Roadranger®

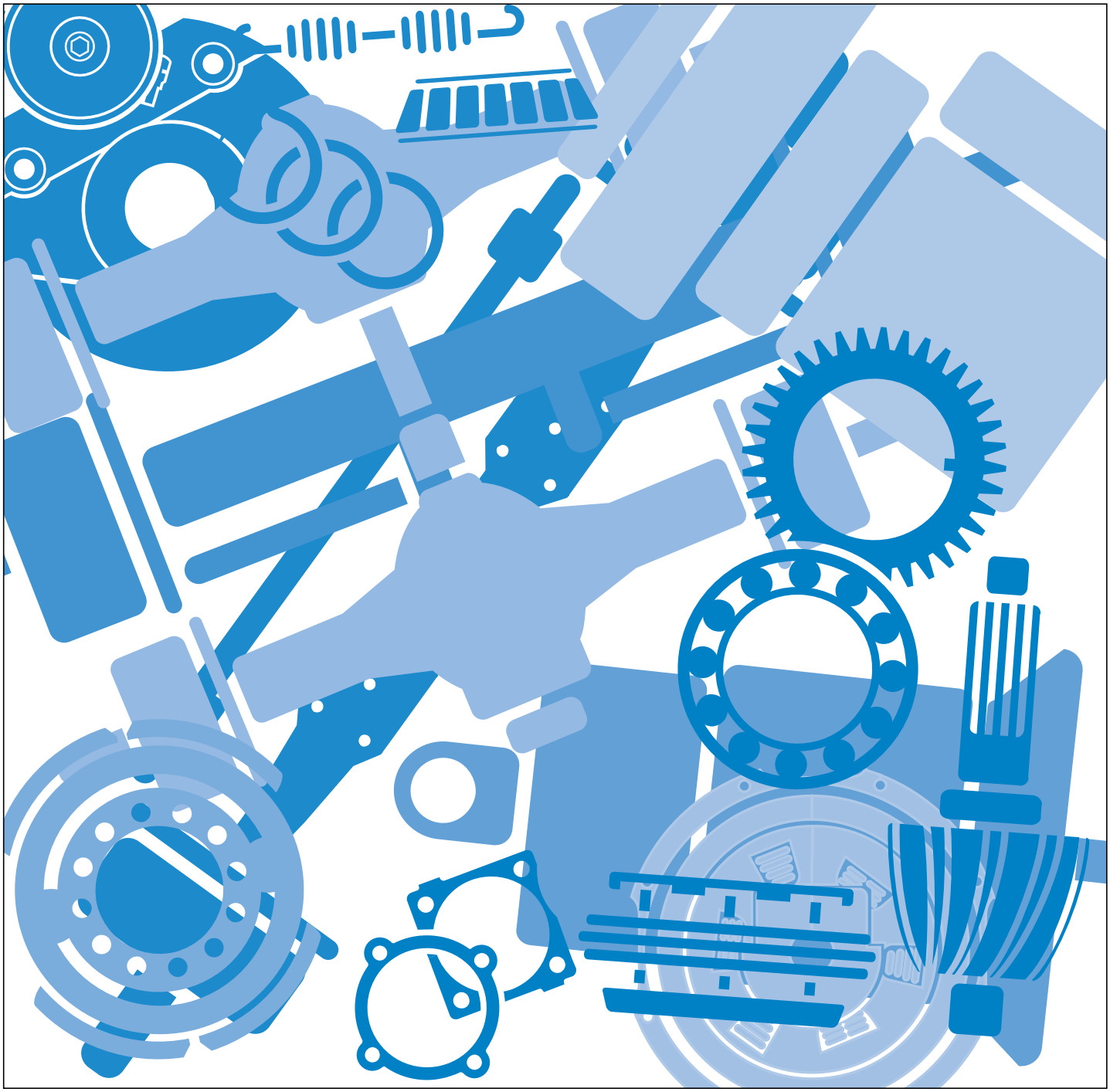
Eaton® Fuller® Transmissions

Mainshaft Assembly

DANA | EATON

One Great Drivetrain from Two Great Companies

Warranty Repair Strategy TRSM-0916 November 2003



For the most current information, visit the Roadranger web site at www.roadranger.com

Warnings and Precautions

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

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

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

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

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

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

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

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

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

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

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

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

Always use genuine Eaton replacement parts.

What is in this Guide?

Most Common Reasons for Delayed, Adjusted, or Rejected Warranty Claims

Mainshaft Assembly Warranty Coverage

Repair Standards

Mainshaft Configurations

Mainshaft Assembly Terminology for Combination Washer Design

Causes For Mainshaft Component Damage

Replacing/Reuse of Parts During Mainshaft Assembly Repair

Non-Selective Mainshaft Kits

Mainshaft Assembly

What is in this Guide?

The repair strategy contained in this publication is intended to guide the technician in the proper replacement of parts and repair procedure associated with a mainshaft assembly repair for heavy duty Eaton Fuller transmissions. After reading this publication, if you have any questions regarding warrantability, call the Eaton Help Line at 1-800-826-HELP (4357).

Tips for Mainshaft Repairs

1. Always confirm the complaint.
2. Always perform diagnostics before any repair.
3. Always verify proper transmission performance after any repair.

Other Helpful Product Literature

Product Literature Order Form - TCFM-0018

Eaton Warranty Manual - TCWY-0600

General Troubleshooting Guide - TRTS-0910

Understanding Spur Gear Life - TRSM-0913

Warranty Repair Strategy for Synchronizers - TRSM-0915

Air System Troubleshooting/Operation Guide - TRTS-0902

Most Common Reasons for Delayed, Adjusted, or Rejected Warranty Claims

(These Apply to Transmission Warranty Claims)

1. Labor hours exceed Standard Repair Times (SRT).
   - The original equipment manufacturer determines R & R labor times.
   - Eaton Truck Components determines bench repair labor times.
2. Labor hours charged to a claim contain operations not required to perform necessary repairs.
   - Example, complete overhaul of transmission for a synchronizer repair or an auxiliary repair for a mainshaft repair.
3. Parts mark-up exceed normal margins.
   - Parts improperly priced
4. Unauthorized product updates.
   - Any product update not related to the warrantable repair must first be authorized by Eaton Truck Components.
5. Over repair.
   - Replacing reusable parts
   - Replacing component that should be repaired
6. All parts replaced during the repair were not returned when requested.
7. Non-covered parts added to an extended warranty claim*.
   - Miscellaneous parts or shop supplies
   - Towing added to a claim
   - Secondary damage to non-Eaton parts
   - See warranty manual for complete list of non-covered items (ref. TCWY-0600, Section 5)
8. Eaton product is not the primary cause for repair.
   - Driveline failure, master clutch breakage, or suspension worn or misadjusted, any of which damages the Eaton component.
9. Subsequent repair/rebuild from an improper prior repair.
   - Gasket leaks
   - Debris from previous failure
   - Repeat failures
10. Non-warrantable failure.
    - Engine/Transmission mismatch (possible result of engine re-rate)
    - Application/Vehicle mismatch which results in an unapproved application
    - Operational abuse
    - Faulty maintenance practices
    - Normal wear
11. No failure.
12. Vehicle out of warranty.
13. Claim too old.
    - Claims must be submitted within 90 days of the repair
14. No Eaton product serial number on claim.
15. Claim has already been paid.
16. Vehicle not meeting the requirements for extended warranty.
17. Re-submitted original rejected claim with no new information to support claim.
18. Warranty claim without an itemized list of parts replaced.

