Freightliner LLC New Vehicle and Aftermarket Parts Limited Warranties warrant that Freightliner LLC products will be free from defects in material and workmanship that occur under normal use within the applicable warranty period, subject to certain limitations and exclusions as specified in the Warranty Manual.

This Warranty Evaluation Guide applies to Remy 41MT and 42MT series starters and differentiates between warrantable and non-warrantable starter failures. Many warrantable starter failures may have similar symptoms to non-warrantable failures: be sure to thoroughly examine the starter for non-warrantable conditions. (See section 1 of the Warranty Manual and sections 15.02.05 to 15.02.10 of this document for a description of damages excluded from warranty).

Always follow the troubleshooting instructions in the appropriate Workshop Manual. **Starters damaged during maintenance or repair are not warrantable and should not be submitted for warranty claims.**

Operators should always follow the starting instructions in the Driver's Manual. Failure to do so will damage the starter and void the warranty. **Starters damaged by abnormal or abusive operation are not warrantable, and should not be submitted for warranty claims.**

Use quality test equipment. Accuracy of warranty checks depends upon the proper use of quality test equipment that is maintained and calibrated. This guide presumes that the technician will use a high quality multi-meter. (In addition, a technician may evaluate a starter with a Delco Remy bench-top tester where available.) If warranty checks are not completed with quality test equipment then warranty may not be assessed correctly.

Numerous starting problems are caused by a problem outside the starter. Analysis indicates that about 1 out of every 5 starters returned for warranty is fully operational. **Submitting a fully operational starter for a warranty claim will be returned as trouble not found.**

Before replacing a starter, verify that there are **no other causes of starting trouble** such as:

- **Batteries.** All the batteries must be fully charged. U.S. and Canadian dealers must use a Midtronics battery tester; each battery must have a result of "Good Battery." (See section 54 of Workshop/Service Manual of the vehicle being serviced for complete details on Battery diagnosis and charging, and optional diagnostic procedures for outside of the USA & Canada.)

- **Cables.** The cables must not be damaged or broken.

- **Cable connections.** All connections at the alternator, starter, battery, frame rail terminal, and all cable junctions (depopulation studs) must be clean and tightened to the proper torque. (See section 15 of Workshop/Service and Maintenance Manual for the vehicle being serviced for details on maintaining connections.)

- **Switches.** The magnetic switch and ignition switch must be operating correctly. (See section 54 of the Workshop/Service, for the vehicle being serviced for complete details on troubleshooting the magnetic switch.)

Definitions

Click, no-crank: The starter solenoid will click and actuate the drive assembly, but the starter motor will not crank. This is caused by either a faulty motor or a tooth abutment.

Closed Switch: The switch position that completes the circuit and allows current to pass

Continuity: A completed electrical path between two points in a circuit; no opens or breaks between two points.

Continuity Test: Using a digital multimeter to confirm continuity.

Gear Reduction Starter: Starter equipped with a gear reduction drive between the motor and pinion. This includes Remy 29MT, 38MT and 39MT starters. Gear reduction starters are also known as planetary gear starters.

No-click, no-crank: The starter solenoid will not click, because the solenoid will not actuate the drive assembly, and the starter motor will not crank.

Non-pressure side: Refers to the side of the pinion tooth that does not contact the ring gear while the engine is being cranked (Fig. A, Ref 2).

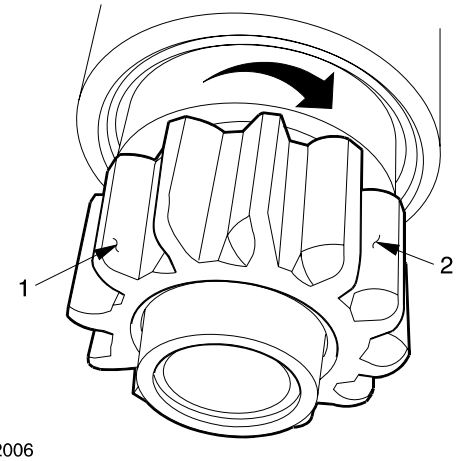

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Figure A. Starter pinion gear with clockwise rotation. Reference 1 is the pressure side of the pinion tooth, and reference 2 is the non-pressure side of the pinion tooth.

