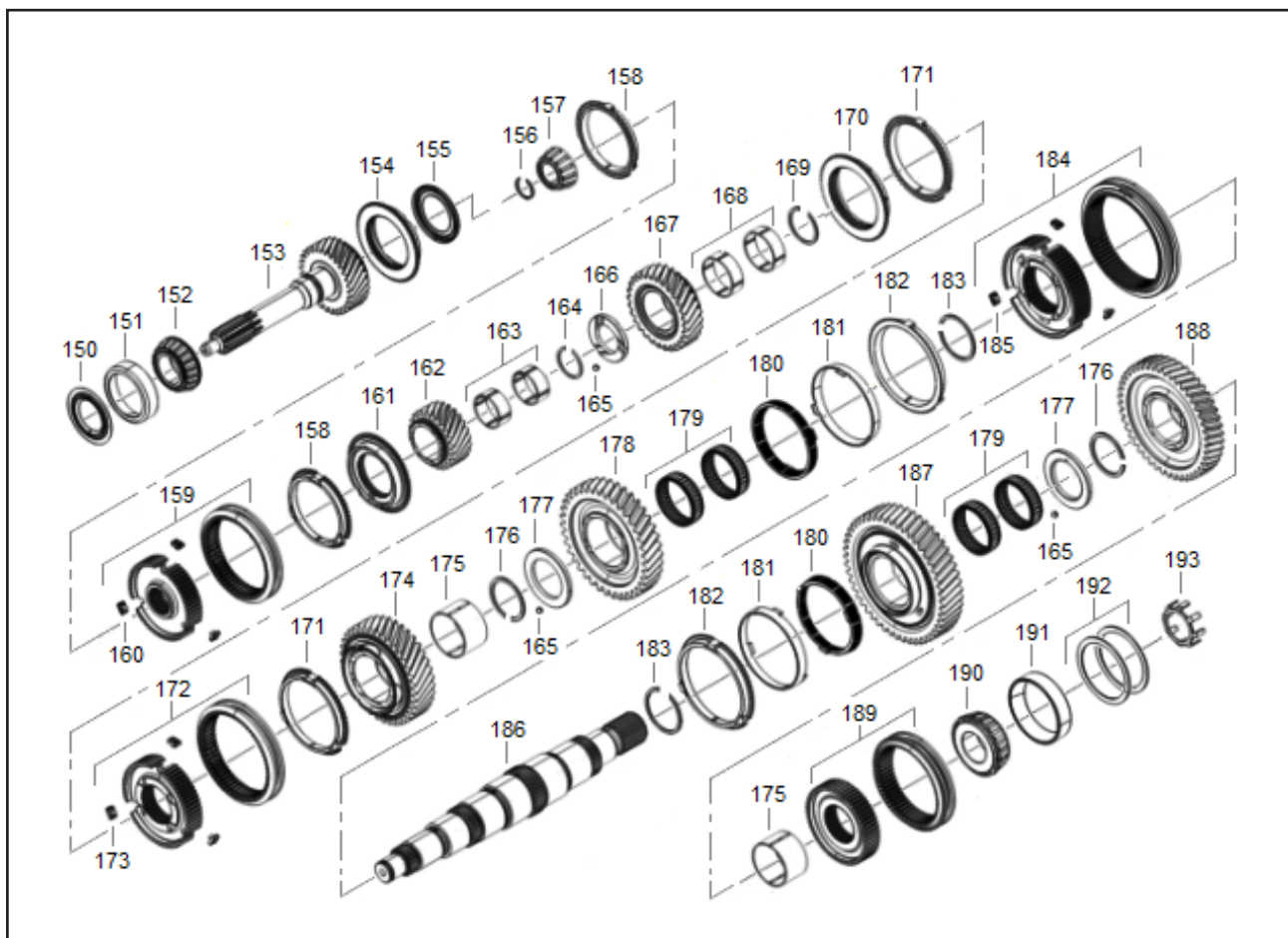
110. Rear case	116. M8x40 Capscrew	122. Retaining plate
111. Actuator	117. Oil seal	123. M8x20 Screw
112. Spring	118. Output yoke - ESO-6106 Flange - ESO-6206	124. Speedometer sensor
113. Shift actuator plug	119. Washer	125. Cover
114. Bracket	120. M16x55 Bolt	126. M6x14 Bolt
115. M8x25 Screw	121. Neutral switch	

Input Shaft and Mainshaft


ESO-6106/6206/explo5

150. Oil baffle	165. Ball	180. Inner synchronizer ring
151. Bearing cup	166. Thrust washer	181. Middle synchronizer ring
152. Bearing cone	167. 4th Speed gear	182. Outer synchronizer ring
153. Input shaft	168. Needle roller bearing	183. Snap ring
154. 5th Speed synchronizer cone	169. Snap ring	184. 1st/2nd synchronizer assy. (includes #185)
155. Oil baffle	170. 4th Speed synchronizer cone	185. Key
156. Snap ring	171. Synchronizer ring	186. Mainshaft
157. Pocket bearing cone	172. 3rd/4th synchronizer assy. (includes #173)	187. 1st Speed gear
158. Synchronizer ring	173. Key	188. Reverse speed gear
159. 5th/6th synchronizer assy. (includes #160)	174. 3rd Speed gear	189. Reverse sliding clutch assy.
160. Key	175. Needle roller bearing	190. Bearing cone
161. 6th Speed synchronizer cone	176. Snap ring	191. Bearing cup
162. 6th Speed gear	177. Thrust washer	192. Mainshaft shim pack (as needed)
163. Needle roller bearing	178. 2nd Speed gear	
164. Snap ring	179. Needle roller bearing	

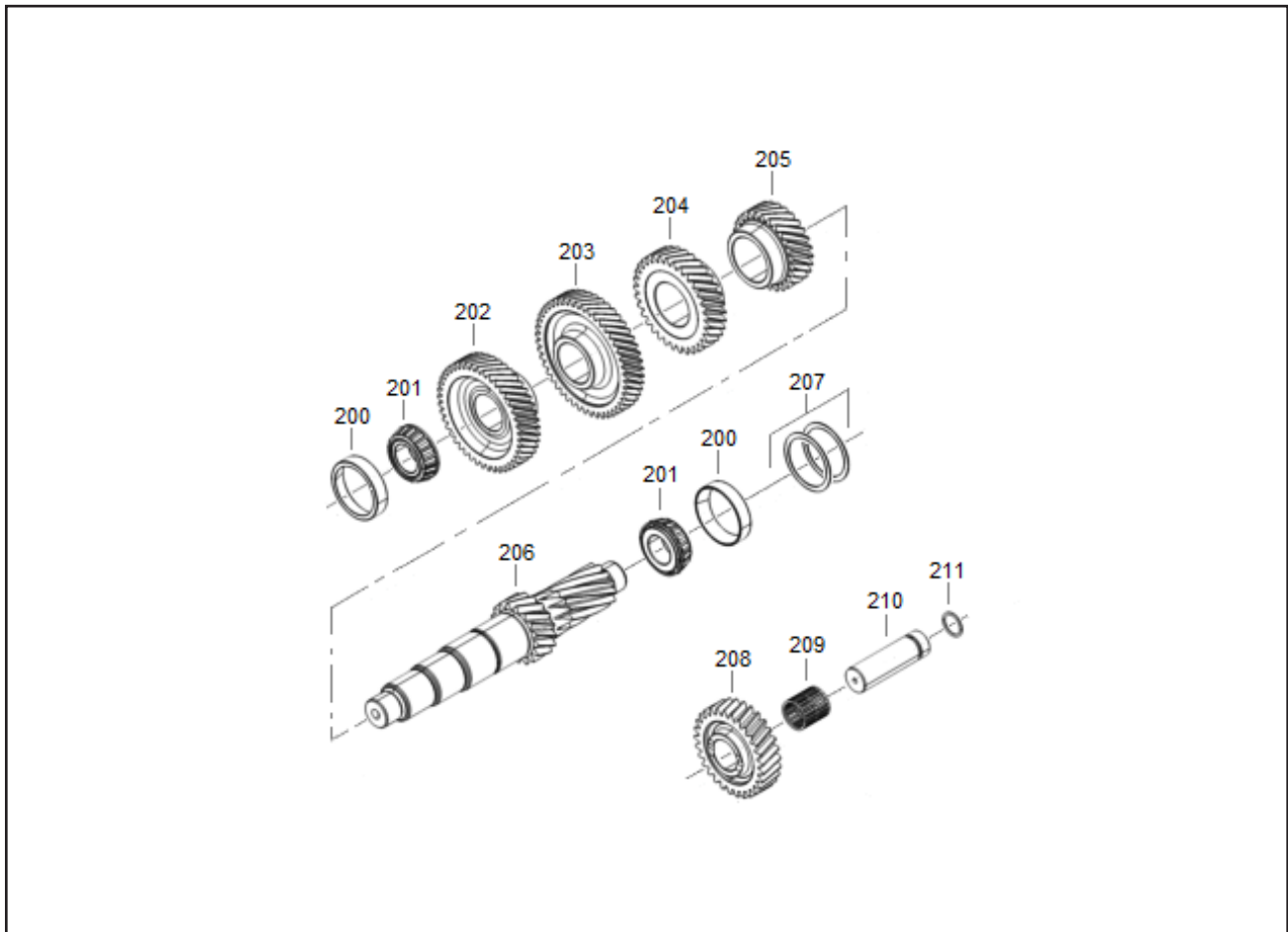
Input Shaft and Mainshaft (continued)



ESO-6106/6206/explo5

192. Shim - 0.050 / 0.070 mm	192. Shim - 0.560 / 0.640 mm	192. Shim - 1.160 / 1.240 mm
192. Shim - 0.087 / 0.113 mm	192. Shim - 0.660 / 0.740 mm	192. Shim - 1.260 / 1.340 mm
192. Shim - 0.175 / 0.225 mm	192. Shim - 0.760 / 0.840 mm	192. Shim - 1.360 / 1.440 mm
192. Shim - 0.275 / 0.325 mm	192. Shim - 0.860 / 0.940 mm	192. Shim - 1.460 / 1.540 mm
192. Shim - 0.362 / 0.438 mm	192. Shim - 0.960 / 1.040 mm	193. Speedometer rotor
192. Shim - 0.462 / 0.538 mm	192. Shim - 1.060 / 1.140 mm	

Countershaft and Reverse Gear



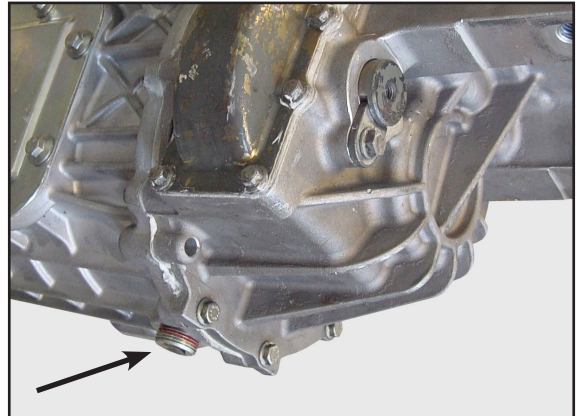
ESO-6106/6206/explo6

200. Bearing cup	207. Shim - 0.087 / 0.113 mm	207. Shim - 1.060 / 1.140 mm
201. Bearing cone	207. Shim - 0.175 / 0.225 mm	207. Shim - 1.160 / 1.240 mm
202. Countershaft drive gear	207. Shim - 0.275 / 0.325 mm	207. Shim - 1.260 / 1.340 mm
203. 6th Speed gear	207. Shim - 0.362 / 0.438 mm	207. Shim - 1.360 / 1.440 mm
204. 4th Speed gear	207. Shim - 0.462 / 0.538 mm	207. Shim - 1.460 / 1.540 mm
205. 3rd Speed gear	207. Shim - 0.560 / 0.640 mm	208. Reverse idle gear
206. Countershaft	207. Shim - 0.660 / 0.740 mm	209. Needle roller bearing
207. Countershaft shim pack (as needed)	207. Shim - 0.760 / 0.840 mm	210. Reverse idle gear shaft
207. Shim - 0.050 / 0.070 mm	207. Shim - 0.860 / 0.940 mm	211. O-ring
	207. Shim - 0.960 / 1.040 mm	

Transmission Disassembly

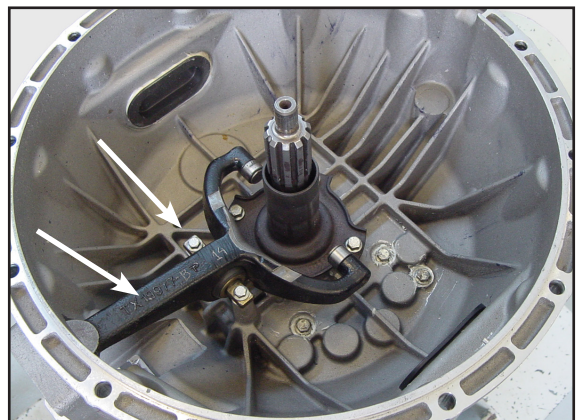


1. Remove the oil drain plug and drain the transmission oil.



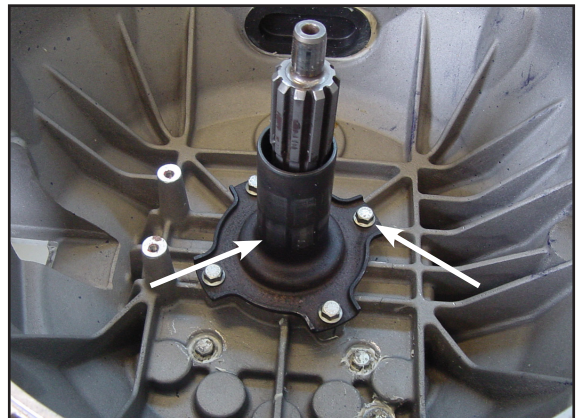
6420a

2. Remove the two capscrews securing the clutch release fork.
3. Remove the clutch release fork.



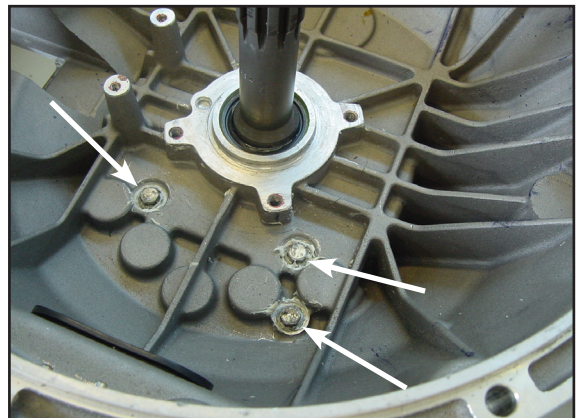
6014

4. Remove the four capscrews securing the clutch release bearing sleeve.
5. Remove the clutch release bearing sleeve.



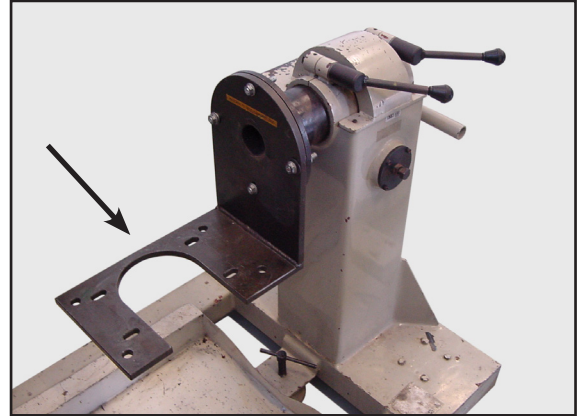
6017

6. Remove the three capscrews securing the shift rails' front support.



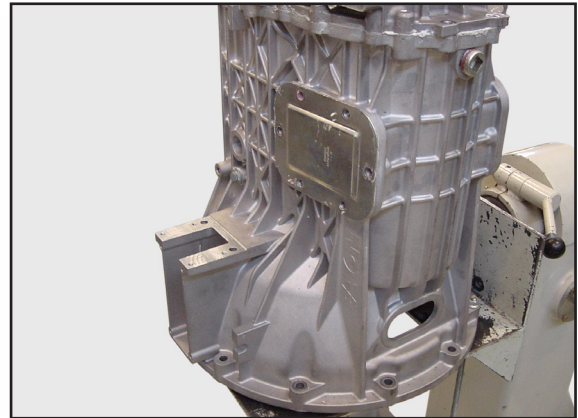
6019

7. Install the mounting plate # EEA-17203 on the transmission stand # EEA-17200 as shown.



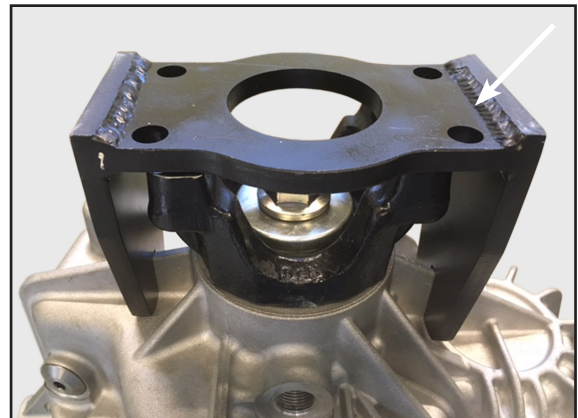
6525

8. Place the transmission on the stand with the rear case facing up and secure the transmission with at least two capscrews.

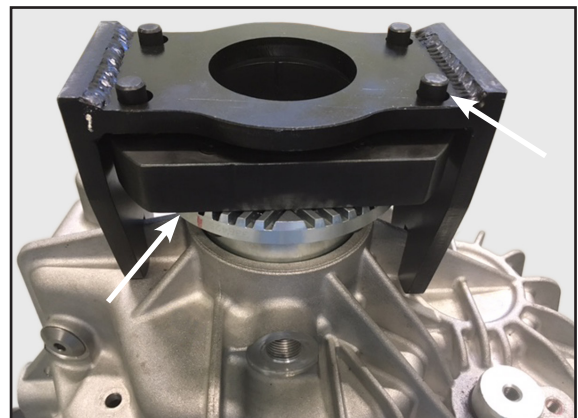


6430

9. On the ESO-6106 transmission model, install the special tool # EEA-17503 to block the output yoke.
- On the ESO-6206 transmission model, install the special tool # EEA-17503 and tool # EEA-17504 to block the mainshaft with the output flange.
10. With a universal wrench and socket, remove the output yoke or flange retaining bolt and washer, depending on the transmission model.



0567

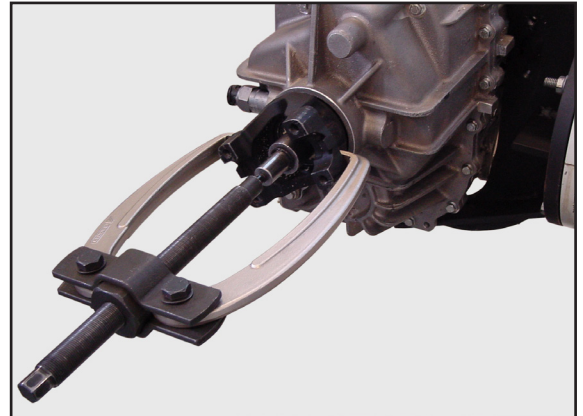


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Transmission Disassembly

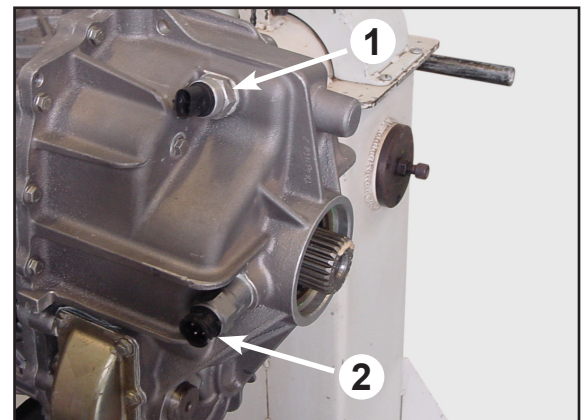


11. Rotate the stand and place the transmission horizontally with the control tower facing up. Remove the output yoke (or flange, depending on the transmission model) using a puller.



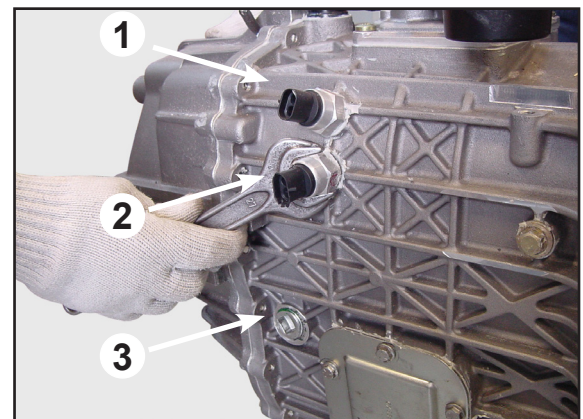
5968

12. Remove the neutral switch (1) and the speedometer sensor (2).



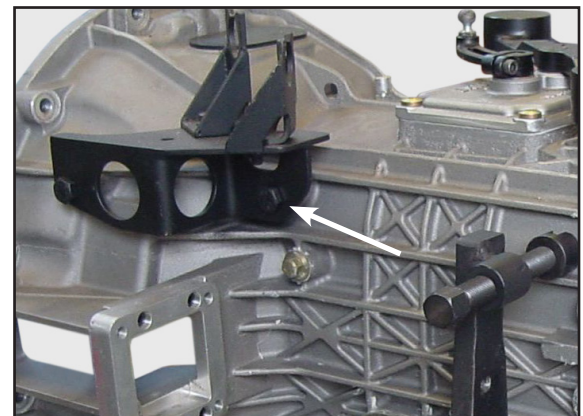
5972a

13. Remove the reverse speed switch (1) and the 1st speed switch (2).
14. Remove the oil fill plug (3).



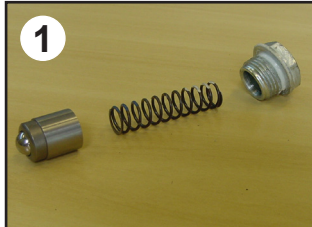
5937

15. Remove the transmission shift cables bracket.

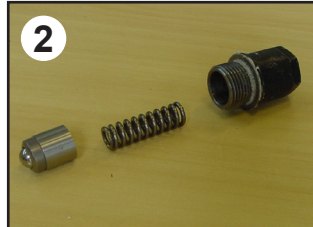


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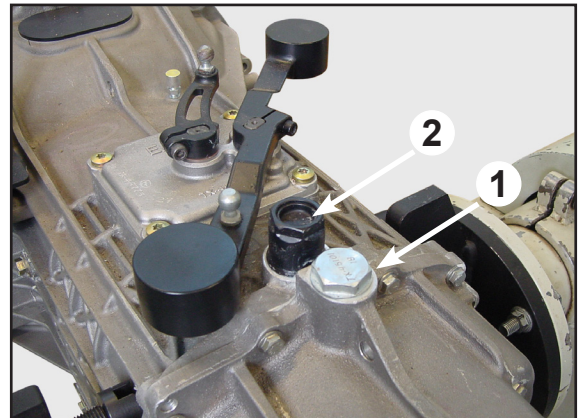
16. Remove the shift actuator (1) and the gear select actuator (2).