* During the OEM warranty period, the truck manufacturer may cover items listed on the Exclusions List in the Eaton Warranty Manual. Contact your OEM for details.

Mainshaft Assembly Warranty Coverage

Please read the following information carefully when performing a warrantable mainshaft assembly related repair during the warranty period. The following explains the kind of transmission repairs not reimbursed during the warranty period.

Mainshaft assembly repairs not covered during the warranty period include damage caused by:

- Drivetrain and engine torsional activity (vibration), refer to service bulletin TRIB-9701 for troubleshooting vibration related complaints.
- Driver induced damage caused by not moving lever completely into gear, improper shifting, and not using the master clutch.
- Repeat damage due to inadequate or improper prior repairs.
- Damage due to over-speeding of the auxiliary, refer to page 6.
- Damage due to engine/transmission mis-match.

During the warranty period, use this guide to make repairs to the mainshaft assembly and related parts. Warranty claims with re-usable parts replaced and non-warrantable parts charged to the claim are not reimbursable during the warranty period. Mainshaft assembly repairs do not require the replacement of the transmission.

Note: Any elective repair* or upgrading made during the warranty period is not reimbursable on a warranty claim. Normal wear on parts not associated with the repair are not covered under warranty.

* Elective Repair - Any repair or upgrade not associated with the warrantable repair where parts are reusable, or damage is the result of operational or application abuse.

Repair Standards

The following descriptions cover the normal repair strategy for the mainshaft assembly. All mainshaft parts should be inspected for abnormal wear while transmission is disassembled.

Labor Necessary to Repair Front Box Mainshaft Assembly

Transmission mainshaft repair requires complete removal of the transmission from the vehicle. Use standard OEM repair times or refer to Section 4 of the Roadranger Warranty Manual for labor hour guidelines. Labor hour guidelines include replacement of all damaged mainshaft pieces. Repair does not normally require overhaul of the auxiliary section, except when contamination is significant as indicated below.

Replace lube and bearings when damage to gearing appears similar to or worse than damage on this gear. Replacement is required due to fine particle contamination.

Air System Repair

Repairing air system component is <u>not</u> part of a mainshaft assembly repair.

Bearing and Lubrication Replacement

Bearing replacement is only required when bearings are damaged during normal removal and with high levels of oil contamination. Reuse most bearings during mainshaft assembly repair. Refer to figures for “rule of thumb” on how to determine when contamination levels require bearing replacement.

Re-use lube and bearings when damage to gearing appears similar to damage on this gear.

Lubrication replacement is recommended when significant damage is done to external gear teeth. Use the same criteria of contamination used for proper bearing replacement. See the Eaton Warranty Manual for specific lubrication usage.

Miscellaneous Parts Normally Replaced During a Repair

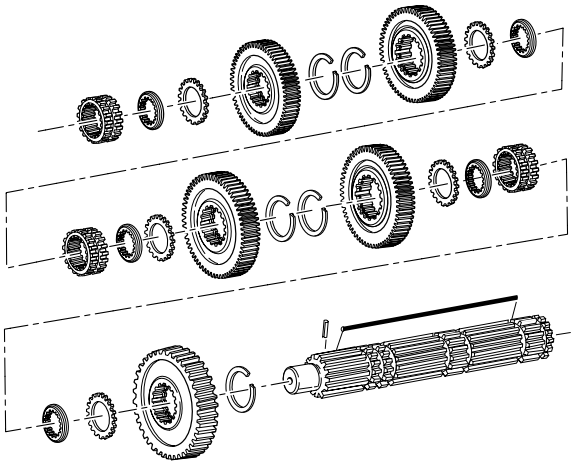
The following parts are considered normal replacement parts for a warrantable mainshaft washer repair:

- All gaskets where sealing surface was broken.
- The rear bearing on the upper countershaft in the front section. This bearing is typically damaged during removal.

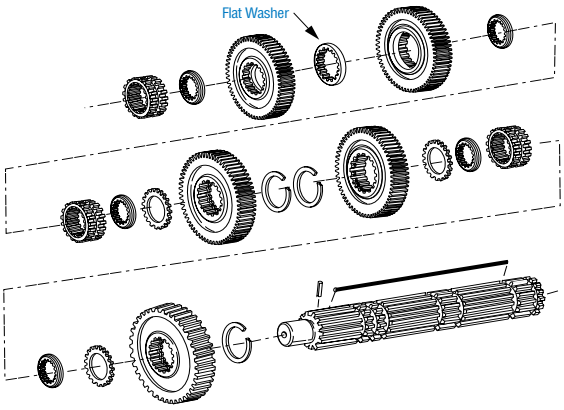
Replacing other gaskets, the input shaft, clutch brake, output seal, output shaft nut, PTO repair, etc. is not considered a normal part of a mainshaft assembly repair.

Mainshaft Configurations

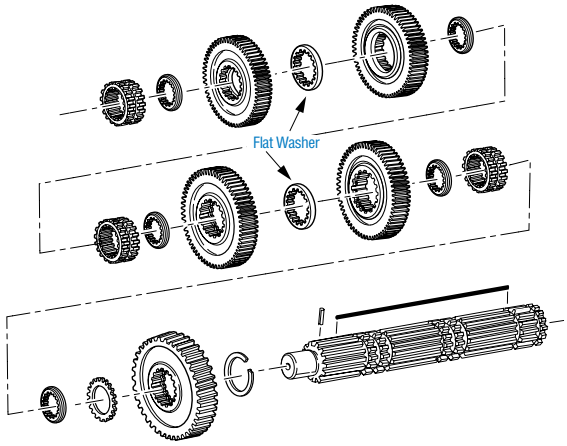
This figure shows the mainshaft assembly design prior to the introduction of the non-selective washer configuration. This design uses a series of variable thickness washers to maintain proper gear clearances.



This figure shows the mainshaft assembly design introduced starting June 1994 for transmissions with the overdrive located in the front section. The first two gears on the mainshaft use a non-selective washer design, identified by the flat washer located between the gears. This gear position is not adjustable. See Mainshaft Assembly Terminology for Combination Washer Design for more parts terminology on this design.



