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Roadranger®

Eaton® Fuller® Heavy Duty Transmissions

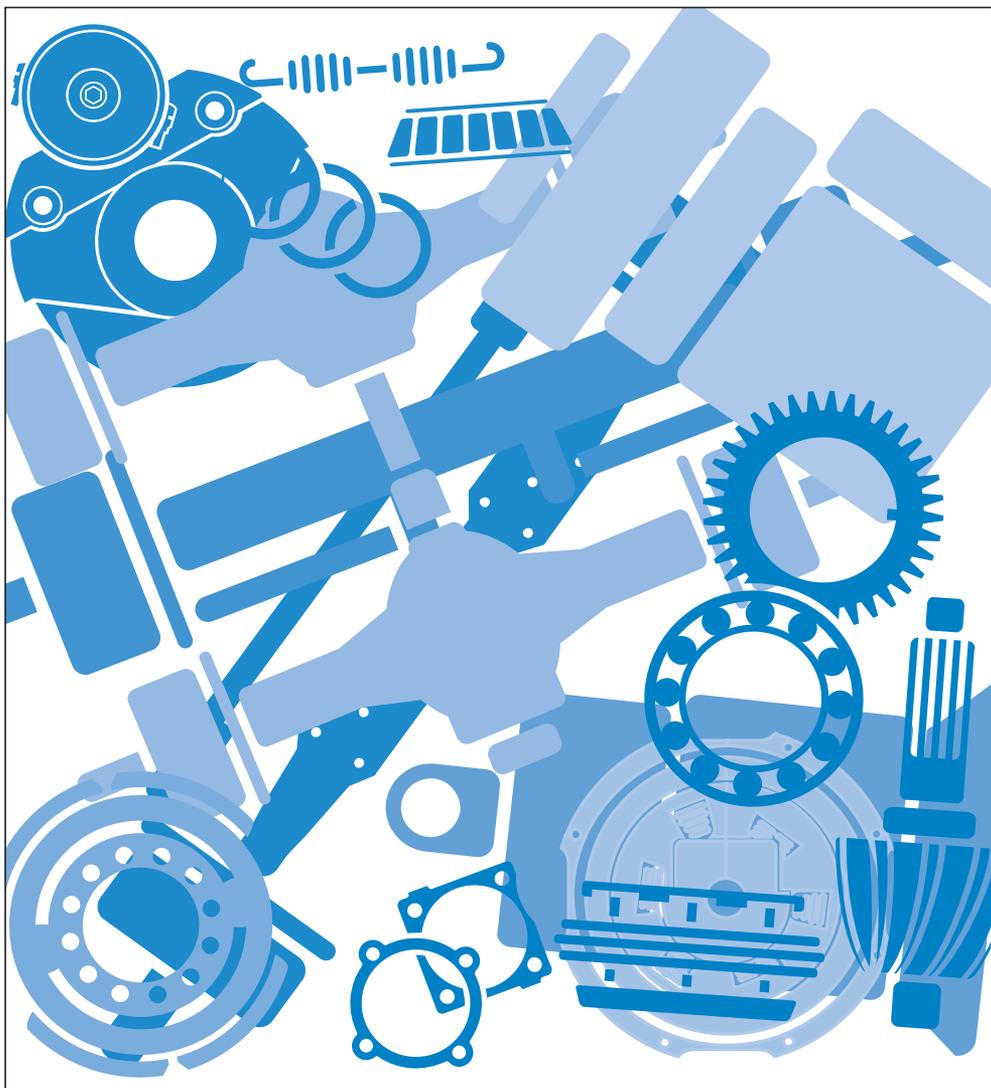
RTLO-10/Top 2 Models



EAT•N

One Great Drivetrain from Two Great Companies

Driver Instructions TRDR-0550 August 1996



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



WARNING

Read the entire driver instructions before operating this transmission.

Before starting a vehicle always be seated in the driver's seat, move the shift lever to neutral, and set the parking brakes.

Before working on a vehicle or when leaving the cab with the engine running, place the transmission in neutral, set the parking brakes, AND block the wheels.

When parking the vehicle or leaving the cab, always place the shift lever in neutral and set the parking brakes.

TOWING: To avoid damage to the transmission during towing, place the transmission in neutral and lift the drive wheels off the ground or disconnect the driveline.

Every effort has been made to ensure the accuracy of all information in this brochure. However, Eaton Truck Components makes no expressed or implied warranty or representation based on the enclosed information. Any errors or omissions may be reported to Technical Communications, Eaton Truck Components, P.O. Box 4013, Kalamazoo, MI 49003.



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Introduction

Congratulations on your purchase of a Super 10 Transmission. This new generation transmission may be different from any other transmission you have operated.

In the Super 10, half of the ten speed ratios are shifted with the shift lever while the other half are shifted by moving the shift button. Button shifts require the driver to raise or lower the engine RPM the same amount as a lever shift.

