USEPA
Fuel Tank Hydrocarbon Emission Testing
040137

Version 1.0
11/03/04

Prepared by:
Sterling Performance
54420 Pontiac Trail
Milford, MI 48381
(248) 685-7811

11/03/04
TEST REPORT FOR: 040137
Fuel Tank Hydrocarbon Emission Testing
PO NUMBER: 5A-2015

TESTED FOR: U.S.E.P.A. N.V.F.E.L.
2565 Plymouth Rd.
Ann Arbor, MI 48105

ATTENTION: Michael Samulski
U.S.E.P.A. N.V.F.E.L
2565 Plymouth Rd.
Ann Arbor, MI 48105

TESTED BY: STERLING PERFORMANCE
54420 PONTIAC TRAIL
MILFORD, MI 48381

PREPARED BY: TIM CUSHING
SR. PROJECT ENGINEER

APPROVED BY: JON HANCOCK
LAB MANAGER

This report and the information contained herein represent the results of testing test articles/products identified and selected by the client. The tests were performed to specifications and/or procedures approved by the client. Sterling Performance makes no representations expressed or implied that such testing fully demonstrates efficiency, performance, reliability, or any other characteristics of the articles being tested, or similar products. This test report shall not be reproduced, except in full, without prior written consent from Sterling Performance.

TABLE OF CONTENTS

1. OVERVIEW 3

2. CONCLUSION 3

3. OBJECTIVE 3

4. TEST PROCEDURES 3

4.1. MINI-SHED PROCEDURE 3

5. TEST EQUIPMENT 4

6. APPENDICES 4

Revision Log

Version	Author	Changes	Date Completed
Draft 1.0	Tim Cushing	Original	11/03/04

1. Overview

Mini-SHED hydrocarbon emission testing was conducted on (4) fuel tanks. This testing was performed in accordance with the requirements of the EPA supplied procedure Variable Temperature Mini-SHED Testing of Small Equipment Fuel Tanks 09/27/04.

2. Conclusion

Model	HC (g)
JD 425	7.8
Exmark	2.9
ONAN	4.1
Champion	69.3*

*Champion tank SHED test exceeded FID concentration limit of 10,000 ppm C_3 approximately 1.5 hours into test at a fuel temperature of 49 °C.

3. Objective

To determine the grams of hydrocarbons (HC) emitted due to the inefficiency of an emission control devise used to contain fuel vapor.

4. Test Procedures

4.1. Mini-SHED Procedure

Thermocouples were installed thru fuel tank wall.
An in tank electric fuel pump was used to increase fuel temperature in the tanks.
The fuel tank was filled to 50% capacity with EEE 9 RVP gasoline.
The fuel cap was installed on the fuel tank. The vent holes in the fuel cap were not sealed.
Mechanical fuel cap vents were opened.
The fuel tanks did not stand with fuel in them for an extended period of time.
The fuel temperature was increased to the starting temperature of the specified variable temperature cycle.
Mini-SHED HC concentration was recorded continuously.
Mini-SHED HC concentration was measured with a FID calibrated on propane.
HC mass was calculated according to the following formula:
HC (g) = (17.14*3*ppm*V*P / 10E-4) / T

5. Test Equipment

The test equipment used in performing this test program is listed below. Calibration records are maintained on file at Sterling Performance Testing Service.

Measurement/Test Device	SN/Model No.	Test Location	Test Performed	CAL Date	DUE Date
Watlow	TC-0003	EC-03	SHED	1/23/2003	1/23/2005
Agilent	DL-0001	FID 3 Cabinet	SHED	4/17/2003	4/17/2005
SHED	SN01	4.084 m^3 EC-03	SHED	7/15/2004	10/15/04
FID 3	HA-0003	FID 3 Cabinet	SHED	8/1/2004	8/1/2005

