

UltraShift *PLUS* MHD EVO Automated Transmissions

TRSM-2940 EN-US

JUNE 2023

UltraShift Plus MHD 10 EVO Linehaul

UltraShift Plus MHD 10 EVO Vocational

UltraShift Plus MHD 8 EVO Passenger Vehicle



Powering Business Worldwide

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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 *UltraShift PLUS MHD*.

How to Use this Manual

Disassembly and assembly instructions in this manual make use of a typical *UltraShift PLUS MHD* 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 its visualization easier 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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pecasouvidor@eaton.com

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 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.



Este símbolo é utilizado em todo este manual para destacar os procedimentos onde o descuido ou a não-observância a essas instruções específicas poderá resultar em ferimentos graves e/ou danos ao componente.

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.

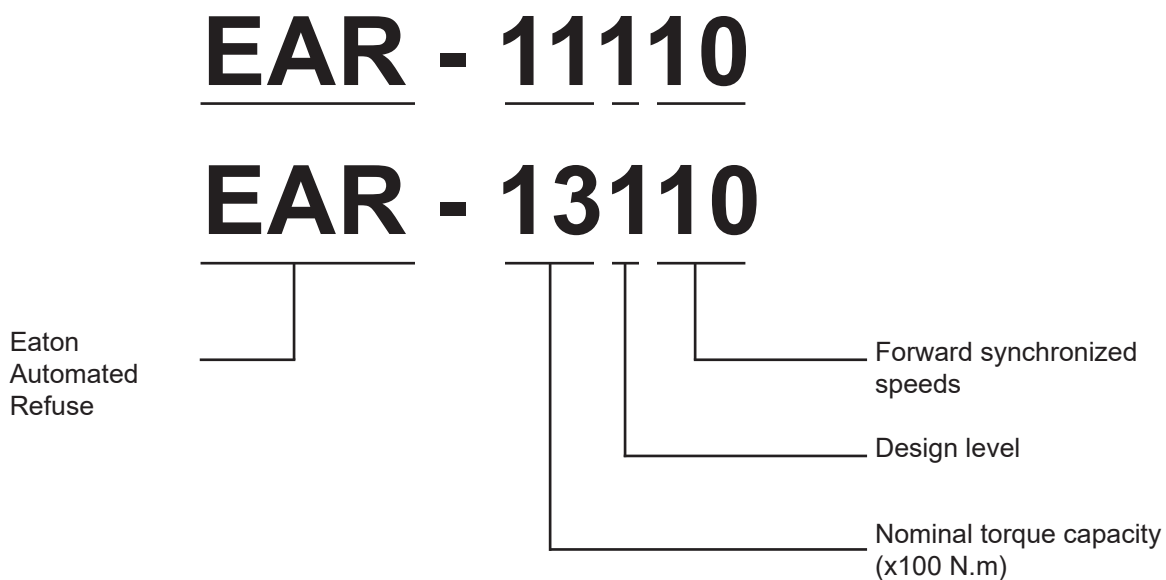
NOTE: Additional service information not covered in the service procedures.

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

Always use genuine Eaton replacement parts.

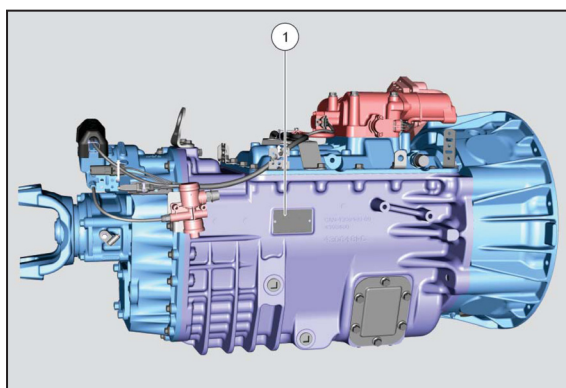
Model designation

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.

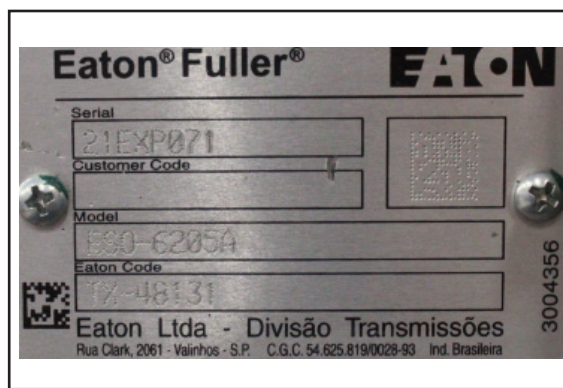


NOTE:

- Do not remove or destroy the transmission identification plate.
- When ordering replacement parts or calling for service support, please inform numbers found in the identification plate.



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Features of the Automated Transmission

The Eaton UltraShift PLUS automated transmission is basically a conventional mechanical transmission from the ES family with 10 forward speeds and 1 or 2 reverse speeds, depending on its configuration.

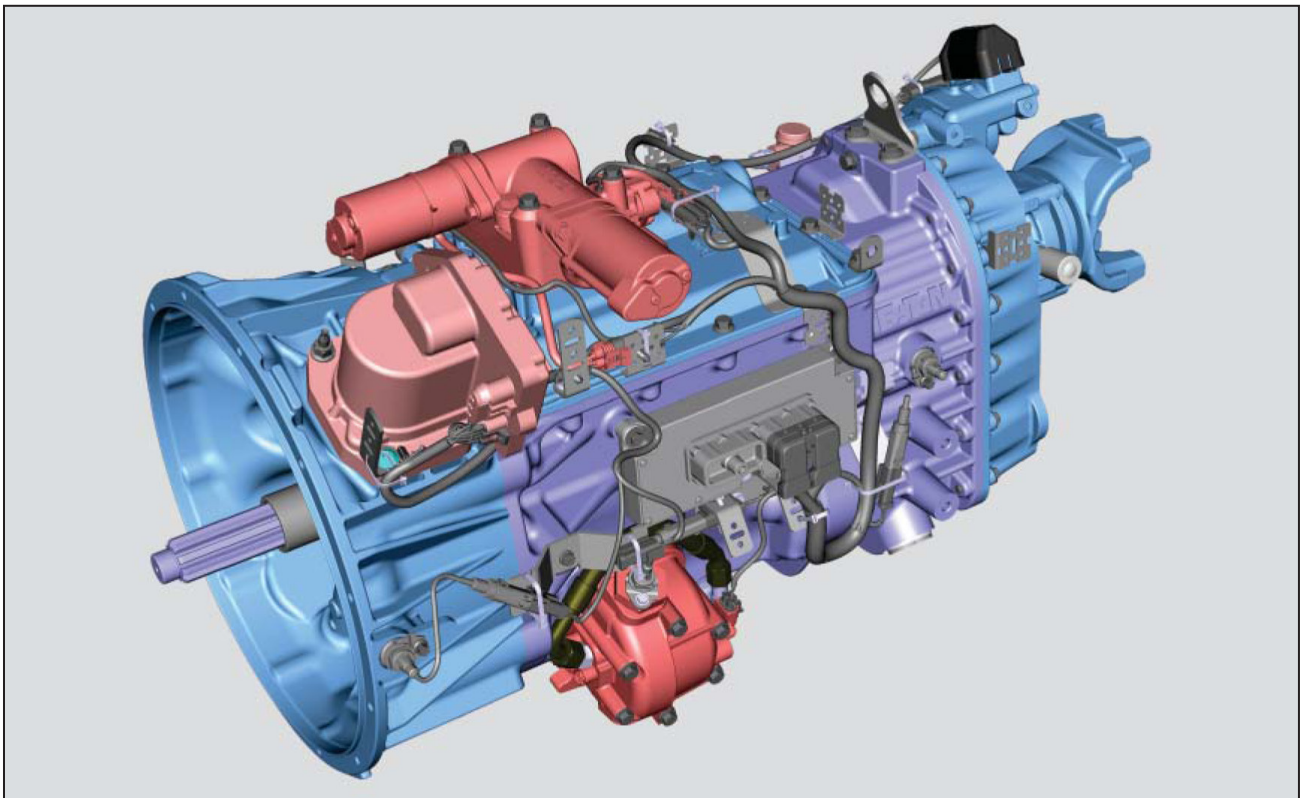
The UltraShift PLUS transmission is controlled by an Electronic Control Unit (TCU), which controls all the necessary energy supply, gear shifting strategy, clutch opening and closing, fault management, troubleshooting and executes commands. Several sensors in the transmission send signals to the TCU to manage the operation of the transmission. The TCU is integrated with other vehicle modules via the CAN-BUS network.

Gear changes are made through two direct current electric motors called “XY” motors that move through worm gear shafts that drive the shift yokes, performing the function of the shift lever.

In the Eaton UltraShift PLUS automated transmission, gear changes are made automatically, intelligently, taking into account the best use of the engine in each situation as the engine and transmission are “talking” to each other all the time via the CAN-BUS connections.

Although the system uses a clutch, the opening and closing work is done through an Electronic Actuator (ECA) controlled by the TCU. Therefore, the vehicle does not have a clutch pedal.

UltraShift PLUS does not have synchronizers. To make the coupling of upward gears easier, the countershaft Inertia Brake is used, which acts whenever necessary to equalize the speed between the sliding clutch (sleeve) and its respective gear, facilitating gear changing. The inertia brake also acts when selecting gear with the truck parked (driving off with the truck).



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Speed	EA-11109 LA	EA-11109 LB	EA-13110 EAR-11110
1st Speed	17.04 : 1	15.28 : 1	15.36 : 1
2nd Speed	11.87 : 1	11.87 : 1	11.93 : 1
3rd Speed	9.19 : 1	9.19 : 1	9.24 : 1
4th Speed	6.85 : 1	6.85 : 1	6.88 : 1
5th Speed	4.91 : 1	4.91 : 1	4.94 : 1
6th Speed	3.53 : 1	3.53 : 1	3.55 : 1
7th Speed	2.60 : 1	2.60 : 1	2.60 : 1
8th Speed	1.94 : 1	1.94 : 1	1.94 : 1
9th Speed	1.39 : 1	1.39 : 1	1.39 : 1
10th Speed	1.00 : 1	1.00 : 1	1.00 : 1
Reverse Speed #1	16.13 : 1	13.84 : 1	13.91 : 1
Reverse Speed #2	—	3.92 : 1	—

NOTE: Transmission specifications may change. The data in the table is provided for reference only.

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 maintenance interval recommendation for oil level check and oil change.



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

Recommended Lubricant:

Lubricant	Use
Silicone Lubricant 3000 CST	O-ring of the range shift selector rod bushing O-rings of the range shift cylinder piston O-ring of the range shift cylinder cover
NLGI 2 Grease	Clutch bearing Clutch fork shaft
SAE 50 Synthetic Oil	Transmission lubricant oil; Capacity: 9.5 liters

Service Class	Transmission Oil Check every	Clutch Release Yoke Grease Lubricate every
Regular, On-road	10,000 km 1 hour	40,000 km 4 hour
Heavy Duty - Refuse	7,500 km 0.75 hour	20,000 km 2 hour

NOTE:

- The oil change should be carried out at the recommended mileage or time, whichever comes first.
- Daily, inspect the transmission for lubricating oil leaks and correct them whenever necessary.
- The type of vehicle service is considered **SEVERE (Heavy Duty)** when the use of the vehicle consists of:
 1. Long periods with low gears engaged;
 2. Use of the vehicle at high speeds on the road;
 3. Use of the vehicle with full load on the road at ambient temperatures above or equal to 40°C;
 4. Typical off-road applications, e.g. unpaved dirt or sand roads;
 5. Use of the vehicle on mountainous routes with considerable slopes and inclines;
 6. Special applications, such as taxis, police vehicles, military vehicles, motorhomes or similar activities.

Draining

Drain transmission oil while the oil is warm.

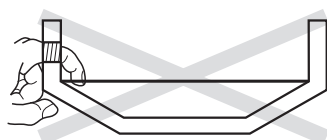
To drain oil, remove the magnetic drain plug. Clean the drain plug before reinstalling it.

Refilling

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.



Correct Oil Level



Incorrect Oil Level

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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.

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.

Tightening Torques and Sealants



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.

Description	Nm
Transmission top cover (shift bar housing) capscrews	55
Remote control housing capscrews	55
Inertia brake lubricating oil hose connection	61
Inertia brake lubricating oil hose	61
Pressure reducing valve retaining capscrews	50
Clutch housing capscrews	205
PTO cover on intermediate housing	54
PTO cover on rear housing	37
Reaction plate retaining Allen screws with Loctite 270	27
Rear housing to the intermediate housing retaining bolts and nuts	50
Fork shafts locking plates	30
Sun gear retaining capscrew	240
Oil pump retaining capscrews	37
Planet gear shaft lockscrew	5
Front countershaft bearing cover with Loctite 5900	51
Rear oil seal cover	37
Speedometer sensor	40
Shift cylinder retaining nut with Loctite 242	105
Epicyclic reduction gear pneumatic actuator cylinder cover capscrews	37
Input shaft cover	27
Output shaft flange nut	650
Clutch release yoke cross-shaft bolt	61
Inspection cover retaining capscrews	3.5
Clutch release yoke cross-shaft plug	95
Electronic clutch actuator (ECA) capscrews	40
Inertia brake capscrews	58
Speed sensor (all)	29
Electrical harness bracket screws	22
Deck plate bolts	23
Electrical connectors' bracket nuts	23
Battery negative cable nut	8

Description	Nm
Inertia brake lubricating oil hose connection	44
TCU securing nut	11
Lubricating oil drain plug (smaller)	36
Lubricating oil drain plug (larger)	44
Lubricating oil filling plug	41
Neutral switch	24
Epicyclic (Planetary) reduction gear pneumatic piston nut	105
Longitudinal drive shaft capscrew (cardan)	71
Transmission to the engine retaining capscrews	48
Exhaust bracket capscrew	48
Exhaust primary pipe clamp securing nut	48
Inertia brake (LCIB) cover retaining capscrews	25

Recommended Threadlocker and Sealant

Threadlocker / Sealant	Use
Eaton E678 Threadlocker	Range shift pneumatic cylinder retaining nut Retaining capscrews
Scotch-Grip 4291	Countershaft shims and cover

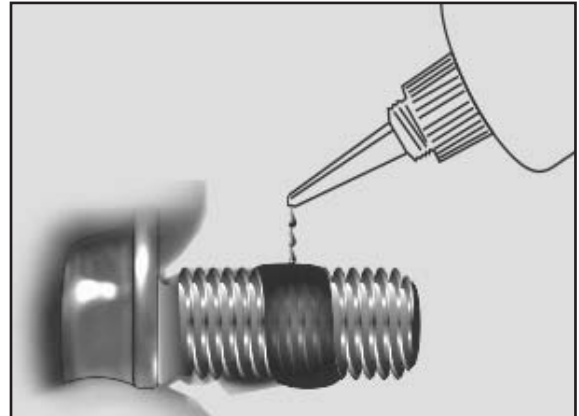
Chemical adhesives can fulfill more than one function:

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.



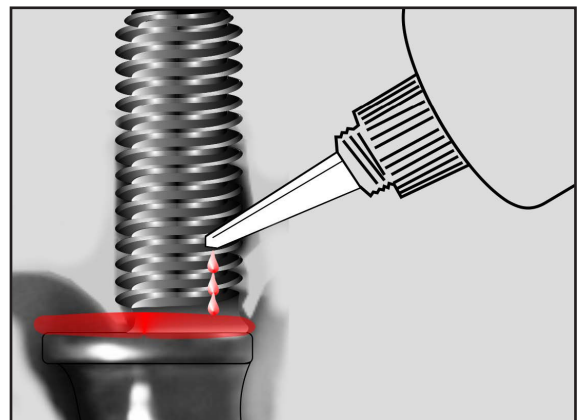
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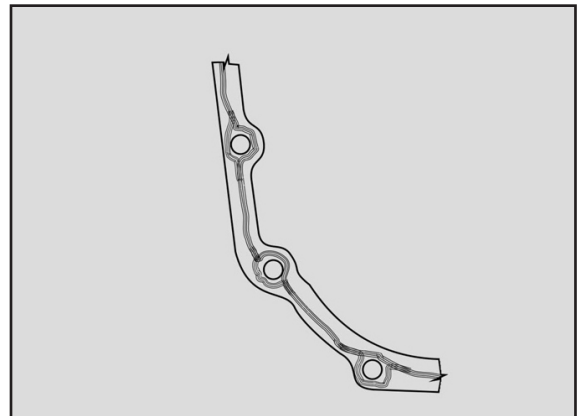
WARNING! Always use safety glasses and hearing protection when using compressed air.

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.



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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.

The following table lists the special tools recommended in this manual and their respective codes.

These special tools should be ordered directly from the approved tools supplier:

Especifer Industria e Comércio de Ferramentas Ltda.

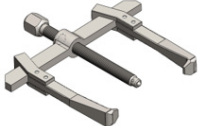
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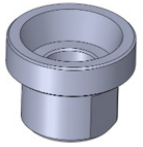
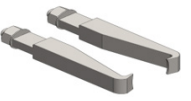
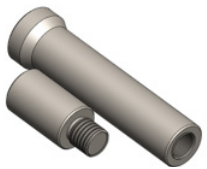
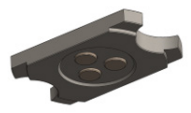
Europark Comercial - CEP 13348-578

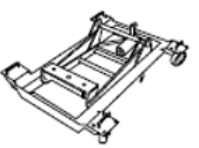
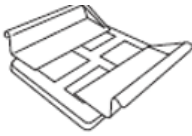
Indaiatuba, São Paulo - Brasil

Phone: +55 19 3936-9797

www.especifer.com.br

Code	Tool	Description	Code	Tool	Description
E001046		Driver, Inertia Brake shaft ball bearing	500053683		Puller, Inertia Brake shaft sleeve
500053690		Puller, Inertia Brake shaft ball bearing	EEA-22100 (PEA-2894)		Puller, Main shaft 3rd/4th and Reverse gear hub
EEA-22300 (PEA-2898)		Sun gear retainer	503646515		Driver, Main shaft 3rd/4th gear hub
E017006-4		Puller, Main shaft front bearing cone (Pocket)			

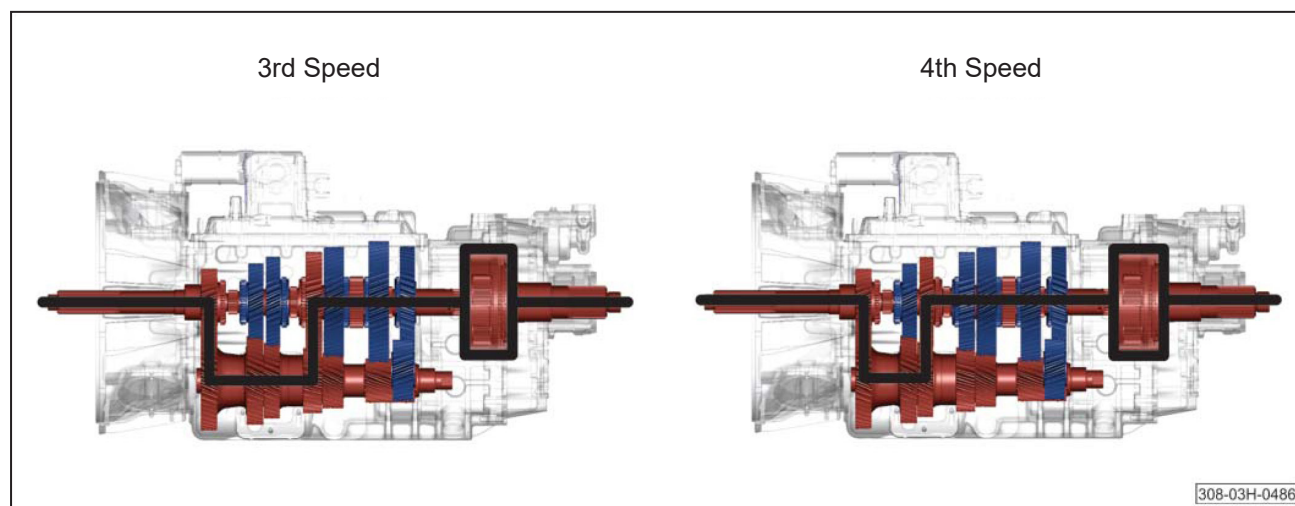
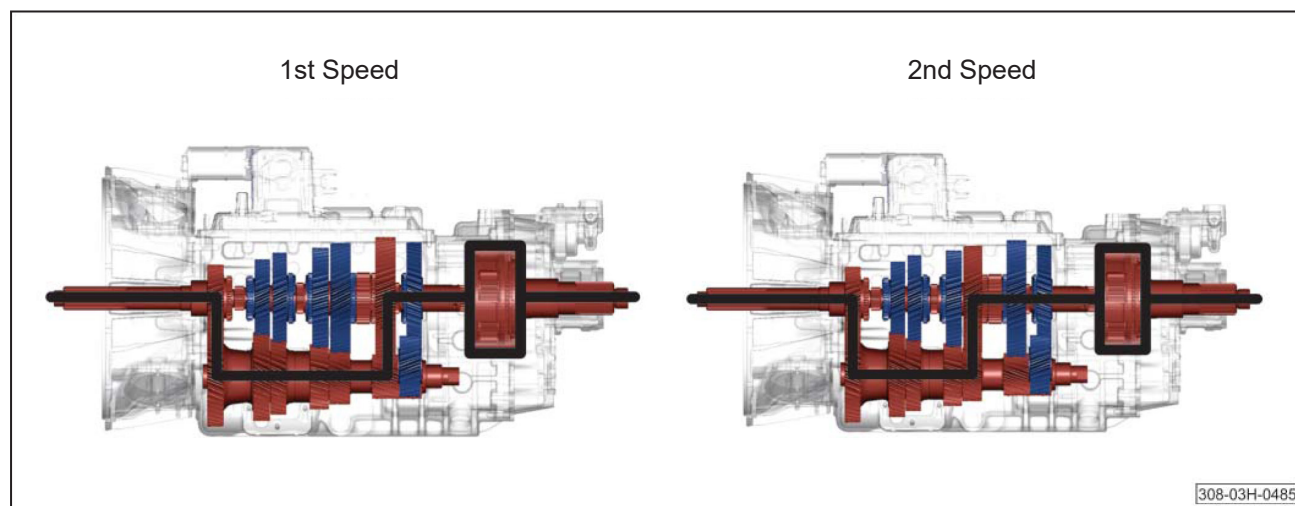
Code	Tool	Description
303-1370		Jaw, Main shaft rear bearing cone puller (use with bridge and spindle #303-803 and use the gear for extraction)
EEA-22200 (PEA-2893)		Support, Main shaft (use with EEA-17505)
702439		Driver, Main shaft rear bearing cone
2405-12		Driver, Main shaft front bearing cone (Pocket)
308-503		Puller, Input shaft rear bearing cone
303-1370		Jaw, Countershaft rear bearing cone puller (use with bridge and spindle #303-803)
EEA-22101 (PEA-2896)		Adapter kit and extractor, Input shaft 6th, 5th and 3rd gear hubs (used with rocker arm)
702439		Driver, Input shaft rear bearing cone
EEA-22201 (PEA-2897)		Inertia shaft positioner

Code	Tool	Description
EEA-22600 (PEA-2899)		OBD/NEXIQ1 Cable harness
EEA-22601 (PEA-2913)		OBD/NEXIQ2 Cable harness
EEA-22301 (PEA-2895)		Wrench, Sun gear retainer
EE-30100		Transmission service stand
EE-30101		Transmission removal device

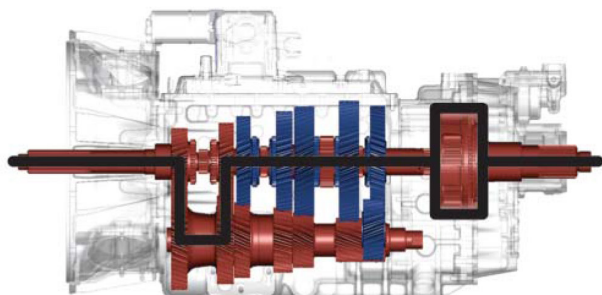
Power Flow

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

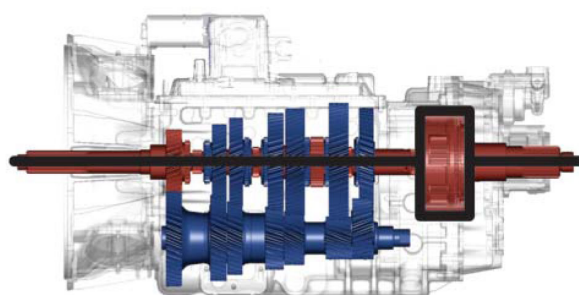
It is essential to know what takes place in the transmission during torque transfer when troubleshooting or making repairs.



5th Speed

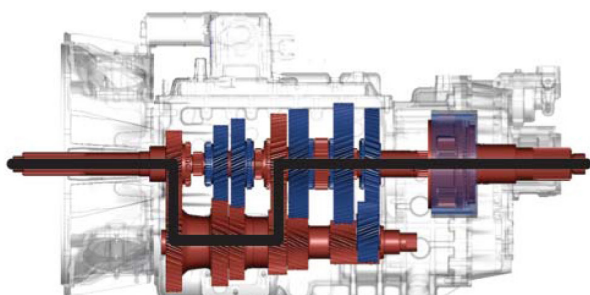


6th Speed

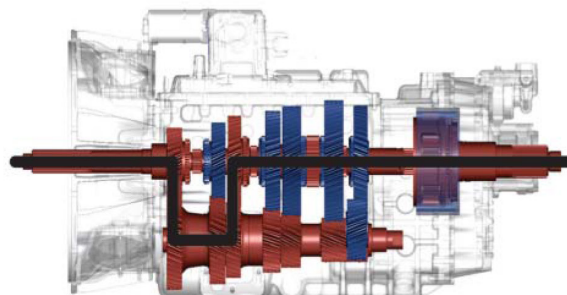


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7th Speed

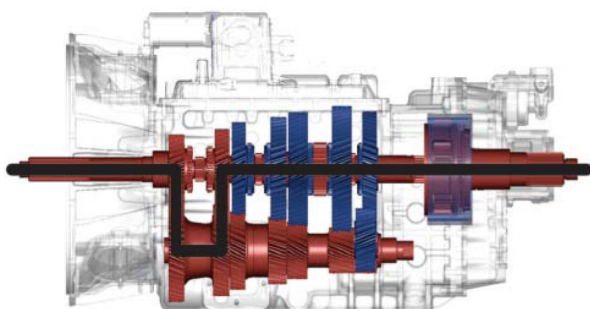


8th Speed

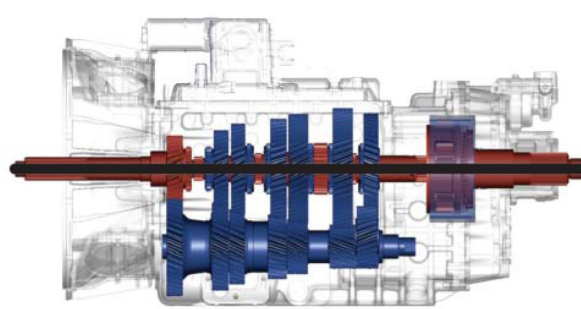


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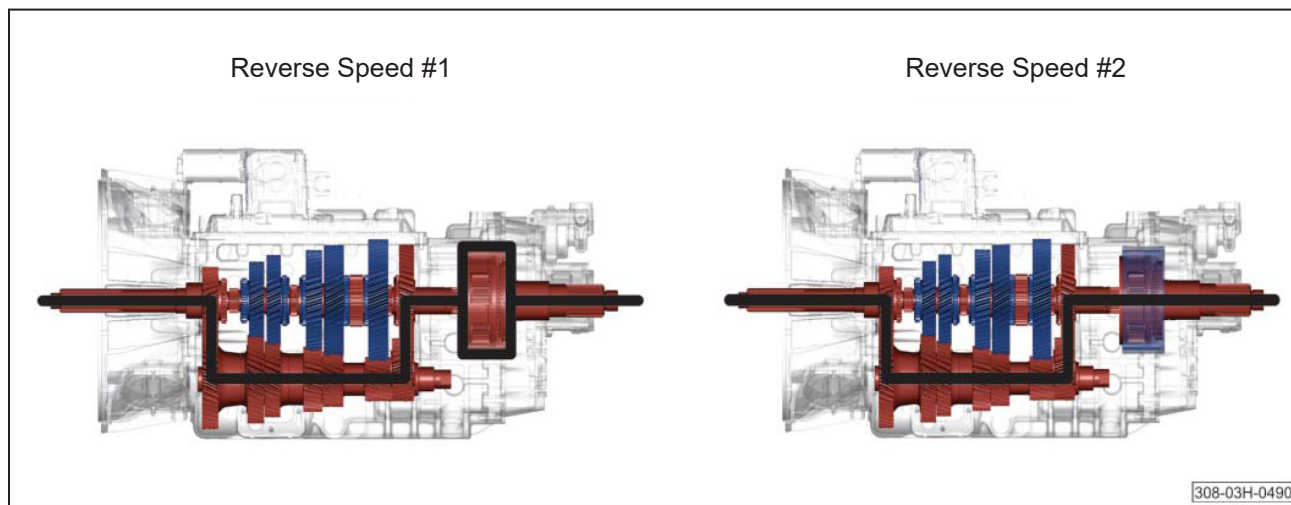
9th Speed



10th Speed



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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 in vehicle's manual
	Improper or damaged clutch disc	Replace disc	Instructions in this manual
	Loose or damaged engine or transmission mounts	Replace and/or tighten mounts	Instructions in vehicle's manual
	Worn or damaged yoke	Replace yoke	Instructions in 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	Lubrication, in this manual
	Contaminated lubricant	Drain and clean transmission and refill with recommended oil	Lubrication, in this manual
	Worn or damaged gears and/or bearings	Replace damaged parts	Instructions in this manual
	Misalignment due to loose tightening capscrews	Retighten capscrews	Instructions in this manual
Transmission noise with shifted gears	Improper or damaged clutch disc	Replace disc	Instructions in this manual
	Low lubricant level	Fill with recommended oil to the proper level	Lubrication, in this manual

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

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

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

Problem	Probable cause	Possible solution	Reference
Oil leak	Lubricant above proper level	Correct to proper level	Lubrication, in this manual
	Clogged breather	Verify and unclog breather	
	Worn or damaged oil seals	Replace damaged seals	Instructions in this manual
	Housing capscrews not properly tightened or lack of sealant	Reassemble with proper sealant and tightening torque	Instructions in 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	Lubrication, in this manual
	Contaminated or not recommended lubricant	Drain and clean transmission and refill with recommended oil	Lubrication, in this manual
	Improper assembly of transmission components	Reassemble transmission	Instructions in this manual
	Improper end play on mainshaft or countershaft	Adjust end play countershaft end play	Instructions in this manual
	Bearings were not lubricated prior to assembly	Replace damaged parts Reassemble following right procedure	Instructions in this manual
Double shifting	Double gear shifting interlock system assembled improperly	Reassemble system	Instructions in 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.*

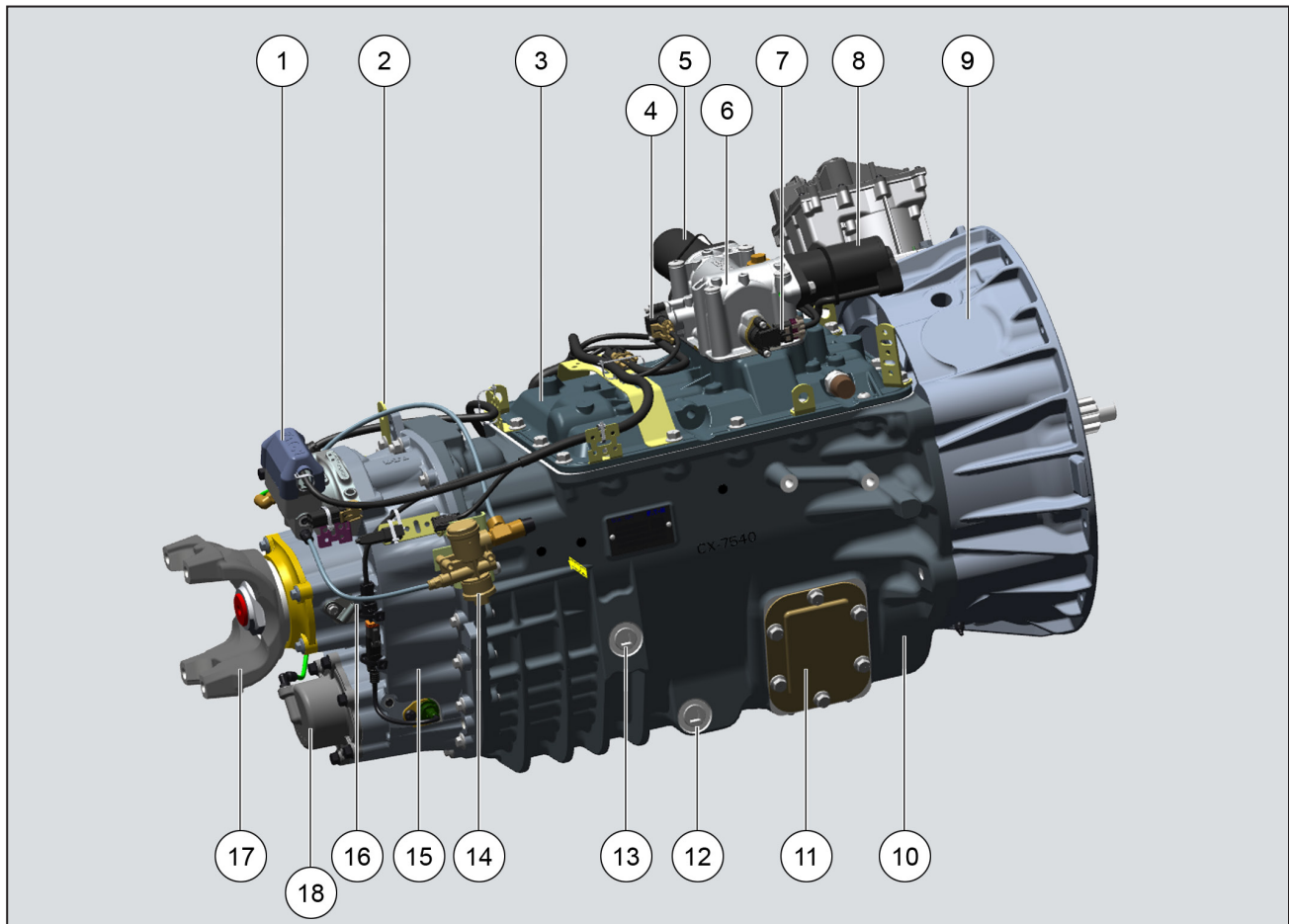
During assembly, lubricate the following parts using the same lubricant specified for the transmission:

- 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 petroleum jelly onto oil seal lips.

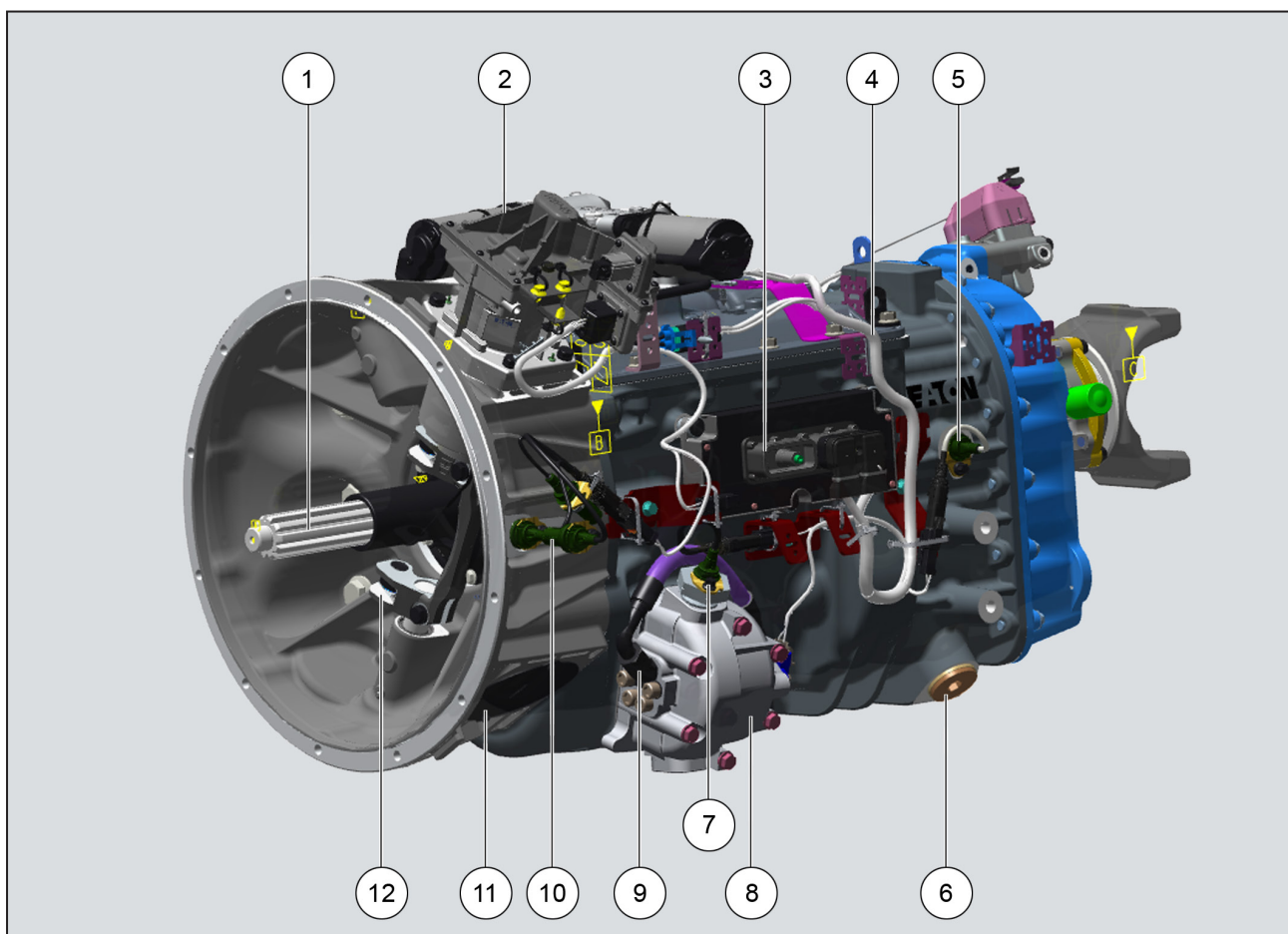
Right Side View



2940-010

- | | |
|--|--|
| 1. Epicyclic (Planetary) reduction gear pneumatic actuator | 10. Main housing |
| 2. Lifting eye bracket | 11. PTO cover |
| 3. Transmission top cover (Shift bar housing) | 12. Drain plug |
| 4. Gear select sensor | 13. Filler plug |
| 5. Gear select motor | 14. Pressure reducing valve |
| 6. Remote shift control | 15. Rear housing with epicyclic (planetary) reduction gear |
| 7. Gear shift sensor | 16. Output shaft speed sensor |
| 8. Gear shift motor | 17. Output flange (yoke) |
| 9. Clutch housing | 18. Inertia brake (EURO 6) |

Left Side View



2940-011

- | | |
|---|---|
| 1. Input shaft | 7. Inertia brake speed sensor |
| 2. Clutch actuator | 8. Inertia brake (EURO 5) |
| 3. Transmission Electronic Control Unit (TCU) | 9. Lubrication tube |
| 4. Wiring harness | 10. Input shaft speed sensor (engine speed) |
| 5. Main shaft speed sensor | 11. Inspection cover |
| 6. Plug with filter | 12. Clutch release yoke |

TCU

- It has two connectors, the right one connects to the transmission components and the left one to the truck.
- Controls all power-up, gear shifting strategy, fault management and troubleshooting and executes commands.

Gear Select and Shift Motors

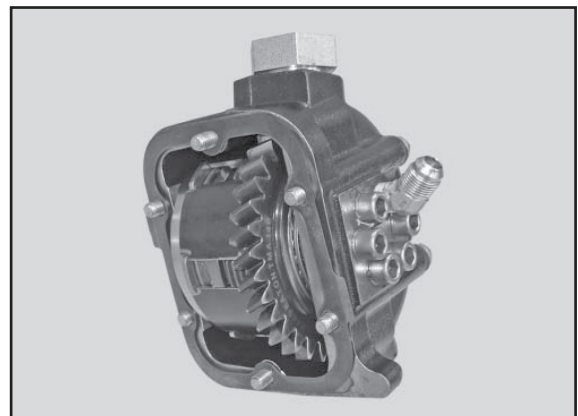
- Performs the function of the shift lever.
- It consists of two direct current motors that move through worm shafts, selecting and shifting gears.

Electrical Wiring Harness

- It has a 38-way connector that connects the sensors and the gear select and shift electric motors with the Transmission Electronic Control Unit (TCU).

Inertia Brake

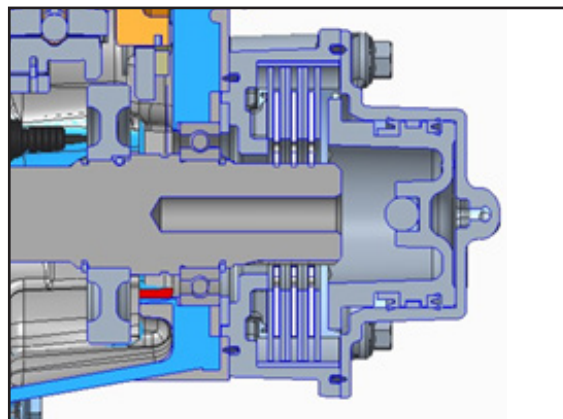
- It is an unit made up of two plates (front and rear), an internal disc and a central hub, which, when compressed, brakes the countershaft and input shaft assembly to equalize the speed between the sliding clutch and its respective gear, facilitating gear shifting. When selecting gear with the truck parked, the countershaft is immobilized to allow smooth gear shifting.



2940-012

Inertia Brake - EURO 6

- It is an unit made up of smooth discs, friction discs and internal seals, with the same functions as the previous one, however the system is repairable and can be replaced without disassembling the transmission.
- Minimum consumption of the pneumatic system, greater durability and ease of maintenance.



2940-001

Speed Sensors

The EAR-11110 and EA-13110 transmissions have 3 speed sensors to allow the electronic module to monitor the engine speed and, consequently, the transmission input, main shaft and transmission output speed.

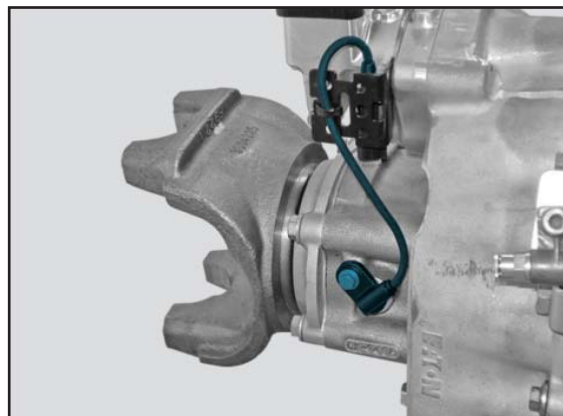
With this information, the module can identify the ideal moment to select and reduce gears, avoiding overload on the transmission components and engine overspeed, among other functions.

- **Input speed sensor**



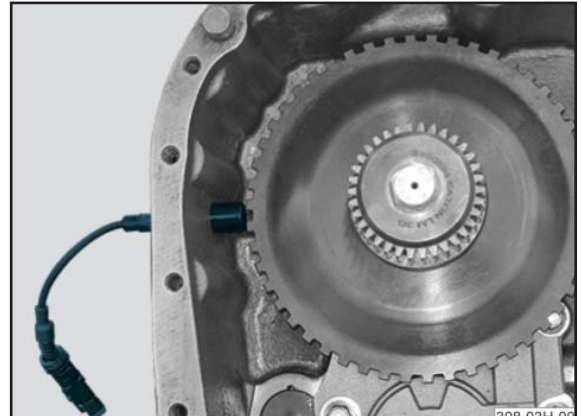
2940-013-1

- **Output speed sensor**



2940-013-2

- Main shaft speed sensor



2940-013-3

Display indication

The display in the center of the instrument cluster informs the driver of the various transmission situations, such as operating information and irregularity warnings.

- N** - Transmission in neutral
- D** - Automatic function (next to, the number of gear selected)
- M** - Manual function (next to, the number of gear selected)
- L** - Engine brake
- R** - Reverse (next to, the number of gear selected)
- F** - Transmission fault information (codes)

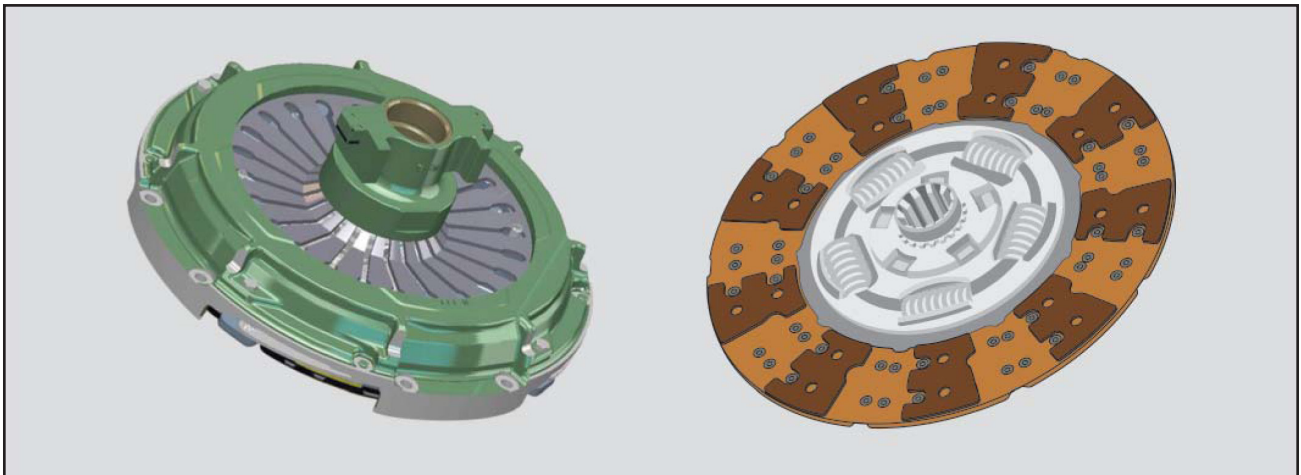


2940-014

NOTE: In manual mode, the display indicates that manual position “M” is selected and which transmission gear is selected. The indicator will flash when the transmission is changing gear.

Clutch Assembly

- Maximum controllability when shifting up and down (downshifting).
- Greater ease of maneuvering at low speeds and in reverse.
- Greater reliability than pneumatic systems.
- Internal electronic control unit - makes decisions even in the event of a power outage or loss of communication.
- Clutch diameter 395mm.
- Sintered disc.
- Ceramic coating.



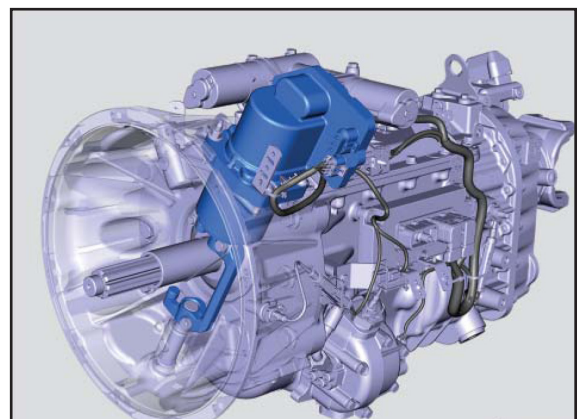
2940-015-1

Clutch Actuator

It acts as the clutch pedal, engaging and disengaging the clutch when necessary.

It has two types of connectors:

- 8-way connector: communication with the TCU and sensors.
- 3-way connector: provides power to the electronic control unit.



2940-015-2

Protection against abuse when using the clutch

This vehicle does not have a clutch pedal and uses an automated clutch to start the vehicle, however the clutch can still overheat and slip with improper use.

- Select the lowest starting gear for the application. If it is necessary to move slowly, select 1st or R1.
- Use the service brakes and let the HSA assist you when starting off on an incline.
- Do not use the accelerator to hold the vehicle on an incline.
- Do not use the accelerator to stop moving backwards on an incline after Hill Start Assist disengages. (Use the service brakes to completely stop the vehicle and then start the truck again).
- Do not continually start and stop the truck, especially when loaded (use a lower gear).
- If the clutch begins to overheat, the display will show “CA” along with an audible signal. Full clutch actuation must be completed quickly. If it is not, the system will release the clutch if you are not accelerating or engage the clutch if you are accelerating. If abuse continues, the system will release the clutch and remove throttle control for a short period of time to allow the clutch to cool.

Gear Shift Lever

R (Reverse): Selects reverse gear

N (Neutral): Mode used when starting and stopping the truck

D (Drive): Driving mode with automatic gear shifting

M (Manual): When the shift lever is placed in MANUAL mode, it allows the driver to select gear, overriding the automatic transmission control by the electronic module

L (Low): Mode that improves engine braking performance



2940-016

Precautions During Operation

Whenever you leave the vehicle, apply the parking brake, place the transmission shift lever in the “N” position, turn off the ignition and remove the key.

The transmission in “D” or “R” does not hold the truck on an incline, so apply the parking brake to keep the truck immobilized.

Do not press the brake pedal and the accelerator pedal simultaneously. Pressing both pedals simultaneously for more than 3 seconds limits engine speed, which may result in difficulty maintaining speed in traffic.

When traveling in traffic jams or remaining stopped at traffic lights, step on the brake pedal, move the gear shift lever to the “N” position and apply the parking brake.

Never leave the shift lever in other modes than “N” when the vehicle is off.

The air reservoirs must be filled before driving off with the truck, to allow proper operation of the pneumatic actuator of the planetary reduction gear.

Automatic Mode

The transmission electronic control unit (TCU) exchanges information with the engine electronic control unit (ECM) and defines the best time to shift gears. Its operation is shown on the instrument cluster display.

The main advantages of automated transmission in function “D” are:

- The driver does not need to worry about shifting gears;
- All driver attention focused on driving;
- Greater driver comfort while driving;
- Reduces the possibility of injury by not having a clutch.

Select “D” for automatic gear shifting. The transmission will select the appropriate gears for best performance based on load condition, vehicle speed and road grade.



2940-017

Vehicles with automated transmission have a 2-stage accelerator pedal, causing the transmission to work in two modes:

- **“Fuel Saving” mode:** Pressing the accelerator pedal between rest and the first stop. In this mode, the transmission will perform gear shifts within the most efficient engine speed range to save fuel.
- **“Performance” mode:** Pressing the accelerator pedal beyond the first stop, a click will be noticed and a forced downshift may occur, the next lower gear is selected to obtain better performance (reduces gear and increases engine speed). In this mode, the transmission will perform gear changes in a higher rpm range, aiming for greater performance. “Performance” mode is recommended for overtaking and speed recovery. Relieve pressure on the accelerator pedal when you no longer need this feature.

Automatic Mode Operation

1. With the engine idling, fully depress the brake pedal and hold it down.
2. Press and hold the button on the front of the shift lever.
3. Move the gear shift lever to the “D” (Drive) position.
4. Release the button.
5. Release the brake pedal.
6. Accelerate the vehicle, it will start moving.

Manual Mode

The driver can select manual mode “M” only in certain situations. For example, when traveling with the truck on a dirt road, on rails or on very steep inclines.

NOTE: The transmission may deny shifting if the selected gear is not suitable for the vehicle travel speed or if the torque or engine speed is outside the acceptable range for shifting. If this happens, an audible signal will sound for a few moments.



2940-018

Using the gear shift button on the side of the lever, the driver can make changes independent of the transmission strategy.

- Press + to shift to the next higher gear.
- Press - to shift to the next lower gear.

Gears can be skipped by pressing the + or - buttons repeatedly in short intervals.

Manual Mode Operation

1. With the engine idling, fully depress the brake pedal and hold it down.
2. Press and hold the button on the front of the shift lever.
3. Move the gear shift lever to the desired position.
4. Release the button and the transmission will remain in the gear selected shown on the instrument cluster display.
5. Release the brake pedal.
6. Accelerate the vehicle, it will start moving.

Reverse

CAUTION: Completely stop the truck before selecting or exiting “R” (Reverse). The truck does not shift reverse gear if the speed is above 3 km/h.

Operation in Reverse Gear

1. With the engine idling, fully depress the brake pedal and hold it down.
2. Press and hold the button on the front of the shift lever.
3. Move the gear shift lever to the “R” position.
4. Release the button and the transmission will remain in the gear selected shown on the instrument cluster display.
5. Release the brake pedal.
6. Gently accelerate the engine and the truck will begin to move in reverse.

N (Neutral)

With the shift lever in N (Neutral), you can start the vehicle, which is free to run.

Keep the brake pedal pressed or the parking brake applied while in this position.

Keep this position whenever you park the vehicle or remain stopped with the engine running.

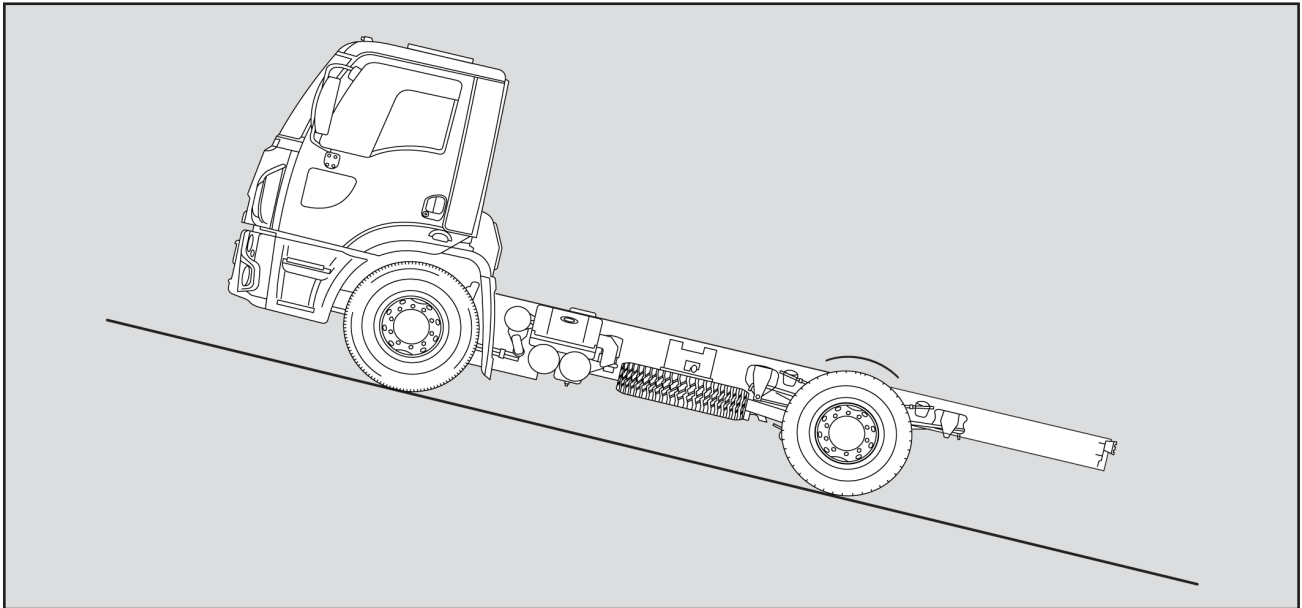
L (Low)

Place the shift lever in “L” when you need to optimize the engine braking action. The gears will be reduced to the best condition for the truck speed.

The “L” position works together with the engine brake, seeking maximum performance and, consequently, greater durability of the service brake. The function “L” must be used to slow down the vehicle, and is highly recommended for mountain descents and long slopes.

CAUTION: It is not recommended to use this function to accelerate the vehicle, as there will be no changes to higher gears.

Hill Start Assist (HSA)



2940-021

WARNING! The HSA system does not replace the parking brake. When leaving the vehicle, always apply the parking brake and move the transmission shift lever to the “N” position.

The driver must remain in the vehicle when the system is activated.

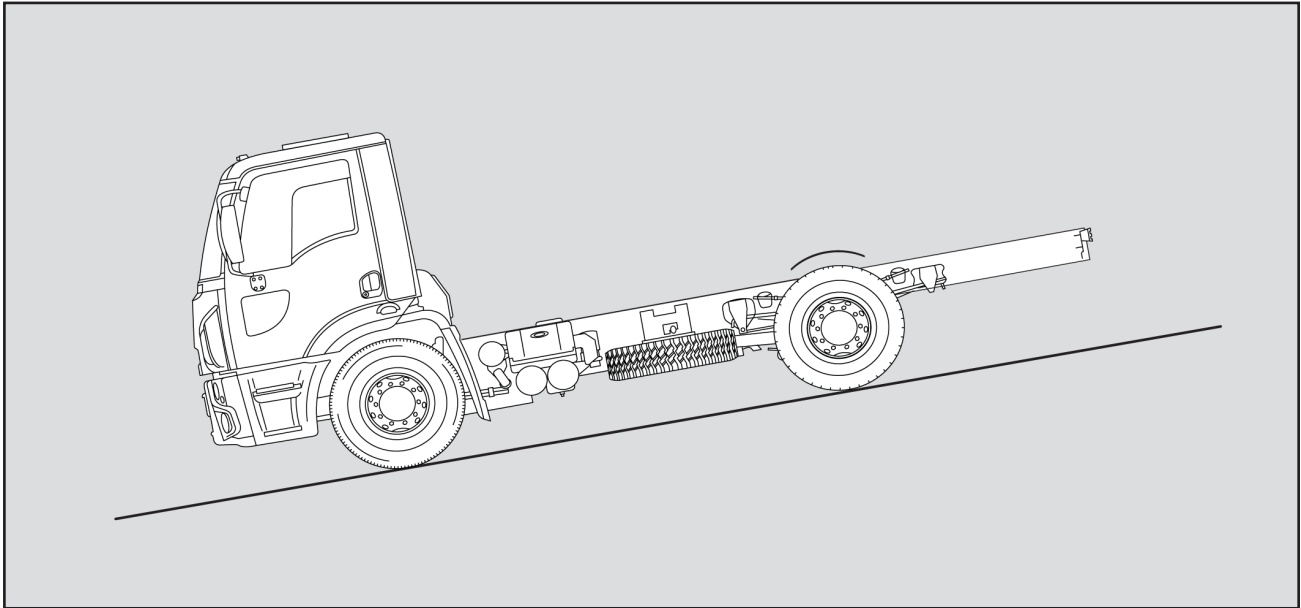
At all times, the driver is responsible for controlling the vehicle, supervising the system operation and being prepared to steer and brake the vehicle overriding the assist system, if necessary.

If the engine is run at excessively high speed or if a fault is detected, the system will deactivate.

The hill start assist (HSA) system makes it easier to exit with the vehicle when it is on a slope and it is necessary to use the parking brake. When hill start assist is active, the truck will remain stationary on the slope for 2 to 3 seconds after releasing the brake pedal. In this interval, there is time to take your foot off the brake pedal, step on the accelerator pedal and drive away. The brakes are automatically released as soon as the engine has developed enough power to prevent the vehicle from rolling back on the incline. This is an advantage when driving the vehicle onto a ramp, for example, a parking ramp, traffic lights or in parking maneuvers.

Hill start assist is automatically activated when the vehicle is stopped on a slope with a grade slope greater than 3%.

Hill start assist works with the vehicle facing downhill if reverse gear has been selected.



2940-022

Using the Hill Start Assist (HSA) on a downward slope

1. Press the brake pedal to completely stop the vehicle. Keep the brake pedal depressed.
2. If the sensors detect that the vehicle is on a slope, the system will activate automatically.
3. When you remove your foot from the brake pedal, the vehicle will remain on the slope without moving for approximately 2 or 3 seconds. This time period will automatically be extended if you are exiting from a completely immobilized position.
4. Accelerate smoothly. The brakes will automatically release and the truck will pull.

Warnings on the Irregularity Display

Transmission Stuck in One Gear

If the truck is turned off or “dies” while the transmission is in gear, the transmission may become stuck in gear. The transmission will attempt to go to Neutral when trying to start the truck again if the shift lever is in “N”.

If the transmission shifts into Neutral, a steady “N” will appear on the display.

If Neutral cannot be engaged, a “DASH” (–) will appear on the display and the engine will not start.

If a dash appears during power-up and the lever is in Neutral, try the following:

1. Select Neutral, “N”. Turn the key to the “OFF” position and leave the transmission without power for at least 2 minutes;
2. Press the brake pedal;
3. Release the parking brake;
4. Select Neutral;
5. Turn the key to the “ON” position;
6. The transmission will attempt to shift into Neutral when you turn the key to “ON”, but you may have to release the brake pedal slightly to help get the torque off the driveline;
7. When you engage Neutral, a steady “N” will appear on the display and the vehicle will start. If after this procedure a dash still appears on the display, it will be necessary to remove the remote shift control assembly to manually disengage the gear.



2940-023

CA - Overloaded Clutch

If the automated clutch starts to heat up excessively, due to excessive consecutive incline starts, “CA” will appear on the display along with an audible warning.

If this occurs, avoid continuing to start for a period of time until the clutch cools down and the warning disappears.

If this procedure is not followed and the “CA” warning on the display persists, the system may release the clutch and disable the accelerator for a short period of time, in order to preserve the integrity of the clutch.

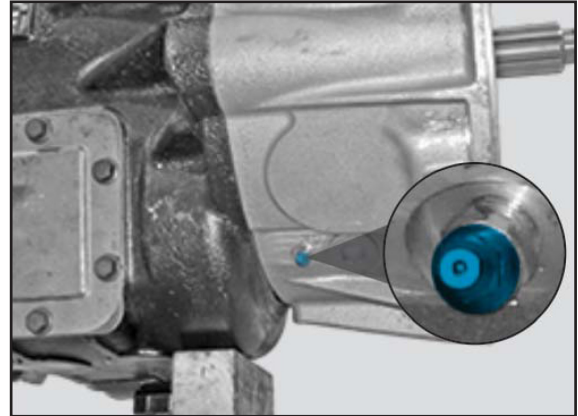
CAUTION: Avoid damage to the clutch: press the service brake pedal when stopping on an incline or slope. Do not hold the vehicle on an incline using the accelerator pedal.

PD - Transmission in Diagnostic Mode

If the transmission is placed in product diagnostic mode, a “PD” will appear on the display and the truck will not start.

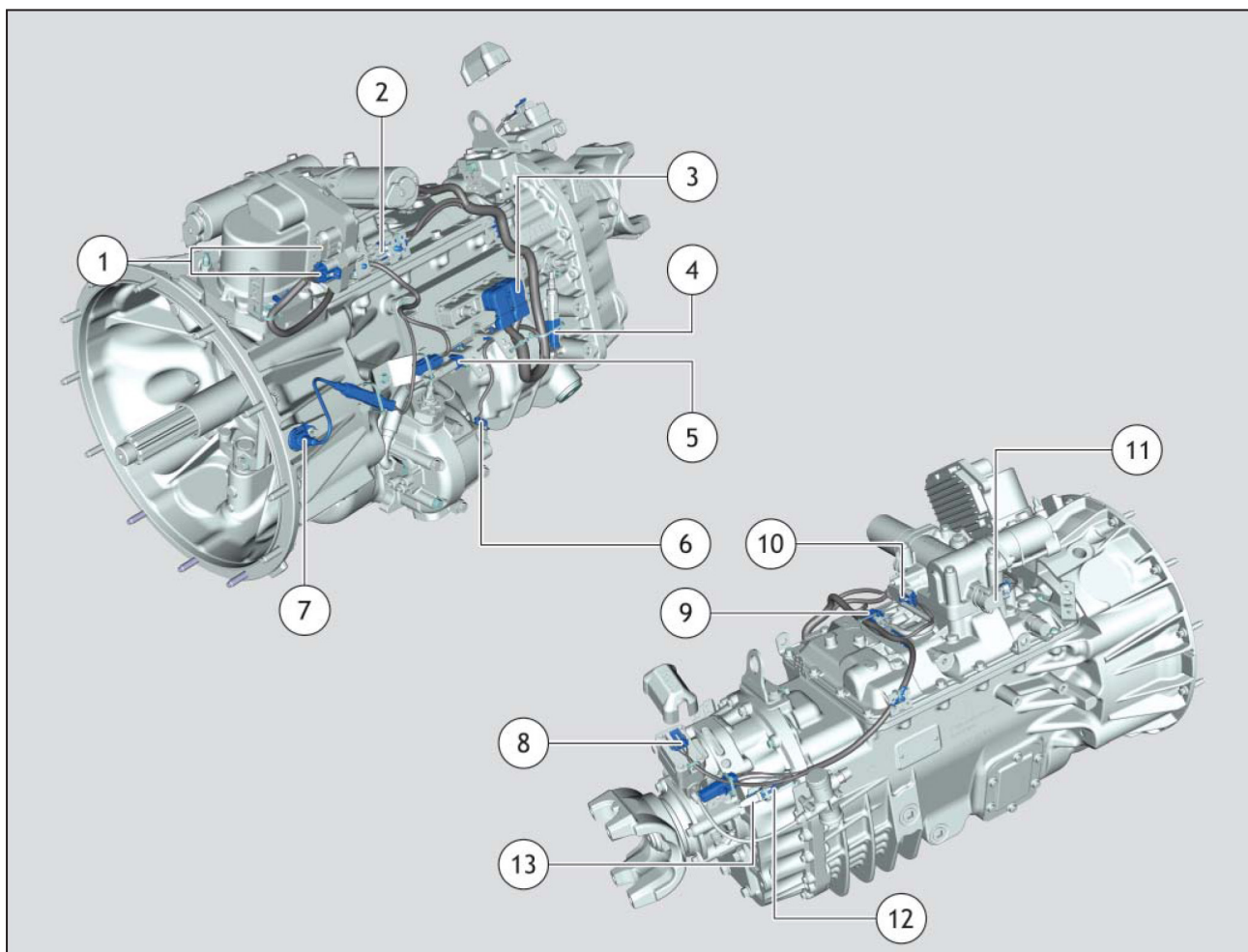
Use the following procedure to exit Product Diagnostic Mode:

1. Select Neutral “N” and turn the key off;
2. Wait for at least 2 minutes;
3. Turn the key on and power up the system;
4. Check if there is an “N” on the gear display;
5. Start the engine.



2940-024

Transmission Harness Replacement In Vehicle

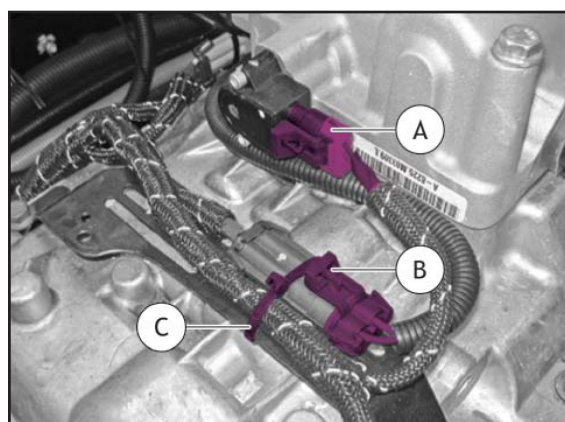


2940-032

- | | |
|---|--|
| 1. Electronic clutch actuator control connectors | 7. Engine speed sensor |
| 2. Gear shift motor connector | 8. Planetary gear pneumatic actuator connector |
| 3. Transmission electronic control unit connector | 9. Gear selection motor connector |
| 4. Main shaft speed sensor connector | 10. Gear selection sensor connector |
| 5. Transmission input speed sensor connector | 11. Shift sensor connector |
| 6. Inertia brake control connector | 12. Transmission output speed sensor connector |
| | 13. Input connector (in-line) |

Harness Removal

1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.
4. Remove the bracket for the electrical and pneumatic connectors from the semi-trailer and place it so as not to interfere with the removal of the deck plate.
5. Remove the deck plate.
6. Remove the gear selector sensor connector (A), the gear selector motor connector (B) and the retaining nylon cable tie (C).