5974



5976

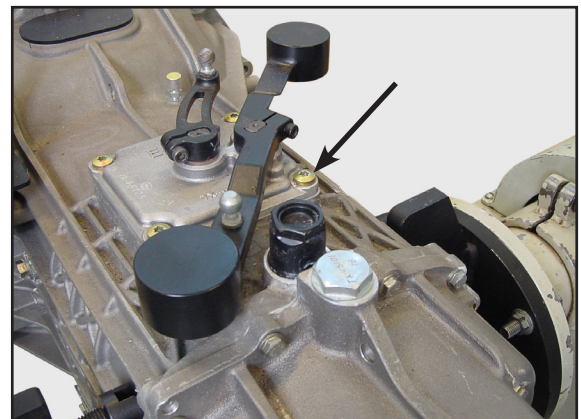


5962

17. From the control tower cover, remove the four retaining screws and remove the control tower.

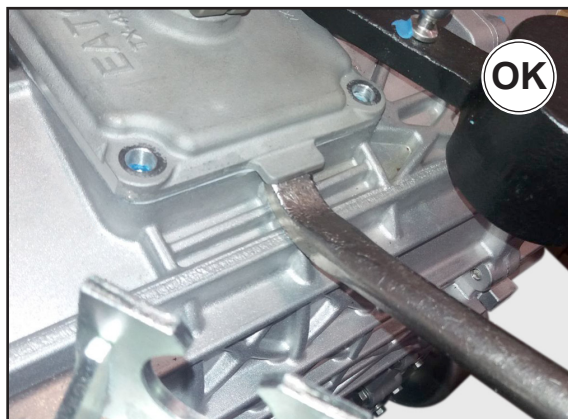
NOTE: To break the seal and make easy to remove the control tower, use a pry bar underneath the existing tab on the tower control cover and, then, push the control tower upward.

CAUTION: DO NOT use a hammer, even a soft one, to tap on the counterweight in order to remove the control tower. This may damage the shift lever and cause it to break.

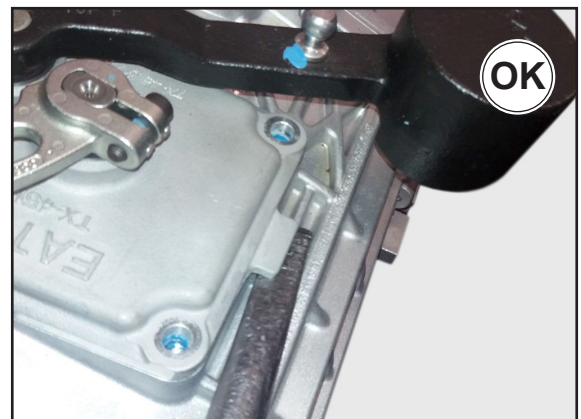


5962

CORRECT procedure

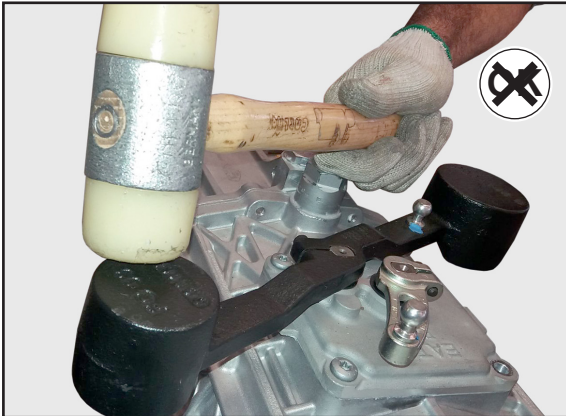


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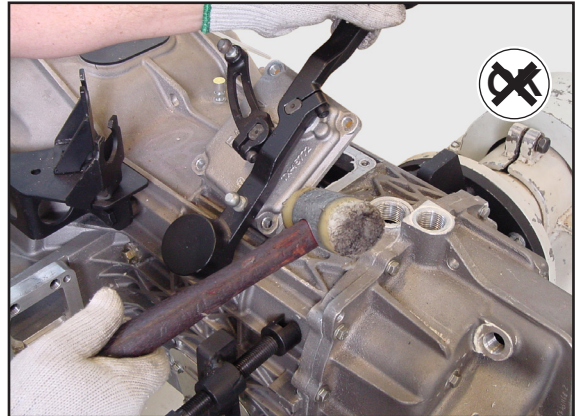


010

INCORRECT procedure

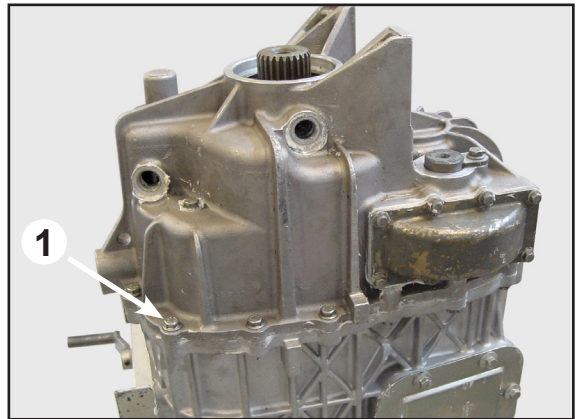


012

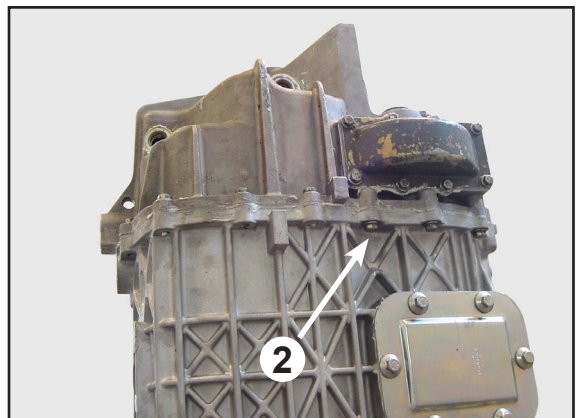


5978

18. Reposition the transmission vertically with the rear case facing up.
19. Remove the sixteen capscrews securing the rear case to the front case, being thirteen above (1) and three underneath (2) the flange.

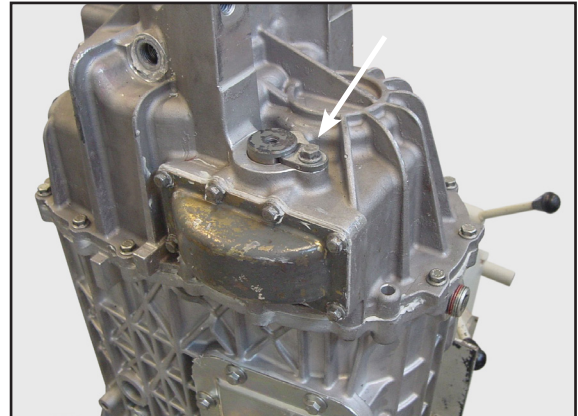


6418



6419

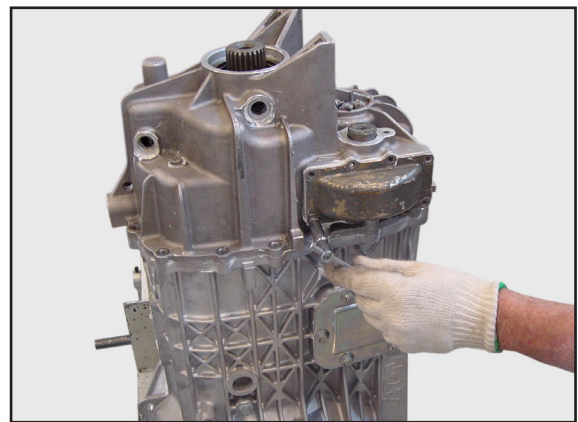
20. Remove the reverse idle gear shaft retaining bolt and plate.



6420

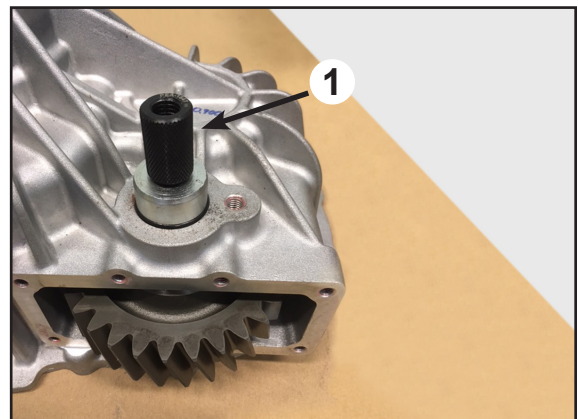
21. From the reverse idle gear cover, remove the eight retaining bolts and remove the cover.

NOTE: With a soft hammer, gently tap on the cover to break the seal.



6424

22. Install the puller EEA-17141 (1) with adapter EEA-17142 (not shown) into the threaded bore at the end of reverse idle gear shaft and remove the reverse idle gear shaft together with the O-ring.

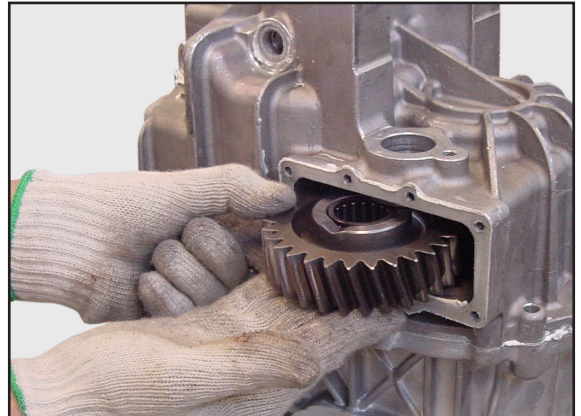


6427a

Transmission Disassembly



23. Remove the reverse idle gear from its housing, being careful to prevent the needle roller bearing from falling underneath.



6433a

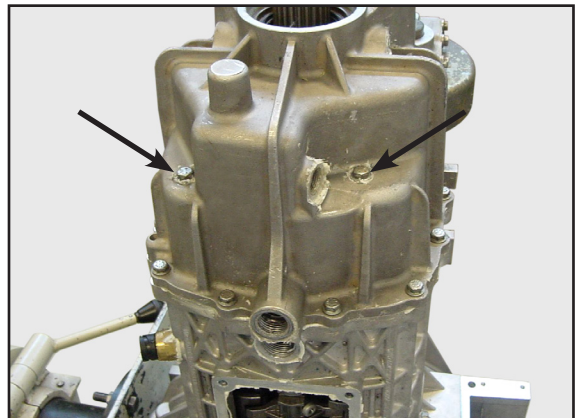
24. Remove the PTO cover.

NOTE: With a soft hammer, gently tap on the cover to break the seal.



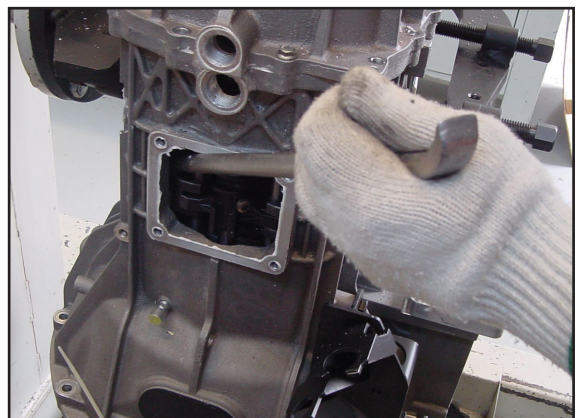
6429

25. Remove the two capscrews securing the shift rails' rear support.



6422a

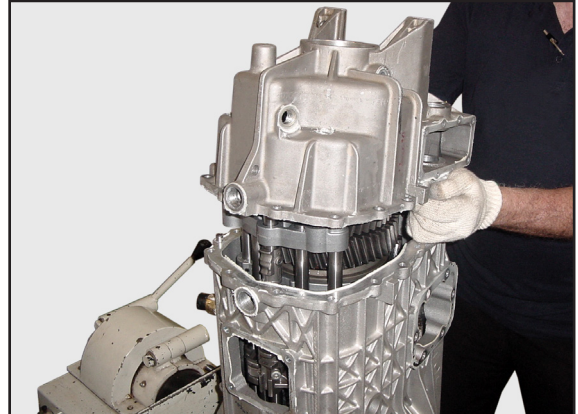
26. Prior removing the transmission rear case, shift into the 2nd speed using a pry bar and pushing the 2nd/3rd gear synchronizer sleeve downward.



5994a

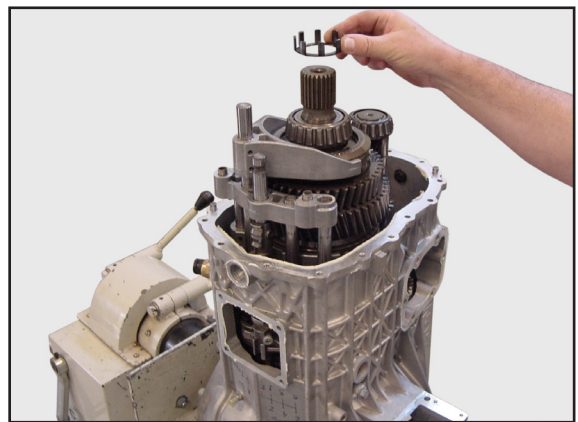
27. Remove the rear case by lifting the case using the hands.

NOTE: Using a soft hammer, gently tap around the case, on the flange or near it, being careful not to damage the case, to break the seal.



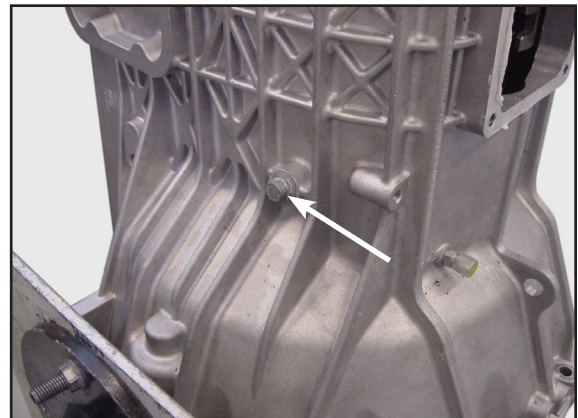
6443

28. Remove the speedometer rotor.

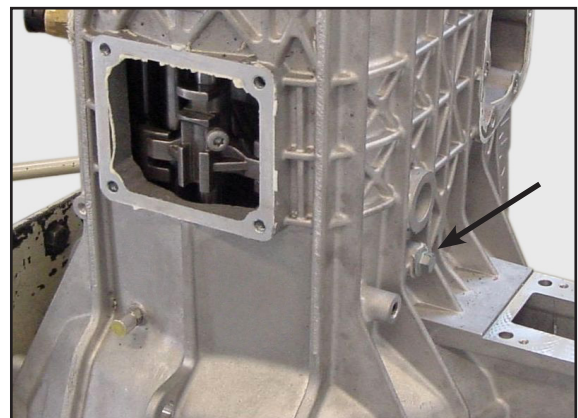


6444

29. Remove the two pivot pins of the 5th/6th shift yoke (one at each side of the case).



6454

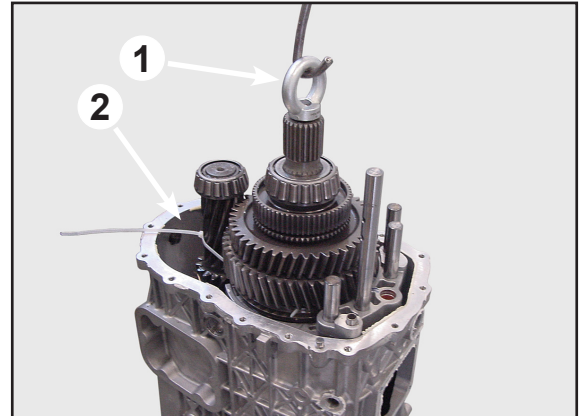


6439a

Transmission Disassembly

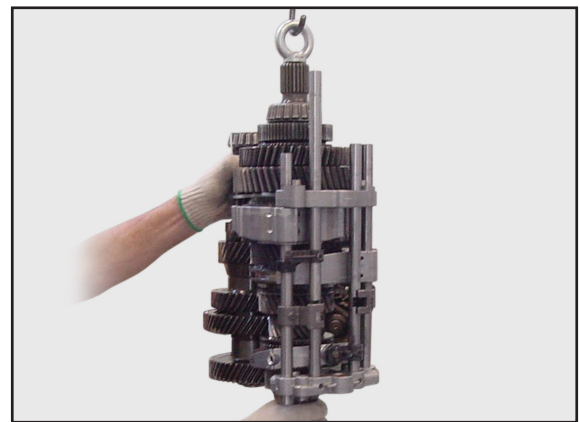


30. Install the eye bolt (1) into the threaded bore at the end of mainshaft, for lifting shafts and shift rails assembly. Using a Hellerman-type strap (2) or wire, tie the shafts and shift rails assembly so that they do not come loose during its removal from the front transmission case (see figure).



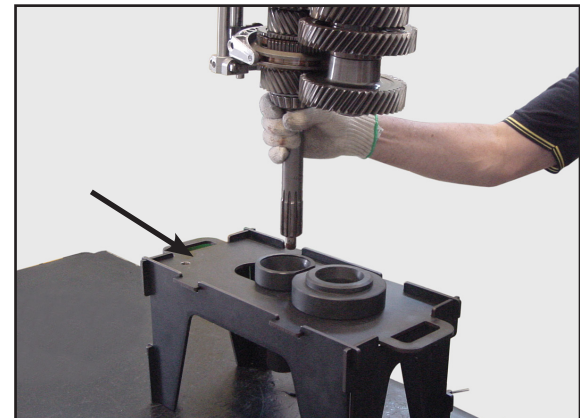
6456

31. With a hoist, lift shafts and shift rails assembly holding the input shaft with one hand to hold the shaft in place.

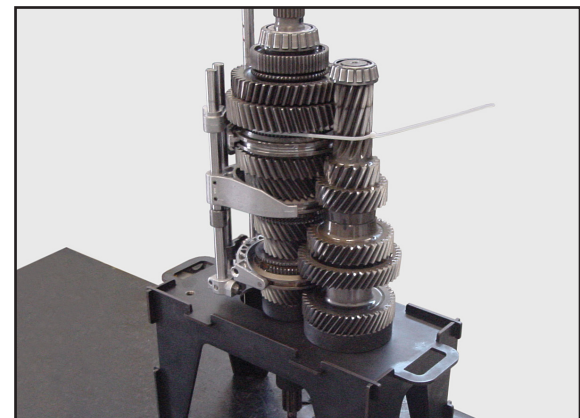


6460a

32. With the base # EEA-17505 already placed on the workbench, position the shafts and shift rails assembly on it, fitting the input shaft and countershaft into their housing in the device.



6462



6465

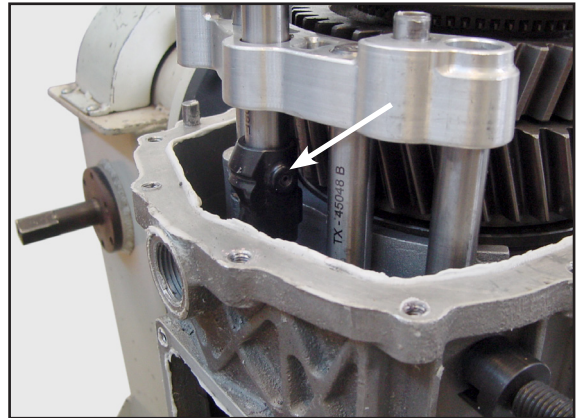
33. Cut the strap used to hold the shafts and shift rails assembly together.



6482

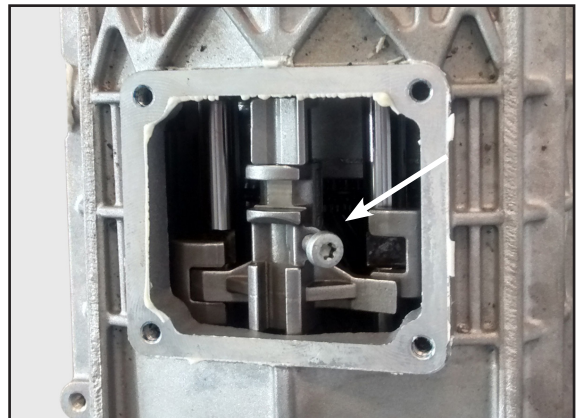
NOTE: Some figures in the following operations show the shafts and shift rails assembly still inside the housing. Proceed with the disassembly outside the housing. The procedure is the same.

34. Place all gears in neutral.
35. Remove the roll pin from the shift lug.



6004

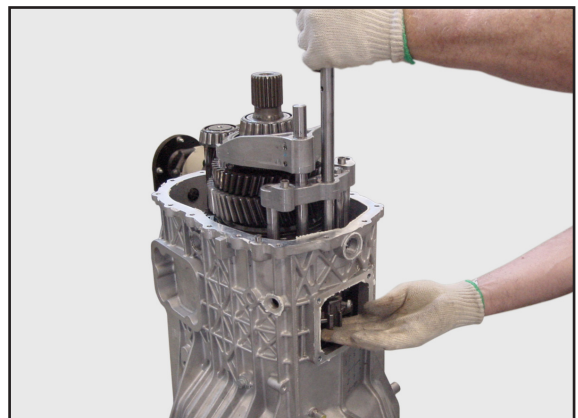
36. Remove the Torx screw from the gear selector block.



163035909b

37. Remove the main shift rail with the tools EEA-17140 and EEA-17125, by pulling it up.

NOTE: Be careful when removing the shift rail as the gear selector block and the shift lug will come out of the rail when it is pulled up. Hold both the selector block and the shift lug to prevent them from falling.

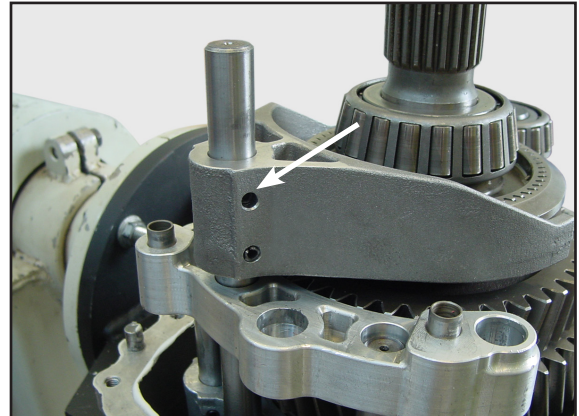


6447

Transmission Disassembly

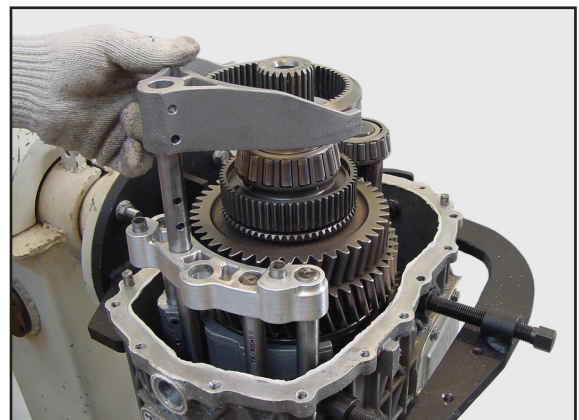


38. Remove the two roll pins from the reverse shift yoke.



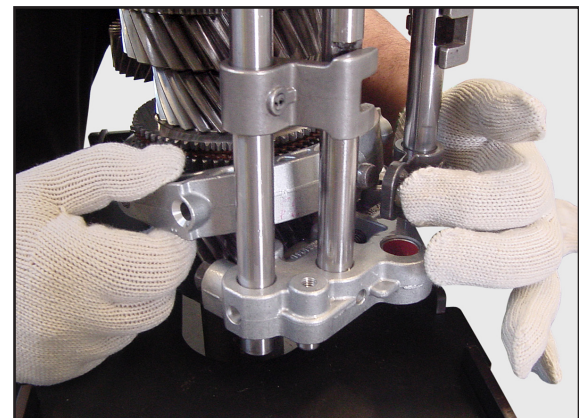
6008

39. Remove the reverse shift yoke together with the reverse sliding clutch.



6009

40. Remove the 5th/6th shift yoke.



6483

41. Remove the rear shift rails support.



6485

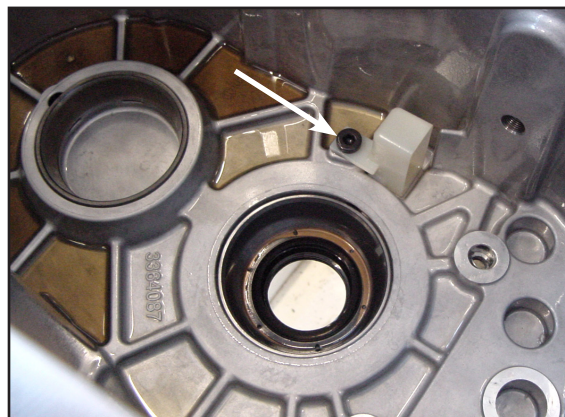
42. Detach the shift rails and yokes from the mainshaft and countershaft.
43. Remove the mainshaft, countershaft and input shaft from the special base and take them apart.



