



Fuller® Transmissions

Roadranger®

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Troubleshooting Guide

Fuller Transmissions

TRTS0070

October 2007

RTLO-11610B	RTLO-16718B	RTLOF-12913A	RTLOF-17610B-T2
RTLO-11610B-T2	RTLO-16913A	RTLOF-13610B	RTLOF-18610B
RTLO-12610B	RTLO-16913A-T2	RTLOF-13610B-T2	RTLOF-18718B
RTLO-12610B-T2	RTLO-16918B	RTLOF-14610B	RTLOF-18913A
RTLO-12713A	RTLO-16918B-T2	RTLOF-14610B-T2	RTLOF-18913A-T2
RTLO-12913A	RTLO-17610B	RTLOF-14613B	RTLOF-18918B
RTLO-13610B	RTLO-17610B-T2	RTLOF-14618A	RTLOF-18918B-T2
RTLO-13610B-T2	RTLO-18610B	RTLOF-14713A	RTLOF-20913A
RTLO-14610A	RTLO-18610B-T2	RTLOF-14718B	RTLOF-20918B
RTLO-14610B	RTLO-18718B	RTLOF-14913A	RTLOF-20918B-T2
RTLO-14610B-T2	RTLO-18718B-T2	RTLOF-14918B	RTLOF-22918B
RTLO-14613B	RTLO-18913A	RTLOF-14918B-T2	RTLOFC-16909A-T2
RTLO-14618A	RTLO-18913A-T2	RTLOF-15610B	
RTLO-14713A	RTLO-18918B	RTLOF-15610B-T2	
RTLO-14718B	RTLO-18918B-T2	RTLOF-16610B	
RTLO-14913A	RTLO-20913A	RTLOF-16610B-T2	
RTLO-14918B	RTLO-20918B	RTLOF-16618A	
RTLO-14918B-T2	RTLO-20918B-T2	RTLOF-16713A	
RTLO-15610B	RTLO-22918B	RTLOF-16713A-T2	
RTLO-15610B-T2	RTLOC-16909A-T2	RTLOF-16718B	
RTLO-16610B	RTLOF-11610B	RTLOF-16913A	
RTLO-16610B-T2	RTLOF-11610B-T2	RTLOF-16913A-T2	
RTLO-16618A	RTLOF-12610B	RTLOF-16918B	
RTLO-16713A	RTLOF-12610B-T2	RTLOF-16918B-T2	
RTLO-16713A-T2	RTLOF-12713A	RTLOF-17610B	

General Warnings

Before starting a vehicle:

1. Sit in driver's seat
2. Place shift lever in neutral
3. Set the parking brake

Before working on a vehicle or leaving the cab with engine running:

1. Place shift lever in neutral
2. Set parking brake
3. Block 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:

1. Place shift lever in neutral
2. Set the parking brake

Do not operate if alternator lamp is lit or if gauges indicate low voltage.

Battery (+) and (-) must be disconnected prior to any type of welding on the vehicle.

Suggested Tools:

- Volt/Ohm Meter
SPX / Kent-Moore 1 (800) 328-6657
P/N 5505027
- PC-based Service Tool "Service Ranger"
Contact your OEM
- Data Link Tester
Eaton Service Parts 1 (800) 826-4357
P/N MF-KIT-04
- Shift Lever Tester
Eaton Service Parts 1 (800) 826-4357
P/N 691795
- Eaton Test Adapter Kit
SPX / Kent-Moore 1 (800) 328-6657
P/N J-43318
- 6-Pin Deutsch Diagnostic Adapter
SPX / Kent-Moore 1 (800) 328-6657
P/N J-38500-60A

For information and assistance, call the Roadranger Help Desk at 1-800-826-HELP (4357) (Mexico: 01-800 826-HELP (4357)). You may also find more information about Eaton Fuller Transmissions at www.Roadranger.com.

Every effort has been made to ensure the accuracy of the information contained in this manual. However, Eaton Corporation makes no warranty, expressed or implied, based on the information provided.

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Introduction

Purpose and Scope of Manual

This manual is designed to provide detailed information necessary to perform diagnostic and troubleshooting procedures for the Eaton Fuller transmissions listed on the cover.

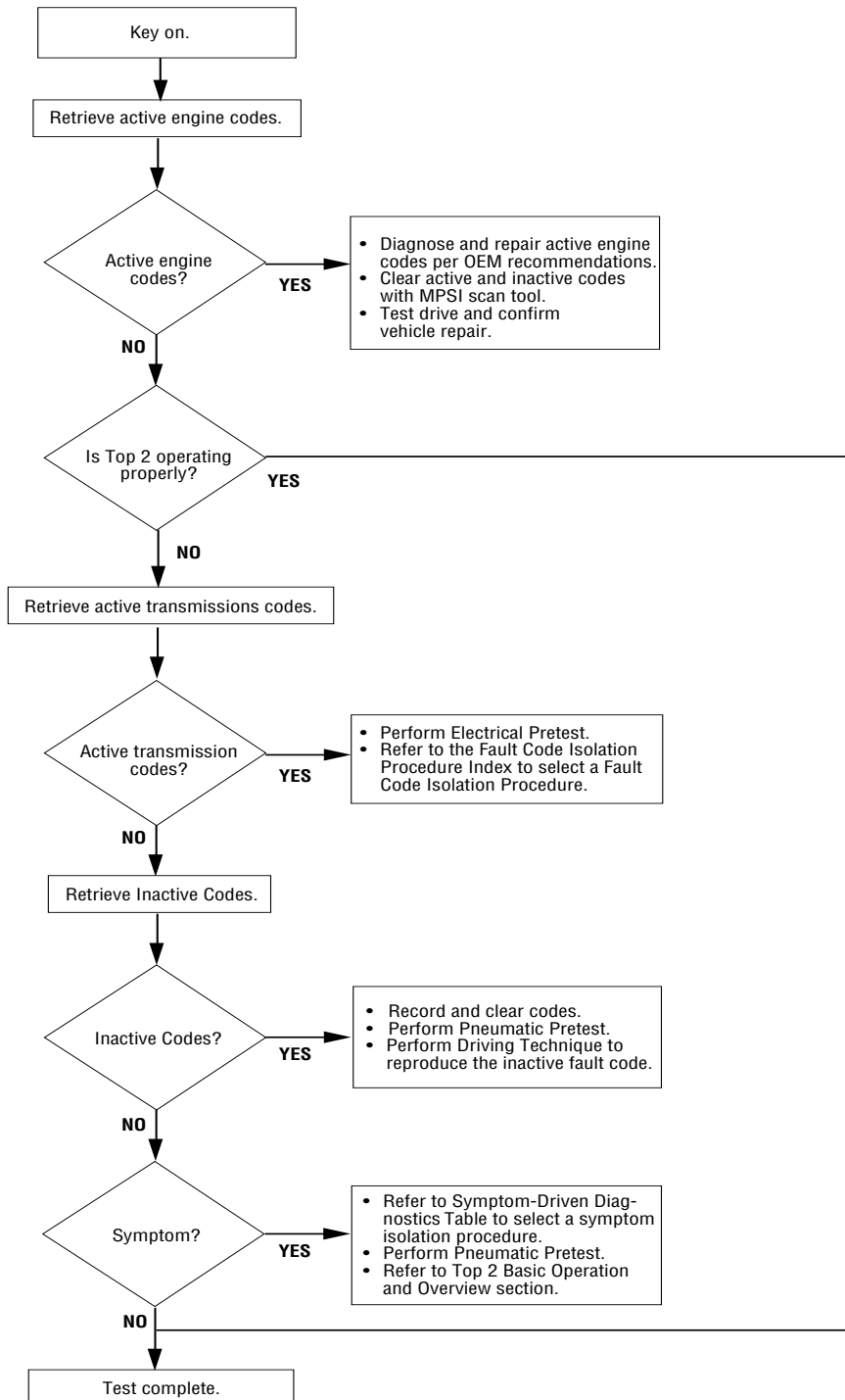
How to Use This Manual

The key to using this manual is to follow the Diagnostic Procedure (see page 1-2) first. This procedure takes you step-by-step through the tests and procedures to help to diagnose the transmission failure.

Diagnostic Procedure

Follow the flowchart below for all Top 2 transmission failures. Perform tests and procedures in order as directed by the flowchart.

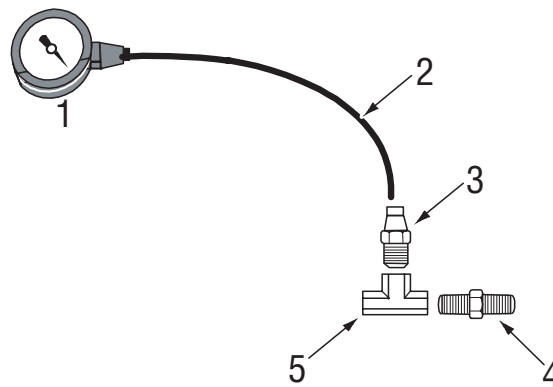
It is recommended to use the MPSI Pro-Link 9000 Diagnostics Tool or an approved engine manufacturers diagnostic tool to diagnose Fault Codes.



Suggested Test Fixtures

Note: Only one gauge required.

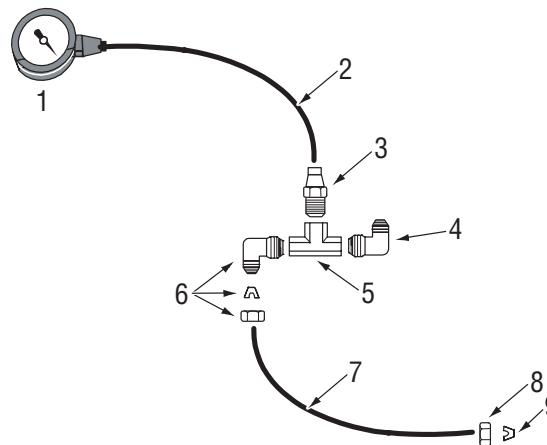
Range Cylinder



- 1. 0-100 PSI gauge
- 2. 5/32" air line
- 3. 5/32" push-to-connect to 1/8" NPTF

- 4. 1/8" nipple
- 5. 1/8" tee

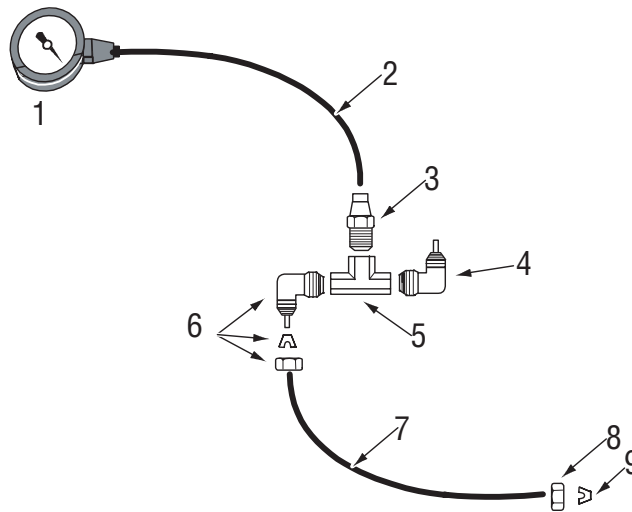
1/8" Air Lines



- 1. 0-100 PSI gauge
- 2. 5/32" air line
- 3. 5/32" push-to-connect to 1/8" NPTF
- 4. Elbow

- 5. 1/8" tee
- 6. Elbow assembly
- 7. 1/8" air line
- 8. Grip nut
- 9. Compression sleeve

5/32" Air Lines



- 1. 0-100 gauge
- 2. 5/32" air line
- 3. 5/32" push-to-connect to 1/8" NPTF
- 4. Elbow

- 5. 1/8" Tee
- 6. Elbow assembly
- 7. 5/32" air line
- 8. Grip nut
- 9. Compression sleeve

Top 2 Basic Operation and Overview

The Top 2 transmission shifts like a normal 10, 13, or 18 speed transmission until the lever is put into the Auto (Top 2) Mode. The transmission shifts automatically between the top two gears based on engine speed and load.

When the transmission is in the Auto Mode the system will:

- a. Shift the transmission between the top two gears.
- b. Increase or decrease engine speed during a shift.
- c. Momentarily interrupts cruise control or engine brake during the shift, then resumes.

Upshift Procedure

1. Upshift the transmission through the shift pattern 7th H position for the 13/18-speed Convertible models and 8th gear for 10-speed models. 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 AUTO 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 7th H position for 13/18-speed models or 8th gear for 10-speed models.

3. When the engine has reached the shift point the transmission will automatically shift into high gear.

Downshift Procedure

1. To downshift from high gear into the AUTO position:

Once the engine has reached the shift point the transmission will automatically downshift.

2. To downshift from AUTO position:
 - a. 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.
3. Continue downshifting through the shift pattern, double-clutching during lever shifts and breaking torque during button shifts.

Driving Tips

- When the transmission is making a shift in the AUTO Mode, depressing the clutch pedal or moving the lever into the neutral position may cause the Top 2 to miss the shift.
- To activate Top 2 Mode, the transmission must be shifted to the highest lever position when the engine has reached its normal shift point of at least 1400 rpm and vehicle speed is at least 40 mph. (Example: On a Super 10 the highest lever position is 9th and 10th gears).
- Shifting the lever into the Auto position below 1400 rpm does not activate the AUTO Mode. If the operator moves the shift lever into the Auto lever position below the engine's normal shift point, the transmission remains in MANUAL MODE.
- Shift points in AUTO Mode vary depending on the following things:
 1. Throttle Position
 2. Engine Load
 3. Engine Brake Status
 4. Terrain
- HOLD Mode is available when the Top 2 Cruise option is enabled. The cruise option allows the operator to turn off the Top 2 function with the master cruise switch. When the AUTO position and Cruise Control is turned OFF, the transmission holds in the current gear disabling auto and manual split shifts until one of the following happens:
 1. The Cruise Control is turned back ON.
 2. The lever is moved to the neutral position.
 3. The clutch pedal is fully depressed.
- Transmission HUNTING may occur under certain driving conditions. Raising or lowering vehicle cruise speed alleviates this condition.

Definitions

Break Torque	Releasing engine power or load from the transmission and drivetrain by releasing the throttle or depressing the clutch pedal.
Double-Clutch	The shifting technique used when moving the shift lever to the next lever position. Procedure: 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 the starting 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.
Auto Position	The highest lever position where the Top 2 shifts between the top two gear positions, also referred to as Top 2 Mode.
Hold Mode	The transmission holds the current gear at the request of the driver by turning off the Cruise Control switch while in the AUTO mode.
Manual Mode	Driver operated splitter shifts when in the AUTO position.
Hunting	A condition causing the transmission to upshift and downshift repeatedly. This condition is dependent on road speed, throttle position, and engine load.

System Problem

If the system malfunctions, the transmission defaults to manual mode or hold mode indicating one the following faults occurred:

- The Top 2 Valve experienced an open or short in the circuit. The check engine light turns on and the system defaults to Manual Mode.
- A failed component in the system prevented the splitter system from making the shift. After three (3) attempts made over a time period of about 9 seconds the system times out. The check engine light does not turn on. Shifting the transmission to neutral or depressing the clutch obtains manual shifting mode. The Top 2 function is inactive until the vehicle is stopped and the key is turned off for at least 10 seconds.

Fault Code Retrieval/Clearing

The procedure for retrieving and clearing fault codes differs between engine OEMs. Here are the procedures for Detroit Diesel, Caterpillar, Cummins, and Mack.

Detroit Diesel

Retrieving DDEC Fault Codes

All transmission related faults are identified by Code 62. Fault isolation is determined by the FMI code that can only be retrieved with a diagnostic tool. The MPSI Pro-Link 9000 diagnostic tool must be used to accurately diagnose the Top 2 system.

Code	FMI
FaultCode 62- Shorted Circuit	3
FaultCode 62- Open Circuit	4
Fault Code 62- Mechanical System Not Responding	7

Flash codes may be retrieved by manually flashing the codes on the check engine light to retrieve the nature of the system fault but when performing troubleshooting diagnostics a diagnostic tool must be used to prevent misdiagnosis.

The following illustrates a code flashing sequence for code 62:



1. 6 Flashes
2. Short pause (1/2 sec)
3. 2 Flashes

Code 62

After the engine lights have been activated:

- Active fault codes are flashing on the Stop Engine light.
- Inactive fault codes are flashing on the Check Engine light.

Note: If there are no fault codes, a fault code 25 is flashed.

Clearing DDEC Fault Codes

Use an MPSI Pro-Link 9000 diagnostic tool to clear fault codes.

Cummins

Retrieving Cummins Fault Codes

There are two methods of retrieving the fault codes:

- Using a Cummins-approved diagnostic tool to retrieve active and inactive fault codes.
- Manually flashing the active codes on the **Stop** and **Warning** lights on the cab panel using the following procedure:
 1. Key off.
 2. Turn the Diagnostic switch on or connect the shorting plug to the diagnostic connector.
 3. Key on.

After the lights have been activated, the lights will continue to flash the same color.

To move to the next code: Move the Idle Speed Adjust switch to the + position.

To move to the previous code: Move the Idle Speed Adjust switch to the - position.

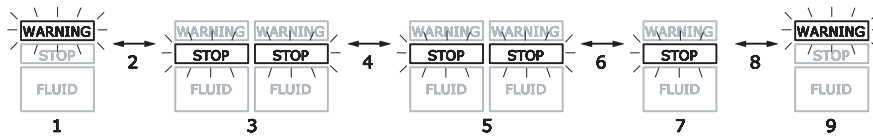
NOTE: If there are no active fault codes both lights will come on and stay on.

Go to the Fault code listing. See fault code list located inside this troubleshooting guide.

The following illustrates a code flashing sequence for a code 221:

Clearing Cummins Fault Codes

Use a Cummins-approved diagnostic tool to clear fault codes.



- | | |
|-----------------------------|-----------------------------|
| 1. 1 Flash | 6. Short pause (1 or 2 sec) |
| 2. Short pause (2 sec) | 7. 1 Flash |
| 3. 2 Flashes | 8. Short pause (1 or 2 sec) |
| 4. Short pause (1 or 2 sec) | 9. 1 Flash |
| 5. 2 Flashes | |

Code 221

Caterpillar (CAT)

Retrieving CAT Fault Codes

There are two methods of retrieving the fault codes:

- Using a Caterpillar-approved diagnostic tool to retrieve the active and inactive fault codes

- Manually flashing the codes on the **Check Engine** light using the following procedure:

1. Make sure the Cruise Control switch is off.
2. Hold the Set/Resume in either Set or Resume position until the **Check Engine** light begins to flash. Release the switch when the light begins to flash.

Go to the Fault Code listing. See fault code list located on the inside of this troubleshooting guide.

The following illustrates a code flashing sequence for code 62:



1. 6 Flashes
2. Shortpause (1/2sec)
3. 2 Flashes

Code 62

After the **Check Engine** light has been activated, both the active fault codes and logged codes since power-up are flashed on the **Check Engine** light.

Note: If there are no fault codes, a fault code 55 is flashed.

Clearing CAT Fault Codes

Use a Caterpillar-approved diagnostic tool to clear fault codes.

Mack (V-MAC III)

Retrieving V-MAC III Fault Codes

There are two methods of retrieving the fault codes:

- Using a MPSI Pro-Link 9000 diagnostic tool to retrieve active and inactive fault codes.
- Manually flashing the active codes on the **Malfunction Lamp** using the following procedure:
- V-MAC Service Diagnostics

1. Key on-wait for two-second power up test on lamp.
2. Lamp remains on after two-second test if code is active. Lamp turns off after two second test if code is inactive.
3. With Cruise ON/OFF switch in OFF position, press and hold the SET/DECEL switch until the malfunction lamp goes off for active codes. In-active codes must be retrieved with Service Diagnostics.
4. The lamp remains off for one-second then the lamp begins to flash the two digit blink codes if present.
5. Only one fault code will be blinked pre SET/DECEL request. Where there are multiple fault codes present, hold in the SET/DECEL switch again until the lamp goes off. The blinking sequence begins again for the next code after another one-second delay.

The following illustrates a code flashing sequence for code 42:



1. 4 Flashes
2. Short pause (1/2 sec)
3. 2 Flashes

Code 42

After every complete fault code blinking sequence, the malfunction lamp returns to normal. It will be on steady if an active code is still present or turns OFF if there are no ACTIVE codes.

Note: If there are no fault codes, no blink codes will flash. Go to fault code listing located in this troubleshooting guide.

Clearing Mack Fault Codes

- Use an MPSI Pro-Link 9000 diagnostic tool to clear fault codes.
- V-MAC Service Diagnostics

Driving Techniques

Detroit Diesel

Fault Codes	Description	Generic Fault Codes		Type of Code	Driving Technique
		SID	FMI		
62	Shift Solenoid or Lockout Solenoid (electrical)	26,40,53,54, 55,56	3,4	Component	Key on. If the fault code is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
62	Mechanical System not Responding (mechanical)	26,40,53,54, 55,56	7	System	Operate the vehicle and allow the engine to perform several Top 2 shifts. If problem occurs and the system has difficulty performing a Top 2 shift, allow the system to continue the attempt for at least 10 seconds while maintaining shift lever and throttle positions. After the system completes the shift attempt, the code will set.

