

© Copyright Statement

All rights reserved. All material in this document is, unless otherwise stated, the property of **FPC International, Inc.** Copyright and other intellectual property laws protect these materials. Reproduction or retransmission of the materials, in whole or in part, in any manner, without the prior written consent of the copyright holder, is a violation of copyright law.

**Manitowoc Transit Field Trial of
of FPC-1 Fuel Performance Catalyst
comparing Emissions Levels of Baseline 60/40 Blended Diesel,
FPC-1 Treated 60/40 Blended Diesel, and FPC-1 Treated Straight # 2 Diesel.**

**Test conducted for Manitowoc Transit
by
UHI Corporation
Provo, Utah
and
FPC Great Lakes
Valders, Wisconsin**

May 30, 1996

Table of Contents

Abstract	ii
I. Introduction	1
Table 1 - Carbon Monoxide Emissions	
Table 2 - Smoke Emissions	
II. Conclusions	
Appendix 1 - Raw Data Sheets	

Abstract

This paper discusses the results of continued field testing to document the benefit of FPC-1 fuel treatment to the Manitowoc Transit System fleet. Under the direction of Mr. Kevin Glaeser, Fleet Manager, this study compared the emissions of baseline 60/40 blended diesel to FPC-1 treated 60/40 blended diesel, and then to straight # 2 diesel treated with FPC-1. The study conducted on a fleet of 6V92 Detroit Diesel powered buses documented the following:

- (1) Smoke density or smoke emissions concentration with FPC-1 treated straight # 2 diesel were nearly identical to that of baseline (untreated) 60/40, but higher than FPC-1 treated 60/40 blended diesel.
- (2) CO emissions were 23% lower with the FPC-1 treated # 2 diesel than the baseline 60/40 blend, and virtually unchanged from the CO emissions with FPC-1 treated 60/40 blend.

These data show the use of FPC-1 in straight # 2 diesel maintains low emissions of smoke and carbon monoxide, emissions as low or lower than the untreated blended fuel. The advantages for the fuel consumer created by FPC-1 fuel treatment are significant. First, straight # 2D is more plentiful and less expensive than the # 1D used when blending winter grade diesels. Second, the # 2D has better lubricating properties. Third, most # 2Ds have greater energy content, so fuel economy is improved even more. In extreme cases, # 2D can contain as much as 7% more energy than # 1D.

UHI recommends Manitowoc Transit System investigate the possibility of eliminating the use of # 1D blended diesel during spring and fall months, and reducing it's use as a blending component during winter months by considering the use of a high quality anti-gel. It is unlikely that # 1D can be eliminated entirely, but significant cost reductions are possible with no sacrifice in engine efficiency and air quality by combining the use of FPC-1, reduced amounts of # 1D, and a proven anti-gel.

I. Introduction

FPC-1 Fuel Performance Catalyst is a burn rate modifier or catalyst, proven to reduce fuel consumption and increase engine horsepower in several recognized, independent laboratory tests, and dozens of independent field trials. The catalyst also has a remarkable impact upon the products of incomplete combustion that are regulated by emissions reduction legislation (smoke and carbon monoxide).

The intent of the Manitowoc Transit test was to determine the effect of FPC-1 fuel treatment on emissions when added to straight # 2 diesel (# 2D). The emissions from the FPC-1 treated # 2D were compared to those of baseline (untreated) 60/40 winter blend diesel, and FPC-1 treated 60/40 winter blend diesel. The test involved the identical fleet of buses previously emissions tested.

Sun Electric Corporation NDIR instrumentation was used to measure carbon monoxide emissions. The Bacharach Truespot Smokemeter method was used to determine smoke density.

This report summarizes the results of baseline and FPC-1 treated fuel emissions test.

