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 Availability: ISIS, Bus ISIS, FleetISIS, NotSIR Revision: 31
 Major System: Electrical Created: 10/22/2014
 Current Language: English Last Modified: 2/21/2024
 Other Languages: NONE Author: Sean McGannon
 Viewed: 28480

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Coding Information

| | | | | | | | |
|---------------|------------------------|---|----------------------|-----------|----------------------|--------------------|-----------------------|
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|---------------|------------------------|---|----------------------|-----------|----------------------|--------------------|-----------------------|

Title: ISB Starting System Diagnostics

Applies To: ISB Engine

Change Log

Please refer to the change log text box below for recent changes to this article:

02/21/2024 - Added chassis ground cleaning guidelines.
 06/28/2023 - Updated article to include battery cable crimp improvement dates
 03/14/2019 - Formatting change only. No content changes.
 01/03/2019 - Added note under diagnostics "Failure to follow all steps may result in a repeat failure."
 11/29/2018 - Updated MidTronics Instruction Manual Hyperlinks.
 08/23/2018 - Updated voltage check on Step 7 for clarification based on dealer feedback. Removed date from Step 10 and added feature code for

Description

This document will guide the user through Cummins ISB starter and ring gear diagnostics. It is important to review all the material to prevent repeat failures, especially in instances of ring gear damage by the starter.

NOTE: Warranty claims with a failure date of 09/21/2015 and later will not be allowed if the complete repair is not performed. See steps 10 and 11 of the diagnostics. As some vehicles may require an overlay harness to prevent repeat starter motor failures. Steps 10 and 11 only apply to vehicles with feature code '0508051 - Electrical system MUX for BC prog only', which are 250k Baud rate vehicles.

Following the step based procedure below will determine if there is an issue with a starter motor and help prevent warranty denials for No Trouble Found (NTF).

When testing for a Starter related failure, the technician will complete the proper [diagnostic worksheet](#). Critical diagnostic testing values are to be printed and submitted with the claim.

NOTE: Before performing any voltage drop test; inspect each cable end nut torque, insulation, routing, clipping, discoloration, and terminal arching

Symptoms

Diagnostic Trouble Codes

| DTC/Light | Description |
|-----------|-------------|
| N/A | |

Customer Observations or Concerns:

Operator may hear one of the following from the starter:

- Click
- Clunk
- Grind
- Squeal
- Starter spins, doesn't rotate engine

- Slow Engine Crank
- Click No-Crank
- No-Click No-Crank
- Crank No-Start

Special Tools / Software

| Tool Description | Tool Number | Comments | Instructions |
|--|-----------------|------------------------------------|------------------------------------|
| Cummins Insite | | Cummins Engine Diagnostic Software | |
| MidTronics inTellec EXP battery and electrical diagnostic tester | EXP-1000-HD-NAV | | Instruction Manual |

[Service Tool Resource Center](#)

Service Parts Information

| Kit Description | Part Number | Package Quantity | Source From | Notes |
|--------------------------------|-------------|------------------|-------------|-----------------------------|
| MOTOR,STARTING 12V, 38MT DELCO | 8201039 | 1 | Navistar | Engine- ISB |
| Flexplate | 3968672 | 1 | Cummins | Trans- 0013ASP Allison 2000 |
| Flexplate | 29545469 | 1 | Allison | Trans- 0013AVE Allison 3000 |

Diagnostics:

NOTE:

All Julian battery cables manufactured after **05/15/2023** will have an improved crimp, designed to reduce voltage drop. See image below for date code location:



NOTE:

When cleaning chassis grounds, both sides of the frame need to have the chassis paint removed. Failure to remove chassis paint from both sides of the frame can lead to excess voltage drop across the connection.



NOTE:

Before performing any voltage drop test; inspect each cable end nut torque, insulation, routing, clipping, discoloration, and terminal arching

| Step | Action | Decision |
|------|---|--|
| 1 | Diagnostic Trouble Code Check: Review current health report for fault codes that may cause an extended crank condition (Crankshaft Position Sensor, Camshaft Sensor, Fuel System, Electrical codes) Are there pending/active/previously active DTC's causing a crank no start? | Yes: Go to appropriate diagnostic manual to diagnose crank no start symptom |
| | | No: Step 2 |

| Step | Action | Decision |
|------|--|--------------------|
| 2 | Manual Engine Barring Test: Have an assistant bar the engine over from the alternator pulley | Yes: Step 3 |

TIP: If an audible noise is heard from the starter area when the engine is rotated by hand, there is most likely flexplate ring gear damage.