Observations: Any indications that can be seen or measured with tools available at all repair facilities.

Open circuit: No electrical path between two points, thus no current flow.

Pinion: The gear on the starter that engages the flywheel (Fig. A).

Planetary gear starter: See gear reduction starter.

Pressure side: Refers to the side of the pinion tooth that contacts the ring gear while the engine is being cranked (Fig. A, Ref. 1).

Short circuit: A path of lower resistance that causes current to bypass the intended circuit.

Slow crank: The starter will crank the engine slowly such that the engine does not turn fast enough to start (Also known as: hard starting and sluggish cranking).

Straight drive starter: The starter motor directly drives the pinion gear without gear reduction. This includes 41MT and 42MT starters.

Symptom: Abnormal operation noticed by the operator.

Tooth abutment: The pinion extends and contacts the ring gear but the gears do not mesh.

Internal Starter Failure	**Section 15.02.01**
	Damage Code: 155-001A04590

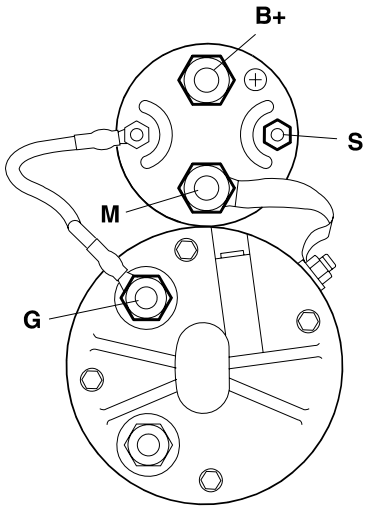

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Figure 1. 42MT starter terminals.

Terminals:
B+: Battery terminal
G: Ground terminal
M: Motor terminal
S: Solenoid terminal

Vehicle Symptoms
An internal starter failure is indicated by any one of the following:

- click, no-crank
- no-click, no-crank
- slow crank

IMPORTANT: The same symptoms can result from a problem outside the starter: **Before replacing the starter,** make sure there are no other causes of starting trouble (see page 1).

Post-Removal Observations
No external damage (See sections 15.02.05 to 15.02.08 below) **AND** any one of the following must be observed to confirm an internal starter failure:

- continuity test indicates: open circuit between the G and S terminals (Fig. 1)
- continuity test indicates open circuit between the M and S terminals (Fig. 1)
- continuity test indicates open circuit between the M and G terminals (Fig. 1)
- Delco-Remy Alternator/Starter bench tester indicates click, no-crank
- Delco-Remy Alternator/Starter bench tester indicates no-click, no-crank

NOTE: Continuity tests must be performed with the B+, Ground, and Solenoid terminals disconnected.

Warranty Coverage
A starter with an internal failure is **warrantable**, unless a **non-warrantable** condition exists as described in sections 15.02.05 to 15.02.10 below.

Unusual Grinding or Growling Noises	**Section 15.02.02**
	Damage Code: 155-001A04500
No Picture.	**Vehicle Symptoms** Unusual noise is typically described as: • grinding • growling • dragging **NOTE:** Unusual noises tend to be seasonal and occur at temperatures below 45^0 F (9^0 C). They also tend to occur more frequently on larger engines that are more difficult to crank. **The noise does not necessarily indicate that a failure is about to happen, so replacement is not necessary.**
	Warranty Coverage If the grinding noise persists after the batteries are fully charged, and the connections are cleaned and tightened, then a noisy starter is considered **warrantable**, unless a **non-warrantable condition exists** as described in sections 15.02.05 to 15.02.10 below.

