Clutch Technical Training

Learning to Work Efficiently and Accurately
with Product Training Provided by ArvinMeritor

Agenda

- Clutch, Meritor 15.5” manual

Meritor 15.5” Manual Clutch

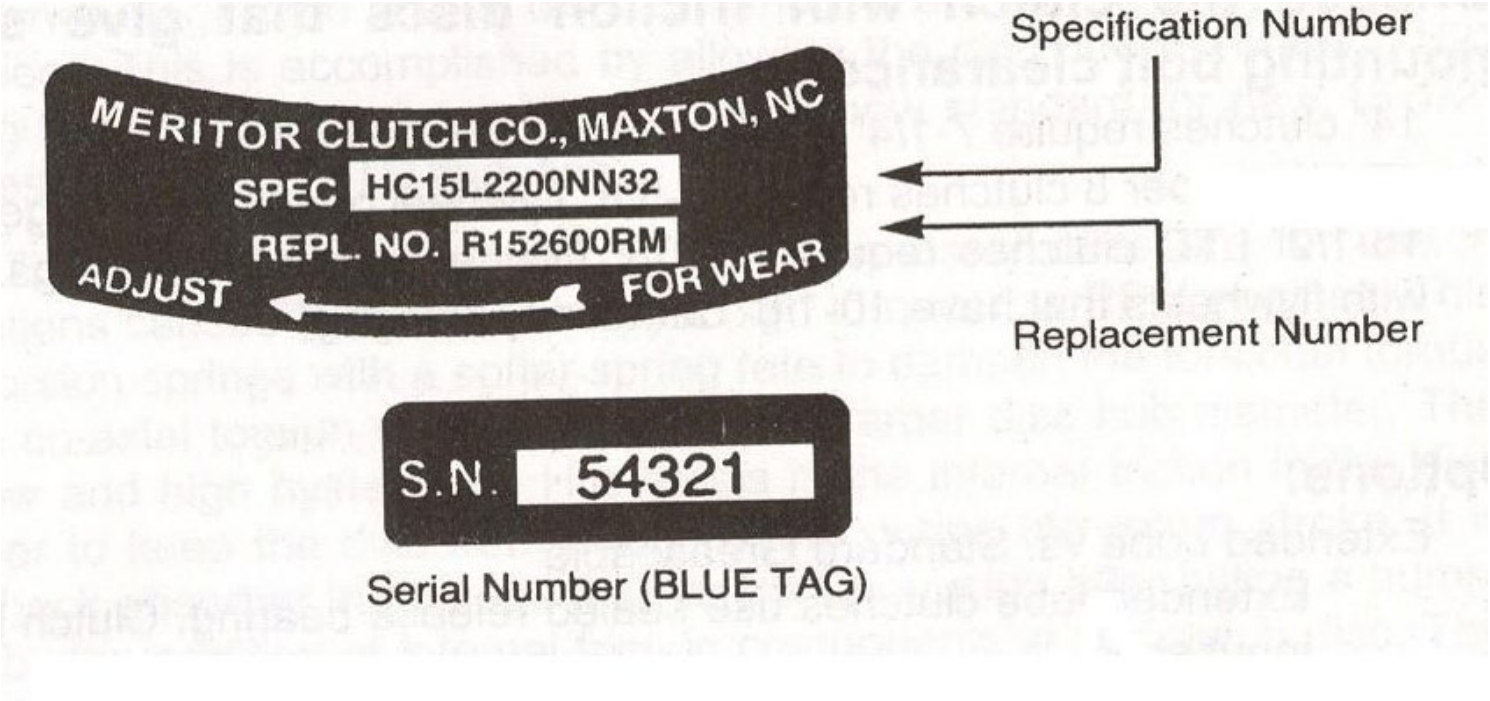
- The mechanical clutch is a friction device used to connect and disconnect a driving force from a driven force. In automotive applications, the clutch is used in conjunction with an engine flywheel to provide smooth engagement and disengagement of the engine and manual transmission.
- The clutch size refers to the nominal diameter of the clutch disc.

Model Identification

- 15.5” manual clutch
  - Each ZFMeritor new clutch has identification and serial numbers engraved directly on the clutch cover. There are three numbers listed:
    - specification number
    - Serial number
    - ZFMeritor aftermarket replacement number
- An example of a specification number is; HC15M2200NN36.
- An example of an aftermarket replacement number is; R151406

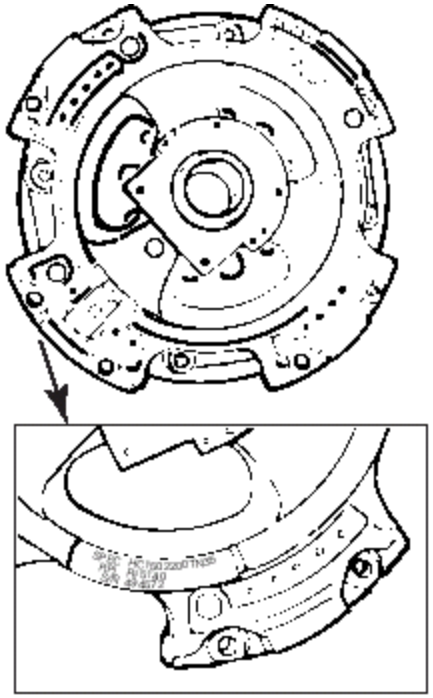
Identification

- Example of clutch identification numbers. Early production.



Identification

- Example of clutch identification numbers. Later production.



