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Project B.10 – Study of Flammability of Materials

Flammability Properties of Engine Compartment Fluids Other than Gasoline

AutoIgnition Characteristics of Non-Gasoline Motor Vehicle Fluids on Heated Surfaces

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Abstract

This report describes flammability tests conducted to determine the ignition characteristics on heated surfaces of non-gasoline fluids used in motor vehicle. Fluids tested in this study included unused and used motor oils, unused and used synthetic motor oils, unused and used transmission fluids, unused and used power steering fluids, unused and used brake fluids, and unused and used antifreeze and engine coolant Fluids were poured onto heated surfaces to determine the minimum surface temperature that would result in ignition of the vaporized fluid in the absence of a pilot ignition source. The effects of fluid temperature, contact time with the heated surface, and airflow over the heated surface on ignition were also studied.

Introduction

The tests described in this report were conducted by General Motors (GM) pursuant to an agreement between GM and the United States Department of Transportation. This report describes flammability tests conducted to determine the ignition characteristics on heated surfaces of non-gasoline fluids used in motor vehicle. Fluids tested in this study included unused and used motor oils, unused and used synthetic motor oils, unused and used transmission fluids, unused and used power steering fluids, unused and used brake fluids, and unused and used antifreeze and engine coolant. Results of gas chromatography / mass spectroscopy (GCIMS) analysis of these fluids, and estimated boiling ranges and liquid heat capacities from the GC/MS data are presented in a separate report [1].

In the present study, fluids were poured onto heated surfaces to determine the minimum surface temperature that would result in ignition of the vaporized fluid in the absence of a pilot ignition source. The effects of fluid temperature, contact time with the heated surface, and airflow over the heated surface on ignition were also studied.

Experimental

The fluids analyzed in this study are listed in Table 1. Unused fluids were purchased from local automotive supply stores in Warren, Michigan, and tested as purchased. Used fluids were collected from General Motors Engineering Test Vehicles and from privately owned vehicles, and tested as removed from the vehicles. When available, the make, model, year, and mileage of the vehicle are indicated for the used fluids. The fluid mileage is the mileage driven by the vehicle while the sampled fluid was in the vehicle.

The sample identifications in Table 1 in this report correspond to the sample identifications in Table 1 of reference [1]. The sample identifications in Table 1 in this report are not sequential because not all of the fluids analyzed in the previous study were tested in this study. Two samples of unused windshield washer fluids, eleven samples of used motor oils, and one sample of used engine coolant analyzed in the previous study [1] were not tested in this study. One sample of cold climate power steering fluid tested in this study was not analyzed in the previous study [1].

Table 1. Fluids Analyzed In this Study

Sample ID	Fluid Information					Vehicle Information				
	Type	Grade	Brand	*State'*	Mileage				Mileage	Comments
BIOFFOOI	Motor Oil	5W30	Havoline	unused	n/a				n/a	n/a
B10FF002	Motor Oil	5W30	Quaker State	unused	n/a	n/a	n/a	n/a	n/a	n/a
B1OFF003	Motor Oil	5W30	Castrol GTX	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF004	Motor Oil	5W30	Valvoline	unused	n/a	n/a	n/a	n/a	n/a	n/a
B1OFF005	Motor Oil	1OW30	Mobil	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF006	Motor Oil	5W30	Pennzoil	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF007	Synthetic Motor Oil	5W30	Mobil 1	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF008	Synthetic Motor Oil	1OW30	Royal Purple	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF009	Synthetic Motor Oil	5W30	Castrol Syntec	unused	n/a	n/a	n/a	n/a	n/a	n/a
BIOFFOIO	Gear Lub	80W90	Quaker State	unused	n/a	n/a	n/a	n/a	n/a	n/a
BIOFFOII	Brake Fluid	Dot 3	Prestone	unused	n/a	n/a	n/a	n/a	n/a	n/a

Table 1, continued. Fluids Analyzed in this Study

Sample ID	Fluid Information					Vehicle Information				
	Type	Grade	Brand	State'	Mileage	Make	Model	Year	Mileage	Comments
B10FF012	Brake Fluid	Dot 3	Albany	unused	n/a	n/a	n/a	nla	n/a	n/a
B10FF013	Brake Fluid	Dot 3	Coastal	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF014	Power Steering Fluid	n/a	Valvoline	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF015	Power Steering Fluid	n/a	Pyroil	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF016	Power Steering Fluid	n/a	Prestone	unused	n/a	n/a	n/a	n/a	n/a	nla
B10FF017	Automatic Transmission Fluid	Dexron III Mercon	Quaker State	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF018	Automatic Transmission Fluid	Dexron III Mercon	Sunoco	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF021	Antifreeze	Ethylene Glycol	Prestone	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF022	Antifreeze	Propylene Glycol	Sierra	unused	n/a	n/a	n/a	n/a	n/a	n/a
B10FF024	Motor Oil	5W30	Mobil	used	230	Chev.	Van	1997	unk.	cold starts 112 short trips 230 miles
B1OFF027	Motor Oil	5w30	Mobil	used	542	Chev.	Suburban	.1997	19,580	city driving 542 miles shorttrips

Table 1, continued. Fluids Analyzed In this Study

Sample ID	Fluid Information					Vehicle Information				
	Type	Grade	Brand	State'	Mileage	Make	Model	Year	Mileage	Comments
B10FF028	Motor Oil	10w30	Mobil	used	3,000	Buick	Skylark	1995	60,410	50% city 50% Highway
B10FF029	Motor Oil	5w30	Pennzoil	used	4475	Chev.	Lumina	1994	63775	25% city 75% highway
B10FF030	Motor Oil	5W30	Motor Craft	used	3,000	Ford	Explorer	1992	156,238	25% city 75% highway
B10FF031						Chev.	Venture	1998	34,927	75% highway 25% city
B10FF032						Dodge	Dakota	1991	205,770	*unk.*
B10FF033						Chev.	Astro Van	1995	48,092	*unk.*
B10FF034	Automatic Transmission Fluid	Dexron III Mercon	Quaker State	used	30,000	Buick	Skylark	1995	60,614	50% city 50% Highway
B10FF035	Engine Coolant	glycole-water (1:1)	Prestone	unused	*unk.*	n/a	n/a	nta	n/a	*unk.*
B10FF036	Engine Coolant	glycole-water (1:1)	Sierra	unused	unk.	n/a	n/a	n/a	n/a	*unk.*
B10FF037	Motor Oil	5W30	Sunfill SJ	used	7,282	GMC	Suburban	1999	18,384	50% city 50% highway

Table 1, continued. Fluids Analyzed In this Study

Sample ID	Fluid Information					Vehicle Information				
	Type	Grade	Brand	State[1]	Mileage	Make	Model	Year	Mileage	Comment8
B10FF040	Synthetic Motor Oil	5W30	Mobil 1	used	1,257	Olds.	Bravada	1994	23,840	short trips start/stops
B10FF041	Motor Oil	5W30	Sunfill SJ	used	2,150	Chev.	Express Van	1996	2,150	cold starts low speed short trips
B1OFF047	Synthetic Motor Oil	5W30	Mobil 1	used	81	Chev.	Corvette	1993	9523	hard driving high speed high RPM
B1OFF049	Engine Coolant	nla	nla	used	*unk.*	Olds.	Bravada	1991	23,840	short trips start/stops
B10FF051	Power Steering Fluid	n/a	nla	used	n/a	pooled from many vehicles				
B1OFF052	Brake Fluid	nla	nla	used	nla	pooled from many vehicles				
B10FF053	Power Steering Fluid	Cold Climate	Goodwrench	unused	n/a	nla	nla	nla	nla	n/a

[1] Unused indicates the fluid tested was obtained from a retail automotive supply store and tested as purchased. Used indicates the fluid tested was obtained from a motor vehicle and tested in the condition as removed from the vehicle.

lanition Characteristics - Cast Iron Crucibles. Metal crucibles with the dimensions shown in Figure 1 were cast from gray iron using green sand molds. A K-Type thermocouple (24 ga.) was spot-welded to the center of the upper surface of the bottom of each crucible (Fig. 1).

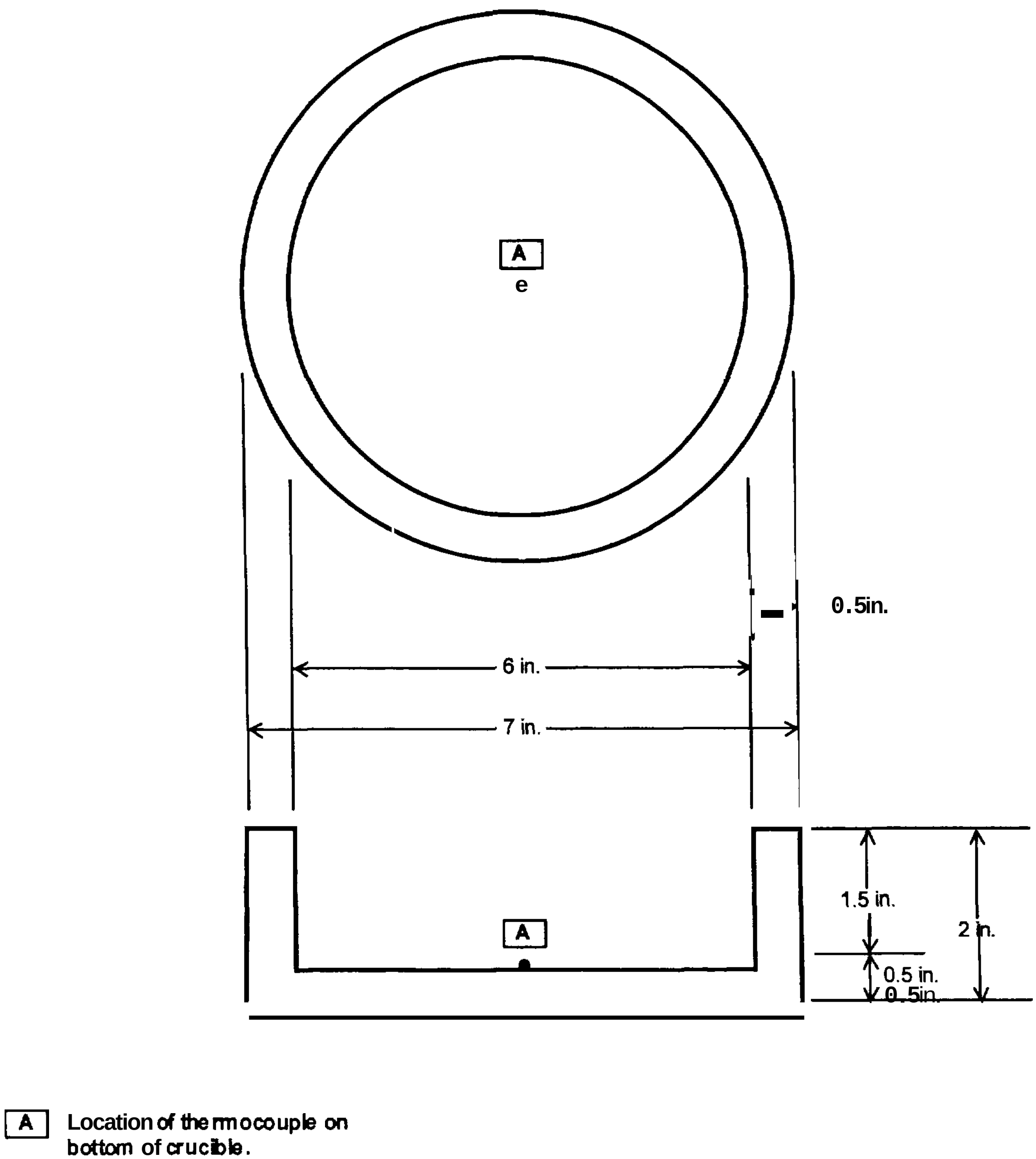

Figure 1. Dimensions of cast iron crucibles. The location of a K-Type thermocouple intrinsically welded to upper surface of the bottom of the crucible is indicated.

An 220V electric hot plate (Chromalox) was used to heat the cast iron crucibles (Fig. 2). Electrical power to the hot plate was supplied by a 220 V variable transformer (Powerstat, Wamer

Electric). The outer wall of the crucible was wrapped with a ceramic fiber insulating material which, in turn, was wrapped with aluminum tape to help maintain a constant and uniform temperature on the upper surface of the bottom of the crucible. Temperature was monitored continuously, and the output power from the transformer was adjusted manually to control temperature. Test sample fluid volume (approximately 25 cc) was measured with a glass, graduated cylinder. After the target temperature was achieved and was constant to ± 1°C for a period of 3 to 5 minutes, the contents of the graduated cylinder were poured directly into the center of the crucible (where the thermocouple was located) in 2 to 3 seconds. Air temperature and dew point were measured using a psychrometer (Model RH5100, Omega Engineering). Barometric pressure was measured using a mercury barometer (Curtin Mathesin Scientific, Inc.).

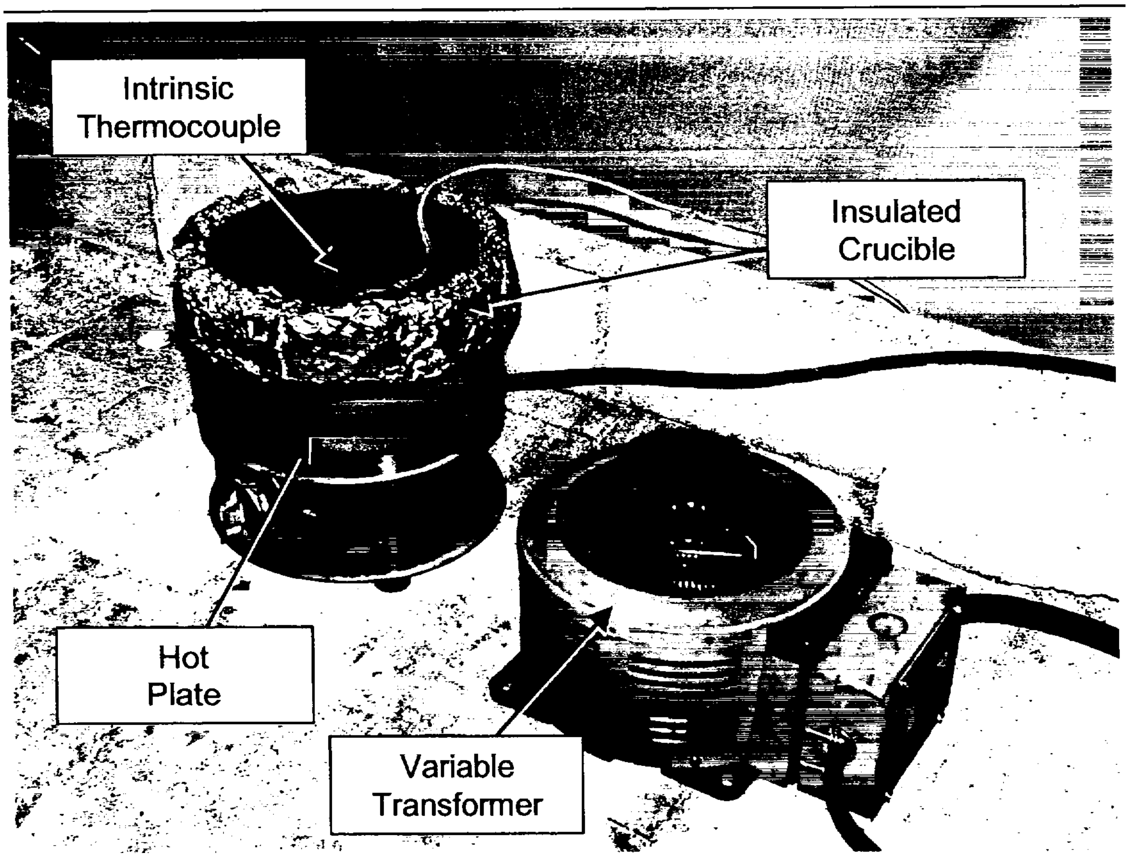

Figure 2. Photograph of the crucible test set-up showing an insulated cast iron crucible, K-Type thermocouple intrinsically welded to the bottom of the crucible, 220 V hot plate, and 220 V variable transfotmer.

The crucibles were cleaned after each test. The thermocouples were detached and the crucibles were placed in a muffle furnace maintained at 600°C for approximately 60 minutes until residual fluid had charred. The crucibles were removed from the muffle furnace and allowed to cool.

Char was removed by sand blasting using garnet. A thermocouple was spot-welded to the center of the bottom of each crucible after it was cleaned.

Surface Innition Characteristics – Cast Iron Hemispheres. Metal hemispheres with the dimensions shown in Figure 3 were cast from gray iron using green sand molds. A Type-K thermocouple (24 ga.) was spot-welded to the apex of each crucible (Fig. 3).