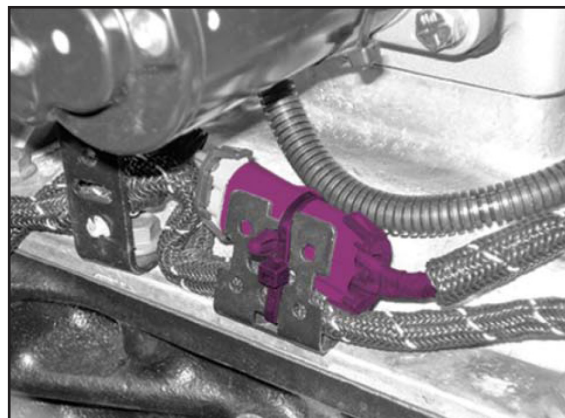
2940-033-1

7. Remove the nylon cable ties securing the harness to the bracket, located on the top of the transmission.



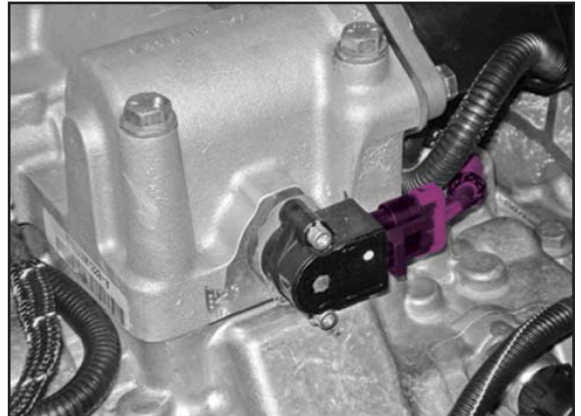
2940-033-2

8. Remove the gear shift motor connector and the retaining nylon cable tie.



2940-034-1

9. Remove the gear shift sensor connector.



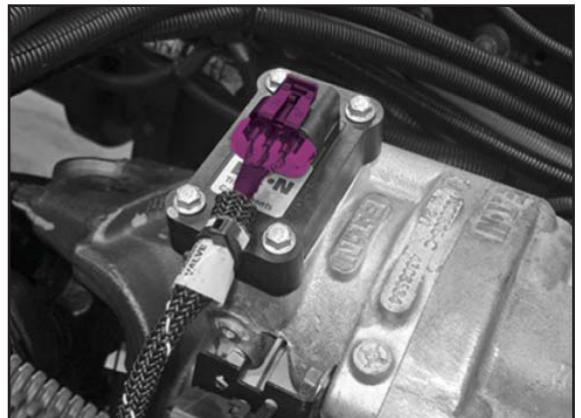
2940-033-2

10. Remove the protective cover of the planetary gear pneumatic actuator connector.



2940-033-3

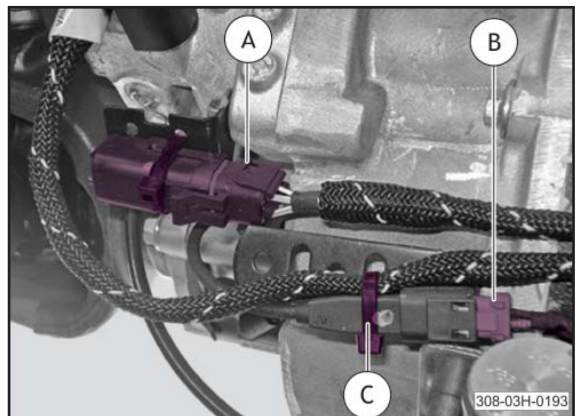
11. Remove the pneumatic actuator connector.



2940-035-1

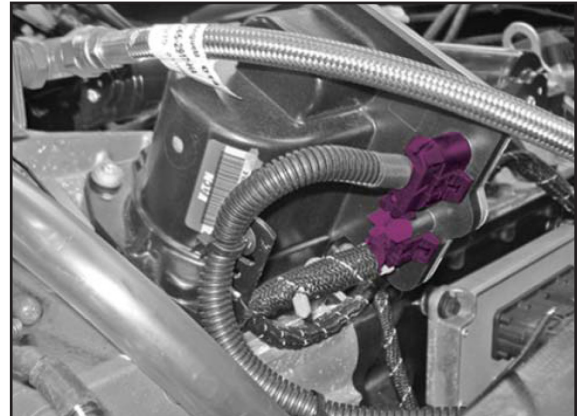
12. Remove the transmission output speed sensor connector "B" and its retaining nylon cable tie.

13. Remove the retaining nylon cable tie "C" of the input connector "A" (in-line).



2940-035-2

14. Remove the electronic clutch actuator control connectors.



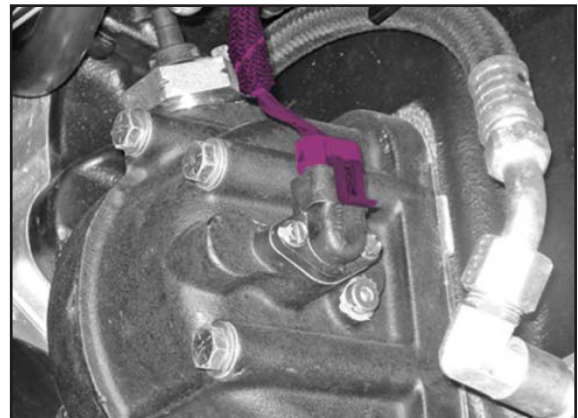
2940-035-3

15. Remove the transmission input speed sensor connector.



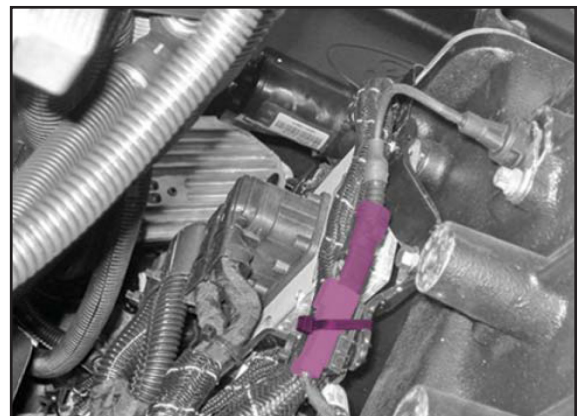
2940-036-1

16. Remove the inertia brake control connector.



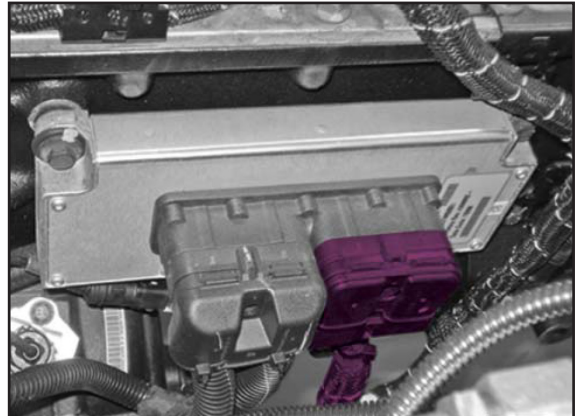
2940-036-2

17. Remove the main shaft speed sensor connector.



2940-036-3

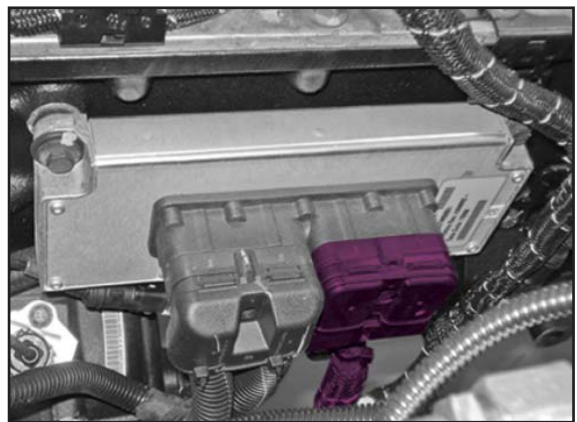
18. Remove the transmission electronic control unit (TCU) connector.
19. Remove the transmission wiring harness.



2940-037-1

Harness Installation

1. Install the transmission wiring harness.
2. Install the transmission electronic control unit (TCU) connector.
3. Install the main shaft speed sensor connector and the retaining nylon cable tie.

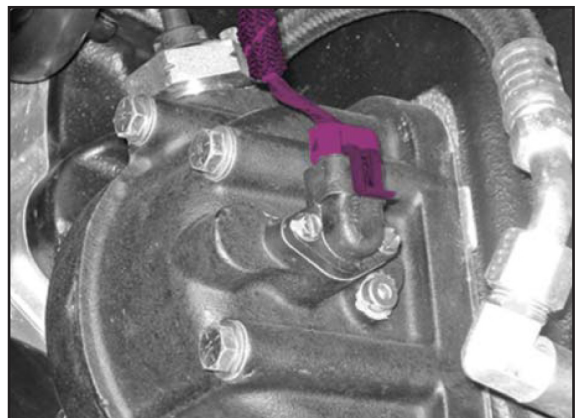


2940-037-1

3. Install the main shaft speed sensor connector and the retaining nylon cable tie.
4. Install the inertia brake control connector.

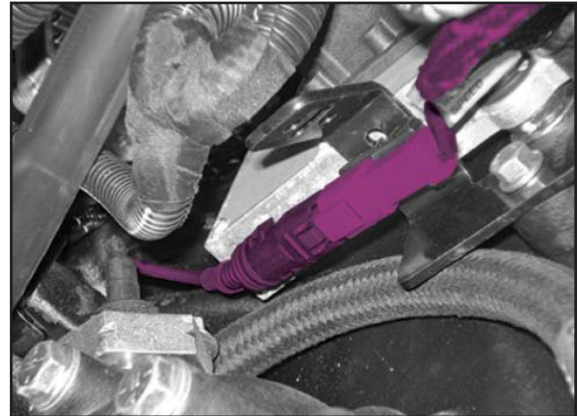


2940-036-3



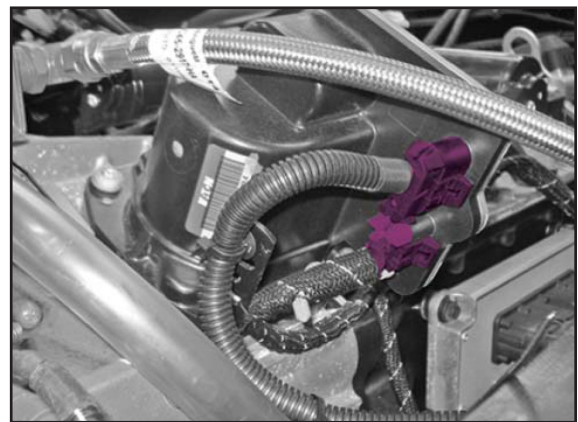
2940-036-2

5. Install the transmission input speed sensor connector located above the inertia brake.



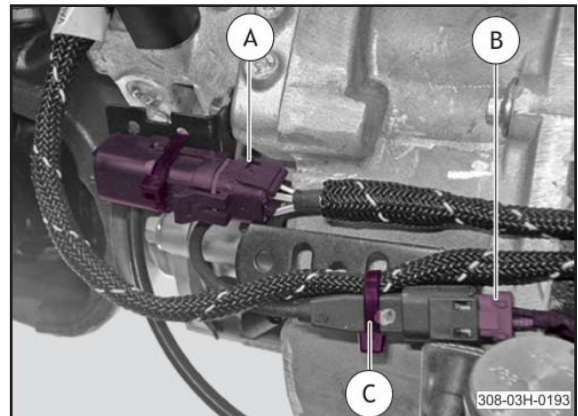
2940-036-1

6. Install the electronic clutch actuator control connectors.



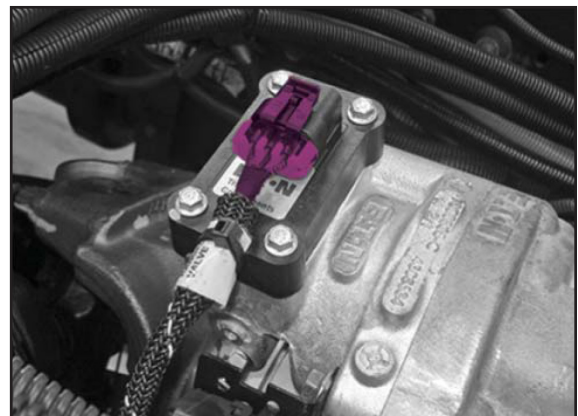
2940-035-3

7. Install the transmission output speed sensor connector "B" and its retaining nylon cable tie.
8. Secure the input connector "A" with the nylon cable tie "C".



2940-035-2

9. Install the planetary gear pneumatic actuator connector.



2940-035-1

10. Install the protective cover of the planetary gear pneumatic actuator connector.



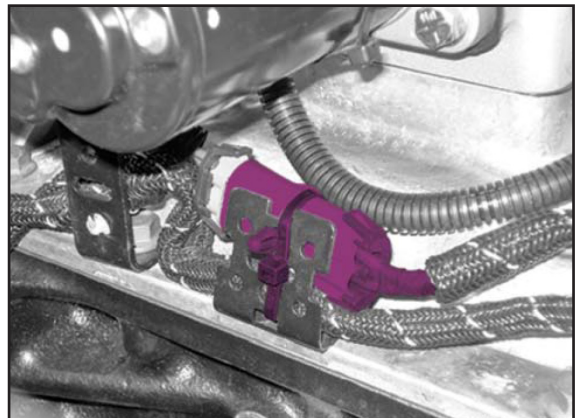
2940-034-3

11. Install the gear shift sensor connector.



2940-034-2

12. Install the gear shift motor connector and the retaining nylon cable tie.



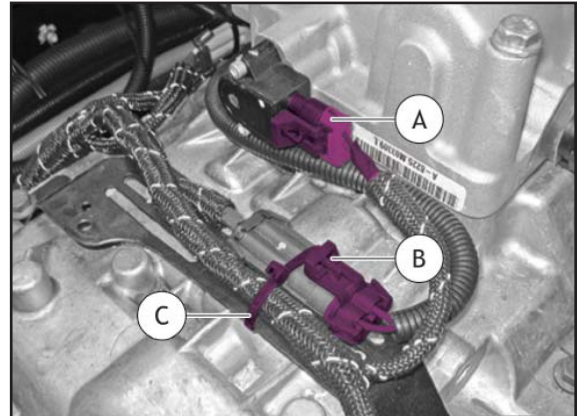
2940-034-1

13. Install the nylon cable ties securing the harness to the bracket, located on the top of the transmission.



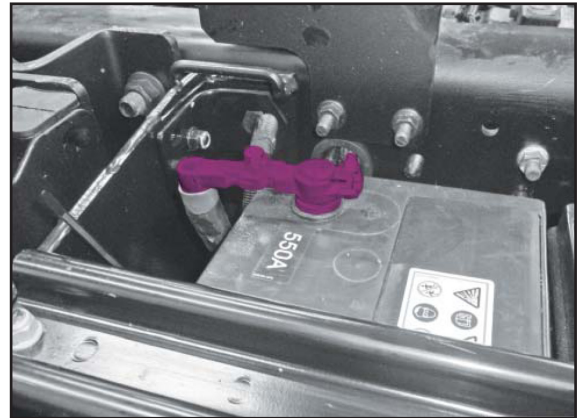
2940-033-2

14. Install the gear selector sensor connector (A), the gear selector motor connector (B) and the retaining nylon cable tie (C).



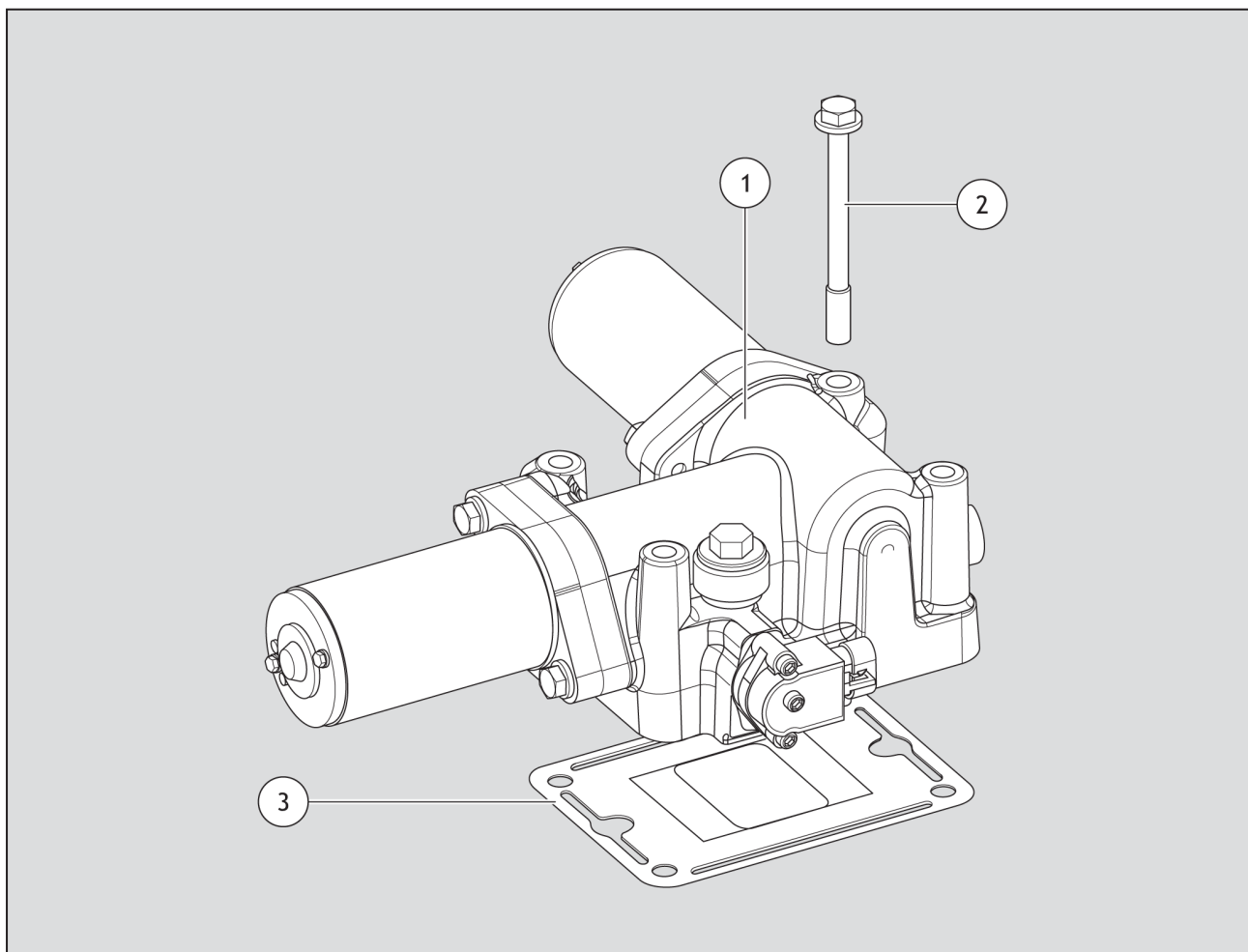
2940-033-1

15. Install the negative battery cable and tighten the nut to a torque of 8 Nm.



2940-041-2

Remote Shift Control Assembly Replacement



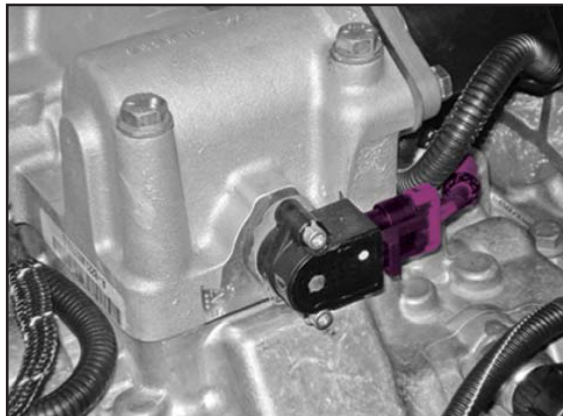
2940-042

1. Remote shift control assembly
2. Remote shift control housing retaining capscrows to the transmission top cover (Shift bar housing)
3. Remote shift control housing gasket

Remote Shift Control Assembly Removal

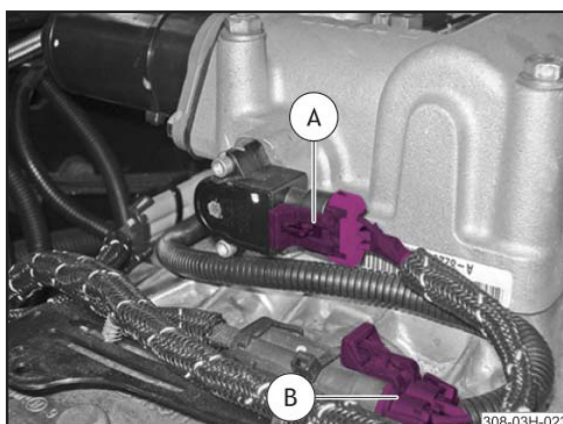
1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.
4. Remove the bracket for the electrical and pneumatic connectors from the semi-trailer and place it so as not to interfere with the removal of the deck plate.
5. Remove the deck plate.

6. Remove the gear shift sensor connector.



2940-034-2

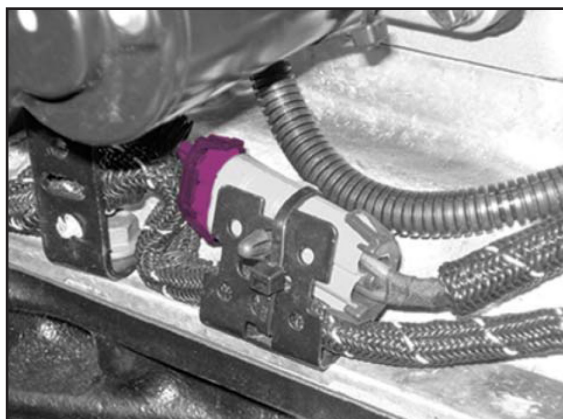
7. Remove the gear selector sensor connector (A) and the gear selector motor connector (B).



2940-043-2

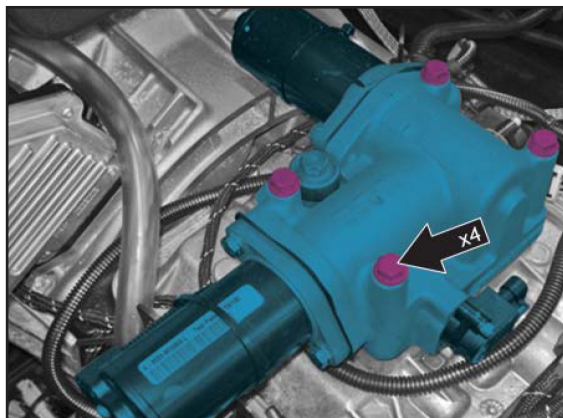
8. Remove the gear shift motor connector.

CAUTION: Remove any impurities that are on the remote shift control housing and on the transmission top cover (shift bar housing).



2940-044-1

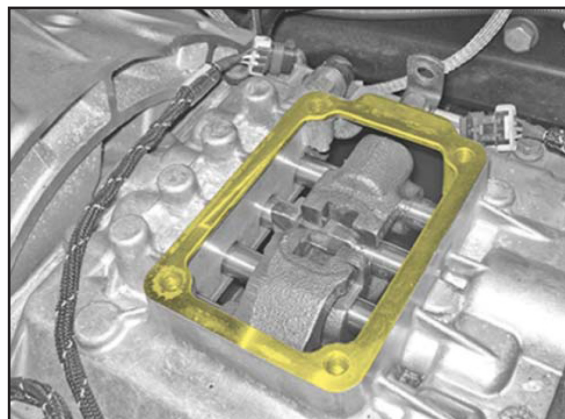
9. Remove the remote shift control assembly retaining capscrews.
10. Remove the remote shift control assembly.



2940-044-2

11. Remove remote shift control housing gasket residue from the transmission top cover (shift bar housing) mating surface.

NOTE: Avoid getting dirt inside the transmission case during remote shift control assembly removal and cover the transmission shift bar housing opening with a clean cloth after the remote shift control removal.



2940-044-3

12. Remove gasket residue from the gasket mating surface on the remote shift control housing.



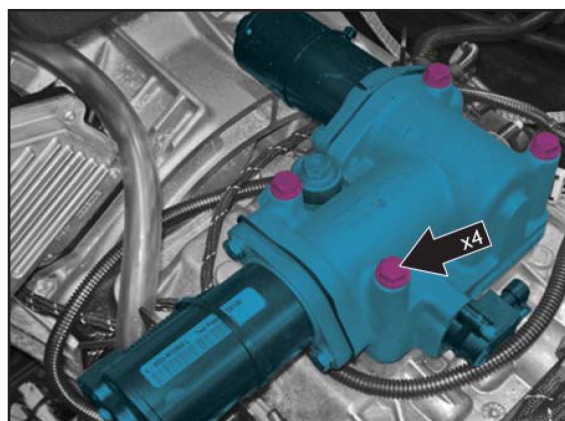
2940-045-1

Remote Shift Control Assembly Installation

1. Replace the remote shift control housing gasket.
2. Install the remote shift control assembly on the transmission top cover (shift bar housing), tightening its 4 retaining capscrews to a torque of 53 Nm.

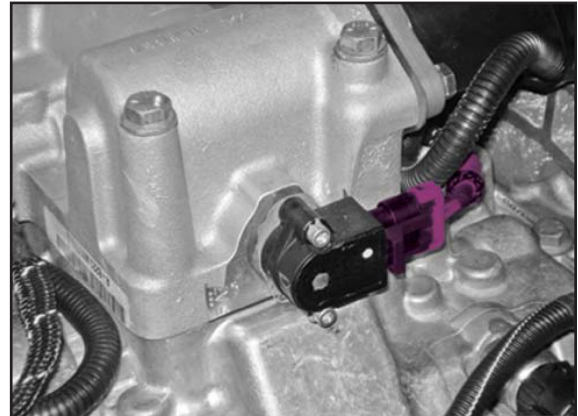


2940-045-2



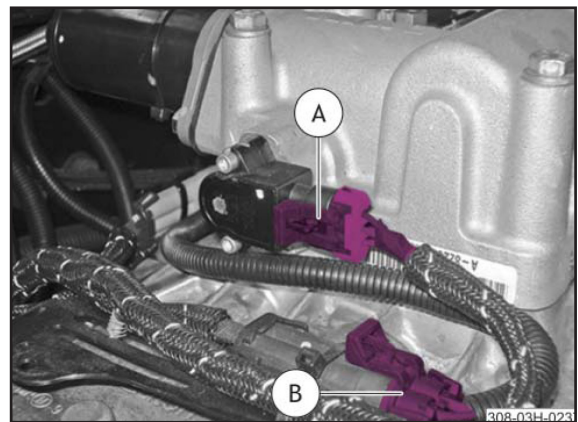
2940-044-2

3. Install the gear shift sensor connector.



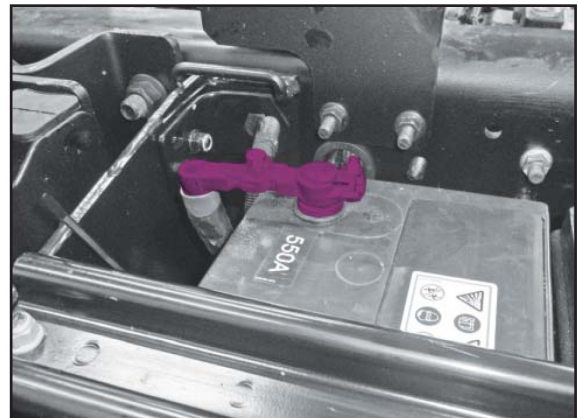
2940-034-2

4. Install the gear selector sensor connector (A) and the gear selector motor connector (B).



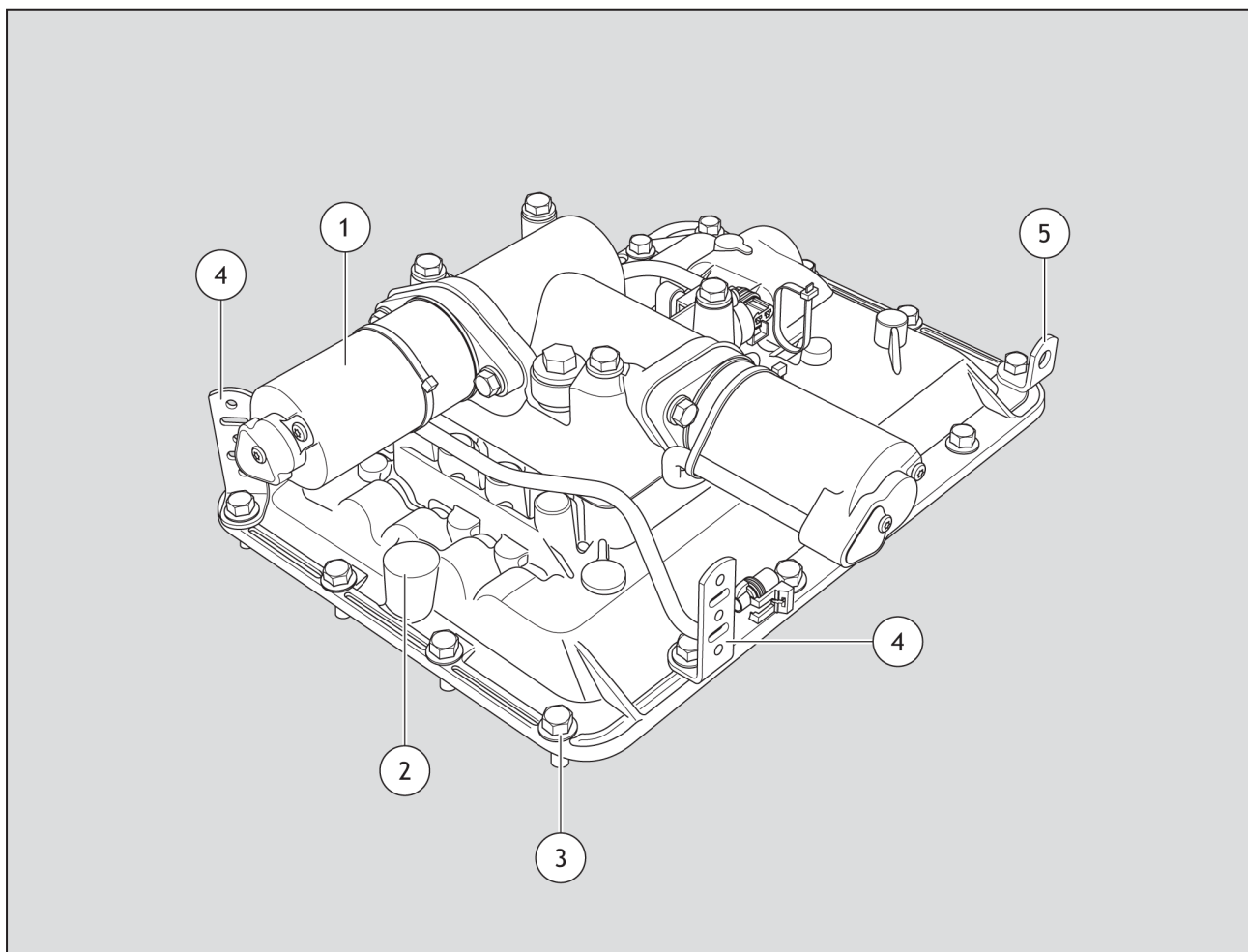
2940-043-2

5. Clear any fault codes from the transmission electronic memory using the EATON electronic service tool "ServiceRanger".



2940-041-2

Shift Bar Housing (Transmission Top Cover) Replacement



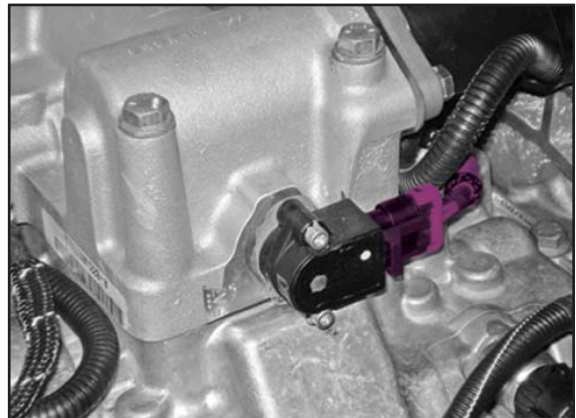
2940-047

- | | |
|---|------------------------|
| 1. Remote shift control assembly | 4. Bracket |
| 2. Shift bar housing (Transmission top cover) | 5. Lifting eye bracket |
| 3. Shift bar housing retaining capscrews | |

Shift Bar Housing Removal

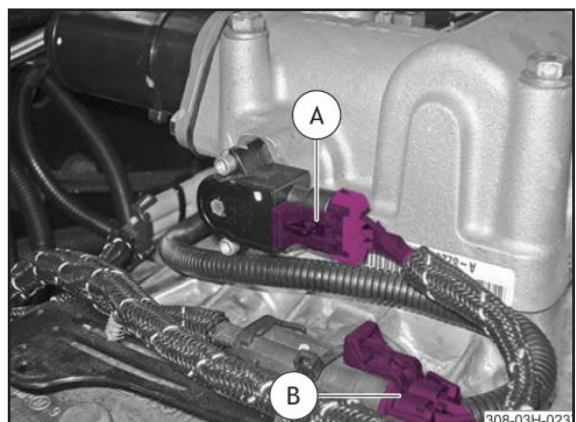
1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.
4. Remove the support for the electrical and pneumatic connectors from the semi-trailer and place it so as not to interfere with the removal of the deck plate.
5. Remove the deck plate.

6. Remove the gear shift sensor connector.



2940-034-2

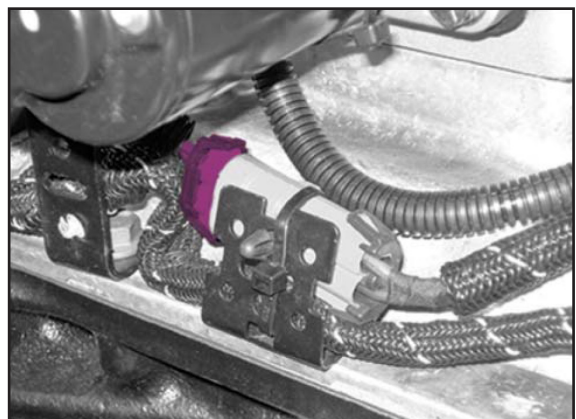
7. Remove the gear selector sensor connector (A) and the gear selector motor connector (B).



2940-043-2

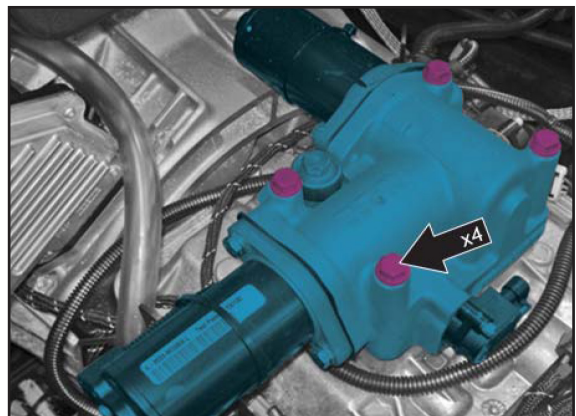
8. Remove the gear shift motor connector.

CAUTION: Remove any impurities that are on the remote shift control housing and on the transmission top cover (shift bar housing).



2940-044-1

9. Remove the remote shift control assembly retaining capscrews.
10. Remove the remote shift control assembly.



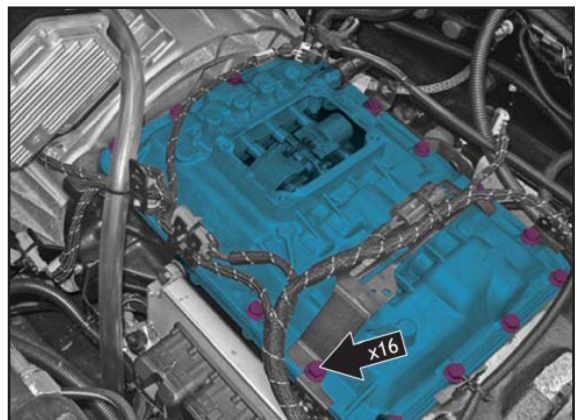
2940-044-2

11. Remove the neutral sensor connector.



2940-049-3

12. Remove the capscrews securing the top cover (shift bar housing) to the transmission case.
13. Remove the shift bar housing.



2940-050-1

CAUTION: Avoid getting dirt inside the transmission case during remote shift control assembly removal and cover the transmission shift bar housing opening with a clean cloth after the remote shift control removal.

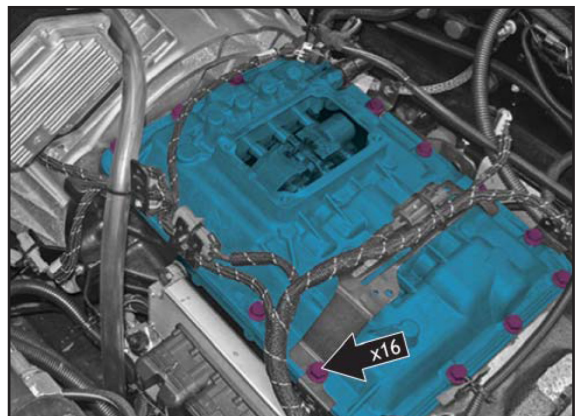
NOTE: Remove gasket residue on the sealing surface of both the shift bar housing and the transmission case.

NOTE: For disassembly, inspection and assembly of the shift bar housing, see “Shift Bar Housing” in this manual.

Shift Bar Housing Installation

NOTE: Replace the shift bar housing sealing gasket and observe the correct position of the wiring harness and its securing brackets.

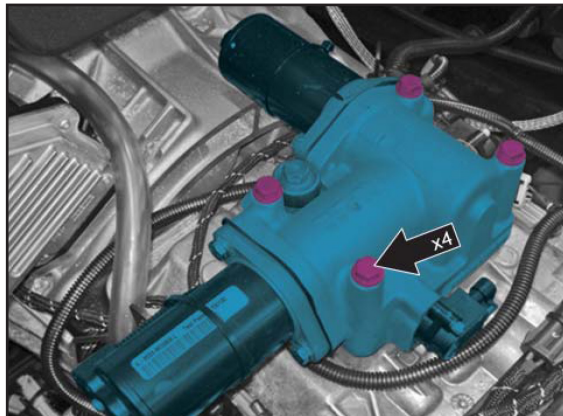
1. Install the shift bar housing on the top of the transmission case and tighten its 16 retaining capscrews to a torque of 55 Nm.



2940-050-1

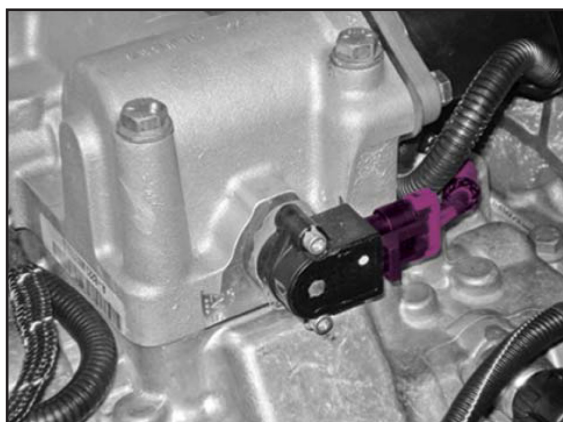
NOTE: Replace the remote shift control housing sealing gasket.

2. Install the remote shift control assembly on the shift bar housing and tighten its 4 retaining capscrews to a torque of 53 Nm.



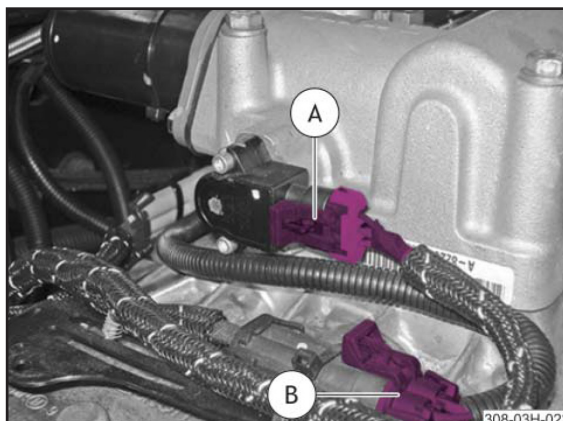
2940-044-2

3. Install the gear shift sensor connector.



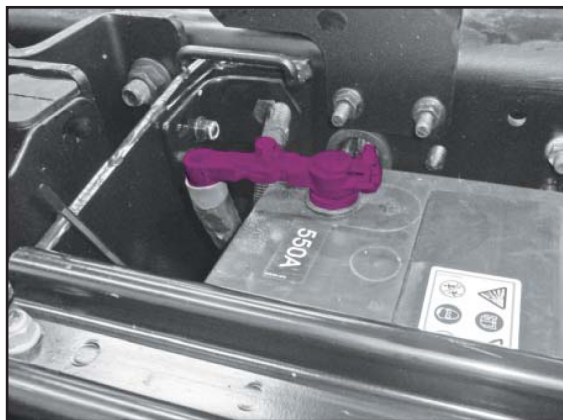
2940-034-2

4. Install the gear selector sensor connector (A) and the gear selector motor connector (B).



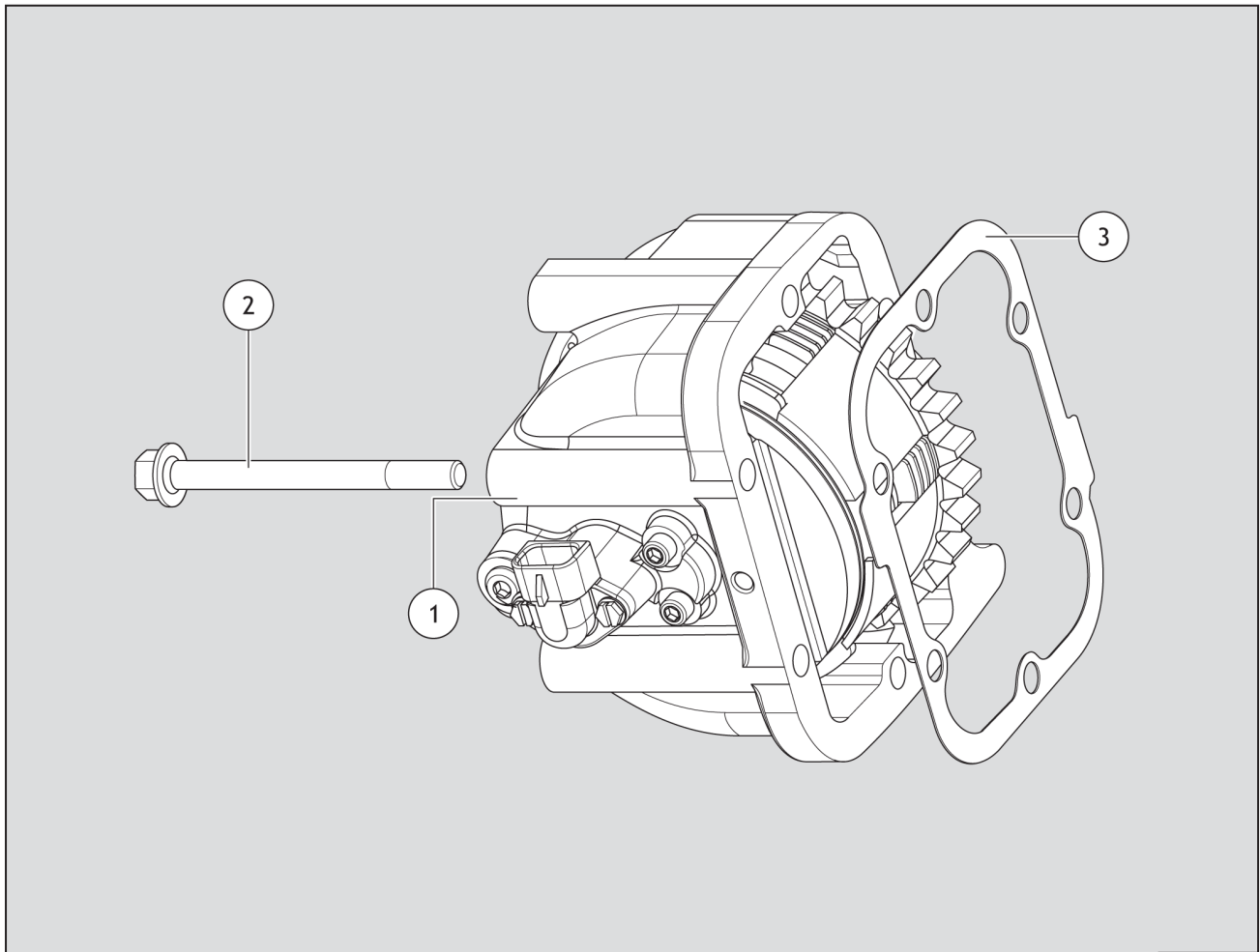
2940-043-2

5. Install the negative battery cable and tighten the nut to a torque of 8 Nm.
6. Install the deck plate.
7. Install the support for the electrical and pneumatic connectors from the semi-trailer.
8. Clear any fault codes from the transmission electronic memory using the EATON electronic service tool "ServiceRanger".
9. Conduct a road test.



2940-041-2

Inertia Brake Replacement

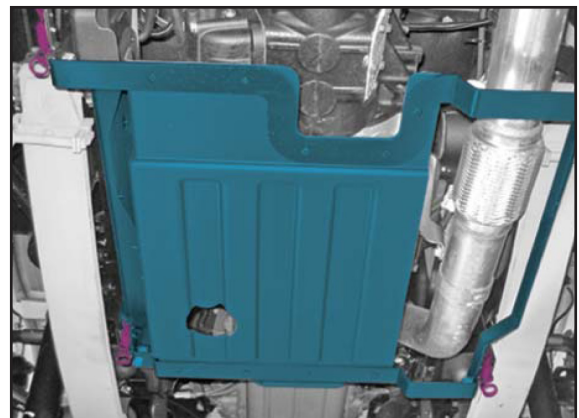


2940-053

1. Inertia brake
2. Inertia brake retaining capscrews
3. Gasket

Inertia Brake Removal

1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.
4. Unlock the 4 retaining clips and remove the transmission guard.



2940-054-1

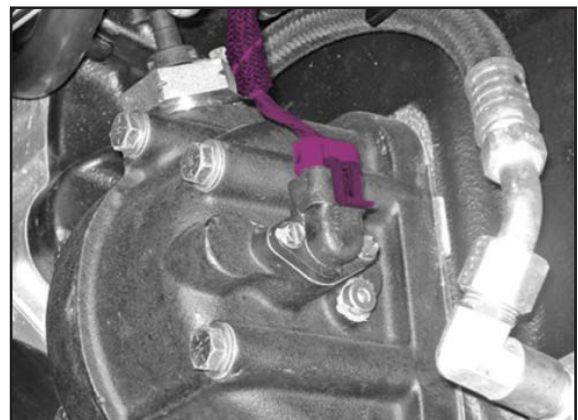
5. Remove the transmission oil drain plug and drain the oil.

CAUTION: Collect the transmission oil using a suitable container.



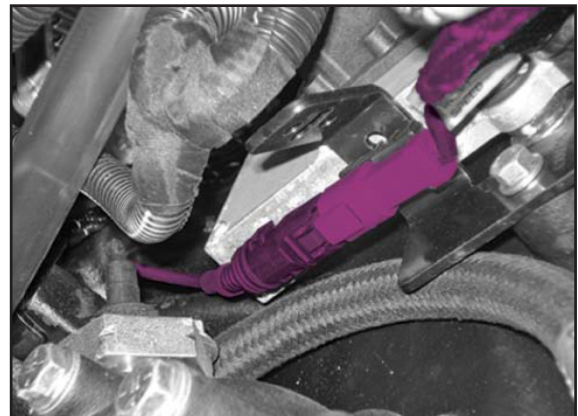
2940-054-2

6. Remove the inertia brake control connector.



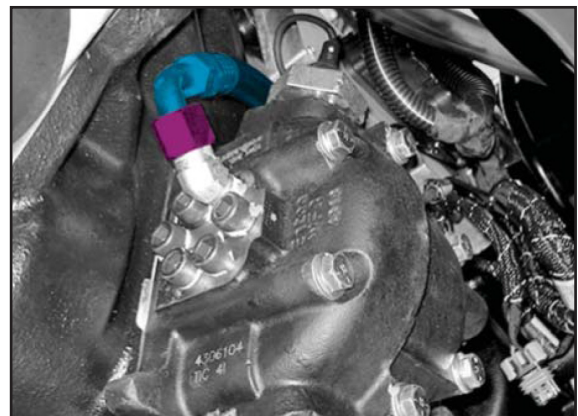
2940-036-2

7. Remove the inertia brake speed sensor connector.



2940-036-1

8. Remove the inertia brake lubricating oil connection.

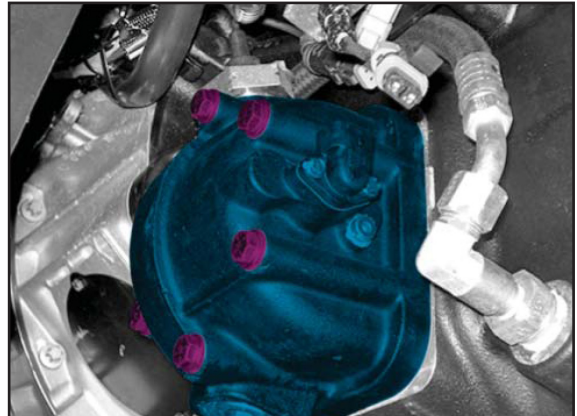


2940-055-2

9. Remove the retaining capscrews and remove the inertia brake.

CAUTION: Collect the inertia brake oil using a suitable container.

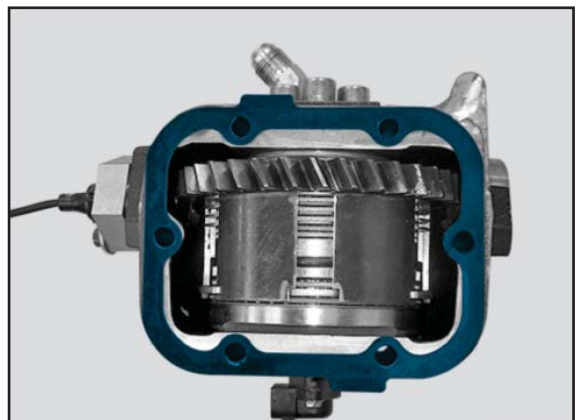
10. Clean the sealing surface of the inertia brake on the transmission housing.



2940-055-3

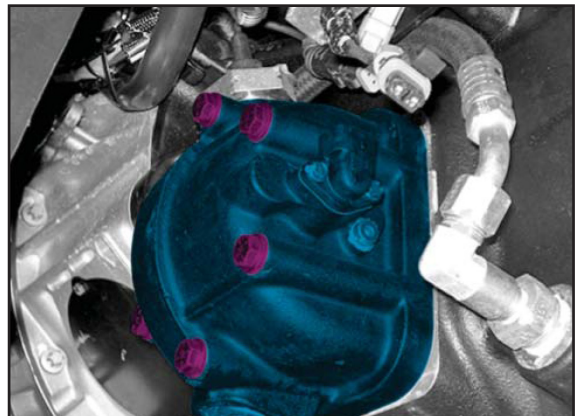
Inertia Brake Installation

1. Install a new gasket on the inertia brake.
2. Install the inertia brake on the transmission and tighten its retaining capscrews to a torque of 58 Nm.

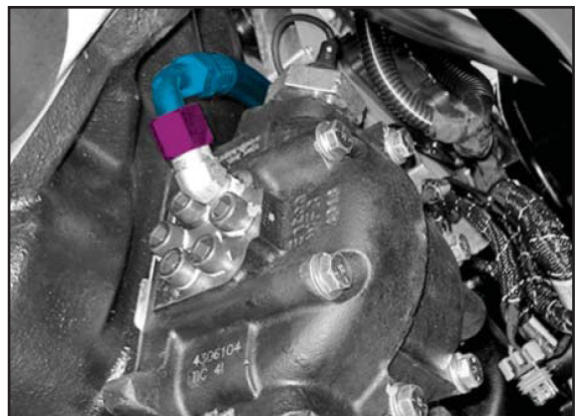


2940-056-1

3. Install the inertia brake lubricating oil hose connection.



2940-055-3



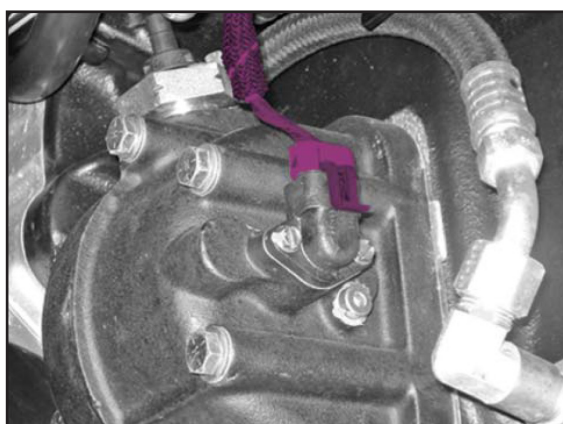
2940-055-2

4. Install the inertia brake speed sensor connector.



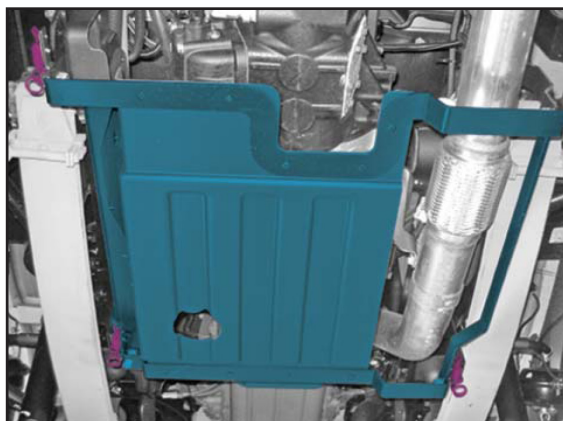
2940-036-1

5. Install the inertia brake control connector.



2940-036-2

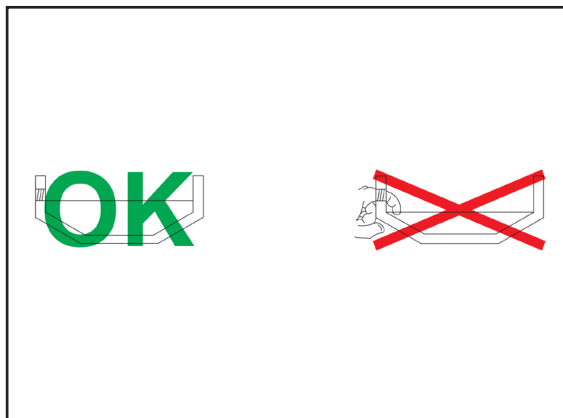
6. Install the transmission guard and secure it with the 4 retaining clips.



2940-054-1

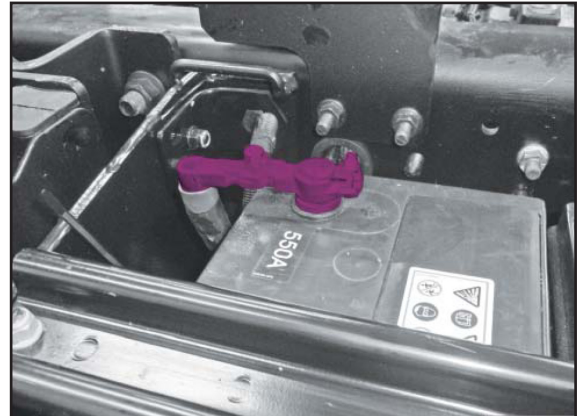
7. Clean transmission case area around the oil filler plug and refill with the specified lubricant oil.

NOTE: O nível de óleo lubrificante deverá estar nivelado com a borda inferior do orifício do bujão de enchimento.



2940-025-2

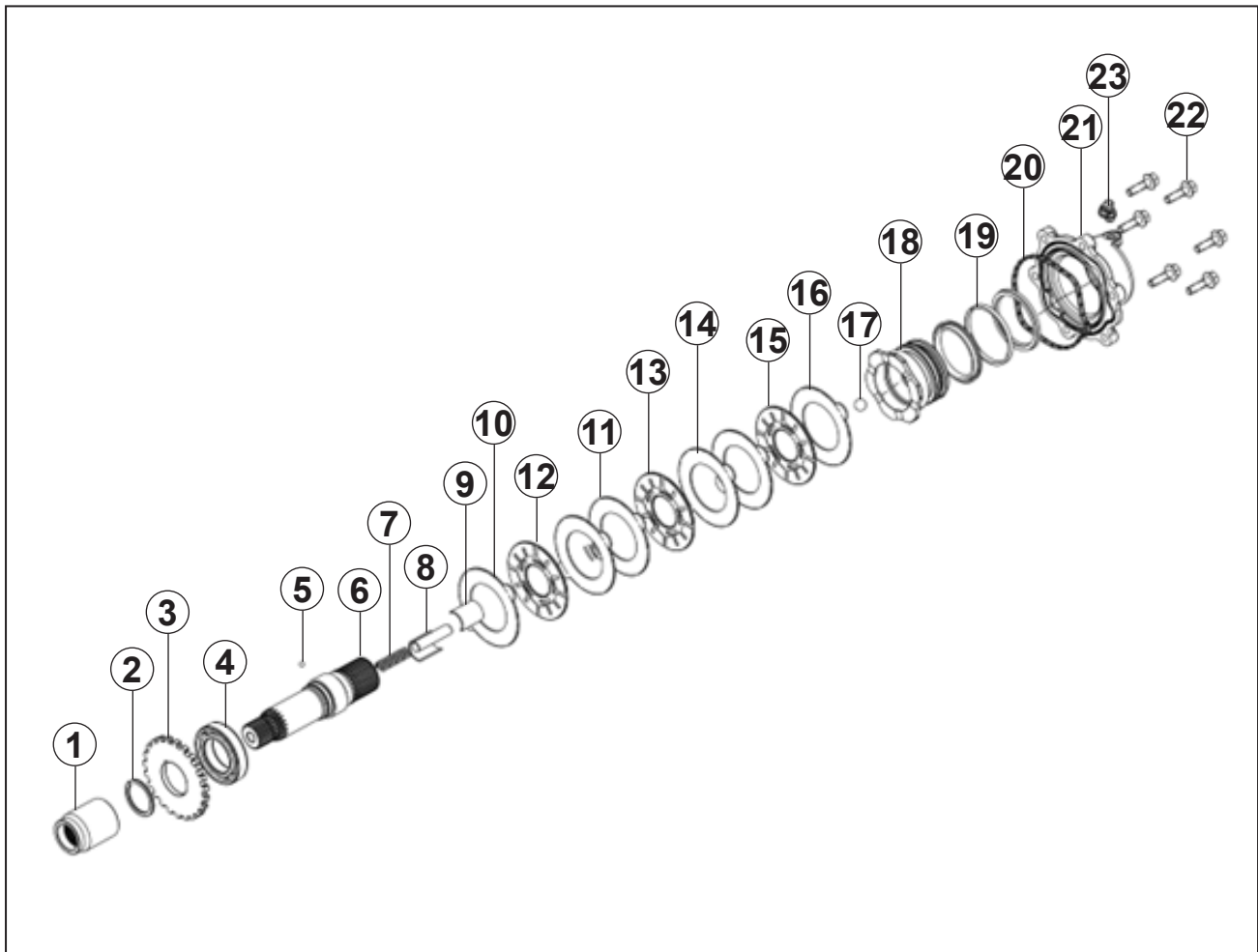
8. Install the negative battery cable and tighten the nut to a torque of 8 Nm.



2940-041-2

9. Clear any fault codes from the transmission electronic memory using the EATON electronic service tool "ServiceRanger".
10. Conduct a road test.

Low Capacity Inertia Brake (LCIB) Replacement

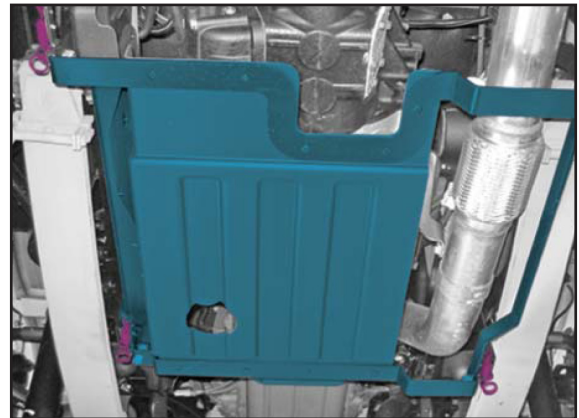


2940-255

- | | |
|------------------------|-----------------------------|
| 1. Sleeve | 13. Friction Disc |
| 2. Snap Ring | 14. Smooth Disc (2) |
| 3. Rotor | 15. Friction Disc |
| 4. Bearing | 16. Smooth Disc |
| 5. Ball | 17. Ball |
| 6. Inertia Brake Shaft | 18. Piston |
| 7. Spring | 19. Sealing Rings (3) |
| 8. Pin | 20. Sealing Ring |
| 9. Guides (2) | 21. Inertia Brake Cover |
| 10. Smooth Disc | 22. Retaining Capscrews (6) |
| 11. Smooth Disc (2) | 23. Pneumatic connection |
| 12. Friction Disc | |

LCIB Removal

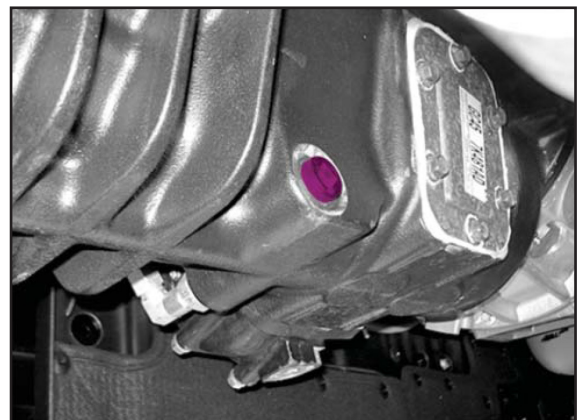
1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.
4. Unlock the 4 retaining clips and remove the transmission guard.



2940-054-1

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

CAUTION: Collect the transmission oil using a suitable container.



2940-054-2

6. From the LCIB cover, remove the 6 retaining capscrews and the pneumatic connection.



2940-054-3

7. Remove the LCIB cover together with the piston.



2940-054-4

CAUTION: Inspect the condition of the rings and replace them if damaged.



2940-054-5

8. Remove the pin, spring and guides manually or with the help of a magnet.



2940-054-6

NOTE: The spring is located beneath the pin.



2940-054-7

9. Remove the smooth discs and friction discs manually or with the help of a magnet.



2940-054-8

CAUTION: There are 6 smooth discs and 3 friction discs, assembled interspersed as shown in the illustration.



2940-054-9

10. Clean the LCIB rear housing and inspect it.



2940-054-10

LCIB Installation

1. Clean the LCIB rear housing and countershaft end of the inertia brake.
2. Carry out the assembly according to the sequence below:
 - a. Install the 2 guides;
 - b. Install 1 smooth disc;
 - c. Install 1 friction disc;
 - d. Install 2 smooth discs;
 - e. Install 1 friction disc;
 - f. Install 2 smooth discs;
 - g. Install 1 friction disc;
 - h. Install 1 smooth disc.



2940-054-10



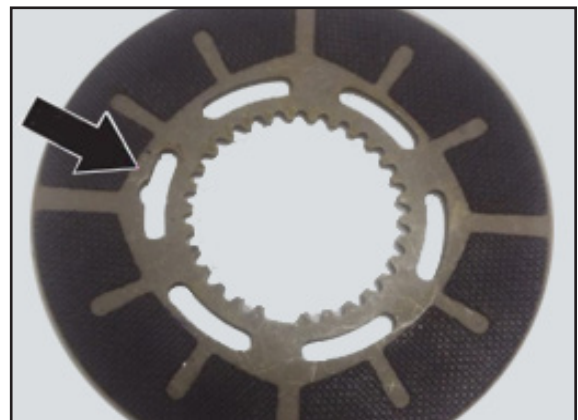
2940-054-9

ATTENTION: It is part of good practice to install smooth and friction discs gently oiled.



2940-054-8

ATTENTION: The assembly of the friction discs must follow the same alignment as the orientation channel of the parts.



2940-054-8a

3. Install the spring inside the inertia brake shaft.



2940-054-7

4. Install the pin into the inertia brake shaft.



2940-054-6

5. Install the piston together its rings into the LCIB cover.



2940-054-4

6. Install the cover/piston onto the rear housing.



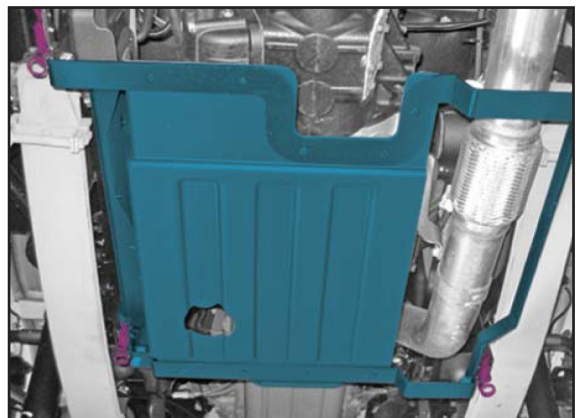
2940-054-11

7. Tighten the 6 retaining capscrews of the cover to a torque of 19-25 Nm. Install the pneumatic connection and tighten it.