To successfully operate this or any transmission, the driver must be aware of the characteristics of today's diesel engines. Today's engines;

- Produce horsepower and torque at a lower RPM
- Operate at a lower RPM
- Are governed at a lower RPM
- Decelerate slower

By understanding these engine characteristics and knowing that the transmission works as a partner with the engine, the driver can successfully manage the powertrain package to achieve the best vehicle performance and fuel economy.

In a Super 10, this means that a driver should remember to shift at a lower RPM and allow enough time for the engine speed to decrease sufficiently for the next higher gear.

By shifting with the proper technique, the driver can fully appreciate the ease and simplicity the Super 10 offers.

Transmission Operation

Definitions / Glossary of Terms

The following terms are used in describing the transmission operating procedures.

Break Torque:

Releasing engine power or load from the transmission and drivetrain by releasing throttle or depressing clutch pedal.

Double-Clutch:

The clutching procedure used when moving the shift lever to the next lever position. See page 12.

Preselect:

Moving the shift button just prior to starting the shift. The shift button should not be moved while the shift lever is in neutral.

Ratio Step:

Amount of change between two gear ratios expressed as a percentage. Example: The ratio step from 1st gear to 2nd gear is 35%.

Shift Button:

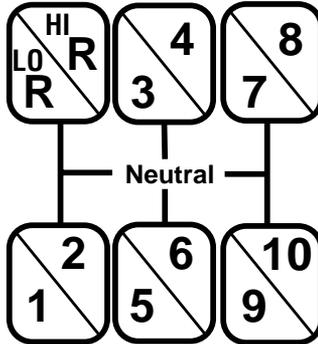
The button on the side of the shift knob used to change gears.

Synchronous:

The point at which the input gearing speed (engine speed) matches the output gearing speed (road speed) and a shift can occur without grinding.

Transmission Operation

Shift Pattern



Shift Knob

Shift Button Rearward

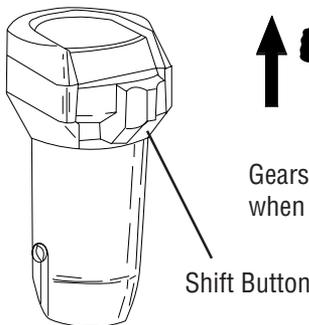


Gears 1, 3, 5, 7, 9
when button is
rearward

Shift Button Forward



Gears 2, 4, 6, 8, 10
when button is forward



Transmission Operation

Initial Start-Up



Before starting a vehicle always be seated in the driver's seat, move the shift lever to neutral, and set the parking brakes.

1. Make sure the lever is in neutral and the parking brakes are set.
2. Depress the clutch pedal, turn on the key switch, and start the engine.
3. Allow the vehicle air pressure to build to the proper operating pressure (90-120 PSI). Refer to your "Operator or Service Manual" supplied with the truck.
4. Depress the brake pedal.
5. Depress the clutch pedal to the floor to contact the clutch brake.
6. Move the shift lever to the desired starting gear.
7. Release the parking brakes on the vehicle.
8. Slowly let up on the clutch pedal.
9. When the clutch is fully engaged, apply the accelerator.

Transmission Operation

Types of Super 10 Shifts

There are three different types of shifts used with the Super 10 transmission.

Button Only Shift: This is a gear ratio change that occurs by moving the shift button.

Combination Button/Lever Shift: This is a gear ratio change that occurs by moving both the shift button and shift lever.

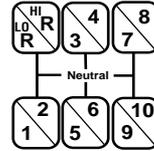
Lever Only Shift: This shift occurs when the shift lever is moved without moving the shift button. It results in a skip of a full gear ratio and should only be used when the vehicle is bobtail or lightly loaded.

Note: Button Only shifts and Combination Button/Lever shifts are both full gear changes. Lever only shifts skip a gear.

Transmission Operation

Procedure

Button Only Shift



Upshift: Used for gear changes 1st to 2nd, 3rd to 4th, 5th to 6th, 7th to 8th, and 9th to 10th

Accelerate through the current gear, when the next gear is desired....

Preselect by moving the shift button forward, immediately break torque by releasing the throttle or depressing the clutch pedal, allow the engine RPM to decrease to provide synchronous for the next desired gear.

The shift will complete when the engine RPM has decreased to the proper speed. Tip: Use the tachometer to determine when the shift completes.

Downshift: Used for gear changes 10th to 9th, 8th to 7th, 6th to 5th, 4th to 3rd, and 2nd to 1st.

As the vehicle decelerates, and a downshift is required*

With the throttle still applied, preselect by moving the shift button rearward, immediately break torque by releasing the throttle or depressing the clutch pedal, increase engine RPM to provide synchronous for the desired gear.

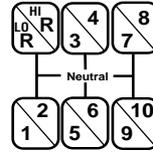
The shift will complete when the engine RPM has increased to the proper speed.