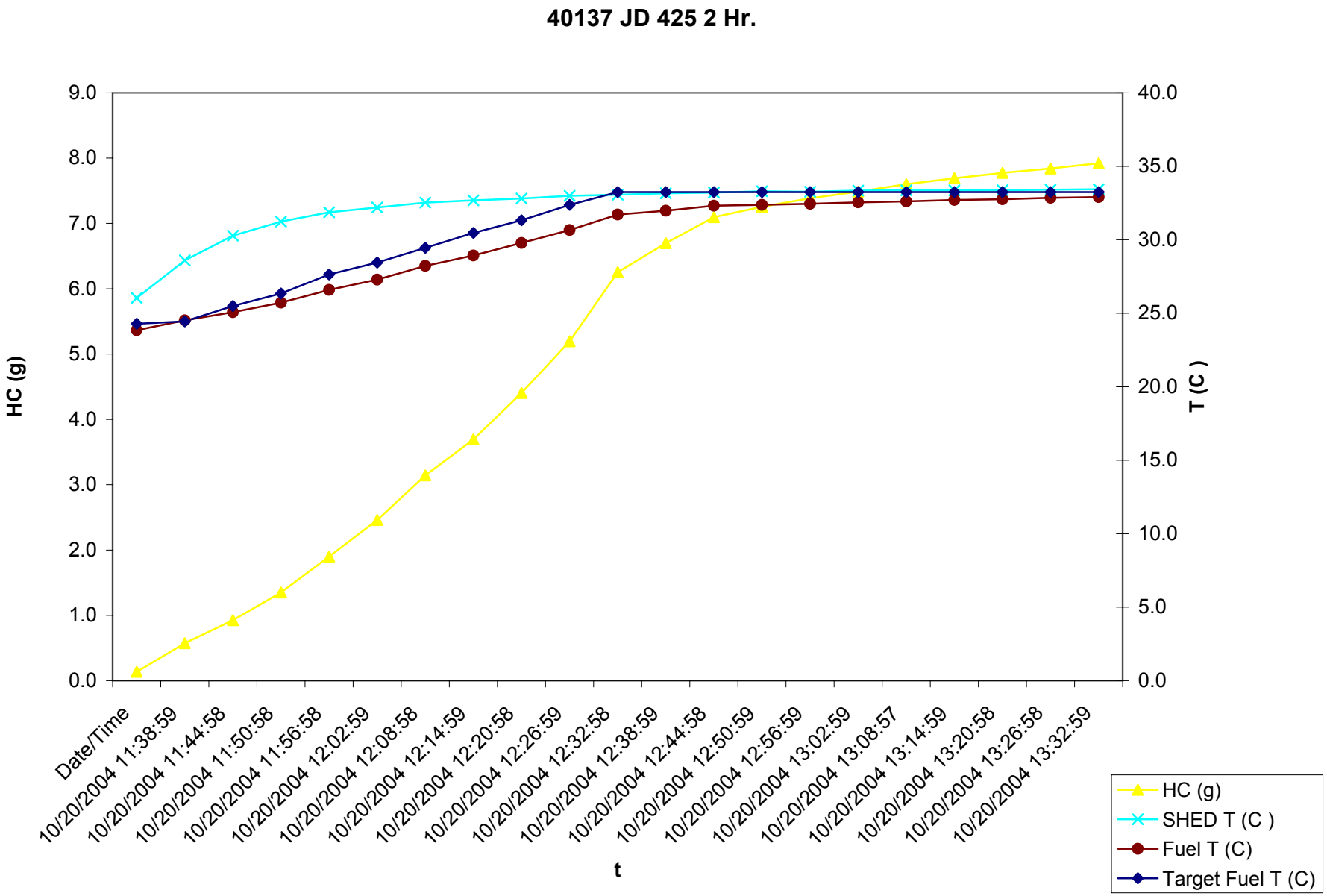
6. Appendices

A Fuel Tank Hydrocarbon Emission Data

JN 040137 2 Hr. JD 425

		SHED V (m^3)	Bag V (m^3)	Part V (m^3)
		4.084	0.200	0.0250
HC loss (g)	7.8			

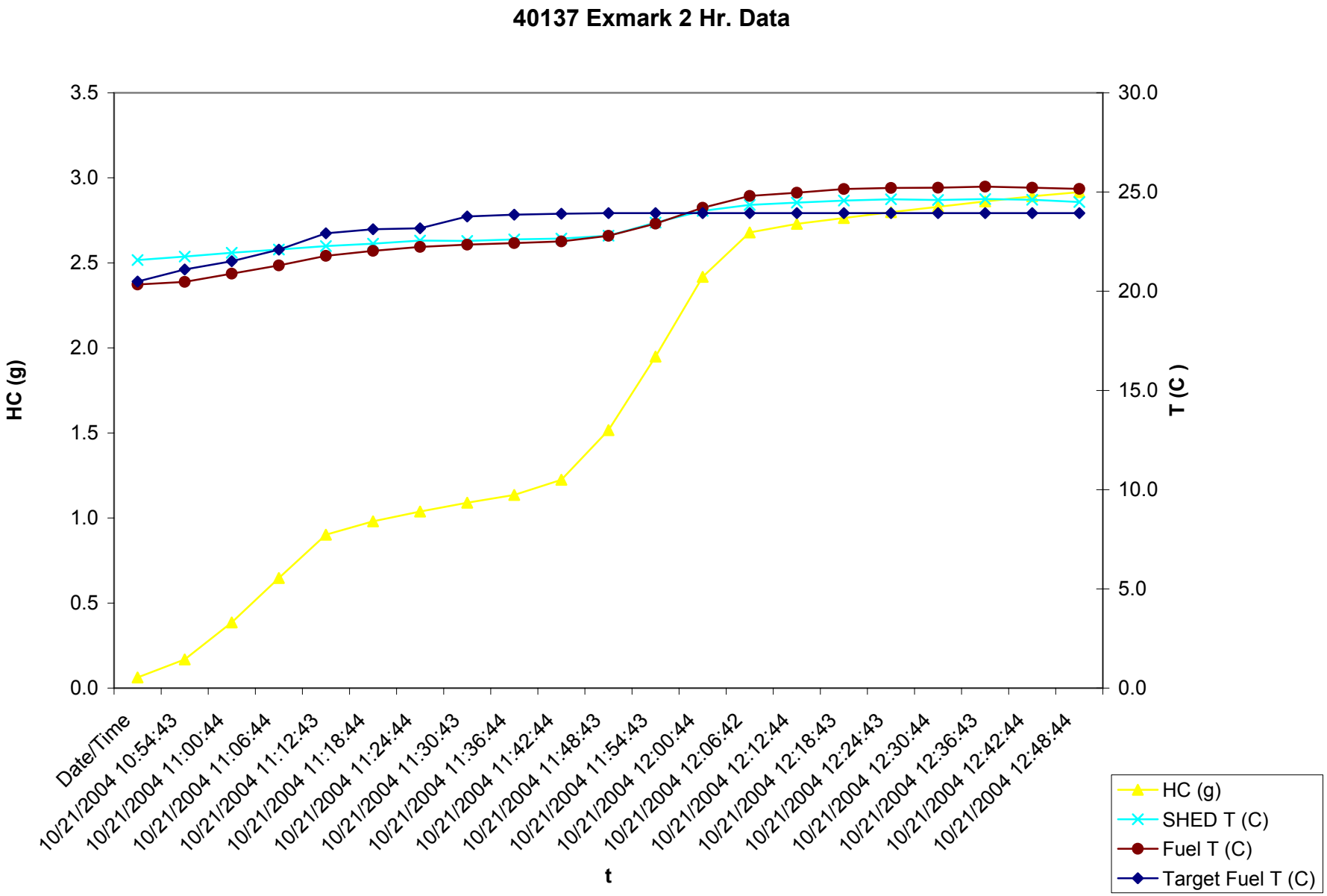
Date/Time	Baro	ppm (C_3)	HC (g)	SHED T (C)	SHED P (in.H2O)	Fuel T (C)	Target Fuel T (C)
10/20/2004 11:38:59	29.23	20.56	0.1	26.0	0.1	23.8	24.3
10/20/2004 11:44:58	29.25	87.98	0.6	28.6	0.1	24.5	24.4
10/20/2004 11:50:58	29.20	143.21	0.9	30.3	0.1	25.1	25.5
10/20/2004 11:56:58	29.20	209.13	1.3	31.2	0.1	25.7	26.3
10/20/2004 12:02:59	29.23	294.82	1.9	31.9	0.1	26.6	27.6
10/20/2004 12:08:58	29.22	382.17	2.5	32.2	0.1	27.3	28.5
10/20/2004 12:14:59	29.23	488.84	3.1	32.5	0.1	28.2	29.5
10/20/2004 12:20:58	29.23	574.52	3.7	32.7	0.1	28.9	30.5