Cummins

Fault Codes	Description	Generic Fault Codes		Type of Code	Driving Technique
		SID	FMI		
536	Lockout Solenoid	40	11	Component	Key on. If the fault code is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
537	Shift Solenoid (electrical)	51	11		
544	Mechanical System not Responding (mechanical)	PID 191	7	System	Operate the vehicle and allow the engine to perform several Top 2 shifts. If problem occurs and the system has difficulty performing a Top 2 shift, allow the system to continue the attempt for at least 10 seconds while maintaining shift lever and throttle positions. After the system completes the shift attempt, the code will set.

Caterpillar (CAT)

Fault Codes	Description	Generic Fault Codes		Type of Code	Driving Technique
		SID	FMI		
66	Shift Solenoid	40	5,6	Component	Key on. If the fault code is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
67	Lockout Solenoid (electrical)	51	5,6		
68	Mechanical System not Responding (mechanical)	PID 191	7	System	Operate the vehicle and allow the engine to perform several Top 2 shifts. If problem occurs and the system has difficulty performing a Top 2 shift, allow the system to continue the attempt for at least 10 seconds while maintaining shift lever and throttle positions. After the system completes the shift attempt, the code will set.

Mack

Fault Codes	Description	Generic Fault Codes		Type of Code	Driving Technique
		SID	FMI		
44	Shift Solenoid	10	3,4	Component	Key on. If the fault code is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
43	Lockout Solenoid (electrical)	11	3,4		
38	Mechanical System not Responding (mechanical)	PID S32	7	System	Operate the vehicle and allow the engine to perform several Top 2 shifts. If problem occurs and the system has difficulty performing a Top 2 shift, allow the system to continue the attempt for at least 10 seconds while maintaining shift lever and throttle positions. After the system completes the shift attempt, the code will set.

Fault Code Isolation Procedure Index

Detroit Diesel

Fault Codes	Description	Generic Fault Codes		Type of Code	Isolation Procedure
		SID	FMI		
62	Shift Solenoid or Lockout Solenoid (electrical)	26,40,53,54, 55,56	3,4	Component	Shift Solenoid or Lockout Solenoid Test located in this troubleshooting guide.
62	Mechanical System not Responding (mechanical)	26,40,53,54, 55,56	7	System	Mechanical System not Responding Test located in this troubleshooting guide.

Cummins

Fault Codes	Description	Generic Fault Codes		Type of Code	Isolation Procedure
		SID	FMI		
536	Lockout Solenoid	40	11	Component	Shift Solenoid or Lockout Solenoid Test located in this troubleshooting guide.
537	Shift Solenoid (electrical)	51	11		
544	Mechanical System not Responding (mechanical)	PID 191	7	System	Mechanical System not Responding Test located in this troubleshooting guide.

Caterpillar (CAT)

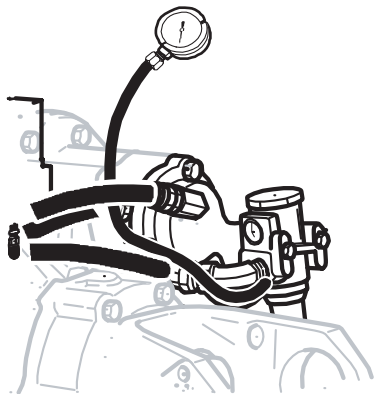
Fault Codes	Description	Generic Fault Codes		Type of Code	Isolation Procedure
		SID	FMI		
66	Shift Solenoid	40	5,6	Component	Shift Solenoid or Lockout Solenoid Test located in this troubleshooting guide.
67	Lockout Solenoid (electrical)	51	5,6		
68	Mechanical System not Responding (mechanical)	PID 191	7	System	Mechanical System not Responding Test located in this troubleshooting guide.

Mack

Fault Codes	Description	Generic Fault Codes		Type of Code	Isolation Procedure
		SID	FMI		
44	Shift Solenoid	10	3,4	Component	Shift Solenoid or Lockout Solenoid Test located in this troubleshooting guide.
43	Lockout Solenoid (electrical)	11	3,4		
38	Mechanical System not Responding (mechanical)	PID S32	7	System	Mechanical System not Responding Test located in this troubleshooting guide.

Pneumatic Pretest

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Install a 0-100 PSI air gauge in between vehicle supply and transmission air filter / regulator supply port (input).		
	3. Start engine.		
	4. Allow air pressure to build to governor cutoff.		
	5. Read vehicle air pressure gauge. →	If air pressure reads at least 90 PSI →	Go to Step B .
		If air pressure is below 90 PSI →	Repair vehicle air system as required. Repeat this step.



Step B	Procedure	Condition	Action
	1. Key off.		
	2. Monitor air pressure on vehicle main air pressure gauge. →	If vehicle maintains air pressure →	Go to Step C .
		If vehicle loses air pressure →	Repair leak in vehicle air system. Repeat this step.

Pneumatic Pretest, continued

Step C	Procedure	Condition	Action
	1. Read air pressure gauge installed in the air filter/regulator regulated test port. →	If air pressure is 58 to 63 PSI →	Test complete.
		If air pressure is not 58 to 63 PSI (above or below) →	Go to Step D .
Step D	Procedure	Condition	Action
	1. Key off.		
	2. Remove air supply line to the air filter/regulator and check the air flow. →	If air flows from the supply line →	Replace air filter/regulator. Go to Step C .
		If air does not flow from the supply line →	Repair vehicle air supply to air filter/regulator. Go to Step C .

Pneumatic Pretest, continued

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Fault Code: 62 (SID: 26,40,53-56, FMI: 3,4) DDEC III - Shift Solenoid or Lockout Solenoid

Overview

This is an active fault indicating an electrical problem in the Top 2 shift or lockout solenoid circuit.

Detection

Key on. If active check engine light is on, Top 2 will not function.

Fallback

Hold current solenoid state or gear until neutral is detected, then manual mode until system powers down.

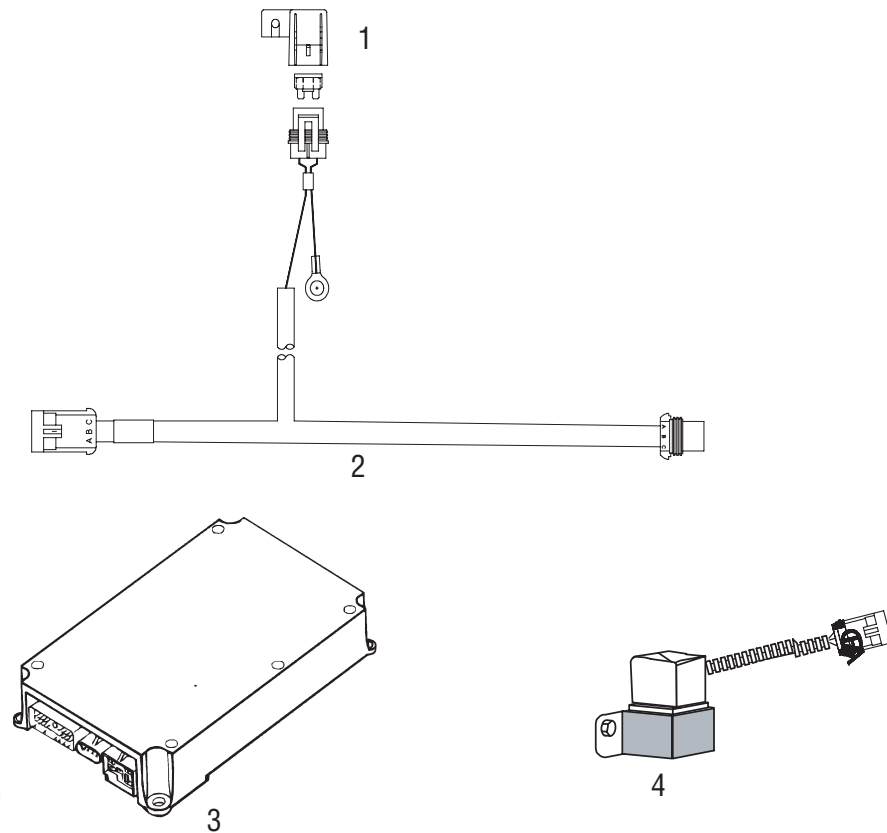
Required Tools

- Pro-Link 9000 or engine manufacturer scan tool
- Basic hand tools
- Digital Volt/Ohm Meter
- Top 2 Troubleshooting Guide

Possible Causes

This fault can be caused by any of the following:

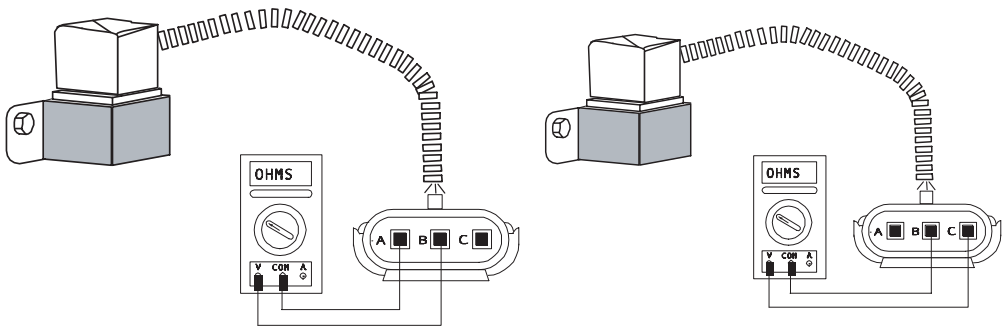
- Blown fuse
- Electrical open or short in the shift solenoid circuit (solenoid, wiring harness, or connector)
- Damaged vehicle interface harness
- Faulty engine control module (ECM)



1. 10 AMP fuse
2. Typical vehicle interface harness OEM supplied
3. DDEC III ECM OEM supplied
4. Top 2 solenoid valve

Fault Code: 62
(SID:26,40,53-56,FMI: 3,4)
DDEC III - Shift Solenoid or Lockout Solenoid

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect three-way connector from Top 2 solenoid.		
	3. Measure resistance between Top 2 valve connector pins: • A and B (red & blue wires) • B and C (blue & white wires)	If resistance is 14 to 34 ohms	Go to Step B .
	Note: Some early Top 2 valves are wired with all blue wires.	If resistance is outside of range	Replace Top 2 valve. Go to Step V .

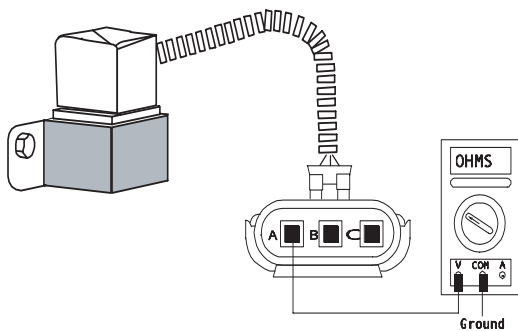


Fault Code: 62
(SID:26,40,53-56,FMI:3,4)

Fault Code: 62 (SID:26,40,53-56,FMI:3,4)

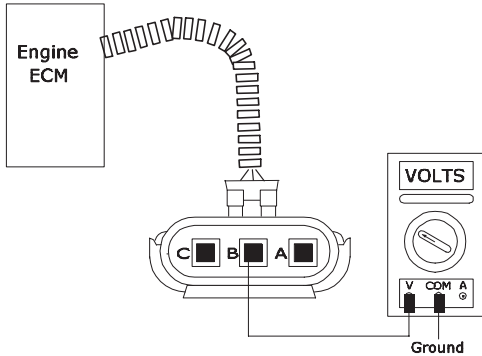
DDEC III - Shift Solenoid or Lockout Solenoid, continued

Step B	Procedure	Condition	Action
	1. Measure resistance between Top 2 valve connector pin A (red wire) and ground.	If the resistance is more than 10K ohms or infinite → If the resistance is less than 10K ohms →	Go to Step C. Replace the Top 2 valve. Go to Step V.



Fault Code: 62 (SID:26,40,53-56,FMI:3,4) DDEC III - Shift Solenoid or Lockout Solenoid, continued

Step C	Procedure	Condition	Action
	1. Key off.		
	2. Measure voltage between vehicle interface harness connector pin B and ground.	→ If voltage is within 1 volt of battery voltage → If voltage is outside of range →	Top 2 valve is OK, problem exists in engine ECM or vehicle harness. Repair according to vehicle OEM recommendations. Go to Step V. Top 2 valve is functioning properly, problem exists in power supply. Repair/replace as required. Go to Step V.



Fault Code: 62
(SID:26,40,53-56,FMI:3,4)

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Use Driving Technique to attempt to reset the code (see page 1-12).		
	5. Retrieve fault codes (see page 1-8).	→ If no codes → If code 62 appears →	Test complete. Return to Step A to find error in testing.

Fault Code: 537, 536 (SID: 40, 51, FMI: 11) Cummins - Shift Solenoid or Lockout Solenoid

Overview

This is an active fault indicating an electrical problem in the Top 2 shift or lockout solenoid circuit.

Detection

Key on. If active check engine light is on, Top 2 will not function.

Fallback

Hold current solenoid state or gear until neutral is detected, then manual mode until system powers down.

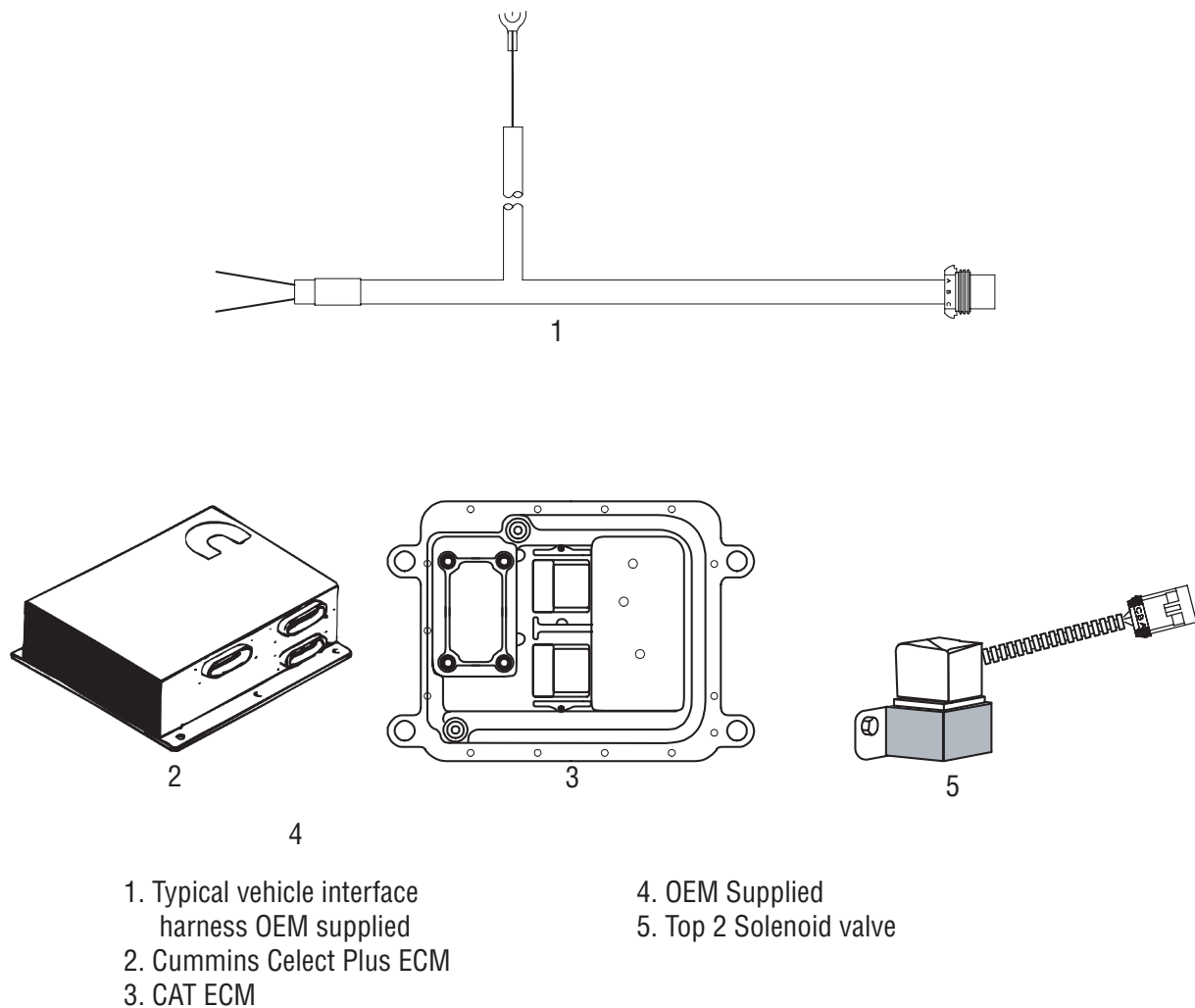
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Top 2 Troubleshooting Guide

Possible Causes

This fault can be caused by any of the following conditions:

- Electrical open or short in the shift solenoid circuit
- Damaged vehicle interface harness
- Faulty engine control module (ECM)



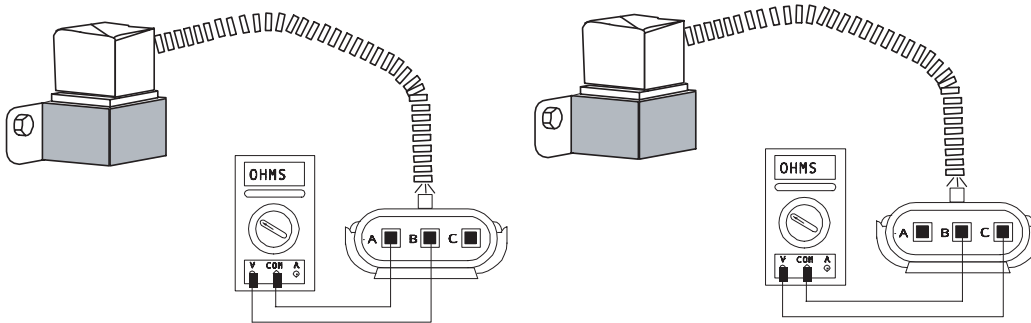
Fault Code: 537, 536

(SID: 40,51, FMI: 11)

Cummins - Shift Solenoid or Lockout Solenoid

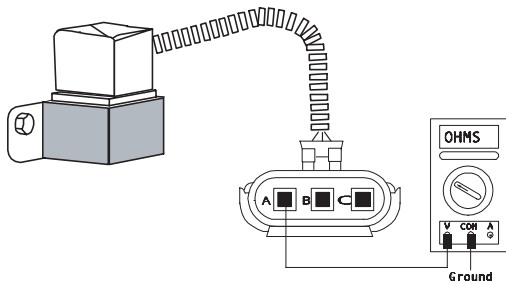
Fault Code: 537, 536
(SID: 40,51, FMI: 11)

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect three-way connector from Top 2 solenoid.		
	3. Measure resistance between Top 2 valve connector pins:		
	- A and B (red & blue wires) - B and C (blue & white wires)	→ If resistance is 14 to 34 ohms →	Go to Step B .
	Note: Some early Top 2 valves are wired with all blue wires.	→ If resistance is outside of range →	Replace Top 2 valve. Go to Step V .

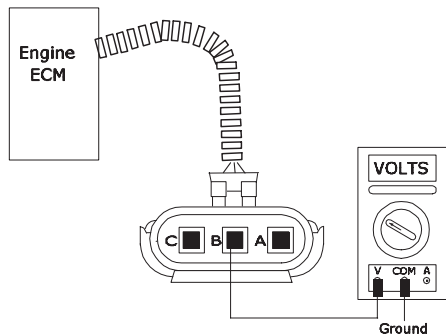


Fault Code: 537, 536 (SID: 40,51, FMI: 11) Cummins - Shift Solenoid or Lockout Solenoid, continued

Step B	Procedure	Condition	Action
	1. Measure the resistance between Top 2 valve connector pin A (red wire) and ground.	If resistance is more than 10K ohms or infinite	Go to Step C .
		If resistance is less than 10K ohms	Replace Top 2 valve. Go to Step V .



Step C	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect battery positive (+) cable.		
	3. Measure resistance between vehicle interface harness connector pin B and ground.	If resistance is 0 to .3 ohms	Top 2 valve is functioning properly, problem exists in engine ECM or vehicle harness. Repair according to OEM recommendations. Go to Step V .
		If resistance is outside of range	Faulty ground. Repair/replace vehicle interface harness.



Fault Code: 537, 536 (SID: 40,51, FMI: 11) Cummins - Shift Solenoid or Lockout Solenoid, continued

Fault Code: 537, 536
(SID: 40,51, FMI: 11)

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Use Driving Technique to attempt to reset the code (see page 1-12).		
	5. Retrieve fault codes (see page 1-8).	→ If no codes → → If code 537 or 536 appears →	Test complete. Return to Step A to find error in testing.

Fault Code: 66,67 (SID: 40,51, FMI: 5,6) Caterpillar - Shift Solenoid or Lockout Solenoid

Overview

This is an active fault indicating an electrical problem in the Top 2 shift or lockout solenoid circuit.

Detection

Hold current solenoid state or gear until neutral is detected, then manual mode until system powers down.

Fallback

Key on. If active check engine light is on, Top 2 will not function.