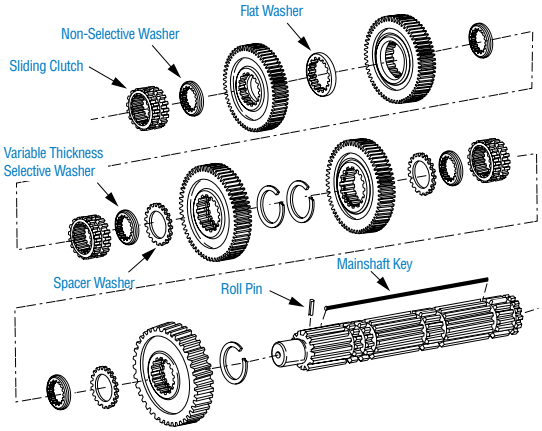
This figure shows the mainshaft assembly design phased into production in 1996. All positions, except reverse*, use this non-selective design washers. Note the flat washer located between both gear sets.



* Except heavy duty transmissions with a "**2**" in the model designation, example RTO-15**2**10C. These models have non-selective washers in all front box gears.

Mainshaft Assembly Terminology for Combination Washer Design

This mainshaft uses both the selective and non-selective washer designs on the mainshaft. The gear set is not adjustable that uses the flat washer and non-selective washer. Therefore, the gear set with the flat washer uses **non-selective** washers. The latest mainshaft washer design uses the non-selective design in all locations except reverse gear. This excludes the heavy duty models such as RTO-15**2**10C that use the non-selective design in all front box gearing locations. These models have a "**2**" designation to distinguish them from other models.



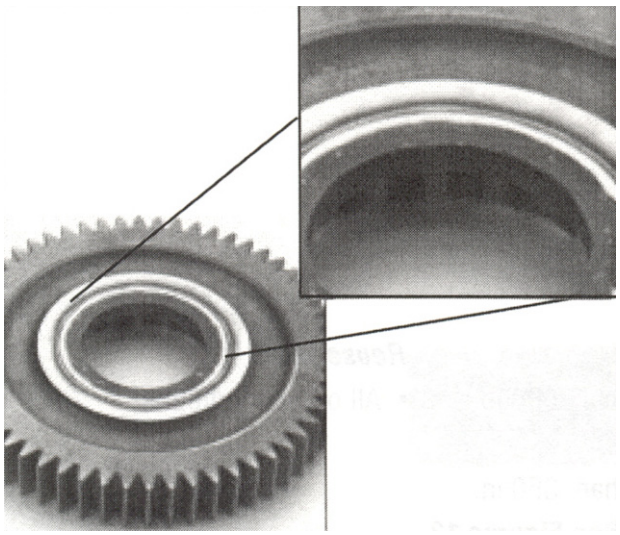
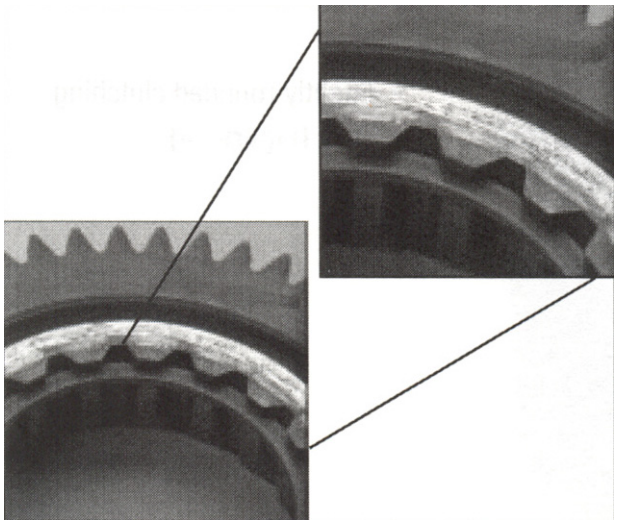
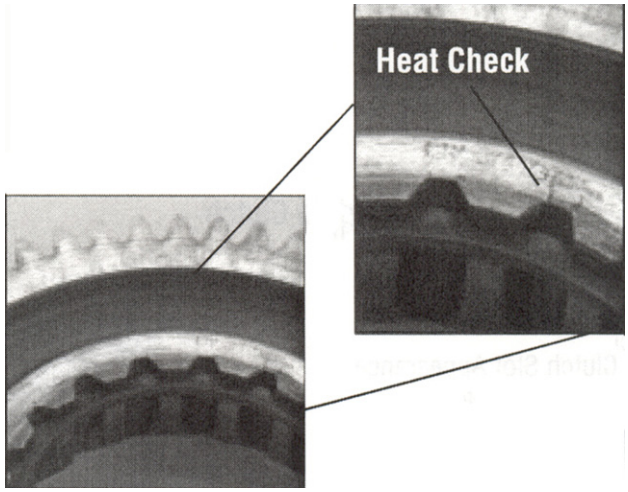
Causes For Mainshaft Component Damage

Observed Condition	Cause*
• Burned/scored washers • Burned/scored gear hubs • Burned/scored mainshaft bushing journal • Broken washer	• Over-speeding of the transmission due to improper towing of the vehicle, refer to the inside cover for towing instructions. • Coasting in neutral in low range at high road speed. • Lever slipout due to severely worn or damaged clutching teeth on gear or sliding clutch. • Lever slipout due to partial lever engagement from improper driving techniques.
• Snubbed or damaged clutching teeth in gears or on sliding clutch • Slot wear on sliding clutch • Worn pads on shift fork	• Out of adjustment master clutch • Excessive drag in master clutch • Improper shifting techniques -Refer to the driver instructions for proper shifting techniques for your transmission. • Out of adjustment remote shift linkage • Out of adjustment or severely worn clutch brake • Failure to use clutch brake for initial gear engagement • Defective (seized) clutch pilot bearing
• Mainshaft spline damage	• Drivetrain torsional activity due to: -Improper driveline angles -Improper air bag (suspension) settings -Damaged master clutch springs -Excessive torsional oscillations from engine • Washer damage -Cracked -Broken • Mainshaft key damage • Twisted mainshaft due to starting truck with transmission in high range, backing into loading dock, abusively sliding fifth wheel, etc.
• Mainshaft gear teeth damage	• Refer to "Understanding Spur Gear Life", TRSM-0913. • Broken washer allowing gear to move on mainshaft • Large particle contaminations (secondary damage)
* Refer to page 3 for repairs not covered during the warranty period.	

