

# Eaton Fuller<sup>®</sup> Heavy-Duty Transmissions TRDR0400

June 2014

RT-8608L  
RT-8609  
RT-1X609 Series  
RT-1X709 Series  
RTX-8608L  
RTX-8609  
RTX-1X609 Series  
RTX-1X609P Series  
RTX-1X609R Series  
RTX-1X709 Series  
RTO-1X609 Series  
RTO-1X709 Series  
RTL-16609E  
RTOC-1X909A Series  
RTOCM-1X909A Series  
RTL-1X909A-T2 Series



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**Roadranger**

SUPPORT



## Warnings and Cautions



Read the entire driver instructions before operating this transmission.

Set the parking brakes before starting a vehicle, always be seated in the driver's seat, move the shift lever to neutral, and depress the master clutch.

If engine cranks in any gear other than neutral or without the master clutch depressed, service your vehicle neutral safety start circuit immediately.

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.

Do not release the parking brake or attempt to select a gear until the air pressure is at the correct level.

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

If your vehicle is equipped with a remote throttle, before operation, the transmission must be in neutral.

**TOWING:** To avoid damage to the transmission during towing, disconnect the driveline.

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# ***Table of Contents***

## **General Information**

Warnings and Cautions . . . . .	i
Purpose . . . . .	1
Identification Tag . . . . .	2
Model Designation . . . . .	3

## **Transmission Operation**

General Information . . . . .	4
Shift Pattern Diagrams . . . . .	5
Transmission Features . . . . .	6
Double-Clutching Procedure . . . . .	8
Initial Start Up . . . . .	9
Upshift Procedure . . . . .	10
Downshift Procedure . . . . .	11
T2 Operation. . . . .	12

## **Service and Maintenance**

Lubrication Information . . . . .	15
Preventive Maintenance Checks . . . . .	17

## **Reference**

Definitions/Glossary . . . . .	19
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## **Purpose**

This manual is designed to provide detailed information necessary for the proper driving techniques of the Eaton® Fuller® transmissions listed on the cover.

## **How To Use This Manual**

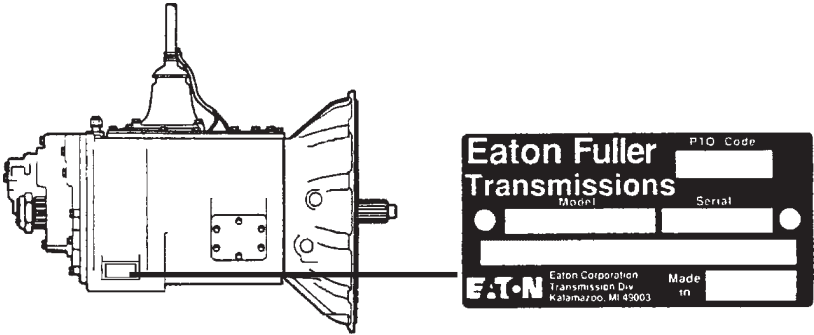
Driver instructions are divided into two sections: Transmission Operation and Service and Maintenance. Transmission Operation contains information on driving techniques along with shift patterns. Service and Maintenance contains information items that deal with basic service and maintenance; such as, identification tags and lubrication information.

The two sections are laid out with a general heading at the top outside edge of each page followed by more specific headings labeling the information. To find the information you need, refer to the Table of Contents or page through the book section that covers what you need.

# General Information

## Identification Tag

### Transmission Tag and Location



DO NOT REMOVE OR DESTROY THE TRANSMISSION 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.

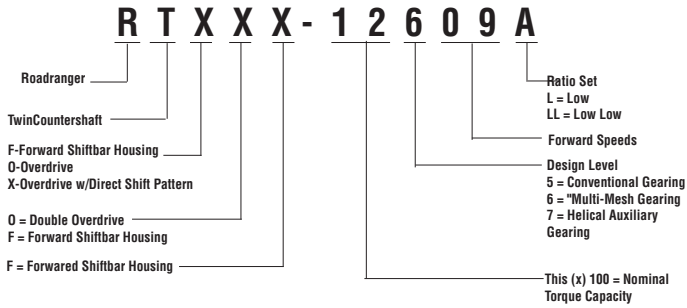
Record transmission identification data. Have these reference numbers handy when ordering replacement parts or requesting service information.

