SS 1033122 – Asymmetric Injection – GHG17 FE1 DD13/DD15 Engines (2016 trucks and newer)

Applicable Vehicles

Current 2016 Cascadias and newer (P3) with DD13/DD15

2017 New Cascadias and newer (P4) with DD13/DD15

Issue

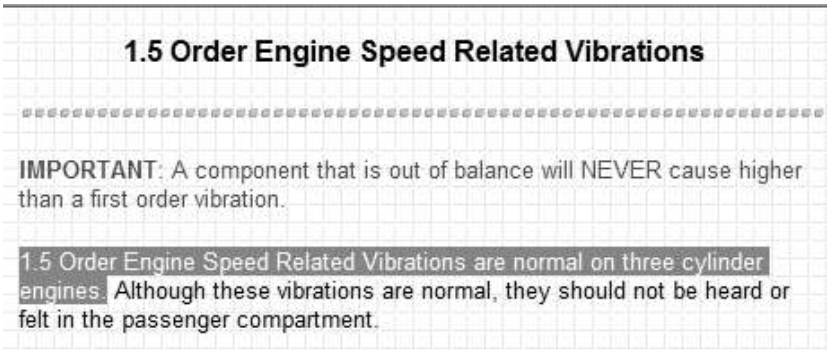
Intermittent vibration felt while using light engine demand over the road (OTR)

Overview

Asymmetric Injection (AI) is an aftertreatment system (ATS) strategy in order to increase exhaust temperatures for regeneration functions on vehicles that no longer have an Intake Throttle Valve (ITV).

The word “asymmetry” is used to signify the fueling-varying difference across certain sets of cylinders on the engine and in any ATS-DPF zones of 0-3. The amount of the asymmetry is controlled by engine speed and load. In some cases, AI can be as little as no change in fuel amount and as much as double fuel to selected cylinders. This is noted with similar sounding ATS characteristics during a stationary regeneration.

AI will normally occur at engine speeds greater than 700 RPM and below roughly 1300 ft-lbs of torque. Because of this, an increase of vibrations will be observed up to an order of 1.5, but is **NOT** an indication of powertrain issues contrary to common literature:

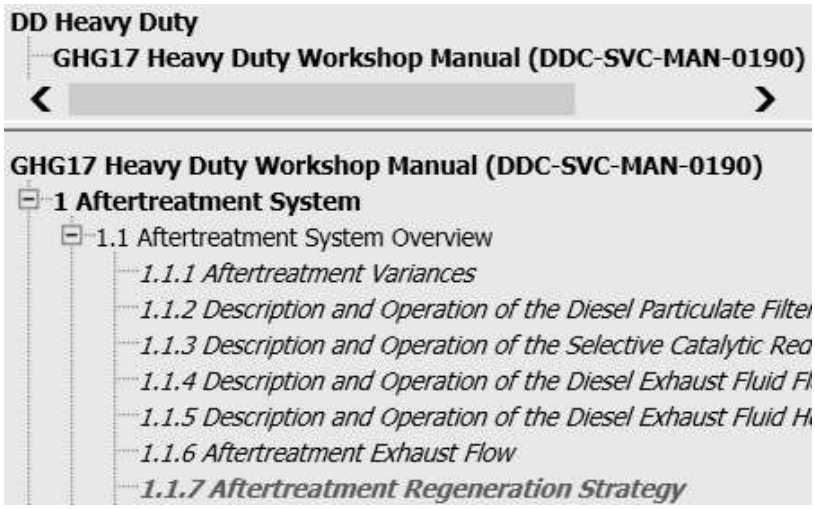


1.5 Order Engine Speed Related Vibrations

IMPORTANT: A component that is out of balance will NEVER cause higher than a first order vibration.

1.5 Order Engine Speed Related Vibrations are normal on three cylinder engines. Although these vibrations are normal, they should not be heard or felt in the passenger compartment.

Further information can be found on Power Service Literature (PSL) in: GHG17 Heady Duty Workshop Manual



Solution

Customer/Tech education of this ATS fueling strategy for new (2016 and newer in Cascadias, for both P3 and P4) DD13/DD15 engines will be necessary and is not to be an indication of any concern for Imminent PowerTrain Failure (IPTF).