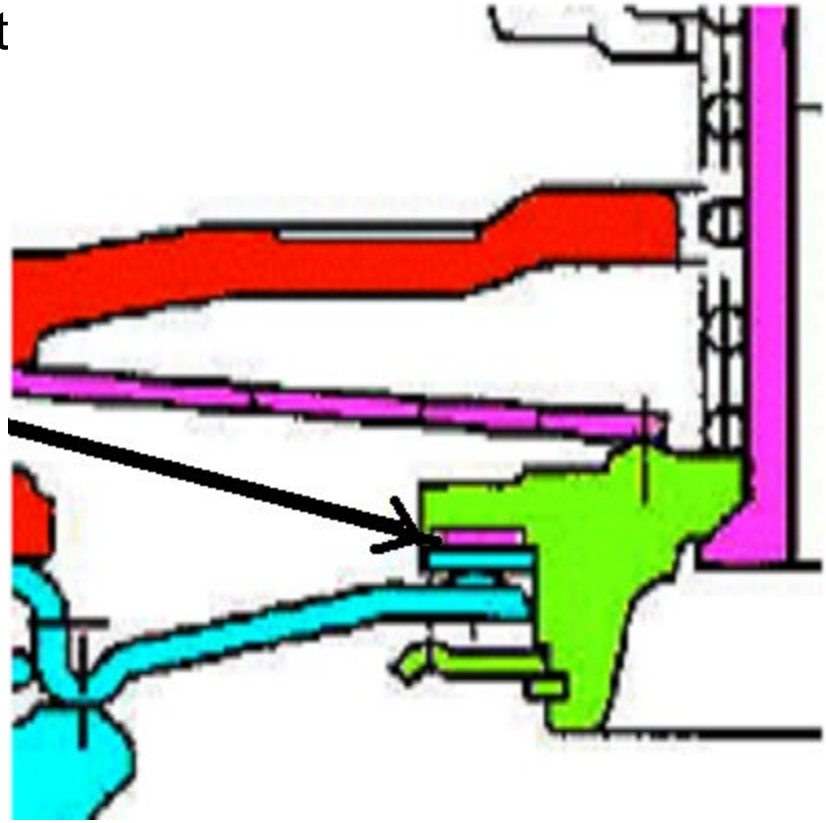
ETCHED SERIAL NUMBER AND IDENTIFICATION INFORMATION

15.5” Clutch Description

- The 15.5” ZFMeritor clutch is a cast, two plate, diaphragm spring, pull type clutch that fits most engine/transmission combinations in North America. The clutch discs have 2” splines and ceramic facings.
- The 15.5” clutch uses a flat engine flywheel and is available in an eight hole installation pattern.

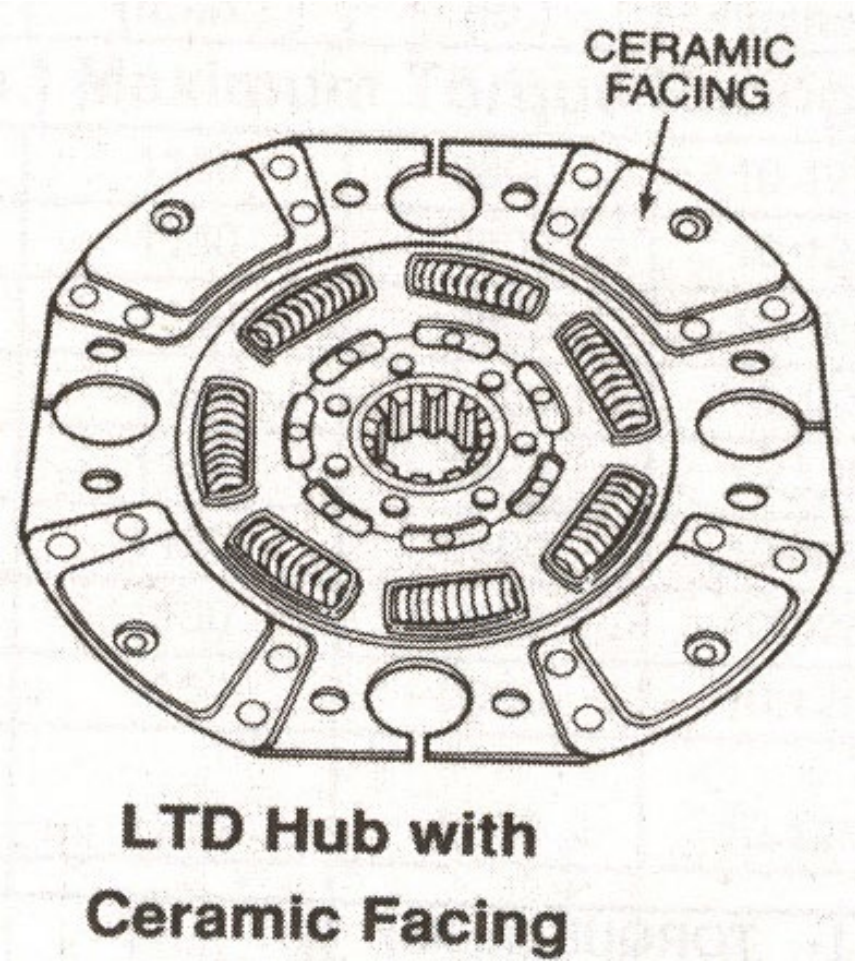
15.5” LTD LITE PEDAL CLUTCH

- Lite Pedal Effort Design Is Standard
- Benchmark 78 Lbs Peak Pedal Effort On High Torque Models
  - Worst Case Depending on Linkage Configuration
- Assist Cone Spring (black arrow)
  - Removes Peak From Release Characteristic
- No Reduction to Clamp Load Capacity