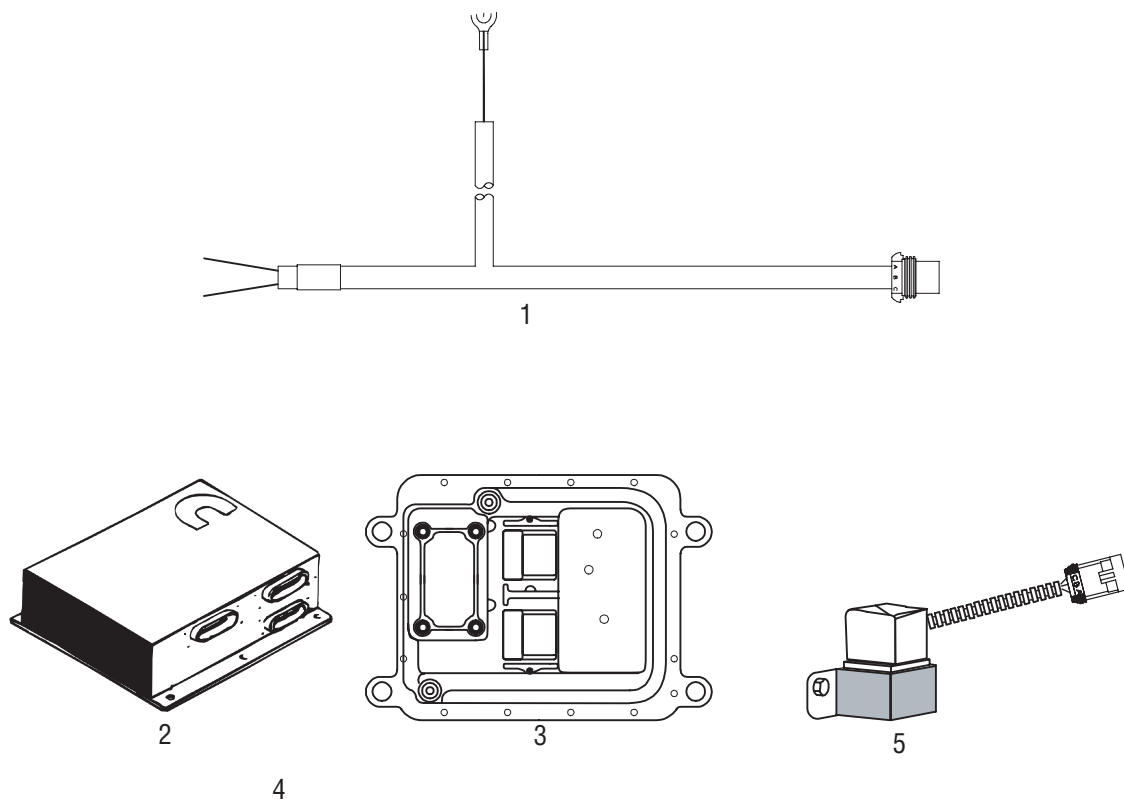
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Top 2 Troubleshooting Guide

Possible Causes

This fault can be caused by any of the following:

- Electrical open or short in the shift solenoid circuit (solenoid, wire harness, or connector)
- Damaged vehicle interface harness
- Faulty engine control module (ECM)



1. Typical vehicle interface harness OEM supplied
2. Cummins Celect Plus ECM
3. CAT ECM

4. OEM Supplied
5. Top 2 Solenoid valve

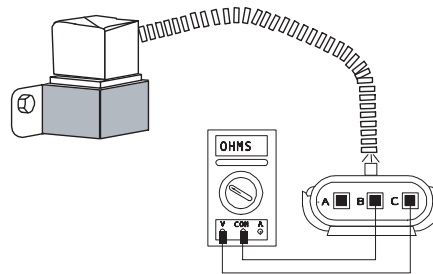
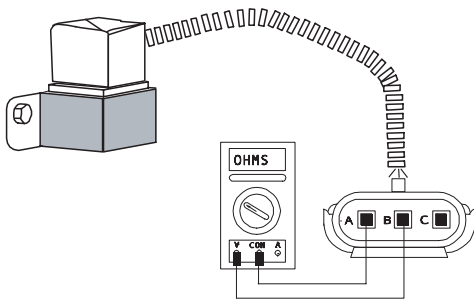
Fault Code: 66,67

(SID: 40,51, FMI: 5,6)

Caterpillar - Shift Solenoid or Lockout Solenoid

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect three way connector from Top 2 solenoid.		
	3. Measure resistance between Top 2 valve connector pins:		
	- A and B (red & blue wires) - B and C (blue and white wires)	→ If resistance is 14 to 34 ohms →	Go to Step B .
	Note: Some early Top 2 valves are wired with all blue wires.	→ If resistance is outside of range →	Replace Top 2 valve. Go to Step V.

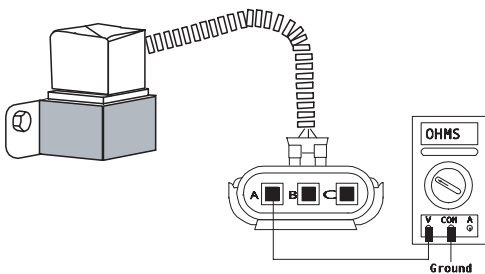
Fault Code: 66,67
(SID: 40,51, FMI 5,6)



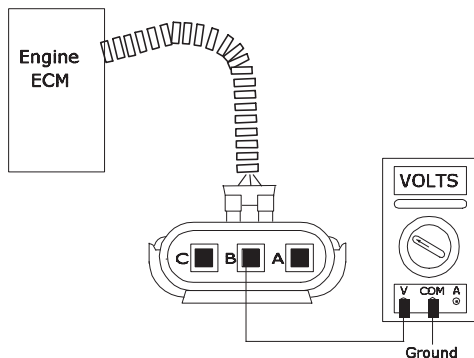
Fault Code: 66,67 (SID: 40,51, FMI 5,6)

Caterpillar - Shift Solenoid or Lockout Solenoid, continued

Step B	Procedure	Condition	Action
	1. Measure the resistance between Top 2 valve connector pin A (red wire) and ground.	If resistance is more than 10K ohms or infinite	Go to Step C .
		If resistance is less than 10K ohms	Replace Top 2 valve. Go to Step V .



Step C	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect battery positive (+) cable.		
	3. Measure resistance between vehicle interface harness connector pin B and ground.	If resistance is 0 to .3 ohms	Top 2 valve is functioning properly, the problem exists in engine ECM or vehicle harness. Repair according to OEM recommendations. Go to Step V .
		If resistance is outside of range	Faulty ground. Repair/replace vehicle interface harness.



Fault Code: 66,67 (SID: 40,51, FMI 5,6)

Caterpillar - Shift Solenoid or Lockout Solenoid, continued

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Use the Driving Technique to attempt to reset the code (see page 1-12).		
	5. Retrieve fault codes, (see page 1-8).	→ If no codes →	Test complete.
		→ If code 537 or 536 appears →	Return to Step A to find error in testing.

Fault Code: 66,67
(SID: 40,51, FMI 5,6)

Fault Code: 44,43 (SID: 10,11, FMI: 3,4) MACK - Shift Solenoid or Lockout Solenoid

Overview

This is an active fault indicating an electrical problem in the Top 2 shift or lockout solenoid circuit.

Detection

Key on. If active check engine light is on, Top 2 will not function.

Fallback

Hold current solenoid state or gear until neutral is detected, then manual mode until system powers down.

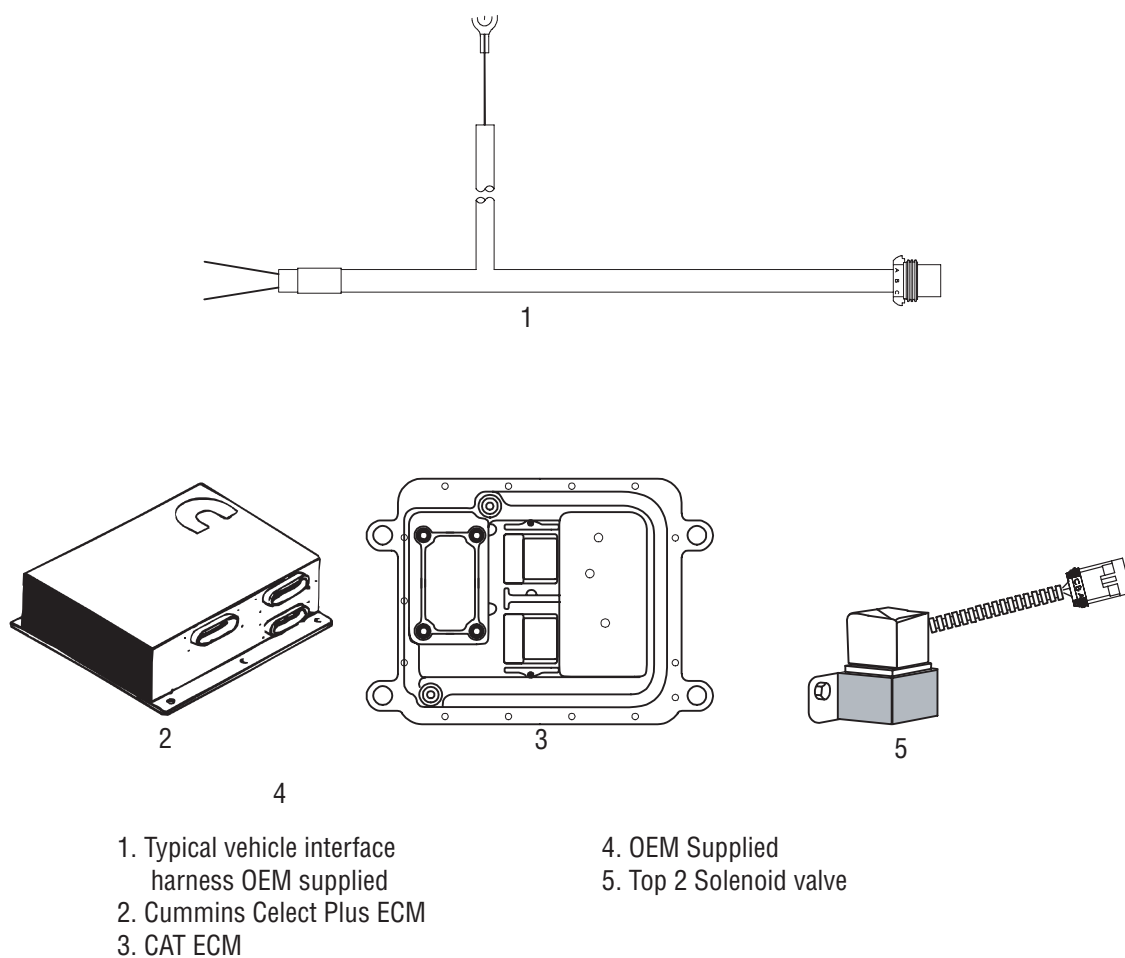
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Top 2 Troubleshooting Guide

Possible Causes

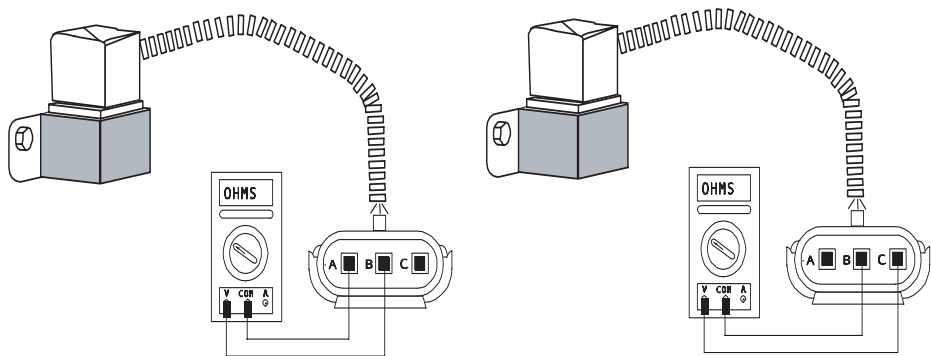
This fault can be caused by any of the following:

- Electrical open or short in the shift solenoid circuit (solenoid, wiring harness, or connector)
- Damaged vehicle interface harness
- Faulty engine control module (ECM)
- Faulty Mack VECU
- Mack 12V supply to Top 2 valve failed (Pin B)



Fault Code: 44,43 (SID: 10,11, FMI: 3,4) MACK - Shift Solenoid or Lockout Solenoid

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect three-way connector from Top 2 solenoid.		
	3. Measure resistance between Top 2 valve connector pins: - A and B (red & blue wires) - B and C (blue & white wires)	If resistance is 14 to 34 ohms	Go to Step B .
	Note: Some early Top 2 valves are wired with all blue wires.	If resistance is outside of range	Replace Top 2 valve. Go to Step V .

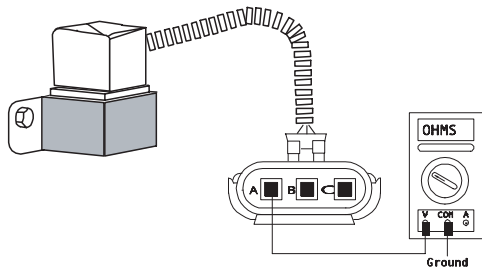


Fault Code: 44,43
(SID: 10,11, FMI: 3,4)

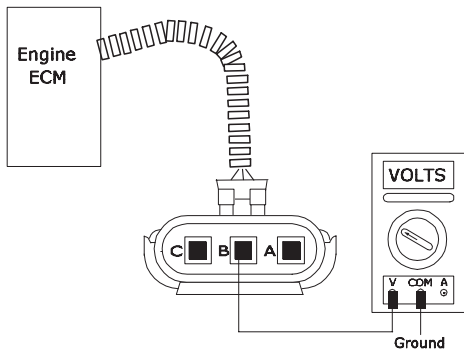
Fault Code: 44,43 (SID: 10,11, FMI: 3,4)

MACK - Shift Solenoid or Lockout Solenoid, continued

Step B	Procedure	Condition	Action
	1. Measure resistance between Top 2 valve connector pin A (red wire) and ground.	If resistance is more than 10K ohms or infinite → If resistance is less than 10K ohms →	Go to Step C. Replace Top 2 valve. Go to Step V.



Step C	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect battery positive (+) cable.		
	3. Measure resistance between vehicle interface harness connector pin B and ground.	If resistance is 0 to .3 ohms → If voltage is outside of range →	Top 2 valve is functioning properly, the problem exists in engine ECM or vehicle harness. Repair according to vehicle OEM recommendations. Go to Step V. Faulty ground. Repair / replace vehicle interface harness.



Fault Code: 44,43 (SID: 10,11, FMI: 3,4)

MACK - Shift Solenoid or Lockout Solenoid, continued

Step V	Procedure	Condition	Action
	1. Key off.		
	2. Reconnect all connectors.		
	3. Key on.		
	4. Use Driving Technique to attempt to reset the code (see page 1-12).		
	5. Retrieve fault codes (see page 1-8).	→ If no codes →	Test complete.
		If code 44 or 43 appears →	Return to Step A to find error in testing.

Fault Code: 44,43
(SID: 10,11, FMI: 3,4)

Fault Code: 62 (SID: 26,40,53-56, FMI: 7) DDEC III - Mechanical System Not Responding

Overview

This fault indicates the transmission failed to complete an automatic Top 2 shift as commanded by the engine's electronic control module (ECM).

Detection

The transmission will make three attempts for the Top 2 to shift. If it fails, the fault is set with check engine light.

Fallback

The transmission will return to manual mode shifting.

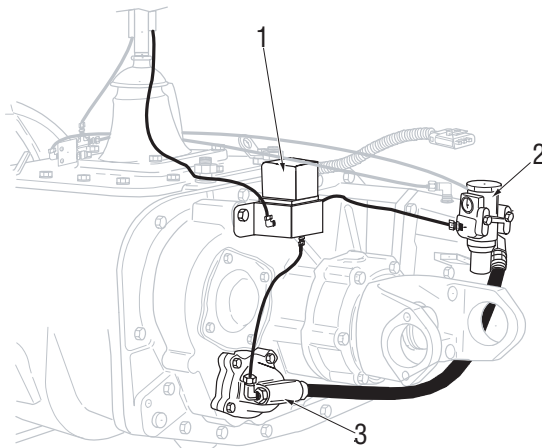
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Top 2 Troubleshooting Guide
- Engine Manufacturer Scan Tool

Possible Causes

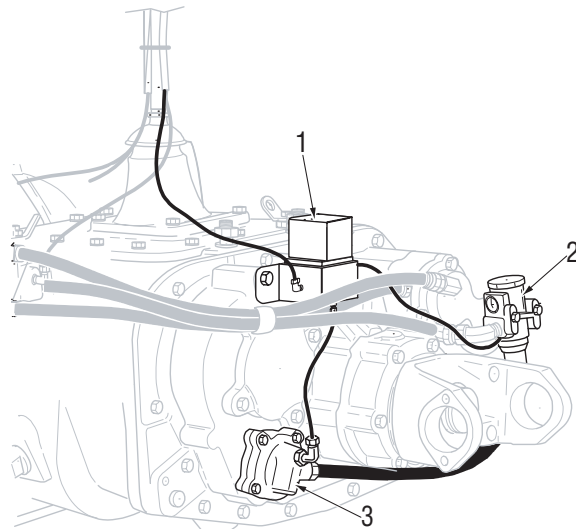
This fault can be caused by any of the following:

- Low air pressure
- Contaminated air supply
- Faulty Top 2 solenoid valve
- Faulty splitter cylinder
- Loose tone wheel
- Faulty/Contaminated Exhaust Breather



1. Top 2 solenoid valve
2. Air filter/regulator
3. Splitter cylinder

10 Speed



1. Top 2 solenoid valve
2. Air filter/regulator
3. Splitter cylinder

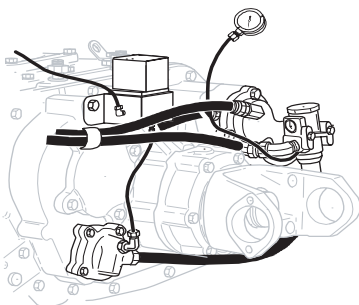
13 and 18 Speed

Fault Code: 62 (SID: 26,40,53-56, FMI: 7) DDEC III - Mechanical System Not Responding

Fault Code: 62
(SID: 26,40,53-56, FMI: 7)

Step A	Procedure	Condition	Action
	1. Operate the vehicle. Attempt to perform HI to LO and LO to HI split shifts using the splitter button. Note: For Convertible models go directly to Step 2 .		
	2. Confirm AUTO Mode function is working correctly.	If the transmission performs split shifts in all gears except AUTO Mode	Go to Step B .
		If the transmission consistently does not perform split shifts	Perform Splitter System Test (see page 3-15). Go to Step V .

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Top 2 valve air supply line (S Port).*		
	3. Connect a 100 psi air gauge to the supply line.	Air pressure 58 to 63 psi	Go to Step C .
		Air pressure not within 58 to 63 psi	Go to Step D .



18 Speed Shown

*See Schematic in Appendix for exact location.

Fault Code: 62 (SID: 26,40,53-56, FMI: 7)

DDEC III - Mechanical System Not Responding, continued

Step C	Procedure	Condition	Action
	1. Inspect exhaust breather on Top 2 valve for damage or contamination.* →	If exhaust breather is restricted or Top 2 functions with breather removed →	Replace breather. Go to Step V .
		If exhaust breather is functioning properly →	Go to Step E .

*If unsure breather is faulty, test drive vehicle with breather removed.

Step D	Procedure	Condition	Action
	1. Inspect the Top 2 valve air supply fittings and line. →	If the fittings and air lines are functioning properly →	Replace air filter/regulator. Go to Step V .
		If the fittings and air lines are restricted or damaged →	Repair as necessary. Go to Step V .

Step E	Procedure	Condition	Action
	1. Connect engine manufacturer scan tool.		
	Note: MPSI Pro-Link Scan Tool with Eaton cartridge may be used on some engines.		
	2. Disconnect air line from P2 and connect 100 psi air gauge to Top 2 valve P2 port. Leave P1 and supply ports connected.		
	3. Remove P1 and plug for Convertible.		
	4. Actuate Shift Solenoid ON (Coil B). →	Air pressure 58 to 63 psi →	Go to Step F .
		Air pressure not within 58 to 63 psi →	Replace Top 2 valve. Go to Step V .

Fault Code: 62 (SID: 26,40,53-56, FMI: 7)

DDEC III - Mechanical System Not Responding, continued

Fault Code: 62
(SID: 26,40,53-56, FMI: 7)

Step F	Procedure	Condition	Action
	1. Leaving Shift Solenoid ON. Reconnect P1 port for Convertible.		
	2. Listen for air leaking at Top 2 exhaust breather and Roadranger valve. →	Air leaks from one or both →	Replace Top 2 valve. Go to Step V.
		Air does not leak from valve or breather →	Go to Step G.

Step G	Procedure	Condition	Action
	1. Leaving 100 psi air gauge connected to P2 port of the Top 2 valve.		
	2. Move splitter button forward. Note: No action required for Convertibles.		
	3. Using diagnostic tool actuate Shift Solenoid OFF and Lockout Solenoid ON. →	Air pressure gauge reads 0 psi →	Go to Step H.
		Air pressure reads above 0 psi →	Replace Top 2 valve. Go to Step V.

Step H	Procedure	Condition	Action
	1. Leave Shift Solenoid OFF and Lockout Solenoid ON.		
	2. Leave splitter button forward. Note: No action required for Convertibles.		
	3. Listen for air leaking from Top 2 breather. →	Air leaks from breather →	Replace Top 2 valve. Go to Step V.
		Air does not leak from breather →	Go to Step I.