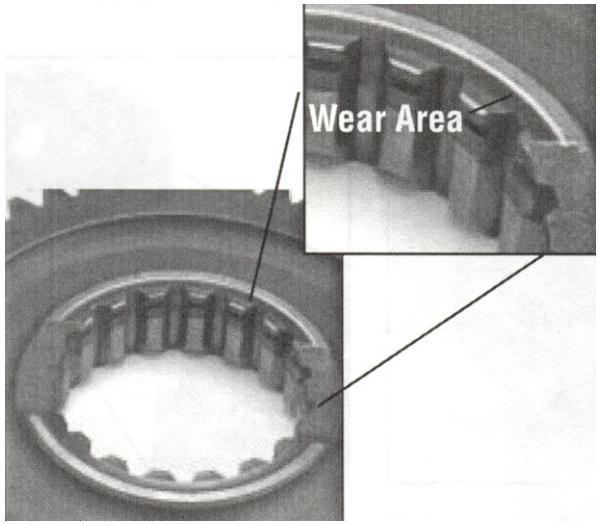
Replacing/Reuse of Parts During Mainshaft Assembly Repair

Gears

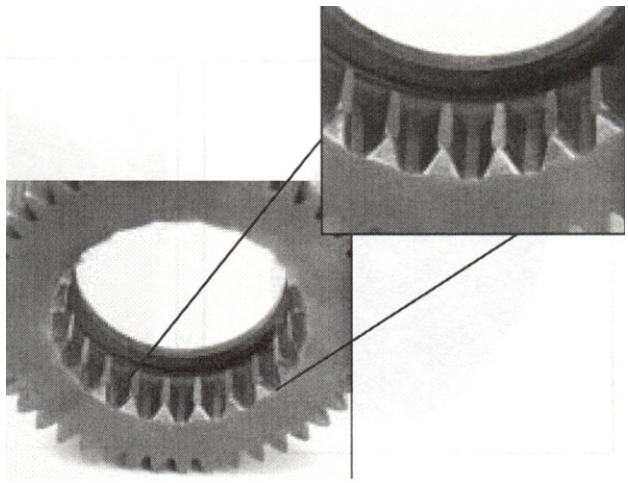
Hub Appearance

Replace when	*Reuse when*
• *Scoring or abrasive welding* • *Bluing from heat*  • *Deep pitting/smearing* 	• *High polish* • *Light smearing*  • *Heat checks (except mainshaft overdrive gear which should be replaced when heat checks are present)*

Hub Appearance (continued)

Replace when	*Reuse when*
• *Heavy wear greater than 0.020 inches (reverse gear only)* 	

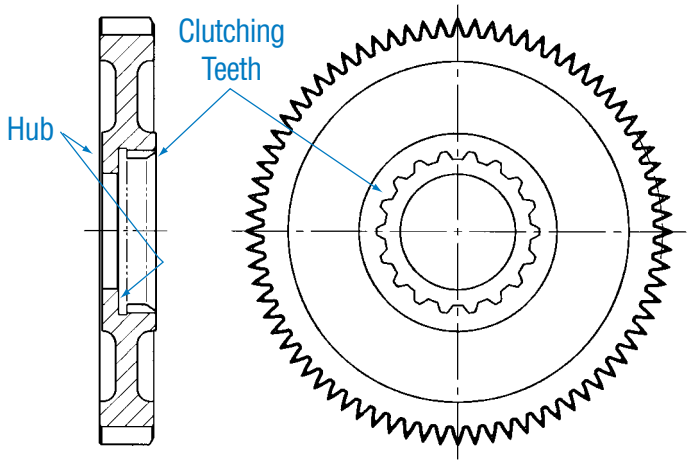
Clutch Teeth Appearance

Replace when	*Reuse when*
• *Severely worn clutching teeth* • *Indents from torsional vibration*	• *Slightly rounded clutching teeth* 

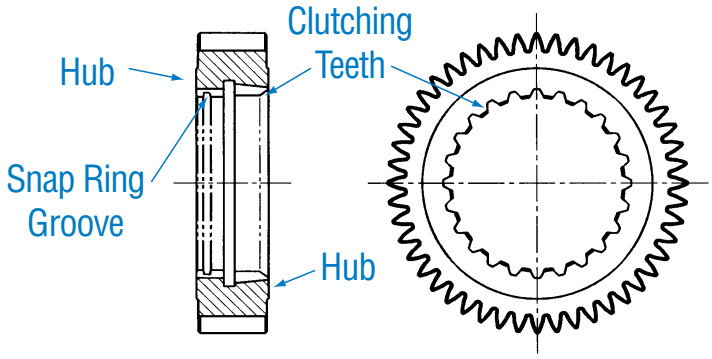
Teeth
(Refer to Understanding Spur Gear Life, TRSM-0913)

Replace when	***Reuse when***
• *Broken* • *Pitted* • *Scored*	• *Frosted* • *Shiny*

Non-Selective Gear Design



Selective Gear Design



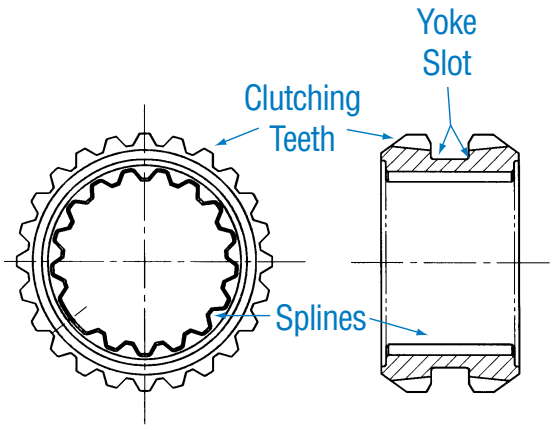
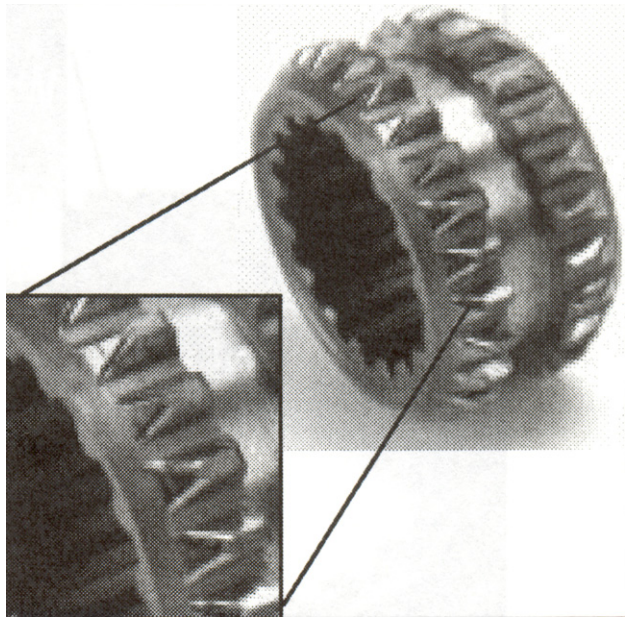
Note: Only if gear replacement is determined as necessary, is an upgrade to the non-selective mainshaft kit an appropriate warranty repair. See “Table 2: Partial Washer Update Kits” on page 17. for kit selection.