6497

Disassembly

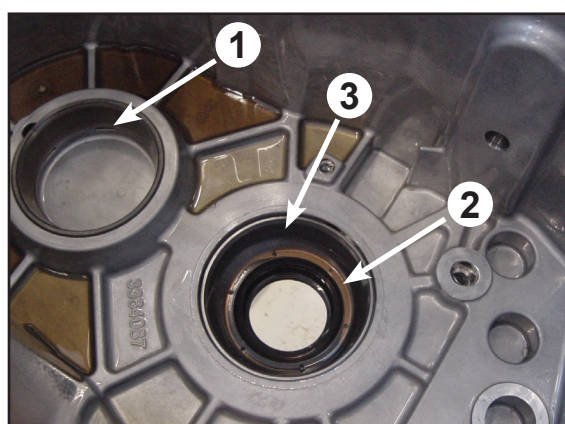
1. Position the front case with its internal side facing up.
2. Remove the oil intake retaining screw and remove the oil intake.



6475

3. Using special tool # EEA-17136 (not shown), remove the countershaft front bearing cup (1).
4. Using special tools # EEA-17107 and EEA-17144 (not shown), remove together: the oil baffle (installed underneath the input shaft front bearing cup) (2) and the input shaft front bearing cup (3).

NOTE: The oil baffle will be damaged during disassembly. Replace it with a new one during assembly.

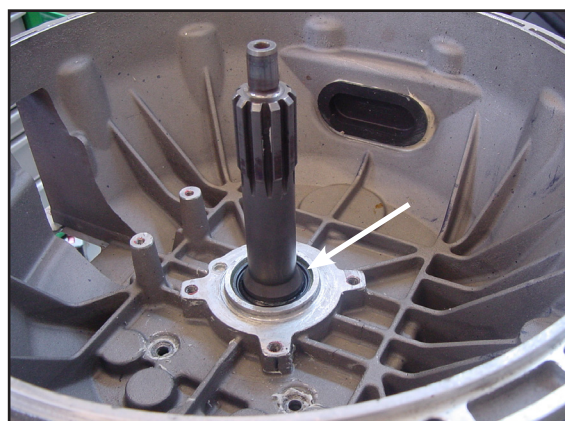


6476

5. With the help of a lever, remove the input shaft front oil seal from the clutch side.

NOTE:

- The picture shows the case with the input shaft installed. The oil seal can be replaced with or without the input shaft installed.
- The front oil seal will be damaged during disassembly. Replace it with a new one during assembly.



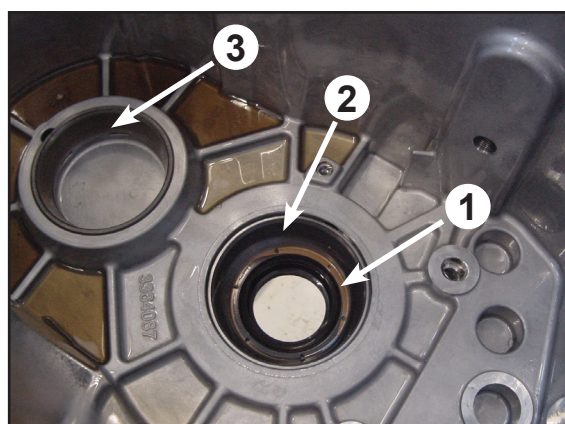
6311

Assembly

NOTE: Clean the parts thoroughly and remove any residue of sealant from the parts' contact surfaces prior to assembly.

1. Carefully clean the bearing housings and caps prior to assembly.
2. With the internal side of the front case facing up, assemble the new oil baffle (1) in the housing of the input shaft front bearing cup.
3. Using specials tools # EEA-17031 and EEA-17501 (not shown), assemble the input shaft front bearing cup (2) on the oil baffle.
4. Using specials tools # EEA-17032 and EEA-17501 (not shown), assemble the countershaft front bearing (3).

NOTE: Do not install shims under the countershaft or input shaft/mainshaft front bearing caps. Adjusting of end play is done through the rear bearing shafts (see Transmission Assembly and End Play Adjustment in this manual).

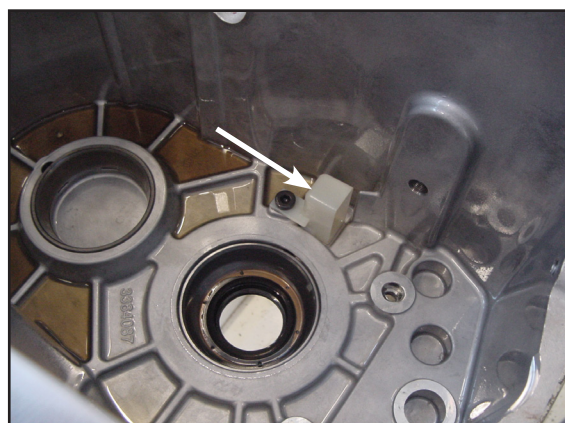


6476

5. Install the oil intake paying attention to correctly mount the tube in its respective opening on the case and the retaining screw in its counterbore.



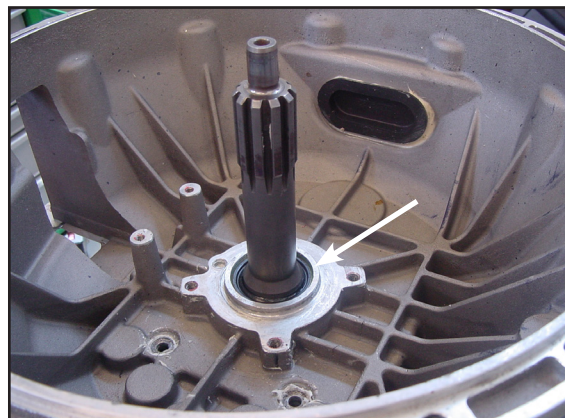
6481



6474

6. From the clutch side, manually align the new front oil seal and install it in the case hitting it with a tubular device until it stops.

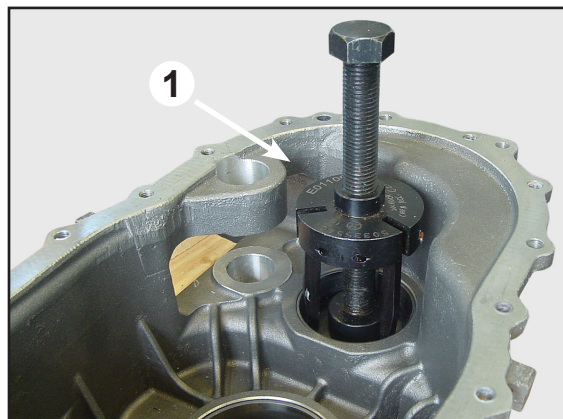
NOTE: The picture shows the case with the input shaft installed. The oil seal can be replaced with or without the input shaft installed.



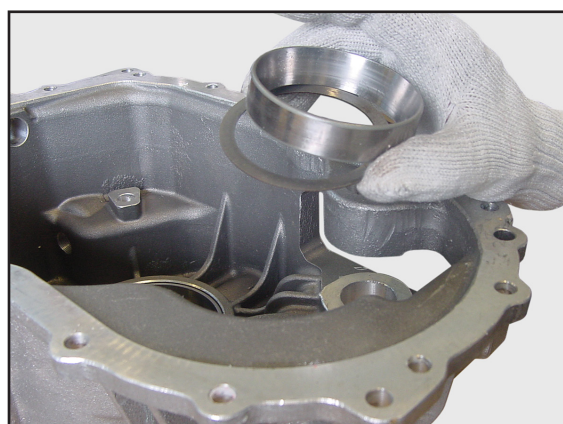
6311

Disassembly

1. Position the rear case with its internal side facing up.
2. Using special tools # EEA-17136 and # EEA-17137 (1), remove the rear bearing cup from the countershaft and remove the end play shims.



6130



6129

3. Using special tools # EEA-17135, # EEA-17138 and # EEA-17136 (not shown), remove the mainshaft rear bearing cup, together with the end play adjusting shims, hitting the cup from behind through the openings on the case, alternating between both sides.



6140



6142

4. With the help of a lever, remove the mainshaft rear oil seal from the outside of the case.

NOTE:

- The rear oil seal will be damaged during disassembly. Replace it with a new one during assembly.
- The oil seal can be replaced with the case assembled. To do that, it is necessary to remove the output yoke.



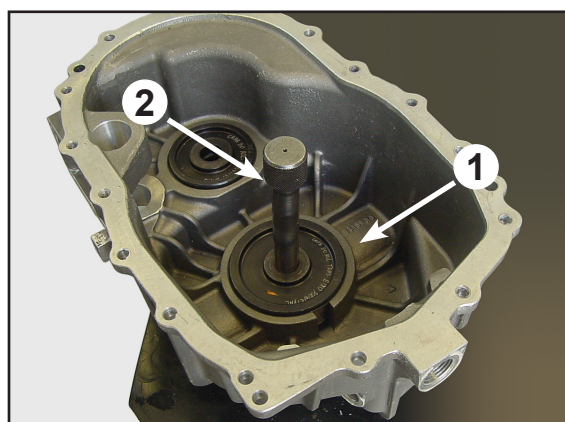
6134

Assembly

NOTE: Clean the parts thoroughly and remove any residue of sealant from the parts' contact surfaces prior to assembly.

1. Position the rear case with its internal side facing up.
2. Carefully clean the bearing housings and caps prior to assembly.
3. Using special tools # EEA-17028 (1) and # EEA-17501 (2), assemble the mainshaft rear bearing, at this moment without the end play adjusting shims, hitting it until it properly sits at the bottom of its housing.

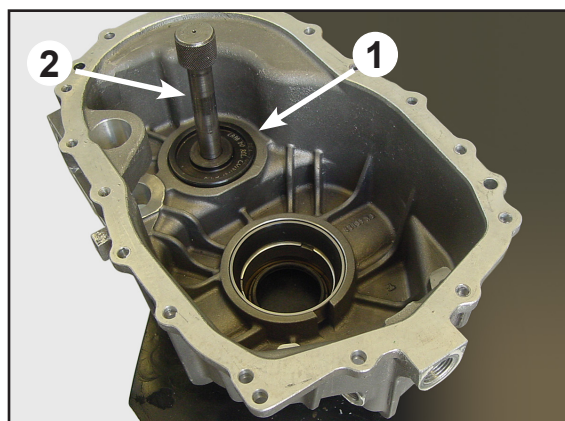
NOTE: The required quantity of shims will be determined at the end of the assembly of the gear box, during the measurement of the end play. After measurement, the correct quantity of shims should be installed by removing and re-installing the bearing cup.



6350

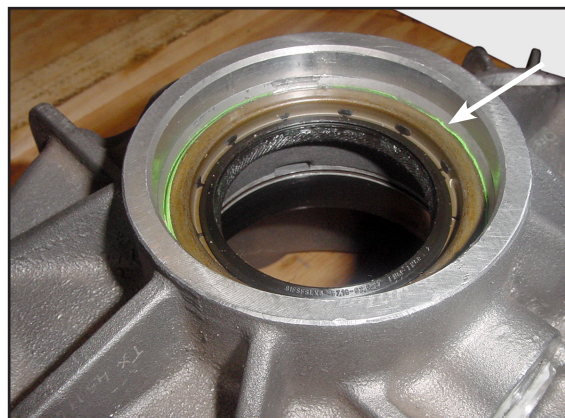
4. Using special tools # EEA-17032 (1) and # EEA-17501 (2), install the countershaft rear bearing cup, at this moment without the end play adjusting shims, hitting it until it properly sits at the bottom of its housing.

NOTE: The required quantity of shims will be determined at the end of the assembly of the gear box, during the measurement of the end play. After measurement, the correct quantity of shims should be installed by removing and re-installing the bearing cup.



6351

5. Turn the rear case with its internal side facing down and place the case on the workbench.
6. Manually align the new oil seal and install it in the case using specials tools EEA-17033 and EEA-17501 (not shown).



6134

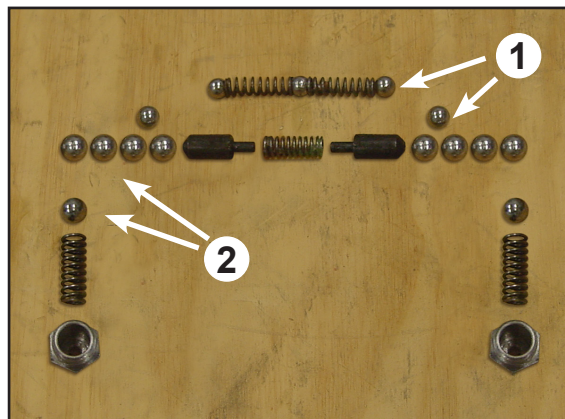
Disassembly

The speed shifting system of the ES(B)O-6X06 transmission has gears positioning and interlocking devices located in the front support of the shift yokes and rails assembly.

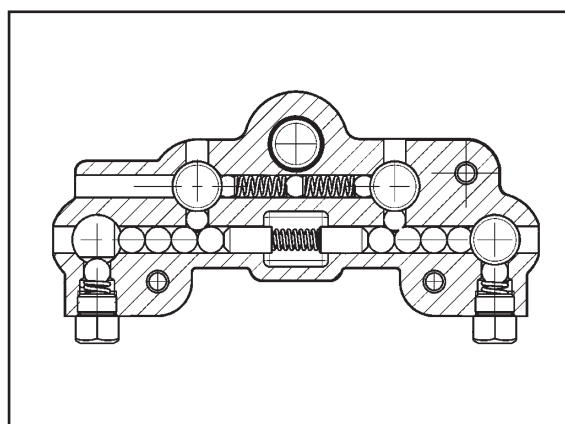
These devices are made of springs and balls actuating on notches on the shift rails that once disassembled should be reassembled very carefully to guarantee its proper functioning. Identification of balls in the pictures (for identification of the shift rails, see Exploded View in this manual):

1 - Diameter 5/16 in (7.9 mm), 5 balls

2 - Diameter 3/8 in (9.5 mm), 10 balls

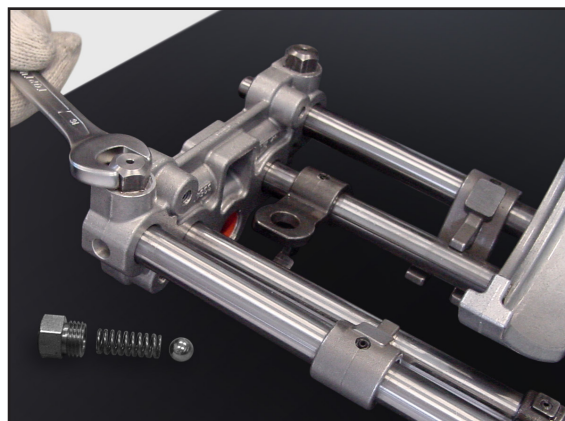


6167a



6167b

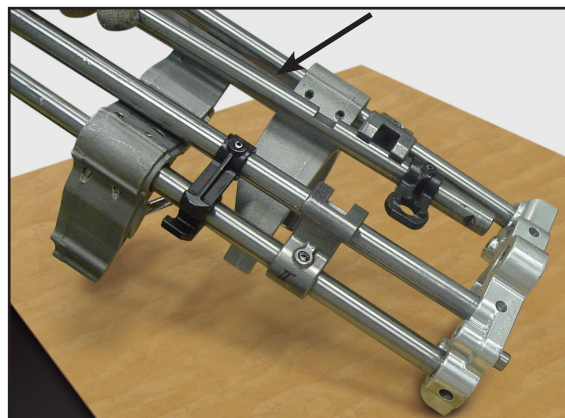
1. Remove the two plugs, two springs and two balls from the rails' support.



6498

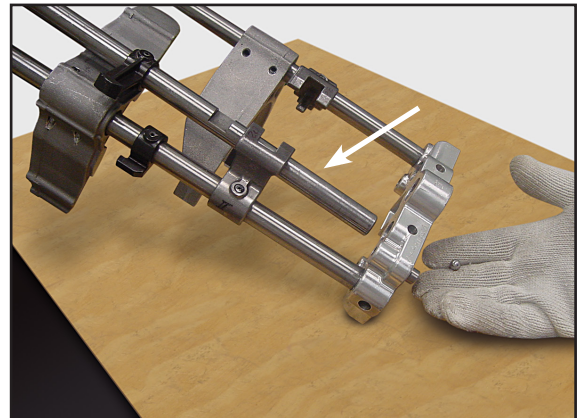
NOTE: When removing the shift rails, be careful not to drop and lose the balls that will come off from inside the rails' support.

2. Remove the 5th/6th gear shift rail and its respective ball.



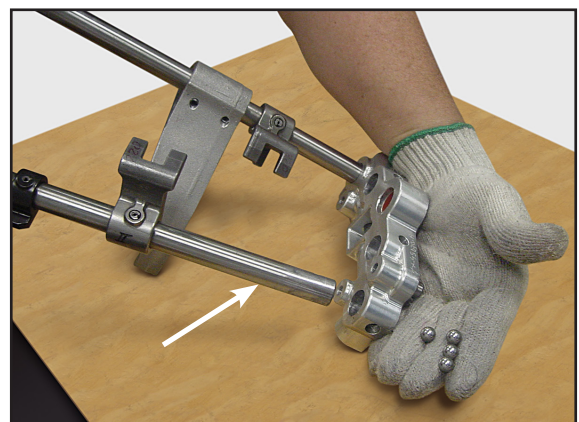
6162

3. Remove the reverse gear shift rail and its respective ball.



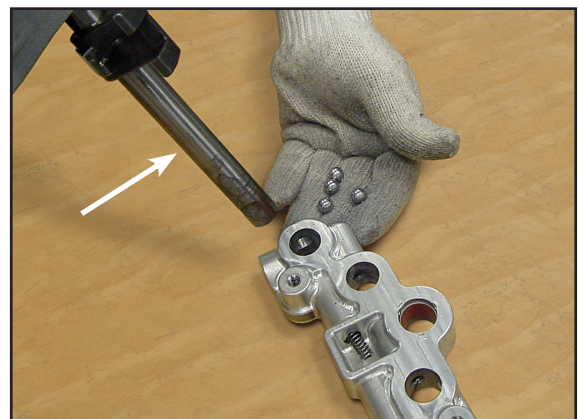
6163

4. Remove the 1st / 2nd gear shift rail.



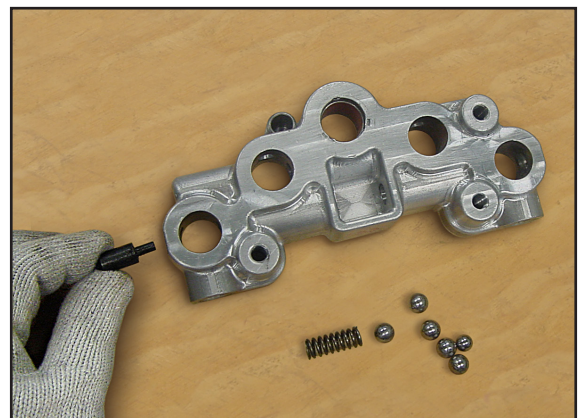
6164

5. At last, remove the 3rd / 4th gear shift rail.



6166

6. Remove balls, pins and springs that are still inside the rails' support.
7. Once the shift rails are disassembled, if necessary, remove yokes, shift blocks and the 1st speed and reverse speed switch actuators from their respective rails, removing the roll pins that secure these parts to the rails.

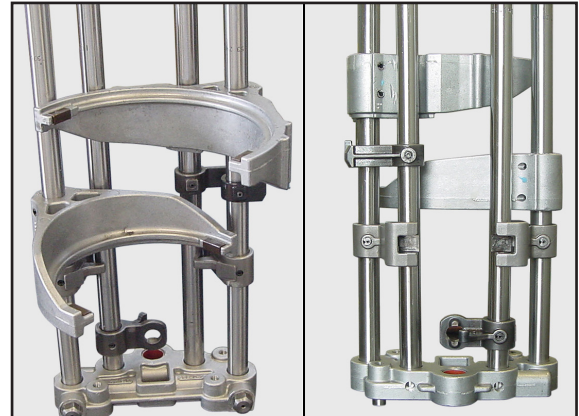


6169

Assembly

1. If removed, assemble the yokes, shift blocks and the 1st speed and reverse speed switch actuators in their respective rails, observing the correct assembly sides and positions. Use the notches at the ends mounted on the front support as a reference for the balls in the rails, as shown in the picture aside.
2. Install the roll pins.

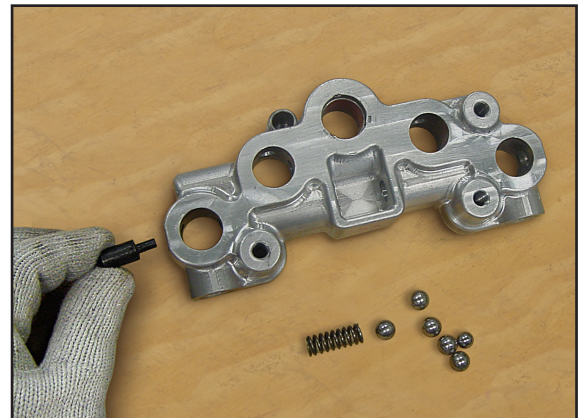
NOTE: The reverse speed shifting yoke should be assembled later, when the transmission is mounted to the stand, after installation of the shafts and rails assembly to the front housing.



6535b

NOTE: The correct side of assembly of the shift rails' front support is with the face of the central recess facing the side of the rails.

3. Place the shift rails' front support on the workbench with the recess side facing up.
4. From one of the sides of the support, in the hole connecting the 1st / 2nd and 3rd / 4th gear shift rails, insert one of the two pins of the interlocking mechanism, with the smaller diameter facing inwards.
5. From the other side, of the same hole, insert the spring and the other pin, in this order, in the opposite position to the first one.



6169a



6170

Shift Yokes and Rails



6. After the pins, insert eight 9.5 mm diameter balls, four on each side.

NOTE: Use grease to keep the balls in their housings.