Trans Model No. \_\_\_\_\_

Trans Serial No. \_\_\_\_\_

## Model Designation

### Nomenclature



# *Transmission Operation*

## **General Information**

Models in this series provide nine forward speeds and two reverse, consisting of a five-speed front section and a 2-speed auxiliary section.

The 1st position in the front section is used only as a starting gear. The other four ratios are used once in LO range and once again in HI range.

After shifting out of the 1st position, you use the easy Roadranger repeat "H" shift pattern. LO range and HI range are selected with the Range Knob/Range Lever. It is used once during the upshift sequence and once during the downshift sequence.

Always preselect the range shift. After preselection, the transmission will automatically make the synchronizer range shift as the shift lever passes through neutral.

## **"X" and "F" Models**

Overdrive models with the letter "X" instead of an "O" in the model designations, such as in RTX-11609B, have their full complement of forward and reverse speeds arranged within a direct shift pattern instead of in a standard overdrive pattern.

On the other hand, the letter "F" appearing in the model designations, such as in RTOF-11609A, indicates a forward-mounted position of the gear shift lever housing on the transmission and does not affect the shift pattern.




# Transmission Operation

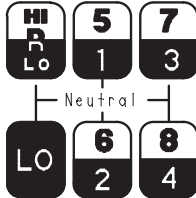
## Shift Pattern Diagram

RT, RTX 8608L / RT, RTX 8609 / RT, RTX 1X609 Series / RT, RTX 1X709 Series / RTLC 16609E / RTOC, RTOCM 1X909A Series

**Eaton® Fuller®**  
**Transmissions**

9 SPEED RANGE SELECTOR





PRE-SELECT ALL RANGE SHIFTS (MOVE RANGE SELECTOR BEFORE MOVING SHIFT LEVER)

UPSHIFTING  
START WITH RANGE SELECTOR DOWN  
SHIFT LO-1-2-3-4 RAISE RANGE SELECTOR  
SHIFT 5-6-7-8

DOWNSHIFTING  
SHIFT 8-7-6-5 MOVE RANGE SELECTOR DOWN  
SHIFT 4-3-2-1-LO

DO NOT CHANGE RANGE WHILE MOVING IN REVERSE

**WARNING** PUT TRANSMISSION IN NEUTRAL BEFORE STARTING ENGINE


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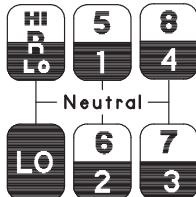
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RTO 1X609 Series / RTO 1X709 Series

**Eaton® Fuller®**  
**Transmissions**

9 SPEED (RTO) RANGE SELECTOR





PRE-SELECT ALL RANGE SHIFTS (MOVE RANGE SELECTOR BEFORE MOVING SHIFT LEVER)

UPSHIFTING  
START WITH RANGE SELECTOR DOWN  
SHIFT LO-1-2-3-4 RAISE RANGE SELECTOR  
SHIFT 5-6-7-8

DOWNSHIFTING  
SHIFT 8-7-6-5 MOVE RANGE SELECTOR DOWN  
SHIFT 4-3-2-1-LO

DO NOT CHANGE RANGE WHILE MOVING IN REVERSE

**WARNING** PUT TRANSMISSION IN NEUTRAL BEFORE STARTING ENGINE


**EATON**

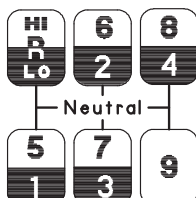
20399

RTX 1X609P Series / RTX 1X609R Series

**Eaton® Fuller®**  
**Transmissions**

PERFORMANCE 9 SPEED RANGE SELECTOR





PRE-SELECT ALL RANGE SHIFTS (MOVE RANGE SELECTOR BEFORE MOVING SHIFT LEVER)

UPSHIFTING  
START WITH RANGE SELECTOR DOWN  
SHIFT 1-2-3-4 RAISE RANGE SELECTOR  
SHIFT 5-6-7-8-9

DOWNSHIFTING  
SHIFT 9-8-7-6-5 MOVE RANGE SELECTOR DOWN  
SHIFT 4-3-2-1

DO NOT CHANGE RANGE WHILE MOVING IN REVERSE

**WARNING** PUT TRANSMISSION IN NEUTRAL BEFORE STARTING ENGINE

**EATON**

21503

# *Transmission Operation*

## **Transmission Features**

### **Range Shift**

The range lever selects LO or HI range. It is used once during an upshift sequence and once during a downshift sequence.