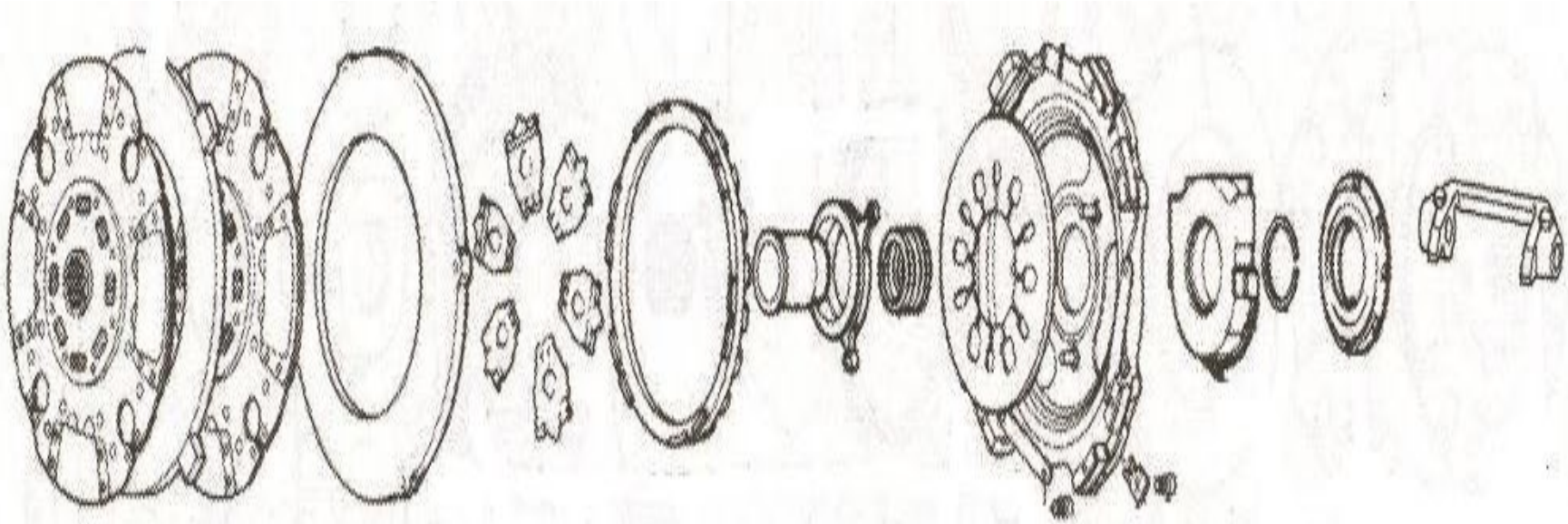


15.5” LTD LITE PEDAL CLUTCH

- Cerametallic Facing, 7-Spring LTD (long travel damped) Type Disc Assemblies
  - High Strength/Durability Torsion Springs with soft rate damping capability to dampen drivetrain torsionals
  - Retainer Plate Shot Peened for added strength



15.5” Clutch Components



15.5” Clutch Operation

- The clutch is engaged at all times except when the driver pushes the clutch pedal. When the clutch is engaged, the input shaft of the transmission is connected to the engine through the plates and the clutch discs.
- When the clutch is engaged, the release fork does not touch the bosses on the release bearing, because the driver is not pushing down the clutch pedal. The diaphragm spring is expanded in the cover and pushes the retainer toward the flywheel.

15.5” Clutch Operation

- The retainer moves the levers and the levers pivot and push against the pressure plate toward the flywheel.
- The front and rear clutch discs, which are connected to the input shaft, are squeezed together (sandwiched) between the pressure plate, the intermediate plate and the flywheel.
- This is done because of the force of the spring and movement of the levers. The squeezing together lets the discs and the input shaft rotate at the same speed as the engine.

15.5” Clutch Operation

- The clutch is disengaged when the driver pushes the clutch pedal.
- The clutch must be disengaged to shift gears in the transmission.
- When the clutch is disengaged, the input shaft of the transmission is not connected to the engine.

15.5” Clutch Operation

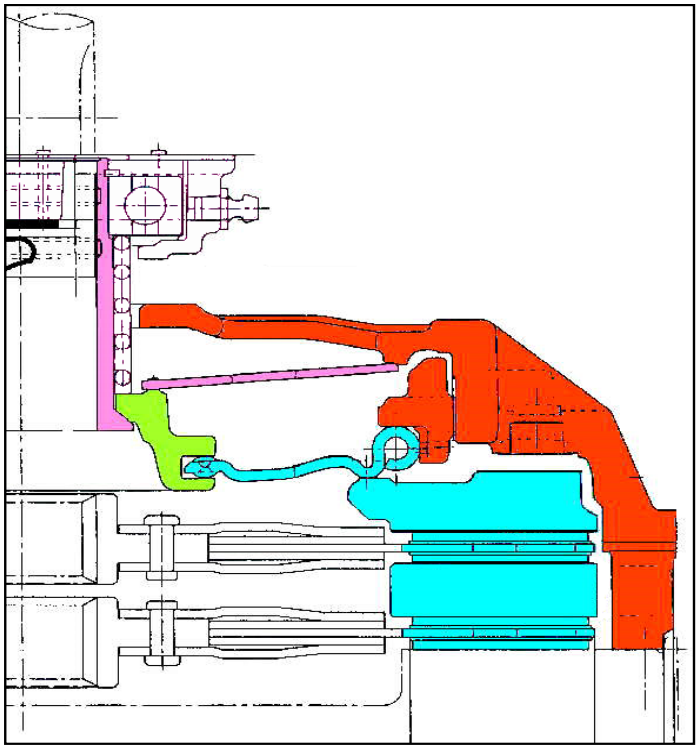
- When the driver pushes the clutch pedal down, the mechanical linkage or hydraulic linkage system causes the release fork to pull the release bearing away from the clutch cover.
- The release bearing and sleeve pull the retainer toward the front of the cover to compress the diaphragm spring.
- The movement of the retainer moves the levers to release the force on the pressure plate by moving the pivot point of the lever toward the cover.