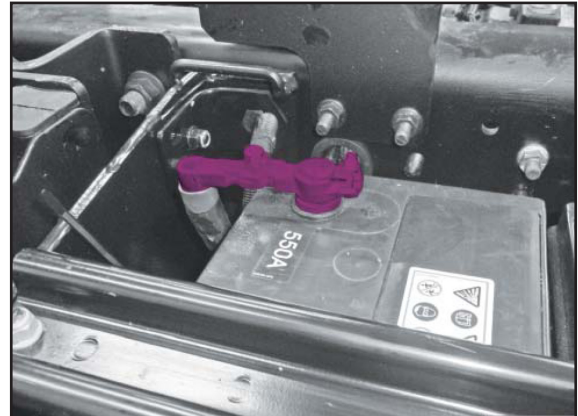
2940-054-3

8. Install the transmission guard and secure it with its 4 retaining clips.



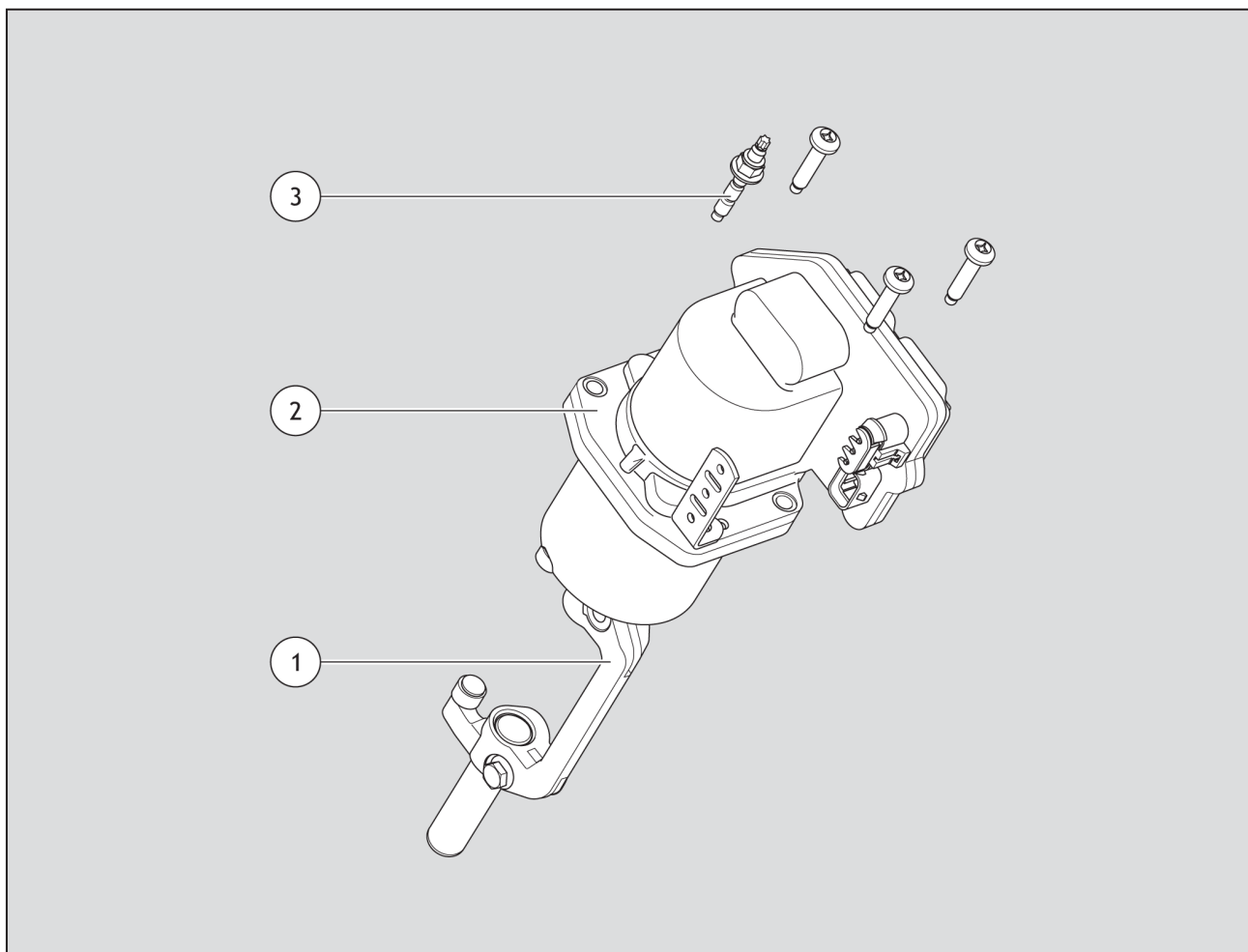
2940-054-1

9. Install the negative battery cable and tighten the nut to a torque of 8 Nm.
10. Clear any fault codes from the transmission electronic memory using the EATON electronic service tool "ServiceRanger".
11. Conduct a road test.



2940-041-2

Electronic Clutch Actuator (ECA) Replacement



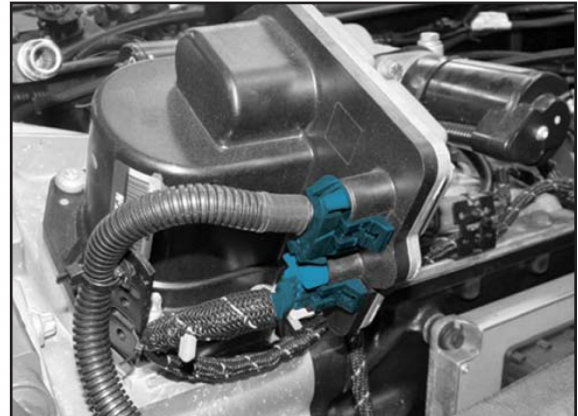
2940-059

1. Clutch release yoke
2. Electronic clutch actuator (ECA)
3. Clutch actuator retaining stud and capscrews to the clutch housing

ECA Removal

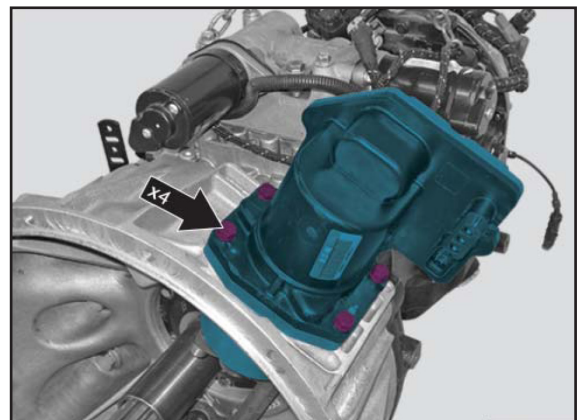
1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.
4. Remove the support for the electrical and pneumatic connectors from the semi-trailer and place it so as not to interfere with the removal of the deck plate.
5. Remove the deck plate.

6. Remove the electronic clutch actuator connectors.



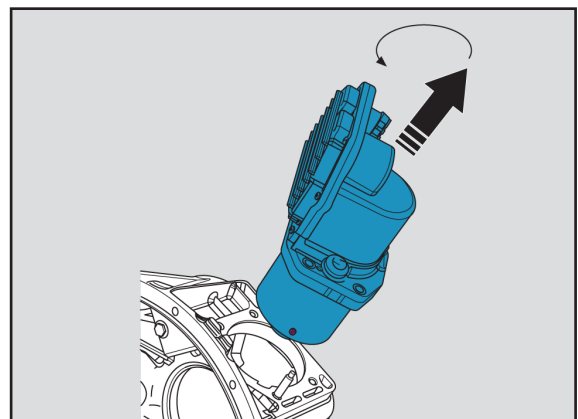
2940-060-1

7. Remove clutch actuator retaining nut and capscrews.



2940-060-2

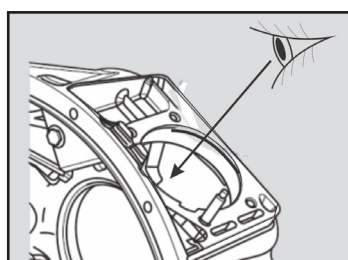
8. Remove the ECA by pulling it and rotating it counterclockwise until the alignment (dowel) pin fits into the housing slot.



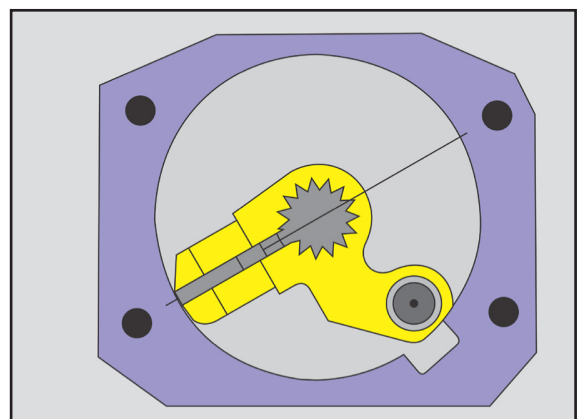
2940-061-1

ECA Installation

1. Check the positioning of the clutch release yoke cross-shaft.

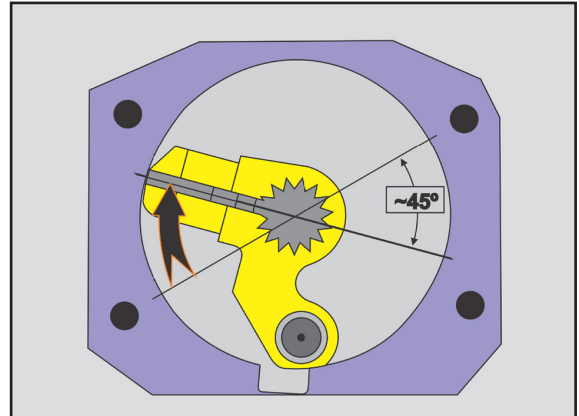


2940-061-2



2940-061-3

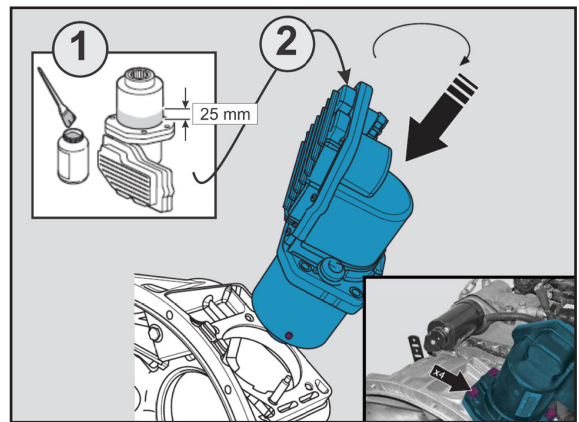
2. Rotate the release yoke cross-shaft clockwise approximately 45°.



2940-062

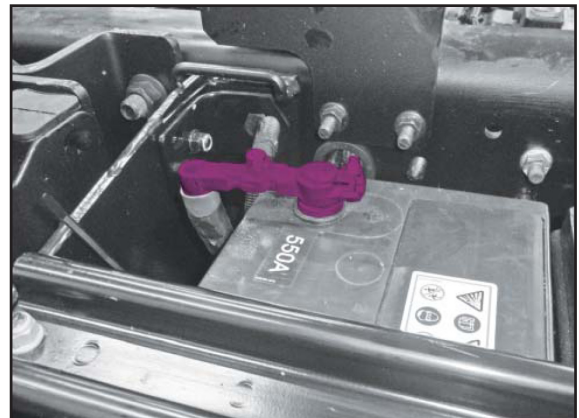
3. Apply a layer of NLGI 2 grease around the ECA, with approximately 25 mm wide.
4. Install the actuator by matching the dowel pin on its external diameter with the slot in the clutch housing. Rotate the actuator clockwise until reaching the end of travel.
5. Install the 4 ECA retaining capscrews and tighten them to a torque of 40 Nm.

NOTE: Apply Eaton E678 threadlocker to the capscrew threads to prevent them from loosening due to vibration.

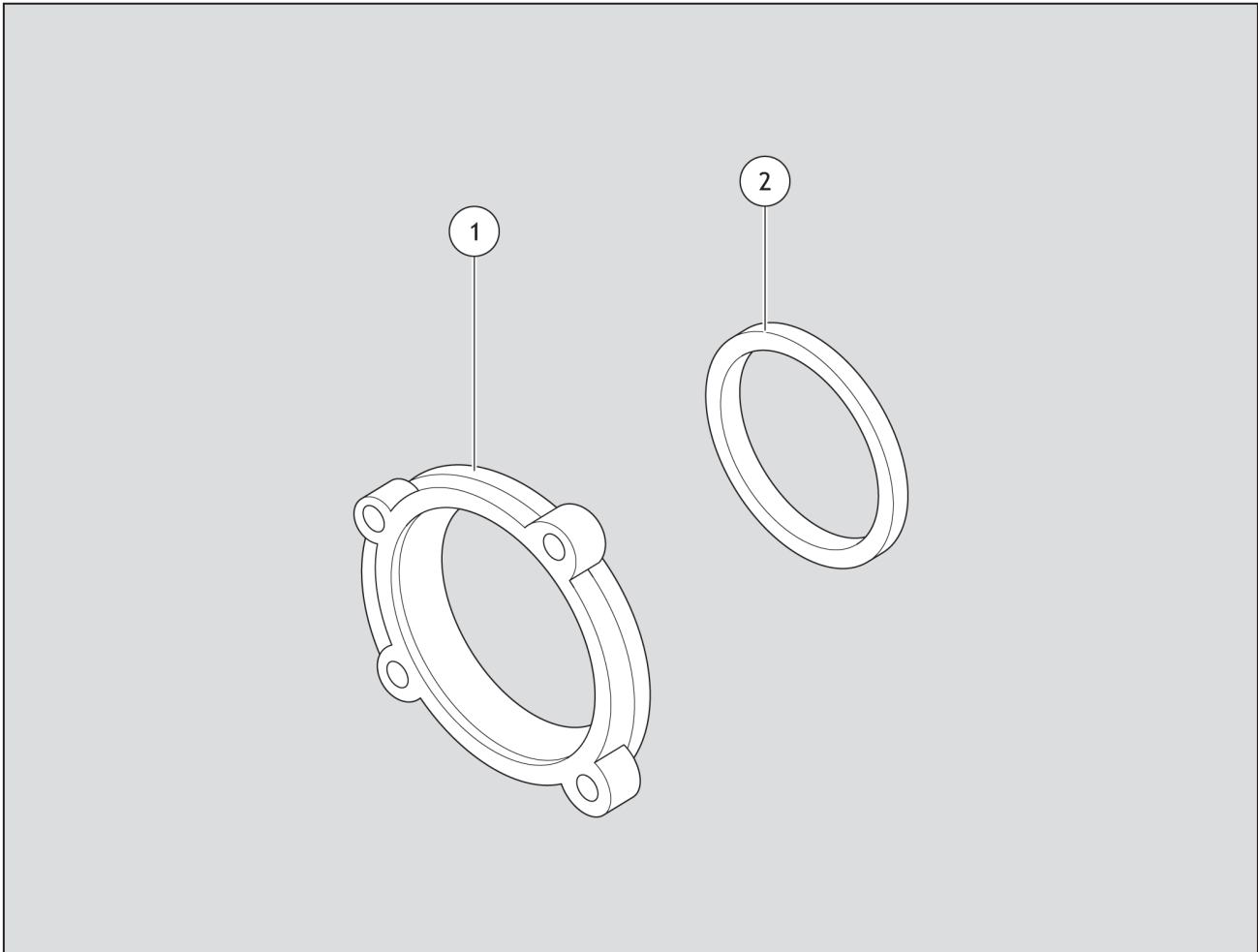


2940-062-2

6. Install the negative battery cable and tighten the nut to a torque of 8 Nm.



2940-041-2

Transmission Rear Seal Replacement

2940-063

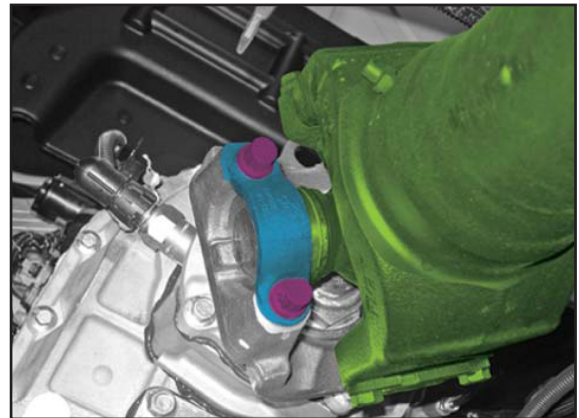
1. Cover
2. Rear seal

Rear Seal Removal

1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.

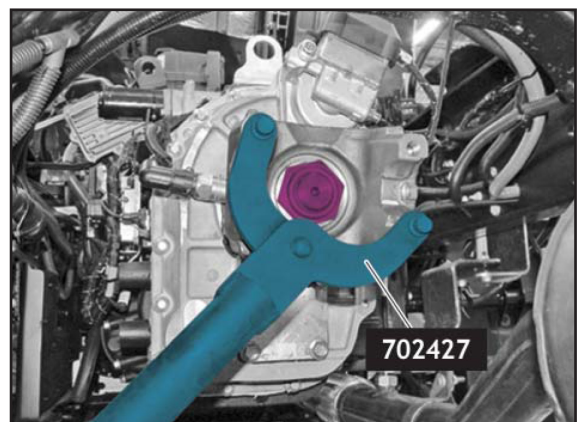
4. Remove the capscrews and clamps from the end of the longitudinal driveshaft (cardan shaft), connected to the transmission output flange.
5. Carefully slide the longitudinal driveshaft end out of the transmission output flange.

NOTE: Tie the longitudinal driveshaft in a position so that it will not hinder seal removal.



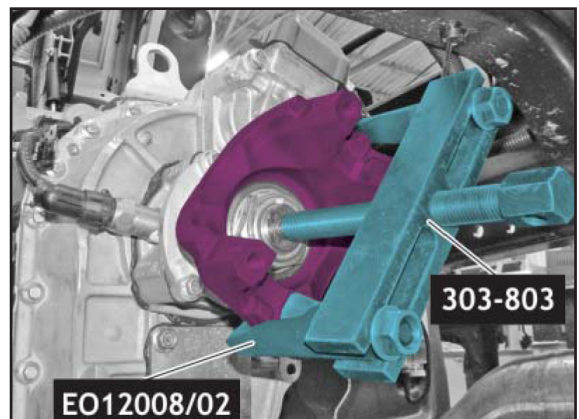
2940-064-1

6. Using special tool #702427, remove the transmission output flange securing nut.



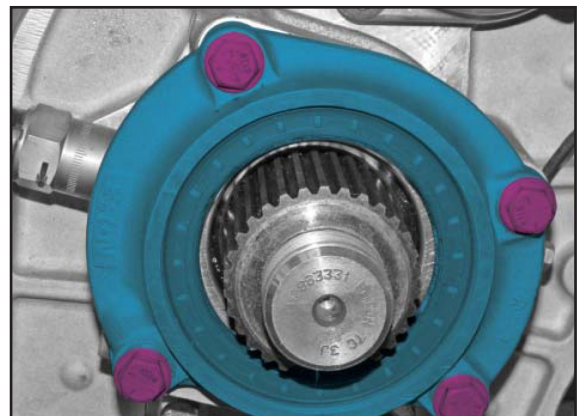
2940-064-2

7. Remove the output flange using puller #303-803 and claws #EO12008/02.



2940-064-3

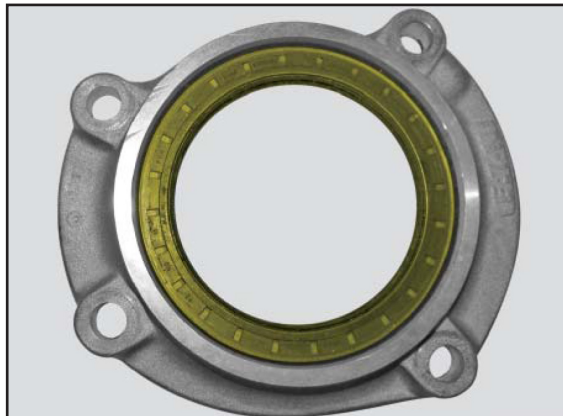
8. From the transmission case, remove retaining capscrews and the rear seal cover.



2940-065-1

9. From the rear seal cover, remove the rear seal using a pin punch.

NOTE: Remove dirt and oil from the transmission rear seal seat.



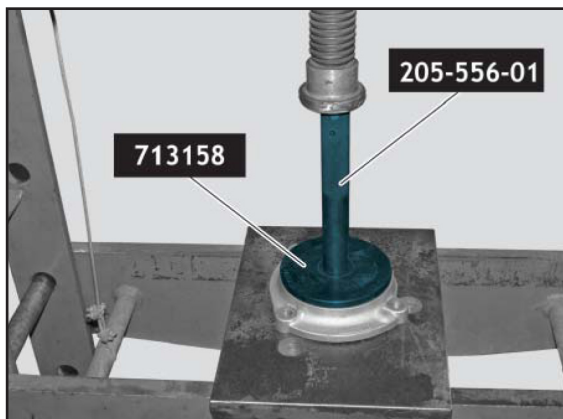
2940-065-2

Rear Seal Inspection

Replace the seal seat if there are signs of deformation or scratches on the seal seating surface.

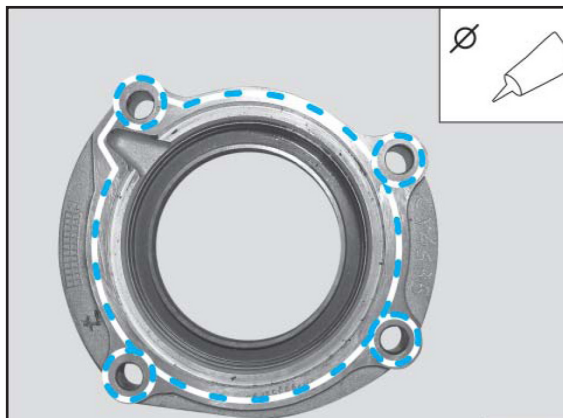
Installation

1. 1. Install the transmission rear seal using special tools #205-556-01 and #713158 and a press.



2940-065-3

2. Apply a bead of approximately 2 mm of Loctite 5900 sealant or similar to the cover sealing surface with the transmission case.

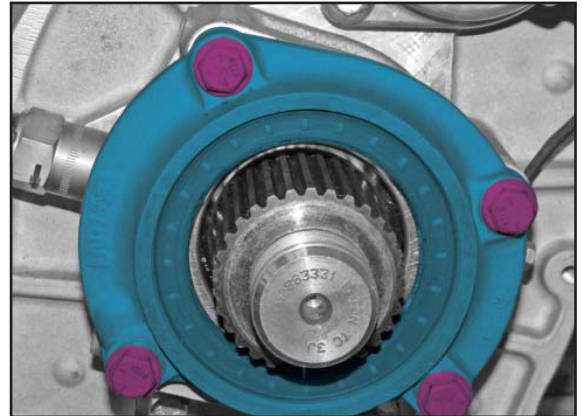


2940-066-1

In-Vehicle Service Procedures



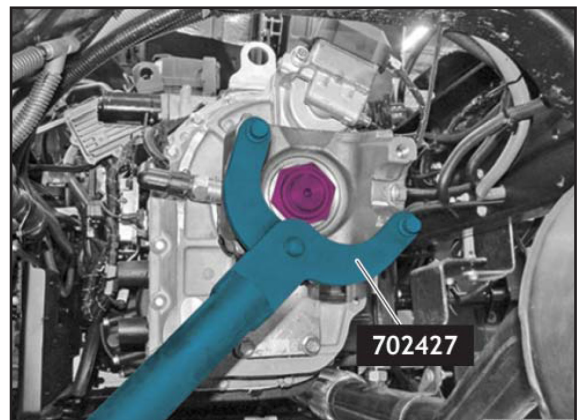
3. Install the rear seal cover onto the transmission case, tightening the retaining capscrews to a torque of 37 Nm.



2940-065-1

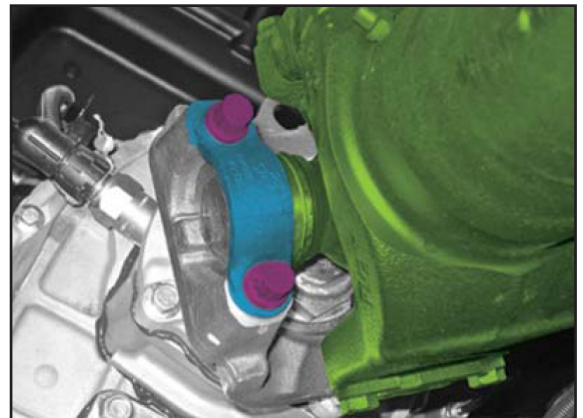
NOTE: Install a new nut.

4. Install the transmission output flange and, using special tool #702427, tighten its securing nut to a torque of 650 Nm.



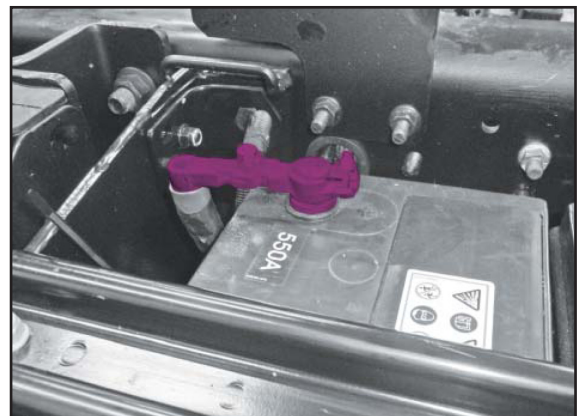
2940-064-2

5. Install the longitudinal driveshaft (cardan shaft) and tighten its retaining capscrews to a torque of 71 Nm.



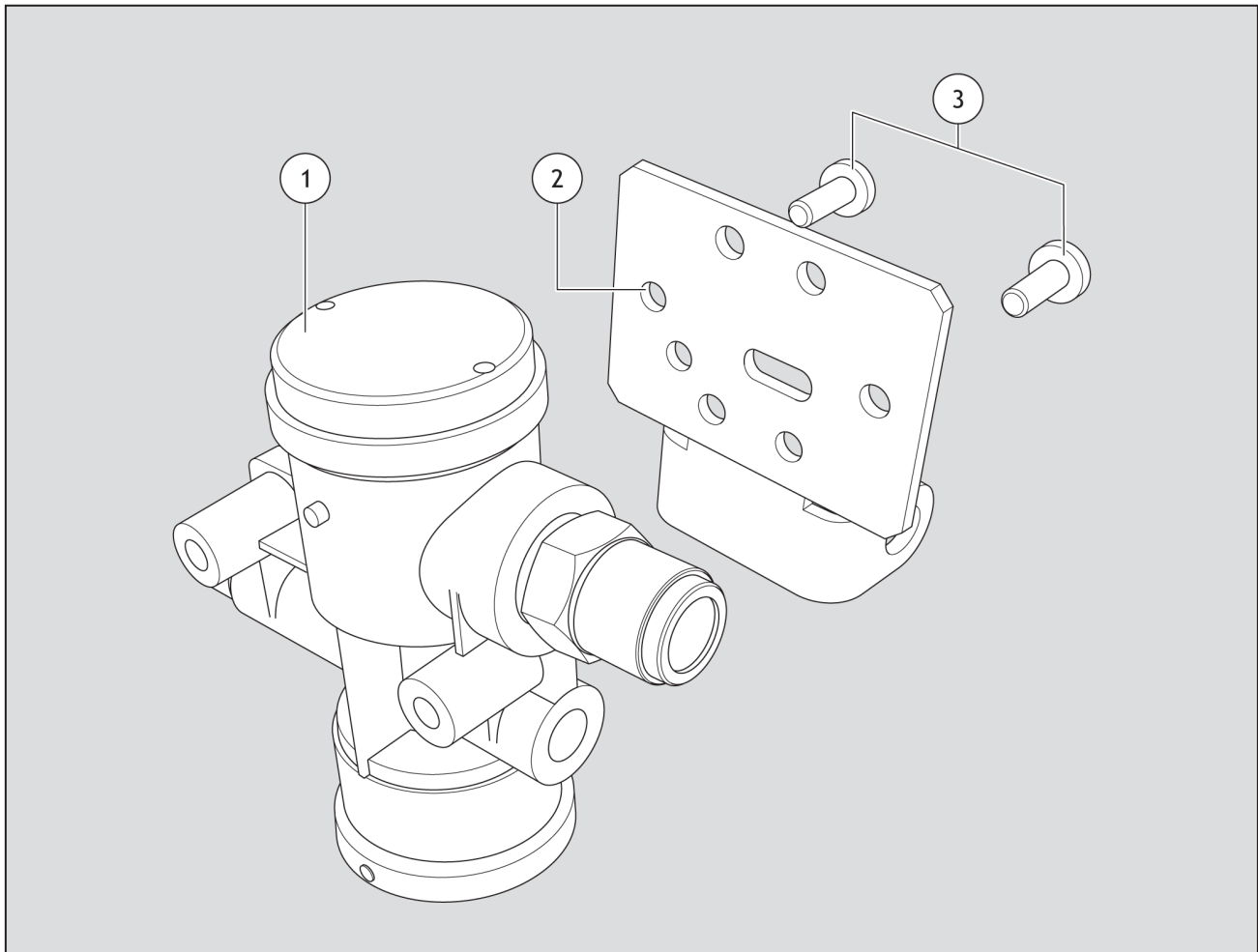
2940-064-1

6. Install the negative battery cable and tighten its nut to a torque of 8 Nm.
7. Conduct a road test.



2940-041-2

Pressure Reducing Valve



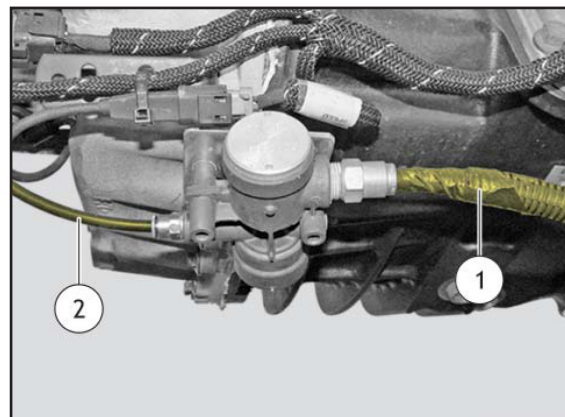
2940-068

1. Pressure reducing valve
2. Bracket securing the valve to the transmission
3. Capscrews securing the valve to the bracket

Removal

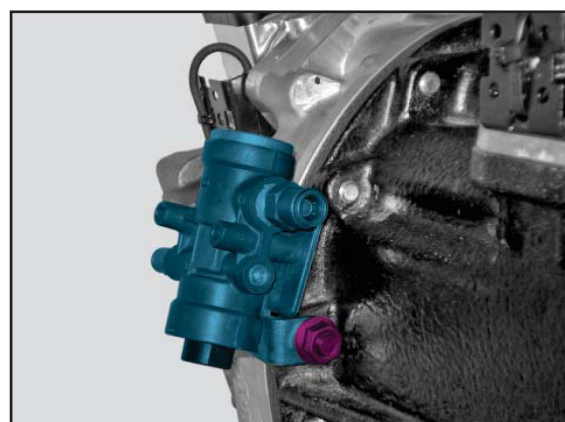
1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.
4. Relieve system air pressure by draining all air reservoirs on the vehicle.

5. Remove the air supply line from the pressure reducing valve (1)
6. Remove the air supply line from the pneumatic valve of the planetary reduction gear (2)



2940-069-1

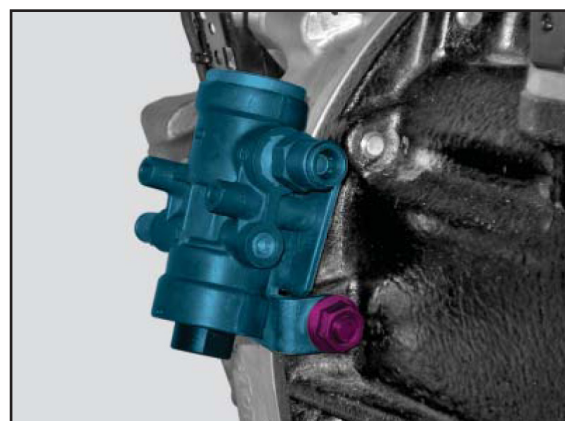
7. Remove the nut, retaining bolt and the pressure reducing valve from the transmission.



2940-069-2

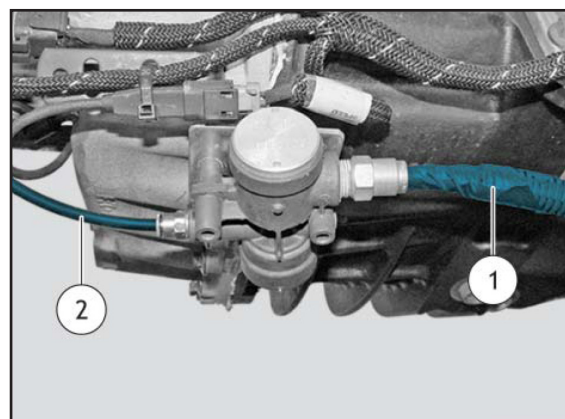
Installation

1. Place the pressure reducing valve on the transmission and install the retaining bolt and nut, applying a torque of 50 Nm.



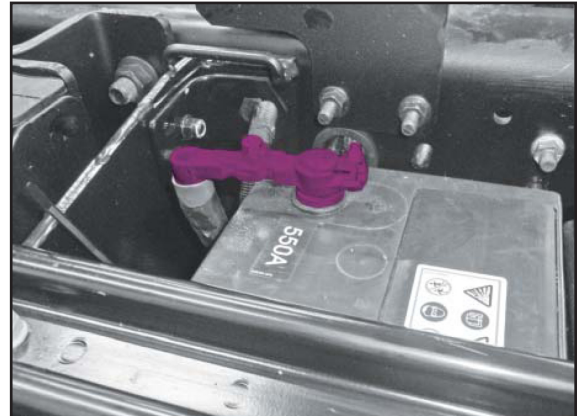
2940-069-2

2. Install the air supply line to the pressure reducing valve (1).
3. Install the air supply line to the pneumatic valve of the planetary reduction gear (2).



2940-070-2

4. Install the negative battery cable and tighten its nut to a torque of 8 Nm.



2940-041-2

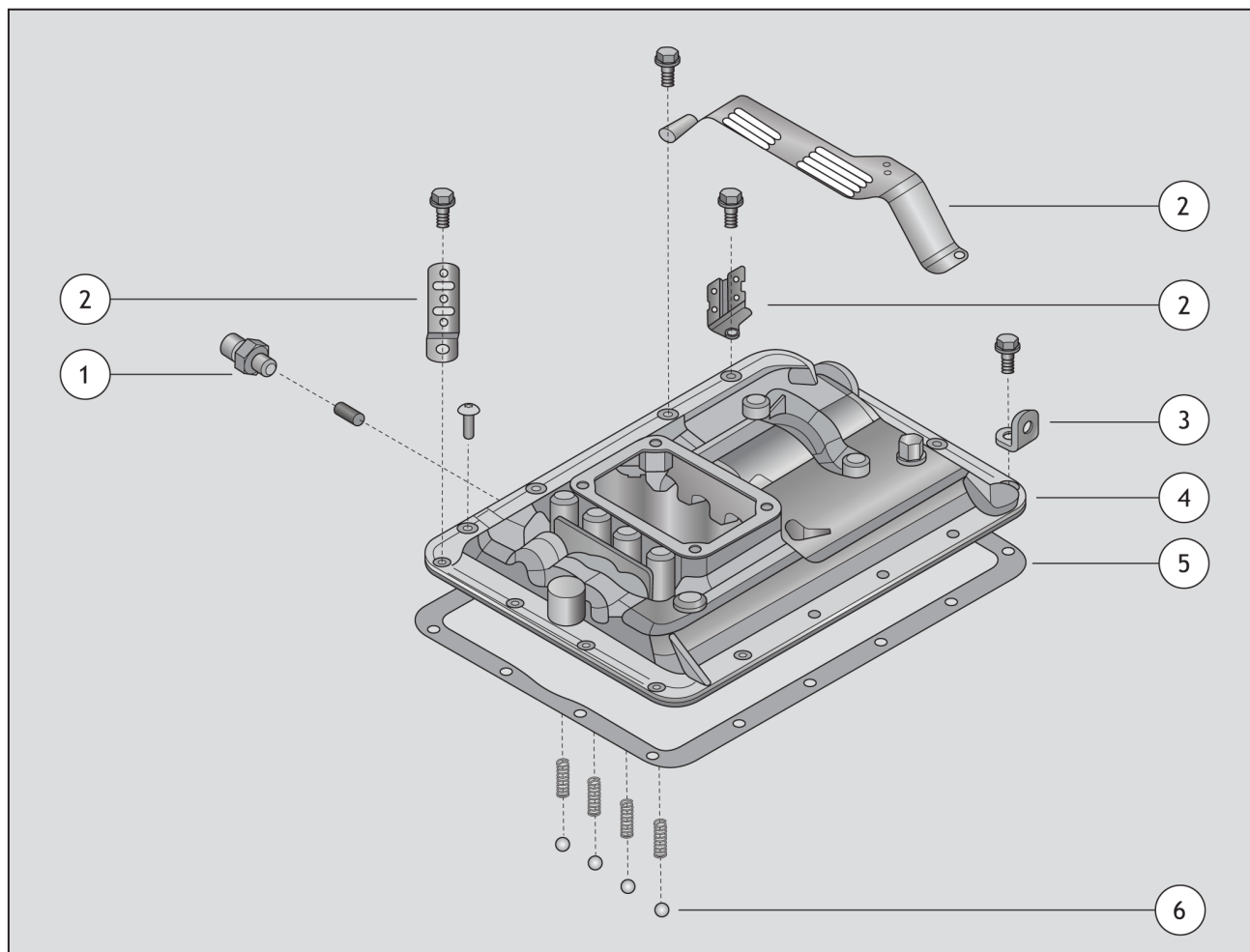
5. Close all air reservoir drains.



2940-071

6. Start the vehicle and recharge the air reservoirs.
7. Clear any fault codes from the transmission electronic memory using the EATON electronic service tool "ServiceRanger".
8. Remove the wheel chocks.
9. Conduct a road test and check the transmission operation.

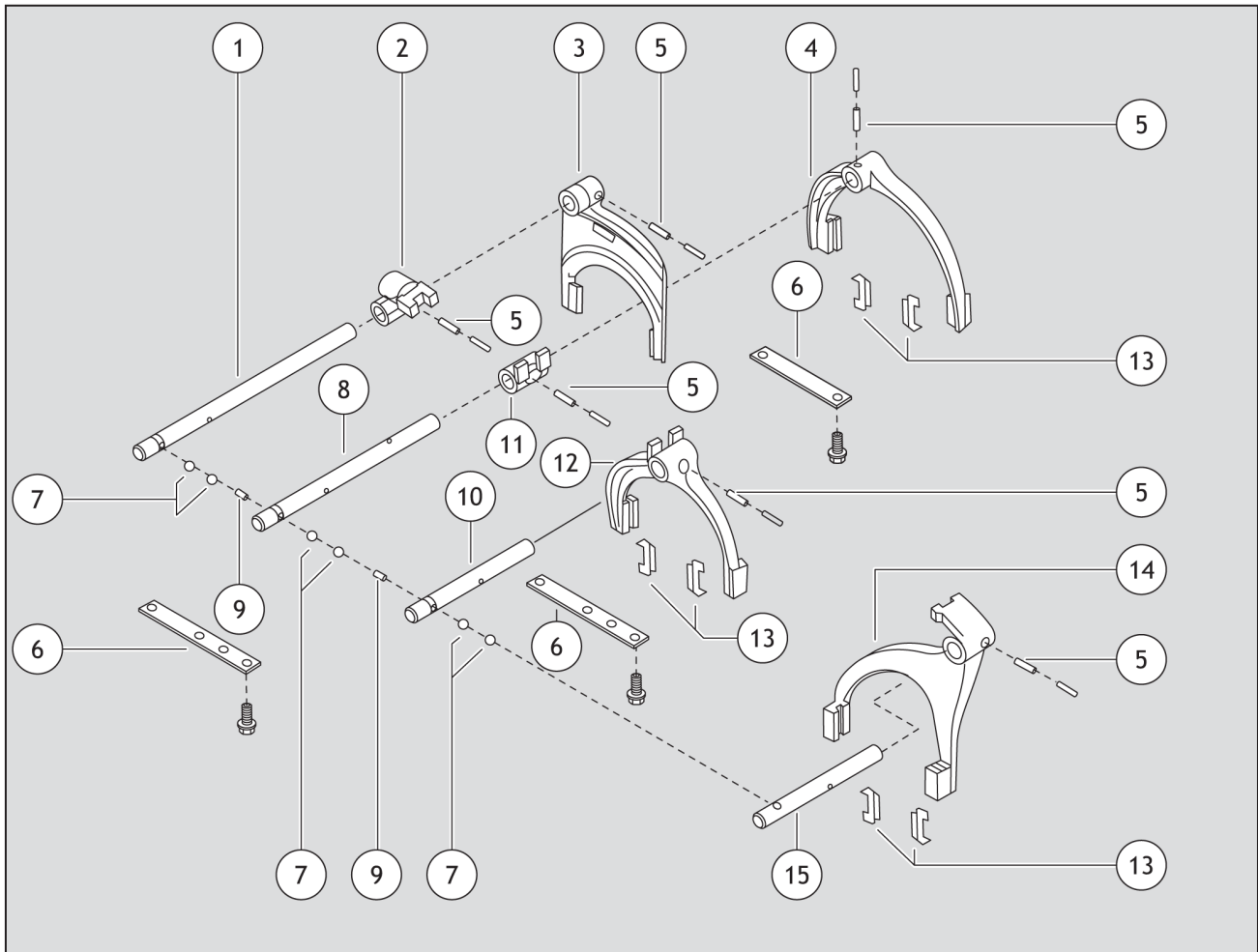
Shift Bar Housing Component Identification



2940-072

- | | |
|------------------------|---|
| 1. Neutral switch | 4. Shift bar housing |
| 2. Retaining bracket | 5. Gasket |
| 3. Lifting eye bracket | 6. Shift yoke bars detent balls and springs |

Gear Shift Component Identification

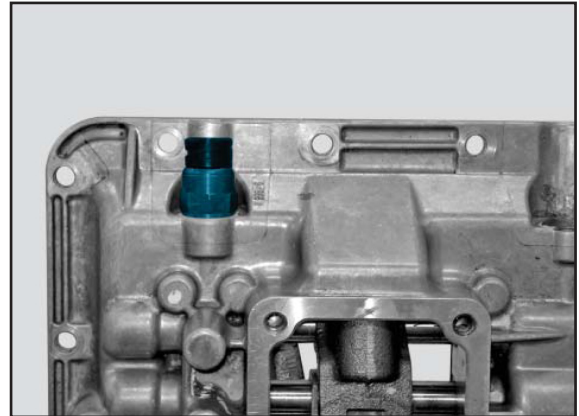


2940-073

- | | |
|----------------------------|------------------------------|
| 1. Reverse shift rail | 9. Interlocking pin |
| 2. Reverse shift block | 10. 3rd/4th gear shift rail |
| 3. Reverse shift yoke | 11. 1st/2nd gear shift block |
| 4. 1st/2nd gear shift yoke | 12. 3rd/4th gear shift yoke |
| 5. Roll pin | 13. Yoke pads |
| 6. Retaining plate | 14. 5th/6th gear shift yoke |
| 7. Interlocking balls | 15. 5th/6th gear shift rail |
| 8. 1st/2nd gear shift rail | |

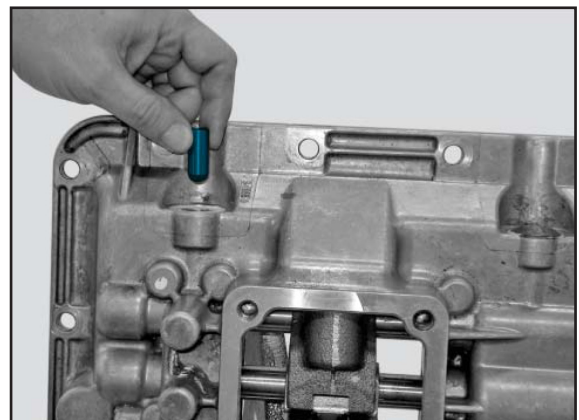
Disassembly

1. Remove the neutral switch.



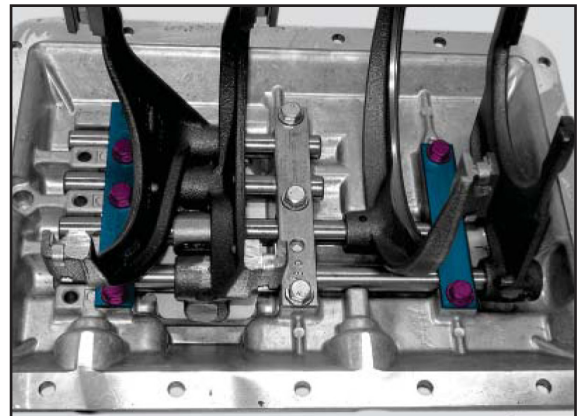
2940-074-1

2. Remove the neutral switch pin.



2940-074-2

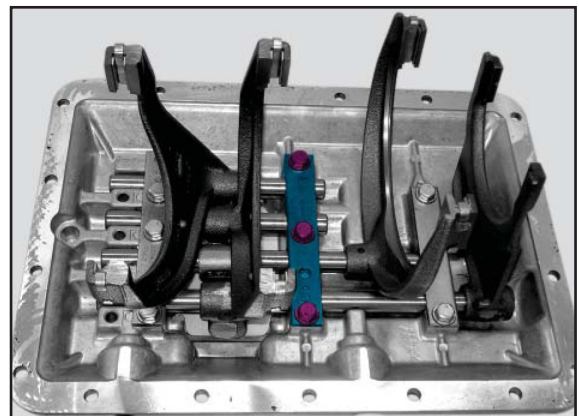
3. Remove the rail end retaining plates.



2940-074-3

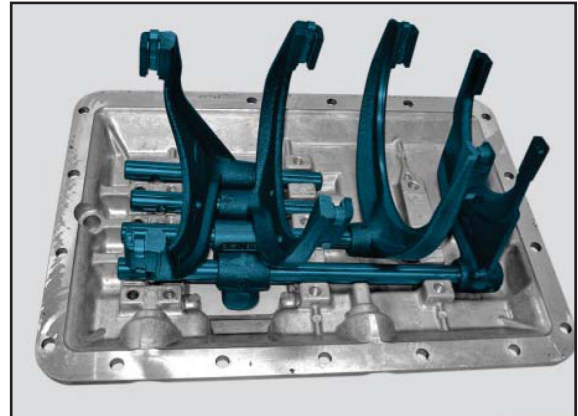
4. Remove the rail central retaining plate.

NOTE: Loosen the capscrews gradually because yoke bars (rails) are pressed by detent springs.



2940-075-1

5. Remove the shift yokes.



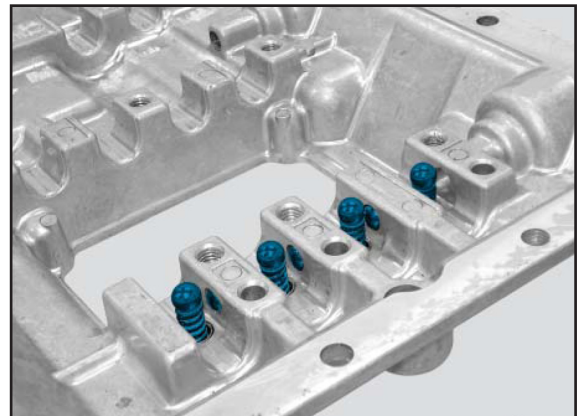
2940-075-2

CAUTION: Avoid dropping interlocking pins from the 1st, 2nd and 3rd gear shift yoke bars (rails).



2940-075-3

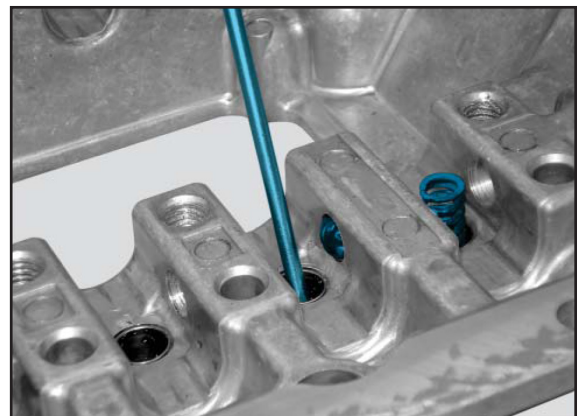
6. Remove rail detent balls and springs.



2940-076-1

7. Remove gear interlocking balls.

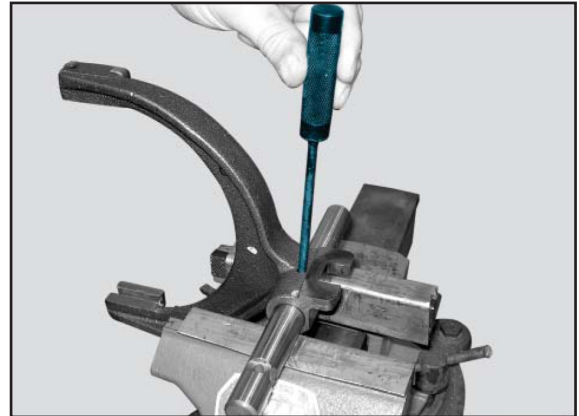
CAUTION: Insert a screwdriver into the detent ball and spring housing bore to prevent the interlocking balls from dropping into them.



2940-076-2

8. When necessary, remove the shift yokes from rails by first removing the retaining roll pins.

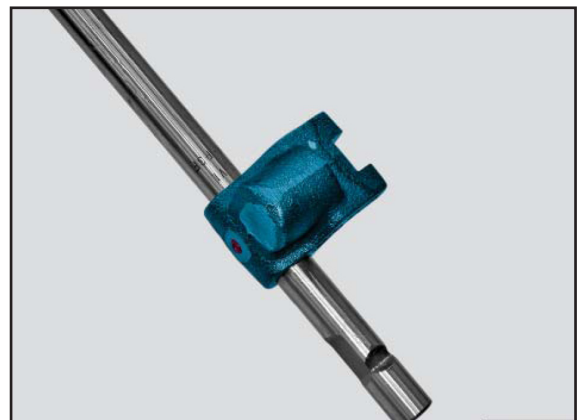
NOTE: Use a hammer and a pin punch with the appropriate diameter and observe the yoke position for subsequent assembly.



2940-076-3

9. When necessary, remove the reverse or 1st gear shift block by first removing the retaining roll pin.

NOTE: Use a hammer and a pin punch with the appropriate diameter and observe the block position for subsequent assembly.

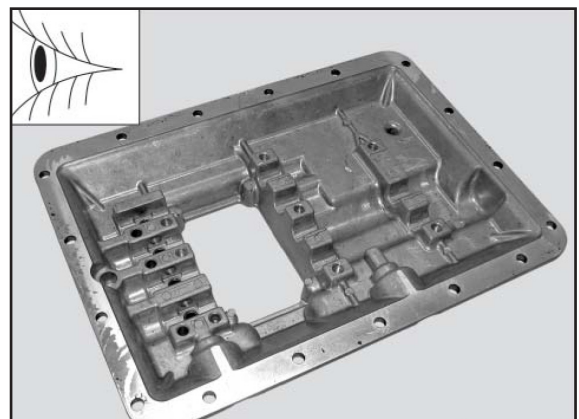


2940-077-1

Inspection

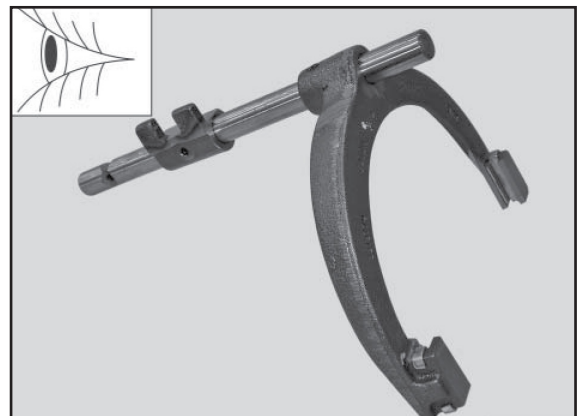
1. Replace the cover if there are scratches or deformations on the sealing surface in contact with the gasket, damaged threads or cracks.

NOTE: There is a second set of holes for repositioning the retained plate located next to the detent assembly. These holes do not have threads: if necessary, use the retaining capscrews to make new threads.



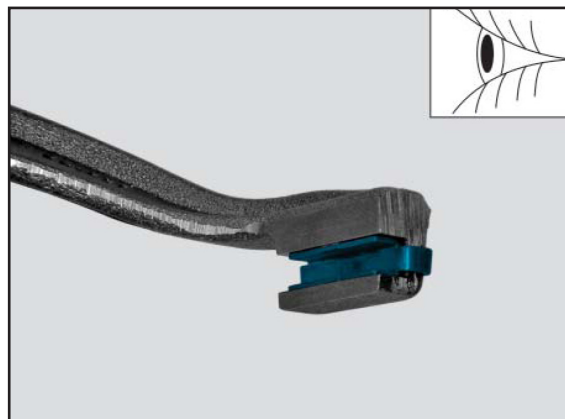
2940-077-2

2. Replace the shift yoke if it shows wear or damage on its contact surface with the gear selector lever or if it is cracked or broken.
3. Replace any shift yoke rail that is broken or presents wear on the detent sliding surface.



2940-077-3

- Shift yoke pads that show wear or overheating signs on the surface contact with the sliding clutches must be replaced.

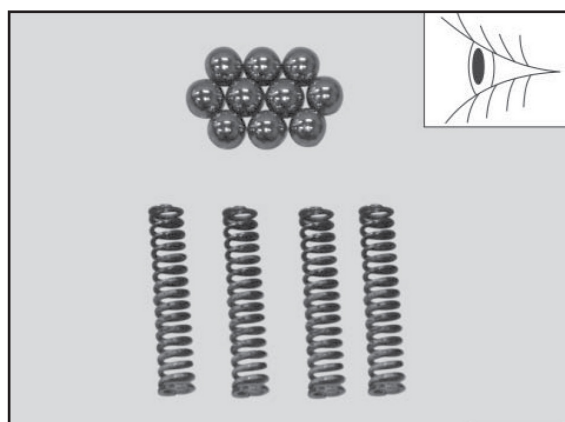


2940-078-1

- Replace any detent and interlocking balls that are worn or have a different diameter than the others.

NOTE: All 10 detent and interlocking balls have the same diameter.

- Replace any damaged detent springs.



2940-078-2

Assembly

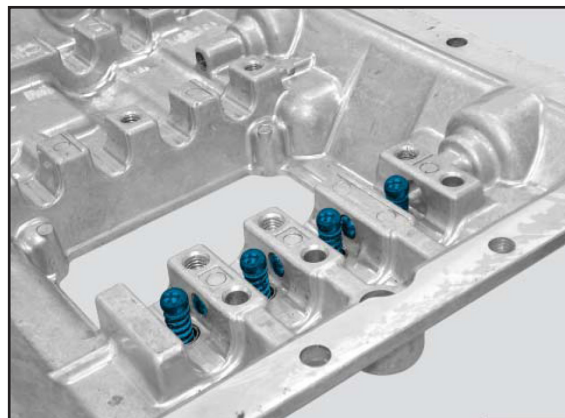
- Place the shift bar housing on a bench with the bottom facing up.
- Install the gear interlocking balls into their housing bores.

NOTE: Use a screwdriver inserted into the detent spring housing bore when installing the interlocking balls.



2940-078-3

- Install the detent springs and balls in their respective housing bores.

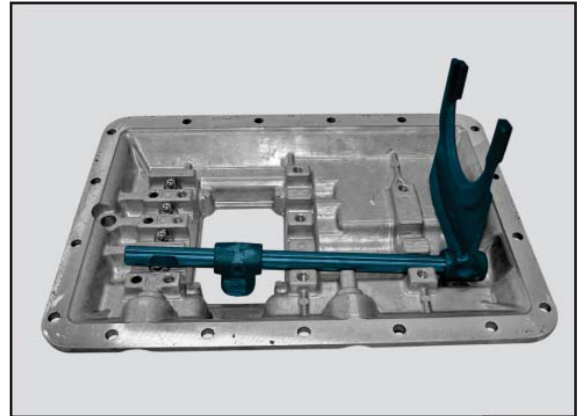


2940-079-1

Shift Bar Housing (Transmission Top Cover)



4. Install the reverse gear shift bar and yoke in its respective seat on the housing, initially securing the two bars in place with the retaining plate.

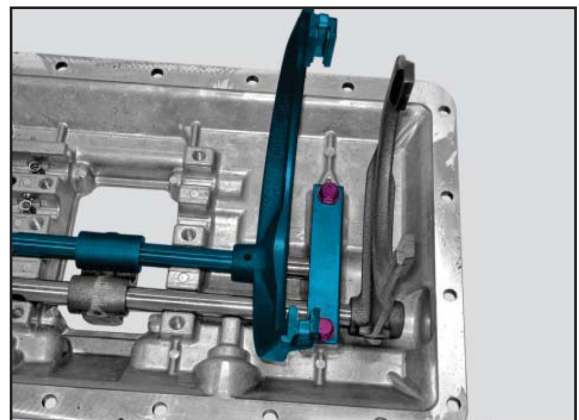


2940-079-2

5. Install the 1st speed gear shift bar and yoke in its respective seat on the housing.
6. Install the retaining plate and give it an initial tightening.

NOTE: Insert the interlocking pin into its hole in the 1st gear shift rail.

CAUTION: Make sure the detent and interlocking balls and the interlocking pin remain in their respective housings.



2940-079-3

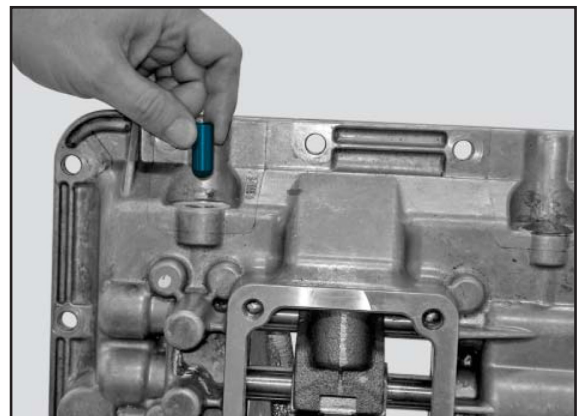
7. Install the 3rd/4th and 5th/6th gear shift bars and yokes in their respective seats on the housing.
8. Install the retaining plates and tighten retaining capscrews to a torque of 30 Nm.

CAUTION: Make sure the detent and interlocking balls and the interlocking pin remain in their respective housings.



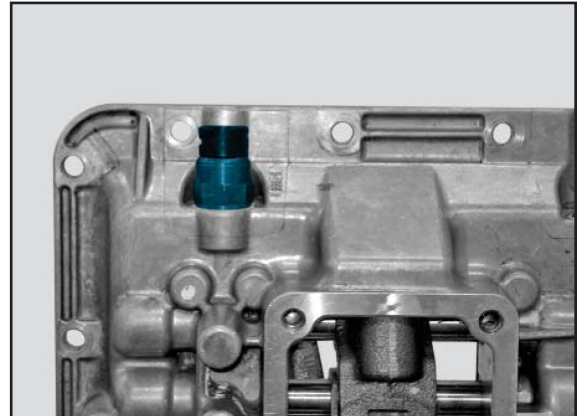
2940-080-1

9. Install the neutral switch pin into its housing bore on the shift bar housing.



2940-080-2

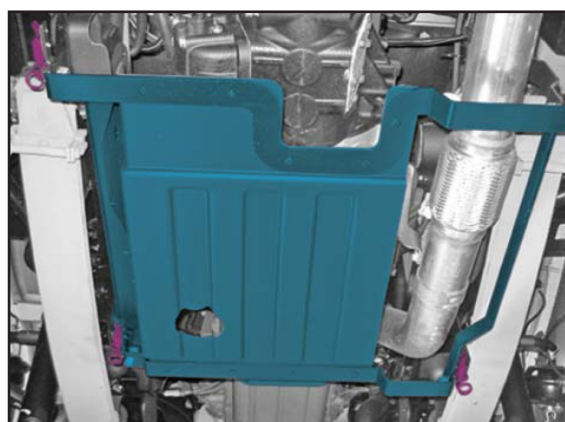
10. Install the neutral switch and tighten it to a torque of 24 Nm.



2940-080-3

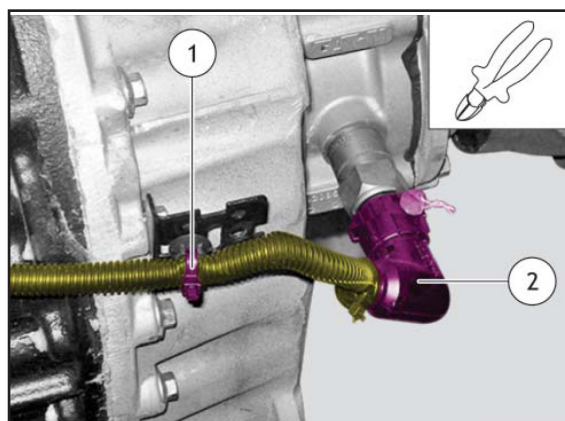
Removal (Rigid Truck)

1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.
4. Open the hood.
5. Tilt the cab.
6. Remove the spare tire.
7. Relieve system air pressure by draining all air reservoirs on the vehicle.
8. Unlock the retaining clips and remove the transmission guard.



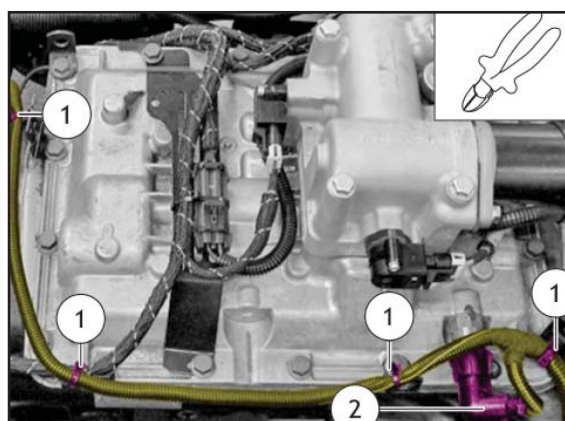
2940-082-1

9. Cut the nylon cable tie securing the wiring harness to the retaining pin (1).
10. Remove the seal and electrical connector from the speed sensor, moving the wiring harness away from its mounting place (2).



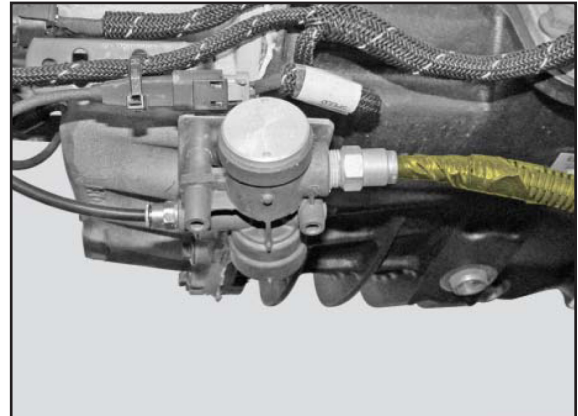
2940-082-2

11. Cut the nylon cable ties securing the wiring harness to the brackets and retaining pins (1).
12. Remove the electrical connector from the reverse sensor (2).



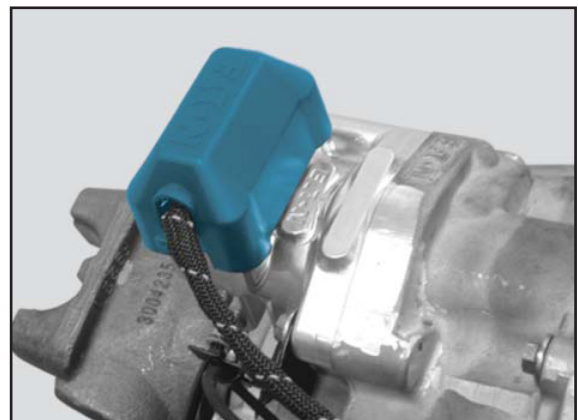
2940-083-1

13. Remove the air supply line from the pressure reducing valve.



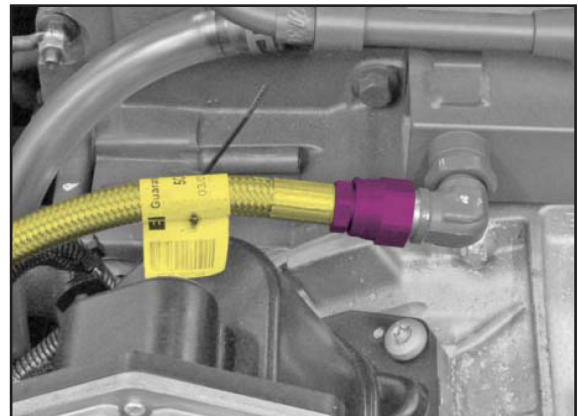
2940-083-2

14. Remove the pneumatic valve electrical connector protective cover.



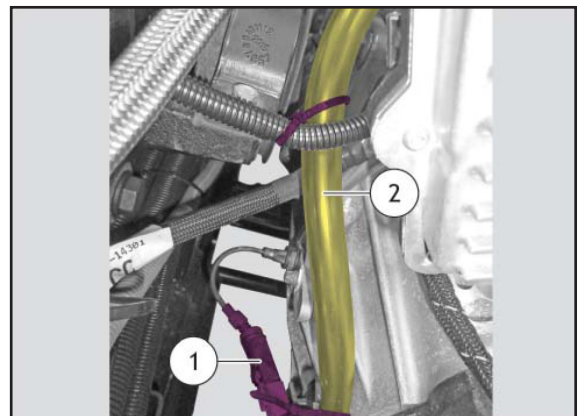
2940-083-3

15. Remove the flexible pipe from the muffler and move it away from its mounting place.



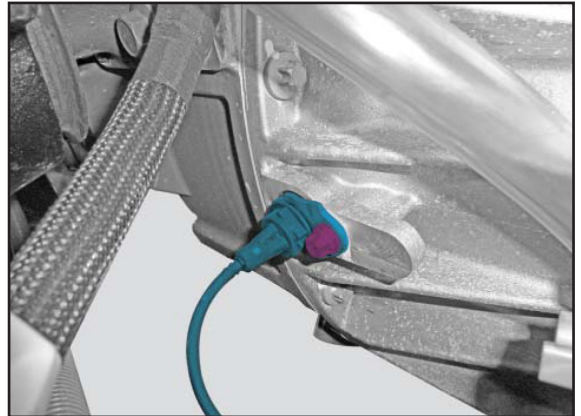
2940-084-1

16. Remove the engine speed sensor connector on the clutch housing (1).
17. Remove the retaining nylon cable ties and move the engine gas breather hose (blow-by line) away from its mounting place (2).



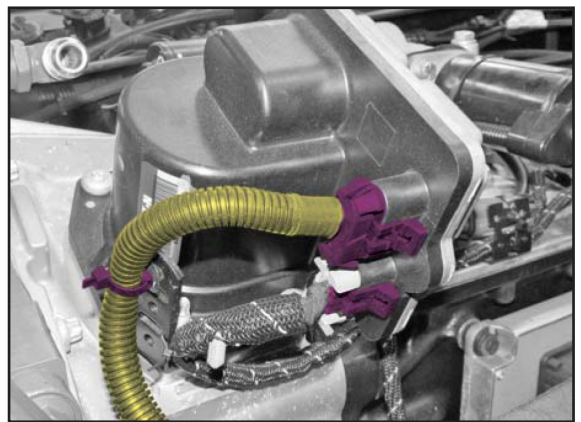
2940-084-2

18. Remove the retaining capscrew and remove the engine speed sensor on the clutch housing.



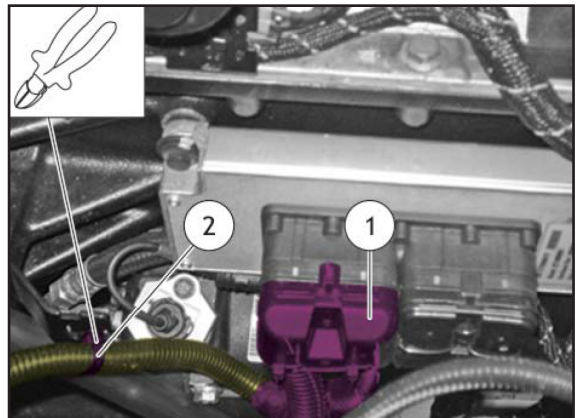
2940-084-3

19. Remove the electrical connectors and move the electronic clutch actuator (ECA) wiring harness away from its mounting place.



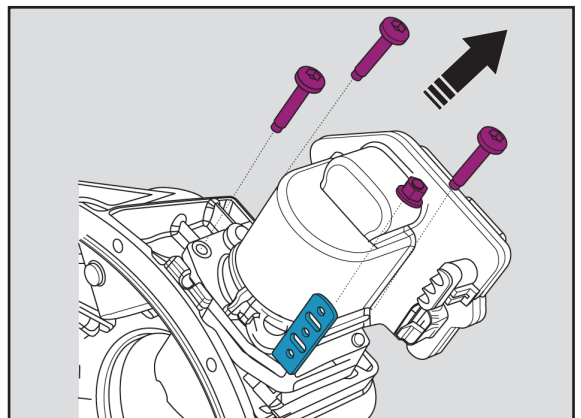
2940-085-1

20. Remove the TCU wiring harness connector (1).
21. Cut the nylon cable tie securing the wiring harness to the retaining pin (2).