Sliding Clutch

Clutch Slot Appearance

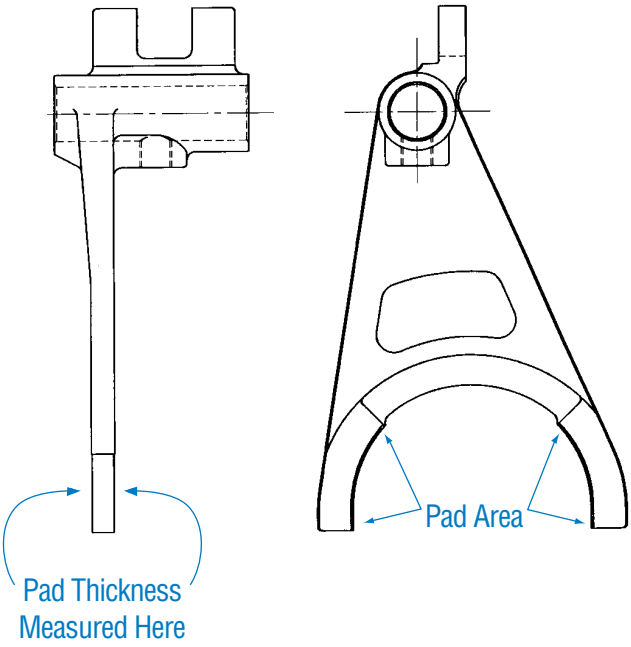
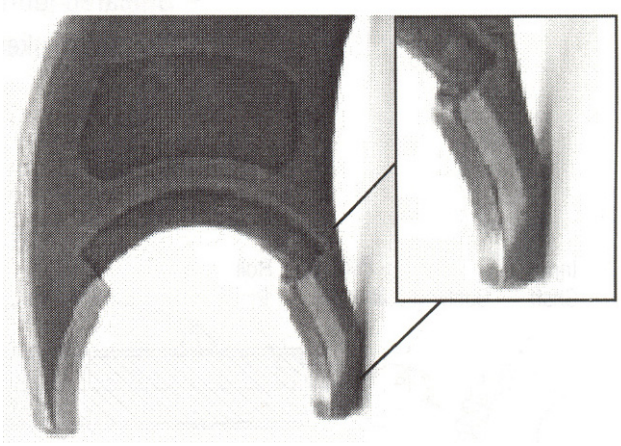
Replace when	*Reuse when*
• Slot width is greater than 0.500 in. for back taper clutches *• Slot width is greater than 0.350 in. for straight clutches* *(back taper teeth)*  *(straight teeth)* 	*• All other conditions*

Clutch Teeth Appearance

Replace when	*Reuse when*
• *Severely worn clutching teeth* • *Indents from torsional vibration* 	• *Slightly rounded clutching teeth* 

Shift Forks

Pad Appearance

Replace when	*Reuse when*
• *Pad thickness is less than 0.275 inch* • *Broken* • *Blued from heat* 	• *Slight pad wear* • *Uneven pad wear* 

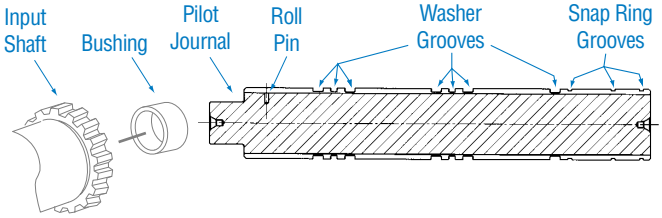
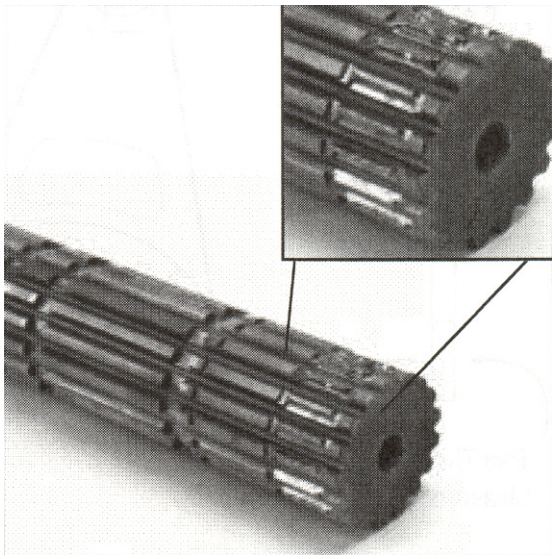
Key (mainshaft)

All appearances

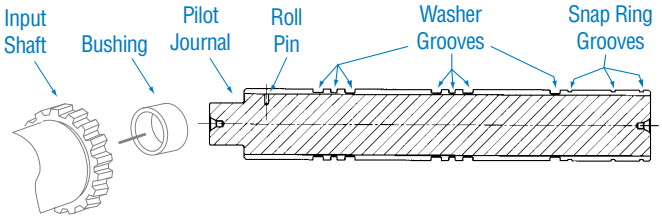
Replace when	*Reuse when*
• *Replacement of the mainshaft key is considered part of any mainshaft assembly repair*	• *Not recommended*

Mainshaft

Mainshaft

Replace when	*Reuse when*
• *Twisted* • *Broken* • *Bluing at washer grooves* • *Smeared splines at washer grooves* • *Smeared journal at pilot* • *Splines broken at snap ring grooves*  • *Torsional damage from vibration* 	• *Polished journal at pilot* • *Polish from sliding clutch movement*

Mainshaft Bushing (at input shaft rear)

Replace when	*Reuse when*
• *Broken* • *I.D. greater than 1.400 inch* • *Smeared* 	• *Light scoring* • *Polished*

Snap Ring

Replace when	*Reuse when*
• *Distorted* • *Loose on shaft*	• *Polished* • *Tight on shaft*

Washer and Spacers

Thrust Surfaces

Replace when	*Reuse when*
• *Broken* • *Cracks* • *Discolored due to heat* • *Pitted, scored, or abrasive welding* 	• *Polished* • *Phosphate coating worn away* 

Internal Splines

Replace when	*Reuse when*
• *Broken* • *Key damage*	• *Polish from key contact*

Non-Selective Mainshaft Kits

All mainshaft washers (part numbers 4303603 and 4302398) provided in these kits are non-selective and **NOT** interchangeable with other mainshaft washers. The axial gear clearance is non-adjustable for these gear sets, proper clearance occurs without adjustment. The reverse gear clearance is set as per the normal Eaton Fuller procedure. Each kit contains all necessary components to update the mainshaft assembly except for reverse gear which can be reused with the new assembly.