10/20/2004 12:26:59	29.22	685.33	4.4	32.8	0.1	29.8	31.3
10/20/2004 12:32:58	29.24	808.73	5.2	33.0	0.1	30.7	32.4
10/20/2004 12:38:59	29.23	974.10	6.3	33.1	0.1	31.7	33.2
10/20/2004 12:44:58	29.22	1043.71	6.7	33.2	0.1	32.0	33.2
10/20/2004 12:50:59	29.23	1105.36	7.1	33.2	0.1	32.3	33.2
10/20/2004 12:56:59	29.26	1129.71	7.3	33.3	0.1	32.4	33.2
10/20/2004 13:02:59	29.24	1150.47	7.4	33.3	0.1	32.4	33.2
10/20/2004 13:08:57	29.25	1166.49	7.5	33.3	0.1	32.5	33.2
10/20/2004 13:14:59	29.25	1183.95	7.6	33.4	0.1	32.6	33.2
10/20/2004 13:20:58	29.24	1198.79	7.7	33.4	0.1	32.7	33.2
10/20/2004 13:26:58	29.24	1211.70	7.8	33.4	0.1	32.8	33.2
10/20/2004 13:32:59	29.24	1222.08	7.8	33.4	0.1	32.9	33.2
10/20/2004 13:38:58	29.26	1234.09	7.9	33.4	0.1	32.9	33.2


