



Mitsubishi Electric Heavy Duty Starters

Non Warrantable Failure Mode Descriptions

Mitsubishi Electric offers a 3 year/350,000 mile Limited Manufacturer's Warranty for HD Starters sold by Mitsubishi Electric Automotive America, Inc. to heavy and medium duty truck manufacturers for installation as original equipment. This warranty guarantees that the starter meets the appropriate OE specifications, ensures proper materials were used, and that good care and workmanship was used in the manufacturing process.

All Mitsubishi Electric HD Starter warranty claims require that the defective starters be returned to our Warranty Analysis center in Northville, Michigan for an extensive analysis by our engineers to determine the cause of the failure and to allow the continual improvement of our products.

Descriptions of the failure modes we typically find are shown below.

Overload failures:

- 1. Extreme temperature failure caused by excessive current draw while cranking.** Excessive heat damage occurs to the starter and the armature, caused from excessive current draw. This situation is likely to occur in extreme cold temperatures with batteries in a low state of charge (resulting in abnormally high current draw), cranking the starter while the truck is in gear and under heavy load, or insufficient use of cold-starting aids recommended by the engine manufacturer. Batteries must be charged properly and cold-starting aids used per the engine manufacturer's recommendations. Cold-starting aids are especially important with the introduction of ULSD (Ultra Low Sulphur Diesel) fuel. The truck should never be moved via the starter.
- 2. Extreme temperature failure caused by excessive cranking time.** Key switch is held on prior to engine starting for an extended period due to

issues such as engine problems (hard starting engine), plugged fuel filters (related to fuel gelling (ULSD), fuel tank contamination with algae, sediment, etc.), resulting heat damage to relay, solenoid and motor coils. If the truck does not start after 15-20 seconds of cranking time, turn off the key switch wait 20-30 seconds for the system to cool down and try again. Batteries must be charged properly, and the use of the proper fuel additives and cold-starting aids is very important.

Overrun failures:

- 1. Mechanical failure caused by the failure/interference of a related vehicle component:** Starter clutch damage due to some abnormal vehicle/system condition that prevented the pinion from dis-engaging and caused the pinion to stay engaged mechanically with the ring gear in an overrunning condition.
- 2. Extreme temperature failure caused by continuous current after engine has started:** The Starter's relay remains electrically energized by the vehicle-side wiring, and starter continues to spin for a period greater than five minutes, resulting in burnt coils. Commutator damage occurs due to extended current from prolonged rotation at no load. Not a driver error but fault of electrical system on vehicle side.

Mis-engagement failures:

- 1. Extreme temperature failure caused by a continuously engaged solenoid due to mis-engagement.** Mis-engagement occurs when the ring gear and pinion contact but cannot mesh or extend fully causing the main solenoid contact to stay open. Several truck-side issues can cause this, such as:
 - Worn or damaged ring-gear
 - Low battery state-of-charge
 - Energizing the starter while the flywheel is in motion
 - Excess wiring harness resistance in the starter control circuit

The continuous current will cause the solenoid coil to be damaged by excess heat within 30-40 seconds, preventing the proper operation of the solenoid. If the starter is not engaged properly (click-no crank), turn off the key switch and re-engage the starter after a few seconds.

Mechanical failures:

- 1. Commutator damage caused by extended and/or high load conditions:**
Operating the starter under conditions with abnormally high engine torque will weaken the commutator which can over time or depending on the severity can instantly & critically damage the commutator.
- 2. Pinion damage caused by starter engagement while engine is running:**
Starter is re-engaged while engine is running either by turning the key switch or by a fault in the key switch circuit on the vehicle side. This will cause the pinion teeth to grind beyond usability and the pinion itself could shear off.
- 3. Pinion damage caused by starter engagement while flywheel/ring-gear not fully stopped:** Starter is engaged while engine is not in a stopped position, caused by turning the key switch while the engine is rocking to a stop after an attempt to start. If the engine does not start on first crank attempt and the key is immediately turned again without waiting a few seconds the ring gear can rock back and impact the pinion causing teeth to break.
- 4. Component damage caused by operation in an extremely corrosive environment:** Starter components do not function correctly due to damage caused by a corrosive environment exceeding the vehicle manufacturer's specifications. Vehicle corrosion seems to be an increasing problem for the industry today, and as a result vehicles are frequently cleaned in truck washes and engine compartments are cleaned as well. The starter is sealed against normal road spray and splash, and an occasional low-pressure washing should not present a problem. High pressure and/or steam should not be used on the starter, and it should not be washed before allowing it to cool down to room/outside temperature.
- 5. Internal component damage caused by extreme water intrusion or submersion:** The starter failed due to extreme internal rust/corrosion damage due to the starter having been immersed in water that caused the commutator brushes to seize, rust and/or corrode preventing a proper current flow. The starter is designed with a drain tube to allow the exit of low-levels of moisture resulting from condensation due to the hot/cold

environment in which the starter operates. The starter is not designed to be immersed or submerged.

Physically/Customer Damaged:

Starter was returned physically damaged or modified from its original version. Starters returned with severe damage (hammer hits, etc.), or missing / removed / modified / damaged components (relays, etc.) do not allow the analysis of the starter in our Warranty Analysis center.

NTF (No Trouble Found):

After extensive and multiple test cycles in our Warranty Analysis Center, the starter is found to be a conforming part, meeting all specifications and performance requirements. No trouble is found with the starter.

In many cases, even though the replacement of a suspect starter with a new replacement starter may seem to have fixed the problem, the actual problem is not the starter. Low battery charge, corroded terminals, loose connections, faulty control circuit wiring, or faulty battery cables/connections can be the cause and be inadvertently remedied during the replacement of the starter. A starter found to be NTF can be re-installed on a vehicle without issue.

It is important to test any starter before submitting a warranty claim to verify that it has failed. A simple test performed before removing the starter from the truck will catch most NTF starters. Please see www.specmystarter.com for complete diagnostic procedures to help prevent the submission of this type of non-warrantable claim.