15.5” Clutch Operation

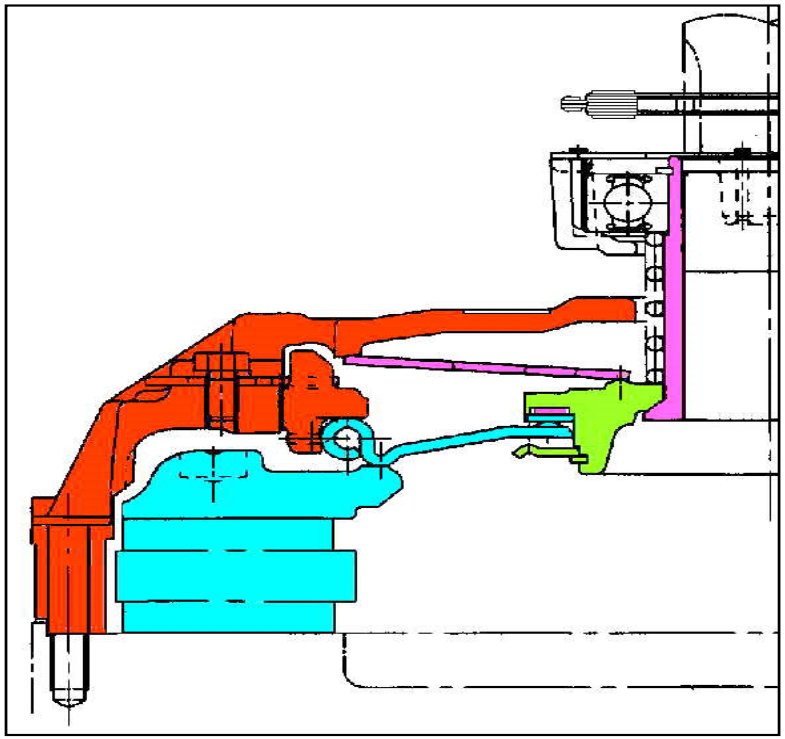
- Without the force from the pressure plate, the discs move freely between the intermediate plate and flywheel.
- When the discs move freely, the input shaft of the transmission is disconnected from the engine. The operator now shifts the transmission.
- When the driver releases the clutch pedal, the diaphragm spring and the levers put the clutch in the engaged position.

15.5” Clutch Operation

15.5” LTD ENGAGED

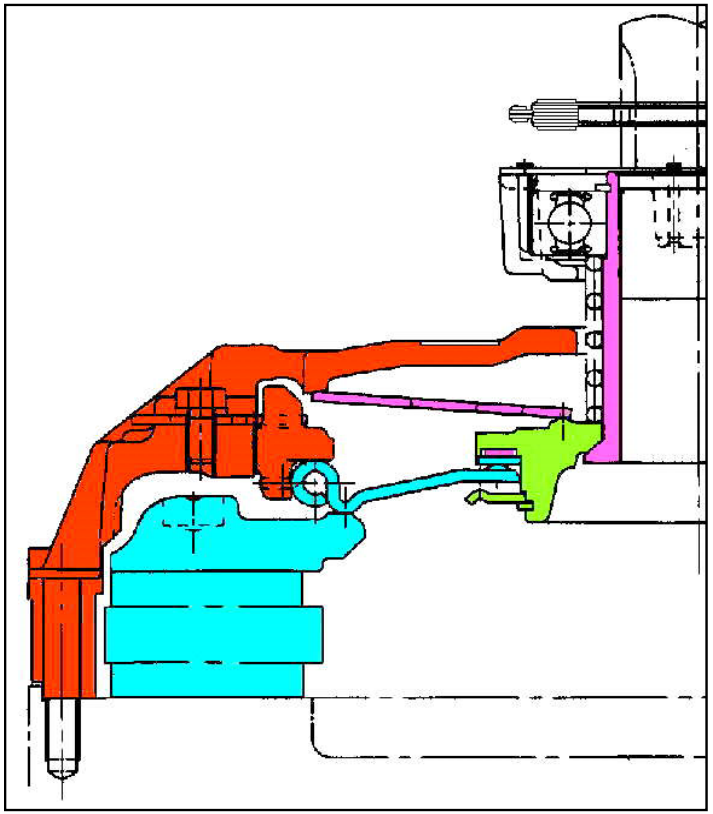


15.5” LITE PEDAL LTD ENGAGED

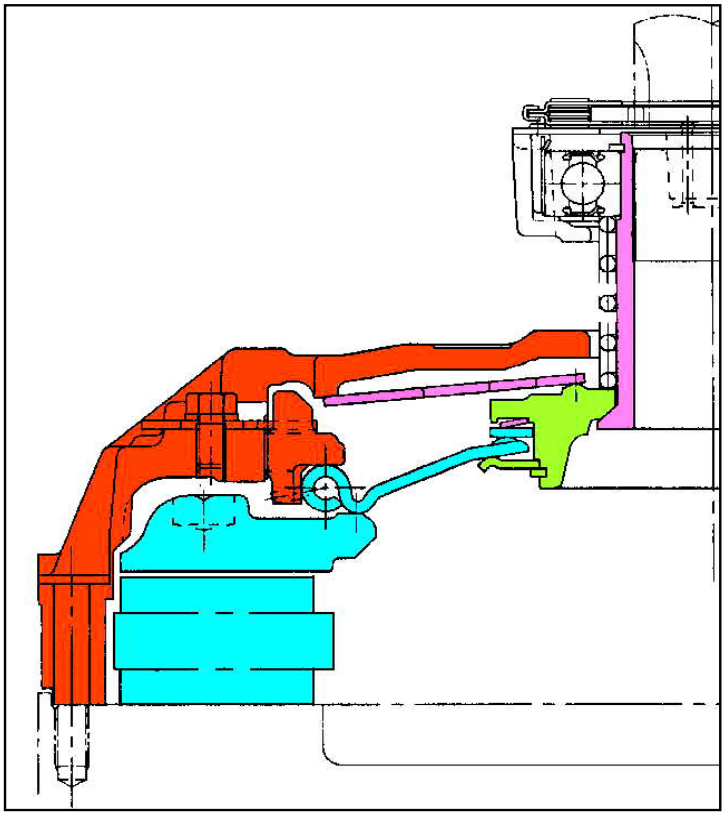


15.5” Clutch Operation

15.5” LITE PEDAL LTD ENGAGED



15.5” LITE PEDAL LTD RELEASED



Clutch Activation Systems

- Two systems used:
  - Mechanical linkage system
  - Hydraulic system
- NOTE: The clutch activation system, designed by the vehicle manufacturer, is a separate system from the ZFMeritor clutch. However, the adjustment, condition and operation of this system can affect the operation of the ZFMeritor clutch.