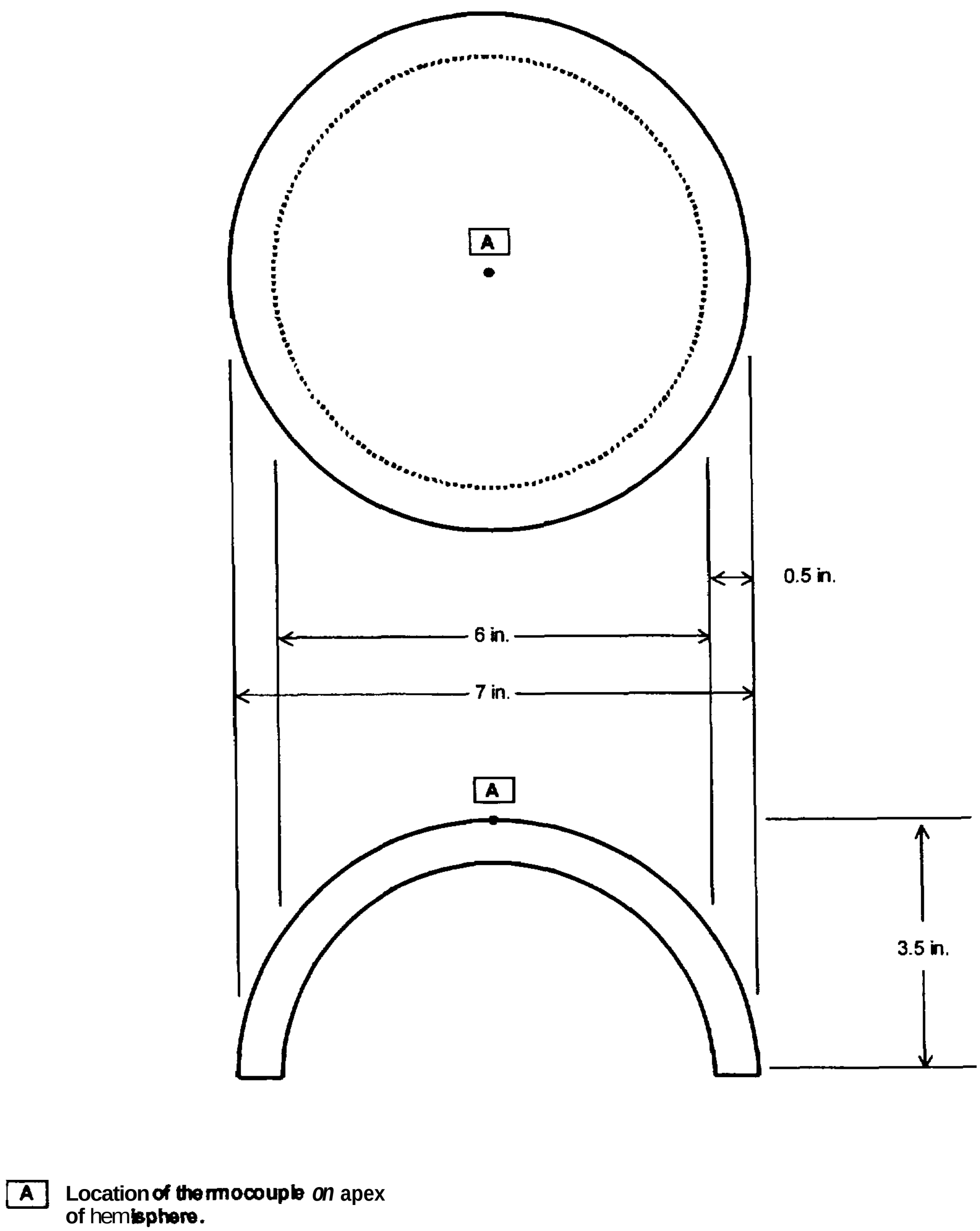

Figure 3. Dimensions of cast iron hemispheres. The location of the thermocouple on the bottom of the crucible is indicated.

A Meeker burner supplied with a welding grade mixture of methane, acetylene, propylene (MAP) was used to heat the cast iron hemispheres (Fig. 4). The hemispheres were supported by a ring attached to the Meeker burner. The height of the ring was adjusted so that the burner surface was approximately ½ in. higher than the lip of the hemispheres. A trough fabricated from carbon steel (30 ga.) was used to collect fluid that ran off of the hemisphere. The trough was located approximately 1 in. below the lip of the hemispheres.

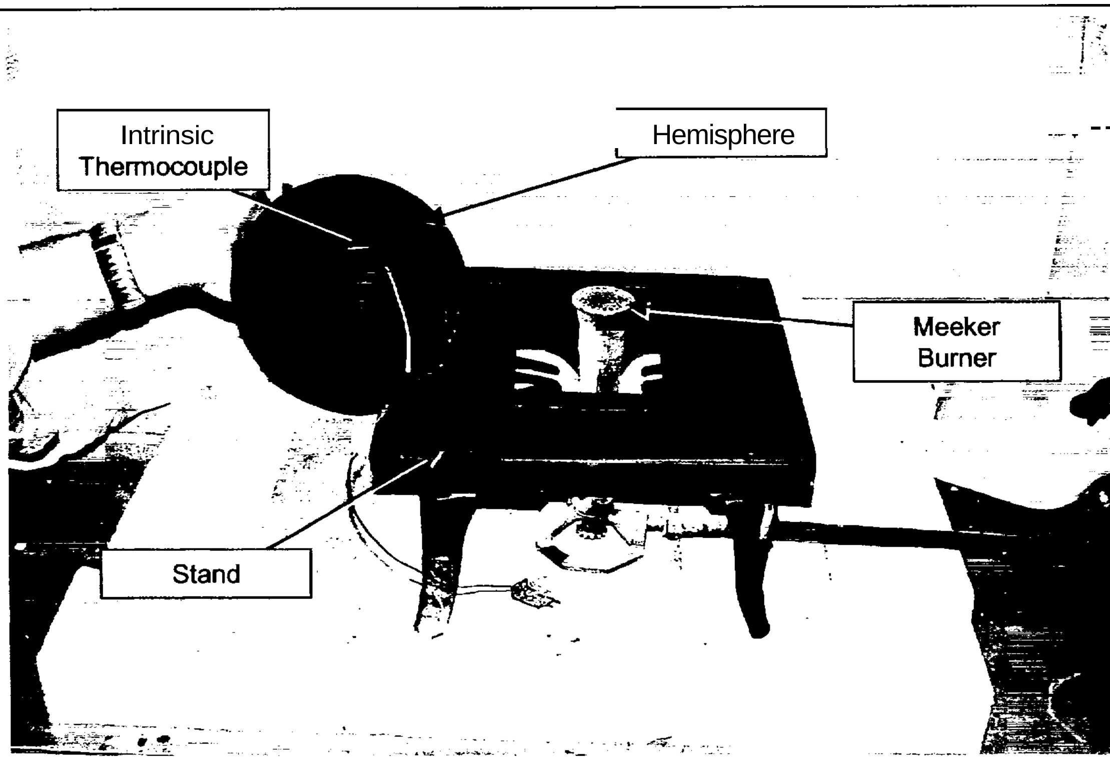

Figure 4. Photograph of the hemisphere test set-up showing a cast iron hemisphere, K-Type thermocouple intrinsically welded to apex of the hemisphere, Meeker bumer, and stand.

The Meeker burner was ignited and the temperature of the thermocouple at the apex of the hemisphere was monitored continuously. Test sample fluid volume was measured with a glass, graduated cylinder. When the temperature was 20 to 25°C greater than the target temperature, the gas supply to the Meeker bumer was turned off and the hemisphere allowed to cool. The contents of the graduated cylinder were poured directly onto the apex of the hemisphere when thermocouple temperature reached the target temperature.

In some tests, a fan was used to produce airflow over the hemisphere. The fan was placed approximately 5 feet from the hemisphere. The height and angle of the fan were adjusted so that direction of airflow was horizontal and impinged directly on the hemisphere. Electrical power to the fan was supplied by a 120 V variable transformer. The airflow rate was adjusted by adjusting the transformer setting (power) and measured at the hemisphere with a propeller anemometer. In these tests, the contents of the graduated cylinder were poured onto the hemisphere slightly upwind of the apex to ensure that the fluid did not run down the leeward side of the hemisphere.

After each test, fluid was removed from the trough. The hemispheres were cleaned by igniting the Meeker bumer and heating the hemisphere until the temperature of the thermocouple at the apex was maintained at > 600°C for a few minutes. This was sufficient to vaporize and oxidize residual fluid film on the outer surface of the hemisphere.

Results

Cast Iron Crucibles Tests

Surface Temperature Distribution - Cast Iron Crucibles. **To** determine the temperature distribution on the upper surface of the bottom of the cast iron crucibles, four K-Type thermocouples were spot-welded to the upper surface of the bottom of one of the cast iron crucibles at ¾" intervals from the center to the wall (Fig. 5).

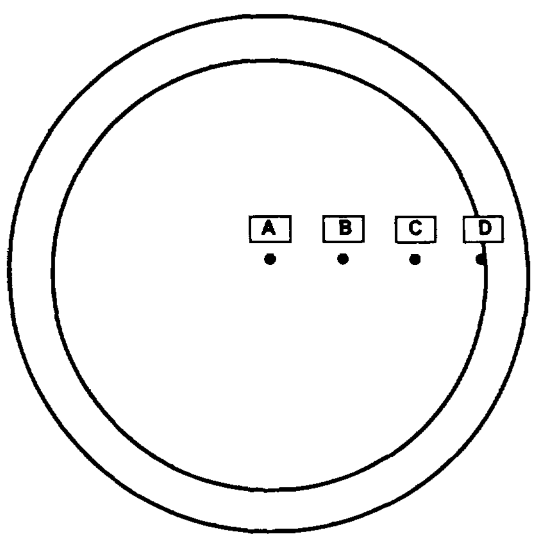

Figure 5. Locations of K-Type thermocouples used to determine surface temperature distribution on the bottom of the crucibles.

The crucible was placed in the center of a hot plate and insulated with foil-wrapped ceramic fiber. After the temperature of thermocouple A had stabilized to ±1°C for 2 to 3 minutes, the temperatures of thermocouples A through D were recorded. Measurements were made at nominal temperatures of 300, 350,400, 450, and 525°C (Table 2).

Table 2.
Temperature Distribution on the Bottom of a Cast Iron Crucible

Nominal Temperature (C)	Temperature (C)			
	A	B	C	D
300	304	305	303	302
350	358	357	356	355
400	404	405	402	400
450	453	453	451	449
525	528	527	524	520

Rotating the crucible on the hot plate did not affect the upper surface temperature distributions shown in Table 2. The results in Table 2 show that the temperature of the upper surface of the bottom of the crucible decreased by 2°C from the center to the wall at a nominal temperature of 300°C and by 8°C at a nominal temperature of 525°C. The temperature difference from center to wall was greater if the insulation around the outer wall of the crucible was removed.

Ignition Characteristics – Cast Iron Crucibles. Each fluid listed in Table 1 was tested over a range of temperatures to determine its ignition characteristics when poured onto the bottom surface of the cast iron crucibles. After the temperature of the thermocouple had equilibrated to ± 1°C of the target temperature for 3 to 5 minutes, approximately 25 cm^3 of fluid was poured into the center of a clean cast iron crucible. If the vapor generated by the heated fluid spontaneously ignited during a five-minute interval after the fluid was poured into the crucible, then an ignition event was recorded for the initial temperature of the thermocouple. If the vapor generated by the heated fluid did not spontaneously ignite at any time during a five-minute interval after the fluid was poured into the crucible, then a no-ignition event was recorded for the initial temperature of the thermocouple. Five or more replicate tests were done at each temperature to determine the reproducibility of the ignition results. Results of these tests are in the appendicies and are summarized in Figures 6 through 13.

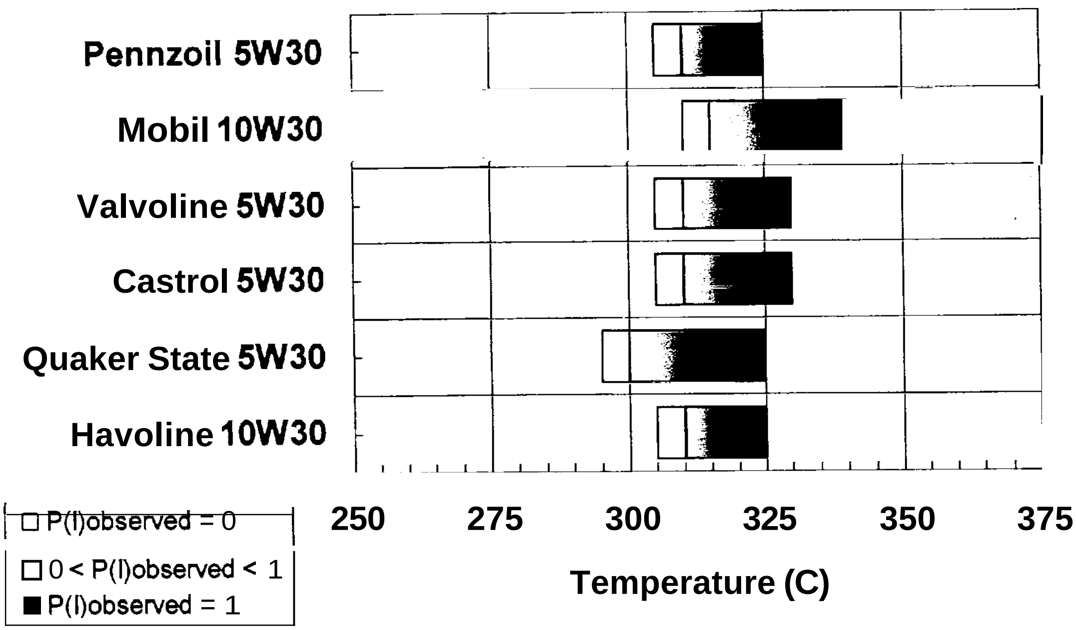

Figure 6. Summary of autoignition results of unused motor oils on heated cast iron crucibles.

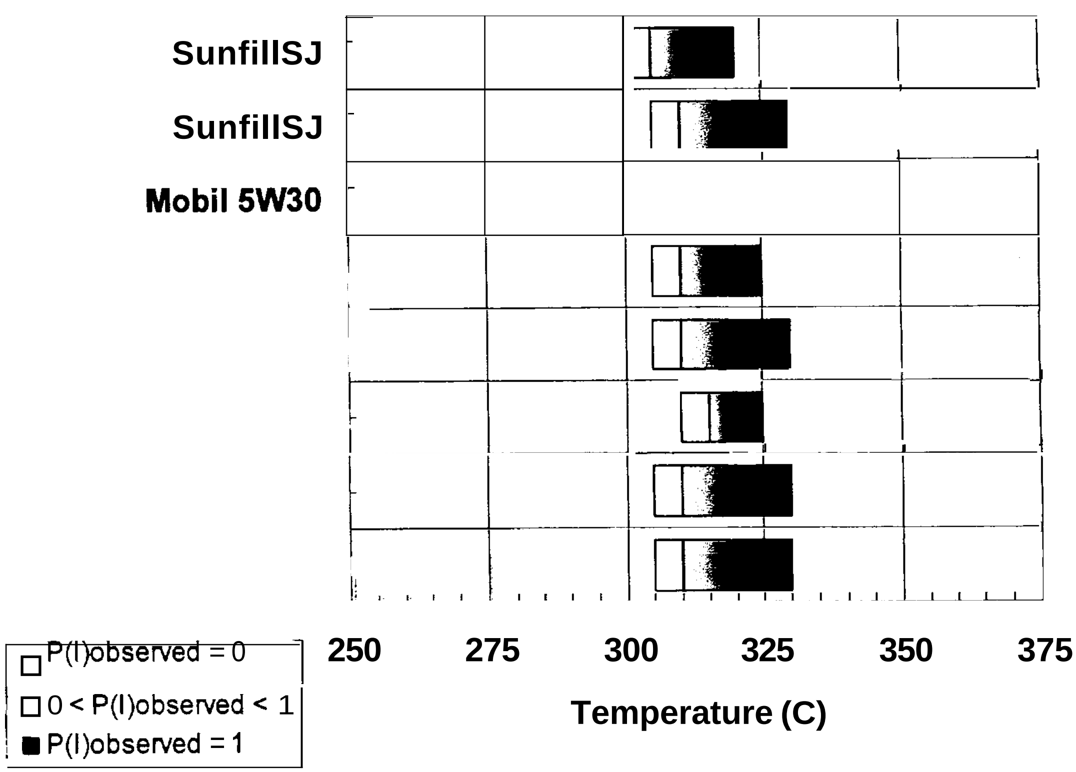

Figure 7. Summary of autoignition results of used motor oils on heated cast iron crucibles.

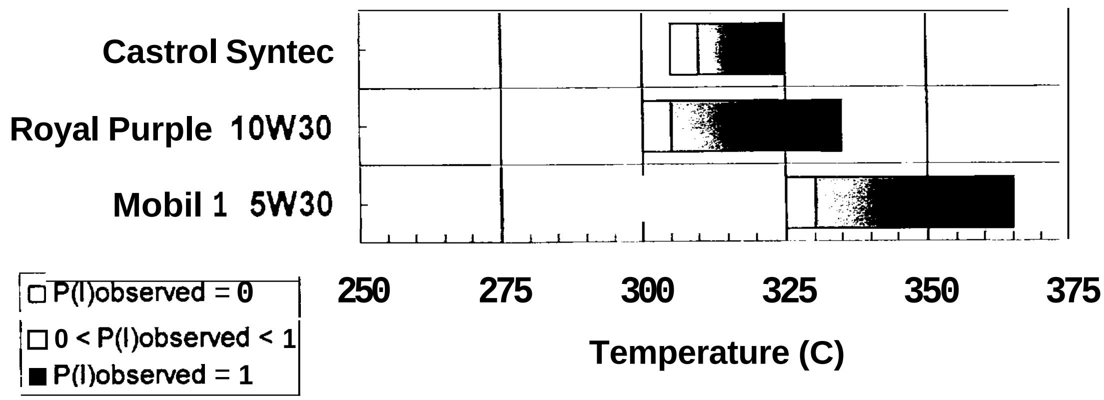

Figure 8. Summary of autoignition results of unused synthetic motor oils on heated cast iron crucibles.