Starting March 1996 **all** service mainshafts for the models listed below will have 3 washer grooves in two locations. The new mainshaft services both the new and old gear and washer configurations. When using the new mainshaft with the old gear and washer system ignore the center washer groove.

There are two (2) levels of update kits for selected models; partial update, and complete update. Partial washer update kits are available for models produced after the listed serial number in Table 2 for each corresponding model group. To locate the unit serial number, see illustration that follows. For questions regarding serial number start, contact the Roadranger Call Center at 1-800-826-HELP (4357).

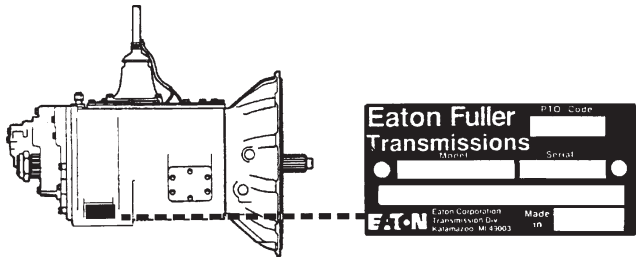
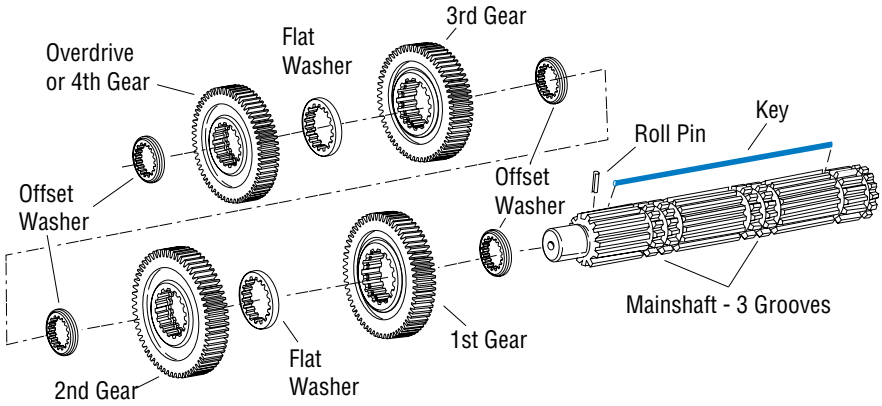


Table 1: Complete Washer Update Kits

This illustration is representative of components contained in a complete update kit.

Note: Gear descriptions vary between models.



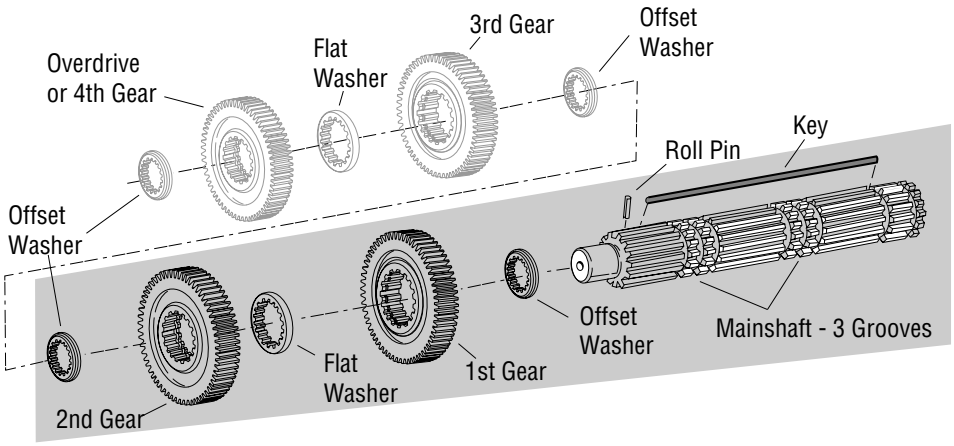
Each kit contains 4 gears, 1 mainshaft, 1 key, 1 roll pin, and necessary washers to update the mainshaft assembly.

New Kit	Replaces Old Kit	For Models
K-3151	K-2785, K-2786, K-2787	RTLO-12,14,16713A
K-3152	K-2792, K-2793	RTO/RTX-11,14,15715, RTO-11,12,14610
K-3153	N/A	RT-11,14,15715, RT-11,12,14610
K-3155	N/A	RT-11,12,13,14609A, RT/RTO-11, 14, 15613
K-3156	K-2788, K-2789, K-2788	RTO/RTX-11,12,13,14609A
K-3157	K-2799, K-2988, K-2784	RTO/RTX-11,12,13,14609B, RTO/RTX-16709B, RTOO-11, 14613
K-3158	N/A	RTX-11,12,13,14609R
K-3159	N/A	RT-8709B, RT-11,12,13,14709H
K-3160	N/A	RT-11,12,13,14710B
K-3161	K-2788, K-2790, K-2791	RTX-11,12,13,14,15,16710B (Includes AutoShift & AutoSelect)
K-3166	K-2782, K-2783, K-2784	RTX-11,12,13,14,16709H
K-3167	K-2782, K-2783, K-2784	RTX-11,12,13,14,15,16710C
K-3228	N/A	RTLO-14613B, RTLO-14618A, RTLO-16618A

Table 2: Partial Washer Update Kits

This illustration is representative of components contained in a partial update kit (shaded area represents kit contents).

Note: Gear descriptions vary between models.



Each kit contains 2 gears, 1 mainshaft, 1 key, 1 roll pin, and necessary washers to update the mainshaft at **1st and 2nd position** (low and 1st position depending on model).

New Kit	For Models	After Serial # Start
K-3168	RTLO-14,16,18718B	ALL
K-3169	RTLO-12,14,16713A	50934613
K-3170	RTO-11,14,15715	70622701
K-3171	RTO-11,14709MLL	ALL
K-3176	RTO-11,12,13,14609A, RTO/RTX-11, 14708LL	70622701
K-3162	RTO/RTX-11,12,13,14609B,RTX-16709B	70622701
K-3173	RTX-11,12,13,14,15,16710B	70622701
K-3174	RTX-11,12,13,14709H	70591705 or 81325033 or 50946891
K-3174	RTX-16709H	70580619
K-3175	RTX-11,12,13,14, 710C	70591705 or 81325033 or 50946891
K-3175	RTX-16710C	70580619 or 81347679

“Non-Selective” Mainshaft Washer Design

The following assembly and disassembly procedures apply to the new “non-selective” mainshaft washer kits shown on Tables 1 and 2. Non-selective means that you do NOT have to adjust mainshaft clearances, and that proper clearance occurs without manual adjustment.