Case Study

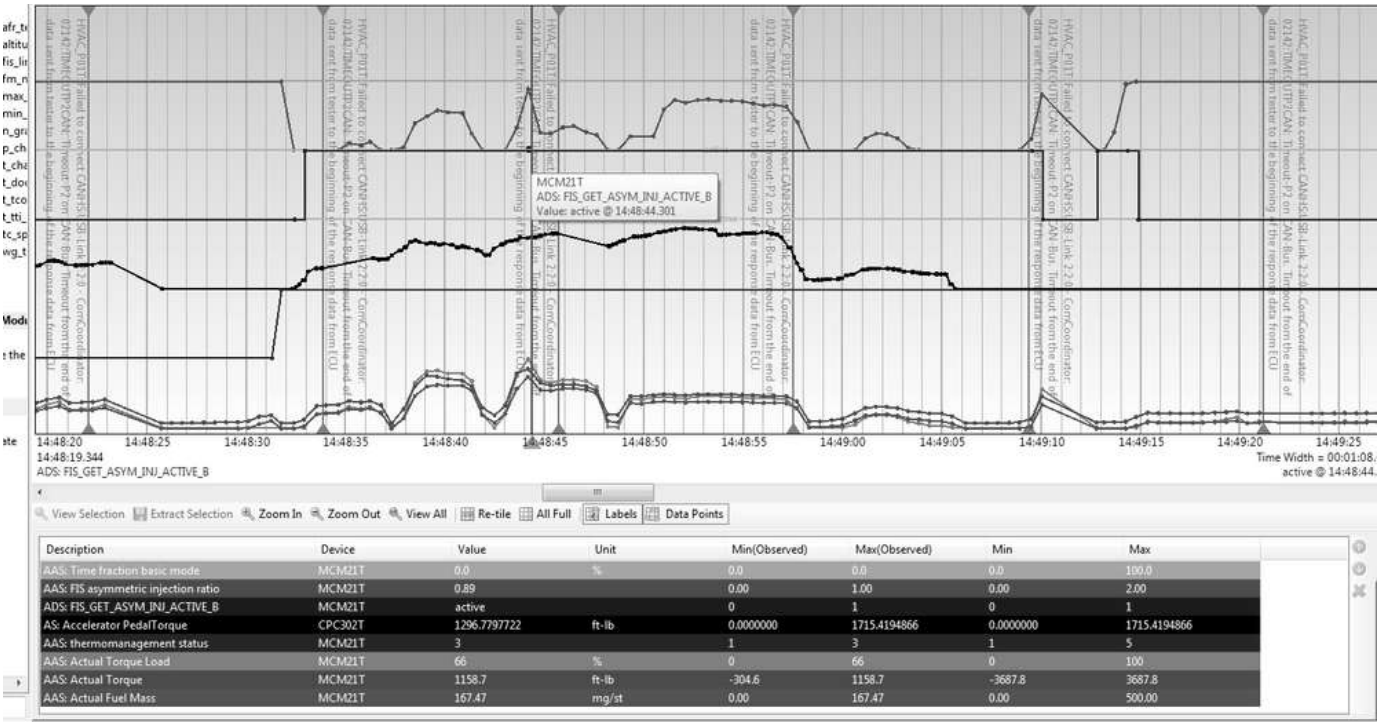
Here is an example of a P4 (New Cascadia) that has had vibration complaints.

"As Received" EVA Readings:

Reading #	Trans Ratio	MPH	EVA RPM	Eng. RPM	G Force	Associated Component
1	1.00	57	14	1100	.07	T2
2	1.00	67	14	1300	.07	4K
3						
4						
5						

Associated component: Prop shaft (P); Tires (T); Engine (E)

Utilizing Diagnostic Link (DLink), you can monitor these signals OTR to observe and verify AI is initiated and active:



Labels :

Freightliner **New Cascadia** **Powertrain & Driveline** **Western Star**

asymmetric injection

cascadia driveshaft vibration engine vibration fe1 ghg17 new cascadia ngc p3 p4 tire vibration vibration

Add tags

19 Kudos

Comments

Robert_Cadell_J 06-13-2017 04:30 PM

So in other words were doing in cylinder dosing as needed to help with light load and low engine rpm. ?