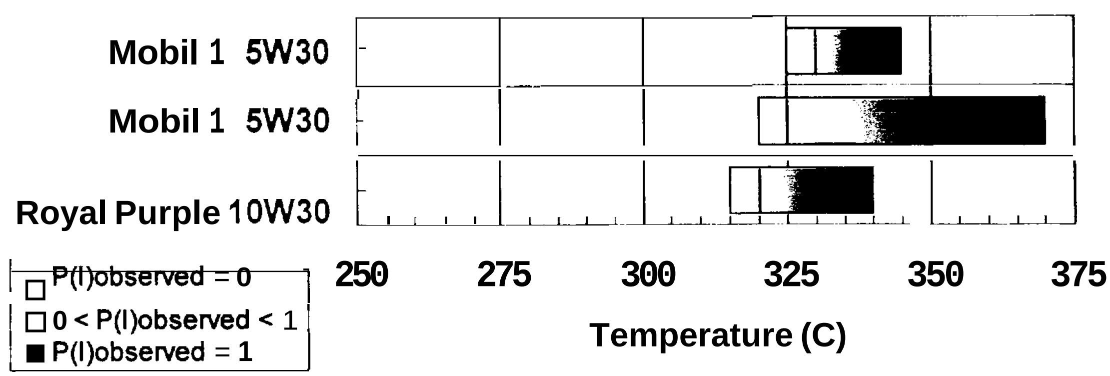

Figure 9. Summary of autoignition results of used synthetic motor oils on heated cast iron crucibles.

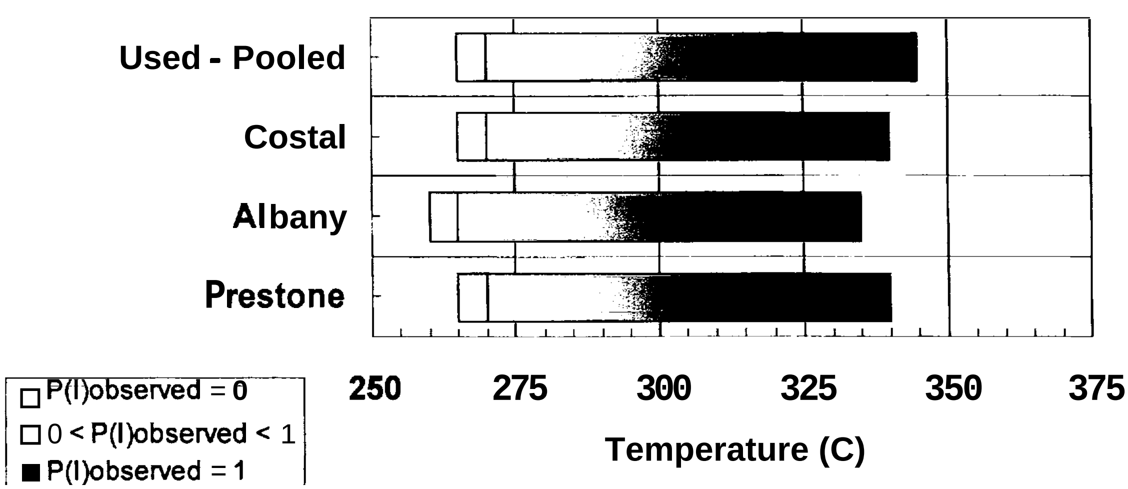

Figure 10. Summary of autoignition results of unused and used brake fluids on heated cast iron crucibles.

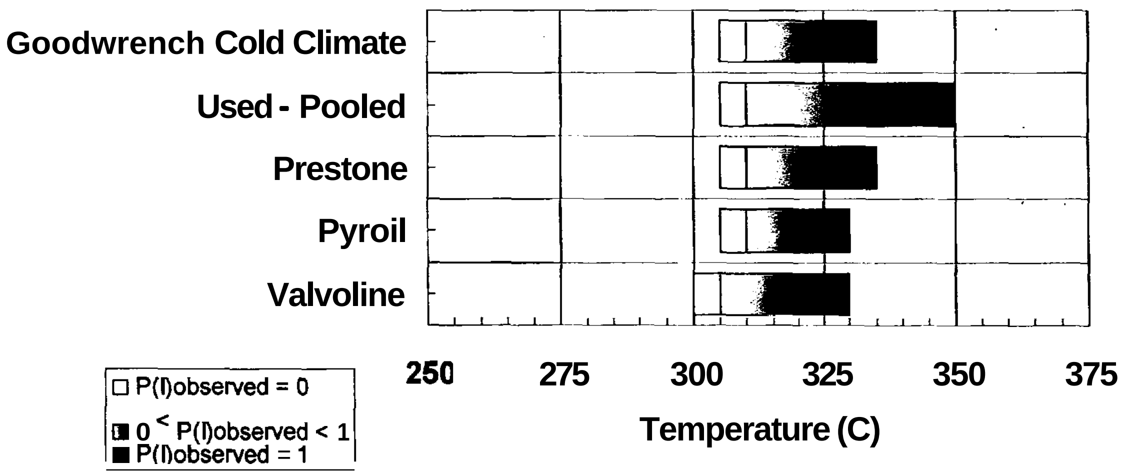

Figure 11. Summary of autoignition results of unused and used power steering fluids on heated cast iron crucibles.

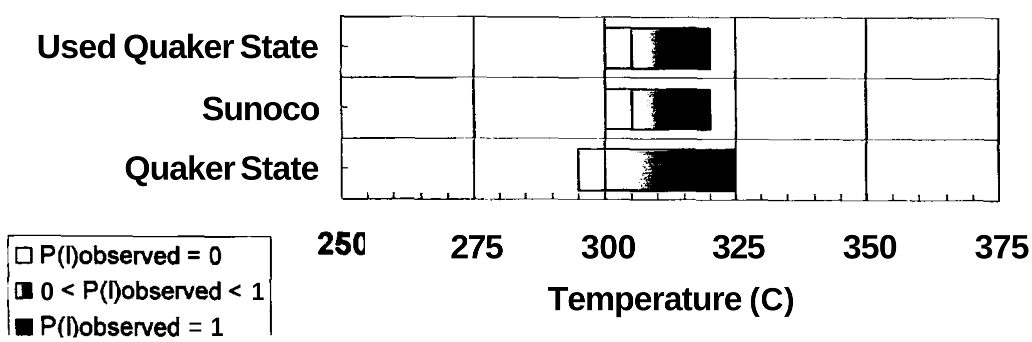

Figure 12. Summary of autoignition results of unused and used automatic transmission fluids on heated cast iron crucibles.

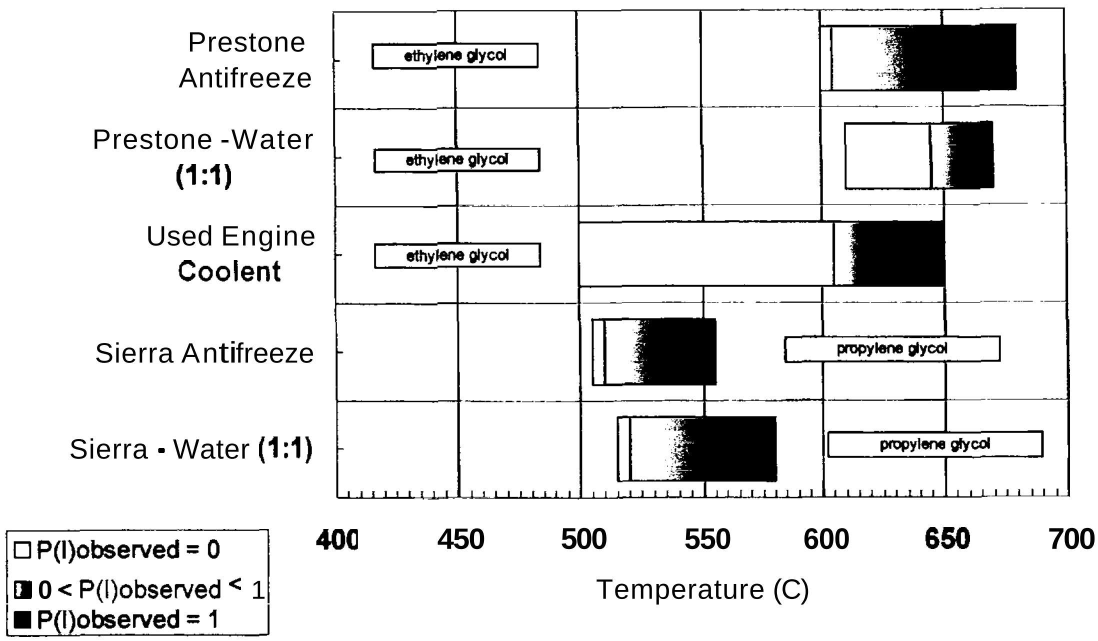

Figure 13. Summary of autoignition results of ethylene glycol- and prolylene glycol-based antifreeze, antifreeze-water (1:1) mixtures, and used engine coolant on heated cast iron crucibles.

A single threshold temperature below which the fluid would never ignite and above which the fluid would always ignite did not describe the ignition characteristics of the fluids tested in this study. The results obtained in this study indicated two temperature thresholds define three temperature regions that characterize the autoignition characteristics of the fluids tested on cast iron crucibles (Fig.'s 6 through 13). A lower temperature region was defined by surface temperatures that were less than a lower threshold temperature where the vapor generated by the heated fluid did not spontaneously ignite during any of the replicate tests at temperatures in this region, giving an observed ignition probability $P(I)_{observed} = 0$ for these temperatures. An upper temperature region was defined by surface temperatures that were greater than an upper threshold temperature where the vapor generated by the heated fluid spontaneously ignited in all of the replicate tests at temperatures in this region, giving an observed ignition probability $P(I)_{observed} = 1$ for these temperatures. An intermediate temperature region was defined by surface temperatures that were between the lower and upper temperature thresholds where the vapor generated by the heated fluid spontaneously ignited in some but not all of the replicate tests done at temperatures in this region, giving an observed ignition probability $0 < P(I)_{observed} < 1$ for these temperatures. The horizontal bars in Figures 6 through 13 indicate the temperature ranges over which each fluid was tested. The white area indicates temperatures where none of the replicate tests ignited ($P(I)_{observed} = 0$), the light blue area indicates temperatures where some, but not all of the replicates tests ignited ($0 < P(I)_{observed} < 1$), and the dark blue area indicates temperatures where all of the replicate tests ignited ($P(I)_{observed} = 1$).

Results in Appendix B10FF001, for example, indicate that 5 replicate tests at 305, 310, 315, 320, and 325°C were done to characterize the autoignition characteristic of unused Pennzoil 5W30 motor oil on cast iron crucibles. The tabulated test results in Appendix BIOFFOOI show that 0/5 ignitions were observed at 305 and 310°C, 4/5 ignitions were observed at 315°C, and 5/5 ignitions were observed at 320 and 325°C. The horizontal bar for Pennzoil 5W30 motor oil in Figure 6 extends from 305 to 325°C – the temperature range over which Pennzoil 5W30 motor oil was tested. The horizontal bar is shaded white between 305 and 310°C to indicate that none of the replicate tests resulted in ignition in this temperature range, light blue between 310 and 320°C to indicate that some, but not all of the replicates tests resulted in ignition in this temperature range, and dark blue between 320 and 325°C to indicate that all of the replicate tests resulted in ignition of the fluid vapor in this temperature range (Fig. 6).

Figures 6 and 7 summarize autoignition characteristics observed for six samples of unused motor oil and eight samples of used motor oils tested on cast iron crucibles. The plots in Figures 6 and 7 show that partial ignition response ($0 < P(I)_{observed} < 1$) occurred in the region bounded by the highest 0% response and the lowest 100% response temperatures, respectively. For the six samples of unused motor oils tested in this study, the highest temperature where $P(I)_{observed} = 0$ was in the range of 300 to 315°C and the lowest temperature where $P(I)_{observed} = 1$ was in the range 320 to 335°C (Fig. 6). Temperatures between the highest temperature where $P(I)_{observed} = 0$ and the lowest temperature where $P(I)_{observed} = 1$ defined a region where $0 < P(I)_{observed} < 1$. For the eight samples of used motor oils tested in this study, the highest temperature where $P(I)_{observed} = 0$ was in the range of 310 to 320°C and the lowest temperature where $P(I)_{observed} = 1$ was in the range 315 to 335°C (Fig. 7). As with the unused motor oils, temperatures within these lower and upper bounds defined a region where $0 < P(I)_{observed} < 1$.

Figures 8 and 9 summarize autoignition characteristics observed for three samples of unused synthetic motor oil and three samples of used synthetic motor oils on cast iron crucibles. For the three unused synthetic motor oils tested in this study, the highest temperature where $P(I)_{observed} = 0$ was in the range of 305 to 330°C and the lowest temperature where $P(I)_{observed} = 1$ was in the range 320 to 360°C (Fig. 8). For the three used synthetic motor oils tested in this study, the highest temperature where $P(I)_{observed} = 0$ was in the range of 320 to 330°C and the lowest temperature where $P(I)_{observed} = 1$ was in the range 335 to 365°C (Fig. 9).

Figure 10 summarizes autoignition characteristics observed for three samples of unused brake fluid and one sample of used pooled brake fluid on cast iron crucibles. For the three unused brake fluids tested in this study, the highest temperature where $P(I)_{observed}$ = 0 was in the range of 265 to 270°C and the lowest temperature where $P(I)_{observed}$ = 1 was in the range 330 to 335°C (Fig. 10). For the one used pooled brake fluid tested in this study, the highest temperature where $P(I)_{observed}$ = 0 was 270°C and the lowest temperature where $P(I)_{observed}$ = 1 was 340°C (Fig. 10).

Figure 11 summarizes autoignition characteristics observed for three samples of unused power steering fluid, one sample of unused cold climate power steering fluid, and one sample of used pooled power steering fluid on cast iron crucibles. For the three unused power steering fluids tested in this study, the highest temperature where $P(I)_{observed}$ = 0 was in the range of 305 to 310°C and the lowest temperature where $P(I)_{observed}$ = 1 was in the range 325 to 330°C (Fig. 11). For the one unused cold climate power steering fluid tested in this study, the highest temperature where $P(I)_{observed}$ = 0 was 310°C and the lowest temperature where $P(I)_{observed}$ = 1 was 330°C (Fig. 11). For the one used power steering fluid tested in this study, the highest temperature where $P(I)_{observed}$ = 0 was 310°C and the lowest temperature where $P(I)_{observed}$ = 1 was 345°C (Fig. 11).

Figure 12 summarizes autoignition characteristics observed for two samples of unused automatic transmission fluid and one sample of used transmission fluid on cast iron crucibles. For the two unused automatic transmission fluids tested in this study, the highest temperature where $P(I)_{observed}$ = 0 was in the range of 300 to 305°C and the lowest temperature where $P(I)_{observed}$ = 1 was in the range 315 to 320°C (Fig. 12). For the one used automatic transmission fluid tested in this study, the highest temperature where $P(I)_{observed}$ = 0 was 305°C and the lowest temperature where $P(I)_{observed}$ = 1 was 315°C (Fig. 12).

Figure 13 summarizes autoignition characteristics observed for one sample of ethylene glycol-based antifreeze, one sample of a 1:1 mixture of ethylene glycol-based antifreeze and water, one sample of used engine coolant which was approximately a 1:1 mixture of ethylene glycol and water, one sample of a propylene glycol-based antifreeze, one sample of a 1:1 mixture of a propylene glycol-based antifreeze and water, and one sample of used engine coolant. The highest temperature where $P(I)_{observed}$ = 0 was 605°C and the lowest temperature where $P(I)_{observed}$ = 1 was 675°C for the ethylene glycol-based antifreeze tested in this study (Fig. 13). The highest temperature where $P(I)_{observed}$ = 0 was 645°C and the lowest temperature where $P(I)_{observed}$ = 1 was 665°C for the 1:1 mixture of ethylene glycol-based antifreeze and water tested in this study (Fig. 13). The highest temperature where $P(I)_{observed}$ = 0 was 605°C and the lowest temperature where $P(I)_{observed} = 1$ was 625°C for the used engine coolant tested in this study (Fig. 13). The highest temperature where $P(I)_{observed} = 0$ was 510°C and the lowest temperature where $P(I)_{observed} = 1$ was **550°C** for the propylene glycol-based antifreeze tested in this study (Fig. 13). The highest temperature where $P(I)_{observed} = 0$ was 520°C and the lowest temperature where $P(I)_{observed} = 1$ was **575°C** for the 1:1 mixture of propylene glycol-based antifreeze and water tested in this study (Fig. 13).

Table 3 summarizes the lowest test temperature, the highest test temperature, the highest temperature where $P(I)_{observed} = 0$, and the lowest temperature where $P(I)_{observed} = 1$ for each fluid tested on cast iron crucibles.

Statistical Analysis of Fluid Ignition Data

In the tests summarized in this report, a number of replicate tests were performed at each of a series of test temperatures. The outcome of interest in these experiments was whether an ignition event was or was not observed in each replicate test. The response variable in these tests was, therefore, a dichotomous or binary variable (i.**e**., ignition = yeslno). Probit analysis is one potentially useful statistical regression method that can be used to analyze binary response data as a function of fixed values of independent variables. Probit analysis, using the normal distribution as the link function, was used to analyze the response (probability of ignition) as a function of a stimulus (test temperature) for each of the tests summarized in Figures 6 through 13. Probit analysis of these data enables one to answer such questions as, "At what test temperature can we expect to find that 50% of test samples will ignite? Or What is the probability of an ignition at a given test temperature?"

Tables A1 through A8 summarize the lowest test temperature, the highest zero response temperature, the lowest 100% response temperature, and the highest test temperature for each test of fluids tested in this study. Tables A1 through A8 also summarize the results of probit analyses of each of the tests depicted in Figures 6 through 13. Summary statistics listed in Tables A1 through A8 include: measures of the goodness of fit of the model, the intercept and slope of the fitted curve, and the **1st, 5th, 50th,** 95" and **99th** ignition temperature percentile values (along with their associated 95% confidence limits). For example, the **50th** ignition temperature percentile is that estimated test temperature at which **50%** of test samples would be expected to ignite under the conditions of the tests as performed in this study. The confidence limits associated with each estimated ignition temperature percentile provide an indication of the potential variability in the results that may be expected with this study's test methodology.