Table 1. Comparison of Carbon Monoxide Emissions

<u>Bus No.</u>	<u>Baseline CO</u>	<u>Treated 1 CO</u>	<u>*Treated 2 CO</u>
1011	0.016	0.010	0.010
1017	0.010	0.008	0.010
1014	0.013	0.010	0.010
Fleet Averages:	0.013	0.009	0.010

*** Straight # 2 diesel treated with FPC-1.**

Table 2. Comparison of Smoke Emissions

<u>Bus No.</u>	<u>Baseline Smoke #</u>	<u>Treated 1 Smoke #</u>	<u>*Treated 2 Smoke #</u>
1011	3.0	2.0	3.0
1017	2.0	1.5	3.0
1014	3.0	1.5	3.0
Fleet Average:	2.7	1.7	3.0

*** Straight # 2 diesel treated with FPC-1**

II. Conclusions

- (1) Smoke density or smoke emissions concentration with FPC-1 treated straight # 2 diesel were nearly identical to that of baseline (untreated) 60/40, but higher than FPC-1 treated 60/40 blended diesel.
- (2) CO emissions were 23 % lower with the FPC-1 treated # 2 diesel than the baseline 60/40 blend, and virtually unchanged from the CO emissions with FPC-1 treated 60/40 blend.

Appendix 1

Raw Data Sheets

Carbon Mass Balance Field Data Form

MANITOWOC

Company: TRANSIT Location: MANITOWOC Test Date: 5-21-96
Test Portion: Baseline: X Treated: Exhaust Stack Diameter: 5 InchesEngine Make/Model: 6V92 Miles/Hours: 159652 I.D.#: 1014
Type of Equipment: DETROITFuel Specific Gravity: .850 @: (°F)Barometric Pressure: inches of Mercury Start Time: 8:45STRAIGHT #2 DIESEL FROM Lakeside Oil Co - Milwaukee

RPM	Exhaust Temp °F	P Inches of H ₂ O	% CO	HC ppm	% CO ₂	% O ₂	NO _x
950	216.4	.53	01	15	1.25	19.6	
950	215	.53	01	15	1.26	19.6	
950	214	.53	01	15	1.24	19.6	
950	213.6	.54	01	15	1.25	19.6	
YEAR	1992						
FUEL IS Treated With F451 & IS Switched to							
#2 DIESEL INSTEAD OF BLEND F451.							

Names of Customer Personnel Participating in Test:

KEVIN GLAESER

Baseline

(3)

Kim LaBaron
DICK REYNOL

Signature of Technicians:

PAUL KRAMER
JERRY HUTCHINS

Base
Line
③

Manitowoc

Company: TRANSIT Location: Manitowoc Test Date: 5-21-96
 Test Portion: Baseline: X Treated: Exhaust Stack Diameter: 5 Inches

Engine Make/Model: 6V92 (Miles) Hours: 153683 I.D.#: 1011
 Type of Equipment: DETROIT

Fuel Specific Gravity: .850 @: (°F)

Barometric Pressure: inches of Mercury Start Time: 8:35PM

STRAIGHT #2 DIESEL FROM LAKESIDE OIL CO - MILWAUKEE

RPM	Exhaust Temp °F	P Inches of H ₂ O	% CO	HC ppm	% CO ₂	% O ₂	NO _x
950	216.8	.50	01	14	1.21	19.3	
950	216.2	.50	01	13	1.22	19.3	
950	216.0	.55	01	15	1.21	19.3	
950	215.6	.50	01	15	1.23	19.3	
950	215.8	.50	01	15	1.21	19.3	
1992							
Fuel is Treated With EPA-1 - Switched From							
60/40 Blended to STRAIGHT #2 DIESEL							

Names of Customer Personnel Participating in Test:

KEVIN GLAESER

Signature of Technicians:

Kim LaRavin
DICK REYNAL

Terry Hutchinson
PAUL KRAMER

BASC
 LINE
 (9)

MANITOWOC TRANSIT

Company: _____ Location: MANITOWOC Test Date: 2-24-96

Test Portion: Baseline: X Treated: ~~X~~ Exhaust Stack Diameter: 5 Inches Pipe

Engine Make/Model: 6V92 Miles/Hours: 148006 I.D.#: 1014

Type of Equipment: DETROIT DIESEL

Fuel Specific Gravity: .856 @: _____ (°F)