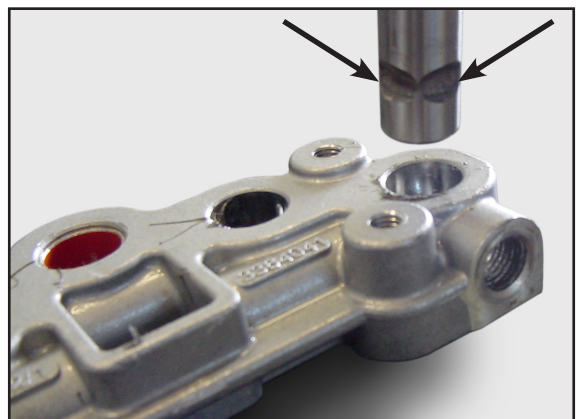
6172

7. Assemble the 1st / 2nd gear shift rail while maintaining the balls in their housings with your finger in the position of the 3rd / 4th gear shift rail. Push the rail until the interlock ball snaps to the notch on the rail.

NOTE: When assembling the shift rail, make sure to correctly position the rail notches for the balls: one notch facing the plug and the other notch facing the interlock hole.

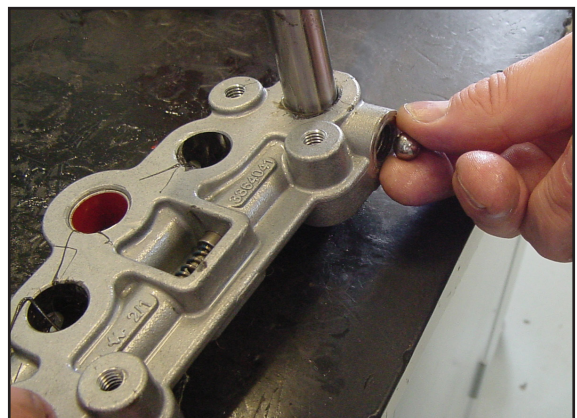


6177



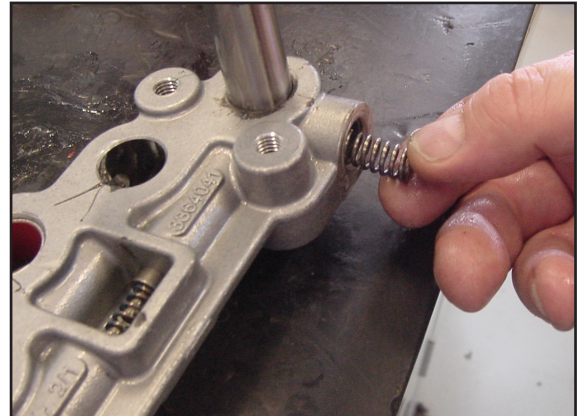
6503

8. Install one 9.5 mm diameter ball.



6504

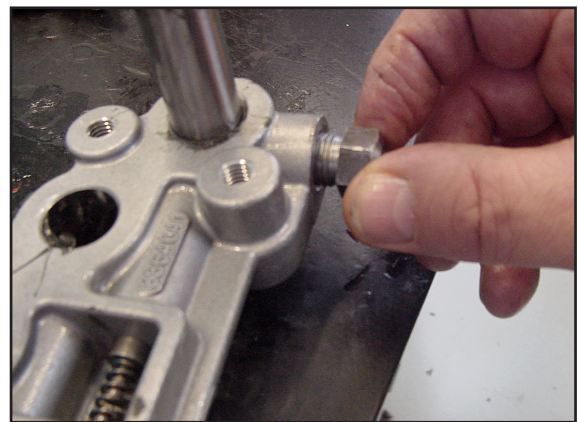
9. Install the positioner spring.



6505

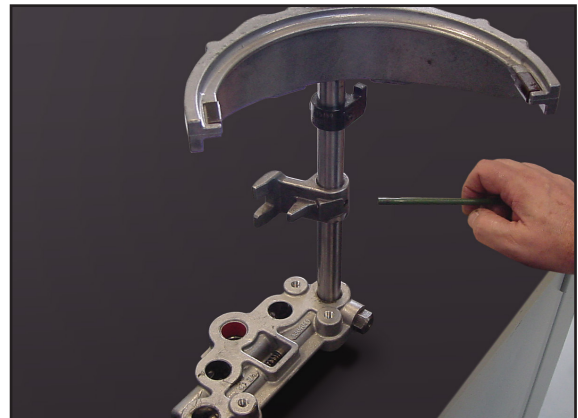
10. Install the positioner plug and tighten it to a torque of 19 – 26 N.m (14 – 19 lb.ft).

NOTE: Apply thread-locker Loctite 262 in the plug thread.



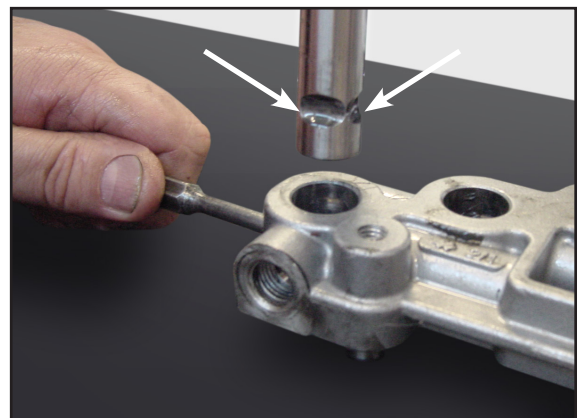
6506

11. Certify that the 1st / 2nd gear shift rail is properly positioned by the balls and maintain it in this position. Push the interlock balls into their housing with a pin punch through the hole on the 3rd / 4th gear shift rail.



6509

12. Install the 3rd / 4th gear shift rail, ensuring that the notches on its end are properly facing the positioner (plug) and interlock balls. Push the rail while gradually removing the pin punch, until the interlock ball snaps to the notch on the rail.



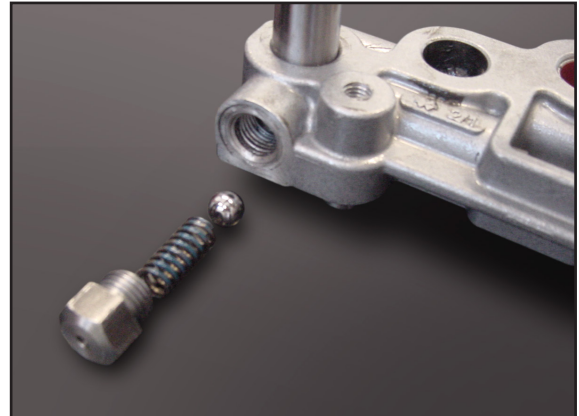
6511

Shift Yokes and Rails



13. Install one 9.5 mm diameter ball, the spring and the positioner plug. Tighten the plug to a torque of 19 – 26 N.m (14 – 19 lb.ft)

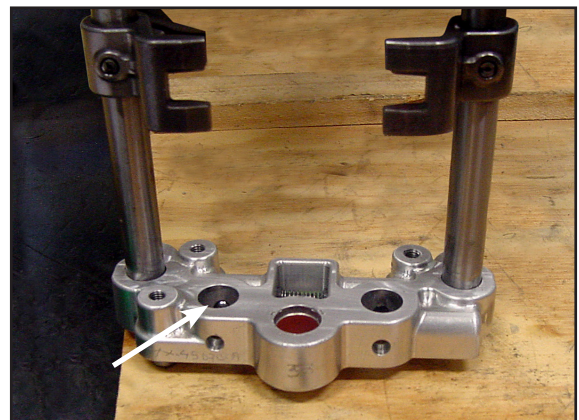
NOTE: Apply threadlocker Loctite 262 in the plug thread.



6516

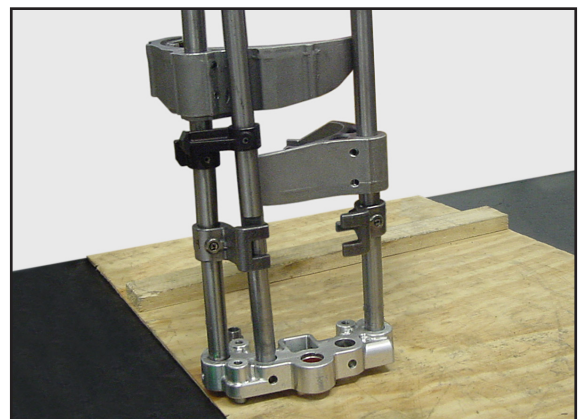
14. Install one 7.9 mm ball in the housing on the reverse gear shift rail, in the hole that connects this rail to the previously installed interlock.

NOTE: Use grease to keep the balls in their housings.



6182

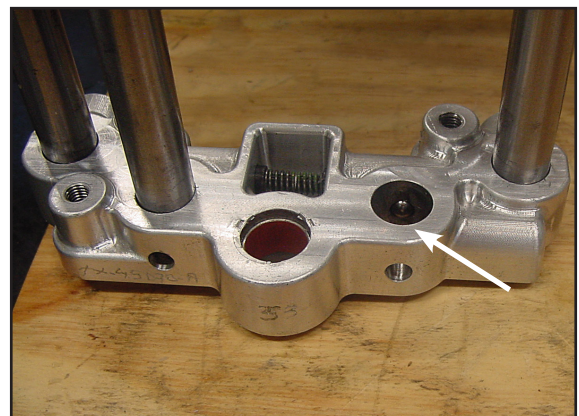
15. Install the reverse gear shift rail, properly aligning the notches on its end with the ball previously installed and with the hole that connects this rail with the 5th / 6th gear shift rail. Push the rail until the ball snaps to the notch on the rail.



6183

16. Install one 7.9 mm ball in the 5th / 6th gear shift rail, on the transverse hole.

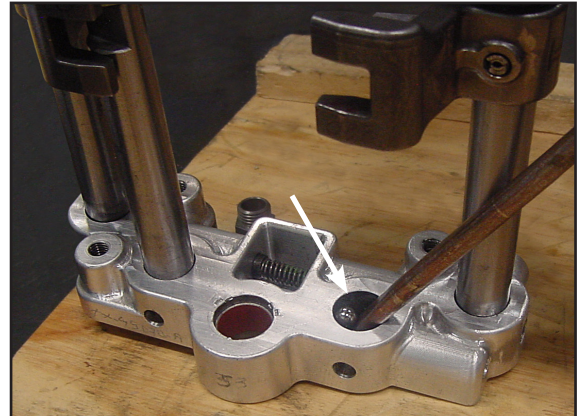
NOTE: Use grease to keep the balls in their housings.



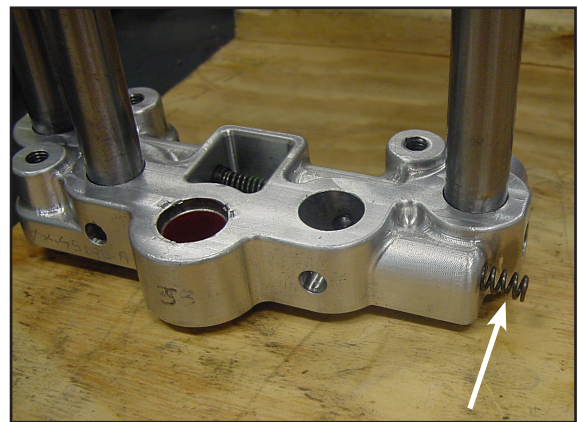
6188

17. In the hole connecting the 5th / 6th gear shift rail to the reverse gear shift rail, install one 7.9 mm diameter ball, a spring, one 7.9 mm diameter ball and another spring, in this order.

NOTE: Use grease to keep the balls in their housings.



6185

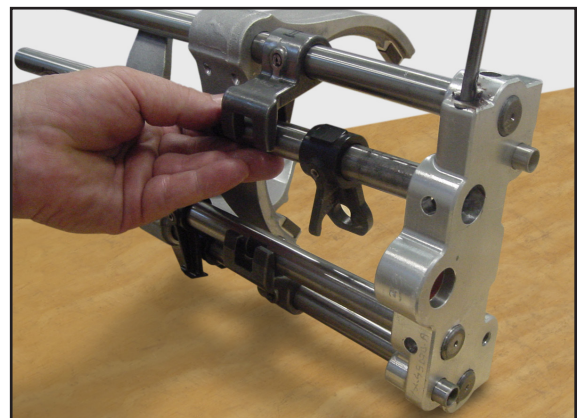


6189

18. After installing the spring, insert the third 7.9 mm diameter ball. Using a pin punch through the hole on the 5th / 6th gear shift rail, push and press the ball inside its housing, holding it pressed as much as possible.
19. Install the 5th / 6th gear shift rail while gradually removing the pin punch, assuring that the notches on the end of the rail are properly aligned with the two balls. Push the rail until the ball snaps to the notch on the rail.



6191



6529a

NOTE: Synchronizers sets are disassembled and assembled during the mainshaft disassembly and assembly, whose instructions in this manual provide the necessary details.

Characteristics

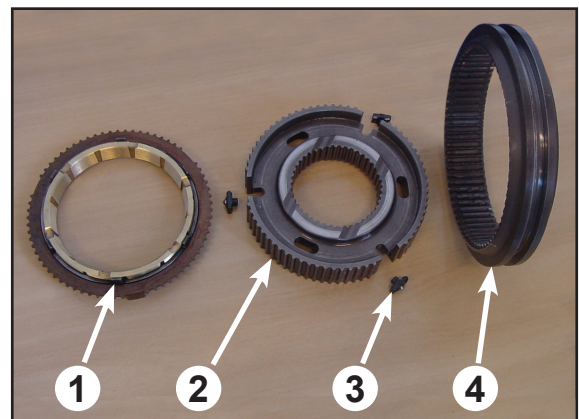
ES(B)O-6X06 transmissions use two types of synchronizer sets, all mounted on the mainshaft:

- Synchronizer with synchronizing rings of the “Tricone” type, used in the 1st and 2nd speed gear
- Synchronizer with single synchronizer ring, one for each gear, used in the 3rd, 4th, 5th and 6th speed gears.

NOTE: In case of repair of a synchronizer set, do not replace parts separately. Always replace the whole set.

Synchronizer with Tricone-type rings

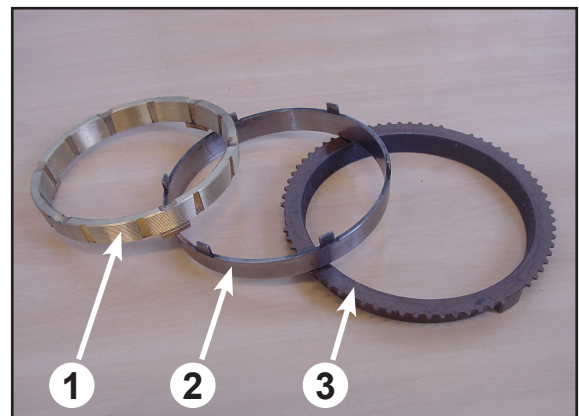
1. Tricone-type synchronizer ring
2. Hub
3. Key (3x)
4. Sliding clutch (synchronizer sleeve)



6203

The Tricone-type synchronizer ring consists of three rings mounted one inside the other: an inner ring, a middle ring and an outer ring. This provides a larger contact area, allowing for a more accurate speed equalization between the gears, making downshifting easier and smoother.

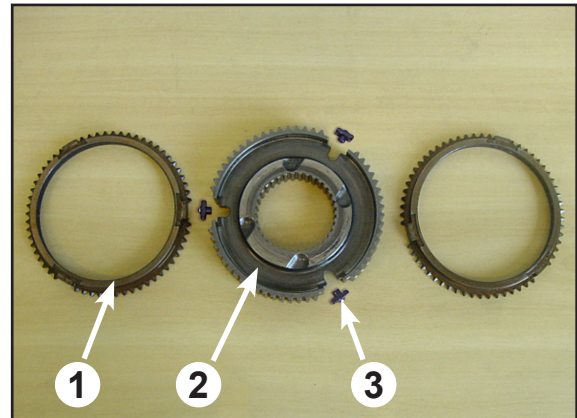
1. Inner ring
2. Middle ring
3. Outer ring



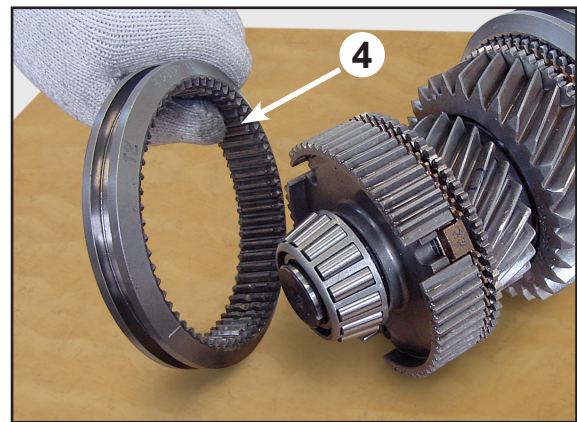
6202

Synchronizer with single-type rings

1. Synchronizer ring
2. Hub
3. Key (3x)
4. Sliding clutch (synchronizer sleeve)



6263a



6069a

Synchronizer cones

The synchronizer cone of the 4th, 5th and 6th speed gears, on which the respective synchronizer ring works, is removable and mounted on splines. The gears of the other speeds have the synchronizer cone integrated into the gear itself.

The fifth speed gear cone is mounted on the input shaft, as shown in the figure.

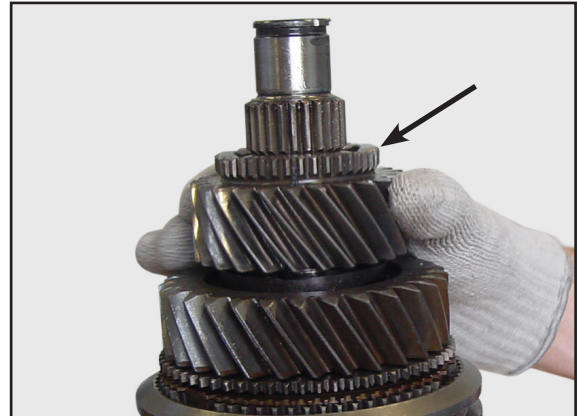


6293

Synchronizers



The synchronizer cone of the 4th and 6th speed gears is mounted on splines in the respective gear, on the mainshaft. Figures show the 6th speed gear without the cone, exposing the splines, and with the cone assembled.



6074

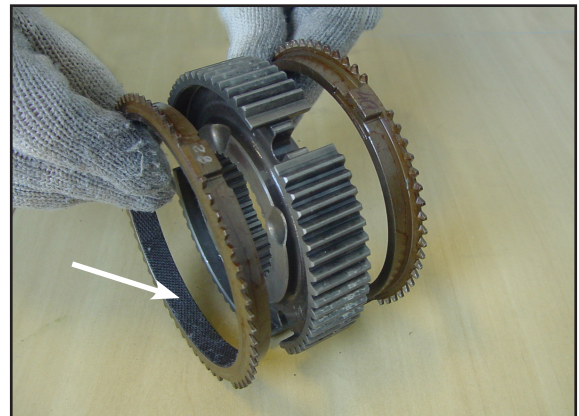


6277

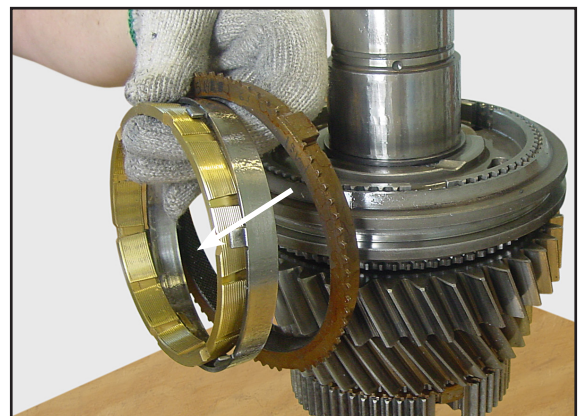
EFM II coating

EFM II (Eaton Friction Material) is a special coating used in some synchronizer rings to increase its lifetime.

On the ES(B)O-6X06 transmission model, the following synchronizer rings have the EFM II coating: the single-type ring and the outer ring in the Tricone-type synchronizer ring.



6264

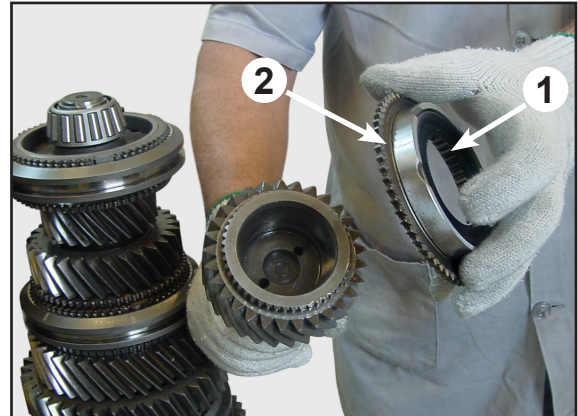


6099a

Disassembly

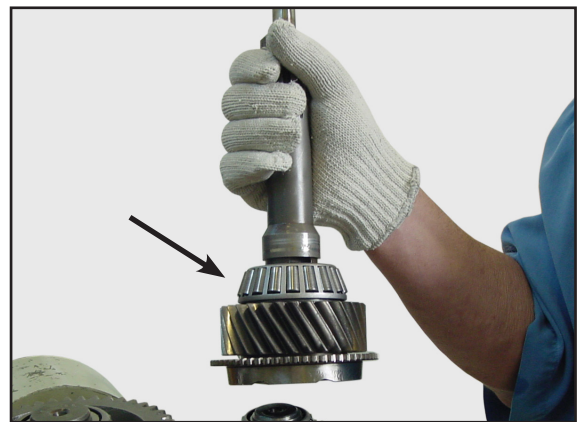
1. Remove the 5th gear synchronizer cone (1).
2. Remove the oil baffle (2) from inside its housing.

NOTE: The oil baffle will be damaged when disassembled. Replace it with a new one during assembly.



6293

3. Remove the input shaft front bearing cone using the special tool # EEA-17128.

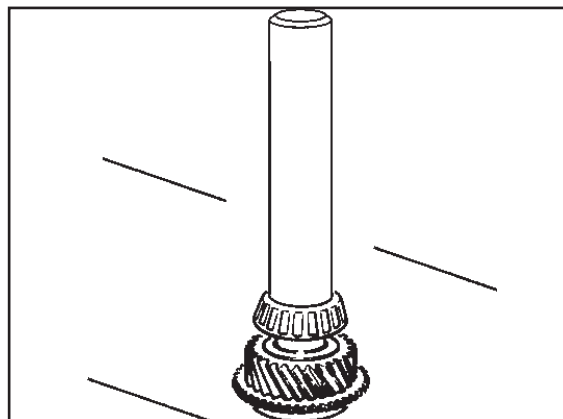


6057b

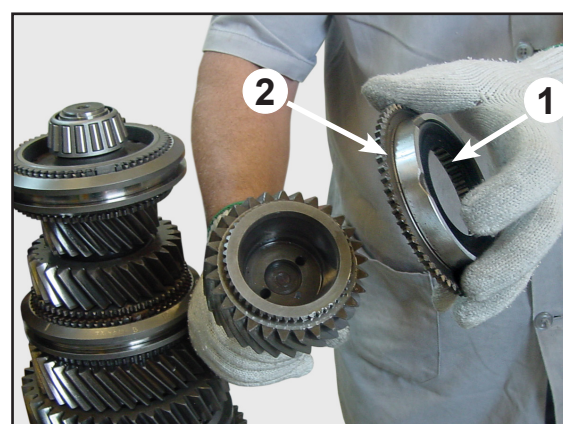
Assembly

1. Position the input shaft in a bench press with the front end facing up.
2. Install the front bearing cone using the special tool # EEA-17004.