Table 3

Summary of Lowest Test Temperature, Highest Test Temperature, Highest Temperature where $P(I)_{observed}$ = 0, and Lowest Temperature where $P(I)_{observed}$ = 1 for Cast Iron Crucibles

Fluid Type	Fluid Description	Sample ID	Lowest Test Temp	Highest 0% Response Temp	Lowest 100% Response Temp	Highest Test Temp
Unused Motor Oil	Havoline SAE 5W-30 Motor Oil	BIOFFOOI	305	310	320	325
	Quaker State 5W-30 Motor Oil	B1OFF002	295	300	320	325
	Castrol GTX 5W-30 Motor Oil	B1OFF003	305	310	325	330
	Valvoline All Climate 5W-30 Motor Oil	B1OFF004	305	310	325	330
	Mobil Proven Performance 1OW-30 Motor Oil	B1OFF005	310	315	335	340
	Pennzoil 5W-30 Motor Oil	B1OFF006	305	310	320	325
Used Motor Oil	Mobile 5W-30 Used Motor Oil	B10FF024	305	310	325	330
	Mobile 5W-30 Used Motor Oil	B10FF027	305	310	325	330
	Mobile 10W-30 Used Motor Oil	B10FF028	310	315	320	325
	Pennzoil 5W-30 Used Motor Oil	B10FF029	305	310	325	330
	Motorcraft 5W-30 Used Motor Oil	B10FF030	305	310	320	325
	Mobile 5W-30 Used Motor Oil	B10FF031	315	320	335	340
	Sunfill SJ 5W-30 Used Motor Oil	B10FF037	305	310	325	330
	Sunfill SJ 5W-30 Used Motor Oil	B10FF041	300	305	315	320
Unused Synthetic Motor Oil	Mobil Advanced Formula 5W-30 Synthetic Motor Oil	B10FF007	325	330	370	375
	Royal Purple Synthetic Motor Oil	B1OFF008	300	305	330	335
	Castrol Syntec Motor Oil	B10FF009	305	310	320	325
Used Synthetic Motor Oil	Royal Purple 10W-30 Used Synthetic Motor Oil	B1OFF032	315	320	335	340
	Mobile1 5W-30 Used Synthetic Motor Oil	B10FF033	320	325	365	370
	Mobill 5W-30 Used Synthetic Motor Oil	B10FF040	310	315	335	340
		B1OFF047	325	330	340	345

Table 3, continued
Summary of Lowest Test Temperature, Highest Test Temperature, Highest Temperature where $P(I)_{observed} = 0$, and Lowest Temperature where $P(I)_{observed} = 1$ for Cast Iron Crucibles

Fluid Type	Fluid Description	Sample ID	Lowest Test Temp	Highest 0% Response Temp	Lowest 100% Response Temp	Highest Test Temp
Brake Fluid	Prestone DOT 3 Brake Fluid	B10FF011	265	265	330	335
	Albany DOT 3 Brake Fluid	B10FF012	260	265	280	285
	Coastal DOT 3 Brake Fluid	B10FF013	265	270	335	340
	Pooled used Brake Fluids	B1OFF052	265	270	340	**345**
Power Steering Fluid	Valvoline Power Steering Fluid	B1OFF014	300	305	325	330
	Pyroil Power Steering Fluid	B10FF015	305	310	325	330
	Prestone Power Steering Fluid	B1OFF016	305	310	330	335
	Goodwrench Cold Climate Power Steering Fluid	B1OFF053	305	310	325	335
	Pooled Used Power Steering Fluid	B10FF051	305	310	**345**	350
Automatic Transmission Fluid	Quaker State Automatic Transmission Fluid	B10FF017	295	300	320	325
	Sunoco Dextron III Mercon Automatic Transmission Fluid	B10FF018	300	305	315	320
	Used Dextron III Automatic Transmission Fluid	B10FF034	300	305	315	320
Antifreeze and Engine Coolant	Prestone 5/150 Extended Life Antifreeze/Coolant	B10FF021	600	605	675	680
	Sierra Antifreeze	B1OFF022	505	510	550	555
	Prestone 5/150 Extended Life Antifreeze - Water 1:1	B1OFF035	610	645	665	670
	Sierra Antifreeze-Water 1:1	B1OFF036	515	520	575	580
	Used Engine Coolant	B10FF049	500	595	625	650

For some tests, the maximum likelihood algorithm used to estimate the model parameters failed to converge (i.e., failed to reach a unique solution). For optimum model results, a given test series should be characterized by a monotonically increasing response (proportion of test samples that ignited) as a function of test temperature. In addition, there should be at least two and preferably three partial responses between the 0% and 100% response extremes. For those tests with only one test temperature resulting in partial ignition response ($0 < P(I)_{observed} < 1$), the numerical algorithm used to derive the maximum likelihood estimates of the model parameters was unable to find a unique solution. Results of these particular analyses should, therefore, be interpreted with caution.

A Chi-square test was conducted to test the hypothesis of equal slopes for the probit regression analyses of the **6** tests of unused motor oils. The result of this test (Chi-square = **4.7688** with **5** degrees of freedom, p-value = 0.445) indicates that the **slopes** of the probit regression curves are not significantly different from one another. Accordingly, the data for all 6 of these tests was pooled and the probit regression model fit to the pooled data to generate a predicted probability of ignition versus test temperature curve over the temperature range: 295-340 C. The curve of predicted ignition probability as a function of increasing test temperature, along with lower and upper confidence limits, is shown in Figure 14 along with observed ignition proportions at each test temperature.

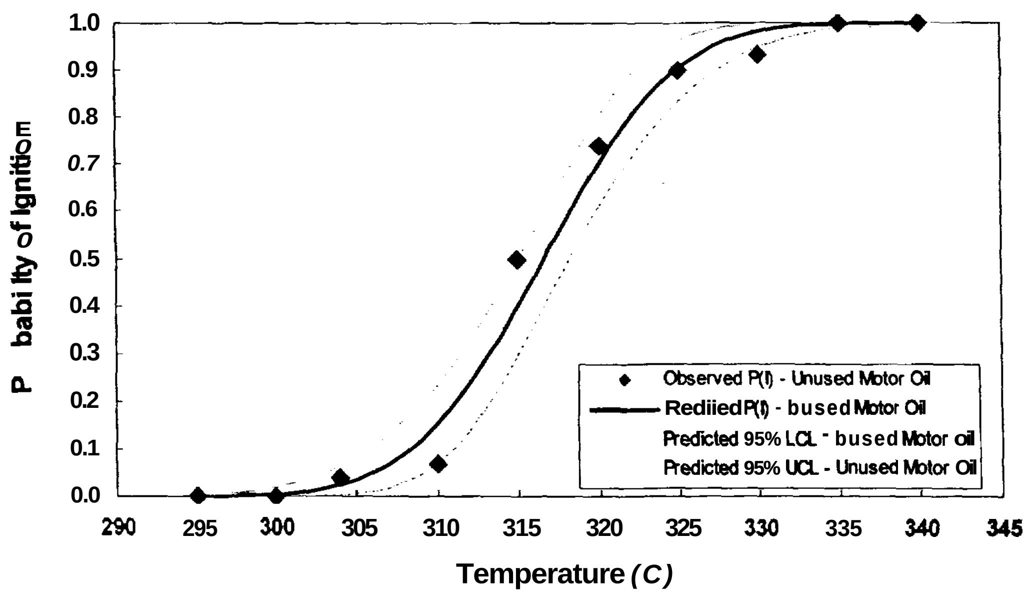

Figure 14. Observed and predicted autoignition probabilities for unused motor oils on cast iron crucibles at temperatures from 295 to 340°C. The predicted autoignition probabilities were obtained from the Probit analysis described in this section.

Similarly, a Chi-square test was conducted to test the hypothesis of equal slopes for the probit regression analyses of the **8** tests of used motor oils. The result of this test (Chi-square = **7.9591** with **7** degrees of freedom, p-value = **0.336)** indicates that the slopes of the probit regression curves are not significantly different from one another. The data for all 8 of these tests was pooled and the probit regression model fit to the pooled data to generate a predicted probability of ignition versus test temperature curve over the temperature range: **295-340** C. The curve of predicted ignition probability as a function of increasing test temperature, along with lower and upper confidence limits, is shown in Figure **15** along with observed ignition proportions at each test temperature.

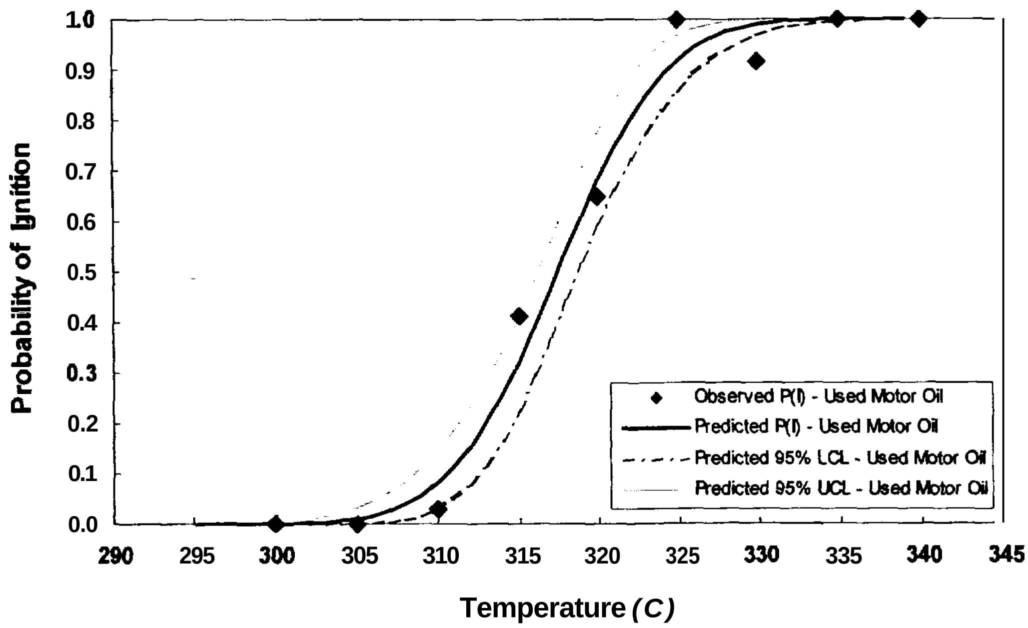

Figure **15.** Observed and predicted autoignition probabilities for used motor oils on cast iron crucibles at temperatures from 295 to 340°C. The predicted autoignition probabilities were obtained from the Probit analysis described in this section.

A final test was performed to determine whether the slopes of the probit regression curves are the same when all of the motor oil data **(6** tests of unused and 8 tests of used motor oils) was combined. The result of this test (Chi-square = **12.6823** with **13** degrees of freedom, p-value = **0.473)** indicates that the slopes of these **14** curves are not significantly different from one another. The data for all **14** tests of motor oils was pooled and the probit regression model fit to the pooled data to generate a single predicted probability of ignition versus test temperature curve over the temperature range: **295-340** C. Figure **16** shows this curve, along with upper and lower confidence limits and the observed ignition proportions at each test temperature. This result is consistent with the results of simulated gas chromatography/mass spectroscopy distillation which showed that the base oils in the samples of unused and used motor oils tested in this study were crude oil distillate fractions with similar boiling ranges and compositions [1].

Probit analyses were not done on data from tests of synthetic motor oils and brake fluids on heated cast iron crucibles because the gas chromatography / mass spectroscopy analysis of these fluids indicated that the chemical compositions of the different brands of synthetic motor oil and brake fluid used in this study had different chemical compositions [1]. Probit analyses were not done on data from tests of brake fluids, power steering fluids, transmission fluids, and antifreezes and engine coolants on heated cast iron crucibles because of the small data sets for each of these fluids.

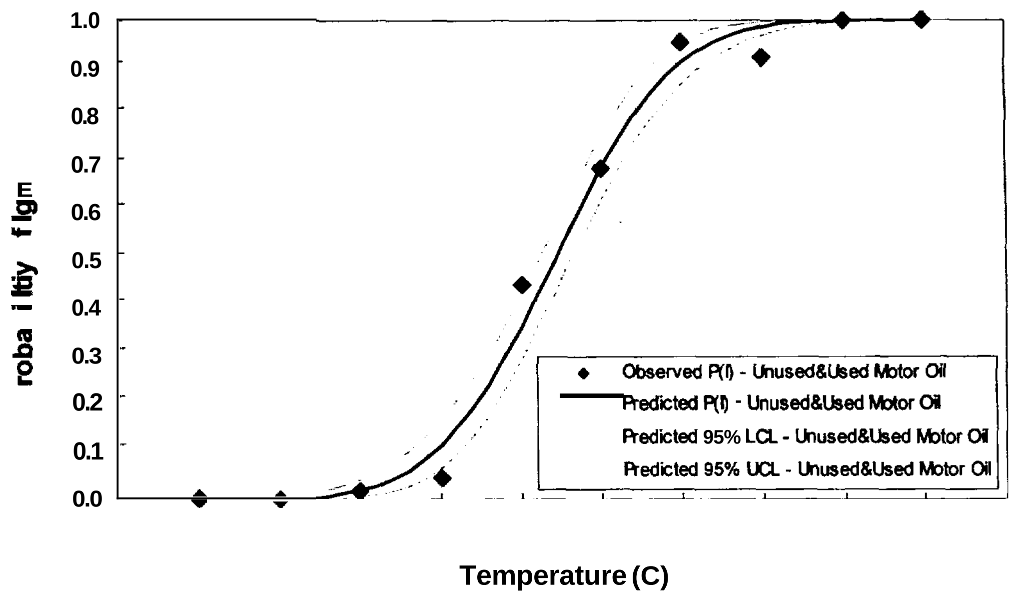

Figure 16. Observed and predicted autoignition probabilities and predicted lower and upper confidence limits for unused and used motor oils on cast iron crucibles at temperatures from 295 to 340°C. The predicted autoignition probabilities were obtained from the Probit analysis described in this section.

Effect of Fluid Temperature on Innition Characteristics - Cast Iron Crucibles. Tests of power steering fluid B10FF015 were conducted to determine the effect of fluid temperature on ignition characteristics on cast iron crucibles. In these tests, the fluid was heated to 25, 50, 100, and 150°C and autoignition characteristics of the heated power steering fluids were determined as described previously. Results of these tests are in Appendix B10FF015 and are summarized in Figure 17. No systematic trends were observed when fluid temperature was varied, indicating that the initial fluid temperature did not affect its autoignition characteristics in these tests.

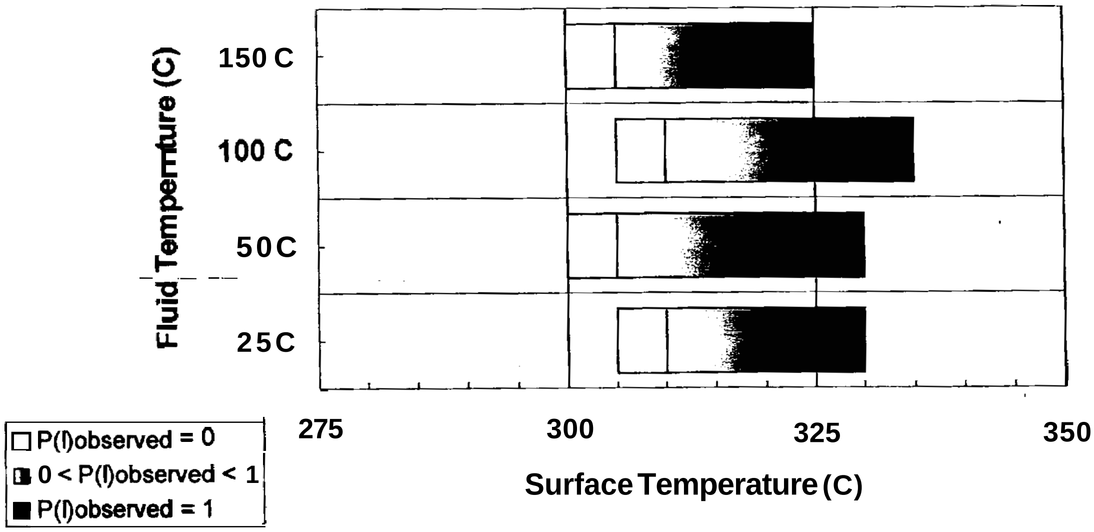

Figure 17. Summary of autoignition results of sample B10FF015 at 25, 50, 100, and 150°C on heated cast iron crucibles.

<u>**Effect of Surface Temperature on Ignition Delay Time - Cast Iron Crucibles.**</u> Tests of power steering fluid B10FF015 were conducted to determine the effect of the initial surface temperature of the crucible on ignition delay time. Figure 18 shows a plot of the surface temperature (Ti) versus ignition delay time (t_i) for power steering fluid B10FF015.

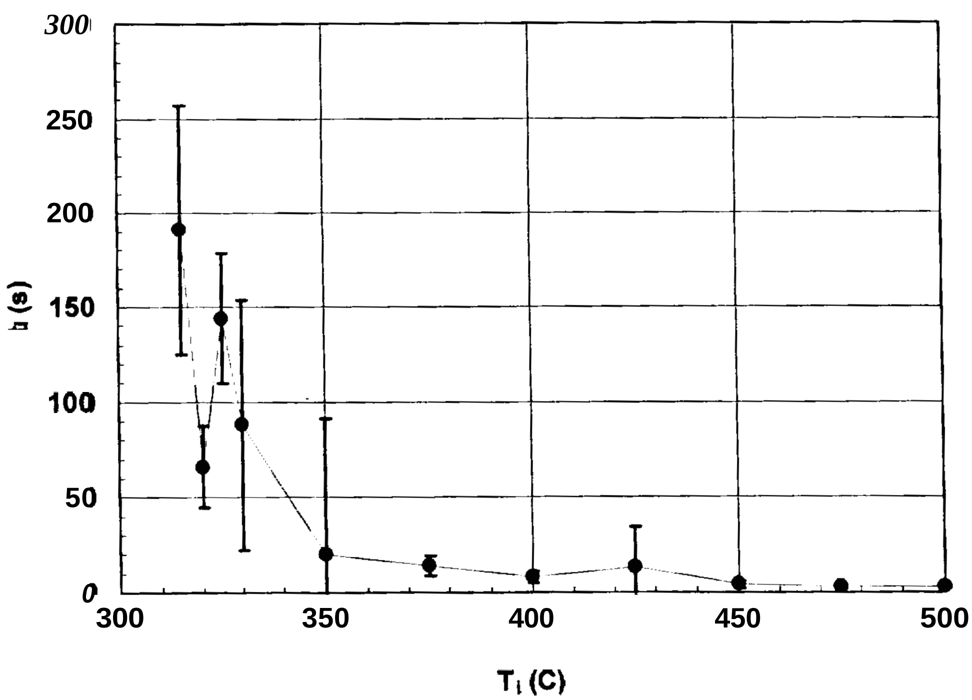

Figure 18. Ignition delay times (mean ± SE) for power steering fluid B10FF015 at surface temperatures in the range of 315 to 500°C.