* Do not attempt a downshift at too high of an engine speed (generally above 1400 RPM)

Transmission Operation

Procedure

Combination Button and Lever Shift



Upshift: Used for gear changes 2nd to 3rd, 4th to 5th, 6th to 7th, and 8th to 9th.

Accelerate through the current gear, when the next gear is desired....

Preselect by moving the shift button rearward, immediately break torque by releasing the throttle and depressing the clutch pedal, then using proper Double-Clutching techniques¹, move the shift lever to the next desired gear position.

Downshift: Used for gear changes 9th to 8th, 7th to 6th, 5th to 4th, and 3rd to 2nd.

As the vehicle decelerates, and a downshift is required*....

With the throttle still applied, preselect by moving the shift button forward, immediately break torque by releasing the throttle and depressing the clutch pedal, then use proper Double-Clutching techniques¹, move the shift lever to the next desired gear position.

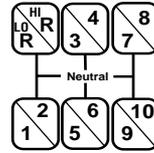
* Do not attempt a downshift at too high of an engine speed (generally above 1400 RPM)

¹ If necessary, see Double-Clutching Procedure page 12

Transmission Operation

Procedure

Lever Only Shift



Used for skipping a full gear ratio when the vehicle is lightly loaded or bobtail.

Upshift: With the shift button rearward - 1st to 3rd, 3rd to 5th, 5th to 7th and 7 to 9th.

With the shift button forward - 2nd to 4th, 4th to 6th, 6th to 8th, and 8th to 10th.

Accelerate through the current gear, when the next gear is desired....

Break torque by releasing the throttle and depressing the clutch pedal, then using normal Double-Clutching techniques¹, move the shift lever to the next desired gear position.

Remember: Lever Only shifts **skip** an entire gear ratio and will require the engine RPM to decrease twice the amount of a normal shift.

Downshift: With the shift button rearward - 9th to 7th, 7th to 5th, 5th to 3rd, and 3rd to 1st.

With the shift button forward - 10th to 8th, 8th to 6th, 6th to 4th, 4th to 2nd.

As the vehicle decelerates and a downshift is required*....

Break torque by releasing the throttle and depressing the clutch pedal, then using normal Double-Clutching techniques¹, move the shift lever to the next desired gear position.

* Do not attempt a lever only downshift at too high of an engine speed (generally above 1000 RPM).

¹ If necessary, see Double-Clutching Procedure page 12.

Transmission Operation

Double-Clutching Procedure

- Purpose:**
- 1) To break torque to allow the transmission to come out of gear, and....
 - 2) To disengage the engine from the transmission when shifting into gear.

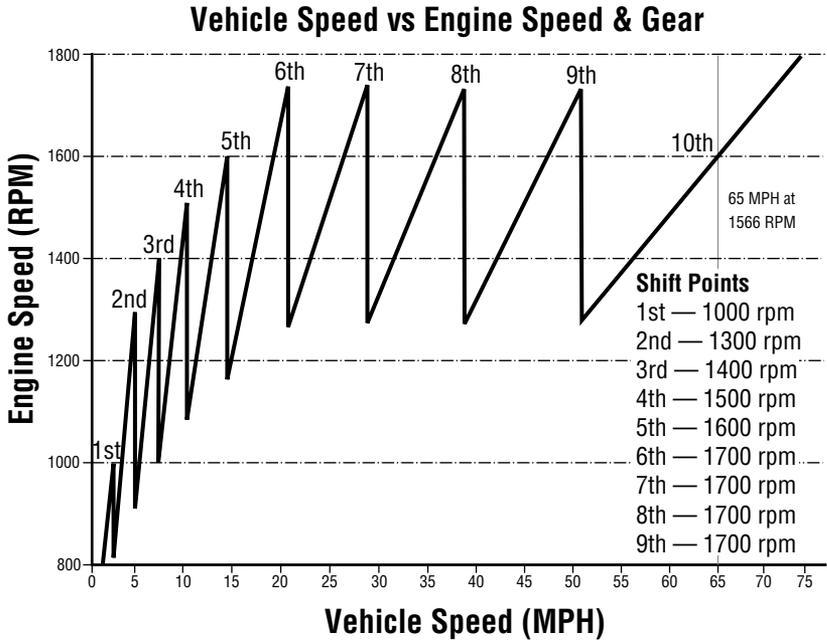
The Procedure:

- 1 Release accelerator
- 2 Depress clutch pedal slightly to break torque enough to move the shift lever to neutral. NOTE: Avoid depressing the clutch pedal too far and contacting the clutch brake.
3. When the shift lever is in neutral, let up on clutch pedal.*
 - a. For upshifts - allow engine RPM to decrease to match road speed.
 - b. For downshifts - increase engine RPM to match road speed.
4. At the correct engine RPM, depress the clutch pedal slightly and **at the same time**, move the shift lever into the desired gear.
5. Let up on the clutch pedal and apply accelerator.

