

# Solenoid Failures

## Topic Background:

- All these failures appears sporadically across 2021 and 2025 with low failure rates

## Progress Updates:

- Solenoid Hi/Pi Coils - Prol. Pow. App. (O/H Coils-Ext. Abut.) 25%
  - Sharp spike in failures, exceeding 51 cases/month at its highest.
  - Post- Nov 2023: Fluctuates at lower levels (~7–12 cases/month).
- Solenoid B+ Terminal - Loose (Customer) 11 %
  - Sharp spike in failures, exceeding 18 cases/month at its highest.
- System/OE - Out Of Warranty 10%
  - Irregular pattern (~5–35 cases/month) of warranty returns that exceed the product's time or mileage limits.
- System/OE - System Issue 6%,
- System/OE - Trouble Not Found 4%,
- CE Ground Terminal - Customer Nut Loose 2 %
- System/OE - External Circuit Control 1%



# Solenoid Hi/Pi Coils - Prol. Pow. App. (O/H Coils-Ext. Abut.)

## Topic Background:

- The solenoid failed a resistance test due to overheating.
- Prolonged energization caused thermal damage to the pull-in and hold-in coils, including solder reflow at the S-terminal.
- A teardown showed no issues with drive pack components.
- Physical signs such as discoloration and reflowed solder confirm the overheating.

## Progress Updates:

- Internal investigation at PHINIA. Application analysis of DD engines  
Collaboration with Freightliner to assess this failure mode as part of the truck application.
- A detailed teardown analysis, supported by laboratory testing, will be conducted to understand this failure mode at application level.





# Solenoid Hi/Pi Coils - Prol. Pow.(O/H Coils-Ext. Abut.)

## Current Status:

- Warranty data analysis
  - Failure rate remains steady
    - No increases identified at Phinia or DTNA
- Teardown of failed parts
  - Group of units confirmed prolonged power failures
  - Solenoid coils overheated
  - No damage to other starter components
    - Passed performance testing with new solenoids
- Phinia tracking 40SI breakpoint
  - Improved battery SOC should reduce failures
  - Phinia team working to quantify expectations
  - Data still immature

# Solenoid Hi/Pi Coils - Prol. Pow.(O/H Coils-Ext. Abut.)

## Next Steps

- DTNA and Phinia Engineering
  - DTNA has shared abutment algorithm
    - Phinia temperature study
      - Map solenoid temperature to abutment delay
      - Explore options to improve abutment response
- Identify Worst Case Applications
  - Targeted warranty analysis
    - Failures concentrated on certain applications?
  - Phinia to perform on vehicle measurements
- Phinia exploring options that may improve 39MT
  - 150MT soft start improvement
    - Gear ratio change
    - Improved ball armature shaft design
- **Phinia, DTNA engineering, and field staff will work to find a WOW test truck for further evaluation.**
- **Fleet may be able to assist?**

## DTNA Abutment Response

**Tooth to tooth detection time varies by temperature (oil temp)**

**Time to identify abutment condition:**

**0.25 sec at 20°C**

**1.0 sec at 0°C**

**1.5 sec at -20°C**

**2.0 sec at -40°C**

**When an abutment is identified:**

**Sequence of 60ms on and 60ms off is repeated 3 times**