### **Preselect**

**IMPORTANT:** Always preselect all range shifts when upshifting or downshifting. Preselection requires that the range lever is moved to the needed position before starting the shift.

Preselected range shifts are completed automatically as the lever is moved through neutral and into the next gear. Preselecting all range shifts prevents damage to the transmission and provides for smoother shifts.

## **Optional Equipment**

For easier and faster gear engagement while the vehicle is standing still, some Eaton® Fuller® transmissions may be equipped with either a Countershaft Brake or a Clutch Brake.

### **Countershaft Brake**

(Used with push-type clutches) - The control button is mounted on the shift lever just below the shift knob. To operate, disengage the clutch, press down the control button, and shift into LO or reverse. This is an air operated mechanical brake which slows down the transmission gearing by forcing a piston against the countershaft PTO gear.

Never use the Countershaft Brake when upshifting or downshifting. Use **only** for initial gear engagement when the vehicle is standing still.

# *Transmission Operation*

## **Clutch Brake**

(Used with pull-type clutches) - The clutch brake is applied by fully depressing the clutch pedal to the floor board. When applied the brake slows down and can stop the transmission front box gearing. It is a disc-type brake incorporated into the clutch and transmission drive gear assemblies.

Never use the Clutch Brake when upshifting or downshifting. Use **only** for initial gear engagement when the vehicle is standing still.

## **Driving Tips**

- Always select an initial starting gear that provides sufficient reduction for the load and terrain.
- Always use normal double-clutching procedures when making lever shifts.
- Never slam or jerk the shift lever to complete gear engagements.
- Never coast with the shift lever in the neutral position.
- Never move the range lever with the shift lever in neutral while the vehicle is moving.
- Never make a range shift while moving in reverse.
- Never downshift at too high of a road speed.
- In most cases, depending on the engine and axle ratios, you can save valuable fuel by operating the vehicle at less than governed RPM while cruising in top gear.
- Never move the shift lever to the LO speed gear position while operating in HI range.

# Transmission Operation

## Double-Clutching Procedure

### Special Instructions

Purpose:

- a. To break torque to allow the transmission to come out of gear, and...
- b. To disengage the engine from the transmission when shifting into gear.

### 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.

**Note:** 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.

- 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.

## Initial Start Up



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



**CAUTION:** Before moving a vehicle, make sure you understand your shift pattern configuration. A shift label should be in your vehicle's cab. If not, refer to General Information to order one.

### Procedure -

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 "Operating 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

## Upshift Procedure

In the following instructions, it is assumed that the driver is familiar with operating heavy-duty trucks and tractors, and can coordinate the movement of the shift lever and clutch pedal to make smooth gear engagements while upshifting or downshifting. Always double-clutch when making lever shifts.



**CAUTION:** Never move the range lever with the shift lever in neutral while the vehicle is moving.

### Procedure -

1. Move the shift lever, double-clutching, to the next desired gear position in LO range.

### Range shift - LO to HI Range (4th to 5th)

2. When in last gear position for LO range and ready for the next upshift, pull up the Range Lever and move the shift lever, double-clutching, to the next higher speed position according to your shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from LO to HI range.



**CAUTION:** Never move the shift lever to the LO speed gear position after HI range preselection, or at anytime the transmission is in HI range.

## Downshift Procedure

In the following instructions, it is assumed that the driver is familiar with operating heavy-duty trucks and tractors, and can coordinate the movement of the shift lever and clutch pedal to make smooth gear engagements while upshifting or downshifting. Always double-clutch when making lever shifts.



