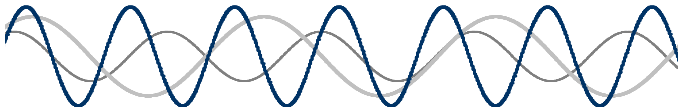
TRUCK VIBRATION TECHNOLOGY



Getting the Most Out of Your System
December 1, 2008

Over the last two years TVT has looked at vibration data from over 200 trucks. We continue to learn from our experience. Here are some suggestions that will help you get to the 95% effectiveness in vibration reduction that we have seen the best users get out of the Eaton Vibration Tool. This is a supplement to the list that was sent to you in March 2008.

Engine Vibration

1. If engine vibration turns red on your Basic System (or even if it is still green) and it feels like an engine miss, it probably is. Send the data to your DSM or to TVT for further analysis. We can format it so that engine companies' service people and/or engineering will respond to the evidence.
2. If engine vibration turns red on your system at a consistent engine speed (regardless of transmission ratio) when the truck is under heavy throttle and feels like a buzz, there is probably a resonance in the engine or other part of the truck that is being excited. Your DSM or TVT can help with this analysis and work to solve the problem.
3. We have seen a couple of instances of engine control instability. If both speed signals and the vibration are all moving together at about 5 to 10 Hz (which can be determined by your DSM or TVT), send the data to your engine supplier. It is most likely that he will have software to correct the problem.

Drive Shaft Vibration

1. Allison transmissions have about 0.010 inch radial slop in their output yoke splines. For long heavy drive shafts, the best shaft balance may not be enough to overcome this. Use the softest carrier bearing bushings to minimize this vibration.
2. We continue to see a lot of inferior drive shaft balancing shops. If the Basic System has indicated a drive shaft vibration issue, and you have checked all the yokes and slip splines and they are less than 0.005 inch run-out, and have sent your shafts out for a supposedly good balance and have not improved the vibration, challenge your driveshaft shop. If all else fails, TVT will recommend a top notch facility. (This may involve shipping.)

Wheel End Vibration

1. The time proven technique for fixing wheel end vibration problems is to first measure all tire run outs, true those tires with run-outs greater than 0.040 inch, then balance **all the wheels <u>on the truck</u>.** Some wheel and frame shops with on vehicle wheel balancers shy away from removing the axle shafts and balancing the drive wheels, because they have

not tried it. In the lion's share of the cases where we have insisted that this be done, it has cured the problem.
2. We worked on a truck that was very sensitive to trailer wheel input. If the tractor wheels have been trued and balanced without any effect, check the condition of the trailer tires. Replace or true if they have significant run out.
3. Sometimes frame, tire and suspension can be especially sensitive to wheel end excitation. If tractor and trailer tires are trued and balanced without getting the problem solved, check with OEM engineering.

Clutch Torsionals
1. If you have a vibration that turns the Clutch Torsional line red at about 1300 engine rpm under heavy load, capture the data and send to your DSM or TVT. We will work with the supplier to get special clutch plates with controlled damping to address the problem.

U-joints
1. If you have a vibration that turns the u-joint line red on the Basic System but only momentarily under heavy throttle in lower gears and the drive line angles measure to be acceptable statically, there is a chance that axles are rotating excessively under heavy torque. This should be addressed with OEM engineering.

General
1. TVT has extra vibration sensors, cables, speed sensors, special brackets and all the support equipment you need for every engine and transmission. Call for help.
2. Please feel free to call TVT when you have any issues or questions. We are committed to help you get the best payback from your system. It is from your success that we hope to grow the use of the tool. If you have an unusual problem that you are wrestling with, we would like to hear about it. By attacking it and solving it, we all learn and get more effective, which is what investing in the tool is all about.

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