* Engaging the clutch with the shift lever in the neutral position connects the transmission input gearing to the engine. This allows the operator to speed up or slow down the transmission input gearing to properly match the desired gear speed to the current road speed.

Transmission Operation

Typical Transmission Shift Points for a Super 10 in An On-Highway Application



The example is based on a 1800 rpm governed engine, RTLO-14610B transmission, 3.90:1 rear axle ratio, and 275/80R24.5 tires.

Note: The transmission is shifted at **less** than the 1800 governed rpm. Also, progressive shifting is used in the lower gears to promote quicker transmission shifting and improved vehicle performance.

Transmission Operation

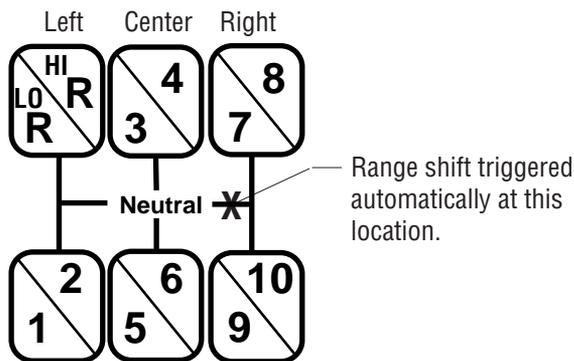
Reverse Operation

The Super 10 has two useable reverse gear ratios. These two reverse ratios are selected by moving the shift button rearward (Low Reverse) or forward (High Reverse) when the gear shift lever is in the reverse position. For maximum vehicle control, Low Reverse is recommended for normal vehicle backing. For a faster vehicle speed when bobtail, high reverse can be used. Although, shifting between reverse ratios can be accomplished when the vehicle is moving, it is recommended that the vehicle be stopped when changing reverse ratios.

Range Shift

The auxiliary range shift automatically occurs between the center rail and the right rail. See illustration. This shift may be audible to the driver.

Important: To avoid unnecessary wear and possible damage to the transmission, the shift lever should not be moved to the center or left rail position when the vehicle speed is greater than 40 MPH.



Transmission Operation

Most heavy-duty trucks are equipped with a clutch brake. Occasionally, a countershaft brake system will be used.

Clutch Brake

A clutch brake stops the rotation of the clutch discs and transmission input gearing. It prevents the clashing or grinding of the gears when the vehicle is stationary and the driver is shifting from neutral into the starting gear.

A properly adjusted clutch brake will be activated when the driver fully depresses the clutch pedal. On a normal shift or when the vehicle is in motion, the driver must avoid activating the clutch brake to prevent transmission hard shifting and/or damage to the clutch brake.

Countershaft Brake

A countershaft brake also stops the rotation of the clutch discs and transmission input gearing. It prevents the clashing or grinding of the gears when the vehicle is stationary and the driver is shifting from neutral into the starting gear.

A countershaft brake is usually activated by a small button mounted onto the shift lever. The driver depresses this button when shifting from neutral to the initial starting gear. The clutch pedal must be depressed. Damage can occur to the countershaft brake and the transmission if the button is depressed with the vehicle in motion or the clutch pedal not depressed.

Transmission Operation

How to get the most from your Super 10

* **Button only upshifts.** *BE PATIENT!* The transmission will only complete a shift when the engine RPM decreases to the level required for the next higher gear.

* **1st to 2nd upshift.** Perform the button shift to 2nd gear just after the vehicle has started in motion. This shift from 1st to 2nd gear can be accomplished at approximately 1000 RPM - even if fully loaded.

* **3rd to 4th Button only shift on tight right turns.** Because of vehicle resistance created during the turn, either stay in 3rd gear through the turn, or shift into 4th before the turn.

* **Select the best starting gear.** If on level ground or lightly loaded, try starting in 2nd gear rather than 1st.

* **Use the vehicle tachometer.** Because newer vehicles and engines are quieter, it is harder to shift by “sound”. Use the vehicle tachometer to determine when a shift completes.

Transmission Operation

Transmission Do's and Don'ts

Do's

- Do use normal Double-Clutching procedures when making lever shifts.
- Do preselect the shift button *just prior* to starting a shift
- Do allow for the shift to complete by waiting for the engine speed to decelerate to the proper speed for the next desired gear.

Don'ts

- Don't slam or jerk the shift lever into gear
- Don't coast with the shift lever in the neutral position.
- Don't move the gear shift lever to the center or left rail position when the vehicle speed is greater than 40 mph.