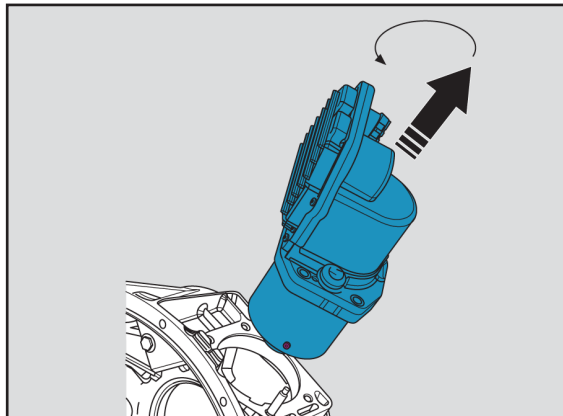
2940-085-2

22. Remove the nut and bolts securing the electronic clutch actuator (ECA) to the clutch housing.



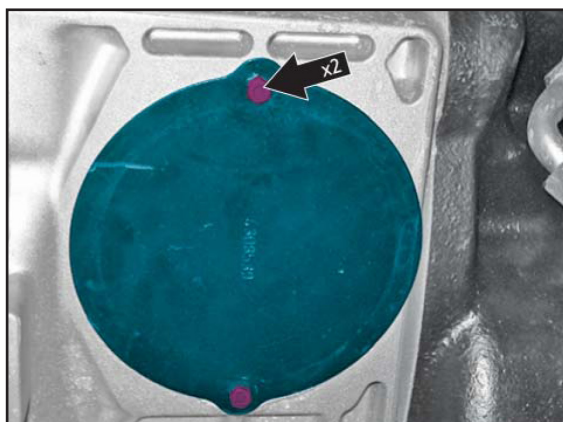
2940-085-3

23. Remove the ECA by pulling it and rotating it counterclockwise until the alignment (dowel) pin fits into the housing slot.



2940-061-1

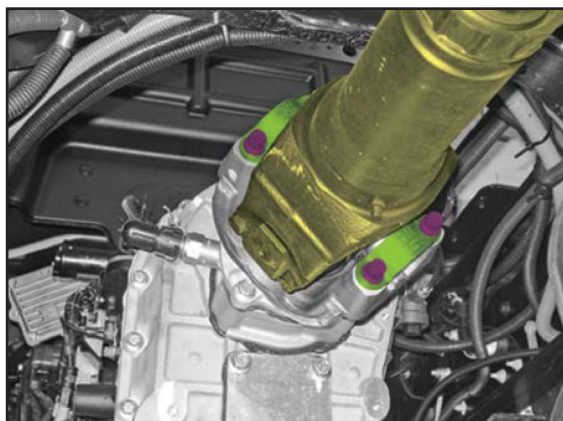
24. Remove the inspection window cover to check transmission alignment during removal.



2940-086-2

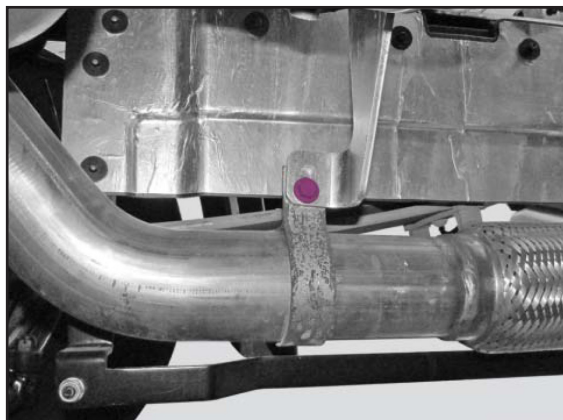
25. Remove bolts and clamps securing the longitudinal driveshaft to the transmission output yoke. Move the driveshaft away from the output yoke so that it will not hinder the transmission removal.

CAUTION: Mark the driveshaft position for later install, avoiding unbalancing the assembly.



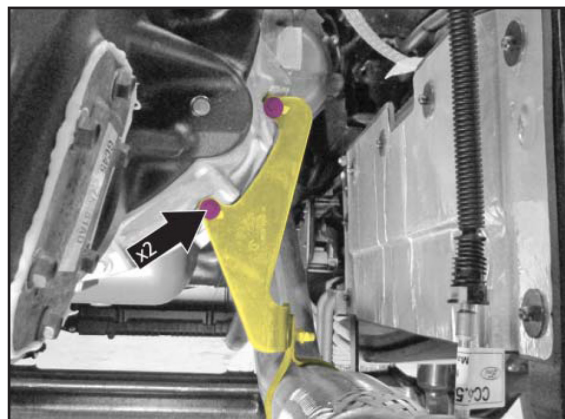
2940-086-3

26. Remove the primary exhaust pipe clamp retaining nut from its bracket on the transmission.



2940-087-1

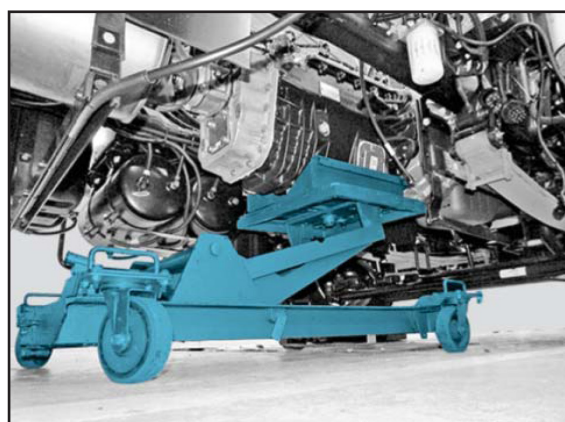
27. Remove the retaining capscrews and remove the primary exhaust pipe bracket from the transmission.



2940-087-2

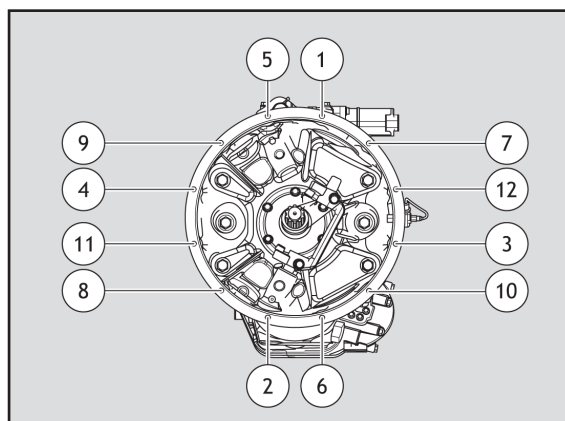
28. Place the #EE30100 hydraulic trolley jack with the #EE30101 saddle under the transmission.

CAUTION: Place a wooden wedge on the saddle to level the transmission, carefully positioning it to prevent the inertia brake from being forced.



2940-087-3

29. Remove the capscrews securing the transmission to the engine, following the indicated sequence.

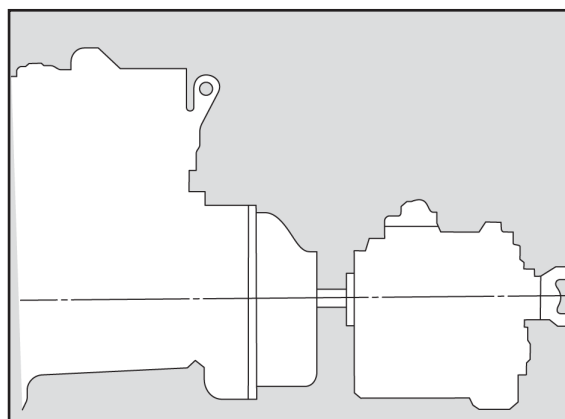


2940-088-1

30. Move the trolley jack back and away from the engine to remove the transmission.

CAUTION: Make sure the transmission is aligned with the engine, so as not to cause damage to the clutch system during removal.

NOTE: After removing the transmission, lift the rear of the vehicle to facilitate its removal.



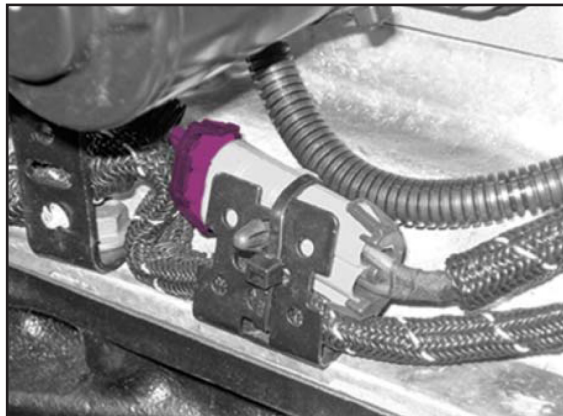
2940-088-2

Installation (Rigid Truck)

NOTE: Lubricate the clutch bearings with the specified grease.

NOTE: Lubricate the input shaft splines with the specified grease.

1. Remove the shift motor connector on the remote shift control.

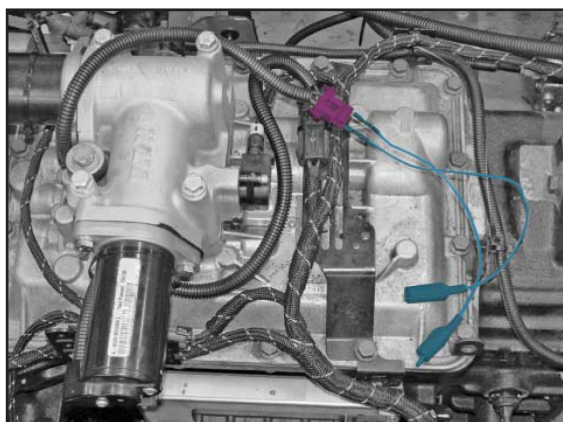


2940-089-1

2. Install a wiring harness to the shift motor connector.
3. Quickly connect the harness wires to the positive (+) and negative (-) poles of a 12 Volt battery, so that a gear can be shifted.

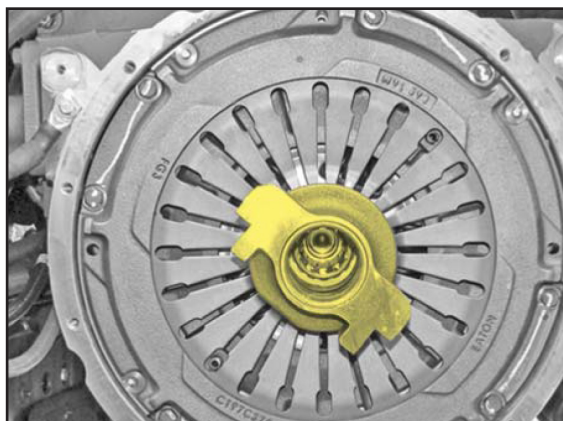
NOTE: With the help of an assistant, rotate the output yoke to make it easier to shift into a gear.

NOTE: If you cannot shift into a gear, reverse the harness wires to the battery poles.



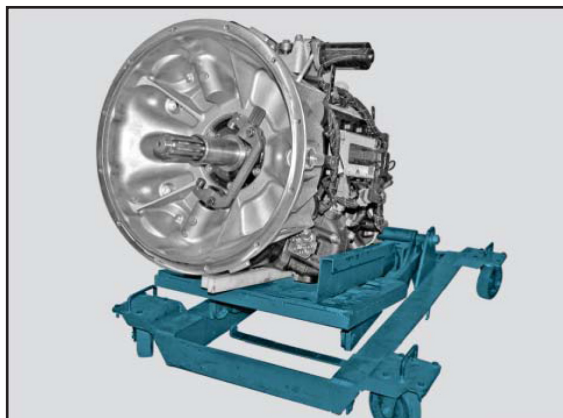
2940-089-2

4. Place the clutch release bearing to facilitate shifting with the yoke.



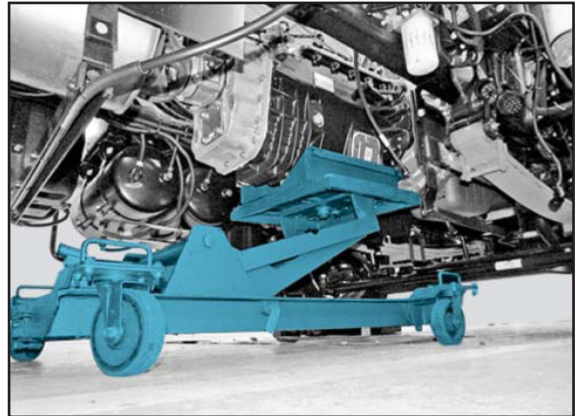
2940-090-1

5. Correctly position the transmission on the trolley jack.



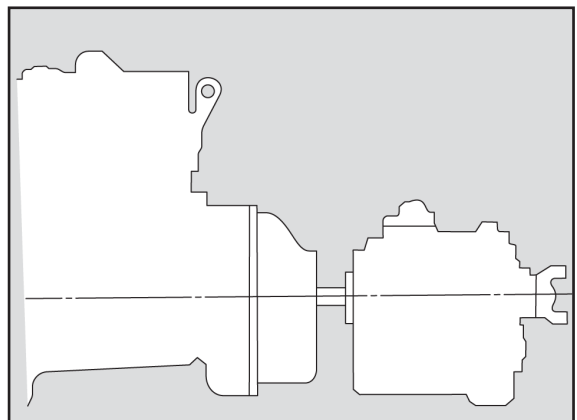
2940-090-2

6. Place the trolley jack with the transmission under the vehicle.



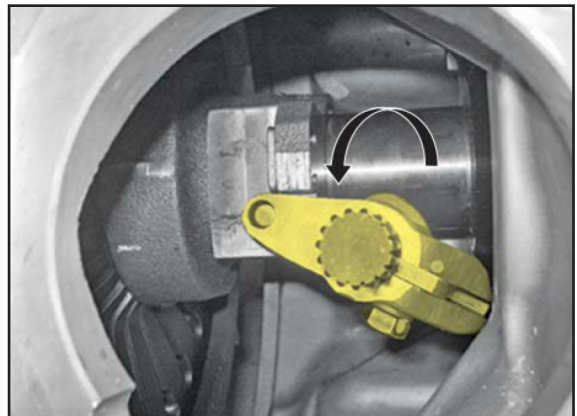
2940-087-3

CAUTION: Make sure the transmission is aligned with the engine, so as not to cause damage to the clutch system during installation.



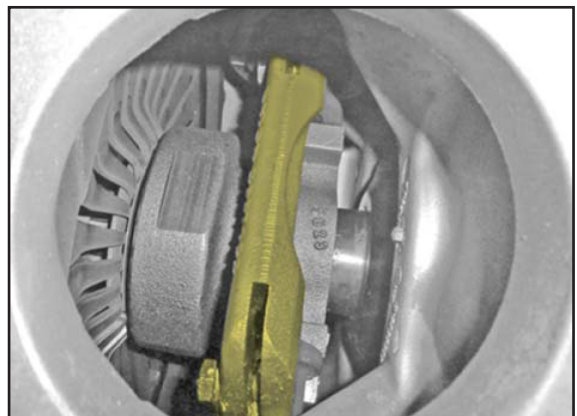
2940-088-2

7. Rotate the output yoke, fitting the input shaft splines on the clutch disc.
8. Push the trolley jack and, through the electronic clutch actuator (ECA) housing bore, rotate the cross-shaft counterclockwise, centering it in the release bearing with the help of an assistant.



2940-091-2

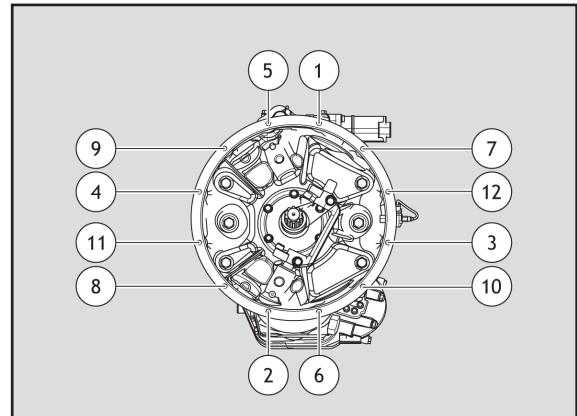
9. Check the alignment between the clutch release yoke and the release bearing through the lower inspection window.



2940-091-3

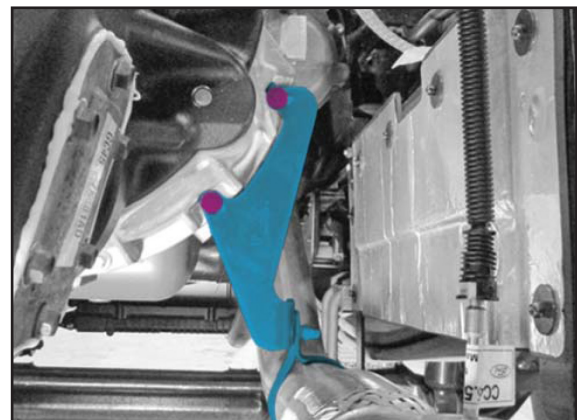
10. Following the indicated sequence, install the transmission retaining capscrews to the engine, applying a torque of 48 Nm.

NOTE: Do not install capscrews 8 and 11.



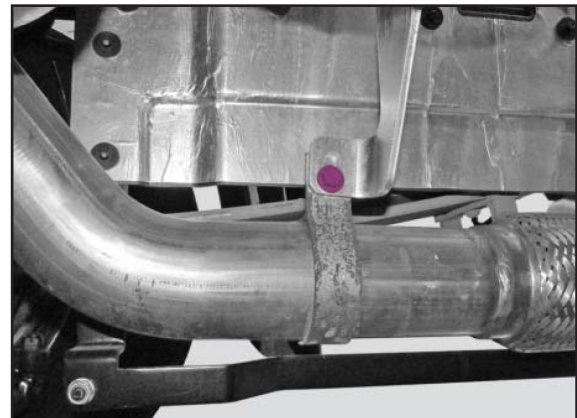
2940-092-1

11. Remove the trolley jack.
12. Place on the transmission the primary exhaust pipe bracket and install the retaining capscrews, applying a torque of 48 Nm.



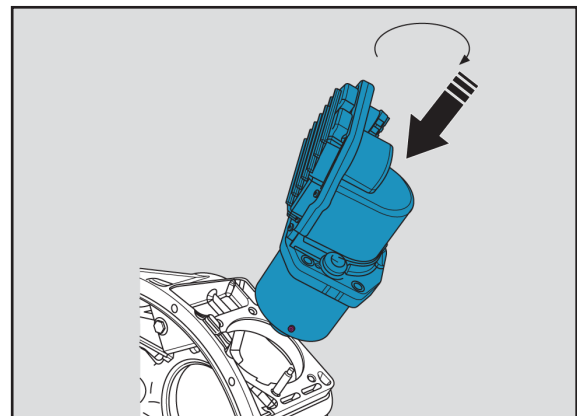
2940-092-2

13. Install the primary exhaust pipe clamp on its bracket on the transmission case and tighten the retaining nut to a torque of 48 Nm.



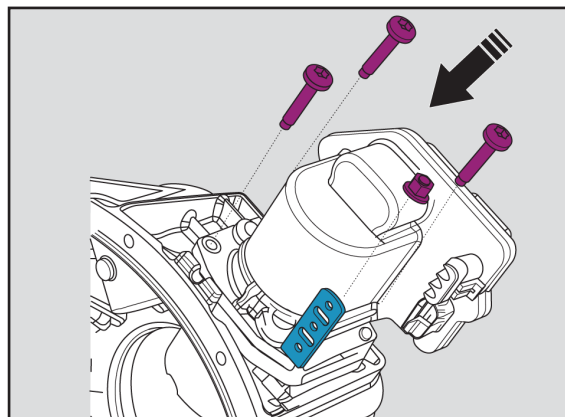
2940-092-3

14. Install the electronic clutch actuator (ECA) by matching the dowel pin on its external diameter with the slot in the clutch housing. Rotate the actuator clockwise until reaching the end of travel.



2940-093-1

15. Install the ECA retaining bolts, the bracket and the nut and tighten them to a torque of 40 Nm.

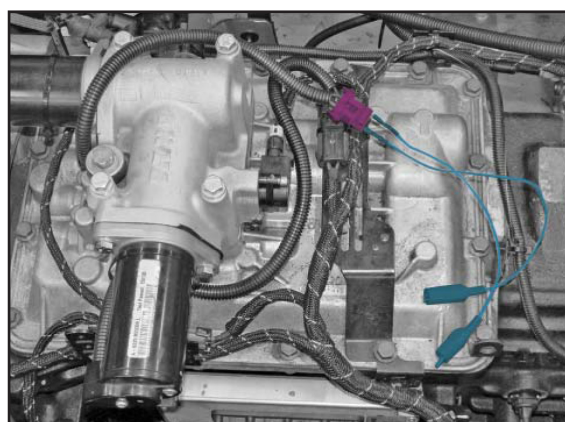


2940-093-2

16. Quickly connect the harness wires, installed on the gear shift motor connector on the remote shift control, to the positive (+) and negative (-) poles of a 12 Volt battery, so that the gear can be disengaged.

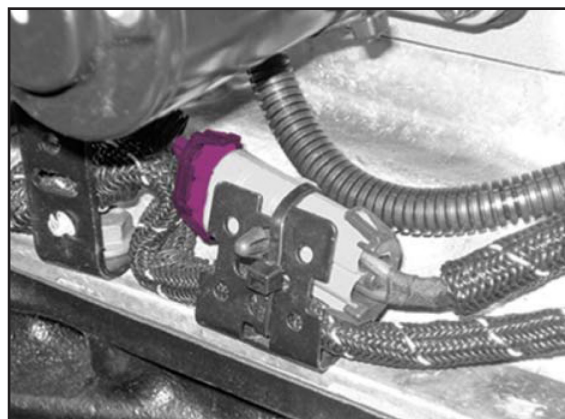
NOTE: With the help of an assistant, rotate the output yoke to make it easier to disengage the gear.

NOTE: If you cannot shift gears, reverse the harness wires to the battery poles.



2940-093-3

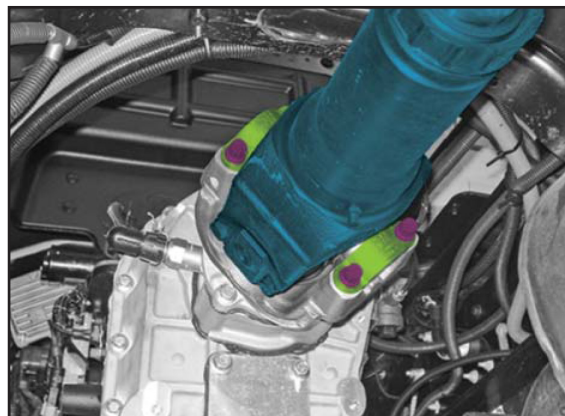
17. Remove the harness wires and install the gear shift motor connector on the remote shift control.



2940-094-1

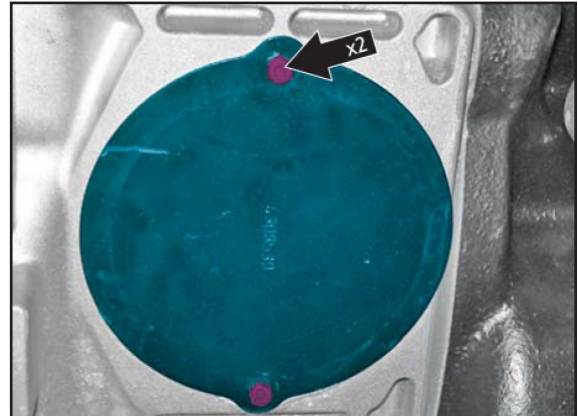
18. Install the longitudinal driveshaft on the output yoke tightening the retaining capscrews to a torque of 125 Nm.

CAUTION: Use the reference mark made during removal to avoid unbalancing the assembly.



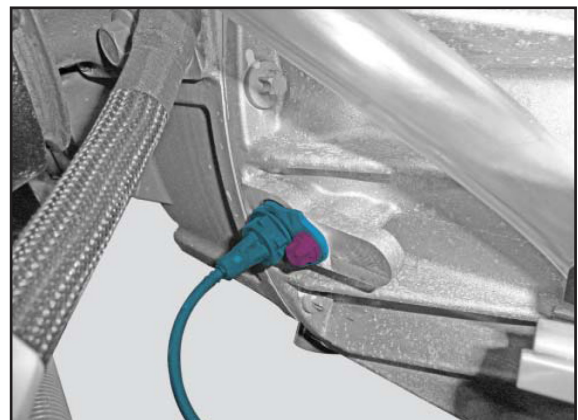
2940-094-2

19. Install the inspection window cover and tighten its retaining capscrews to a torque of 3.5 Nm.

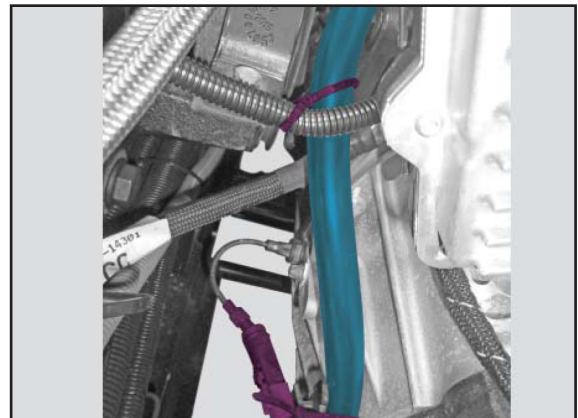


2940-086-2

20. Position the engine speed sensor on the clutch housing and install its retaining capscrew, applying a torque of 29 Nm.



2940-084-3



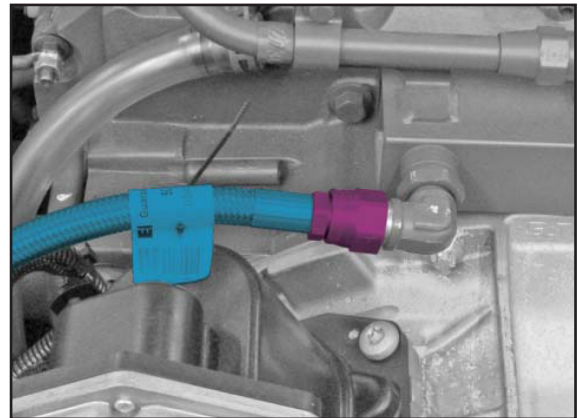
2940-095-2

21. Install the electronic clutch actuator (ECA) electrical connectors.



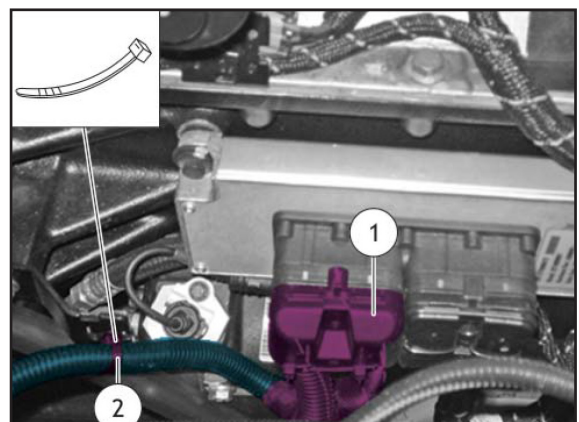
2940-095-3

22. Connect the flexible pipe to the muffler and apply a torque of 50 Nm.



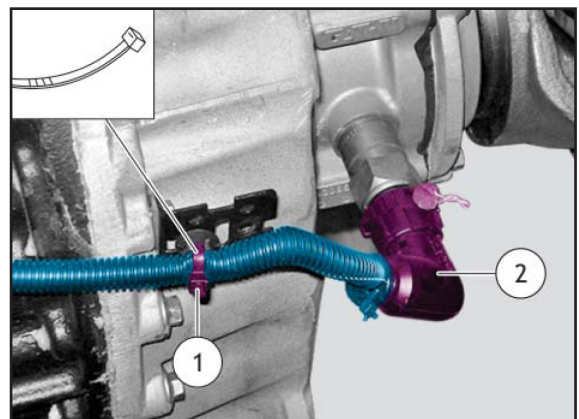
2940-096-1

23. Install the wiring harness connector onto the transmission electronic control unit (TCU) (1).
24. Install the wiring harness nylon cable tie on the retaining pin (2).



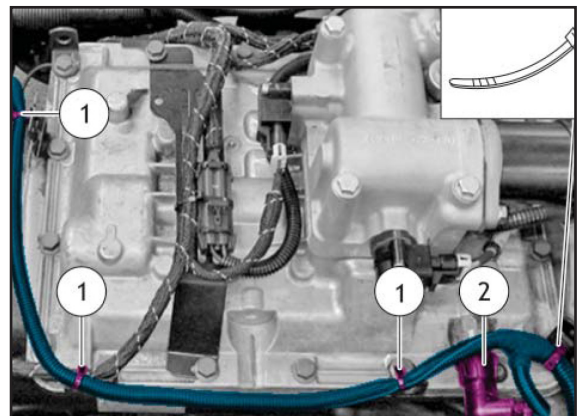
2940-096-2

25. Position the wiring harness and install the nylon cable tie on the retaining pin (1).
26. Install the speed sensor electrical connector and the new seal (2).



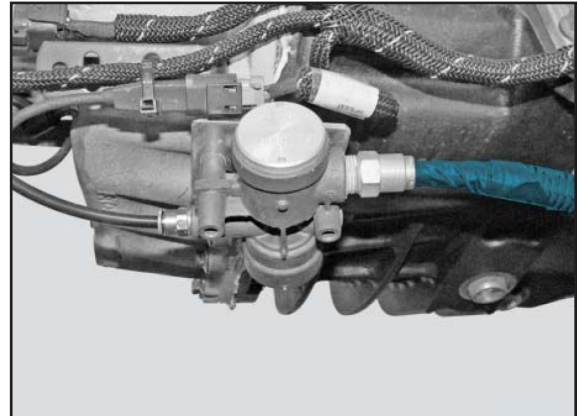
2940-096-3

27. Position the vehicle's wiring harness on the transmission top cover and install the nylon cable ties on the brackets and retaining pins (1).
28. Install the reverse sensor electrical connector (2).



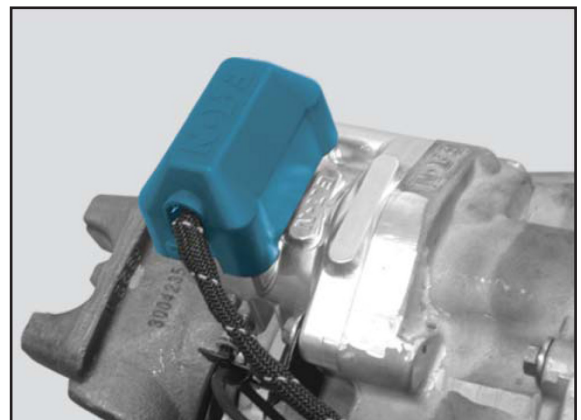
2940-097-1

29. Connect the pressure reducing valve air supply line.



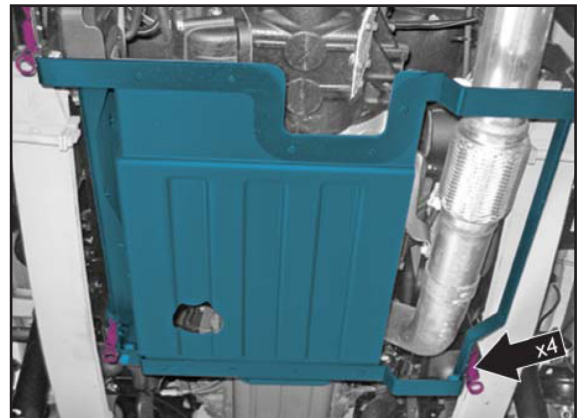
2940-097-2

30. Install the pneumatic valve electrical connector protective cover.



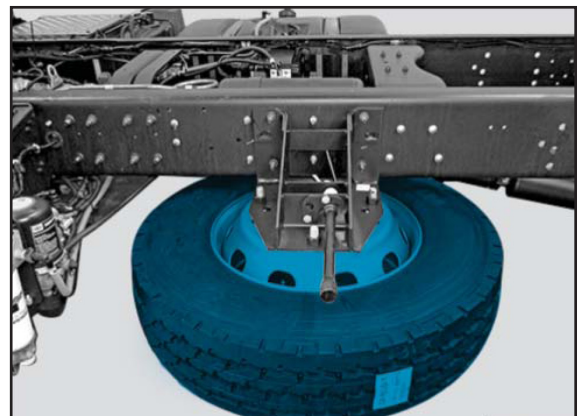
2940-083-3

31. Install the transmission guard and secure it with the retaining clips.



2940-098-1

32. Install the spare tire.

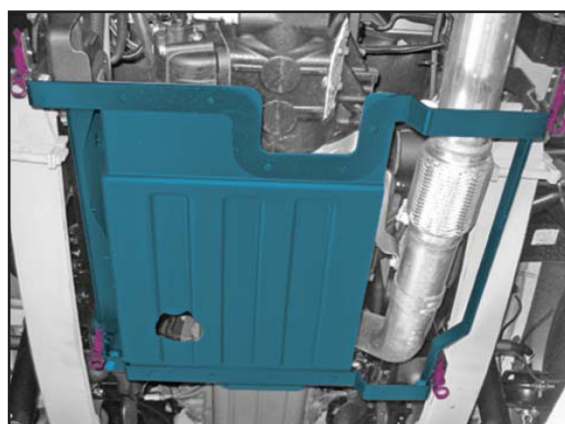


2940-098-2

33. Lower the cab.
34. Close all air reservoir drains.
35. Close the hood.
36. Install the negative battery cable and tighten the nut to a torque of 8 Nm.
37. Start the vehicle and recharge the air reservoirs.
38. Remove the wheel chocks.
39. Conduct a road test and check the transmission operation.

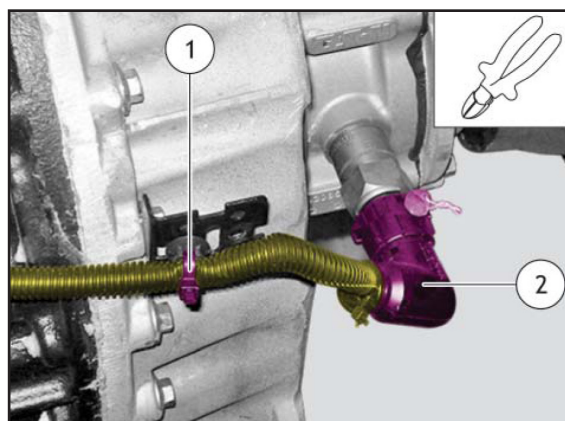
Removal (Semi-Truck)

1. Park the vehicle on a flat and firm surface.
2. Chock the wheels.
3. Remove the negative battery cable.
4. Tilt the cab.
5. Remove the retaining nut and remove the spare tire from the deck plate by using a shop crane or hoist.
6. Remove the bracket for the electrical and pneumatic connectors from the semi-trailer and position it so as not to interfere with the removal of the deck plate.
7. Remove the deck plate.
8. Relieve system air pressure by draining all air reservoirs on the vehicle.
9. Unlock the retaining clips and remove the transmission guard.



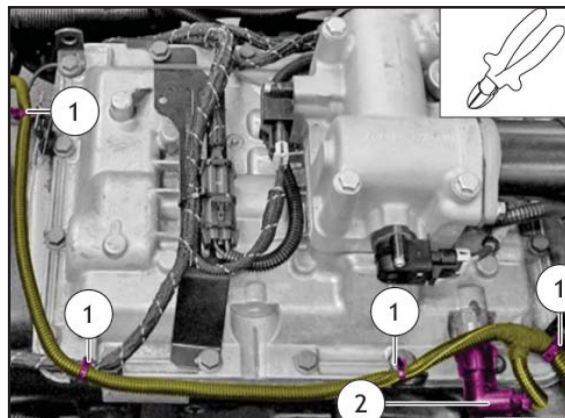
2940-054-1

10. Cut the nylon cable tie securing the wiring harness to the retaining pin (1).
11. Remove the seal and electrical connector from the speed sensor, moving the wiring harness away from its mounting place (2).



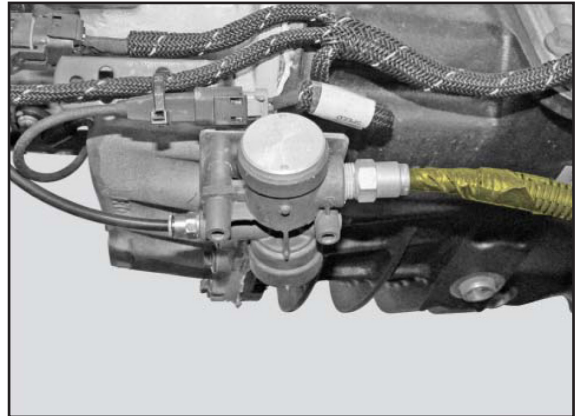
2940-099-2

12. Cut the nylon cable ties securing the wiring harness to the brackets and retaining pins (1).
13. Remove the electrical connector from the reverse sensor (2).



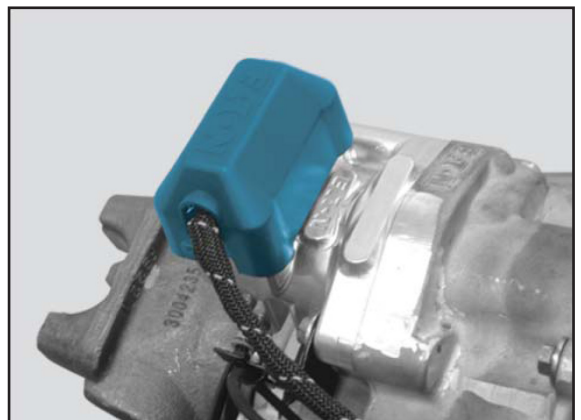
2940-100-1

14. Remove the air supply line from the pressure reducing valve.



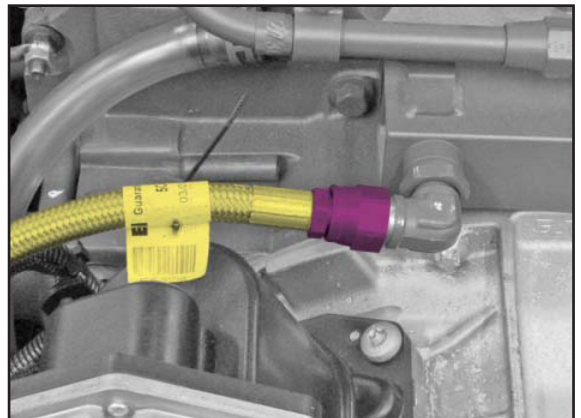
2940-100-2

15. Remove the pneumatic valve electrical connector protective cover.



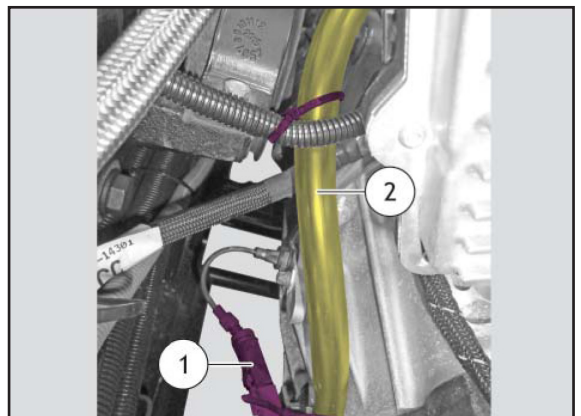
2940-083-3

16. Remove the flexible pipe from the muffler and move it away from its mounting place.



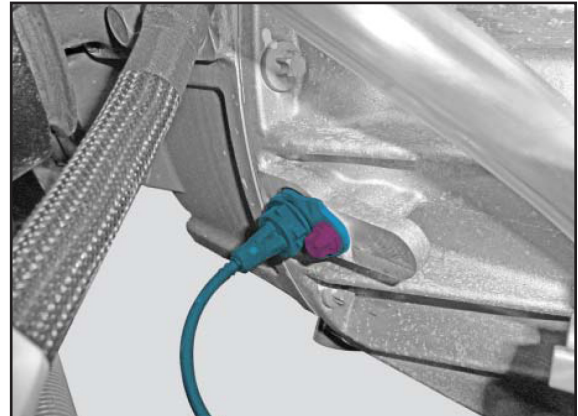
2940-084-1

17. Remove the engine speed sensor connector on the clutch housing (1).
18. Remove the retaining nylon cable ties and move the engine gas breather hose (blow-by line) away from its mounting place (2).



2940-101-2

19. Remove the retaining capscrew and remove the engine speed sensor on the clutch housing.



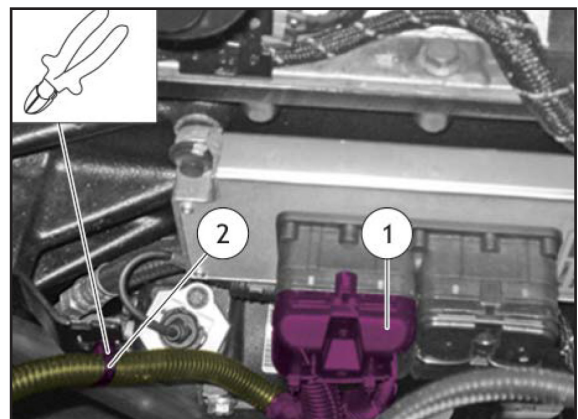
2940-101-3

20. Remove the electrical connectors and move the electronic clutch actuator (ECA) wiring harness away from its mounting place.



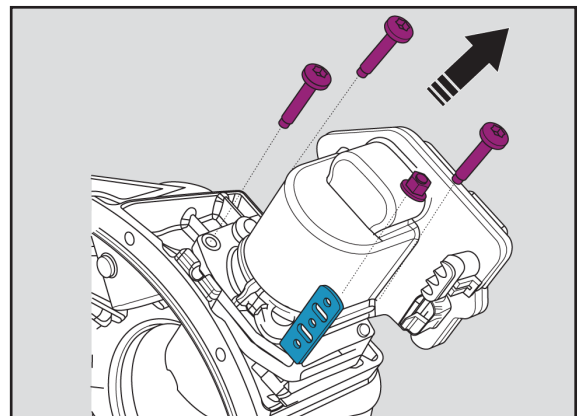
2940-085-1

21. Remove the TCU wiring harness connector (1).
22. Cut the nylon cable tie securing the wiring harness to the retaining pin (2).



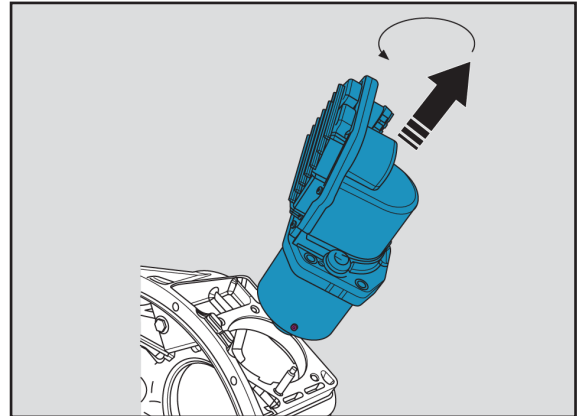
2940-085-2

23. Remove the nut and bolts securing the electronic clutch actuator (ECA) to the clutch housing.



2940-085-3

24. Remove the ECA by pulling it and rotating it counterclockwise until the alignment (dowel) pin fits into the housing slot.



2940-061-1

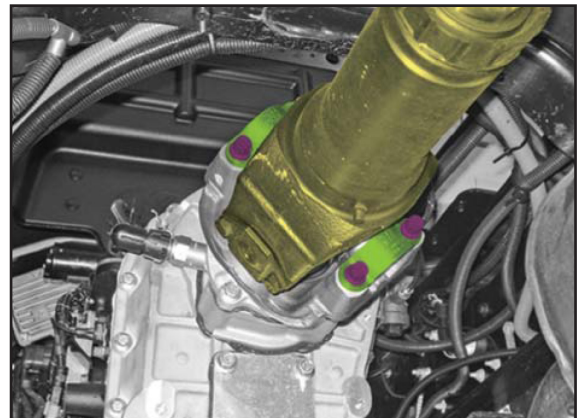
25. Remove the inspection window cover to check transmission alignment during removal.



2940-086-2

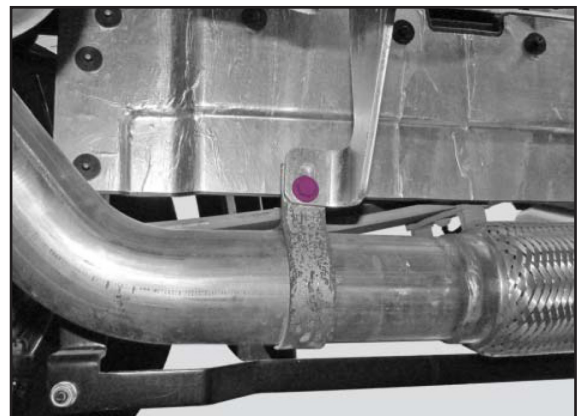
26. Remove bolts and clamps securing the longitudinal driveshaft to the transmission output yoke. Move the driveshaft away from the output yoke so that it will not hinder the transmission removal.

CAUTION: Mark the driveshaft position for later install, avoiding unbalancing the assembly.



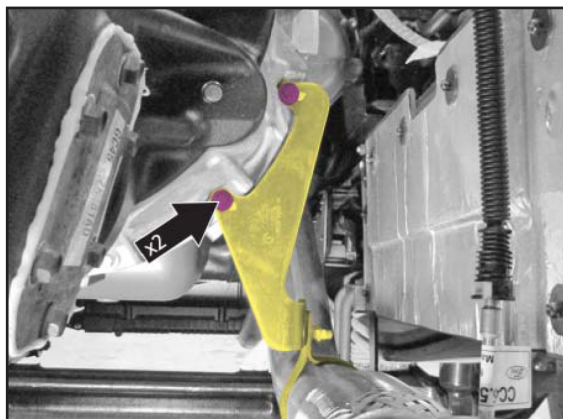
2940-086-3

27. Remove the primary exhaust pipe clamp retaining nut from its bracket on the transmission.



2940-087-1

28. Remove the retaining capscrews and remove the primary exhaust pipe bracket from the transmission.



2940-087-2

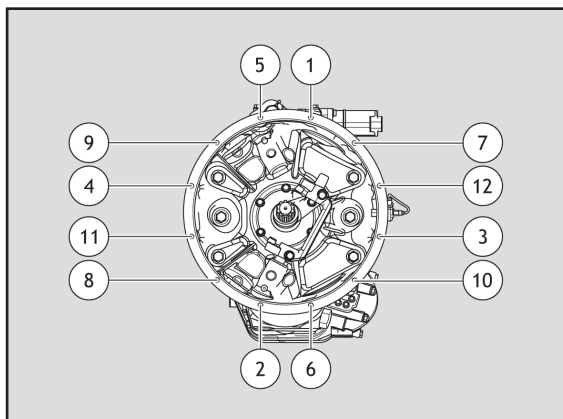
29. Use a 3-leg chain sling and a hoist to support the transmission.

NOTE: Use a cabin removal hoist.



2940-104-3

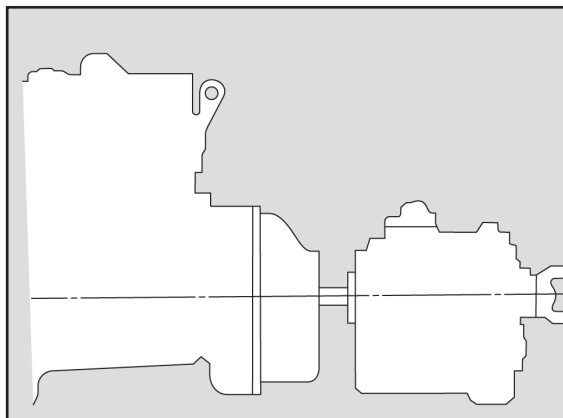
30. Remove the capscrews securing the transmission to the engine, following the indicated sequence.



2940-105-1

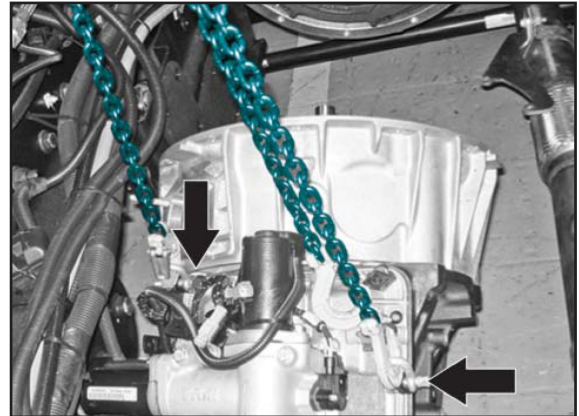
31. With the help of an assistant, move the transmission away from the engine.

CAUTION: Make sure the transmission is aligned with the engine, so as not to cause damage to the clutch system during removal.



2940-105-2

32. After removing the transmission, support it on a wooden block, avoiding resting it on the inertia brake.
33. Change the lifting chain sling attachment points on the cover in order to remove the transmission from the vehicle at an angle.



2940-105-3

34. Raise the transmission removing it from the vehicle at an angle.



2940-106-1

Installation (Semi-Truck)

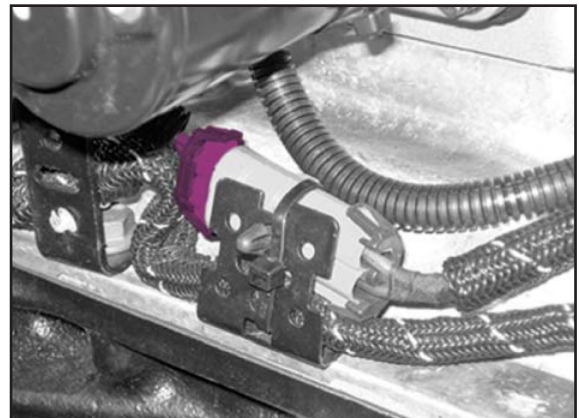
NOTE: Lubricate the clutch bearings with the specified grease.

NOTE: Lubricate the input shaft splines with the specified grease.

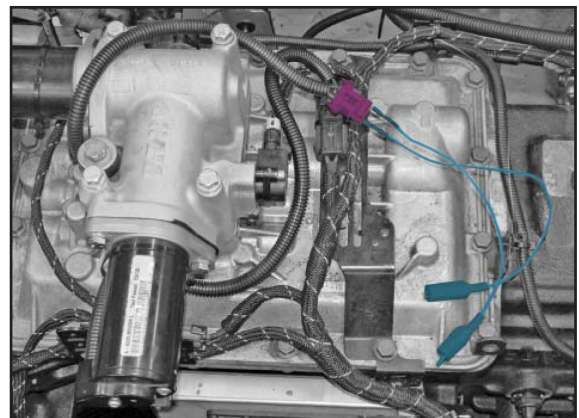
1. Remove the shift motor connector on the remote shift control.
2. Install a wiring harness to the shift motor connector.
3. Quickly connect the harness wires to the positive (+) and negative (-) poles of a 12 Volt battery, so that a gear can be shifted.

NOTE: With the help of an assistant, rotate the output yoke to make it easier to shift into a gear.

NOTE: If you cannot shift gears, reverse the harness wires to the battery poles.



2940-044-1



2940-089-2

4. Place the clutch release bearing to facilitate shifting with the yoke.



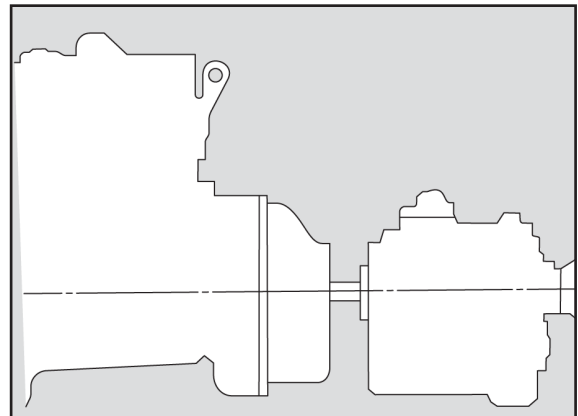
2940-090-1

5. Using a 3-leg chain sling and a hoist, lift the transmission and install it on its mounting position. Position the input shaft aligned with the clutch release bearing.



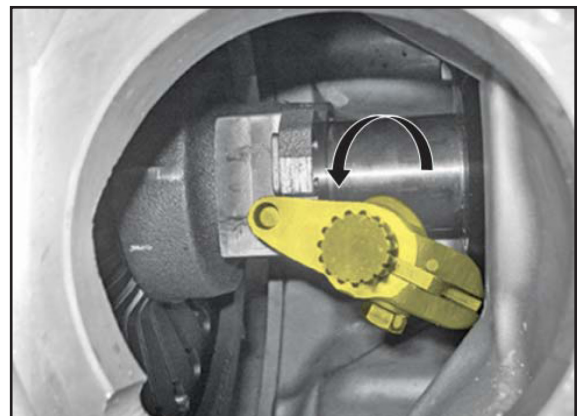
2940-104-3

CAUTION: Make sure the transmission is aligned with the engine, so as not to cause damage to the clutch system during installation.



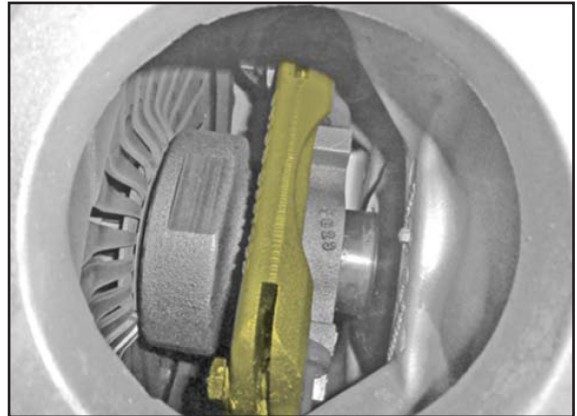
2940-088-2

6. Rotate the output yoke, fitting the input shaft splines on the clutch disc.
7. Push the transmission and, through the electronic clutch actuator (ECA) housing bore, rotate the cross-shaft counterclockwise, centering it in the release bearing with the help of an assistant.



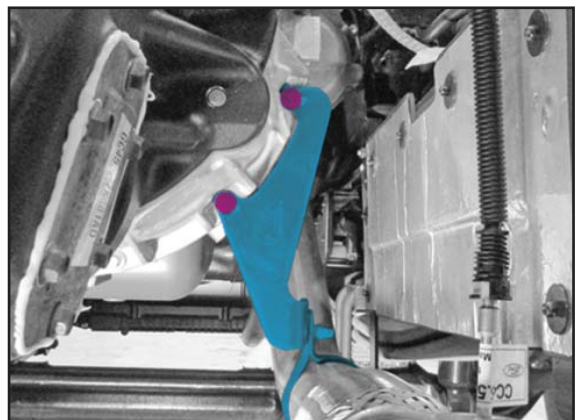
2940-091-2

8. Check the alignment between the clutch release yoke and the release bearing through the lower inspection window.



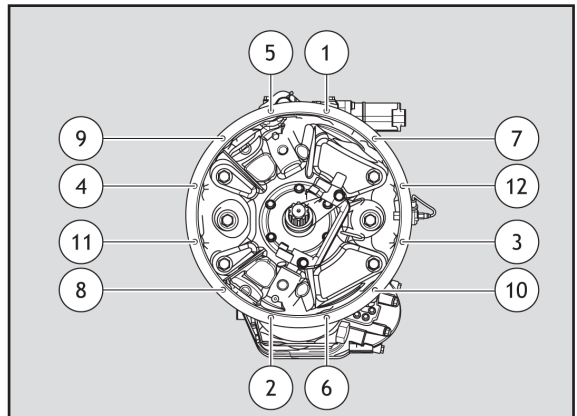
2940-091-3

9. Position on the transmission the primary exhaust pipe bracket and install the retaining capscrews, applying a torque of 48 Nm.



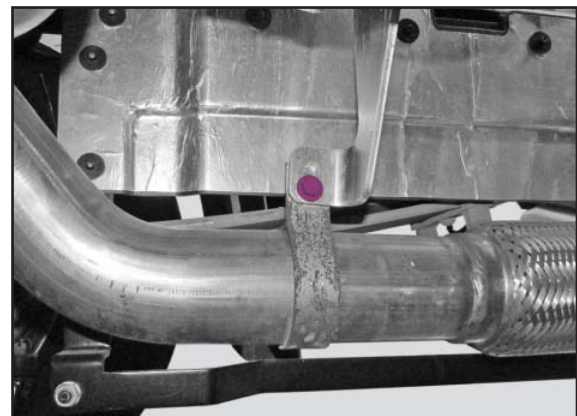
2940-109-1

10. Following the indicated sequence, install the transmission retaining capscrews to the engine, applying a torque of 48 Nm.



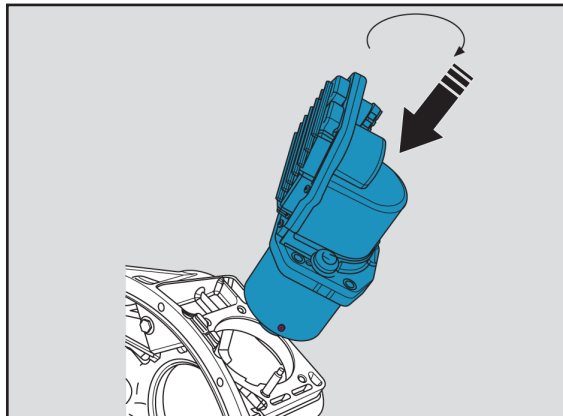
2940-088-1

11. Install the primary exhaust pipe clamp on its bracket on the transmission case and tighten the retaining nut to a torque of 48 Nm.



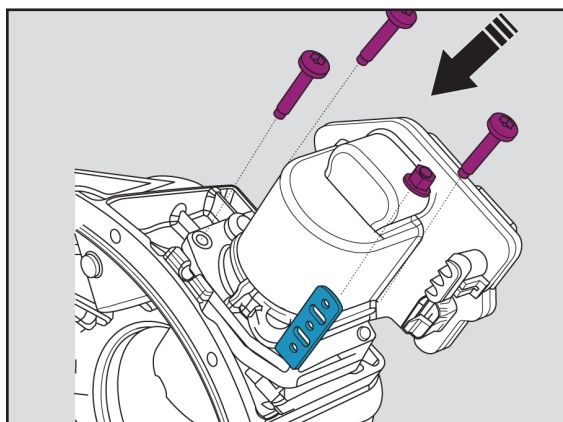
2940-087-1

12. Install the electronic clutch actuator (ECA) by matching the dowel pin on its external diameter with the slot in the clutch housing. Rotate the actuator clockwise until reaching the end of travel.



2940-093-1

13. Install the ECA retaining bolts, the bracket and the nut and tighten them to a torque of 40 Nm.

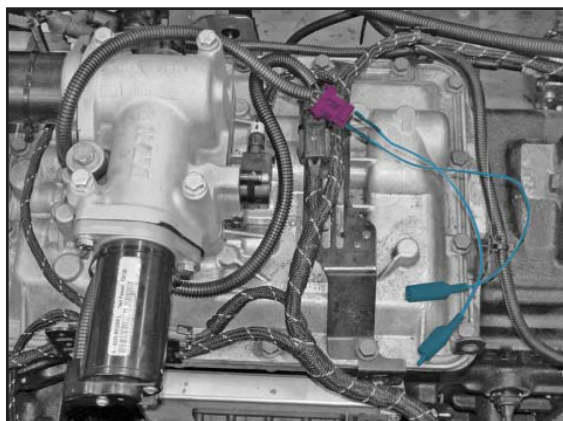


2940-093-2

14. Quickly connect the harness wires, installed on the gear shift motor connector on the remote shift control, to the positive (+) and negative (-) poles of a 12 Volt battery, so that the gear can be disengaged.

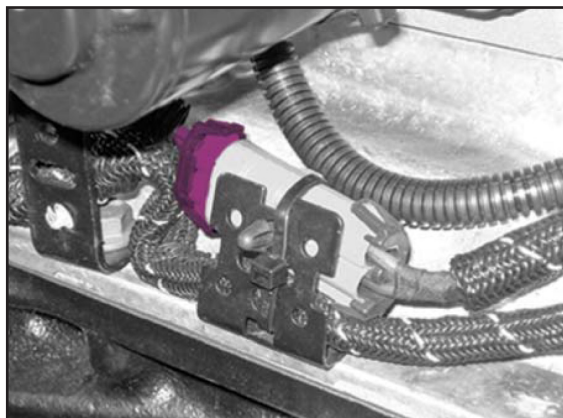
NOTE: With the help of an assistant, rotate the output yoke to make it easier to disengage the gear.

NOTE: If you cannot shift gears, reverse the harness wires to the battery poles.



2940-093-3

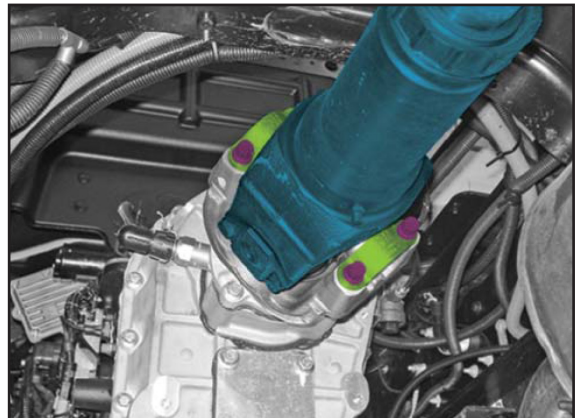
15. Remove the harness wires and install the gear shift motor connector on the remote shift control.



2940-094-1

16. Install the longitudinal driveshaft on the output yoke tightening the retaining capscrews to a torque of 125 Nm.

CAUTION: Use the reference mark made during removal to avoid unbalancing the assembly.



2940-094-2

17. Install the inspection window cover and tighten its retaining capscrews to a torque of 3.5 Nm.



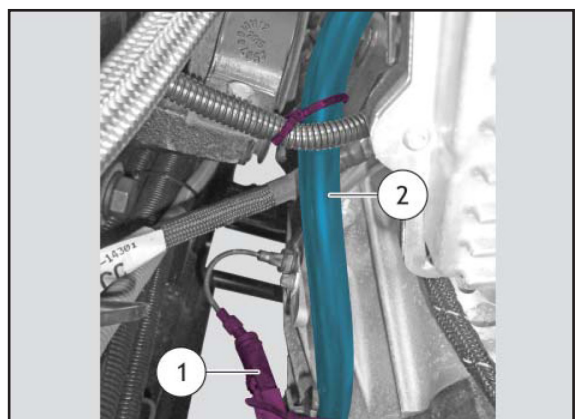
2940-086-2

18. Position the engine speed sensor on the clutch housing and install its retaining capscrew, applying a torque of 29 Nm.



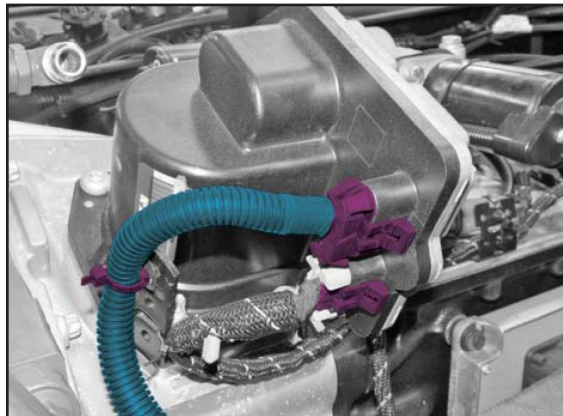
2940-112-1

19. Install the engine speed sensor electrical connector on the clutch housing (1).
20. Position the engine gas breather hose (blow-by line) and install the retaining nylon cable ties securing it together with the speed sensor connector (2).



2940-112-2

21. Install the electronic clutch actuator (ECA) electrical connectors.



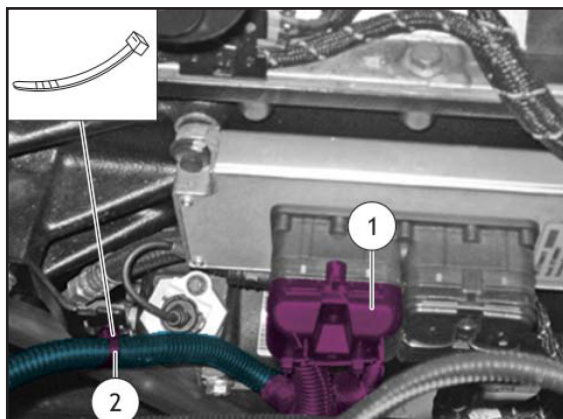
2940-095-3

22. Connect the flexible pipe to the muffler and apply a torque of 50 Nm.



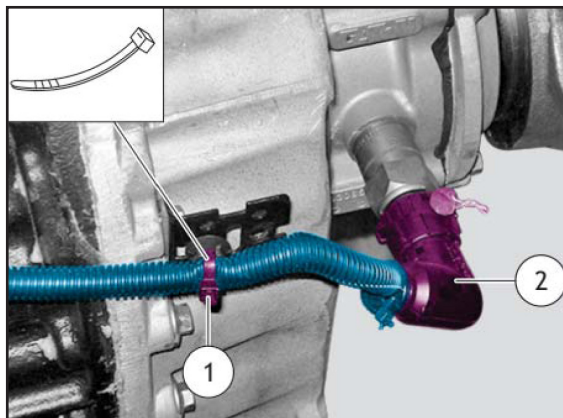
2940-096-1

23. Install the wiring harness connector onto the transmission electronic control unit (TCU) (1).
24. Install the wiring harness nylon cable tie on the retaining pin (2).



2940-096-2

25. Position the wiring harness and install the nylon cable tie on the retaining pin (1).
26. Install the speed sensor electrical connector and the new seal (2).

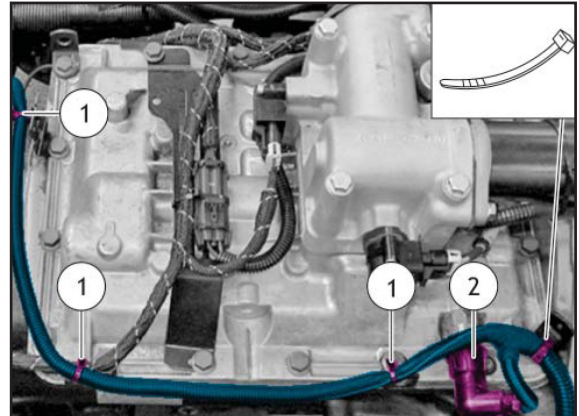


2940-096-3

Transmission Removal and Installation

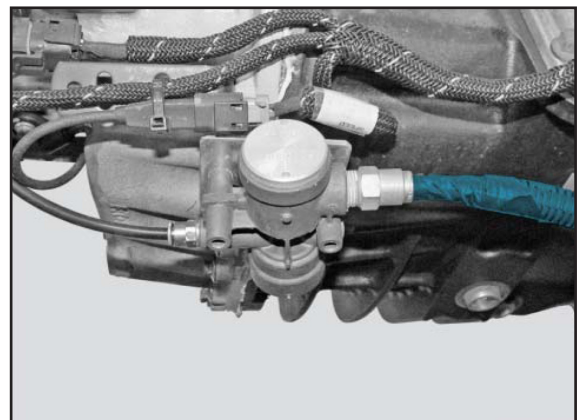


27. Position the vehicle's wiring harness on the transmission top cover and install the nylon cable ties on the brackets and retaining pins (1).
28. Install the reverse sensor electrical connector (2).