40137 JD 425 2 Hr.
HC (g)
T (C)
t
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Date/Time
10/20/2004 11:38:59
10/20/2004 11:44:58
10/20/2004 11:50:58
10/20/2004 11:56:58
10/20/2004 12:02:59
10/20/2004 12:08:58
10/20/2004 12:14:59
10/20/2004 12:20:58
10/20/2004 12:26:59
10/20/2004 12:32:58
10/20/2004 12:38:59
10/20/2004 12:44:58
10/20/2004 12:50:59
10/20/2004 12:56:59
10/20/2004 13:02:59
10/20/2004 13:08:57
10/20/2004 13:14:59
10/20/2004 13:20:58
10/20/2004 13:26:58
10/20/2004 13:32:59
HC (g)
SHED T (C)
Fuel T (C)
Target Fuel T (C)

JN 040137 2 Hr. Exmark

		SHED V (m^3)	Bag V (m^3)	Part V (m^3)
		4.084	0.200	0.0110
HC loss (g)	2.9			

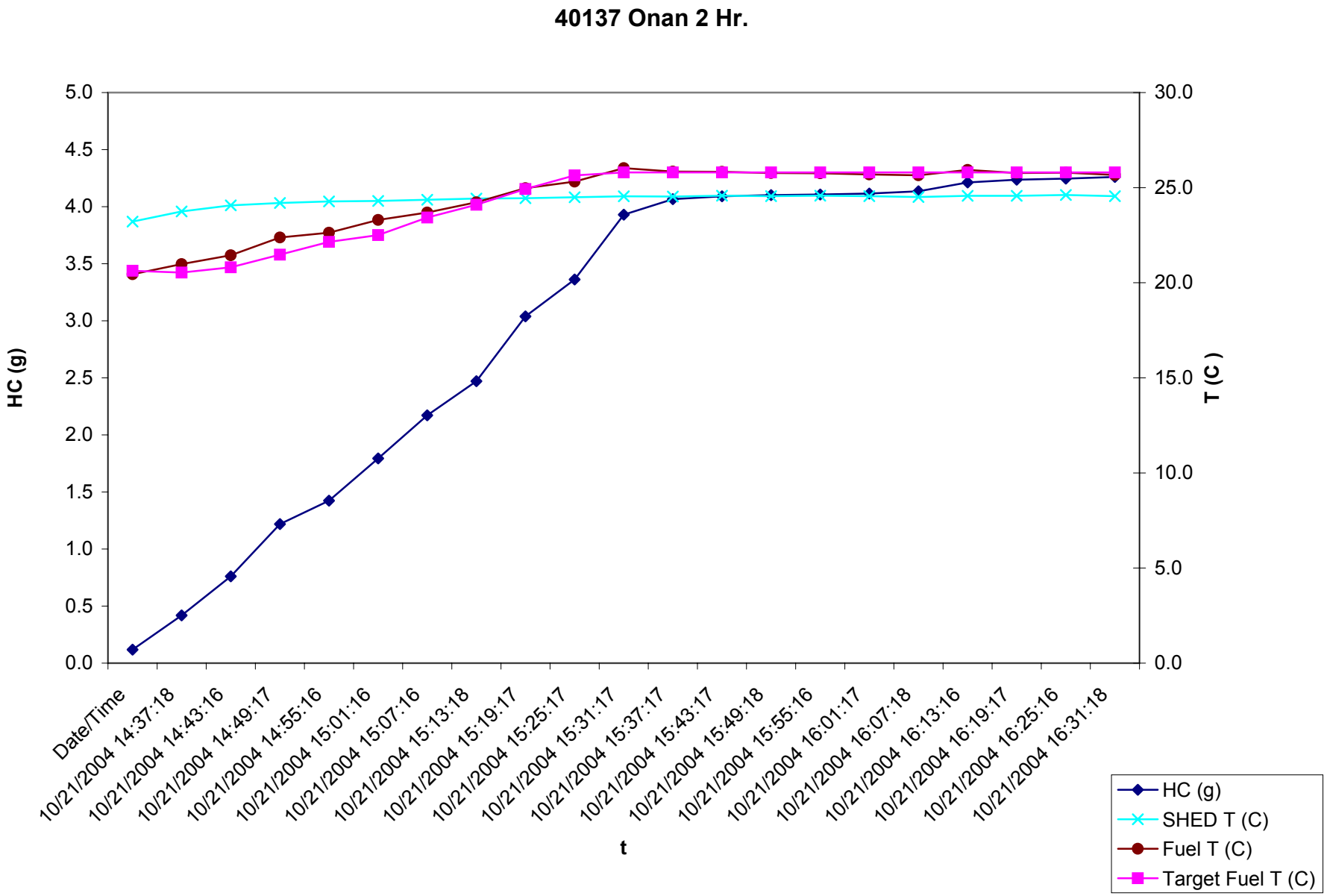
Date/Time	Baro	ppm (C_3)	HC (g)	SHED T (C)	SHED P (in.H2O)	Fuel T (C)	Target Fuel T (C)
10/21/2004 10:54:43	29.36	9.28	0.1	21.6	0.1	20.3	20.5
10/21/2004 11:00:44	29.39	25.01	0.2	21.7	0.1	20.5	21.1
10/21/2004 11:06:44	29.37	57.42	0.4	21.9	0.1	20.9	21.5
10/21/2004 11:12:43	29.38	96.36	0.6	22.1	0.1	21.3	22.1
10/21/2004 11:18:44	29.38	134.34	0.9	22.3	0.1	21.8	22.9
10/21/2004 11:24:44	29.38	146.09	1.0	22.4	0.1	22.0	23.1
10/21/2004 11:30:43	29.37	154.80	1.0	22.6	0.1	22.2	23.2
10/21/2004 11:36:44	29.37	162.54	1.1	22.5	0.1	22.3	23.8
10/21/2004 11:42:44	29.39	169.28	1.1	22.6	0.1	22.4	23.9