Transmission Operation

Gear Ratios

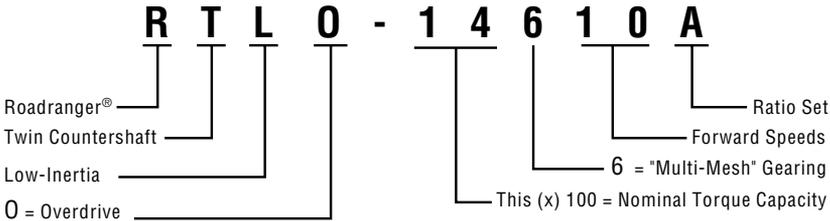
Gear	RTLO-14610A		RTLO-XX610B	
	Gear Ratio	Ratio Step	Gear Ratio	Ratio Step
10th	.76 : 1	32	.74 : 1	35
9th	1.00	35	1.00	35
8th	1.35	32	1.35	35
7th	1.78	32	1.82	35
6th	2.36	32	2.46	35
5th	3.12	35	3.32	35
4th	4.20	32	4.49	35
3rd	5.57	34	6.06	35
2nd	7.48	32	8.20	35
1st	9.91		11.06	
Reverse - Low	12.15		12.93	
Reverse - High	9.17		9.58	

Service and Maintenance

Important Safety Notes:

Before working on a vehicle or when leaving the cab with the engine running, place the transmission in neutral, set the parking brakes, AND block the wheels.

Model Designation



Service and Maintenance

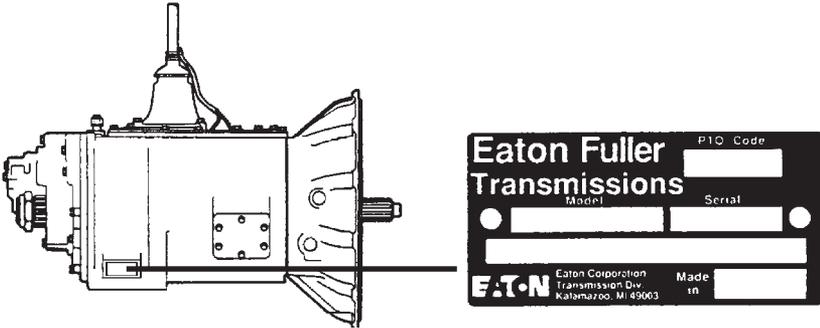
Vehicle Towing

To avoid damage to the transmission during towing, place the transmission in neutral and lift the drive wheels off the ground or disconnect the driveline.

Identification Tag

Transmission model designation and other transmission identification information are stamped on the transmission tag. To identify the transmission model designation and serial number, locate the tag on the transmission and then locate the numbers as shown.

DO NOT REMOVE OR DESTROY THE TRANSMISSION IDENTIFICATION TAG.



The blank spaces provided below are for recording transmission identification data. Have these reference numbers handy when ordering replacement parts or requesting service information:

Transmission Model _____

Transmission Serial Number _____

Service and Maintenance

Proper Lubrication . . . the Key to long transmission life

Proper lubrication procedures are the key to a good all-around maintenance program. If the oil is not doing its job, or if the oil level is ignored, all the maintenance procedures in the world are not going to keep the transmission running or assure long transmission life.

Eaton Fuller Transmissions are designed so that the internal parts operate in an oil circulating bath created by the motion of the gears and shafts.

Thus, all parts are amply lubricated if these procedures are closely followed:

1. **Maintain oil level.**
2. **Follow maintenance interval chart.**
3. **Use only recommended lubrication.**
4. **Buy lubricant from a reputable dealer.**

Recommended Lubricant		
Type	Grade (SAE)	Fahrenheit Ambient Temperature
Eaton® Approved Synthetic Lubricant*	50	All
Heavy Duty Engine Oil MIL-L-2104D, API-CD or Cat TO-4	50 40 30	Above 10°F (-12°C) Above 10°F (-12°C) Below 10°F (-12°C)
Automotive Gear Oil API MT-1	80W-90 75W	Above 10°F (-12°C) Below 10°F (-12°C)

Additives and friction modifiers must not be introduced.

Never mix engine oils & gear oils in the same transmission.

* For a list of Eaton Approved Synthetic Lubricants, call 1-800-826-HELP (4357).