**CAUTION:** Never move the range lever with the shift lever in neutral while the vehicle is moving.

### Procedure -

1. Move the shift lever, double-clutching, to the next desired gear position in HI range.

### Range shift from HI range to LO range (5th to 4th)

2. While in 5th and ready for the next downshift, preselect LO range, push the range preselection lever down.
3. Move the shift lever, double-clutching, to the next desired gear position in LO range. As the shift lever passes through neutral, the transmission automatically shifts from HI range to LO range.
4. Continue downshifting, double-clutching, to the next desired gear position in LO range.

# T2 Operation

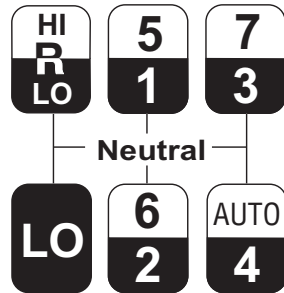
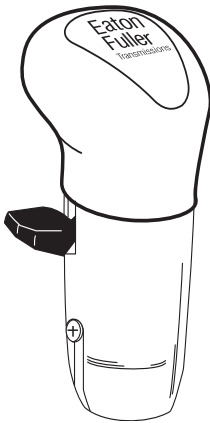
## Basic Operation & Overview

### RTLOC-1X909A-T2 Models

The 9-speed Top 2 Transmission operates like a normal 9-speed in 1st thru 7th gears. The transmission shifts automatically in the “AUTO” position based on engine speed and load.

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

- Shift the transmission between the top two gears automatically.
- Increase or decrease engine speed during a Top 2 shift.
- Momentarily interrupt cruise control or engine brake during the shift.





## Upshift Procedure

1. Upshift the transmission through the shift pattern to 7th position. Double-clutching during lever shifts and breaking torque during button shifts.
2. When the engine has reached the shift point, use the normal double-clutching procedure and move the shift lever into the “AUTO” position.
3. When the engine has reached the shift point, the transmission will automatically shift into top gear.

## Downshift Procedure

1. To downshift from top gear: Once the engine has reached the shift point the transmission will automatically downshift.
2. To downshift from “AUTO” position to 7th position, use normal double-clutching procedures.:
  - Once the engine has reached the shift point move the lever to the next lower lever position while double-clutching.
3. Continue downshifting through the shift pattern, double-clutching during lever shifts.



**CAUTION:** Never move the shift lever to the LO gear position after HI range preselection, or at any time the transmission is in HI range.

# T2 Operation

## Driving Tips

To activate Top 2 mode, the transmission must be shifted from 7th to “AUTO” once the engine has reached the normal shift point. If the operator moves the shift lever into the AUTO lever position below the engine’s normal shift point, the transmission will be in normal 9-speed 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 upshift point. To reset the shift points the engine must drop below its 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 upshifts and downshifts. When the shift lever is in the AUTO position and the transmission has just completed an upshift, the downshift point will be lower than normal. If the transmission has just completed a downshift, the upshift point will now be higher than normal.

## System Problem

If the system malfunctions, the transmission will typically default to 9-speed mode. For some malfunctions, the system will detect a failure that the operator must allow the Top 2 to **time out**. The time out process takes 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 9-speed 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 electrical connections to the Top 2. To help assure operation of the 9-speed 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 correctly.

## Lubrication Information

Proper lubrication procedures are the key to a good all-around maintenance program.

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.

All parts will be properly lubricated if these procedures are closely followed:

- Maintain oil level. Inspect regularly.
- Follow maintenance interval chart.
- Use the correct grade and type of oil.
- Buy from a reputable dealer.

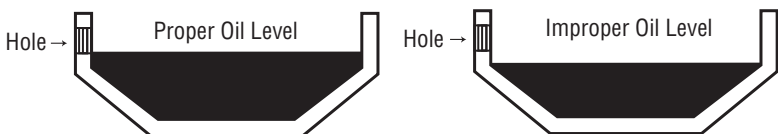
For additional lubrication information, see TCMT-0021.