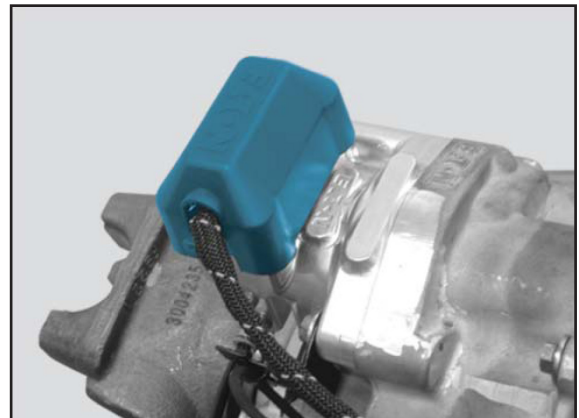
2940-097-1

29. Connect the pressure reducing valve air supply line.



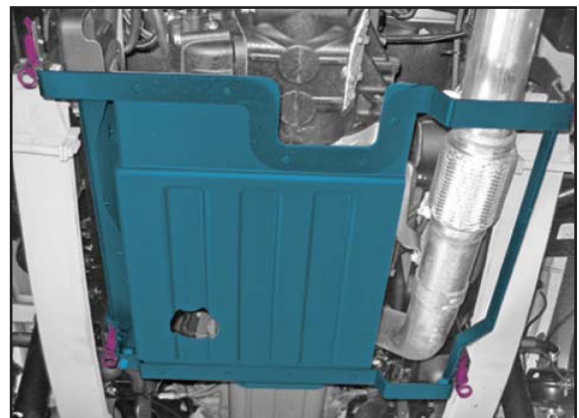
2940-097-2

30. Install the pneumatic valve electrical connector protective cover.



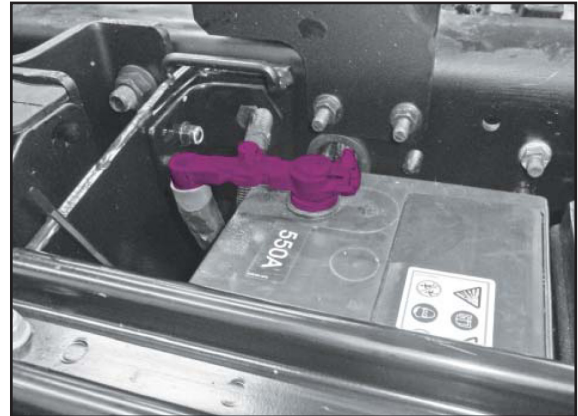
2940-083-3

31. Install the transmission guard and secure it with the retaining clips.



2940-054-1

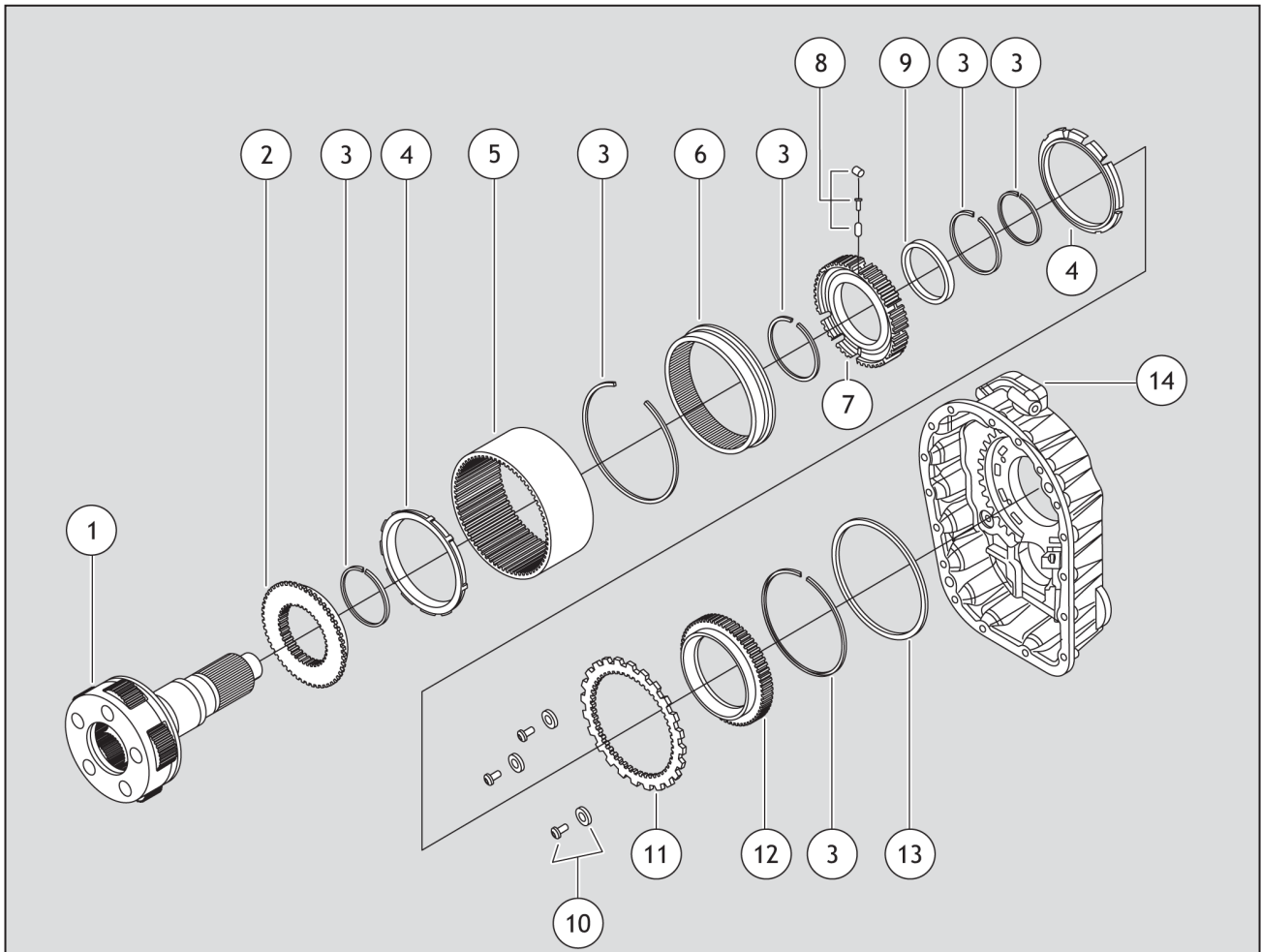
32. Install the negative battery cable and tighten the nut to a torque of 8 Nm.



2940-041-2

33. Install the deck plate.
34. Install the bracket for the electrical and pneumatic connectors from the semi-trailer.
35. Install the spare tire and its retaining nut on the deck plate.
36. Lower the cab.
37. Close the hood.
38. Close all air reservoir drains.
39. Start the vehicle and recharge the air reservoirs.
40. Remove the wheel chocks.
41. Conduct a road test and check the transmission operation.

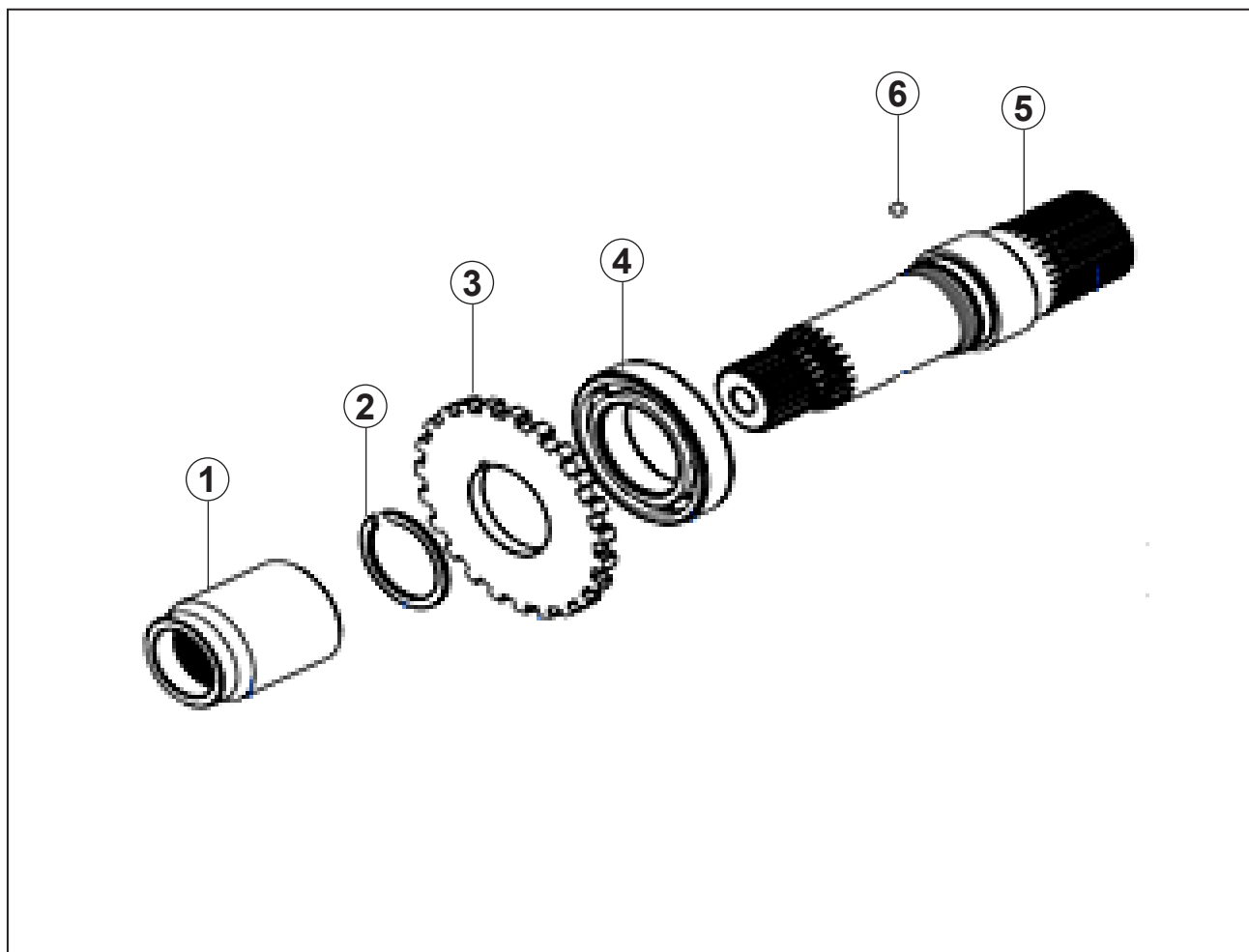
Rear Housing with the Epicyclic (Planetary) Reduction Gear



2940-117

- | | |
|---|---------------------------------|
| 1. Planet gear assembly and output shaft | 7. Synchronizer hub |
| 2. High Range synchronizer ring | 8. Detent |
| 3. Snap ring | 9. Bearing |
| 4. Planetary reduction gear synchronizer cone | 10. Retainer plate screw/washer |
| 5. Annulus | 11. Retainer plate |
| 6. Sliding clutch | 12. Low Range synchronizer |
| | 13. Spacer |
| | 14. Rear housing |

Inertia Brake Shaft

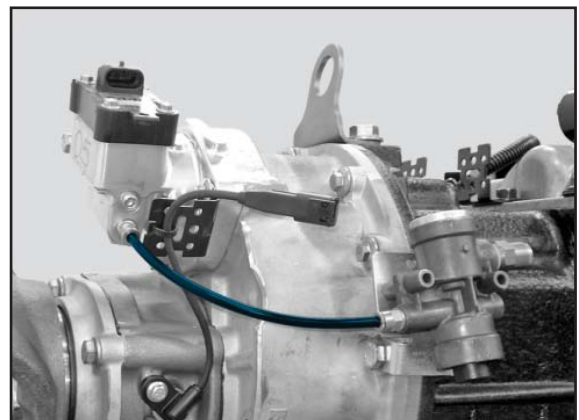


2940-117-1

- | | |
|--------------|------------------------|
| 1. Sleeve | 4. Bearing |
| 2. Snap ring | 5. Inertia brake shaft |
| 3. Rotor | 6. Ball |

Removal (Semi-Truck)

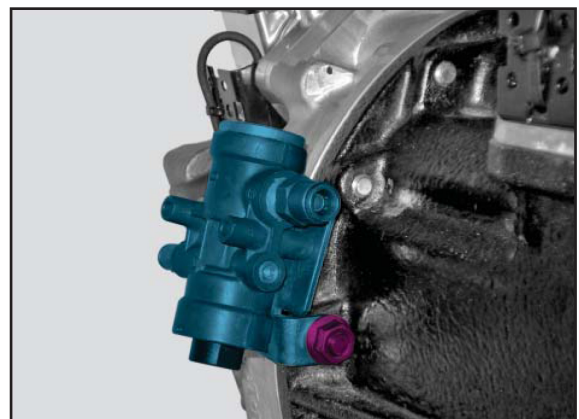
1. Drain the lubricating oil from the transmission.
2. Remove the transmission from the truck.
3. Remove the transmission electronic control unit (TCU)
4. Remove the inertia brake.
5. Remove the clutch housing.
6. Install the transmission onto the swivel overhauling stand.
7. Remove the pressure reducing valve air supply line from the planetary reduction gear pneumatic valve.



2940-118-1

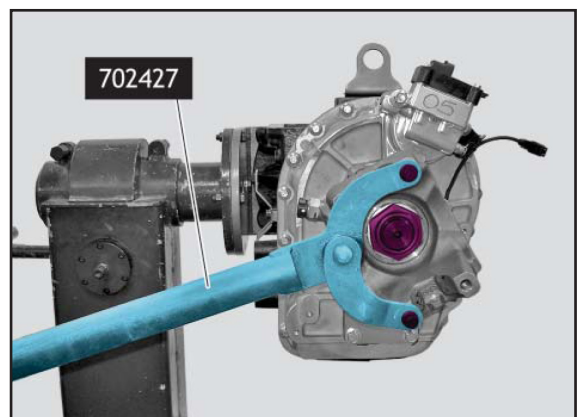
8. Remove the nut and fastening bolt, and the bracket with the pressure reducing valve.

CAUTION: Mark the position for later installation.



2940-069-2

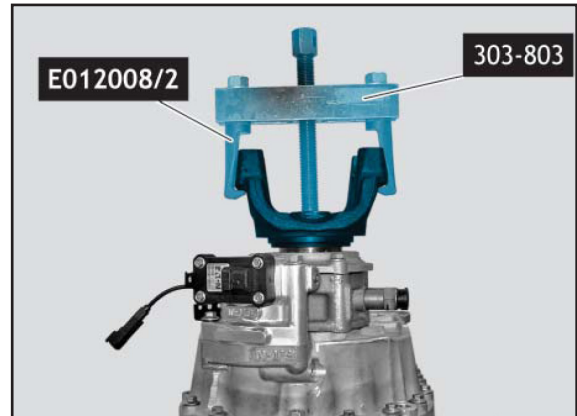
9. Using special tool #702427, loosen the output flange retaining nut, without removing it.



2940-119-1

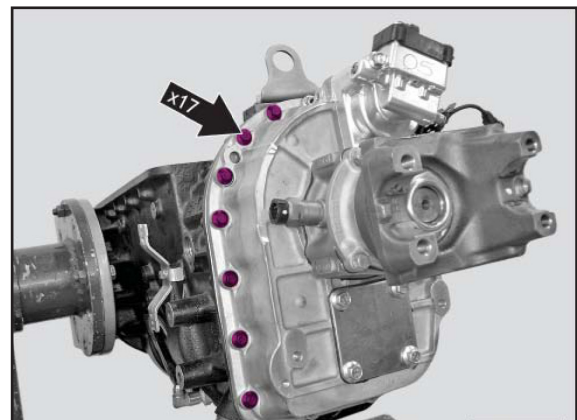
10. Detach the output flange using puller #303-803 and claws #EO12008/02.

NOTE: Do not completely remove the output flange.



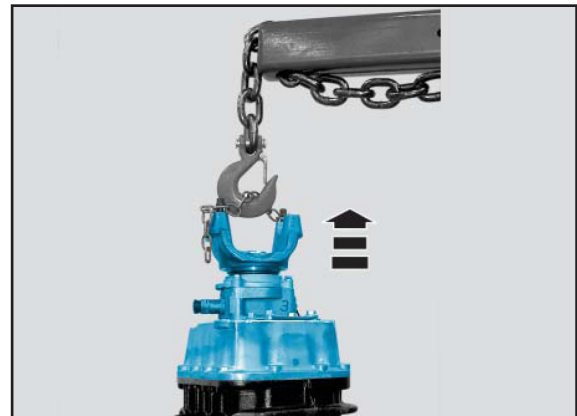
2940-119-2

11. Remove the 17 planetary reduction gear (GP) retaining capscrews.



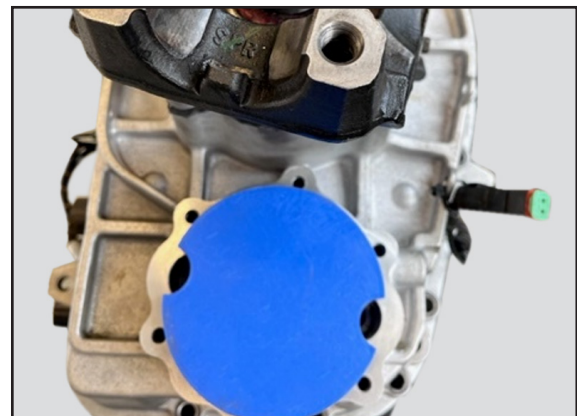
2940-119-3

12. Using a hoist, remove the planetary reduction gear (GP) from the transmission.



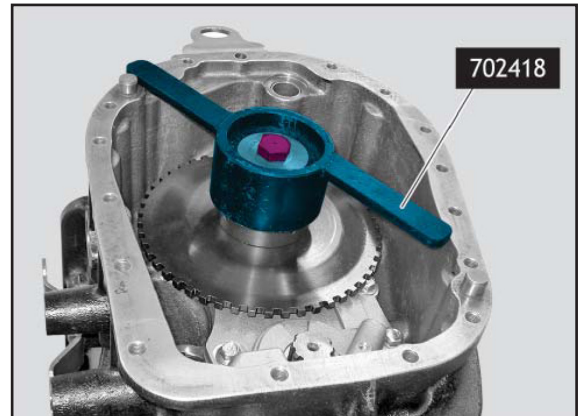
2940-120-1

CAUTION: For the MHD-EVO transmission, use the special tool #EEA-22201 (Inertia brake shaft positioner).



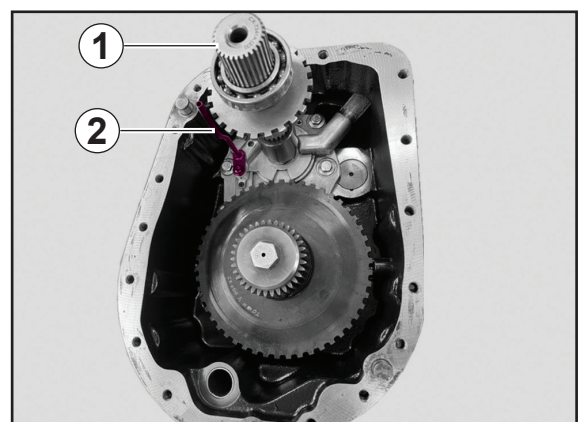
2940-255

13. Hold the sun gear with special tool #702418 for MHD or #EEA-22300 and #EEA-22301 for MHD-EVO and remove the retaining bolt and thrust washer.



2940-120-2

14. Remove the inertia brake shaft (1) with the help of a rubber hammer and remove the pump lubrication tube (2).

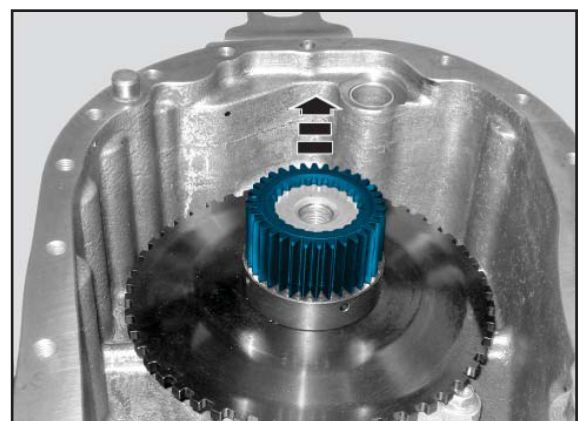


2940-256

15. Remove the sun gear by hand.

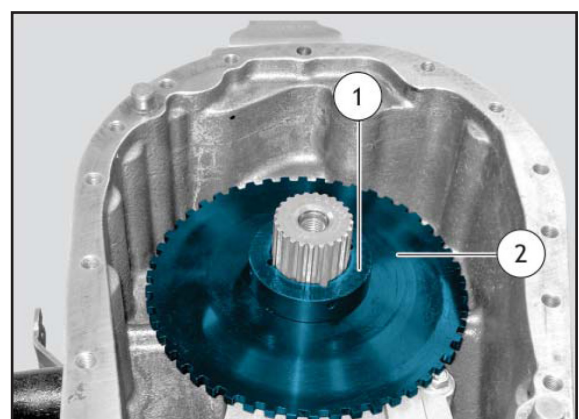
NOTE: If the sun gear presents any difficulty in removing, use puller #EAM09104.

CAUTION: Make a reference mark on one side of the gear for later assembly in the same position.



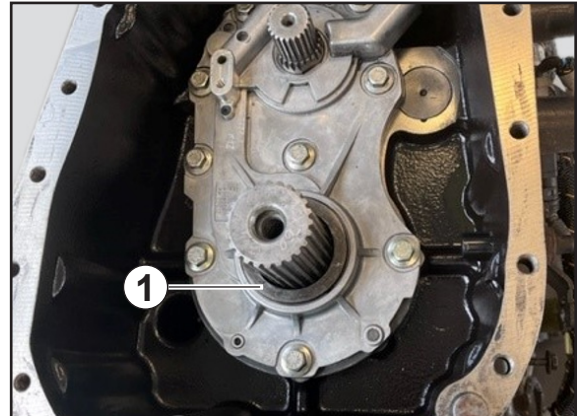
2940-120-3

16. Remove the retaining hub (1) and the phonic wheel (2).



2940-121-1

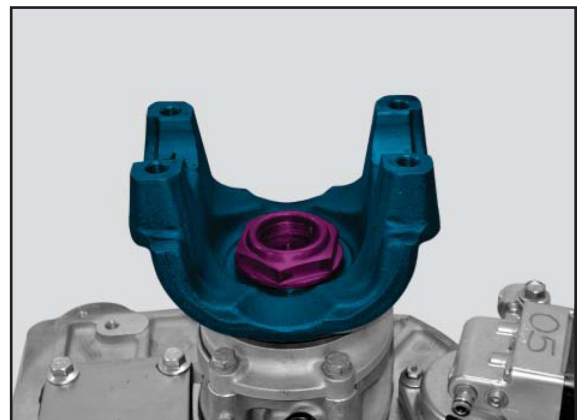
17. Remove the lubrication sleeve by hand (1).
18. Loosen the capscrews and remove the oil pump.



2940-257

Disassembly

1. Remove the transmission output yoke nut.



2940-121-2

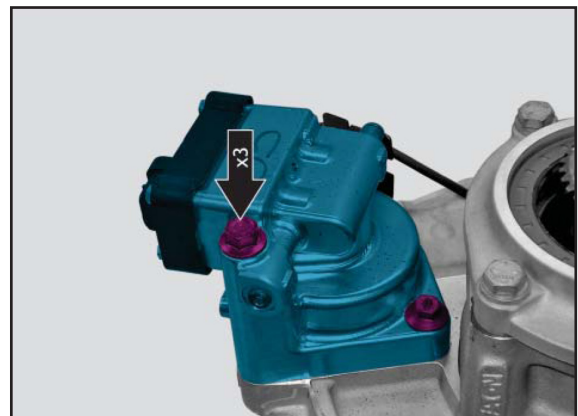
Exclusive MHD EVO

2. Remove the inertia brake shaft using a manual press.



2940-258

3. Remove the planetary reduction gear (GP) pneumatic actuator cylinder.



2940-121-3

4. Remove the sealing ring (O-ring) from the pneumatic actuator cylinder of the planetary reduction gear (GP).

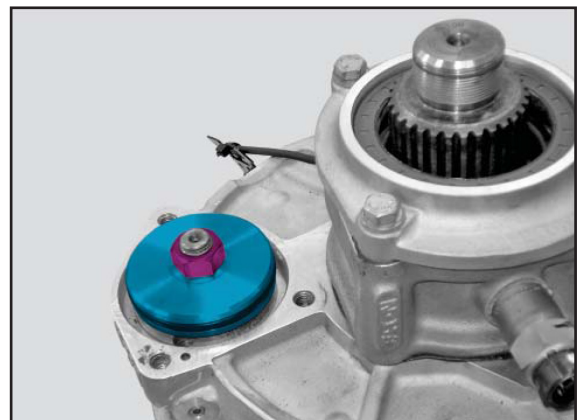
NOTE: Use a thin screwdriver.



2940-122-1

5. Remove the pneumatic actuator piston from the planetary reduction gear assembly.

NOTE: Remove its retaining nut and manually pull the piston from the case.



2940-122-2

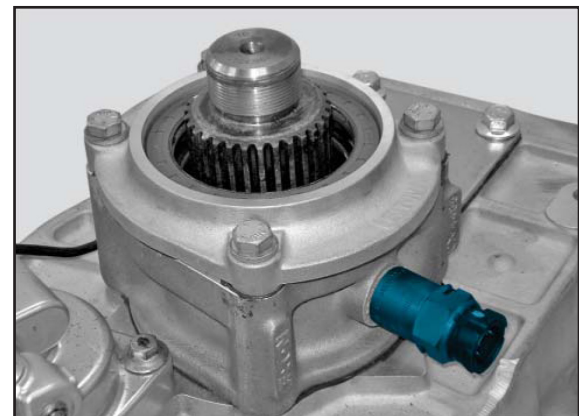
6. Remove the inner and outer sealing rings from the pneumatic piston.

NOTE: Use a screwdriver.



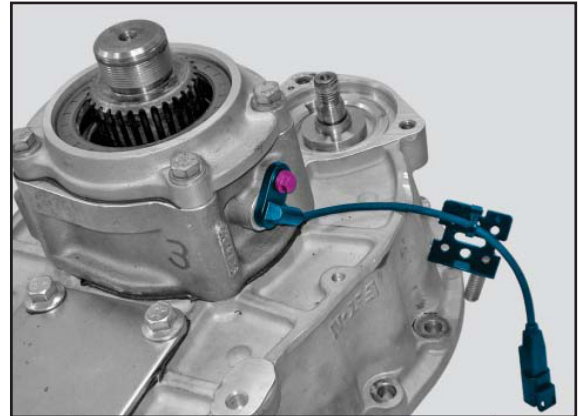
2940-122-3

7. Remove the vehicle output speed sensor.



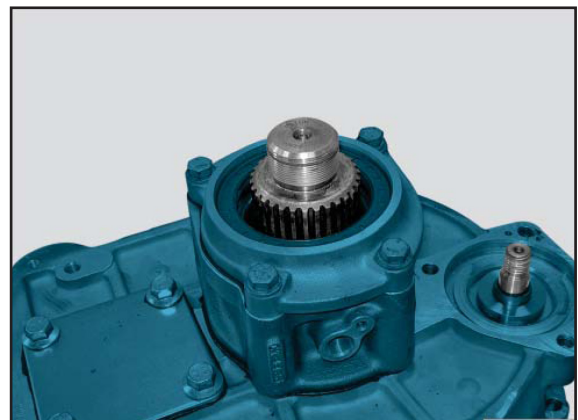
2940-123-1

8. Remove the transmission electronic control unit output speed sensor.



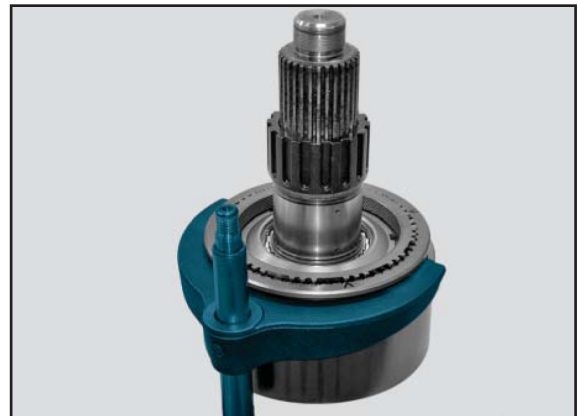
2940-123-2

9. Remove the rear housing.



2940-123-3

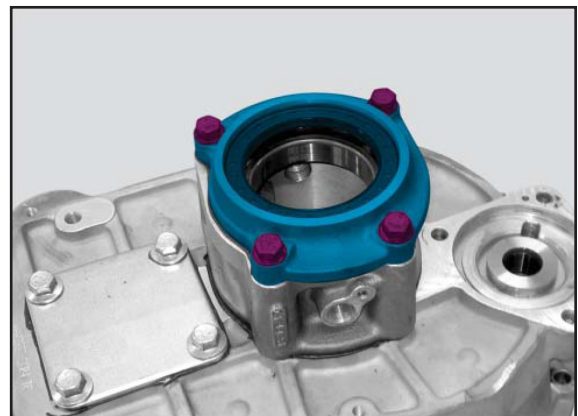
10. Remove the planetary reduction gear shift yoke.



2940-124-1

11. Remove the 4 retaining capscrews and remove the transmission rear seal cover.

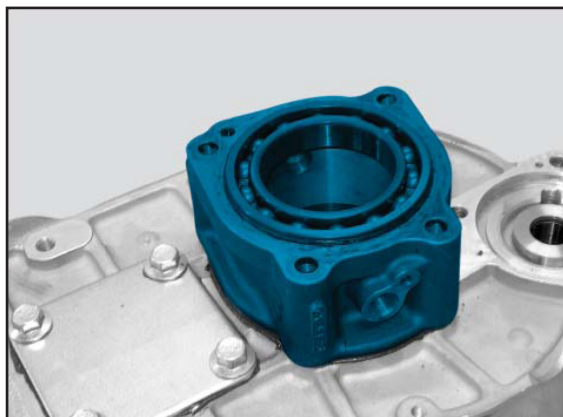
12. Remove the rear seal from the cover using a pin punch.



2940-124-2

13. Remove the speedometer sensor housing with the ball bearing.

NOTE: For MHD-EVO, speedometer sensor housing integrated into the rear housing.



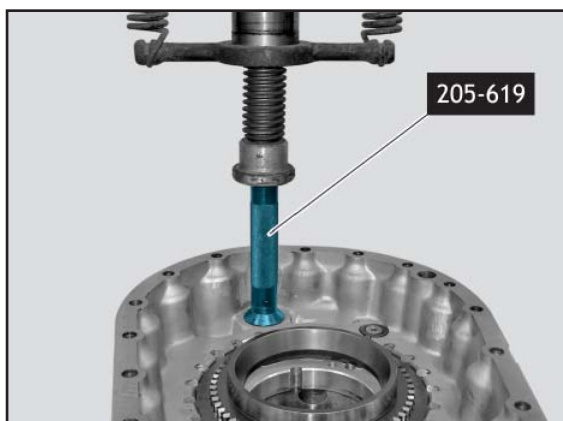
2940-124-3

14. Using a pin punch, remove the ball bearing from the speed sensor housing.



2940-125-1

15. Remove the planetary reduction gear shift yoke shaft bushing from the housing, using special tool #205-619 and a hydraulic press.



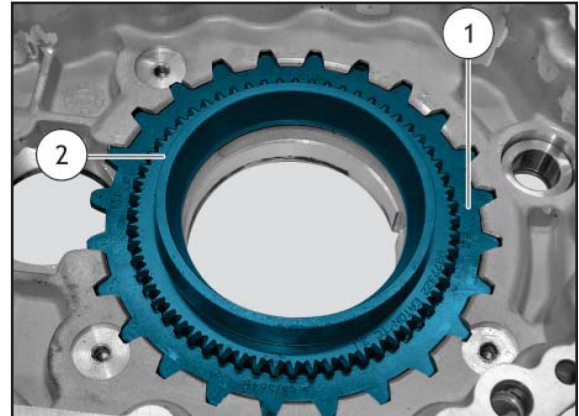
2940-125-2

16. Remove the Allen screws and special washers that secure the "LOW" rear synchronizer flange.



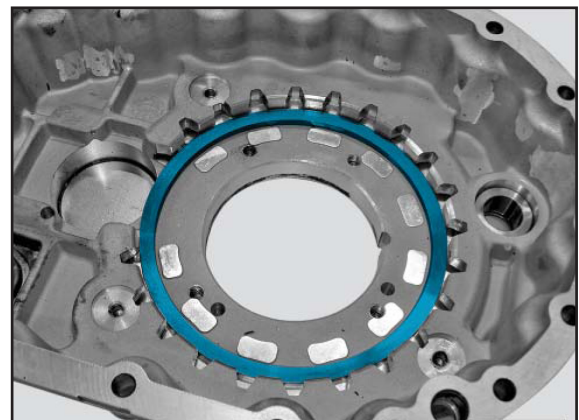
2940-125-3

17. Remove the reaction plate (1) and the planetary reduction gear synchronizer cone (2) from the rear housing.



2940-126-1

18. Remove the spacer ring from the rear housing.

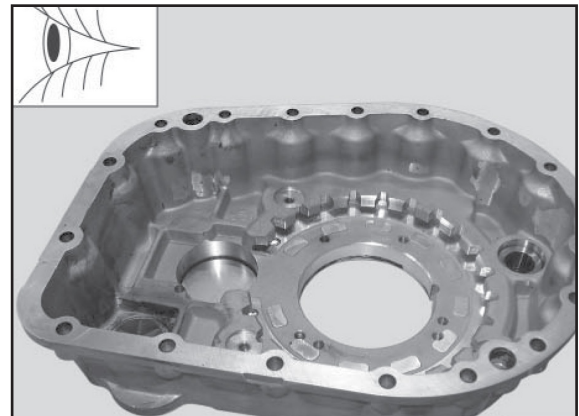


2940-126-2

Inspection

Rear Housing

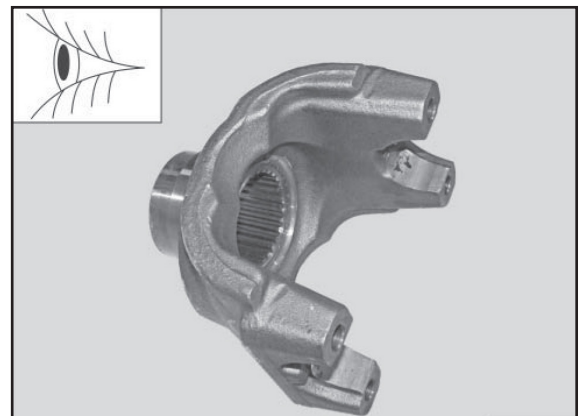
1. Replace the housing if there are scratches or deformations on the surface in contact with the gasket or damaged threads or cracks on its surface.



2940-126-3

Transmission Output Yoke

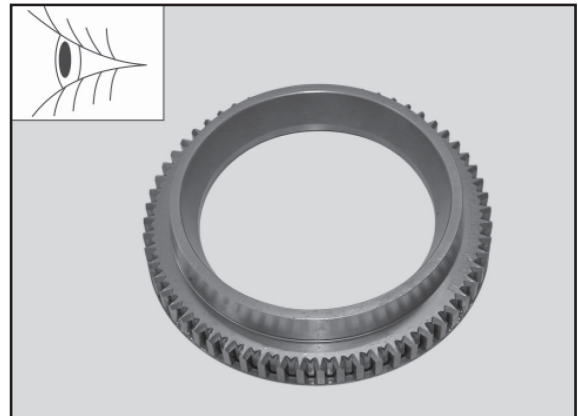
1. Replace the output yoke if it shows wear or damage to the splines or damaged threads, deformations or cracks on its surface.



2940-127-1

Synchronizer Assembly Reaction Plate

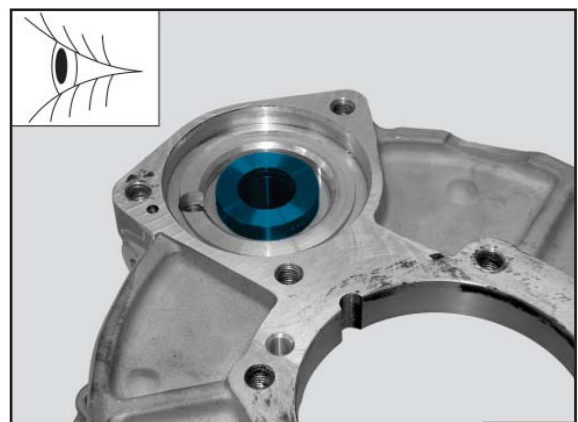
1. Replace the plate if it is excessively worn or showing the effects of overheating on the synchronizer sliding surface or engagement teeth.



2940-127-2

Shift Yoke Shaft Bushing

1. Replace the bushing that shows scratches or wear signs.



2940-127-3

Ball Bearing

1. Check the balls and bearing races (internal and external) for pitting, spalling or signs of overheating.
2. Check that the ball separators (cage) are not deformed or damaged.

NOTE: Replace the bearing that shows any damage indicated in the items above.



2940-128-1

Planetary Reduction Gear (GP) Shift Yoke

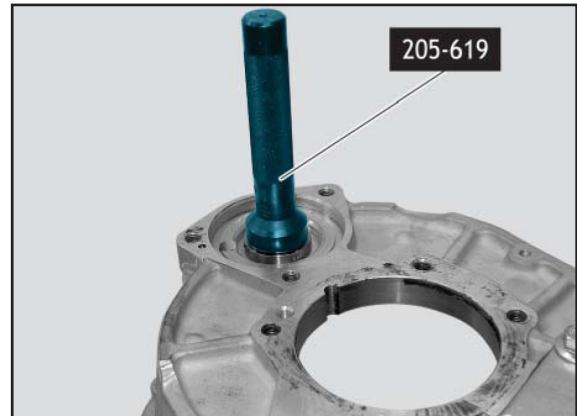
1. Replace any shift yoke that is cracked or broken.
2. Replace shift yoke shaft that is broken, worn or scratched on the bushing sliding surface or with damaged end thread.



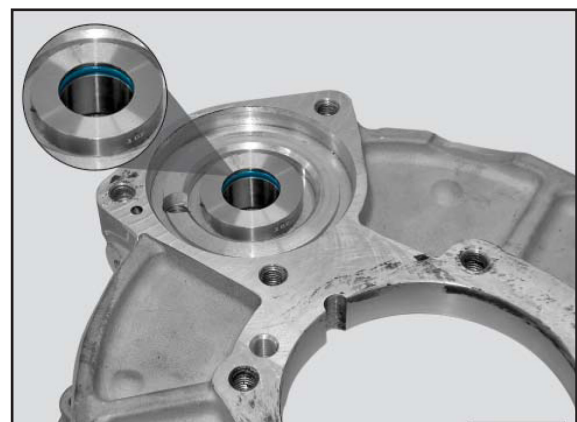
2940-128-2

Assembly

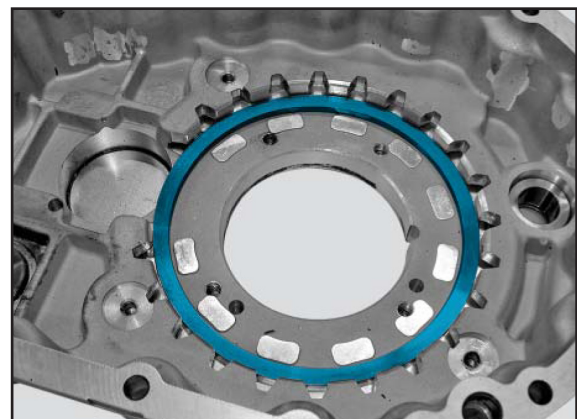
1. Install the planetary reduction gear (GP) shift yoke shaft bushing using special tool #205-619 and a hydraulic press.
2. Install the planetary reduction gear (GP) shift yoke shaft bushing sealing ring.
3. Place the rear housing on the bench with the inside facing up and install the spacer ring in its seat.
4. Install the planetary reduction gear (GP) reaction plate in its seat and install the synchronizer cone.



2940-128-3



2940-129-1

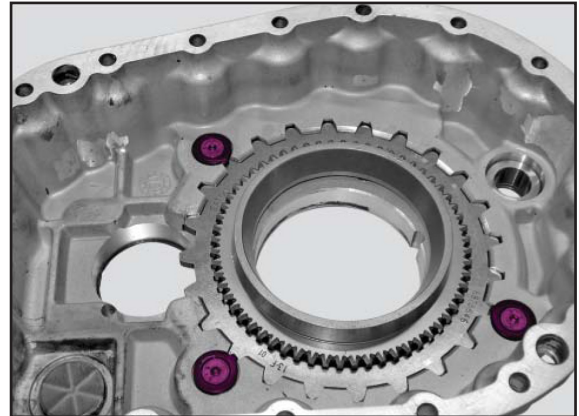


2940-126-2



2940-129-3

5. Install the Allen screws and the special retaining washers that secure the rear synchronizer flange, tightening them to a torque of 27 Nm.



2940-130-1

6. Using a soft faced mallet, install the reduction gear bearing in its seat, in the speed sensor housing.

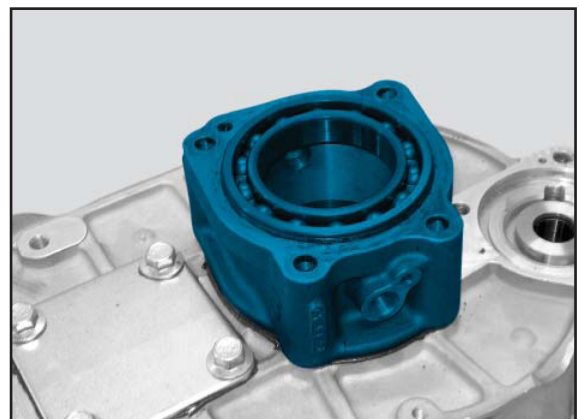
NOTE: For MHD-EVO, speedometer sensor housing integrated into the rear housing.



2940-125-1

NOTE: Apply a bead of approximately 2 mm of Loctite 5900 sealant or similar to the speedometer sensor housing sealing surface with the transmission rear housing.

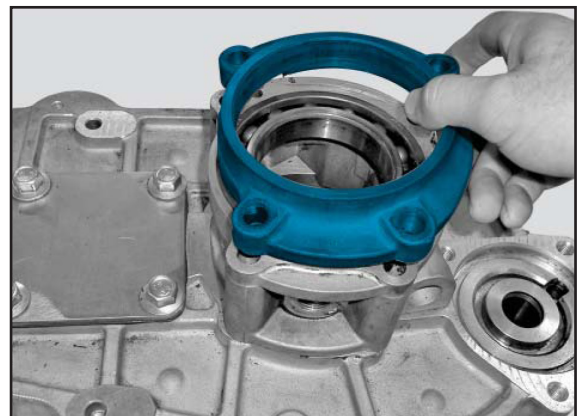
7. Install the speedometer sensor housing with the ball bearing onto the transmission rear housing.



2940-124-3

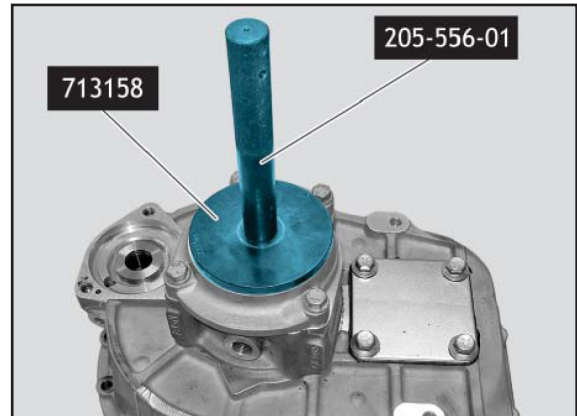
NOTE: Apply a bead of approximately 2 mm of Loctite 5900 sealant or similar to the rear seal cover sealing surface with the transmission rear housing.

8. Install the rear seal cover and tighten the 4 retaining capscrews to 37 Nm.



2940-131-1

9. Install the rear seal using special tools #205-556-01 and #713158.



2940-131-2

10. Support the planetary reduction gear (GP) on a bench.
11. Install the shift yoke onto the planetary reduction gear (GP).

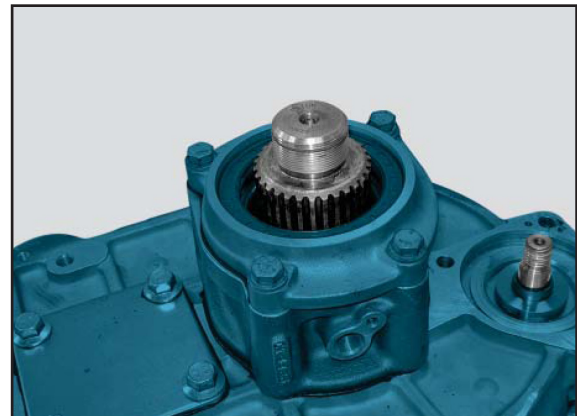
NOTE: Place the threaded side facing up.



2940-124-1

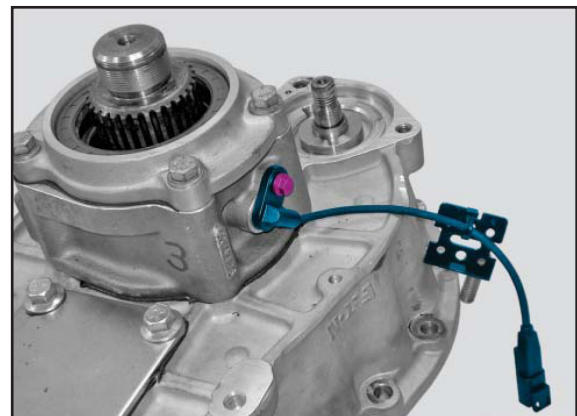
12. Install the rear housing over the reduction hub.

NOTE: Correctly center the shift yoke shaft in its mounting bushing.



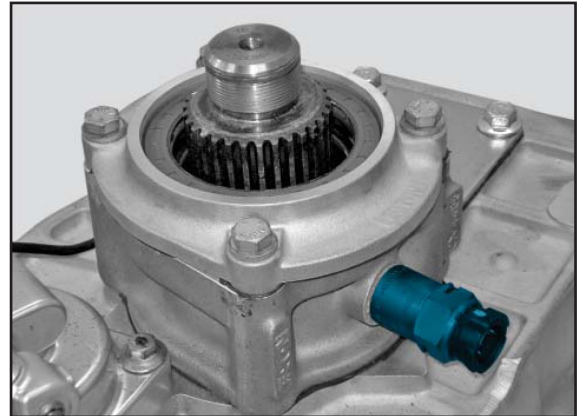
2940-123-3

13. Install the transmission electronic control unit output speed sensor, tightening its retaining capscrew with a torque of 29 Nm.



2940-123-2

14. Install the vehicle output speed sensor, tightening it with a torque of 40 Nm.

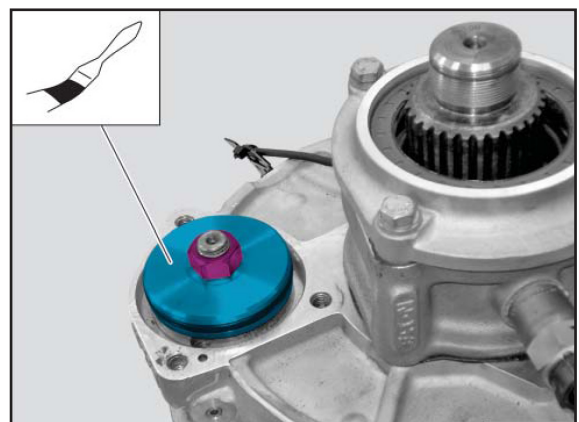


2940-132-3

15. Install the pneumatic actuator piston of the reduction gear, tightening its nut with a torque of 105 Nm.

NOTE: Replace the piston sealing rings and lubricate the sealing rings with grease specified for pneumatic valves.

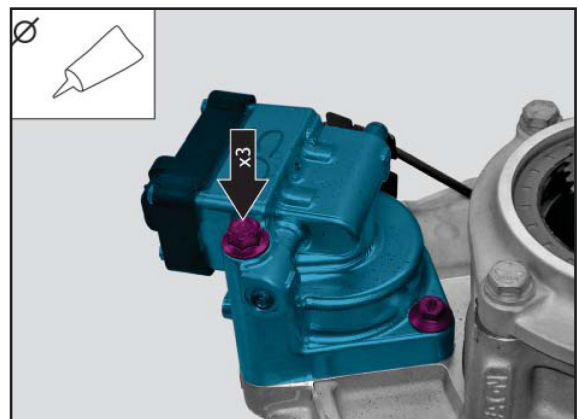
NOTE: Apply Loctite 242 threadlocker or similar to the piston nut thread.



2940-133-1

NOTE: Apply a bead of approximately 2 mm of Loctite 5900 sealant or similar to the pneumatic cylinder sealing surface.

16. Install the pneumatic actuator cylinder of the planetary reduction gear (GP), tightening the 3 retaining capscrews with a torque of 37 Nm.

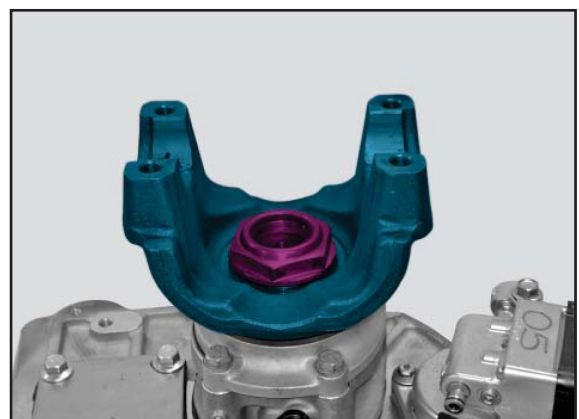


2940-133-2

17. Install the transmission output yoke by tightening its nut by hand.

NOTE: Final tightening is applied after installing the rear casing.

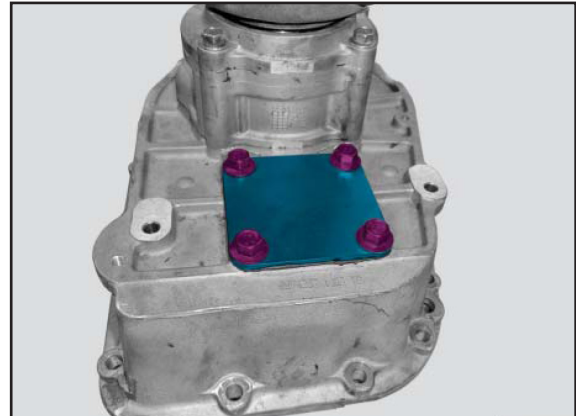
NOTE: Lubricate the rear seal lip with NLGI2 grease.



2940-133-3

18. If removed, install the PTO cover and tighten the screws to 37 Nm.

NOTE: Apply a bead of approximately 2 mm of Loctite 5900 sealant or similar to the cover sealing surface.



2940-134-1

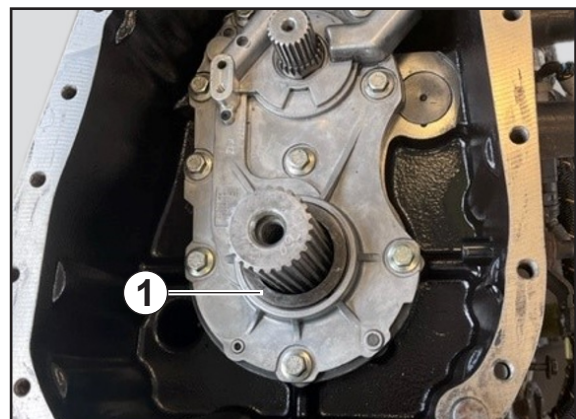
19. For MHD-EVO, assemble the sleeve and inertia brake shaft together in a manual press.



2940-258

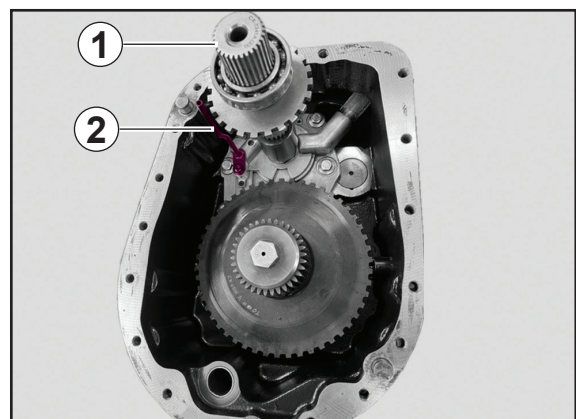
Installation

1. Install the oil pump and oil sleeve (1) and tighten the retaining capscrews.



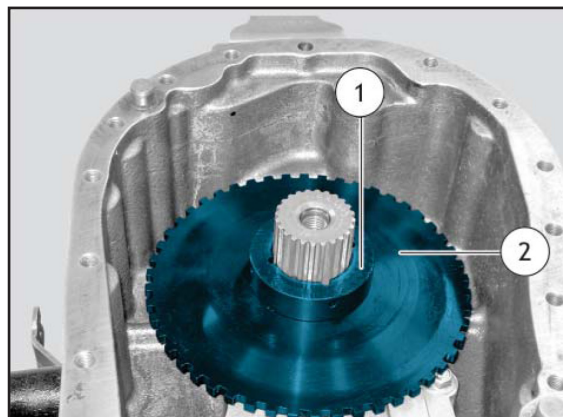
2940-257

2. For MHD-EVO, install the inertia brake shaft (1) and oil tube (2).



2940-256

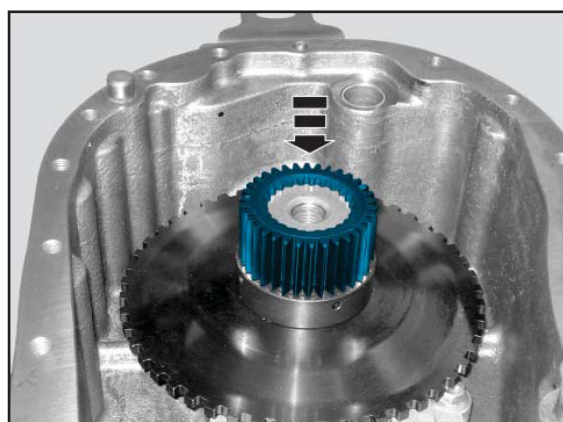
3. Install the phonic wheel (2) and the retaining hub (1) on the main shaft.



2940-121-1

4. Install the sun gear.

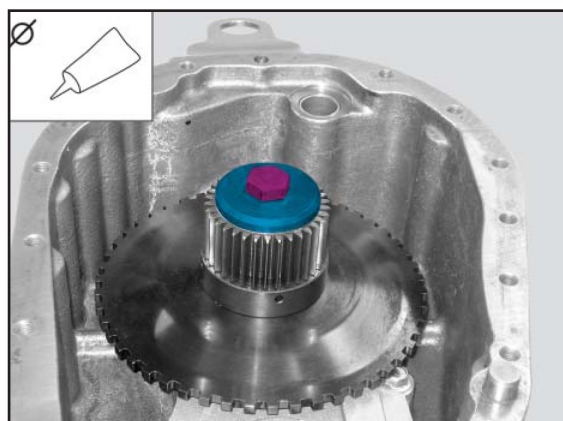
NOTE: Use the reference mark made during disassembly to maintain its original position.



2940-134-3

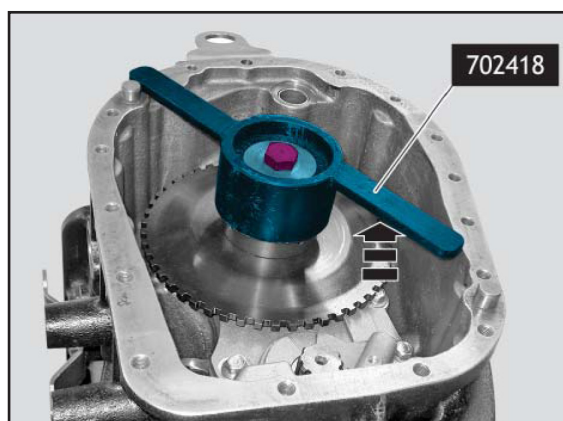
5. Install the sun gear retaining washer and bolt.

NOTE: Apply Loctite 270 to the retaining bolt.



2940-135-1

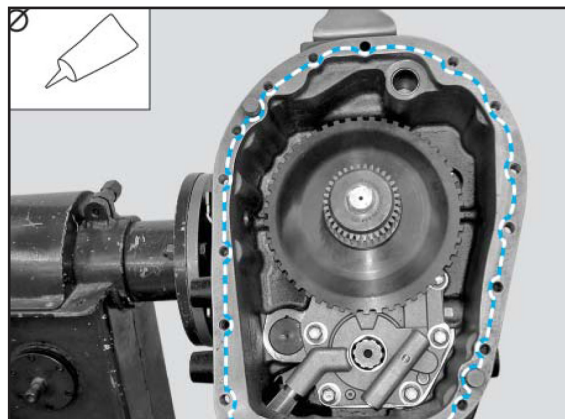
6. Secure the sun gear with the special tool #702418 and tighten its retaining bolt with a torque of 240 Nm.



2940-135-2

7. Apply a 4 mm bead of Loctite 5900 to the junction surface of front and rear cases.

NOTE: Lubricate the GP synchronizer yoke shaft and its bushing with specified lubricating oil.



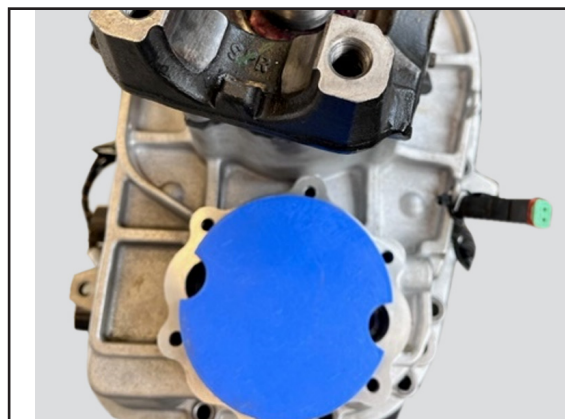
2940-135-3

8. Using a hoist, install the rear housing with the planetary reduction gear (GP) onto the transmission front case, observing the correct alignment between the sun gear and the planet gears of the reduction assembly.



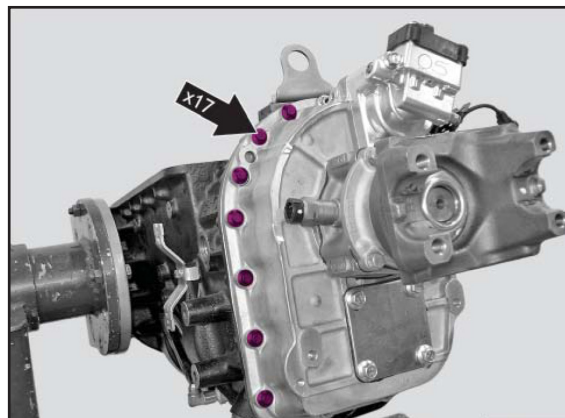
2940-136-1

NOTE: For the MHD-EVO, use the Special tool #EEA-22201 (Inertia brake shaft positioner).



2940-255

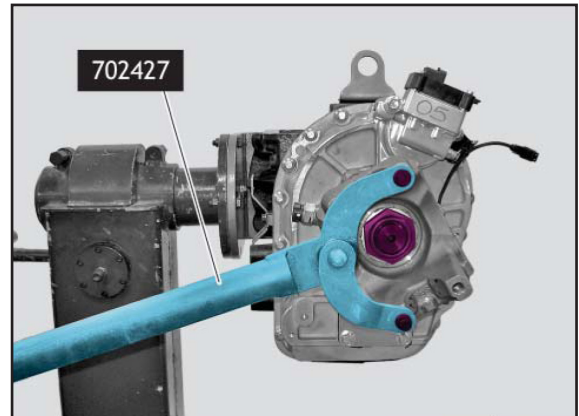
9. Install the 17 GP retaining capscrews on the housing, applying a torque of 50 Nm.



2940-136-2

10. Using the special tool #702427, apply a torque of 650 Nm to the output shaft flange retaining nut.

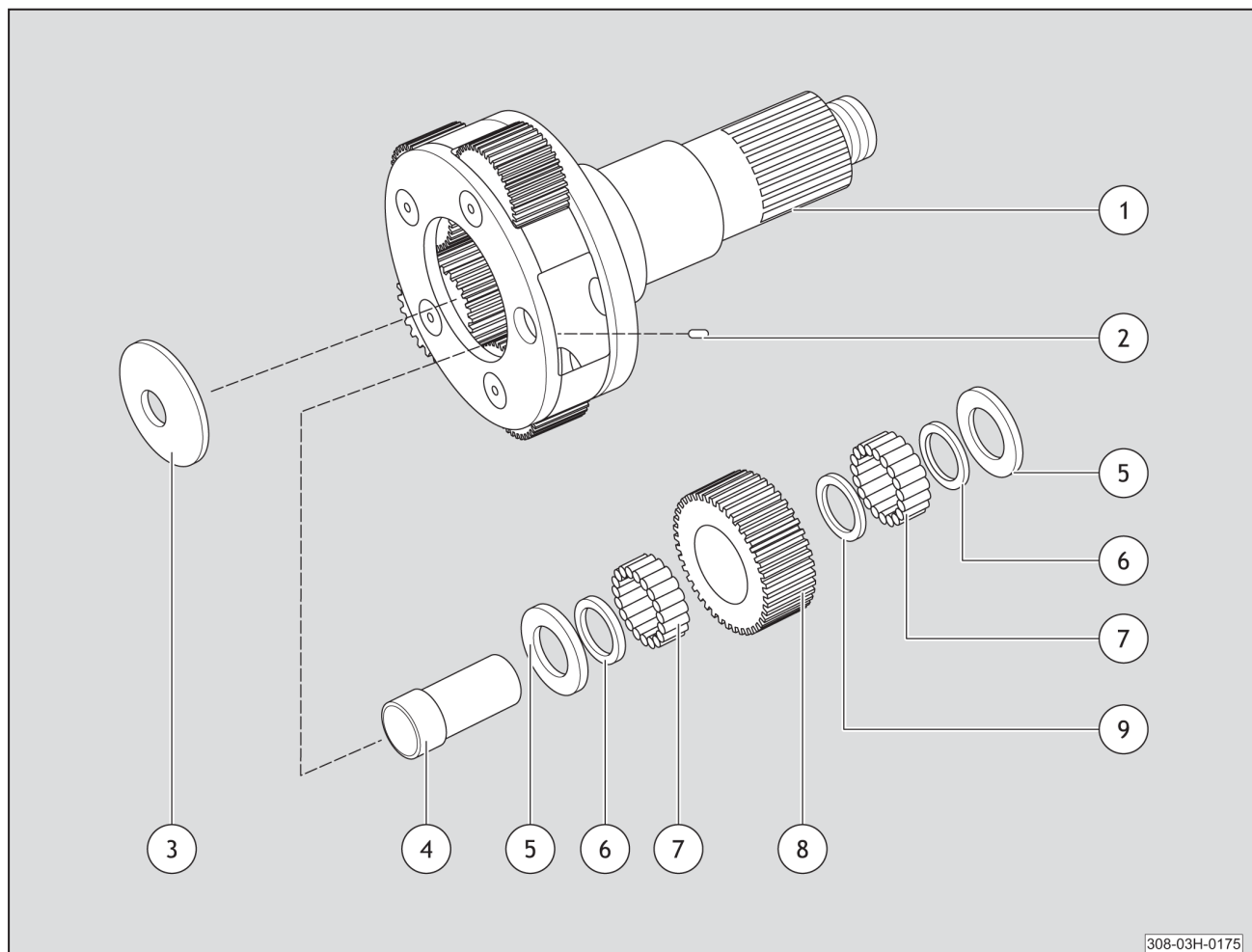
NOTE: Use a new nut.



2940-136-3

11. Remove the transmission from the swivel stand.
12. Install the clutch housing.
13. Install the inertia brake.
14. Install the transmission electronic control unit (TCU).
15. Install the transmission into the truck.
16. Fill the transmission with the lubricating oil specified in this manual.

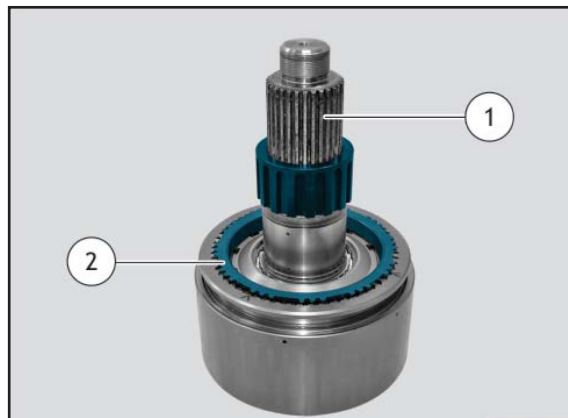
Planet Carrier Assembly



- | | |
|------------------------------------|------------------|
| 1. Output shaft and planet carrier | 6. Thrust washer |
| 2. Grub screw | 7. Needle roller |
| 3. Oil restrictor (if fitted) | 8. Planet gear |
| 4. Spindle | 9. Spacer |
| 5. Thrust washer | |

Disassembly

1. Remove the output speed sensor rotor (1).
2. Remove the synchronizer cone from the planetary gear (2).



2940-139-1

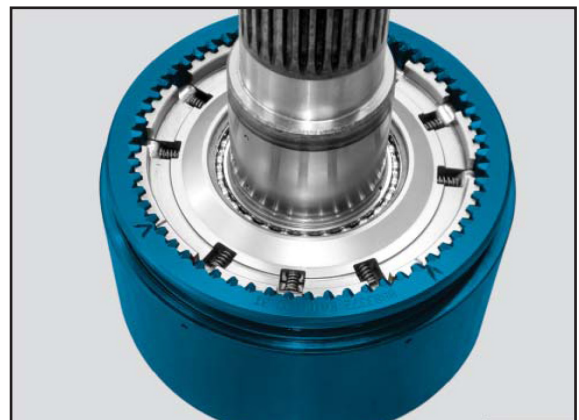
3. Make two reference marks between the sliding clutch and the planetary gear hub.



2940-139-2

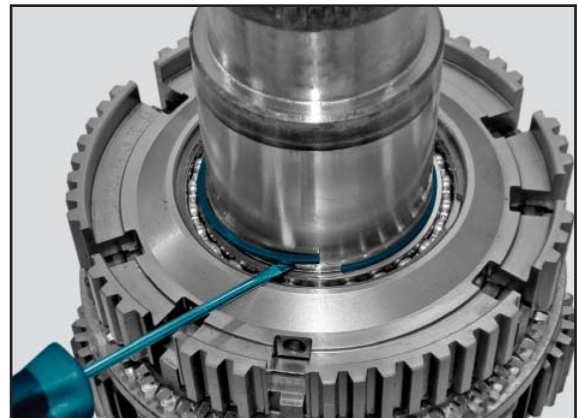
CAUTION: To avoid losing any detents, cover the assembly with a shop rag and remove the sliding clutch with the annulus.

4. Pull the assembly upward to remove the sliding clutch and annulus.



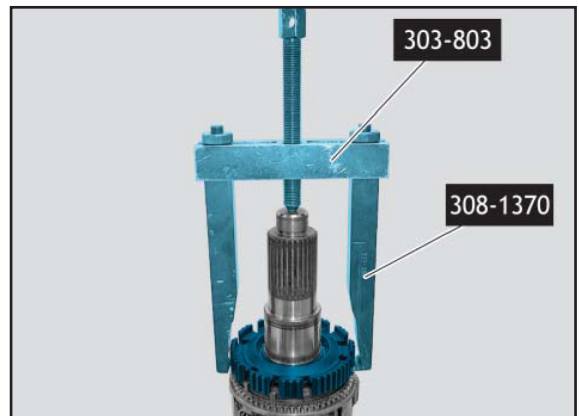
2940-139-3

5. Remove the snap ring from the synchronizer hub using flat-nose pliers and a screwdriver.



2940-140-1

6. Remove the synchronizer hub with its bearing from the planetary reduction gear using special tools #303-803 and #308-1370.



2940-140-2

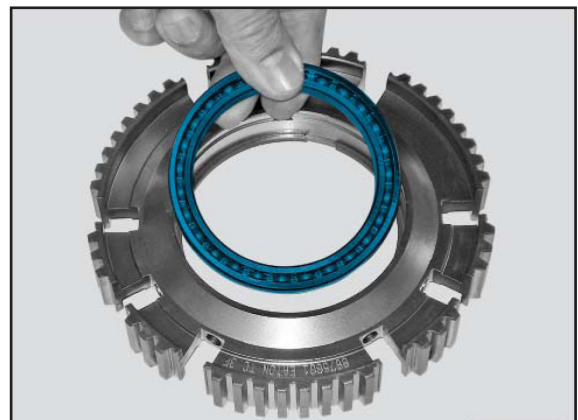
7. Remove the synchronizer hub bearing snap ring.