Service and Maintenance

Maintenance Interval Chart

Eaton® Approved Synthetic Transmission Oil*	
HIGHWAY USE-Heavy Duty and Mid-Range	
Initial Fill with Eaton® Approved Synthetic Transmission Oil	
Every 10,000 miles (16090Km)	Check fluid level. Check for leaks.
Every 250,000 miles (402336Km)	Change transmission fluid.
OFF-HIGHWAY USE	
Every 40 hours	Inspect lubricant level. Check for leaks.
Every 1,000 hours	Change transmission fluid where severe dirt conditions exist.
Every 2,000 hours	Change transmission fluid (Normal off-highway use.)
HIGHWAY USE-Heavy Duty and Mid-Range	
Initial Fill with Other Recommended Oil	
First 3,000 to 5,000 miles (4827 to 8045 Km)	Factory fill initial drain. Refill with Eaton® Approved Synthetic Transmission Oil; thereafter follow maintenance intervals above.
Heavy Duty Engine Lubricant or Mineral Gear Lubricant	
HIGHWAY USE	
First 3,000 to 5,000 miles (4827 to 8045 Km)	Factory fill initial drain .
Every 10,000 miles (16090Km)	Inspect lubricant level. Check for leaks.
Every 50,000 miles (80450Km)	Change transmission lubricant.
OFF-HIGHWAY USE	
First 30 hours	Change transmission lubricant on new units.
Every 40 hours	Inspect lubricant level. Check for leaks.
Every 500 hours	Change transmission lubricant where severe dirt conditions exist.
Every 1,000 hours	Change transmission lubricant (Normal off-highway use.)

If your vehicle has a transmission oil filter, you must change the filter when fluid or lubricant is changed.

* For a list of Eaton Approved Synthetic Lubricants, call 1-800-826-HELP (4357).

Service and Maintenance

Proper Oil Level

Make sure oil is level with the filler opening. Because you can reach oil with your finger does not mean oil is at the proper level. **(One inch of oil level is about one gallon of oil.)**

Draining Oil

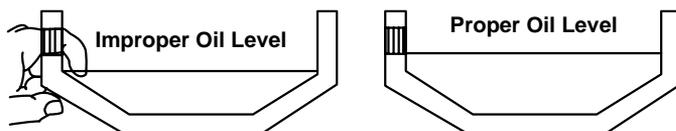
Drain transmission while oil is warm. To drain oil, remove the drain plug at case bottom. Clean the drain plug before re-installing.

Refilling

Clean case around filler plug and remove plug from case side. Fill the transmission to the level of the filler opening.

RTLO-10 Oil Capacity	28 Pints
----------------------	----------

The exact amount of oil depends on the transmission inclination and model. Do not over fill—this causes oil to be forced out of the case through the front bearing cover.



When adding oil, types and brands of oil should not be mixed because of possible incompatibility.

Service and Maintenance

Preventive Maintenance

The following maintenance items are necessary to prevent costly transmission failures which may not be covered by warranty.

Transmission Oil -

- Check transmission daily for oil leaks. Repair promptly to prevent oil loss and subsequent transmission failure.
- Check transmission oil level at every engine oil change interval. Add transmission oil as necessary.
- Drain and replace transmission oil as recommended by the schedule in this book.

Air System -

- Drain moisture from vehicle air system daily.
- Listen for air leaks daily, repair promptly.
- If the vehicle is equipped with an air dryer, confirm that the air dryer system is working properly. Repair as necessary.
- Service the vehicle air compressor as required to prevent oil from entering the vehicle air system.

Master Clutch System -

- Lubricate clutch release pedal shaft bushings at every chassis lubrication interval. There should be one grease fitting on each side of the transmission clutch housing.
- Have the clutch checked and adjusted if any of the following occurs:
Clutch does not disengage completely
Clutch brake does not function
Clutch pedal free-play is less than 1/2"

Service and Maintenance

- When replacing the clutch, use a high quality spring damped replacement unit.

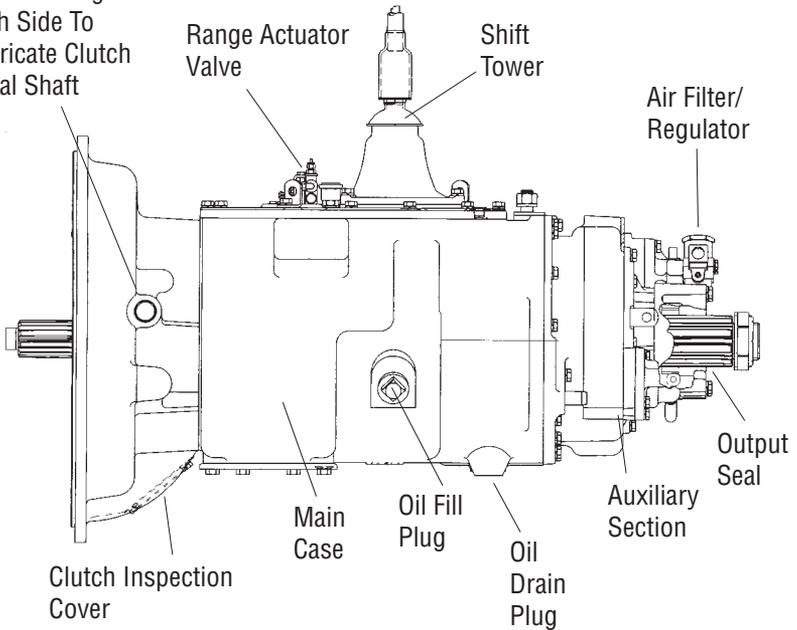
Drivetrain -

- Inspect the driveshaft for loose or worn U-joints weekly. Repair promptly to prevent excessive driveline vibration.
- Have the driveline checked by a repair facility if unusual noise or vibration is detected.