Barometric Pressure: _____ inches of Mercury

Start Time: 8:00 PM

BLENDED FUEL 60/40

Finish 8:14 PM

Re-Cal
Re-Cal
Re-Cal

RPM	Exhaust Temp °F	P Inches of H ₂ O	% CO	HC ppm	% CO ₂	% O ₂	NO _x
950	192.6	.50	.02	9	1.33	16.8	
950	195.6	.50	.01	4	1.26	18.4	
950	196.2	.50	.01	4	1.27	18.4	
950	196.4	.50	.02	4	1.19	18.2	
950	194.8	.60	.01	2	1.20	18.6	
950	194.8	.60	.01	2	1.21	18.5	
MILEAGE	148006						
YEAR	1992						
Then Sample is Placed 5" Bottom Center of STACK							

D-Dec

1014

Names of Customer Personnel Participating in Test:
KEVIN GLAZER DON MODDIE

GUEST EMISSIONS PEOPLE
JERRY HUTCHINSON - DKK REYNOLDS - ALLEN GEIMER

Signature of Technicians:

Saul Kramers Ken L. Bunn

Carbon Mass Balance Test Data

MILWAUKEE TRANSIT

Company:

Location:

MILWAUKEE

Test Date:

2-1-96

Test Portion: Baseline:

☒

Treated:

☐

Exhaust Stack Diameter:

5 Inches

Engine Make/Model:

6V 92

Miles/Hours:

14143 I.D.#:

1011

Type of Equipment:

DETROIT

Fuel Specific Gravity:

.852

@:

(°F)

Barometric Pressure:

inches of Mercury

Start Time:

9:00 PM

FINISH

9:08 PM

RPM	Exhaust Temp °F	P Inches of H ₂ O	% CO	HC ppm	% CO ₂	% O ₂	NO _x
950	188.4	.50	02	10	12.9	17.8	
950	188.4	.50	02	10	13.1	17.7	
950	188.6	.50	02	10	1.31	17.7	
950	189.0	.50	01	10	1.31	17.7	
950	189.4	.50	.01	13	1.29	17.8	
Milage		14143					
Year		1992					
Thermo Couple is PLACED 5" Bottom Center of STACK							

D-Dec

Names of Customer Personnel Participating in Test:

KEVIN GLASER

Don Modder

GUEST EMISSIONS PEOPLE

JERRY HUTCHINS - DICK REVINAL - ALLEN GEIMER

Signature of Technicians:

Paul Krom

Kim La Borne

 Total
 (3)
 Base

MINITRUCK TRANSIT

Company: _____ Location: MINITRUCK Test Date: 2-1-96
Test Portion: Baseline: X Treated: XXXX Exhaust Stack Diameter: 5 InchesSMOKE
(2)Engine Make/Model: 6V92 Miles/Hours: 66686 I.D.#: 1017
Type of Equipment: DETRITFuel Specific Gravity: .856 @: _____ (°F)Barometric Pressure: ~~29.97~~ inches of MercuryStart Time: 8:27BLENDED 60/40FINISH 8:35

RPM	Exhaust Temp °F	P Inches of H ₂ O	% CO	HC ppm	% CO ₂	% O ₂	NO _x
950	177.2	.48	.01	0	1.17	18.8	
950	177.8	.48	.01	0	1.18	18.9	
950	178.2	.48	.01	2	1.17	18.8	
950	178.4	.48	.01	2	1.15	18.8	
950	178.6	.48	.01	0	1.16	18.9	
Mileage		66686					
Year		1993					
Thermo Couple is Placed 5" Bottom Center of STACK							

D-Dee

1017

②
Base

Names of Customer Personnel Participating in Test:

Kevin Glazer Don Madden

GUEST EMISSION PEOPLE

TERRY HUTCHINSON - DICK REVINGAL - ALLEN GEIMOLL

Signature of Technicians:

Paul Ramm Kim La Borm