Loose M Terminal Screw	**Section 15.02.03**
	Damage Code: 155-001A04590
 Figure 3. Arcing and discoloration near the M terminal are indicators that the M terminal has become loose.	**Vehicle Symptoms** A loose M terminal screw is indicated by <u>any one</u> of the following: • no-click, no-crank • slow crank **Post-Removal Observations** <u>Any one</u> of the following must be observed to confirm a loose M terminal screw: • arcing marks near the M-terminal (Fig. 3) • discoloration near the M-terminal (Fig. 3)
	Warranty Coverage A starter with a loose M terminal is **warrantable** if it becomes loose during normal operation. The starter is **non-warrantable** if the terminal has been loosened by the customer or the repairing dealer, or a **non-warrantable condition exists** as described in sections 15.02.05 to 15.02.10 below.

Loose Field Coil Terminal Screw	**Section 15.02.04**
	Damage Code: 155-001A04590
 Figure 4. Arcing marks near the field coil terminal screw.	**Vehicle Symptoms** A loose field coil terminal screw is indicated by <u>any one</u> of the following: • no-click, no-crank • slow crank **Post-Removal Observations** <u>Any one</u> of the following must be observed to confirm a loose field coil terminal screw: • arcing mark(s) near the field coil terminal (Fig. 4) • discoloration near the M-terminal (Fig. 3)
	Warranty Coverage A starter with a loose field coil terminal screw is **warrantable** if it becomes loose during normal operations. The starter is **non-warrantable** if the terminal has been loosened by the customer or the repairing dealer, or a **non-warrantable condition exists** as described in sections 15.02.05 to 15.02.10 below.

Milled Pinion	**Section 15.02.05** **Damage Code: N/A**
 Figure 5. Milled pinion (The arrow shows the direction of rotation). The pinion extends into a running ring gear, then the ring gear mills off the pinion teeth. Once the pinion teeth are damaged, the likelihood of "click, no-crank" caused by tooth-abutment increases because the pinion gear will not engage the ring gear.	**Vehicle Symptoms** A milled pinion is indicated by <u>any one</u> of the following: • frequent click, no-crank because the pinion can not engage the ring gear • no-click, no-crank if the solenoid is damaged as a result of holding the ignition switch when the pinion does not engage the ring gear **Post-Removal Observations** Attempted engagement to a running ring gear causing milled pinion teeth is indicated by several milled teeth with the burr toward the pressure side of the tooth (Fig. 5). **Warranty Coverage** A starter with milled pinion teeth is **not warrantable**, because the operator caused this damage by turning the ignition switch while the engine was running. Usually pinion milling will also damage the ring gear. Inspect the entire ring gear, because the damage may be visible at only one point. A damaged ring-gear must be replaced, but it is **not warrantable**. Not replacing a damaged ring gear will cause intermittent starting problems to continue. (Refer to the Workshop manual section 15 for ring gear inspection details.)

Chipped Pinion Tooth	**Section 15.02.06**
	Damage Code: N/A
 Figure 6. Starter pinion damage resulting from attempting to start an engine that has not completely stopped, and is usually caused by the operator. Trucks equipped with clutch lock-outs fail in this manner more often, because the operator accidentally releases and quickly re-applies the clutch during cranking. The Driver's Manual states: "If a vehicle does not start on the first attempt, make sure that the engine has completely stopped rotating before reapplying the starter switch. Failure to do so can cause the pinion to release and re-engage, which could cause ring gear and starter pinion damage."	**Symptoms** A chipped pinion gear tooth is indicated by <u>any one</u> of the following: • intermittent "click, no-crank" • "no-click, no-crank" if the solenoid is damaged as a result of holding the ignition switch when the pinion does not mesh with the ring gear **Post-Removal Observations** Attempted re-engagement to a running ring gear causing a chipped pinion tooth will have one or more teeth chipped and the burr will be toward the non-pressure side of the pinion gear. **Warranty Coverage** A starter with one or more chipped pinion teeth is **not warrantable**, because the operator caused this damage by turning the ignition switch before the engine completely stopped. On vehicles with clutch lock-outs: releasing and reapplying the clutch while cranking will cause this damage. Most times a chipped pinion tooth will also damage the ring gear. Inspect the entire ring gear, because the damage may only be visible at only one point. A damaged ring-gear must be replaced, but it is **not warrantable**. Not replacing a damaged ring gear will cause intermittent starting problems to continue. (Refer to the Workshop manual section 15 for ring gear inspection details.)