Mechanical Linkage System

- Components
  - pedal, linkage rods/levers, release fork
- Adjustments
  - pedal height
  - total pedal travel
  - clutch brake squeeze
  - free travel

Hydraulic System

- Components
  - master cylinder
  - slave cylinder
  - pedal
  - hydraulic lines
  - release fork
- Adjustments
  - refer to the vehicle manufacturer's procedures

Clutch Adjustment Inspection

- When to check clutch adjustment:
  - At clutch removal or installation.
  - When servicing any component of the clutch linkage
  - Whenever the clutch pedal free travel is less than ½ inch.
  - Every PM service

➢ **Vehicle mileage is not an accurate inspection benchmark.**

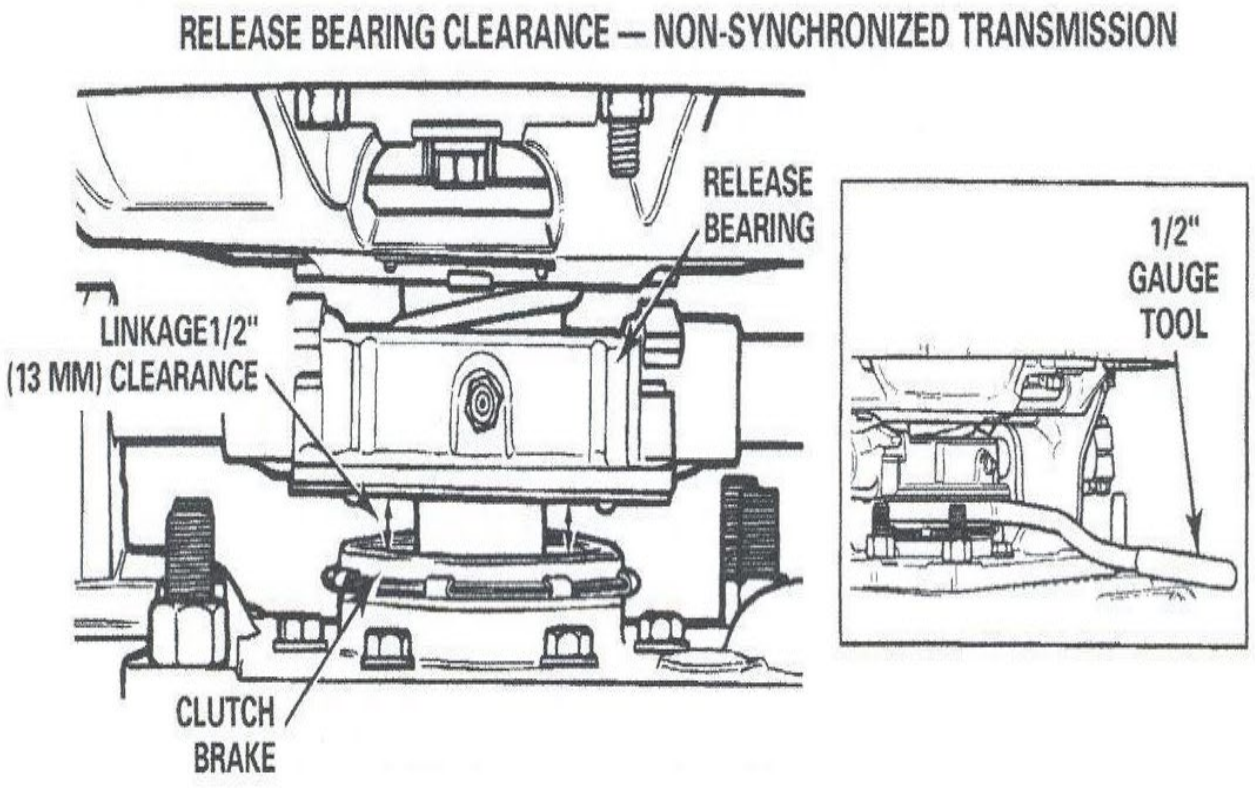
Clutch Adjustment Inspection

- Before you adjust the clutch, check:
  - that the linkage is tight and moves freely.
  - for false free travel in the vehicle linkage.*
  - that the release fork moves when you press the clutch pedal.
  - the transmission bearing retainer, clutch brake and release fork cross shaft bushings for excessive wear.*
  - that the fluid (hydraulically activated clutch) is at the specified level in the reservoir.

  - ***Refer to procedures in Clutch Maintenance Manual # 25A and Clutch Failure Analysis Manual TP 9494.**