## Maintain Proper Oil Level

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

**When adding oil, never mix engine oils and gear oils in the same transmission.**

### Oil Level



## 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:

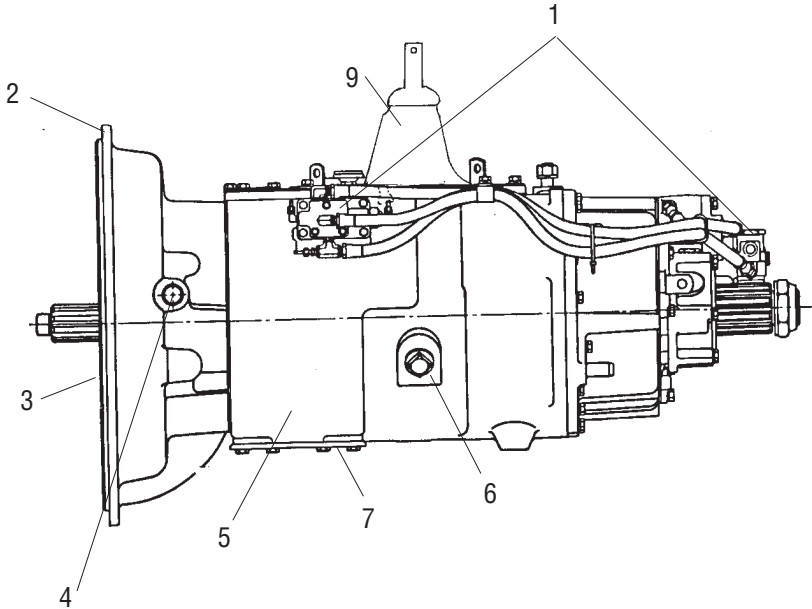
- Operating consistently at slow speed.
- High ambient temperatures.
- Restricted air flow around transmission.
- Exhaust system too close to transmission.
- High horsepower operation.

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

## Oil Cooler Chart

Transmission Oil Coolers are:
Recommended
<ul style="list-style-type: none"><li>• With engines of 350 H.P. and above.</li></ul>
Required
<ul style="list-style-type: none"><li>• With engines 399 H.P. and above and GCW's over 90,000 lbs.</li></ul>
<ul style="list-style-type: none"><li>• With engines 399 H.P. and above and 1400 lbs. ft. or greater torque.</li></ul>
<ul style="list-style-type: none"><li>• With engines 450 H.P. and above.</li></ul>

## Preventive Maintenance Checks



Note: Item numbers refer to the illustration.

1. Air System and Connections
  - Check for leaks, worn air lines, loose connections and cap-screws.
2. Clutch Housing Mounting
  - Check all capscrews of the clutch housing flange for looseness.
3. Clutch Release Bearing (Not Shown)
  - Remove hand hole cover and check radial and axial clearance in release bearing.
  - Check relative positive of thrust surface of release bearing with thrust sleeve on push-type clutches.

# ***Service and Maintenance***

4. Clutch Pedal Shaft and Bores
  - Pry upward on shafts to check wear.
  
  - If excessive movement is found, remove clutch release mechanism and check bushing on bores and wear on shafts.
  
5. Lubricant
  - Change at specified service intervals.
  
  - Use only the types and grades recommended.
  
6. Filler and Drain Plugs
  - Remove filler plugs and check level of lubricant at specified intervals. Tighten filler and drain plugs securely.
  
7. Capscrews and Gaskets
  - Check all capscrews, especially those on P.T.O. covers and rear bearing covers for looseness which would cause oil leakage.
  
  - Check P.T.O. opening and rear bearing covers for oil leakage due to faulty gasket.
  
8. Shift Lever
  - Check for looseness and free play in housing. If lever is loose in housing, proceed with check number 9.
  
9. Shift lever Housing Assembly
  - Remove air lines at slave valve and remove the shift lever housing assembly from transmission.
  
  - Check tension spring and washer for set and wear.
  
  - Check the shift lever spade pin and slot for wear.
  
  - Check bottom end of shift lever for wear and check slot of yokes and blocks in shift bar housing for wear at contact points with shift lever.

## Definitions/Glossary

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 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.
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.

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