In Figure 18, Ignition delay time (t_i) is defined as the elapsed time between the start of pouring fluid into the crucible and the observation of flaming ignition. In general, ignition delay time was a decreasing function of the initial surface temperature of the crucible, approaching a mean value of 3 seconds by 475°C.

Cast Iron Hemisphere Tests

Surface Temperature Distribution - Cast Iron Hemispheres. To determine the temperature distribution on the outer surface of the cast iron hemispheres, five K-Type thermocouples were spot-welded to the outer surface of one of the cast iron hemispheres at approximately 3 inch intervals from the apex to the lower edge of the hemisphere (Fig. 19).

The hemisphere was placed on the stand over the Meeker burner and the bumer was ignited. The gas supply to the Meeker bumer was turned off when the temperature was 20 to 25°C greater than the target temperature, the hemisphere allowed to cool, and temperatures from thermocouples A through E were recorded when the temperature of thermocouple A reached the target temperature. Measurements were made at target temperatures of 530 and 700°C (Table 4).

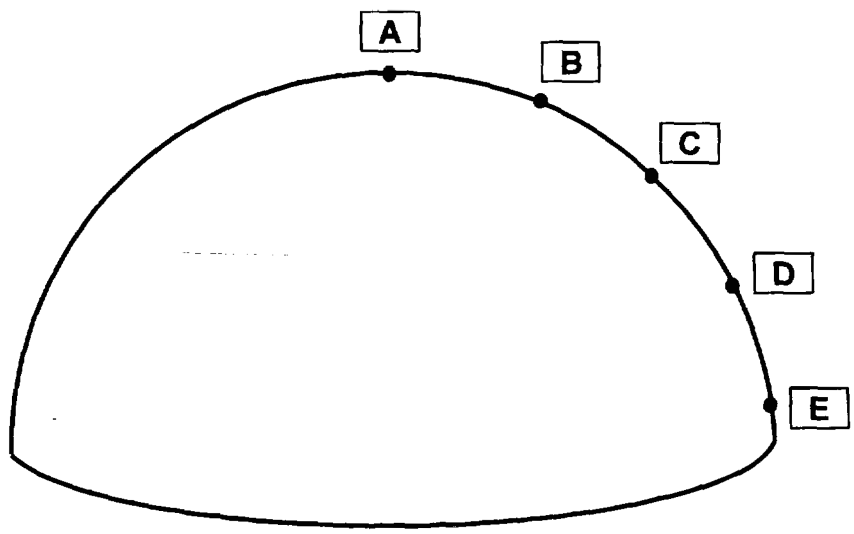

Figure 19. Locations of K-Type thermocouples used to determine temperature distribution on the outer surface of the cast iron hemispheres.

Table 4
Temperature Distribution on the Outer Surface of a Cast Iron Hemisphere

Target Temperature (C)	Temperature (C)				
	A	B	C	D	E
530	530	530	528	527	530
700	700	698	686	670	656

The results in Table 4 show that the temperature of the outer surface of the cast iron hemispheres varied by 3°C from the apex to the edge at an apex target temperature of 530°C and by 44°C at an apex target temperature of 700°C. These temperature differences were decreased if the outer surface of the hemisphere was covered with insulation while being heated.

__Ianition Characteristics - Cast iron Hemispheres.__ One sample each of unused motor oil (B10FF002), synthetic motor oil (B10FF007), brake fluid (B10FF011), power steering fluid (B10FF015), and automatic transmission fluid (B10FF017) was tested over a range of temperatures to determine its ignition characteristics when poured onto the apex of a heated cast iron hemisphere. In these tests, the cast iron hemispheres were heated to 20 to 25°C above the target temperature, the gas supplies to the Meeker burner was turned off, and the hemisphere was allowed to cool. When the temperature at the apex reached the target temperature, approximately 25 cm^3 of fluid was poured onto the apex of the hemisphere aver a period of a few seconds and ran down the sides the hemisphere into the trough. If the vapor generated by the heated fluid spontaneously ignited while the fluid was being poured onto the hemisphere or while residue of the fluid was vaporizing and visibly generating smoke, then an ignition event was recorded for the initial temperature of the thermocouple. If the vapor generated by the heated fluid did not spontaneously ignite before the disappearance of any smoke generated by residual fluid on the hemisphere, then a no-ignition event was recorded for the initial temperature of the thermocouple. Five or more replicate tests were done at each temperature to determine the reproducibility of the ignition results.

Results of these tests B10FF002, B10FF007, B10FF011, B10FF015, and B10FF017, are summarized in Figure 20 (see data in Appendicies B10FF002, B10FF007, B10FF011, B10FF015, and B10FF017). These results indicate that the lowest temperatures where $P(I)_{observed}$ = 0 were between 30 and 45°C higher and temperatures where $P(I)_{observed}$ = 1 were between 35 and 55°C higher when these fluids were poured onto cast iron hemispheres than when poured onto cast iron crucibles (Fig. 20).

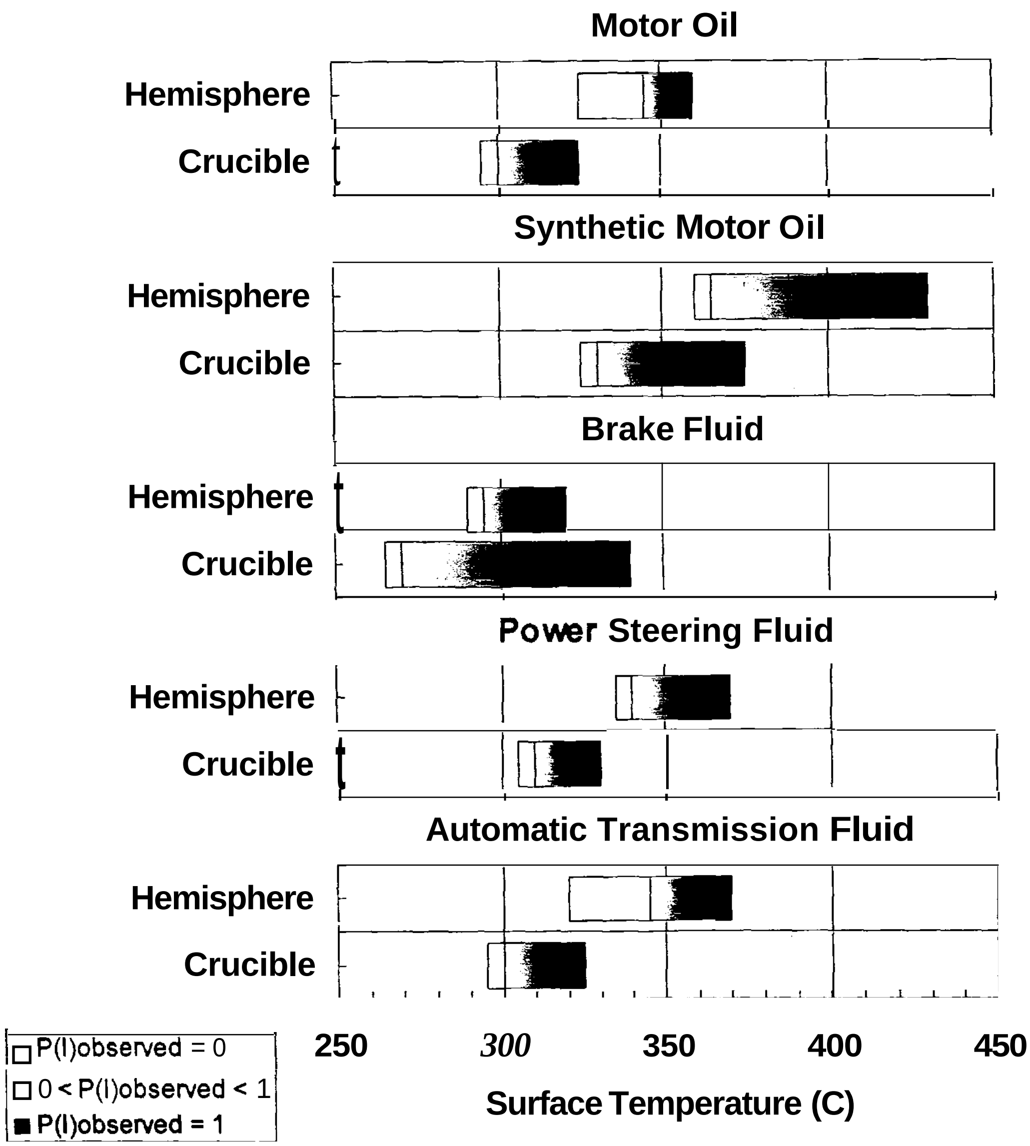

Figure 20. Comparison of ignition characteristics of motor oil, synthetic motor, brake fluid, power steering fluid, and transmission fluid in cast iron crucibles and on cast iron hemispheres.

For unused motor oil (B10FF002), the lowest temperature where $P(I)_{observed} = 0$ was 45°C higher on cast iron hemispheres (345°C) than on cast iron crucibles (300°C), and the lowest temperature where $P(I)_{observed} = 1$ was 40°C higher on cast iron hemispheres crucibles (355°C) than on cast iron crucibles (320°C). For unused synthetic motor oil (B10FF007), the lowest temperature where $P(I)_{observed} = 0$ was 35°C higher on cast iron hemispheres (365°C) than on cast iron crucibles (330°C), and the lowest temperature where $P(I)_{observed} = 1$ was 55°C higher on cast iron hemispheres crucibles (420°C) than on cast iron crucibles (360°C). For unused brake fluid

(B10FF011), the lowest temperature where $P(I)_{observed}$ = 0 was **30°C** higher on cast iron hemispheres **(295°C)** than on cast iron crucibles **(260°C)**, and the lowest temperature where $P(I)_{observed}$ = 1 was 15°C lower on cast iron hemispheres crucibles (310°C) than on cast iron crucibles **(335°C).** For unused power steering fluid (B10FF015), the lowest temperature where $P(I)_{observed}$ = 0 was **30°C** higher on cast iron hemispheres **(340°C)** than on cast iron crucibles (310°C), and the lowest temperature where $p(I)_{observed}$ = 1 was **45°C** higher on cast iron hemispheres crucibles **(365°C)** than on cast iron crucibles **(325°C).** For unused transmission fluid (B10FF017), the lowest temperature where $P(I)_{observed}$ = 0 was **45°C** higher on cast iron hemispheres **(345°C)** than on cast iron crucibles (300°C), and the temperature where $P(I)_{observed}$ = 1 was 50°C higher on cast iron hemispheres crucibles **(365°C)** than on cast iron crucibles **(320°C).**

Effect of Airflow Rate on Ianition Characteristics - Cast Iron Hemispheres. Tests **of** power **steering** fluid B10FF015 were conducted to determine the effect of airflow rate on ignition characteristics on cast iron hemispheres. In these tests, autoignition characteristics of the fluid on cast iron hemispheres were determined at airflow rates of approximately 1.1 and **2.2** m/s. Results of these tests are in Appendix B10FF015 and are summarized in Figure 21.

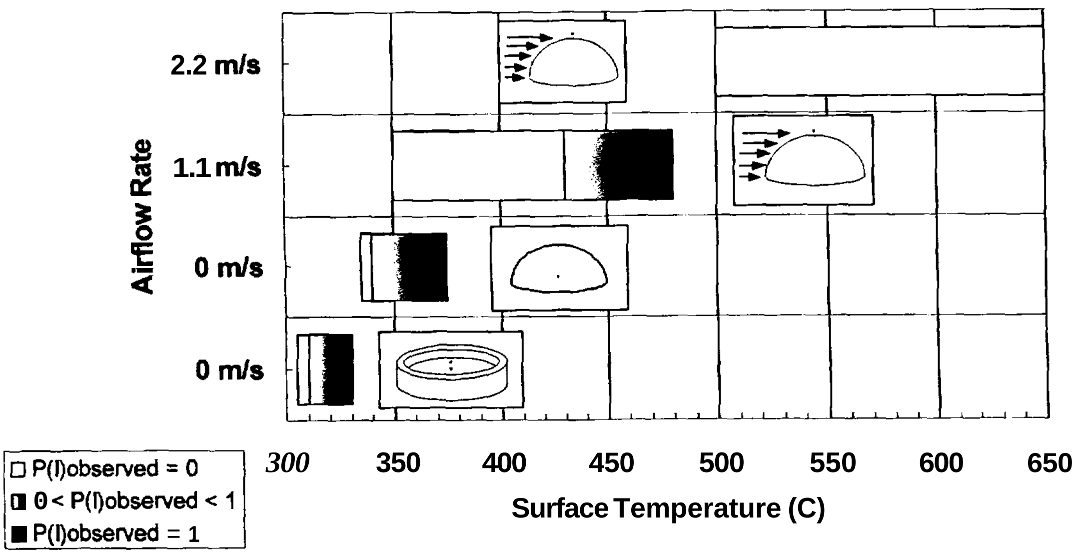

Figure 21. Ignition characteristics **of** power steering fluid B10FF015 on cast iron crucibles with no forced airflow, cast iron hemispheres with no forced airflow, cast iron hemispheres with 1.1 m/s airflow, and cast iron hemispheres with 2.2 mls airflow.

Figure 21 also contains ignition characteristics of power steering fluid B10FF015 on cast iron crucibles with no forced airflow (see Fig. 11) and on cast iron hemispheres with no forced airflow (see Fig. 17) for reference. The temperature required for autoignition of power steering fluid on cast iron hemispheres increased with increasing airflow over the hemisphere. For example, the temperature for transition from $P(I)_{observed} = 0$ to $0 < P(I)_{observed} < 1$ was 340°C with no airflow and 430°C with an airflow rate of 1.1 m/s. The temperature for transition from $0 < P(I)_{observed} < 1$ to $P(I)_{observed} = 1$ was 365°C with no airflow and 465°C with an airflow rate of 1.1 m/s. Power steering fluid did not autoignite when poured onto cast iron hemispheres at temperatures between 500 and 650°C at an airflow rate of 2.2 m/s.

Discussion

Combustion is a series of gas-phase chemical reactions between fuel vapor and an oxidant, usually oxygen in air. Ignition of a liquid fuel in air requires vaporization of the liquid fuel and admixture of the fuel vapor with air. The resulting fuellair mixture can be ignited by one of two mechanisms: piloted ignition or autoignition. Piloted ignition refers to ignition of a fuellair mixture by an ignition source such as an open flame, electric arc, or friction spark. Autoignition refers to spontaneous ignition of a heated fuel/air mixture [2]. In both cases, heat transferred into the fuellair mixture, either from a pilot source or from a heat-source such as a heated surface, initiates a series of exothermic free-radical chain reactions between the fuel vapor and oxygen in air. A propagating combustion process can result if the net rate of heat production in the combustion zone provides sufficient thermal energy to initiate combustion reactions between unburned fuel and oxygen both within and adjacent to the combustion zone. The net rate of heat production is related to the rate of reaction of fuel and oxygen and the rate of heat removal from the combustion zone.

Two parameters that affect the rate of reaction of fuel and oxygen are the fuel and air concentrations in the combustion zone. If the concentration of fuel is too low, then the amount of fuel limits the rates of the combustion reactions and the net rate of heat production is not sufficient to sustain a propagating combustion process. If the concentration of fuel is too high, then the amount of oxygen available for combustion is too low, oxygen limits the rates of the combustion reactions, and the net rate of heat production is not sufficient for a propagating combustion process. The threshold describing the minimum fuel vapor concentration in air necessary to sustain combustion is called the lower flammability limit (LFL), and the threshold describing the maximum fuel vapor concentration in air necessary to sustain combustion is called the upper flammability limit (UFL). Thus, combustion can occur only if the concentration of fuel vapor in air is greater than the lower flammability limit (LFL) and less than the upper flammability limit (UFL) for ignition of the fuellair mixture.

In this study, the autoignition characteristics of a number of combustible fluids used in motor vehicles were studied when the fluids were poured onto heated surfaces. The heated surfaces provided the thermal energy for vaporization of the fluids and for autoignition of the fuel vapor in air. The mechanism of autoignition of multi-component fluids on a heated surface is a complex phenomenon, involving considerations of the thermodynamic phase equilibria of the fluid, heat transfer, mass transport, and kinetics of the chemical reactions in the combustion zone. This

Superimposed on this diagram are the lower flammability limit, upper flammability limit, autoignition limit, minimum flash point, and minimum autoignition temperature. In discussing flammability, it is more convenient to refer to vapor concentration rather than vapor pressure. In an open system at atmospheric pressure, vapor concentration is [vapor pressure]/[barometric pressure] and the ordinate in Figure 22 is labeled to reflect the relationship between vapor pressure and concentration. In Figure 22, the liquid-to-vapor transition line, the lower flammability limit, and the upper flammability limit define the flammable range. The minimum liquid temperature required for piloted ignition of vapor in equilibrium with the liquid is t_{FP} in Figure 22.