Rob "Doc" Cadell

Diagnostic Technician

TransChicago Truck Group BFWD

Shorewood IL 60404

803 917 5397 cell

Keep digging you'll find the answer

Travis_Gladbach 06-13-2017 05:56 PM

Rob, I could be wrong but this is my interpretation . Thievy are not dosing in cylinder like mid range cummins. When asymmetric injection is occouring they are making some cylinders run at higher load (more injection) = higher exhaust temp to get doc inlet hot enough for dosing with doser injector . This replaces the need of the intake throttle valve. It feels like viberations to to drivers ands other . In short computer controlled over fueling injectors Travis

1 Kudo

Scott_Trippel 06-14-2017 07:19 AM

From the ATS guide

Engine control strategy used to increase exhaust temps for ATS over the road regens. No more ITV on DD15 and DD13

Biasing of fuel injection quantity to rear bank cyls 4 to 6

Biasing amount varies with speed and load, primarily with load. As little as none to as much as full = double the amount

Similar to GHG14 production for parked regen, but does not use engine brake.

2 Kudos

Kyle_Smith3 06-14-2017 09:54 AM

VERY HELPFUL, THANKS

Noah_Alandt 06-14-2017 10:49 AM

When you look at my example of the chart in DLink, those are the majority of signals needed to confirm the amount of AI when this fueling strategy is happening. It will and DOES cause vibration complaints because the firing order of the 2nd bank is more heavily loaded than the front bank causing an uneven loping in power production to the PT.

This is actually more efficient than HC dosing in the exhaust BECAUSE that fuel/heat is actually being used in the combustion chamber in lieu of the DOC in the ATS.

So with this information you cannot find in any driver's manual, you can and will get more complaints of "driveline" vibration OTR that comes and goes. The best thing to do when confirming this is to take your EVA2 **and** your DLink in addition to monitor the thermal mode when the vibration is occurring and the ASYM_INJ_ACTIVE signal. Keep in mind, when the ASYM INJ RATIO is close to "1," the amount of injection difference is close to 0. When the ratio is "0," technically the front bank is no longer firing (or very little for that matter). You can also observe how the torque request changes in relationship to the AI ratio. Therefore, when monitoring your vibration complaint, observe how that changes with the ASYM INJ ratio and the magnitude of the vibration.

Does the vibration come in with stronger magnitude when the ratio is closer to 0? Then you can see the relationship with the overall effect on vibration perception.

2 Kudos

Melvin_Deboer 06-16-2017 07:36 AM

Since the Western Star 5700XE and Cascadia share the same powertrain, shouldn't the "applicable vehicles" include the Western Star 5700XE as well?

1 Kudo

Noah_Alandt 06-16-2017 08:58 AM

Indeed...that is very true

Jarrod_Selkirk

06-21-2017 07:39 AM

Good info! Thanks!

Chaz_Trimble

06-21-2017 11:13 AM

This type of information is what makes SS and TTF great.

2 Kudos

Chris_Reed

09-20-2017 11:00 AM

IF YOU REFER TO THE CASE STUDY IN THIS SOLUTION IT SHOWS THE EVA READINGS WERE TAKEN IN DIRECT DRIVE. AS FAR AS WE KNOW, EVA READINGS ARE NEVER TO BE TAKEN IN DIRECT DRIVE (1.0 TRANS RATIO) CANT TELL BETWEEN ENGINE OR PROP SHAFT SPEED BECAUSE THEY ARE SPINNING AT SAME RPM.

1 Kudo

David_Lane

09-20-2017 11:21 AM

Is Asymmetric Injection used during PTO Dosing?

2 Kudos

Scott_Trippel

09-20-2017 03:32 PM

good question

1 Kudo

Robert_Cadell_J

09-21-2017 10:57 AM

if its in pto dosing regen, I would think that the same strategy would apply,

David_Lane

09-21-2017 11:47 AM

I would agree with you, but it's strange that Detroit hasn't published anything on PTO regeneration strategy. Maybe that's because it's the same strategy as parked? Shure would be nice to know exactly what is going on so that we can advise our customers on an operating routine to minimize downtime from parked regenerations.

1 Kudo

Robert_Cadell_J 09-21-2017 11:51 AM

thanks it just makes sense, and I agree with you theres a lot of questions we have with no answers product updates, changes, software changes etc. we all are caught off guard then the customer is upset then we are upset. its a big circle but when we find the issue its very satisfying

Nahum_Veach 08-15-2019 06:29 AM

Ran into a Next Gen with a driver complaint of severe noise (growling) during parked regen and bob-tailing at lower speeds. Unit has a manual transmission and stethoscope pointed to noise emanating from the transmission area. The tech noted that the transmission cooler lines vibrate like crazy. This asymmetrical injection strategy may be causing manual transmission to resonate and produce this growling noise more so than a DT12 transmission. VIN is LS3337.

5 Kudos

Scott_Trippel 06-26-2020 06:26 AM

I can see that happening easily.