The new mainshaft, washers, and gears described in this manual are interchangeable with previous mainshaft designs when replaced as a complete assembly. Mixing of designs can create assembly problems and/or transmission failures with the exception of the mainshaft only. The mainshaft is interchangeable with previous design gears and washers.

To remove and re-install the new mainshaft design, use the procedures found in your current Eaton service manual for the model being serviced. The following procedures cover only disassembly and re-assembly of the mainshaft assembly.

For more information contact Roadranger Call Center at 1-800-826-HELP (4357).

Mainshaft Assembly

Disassembly instructions only apply to transmissions with non-selective design.

How to Disassemble the Mainshaft Assembly

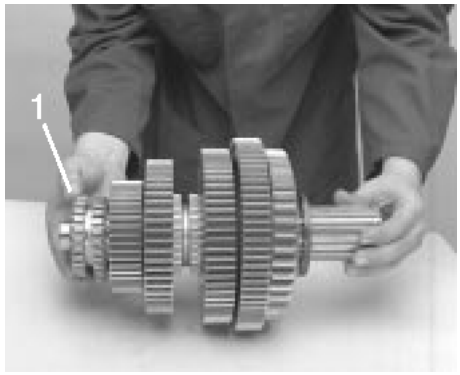
What To Do First
Remove the mainshaft assembly per your Eaton Fuller Service Manual.

Special Tools
None

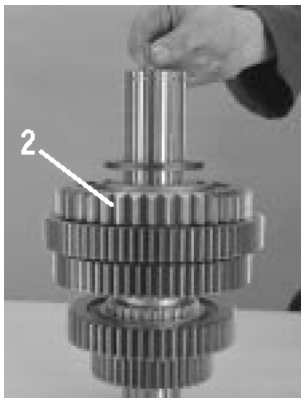
To Disassemble

Note: Lay all parts on a clean bench in order of removal to facilitate assembly.

1. Lay the mainshaft on its side, and from the front, remove the 4th (or overdrive) and 5th sliding clutch.

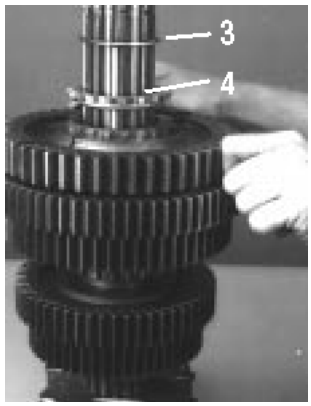


2. Place the mainshaft in a vertical position, pilot end down.

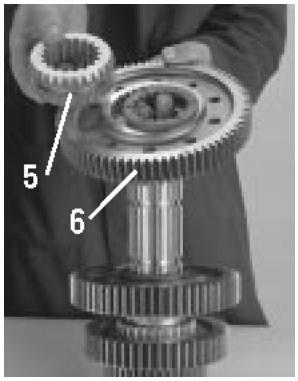


3. Remove Snap Ring (if applicable)
4. Remove key, washer, and reverse gear. Mark keyway location.

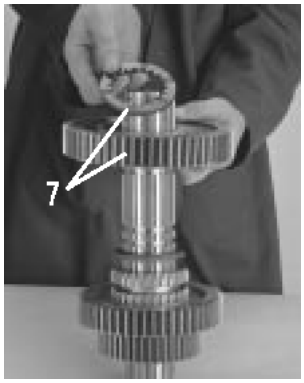
Note: When removing washer and reverse gear, note their location. Keep the washer with the reverse gear.



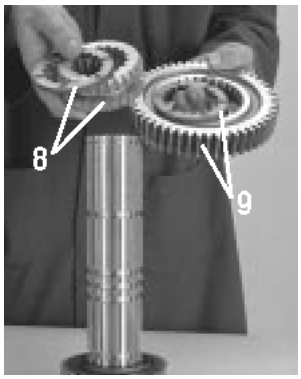
5. Remove the 1st and reverse sliding clutch.
6. Remove the offset washer and 1st gear.



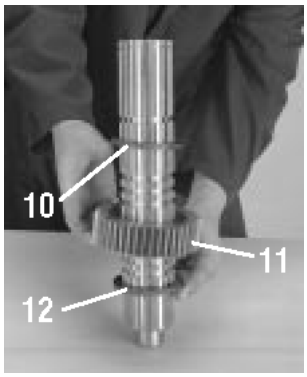
7. Remove the flat washer and 2nd gear.



8. Remove the offset washer and sliding clutch.
9. Remove the offset washer and 3rd gear.



10. Remove the flat washer.
11. Remove the 4th or overdrive gear.
12. Remove the offset washer.

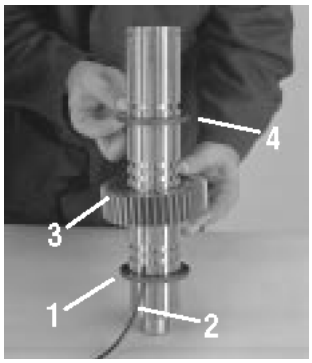


How to Assemble the Mainshaft Assembly

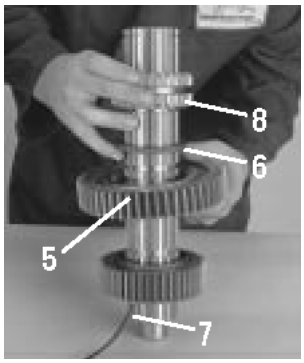
Special Tools
A piece of 5/32" air line, 1' long

To Assemble

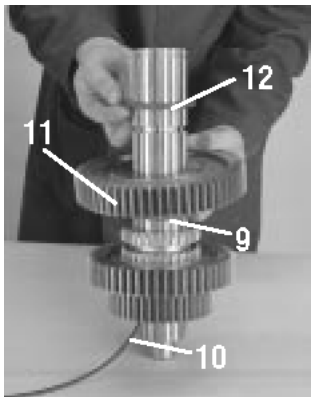
1. With mainshaft pilot-end down, install offset washer (flat surface up). Rotate the washer until the washer splines and mainshaft splines align.
2. Start at the mainshaft bottom and install a plastic line in the marked keyway to lock the washer in place.
3. With clutching teeth down, position the 4th speed or overdrive gear on the mainshaft.
4. Install the flat washer. Rotate the washer until the washer splines and mainshaft splines align.



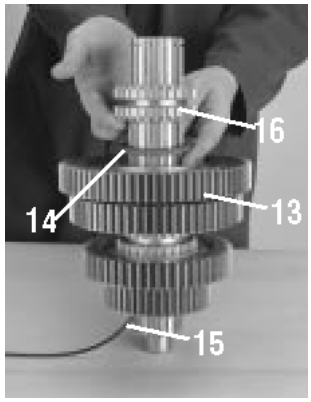
5. With clutching teeth up and against the spacer, install the 3rd speed gear.
6. Position the offset washer (flat surface down) against the gear. Rotate the washer until the washer splines and mainshaft splines align.
7. Push the air line up to lock the washers on the mainshaft.
8. With the missing internal splines aligned with the plastic line, install the 2nd-3rd sliding clutch (flat surface up).