2940-140-3

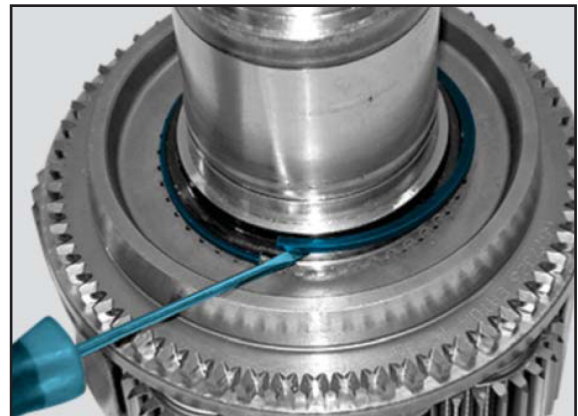
8. Remove the synchronizer hub bearing.

NOTE: If necessary, use a pin punch to remove this bearing.



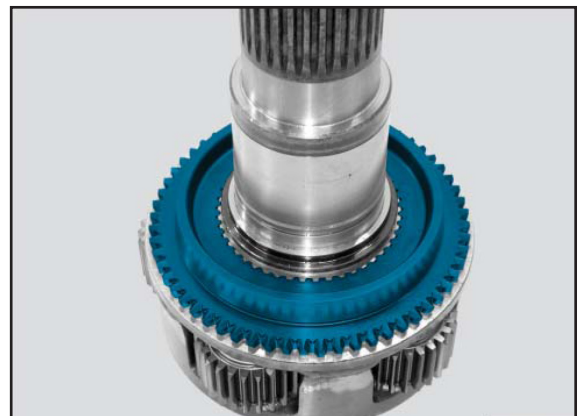
2940-141-1

9. Using appropriate pliers, remove the snap ring from the planetary reduction gear (GP) synchronizer cone.



2940-141-2

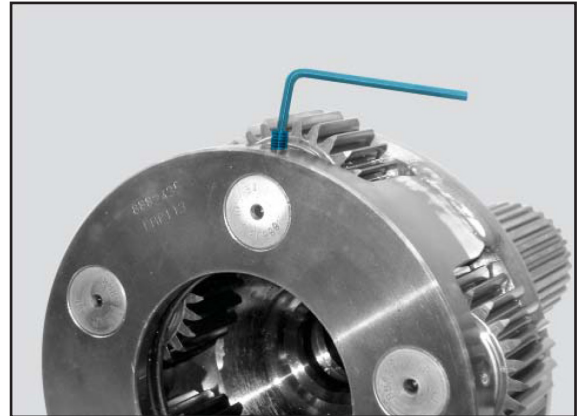
10. Remove the synchronizer cone from the planetary reduction gear (GP).



2940-141-3

11. Remove the planet gear spindle retaining grub screws from the planet gear carrier.

NOTE: Countersink the grub screw holes to unlock them.



2940-142-1

12. Using a pin punch, remove the planet gear spindles the way shown.

NOTE: Keep the planet gear carrier supported on a piece of wood to make it easier to remove the spindle.

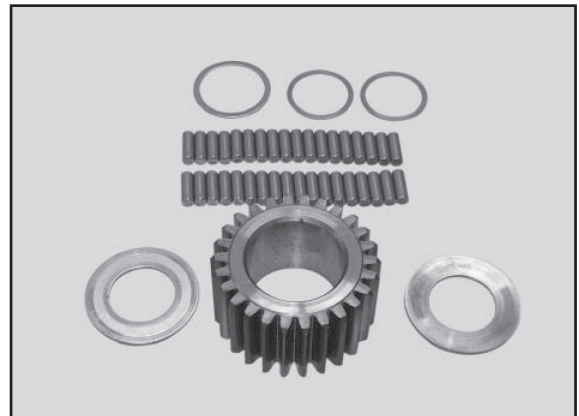


2940-142-2

13. Remove the planet gears individually with the bearing rollers, spacers and thrust washers from the carrier.

CAUTION: The 36 rollers are loose, they do not have cage, so avoid mixing them with the bearing rollers of other planet gears.

NOTE: If reusing, make a reference mark on the side to install the planet gear in the same direction of rotation.

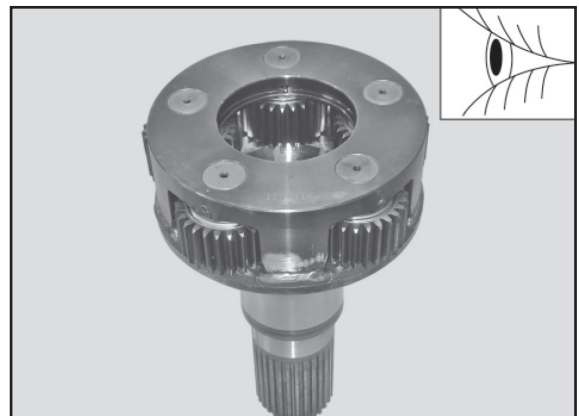


2940-142-3

Inspection

Planet Gear Carrier

1. Replace the planet gear carrier if there is damage or wear on the splines, on the planet gear spindle bores or on the contact surface of the gear thrust washers or on the threads of the spindle grub screws.

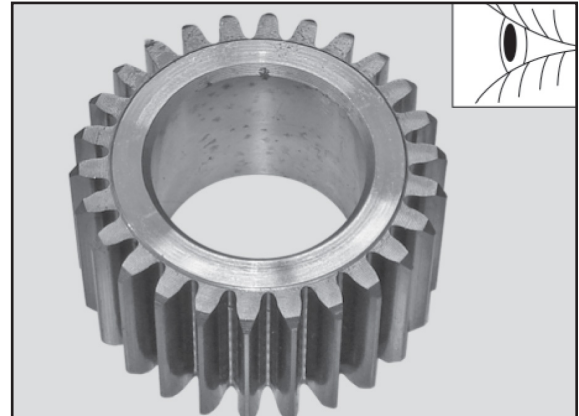


2940-141-3

Planet Gears

1. Check planet gear teeth for pitting on the faces or broken teeth.
2. Check the gear internal surfaces for signs of overheating, wear or pitting.

NOTE: Replace gears that show any of the faults described above.

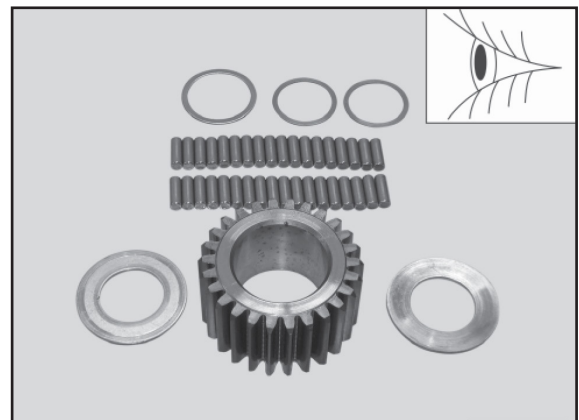


2940-143-2

Roller Bearings

1. Check the bearing rollers for pitting, spalling or signs of overheating.
2. Check the spacer and thrust washers for damage or deformation.
3. Check the planet gear spindles for pitting, spalling or signs of overheating.

NOTE: Replace any bearing and spindle that shows any of the defects described above.



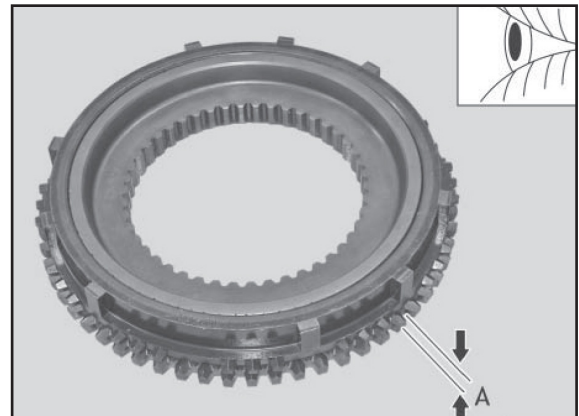
2940-143-3

Synchronizer Cone and Hub

1. Replace the synchronizer cone and hub if they are excessively worn or showing the signs of overheating on the sliding surface.
2. Using a feeler gauge, measure the clearance between the ring and the synchronizer cone (flange). If the clearance is not within specification, replace the flange and ring.

Specified clearance: 0.5 to 2.16 mm.

NOTE: Lubricate the sliding surface of the ring and synchronizer cone to take the measurement.

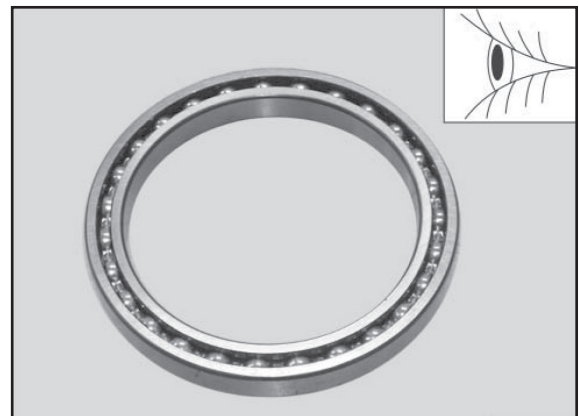


2940-144-1

Ball Bearing

1. Check the balls and bearing races (internal and external) for pitting, spalling or signs of overheating.
2. Check the ball separators (cage) that they are not deformed or damaged.

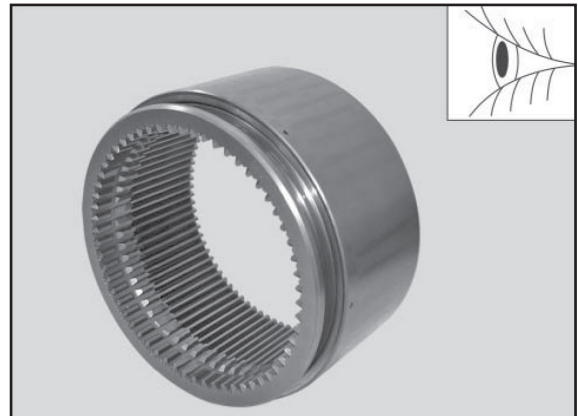
NOTE: Replace the bearing that shows any damage indicated in the items above.



2940-144-2

Sliding Clutch and Annulus

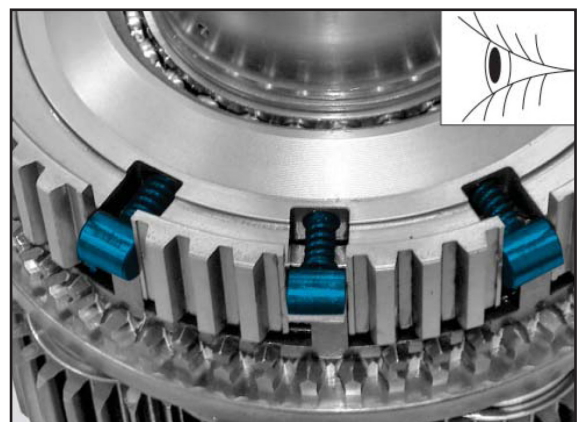
1. Replace the sliding clutch if it shows wear or damage to the engagement teeth, internal annulus teeth or shift yoke sliding surface.



2940-145-1

Detent Set

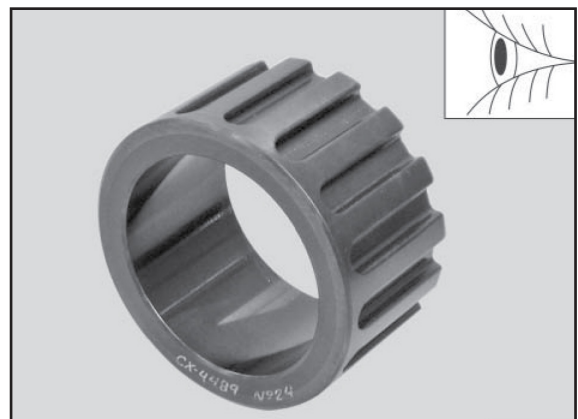
1. Replace the detent set that shows damage or scratches on the surfaces of the rollers or springs.



2940-145-2

Speed Sensor Toothed Rotor

1. Replace the speed sensor rotor if it shows damage or wear on its surface.

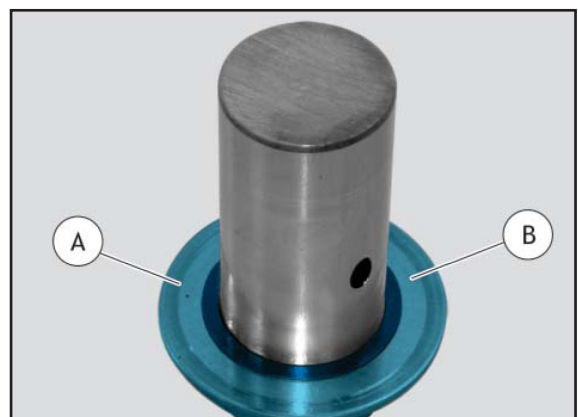


2940-145-3

Assembly

1. Install the thrust washer "A" on the planet gear spindle and then the roller spacer washer "B" on it.

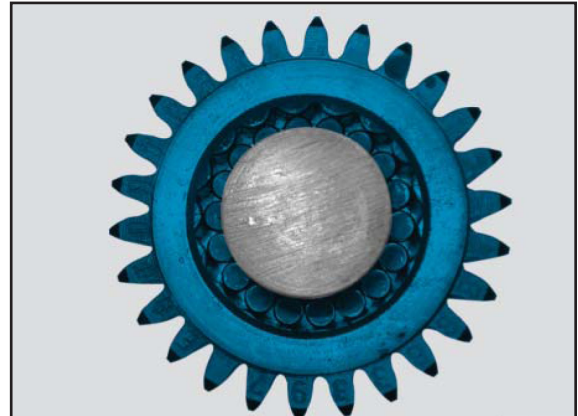
NOTE: There are 3 spacer washers: the two smaller ones must be placed at the ends and the largest one in the middle, between the two sets of rollers.



2940-146-1

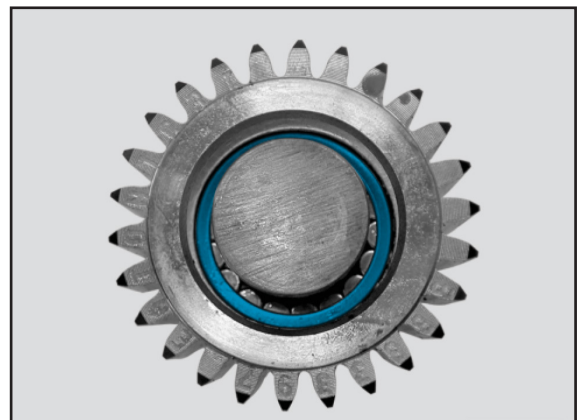
2. Install the planet gear and place the first set of 18 rollers against the first spacer washer.

NOTE: To make rollers positioning easier, use a screwdriver.



2940-146-2

3. Install the larger spacer washer over the first set of rollers.

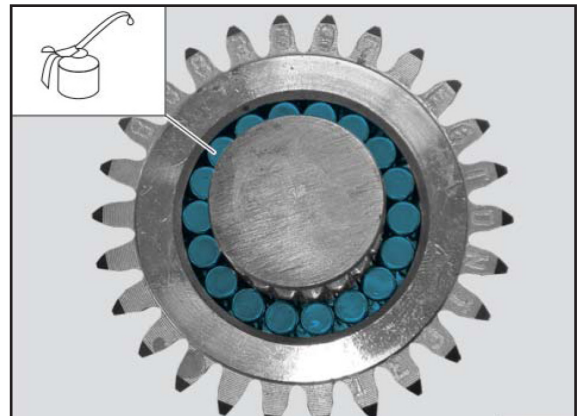


2940-146-3

4. Install the second set of 18 rollers over the larger spacer washer.

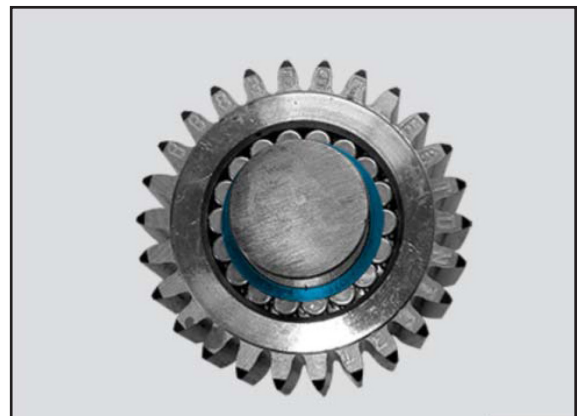
NOTE: To make rollers positioning easier, use a screwdriver.

NOTE: Lubricate the internal roller bearings of the planet gears with transmission oil.



2940-147-1

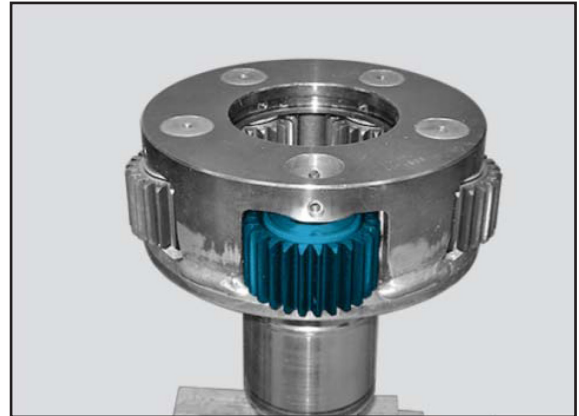
5. Install the third spacer washer over the second set of rollers.



2940-147-2

6. Install the second thrust washer over the planet gear and remove the spindle.
7. Clamp the planet gear carrier in a vise and install the planet gear with the installed bearing rollers in its seat, trying to center it with the spindles's through hole.

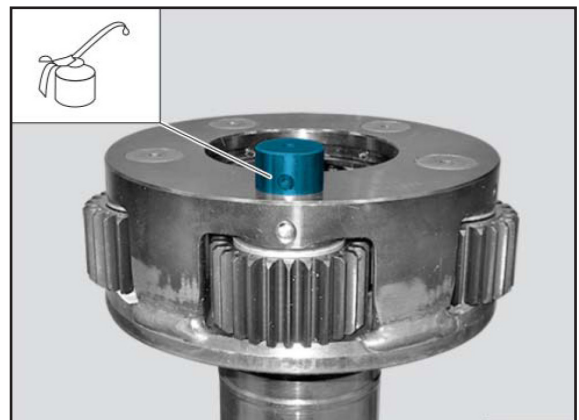
NOTE: The gear is symmetrical, but if it is being reused, use the reference mark to position it.



2940-147-3

8. Install the planet gear spindle by correctly aligning its locating hole with the grub screw hole in the carrier.

NOTE: Use a soft faced mallet, leaving the spindle flush with the planet gear carrier face.

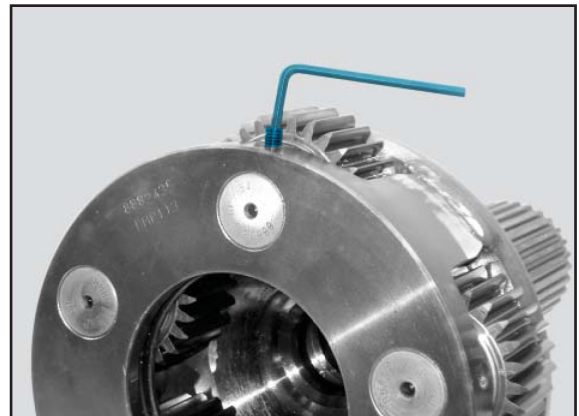


2940-148-1

9. Install the locating grub screw, tightening it with a torque of 5 Nm.

CAUTION: It is necessary to lock the grub screw by peening the beginning of the thread on the carrier.

NOTE: Repeat steps 1 to 9 for the other planet gears.



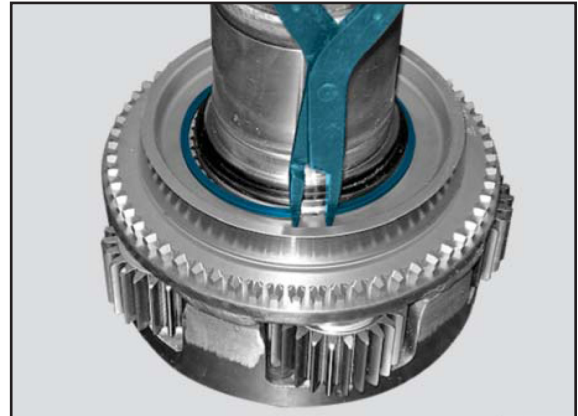
2940-142-1

10. With the planet carrier supported on a bench, install the synchronizer hub.



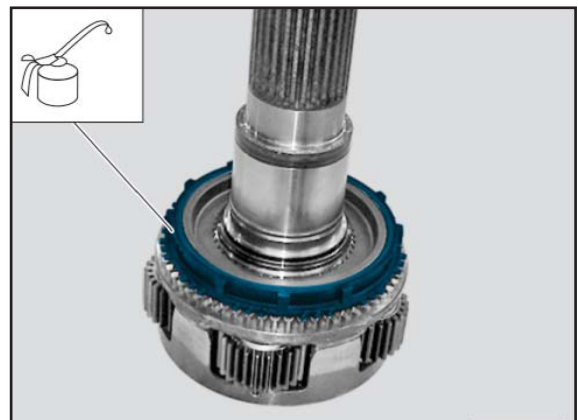
2940-141-3

11. Using appropriate pliers and a screwdriver, install the planetary reduction gear (GP) synchronizer cone snap ring.



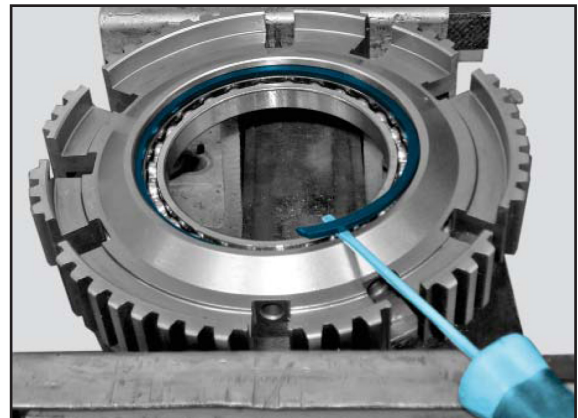
2940-149-1

12. Install the synchronizer cone.



2940-149-2

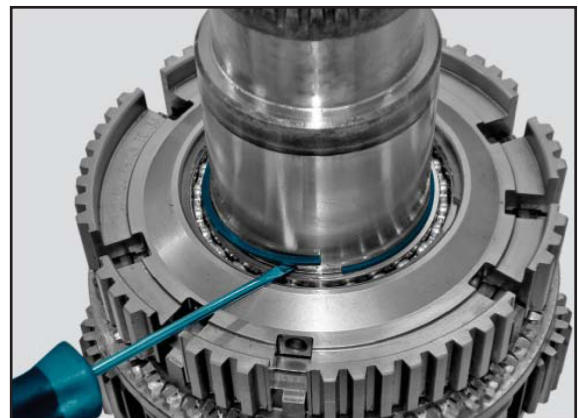
13. Install the bearing on the synchronizer hub and, using a screwdriver, install its snap ring.



2940-140-3

14. Install the synchronizer hub and, using a screwdriver, install the hub retaining snap ring.

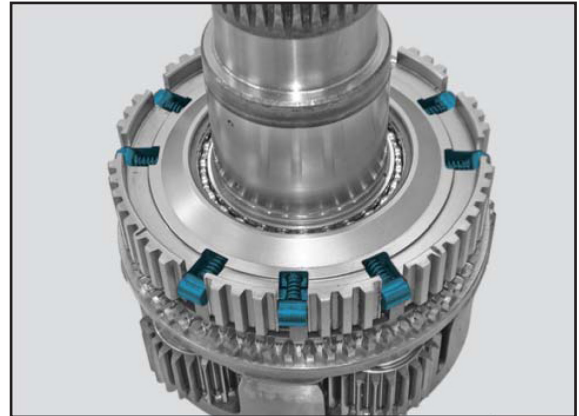
NOTE: Correctly align the hub with the synchronizer cone.



2940-140-1

15. Install the 9 detents on the synchronizer hub, positioning them correctly.

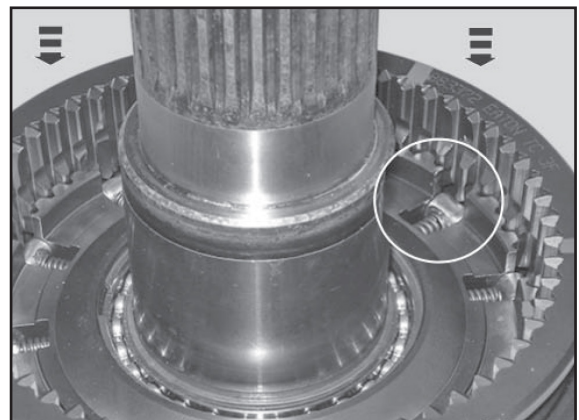
NOTE: To make the assembly easier, apply a thin film of grease to the detent rollers.



2940-150-2

16. Note that there are some recessed notches in the sliding clutch that must be aligned with the detent rollers to allow assembly. Without perfect alignment of these recesses with the detents, the sliding clutch cannot be assembled.

NOTE: Force the sliding clutch down, pushing it with both hands until the clutch locks onto the detents.



2940-150-3

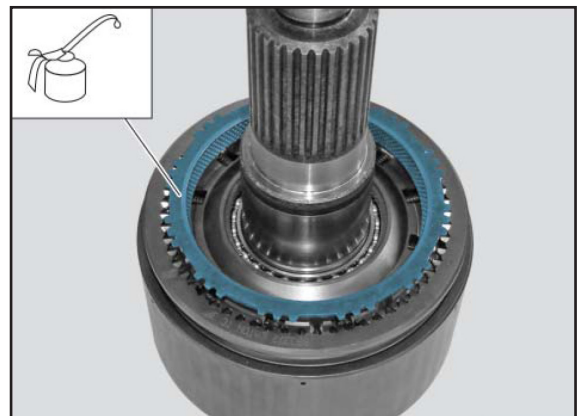
17. Install the sliding clutch with the sun gear, correctly aligning the reference marks.



2940-151-1

18. Install the synchronizer cone.

NOTE: Correctly align the cone with the synchronizer hub.



2940-151-2

19. Install the output speed sensor rotor.

NOTE: Place the smooth side facing up.

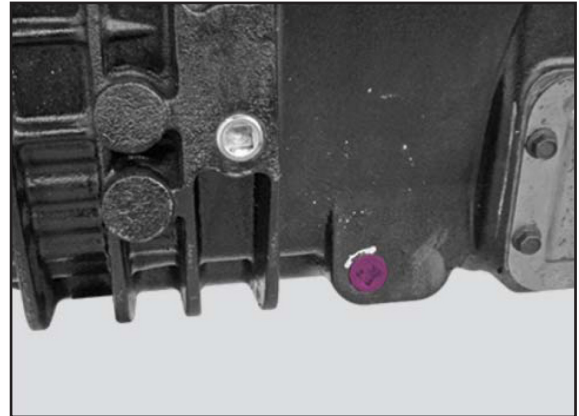


2940-151-3

Disassembly

1. Using a hoist, lift the transmission, remove the drain plug and drain the lubricating oil from the transmission.

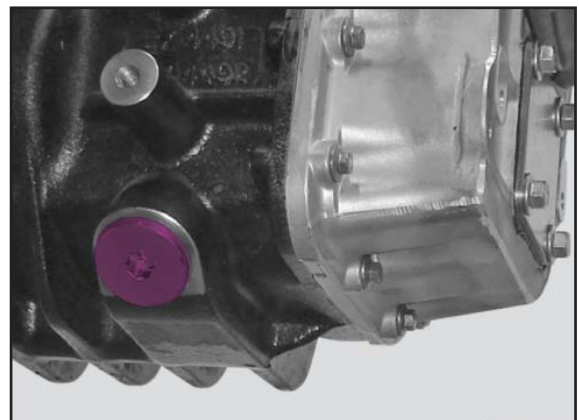
NOTE: Collect the transmission oil using a suitable container and send it to be recycled in accordance with current environmental regulations.



2940-153-1

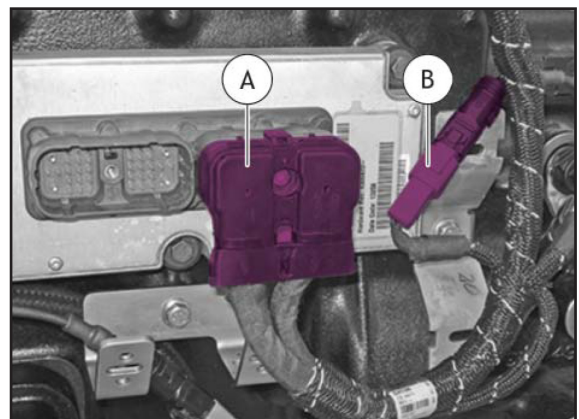
2. Remove the plug with the oil pump filter, draining the remaining oil.

NOTE: Collect the transmission oil using a suitable container and send it to be recycled in accordance with current environmental regulations.



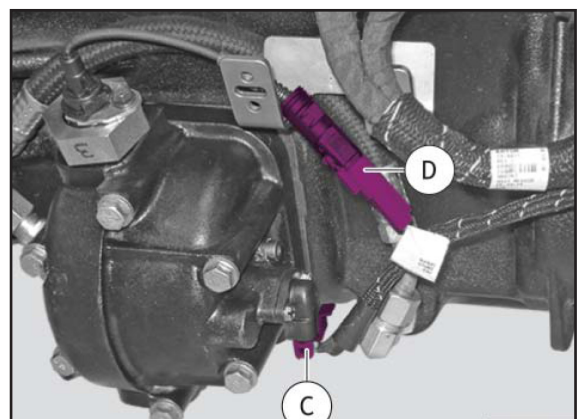
2940-153-2

4. Disconnect the following electrical connectors:
 - TCU – Transmission electronic control unit (A);
 - Main shaft speed sensor (B);



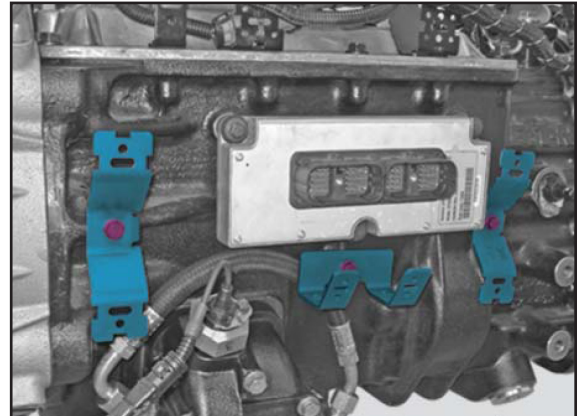
2940-153-4

- Inertia brake (C);
- Transmission input speed sensor (D).



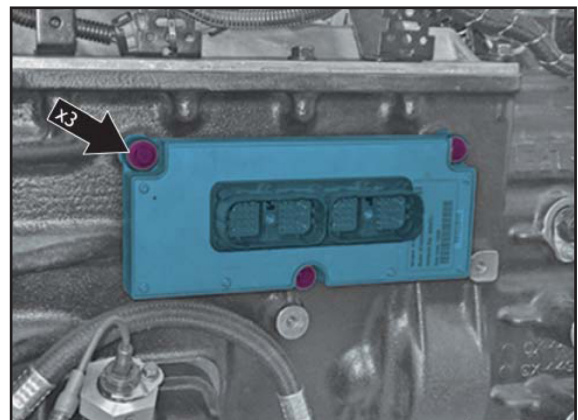
2940-154-1

5. Remove the retaining capscrews and wiring harness brackets.



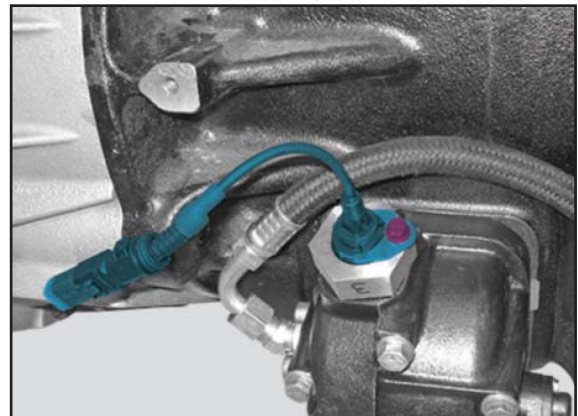
2940-154-2

6. Remove the retaining capscrews and the TCU.



2940-154-3

7. Remove the retaining bolt and the input speed sensor on the inertia brake.



2940-155-1

8. Loosen the connection fittings and remove the inertia brake hydraulic hose.

NOTE: Use a container to collect the lubricating oil.

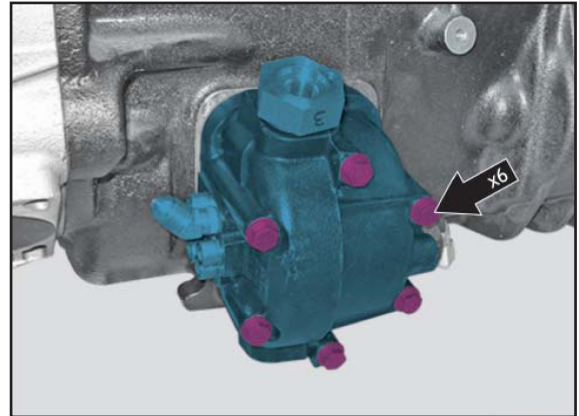


2940-155-2

Front Case

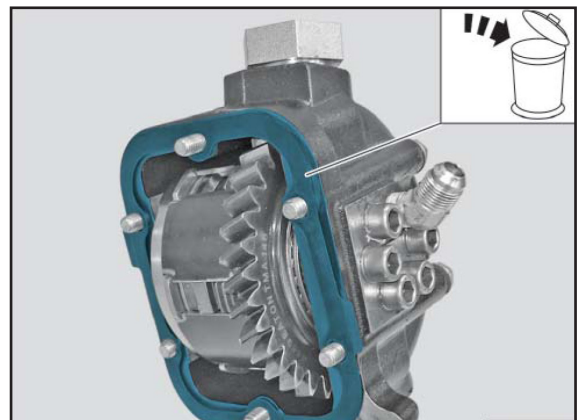
9. Remove the retaining capscrews and the inertia brake.

NOTE: Use a container to collect the lubricating oil.



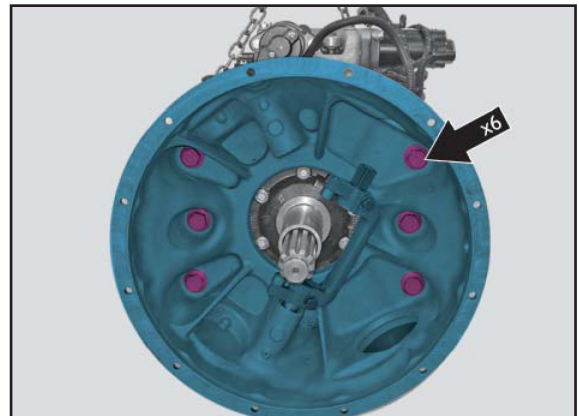
2940-155-3

10. Discard the inertia brake gasket.



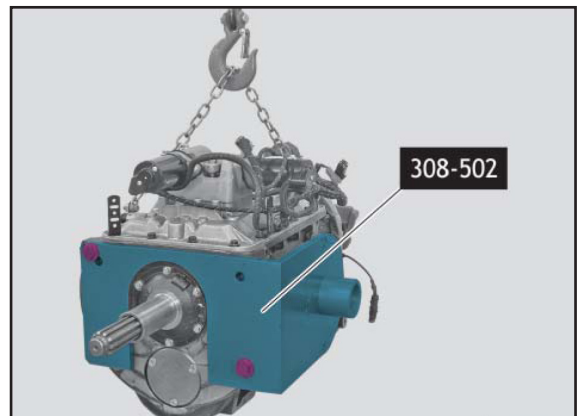
2940-156-1

11. Remove from the transmission front case, the retaining capscrews and the clutch housing.



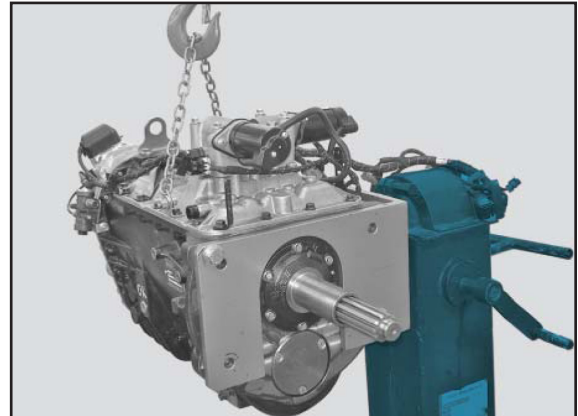
2940-184-3

12. Install bracket #308-502 on the transmission.



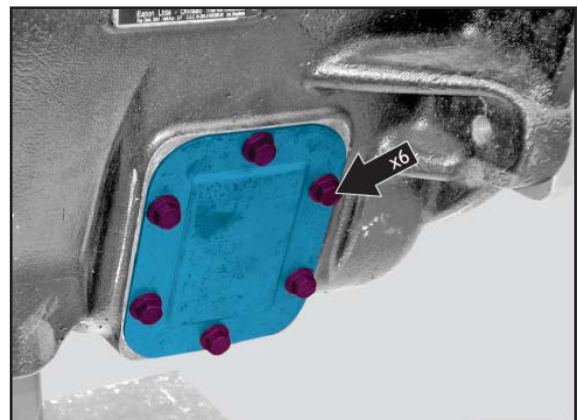
2940-156-3

13. Install the transmission onto the swivel stand.



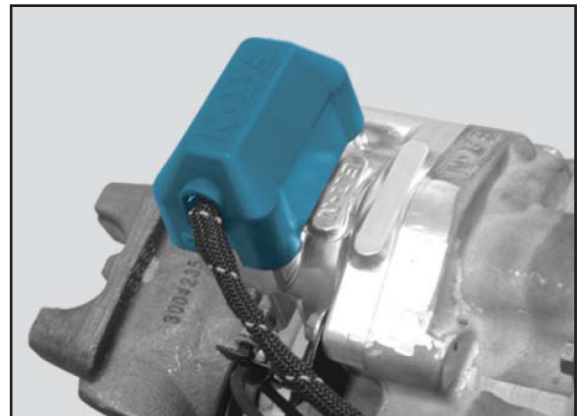
2940-157-1

14. Remove the retaining capscrews and the PTO cover.



2940-157-2

15. Remove the protective cover of the pneumatic valve electrical connector.



2940-157-3

16. Remove the remaining wiring harness connectors:

- Power supply to the electric gear shift actuators

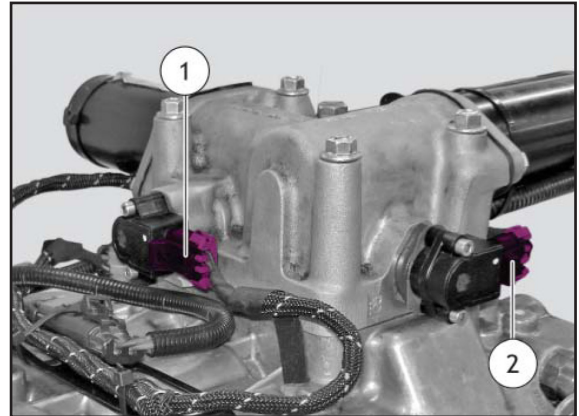


2940-158-1

Front Case

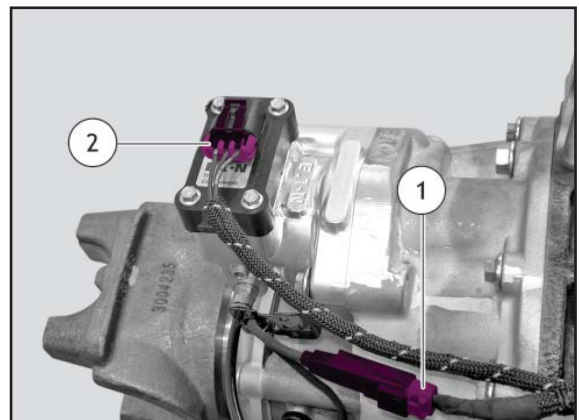


- Gear selection sensor (1) and gear shift sensor (2);



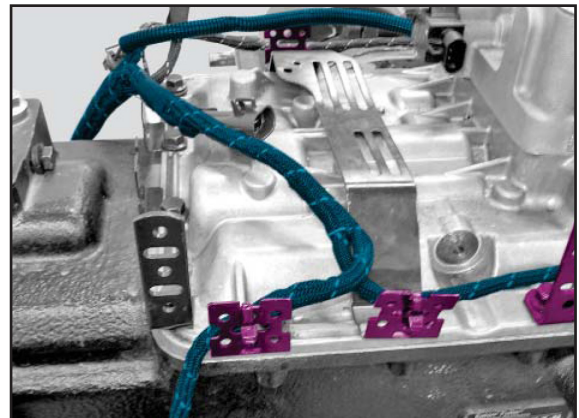
2940-158-2

- Output shaft speed sensor (1);
- Planetary reduction gear (GP) pneumatic actuator solenoid (2).



2940-158-3

17. Remove the retaining capscrews from the wiring harness brackets and remove the brackets together with the wiring harness.



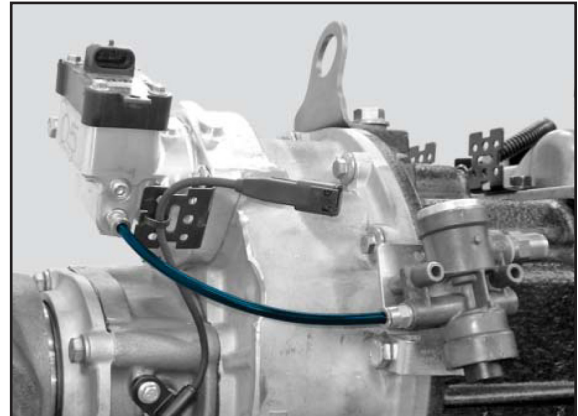
2940-159-1

18. Remove the retaining bolt and the main shaft speed sensor.



2940-159-2

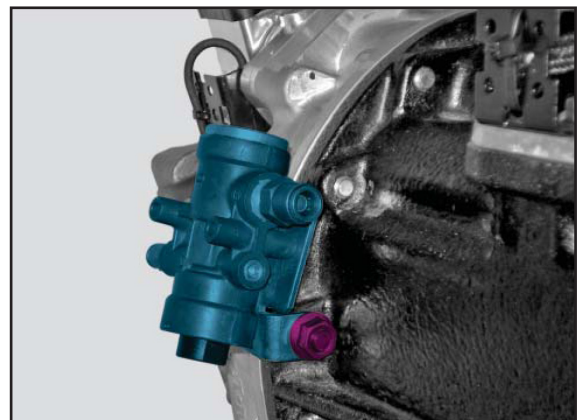
19. Remove the pressure reducing valve air supply line on the pneumatic valve of the planetary reduction gear.



2940-159-3

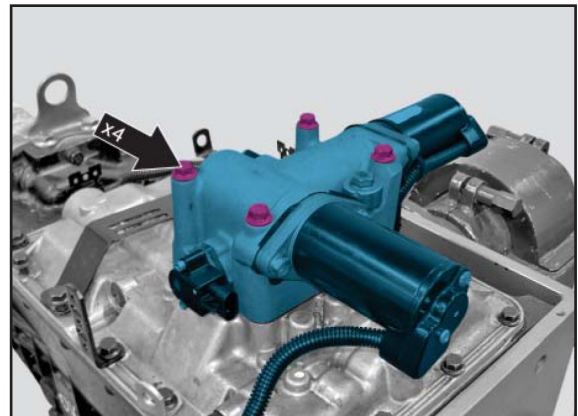
20. Remove the nut, retaining bolt and bracket with the pressure reducing valve.

NOTE: Mark the valve for later installation in the same position.



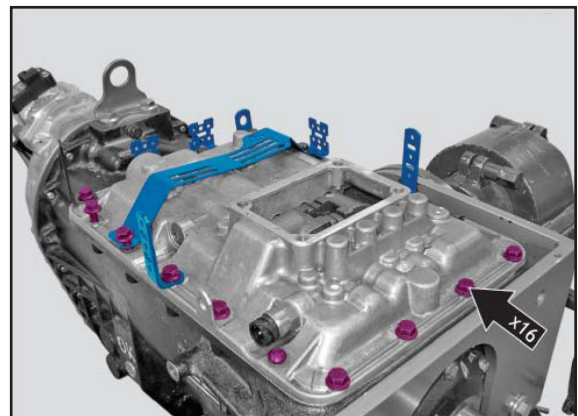
2940-160-1

21. Remove the retaining capscrews and remote shift control assembly.



2940-160-2

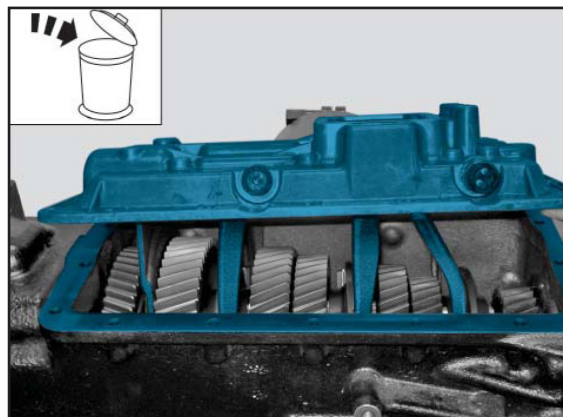
22. Remove the retaining capscrews and mounting brackets from the transmission top cover (shift bar housing).



2940-160-3

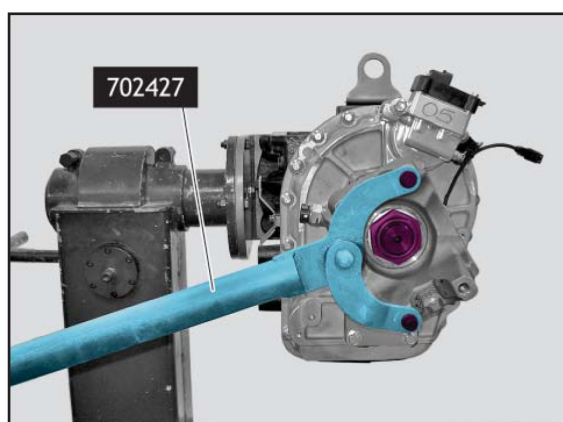
23. Remove the transmission shift bar housing.

NOTE: Discard the gasket.



2940-161-1

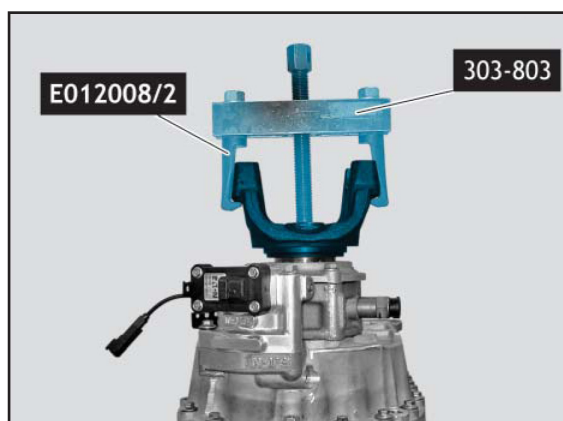
24. Using special tool #702427, remove the output flange retaining nut.



2940-161-2

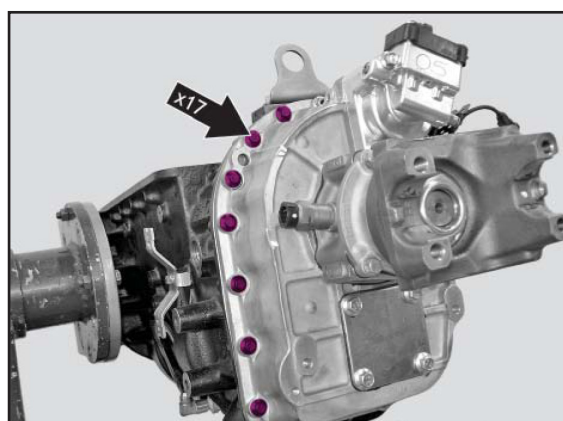
25. Detach the output flange using puller #303-803 and claws #E012008/02.

NOTE: Do not completely remove the output flange to use it as support for removing the planetary reduction gear section (rear case).



2940-161-3

26. Remove the retaining capscrews from the planetary reduction gear (GP) housing.



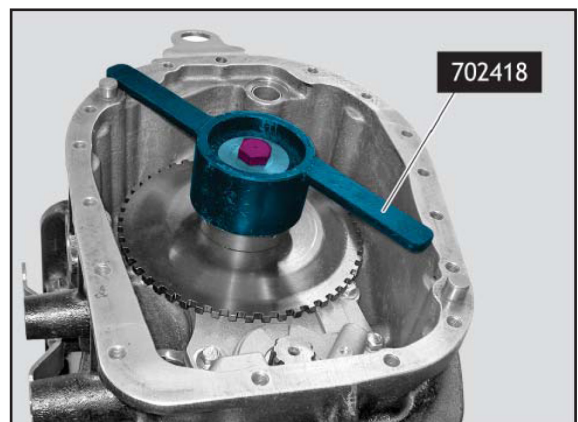
2940-162-1

27. Using a hoist, remove the planetary reduction gear (GP) section (rear case) from the transmission front case.



2940-162-2

28. Secure the sun gear with special tool #702418 and remove the retaining bolt and special washer.

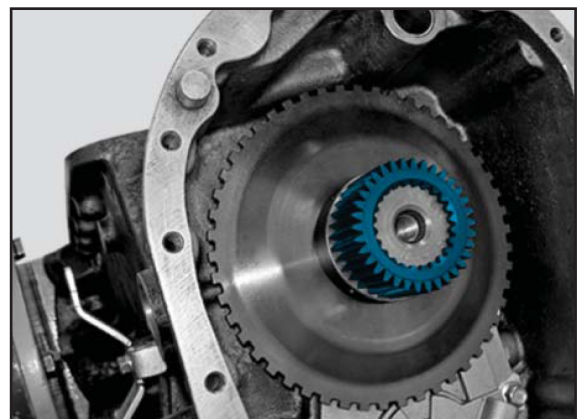


2940-162-3

29. Remove the sun gear by hand.

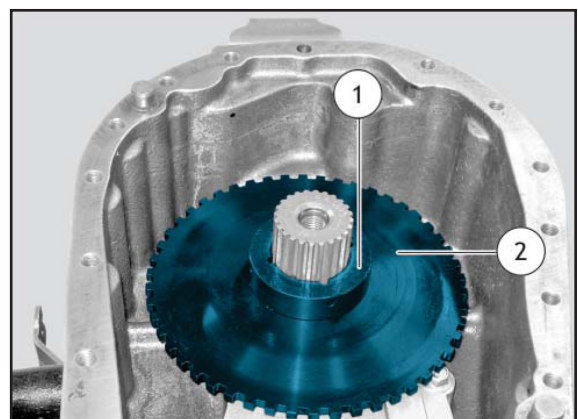
NOTE: If the sun gear presents any difficulty to be removed, use the #EAM09104 puller.

CAUTION: Make a reference mark on one side of the gear for later assembly in the same position.



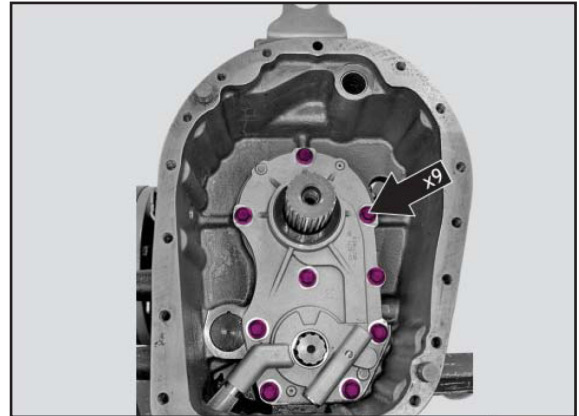
2940-163-1

30. Remove the retaining hub (1) and the phonic wheel (2).



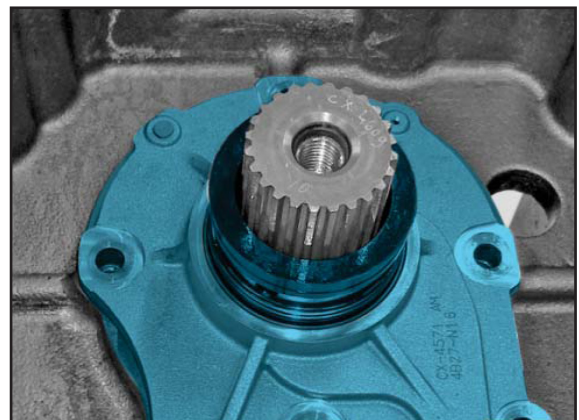
2940-163-2

31. Remove the lubricating oil pump retaining capscrews.



2940-163-3

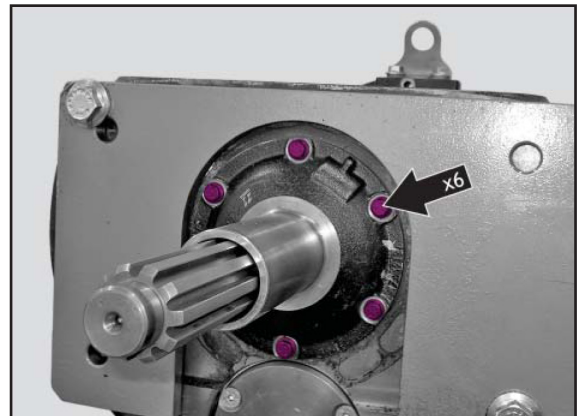
32. Remove the sleeve and the lubricating oil pump.



2940-164-1

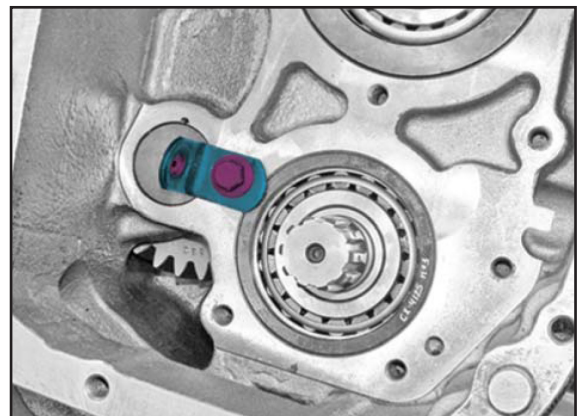
33. Remove the retaining capscrews and the cover with the input shaft.

NOTE: Use a rubber hammer to detach the cover from the housing.



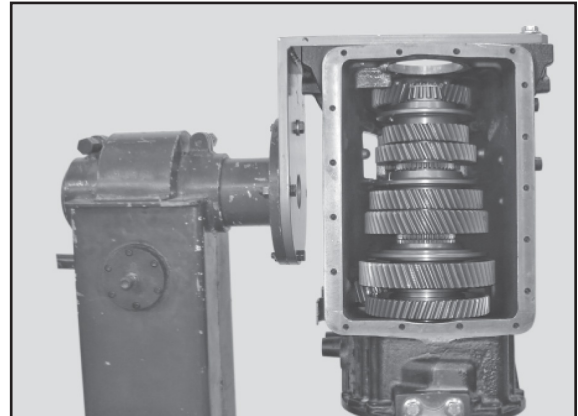
2940-164-2

CAUTION: Install a lifting eye plate to secure and prevent the reverse gear shaft and countershaft bearing thrust washer from falling.



2940-164-3

34. Rotate the transmission and place it vertically with the front facing up.



2940-165-1

35. Move the main shaft and countershaft so that the main shaft bearing cup seat dislocates to allow the main shaft to be removed.



2940-165-2

36. Rotate the transmission to a horizontal position.
37. Using a suitable sling belt wrapped around the main shaft and, using a hoist, remove the main shaft from the transmission.

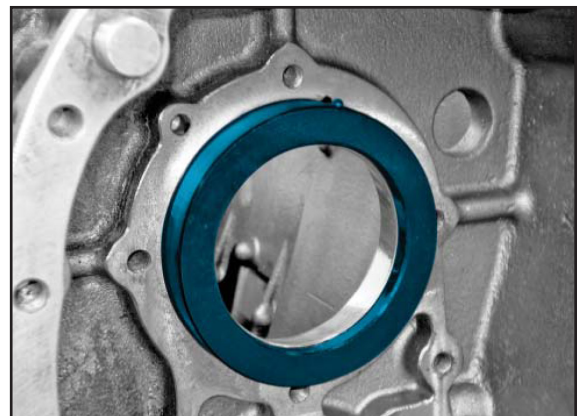
NOTE: Request help from an assistant.



2940-165-3

38. Remove the main shaft bearing cup seat.

CAUTION: Pay attention to the bearing cup seat locating ball fitted in the transmission housing.



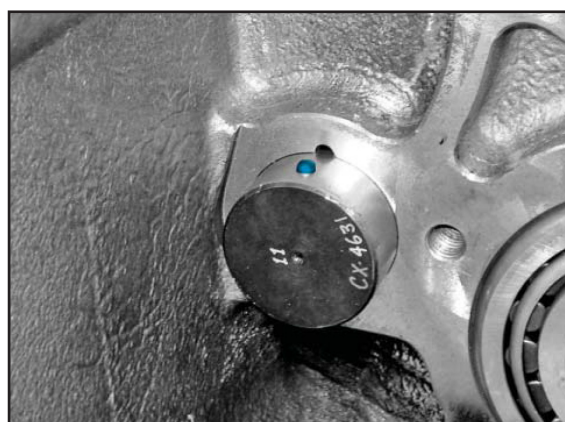
2940-166-1

39. Remove the reverse idler gear shaft.



2940-166-2

NOTE: Remove and store separately the shaft locating ball.

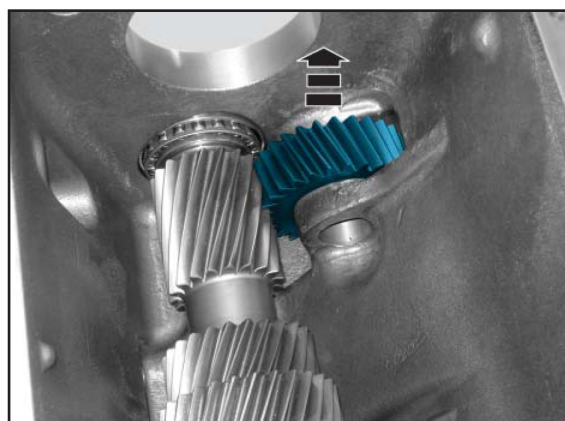


2940-166-3

40. Remove the reverse idler gear with its bearings.

NOTE: To help in removal, rotate the countershaft while removing the idler gear.

CAUTION: After removal, make a reference mark on one side of the gear for later assembly in the same position.



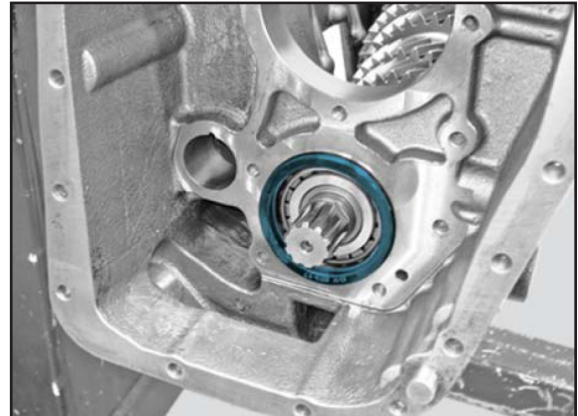
2940-167-1

41. Displace the countershaft to remove the bearing cup from the housing.



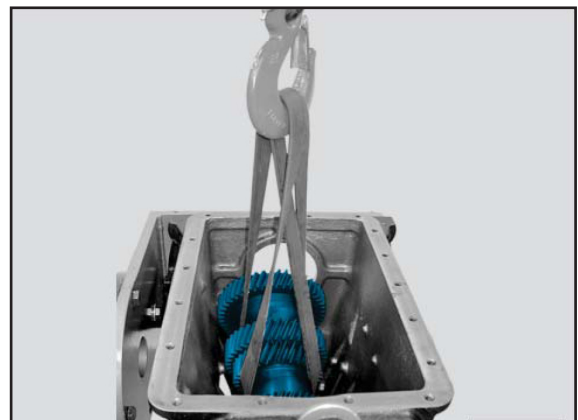
2940-167-2

42. Remove the shim washer and countershaft rear bearing cup.



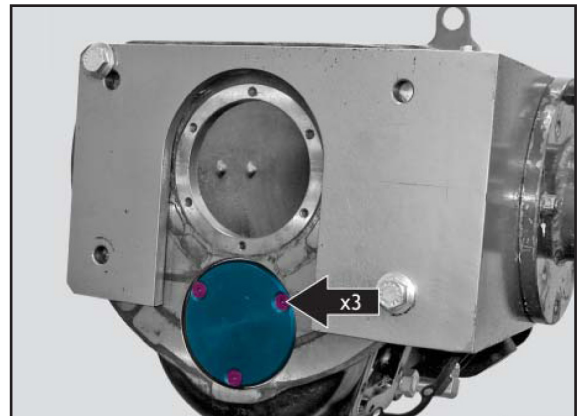
2940-167-3

43. Remove the countershaft using a sling belt and a hoist.



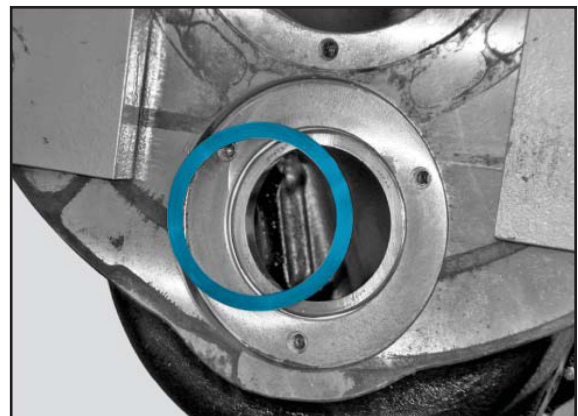
2940-168-1

44. Remove the retaining capscrews, the cover and the countershaft end play adjustment shims.



2940-168-2

45. Remove the countershaft end play adjustment shims.



2940-168-3

Front Case

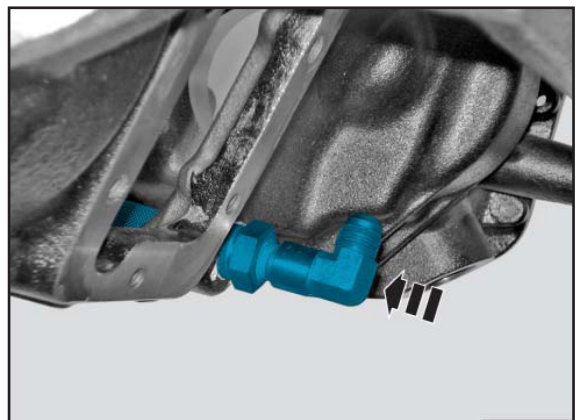


46. Remove the countershaft front bearing cup from the housing.



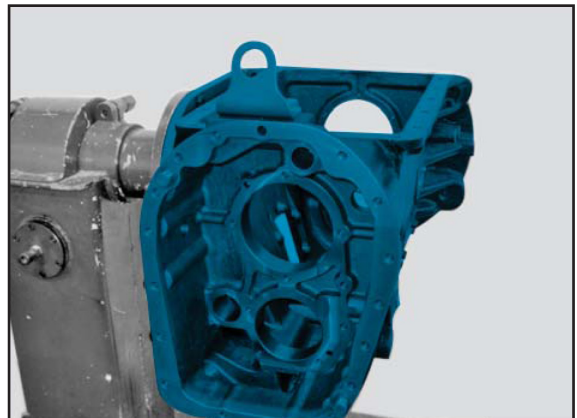
2940-169-1

47. Remove the fitting with the oil filter from the housing.



2940-169-2

48. Remove the housing from the stand for washing and inspection.

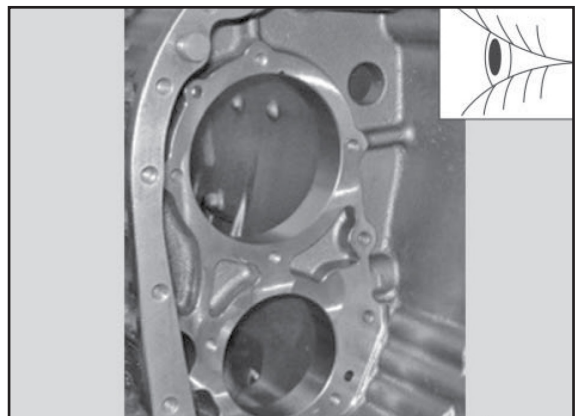


2940-169-3

Housing Inspection

1. Check housing for cracks or breaks.
2. Check input shaft and main shaft bearing cups housing bores for signs of wear or deformation.
3. Check housing threads for mounting capscrews and fittings.

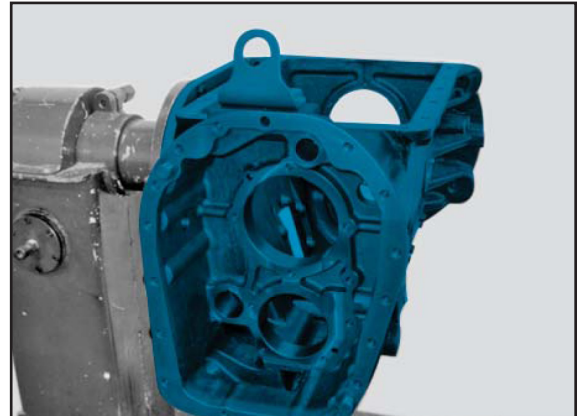
NOTE: Repair the damaged thread or replace the housing if the thread cannot be repaired.



2940-170-1

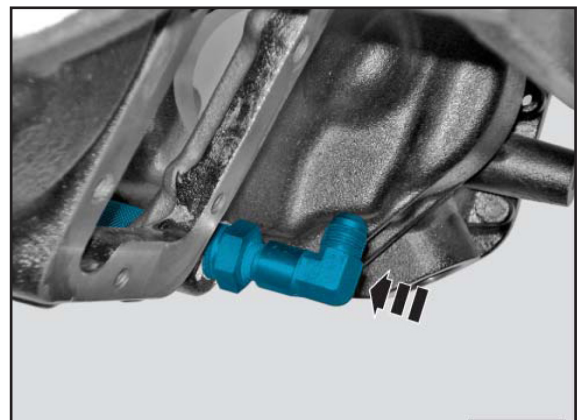
Assembly

1. Install the transmission housing onto the swivel stand.



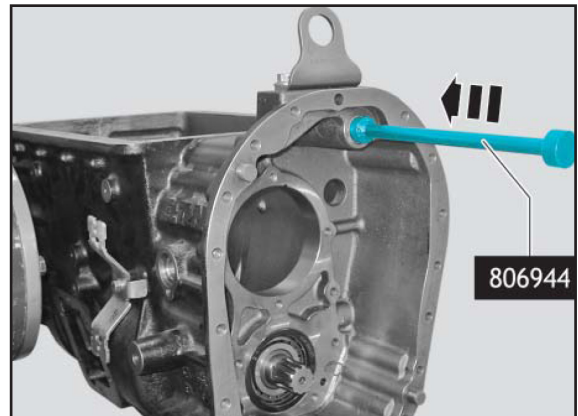
2940-169-3

2. Install the fitting with the oil filter in the housing, applying a torque of 41 Nm.



2940-170-3

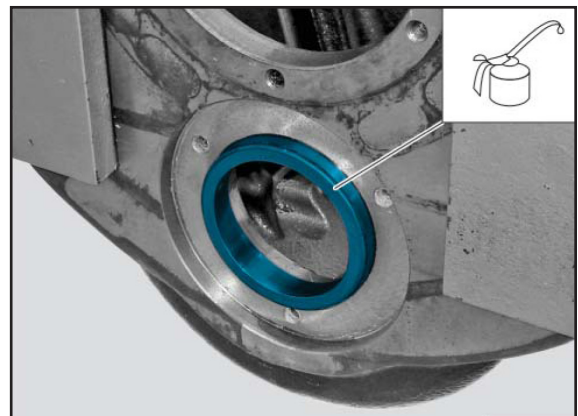
3. If removed, install the metal bushing of the planetary reduction gear (GP) shift yoke shaft using special tool #806944 and a soft face mallet.