Fault Code: 62 (SID: 26,40,53-56, FMI: 7)

DDEC III - Mechanical System Not Responding, continued

Step I	Procedure	Condition	Action
	1. Disconnect Top 2 valve 3-way connector from vehicle harness.		
	2. Turn on ignition key.		
	3. Using MPSI Scan Tool read the Active Fault Codes.	Active Shift or Lockout Solenoid Fault present (see page 1-12).	Go to Step V .
		No Active Fault set	Engine ECU not programmed for Top 2. Contact Engine OEM for service. Go to Step V .

Step V	Procedure	Condition	Action
	1. Reconnect all air lines and electrical connectors.		
	2. Start engine.		
	3. Allow air pressure to build to governor cutoff.		
	4. Key off.		
	5. Listen for constant air leaks under the following conditions: Note: Skip the following procedures for Convertibles		
	- Shift lever in neutral with splitter button back. - Shift lever in neutral with splitter button forward. - Shift lever in 7th/8th gear position.		
	6. Perform test drive.	If there are no constant air leaks and test drive confirms repair	Test complete.
		If there are constant leaks or test drive does not confirm vehicle repair	Return to Step A to find error in testing.

Fault Code: 62 (SID: 26,40,53-56, FMI: 7)
DDEC III - Mechanical System Not Responding, continued

Fault Code: 62
(SID: 26, 40, 53-56, FMI: 7)

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Fault Code: 544 (PID: 191, FMI: 7) Cummins - Mechanical System Not Responding

Overview

This fault indicates the transmission failed to complete an automatic Top 2 Shift as commanded by the engine's electronic control module (ECM).

Detection

The transmission will make three attempts for the Top 2 to shift. If it fails, the fault is set with check engine light.

Fallback

The transmission will return to manual mode shifting.

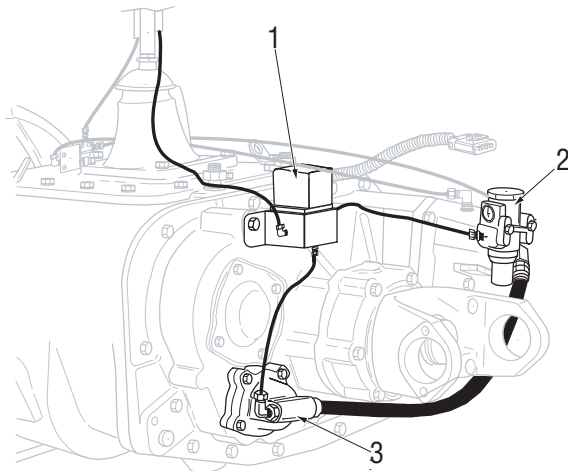
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Top 2 Troubleshooting Guide
- Engine Manufacturer Scan Tool

Possible Causes

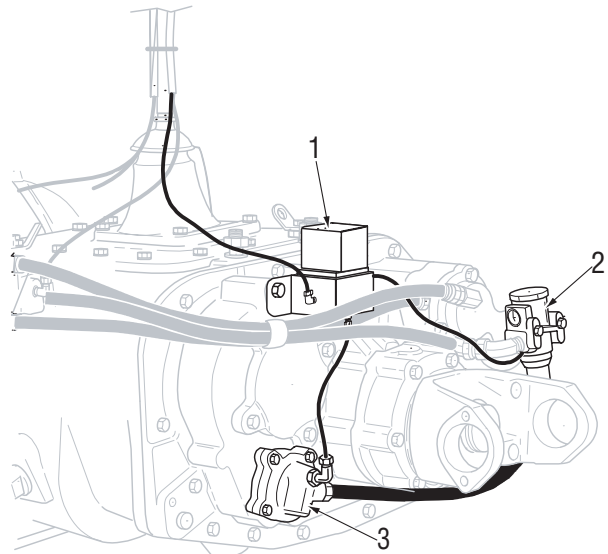
This fault code can be caused by any of the following:

- Low air pressure
- Contaminated air supply
- Faulty Top 2 solenoid valve
- Faulty splitter cylinder
- Loose tone wheel
- Faulty/Contaminated Exhaust Breather
- Cruise Switch



1. Top 2 solenoid valve
2. Air filter/regulator
3. Splitter cylinder

10 Speed



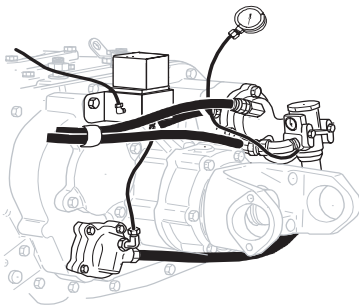
1. Top 2 solenoid valve
2. Air filter/regulator
3. Splitter cylinder

13 and 18 Speed

Fault Code: 544 (PID: 191, FMI: 7) Cummins - Mechanical System Not Responding

Step A	Procedure	Condition	Action
	1. Operate the vehicle. Attempt to perform HI to LO and LO to HI split shifts using the splitter button. Note: For Convertible models go directly to Step 2.		
	2. Confirm AUTO Mode function is working correctly.	→ If the transmission performs split shifts in all gears except AUTO Mode →	Go to Step B .
		→ If the transmission consistently does not perform split shifts →	Perform Splitter System Test on (see page 3-15). Go to Step V .

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Top 2 valve air supply line (S Port).*		
	3. Connect a 100 psi air gauge to the supply line.	→ Air pressure 58 to 63 psi →	Go to Step C .
		→ Air pressure not within 58 to 63 psi →	Go to Step D .



18 Speed Shown

*See Schematic in Appendix for exact location.

Fault Code: 544
(PID: 191, FMI: 7)

Fault Code: 544 (PID: 191, FMI: 7)

Cummins - Mechanical System Not Responding, continued

Step C	Procedure	Condition	Action
	1. Inspect exhaust breather on Top 2 valve for damage or contamination.* →	If exhaust breather is restricted or Top 2 functions with breather removed →	Replace breather. Go to Step V .
		If exhaust breather is functioning properly →	Go to Step E .

*If unsure breather is faulty, test drive vehicle with breather removed.

Step D	Procedure	Condition	Action
	1. Inspect the Top 2 valve air supply fittings and line. →	If the fittings and air lines are functioning properly →	Replace air filter/regulator. Go to Step V .
		If the fittings and air lines are restricted or damaged →	Repair as necessary. Go to Step V .

Step E	Procedure	Condition	Action
	1. Connect engine manufacturer scan tool.		
	Note: MPSI Pro-Link Scan Tool with Eaton cartridge may be used on some engines.		
	2. Disconnect air line from P2 and connect 100 psi air gauge to Top 2 valve P2 port. Leave P1 and supply ports connected.		
	3. Remove P1 and plug for Convertilbe.		
	4. Actuate Shift Solenoid ON (Coil B). →	Air pressure 58 to 63 psi →	Go to Step F .
		Air pressure not within 58 to 63 psi →	Replace Top 2 valve. Go to Step V .

Fault Code: 544 (PID: 191, FMI: 7)

Cummins - Mechanical System Not Responding, continued

Step F	Procedure	Condition	Action
	1. Leaving Shift Solenoid ON. Reconnect P1 port for Convertible.		
	2. Listen for air leaking at Top 2 exhaust breather and Roadranger valve.	Air leaks from one or both →	Replace Top 2 valve. Go to Step V.
		Air does not leak from valve or breather →	Go to Step G.

Step G	Procedure	Condition	Action
	1. Leaving 100 psi air gauge connected to P2 Port of the Top 2 valve.		
	2. Move splitter button forward. Note: No action required for Convertibles.		
	3. Using diagnostic tool actuate Shift Solenoid OFF and Lockout Solenoid ON.	Air pressure gauge reads 0 psi →	Go to Step H.
		Air pressure reads above 0 psi →	Replace Top 2 valve. Go to Step V.

Step H	Procedure	Condition	Action
	1. Leave Shift Solenoid OFF and Lockout Solenoid ON.		
	2. Leave splitter button forward. Note: No action required for Convertibles.		
	3. Listen for air leaking from Top 2 breather.	Air leaks from breather →	Replace Top 2 valve. Go to Step V.
		Air does not leak from breather →	Go to Step I.

Fault Code: 544
(PID: 191, FMI: 7)

Fault Code: 544 (PID: 191, FMI: 7)

Cummins - Mechanical System Not Responding, continued

Step I	Procedure	Condition	Action
	1. Disconnect Top 2 valve 3-way connector from vehicle harness.		
	2. Turn on ignition key.		
	3. Using MPSI Scan Tool read the Active Fault Codes.	Active Shift or Lockout Solenoid Fault present (see page 1-12)	Go to Step V .
		No Active Fault set	Engine ECU not programmed for Top 2. Contact Engine OEM for service. Go to Step V .

Step V	Procedure	Condition	Action
	1. Reconnect all air lines and electrical connectors.		
	2. Start engine.		
	3. Allow air pressure to build to governor cutoff.		
	4. Key off.		
	5. Listen for constant air leaks under the following conditions: Note: Skip these procedures for Convertibles		
	- Shift lever in neutral with splitter button back. - Shift lever in neutral with splitter button forward. - Shift lever in 7th/8th gear position.		
	6. Perform test drive.	If there are no constant air leaks and test drive confirms repair	Test complete.
		If there are constant leaks or test drive does not confirm vehicle repair	Return to Step A to find error in testing.

Fault Code: 544 (PID: 191, FMI: 7)

Cummins - Mechanical System Not Responding, continued

**Fault Code: 544
(PID: 191, FMI: 7)**

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Fault Code: 68 (PID: 191, FMI:7) Caterpillar - Mechanical System Not Responding

Overview

This fault code indicates the transmission failed to complete an automatic Top 2 shift as commanded by the engine's electronic control module (ECM).

Detection

The transmission will make three attempts for the Top 2 to shift. If it fails, the fault is set with check engine light.

Fallback

The transmission will return to manual mode shifting.

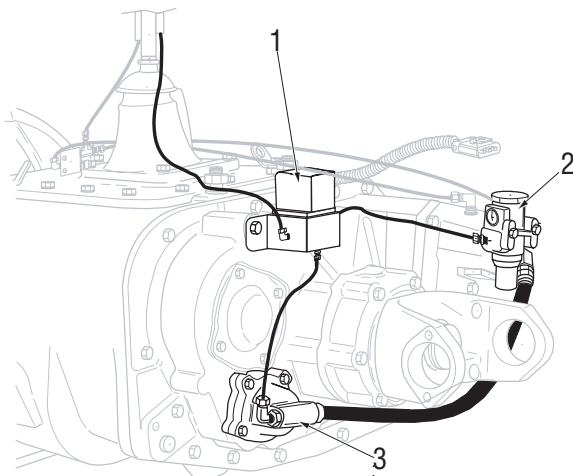
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Top 2 Troubleshooting Guide
- Engine Manufacturer Scan Tool

Possible Causes

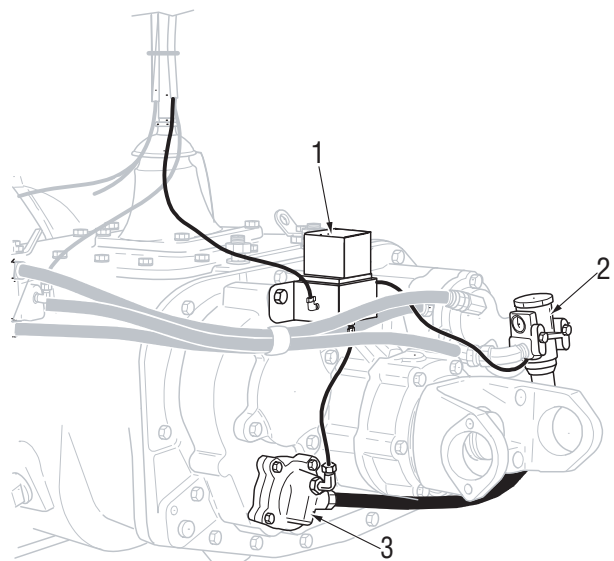
This fault can be caused by any of the following:

- Low air pressure
- Contaminated air supply
- Faulty Top 2 solenoid valve
- Faulty splitter cylinder
- Loose tone wheel
- Faulty/Contaminated Exhaust Breather



1. Top 2 solenoid valve
2. Air filter/regulator
3. Splitter cylinder

10 Speed



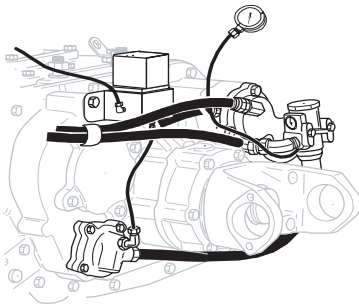
1. Top 2 solenoid valve
2. Air filter/regulator
3. Splitter cylinder

13 and 18 Speed

Fault Code: 68 (PID: 191, FMI: 7) Caterpillar - Mechanical System Not Responding

Step A	Procedure	Condition	Action
	1. Operate the vehicle. Attempt to perform HI to LO and LO to HI split shifts using the splitter button. Note: For Convertible models go directly to Step 2.		
	2. Confirm AUTO Mode function is working correctly.	→ If the transmission performs split shifts in all gears except AUTO Mode →	Go to Step B .
		If the transmission consistently does not perform split shifts →	Perform Splitter System Test on (see page 3-15). Go to Step V .

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Top 2 valve air supply line (S Port).*		
	3. Connect a 100 psi air gauge to the supply line.	→ Air pressure 58 to 63 psi →	Go to Step C .
		Air pressure not within 58 to 63 psi →	Go to Step D .



18 Speed Shown

*See Schematic in Appendix for exact location.

Fault Code: 68
(PID: 191, FMI: 7)

Fault Code: 68 (PID: 191, FMI: 7)

Caterpillar - Mechanical System Not Responding, continued

Step C	Procedure	Condition	Action
	1. Inspect exhaust breather on Top 2 valve for damage or contamination.* →	If exhaust breather is restricted or Top 2 functions with breather removed →	Replace breather. Go to Step V .
		If exhaust breather is functioning properly →	Go to Step E .
*If unsure breather is faulty, test drive vehicle with breather removed.			

Step D	Procedure	Condition	Action
	1. Inspect the Top 2 valve air supply fittings and line. →	If the fittings and air lines are functioning properly →	Replace air filter/regulator. Go to Step V .
		If the fittings and air lines are restricted or damaged →	Repair as necessary. Go to Step V .

Step E	Procedure	Condition	Action
	1. Connect engine manufacturer scan tool.		
	Note: MPSI Pro-Link Scan Tool with Eaton cartridge may be used on some engines.		
	2. Disconnect air line from P2 and connect 100 psi air gauge to Top 2 valve P2 port. Leave P1 and supply ports connected.		
	3. Remove P1 and plug for Convertible.		
	4. Actuate Shift Solenoid ON (Coil B). →	Air pressure 58 to 63 psi →	Go to Step F .
		Air pressure not within 58 to 63 psi →	Replace Top 2 valve. Go to Step V .

Fault Code: 68 (PID: 191, FMI: 7)

Caterpillar - Mechanical System Not Responding, continued

Step F	Procedure	Condition	Action
	1. Leaving Shift Solenoid ON. Reconnect P1 port for Convertible.		
	2. Listen for air leaking at Top 2 exhaust breather and Roadranger valve. →	Air leaks from one or both →	Replace Top 2 valve. Go to Step V.
		Air does not leak from valve or breather →	Go to Step G.

Step G	Procedure	Condition	Action
	1. Leaving 100 psi air gauge connected to P2 Port of the Top 2 valve.		
	2. Move splitter button forward. Note: No action required for Convertibles.		
	3. Using diagnostic tool actuate Shift Solenoid OFF and Lockout Solenoid ON. →	Air pressure gauge reads 0 psi →	Go to Step H.
		Air pressure reads above 0 psi →	Replace Top 2 valve. Go to Step V.

Step H	Procedure	Condition	Action
	1. Leave Shift Solenoid OFF and Lockout Solenoid ON.		
	2. Leave splitter button forward. Note: No action required for Convertibles.		
	3. Listen for air leaking from Top 2 breather. →	Air leaks from breather →	Replace Top 2 valve. Go to Step V.
		Air does not leak from breather →	Go to Step I.

Fault Code: 68
(PID: 191, FMI: 7)

Fault Code: 68 (PID: 191, FMI: 7)

Caterpillar - Mechanical System Not Responding, continued

Step I	Procedure	Condition	Action
	1. Disconnect Top 2 valve 3-way connector from vehicle harness.		
	2. Turn on ignition key.		
	3. Using MPSI Scan Tool read the Active Fault Codes.	Active Shift or Lockout Solenoid Fault present (see page 1-12)	Go to Step V .
		No Active Fault set	Engine ECU not programmed for Top 2. Contact Engine OEM for service. Go to Step V .

Step V	Procedure	Condition	Action
	1. Reconnect all air lines and electrical connectors.		
	2. Start engine.		
	3. Allow air pressure to build to governor cutoff.		
	4. Key off.		
	5. Listen for constant air leaks under the following conditions: Note: Skip these procedures for Convertibles		
	- Shift lever in neutral with splitter button back. - Shift lever in neutral with splitter button forward. - Shift lever in 7th/8th gear position.		
	6. Perform test drive.	If there are no constant air leaks and test drive confirms repair	Test complete.
		If there are constant leaks or test drive does not confirm vehicle repair	Return to Step A to find error in testing.

Fault Code: 68 (PID: 191, FMI: 7)

Caterpillar - Mechanical System Not Responding, continued

**Fault Code: 68
(PID: 191, FMI: 7)**

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Fault Code: 38 (PID: S32, FMI: 7) MACK - Mechanical System Not Responding

Overview

This fault indicates the transmission failed to complete an automatic Top 2 shift as commanded by the engines electronic control module (ECM).

Detection

The transmission will make three attempts for the Top 2 to shift. If it fails, the fault is set with check engine light.

Fallback

The transmission will return to manual mode shifting.

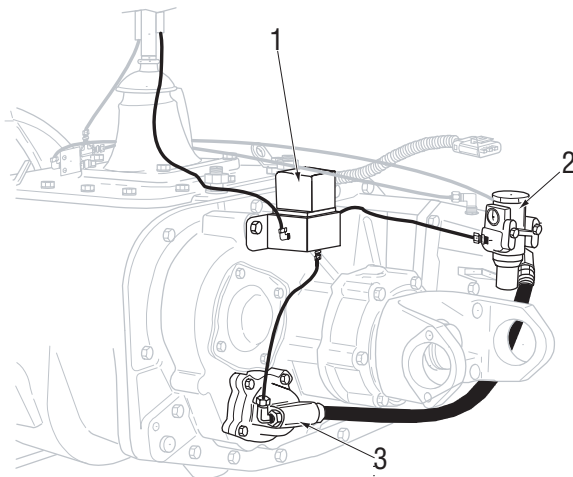
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Top 2 Troubleshooting Guide
- Engine Manufacturer Scan Tool

Possible Causes

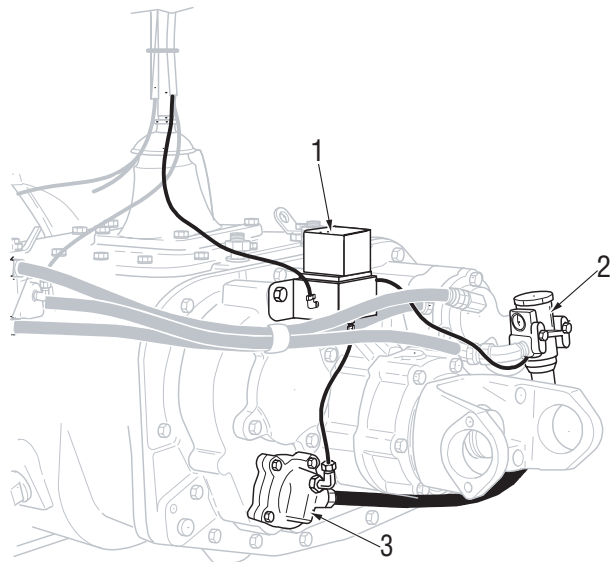
This fault can be caused by any of the following:

- Low air pressure
- Contaminated air supply
- Faulty Top 2 solenoid valve
- Faulty splitter cylinder
- Loose tone wheel
- Faulty/Contaminated Exhaust Breather



1. Top 2 solenoid valve
2. Air filter/regulator
3. Splitter cylinder

10 Speed



1. Top 2 solenoid valve
2. Air filter/regulator
3. Splitter cylinder

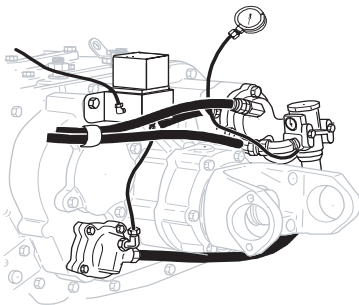
13 and 18 Speed

Fault Code: 38 (PID: S32, FMI: 7) MACK - Mechanical System Not Responding

Fault Code: 38
(PID: S32, FMI: 7)

Step A	Procedure	Condition	Action
	1. Operate the vehicle. Attempt to perform HI to LO and LO to HI split shifts using the splitter button. Note: For Convertible models go directly to Step 2.		
	2. Confirm AUTO Mode function is working correctly.	If the transmission performs split shifts in all gears except AUTO Mode	Go to Step B .
		If the transmission consistently does not perform split shifts	Perform Splitter System Test on (see page 3-15). Go to Step V .

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Top 2 valve air supply line (S Port).*		
	3. Connect a 100 psi air gauge to the supply line.	Air pressure 58 to 63 psi	Go to Step C .
		Air pressure not within 58 to 63 psi	Go to Step D .