NOTE: If needed, heat the bearing to 120°C to facilitate the installation

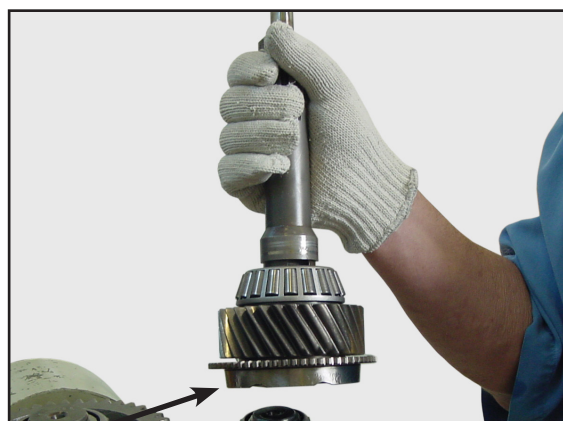


4405/171



6293

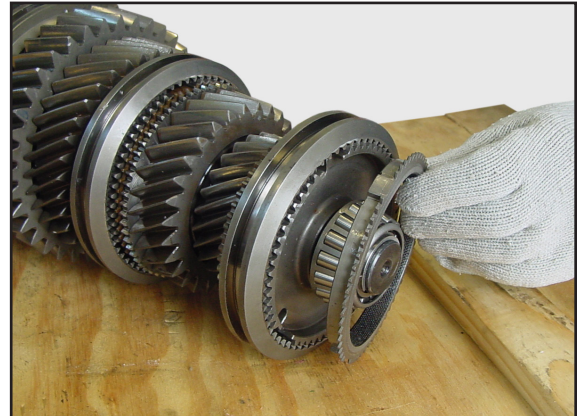
3. Install a new oil baffle (1) inside the 5th gear synchronizer cone (2).
4. Install the 5th gear synchronizer cone in the input shaft, with the cone side facing out.



6057b

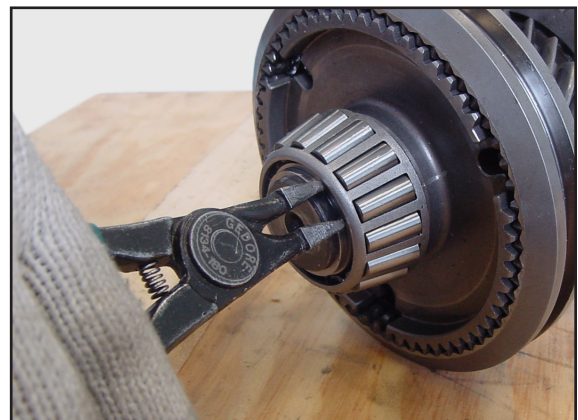
Disassembly

1. Remove the 5th speed synchronizer cone.



6064

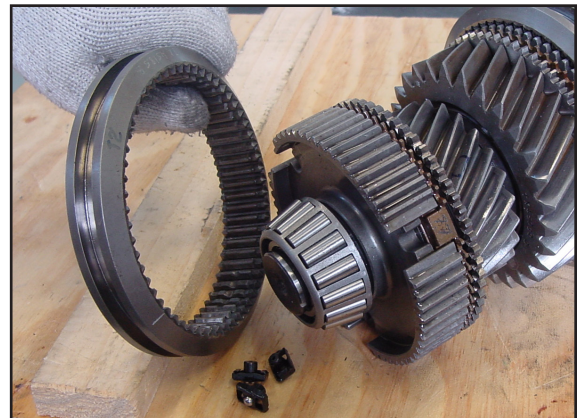
2. Remove the “pocket” bearing snap ring.



6067

3. Remove the sleeve and the three keys of the 5th and 6th speed synchronizer.

NOTE: Pay attention not to drop and lose the keys.



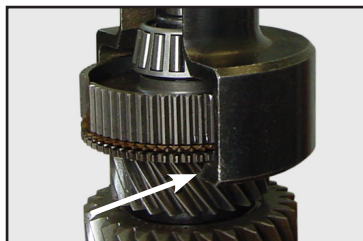
6069

4. Place the mainshaft in vertical position on a work bench with the “pocket” end facing up and the rear (yoke) end supported on the special tool # EEA-17506.



6070

5. Using the special tool # EEA-17131 supported in the lower face of the 6th speed gear synchronizer cone, remove together: the cone, the 6th speed synchronizer ring, the 5th and 6th speed synchronizer hub and the “pocket” bearing cone.



6071a



6071

6. Remove the 6th speed gear.



6074

7. Remove the two needle bearings of the 6th speed gear.



6075

8. Remove the thrust washer snap ring.



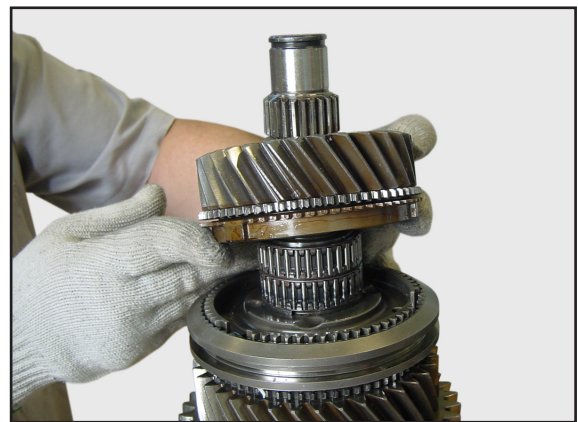
6077

9. Remove the thrust washer and the positioning ball.



6078

10. Remove together: the 4th speed synchronizer ring, the synchronizer cone and the 4th speed gear.



6079

11. Remove the two needle bearings of the 4th speed gear.



6080

12. Remove the 3rd and 4th speed synchronizer hub snap ring.



6082

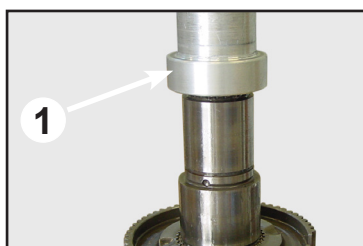
13. Remove the sleeve and the three keys of the 3rd and 4th speed synchronizer.

NOTE: Pay attention not to drop and lose the keys.

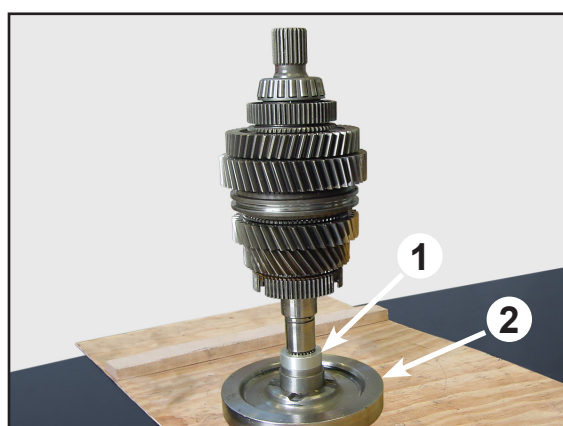


6083

14. Place the protecting device (1) on the end of the “pocket” bearing of the mainshaft to protect the bearing seat. Now, invert the shaft position and place this end (with the protecting device) in the tool # EEA-17506 (2), placing the shaft with the rear (yoke) end facing up.



6084



6085

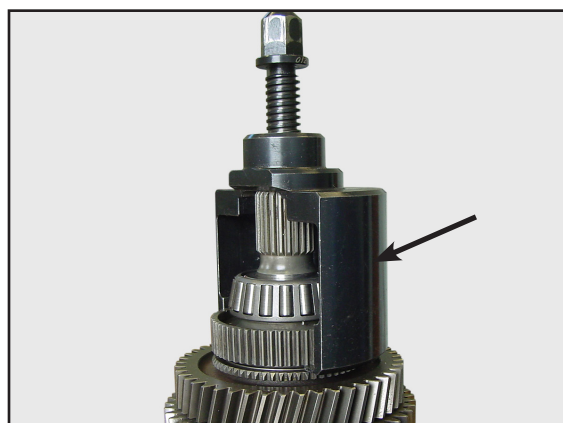
15. Using the special tool # EEA-17131 supported in the lower face of the reverse speed coupling hub, remove together: the hub and the rear bearing cone.



6090



6088



6087

16. Remove the reverse speed gear.



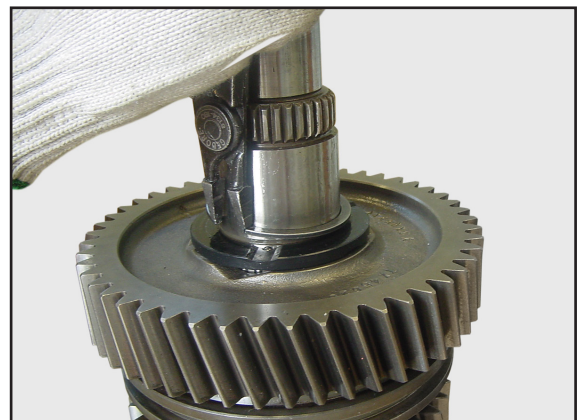
6091

17. Remove the double needle bearing of the reverse speed gear.



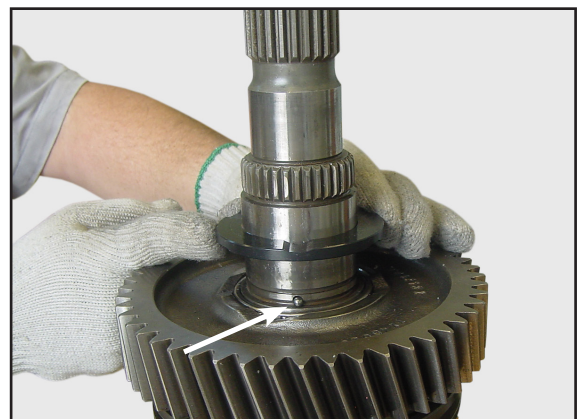
6092

18. Remove the thrust washer snap ring.



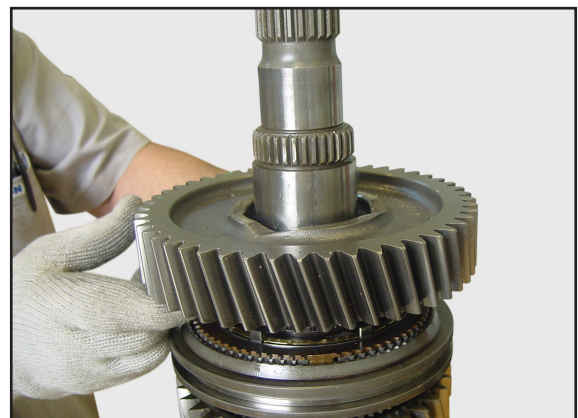
6093

19. Remove the thrust washer and the positioning ball.



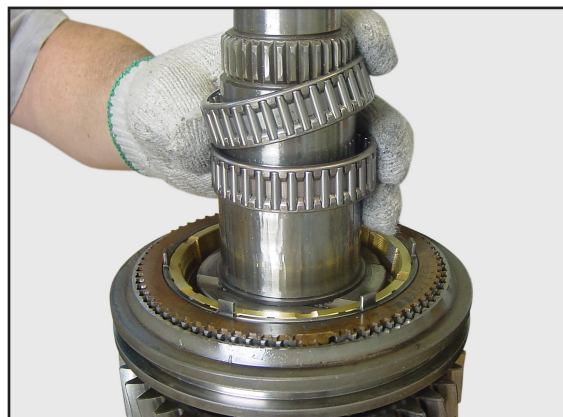
6094

20. Remove the 1st speed gear.



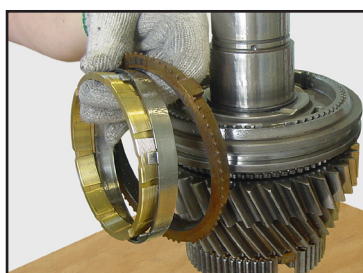
6096

21. Remove the two needle bearings of the reverse speed gear.



6097

22. Remove the 1st speed synchronizer ring (tricone) assembly.



6099



6098

23. Remove the 1st and 2nd speed synchronizer assembly snap ring.



6100

24. Remove the sleeve and the three keys of the 1st and 2nd speed synchronizer.

NOTE: Pay attention not to drop and lose the keys.



6101

25. Place the mainshaft in a press with the yoke end facing up and supported by the 2nd speed gear.

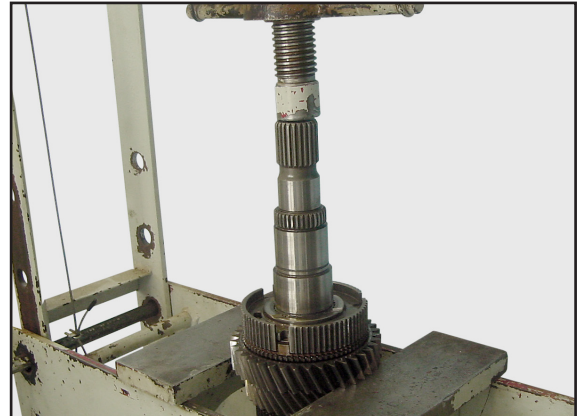


ATTENTION! Make sure that the gear face is properly supported on the press base.

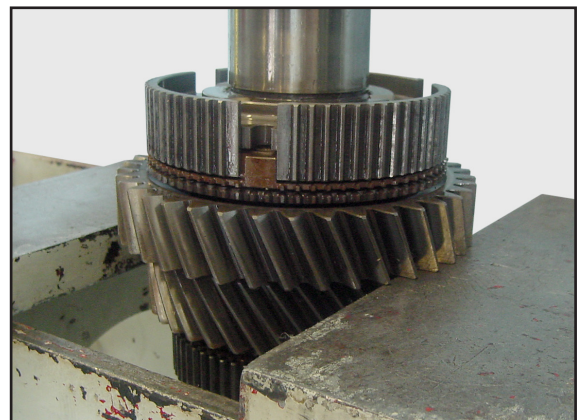
26. Press the mainshaft down and remove together: the 1st and 2nd speed synchronizer hub, the 2nd speed synchronizer ring (tricone) assembly and the 2nd speed gear.



ATTENTION! Hold the shaft from underneath the press so it does not fall.



6102



6103

27. Invert the position of the mainshaft in the press and place it now with the "pocket" end facing up, supported by the 3rd speed gear

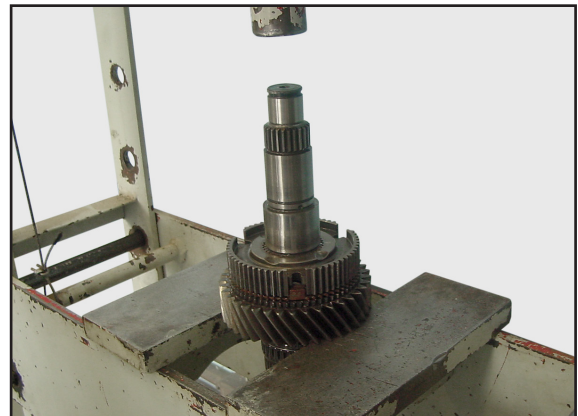


ATTENTION! Make sure that the gear face is properly supported on the press base.

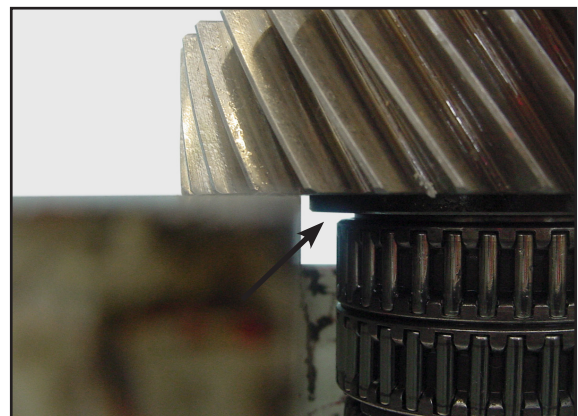
28. Press the mainshaft down and remove together: the 3rd and 4th speed synchronizer hub, the 3rd speed synchronizer ring and the 3rd speed gear.



ATTENTION! Hold the shaft from underneath the press so it does not fall.



6107



6110

29. Place the mainshaft on the work bench once again, with the “pocket: end facing up and supported on the special tool.
30. Remove the double needle bearing of the 3rd speed gear.



6113

31. Remove the thrust washer snap ring.



6114

32. Remove the thrust washer and the positioning ball.



6117

33. Remove the two needle bearings of the 2nd speed gear.



6118

34. Remove the 1st and 2nd speed synchronizer hub snap ring.



6119

Assembly

1. Place the mainshaft in vertical position on a work bench with the front ("pocket") end facing up and the rear (yoke) end supported on the special tool # EEA-17506.
2. Install the 1st and 2nd speed synchronizer hub snap ring in the front groove of the spline.



6210

3. Place the protecting device on the end of the "pocket" bearing of the mainshaft to protect the bearing seat.



6212

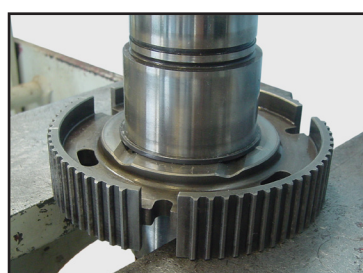
4. Now, invert the shaft position and place this end (with the protecting device) in the tool on the bench, placing the shaft with the rear (yoke) end facing up.

Heat the 1st and 2nd speed synchronizer hub to 140°C and, with special tool # EEA-17029 and a hammer, mount the hub in its position in the shaft, until the hub touches the snap ring.

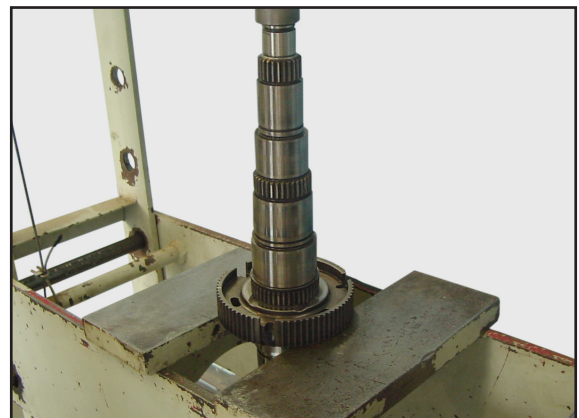
NOTE: As an option, the synchronizer hub can be mounted on a press. Place the hub on the base of a press. Position the mainshaft rear (yoke) end on the hub opening and, with the press, insert the shaft in the hub until the hub touches the snap ring.



6214



6217



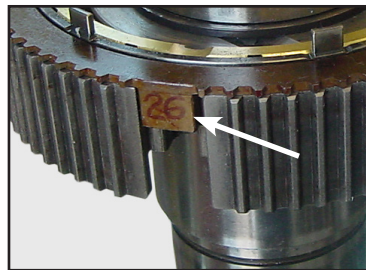
6216

5. Install the second 1st and 2nd speed synchronizer hub snap ring.



6219

6. Install the 1st speed synchronizer ring (tricone) outer ring, with the teeth side facing up, matching the ridges on the ring to the slots on the hub.

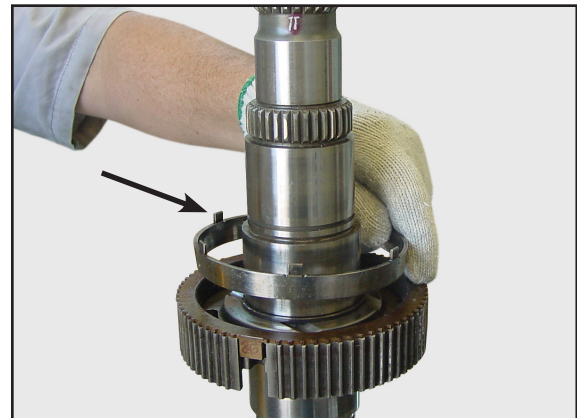


6227



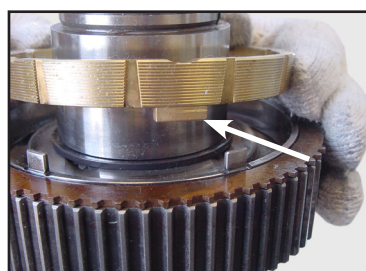
6220

7. Install the 1st speed synchronizer ring (tricone) middle ring, with the tabs on the ring facing up.

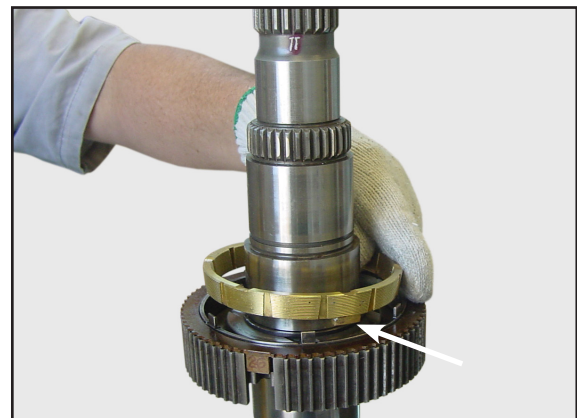


6221

8. Install the 1st speed synchronizer ring (tricone) inner ring, with the tabs on the ring facing down.

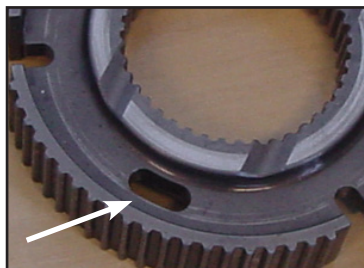


6225



6222

9. Turn the ring until the ridges snap onto the elongated holes in the hub.



6203



6227

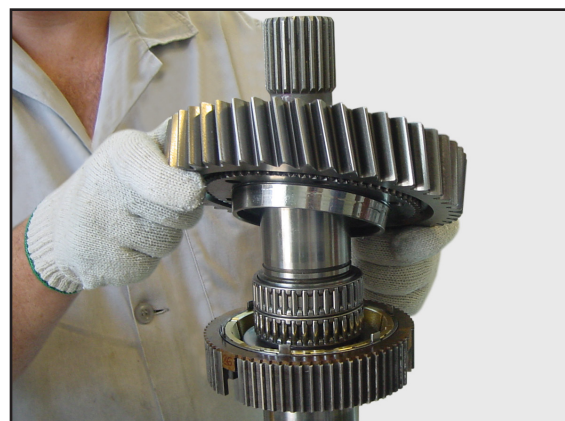
10. Install the two needle bearings of the 1st speed gear.

NOTE: Lubricate the bearings with oil from the gearbox.