10/21/2004 11:48:43	29.41	182.54	1.2	22.7	0.1	22.5	23.9
10/21/2004 11:54:43	29.40	226.11	1.5	22.8	0.1	22.8	23.9
10/21/2004 12:00:44	29.38	291.49	1.9	23.5	0.1	23.4	23.9
10/21/2004 12:06:42	29.39	362.21	2.4	24.1	0.1	24.2	23.9
10/21/2004 12:12:44	29.38	401.76	2.7	24.4	0.1	24.8	23.9
10/21/2004 12:18:43	29.39	409.41	2.7	24.5	0.1	25.0	23.9
10/21/2004 12:24:43	29.38	414.93	2.8	24.6	0.1	25.2	23.9
10/21/2004 12:30:44	29.37	420.16	2.8	24.6	0.1	25.2	23.9
10/21/2004 12:36:43	29.37	424.96	2.8	24.6	0.1	25.2	23.9
10/21/2004 12:42:44	29.39	429.47	2.9	24.6	0.1	25.3	23.9
10/21/2004 12:48:44	29.40	433.74	2.9	24.6	0.1	25.2	23.9
10/21/2004 12:54:43	29.38	437.57	2.9	24.5	0.1	25.2	23.9


40137 Exmark 2 Hr. Data
HC (g)
T (C)
t
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Date/Time
10/21/2004 10:54:43
10/21/2004 11:00:44
10/21/2004 11:06:44
10/21/2004 11:12:43
10/21/2004 11:18:44
10/21/2004 11:24:44
10/21/2004 11:30:43
10/21/2004 11:36:44
10/21/2004 11:42:44
10/21/2004 11:48:43
10/21/2004 11:54:43
10/21/2004 12:00:44
10/21/2004 12:06:42
10/21/2004 12:12:44
10/21/2004 12:18:43
10/21/2004 12:24:43
10/21/2004 12:30:44
10/21/2004 12:36:43
10/21/2004 12:42:44
10/21/2004 12:48:44
HC (g)
SHED T (C)
Fuel T (C)
Target Fuel T (C)