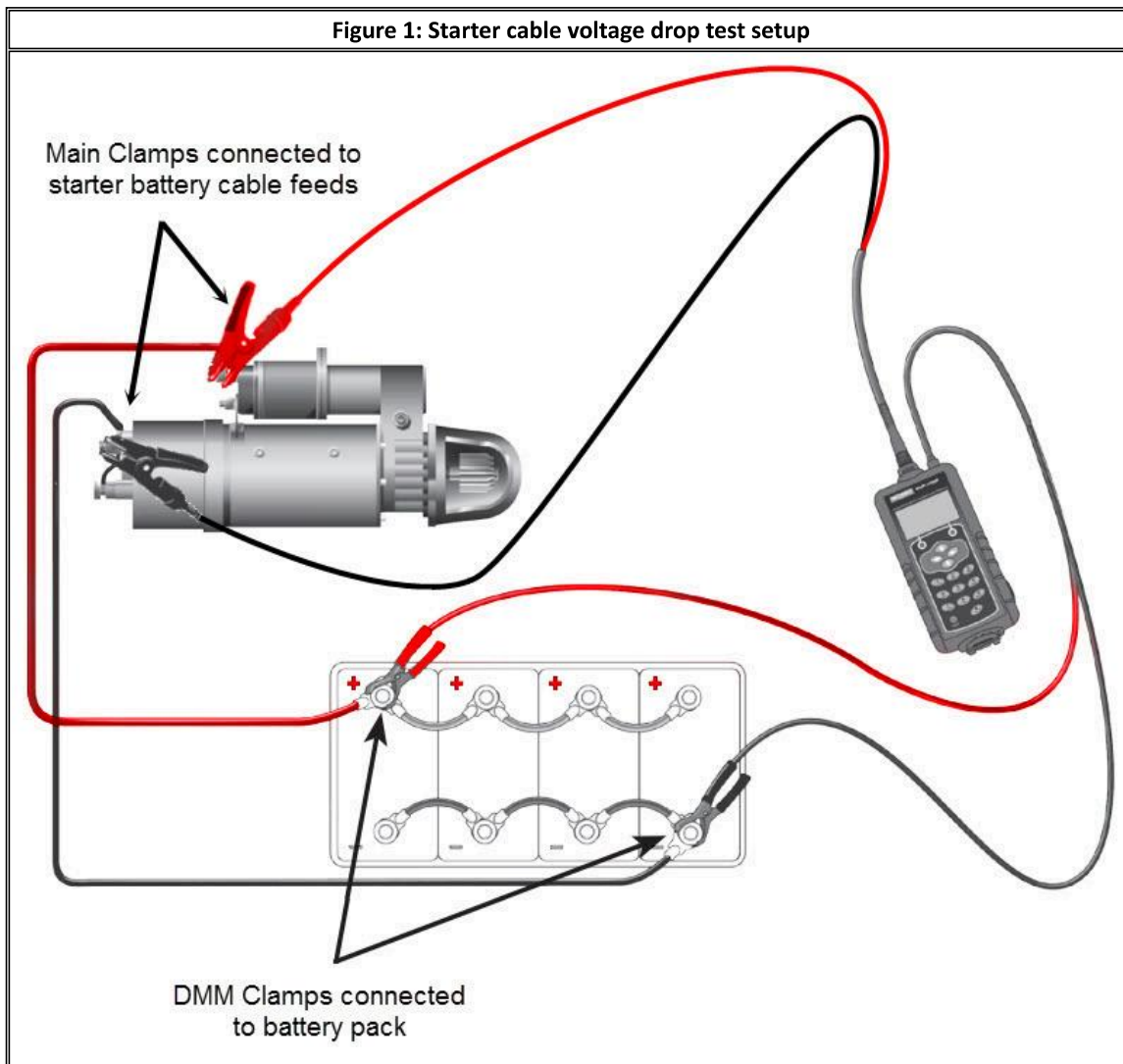
Does the engine rotate freely?