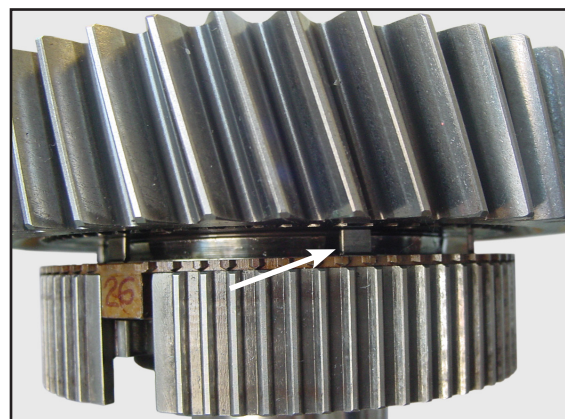
6228

11. Install the 1st speed gear with the cone side facing the synchronizer hub.



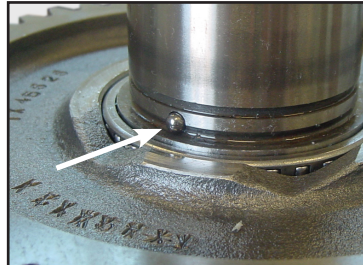
6229

12. Turn the gear until the tabs on the synchronizer ring snap onto the elongated holes in the gear.



6231

13. Install the positioning ball of the 1st speed gear thrust washer.

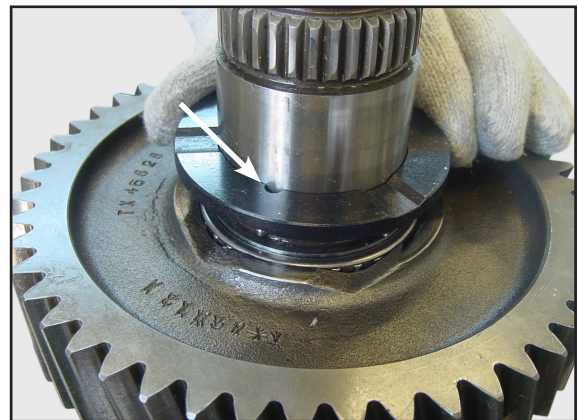


6233



6234

14. Install the 1st speed gear thrust washer, aligning the slot on the washer with the positioning ball.



6236

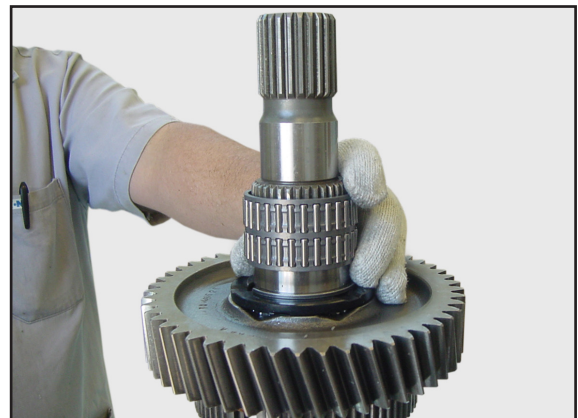
15. Install the thrust washer snap ring.



6237

16. Install the double needle bearing of the reverse speed gear.

NOTE: Lubricate the bearings with oil from the gearbox.



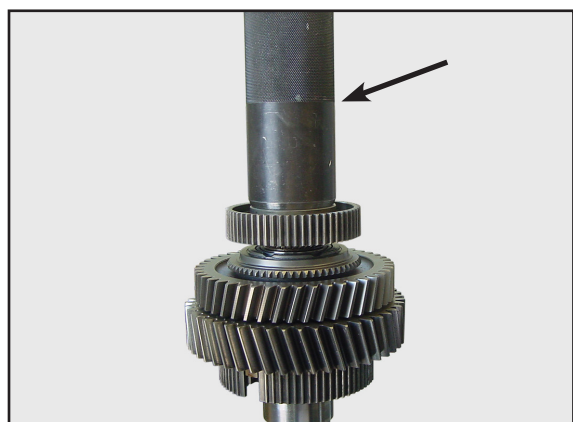
6238

17. Install the reverse speed gear with the teeth side facing up.



6239

18. Heat the reverse speed coupling hub to 140°C and, with special tool # EEA-17029 and a hammer, mount the hub in its position in the shaft, until the hub touches the snap ring.



6241

19. With the special tool # EEA-17027 and a hammer, install the rear bearing cone.

NOTE: If needed, heat the bearing to 120°C to facilitate the installation.



6243

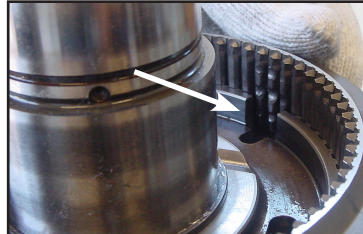
20. Invert the mainshaft position on the bench, placing it on the tool supported by the yoke end.



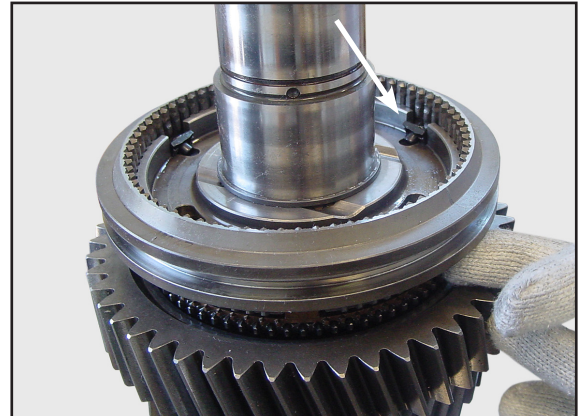
6244

21. Install the three keys and the 1st and 2nd speed synchronizer sleeve on the synchronizer hub.

NOTE: Align the detent grooves for the keys on the sleeve to the key slots on the hub.

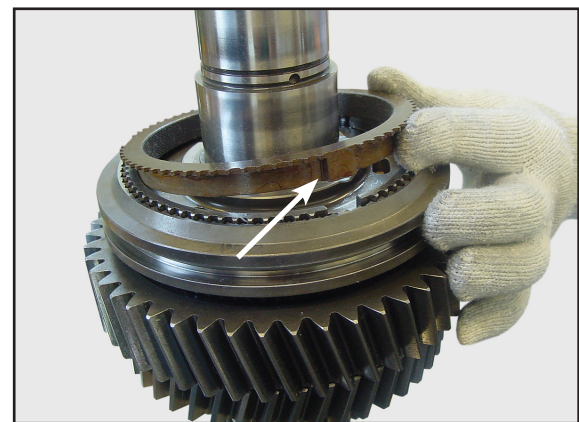


6246



6248

22. Install the 2nd speed synchronizer ring (tricone) outer ring, with the teeth side facing up, matching the ridges on the ring to the slots on the hub.



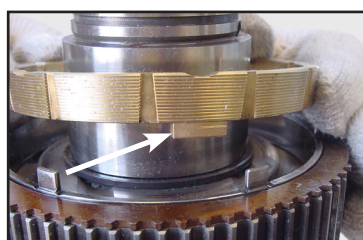
6249

23. Install the 2nd speed synchronizer ring (tricone) middle ring, with the tabs on the ring facing up.



6250

24. Install the 2nd speed synchronizer ring (tricone) inner ring, with the tabs on the ring facing down.
25. Turn the ring until the tabs snap onto the elongated holes in the hub.



6225



6251

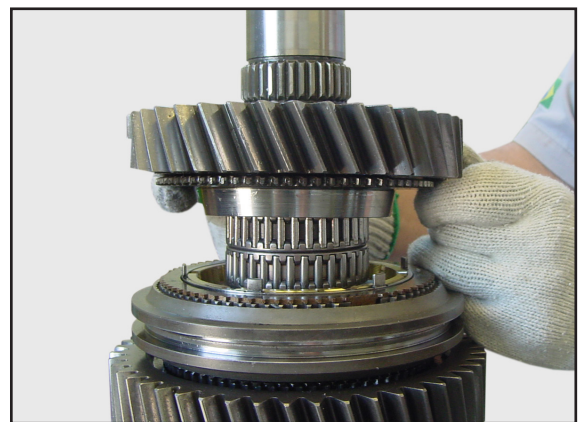
26. Install the two needle bearings of the 2nd speed gear.

NOTE: Lubricate the bearings with oil from the gearbox.



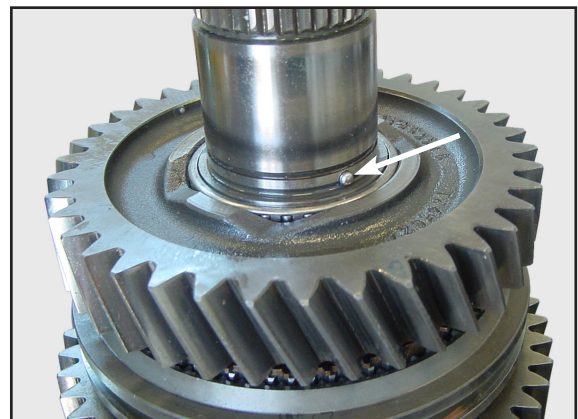
6252

27. Install the 2nd speed gear with the cone side facing the synchronizer hub.
28. Turn the gear until the tabs on the tricone synchronizer ring snap onto the elongated holes in the gear.



6253

29. Install the positioning ball of the thrust washer.



6254

30. Install the thrust washer, aligning the slot on the washer with the positioning ball.



6255

31. Install the thrust washer snap ring.



6077

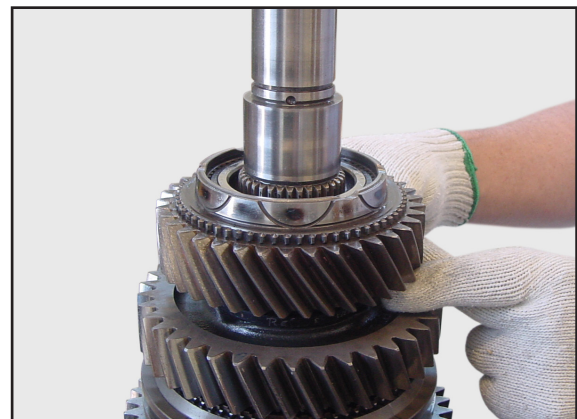
32. Install the double needle bearing of the 3rd speed gear.

NOTE: Lubricate the bearings with oil from the gearbox.



6257

33. Install the 3rd speed gear with the cone side facing up.



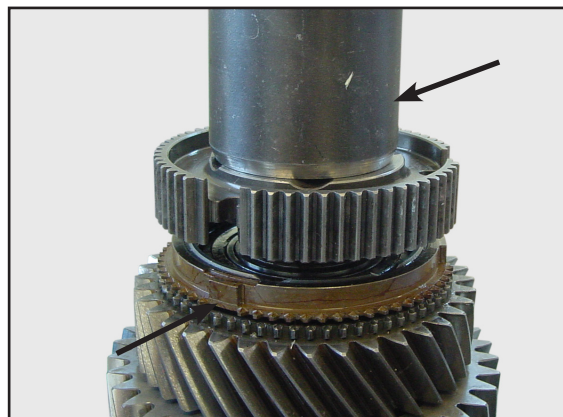
6258

34. Install the 3rd speed synchronizer ring on the gear cone, with the teeth facing towards the gear.



6259

35. Heat the 3rd and 4th speed synchronizer hub to 140°C and, with the special tool # EEA-17029 and a hammer, mount the hub in its position in the shaft. During installation of the hub, align and fit the slots on the hub to the ridges on the synchronizer ring.



6265

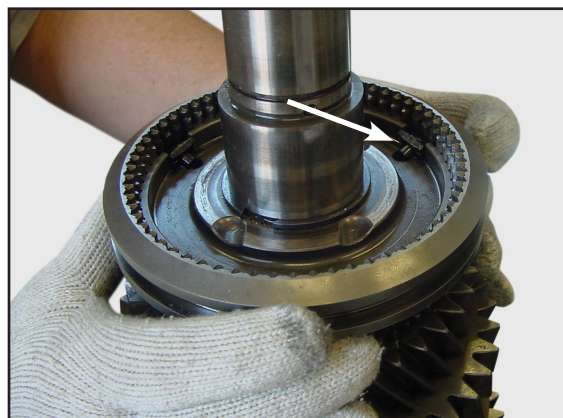
36. Install the 3rd and 4th speed synchronizer hub snap ring.



6266

37. Install the three keys and the 3rd and 4th speed synchronizer sleeve on the synchronizer hub.

NOTE: Align the detent grooves for the keys on the sleeve to the key slots on the hub.



6269

38. Install the 4th speed synchronizer ring with the teeth side facing up, matching the ridges on the ring to the slots on the hub.



6270

39. Install the two needle bearings of the 4th speed gear.

NOTE: Lubricate the bearings with oil from the gearbox.



6271

40. Install the 4th speed gear with the cone side facing the synchronizer hub.



6272

41. Install the positioning ball of the thrust washer.

NOTE: When carrying out maintenance on the transmission, the level of revision being carried out must be observed. If it is necessary to replace the mainshaft, it is mandatory to simultaneously replace the shaft and the thrust washer and eliminate the positioning ball. Refer to the Parts Catalog.



6273

42. Install the thrust washer, aligning the slot on the washer with the positioning ball.



6274

43. Install the 4th speed gear thrust washer snap ring.



6275

44. Install the two needle bearings of the 6th speed gear.

NOTE: Lubricate the bearings with oil from the gearbox.



6276

45. Install the 6th speed gear with the cone side facing the synchronizer hub.



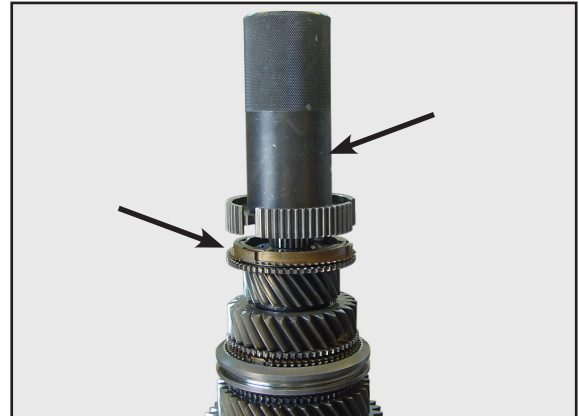
6277

46. Install the 6th speed synchronizer ring on the gear cone, with the teeth facing towards the gear.



6278

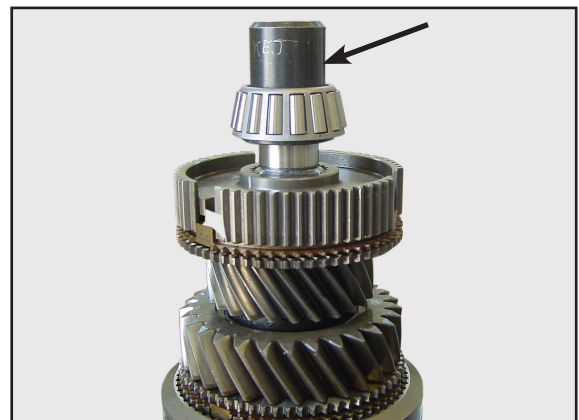
47. Heat the 5th and 6th speed synchronizer hub to 140°C and, with the special tool # EEA-17029 and a hammer, mount the hub in its position in the shaft. During installation of the hub, align and fit the slots on the hub to the ridges on the synchronizer ring.



6281

48. With the special tool # EEA-17026 and a hammer, install the front bearing cone.

NOTE: If needed, heat the bearing to 120°C to facilitate the installation.



6284

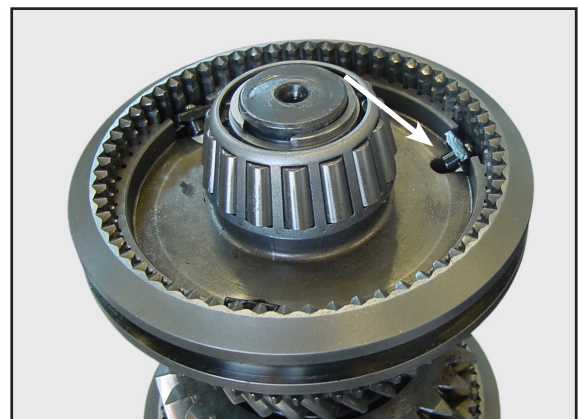
49. Install the “pocket” bearing snap ring.



6286

50. Install the three keys and the 5th and 6th speed synchronizer sleeve on the synchronizer hub.

NOTE: Align the detent grooves for the keys on the sleeve to the key slots on the hub.



6288

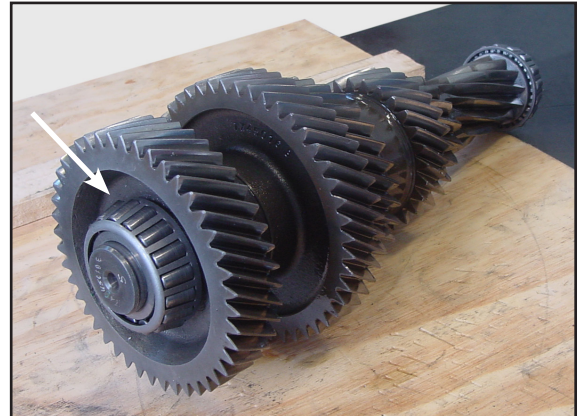
51. Install the 5th speed synchronizer ring with the teeth side facing up, matching the ridges on the ring to the slots on the hub.



6292

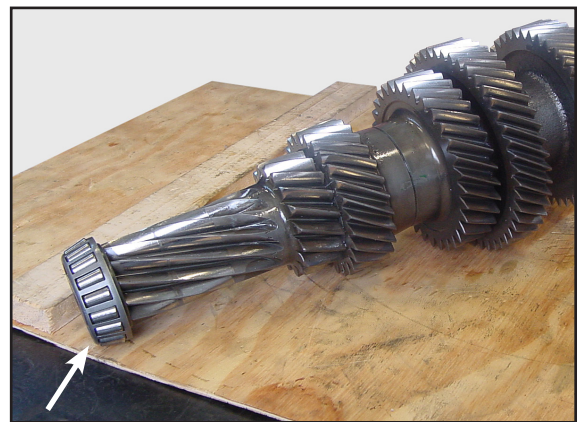
Disassembly

1. With special tool # EEA-17134 with # EEA-17103 (not shown), remove the front bearing cone.



6124

2. With special tool # EEA-17134 with # EEA-17103 (not shown), remove the rear bearing cone.

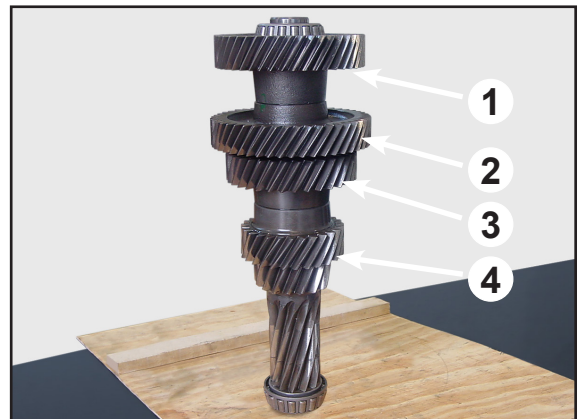


6123

3. Place the countershaft vertically in a press, with the front end facing up. Supporting the countershaft by the lower face of the drive gear (1), press the shaft down and remove the drive gear.



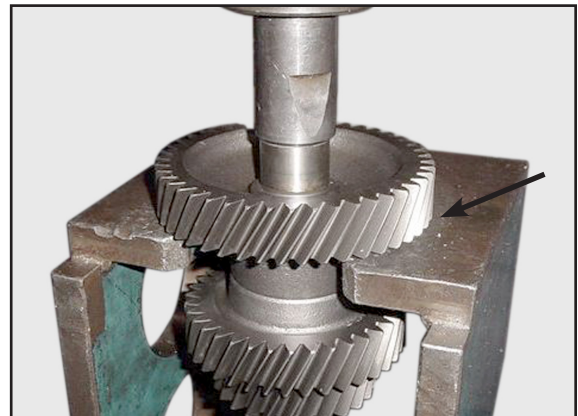
ATTENTION! Hold the countershaft from underneath the press so it does not fall.



6122

4. Repeat the previous step for each of the following gears, in this order:

- 6th speed gear (2)
- 4th speed gear (3), using special tool # EEA-17132
- 3rd speed gear (4), using special tool # EEA-17133



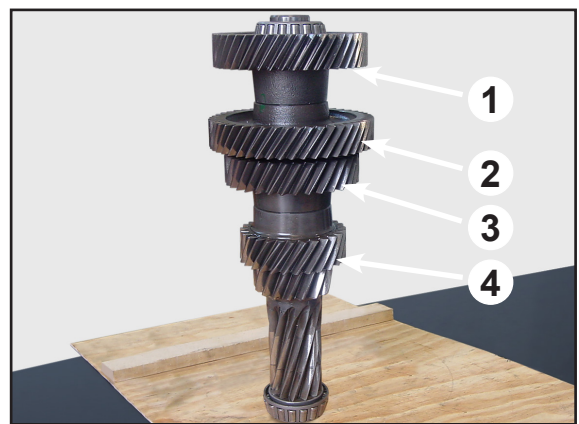
0368

Assembly

1. Position the countershaft vertically in a press with the front end facing up and supported by the lower face of the 2nd speed gear (machined on the countershaft). Position the 3rd speed gear (4) on the shaft with the most prominent side of the flange facing up and, with a proper tubular device on the gear, press the shaft and install the 3rd speed gear.
2. Repeat the previous step for each of the following gears, in this order:
 - 4th speed gear (3), with the prominent side facing the 3rd speed gear.
 - 6th speed gear (2), with the prominent side facing up
 - Countershaft drive gear (1) with the prominent side facing the 6th speed gear.



0355



6122

3. Using a tubular device # EEA-17004, press the front bearing cone until its stop, with the smaller diameter of the cone facing up.



ATTENTION! Place the tubular device in the inner track of the bearing. NEVER place it on the cage.

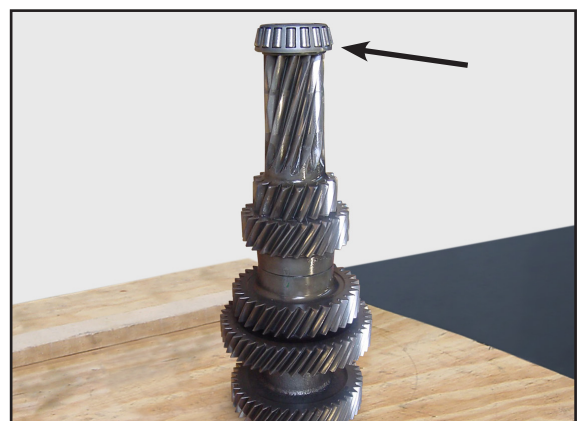


0359

4. Turn the countershaft on the press and maintain it in the vertical position, but this time with the rear end facing up and supporting it on the drive gear.
5. Using a proper tubular device (not shown), press the rear bearing cone until its stop, with the smaller diameter of the cone facing up.



ATTENTION! Place the tubular device in the inner track of the bearing. NEVER place it on the cage.



6123a

NOTE:

- Thoroughly clean casings and any previous signs of sealants or adhesives on their contact surfaces, as well as any residue of thread locker on threaded holes and bolts.
- See instructions for proper sealant application in the topic “Tightening Torques and Sealants” in this manual.

1. With the special base # EEA-17505 on the workbench, position the input shaft on the device with the front bearing end facing down and fit the input shaft bearing into the proper housing on the device.



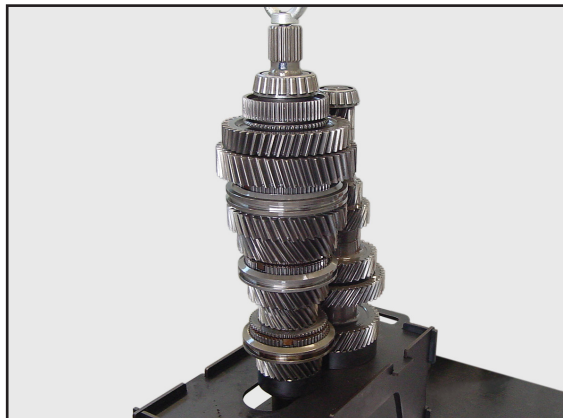
6463a

2. If it has not already been installed, install the 5th speed gear synchronizer cone on the input shaft gear, with the cone side facing up.
3. Position the mainshaft over the input shaft and fit the “pocket” bearing into its housing. Make sure that the mainshaft is properly fitted and check if the synchronizer sleeve shifts into the 5th gear without any difficulty.