Overrun

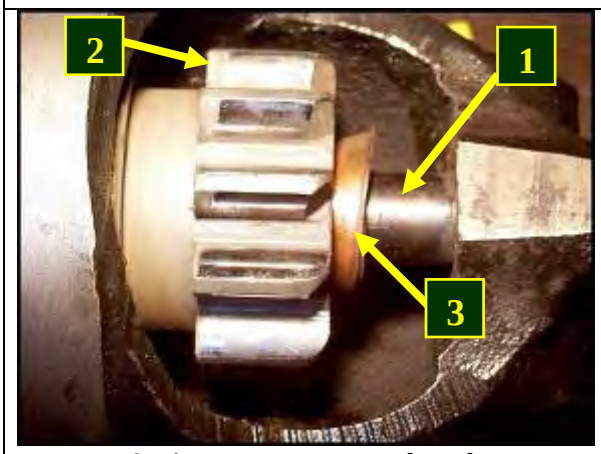

Figure 7A. An overrun starter has three indicators: a discolored shaft (Ref. 1), wiping or polishing of the non-pressure side of the pinion teeth (Ref. 2), and a damaged thrust bearing (Ref. 3).

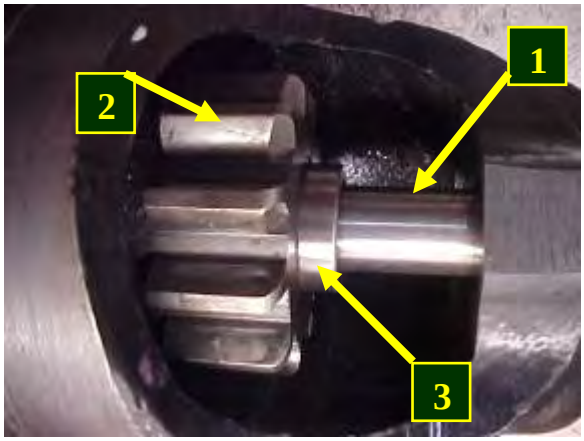

Figure 7B. For reference this figure shows a starter with normal wear: The shaft will not be discolored (Ref. 1), no wiping or polishing of the non-pressure side of the pinion teeth (Ref. 2), and the thrust bearing will not be damaged (Ref. 3).

Section 15.02.07

Damage Code: N/A

Vehicle Symptoms

An overrun starter is indicated by no-click, no-crank.

Post-removal Observations

All of the following must be observed to confirm overrun:

- Shaft discoloration (bluing) and excessive wear (Fig. 7A, Ref. 1).
- The non-pressure of the pinion tooth side will appear to be polished or wiped (Fig. 7A, Ref. 2).
- The thrust bearing will be damaged (Fig. 7A, Ref. 3).

Warranty Coverage

An overrun starter failure is **not warrantable**, because the starter remains engaged to the engine after the engine is already running.

Overrun is the engine turning the starter pinion at excessive speed damaging the shaft, thrust bearing and motor. Overrun is caused by one of the following:

- The vehicle operator held the ignition switch too long after the engine started running.
- A failed magnetic switch that remains closed after the ignition switch is released.
- A failed ignition switch that remains closed after it is released.

