

Volvo-TRW Trip Report / EA09-003 Drag-link Failure

Date: May 27, 2009

Location: Livonia, Michigan @ TRW Facility

Participants: Bob Esser, Test Engineer (VRTC)

Richard Boyd, Division Chief Heavy Truck (NHTSA)

Tim LaFon, Manager Regulatory Affairs (VOLVO)

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John Leidy, Director, Product Engineering & Customer Development (TRW)

Jim Rau, Executive Advisor (Non-TRW)

Peter Kivett, Investigator (NHTSA)

Purpose: / TRW gave a presentation concerning the evolution, proficiency and wear out properties of the ball socket located within the drag link and used in certain Volvo Trucks. The . They discussed the possible outcomes resulting from a lack of mandated Maintenance on the “service free” ball joint within the drag link. Eight ball sockets with various degrees of “wear” (from 1mm to 8 mm) were presented for visual and physical inspection by ODI and VRTC. .

Vehicles Involved: MY 1998 - 2005 Volvo VNL and VN trucks

Event: TRW presented the following information and provided an overview on each subject:

1. Volvo Drag Link G31 Design
2. Inspection Procedures
3. Product Demonstration

Volvo Drag Link G31 Ball Joint Design

- TRW defined all of Volvo’s technical requirements for build including
 1. Articulation
 2. Height
 3. Projected Service life
 - 625,000 miles
 4. Pull out strength at various stages of wear
 5. Integrity
 6. Design criteria
 - 35 mm ball joint exceeded required specs set by Volvo
- The drag link’s ball and socket arrangement
(Defined all the critical pieces and dimensions)
- The drag links are “maintenance free” with no provision to service or grease

- Defined required service maintenance over the life cycle of the ball joint

Inspection Procedure

Looseness:

- Precursor to drag link separation from *Atypical* use caused by:
 1. Water contamination
 2. Cut / damage boot seal
 3. Ball joint ingression over time
 - Extreme ball wear
 - compromised crimp seal
- Atypical ball joint end play (ball & socket lash) progressive and detectable during prescribed maintenances
 1. detectable @ 2.5 mm
 2. 4.1 mm wear to reach free play
 3. > 8 mm wear progression to separation
 - End play has exceeded maximum travel
 - Spring feel is ineffective
 - At critical ball dimension to where the ball joint can fall apart
- Time to failure if no service maintenance is performed
 1. 6 ~ 8 (2 years) required quarterly inspections must be missed before failure
 - Reaching the < 8 mm ball stud dimension
- Average failures occur at 502,000 miles(80% - 88% of design life 625,000 miles)
- Proper Inspections prescribed Intervals
 1. Volvo every 4 months
 2. FMCSA – annually minimum
 3. Volvo updated service PM & TSB bulletin trucks (what is date and Number?)
 - Including seal bulletin
 4. TRW bulletin
 - #LNK-105 (no free lash X hand)
- Validation and Fatigue Testing
 - One week equals 650,000 miles of typical usage

Product Demonstration

- TRW had available 7 drag link ball joints for display each incorporating different ball stud end play measurements
 - There is a noticeable difference concerning the end play with the displayed models
 - The display models ranged between zero lash sprung loaded to 8 mm max wear ball socket diameter in increments of 2 mm
- ODI/VRTC will take possession of these ball joints for future testing

The presentation lasted 3.5 hours with a demonstration/question and answer session that followed. The joint meeting with TRW/Volvo increased ODI's understanding of the

product line, the drag link evolution, projected life expectancy and wear out symptoms
ODI also now has a better understanding of the impact when required
maintenances/inspections are not performed at recommended intervals.

Peter Kivett

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