6294a

4. Position the countershaft on the device with the front bearing end facing down and fit the countershaft bearing into its housing on the device, ensuring that all gears mesh properly on both shafts.



6500

NOTE: Place all gears in neutral.

5. Attach the shift rails set, as assembled before in this manual, to the mainshaft and countershaft assembly, fitting the 1st/2nd and 3rd/4th shift yokes into their respective sliding sleeves.



6497



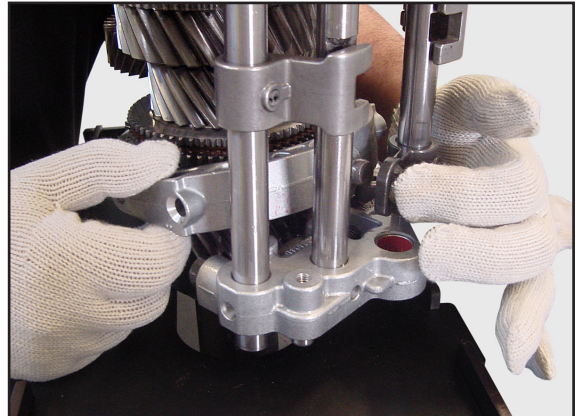
6492

6. Install the shift rails' rear support.

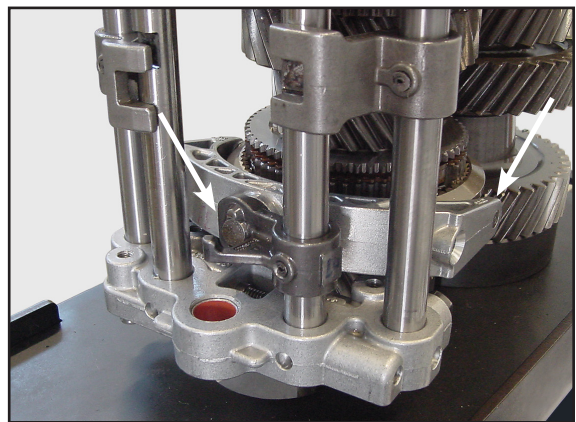


6485

7. Install the 5th/6th shift yoke, fitting the yoke pads into the sliding sleeve and the pin into the shift block hole.



6483



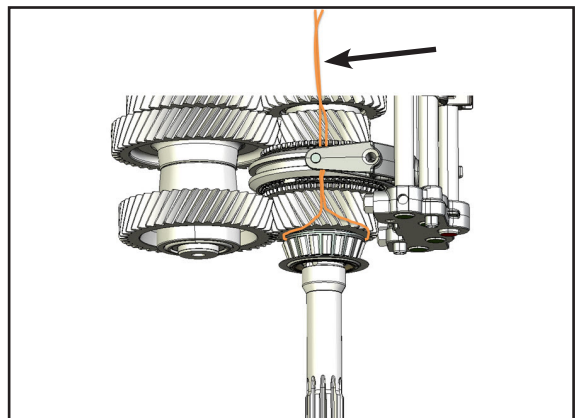
6472

8. Using a Hellerman-type strap or wire, tie the shafts and shift rails assembly so that they do not come loose during its moving and installation into the front transmission case.
9. Install the eye bolt into the threaded bore at the end of mainshaft, for lifting shafts and shift rails assembly.



6466

10. Secure the input shaft using two pieces of flexible wire or sturdy string. With one of the pieces, make a loop under the gear of the input shaft as shown in the figure and, through the 5th/6th shift yoke, tie the ends to the eye bolt. Do the same for the second piece on the opposite side.



6460b

Transmission Assembly

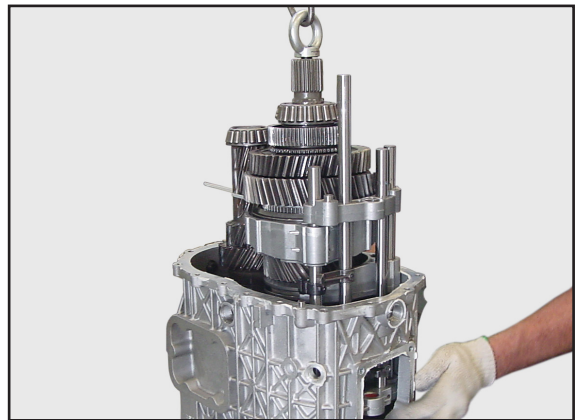


11. Place the front case with its front side (bell housing) facing down on the stand mounting bracket and secure the case with at least two capscrews.
12. With a hoist, lift shafts and shift rails assembly from the special base and position the assembly over the front case.



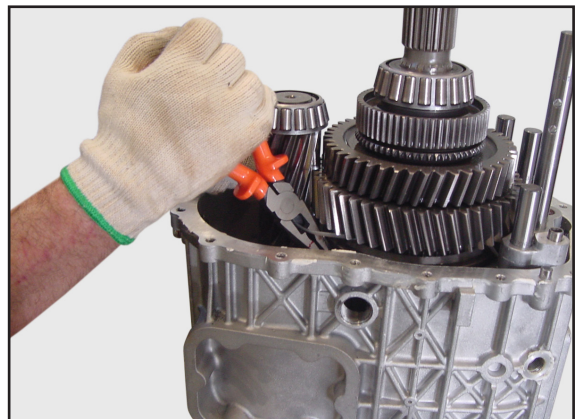
6570

13. Carefully, lower the shafts and shift rails assembly into the front case.



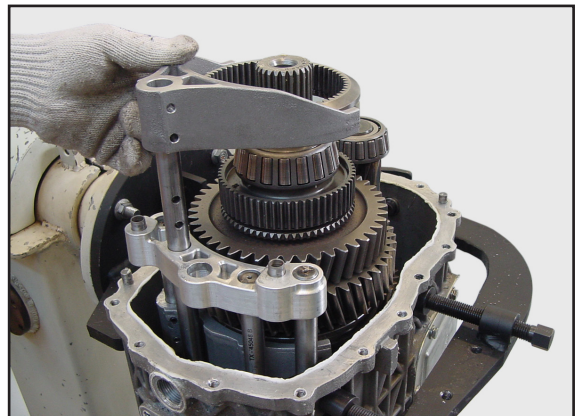
6575

14. After seating the shafts and rails assembly into the case, cut and remove the strap used to hold them together and untie the strings used to secure the input shaft and pull them out.



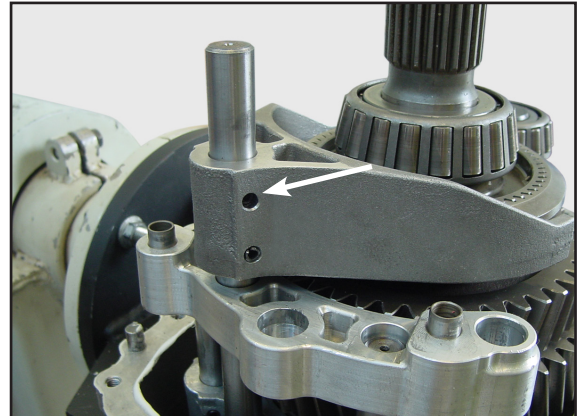
6578

15. Install the reverse shift yoke together with the reverse coupling sleeve.



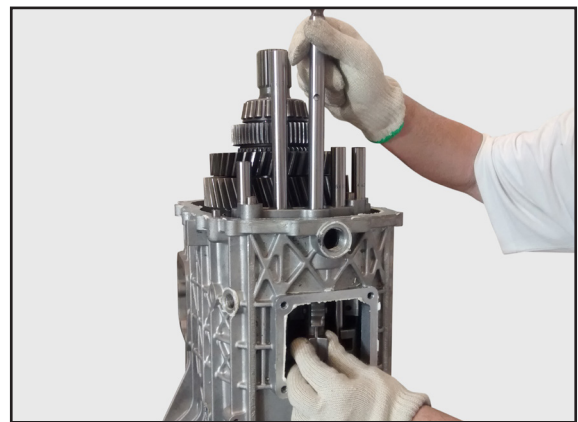
6009

16. Install the two roll pins of the reverse shift yoke.



6008

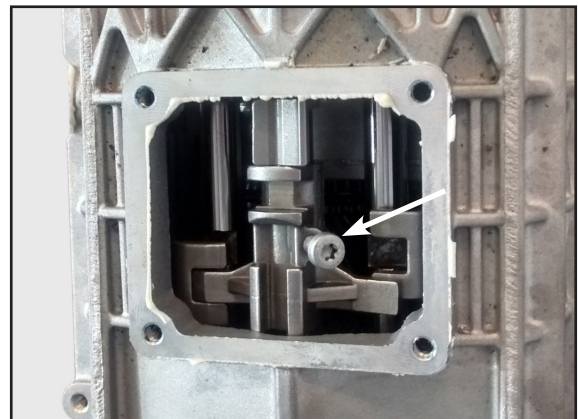
17. Install the main shift rail at the same time that the shift selector block and the shift lug are installed, making the rail pass through their holes. Fit the lower end of the rail into the front support.



162811690

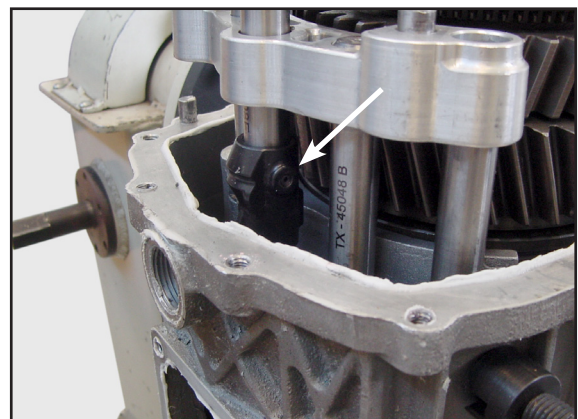
18. Install and tighten the selector block Torx screw to the specified torque.

NOTE: Apply Loctite 262 threadlocker onto the screw threads. Tighten to the torque of 38-44 N.m (28-32 Lb.ft).



163035909b

19. Install the shift lug retaining roll pin.

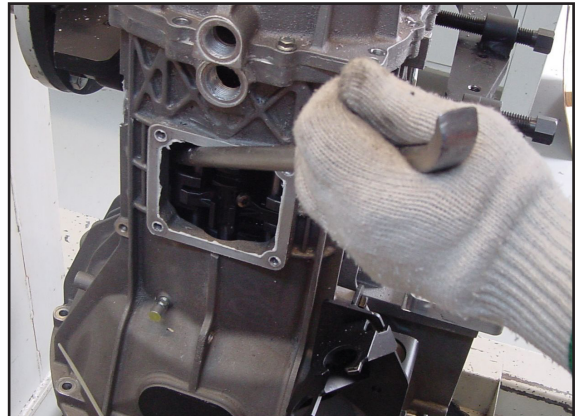


6004

Transmission Assembly



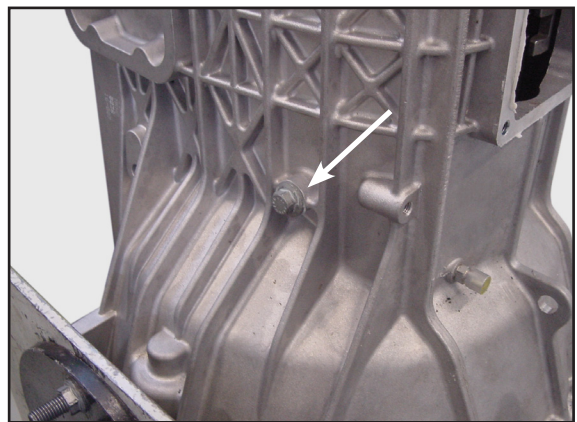
20. Using a pry bar, shift transmission into the 2nd speed by pushing the 2nd/3rd gear synchronizer sleeve downward.



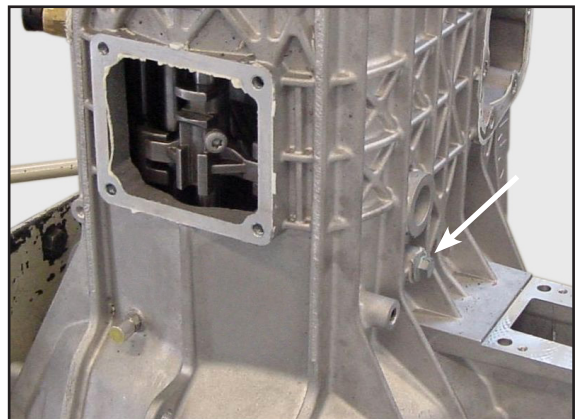
5994

21. Install the two pivot pins of the 5th/6th shift yoke (one at each side of the case).

NOTE: Apply Dow Corning 780 sealant onto the threads and contact face of the pins. Tighten to the torque of 19-26 N.m (14-19 Lb.ft).

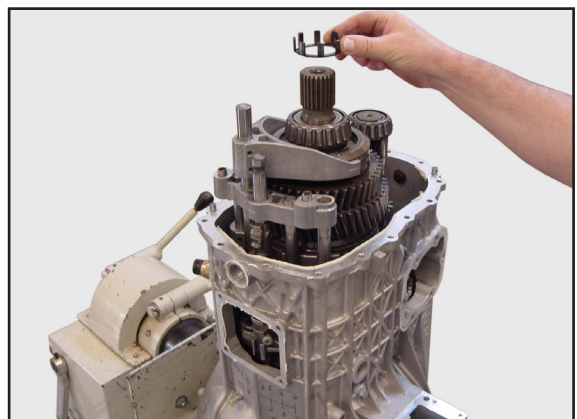


6454



6439a

22. Install the speedometer rotor.

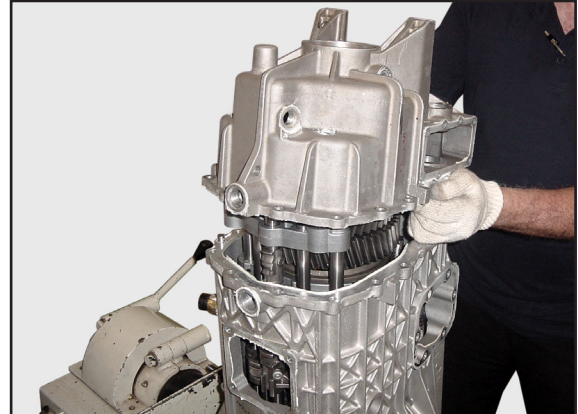


6444

23. Clean the contact faces of the front and rear cases, removing any signs of the old sealant.



ATTENTION! If either the mainshaft or countershaft end play has not yet been adjusted, DO NOT apply sealant to the housing faces at this point and provisionally install the rear case with its retaining screws. Perform the end play measurement and determine the number of shims required for adjustment (see “End Play Adjustment” in this manual). Otherwise, proceed to the next step.

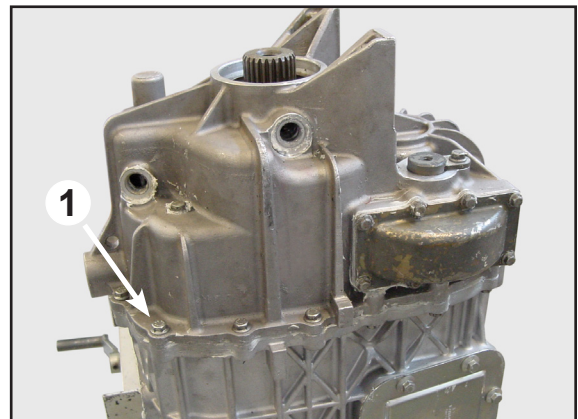


6443

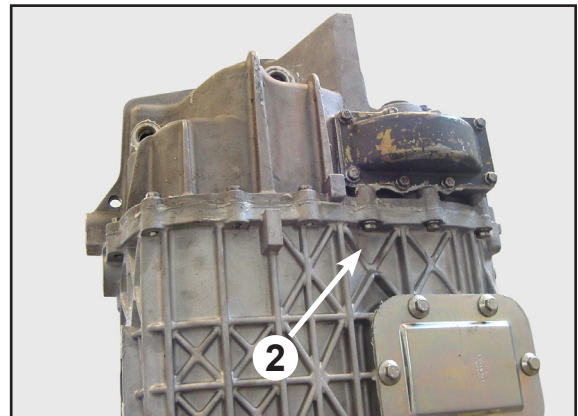
24. Apply a continuous sealant string along the contact surface of either the front or the rear case and install the rear case.

NOTE: See topic “Tightening Torques and Sealants” in this manual for the proper application of sealant.

25. Install the sixteen rear case retaining capscrews to the front case, being thirteen above (1) and three underneath (2) the flange. Tighten capscrews in a criss-cross tightening sequence to the torque of 19-26 N.m (14-19 Lb.ft).



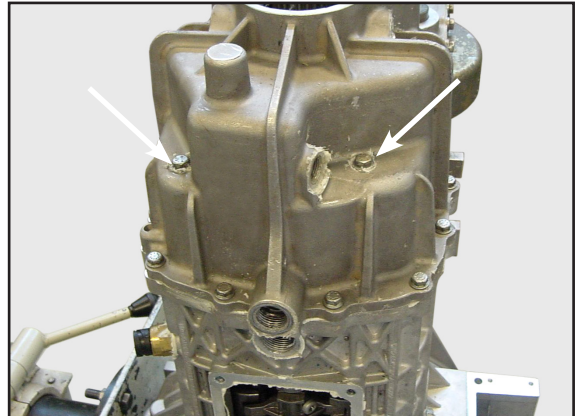
6418



6419

26. Install the two retaining capscrews of the shift rails' rear support.

NOTE: Apply Dow Corning 780 sealant onto the capscrews contact face. Tighten to the torque of 19-26 N.m (14-19 Lb.ft).



6422a

27. Install the PTO cover and tighten capscrews in a criss-cross tightening sequence.

NOTE: Apply Dow Corning 780 sealant onto the cover contact surface. Tighten capscrews to the torque of 29-35 N.m (21-25 Lb.ft).

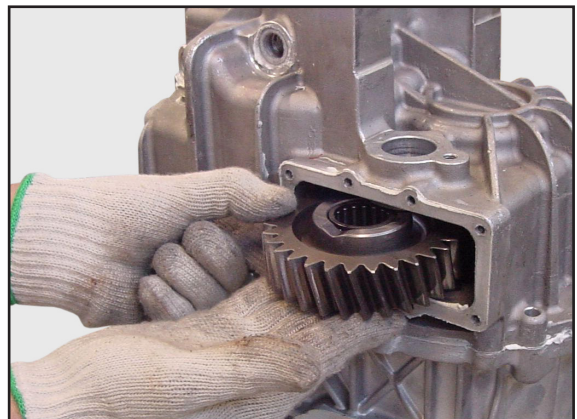


6429

28. Install the double needle bearing onto the reverse idle gear and position the gear in its housing, being careful to prevent the needle roller bearing from falling underneath.

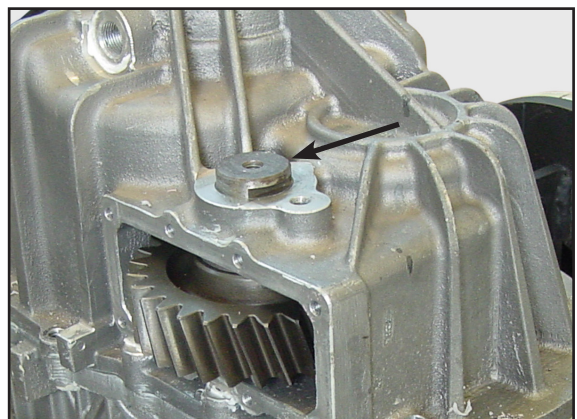


5991a



6433a

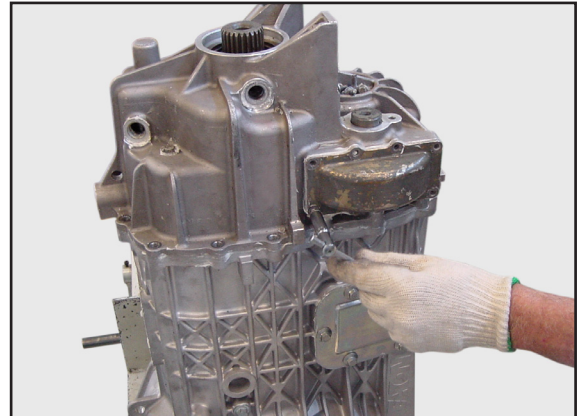
29. Insert the reverse idle gear shaft with the slot and O-ring side facing up. Rotate and position the shaft so that the slot is facing the retaining plate bolt.



5985a

30. Install the reverse idle gear cover and the eight retaining bolts.

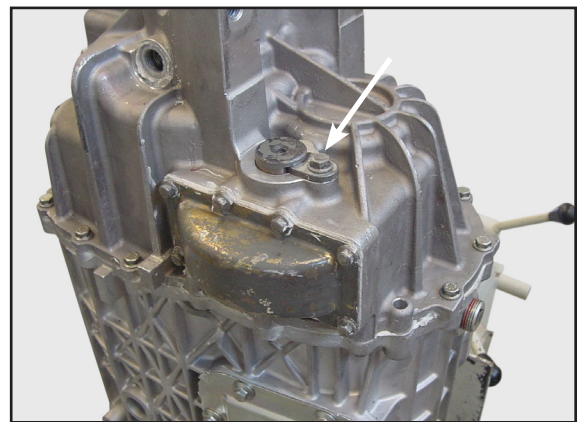
NOTE: Apply Dow Corning 780 sealant onto the cover contact surface. Tighten bolts in a criss-cross sequence to the torque of 12-15 N.m (9-11 Lb.ft).



6424

31. Install the reverse idle gear retaining plate and bolt, fitting the plate onto the shaft slot.

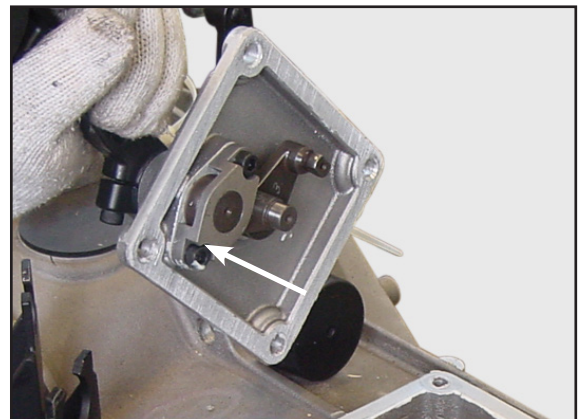
NOTE: Tighten the bolt to the torque of 16-26 N.m (11-19 Lb.ft).



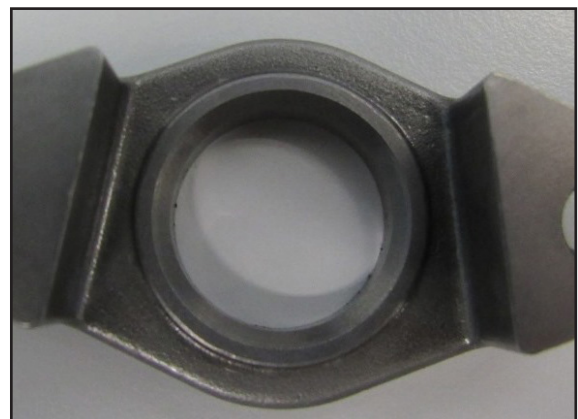
6420

32. Rotate the stand and place the transmission horizontally with the control tower opening facing up.
33. If disassembled, assemble the control tower levers paying attention to properly install the shift lever pivot bearing. The pivot bearing base must be assembled with the wider opening (see picture showing the bearing base seen from below) facing toward the cover inner side.

