# The effect of transient operation on diesel particulate emission

Ali Zare[1, 2], Timothy Bodisco[1, 2], Md Mostafizur Rahman[1], Zoran Ristovski[2, 3], Richard J. Brown[1, 2]

[1]Biofuel Engine Research Facility, Queensland University of Technology (QUT), Brisbane, Queensland 4001, Australia
[2]School of Chemistry, Physics and Mechanical Engineering, QUT, Brisbane, Queensland 4001, Australia
[3] International Laboratories for Air Quality and Health, QUT, Brisbane, Queensland 4001, Australia
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Presenting author email: ali.zare@qut.edu.au

One adult male inhales about 10.8 $m^3$ of air per day. Therefore, achieving good air quality is a global concern from a health point of view. As one of the most prevalent toxic pollution sources are emissions from diesel fleets, researchers have been introducing various approaches to reduce the exhaust emission, such as introducing new fuels and engine modifications (Ristovski, 2012).

Most of the current research has focused on emission reduction methods in steady-state operating modes; however, the daily driving schedule of automotive and truck vehicles is inherently unsteady. Moreover, the most critical conditions encountered by engines are met during transient operations. Despite the increased complexity, results from tests involving transient operation are more closely related to reality than steady-state testing, in most cases (Giakoumis, 2012).

Generally, transient operation could refer to operating conditions that are not steady-state, such as: free acceleration, load changes, cold start and driving cycles. For example, cold start emissions from a heavy duty vehicle reported to be 15 times higher than their steady-state values (Giakoumis, 2012).

This study intends to show the effect of transient operation on exhaust particulate emission by adapting the stall test, as outlined in MDG29, Guideline for the management of diesel engine pollutants in underground environments in New South Wales-Australia (MDG29, 2008), to a repeatable engine testbed drive cycle.

For this implementation, the stall test is designed to be performed on three speeds, (1500, 2000 and 2400) with a similar pattern. At each speed the engine is on idle for 20 s, then accelerated from idle to full load (100% throttle) as quickly as possible and held there for a defined period at which point the throttle is return to 0%. Each point is repeated three times with 20 s of idle between each test. To ensure integrity between the tests, there is 50 s of idle between the unique tests (varying period at full load). The full load time are defined as 5, 10, 20, 30, 40, 50 and 60 s.

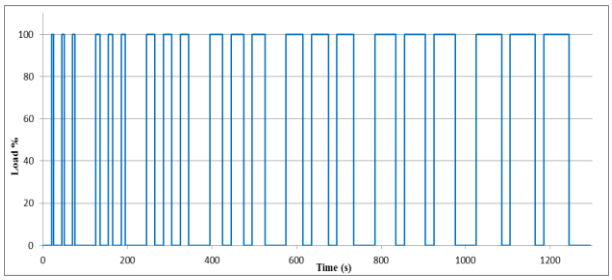


Figure 1. Stall Test developed in this study

In this experimental study a heavy-duty, six cylinder, turbo-charged, after-cooled diesel engine with a common rail injection system is used. Engine load and speed are controlled by an electronically water brake dynamometer. DMS500 MkII Fast Particle Analyzer utilised to measure diesel particulate matter.

The results show that the amount of emission depends on the duration of full load operation. Figure 2 shows the average particulate mass of three repeats under different durations of full load at 2000 RPM on the stall test. It shows that by increasing the duration of full load operation from 5 s to 60 s, the measured diesel particulate emission reduces significantly by 40 %.

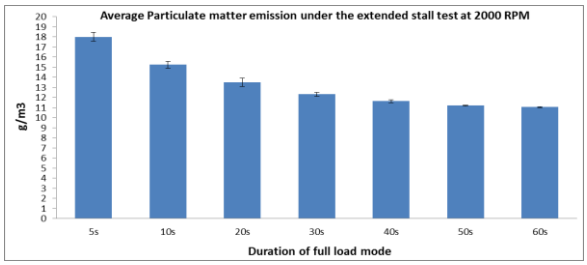


Figure 2. The average diesel particulate matter

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