Overall Inspection -

- Inspect the transmission at the chassis lubrication interval for loose or missing capscrews and fasteners. Pay particular attention to the capscrews that attach the transmission to the engine.

Grease Fitting On
Each Side To
Lubricate Clutch
Pedal Shaft



Service and Maintenance

Operating Temperatures with Oil Coolers

The transmission must not be operated consistently at temperatures above 250°F. However, intermittent operating temperatures to 300°F do not harm the transmission. Operating temperatures above 250°F increases the lubricant's oxidation rate and shortens its effective life. When the average operating temperature is above 250°F, the transmission can require more frequent oil changes or external cooling.

The following conditions in any combination can cause operating temperatures of over 250°F: (1) operating consistently at slow speeds, (2) high ambient temperatures, (3) restricted air flow around transmission, (4) exhaust system too close to transmission, (5) high horsepower, overdrive operation.

External oil coolers are available to reduce operating temperatures when the above conditions are encountered.

Transmission Oil Coolers are:

Recommended

- With engines of 350 H.P. and above.

Required

- With engines 399 H.P. and above and GCW's over 90,000 lbs,
- With engines 399 H.P. and above and 1400 Lb_f·ft or greater torque,
- With engines 450 H.P. and above.

Appendix I

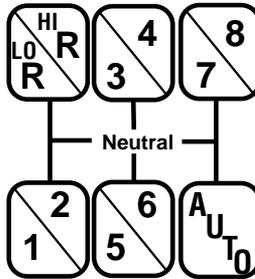
Super 10 Top 2

Basic Operation and Overview:

The Super 10 Top 2 transmission operates like a normal Super 10 in gears 1 through 8. The transmission shifts automatically between 9th and 10th gear based on engine speed and load.

When the transmission is in the Top 2 Mode, the system will:

- Shift the transmission between 9th and 10th gear automatically.
- Increase or decrease engine speed during a Top 2 shift.
- Momentarily interrupt cruise control or engine brake during the shift, then resume.



SHIFT PATTERN

Button
Rearward



Shift 1, 3, 5, 7
when button is
rearward

Button
Forward



Shift 2, 4, 6, 8
When button is
forward

Appendix I

Upshift Procedure

- Step 1) Upshift the transmission through the shift pattern to 8th gear. Double-clutching during lever shifts and breaking torque during button shifts.
- Step 2) When the engine has reached the shift point use the normal double-clutching procedure and move the shift lever into 9th gear.

NOTE: The position of the shift button does not matter when moving the lever into the AUTO position. It is recommended to leave the shift button in the forward position so it is ready when you want to make a downshift into 8th gear.

- Step 3) When the engine has reached the shift point the transmission will automatically shift into 10th gear.

Downshift Procedure

- Step 1) To downshift from 10th to 9th gear: Once the engine has reached the shift point the transmission will automatically downshift.
- Step 2) To downshift from 9th gear to 8th gear: a) While in 9th gear, make sure the shift button is in the forward position. b) Once the engine has reached the shift point move the lever to the next lower lever position while double-clutching.
- Step 3) Continue downshifting through the shift pattern, double-clutching during lever shifts and breaking torque during button shifts.

Appendix I

Driving Tips

To activate Top 2 mode, the transmission must be shifted from 8th to 9th once the engine has reached the normal shift point. If the operator moves the shift lever into the AUTO lever position below the engines' normal shift point, the transmission will be in normal Super 10 mode. Once the engine reaches the normal shift point, Top 2 mode will become active.

Throttle position determines the upshift point. Less throttle will lower the shift point. Zero throttle (down hill push) will raise the up shift point. To reset the shift points the engine must drop below it's normal shift point.

With the engine brake active, the up and down shift points will be raised.

A feature of Top 2 is ANTI HUNT mode. This is built in to avoid constant up and down shifts. When the shift lever is in the AUTO position and the transmission has just completed an up shift, the down shift point will be lower than normal. If the transmission has just completed a down shift, the up shift point will now be higher than normal.