The autoignition limit shown in Figure 22 defines conditions of temperature and vapor concentration where the vapor/air mixture will ignite spontaneously in the absence of an ignition source. Tests designed to measure autoignition temperatures, such as ASTM E 659 - 78 [6], generally determine the temperature at which a stoichiometric vapor / air mixture spontaneously ignites while contained in a heated vessel. These tests report an ignition or autoignition temperature which is assumed to be the lowest temperature where the vapor/mixture will ignite spontaneously [2], equivalent to t_{ig} in Figure 22. However, autoignition temperature varies with the fuel / air ratio, and it has not been shown experimentally that a stoichiometric mixture gives the lowest autoignition temperature for a pure compound or for a mixture. Additionally, autoignition will not occur at $t > t_{ig}$ if the vapor concentration is outside the bounds of concentration defined by the autoignition limit shown in Figure 22.

Variability in the autoignition behavior of combustible fluids at surface temperatures where $0 < P(I)_{observed} < 1$ (surface temperatures between the highest temperature where $P(I)_{observed} = 0$ and the lowest temperature where $P(I)_{observed} = 1$) can be explained by referring to the conceptualized phase diagram in Figure 22. The tests described in this report were done in open air, where thermal convection of the heated vapor created a rising vapor plume. For autoignition to occur, the temperature of the heated surface must be sufficiently high to raise the temperature of the fluid so that (1) the vapor pressure above the fluid is within the autoignition region in Figure 22 and (2) the temperature of the vapor is greater than T_{ig}. These conditions must occur simultaneously in some finite volume within the vapor plume. Autoignition temperatures for petroleum-based oils (motor oil, transmission fluid, and power steering fluid), polyglycol ethers (brake fluid), ethylene glycol (antifreeze), and propylene glycol (antifreeze) determined in tests such as ASTM E 659 - 78 generally are greater than the boiling points of at least some of the components in these fluids [2,4,5]. It is therefore likely that, in the tests described in this report, the vapor concentration just above the fluid on the heated surface was greater than the upper bound of the autoignition limit. The vapor concentration and gas temperature decreased as the rising vapor plume mixes with air at room temperature. As this mixing occurs, the trajectories of the fuel / air mixture within the vapor pressure - temperature space in Figure 22 will depend on the extent of vapor dilution with air.

Consider examples of three vapor concentration-temperature conditions, indicated by points A, B, and C in Figure 22. As the heated surface provides both the energy for vaporization of the fluid and raising the temperature of the vapor, these conditions are related to the temperature of the heated surface. The extent of dilution with air as the vapor plume rises determines the trajectory of a volume of fuel vapor as it is cooled and diluted. At low surface temperatures, the trajectory of a volume of fuel vapor never intersects the autoignition region (Point A, Fig. 22). This condition corresponds to temperatures where $P(I)_{observed} = 0$ in the tests described in this report. At high surface temperatures, the trajectory of a volume of fuel vapor always intersects the autoignition region (Point C, Fig. 22). This condition corresponds to temperatures where $P(I)_{observed} = 1$ in the tests described in this report. At intermediate temperatures, the trajectory of a volume of fuel vapor may or may not intersect the autoignition region (Point B, Fig. 22). This condition corresponds to temperatures where $0 < P(I)_{observed} < 1$ in the tests described in this report.

Ignition delay may also be associated with the rate of chemical reaction between fuel vapor and oxygen - a function of the chemical reaction kinetics. The reaction rate between fuel and oxygen molecules in the gas phase is a function of vapor temperature and the concentrations of the reactants. At lower vapor temperatures (lower surface temperatures), ignition is not instantaneous even for temperatures and concentrations within the autoignition region shown in Figure 22. The variability at lower temperatures where $0 < P(I)_{observed} < 1$ may have resulted, in part, from this kinetic ignition delay. For example, if a rising fuel / air mixture initially within the autoignition region is cooled and diluted by mixing with air before the kinetic ignition delay time, then ignition will not occur.

The shift to higher temperatures for autoignition of fluids on cast iron hemispheres as compared to autoignition on cast iron crucibles was not explained solely on the basis of decreased residence time of the fluid in contact with the heated surface. The time from the start of pouring fluid onto the apex of the hemispheres until all fluid had flowed off of the hemisphere into the collection trough was approximately 5 seconds. The data in Figure 15 indicated mean $t_{ig} < 5$ correlated with surface temperatures greater than 450°C. However, for power steering fluid B10FF015, the highest temperature where $P(I)_{observed} = 0$ increased from 315°C on heated cast iron crucibles to 345°C on cast iron hemispheres and the lowest where to $P(I)_{observed} = 1$ increased from 325°C on heated cast iron crucibles to 370°C on heated cast iron hemispheres (Fig. 17). Although the decrease in residence time of the fluid on the heated surface resulted in an increase in the temperature required for autoignition, the surface temperatures where autoignition occurred in these studies were **80** to **110°C** lower than the temperature required for autoignition in 5 seconds predicted from the t_{ig} data in Figure 18. This result suggests that physical factors other than residence time, such as fluid film thickness or the ratio of the mass of the fluid in contact with the heated surface to the mass of the heated surface, may affect the autoignition characteristics of fluids on heated surfaces.

The trend toward increasing temperatures observed for autoignition of power steering fluid on cast iron hemispheres with increasing airflow is consistent with cooling and dilution of the vapor by mixing with air at room temperature. At a constant vaporization rate, higher airflow rates over the fluid surface would be expected to produce greater cooling and dilution of the vapor generated from the fluid, and lead to higher surface temperatures required for autoignition. This was observed in the tests summarized in Figure **21,** where the highest temperature where $P(I)_{observed}$ = 0 increased from 340 to **430°C** and the lowest temperature where $P(I)_{observed}$ = **1** increased from **370** to **470°C** as the airflow rate increased for 0 to **1.1 m/s** (approximately **2.5** mph). At an airflow rate of **2.2 m/s** (approximately **5** mph), no ignitions were observed at any temperature up to and including 650°C.

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Appendix A

Pribit Analysis of Autoignition Test Data

Cast Iron Crucibles

Tables A1 – A8 in this Appendix summarize the statistical analyses performed on autoignition test data for each of the following fluid types: unused motor oil, used motor oil, unused synthetic motor oil, used synthetic motor oil, unused and used brake fluid, unused and used power steering fluid, unused and used automatic transmission fluid, and antifreeze and unused and used engine coolant. Listed summary statistics describe the results obtained from fitting the Probit regression model to the observed data. The Chi-square goodness of fit test evaluates how well the model fit the data. A high p-value associated with this test indicates that the model provided a reasonable fit to the data. The intercept and slope statistics, along with their associated p-values, describe the stimulus (test temperature)-response (ignition = yes/no) relationship. Five ignition temperature percentiles, along with their associated 95% lower and upper fiducial limits) are shown to provide information about expected ignition temperatures at the lower, middle and upper portions of the cumulative response-stimulusdistribution.

Table A I
Summary of Probit Analyses of Surface Ignition Test Data
Unused Motor Oils – Cast Iron Crucibles

	Sample ID	BIOFFOOI	B10FF002	B10FF003	B10FF004	B10FF005	B10FF006
Sample Identification	Fluid Type	Havoline 5W-30 Motor Oil	Quaker State 5W-30 Motor Oil	Castrol GTX 5W-30 Motor Oil	Valvoline 5W-30 Motor Oil	Mobil IOW-30 Motor Oil	Pennzoil 5W-30 Motor Oil
Probit Analysis Summary Statistics	Chi-square	0	0.557	0.242	1.246	0.557	0
	p-value	1	0.99	0.993	0.87	0.99	1
	Comments on Fit	no convergence, only one test tempwith partial response	NIA	N/A	N/A	N/A	no convergence, only one test temp with partial response
	Intercept	-432	-65.4	-99.67	-79.54	-68.56	-432
	p-value	0.998	0.002	0.009	0.005	0.002	0.998
	Slope	1.4	0.2107	0.3133	0.2505	0.2107	1.4
	p-value	0.998	0.002	0.009	0.005	0.002	0.998
Ignition Temperature Percentiles and Associated 95% Fiducial Limits'	1st %ile (LCL, UCL)	312.7 (N/C, NIC)	299.4 (280.9, 304.3)	310.7 (287.8, 314.5)	308.2 (286.9, 312.6)	314.4 (295.9, 319.3)	312.7 (N/C, N/C)
	5th %ile (LCL, UCL)	313.2 (N/C, N/C)	302.6 (289.1, 306.6)	312.9 (296.3, 315.9)	310.9 (295.4, 314.5)	317.6 (304.1, 321.6)	313.2 (N/C, N/C)
	50th %ile (LCL, UCL)	314.4 (N/C, N/C)	310.4 (306.5, 314.5)	318.2 (314.3, 321.8)	317.5 (313.5, 321.5)	325.4 (321.5, 329.5)	314.4 (N/C, N/C)
	95th %ile (LCL, UCL)	315.6 (N/C, N/C)	318.2 (314.3, 332.1)	323.4 (320.5, 339.5)	324.1 (320.5, 339.6)	333.2 (329.3, 347.1)	315.6 (N/C, N/C)
	99th %ile (LCL, UCL)	316.1 (N/C, N/C)	321.5 (316.5, 340.3)	325.6 (321.9, 348.0)	326.8 (322.4, 348.1)	336.5 (331.5, 355.3)	316.1 (N/C, N/C)

Table *A2*
Summary of Probit Analyses of Surface Ignition Test Data
Used Motor Oils - Cast Iron Crucibles

	Sample ID	B10FF024	B10FF027	B10FF028	B10FF029	B10FF030	B10FF031	B10FF037
Sample Identification	Fluid Type	Mobile 5W-30 Used Motor Oil	Mobile 5W-30 Used Motor Oil	Mobile 1OW-30 Used Motor Oil	Pennzoil 5W-30 Used Motor Oil	Motorcraft 5W-30 Used Motor Oil	Mobile 5W-30 Used Motor Oil	Sunfill SJ 5W-30 Used Motor Oil
Probit Analysis Summary Statistics	Chi-Square	1.246	0.402	0	1.246	0	8.642	2.985
	p-value	0.87	0.982	1	0.87	1	0.071	0.56
	Comments on Fit	N/A	N/A	no convergence, no test temps with partial response	NIA	no convergence, only one test temp with partial response	poor fit, only one test temp with partial response	N/A
	Intercept	-79.54	-96.03	-774	-79.54	-432	-67.66	-67.71
	pvalue	0.005	0.009	0.998	0.005	0.998	0.002	0.002
	Slope	0.2505	0.3016	2.4	0.2505	1.4	0.2083	0.2132
	p-value	0.005	0.009	0.998	0.005	0.998	0.002	0.002
Ignition Temperature Percentiles and Associated 95% Fiducial Limits[1]	1st %ile (LCL, UCL)	308.2 (286.9, 312.6)	310.7 (287.8, 314.6)	316.5 (NIC, N/C)	308.2 (286.9, 312.6)	312.7 (NIC, NIC)	313.6 (292.4, 318.9)	306.6 (286.3, 311.5)
	5th %ile (LCL, UCL)	310.9 (295.4, 314.5)	313.0 (296.5, 316.1)	316.8 (NIC, N/C)	310.9 (295.4, 314.5)	313.2 (N/C, N/C)	316.9 (301.1, 321.1)	309.8 (295.0, 313.3)
	50th %ile (LCL, UCL)	317.5 (313.5, 321.5)	318.4 (314.6, 322.5)	317.5 (N/C, N/C)	317.5 (313.5, 321.5)	314.4 (N/C, NIC)	324.8 (320.2, 328.6)	317.5 (313.7, 321.4)
	95th %ile (LCL, UCL)	324.1 (320.5, 339.6)	323.9 (320.7, 341.0)	318.2 (N/C, NIC)	324.1 (3205339.6)	315.6 (NIC, NIC)	332.7 (328.9, 346.4)	325.2 (321.4, 340.1)
	99th %ile (LCL, UCL)	326.8 (322.4, 348.1)	326.1 (322.2, 349.7)	318.5 (N/C, N/C)	326.8 (322.4, 348.1)	316.1 (N/C, N/C)	336.0 (331.2, 355.0)	328.4 (323.5, 348.9)

[1] LCL = Lower Confidence Limit. UCL = Upper Confidence Limit.

Table A3
Summary of Probit Analyses of Surface Ignition Test Data
Unused Synthetic Motor Oils - Cast Iron Crucibles

Sample Identification	Sample ID	B10FF007	B10FF008	B10FF009
	Fluid Type	Mobil One 5W-30 Synthetic Motor Oil	Royal Purple 1OW-30 Synthetic Motor Oil	Castrol Syntec 5W-30 Synthetic Motor Oil
Probit Analysis Summary Statistics	Chi-square	7.148	4.852	0
	pvalue	0.622	0.563	1
	Comments on Fit	N/A	N/A	no convergence, only one test tempwith partial response
	Intercept	-29.44	-48.62	-398
	p-value	0	0	0.998
	Slope	0.0834	0.1514	1.3
	p-value	0	0	0.998
Ignition Temperature Percentiles and Associated 95% Fiducial Limits'	1st %ile (LCL, UCL)	325.3 (303.8, 334.5)	305.8 (288.4, 311.8)	313.0 (N/C, N/C)
	5th %ile (LCL, UCL)	333.4 (317.7, 340,6)	310.3 (297.6, 315.1)	313.5 (N/C, N/C)
	50th %ile (LCL, UCL)	353.2 (347.7, 359.0)	321.2 (317.0, 326.0)	314.8 (N/C, N/C)
	95th %ile (LCL, UCL)	372.9 (365.3, 389.7)	332.1 (327.0, 346.3)	316.1 (N/C, N/C)
	99th %ile (LCL, UCL)	381.1 (37114,403.7)	336.6 (330.2, 355.6)	316.6 (N/C, NIC)

[1] LCL = Lower Confidence Limit. UCL = Upper Confidence Limit.

Table A4
Summary of Probit Analyses of Surface Ignition Test Data
Used Synthetic Motor Oils – Cast iron Crucibles

Sample Identification	Sample ID	B10FF032	B10FF033	B10FF040	B10FF047
	Fluid Type	Royal Purple 1OW-30 Used Synthetic Motor Oil	Mobile One 5W-30 Used Synthetic Motor Oil	Mobil One 5W-30 Used Synthetic Motor Oil	Mobil One 5W-30 Used Synthetic Motor Oil
Probit Analysis Summary Statistics	Chi-square	0.053	7.137	2.254	0
	p-value	I	0.623	0.813	1
	Comments on Fit	poor fit	N/A	N/A	no convergence, only one test temp with partial response
	Intercept	-118.48	-26.46	-56.15	-423
	p-value	0.015	0	0.001	0.998
	Slope	0.3618	0.0771	0.1725	1.3
	p-value			0.001	0.998
Ignition Temperature Percentiles and Associated 95% Fiducial Limits[1]	1st %ile (LCL, UCL)			312.0 (293.2, 317.4)	333.4 (NIC, N/C)
	5th %ile (LCL, UCL)			315.9 (302.5, 320.2)	333.9 (N/C, N/C)
	50th %ile (LCL, UCL)	327.5 (323.4 (331.6)	343.3 (337.1, 349.1)	325.5 (321.6, 330.3)	335.2 (NIC, N/C)
	95th %ile (LCL, UCL)	332.0 (329.3, 351.5)	364.6 (356.8, 382.8)	335.0 (330.2, 350.9)	336.5 (N/C, N/C)
	99th %ile (LCL, UCL)	333.9 (330.5, 360.9)	373.9 (363.3, 398.3)	339.0 (332.9, 360.2)	337.0 (N/C, NIC)

[1] LCL = Lower Confidence Limit. UCL = Upper Confidence Limit.

Table A5
Summary of Probit Analyses of Surface Ignition Test Data
Unused and Used Brake Fluids – Cast Iron Crucibles

Sample Identification	Sample ID	BIOFFOII	B10FF012	B10FF013	B1OFF052
	Fluid Type	Prestone DOT3 Brake Fluid	Albany DOT3 Brake Fluid	Coastal DOT3 Brake Fluid	Pooled – Used DOT3 Brake Fluid
Probit Analysis Summary Statistics	Chi-square	16.591	0.402	22.904	27.12
	pvalue	0.121	0.982	0.062	0.028
	Comments on Fit	poor fit, no clear dose-response pattem	N/A	poor fit, no clear dose-response pattem	poor fit, no clear dose-response pattem
	Intercept	-5.752	-82.46	-10.13	-9.4
	p-value	0.018	0.009	0	0
	Slope	0.0202	0.3016	0.034	0.0301
	p-value	0.012	0.009	0	0
Ignition Temperature Percentiles and Associated 95% Fiducial Limits'	lst %ile (LCL, UCL)	169.9 (-295.6, 228.7)	265.7 (242.8, 269.6)	229.5 (173.6, 252.5)	235.3 (173.2, 259.2)
	5th %ile (LCL, UCL)	203.7 (-143.1, 248.1)	268.0 (251.5, 271.1)	249.6 (208.4, 267.0)	258.0 (214.6, 275.4)
	50th %ile (LCL, UCL)	285.3 (219.4, 300.5)	273.4 (269.6, 277.5)	298.0 (287.1, 307.0)	312.7 (302.6, 326.2)
	95th %ile (LCL, UCL)	366.9 (336.0, 598.8)	278.9 275.7, 296.0)	346.3 (331.0, 381.9)	367.4 (346.4, 421.3)
	99th %ile (LCL, UCL)	400.6 (355.8, 750.9)	281.1 (277.2, 304.7)	366.4 (345.6, 416.6)	390.1 (362.4, 462.8)

[1] LCL = Lower Confidence Li

Sample Identification	Sample ID	B10FF014	B10FF015	B10FF016	B10FF053	B10FF051
	Fluid Type	Valvoline Power Steering Fluid	Pyroil Power Steering Fluid	Prestone Power Steering Fluid	Goodwrench Cold Climate Power Steering Fluid	Pooled – Used Power Steering Fluid
Probit Analysis Summary Statistics	Chi-square	1.765	4.059	2.025	0.727	5.164
	p-value	0.881	0.398	0.846	0.981	0.74
	Comments on Fit	N/A	poor fit	N/A	N/A	N/A
	Intercept	-67.58	-66.79	-60.96	-88.47	-37.06
	p-value	0.002	0.001	0.001	0.008	0
	Slope	0.2155	0.2122	0.1919	0.2773	0.1128
	p-value	0.002	0.001	0.001	0.008	0
Ignition Temperature Percentiles and Associated 95% Fiducial Limits[1]	1st %ile (LCL, UCL)	302.9 (284.2, 307.8)	303.8 (287.3, 308.7)	305.6 (286.6, 311.0)	310.7 (286.8, 314.7)	307.9 (290.4, 315.1)
	5th %ile (LCL, UCL)	306.0 (292.2, 310.0)	307.1 (294.6, 310.9)	309.1 (295.1, 313.5)	313.1 (296.1, 316.3)	313.9 (301.0, 319.7)
	50th %ile (LCL, UCL)	313.7 (311.3, 319.5)	314.8 (311.0, 317.2)	317.7 (313.3, 321.6)	319.0 (315.4, 323.4)	328.5 (323.9, 333.4)
	95th %ile (LCL, UCL)	321.3 (317.5, 334.1)	322.6 (319.6, 331.4)	326.3 (322.2, 339.2)	325.0 (321.6, 343.5)	343.1 (337.2, 356.5)
	99th %ile (LCL, UCL)	324.5 (319.8, 342.1)	325.8 (321.0, 338.6)	329.8 (324.7, 347.6)	327.4 (323.2, 352.8)	349.1 (341.7, 367.2)

[1] LCL = Lower Confidence Limit. UCL = Upper Confidence Limit.