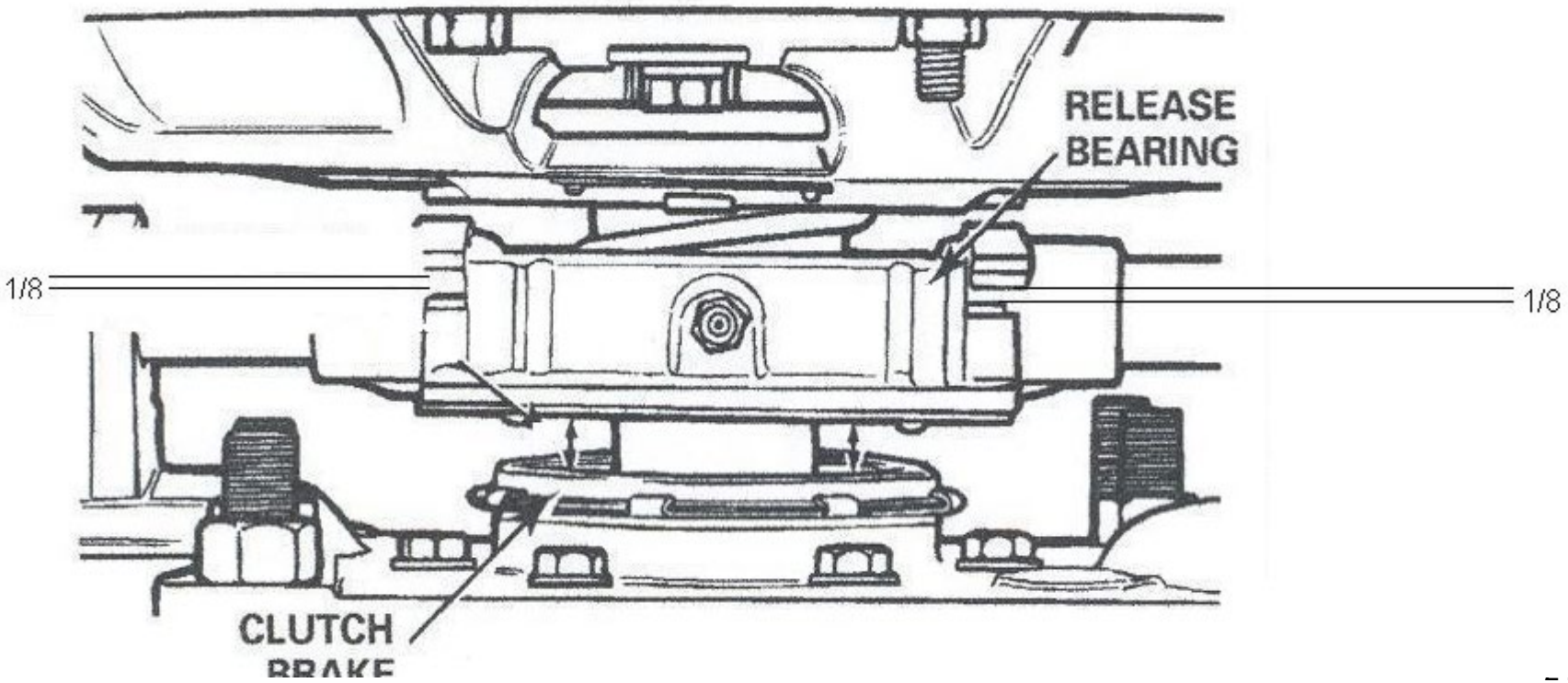
Clutch Adjustment Procedure

- Check release bearing clearance:
  - 0.53” between the release bearing and the clutch brake.
  - adjust the clutch as necessary.



Clutch Adjustment Procedure

- Check release fork clearance:
  - mechanical linkage; 1/8” between the release fork and bearing
  - adjust the clutch linkage as necessary



Clutch Adjustment Procedure

- Check release fork clearance:
  - hydraulically activated linkage; refer to vehicle manufacturer's procedures

Lubrication Interval & Lubricant Specifications

- Refer to MM25A, Lubrication and Maintenance Section.

Greasing Interval and Specifications

Component	Greasing Interval	Grease	Meritor Specification	NLGI Grade	Grease Classification	Outside Temperature
Release Bearing	①	High Temperature Multi-Purpose Wheel Bearing Grease	O-661	3	Lithium Complex	Down to −40°F (−40°C)
Bell Housing	①	②	—	—	—	—
Clutch Linkage	①	②	—	—	—	—

① Use the interval specified by the vehicle manufacturer or the fleet, but make sure the release bearing is greased once per month.
② Use the grease specified by the vehicle manufacturer.

Approved Lubricants

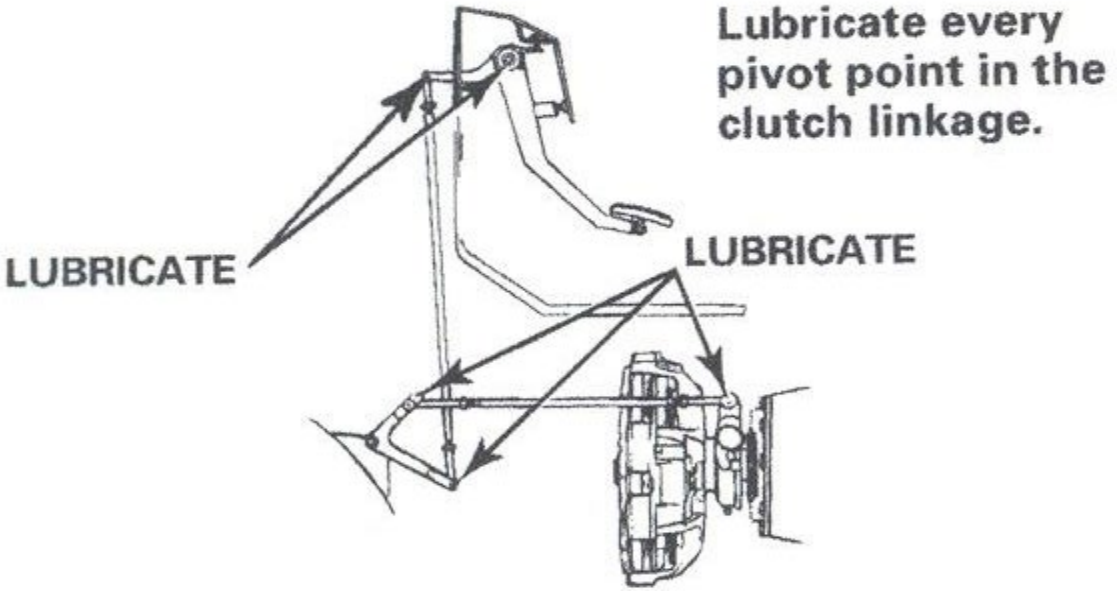
Lubricant	Recommendation
Clutch Bearing Grease	Exxon Unirex N Grade 3 (NLGI Grade No. 3, Lithium Complex)

Lubrication, Greasing Components

- Release bearing
  - apply until a small amount of grease expels from the bearing housing.
- Yoke to release bearing tips
  - apply grease between these two components.
- Release bearing sleeve bushing
  - apply grease on the input shaft where the release bearing sleeve contacts during clutch release.

Lubrication, Greasing Components, continued

- Clutch housing
  - release fork cross shaft, until a small amount purges out.
- Clutch linkage
  - refer to the vehicle manufacturer's procedures.