18 Speed Shown

*See Schematic in Appendix for exact location.

Fault Code: 38 (PID: S32, FMI: 7)

MACK - Mechanical System Not Responding, continued

Step C	Procedure	Condition	Action
	1. Inspect exhaust breather on Top 2 valve for damage or contamination.* →	If exhaust breather is restricted or Top 2 functions with breather removed →	Replace breather. Go to Step V .
		If exhaust breather is functioning properly →	Go to Step E .
*If unsure breather is faulty, test drive vehicle with breather removed.			

Step D	Procedure	Condition	Action
	1. Inspect the Top 2 valve air supply fittings and line. →	If the fittings and air lines are functioning properly →	Replace air filter/regulator. Go to Step V .
		If the fittings and air lines are restricted or damaged →	Repair as necessary. Go to Step V .

Step E	Procedure	Condition	Action
	1. Connect engine manufacturer scan tool.		
	Note: MPSI Pro-Link Scan Tool with Eaton cartridge may be used on some engines.		
	2. Disconnect air line from P2 and connect 100 psi air gauge to Top 2 valve P2 port. Leave P1 and supply ports connected.		
	3. Remove P1 and plug for Convertible.		
	4. Actuate Shift Solenoid ON (Coil B). →	Air pressure 58 to 63 psi →	Go to Step F .
		Air pressure not within 58 to 63 psi →	Replace Top 2 valve. Go to Step V .

Fault Code: 38 (PID: S32, FMI: 7)

MACK - Mechanical System Not Responding, continued

Fault Code: 38
(PID: S32, FMI: 7)

Step F	Procedure	Condition	Action
	1. Leaving Shift Solenoid ON. Reconnect P1 for Convertible.		
	2. Listen for air leaking at Top 2 exhaust breather and Roadranger valve. →	Air leaks from one or both →	Replace Top 2 valve. Go to Step V.
		Air does not leak from valve or breather →	Go to Step G.

Step G	Procedure	Condition	Action
	1. Leaving 100 psi air gauge connected to P2 Port of the Top 2 valve.		
	2. Move splitter button forward. Note: No action required for Convertibles.		
	3. Using diagnostic tool actuate Shift Solenoid OFF and Lockout Solenoid ON. →	Air pressure gauge reads 0 psi →	Go to Step H.
		Air pressure reads above 0 psi →	Replace Top 2 valve. Go to Step V.

Step H	Procedure	Condition	Action
	1. Leave Shift Solenoid OFF and Lockout Solenoid ON.		
	2. Leave splitter button forward. Note: No action required for Convertibles.		
	3. Listen for air leaking from Top 2 breather. →	Air leaks from breather →	Replace Top 2 valve. Go to Step V.
		Air does not leak from breather →	Go to Step I.

Fault Code: 38 (PID: S32, FMI: 7)

MACK - Mechanical System Not Responding, continued

Step I	Procedure	Condition	Action
	1. Disconnect Top 2 valve 3-way connector from vehicle harness.		
	2. Turn on ignition key.		
	3. Using MPSI Scan Tool read the Active Fault Codes.	Active Shift or Lockout Solenoid Fault present (see page 1-12)	Go to Step V .
		No Active Fault set	Engine ECU not programmed for Top 2. Contact Engine OEM for service. Go to Step V .

Step V	Procedure	Condition	Action
	1. Reconnect all air lines and electrical connectors.		
	2. Start engine.		
	3. Allow air pressure to build to governor cutoff.		
	4. Key off.		
	5. Listen for constant air leaks under the following conditions: Note: Skip these procedures for Convertibles.		
	- Shift lever in neutral with splitter button back. - Shift lever in neutral with splitter button forward. - Shift lever in 7th/8th gear position.		
	6. Perform test drive.	If there are no constant air leaks and test drive confirms repair	Test complete.
		If there are constant leaks or test drive does not confirm vehicle repair	Return to Step A to find error in testing.

Symptom Driven Diagnostics Table

If there are no fault codes present (active or inactive), it may be necessary to determine the cause of the problem on symptoms exhibited by the vehicle. Locate the symptom that best describes the problem in the index below and perform the necessary fault isolation procedure. All procedures can be located inside this troubleshooting guide.

Table 1

Symptom	Isolation Procedure
Transmission has an air leak	Air Leak Check - 10 Speed Only
	Air Leak Check - 13 and 18 Speed Only
Splitter shift is not satisfactory (slow, grinding, does not complete)	Splitter System Test
System attempts Top 2 shift does not complete. All other splitter shifts satisfactory.	Mechanical System Not Responding Test
	DDEC III, Cummins, CAT, and MACK
Top 2 does not function. No fault set.	Engine Programming/Cruise Control, refer to OEM Diagnostics

Symptom Driven
Diagnostics Table

Air Leak Test

Overview

This symptom-driven test is performed if the transmission has an air leak and there are no Active or Inactive fault codes.

Detection

There is no detection process specifically for a transmission air leak. However, failures of this type are generally detected by the transmission or driver as some other type of fault code or symptom.

Fallback

There is no fallback mode for a transmission air leak, however, it may effect other vehicle systems.

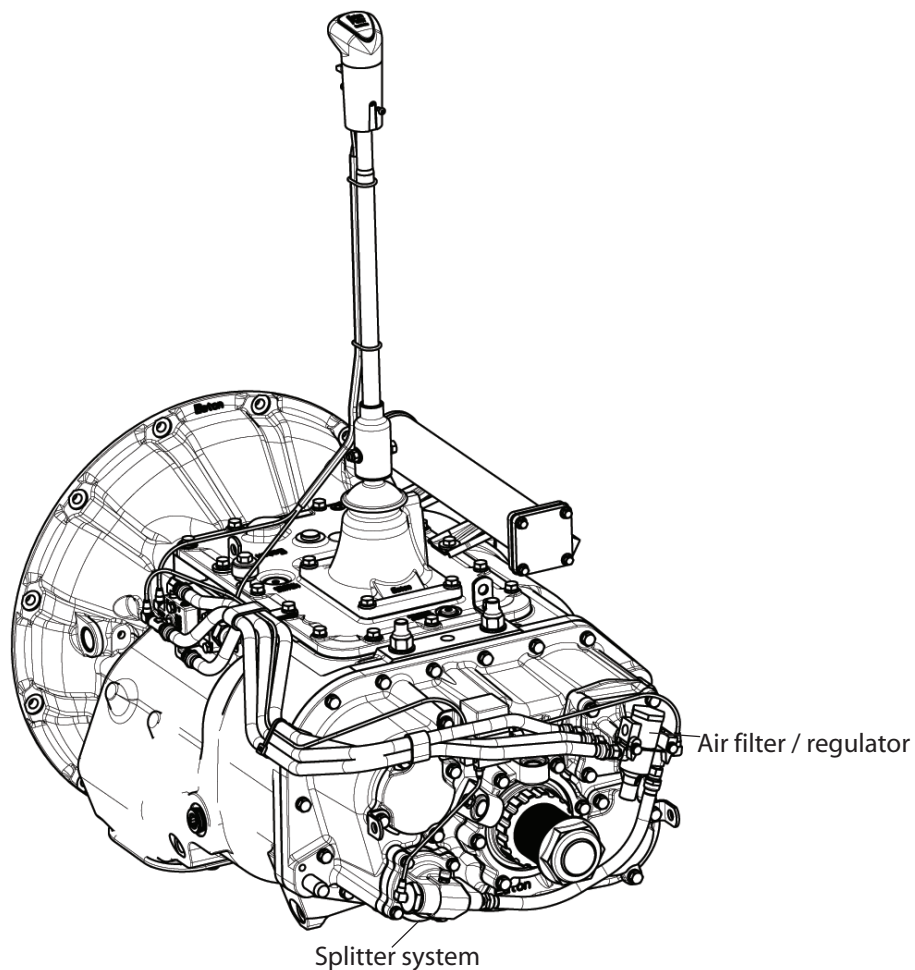
Required Tools

- Basic Hand Tools
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

- Contaminated Air
- Range Valve
- Splitter Valve
- Air Filter/Regulator
- Range Piston / O-ring



Air Leak Check - T2 Convertible Model Only

Step A	Procedure	Condition	Action
	1. Start engine.		
	2. Allow air pressure to build to governor cutoff.		
	3. Place transmission in neutral and range lever down.		
	4. Key off.		
	5. Listen for constant leaks.	If there are no constant air leaks → If air leaks from fittings or lines at: • Slave valve • Air filter/regulator • Splitter cylinder supply line • Top 2 valve supply line If air leaks at the Roadranger valve → If air leaks at the splitter cylinder cover exhaust port → If air leaks at the transmission breather → If air leaks at the Top 2 valve breather → If air leaks at the slave valve →	Go to Step B. Repair fittings or lines as required. Repeat this step. Repair or replace the Roadranger valve as required. Repeat this step. Replace splitter cover. If problem persists, repair splitter piston/cylinder. Repeat this step. Go to Step D. Replace Top 2 valve. Repeat this step. Replace slave valve. Repeat this step.

Air Leak Check - T2 Convertible Model Only, continued

Step B	Procedure	Condition	Action
	1. Use MPSI tool cycle valve Top 2. Note: High split - no action required.		
	2. Listen for constant air leaks. →	If there are no constant air leaks →	Go to Step C .
		If air leaks from fittings or lines at: →	Repair fittings or lines as required. Repeat this step.
		• Top 2 ports P1 or P2 • Splitter cylinder signal line	
		If air leaks at Top 2 valve exhaust port →	Replace Top 2 valve. Repeat this step.
		If air leaks at the splitter cylinder cover exhaust port →	Replace splitter insert valve. Repeat this step.
		If air leaks at transmission breather →	Repair splitter yoke bar O-rings. Repeat this step.

Step C	Procedure	Condition	Action
	1. Move range up.		
	2. Listen for constant air leaks. →	If there are no constant air leaks →	Test complete.
		If air leaks at range actuator valve exhaust port →	Replace range actuator valve. Repeat this step.
		If air leaks from LO range insert valve →	Replace LO range insert valve. Repeat this step.
		If air leaks from HI range insert valve →	Replace HI range insert valve. Repeat this step.

Step D	Procedure	Condition	Action
	1. Move range down.		
	2. Listen for constant air leaks. →	If the air leak continues or is present at transmission breather →	Repair or replace the range bar O-rings as required. Go to Step V .
		If the air leak stops →	Test complete.

Air Leak Check - T2 Convertible Model Only, continued

Step V	Procedure	Condition	Action
	1. Start engine.		
	2. Allow air pressure to build to governor cutoff.		
	3. Key off		
	4. Listen for constant air leaks under the following conditions:		
	• Shift lever in neutral with range button up. • Shift lever in neutral with range button down. MPSI-trigger down. • Shift lever in 7th/8th gear position.		
		If there are no constant air leaks	Test complete.
		If there are constant air leaks	Return to Step A to find error in testing.

Air Leak Test

Overview

This symptom-driven test is performed if the transmission has an air leak and there are no Active or Inactive fault codes.

Detection

There is no detection process specifically for a transmission air leak. However, failures of this type are generally detected by the transmission or driver as some other type of fault code or symptom.

Fallback

There is no fallback mode for a transmission air leak, however, it may effect other vehicle systems.

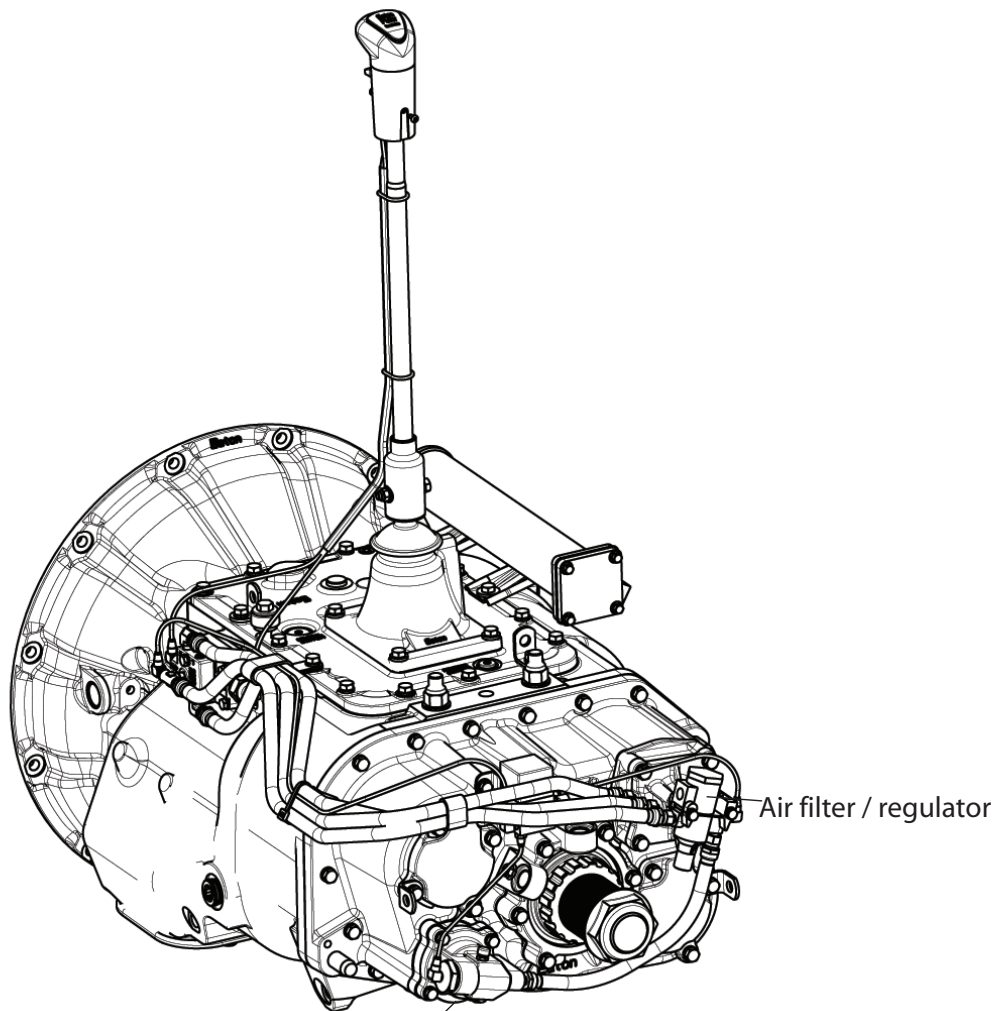
Required Tools

- Basic Hand Tools
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

- Contaminated Air
- Range Valve
- Splitter Valve
- Air Filter/Regulator
- Range Piston / O-ring



Air Leak Check- 10 Speed Only

Step A	Procedure	Condition	Action
	1. Start engine.		
	2. Allow air pressure to build to governor cutoff.		
	3. Place transmission in neutral and move splitter button back.		
	4. Key off.		
	5. Listen for constant leaks.	→ If there are no constant air leaks → Go to Step B. → If air leaks from fittings or lines at: → Repair fittings or lines as required. Repeat this step. • Range actuator valve • Air filter/regulator • Splitter cylinder supply line • Top 2 valve supply line → If air leaks at the Roadranger valve → Repair or replace the Roadranger valve as required. Repeat this step. → If air leaks at the splitter cylinder cover exhaust port → Replace splitter cover. If problem persists, repair splitter piston/cylinder. Repeat this step. → If air leaks at the range actuator valve exhaust port → Replace the range actuator valve. Repeat this step. → If air leaks at the LO range insert valve → Replace the LO range insert valve. Repeat this step. → If air leaks at the transmission breather → Go to Step D. → If air leaks at the HI range insert valve → Go to Step E.	

Air Leak Check- 10 Speed Only, continued

Step B	Procedure	Condition	Action
	1. Move splitter button forward.		
	2. Listen for constant air leaks.	If there are no constant air leaks → If air leaks from fittings or lines at: • Top 2 ports P1 or P2 • Splitter cylinder signal line If air leaks at Top 2 valve exhaust port → If air leaks at the splitter cylinder cover exhaust port →	Go to Step C. Repair fittings or lines as required. Repeat this step. Replace Top 2 valve. Repeat this step. Replace splitter insert valve. Repeat this step.

Step C	Procedure	Condition	Action
	1. Move shift lever to 7th/8th gear position.		
	2. Listen for constant air leaks.	If there are no constant air leaks → If air leaks at range actuator valve exhaust port → If air leaks from LO range insert valve → If air leaks from HI range insert valve →	Test complete. Replace range actuator valve. Repeat this step. Replace LO range insert valve. Repeat this step. Replace HI range insert valve. Repeat this step.

Step D	Procedure	Condition	Action
	1. Move shift lever to 7th/8th gear position.		
	2. Listen for constant air leaks.	If the air leak continues → If the air leak stops →	Repair or replace the splitter bar O-rings as required. Go to Step V. Repair or replace the range bar O-rings as required. Go to Step V.

Air Leak Check- 10 Speed Only, continued

Step E	Procedure	Condition	Action
	1. Move shift lever to 7th/8th gear position.		
	2. Listen for constant air leaks.	→ If the air leak changes to the LO range insert valve →	Repair the range cylinder and piston as required. Go to Step V .
		If the air leak stops or continues from the HI range insert valve →	Replace range insert valves. Go to Step V .

Step V	Procedure	Condition	Action
	1. Start engine.		
	2. Allow air pressure to build to governor cutoff.		
	3. Key off		
	4. Listen for constant air leaks under the following conditions:	→ If there are no constant air leaks →	Test complete.
	• Shift lever in neutral with splitter button back. • Shift lever in neutral with splitter button forward. • Shift lever in 7th/8th gear position.		
		If there are constant air leaks →	Return to Step A to find error in testing.

Air Leak Test

Overview

This symptom-driven test is performed if the transmission has an air leak and there are no Active or Inactive fault codes.

Detection

There is no detection process specifically for a transmission air leak. However, failures of this type are generally detected by the transmission or driver as some other type of fault code or symptom.

Fallback

There is no fallback mode for a transmission air leak, however, it may effect other vehicle systems.

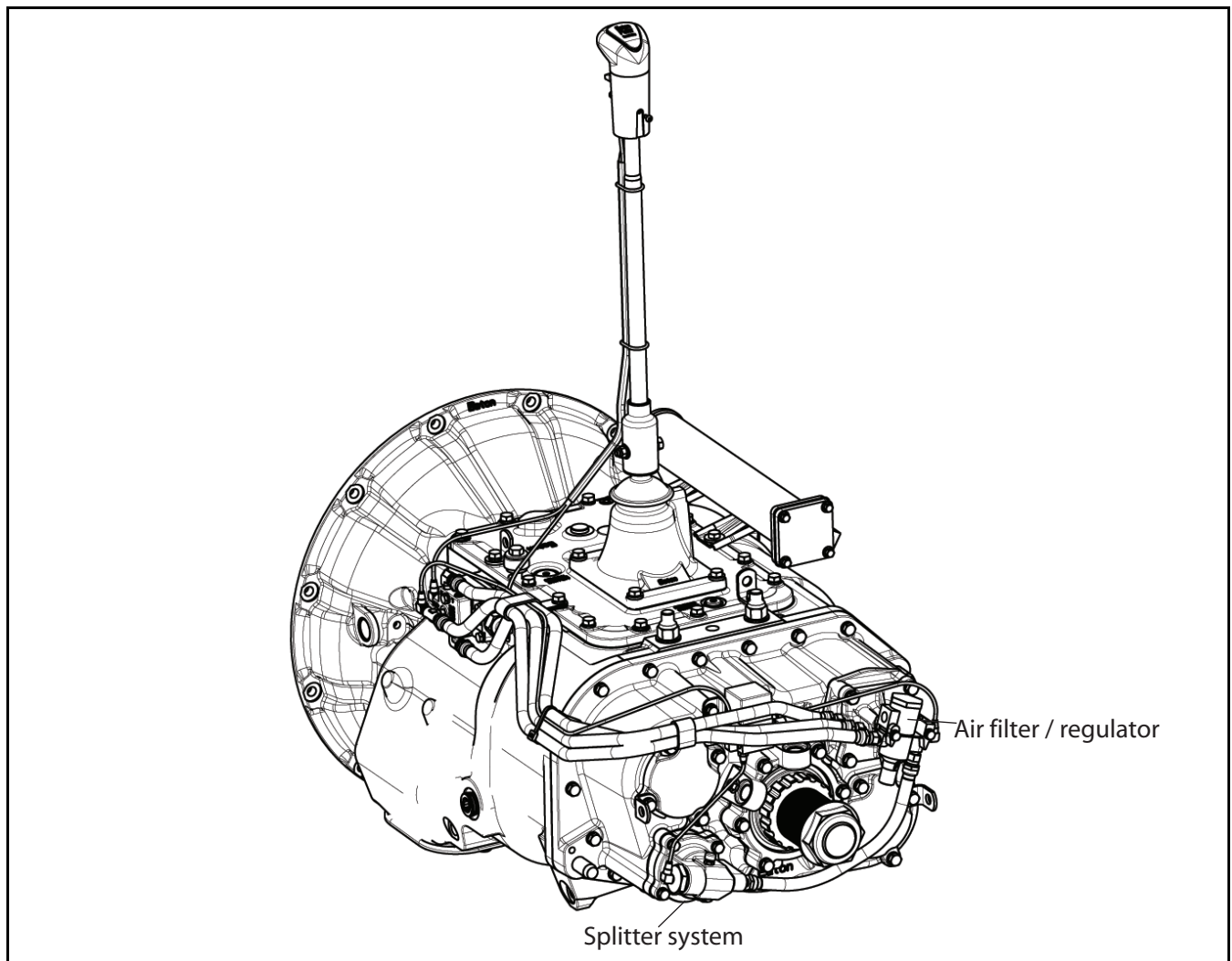
Required Tools

- Basic Hand Tools
- Troubleshooting Guide

Possible Causes

This symptom can be caused by any of the following:

- Contaminated Air
- Range Valve
- Splitter Valve
- Air Filter/Regulator
- Range Piston / O-ring



Air Leak Check - 13 and 18 Speed Only

Step A	Procedure	Condition	Action
	1. Start engine.		
	2. Allow air pressure to build to governor cutoff.		
	3. Place transmission in neutral and move splitter button back.		
	4. Move range lever down.		
	5. Key off.		
	6. Listen for constant air leaks.	If there are no constant air leaks → If air leaks from fittings or lines at: • Range actuator valve • Air filter/regulator • Splitter cylinder supply line • Top 2 valve supply line If air leaks at the Roadranger valve → If air leaks at the splitter cylinder cover exhaust port → If air leaks at the slave valve → If air leaks at the transmission breather →	Go to Step B. Repair fittings or lines as required. Repeat this step. Repair or replace the Roadranger valve as required. Repeat this step. Replace splitter cover. If problem persists, repair splitter piston/cylinder. Repeat this step. Replace the slave valve. Repeat this step. Go to Step D.