Appendix I

Definitions

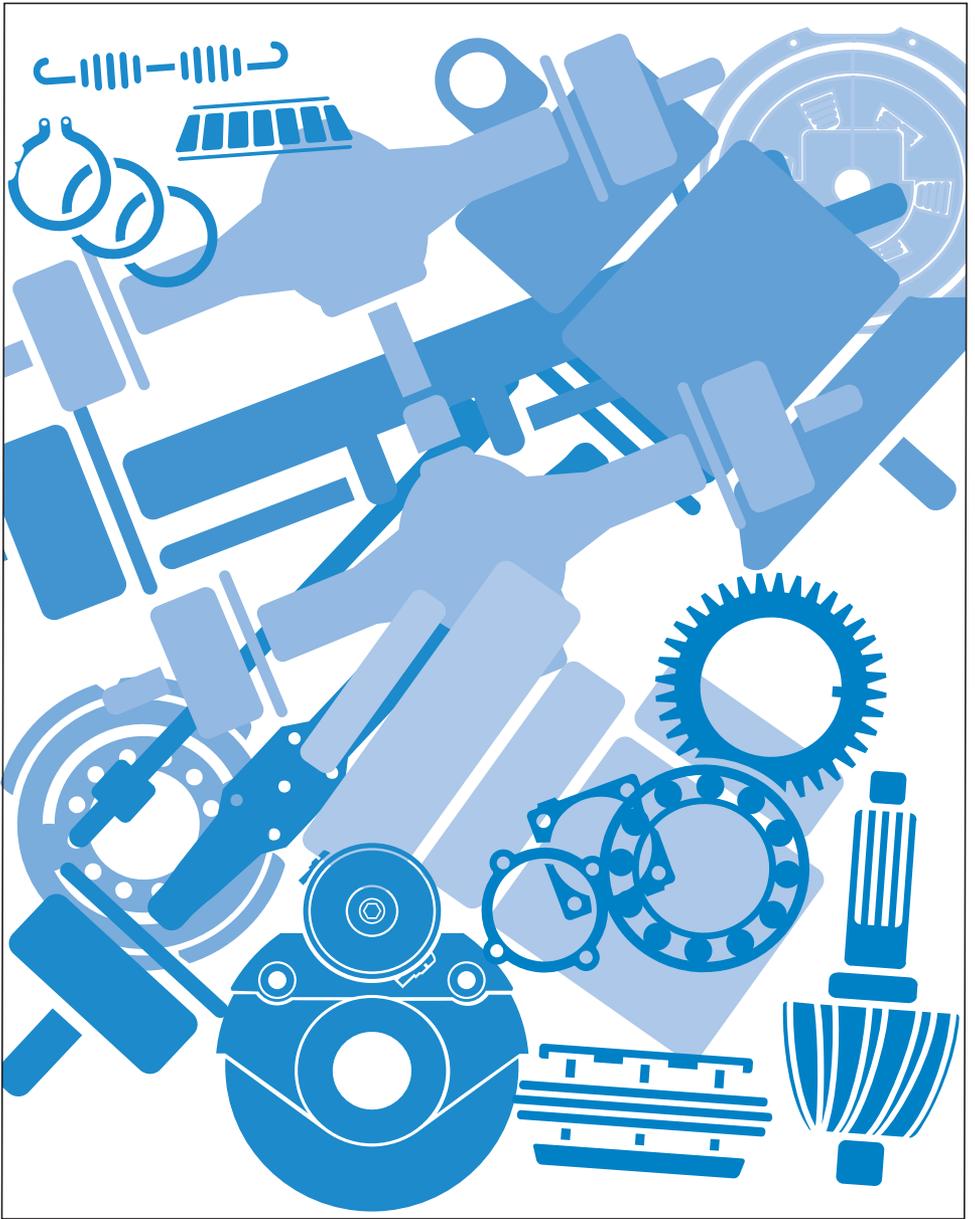
Auto Position-	When the shift lever is in the position labeled “AUTO”. This position is where 9th and 10th gears are located
Break Torque-	Releasing engine power or load from transmission and drivetrain.
Double-Clutch-	The shifting technique used when moving the shift lever to the next lever position. Procedures: Depress clutch pedal, move lever to neutral, let up clutch pedal, accelerate or decelerate engine to obtain synchronous, depress clutch pedal again, and move lever into gear.
Shift Button-	The button on the side of the shift knob used to change gears.
Synchronous-	The point at which the input gearing speed (engine) matches output gearing speed (road speed) and a shift can occur without grinding.
Top 2 Mode-	The state where the transmission automatically shifts between 9th and 10th gears.

Appendix I

System Problem

If the system malfunctions, the transmission will typically default to Super 10 mode. For some malfunctions, the system will detect a failure, that the operator must allow the Top 2 to time out. This will take 9 seconds. During the 9 seconds the Top 2 will try to complete the shift. Once the Top 2 has timed out the operator must place the transmission in neutral to obtain manual Super 10 mode. The Top 2 function will be inactive until the vehicle is stopped and the key is turned off.

In some situations, the system can be reset at a stop by leaving the key off for 10 seconds and then restarting the engine. If this does not clear the problem verify air pressure and check the fuse to the Top 2. To help assure operation of the Super 10 Top 2, advise your maintenance personnel of any oil leaks, above normal operating temperatures, unusual noises, fault codes, or if the transmission is not operating right.



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National Institute for
**AUTOMOTIVE
SERVICE
EXCELLENCE**

Roadranger

MORE TIME ON THE ROAD

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