Table A7
Summary of Probit Analyses of Surface Ignition Test Data
Unused and Used Automatic Transmission Fluids – Cast Iron Crucibles

Sample Identification	Sample ID	B10FF017	B10FF018	B10FF034
	Fluid Type	Quaker State Automatic Transmission Fluid	Sunoco Mercon Automatic Transmission Fluid	Used Automatic Transmission Fluid
Probit Analysis Summary Statistics	Chi-square	**4.066**	**0**	***0***
	p-value	**0.54**	**1**	**1**
	Comments on Fit	NIA	no convergence, only one test temp with partial response	no convergence, only one test temp with partial response
	Intercept	**-50.49**	**-390**	**391**
	pvalue	**0.001**	**0.998**	**0.998**
	Slope	**0.1621**	**1.3**	**1.3**
	pvalue	0.001	**0.998**	**0.998**
Ignition Temperature Percentiles and Associated **95%** Fiducial Limits'	**1st** %ile (LCL, UCL)	**297.1** **(277.2, 303.1)**	**308.3** (N/C, NIC)	**308.4** (N/C, N/C)
	5th %ile (LCL, UCL)	**301.3** **(286.8, 306.0)**	**308.8** (N/C, **N/C**)	**308.9** **(N/C,** NIC)
	50th %ile (LCL, UCL)	**311.5** **(307.1, 316.0)**	**310.1** (NIC, NIC)	**310.2** **(N/C,** NIC)
	95th %ile (LCL, UCL)	**321.6** **(316.8, 336.6)**	**311.5** (N/C, N/C)	**311.5** (N/C, N/C)
	99th %ile **(LCL. UCL)**	**325.8** (319.8, 346.2)	**312.0** (N/C, N/C)	**312.0** (NIC. N/C)

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Table A8
Summary of Probit Analyses of Surface Ignition Test Data
Antifreezes, Unused and Used Coolants – Cast Iron Crucibles

	Sample ID	B10FF021	B IOFF022	B10FF035	B10FF036	B10FF049
Sample Identification	Fluid Type	Prestone Antifreeze (ethylene glycol)	Sierra Antifreeze (propylene glycol)	**Prestone Antifreeze/Water (1:1)**	**Sierra Antifreeze/Water (1:1)**	Used Engine Coolant
Probit Analysis Summary	**Chi-Square**	**19.485**	12.245	**2.901**	**12.438**	2.712
	p-value	**0.193**	0.2	0.715	0.411	0.994
	Comments on Fit	poor fit, no clear dose-response pattem	poor fit	N/A	N/A	N/A
	Intercept	-23.669	-54.7	-112.82	-24.22	-73.99
	p-value	0	*0*	0.001	0	*0*
	Slope	0.0374	0.1021	0.173	0.0448	0.1217
	pvalue	0	0	0.001	0	*0*
Ignition Temperature Percentiles and Associated 95% Fiducial Limits'	**lst %ile (LCL, UCL)**	**570.6 (526.5, 590.6)**	512.8 (495.0, 520.4)	**638.9 (619.5, 644.7)**	488.6 **(444.2, 506.7)**	588.6 (568.9, 596.0)
			519.5 (506.5,525.5)	**642.8 (628.6, 647.6)**	**503.8 (470.7, 516.0)**	594.2 (579.5, 600.1)
	50th %ile (LCL, UCL)	632.8 (623.0, 641.2)	535.6 (530.7, 541.2)	652.3 (647.5, 657,7)	540.5 (530.8, 548.1)	607.7 (602.7, 612.4)
	95th %ile (LCL, UCL)	676.8 (663.5, 704.8)	551.7 (545.0, 567.0)	661.9 (656.8, 677.4)	577.2 (565.5, 603.8)	621.3 (615.7, 634.8)
	99th %ile (LCL, UCL)	695.0 **(677.1, 734.2)**	558.4 (550.0, 578.6)	665.8 (659.6, 686.5)	592.3 (576.7, 629.6)	626.8 (619.8, 645.4)

Confidence Limi

Appendix B10FF001

Surface Ignition Data

Unused Havoline 5W30 Motor Oil

Sample ID: B1OFFOO?
Fluid Type: Havoline 5W30 Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	n/r	n/r	749.6
305	n/a	N	n/a	n/r	n/r	749.7
305	n/a	N	n/a	n/r	n/r	749.7
305	n/a	N	n/a	n/r	n/r	749.8
305	n/a	N	n/a	n/r	n/r	749.8
310	n/a	N	n/a	n/r	n/r	753.6
310	n/a	N	n/a	n/r	n/r	753.6
310	n/a	N	n/a	n/r	n/r	753.5
310	n/a	N	n/a	n/r	n/r	753.4
310	n/a	N	n/a	n/r	n/r	753.3
315	292	Y	29	n/r	n/r	752.9
315	304	Y	93	n/r	n/r	753.0
315	300	Y	56	n/r	n/r	752.9
315	300	Y	27	n/r	n/r	752.9
315	n/a	N	n/a	n/r	n/r	752.9
320	311	Y	76	n/r	n/r	753.6
320	310	Y	82	n/r	n/r	752.7
320	311	Y	150	n/r	n/r	752.5
320	310	Y	176	n/r	n/r	752.5
320	300	Y	41	n/r	n/r	752.4
325	314	Y	102	n/r	n/r	752.4
325	298	Y	10	n/r	n/r	749.4
325	310	Y	70	n/r	n/r	749.5
325	310	Y	47	n/r	n/r	749.4
325	316	Y	74	n/r	n/r	749.6

Appendix B10FF002
Surface Ignition Data
Unused Quaker State 5W30 Motor Oil

Sample ID: B10FF002
Fluid Type: Quaker State 5W30 Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
295	n/a	N	n/a	n/r	n/r	745.6
295	n/a	N	n/a	n/r	n/r	744.4
295	n/a	N	n/a	n/r	nlr	751.6
295	n/a	N	n/a	n/r	n/r	752.2
295	n/a	N	n/a	n/r	n/r	754.0
300	n/a	N	n/a	n/r	n/r	747.1
300	n/a	N	n/a	n/r	n/r	746.9
300	n/a	N	n/a	n/r	n/r	746.9
300	n/a	N	n/a	n/r	n/r	746.9
300	n/a	N	n/a	n/r	n/r	746.5
305	300	Y	93	n/r	n/r	746.4
305	n/a	N	n/a	n/r	n/r	745.8
305	n/a	N	n/a	n/r	n/r	745.4
305	n/a	N	n/a	n/r	nlr	745.7
305	n/a	N	n/a	n/r	n/r	745.7
310	294	Y	42	n/r	nlr	747.6
310	n/a	N	n/a	n/r	nlr	747.5
310	n/a	N	n/a	n/r	n/r	745.9
310	309	Y	183	n/r	nlr	745.8
310	n/a	N	n/a	n/r	n/r	745.7
315	310	Y	182	n/r	nlr	748.3
315	n/a	N	n/a	n/r	n/r	748.3
315	308	Y	118	n/r	n/r	748.4
315	307	Y	176	n/r	n/r	748.4
315	306	Y	87	n/r	n/r	748.5

Sample ID: B10FF002
Fluid Type: Quaker State 5W30 Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	**At Ignition**			**t (C)**	**DP (C)**	P_{BARR}
320	315	Y	105			748.5
320	308	Y	54	n/r	n/r	748.5
320	310	Y	116	nlr	n/r	748.5
320	302	Y	27	nlr	n/r	748.4
320	305	Y	56	n/r	n/r	748.5
325	303	Y	33	nlr	nlr	748.5
325	313	Y	64	nlr	nlr	748.4
325	309	Y	57	nlr	nlr	748.4
325	317	Y	135	n/r	n/r	748.1
325	312	Y	72	nlr	nlr	747.9

Sample ID: B1OFF002
Fluid **Type:** Quaker State 5W30 Motor Oil
State: **Unused**
Test Apparatus: Cast Iron Hemisphere
Airflow Rate: 0 m/s (0 mph)

t (C)	Ignition
325	N
325	N
325	N
325	N
325	N
340	N
340	N
340	N
340	N
340	N
345	N
345	N
345	N
345	N
345	N
350	Y
350	N
350	N
350	Y
350	N
355	N
355	Y
355	N
355	Y
355	Y

t (C)	Ignition
360	Y
360	Y
360	Y
360	Y
360	Y
365	Y
365	Y
365	Y
365	Y
365	Y

Appendix B10FF003

Surface Ignition Data

Unused Castrol GTX 5W30 Motor *Oil*

Sample ID: B10FF003
Fluid Type: Castrol **GTX 5W30** Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	nla	N	nla	nlr	nlr	749.7
305	nla	N	nla	n/r	n/r	749.6
305	nla	N	nla	n/r	nlr	749,7
305	nla	N	nla	nlr	nlr	749.7
305	nla	N	nla	nlr	nlr	749.7
310	nla	N	nla	nlr	nlr	749.6
310	nla	N	nla	nlr	nlr	750.3
310	nla	N	nla	n/r	nlr	750.6
310	nla	N	nla	nlr	n/r	750.7
310	nla	N	nla	nlr	nlr	750.7
315	304	N	65	nlr	nlr	749.7
315	nla	N	nla	nlr	nlr	750.8
315	nla	N	nla	n/r	nlr	750.8
315	nla	N	nla	nlr	nlr	750.8
315	305	Y	63	n/r	nlr	750.7
320	314	Y	93	nlr	nlr	750.7
320	321	Y	194	nlr	nlr	750.7
320	nla	N	nla	nlr	nlr	750.7
320	318	Y	172	n/r	nlr	750.8
320	nla	N	nla	n/r	n/r	750.7
320	302	Y	45	nlr	nlr	750.7
325	313	Y	108	nlr	nlr	750.7
325	313	Y	43	nlr	nlr	750.8
325	312	Y	82	nlr	nlr	750.6
325	303	Y	43	nlr	nlr	750.6
325	312	1	63	n/r	n/r	750.6

Sample ID: B1OFF003
Fluid Type: Castrol GTX 5W30 Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
330	308	Y	28	n/r	n/r	750.9
330	310	Y	27	n/r	n/r	750.9
330	324	Y	112	n/r	n/r	750.9
330	309	Y	24	n/r	n/r	750.9
330	305	Y	18	n/r	n/r	750.8

Appendix B10FF004
Surface Ignition Data
Unused Valvoline 5W30 Motor Oil

Sample ID: B10FF004
Fluid Type: Valvoline 5W30 Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	n/r	nlr	742.8
305	n/a	N	n/a	nlr	nlr	743.5
305	n/a	N	n/a	nlr	n/r	743.4
305	n/a	N	n/a	nlr	nlr	743.1
305	n/a	N	n/a	nlr	nlr	742.7
310	nla	N	n/a	n/r	n/r	746.7
310	nla	N	nla	n/r	n/r	746.4
310	nla	N	nla	nlr	nlr	747.5
310	nla	N	nla	n/r	n/r	745.9
310	nla	N	nla	nlr	nlr	742.8
315	310	Y	151	nlr	n/r	746.4
315	nla	N	nla	nlr	nlr	746.8
315	nla	N	n/a	nlr	nlr	746.6
315	nla	N	nla	nlr	n/r	746.2
315	292	Y	22	nlr	nlr	746.7
320	nla	N	nla	nlr	nlr	750.8
320	302	Y	45	n/r	n/r	751.2
320	313	Y	226	nlr	nlr	751.0
320	308	Y	113	nlr	n/r	746.9
320	nla	N	nla	nlr	nlr	746.7
325	314	Y	67	n/r	n/r	751.3
325	302	Y	27	n/r	n/r	751.2
325	313	Y	91	n/r	n/r	751.3
325	313	Y	72	n/r	n/r	751.2
325	314	Y	118	n/r	n/r	751.3

Sample ID: B10FF004
Fluid Type: Valvoline 5W30 Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
330	309	Y	32	nlr	n/r	750.9
330	306	V	22	n/r	n/r	750.9'
330	308	Y	21	n/r	n/r	751.2
330	303	Y	16	n/r	n/r	751.2
330	305	Y	16	n/r	nlr	751.3

Appendix B10FF005

Surface Ignition Data

Unused Mobil 5W30 Motor Oil

Sample ID: B1OFF005
Fluid Type: Mobil 5W30 Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
310	n/a	N	n/a	n/r	n/r	750.9
310	n/a	N	n/a	n/r	n/r	750.9
310	n/a	N	n/a	n/r	n/r	750.8
310	nla	N	nla	nlr	nlr	750.8
310	nla	N	nla	n/r	nlr	750.8
315	n/a	N	n/a	n/r	n/r	742.8
315	n/a	N	n/a	n/r	n/r	750.6
315	n/a	N	n/a	n/r	n/r	750.6
315	n/a	N	n/a	n/r	n/r	750.6
315	n/a	N	n/a	n/r	n/r	750.5
320	n/a	N	n/a	n/r	n/r	750.7
320	312	Y	172	n/r	n/r	750.9
320	n/a	N	n/a	n/r	n/r	750.9
320	n/a	N	n/a	n/r	n/r	750.9
320	n/a	N	n/a	n/r	n/r	750.9
325	311	Y	87	n/r	n/r	742.7
325	n/a	N	n/a	n/r	n/r	742.7
325	nla	N	nla	nlr	nlr	742.3
325	nla	N	nla	nlr	nlr	748.5
325	316	Y	178	nlr	nlr	748.7
330	nla	Y	363	nlr	nlr	749.0
330	329	Y	109	n/r	n/r	749.0
330	327	Y	87	n/r	n/r	749.1
330	327	Y	215	n/r	n/r	749.1
330	n/a	N	n/a	n/r	n/r	749.2

Sample ID: B1OFF005
Fluid Type: Mobil 5W30 Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
335	311	Y	30	nlr	n/r	749.3
335	321	Y	73	n/r	n/r	749.2
335	326	Y	106	n/r	n/r	749.2
335	318	Y	71	n/r	n/r	749.3
335	325	Y	101	n/r	n/r	749.3
340	313	Y	26	n/r	[illegible]	750.8
340	329	Y	84	n/r	[illegible]	750.7
340	328	Y	121	n/r	[illegible]	750.8
340	318	Y	32	n/r	[illegible]	751.5
340	335	Y	351	n/r	nlr	751.6

Appendix B10FF006

Surface Ignition Data

Unused Pennzoil 5W30 Motor Oil

Sample ID: B10FF006
Fluid Type: Pennzoil 5W30 Motor **Oil**
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	n/r	n/r	751.8
305	n/a	N	n/a	n/r	n/r	751.9
305	n/a	N	n/a	n/r	n/r	751.9
305	n/a	N	n/a	n/r	n/r	751.9
305	n/a	N	n/a	n/r	n/r	751.9
310	n/a	N	n/a	n/r	n/r	751.9
310	n/a	N	n/a	n/r	n/r	751.9
310	n/a	N	n/a	n/r	n/r	751,9
310	n/a	N	n/a	n/r	n/r	751,9
310	n/a	N	n/a	n/r	n/r	751.9
315	312	Y	150	nlr	n/r	751.7
315	293	Y	23	n/r	n/r	751.9
315	n/a	N	n/a	n/r	n/r	751.9
315	310	Y	67	n/r	n/r	751.9
315	308	Y	96	n/r	n/r	751.8
320	302	Y	48	n/r	n/r	751.8
320	307	Y	54	n/r	nlr	751.7
320	296	Y	24	n/r	nlr	748.9
320	306	Y	45	n/r	n/r	749.0
320	309	Y	75	nlr	nlr	749.0
325	309	Y	47	nlr	nlr	749.0
325	308	Y	44	nlr	nlr	749.0
325	313	Y	86	nlr	n/r	749.0
325	303	Y	23	nlr	nlr	749.0
325	316	Y	152	nlr	nlr	749.0

Appendix B10FF007
Surface Ignition Data
Unused Mobil One 5W30 Synthetic Motor Oil