JN 040137 2 Hr. Onan

		SHED V (m^3)	Bag V (m^3)	Part V (m^3)
		4.084	0.200	0.0095
HC loss (g)	4.1			

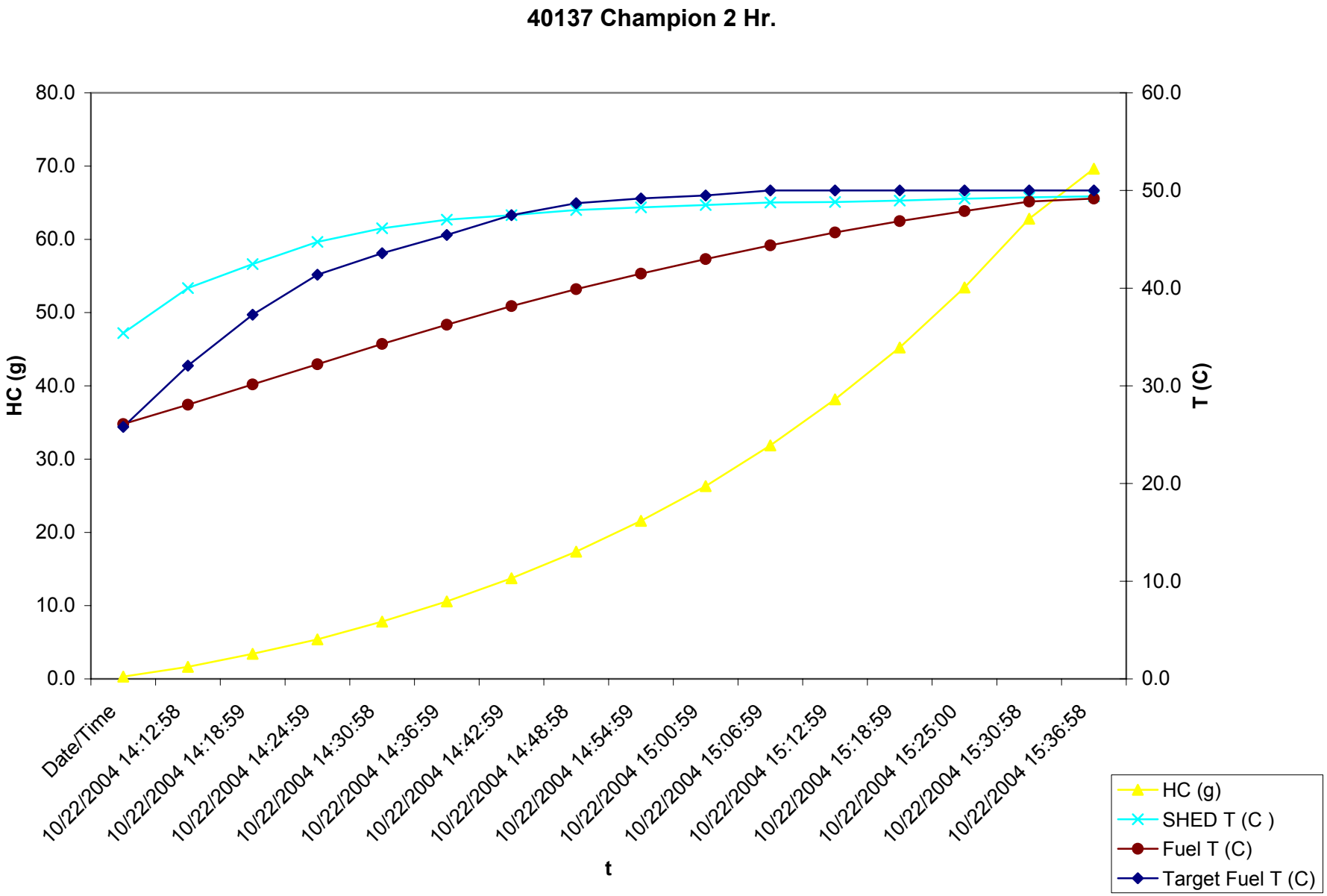
Date/Time	Baro	ppm (C_3)	HC (g)	SHED T (C)	SHED P (in.H2O)	Fuel T (C)	Target Fuel T (C)
10/21/2004 14:37:18	29.39	17.70	0.1	23.2	0.1	20.4	20.6
10/21/2004 14:43:16	29.39	62.52	0.4	23.7	0.1	21.0	20.5
10/21/2004 14:49:17	29.38	113.85	0.8	24.1	0.1	21.4	20.8
10/21/2004 14:55:16	29.37	182.71	1.2	24.2	0.1	22.4	21.5
10/21/2004 15:01:16	29.36	213.50	1.4	24.3	0.1	22.6	22.1
10/21/2004 15:07:16	29.37	269.03	1.8	24.3	0.1	23.3	22.5
10/21/2004 15:13:18	29.38	325.60	2.2	24.4	0.1	23.7	23.4
10/21/2004 15:19:17	29.38	370.60	2.5	24.4	0.1	24.2	24.1
10/21/2004 15:25:17	29.36	456.05	3.0	24.4	0.1	25.0	24.9
10/21/2004 15:31:17	29.38	504.35	3.4	24.5	0.1	25.3	25.6
10/21/2004 15:37:17	29.34	590.32	3.9	24.5	0.1	26.0	25.8
10/21/2004 15:43:17	29.35	610.65	4.1	24.5	0.1	25.8	25.8
10/21/2004 15:49:18	29.37	614.00	4.1	24.6	0.1	25.8	25.8
10/21/2004 15:55:16	29.37	615.54	4.1	24.6	0.1	25.8	25.8
10/21/2004 16:01:17	29.37	616.47	4.1	24.6	0.1	25.8	25.8
10/21/2004 16:07:18	29.36	617.84	4.1	24.6	0.1	25.7	25.8
10/21/2004 16:13:16	29.40	619.77	4.1	24.5	0.1	25.7	25.8
10/21/2004 16:19:17	29.39	631.90	4.2	24.6	0.1	25.9	25.8
10/21/2004 16:25:16	29.37	635.91	4.2	24.6	0.1	25.8	25.8
10/21/2004 16:31:18	29.36	637.62	4.2	24.6	0.1	25.8	25.8
10/21/2004 16:37:16	29.40	638.76	4.3	24.6	0.1	25.7	25.8