Air Leak Check - 13 and 18 Speed Only

Air Leak Check - 13 and 18 Speed Only, continued

Step B	Procedure	Condition	Action
	1. Move splitter button forward.		
	2. Listen for constant air leaks.	→ If there are no constant air leaks → Go to Step C. If air leaks from fittings or lines at: → Repair fittings or lines as required. Repeat this step. • Top 2 ports P1 or P2 • Splitter cylinder signal line If air leaks at Top 2 valve exhaust port → Replace Top 2 valve. Repeat this step. If air leaks at the splitter cylinder cover exhaust port → Replace splitter insert valve. Repeat this step.	

Step C	Procedure	Condition	Action
	1. Move shift lever up.		
	2. Listen for constant air leaks.	→ If there are no constant air leaks → Test complete. If air leaks at slave valve. → Replace slave valve. Repeat this step.	

Step D	Procedure	Condition	Action
	1. Move shift lever up.		
	2. Listen for constant air leaks.	→ If the air leak continues → Repair or replace the splitter bar O-rings as required. Go to Step V. If the air leak stops → Repair or replace the range bar O-rings as required. Go to Step V.	

Air Leak Check - 13 and 18 Speed Only, continued

Step V	Procedure	Condition	Action
	1. Start engine.		
	2. Allow air pressure to build to governor cutoff.		
	3. Key off.		
	4. Listen for constant air leaks under the following conditions: • Shift lever in neutral with splitter button back. • Shift lever in neutral with splitter button forward.	If there are no constant air leaks If there are constant air leaks	Test complete. Return to Step A to find error in testing.

Air Leak Check - 13 and 18
Speed Only

Splitter System Test

Overview

This symptom-driven test is completed if the transmission does not perform Splitter Shifts, and there are no active or inactive fault codes.

Detection

The failure is observed by the driver when operating the vehicle. To observe this failure, operate the vehicle and make several shifts up and down across the Splitter.

Fallback

There is no fallback for this symptom.

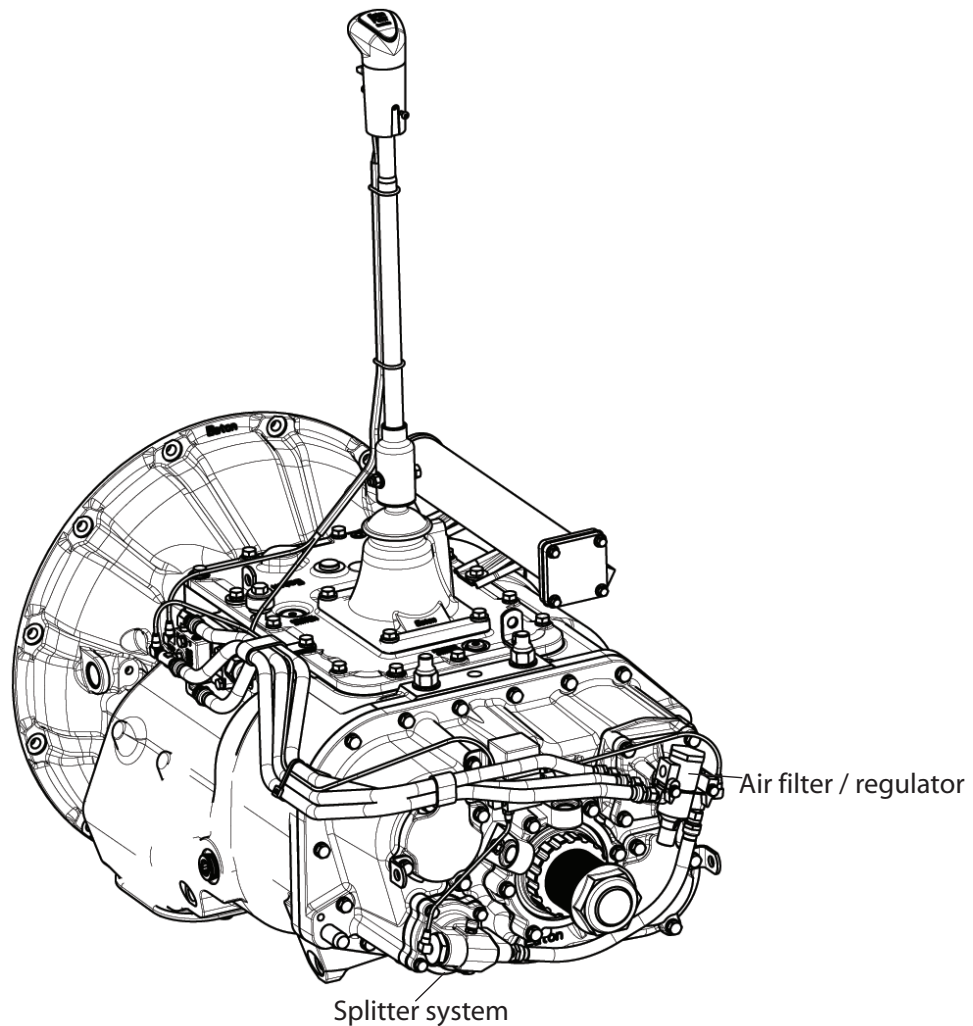
Required Tools

- Basic Hand Tools
- 0-100 PSI Air Pressure Gauges
- Troubleshooting Guide

Possible Causes

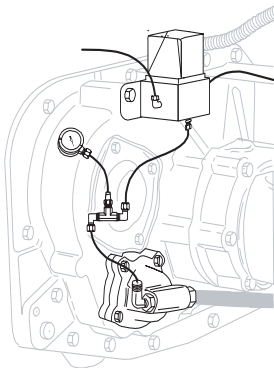
This symptom can be caused by any of the following:

- Low Air Pressure
- Contaminated Air Supply
- Air Leak
- Splitter Valve
- Splitter Actuator / Cylinder / Piston / Yoke

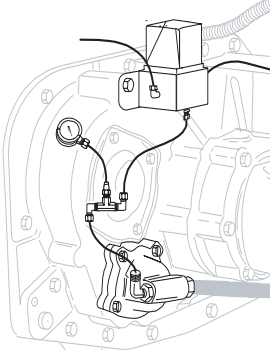


Splitter System Test

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Place transmission in neutral. Move splitter button back.		
	3. Locate the signal line from the Top 2 P2 port valve to the splitter cylinder. Tee a 0-100 PSI air pressure gauge into the line at the splitter cylinder cover.		
	4. Move the splitter button forward and back. Observe the pressure gauge.	→ If the pressure rapidly rises to regulated pressure when the button is forward and Pressure rapidly decreases when the button is back → Go to Step E. If the pressure does not reach regulated pressure or pressure does not change rapidly → Go to Step B.	



Splitter System Test, continued

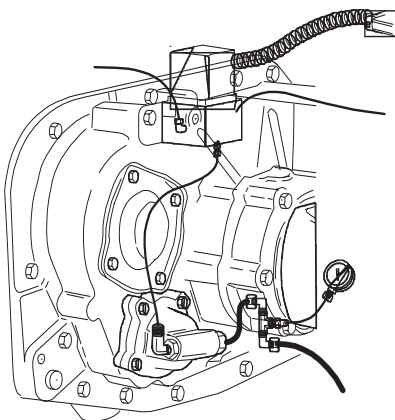
Step B	Procedure	Condition	Action
	1. Remove gauge from Top 2 valve signal line.		
	2. Locate the signal line from the Roadranger valve to the Top 2 valve P1 port. Tee the pressure gauge into the signal line at the Top 2 valve.		
	3. Move the splitter button forward and back. Observe the pressure gauge.	→ If the pressures rapidly rises to regulated pressure when the button is forward and Pressure rapidly decreases when the button is back → Go to Step C. If the pressure does not reach regulated pressure or pressure does not change rapidly → Go to Step D.	
			

Step C	Procedure	Condition	Action
	1. Inspect fittings and air lines at port P1 and P2 or the Top valve.		
	2. Inspect signal line fittings and air line between Top 2 valve and splitter cylinder.	→ If the fittings and air lines are functioning properly → Replace Top 2 valve. Go to Step V. If the fittings and air lines are restricted → Repair or replace as necessary. Go to Step V.	

Splitter System Test, continued

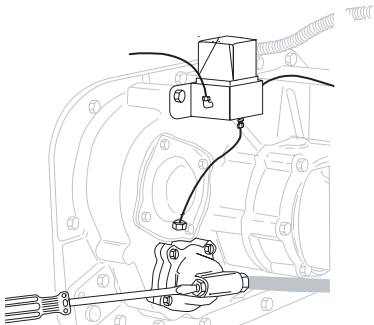
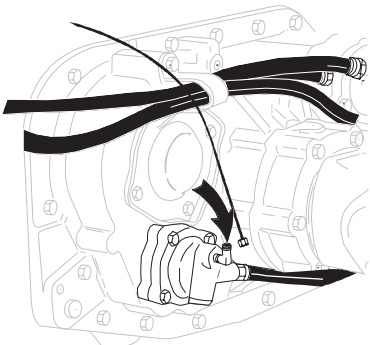
Step D	Procedure	Condition	Action
	1. Inspect fittings and air lines between the: • Top 2 valve and Roadranger valve • Roadranger valve, range actuator valve, and air filter/regulator	If the fittings and air lines are functioning properly	Replace Roadranger valve. Go to Step V.
		If the fittings and air lines are functioning properly	Repair as necessary. Go to Step V.

Step E	Procedure	Condition	Action
	1. Locate the supply line between the splitter cylinder and air filter/regulator. Tee a 0-100 PSI air gauge into the line at the splitter cylinder.		
	2. Observe the pressure gauge.	If the pressure is 55 to 65 PSI	Go to Step G.
		If the pressure is not 55 to 65 PSI	Go to Step F.



Step F	Procedure	Condition	Action
	1. Inspect supply fittings and air lines between the splitter cylinder and the air filter/regulator.	If the fittings and air lines are functioning properly	Replace air filter/regulator. Go to Step V.
		If the fittings and air lines are restricted	Repair as necessary. Go to Step V.

Splitter System Test, continued

Step G	Procedure	Condition	Action
	1. Hold the spool valve down. Note: Use a small screwdriver through the signal line opening.	If air does not exhaust when the insert valve is pushed in and	
		Air briefly exhaust when the insert valve is let out	Go to Step I.
		If air does not exhaust as indicated above	Go to Step H.
	 10 Speed Only		
	Note: Blow shop air into signal line opening with a rubber tip air gun.	If air briefly exhausts when shop air is applied	Go to Step I.
		Air does not exhaust when shop air is applied	Go to Step H.
	 13 and 18 Speed Only		
	Note: Spool Valve Cylinder Only: Through the signal line opening use a small screwdriver to push in the spool valve. Valve travels approximately 1/4 inch.	If splitter shifts	Replace spool valve. Go to Step V.
		If splitter does not shift	Go to Step J.

Splitter System Test, continued

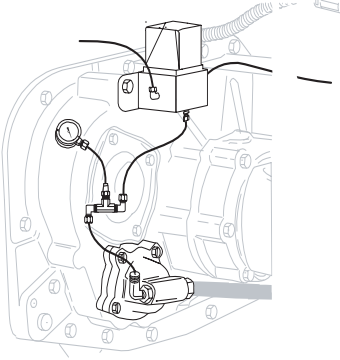
Step H	Procedure	Condition	Action
	1. Inspect the exhaust port and insert valve for contamination.	If exhaust port and insert valves are functioning properly →	Replace the insert valve. Go to Step V.
		If contamination is found →	Repair or replace as needed. Go to Step V.

Step I	Procedure	Condition	Action
	1. Remove the splitter cylinder cover.		
	2. Inspect gasket. →	If the gasket is installed correctly →	Remove the auxiliary section and repair as required. Go to Step V.
		If the gasket is not installed correctly →	Repair as required. Go to Step V.

Step J	Procedure	Condition	Action
	1. Spool Valve Cylinder Only: Remove exhaust breather on cylinder top.		
	2. Push in the spool valve with a small screwdriver through the signal line. →	If splitter shifts →	Replace breather. Go to Step V.
		If splitter does not shift →	Replace spool valve. Go to Step V.

Splitter System Test, continued

Step V	Procedure	Condition	Action
	1. Move the splitter button forward and back. Observe the pressure gauge.	If the pressure rapidly rises to regulate pressure when the button is forward and	
		Pressure rapidly decreases when the button is back	Test complete.
		If the pressure does not reach regulated pressure or pressure does not change rapidly	Go to Step B .



Service Information

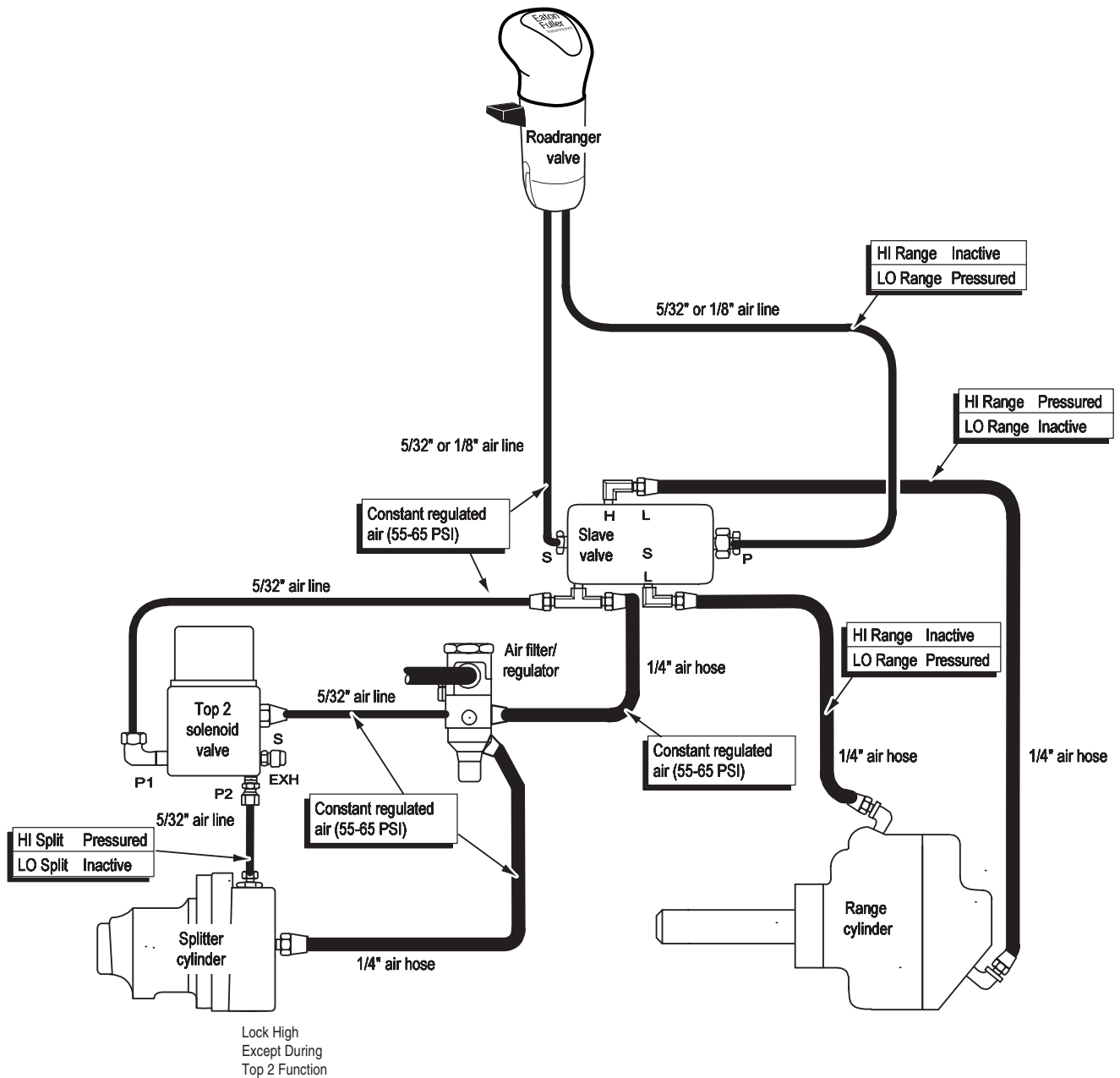
This appendix section provides helpful background information on the Top 2 system.

Major topics:

- 9 speed convertible overview
- 10 speed overview
- 13 speed overview
- 18 speed overview
- Splitter cylinder operation - 10 speed only (old design)
- Splitter cylinder insert valve operation -10 speed only (old design)
- Splitter cylinder operation - 10 speed only (latest design)
- Splitter cylinder spool valve operation - 10 speed only (latest design)
- Splitter cylinder - 13 and 18 speed (old design)
- Insert valve - 13 and 18 speed (old design)
- Splitter cylinder - 13 and 18 speed only (latest design)
- Spool valve - 13 and 18 speed (latest design)
- Suggested test fixtures

Top 2 System Overview - 9 Speed Convertible Only

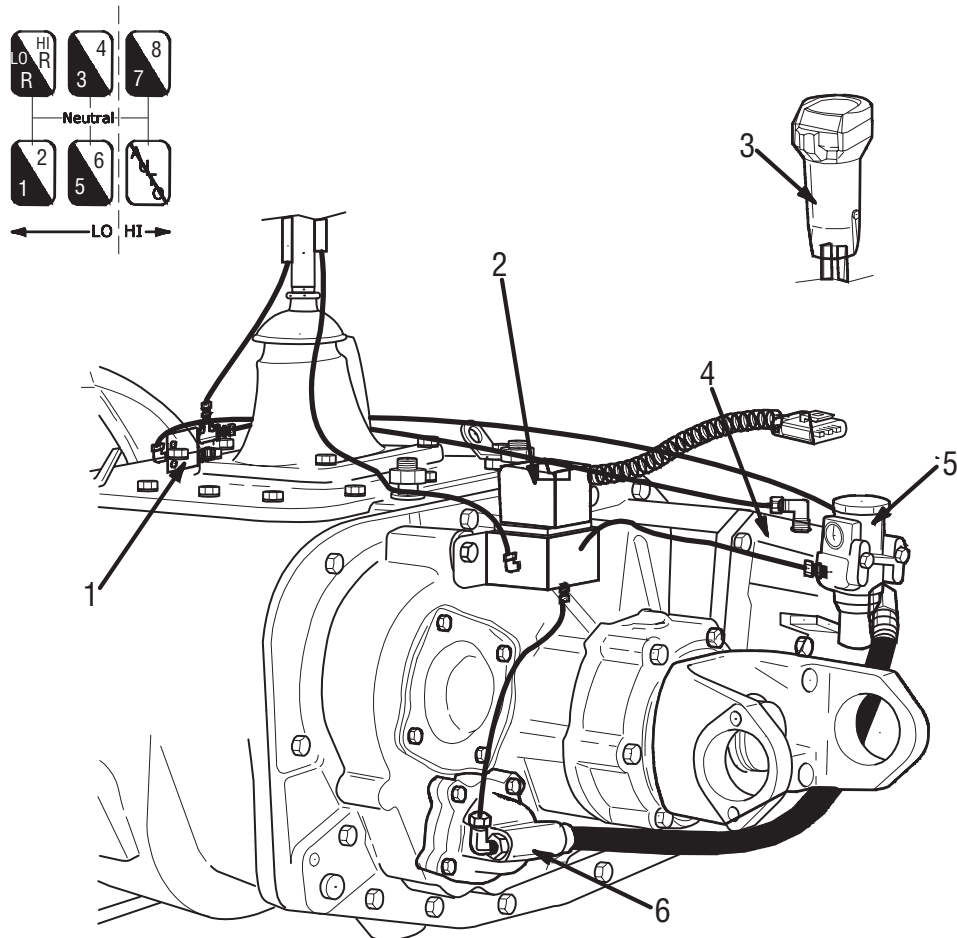
Here is a schematic showing the components, air connectors, and air flow between the Top 2 Convertible components under different gears.



