EXTENDED ABSTRACT

Experiences on E85 Dual-Fuel Combustion

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E85 high-speed dual fuel engine experimental studies

In these studies a six-cylinder high-speed heavy-duty engine was modified from a direct injection production engine to a dual-fuel engine running on E85 as the main fuel and diesel fuel as the ignition fuel. The modifications consisted of a new intake manifold with port fuel injection (PFI) system and parallel ECU for PFI control. The measurement set-up is in figure 1.

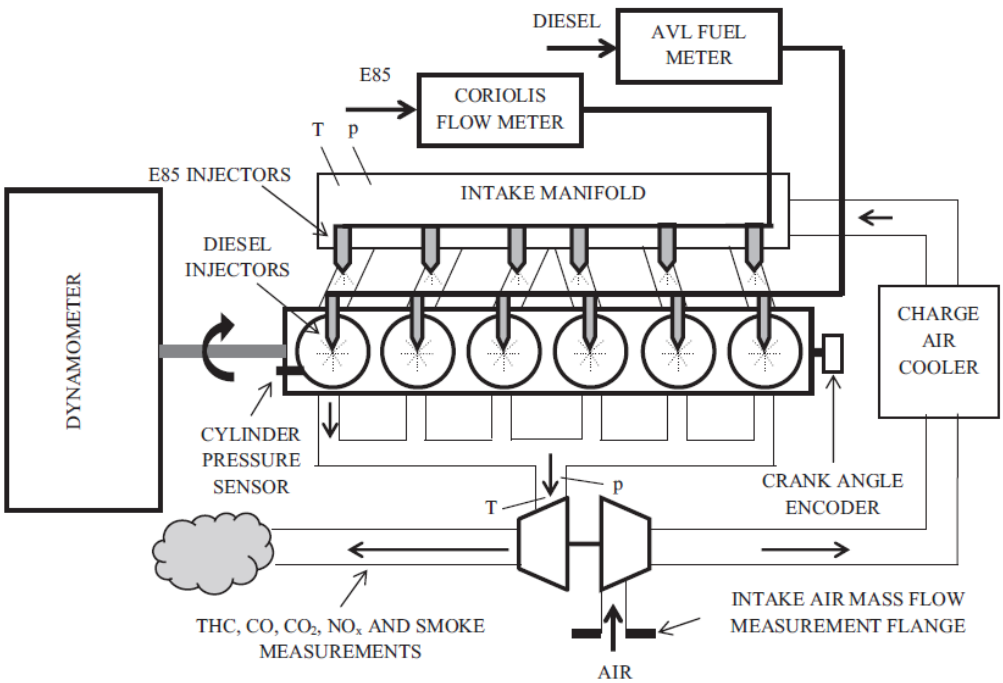

Figure 1. *The experimental set-up in E85 dual-fuel tests.*

The studies were made in two phases: first without charge air cooling at several engine load conditions and secondly, with charge air cooling at most interesting load conditions found in first test phase. The results from these studies proved the potential of E85 as candidate for alternative heavy-duty engine fuel, but also showed the main problems of the concept. At the best, the energy based E85 fuel share was close to 90% while at worst it was around 30%. The limiting factors for maximum E85 share were too high pressure rise rate (PRR) and minimum injection quantity of diesel injector, which was kept as original. Charge air-cooling

decreased the PRR and thus higher E85 shares were achieved – especially at high load conditions. The effect of the charge air temperature at 100% load is presented in figure 2.

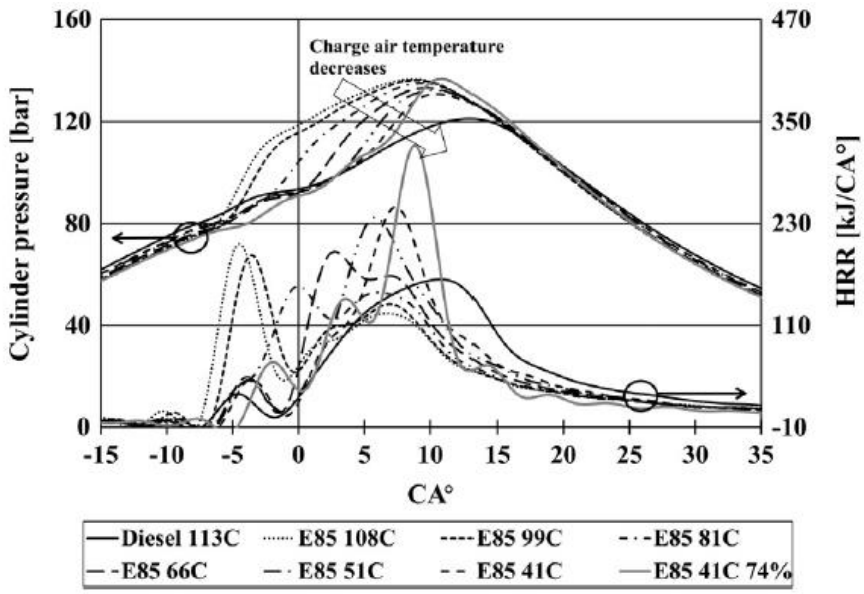

Figure 2. *The effect of the charge air temperature at 11.8bar BMEP and 2300rpm. The maximum E85 share at the lowest temperature was 74%, while at other temperatures the share was constant 36%.*

The drawbacks on E85 dual-fuel concept were very high CO and THC emissions, which also caused decreased combustion efficiency. These increased emissions, will require exhaust gas after-treatment to fulfill the emission legislations. Notable was, that faster combustion and better combustion phasing, compensated the lower combustion efficiency. The study also showed the charge air temperature and air/fuel-ratio needs to be controlled, to reach high E85 share,.

As a conclusion of these studies, the E85 has evident potential as fuel for dual-fuel combustion, but there are still clear obstacles to be won. The main problems are related to high CO and THC emissions, which mainly caused by PFI concept and high lambda.