



HAUL TRUCK VOLUMETRIC FUEL MEASUREMENT PROCEDURE

Introduction

In marketing FTC Combustion Catalysts to clients with mobile mine equipment Fuel Technology have recognised the need to provide a means to demonstrate the expected benefits of FTC in the clients own mining fleet. The main difficulty in running any trial is controlling the variables of normal operation which can influence the results of a trial other than the effects as a result of FTC.

Whilst various methods have been used in the past, namely a method derived from AS2077-1982 Carbon Balance and the statistical analysis of daily operational data, in some instances these methods have not been suitable to evaluate FTC under the prevailing site conditions.

To provide an alternative basis for measuring haul truck fuel consumption under as close to normal operating conditions as possible, Fuel Technology, in conjunction with a major mining contractor have developed a method where the fuel consumed by the haul truck can be measured against work done to provide a fuel efficiency measure for comparison of untreated and treated tests.

This technical bulletin provides an overview of the test procedure, equipment required and the reporting of results for clients wishing to undertake a trial of FTC using the Haul Truck Volumetric Fuel Measurement Procedure.

Equipment

To enable a controlled test to be conducted the work done, being the load carried and distance traveled must be established. Therefore, the method requires that the test vehicle be fitted with a payload monitor or a set of platform scales are available to determine the load on each run. The distance over the test route will be measured by a surveyors wheel or other acceptable means.

Fuel flow is measured by two (2) flow transducers fitted with pulse output coupled to a Minitrol totaliser and ratemeter. These units have been calibrated and certified by a NATA certified laboratory. Photograph 1 and 2 show the flow transducers and Minitrol in operation on a Cat 777B haul truck.

Fuel Temperature/Density to be monitored.

- A) Density is measured by a calibrated hydrometer and thermometer, corrections for variations in fuel temperature and density are made in accordance with Institute of Petroleum Density Correction Tables 53B.
- B) Fuel Operating Temperatures are measured by thermocouple probes fitted to each flow transducer and a Fluke 51 K/J digital thermometer with dual temperature readouts.

A quartz crystal digital stop watch is employed for timing each run.

Method

The test truck will be operated for one shift to establish baseline data and assess the repeatability of the data. It is estimated that 20 to 30 cycles per shift will be involved.

A start point at a given distance from the ramp base and a finish point at the top of ramp will be set up and the distance between the two is measured by surveyors wheel.

Two markers set up to act as visual references to enable an accurate alignment to be established for the start and stop points for each run.

The Flow transducers will be connected to the truck's fuel tank inlet and outlet pipework and electrically connected to the Minitrol unit in the cab. Time involvement is approximately 20 minutes and can be performed during crib break or shift change.

Thermocouple probes are fitted to the inlet fuel line flow transducer to the injectors and also the return fuel line transducer and both are electrically connected to the digital thermometer in the cab.

Prior to the first run a sample of fuel will be drawn from the truck's tank and density assessed and corrected to 15°C.

The trial crew will generally involve:-

- 1) The truck driver
- 2) Fuel Technology engineer
- 3) Customer engineer

Procedure

At the commencement of a test or run, the truck will be loaded and the load monitored. Upon arrival at the start point the truck will stop, stop watch and

Minitrol zeroed. Upon the signal "GO" simultaneously the driver will accelerate and the test engineer will activate the Minitrol and commence timing.

At the top of the ramp marks the test engineer will simultaneously press the Stop Watch button and Minitrol button and record the observed time taken to ascend the ramp and fuel measured in litres by each transducer. The test engineer will also observe and record the fuel temperature for each transducer during each test run.

At the completion of the day's run, the performance will be assessed by converting the volume consumption to mass, by calculating the fuel density at the observed temperature and the extent of variation in readings noted.

Reporting

At the conclusion of the trial the fuel consumed by the truck for each run will be calculated by:-

- 1) Calculating the mass (kilograms) of the fuel measured by each flow transducer for each run at the observed temperature.
- 2) The outlet mass of fuel from the engine is subtracted from the inlet mass of fuel to the engine to calculate the total fuel consumed for the truck over the run.

From the payload monitor the load and the distance of each run can be extracted and the work done by the truck can be calculated and expressed as Tonnes per Kilometres (Tk).

The truck efficiency is then calculated as units of work done per mass (kilogram) of fuel consumed expressed as Tonnes kilometre per kilogram (Tkm/kg). The means and standard deviation are calculated for each test and the results are compared for change and significance (by Students t test).

The trial is based on a *back to back* untreated and treated tests with approximately four (4) weeks treatment period. On completion of a successful trial a full report will be submitted detailing the results and test methods supported by all raw data.

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