40137 Onan 2 Hr.
HC (g)
T (C)
t
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Date/Time
10/21/2004 14:37:18
10/21/2004 14:43:16
10/21/2004 14:49:17
10/21/2004 14:55:16
10/21/2004 15:01:16
10/21/2004 15:07:16
10/21/2004 15:13:18
10/21/2004 15:19:17
10/21/2004 15:25:17
10/21/2004 15:31:17
10/21/2004 15:37:17
10/21/2004 15:43:17
10/21/2004 15:49:18
10/21/2004 15:55:16
10/21/2004 16:01:17
10/21/2004 16:07:18
10/21/2004 16:13:16
10/21/2004 16:19:17
10/21/2004 16:25:16
10/21/2004 16:31:18
HC (g)
SHED T (C)
Fuel T (C)
Target Fuel T (C)

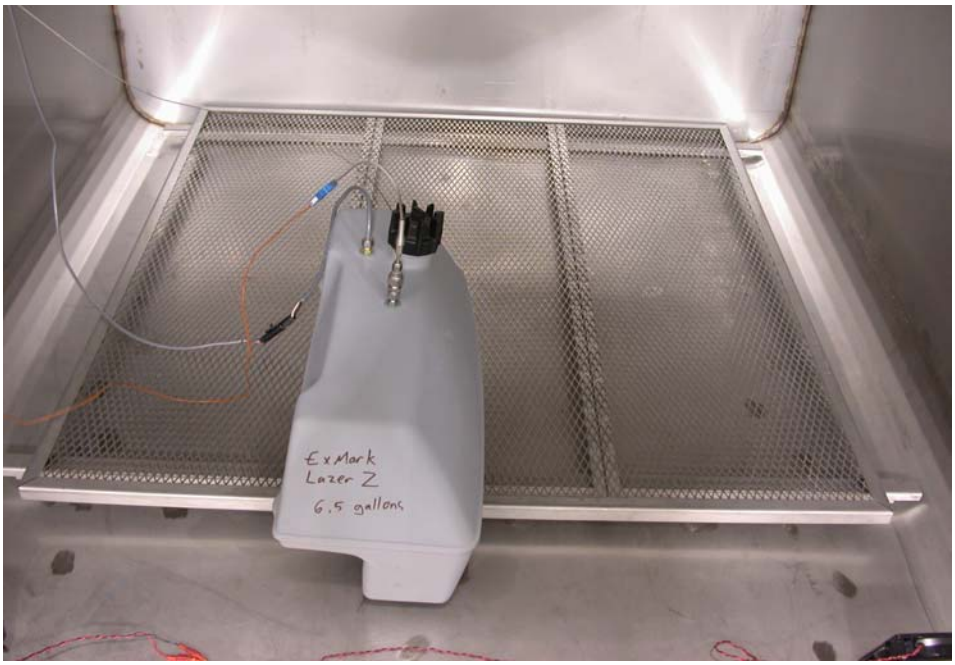
JN 040137 2 Hr. Champion

		SHED V (m^3)	Bag V (m^3)	Part V (m^3)
		4.084	0.200	0.0265
HC loss (g)	69.3			

Date/Time	Baro	ppm (C_3)	HC (g)	SHED T (C)	SHED P (in.H2O)	Fuel T (C)	Target Fuel T (C)
10/22/2004 14:12:58	29.37	49.1	0.3	35.4	0.1	26.1	25.8
10/22/2004 14:18:59	29.35	261.6	1.6	40.0	0.1	28.1	32.1
10/22/2004 14:24:59	29.39	546.5	3.4	42.5	0.1	30.1	37.3
10/22/2004 14:30:58	29.37	868.2	5.4	44.7	0.1	32.2	41.4
10/22/2004 14:36:59	29.37	1265.3	7.8	46.1	0.1	34.3	43.6
10/22/2004 14:42:59	29.37	1714.9	10.6	47.0	0.1	36.3	45.4
10/22/2004 14:48:58	29.35	2231.5	13.7	47.5	0.1	38.2	47.5