Diagnostics

- Seven Keys to Prevent Clutch Failure
  - Timely lubrication
  - Timely and correct adjustments
  - Timely inspection of clutch and linkage
  - Replacement of worn parts
  - Correct installation procedures
  - Correct clutch application
  - Driver education

Diagnostics

- Common complaints
  - clutch drag/non release
  - clutch slipping
  - clutch brake inoperative
  - hard pedal
- These common complaints, their causes and corrections plus additional troubleshooting of operating conditions are covered in Clutch Maintenance Manual 25A, Section 9, Diagnostics and the slides that follow.

Troubleshooting

Before troubleshooting the clutch, make sure of the following:

1. The engine is operating correctly.
2. The engine mounts are in good condition.
3. The driveline angles of the engine, transmission, driveshaft and rear axle are correct.
4. The inspection cover is installed on the clutch housing.

Refer to the following charts to troubleshoot the clutch.

Table A: Troubleshooting — Operating Conditions

Condition	Possible Cause	Correction
Clutch does not release or does not release completely.	1. Release bearing clearance needs adjustment.	1. Adjust release bearing clearance.
	2. Clutch linkage needs adjustment.	2. Adjust clutch linkage.
	3. Worn or damaged linkage.	3. Lubricate linkage. Make sure the linkage is not loose. If condition still exists, replace linkage.
	4. Worn or damaged release bearing.	4. Lubricate release bearing. If condition still exists, replace release bearing.
	5. Worn or damaged splines on input shaft.	5. Replace input shaft.
	6. Bell housing loose.	6. Tighten fasteners to specified torque. If necessary, replace fasteners.
	7. Worn or damaged pressure plate.	7. Replace pressure plate and cover assembly.
	8. Worn or damaged center plate.	8. Replace center plate.
	9. Center plate binding.	9. **14-inch Clutch:** Inspect drive pins in flywheel housing and slots in center plate. **15-1/2-inch Clutch:** Inspect tabs on center plate and slots in cover. Service as necessary.
	10. Damaged hub in clutch discs.	10. Replace discs.
	11. Facings worn below specified dimension.	11. Replace discs.
	12. Facings damaged.	12. Replace discs.
	13. Oil or grease on facings.	13. Clean facings. If oil or grease cannot be removed, replace discs.
	14. Facings not specified for vehicle operation.	14. Install discs with correct facings.
	15. Damaged pilot bearing.	15. Replace pilot bearing.
Clutch pedal is hard to operate.	1. Damaged bosses on release bearing.	1. Replace release bearing assembly. Make sure clutch is correctly adjusted.
	2. Tight or stiff pivots in clutch linkage.	2. Lubricate linkage. If condition still exists, replace linkage.
	3. Worn or damaged clutch components.	3. Replace pressure plate and cover assembly.
	4. Worn or damaged pedal shaft and/or cross shaft bushings.	4. Repair or replace as necessary.

Condition	Possible Cause	Correction
Clutch slips out of engagement.	1. Driver keeps foot on clutch pedal.	1. Use correct vehicle operating procedure.
	2. Clutch release bearing clearance needs adjustment.	2. Adjust release bearing clearance.
	3. Clutch linkage needs adjustment.	3. Adjust clutch linkage.
	4. Worn or damaged clutch components.	4. Replace pressure plate and cover assembly.
	5. Worn or damaged facings.	5. Replace clutch discs.
	6. Oil or grease on facings.	6. Clean facings. If oil or grease cannot be removed, replace discs.
	7. Facings not as specified for vehicle operation.	7. Use discs with correct facings.
	8. Worn or damaged flywheel.	8. Service flywheel as necessary. Refer to the procedure of engine or vehicle manufacturer.
Clutch is noisy.	1. Release bearing clearance needs adjustment.	1. Adjust release bearing clearance.
	2. Clutch linkage needs adjustment.	2. Adjust linkage.
	3. Tight or stiff pivots in clutch linkage.	3. Lubricate linkage. If condition still exists, replace linkage.
	4. Worn or damaged release bearing.	4. Lubricate release bearing. If condition still exists, replace release bearing.
	5. Worn or damaged clutch housing.	5. Replace clutch housing and pressure plate assembly.
	6. Bell housing loose.	6. Tighten fasteners to specified torque. If necessary, replace fasteners.
	7. Damaged hub or broken co-axial springs in clutch discs.	7. Replace clutch discs.
	8. Facings worn below specified dimension.	8. Replace clutch discs.
	9. Facings damaged.	9. Replace discs.
	10. Oil or grease on facings.	10. Clean facings. If oil or grease cannot be removed, replace discs.
	11. Damaged pilot bearing.	11. Replace pilot bearing.
Clutch vibrates.	1. Worn or damaged splines on input shaft.	1. Replace input shaft.
	2. Pressure plate and cover assembly out-of-balance.	2. Remove, check balance and install pressure plate and cover assembly. If condition still exists, replace pressure plate and cover assembly.
	3. Worn or damaged splines in hub of clutch discs.	3. Replace clutch discs.
	4. Loose flywheel.	4. Tighten fasteners to specified torque. If necessary, replace fasteners. Check flywheel mounting surface for damage, replace if necessary.
	5. Transmission-to-engine misalignment.	5. Check runout of flywheel and bell housing. Make sure the transmission-to-engine alignment is correct. Refer to vehicle manufacturer's procedure.