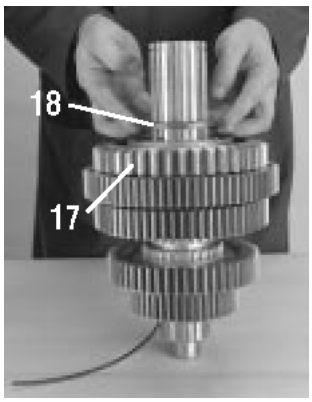
9. Position the 2nd speed gear offset washer in the next available groove. Rotate the washer until the washer splines and mainshaft splines align.
10. Push the air line up to lock the washer on the mainshaft.
11. With clutching teeth down, position the 2nd speed gear on the mainshaft.
12. Position the flat washer against the gear. Rotate the washer until the washer splines and mainshaft splines align.



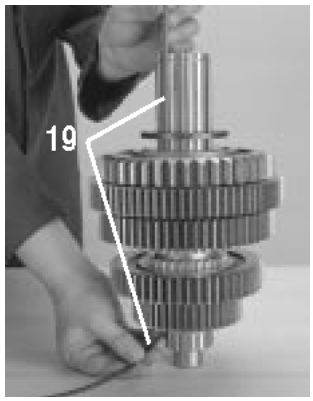
13. With clutching teeth up, install 1st speed gear on shaft against 2nd speed gear.
14. Position the offset washer (flat surface down) against the gear. Rotate the washer until the washer splines and mainshaft splines align.
15. Push the air line up to lock the washer on the mainshaft.
16. With the missing internal splines aligned with the plastic line, install the 1st-reverse sliding clutch.



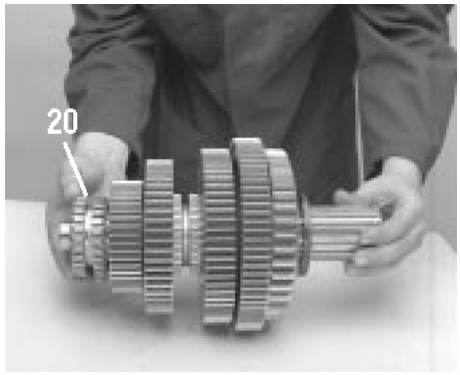
17. With clutching teeth down, position the reverse gear on the mainshaft.
18. Position the selective washer (flat side up) in the next available groove. Rotate the washer until the washer splines and mainshaft splines align.

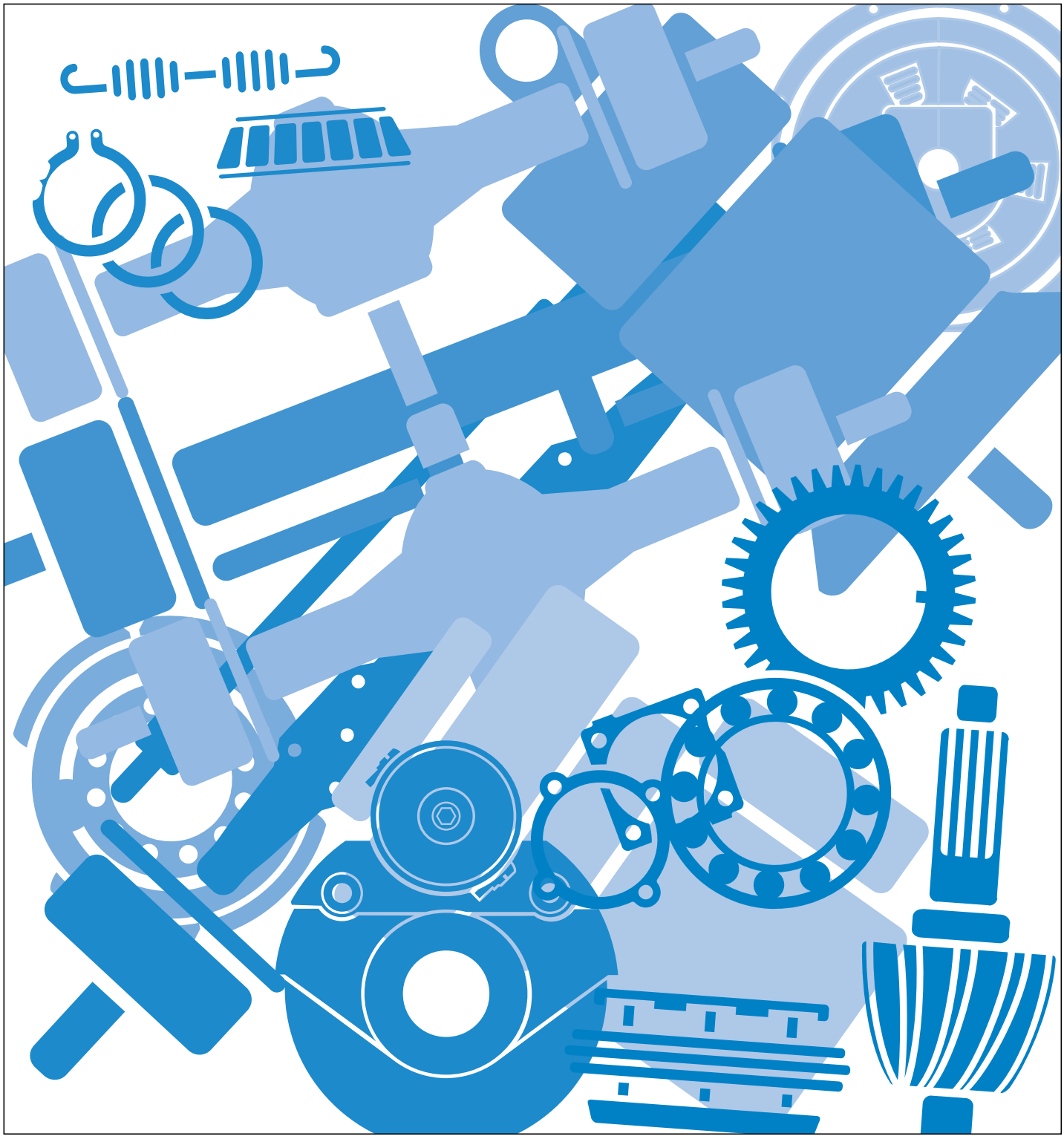


19. Install the key from the top as the air line is pulled out the bottom.



20. Lay the mainshaft on its side, and from the front, install the 4th and 5th sliding clutch.





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