No: Diagnose engine lock up condition.

| Step | Action | Decision |
|------|--|--|
| 3 | Cranking RPM Test: Monitor Engine RPM while cranking the engine. Does the engine crank? | Yes: Go to appropriate crank no start diagnostic. Do NOT replace starter motor |
| | | No: Step 4 |

| Step | Action | Decision |
|------|--|--|
| 4 | Perform battery test: Follow IK0800482- Battery Testing, Diagnostics & Maintenance Is a warranty approval code (WAC) or failed battery result from any battery generated? | Yes: Replace ONLY failed battery and then recheck for symptom |
| | | No: Step 5 |

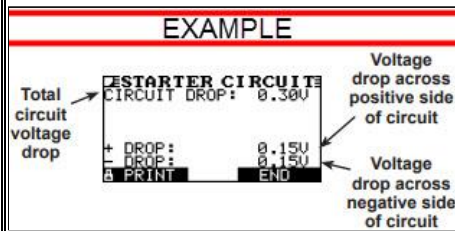
Figure 1: Starter cable voltage drop test setup



| Step | Action | Decision |
|------|---|---|
| 5 | Starter Cable Voltage Drop Test: | Yes: Make required repair to the cable with the excessive voltage drop |

Follow Midtronics starter cable voltage drop test

The test sends a signal through the circuit at the component under test. The tester then simultaneously calculates voltage drop on the positive (+) and negative (-) sides of any circuit as well as the total voltage drop.



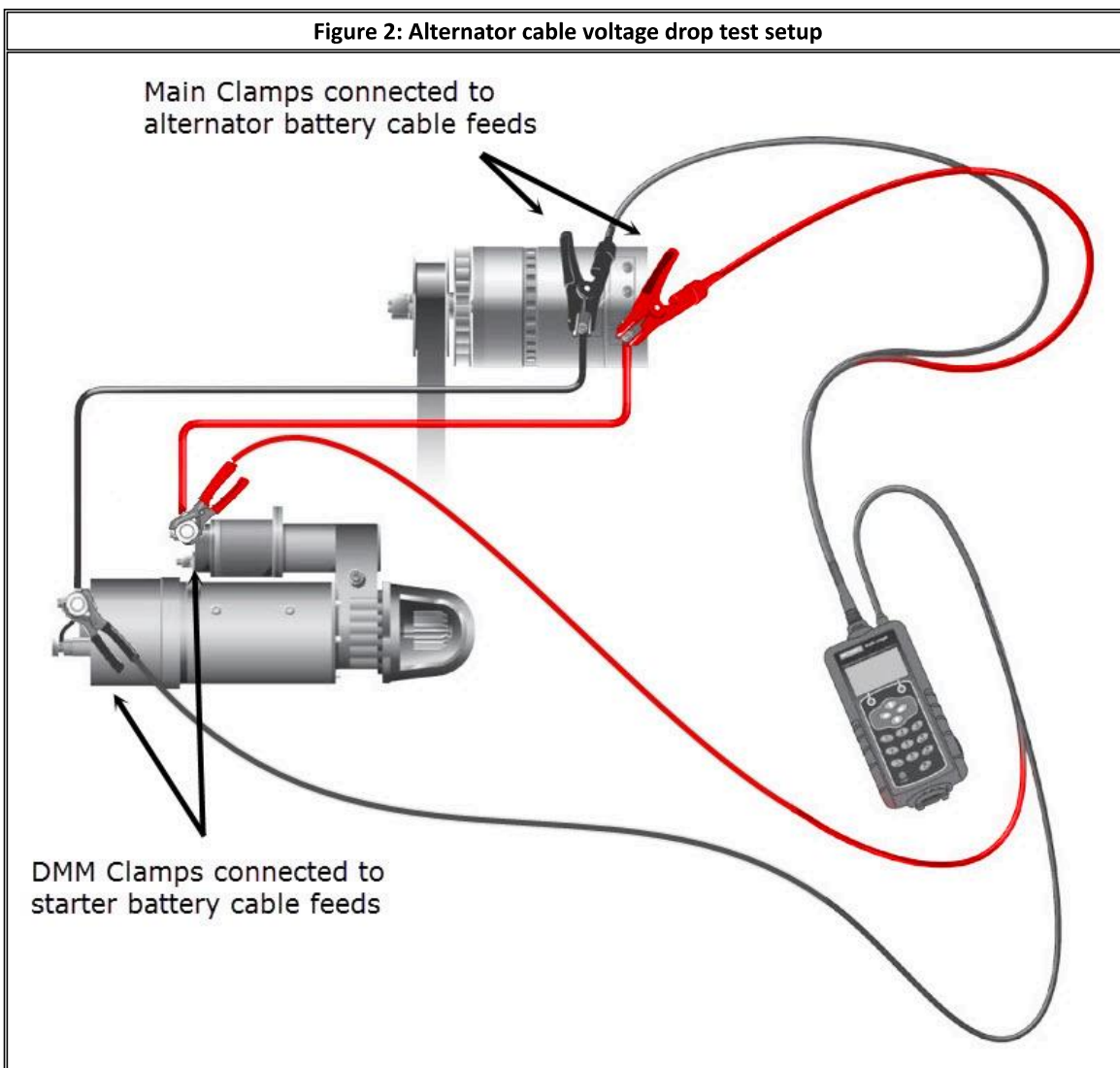
Is total circuit voltage drop greater than 1.0v?