2940-171-1

4. Install the countershaft front bearing cup.

NOTE: Use a rubber mallet if necessary.

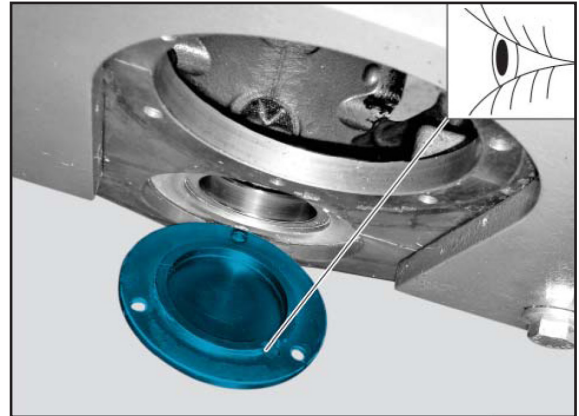


2940-171-2

Front Case

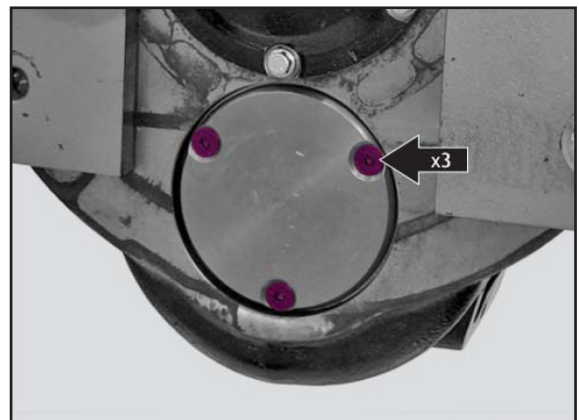
5. Install the countershaft front cover without the end play adjustment shims.

CAUTION: Pay attention to the mounting position.



2940-171-3

6. Install the cover retaining capscrews and tighten them by hand.

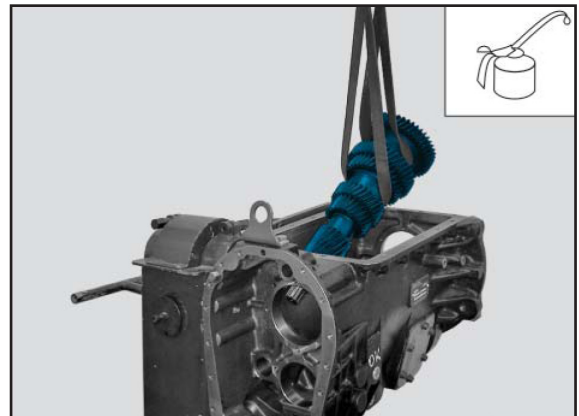


2940-172-1

7. Install the countershaft into the transmission housing using a sling belt and hoist.

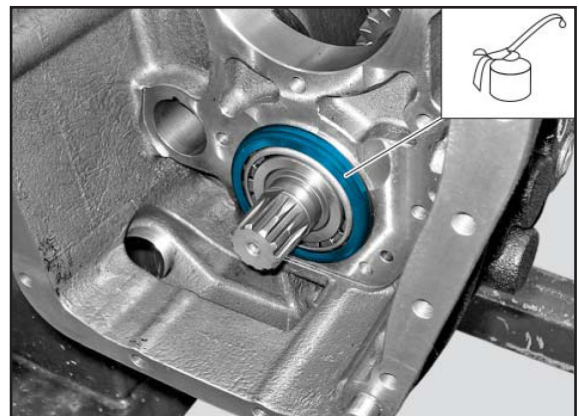
NOTE: Lubricate both countershaft bearings with transmission oil.

NOTE: Lubricate the countershaft rear bearing cup internally and externally with specified lubricant.



2940-172-2

8. Rotate the transmission and place it vertically with the rear facing up.
9. Install the countershaft rear bearing cup into the housing, without installing it completely.



2940-172-3

10. Install the reverse idler gear.

CAUTION: Use the position mark made during disassembly to maintain its original position.

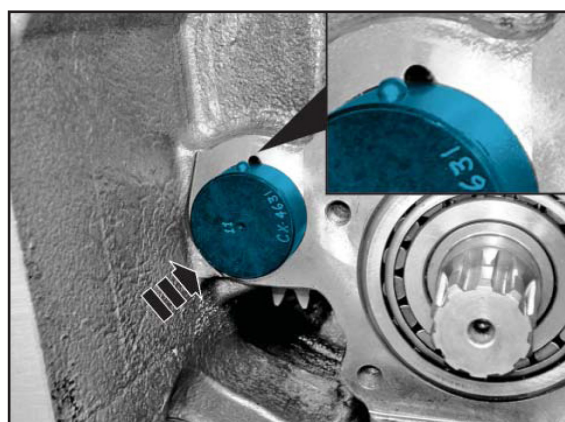
NOTE: Rotate the countershaft to make assembly easier.



2940-173-1

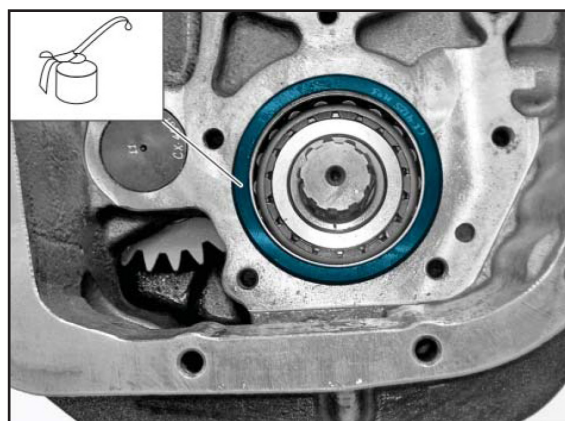
11. Place the transmission horizontally and install the reverse idler gear shaft.

CAUTION: Pay attention to the shaft locating ball fitted into the transmission housing.



2940-173-2

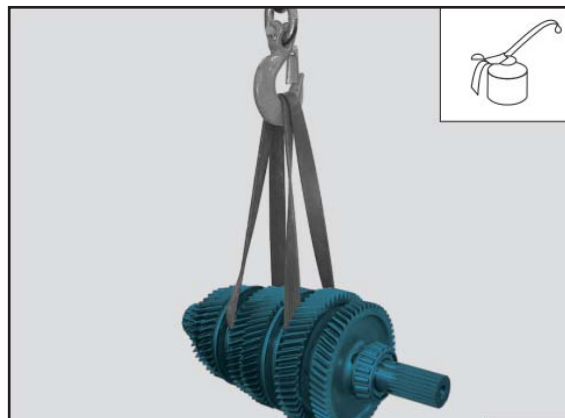
12. Install the countershaft rear bearing cup spacer.



2940-173-3

13. Using a hoist and sling belt, raise the main shaft.

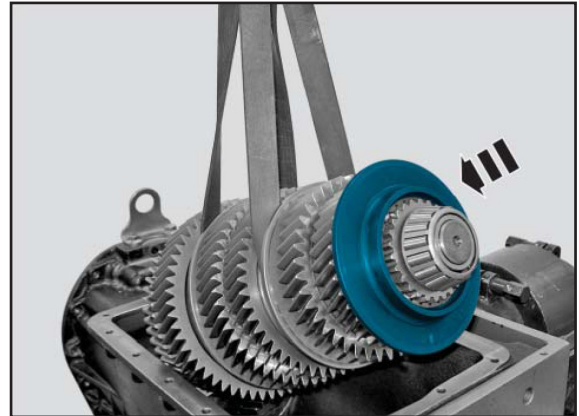
NOTE: Lubricate both main shaft bearings with transmission oil.



2940-174-1

14. Place the 4th and 5th speed sliding clutch onto the main shaft and install the main shaft into the transmission housing.

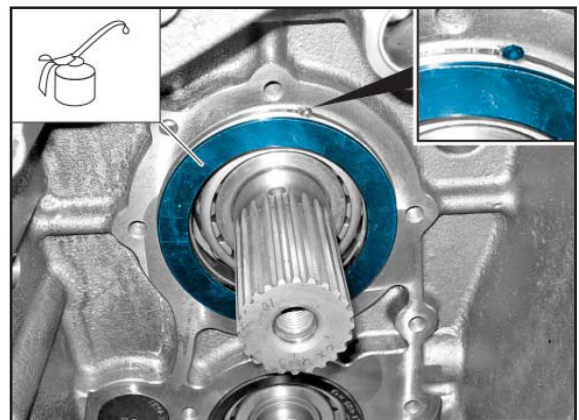
NOTE: Request help from an assistant.



2940-174-2

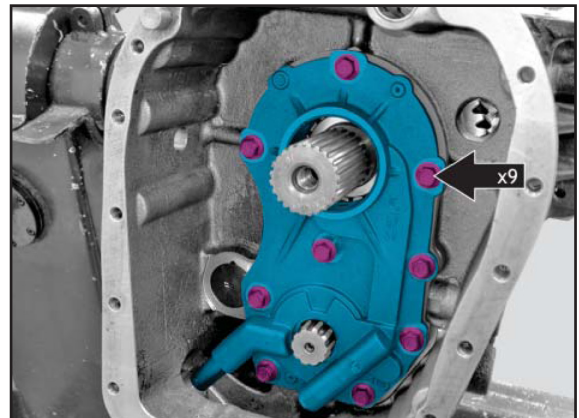
15. Install the main shaft rear bearing cup seat into the housing.

CAUTION: Pay attention to the rear bearing cup seat locating ball fitted in the transmission housing.



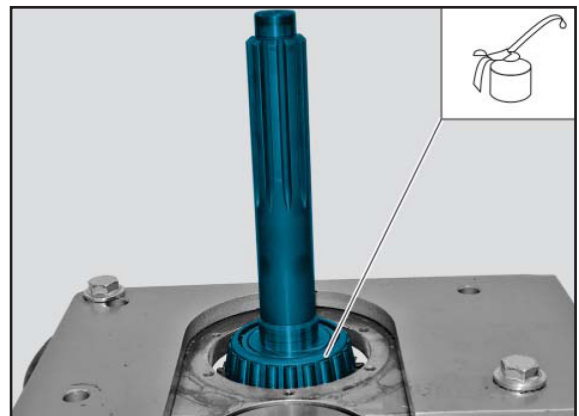
2940-174-3

16. Place the oil pump in the housing, correctly aligning the countershaft splines with the pump rotor splines and install the retaining capscrews without tightening them.



2940-175-1

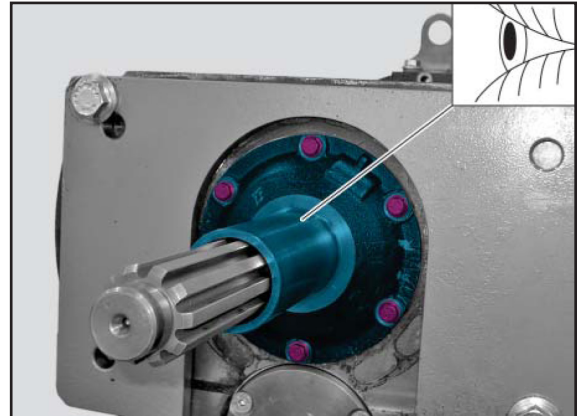
17. Rotate the transmission and place it vertically with the front facing up.
18. Install the input shaft.



2940-175-2

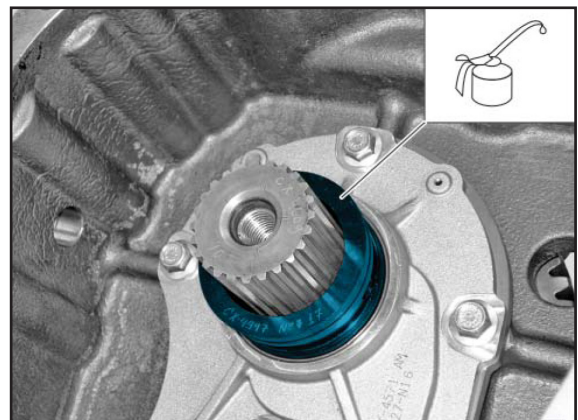
19. Without the end play adjustment shims, install the input shaft cover and its retaining capscrews tightening them by hand.

CAUTION: The lubrication channel in the cover must be facing upwards.



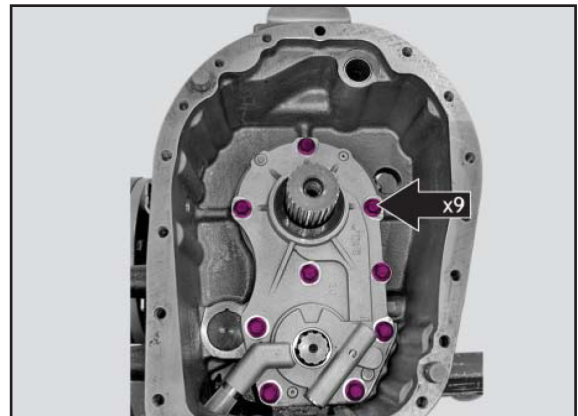
2940-175-3

20. Rotate the transmission.
21. Install the lubrication sleeve on the oil pump.



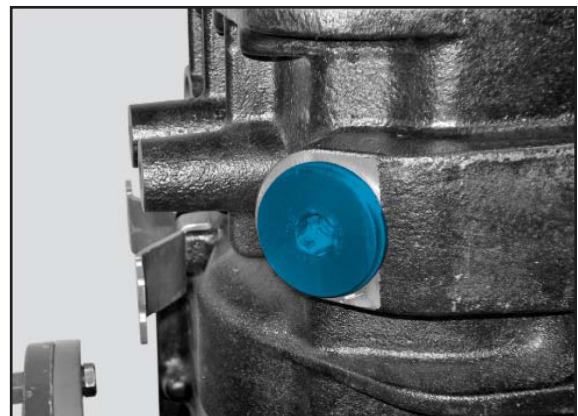
2940-176-1

22. Tighten the lubricating oil pump capscrews by applying a torque of 37 Nm.



2940-176-2

23. Install the drain plug with the oil pump filter, applying a torque of 44 Nm.

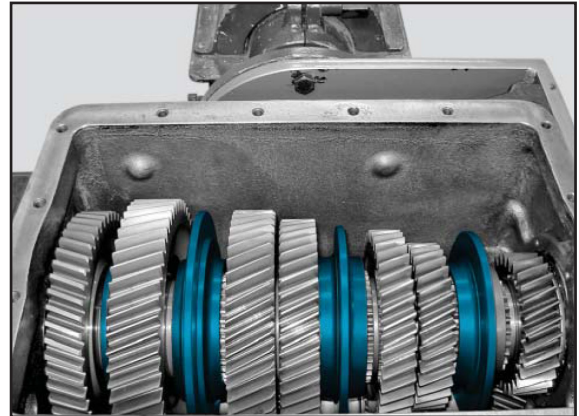


2940-176-3

Front Case



- 24. Place the gearbox horizontally.
- 25. Place all gears in neutral.

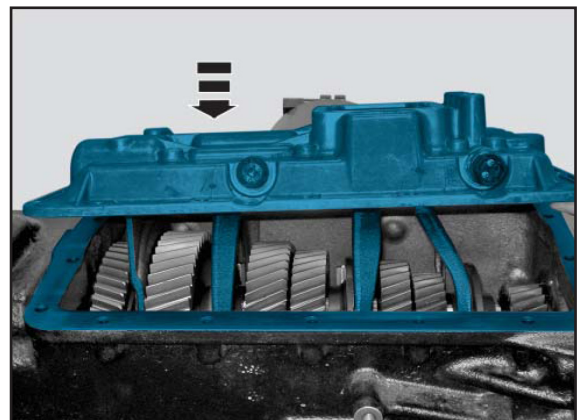


2940-177-1

- 26. Install the shift bar housing assembly (top cover) with only 4 capscrews, tightening them by hand.

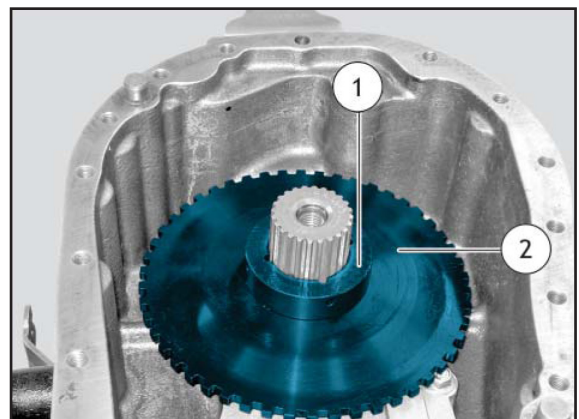
NOTE: Install a new gasket.

- 27. Check the the main shaft and countershaft end play.



2940-177-2

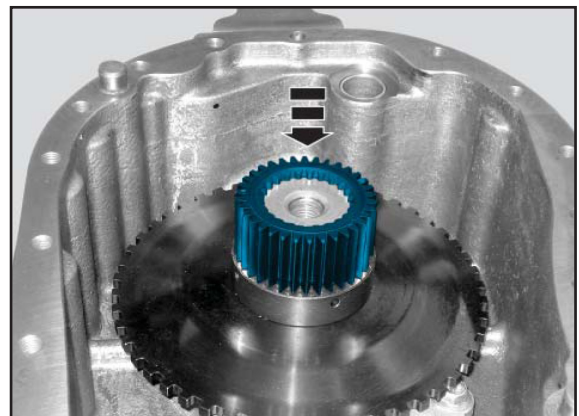
- 28. Install the phonic wheel (2) and the retaining hub (1) on the main shaft.



2940-121-1

- 29. Install the sun gear onto the main shaft.

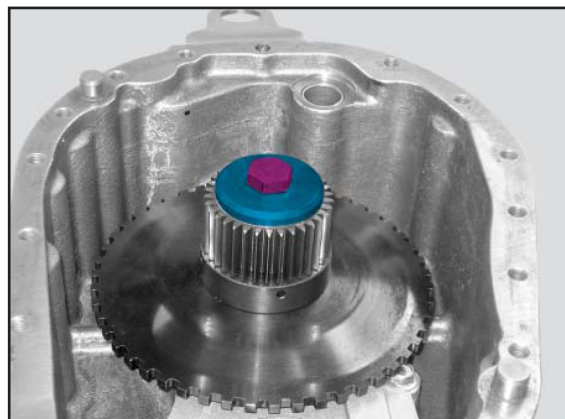
NOTE: Use the reference mark made during disassembly to maintain its original position.



2940-178-1

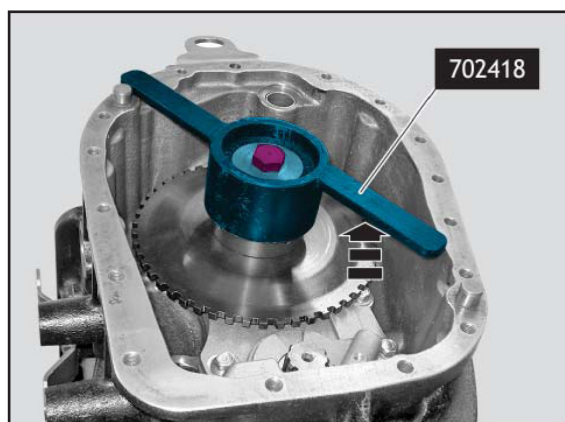
30. Install the sun gear retaining washer and bolt.

NOTE: Apply Loctite 270 to the bolt thread.



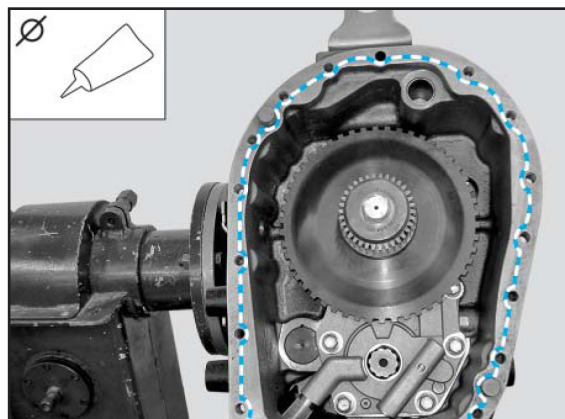
2940-178-2

31. Secure the sun gear with special tool #702418 and apply a torque of 240 Nm to its retaining bolt.



2940-135-2

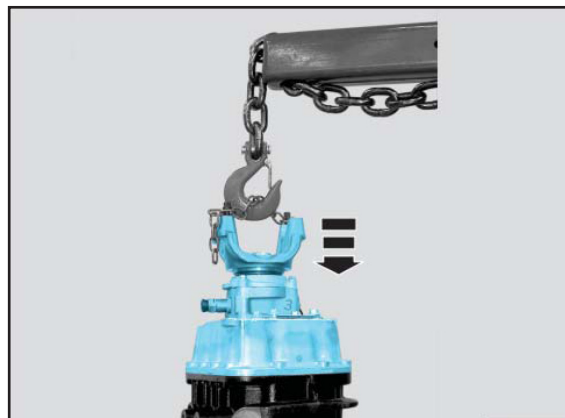
32. Apply a 4 mm bead of Loctite 5900 to the junction surface of the front and rear cases.



2940-179-1

33. Using a hoist, install the planetary reduction gear (GP) section (rear case) onto the transmission front case, observing the correct alignment between the sun gear and the planet gears of the reduction gear assembly.

NOTE: If necessary, shift into a gear and rotate the input shaft to align the gears.

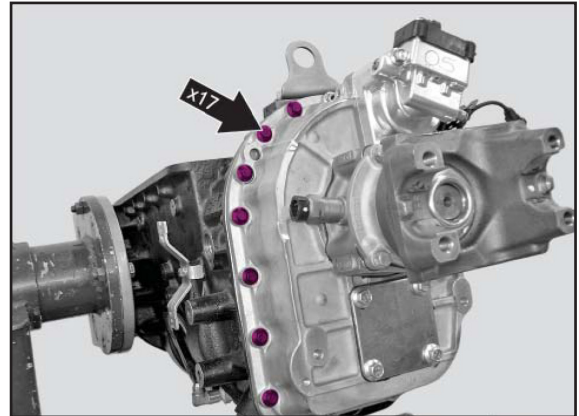


2940-179-2

Front Case



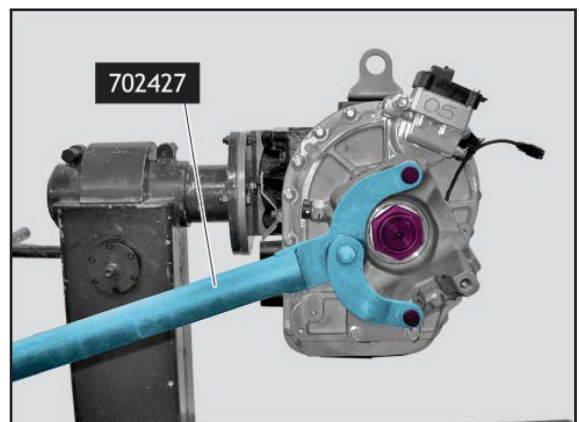
34. Install the planetary reduction gear section (rear case) retaining capscrews, applying a torque of 50 Nm.



2940-162-1

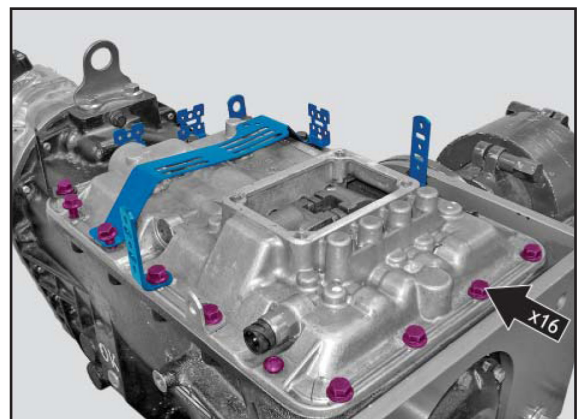
35. Using special tool #702427, apply a torque of 650 Nm to the output shaft flange retaining nut.

NOTE: Use a new nut.



2940-119-1

36. Install the mounting brackets and retaining capscrews on the transmission top cover (shift bar housing), applying a torque of 51 Nm.

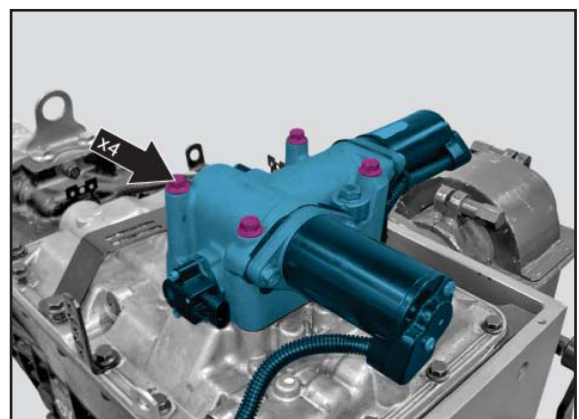


2940-180-2

37. With the transmission in neutral, install the remote shift control assembly onto the shift bar housing, applying a torque of 37 Nm to the retaining capscrews.

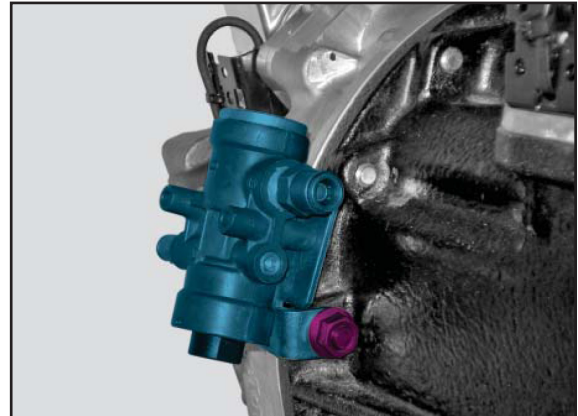
NOTE: Install a new gasket.

NOTE: Observe the correct position of the remote shift control in the picture.



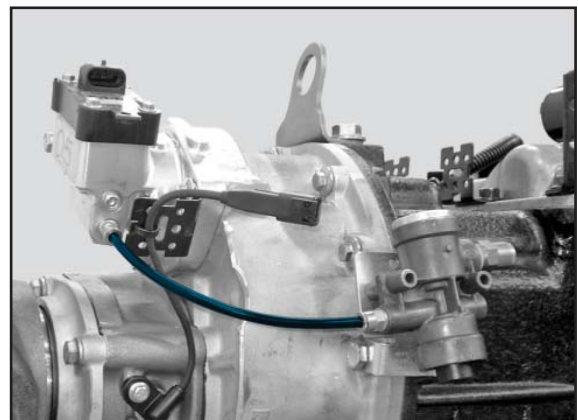
2940-160-2

38. Place the bracket with the pressure reducing valve in the transmission housing and install the bolt and retaining nut applying a torque of 50 Nm.



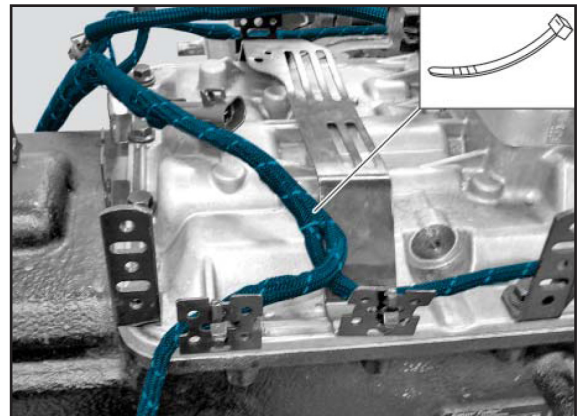
2940-160-1

39. Install the pressure reducing valve air supply line on the pneumatic valve of the planetary reduction gear.



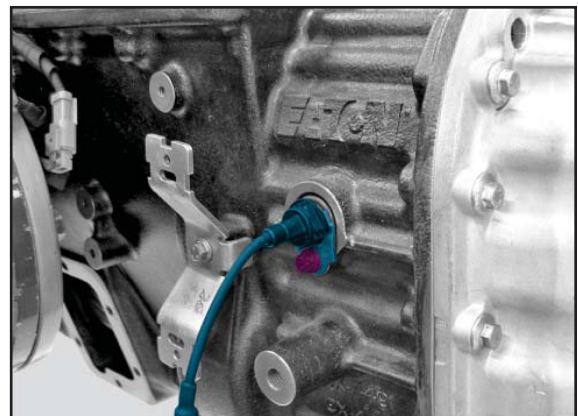
2940-159-3

40. Install the wiring harness on the top cover retaining bracket and secure it using nylon cable ties.



2940-181-3

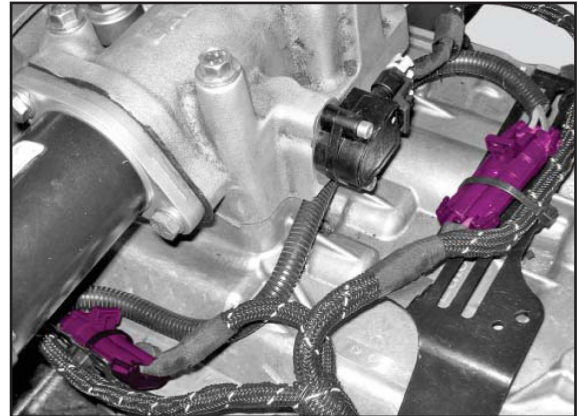
41. Install the main shaft speed sensor by applying a torque of 29 Nm to the fastening bolt.



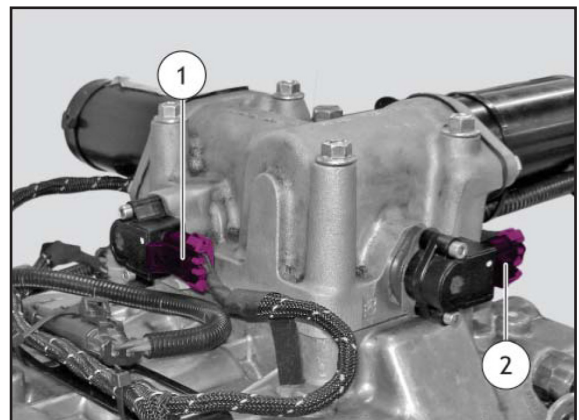
2940-182-1

42. Install the following electrical connectors:

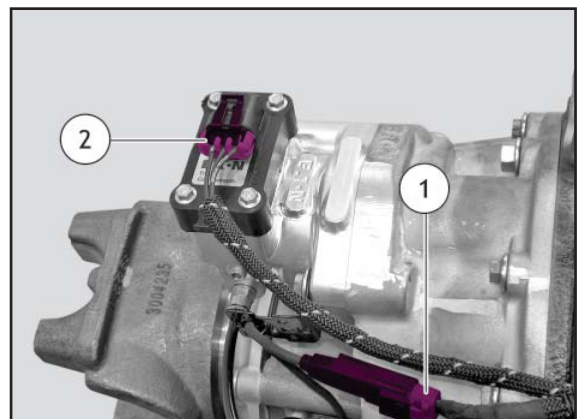
- Power supply to the electric gear shift actuators;
- Gear selection sensor (1) and gear shift sensor (2);
- Output shaft speed sensor (1);
- Planetary reduction gear pneumatic actuator solenoid (2).



2940-158-1

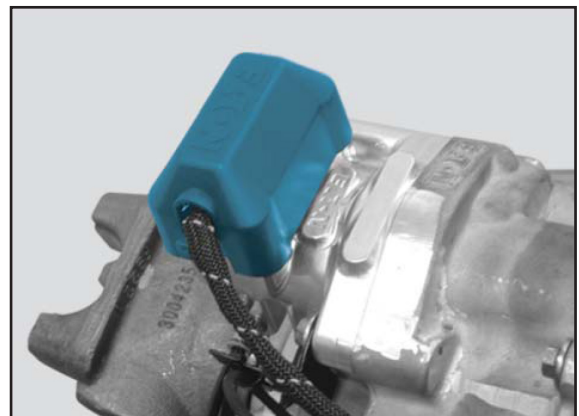


2940-158-2



2940-158-3

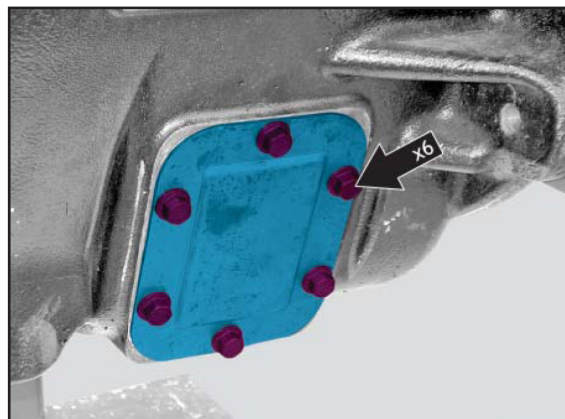
43. Install the protective cover of the planetary gear pneumatic actuator connector.



2940-157-3

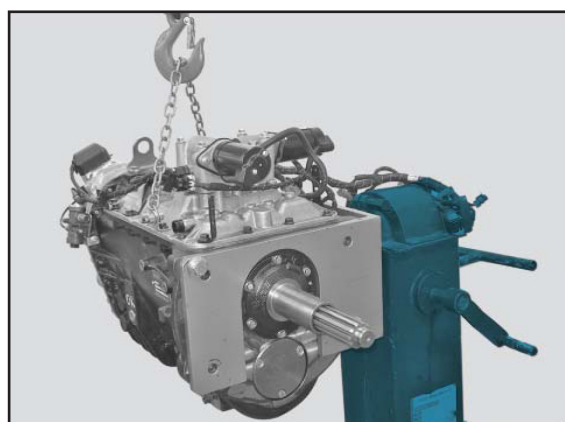
44. Install the PTO cover by applying a torque of 37 Nm to its retaining capscrews.

NOTE: Apply a 4 mm bead of Loctite 5900 sealant to the cover sealing surface.



2940-157-2

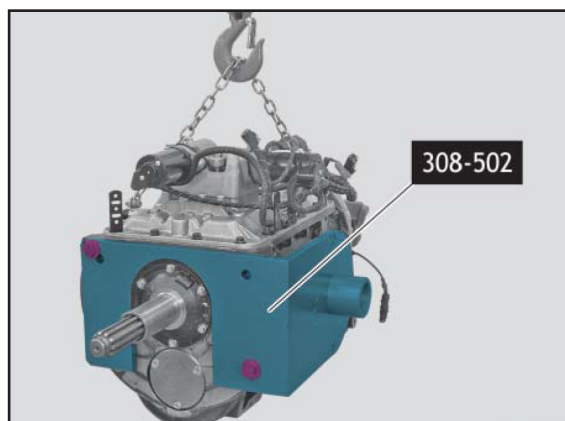
45. Remove the transmission from the stand.



2940-157-1

46. Place the transmission on a solid base.

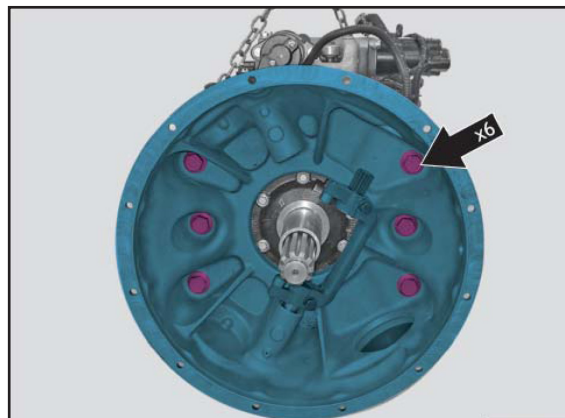
47. Remove bracket #308-502 from the transmission.



2940-156-3

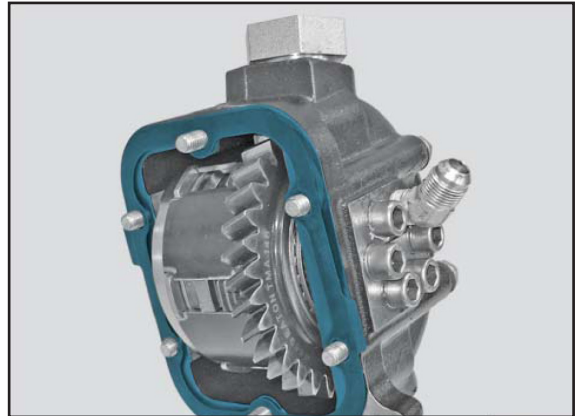
48. Place the clutch housing on the transmission front case and install the retaining capscrews applying a torque of 205 Nm.

NOTE: Apply Loctite 272 threadlocker or similar to the capscrew threads.



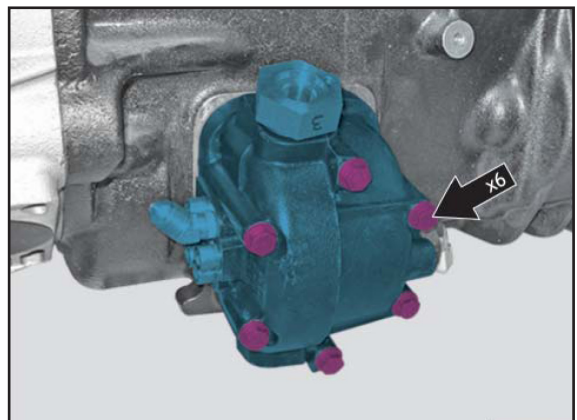
2940-184-3

49. Install a new gasket on the inertia brake.



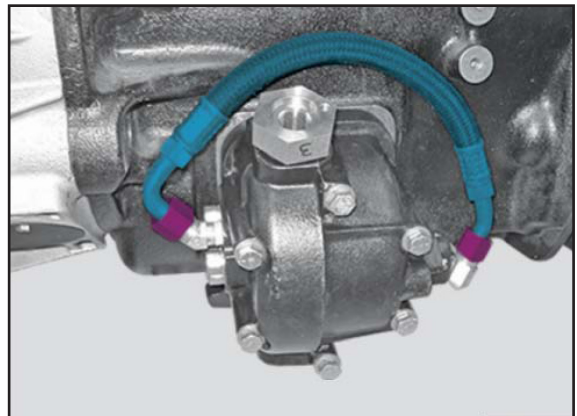
2940-185-1

50. Install the inertia brake by applying a torque of 58 Nm to its retaining capscrews.



2940-155-3

51. Install the inertia brake hydraulic hose by applying a torque of 51 Nm to the fittings.



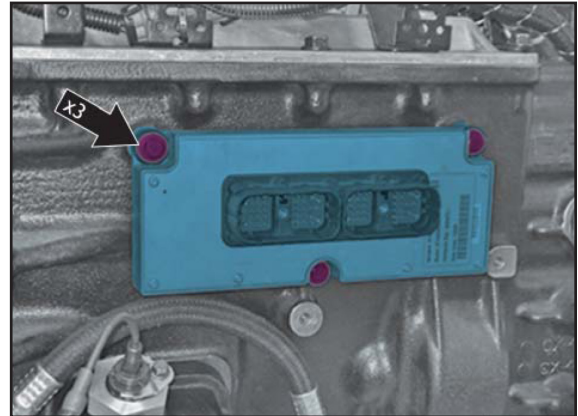
2940-155-2

52. Install the inertia brake speed sensor by applying a torque of 29 Nm to its retaining bolt.



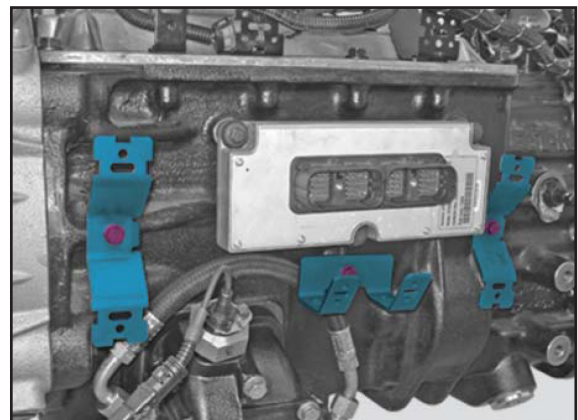
2940-155-1

53. Install the TCU by applying a torque of 11 Nm to its retaining capscrews.



2940-154-3

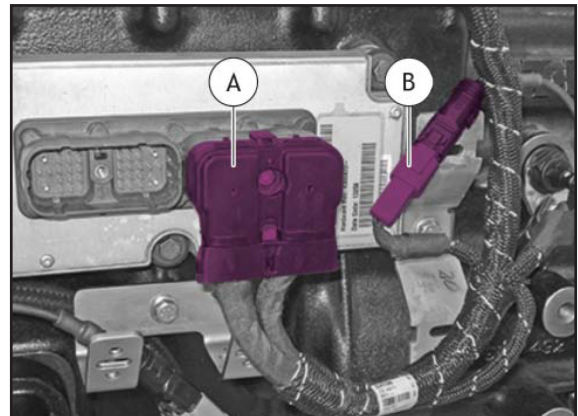
54. Install the wiring harness brackets by applying a torque of 22 Nm to their retaining capscrews.



2940-154-2

55. Install the following electrical connectors:

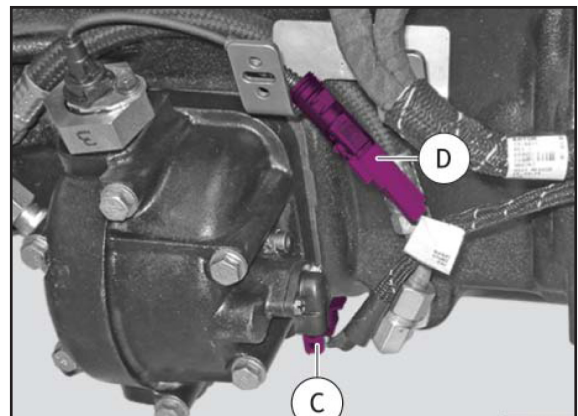
- TCU – Transmission electronic control unit (A);
- Main shaft speed sensor (B);



2940-153-3

- Inertia brake (C);
- Inertia brake speed sensor (D).

56. Install nylon cable ties to secure the wiring harness to the brackets.



2940-154-1

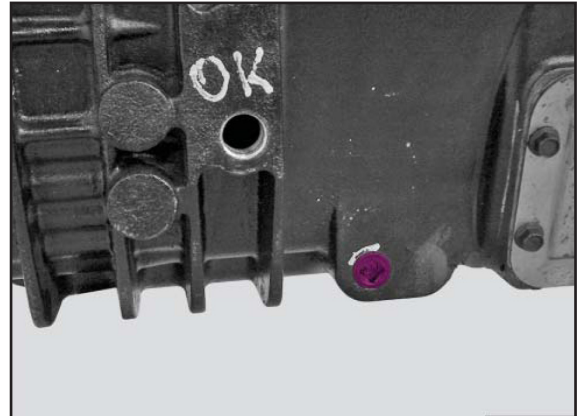
Front Case



57. Install the oil drain plug applying a torque of 36 Nm.

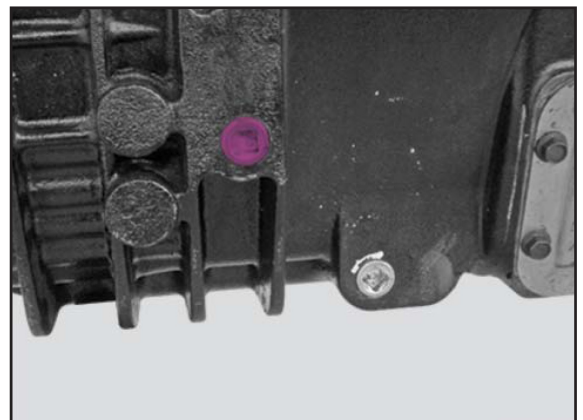
58. Fill the transmission with the specified lubricant:

- Specified lubricant: SAE 50 Synthetic.
- Volume: 9.5 liters.



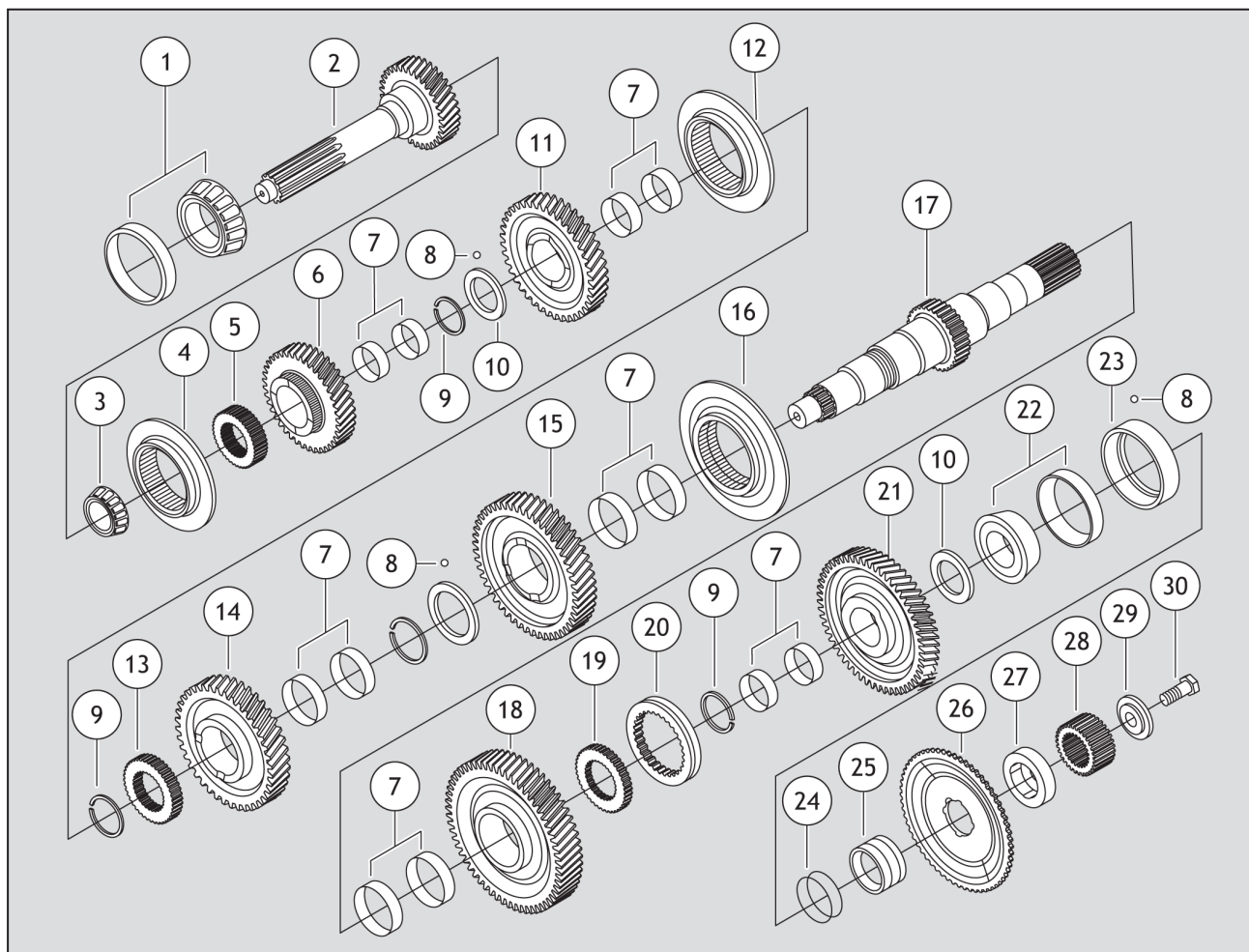
2940-187-3

59. Install the oil level and fill plug applying a torque of 41 Nm.



2940-188

Input Shaft and Main Shaft

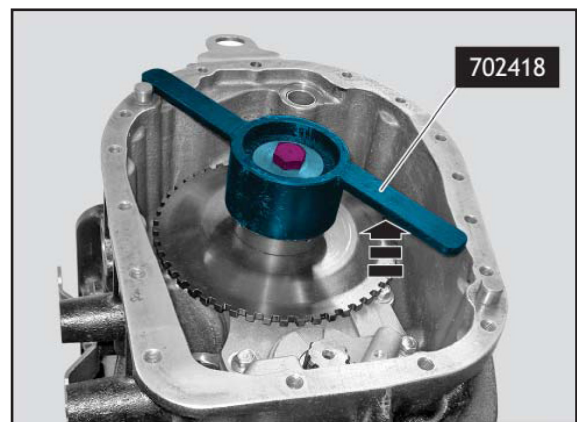


2940-190

- | | |
|---|---|
| 1. Input shaft bearing cup and cone | 16. 1st/2nd speed sliding sleeve (clutch) |
| 2. Input shaft | 17. Main shaft |
| 3. Main shaft front bearing cone | 18. 1st speed gear |
| 4. 5th/6th speed sliding sleeve (clutch) | 19. Reverse speed hub |
| 5. 5th/6th speed hub | 20. Reverse speed sliding clutch |
| 6. 5th speed gear | 21. Reverse speed gear |
| 7. 5th speed gear needle bearings | 22. Main shaft rear bearing |
| 8. Ball | 23. Spacer ring |
| 9. Snap ring | 24. Sealing ring |
| 10. Thrust washer | 25. Oil deflector sleeve (Oil muff) |
| 11. 4th speed gear | 26. Rotor |
| 12. 3rd/4th speed sliding sleeve (clutch) | 27. Spacer |
| 13. 3rd/4th speed hub | 28. Sun gear |
| 14. 3rd speed gear | 29. Washer |
| 15. 2nd speed gear | 30. Bolt |

Removal

1. Drain the lubricating oil from the gearbox.
2. Remove the gearbox from the truck.
3. Remove the transmission electronic control unit.
4. Remove the clutch housing.
5. Remove the wiring harness.
6. Remove the remote shift control assembly from the transmission.
7. Remove the top cover (shift bar housing).
8. Remove the inertia brake.
9. Remove the rear housing with the planetary reduction gear.
10. Secure the sun gear with special tool #702418 (for MHD) or #EA-22300 and #EEA-22301 (for MHD-EVO), and remove its retaining bolt and special washer.

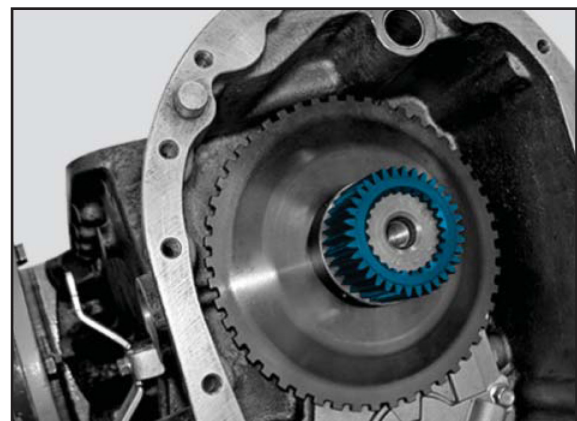


2940-192

11. Remove the sun gear by hand.

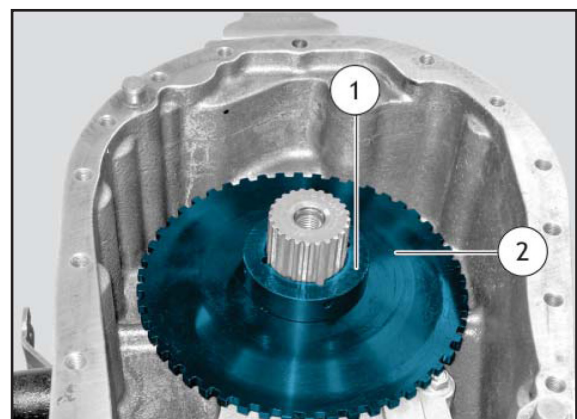
NOTE: If the sun gear presents any difficulty to be removed, use the #EAM09104 puller.

CAUTION: Make a reference mark on one side of the gear for later assembly in the same position.



2940-163-1

12. Remove the retaining hub (1) and the phonic wheel (2).



2940-163-2

13. Remove the 9 lubricating oil pump mounting capscrews.



2940-163-3

14. Remove the oil pump sleeve.

CAUTION: Be careful to not damage the sealing rings.



2940-194-1

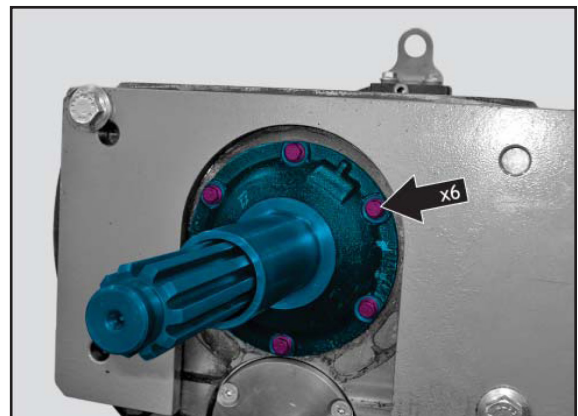
15. Remove the oil pump.



2940-194-2

16. Remove the retaining capscrews, input shaft cover and input shaft.

NOTE: Use a rubber hammer to detach the cover from the housing.

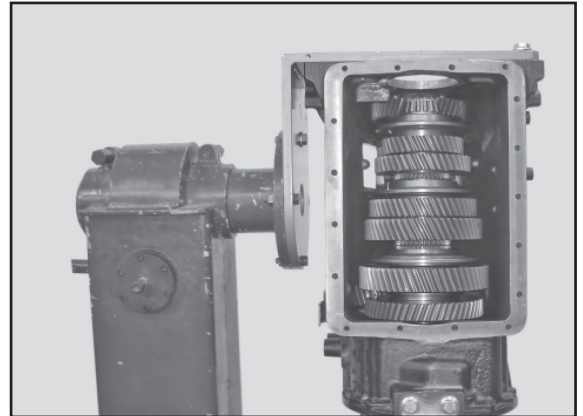


2940-194-3

Main Shaft and Countershaft

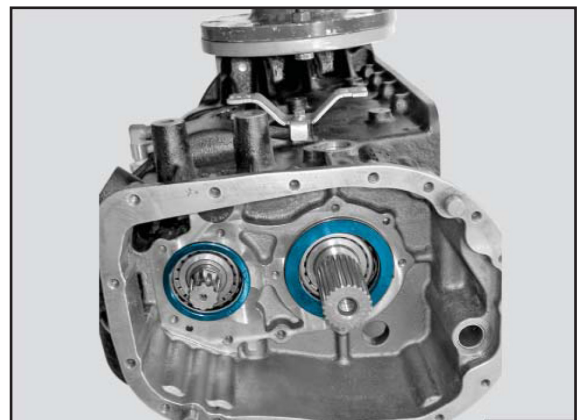


17. Rotate the transmission and place it vertically with the front facing up.



2940-165-1

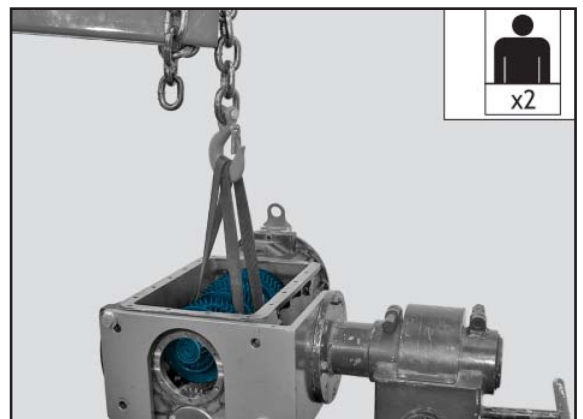
18. Move the main shaft and countershaft so that the main shaft bearing cup seat moves to allow the main shaft to be removed.



2940-195-2

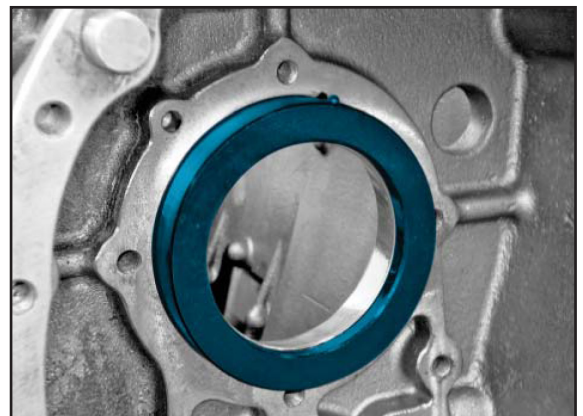
19. Rotate the transmission to a horizontal position.
20. Using a suitable sling belt wrapped around the main shaft and, using a hoist, remove the main shaft from the transmission.

NOTE: Request help from an assistant.



2940-195-3

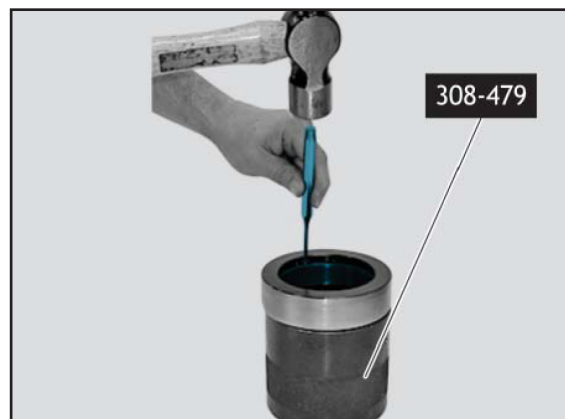
CAUTION: Pay attention to the main shaft rear bearing cup seat locating ball fitted in the transmission housing.



2940-166-1

21. Position the bearing cup seat over the special tool #308-479 and, using a pin punch, remove the bearing cup.

NOTE: The help of an assistant is required.



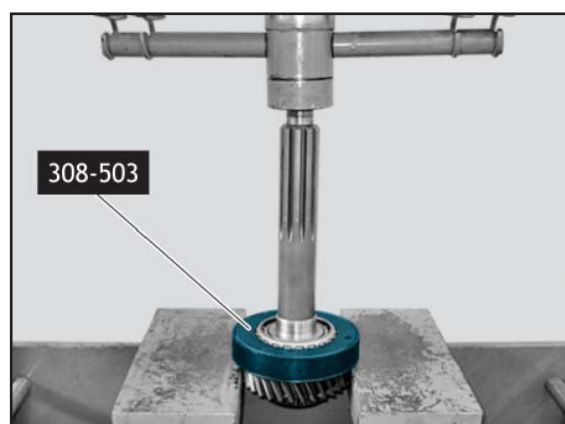
2940-196-2

Input Shaft

Disassembly

1. Position the input shaft in a press with the special tool #308-503 and remove the bearing cone.

CAUTION: Support the input shaft to avoid falling.



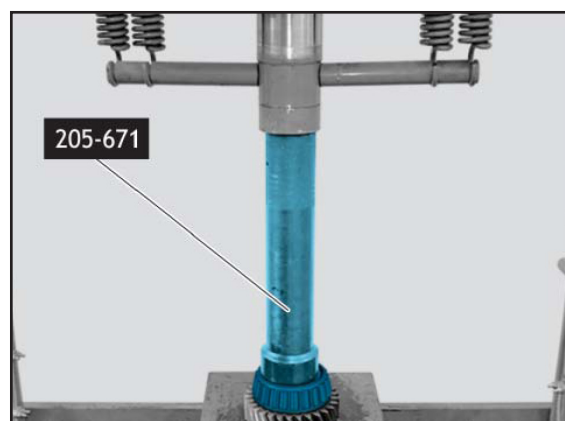
2940-196-3

Inspection

1. Check for damaged or excessively worn splines.
2. Inspect gear teeth for wear, chipping or cracks.

Assembly

1. Position the input shaft in a press and install the bearing cone using the special tool #205-671.



2940-197-1

Main Shaft

Disassembly

1. Clamp the main shaft in the vise, supporting it with the special tool #804626 for MHD or special tool PEA-2893 for MHD-EVO (support for the main shaft).

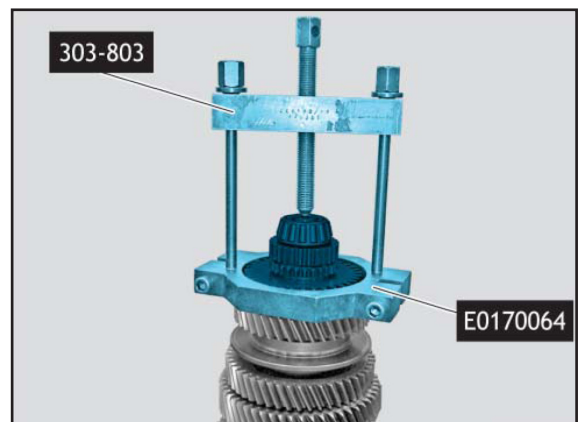
CAUTION: Use vise jaw protectors to not cause any damage to the shaft.

WARNING: The 5th and 6th speed sliding sleeve (clutch) is removed immediately after removing the main shaft to avoid accidents.



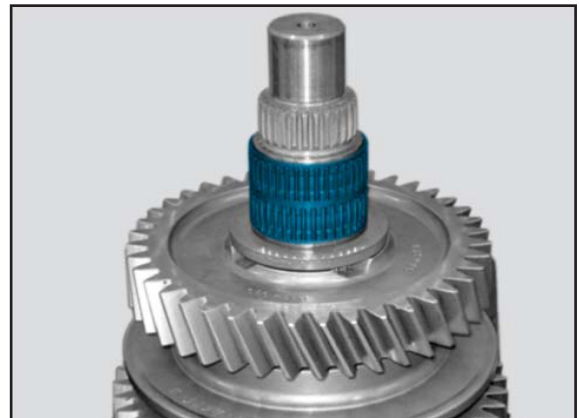
2940-197-2

2. Remove the main shaft front bearing, 5th and 6th speed hub and 5th speed gear using special tools #308-803 and #E017006/4.



2940-197-3

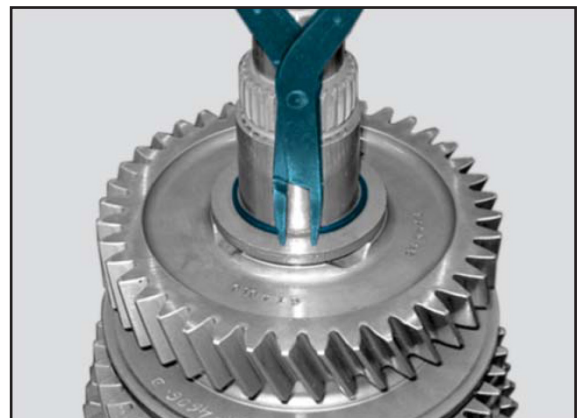
3. Remove the 5th speed gear needle bearings.



2940-198-1

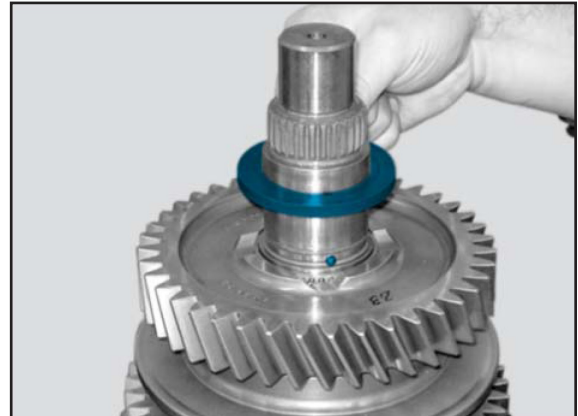
4. Remove the 4th speed gear snap ring.

NOTE: Use appropriate pliers.



2940-198-2

5. Remove the 4th and 5th speed gear thrust washer and locating ball.



2940-198-3

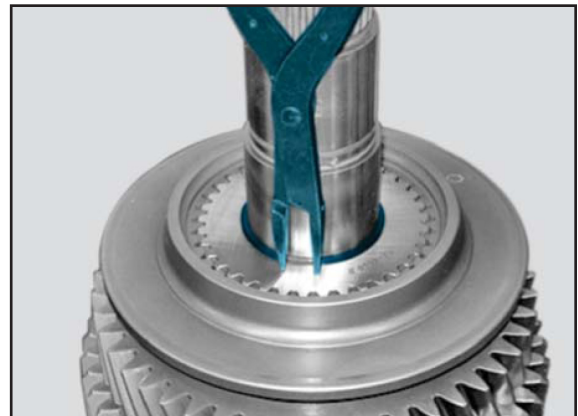
6. Remove the 4th speed gear and bearings.



2940-199-1

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

NOTE: Use appropriate pliers.



2940-199-2

8. Remove the 3rd and 4th speed sliding sleeve (clutch).



2940-199-3

9. Remove the 3rd and 4th speed hub.



2940-200-1

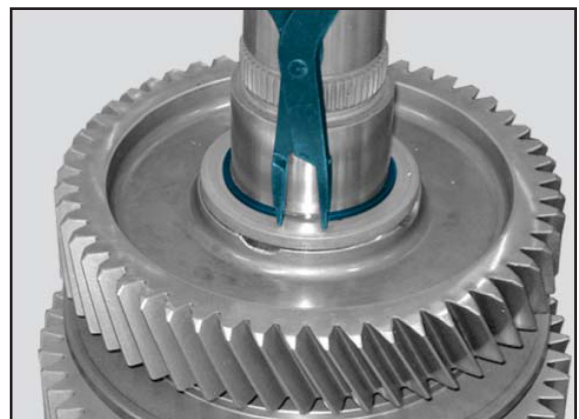
10. Remove the 3rd speed gear and bearings.



2940-200-2

11. Remove the 2nd speed gear snap ring.

NOTE: Use appropriate pliers.



2940-200-3

12. Remove the 2nd and 3rd speed gear thrust washer and locating ball.



2940-201-1

13. Remove the 2nd speed gear.



2940-201-2

14. Remove the 2nd and 1st speed sliding sleeve (clutch).



2940-201-3

15. Flip the main shaft over and clamp it in the vise.

CAUTION: Use vise jaw protectors to not cause any damage to the shaft.

16. Remove the main shaft rear bearing, bearing thrust washer and reverse speed gear using special tools #308-803 and #303-1370 and a support for the puller screw.



2940-202-1

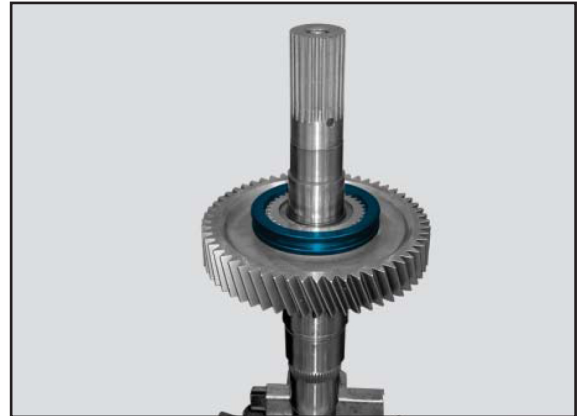
17. Remove the reverse gear bearing.



2940-202-2

18. Remove the reverse speed sliding clutch.

NOTE: Note that the engagement teeth of the sleeve that face the reverse gear have a pointed shape while the smooth part faces the 1st speed gear.



2940-202-3

19. Remove the reverse gear hub snap ring.

NOTE: Use appropriate pliers.



2940-203-1

20. Remove the reverse gear hub.



2940-203-2

21. Remove the 1st speed gear with bearings.

22. Remove the main shaft from the vise.

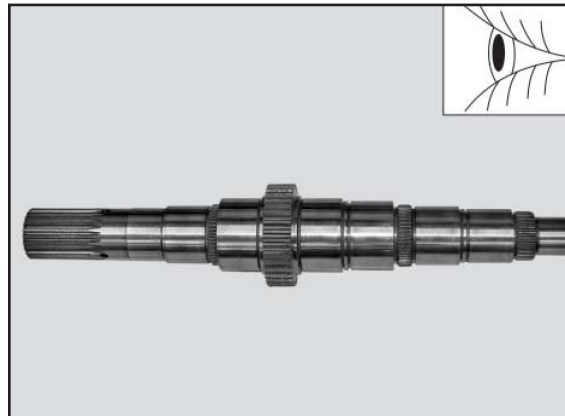
NOTE: The 1st speed gear is electronically inhibited in this application.