NOTE: Apply grease MS-9C onto following parts of the control tower: bushings, inner levers, pivot balls of external shift levers and pivot pins.



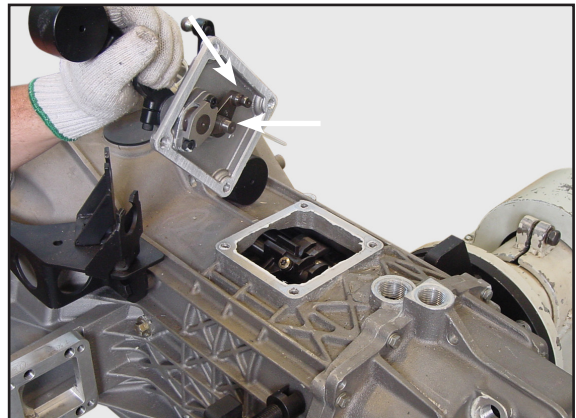
5980



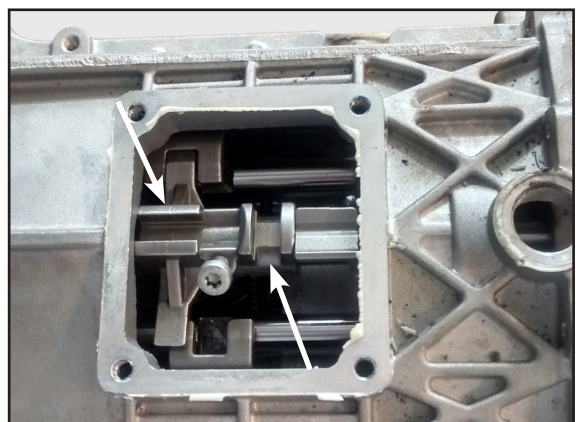
0151

34. Install the control tower cover, fitting the pins into the shift selector block grooves as shown in the figure.

NOTE: Apply Dow Corning 780 sealant onto the cover contact surface.



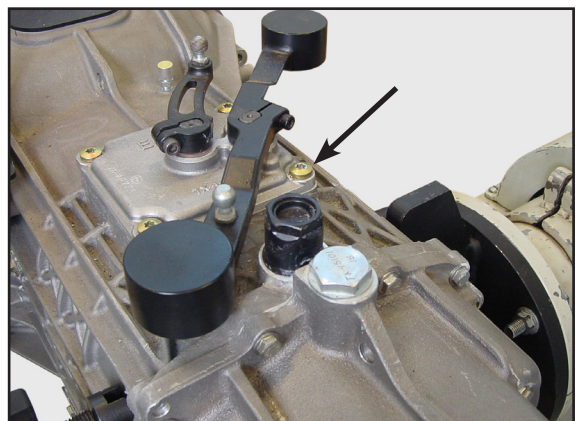
5980



163035909a

35. Install and tighten the four retaining screws of the control tower cover.

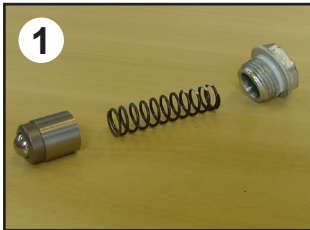
NOTE: Tighten screws to the torque of 19-26 N.m (14-19 Lb.ft).



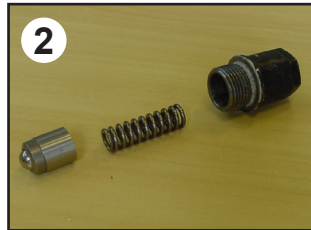
5962

36. Install the shift actuator (1) and the gear select actuator (2). Make sure you are assembling the correct springs in each of them.

NOTE: Apply Dow Corning 780 sealant onto the plug contact surfaces. Tighten to the torque of 28-32 N.m (20-23 Lb.ft).

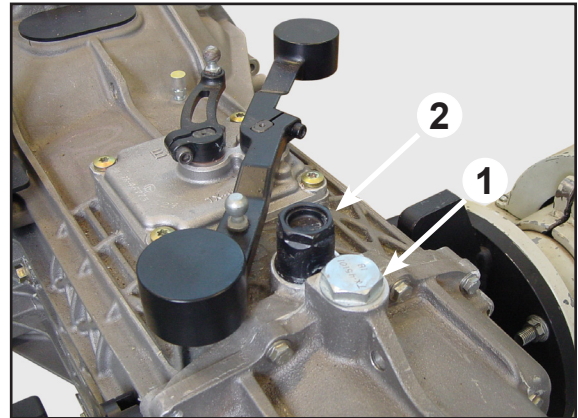


5974

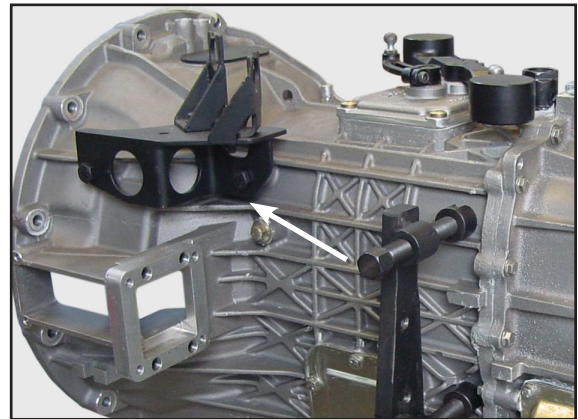


5976

37. Install the transmission shift cables bracket.



5692



5951a

Transmission Assembly

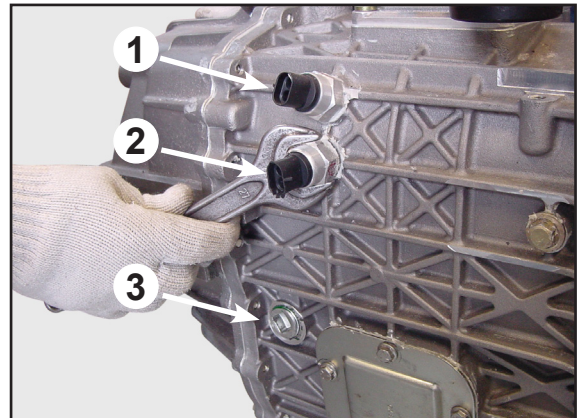


38. Install the reverse speed switch (1) and the 1st speed switch (2).

NOTE: Apply Dow Corning 780 sealant onto the switch contact surfaces. Tighten to the torque of 19-26 N.m (14-19 Lb.ft).

39. Install the oil fill plug (3).

NOTE: Apply Loctite 570 (Eaton E677) threadlocker onto the plug thread. Tighten to the torque of 36-40 N.m (26-29 Lb.ft).



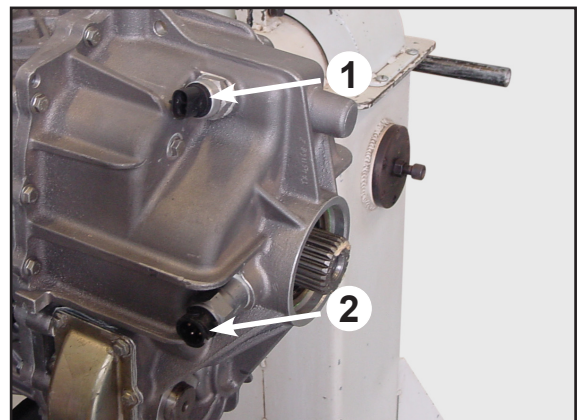
5937

40. Install the neutral switch (1) and the speedometer sensor (2).

NOTE: Apply Dow Corning 780 sealant onto the switch contact surfaces. Tighten switches to the torque of:

(1) 19-26 N.m (14-19 Lb.ft)

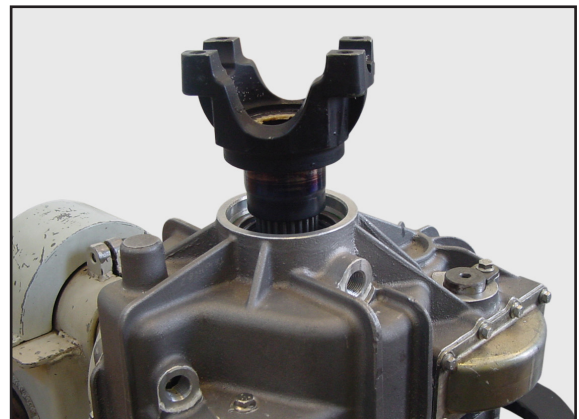
(2) 14-20 N.m (10-15 Lb.ft)



5972a

41. Rotate the stand and return the transmission to the vertical position with the rear case facing up.

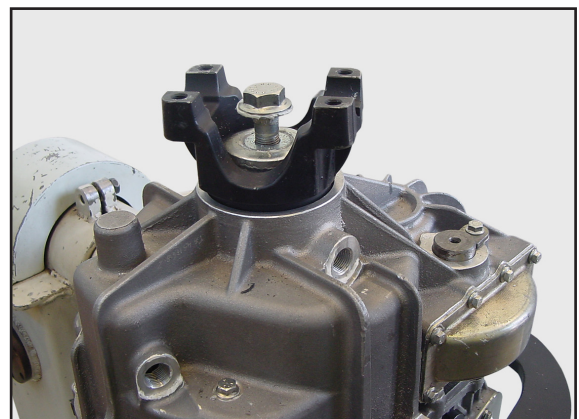
42. Heat the output yoke to a temperature of 110°C to 120°C and position the yoke over the mainshaft rear spline. Using a proper tubular device and a hammer, drive the yoke onto the shaft.



6382

43. Install the yoke retaining bolt and washer. Use the tool EEA-17503 (transmission model ESO-6106) or the tool EEA-17504 with the tool EEA-17503 (transmission model ESO-6206) to lock the mainshaft in order to tighten the bolt.

NOTE: Apply Dow Corning 780 sealant onto the washer and bolt contact surfaces. Tighten bolt to the torque of 109-122 N.m (80-90 Lb.ft).

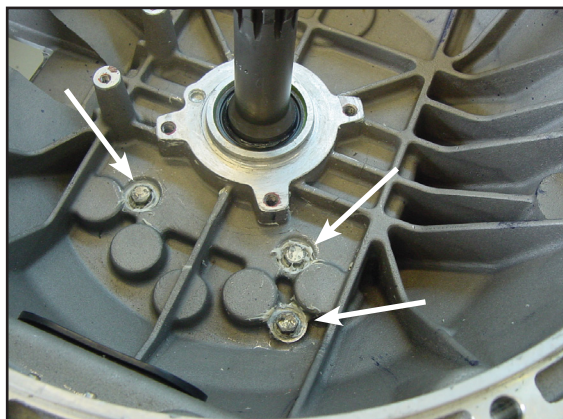


6384

NOTE: For the following steps, access the transmission from the front side (bell housing side), with the housing installed on the stand or with the box already removed and supported on a workbench.

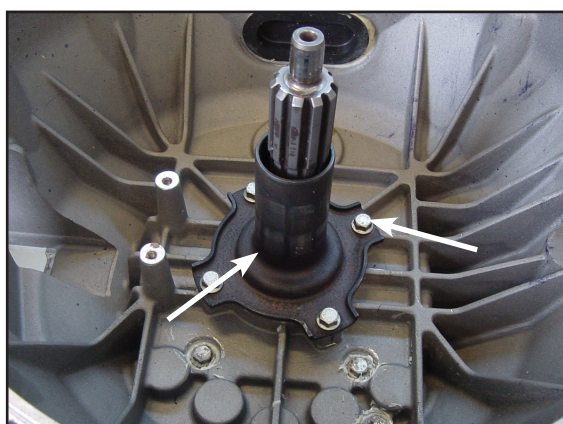
44. Install the three retaining capscrews of the shift rails' front support.

NOTE: Apply Dow Corning 780 sealant onto the capscrew contact surfaces. Tighten capscrews to the torque of 19-26 N.m (14-19 Lb.ft).



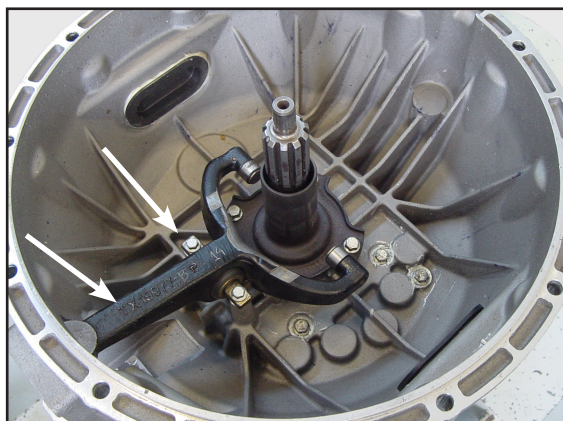
6019

45. Install the clutch release bearing sleeve.
46. Install the four retaining capscrews of the clutch release bearing sleeve. Tighten to the torque of 19-26 N.m (14-19 Lb.ft).



6017

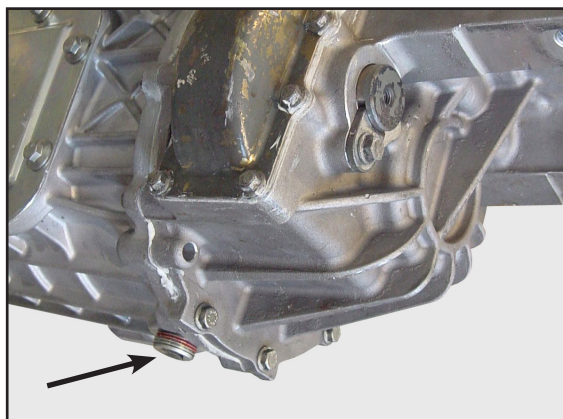
47. Install the clutch release fork. Tighten the two fork retaining capscrews to the torque of 12-15 N.m (9-11 Lb.ft).



6014

48. Install the oil drain plug.

NOTE: Apply Loctite 570 (Eaton E677) threadlocker onto the plug thread. Tighten to the torque of 36-40 N.m (26-29 Lb.ft).



6420a



CAUTION! The mainshaft and countershaft end play is set by a shim pack installed under their respective rear bearing cups, installed in the transmission rear case.

NOTE:

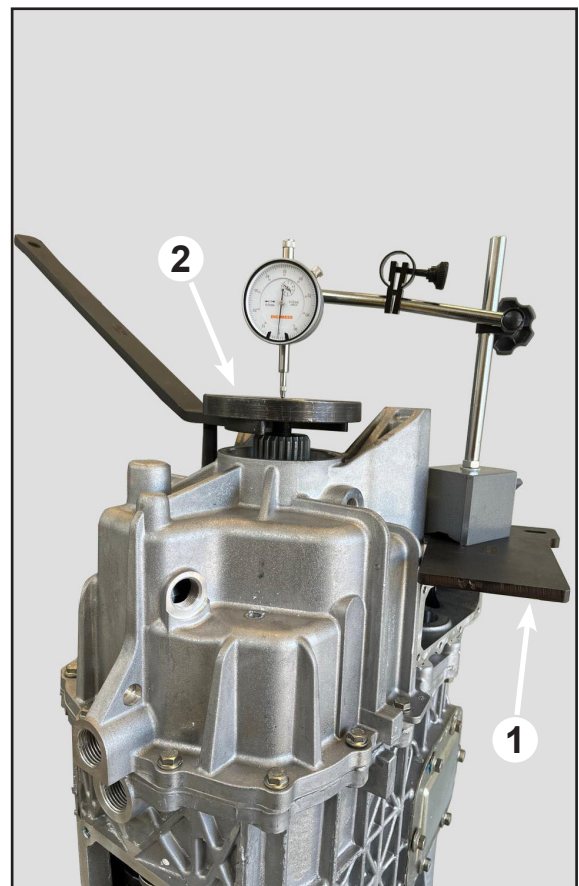
- Prior to the shim installation, thoroughly clean the parts and remove any signs of sealant left on their contact faces.
- Rotate the mainshaft several turns clockwise and counterclockwise, to ensure that the mainshaft and countershaft bearings are properly seated on their cups.
- Install thicker shims at the pack ends.

Mainshaft

NOTE:

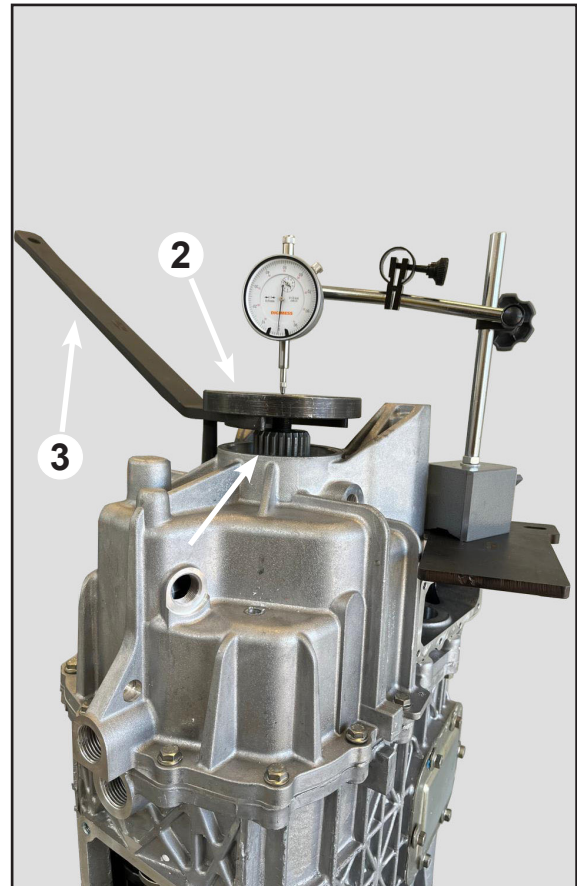
- End play should be measured with the transmission shifted into the 1st speed.
- Mainshaft end play = 0.025 - 0.100 mm (0.001 - 0.004 in)

1. Place the transmission in the vertical position, with the rear case facing up.
2. Install the special tool #EEA-17405 (1) to support the dial indicator magnetic base, using the threaded hole and the retaining bolt of the reverse idle gear shaft to secure the tool.
3. Install the tool #EEA-17406 (2) using the threaded hole on the mainshaft.
4. Place the dial indicator magnetic base on the special tool #EEA-17405 (1) used to support it and position the dial indicator tip on the upper face of the tool #17406 (2).
5. With a preload, set the dial indicator needle to zero.



6360c

6. Using the tool #EEA-17404 (3), make a lever by applying the force under the tool #EEA-17406 (2) and push the mainshaft upwards at once. Read the mainshaft end play in the dial indicator.
7. If the mainshaft end play reading in the dial indicator is within the specified limits, proceed with measuring the countershaft end play or go back to the transmission assembly and continue from the point where the assembly was stopped. Otherwise, determine the shim pack thickness needed to adjust the mainshaft end play before proceeding.
8. If necessary to remove or add shims to adjust the mainshaft end play, refer to "Rear Case, Disassembly and Assembly" in this manual for instructions on how to remove and install the mainshaft rear bearing cup.



6360c

Countershaft

NOTE:

- End play should be measured with the transmission shifted into the 1st speed.
- Countershaft end play = 0.025 - 0.100 mm (0.001 - 0.004 in)

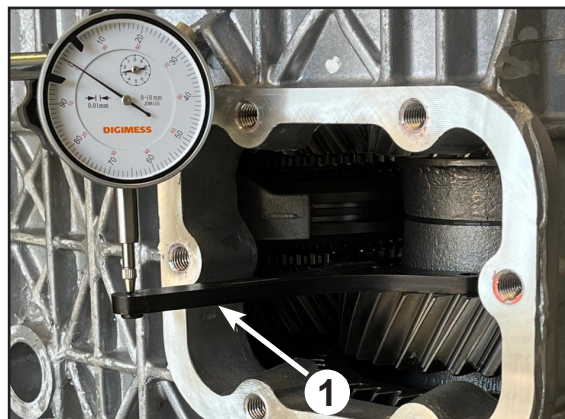
1. If not removed, remove now the PTO cover.



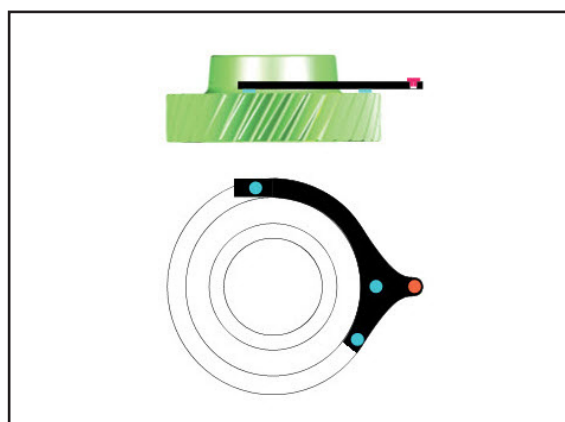
6429

End Play Adjustment

2. Place the special tool # EEA-17403 (1) on the countershaft 4th speed gear with the three magnets facing down, positioning the device so that the projecting tip pad stay out of the PTO opening, as shown in the figure. The device should be secured magnetically to the gear.

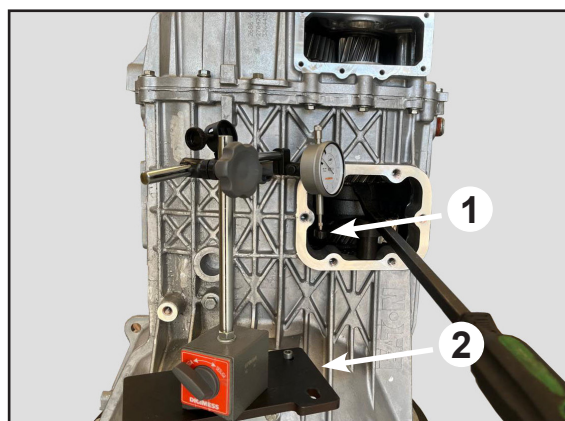


6582d



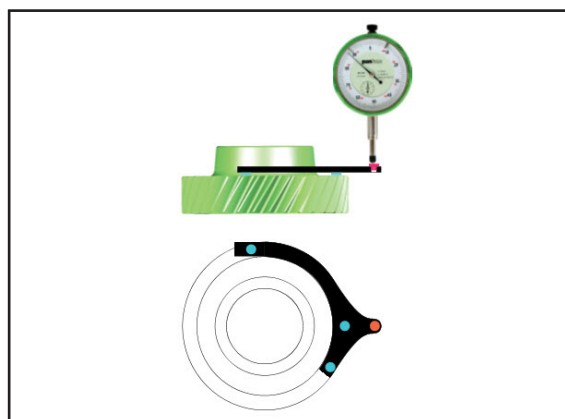
6582b

3. Install the special tool #EEA-17405 (2) to support the dial indicator magnetic base, using one threaded hole and one capscrew on the clutch actuator flange, as shown.
4. Place the dial indicator magnetic base on the special tool # EEA-17405 (2) and position the dial indicator tip on the tip pad of the special tool # EEA-17403 (1) installed on the countershaft 4th speed gear.



6365a

5. With a preload, set the dial indicator needle to zero.



6582c

6. Using a pry bar through the PTO opening and, with the pry bar supported on the transmission case and applying the force under the gear, push the countershaft upward at once. Read the countershaft end play in the dial indicator.
7. If the countershaft end play reading in the dial indicator is within the specified limits, go back to the transmission assembly and continue from the point where the assembly was stopped. Otherwise, determine the shim pack thickness needed to adjust the countershaft end play before proceeding.
8. If necessary to remove or add shims to adjust the countershaft end play, refer to “Rear Case, Disassembly and Assembly” in this manual for instructions on how to remove and install the countershaft rear bearing cup.



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