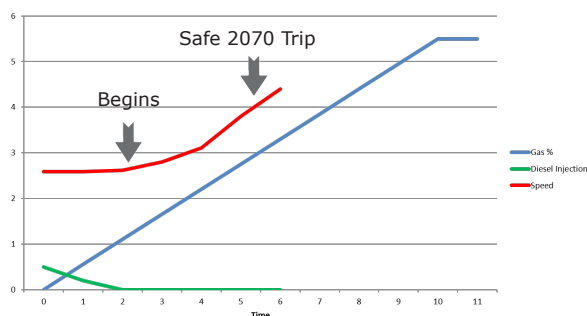
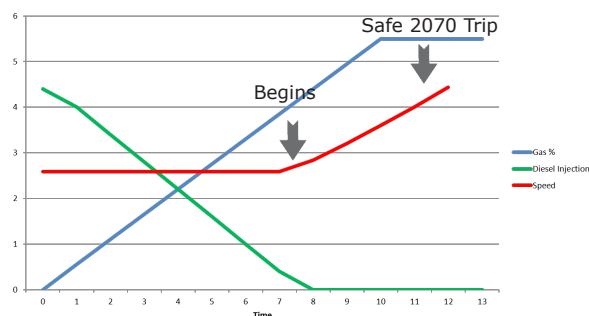


IEC & MTU Test Program: Runaway is No Longer a Theory

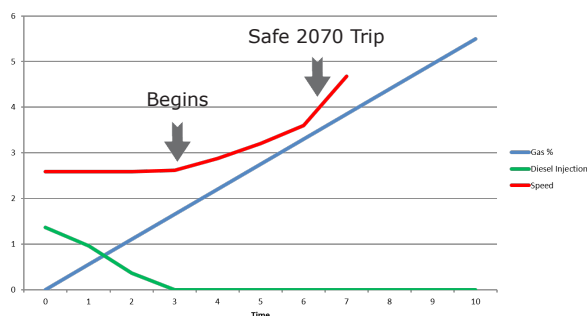
In 2017, IEC and MTU completed an extensive set of tests in Australia using an MTU 12V4000 (2105 kW) engine. The results illustrated how rapidly the engine can run out of control on relatively low gas concentrations.



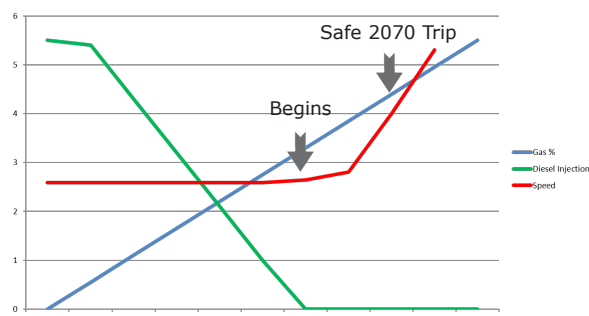
For this test, the turbocharger was removed to show how a smaller, naturally-aspirated diesel engine would react. With no load, the engine runs with a low fuel injection rate (green line). As gas is mixed into the intake air, the fuel drops to zero with the gas concentration of just 1.1% (22% of LEL). Runaway begins and the engine accelerates in 3.6 seconds beyond the red line to the pre-set RPM trip point. The automatic system closes the intakes when the gas is at 3.1% (62% of LEL). MTU recorded 5.5 seconds from a gas leak starting to the overspeed valves operating.



The same configuration was operated at full load, as found on pumps or light towers. This meant higher fuel rate and more time before it dropped to zero. Runaway then begins at a gas level of 4.1% (82% of LEL) and the engine accelerates up beyond the RPM red line in another 4.6 seconds. The automatic overspeed system closes the intakes when the gas is at 5.1% (110% of LEL) and, critically, before valve bounce creates flames. While this is a slower reaction than experienced at no load, the gas cloud would be close to flammable range. Without positive closing of the intakes, the runaway and consequent valve bounce would likely ignite the (above LEL) gas cloud, estimated at 6.5 seconds after runaway began.



This standard engine configuration, with turbocharger, was operated at 7% load. The fuel rate is therefore low and drops to zero quickly. Runaway begins at a gas level of just 1.4% (28% of LEL), and the engine accelerates beyond the red line only 5.5 seconds later. The automatic system operates when the gas is at 3.6% (72% of LEL). In this situation there is little time for manual operation of any intake shutdown device, and only automatic sensing will prevent an explosion.



At full load, the fuel rate is high initially and drops to zero over a longer time. Runaway begins at a gas level of 3.3% (66% of LEL) and the engine accelerates rapidly to the red line. The automatic overspeed system closes the intakes when the gas is at 4.6% (92% of LEL). This is the second highest gas level recorded, but it's still below the flammable range. The time from runaway beginning to an actual gas explosion would be about 6 seconds.