



## CARBON MASS BALANCE TEST (CMB)

### SUMMARIES

## AR6200 FUEL MODIFICATION COMPLEX



## AR6200 Fuel Modification Complex Case Study Road Train Tractor Test

### Test Method:

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The procedures utilized to measure the fuel consumption of two (2) 2003 and two (2) 2005 Peterbilt tractors with C-15 Caterpillar engines, is an adaptation of the US-EPA Federal Test Procedures (FTP) and the Australian Standards engineering method AS2077-1982 known as the carbon mass balance. The method measures the fuel consumed by each engine while operating under steady-state or static engine conditions. The Bacharach True Spot Smoke meter was used to determine the change in particulate emissions (soot).

The second method, or validation test, required data accumulated from the onboard E-cat system, which monitored fuel consumption, idle time, drive speed, load, and other pertinent data necessary to monitor fuel consumption accurately.

### Test Results:

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The combined test fleet realized a 8.5% improvement in engine fuel efficiency with the Carbon Mass Balance evaluation utilizing the onboard computerized E-cat data, after AR6200. The same engines experienced a 26% reduction in particulate density (smoke reduction) with similar reductions in all other harmful emissions.



## AR6200 Fuel Modification Complex Case Study Over the Road Tractor Trailer Test

### Test Method:

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The procedure utilized to measure the fuel consumption of three (3) 2004 Peterbilt tractors with C-15 Caterpillar engines, is an adaptation of the US-EPA Federal Test Procedures (FTP) and the Australian Standards engineering method AS2077-1982 known as the Carbon Mass Balance. The method measures the fuel consumed by each engine while operating under steady-state or static engine conditions. The Bacharach True Spot Smoke meter was used to determine the change in particulate emissions (soot).

### Test Results:

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The



combined test fleet realized a 5.5% improvement in engine fuel efficiency with the Carbon Mass Balance evaluation, after 6200 installed. The same engines experienced a 25% reduction in particulate density (smoke reduction) with similar reductions in all other harmful emissions.

## AR6200 Fuel Modification Complex Case Study Haul Truck Test

## Test Method:



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The procedure used to measure the fuel consumption in four (4) 777C Caterpillar haul trucks, is an adaptation of the USEPA Federal Test Procedures (FTP) and the Australian Standards engineering method AS2077-1982 known as the Carbon Mass Balance evaluation. The method measures the fuel consumed by each engine while operating under steady-state or static engine conditions. The Bacharach True Spot Smoke meter was used to determine the change in particulate emissions (soot). Concurrently, an in-house fuel study was conducted to determine fuel consumption improvements based on daily fuel, weight, and hour meter records.

## Test Results:

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The combined fleet test realized a 9% improvement in fuel efficiency with the Carbon Mass Balance procedure, after installing AR6200. The same engines experienced a 28% reduction in particulate density (smoke reduction), with similar reductions in other harmful emissions.

# AR6200 Fuel Modification Complex Case Study

## Loader Test

### Test Method:

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The procedure used to measure the fuel consumption in this 992C Caterpillar loader, is an adaptation of the US-EPA Federal Test Procedures (FTP), and the Australian Standards engineering method AS2077-1982 known as the Carbon Mass Balance evaluation. The method measures the fuel consumed by the engine while operating under steady-state or static engine conditions. The Bacharach True Spot Smoke meter was used to determine the change in particulate emissions (soot).

### Test Results:

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This test unit realized a 7% improvement in fuel efficiency, with the Carbon Mass Balance procedure, after 6200 added. The same engine experienced a 27% reduction in particulate density (smoke reduction), with similar reductions in other harmful emissions.

AR6200



Fuel

## Modification Complex Case Study Crawler Test

### Test Method:

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The procedure used to measure the fuel consumption in this D10R Caterpillar crawler, is an adaptation of the US-EPA Federal Test Procedures (FTP) and the Australian Standards engineering method AS2077-1982 known as the Carbon Mass Balance evaluation. The method measures the fuel consumed by the engine while operating under steady-state or static engine conditions. The Bacharach True Spot Smoke meter was used to determine the change in particulate emissions (soot).

### Test Results:

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This test unit realized a 6.5% improvement in fuel efficiency, with the Carbon Mass Balance procedure, after 6200 added. The same engine experienced a 25% reduction in particulate density (smoke reduction), with similar reductions in other harmful emissions levels.



## AR6200 Fuel Modification Complex Haul Truck Test

### Test Method:

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The procedure used to measure the fuel consumption in this Rimpull 150 ton coal hauler, is an adaptation of the US-EPA Federal Test Procedures (FTP) and the Australian Standards engineering method AS2077-1982 known as the Carbon Mass Balance evaluation. The method measures the fuel consumed by the engine while operating under steady-state or static engine conditions. The Bacharach True Spot Smoke meter was used to determine the change in particulate emissions (soot). Concurrently, an in-house fuel study was conducted to determine fuel consumption improvements based on daily fuel, weight, and hour meter records.

### Test Results:

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This equipment test realized 7.1% improvement in engine efficiency, with the Carbon Mass Balance procedure after 6200 added. The same engine experienced a 30% reduction in particulate density (smoke reduction), with similar reductions in other harmful emissions levels.





## AR6200 Fuel Modification Complex Shovel Test

### Test Method:

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The procedure used to measure the fuel consumption in this O&K 120-C shovel, is an adaptation of the US-EPA Federal Test Procedures (FTP) and the Australian Standards engineering method AS2077-1982 known as the Carbon Mass Balance evaluation. The method measures the fuel consumed by the engine operating under steady-state or static engine conditions. The Bacharach True Spot Smoke meter was used to determine the change in particulate emissions (soot).

### Test Results:

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This test unit realized a 7.4% improvement in fuel efficiency with the Carbon Mass Balance procedure, after AR6200. The same engine experienced a 28% reduction in particulate density (smoke reduction), with similar reductions in other harmful exhaust emissions.



## AR6200 Fuel Modification Complex Locomotive Test

### Test Method:

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The procedure used to measure the fuel consumption in this EMD 645 locomotive engine, is an adaptation of the US-EPA Federal Test Procedures (FTP) and the Australian Standards engineering method AS2077-1982 known as the Carbon Mass Balance evaluation. The method measures the fuel consumed by the engine, while connected to a load box, operating under steady-state engine conditions. The Bacharach True Spot Smoke meter was used to determine the change in particulate emissions (soot).

### Test Results:

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This test unit realized a 7.2% improvement in engine efficiency, with the Carbon Mass Balance procedure, after 6200 added. The same engine experienced a **30%** reduction in particulate density (*smoke reduction*), with similar reductions in other harmful exhaust emissions.



## AR6200 Fuel Modification Test Locomotive, Crane and Truck

### Test Method:

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The procedure used to measure the fuel consumption in this EMD 645 locomotive engine, is an adaptation of the US-EPA Federal Test Procedures (FTP) and the Australian Standards engineering method AS2077-1982 known as the Carbon Mass Balance evaluation. The method measures the fuel consumed by the engine, while connected to a load box, operating under steady-state engine conditions. The Bacharach True Spot Smoke meter was used to determine the change in particulate emissions (soot).

### Test Results:

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