

Engineering Analysis by ZeroCrisis on 05-12-2016 of files sent to him for inspection
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There were 2 files. One was an ecfg file “3409195.ecfg” and the other was file “diesel spec def delete cm2250”...

Initial Problems...

- Investigating the contents of file “3409195.ecfg” reveals that it is in fact NOT for a CM2250 engine at all. It is in fact for a CM871 engine software phase 8.0.0.33. The file is simply a copy of master ecfg file “BAC_CM87X_8.0.0.33.ecfg”, and is a since long out-dated ecfg file that should no longer be used on any engines. When the files were sent, it was implied that the “3409195.ecfg” file was for reading the other CM2250 file. This is clearly NOT the correct file at all, is an out of date file, and is not even for the same class of engine.

Moving on to the “diesel spec def delete cm2250” file... This is in fact a “Monarch” BBZ file for a CM2250 engine. It requires software phase 7.70.0.53 as stated in its header and ecfg file “BBZ_CM22xx_7.70.0.53.ecfg” should be used to read it. The Assigned ECM software calibration and version for the engine is “CL10114.33”. A compare to the master release version of this calibration will be used to analyze its contents and reveal what, if any alterations have been made to it.

Both the master and this file will be documented in full detail then compared. The results are as follows...

The comparison reveals the following truck information...

Truck: Volvo 780

Engine Serial Number: { Omitted from the public report }

Model: ISX15 450ST (Smart Torque). Built Aug. 21, 2012.

Original Owner: { Omitted from the public report }

Problems...

- The Original ECM code was CL10138 and NOT CL10114. The CL10114 calibration is meant for a different style of injectors and creates several minor problems with fuel, injection mapping, and cylinder pressure calculations/stability. This also somewhat invalidates all injector trim codes and promotes cylinder imbalance conditions. As well, the accelerator pedal data for the vehicle (meant for a paccar product and not a Volvo product) is different. This can lead to response issues, possibly making the truck feel more sluggish than it should be for its power setting. All air density and charge flow mapping is for a kenworth/Peterbilt (Paccar product) truck and is not compatible with Volvo

products. This will lead to incorrect charge calculations and cause the turbocharger to provide the incorrect amount of air flow, lowering the vehicles efficiency a bit. The Altitude and Density mapping is incorrect in this calibration for this vehicle as well. Incorrect Altitude corrections will lead to amplified efficiency problems at different elevations. There are several moderate issues with the calibration in reference to NOx gas, EGR fraction, etc. and the calibration is incorrect for the exhaust piping and size for the truck as well. Again, this leads to efficiency issues regardless of other alterations.

The calibration CL10114.33 calibration is clearly not designed for a Volvo truck and it should not be in this vehicle.

Alterations ...

The following are considered potentially harmful to the engine and its operation.

- Exhaust pressure limiting detection has been disabled. This has the potential to allow for a dropped valve during hard engine braking, resulting in damage to the engine/head.
- All derates and shutdowns are disabled. This is not harmful in itself, but it must be clearly understood by anyone driving the vehicle. It is left to the operator to turn the key-switch off when the engine has an alarm that can damage the engine such as low oil or coolant. Long periods of unattended operation such as long idle or remote/unattended PTO operation are not recommended.
- The engine brake settings have been heavily altered to the point of potential damage to the engine. It will only be a matter of time before the head develops cracks between the valve seats due to such alterations. Also the engine brake is not going to operate correctly and feel weak at times, but too strong during other conditions.
- 100 N-m of torque has been added to all structural and request torque tables. This alteration increases the actual HP rating of the engine to a requested 589 HP, and is inconsistent with the data plate settings that are revealed when connecting to the engine, as it is only set to show the engine is set to 550 HP. Simple editing of GTIS in the calibration could have prevented this if the desired HP setting was in fact 589 HP.
- Vehicle Acceleration management has been partially disabled, making the engine over fuel during acceleration, possibly producing black smoke in an inefficient manner.
- A complete lack of corrections to the charge flow and turbocharger programming after hardware modification to the exhaust and EGR system ... This sends the turbocharger into chaos and sets it up for over-boosting and over-spooling,

eventually causing turbocharger and eventually cylinder damage under high torque loads.

- The fuel system stability control is inoperable due to instability in the engine charge flow control.
- The average fueling error is maxed out at a full 10% on all 6 cylinders. This has halted the ECM's ability to do live cylinder corrections and disables all cylinder balancing ability, as it is off the scale for possible correction. As well, live cylinder balancing has been completely disabled in the ECM, creating conditions for an unbalanced engine. This can shorten the lifespan of the engine depending on how severe it is.
- The cylinder convergence error counter is maxed out for all 6 cylinders, indicating there is an error in all 6 injectors and their trims. This is consistent with incorrect charge circuit calculations and incorrect cylinder balance data.