Loose B+ Terminal

Section 15.02.08

Damage Code:
155-001085690 (corroded), or
155-001085950 (loose)

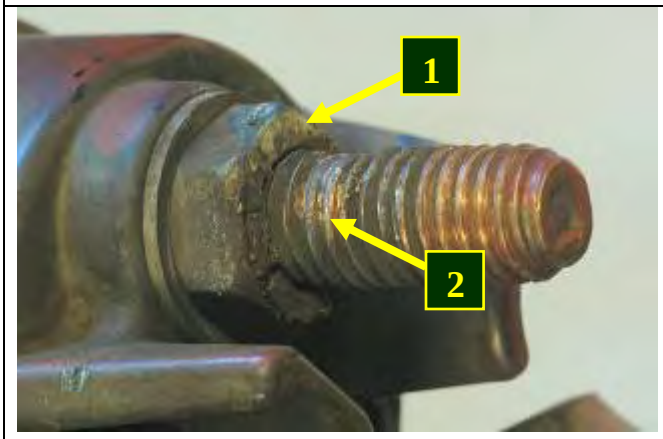

Figure 8A. This B+ terminal has evidence that the terminal nut became loose. The rust and dirt build-up on the terminal's contact surface (Fig. 8A, Ref. 1) and arcing marks (Fig. 8A, Ref. 2) indicate poor contact between the cable and B+ terminals.

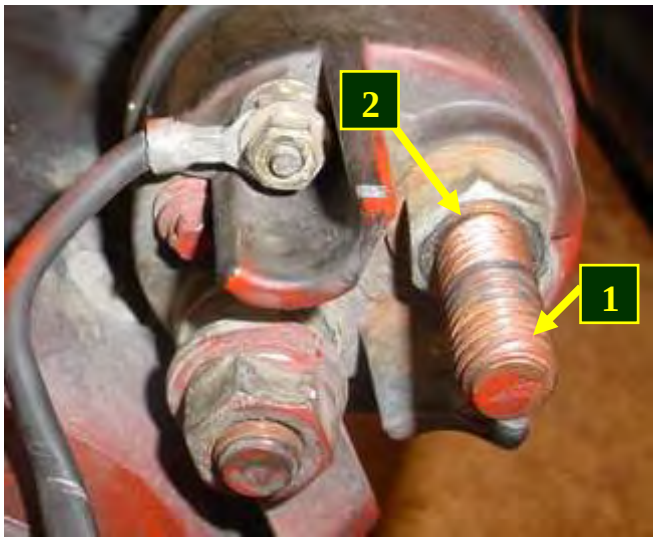

Figure 8B. For reference, this B+ terminal has a normal accumulation of rust and dirt build up on non-conducting surfaces (Fig. 8B, Ref. 1). Notice that the contact surface is not corroded (Fig. 8B, Ref. 2).

Vehicle Symptoms
A loose B+ terminal is indicated by <u>any one</u> of the following:

- intermittent no-click, no-crank
- slow cranking

Post-Removal Observations
<u>Any one</u> of the following indicate that the B+ terminal became loose:

- rust or dirt build-up on the terminal contact surface (Fig. 8A, Ref. 1)
- arcing marks on the terminal (Fig. 8A, Ref. 2)

NOTE: Terminals should be maintained periodically by removing the cables and brushing off the contact surfaces (See the vehicle's Maintenance Manual for details).

Warranty Coverage
A starter with evidence of a Loose B+ is **warrantable** if the condition occurs within the initial operating period. (Refer to the Initial Operating Period in section 1.5 of the Warranty Manual for details.)

A starter with evidence of a Loose B+ is **not warrantable** if any of the following apply:

- The starter is a replacement part.
- The damage occurred after the vehicle's initial operating period. (Refer to the Initial Operating Period in section 1.5 of the Warranty Manual for details.)

Damaged, Modified, Repaired, or Disassembled Starter	**Section 15.02.09** **Damage Code: N/A**
 Figure 9A. Cross-threaded B+ terminal.  Figure 9B. Terminal broken during removal. Excessive torque can break the starter terminals.  Figure 9C. Damaged Terminal.	**Observations** A damaged, modified, repaired, or disassembled starter is indicated by <u>any one</u> of the following: • damaged terminal (Fig. 9A, 9B, & 9C) • disassembled starter or missing components (Fig. 9D) • cracked solenoid end cap (Fig. 9E) • other damage IMPORTANT: Excessive torque while tightening or loosening a starter terminal can cause internal damage, break the terminal, or crack the solenoid end cap. **Warranty Coverage** Damaged, modified, repaired, or disassembled starters are **not warrantable.**