2940-203-3

Inspection

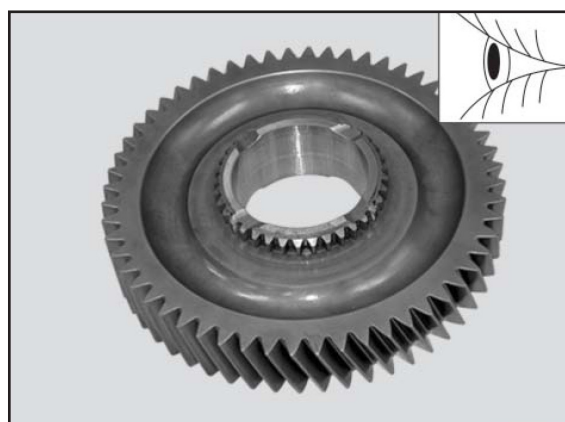
1. Replace the main shaft if the splines are worn, if the bearing contact surface or the thrust washer contact surfaces are worn, show signs of overheating or deformation, or if the locating ball seats are damaged.



2940-204-1

2. Check the gear teeth for erosion ("pitting") on the faces or broken teeth.
3. Check the engagement teeth for wear or deformation.
4. Check the internal supporting surfaces of the gears for wear due to overheating, wear or erosion ("pitting").

NOTE: Replace gears that show any of the faults described above.



2940-204-2

5. Check rollers and tapered roller bearing races (internal and external) for pitting, spalling or signs of overheating.
6. Check cylindrical roller bearing rollers for pitting, spalling or signs of overheating.
7. Check roller separators (cage) for deformation or damage.

NOTE: Replace the bearings that show any of the faults described above.



2940-204-3

8. Replace sliding sleeves (clutches) that show wear signs on the engagement teeth.



2940-205-1

9. Replace all snap rings.



2940-205-2

10. Replace thrust washers that show wear or deformation on their contact surface with the gears.

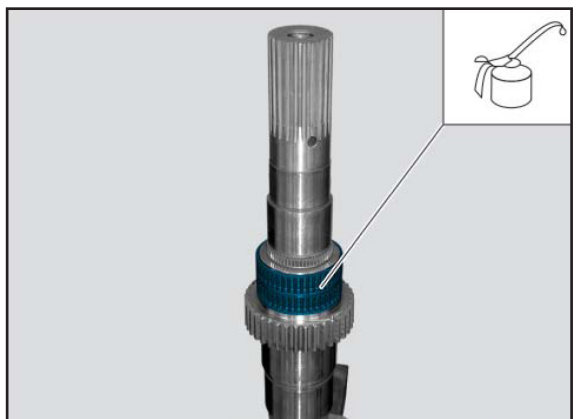
CAUTION: To avoid damage to the main shaft, do not install the thrust washers without their respective locating balls.



2940-205-3

Assembly

1. Clamp the main shaft in the vise with the rear side facing up.
2. Install the 1st speed gear bearings.



2940-206-1

3. Install the 1st speed gear.

NOTE: The 1st speed gear is electronically inhibited in this application.



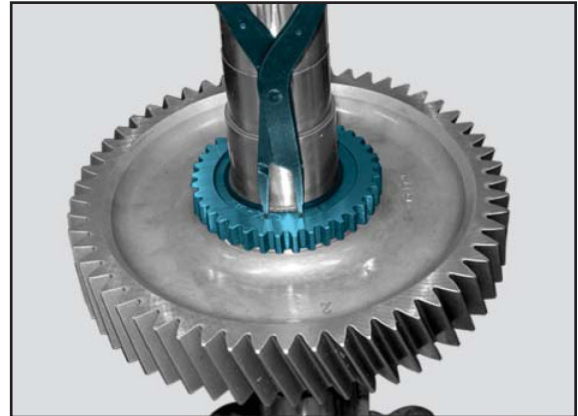
2940-206-2

4. Install the reverse speed gear hub.

NOTE: Recessed side facing up.

5. Install the reverse gear hub snap ring.

NOTE: Use the appropriate pliers.



2940-206-3

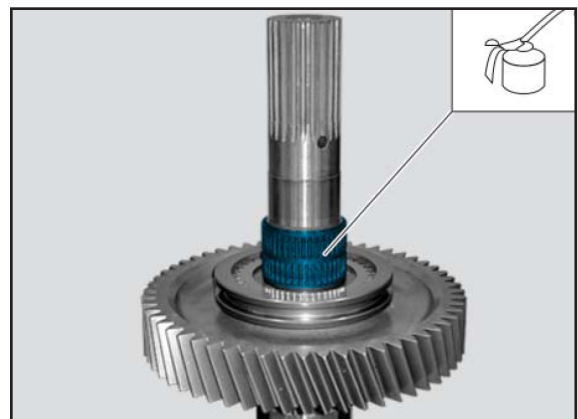
6. Install the reverse speed sliding sleeve (clutch).

NOTE: The engagement teeth must face upwards.



2940-207-1

7. Install the reverse gear bearings.



2940-207-2

8. Install the reverse gear with the engagement teeth facing down.

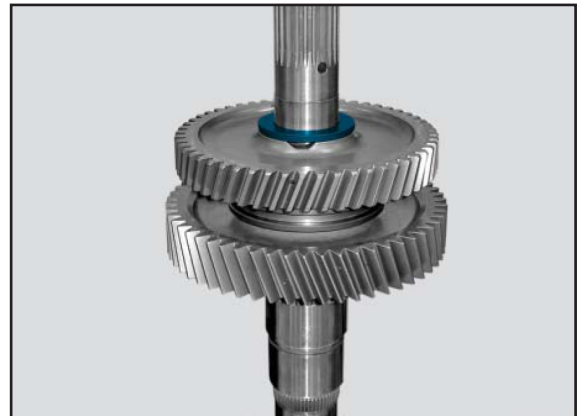


2940-207-3

Main Shaft and Countershaft



9. Install the reverse gear thrust washer.



2940-208-1

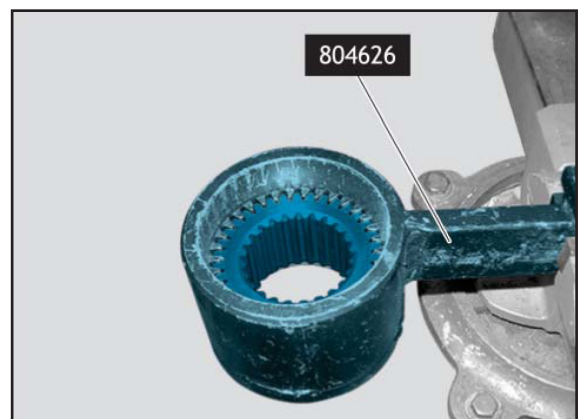
10. Install the main shaft rear bearing using special tool #702439 and a soft face mallet.

NOTE: Tap the special tool #702439 until the bearing rests against the thrust washer.



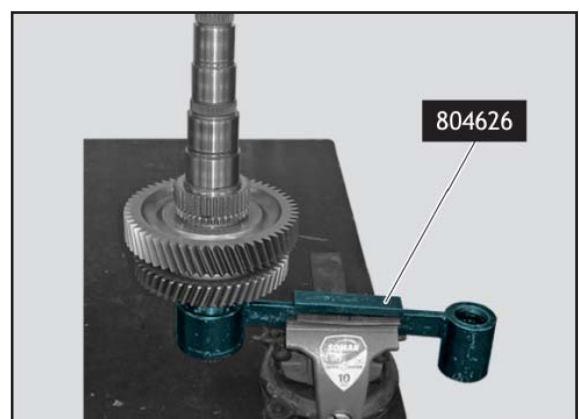
2940-208-2

11. Remove the main shaft from the vise and clamp special tool #804626 in the vise.
12. Install the sun gear into the splines of special tool #804626.



2940-208-3

13. Flip the main shaft over and install it into the splines of the sun gear that is installed in special tool #804626.



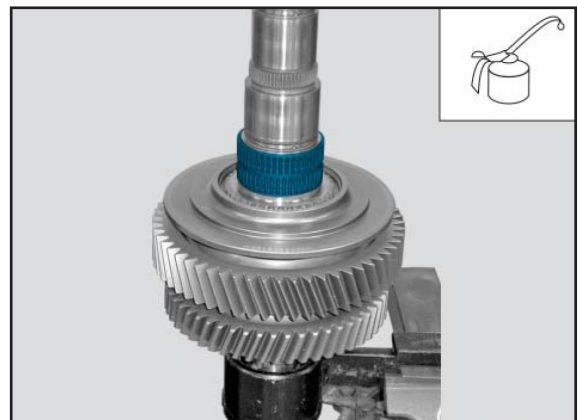
2940-209-1

14. Install the 2nd and 1st speed sliding sleeve (clutch).



2940-209-2

15. Install the 2nd speed gear bearings.



2940-209-3

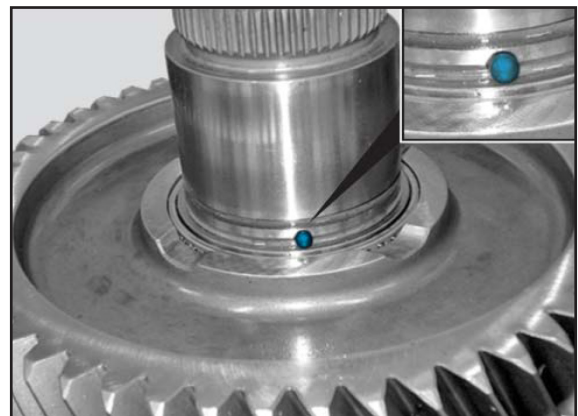
16. Install the 2nd speed gear.



2940-210-1

17. Install the locating ball in its seat, on the main shaft.

CAUTION: To avoid damage to the main shaft, do not install the thrust washers without their respective locating balls.



2940-210-2

Main Shaft and Countershaft



18. Install the thrust washer.

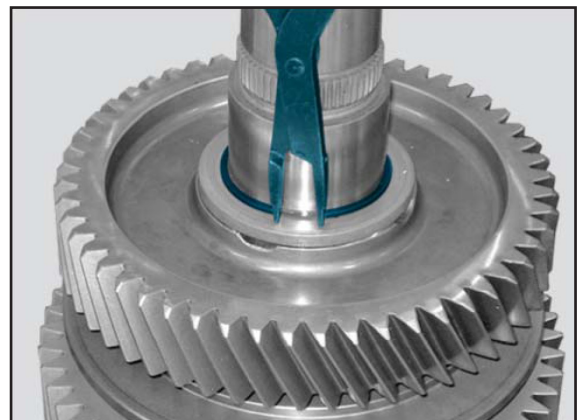
NOTE: Correctly position the thrust washer notch on the locating ball.



2940-210-3

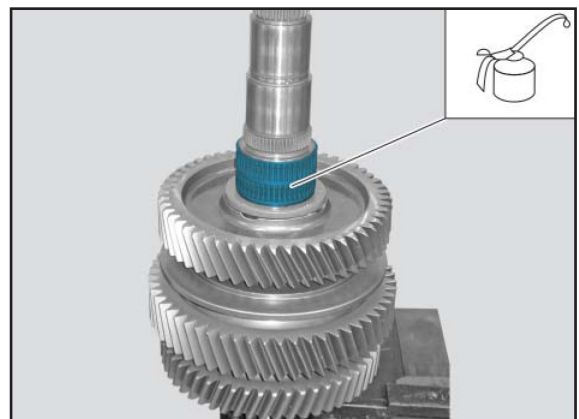
19. Install the 2nd speed gear snap ring.

NOTE: Use the appropriate pliers.



2940-200-3

20. Install the 3rd speed gear bearings.



2940-211-2

21. Install the 3rd speed gear with the engagement teeth facing up.



2940-200-2

22. Install the 3rd and 4th speed hub with the smooth side facing up.



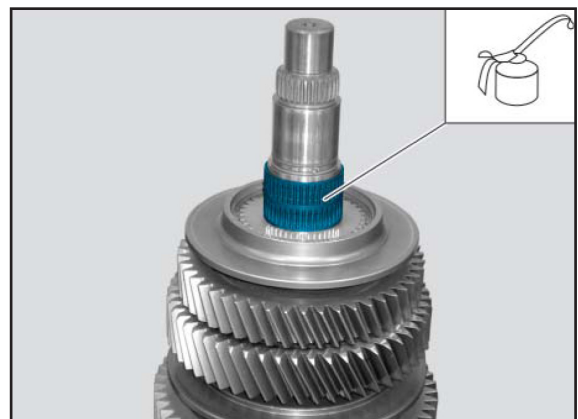
2940-200-1

23. Install the 3rd and 4th speed sliding sleeve (clutch).



2940-199-3

24. Install the 4th speed gear bearings.



2940-212-3

25. Install the 4th speed gear with the engagement teeth facing down.



2940-199-1

26. Install the thrust washer locating ball.

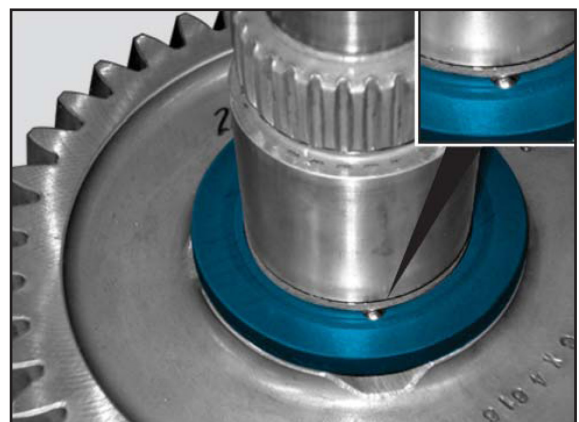
CAUTION: To avoid damage to the main shaft, do not install the thrust washers without their respective locating balls.



2940-213-2

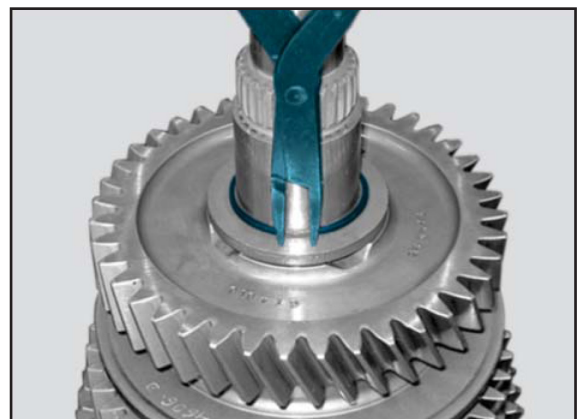
27. Install the thrust washer.

NOTE: Correctly position the thrust washer notch on the locating ball.



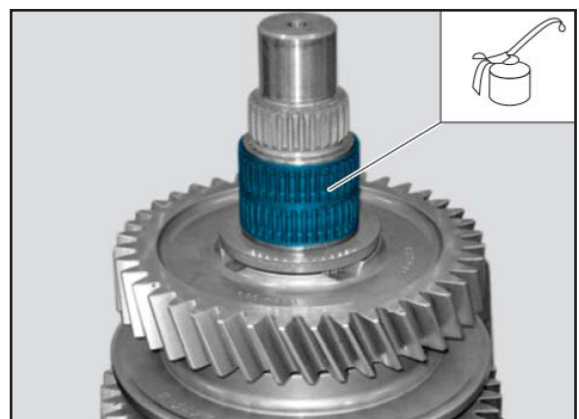
2940-213-3

28. Install the 4th speed gear snap ring.



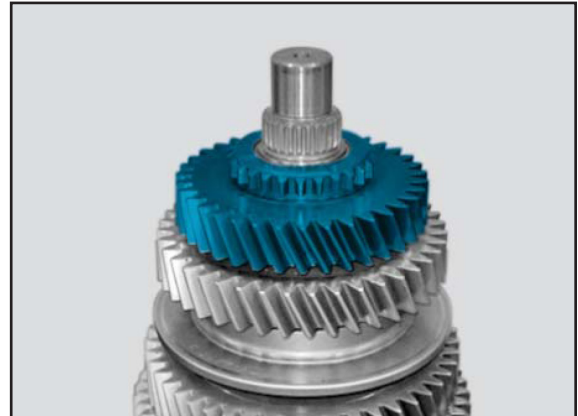
2940-198-2

29. Install the 5th speed gear bearings.



2940-214-2

30. Install the 5th speed gear with the engagement teeth facing up.



2940-214-3

31. Install the 5th and 6th speed hub with the engagement teeth facing up.



2940-215-1

32. Install the 5th and 6th speed sliding sleeve (clutch).



2940-215-2

33. Install the main shaft front bearing using special tool #308-454 and a soft face mallet.

34. Remove the main shaft from the special tool #804626.

NOTE: Request help from an assistant.



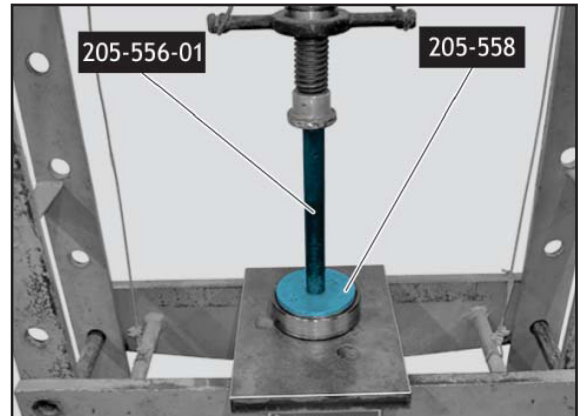
2940-215-3

Main Shaft and Countershaft



Installation

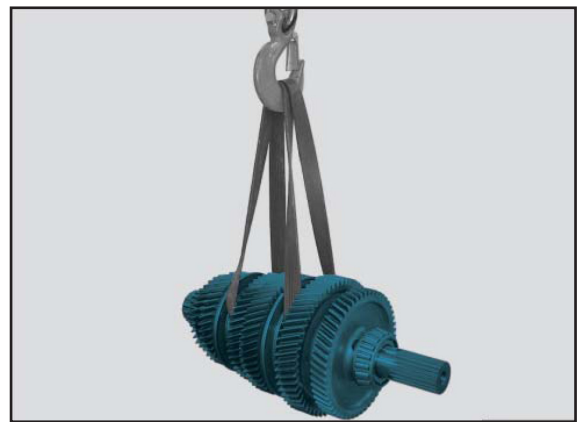
1. Install the main shaft rear bearing cup using special tools #205-558 and #205-556-01 and a press.



2940-216-1

2. Using a hoist and a sling belt, lift the main shaft.

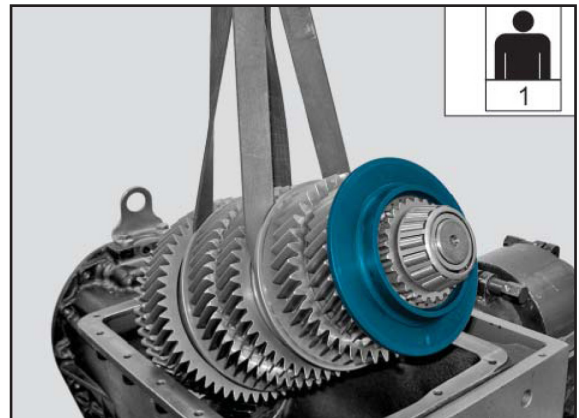
NOTE: When lifting the main shaft, it is recommended to remove the 5th and 6th speed sliding sleeve (clutch).



2940-216-2

3. Install the sliding sleeve on the main shaft and place the main shaft into the transmission housing.

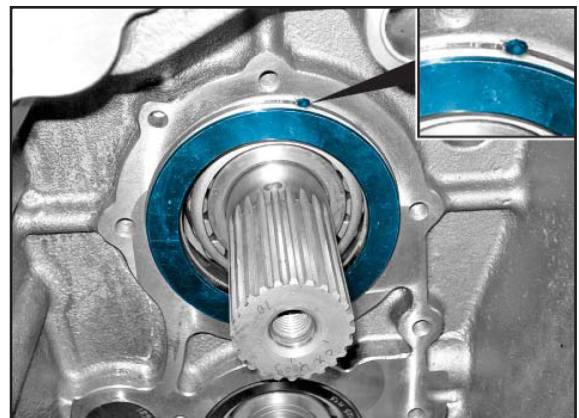
NOTE: Request help from an assistant.



2940-216-3

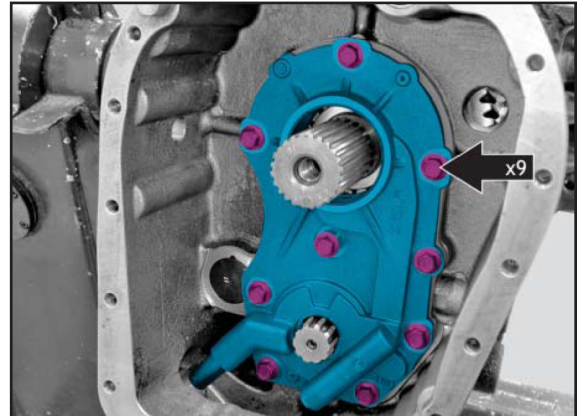
4. Install the seat with the main shaft rear bearing cup installed into the housing.

CAUTION: Pay attention to the rear bearing cup seat locating ball fitted into the transmission housing.



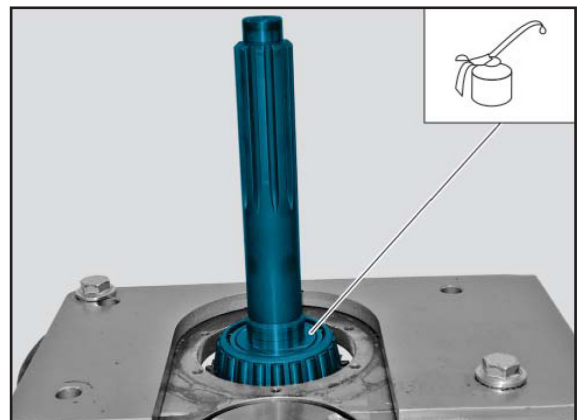
2940-217-1

5. Position the oil pump in the transmission housing, correctly aligning the countershaft splines with the pump rotor splines and install the retaining capscrews without tightening them.



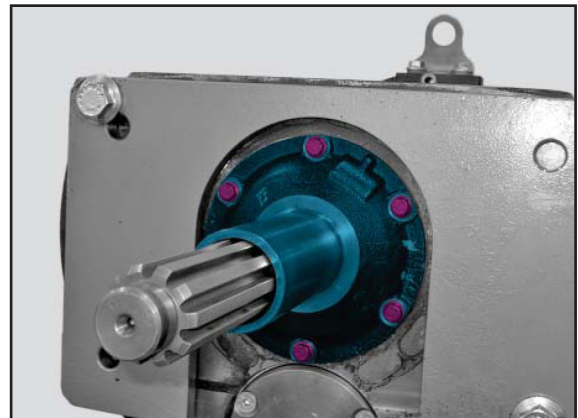
2940-217-2

6. Place the transmission vertically with the front facing up.
7. Install the input shaft.



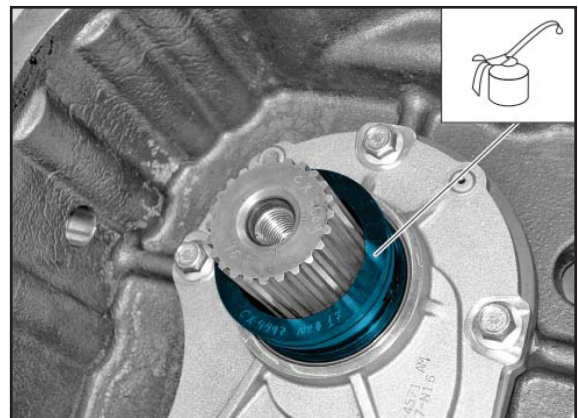
2940-217-3

8. Without the adjustment shims, install the input shaft cover and its retaining capscrews tightening them by hand.



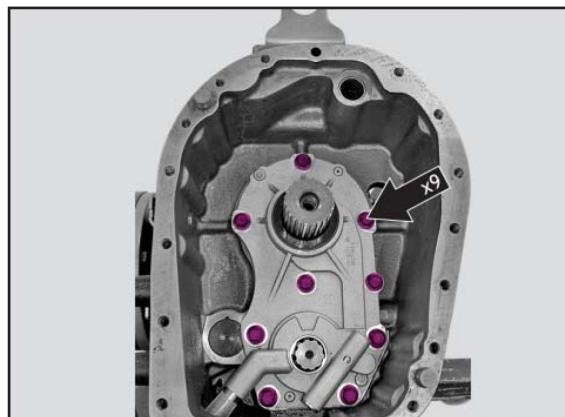
2940-218-1

9. Rotate the case and install the sleeve on the oil pump.



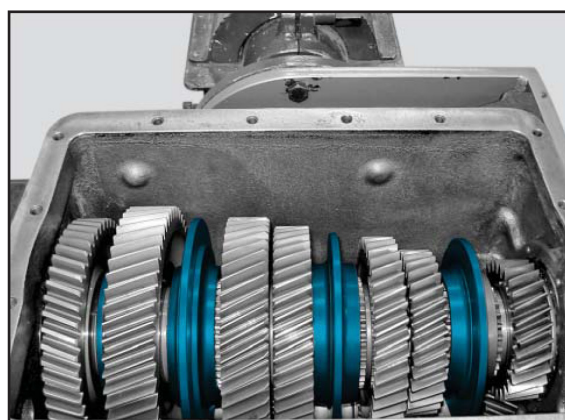
2940-218-2

10. Tighten the oil pump capscrews by applying a torque of 37 Nm.



2940-218-3

11. Place the gearbox horizontally and place all gears in neutral.

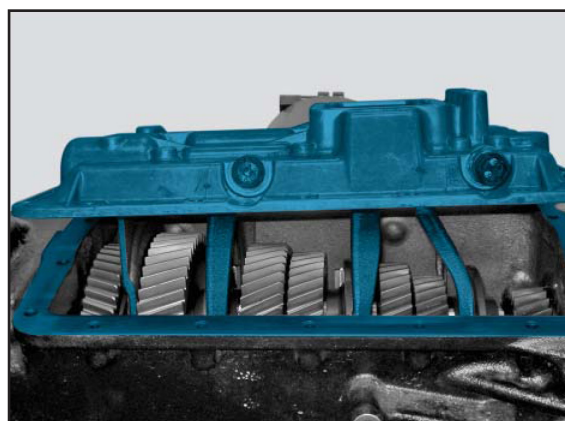


2940-219-1

12. Install the shift bar housing with only four screws, tightening them by hand.

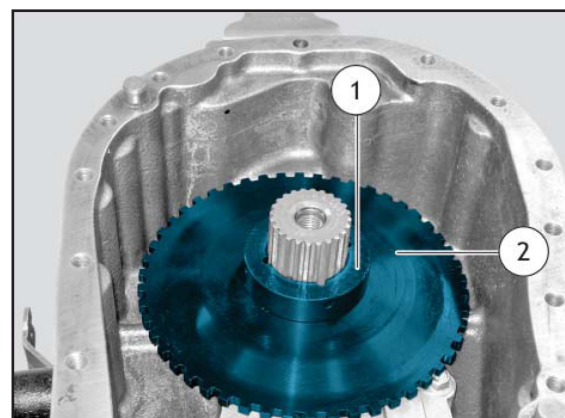
NOTE: Install a new gasket.

13. Check the main shaft and countershaft end play.



2940-219-2

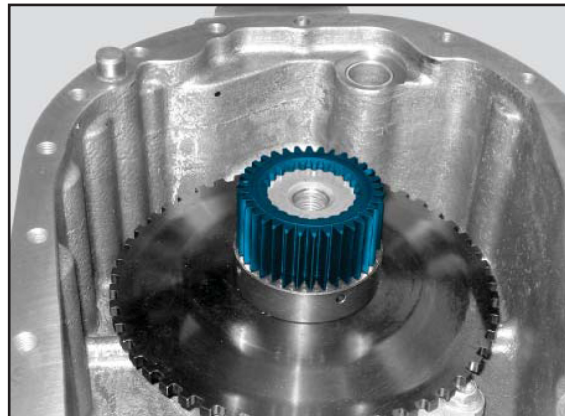
14. Install the phonic wheel (2) and the retaining hub (1) on the main shaft.



2940-163-2

15. Install the sun gear.

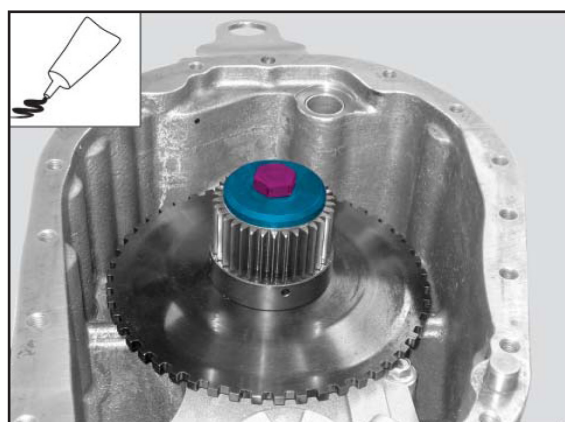
NOTE: Use the reference mark made during disassembly to maintain its original positioning.



2940-220-1

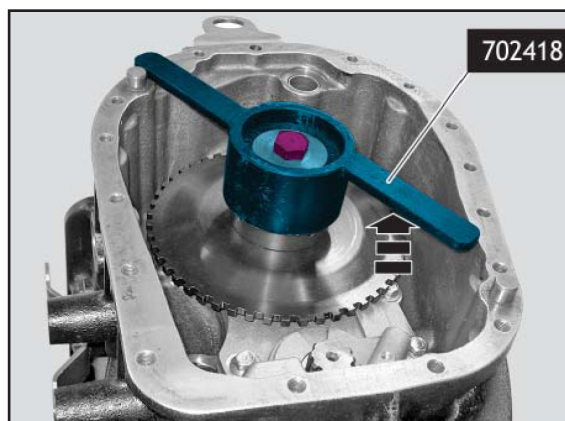
16. Install the sun gear retaining washer and bolt.

NOTE: Apply Loctite 270 to the bolt thread.



2940-220-2

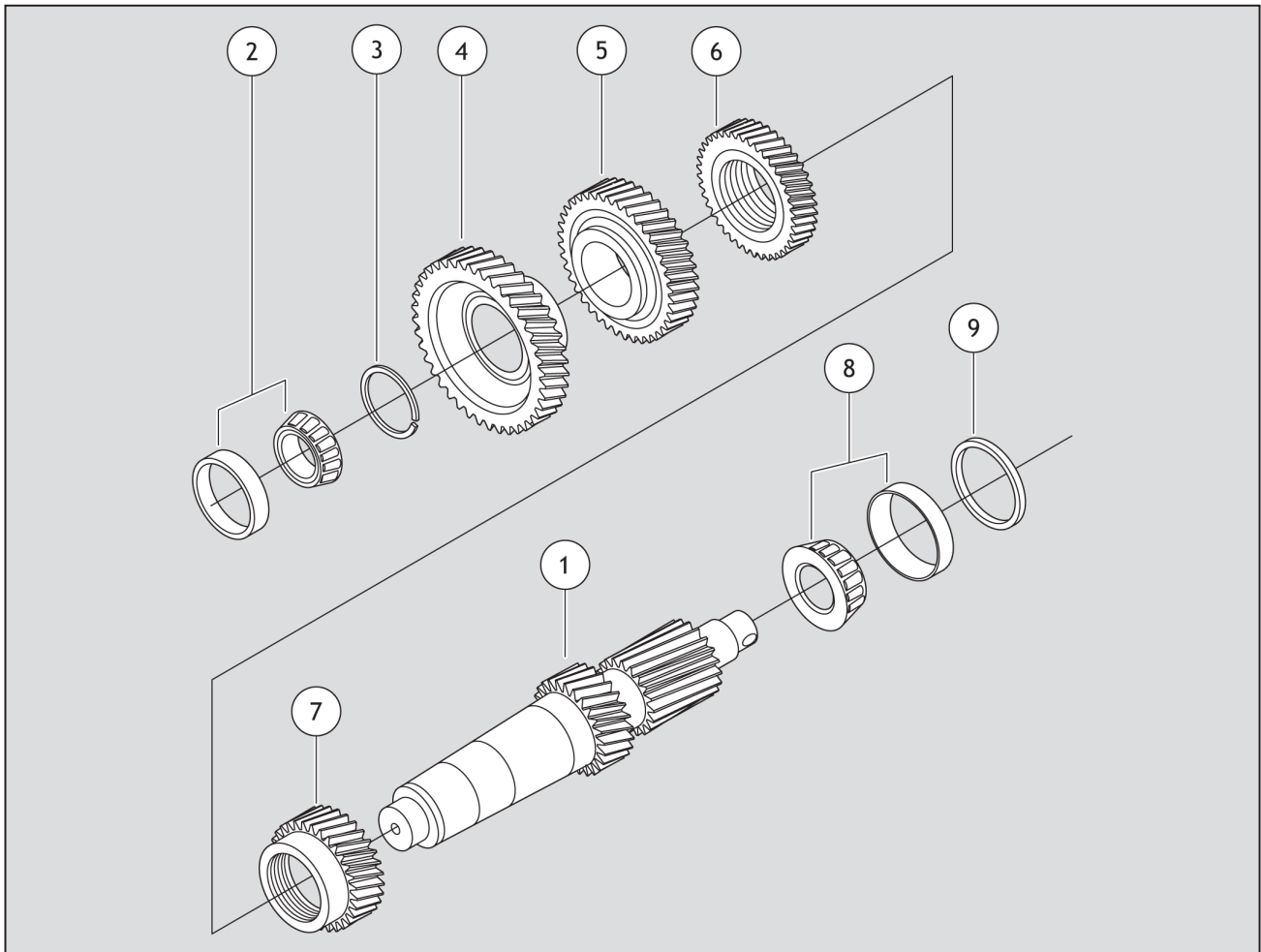
17. Secure the sun gear with special tool #702418 for MHD or, for MHD-EVO, special tool #EEA-22300 and #EEA-22301 and apply a torque of 240 Nm to its retaining bolt.



2940-220-3

18. Install the rear housing with the planetary reduction gear.
19. Install the inertia brake.
20. Install the transmission remote shift control assembly.
21. Install the wiring harness.
22. Install the clutch housing.
23. Install the transmission electronic control unit.
24. Install the transmission into the truck.
25. Fill the transmission with the specified lubricating oil.

Countershaft



2940-222

- | | |
|--|---|
| 1. Countershaft | 6. 4th speed gear |
| 2. Countershaft front bearing cup and cone | 7. 3rd speed gear |
| 3. Snap ring | 8. Countershaft rear bearing cup and cone |
| 4. Drive gear | 9. Spacer ring |
| 5. 5th speed gear | |

Removal

1. Remove the lubricating oil from the transmission.
2. Remove the transmission from the truck.
3. Remove the transmission electronic control unit (TCU).
4. Remove the inertia brake.
5. Remove the clutch housing.
6. Install the transmission onto the swivel stand.
7. Remove the wiring harness.
8. Remove the remote shift control from the transmission.
9. Remove the shift bar housing with the shift yokes.
10. Remove the rear housing with the planetary reduction gear.
11. Remove the lubricating oil pump.
12. Remove the input shaft.
13. Remove the main shaft.

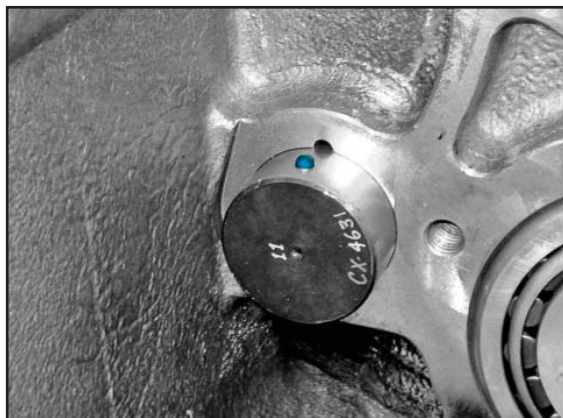
14. Remove the reverse idler gear shaft.

NOTE: Pay attention to the shaft locating ball fitted in the housing.



2940-166-2

CAUTION: Remove and store separately the shaft locating ball.



2940-166-3

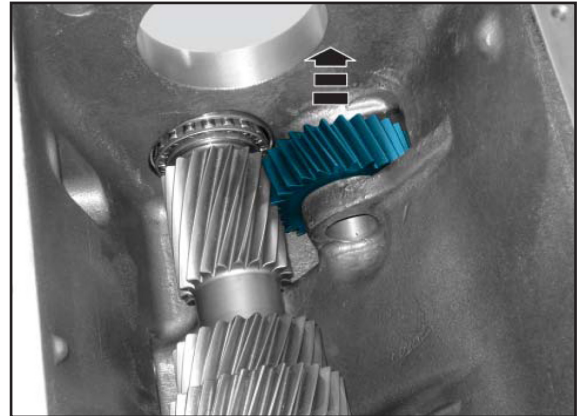
Main Shaft and Countershaft



15. Remove the reverse idler gear with its bearings.

NOTE: To make it easier to remove the gear, rotate the countershaft while removing the gear.

CAUTION: Make a reference mark on one side of the gear for later assembly in the same position.



2940-167-1

16. Displace the countershaft to remove the bearing cup from the housing.



2940-167-2



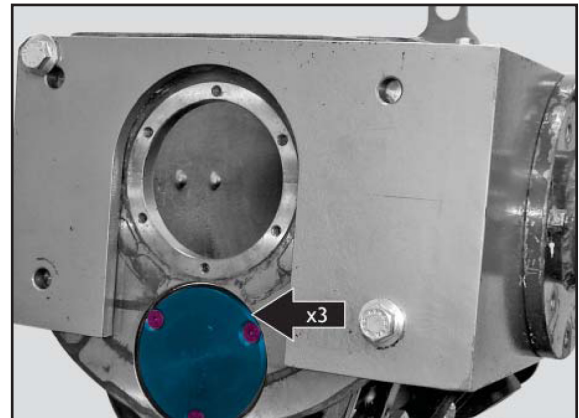
2940-225-1

17. Remove the countershaft using a sling belt and a hoist.



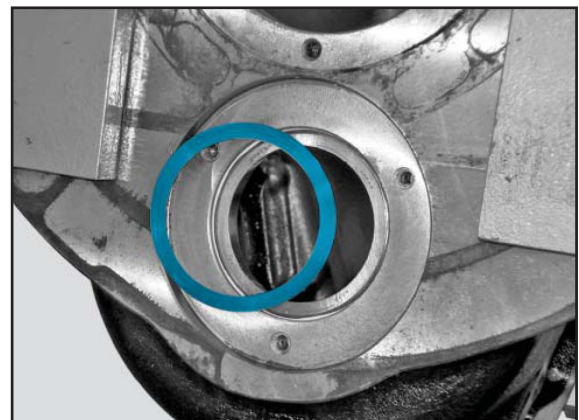
2940-168-1

18. Remove the retaining capscrews and cover from the countershaft end play adjustment shims.



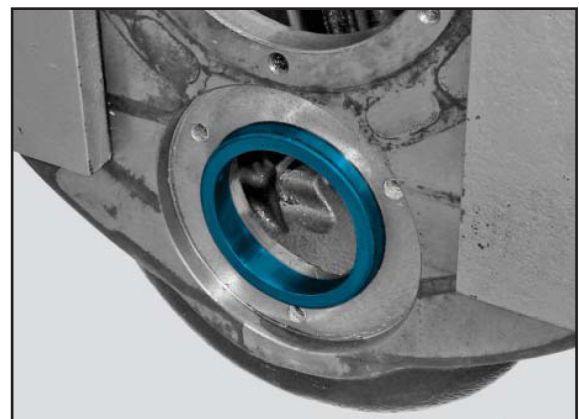
2940-225-3

19. Remove the countershaft end play adjustment shims.

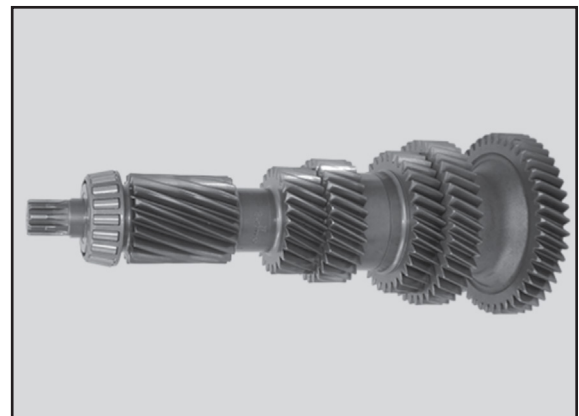


2940-168-3

20. Remove the countershaft front bearing cup from the housing.



2940-169-1



2940-226-3

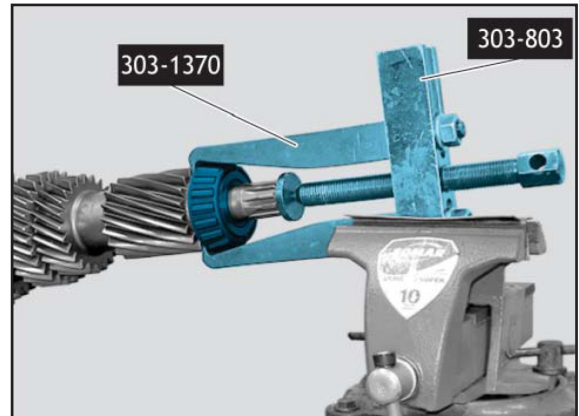
Main Shaft and Countershaft



Disassembly

1. Remove the countershaft rear bearing using special tools #303-803 and #303-1370 and a support for the puller screw.

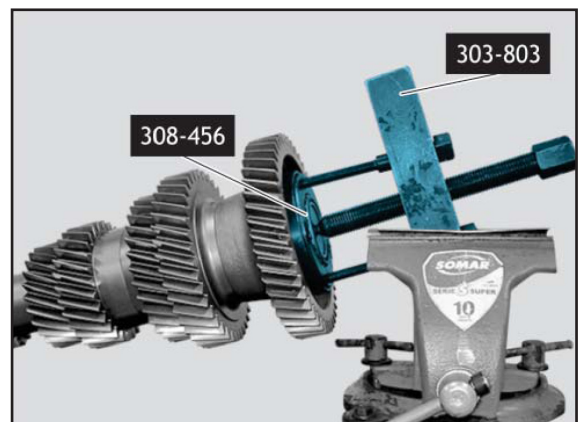
NOTE: Clamp the assembly in a vise to make removal easier.



2940-227-1

2. Remove the countershaft front bearing using special tools #303-804 and #308-456.

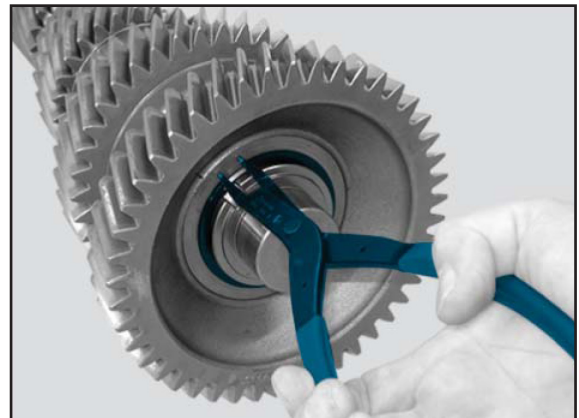
NOTE: Clamp the assembly in a vise to make removal easier.



2940-227-2

3. Remove the snap ring securing the drive gear.

NOTE: Use appropriate pliers and a screwdriver.



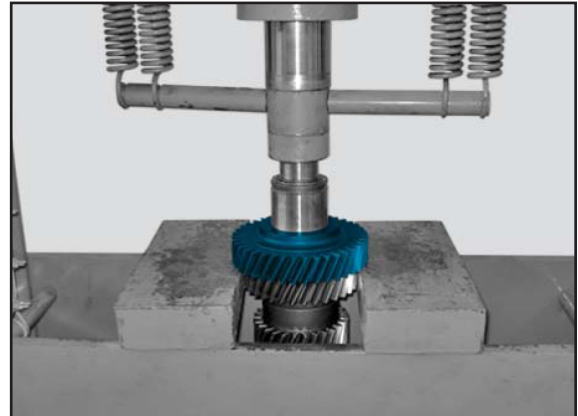
2940-227-3

4. Place the countershaft in a press and remove the drive gear.



2940-228-1

5. Remove the 5th speed gear.



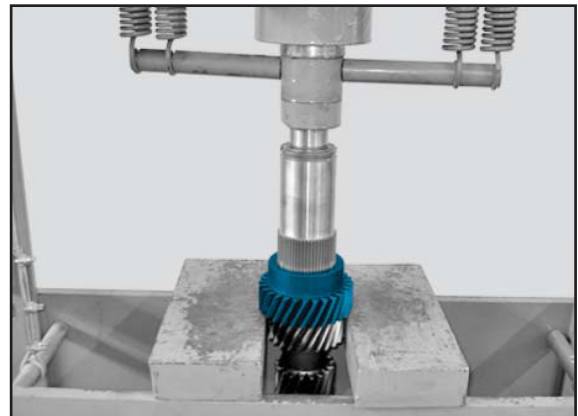
2940-228-2

6. Remove the countershaft from the press and remove the 4th speed gear by hand.



2940-228-3

7. Place the countershaft in the press and remove the 3rd speed gear.



2940-229

Inspection

1. Replace the countershaft if its gears show signs of wear, corrosion, broken teeth or signs of overheating or have damaged splines.
2. Check gears for wear, corrosion, broken teeth or signs of overheating.

NOTE: Replace the gear that shows any of the faults described above.

Main Shaft and Countershaft

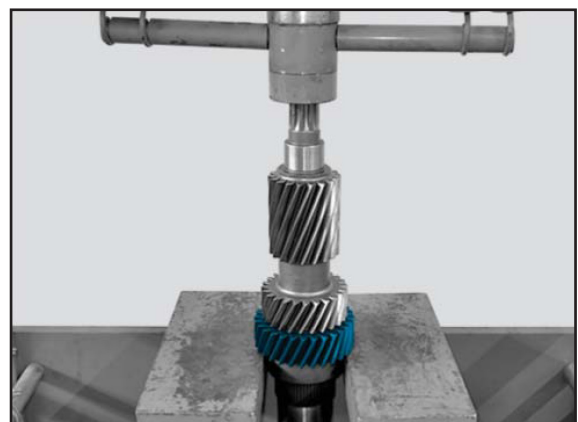


3. Check the bearings for wear, pitting, scratches or signs of overheating on the rollers or races. Also check the roller separators (cage) for damage.

NOTE: Replace the entire bearing if there is any sign of damage.

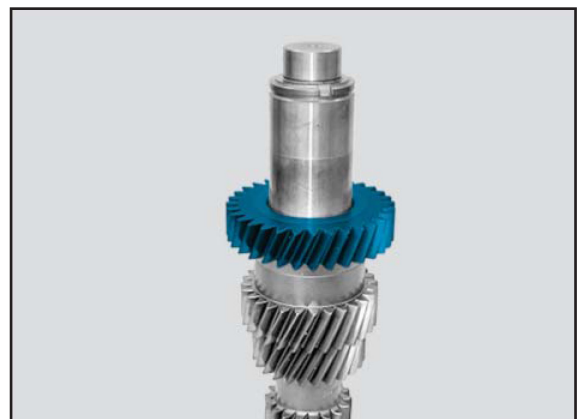
Assembly

1. Place the countershaft in the press and install the 3rd speed gear.



2940-230-1

2. Remove the countershaft from the press and install the 4th speed gear by hand.



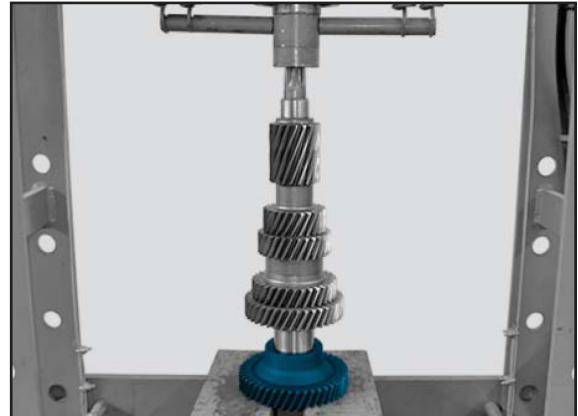
2940-230-2

3. Place the intermediate shaft in the press and install the 5th speed gear.



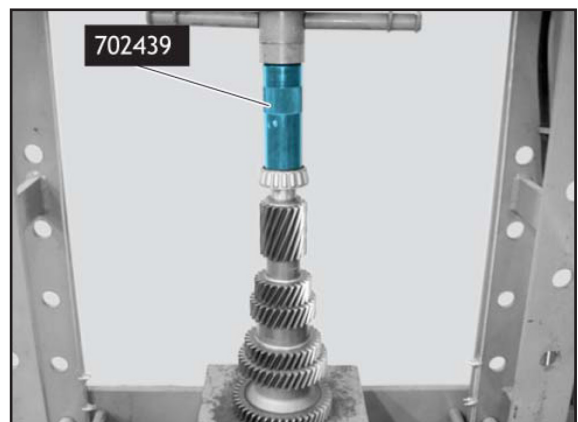
2940-230-3

4. Install the drive gear.



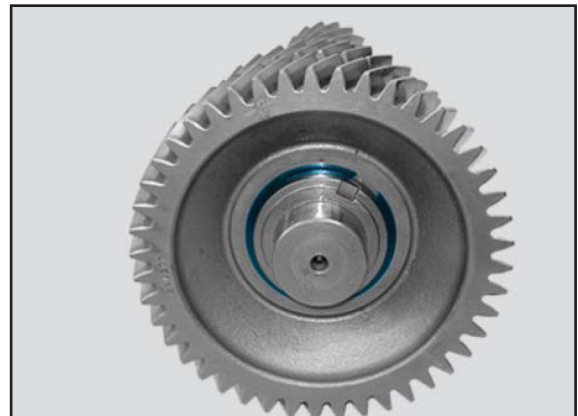
2940-231-1

5. Install the countershaft rear bearing cone using special tool #702439.



2940-231-2

6. Install a new drive gear retaining snap ring.



2940-231-3

7. Flip the intermediate shaft over in the press and install the front bearing cone using special tool #308-457.

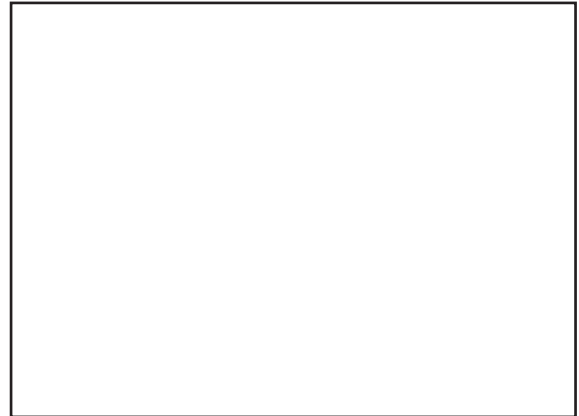


2940-232-1

Installation

1. Install the countershaft front bearing cup.

NOTE: Use a rubber mallet if necessary.



2940-232-2

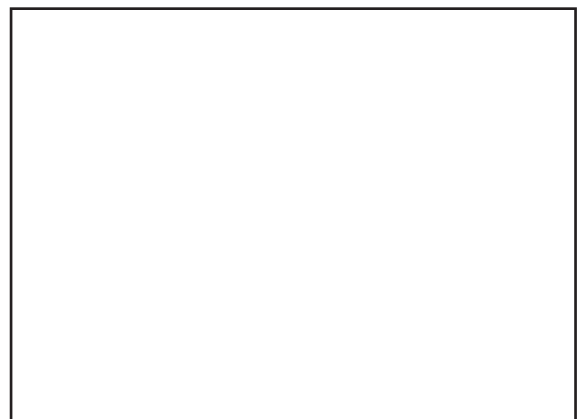
2. Install the countershaft front cover without the end play adjustment shims.

CAUTION: Pay attention to the mounting position.



2940-232-3

3. Install the cover retaining capscrews by tightening them with a initial torque.



2940-231-1

NOTE: Lubricate the front and rear countershaft bearing cones with specified lubricant.

4. Install the countershaft into the transmission housing using a sling belt and a hoist.
5. Place the transmission vertically, with the rear facing up, to fit the front bearing cone into its cup.



2940-172-2

6. Position the countershaft rear bearing cup on the housing, without inserting it completely.



2940-234-1

7. Install the reverse idler gear.

CAUTION: Use the reference mark made during disassembly to maintain its original position.

NOTE: Rotate the countershaft to make the assembly easier.



2940-173-1

8. Place the transmission horizontally and install the reverse idler gear shaft.

CAUTION: Pay attention to the position where the shaft locating ball fits into the housing.



2940-234-3

9. Completely install the countershaft rear bearing cup and then the spacer ring.



2940-173-3

10. Install the main shaft.
11. Install the input shaft.
12. Install the lubricating oil pump.
13. Check the main shaft and countershaft end play.

NOTE: Pay special attention to checking the end play of the countershaft and main shaft to make corrections to the adjustment shims if necessary.

14. Install the shift bar housing with the shift yokes.
15. Install the rear housing with the planetary reduction gear.
16. Install the transmission remote shift control assembly.
17. Install the wiring harness.
18. Remove the transmission from the swivel stand.
19. Install the clutch housing.
20. Install the inertia brake.
21. Install the transmission electronic control unit.
22. Install the transmission into the truck.
23. Fill the transmission with the specified lubricating oil.

Main Shaft and Countershaft End Play Check

Main Shaft

1. Place the transmission in a horizontal position.
2. Rotate the input shaft and check that the transmission is in neutral, checking that the assembly is correct.



2940-236-1

3. Place the transmission vertically with the input shaft down.
4. Rotate the input shaft clockwise and counterclockwise to seat the main shaft bearing.



2940-236-2

5. Install the sun gear retaining washer and bolt onto the main shaft, tightening it by hand.
6. Install a magnetic base with a dial indicator on the transmission housing, and the probe on the main shaft washer.

7. Apply a 2.0 mm preload and reset the dial indicator.
8. Using two pry bars, force the shaft upwards, taking the reading.

Specified clearance:

- MHD-EA11109L: 0.150 to 0.250 mm
- MHD EVO-EA13110 and EAR11100: 0.070 to 0.145 mm



2940-237-1

9. Make the following calculation:

Play found – specified play = shim(s) to be installed.

Example: 1.62 mm – 0.20 mm = 1.42 mm (thickness of the shims to be installed).

10. Rotate the housing and remove the input shaft cover retaining capscrews and remove the cover.

11. Install the adjusting shims.

NOTE: Install thicker shims on the outside.



2940-237-2

12. Install the input shaft cover and tighten the retaining capscrews to 24 Nm.

CAUTION: When installing the cover, make sure that the lubrication channel faces upwards.



2940-237-3

13. Carry out the end play measurement again and correct it if necessary.
14. After adjusting the end play, remove the capscrews, input shaft cover and adjustment shims.
15. Apply a thin layer of Scotch-Grip 4291 sealant to the shims and the contact face of the seal cover with the housing.
16. Install the assembly by applying a torque of 24 Nm to the input shaft cover retaining capscrews.

NOTE: Apply Loctite 270 threadlocker to the retaining capscrews.

17. Remove the sun gear retaining bolt and washer from the main shaft.

Countershaft

1. Place the gearbox in a vertical position with the rear facing up.
2. Rotate the input shaft clockwise and counterclockwise to seat the countershaft bearing.
3. Install a magnetic base with a dial indicator on the transmission housing, and the probe on the countershaft.

4. Apply a 2.0 mm preload and reset the dial indicator.



2940-239-1

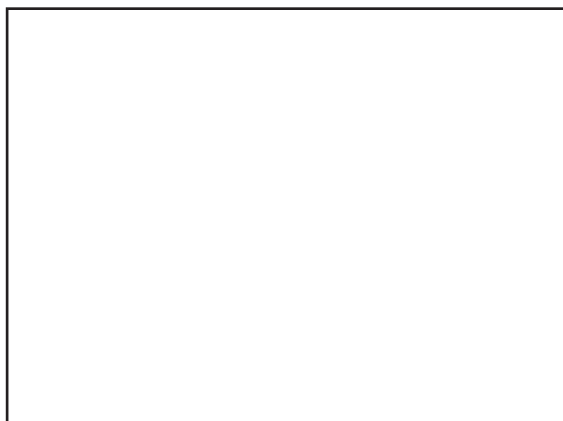
5. Using a pry bar, through the power take-off window, force the shaft upwards, taking the reading.

Specified clearance:

- MHD-EA11109L: 0.150 to 0.250mm
- MHD EVO-EA13110 and EAR11100: 0.070 to 0.145mm

6. Make the following calculation:

- $\text{Play found} - \text{specified clearance} = \text{thickness of the shim(s) to be installed.}$
- Example: $1.35 \text{ mm} - 0.20 \text{ mm} = 1.15 \text{ mm}$ (thickness of the shims to be installed).



2940-239-2

NOTE: If the value found is greater than the minimum and less than the maximum specified, it is not necessary to place a shim.

7. Install the adjusting shims (1) and front cover (2) of the countershaft bearing.

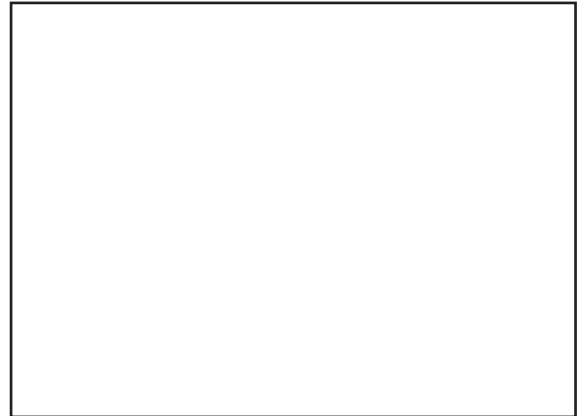
CAUTION: Place the gearbox in a vertical position and tap the bearing cover with a rubber mallet for perfect seating.

NOTE: Pay attention to the mounting position of the lubrication channel on the cover. Make sure that the lubrication channel faces upwards.



2940-240-1

8. Install the retaining capscrews with a torque of 51 Nm.



2940-240-3

9. Carry out the play measurement again and correct it if necessary.
10. After adjusting the end play, remove the capscrews, cover and adjustment shims.
11. Apply a thin coat of Scotch-Grip 4291 sealant to the adjusting shims.

NOTE: Install thicker shims on the outside.

12. Apply sealant to the countershaft front cover in two steps:
- apply a bead of sealant to the center of the contact face and around the holes.
 - apply a bead of sealant to the edge of the cover face.

NOTE: Apply Loctite 270 sealant to the mounting capscrew threads.

13. Install the countershaft front cover by applying a torque of 51 Nm to the retaining capscrews.



2940-241

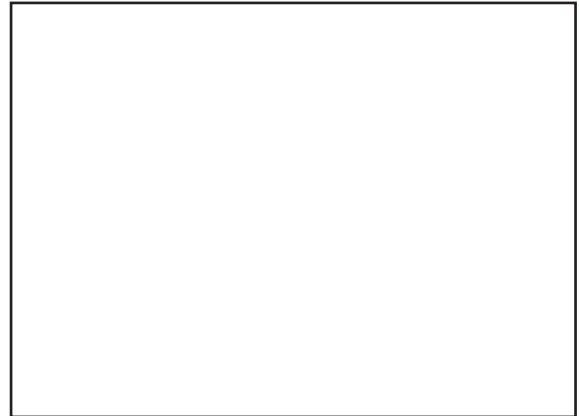
Clutch Housing

2940-242

- | | |
|--|---|
| 1. Clutch release yoke shaft seal | 7. Electronic clutch actuator (ECA) splined shaft (cross-shaft) |
| 2. Clutch release yoke shaft bushings | 8. Engine speed sensor |
| 3. Clutch release yoke shaft (cross-shaft) | 9. Inspection window cover |
| 4. Clutch release yoke shaft snap ring | 10. Grease zerk |
| 5. Clutch release yoke | 11. Clutch release yoke shaft plug |
| 6. Clutch housing | |

Disassembly

1. Remove the release yoke plug.



2940-243-1

2. Remove the mounting bolt and release yoke from shaft.



2940-243-2

3. Remove the release yoke shaft from the clutch housing.



2940-243-3

4. Remove the release yoke bushing grease seals from the clutch housing using a screwdriver.



2940-244-1

5. Remove the grease zerk.



2940-244-2

6. Remove the clutch release yoke shaft bushings using special tool #806945 and a press.

NOTE: Use special tool #308-454 as a support, with the internal hole facing the clutch housing.



2940-244-3

7. Remove the retaining capscrews and inspection cover.



2940-245-1

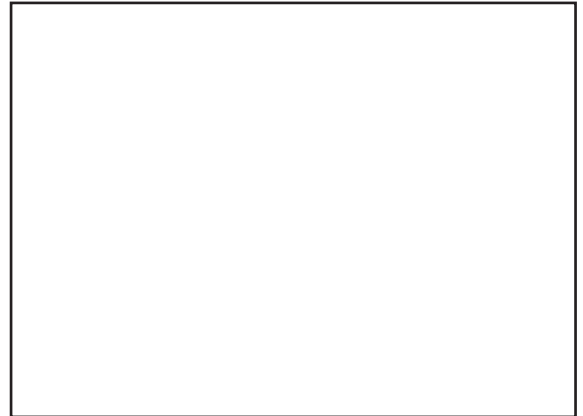
Inspection

1. Check the clutch housing for cracks.
2. Check the release yoke shaft bushings for wear and out-of-roundness, replacing them if necessary.
3. Check the grease zerk for operation and the lubrication channel for clogging.

NOTE: Replace the component that shows any of the faults described above.

Assembly

1. Install the release yoke shaft plug tightening it by hand.



2940-245-2

2. Install the first bushing into the housing using special tools #806944 and #308-454 and a press.

NOTE: The bushing will stop on the plug.



2940-246-1

3. Install the second bushing into the housing using special tools #806945 and #308-454 and a press.

NOTE: Tool #806945 will make a stop on the housing.



2940-246-2

4. Remove the plug and check if bushing faces flush with clutch housing face.



2940-246-3



2940-247-1

5. Install the grease seal using special tool #804692.



2940-247-2

6. Install the release yoke shaft grease zerk.



2940-247-3

7. Install the release yoke shaft into the clutch housing.

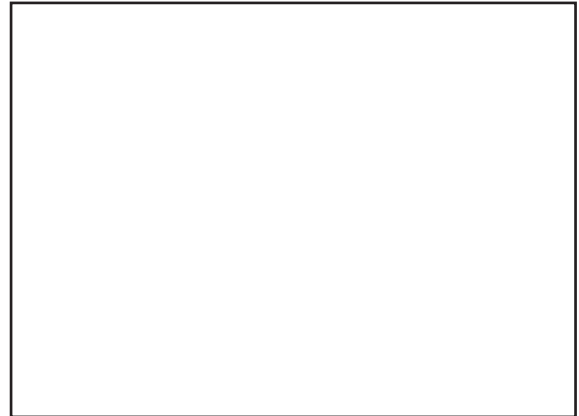


2940-248-1

8. Install the release yoke on the shaft and place the retaining bolt, applying a torque of 61 Nm.

NOTE: Apply Loctite 272 to the bolt thread.

NOTE: Lubricate the release yoke shaft with NLGI2 grease.



2940-248-2

9. Install the release yoke shaft plug, applying a torque of 95 Nm.

NOTE: Install a new O-ring on the plug.



2940-248-3

10. Install the inspection window cover and tighten the capscrews to a torque of 3.5 Nm.



2940-249

Clutch Release Yoke

Disassembly

1. Remove bolts (B), the locating washer and the electronic clutch actuator splined shaft.



2940-250-1

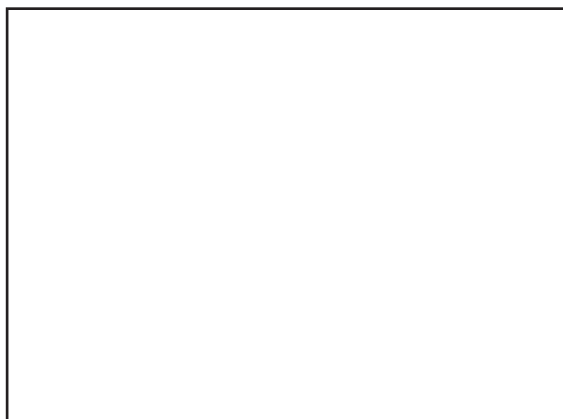
Inspection

1. Check cross-shafts for out-of-roundness and wear, replacing them if necessary.



2940-250-2

2. Check the release yoke pulleys for wear or seizing signs, replacing the release yoke if necessary.



2940-250-3

Assembly

1. Install the locating washer onto the splined shaft.
2. Install the washer (A) and splined shaft (B) into the release yoke.
3. Install the retaining bolt on the release yoke and tighten it to a torque of 61 Nm.

NOTE: Apply Loctite 272 to the bolt thread.



2940-251

Input Shaft Oil Seal Replacement



2940-252

1. Input shaft bearing cover
2. Oil seal

Oil Seal Removal

1. Remove the transmission from the truck.
2. Remove the retaining capscrews securing the transmission clutch housing to the transmission case and remove the clutch housing.



2940-184-3

3. Remove the retaining capscrews and remove the input shaft bearing cover.

NOTE: Use a rubber mallet to detach the input shaft bearing cover from the housing.



2940-253-2

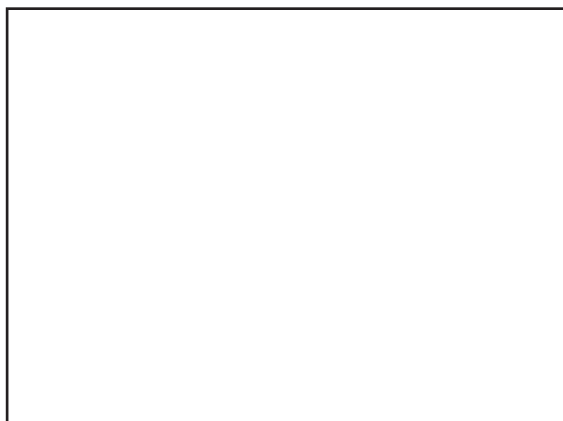
4. Using a small chisel and hammer remove the input shaft cover oil seal.
5. Replace the input shaft bearing cover if it presents wear, scratches or deformation on the oil seal seat, cover sealing surface or clutch release bearing sliding surface.



2940-253-3

Seal Installation

1. Install the oil seal into the input shaft bearing cover using special tool #205-586 and a press.



2940-254-1

2. Install the input shaft bearing cover by tightening its capscrews with a torque of 27 Nm.

CAUTION: When installing the cover, make sure that the lubrication channel faces upwards.



2940-254-2

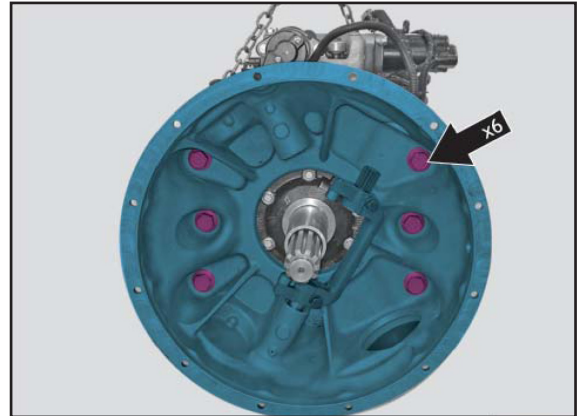
Main Shaft and Countershaft



3. Install the clutch housing on the transmission and tighten the 6 retaining capscrews to a torque of 205 Nm.

NOTE: Apply Loctite 272 to capscrews.

4. Install the gearbox into the truck.
5. Conduct a road test.



2940-184-3

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