Top 2 System Overview - 10 Speed Only

The Eaton Fuller Top 2 is an add-on system to the Super 10 heavy-duty transmission. By itself, the Super 10 is a manually operated transmission. When equipped with the Top 2 system; however, the Super 10 provides automatic shifting functions between the top two gears.

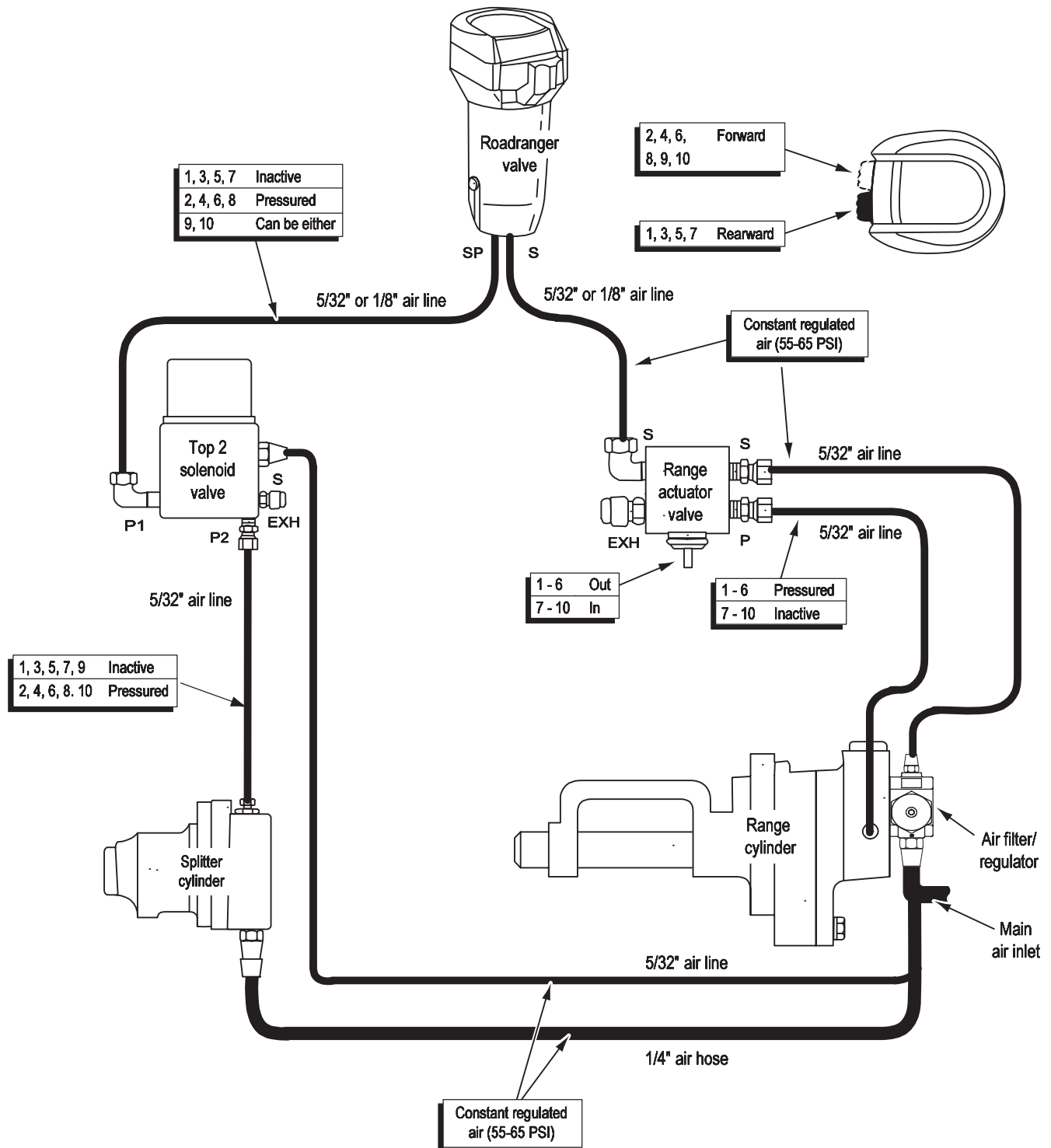
The following figure highlights the components and features of the Top 2 system.



1. Range actuator valve - automatically activate LO and HI range
2. Top 2 solenoid valve - automatically shifts between the Top 2 gears
3. Roadranger valve - shifts transmission to the six gear positions
4. Range cylinder - shifts transmission between LO and HI range
5. Air filter/regulator
6. Splitter cylinder - shifts transmission between odd/even numbered gear positions

Top 2 System Overview - 10 Speed Only (continued)

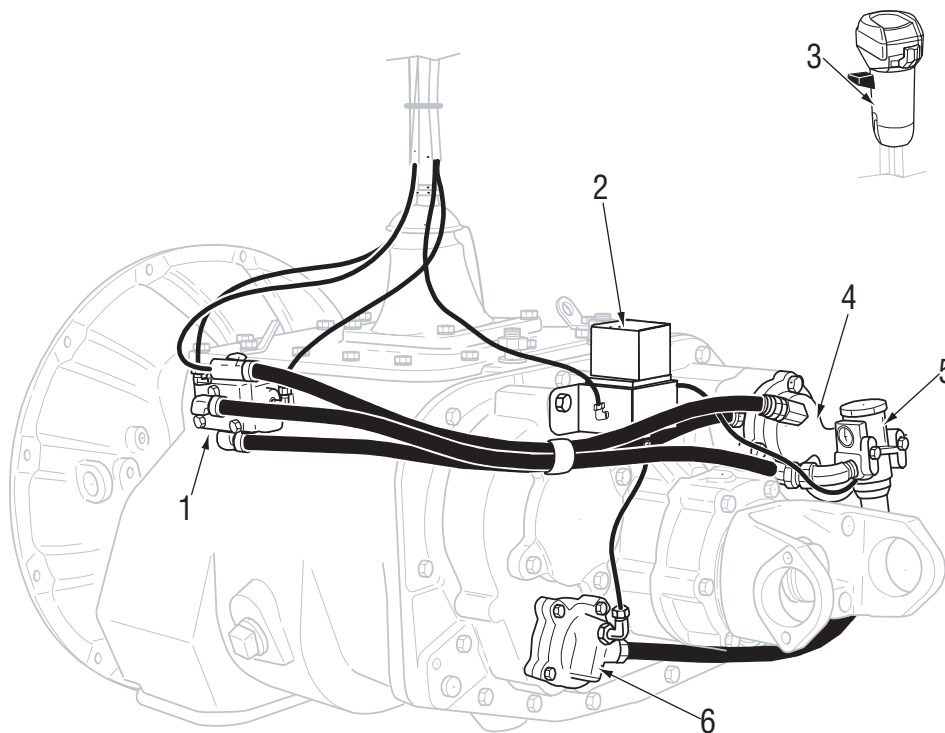
Here is a schematic showing the components, air connectors, and air flow between the Top 2 components under different gears.



Top 2 System Overview - 13 Speed Only

The Eaton Fuller Top 2 is an add-on system to the Super 13 heavy duty transmission. By itself, the Super 13 is a manually operated transmission. When equipped with the Top 2 system; however, the Super 13 provides automatic shifting functions between the top two gears.

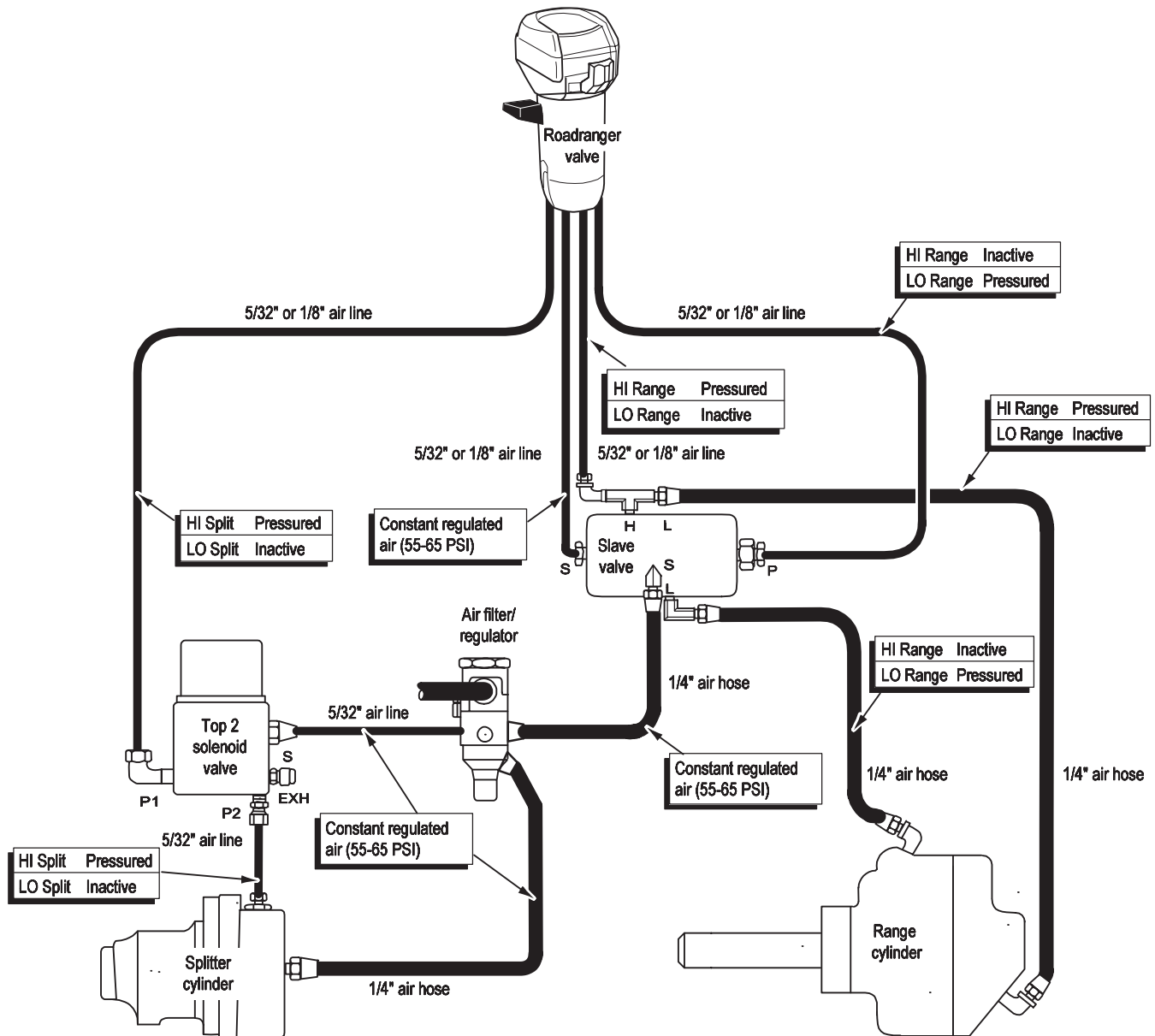
The following figure highlights the components and features of the Top 2 system.



1. Slave Valve - directs air to the range cylinder
2. Top 2 solenoid valve - automatically shifts between the Top 2 gears
3. Roadranger valve - shifts transmission to the six gear positions
4. Range cylinder - shifts transmission between LO and HI range
5. Air Filter/ regulator
6. Splitter cylinder - shifts transmission between odd/even numbered gear positions

Top 2 System Overview - 13 Speed Only (continued)

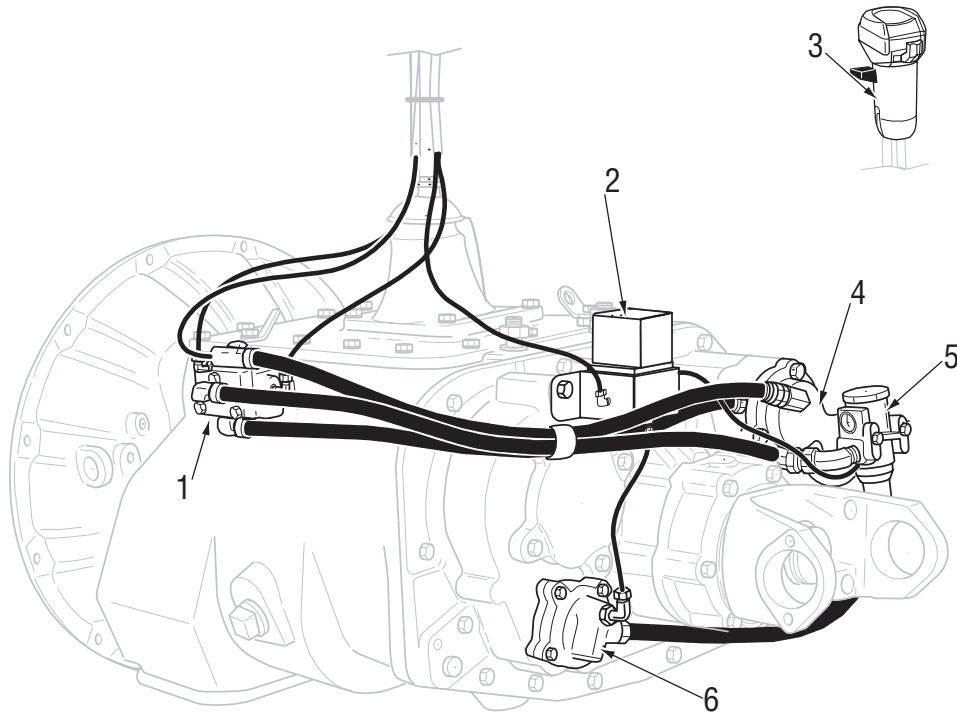
Here is a schematic showing the components, air connectors, and air flow between the Top 2 components under different gears.



Top 2 System Overview - 18 Speed Only

The Eaton Fuller Top 2 is an add-on system to the Super 18 heavy-duty transmission. By itself, the Super 18 is a manually operated transmission. When equipped with the Top 2 system; however, the Super 18 provides automatic shifting functions between top two gears.

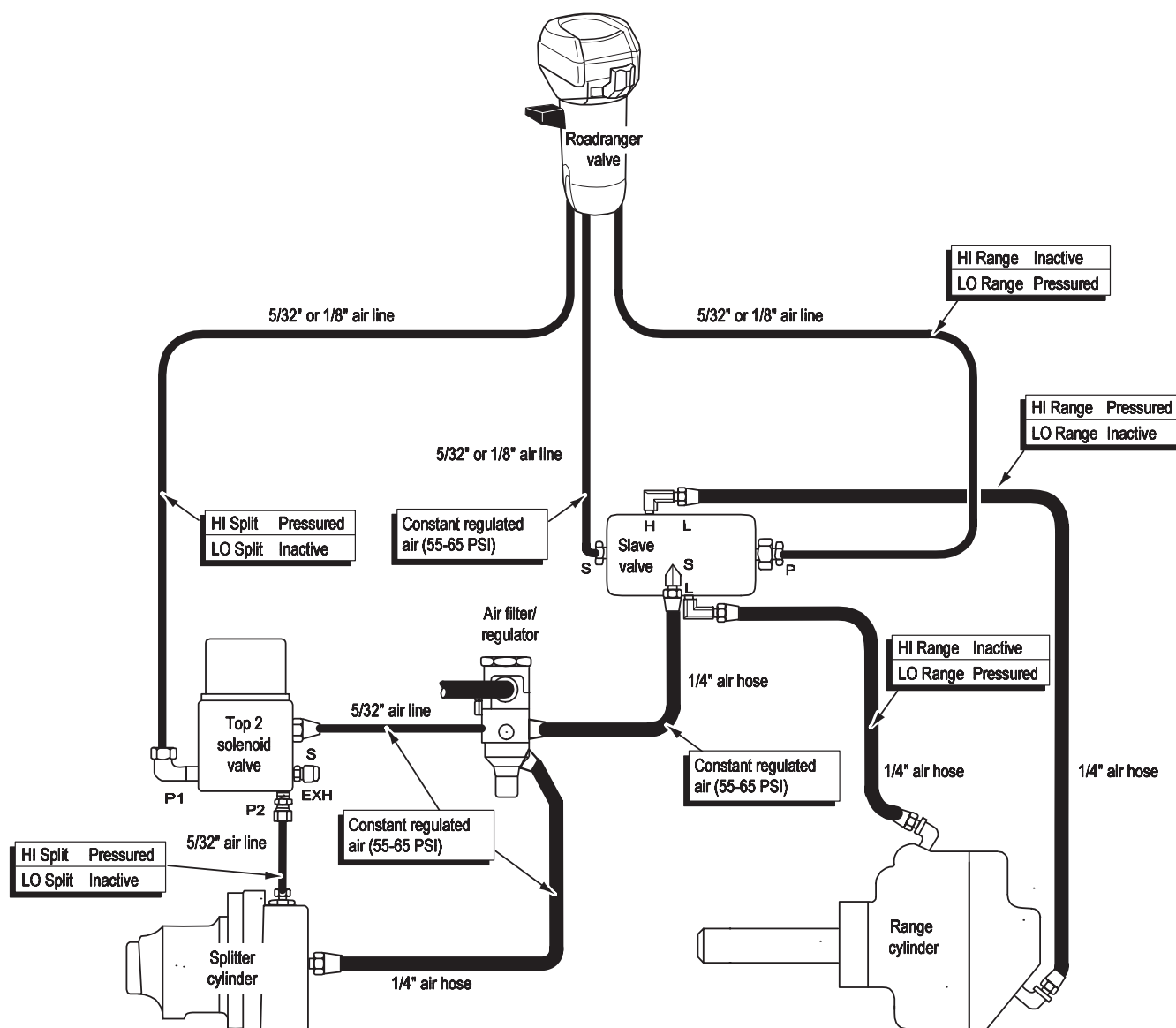
The following figure highlights the components and features of the Top 2 System.



1. Slave valve - directs air to the range cylinder
2. Top 2 solenoid valve- automatically shifts between the Top 2 gears
3. Roadranger valve - shifts transmission to the six gear positions
4. Range cylinder - shifts transmission between LO and HI range
5. Air filter/regulator
6. Splitter cylinder - shifts transmission between odd/even numbered gear positions

Top 2 System Overview - 18 Speed Only (continued)

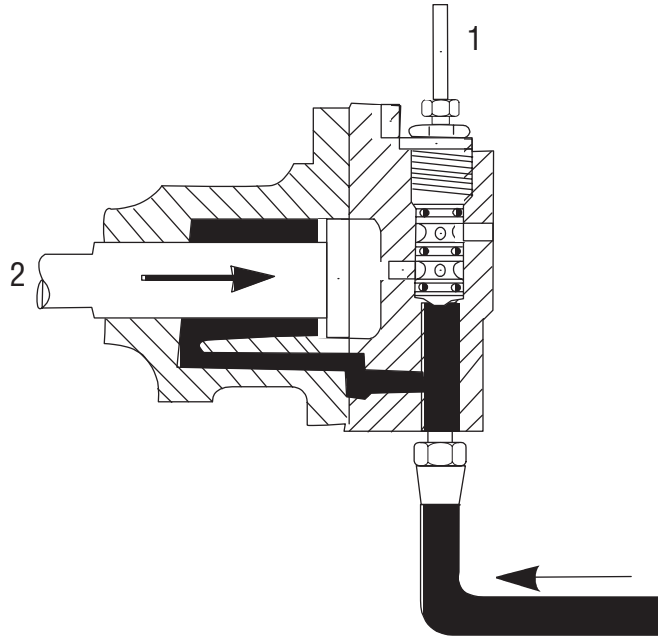
Here is a schematic showing the components, air connector, and air flow between the Top 2 components under different gears.



Splitter Cylinder Assembly - 10 Speed Only (old design)

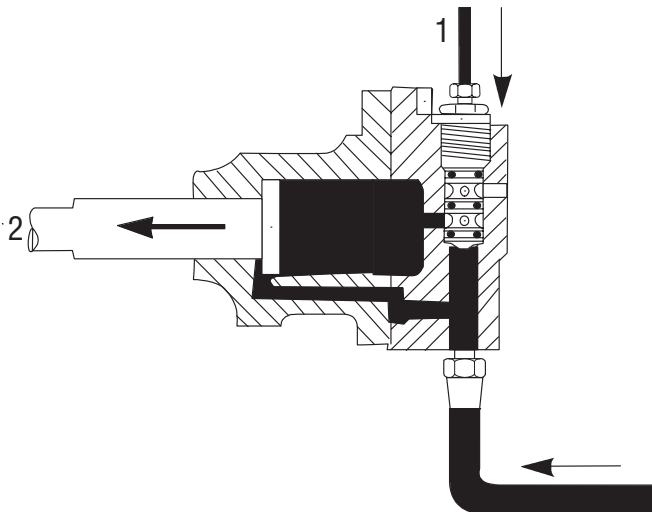
1, 3, 5, 7 Gear Positions

With the Roadranger valve button in the rearward position, no air is supplied to the splitter cylinder cover port (1), moving the piston rearward, disengaging splitter gearing (2).



2, 4, 6, 8 Gear Positions

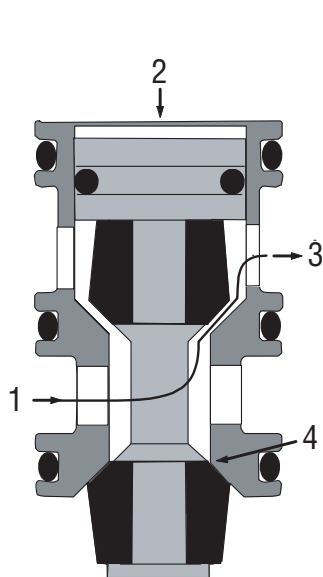
With the Roadranger valve button in the forward position, air is supplied to the splitter cylinder cover port (1), moving the piston forward, engaging splitter gearing (2).