NOTE:

This procedure is outlined in Chapter 6 of the [Midtronics Instruction Manual](#)
Refer to Image 2 above for connecting the tester

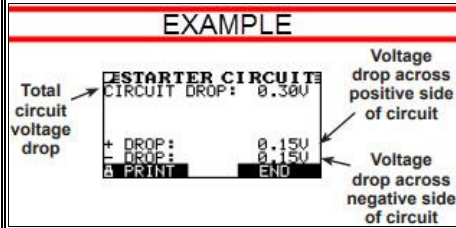
No: Step 6

Figure 2: Alternator cable voltage drop test setup



| Step | Action | Decision |
|------|---|--|
| 6 | <p>Alternator Cable Voltage Drop Test:</p> <p>Follow Midtronics alternator cable voltage drop test</p> | <p>Yes: Make required repair to the cable with the excessive voltage drop</p> |

The test sends a signal through the circuit at the component under test. The tester then simultaneously calculates voltage drop on the positive (+) and negative (-) sides of any circuit as well as the total voltage drop.



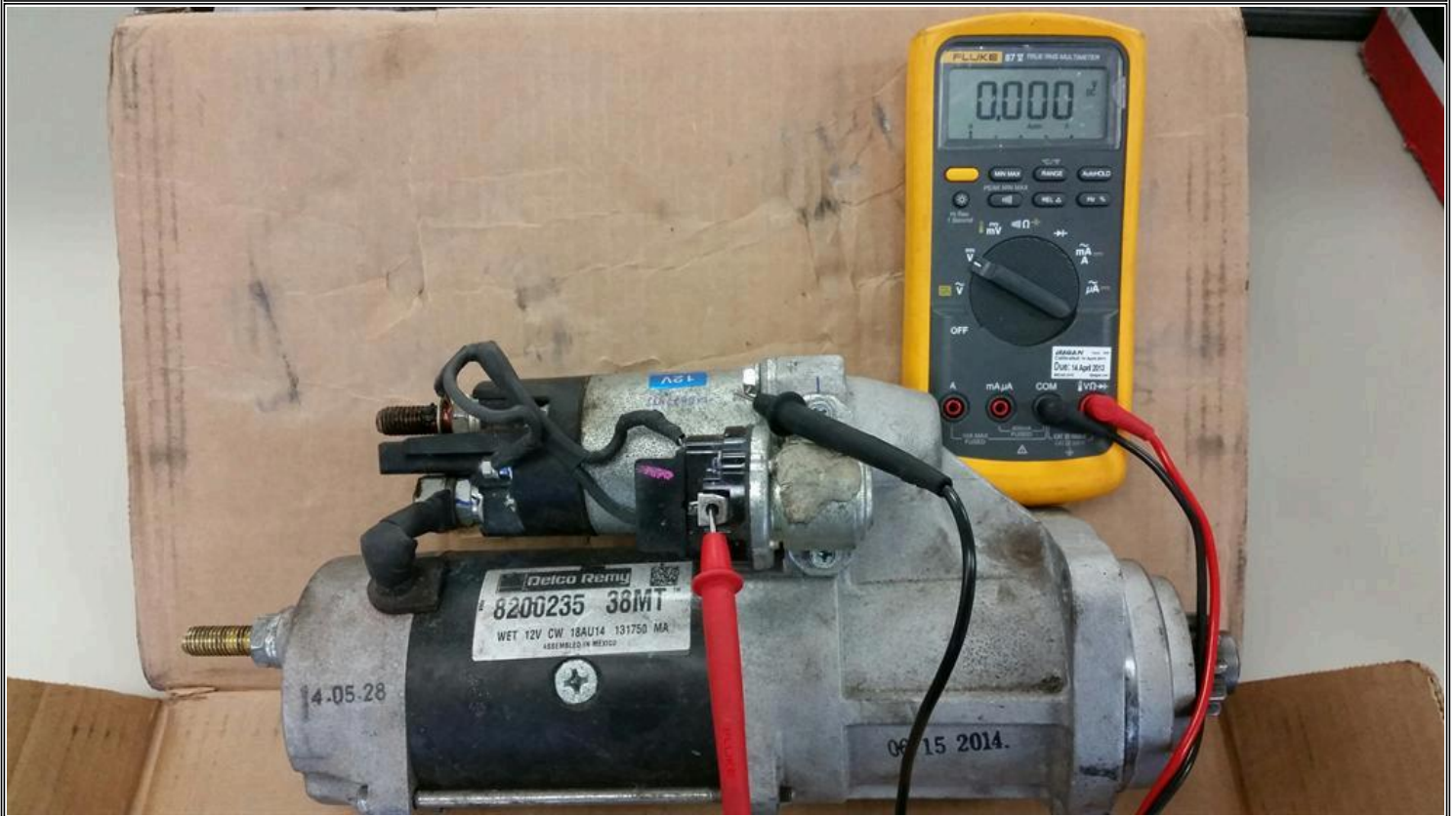
Is total circuit voltage drop greater than 1.0v?

NOTE:

This procedure is outlined in Chapter 6 of the [Midtronics Instruction Manual](#)

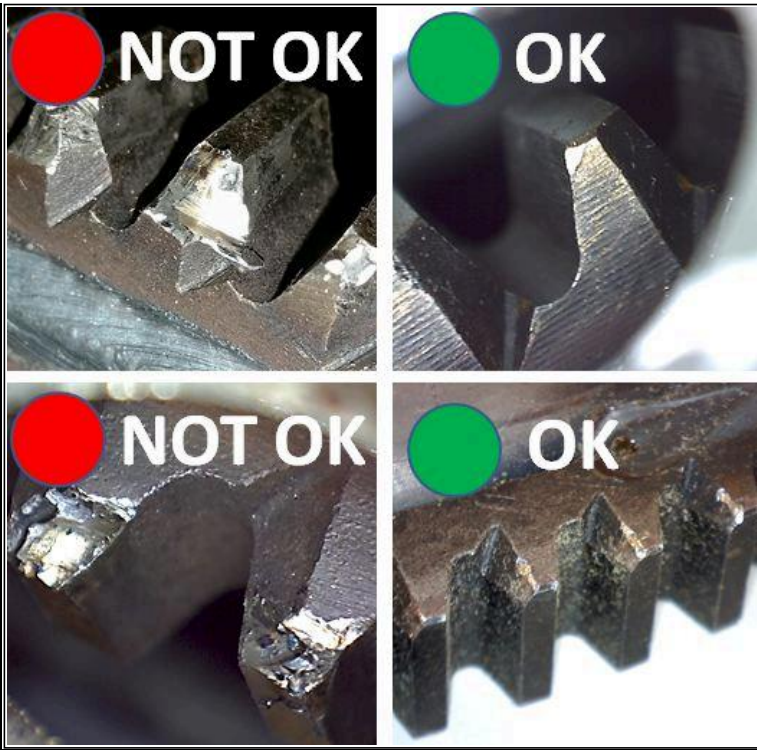
Refer to Image 3 above for connecting the tester