The following engine errors have been suppressed...

3138 -- Engine Exhaust Gas Recirculation Outlet Pressure - Data erratic, intermittent or incorrect (The component was Not properly unassigned from the ECM during the Delete programming).

2771 -- Aftertreatment 1 Outlet NOx Sensor - Abnormal update rate (The component was Not properly unassigned from the ECM during the Delete programming)

3232 -- Aftertreatment 1 Intake NOx Sensor - Abnormal update rate (The component was Not properly unassigned from the ECM during the Delete programming)

2288 -- Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Least Severe Level and .. 687 -- Turbocharger 1 Speed - Data Valid But Below Normal Operating Range - Moderately Severe Level (The turbocharger was not re-programmed for non-egr operation and now likely easily overs-pools. The error was suppressed, so not it is a matter of time before the turbo destroys itself with no warning.

3597 -- Aftertreatment Diesel Exhaust Fluid Controller - Abnormal update rate (The component was Not properly unassigned from the ECM during the Delete programming)

1867 -- Exhaust Gas Recirculation Temperature - Data erratic, intermittent or incorrect (The component was Not properly unassigned from the ECM during the Delete programming)

1942 -- Crankcase Pressure - Data erratic, intermittent or incorrect (The component was Not properly unassigned from the ECM during the Delete programming)

3733 -- Crankcase Breather Filter Heater Circuit - Voltage above normal, or shorted to high source (The component was Not properly unassigned from the ECM during the Delete programming)

1896 -- EGR Valve Controller - Out of Calibration (The component was Not properly unassigned from the ECM during the Delete programming)

1866 -- Exhaust Gas Recirculation Differential Pressure - Data erratic, intermittent or incorrect (The component was Not properly unassigned from the ECM during the Delete programming)

3135 -- Aftertreatment 1 Diesel Particulate Filter Outlet Pressure - Data erratic, intermittent or incorrect (The component was Not properly unassigned from the ECM during the Delete programming)

1885 -- Aftertreatment 1 Intake NOx Sensor Circuit - Voltage below normal, or shorted to low source (The component was Not properly unassigned from the ECM during the Delete programming).

This Calibration is clearly an attempt to perform an EGR/DPF/SCR delete, but it is unfinished. Here are some of the things still not set properly, or are incorrect ...

- The Exhaust Aftertreatment task manager has not been disabled and has mission data for passive and parked regen cycles it is still trying to perform but can not due to internal errors.
- The EGR Actuator (Valve) has not been properly shut down or unassigned, and is still trying to perform cleaning cycles and other functions.
- The engine is still trying to control NOx and EGR fraction from within the cylinders as a fall-back to normal methods because the functions have not been turned off. Fueling and in injection mapping is still being heavily altered by these managers, causing power to fall off, final crank angle to be too low, and fuel-to-air ratios to suffer. As well, Hydrocarbon, Particulate Matter, and NOx estimation logic is still active, altering the fueling and injection mapping states.
- There is no control of mode vectoring or stable control of the actual engine operating modes. This sends the engine and turbocharger into slight chaos depending on the engine mode it jumps into unpredictably. This instability is amplified by the fact that there is also no corrections in injection mapping, charge flow, or air flow ratio. There is also no corrections or compensations based upon the compression ratio of the engine at all, especially for non-egr operation.

This makes the engine less efficient than it should be and sets it up for a shortened lifespan.

- Pulse injection is still set to control emissions through backup methods. This makes the engine slightly less fuel efficient than it can be and will cause exhaust heating and back-pressure issues due to the improper corrections.
- None of the multiple layers of emissions management has been disabled. This heavily alters fuel to air ratios and injection mapping in a negative way and sets the engine up for excess vibration when combined with the improper air-flow mentioned above.
- Many of the tables have been altered in operating modes that are no longer used such as parked and passive regen modes. It makes the calibration appear as if someone was poking around blindly trying different things that were unsuccessful.
- The temperature adjustment feature for the charge circuit has been disabled. This causes incorrect cylinder pressures based on inlet temps and sets the engine up for possible failure in extreme hot environments such as desert conditions.

There are many more problems than the ones highlighted above. The overall consensus is that it clearly points to instability in the ECM, setting it up for conditions that are far from optimal. This results in unpredictable conditions and mode changes that can and will eventually lead to engine damage.