Table B: Troubleshooting — Components

Condition	Possible Cause	Correction
Broken tabs on clutch brake.	1. Vibration.	1. Inspect hubs of clutch discs. Also check clutch installation. Make sure dampened clutch discs are used.
	2. Release bearing clearance needs adjustment.	2. Adjust release bearing clearance.
	3. Clutch linkage needs adjustment.	3. Adjust clutch linkage.
	4. Driver engages clutch brake improperly while vehicle is moving.	4. Use correct driving procedures.
Worn or damaged release bearing housing.	1. Driver keeps foot on clutch pedal.	1. Use correct vehicle operating procedures.
	2. Free travel not adjusted correctly.	2. Adjust free travel correctly.
Worn bosses on release bearing housing.	1. Damaged or out-of-adjustment linkage.	1. Lubricate and adjust linkage. Inspect linkage for wear or damage.
	2. Release yoke binding.	2. Lubricate shaft of release yoke. If yoke does not move freely, replace shaft and yoke assembly.
	3. Free travel out-of-adjustment.	3. Adjust free travel to specifications.
Worn or damaged input shaft splines.	1. Transmission not aligned.	1. Make sure driveline angles are correct.
	2. Incorrect transmission installation procedures.	2. Install transmission correctly.
	3. Damaged hubs in clutch discs.	3. Replace clutch discs.
	4. Worn or damaged pilot bearing.	4. Replace pilot bearing.
	5. Engine vibration.	5. Make sure dampened discs are used. Lubricate at scheduled intervals.
Pressure plate cracked or damaged by heat.	1. Driver engages clutch while vehicle is coasting to create shock load.	1. Use correct vehicle operating procedures.
	2. Driver uses clutch as a brake to hold vehicle on a grade.	2. Use correct vehicle operating procedures.
	3. Free travel not adjusted correctly.	3. Adjust free travel to specifications.
	4. Oil or grease on facings.	4. Clean discs. If oil or grease cannot be removed, replace discs. Repair cause of grease or oil leak.
	5. Worn or damaged diaphragm spring.	5. Replace pressure plate and cover assembly.
	6. Driver slips clutch excessively during engagement.	6. Use correct vehicle operating procedures.
Grooves worn in pressure plate.	1. Worn or damaged clutch discs.	1. Replace clutch discs. Also, replace pressure plate, center plate or flywheel if damaged.
Adjusting ring does not move.	1. During adjustment, clutch pedal pushed down too far.	1. During adjustment, push the clutch pedal to within 0.5-inch (13 mm) or clutch brake contact.
	2. Too much dirt in bell housing.	2. Remove dirt from bell housing. Service as necessary. Make sure inspection cover is installed.
	3. Worn or damaged adjusting ring.	3. Replace clutch as pressure plate assembly.
Warped hub in clutch disc.	1. Incorrect transmission installation procedures.	1. Replace discs. Install transmission correctly.
Hub separates from disc.	1. Excessive engine vibration.	1. Repair engine.
	2. Incorrect transmission installation procedures.	2. Install transmission correctly.
	3. Clutch housing loose.	3. Tighten clutch housing to specified torque. If necessary, replace fasteners.
	4. Clutch engaged while vehicle is coasting.	4. Use correct vehicle operating procedures.
	5. Shock loading.	5. Use correct vehicle operating procedures.

Condition	Possible Cause	Correction
Co-axial springs separate from disc.	1. Excessive engine vibration. 2. Driver engages clutch while coasting. 3. Shock loading.	1. Repair engine as required. 2. Use correct vehicle operating procedures. 3. Use correct vehicle operating procedures.
Heat damage on disc.	1. Driver keeps foot on clutch pedal or slips clutch. 2. Clutch does not engage or disengage completely 3. Free travel not adjusted correctly. 4. Worn or damaged diaphragm spring. 5. Grease or oil on facings.	1. Use correct vehicle operating procedures 2. Refer to Table A: Troubleshooting — Operating Conditions. 3. Adjust free travel correctly. 4. Replace pressure plate and cover assembly. 5. Clean facings. If oil or grease cannot be removed, replace discs.
Linings separate from discs.	1. Facings worn past specified dimension. 2. Vehicle coasting downhill with transmission in gear and clutch engaged.	1. Replace discs. 2. Use correct vehicle operating procedures.
Cracked or damaged center plate.	1. Driver does not start vehicle in correct gear. 2. Driver uses clutch as a brake to hold vehicle on a grade. 3. **14-inch Clutch:** Worn or damaged drive pins in flywheel housing. 4. **15-1/2-inch Clutch:** Tabs on center plate binding in clutch cover. 5. Driver slips clutch excessively during engagement.	1. Use correct vehicle operating procedures. 2. Use correct vehicle operating procedures. 3. Make sure drive pins are correctly installed. Service drive pins as necessary. 4. Replace pressure plate and cover assembly and/or center plate. 5. Use correct vehicle operating procedures.

Table C: Troubleshooting — Driver Procedures

Driver Procedures	Results
Driver keeps foot on clutch pedal.	Clutch is always partially disengaged. Results in too much slipping and causes clutch to overheat. Overheating causes damage to the linings, the pressure plate, the center plate and flywheel. Release bearing also damaged.
Driver uses clutch as a brake.	Promotes faster wear of linings on disc and causes clutch to overheat.
Driver shifts transmission before minimum shift speed.	Puts a severe shock on the drivetrain. Will damage disc hub assemblies.
Driver coasts downhill with the transmission in gear and the clutch released.	Will put too many RPMs on input shaft due to rear axle driving transmission. Can cause facings to separate from disc. ①
Driver applies clutch while coasting downhill.	Puts a severe shock load on the drivetrain. Will damage disc and hub assemblies, as well as the entire powertrain.
Driver applies clutch brake while shifting when vehicle is moving.	Damages clutch brake. Damaged clutch brake results in gear clash (noise) when engaging first or reverse gears.

NOTE: ① Refer to the following Warning.

WARNING

Operate the vehicle according to the procedure of the manufacturer of the vehicle. Do not coast downhill with the transmission in gear and the clutch released. If the vehicle coasts downhill with the transmission in gear and the clutch released, the facings can separate from the disc and cause serious personal injury and damage.

Summary

- This program has provided technical information on the ZFMeritor 15.5” clutch.
- Clutch product overview, inspection, lubrication, and diagnostic information was presented.
- What additional information do you require that was not covered in the presentation?
- Questions or comments?

Where to Get More Information

- Other training sessions
  - Arrange with your DSM
- Maintenance Manuals
- Technical Bulletins
- Technology White Papers
- Product Videos
- Technical Library CD
- ARM Web Site
- Customer Service 800 535 5560
- TMC Recommended Practices Manual
- Vehicle manufacturer

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- A list of publications referencing that sub topic will be displayed in the center of the web page.
- Select the item by clicking on it and the publication will launch onto your computer screen.