Figure 4: Starter IMS S terminal DVOM Hookup Location



| Step | Action | Decision |
|------|---|---|
| 7 | <p>Starter Control Circuit Check:</p> <p>Connect DVOM test leads on IMS (Mag switch) "S terminal" and ground to solenoid case as indicated in Figure 1.</p> <p>Have an assistant hold key switch in start position for 5 seconds.</p> <p>Is measured voltage less than 9v?</p> | <p>Yes: Perform starter control diagnostics for possible causes:</p> <ul style="list-style-type: none"> Wiring F3A Fuse Start Relay (Neutral Relay) Crank Inhibit Relay Clutch Switch (Manual Trans) TCM (Auto Trans) ECM Key Switch |
| | | No: Step 8 |

Figure 2: Flexplate / Flywheel Ring Gear



| Step | Action | Decision |
|------|--|-------------------------------|
| 8 | Ring Gear Inspection: Remove starter. Mark the flexplate ring gear with a paint pen. Have an assistant bar the engine over while you inspect each tooth for damage: burrs, milling, chips, etc. (Figure 2) TIP: This can be done as a one man operation using a borescope or by looking through the starter mount hole Did all 127 teeth get inspected? | Yes: Step 9 |
| | | No: Inspect each tooth |

| Step | Action | Decision |
|------|---|---|
| 9 | Flexplate replacement determination: Does the flexplate need to be replaced when ring gear teeth are compared to Figure 3? | Yes: Replace flexplate & starter and then go to step 10 (Manual Transmission equipped vehicles End diagnostics here) |
| | | No: Replace starter and then go to step 10 (Manual Transmission equipped vehicles End diagnostics here) |

| Step | Action | Decision |
|------|---|---------------------|
| 10 | Feature code inspection: Inspect truck or bus feature code for 250k baud rate identification. Does the truck or bus have feature code 0508051 ? | Yes: Step 11 |
| | NOTE: | |

- 0508051 indicated the vehicle is 250k baud rate
- The feature codes are listed in the components tab of the vehicle information page in Service Portal
- This inspection will not apply to 500k baud rate vehicles

No: Repair complete

Figure 4: Rectifier Diode Inspection



| Step | Action | Decision |
|------|--|--|
| 11 | Overlay harness inspection: Inspect for previously installed rectifier diode assembly <ul style="list-style-type: none"> • CE Bus located on trunk of harness under dash next to cowl on driver side • DuraStar located near relay block, or located beneath the dash by the steering column. Is the overlay harness with rectifier diode installed when compared to Figure 4? | Yes: Repair complete (state in warranty claim the harness was installed prior to repair) |
| | | No: Click Here and follow instructions to add Rectifier Diode (Manual Transmission equipped vehicles do not click for instructions end diagnostics) |

Warranty Information

Any of the following symptoms should be documented in notes on the warranty claim

- Click
- Clunk
- Grind
- Squeal
- Slow engine crank
- Click no-crank
- No-click no-crank
- Crank no-start

Warranty Claim Coding:

| | |
|---------------|------------------------|
| Group: | 08540- Cranking System |
| Noun: | 202- Motor, Starter |

Standard Repair Times:

| Description | Chassis | Engine | SRT | |
|---|---------|-------------|-----------------------------|---------------------------|
| Starter Diagnostics | CE Bus | Cummins ISB | GY08-2202A | SRT Times |
| Starter Diagnostics | 4300 | Cummins ISB | KL08-2202A | |
| Starter Motor Replacement (SRT Not allowed w/ Transmission Removal) | CE Bus | Cummins ISB | GY08-4202SB | |
| Starter Motor Replacement (SRT Not allowed w/ Transmission Removal) | 4300 | Cummins ISB | KL08-4202SB | |

| | | | |
|--|--------|-------------|-------------------------------|
| Automatic Transmission (Removal & Reinstall) | CE Bus | Cummins ISB | GY13-9114SB |
| Automatic Transmission (Removal & Reinstall) | 4300 | Cummins ISB | KL13-9114SB |
| Flexplate Replacement | CE Bus | Cummins ISB | GY13-9114SB-1 |
| Flexplate Replacement | 4300 | Cummins ISB | KL13-9114SB-1 |

Other Resources

[Master Service Information Site](#)

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