10/22/2004 14:54:59	29.33	2827.5	17.4	48.0	0.1	39.9	48.7
10/22/2004 15:00:59	29.35	3512.9	21.6	48.3	0.1	41.5	49.2
10/22/2004 15:06:59	29.34	4289.9	26.3	48.5	0.1	43.0	49.5
10/22/2004 15:12:59	29.36	5197.1	31.9	48.8	0.1	44.4	50.0
10/22/2004 15:18:59	29.35	6225.2	38.2	48.8	0.1	45.7	50.0
10/22/2004 15:25:00	29.34	7383.7	45.2	49.0	0.1	46.9	50.0
10/22/2004 15:30:58	29.34	8728.7	53.4	49.2	0.1	47.9	50.0
10/22/2004 15:36:58	29.35	10261.7	62.8	49.3	0.1	48.9	50.0
10/22/2004 15:42:59	29.34	11385.8	69.6	49.4	0.1	49.2	50.0
							50.0
							50.0
							50.0
							50.0
							50.0

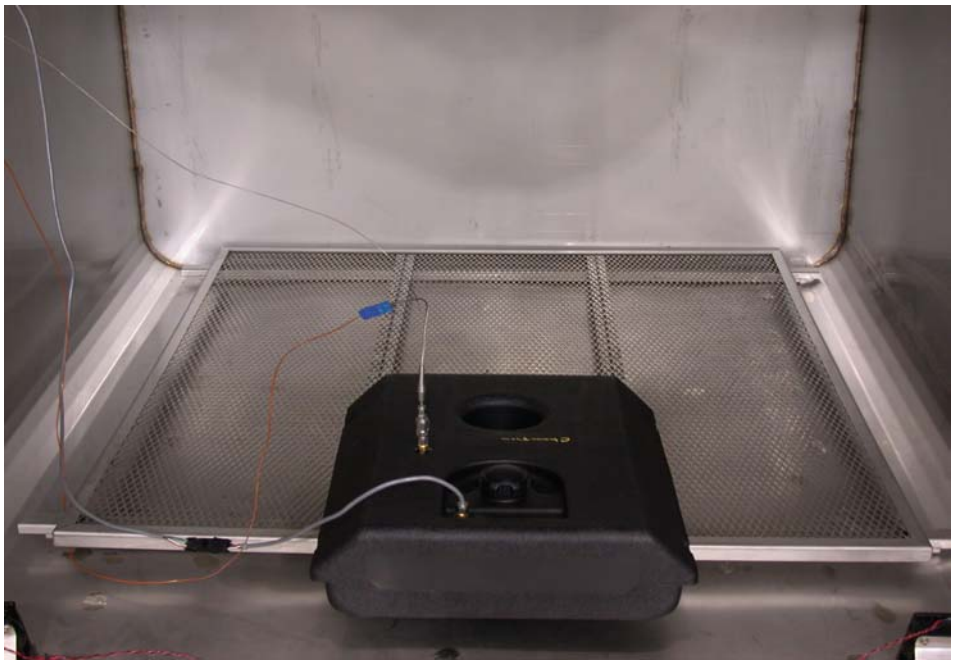

40137 Champion 2 Hr.
HC (g)
T (C)
t
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Date/Time
10/22/2004 14:12:58
10/22/2004 14:18:59
10/22/2004 14:24:59
10/22/2004 14:30:58
10/22/2004 14:36:59
10/22/2004 14:42:59
10/22/2004 14:48:58
10/22/2004 14:54:59
10/22/2004 15:00:59
10/22/2004 15:06:59
10/22/2004 15:12:59
10/22/2004 15:18:59
10/22/2004 15:25:00
10/22/2004 15:30:58
10/22/2004 15:36:58
HC (g)
SHED T (C)
Fuel T (C)
Target Fuel T (C)

JD 425 Set-Up



Exmark Set-Up

Onan Set-Up



Champion Set-Up