Damaged, Modified, Repaired, or Disassembled Starters (cont.)	**Section 15.02.09 (cont.)**
	Damage Code: N/A
 Figure 9D. Disassembled starter with solenoid removed.  Figure 9E. Cracked solenoid end cap.	**Observations** Refer to the previous page. **Warranty Coverage** Disassembled, damaged, modified, or repaired starters are **not warrantable.**

Non-Remy or Wrong Part Returned	**Section 15.02.10**
	Damage Code: N/A

Figure 10A. A non-Remy badge indicates that this is a non-Remy rebuilt starter.

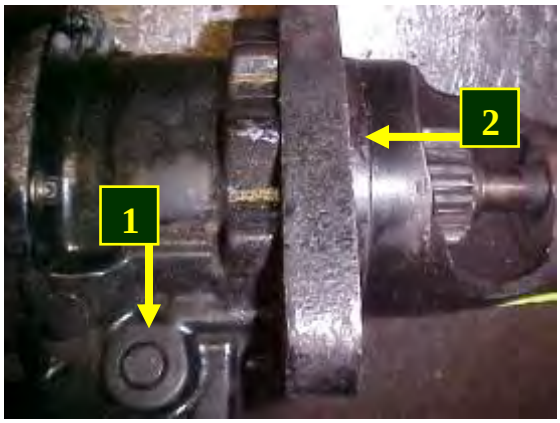

Figure 10B. Painted shift lever pin (Ref. 1) and painted mounting collar (Ref. 2) indicate that this is a non-Remy rebuilt starter.

Figure 10C. Painted solenoid indicates that this is a non-Remy rebuilt starter.

Observations

A non-Remy starter or wrong part returned is indicated by any one of the following:

- Starter without a Remy badge or with a non-Remy badge (Fig. 10A).
- Starter does not have a Remy part number.
- Starter is not compatible with vehicle.
- Starter does not match claimed primary failed item.
- Starter with Non-Remy components installed, such as a non-Remy screw (Fig 10E, Ref. 2).
- Paint on surfaces that Remy does not paint:
  - painted shift lever pin (Fig. 10B, Ref. 1)
  - painted mounting collar (Fig. 10B, Ref. 2)
  - painted Solenoid (Fig. 10C)
  - painted pinion gear (Fig. 10D)
  - painted motor strap (Fig. 10E, Ref. 1)
  - Painted pole shoe screw (Fig. 10F).

Warranty Coverage

Returned parts that do not match the claimed primary failed item are **not warrantable**.

Non-Remy Part or Wrong Part Returned (cont.)

Figure 10D. Painted pinion gear indicates that this is a non-Remy rebuilt starter.

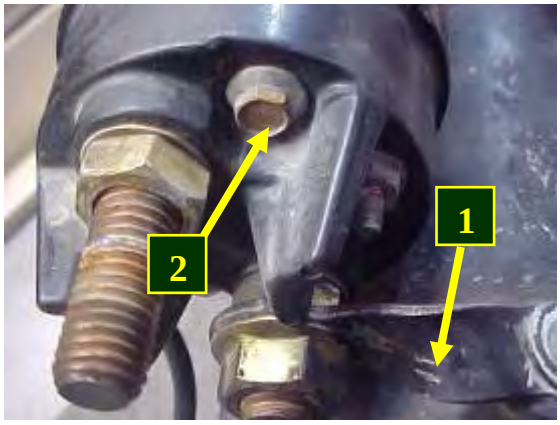

Figure 10E. The motor strap is painted over (Ref. 1), and there are hex-head screws installed (Ref. 2) where Remy uses TORX screws.

Figure 10F. The pole shoe screw is painted over indicates that this is a non-Remy rebuilt starter.

Section 15.02.10 (cont.)

Damage Code: N/A

See previous page for observations.

Warranty Coverage

Returned parts that do not match the claimed primary failed item are **not warrantable**.