Title: Development of a Dust in Fuel Durability Test of Common Rail Fuel System and Filtration Systems Components for High Horsepower Engines

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Abstract:

Development of a dust in fuel engine-based durability test has been pursued following the introduction of the Modular Common Rail fuel system (MCRS) on Cummins High Horsepower QSK19 Tier 3 industrial engines in 2005. During extensive field testing and first customer usage, it became evident that there was a lack of robustness of some components of the MCRS to dust and hard particle contamination in fuels. Lack of robustness to hard particle wear at critical sealing and control surfaces is a known issue with most modern high pressure common rail systems. An engine-based dust durability test is desired to simulate the known field operational problems and validate the effectiveness of the filtration system and fuel system to known levels of fuel contamination. Rig-based dust contaminated fuel tests for components exist, but do not effectively test the complete engine system in realistic duty cycles.

This presentation describes a test method which is parented off the ISO 4548 multipass lube oil filtration test method and applied to dust in fuel contamination. It has been now developed for release within Cummins as a new test method. The test has proven to be useful as a predictor of filter effectiveness and efficiency and filter change intervals. It had clearly shown correlation between hard particle contaminated fuel and immediate wear rates of injector components (as determined by injector leakage). It has also demonstrated the effects of filtration media plugging, reentrainment of hard particles into the clean side of the system, effects of cyclic operation of the engine with vibration, flow surge and shock loading to the filtration system. Particle counters conforming to ISO 11171 calibration method were used to measure dynamic contamination levels at initial and final (polishing) filter inlet and outlet levels to show effectiveness changes during an extended period of operation.