Insert Valve

LO Split

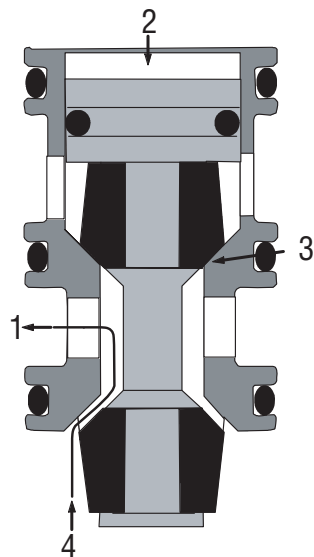
The insert valve is a self contained 13/16" valve assembly located in the splitter cylinder cover. It cannot be disassembled except for the three o-rings on the outer diameter. The o-rings provide a stationary seal and do not move in the cylinder.



1. From piston backside, yoke bar rearward
2. No air on signal line
3. Exhaust
4. Constant air sealed off at this point

HI Split

Insert valve piston travel is only 1/32". When no air is applied to the valve piston top side through the signal line, constant air from the air filter/regulator moves the yoke bar rearward. This engages the rear auxiliary drive gear (LO and HI split direct) while air is exhausted out the insert valve.



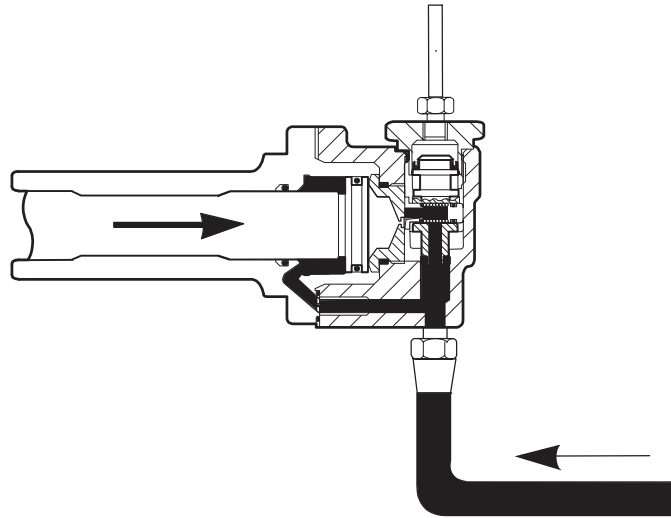
1. From piston backside, yoke bar forward
2. Air on signal line
3. Constant air sealed off at this point
4. Constant air

When air is applied to the valve piston top side, the piston moves down, passing air through the insert valve bottom to the cylinder piston front and backside. This air moves the yoke bar forward to engage the front auxiliary drive gear (LO and HI split overdrive).

Splitter Cylinder Assembly - RTL-XX710 Model (latest design)

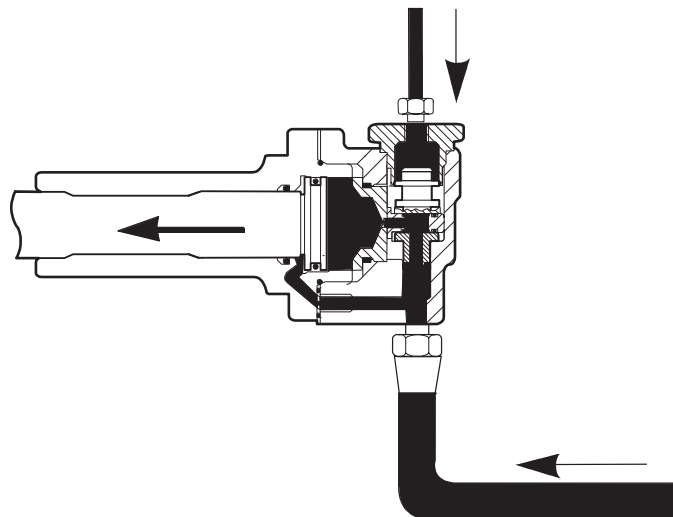
Odd Numbered Gear Positions (1,3,5,7,9)

With the Roadranger valve button in the **rearward** position, no air is supplied to the splitter piston rear, moving the piston rearward.



Even Numbered Gear Positions (2,4,6,8,10)

With the Roadranger valve button in the **forward** position, air is supplied to the splitter piston rear, forcing the piston forward.

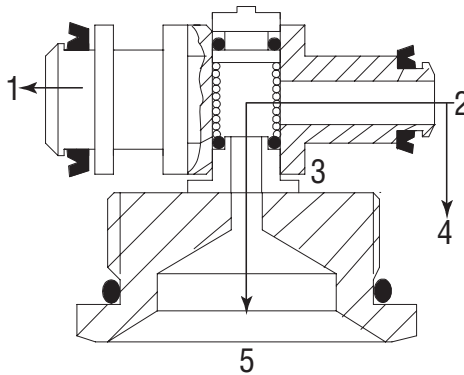


Spool Valve

LO Range and HI Range High Split

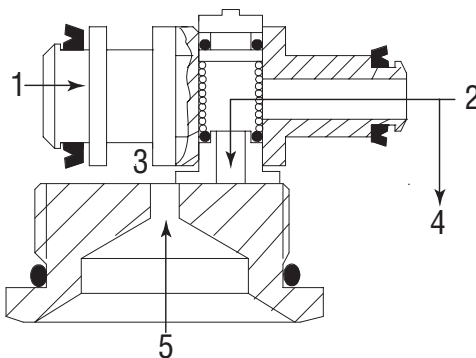
The spool valve components shown are part of a self-contained valve assembly, part number A-6861.

The spool valve piston travel is approximately 1/2". When no air is supplied from the Roadranger valve to the valve spool left side (1), constant air from the filter/regulator (2) is supplied to the splitter cylinder piston rear side moving the yoke bar forward. Air is exhausted from the splitter cylinder front (3) and from the breather situated on the valve assembly rear.



1. No air on signal line
2. Constant air from air filter/regulator
3. Splitter cylinder front
4. To piston front
5. To piston rear, yoke bar forward

LO Range and HI Range Low Split

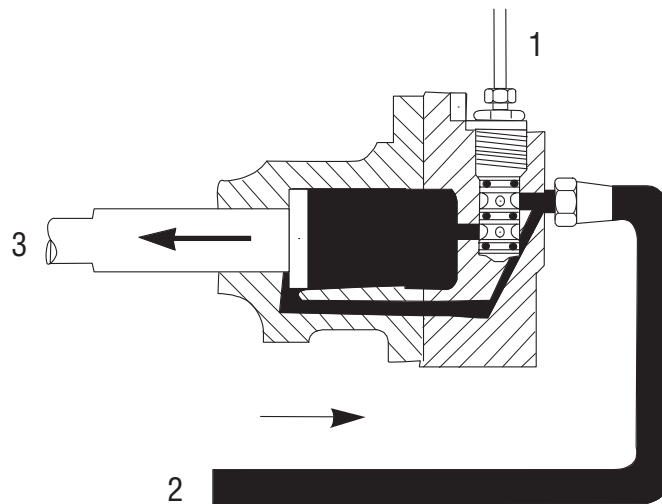


1. Air on signal line
2. Constant air from air filter/regulator
3. Splitter cylinder rear
4. To piston front, yoke bar rearward
5. Exhaust from rear side of cylinder

Splitter Cylinder Assembly - RTLO-XX713 and XX718 (old design)

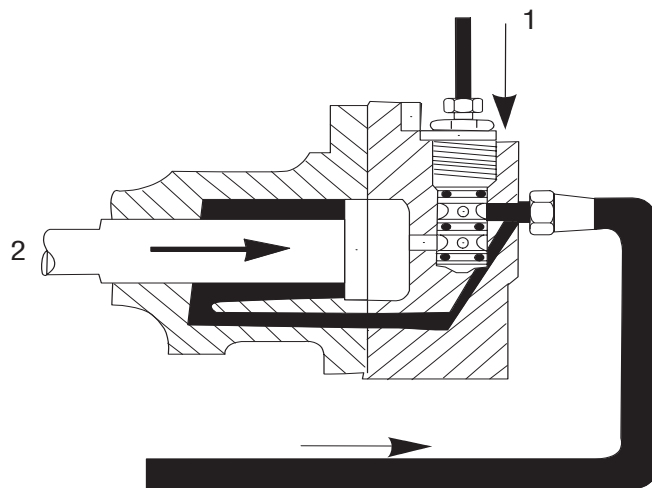
LO Split

With the splitter button in the **rearward** position, no air is supplied to the splitter cylinder cover top port (1). The constant air from the air filter/regulator assembly (2) moves the the splitter piston forward, engaging the auxiliary drive gear (3).



HI Split

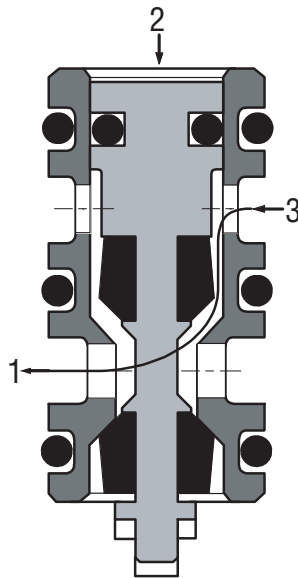
With the splitter button in the **forward** position, air is supplied to the splitter cylinder cover top port (1), moving the splitter piston rearward, engaging the splitter gear (2).



Insert Valve

LO Range and HI Range LO Split

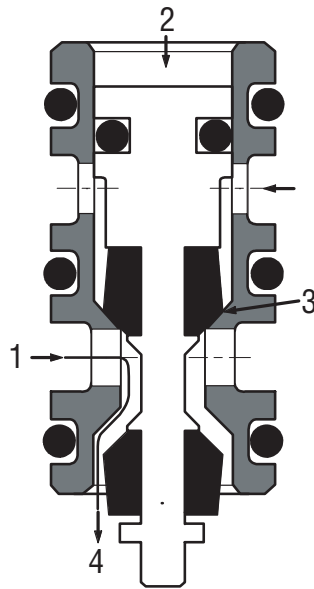
The insert valve is a self contained 13/16" valve assembly located in the intermediate shift splitter cylinder cover. It cannot be disassembled except for the three o-rings on the outer diameter. The o-rings provide a stationary seal and do not move in the cylinder. Insert valve piston travel is only 1/32". When no air is applied to the valve piston top side, constant air supplied from the air filter/regulator passes freely through the insert valve and to the cylinder piston backside, moving the yoke bar forward to disengage the rear auxiliary drive gear (LO range and HI range Low split).



- 1. To piston backside, yoke bar forward
- 2. No air on signal line
- 3. Constant air

LO Range (18 Speed Only) and HI Range HI Split

When air is applied to the valve piston top side through the signal line, the piston moves down to cut off air supplied to the cylinder piston backside. This air is exhausted out the cover bottom port as constant air supplied from the regulator is directed to the cylinder piston front side, moving the yoke bar rearward to engage the rear auxiliary drive gear (LO range [18 Speed Only] and HI range HI split).



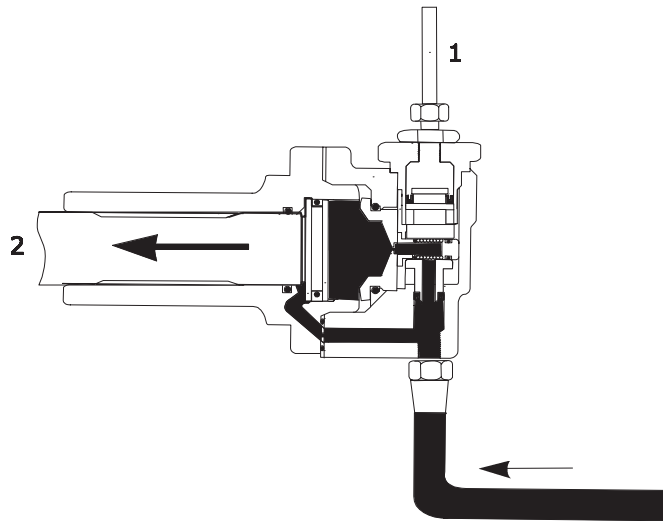
1. From piston backside, yoke bar rearward
2. Air on signal line
3. Constant air sealed off at the point
4. Exhaust

When air is applied to the valve piston top side, the piston moves down, passing air through the insert valve bottom to the cylinder piston front and backside. This air moves the yoke bar forward to engage the front auxiliary drive gear (LO and HI split overdrive).

Splitter Cylinder Assembly - RTLO-XX710 Model (latest design)

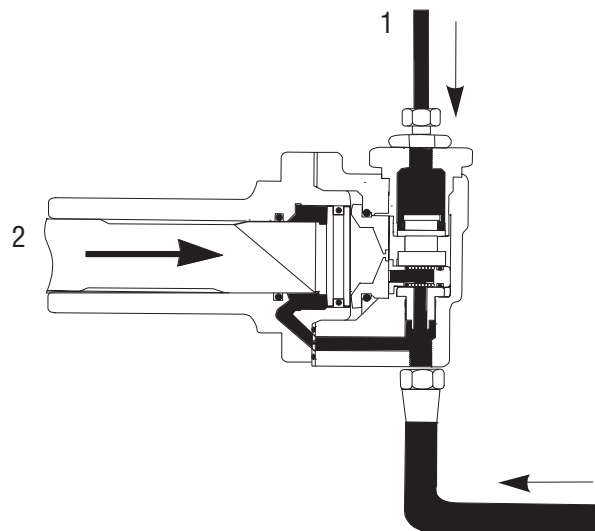
Odd Numbered Gear Positions (1, 3, 5, 7, 9)

With the Roadranger valve button in the **forward** position, air is supplied to the splitter cylinder cover port (1), moving the piston rearward, disengaging splitter gearing (2).



Even Numbered Gear Positions (2, 4, 6, 8, 10)

With the Roadranger valve button in the **rearward** position, no air is supplied to the splitter cylinder cover port, moving the piston forward, engaging splitter gearing (2).

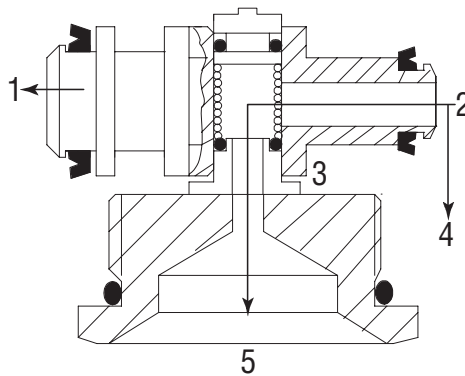


Spool Valve

LO Range and HI Range HI Split

The spool valve components shown are part of a self-contained valve assembly, part number A-6862.

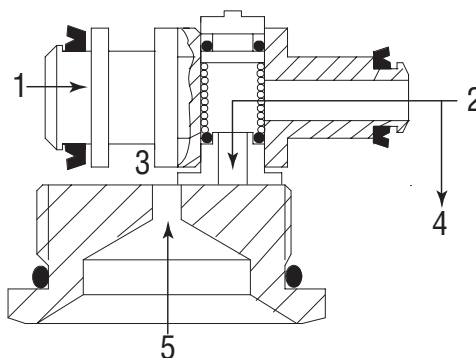
The spool valve piston travel is approximately 1/2". When no air is supplied from the Roadranger valve to the valve spool left side (1), constant air from the filter/regulator (2) is supplied to the splitter cylinder piston rear side moving the yoke bar forward. Air is exhausted from the splitter cylinder front (3) and from the breather situated the valve assembly rear.



1. No air on signal line
2. Constant air from air filter/ regulator
3. Splitter cylinder front
4. To piston front
5. To piston rear, yoke bar forward

LO Range and HI Range LO Split

When air is supplied from the Roadranger valve to the valve spool left side (1), constant air from the filter/ regulator (2) is supplied to the splitter cylinder piston front side moving the yoke bar rearward. Air is exhausted from the splitter cylinder rear (3) and from the breather situated on the valve assembly rear.

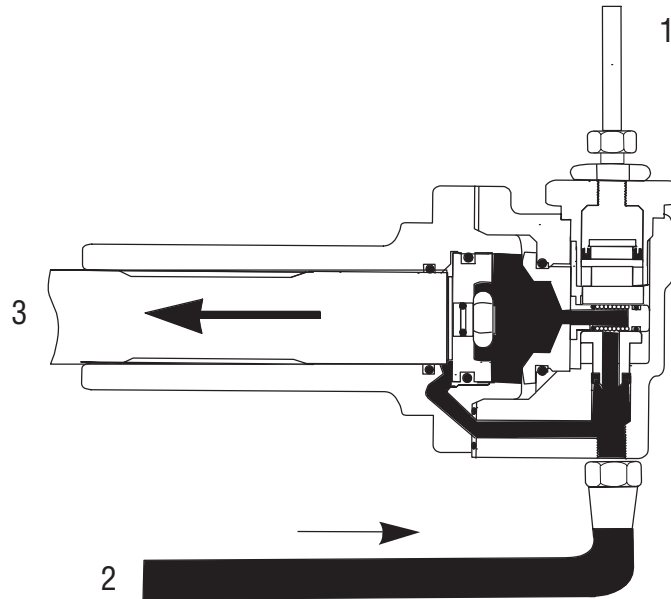


1. Air on signal line
2. Constant air from air filter/ regulator
3. Splitter cylinder rear
4. To piston front, yoke bar rearward
5. Exhaust from rear side of cylinder

Splitter Cylinder Assembly - RTLO-XX913 and XX918 (latest design)

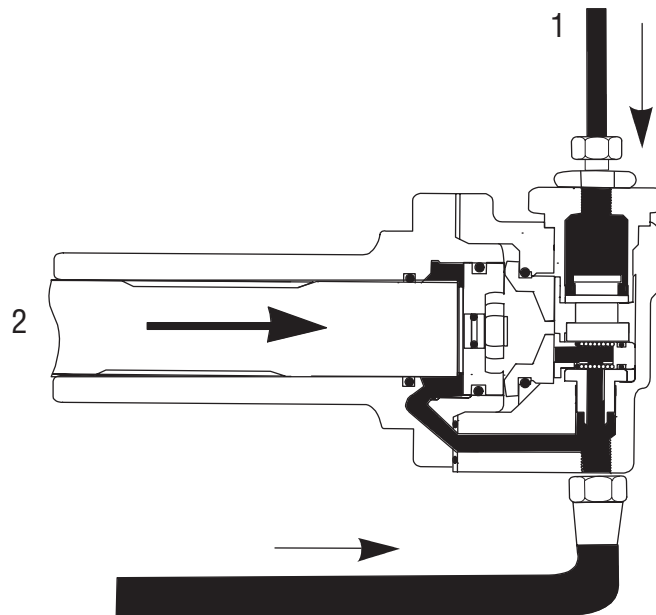
LO Range or HI Range LO Split

With the splitter control button in the rearward position, no air is supplied to the splitter cylinder cover top port (1). The constant air from the air filter/regulator assembly (2) moves the splitter piston forward, disengaging the rear auxiliary drive gear (3).



LO Range (18 Speed only) or HI Range HI Split

With the splitter control button in the forward position, air is supplied to the splitter cylinder cover top port (1), moving the splitter piston rearward, engaging the rear auxiliary drive gear (2).

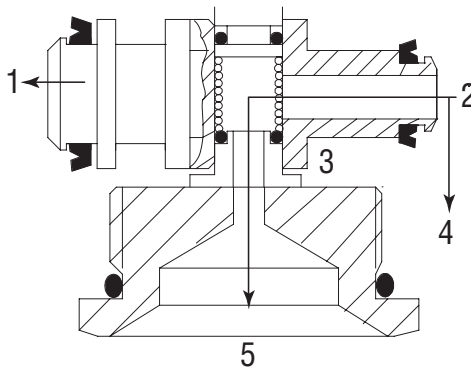


Spool Valve

LO Range and HI Range LO Split

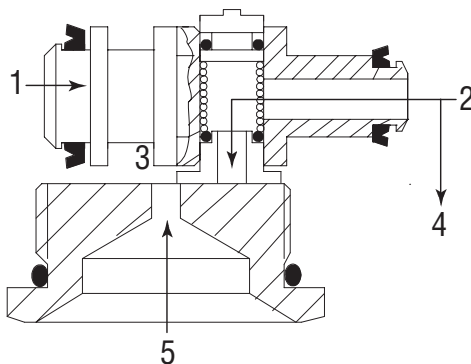
The spool valve components shown are part of a self-contained valve assembly, part number A-6862.

The spool valve piston travel is approximately 1/2". When no air is supplied from the Roadranger valve to the valve spool left side (1), constant air from the filter/regulator (2) is supplied to the splitter cylinder piston rear side moving the yoke bar forward. Air is exhausted from the splitter cylinder front (3) and from the breather situated on the valve assembly rear.



1. No air on signal line
2. Constant air form air filter/regulator
3. Splitter cylinder front
4. To piston front
5. To piston rear, yoke bar forward

LO Range (18 Speed only) and HI Range HI Split



1. Air on signal line
2. Constant air form air filter/regulator
3. Splitter cylinder rear
4. To piston front, yoke bar rearward
5. Exhaust from rear side of cylinder

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