Sample ID: B10FF007
Fluid Type: Mobil One 5W30 Synthetic Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
325	nla	N	nla	25.0	7.8	757.1
325	nla	N	nla	24.8	8.7	757.0
325	n/a	N	n/a	21.9	8.8	765.8
325	nla	N	nla	24.8	8.9	756.7
325	n/a	N	nla	26.2	8.7	756.4
330	nla	N	nla	25.3	6.8	757.0
330	n/a	N	n/a	25.8	6.8	757.1
330	n/a	N	n/a	25.7	6.8	757.1
330	n/a	N	n/a	25.5	6.8	757.0
330	n/a	N	n/a	25.5	6.3	756.9
335	n/a	N	n/a	24.0	6.9	755.2
335	nla	N	nla	24.4	7.2	755.4
335	334	Y	286	25.0	7.3	756.6
335	nla	N	nla	25.0	7.2	756.8
335	nla	N	nla	24.6	6.3	757.0
340	n/a	N	nla	24.2	6.4	759.5
340	nla	N	nla	24.6	7.6	759.1
340	nla	N	nla	24.9	7.7	759.1
340	339	Y	n/a	24.4	7.0	758,6
340	n/a	N	nla	25.0	5.6	758.6
345	339	1	nla	24.2	6.8	751.7
345	nla	N	nla	24.0	7.1	752.1
345	nla	N	nla	24.3	7.4	752.0
345	nla	N	nla	24.7	7.3	751.5
345	n/a	N	nla	24.4	9.1	751.2

Sample ID: B1OFF007
Fluid Type: Mobil One 5W30 Synthetic Motor Oil
State: Unused
Test **Apparatus:** Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
350	346	Y	n/a	24.3	5.7	760.0
350	n/a	N	n/a	25.1	9.5	751.4
350	n/a	N	n/a	25.2	9.6	750.8
350	n/a	N	n/a	25.4	9.9	750.7
350	n/a	N	n/a	25.5	9.9	749.9
355	n/a	N	n/a	25.6	8.3	756.0
355	n/a	N	n/a	23.8	5.8	753.8
355	n/a	N	n/a	24.0	5.6	754.2
355	351	Y	136	24.5	5.5	754.9
355	348	Y	145	24.3	5.4	755.0
360	355	Y	160	25.9	10.3	742.4
360	352	Y	192	26.0	11.0	742.3
360	355	Y	193	25.8	11.6	741.9
360	355	Y	186	26.6	11.5	741.7
360	356	Y	44	23.0	6.0	753.6
365	356	Y	n/a	26.0	7.6	754.5
365	355	Y	117	24.9	9.5	743.7
365	355	Y	90	24.6	9.6	743.6
365	n/a	N	n/a	25.6	10.1	743.1
365	355	Y	63	25.3	10.4	742.9
365	n/a	N	n/a	25.7	10.1	742.6
370	356	Y	n/a	26.2	8.1	755.2
370	357	Y	65	24.5	5.2	755.2
370	341	Y	30	24.8	5.2	754.9
370	345	Y	22	24.7	4.9	754.9
370	350	Y	85	24.8	5.0	754.9

Sample ID: B10FF007
Fluid Type: Mobil One 5W30 Synthetic Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
375	339	Y	10	25.3	4.9	754.6
375	350	Y	11	24.0	5.9	751.6
375	365	Y	121	25.3	5.6	751.6
375	354	Y	34	26.2	6.3	751.5
375	332	Y	13	25.8	6.5	751.7

Sample ID: B1OFF007
Fluid Type: Mobil One 5W30 Synthetic Motor Oil
State: New
Test Apparatus: Cast Iron Hemisphere
Airflow Rate: 0 m/s

t (C)	Ignition
360	N
360	N
360	N
360	N
360	N
370	N
370	Y
370	Y
370	N
370	N
375	Y
375	N
375	N
375	Y
375	Y
380	Y
380	N
380	N
380	N
380	Y
385	Y
385	Y
385	Y
385	N
385	Y

t (C)	Ignition
390	N
390	N
390	Y
390	N
390	Y
395	Y
395	Y
395	Y
395	Y
395	N
400	N
400	Y
400	N
400	Y
400	N
405	Y
405	N
405	N
405	N
405	Y
420	N
420	Y
420	N
420	Y
420	N

t (C)	Ignition
425	Y
425	Y
425	Y
425	Y
425	Y
430	Y
430	Y
430	Y
430	Y
430	Y

Appendix B10FF008

Surface Ignition Data

Unused Royal Purple 10W30 Synthetic Motor Oil

Sample ID: B1OFF008
Fluid Type: Royal Purple 1OW30 Synthetic Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		ignition	ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
300	n/a	N	n/a	n/r	n/r	744.5
300	n/a	N	n/a	n/r	n/r	744.5
300	n/a	N	n/a	n/r	n/r	743.8
300	n/a	N	n/a	n/r	n/r	743.6
300	n/a	N	n/a	n/r	n/r	744.0
305	n/a	N	n/a	n/r	n/r	744.1
305	n/a	N	n/a	n/r	n/r	744.4
305	n/a	N	n/a	n/r	n/r	744.4
305	n/a	N	n/a	n/r	n/r	744.3
305	n/a	N	n/a	n/r	n/r	744.4
310	n/a	N	n/a	n/r	n/r	754.4
310	308	Y	130	n/r	n/r	754.5
310	n/a	N	n/a	n/r	n/r	754.4
310	n/a	N	n/a	n/r	n/r	754.1
310	n/a	N	n/a	n/r	n/r	754.0
315	nla	N	n/a	n/r	n/r	743.4
315	nla	N	nla	nlr	nlr	743.1
315	nla	N	nla	nlr	nlr	742.7
315	nla	N	n/a	nlr	nlr	738.2
315	nla	N	nla	nlr	nlr	738.4
320	310	Y	97	n/r	n/r	754.6
320	nla	N	nla	n/r	nlr	738.6
320	318	Y	176	nlr	nlr	738.7
320	nla	N	n/a	nlr	n/r	739.4
320	nla	N	nla	nlr	nlr	739.5

Sample ID: B10FF008
Fluid Type: Royal Purple 10W30 Synthetic Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
325	n/a	N	nla	n/r	nlr	739.6
325	319	Y	127	nlr	nlr	739.6
325	n/a	N	n/a	n/r	n/r	739.7
325	316	Y	134	n/r	n/r	739.9
325	312	Y	106	n/r	n/r	740.1
330	315	Y	46	n/r	n/r	746.3
330	306	Y	20	n/r	n/r	746.7
330	314	Y	38	n/r	n/r	746.8
330	308	Y	27	n/r	n/r	746.8
330	305	Y	25	n/r	n/r	746.9
335	317	Y	47	n/r	n/r	746.7
335	322	Y	57	n/r	n/r	747.0
335	315	Y	45	n/r	n/r	747.1
335	314	Y	31	n/r	n/r	747.2
335	314	Y	38	n/r	n/r	747.5

Appendix B10FF009
Surface Ignition Data
Unused Castrol Syntec 5W30 Synthetic Motor Oil

Sample ID: B10FF009
Fluid Type: Castrol Syntec 5W30 Synthetic Motor Oil
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	nla	n/r	n/r	750.0
305	n/a	N	nla	n/r	n/r	750.1
305	n/a	N	nla	n/r	n/r	750.0
305	n/a	N	nla	n/r	n/r	nlr
305	n/a	N	nla	n/r	n/r	nlr
310	n/a	N	n/a	n/r	n/r	742.9
310	n/a	N	n/a	n/r	n/r	743.8
310	n/a	N	n/a	n/r	n/r	744.2
310	n/a	N	n/a	n/r	n/r	744.3
310	n/a	N	n/a	n/r	n/r	744.3
315	306	Y	108	n/r	n/r	744.3
315	302	Y	48	n/r	n/r	744.3
315	n/a	N	n/a	n/r	n/r	744.4
315	310	Y	87	n/r	n/r	744.5
315	n/a	N	n/a	n/r	n/r	749.9
320	305	Y	36	n/r	n/r	742.7
320	315	Y	144	n/r	n/r	750.3
320	310	Y	84	n/r	n/r	750.3
320	307	Y	47	n/r	n/r	750.4
320	299	Y	21	n/r	n/r	750.4
325	304	Y	20	nlr	nlr	750.3
325	311		58	n/r	n/r	750.2
325	312	Y	56	n/r	n/r	750.2
325	304	Y	20	n/r	nlr	750.1
325	304	Y	37	nlr	nlr	750.1

Appendix BIOFFOIO
Surface Ignition Data
Unused Quaker State SAE 80W90 Gear Lube

Sample ID: BIOFFOIO
Fluid Type: Quaker State SAE 80W90 Gear Lube
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
335	n/a	N	n/a	25.8	11.2	751.0
335	n/a	N	nla	25.7	11.6	750.6
335	nla	N	nla	27.0	10.8	750.0
335	n/a	N	n/a	25.1	10.8	
335	n/a	N	nla	25.3	10.9	754.1
340	n/a	N	n/a	n/r	nlr	750.4
340	n/a	N	n/a	23.8	10.0	750.7
340	n/a	N	n/a	25.4	9.8	750.9
340	n/a	N	n/a	25.4	10.5	751.0
340	nla	N	n/a	25.8	11.2	751.1
345	n/a	N	n/a	26.1	3.9	749.0
345	n/a	N	n/a	25.5	4.0	749.1
345	325	Y	29	24.9	6.9	749.1
345	n/a	N	n/a	n/r	n/r	749.0
345	n/a	N	n/a	n/r	n/r	750.2
350	n/a	N	n/a	23.1	3.2	751.8
350	n/a	N	n/a	24.9	3.9	751.1
350	310	Y	23	24.5	3.6	750.8
350	n/a	N	n/a	25.9	3.6	750.1
350	n/a	Y	nlr	nlr	4.8	749.0
355	312	Y	26	23.3	3.8	751.9
355	323	Y	21	23.8	4.1	751.8
355	n/a	N	n/a	23.4	3.8	751.7
355	318	Y	7.5	23.9	3.5	751.6
355	n/a	N	n/a	24.7	3.6	751.4

Sample ID: BIOFFOIO
Fluid Type: Quaker State SAE 80W90 Gear Lube
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	**At Ignition**			**t (C)**	**DP (C)**	P_{BARR}
360	318	Y	16	23.6	4.6	751.8
360	330	Y		24.7		753.8
360	327	Y	18	25.1	10.7	7538
360	332	Y	39	24.9	10.9	753.4
360	nla	N	nla	25.3	10.7	753.3
365	336	Y	17	24.8	9.9	752.6
365	327	Y	16	26.2	12.4	751.9
365	323	Y	16	25.6	14.1	750.8
365	325	Y	12	22.6	4.5	759.3
365	338	Y	15	22.8	4.5	759.3
370	323	Y	n/r	22.3	4.1	760.8
370	327	Y	11	23.7	5.4	755.8
370	331	Y	12	22.9	8.0	755.4
370	323	Y	12	23.8	8.7	754.8
370	n/r	Y	n/r	23.3	13.0	753.9

Appendix B10FF011
Surface Ignition Data
Unused Prestone DOT3 Brake Fluid

Sample ID: BIOFFOll
Fluid Type: Prestone **DOT3** Brake Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
265	nla	N	nlr	26.2	15.0	747.2
265	nla	N	nlr	26.2	15.0	747.2
265				26.2	15.0	747.2
265	n/a	N	n/r	26.2	15.0	747.2
265	n/a	N	n/r	26.2	15.0	747.2
270	nlr	Y	n/r	26.9	12.6	752.7
270	nla	N	n/r	26.9	12.6	752.7
270	nlr	Y	nlr	26.5	14.6	747.9
270	nla	N	nlr	26.5	14.6	747.9
270	nlr	Y	n/r	26.2	15.0	747.2
285	nlr	Y	n/r	25.9	13.4	754.1
285	nlr	Y	nlr	25.9	13.4	754.1
285	nlr	Y	nlr	25.9	13.4	754.1
285	nlr	Y	nlr	29.0	12.7	753.3
285	nlr	Y	nlr	29.0	12.7	753.3
290	nla	N	nlr	21.6	13.9	753.3
290	nlr	Y	n/r	21.6	13.9	753.3
290	nlr	Y	nlr	21.6	13.9	753.3
290	nla	N	nlr	21.6	13.9	753.3
290	nlr	Y	nlr	25.9	13.4	754.1
295	nlr	Y	n/r	26.3	12.9	753.4
295	n/r	Y	n/r	26.3	12.9	753.4
295	n/r	Y	n/r	26.8	13.1	753.5
295	n/a	N	n/r	26.8	13.1	753.5
295	n/r	N	n/r	28.4	16.4	742.2

Sample ID: B1OFFOI1
Fluid Type: Prestone DOT3 Brake Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
300	nlr	Y	nlr	27.7	16.9	742.7
300	n/a	N	nlr	27.7	1 6 9	742.7
300	nla	N	n/r	28.8	16.6	742.9
300	n/r	Y	nlr	28.8	16.6	742.9
300	nla	N	nlr	29.0	17.0	742.4
300	n/a	N	n/r	28.2	15.6	744.0
300	n/r	Y	n/r	27.3	16.1	743.7
300	n/r	Y	n/r	27.3	16.1	743.7
300	n/a	N	n/r	27.7	15.9	743.3
300	nla	N	nlr	27.7	15.9	743.3
305	nlr	Y	nlr	26.6	15.1	749.9
305	nlr	Y	nlr	26.6	15.1	749.9
305	n/r	Y	n/r	27.6	15.6	744.4
305	nla	N	nlr	27.6	15.6	744.4
305	nla	N	nlr	28.2	15.6	744.0
310	n/r	Y	n/r	25.5	18.4	748.4
310	nlr	Y	nlr	25.5	17.6	747.8
310	nlr	Y	n/r	25.5	17.6	747.8
310	n/a	N	nlr	26.0	15.2	746.5
310	nlr	Y	nlr	26.0	15.2	746.5
315	nlr	Y	nlr	24.2	19.3	748.8
315	nla	N	nlr	24.2	19.3	7488
315	n/r	Y	nlr	24.4	18.6	748.8
315	n/r	Y	n/r	24.4	18.6	748.8
315	nla	N	nlr	25.5	18.4	748.4

Sample ID: B1OFFOl1
Fluid Type: Prestone **DOT3** Brake Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
320	nlr	Y	nlr	22.9	14.4	747.7
320	nlr	Y	n/r	23.0	14.5	747.5
320	n/r	Y	n/r	23.0	14.5	747.5
320	n/r	Y	n/r	24.5	16.3	749.2
320	nla	N	nlr	24.5	16.3	749.2
325	nla	N	n/r	23.7	16.8	750.0
325	n/a	N	nlr	24.0	16.7	748.0
325	n/r	Y	n/r	24.0	16.7	748.0
325	n/r	Y	n/r	24.3	16.6	747.0
325	n/a	N	n/r	24.3	16.6	747.0
325	n/r	Y	nlr	22.9	14.4	747.7
330	nlr	Y	n/r	23.6	16.7	750.0
330	n/r	Y	nlr	23.4	16.5	749.0
330	nlr	Y	nlr	23.4	16.5	749.0
330	n/r	Y	n/r	23.7	16.8	748.0
330	n/r	Y	nlr	23.7	16.8	748.0
335	n/r	Y	nlr	n/r	nlr	759.2
335	n/r	Y	n/r	n/r	nlr	759.6
335	n/r	Y	n/r	n/r	n/r	760.2
335	n/r	Y	nlr	n/r	n/r	760.4
335	nlr	Y	nlr	nlr	nlr	760.8

Sample ID: B10FF011
Fluid Type: Prestone DOT3 Brake Fluid
State: Unused
Test Apparatus: Cast Iron Hemisphere
Airflow Rate: 0 m/s

t (C)	Ignition
290	N
290	N
290	N
290	N
290	N
295	N
295	N
295	N
295	N
295	N
300	N
300	N
300	Y
300	N
300	Y
305	Y
310	N
310	N
310	N

t (C)	Ignition
315	Y
315	Y
315	Y
315	Y
315	Y
320	Y
320	Y
320	Y
320	Y
320	Y
325	Y
325	Y
325	Y
325	Y
325	Y

Appendix B10FF012
Surface Ignition Data
Unused Albany DOT3 Brake Fluid

Sample ID: B10FF012
Fluid Type: Albany **DOT3** Brake Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
260	nla	N	nla	n/r	n/r	737.9
260	n/a	N	nla	nlr	nlr	737.8
260	nla	N	nla	nlr	n/r	737.8
260	nla	N	n/a	n/r	n/r	737.7
260	nla	N	nla	n/r	n/r	737.7
265	nla	N	nla	n/r	n/r	747.1
265	n/a	N	nla	n/r	n/r	746.8
265	/a	N	n/a	nlr	nlr	746.4
265	n/a	N	n/a	n/r	n/r	746.2
265	nla	N	nla			
270	266	1	284			747.8
270	nla	N	n/a	nlr	nlr	747.8
270	n/a	N	nla	n/r	n/r	747.6
270	n/a	N	nla	n/r	n/r	747.5
270	nla	N	n/a	nlr	n/r	747 3
275	266	Y	232	n/r	n/r	748.2
275	n/a	N	nla	nlr	nlr	748.3
275	272	Y	164	nlr	nlr	748.2
275	267	Y	70	nlr	n/r	748.1
275	nla	N	nla	nlr	n/r	748.2
280	273	Y	139	nlr	nlr	749
280	273	Y	119	n/r	n/r	748.8
280	274	Y	93	nlr	n/r	748.2
280	272	Y	151	nlr	n/r	748.1
280	274	Y	148	nlr	nlr	748.2

Sample ID: B10FF012
Fluid Type: Albany DOT3 Brake Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
285	274	Y	129	nlr	nlr	750.3
285	276	Y	126	nlr	nlr	749.9
285	272	Y	150	nlr	nlr	749.8
285	278	Y	125	n/r	n/r	749.8
285	276	Y	114	nlr	nlr	749.5
285	273	Y	128	nlr	nlr	749.2
290	280	Y	117	n/r	n/r	751.3
290	278	Y	78	nlr	n/r	751.2
290	279	Y	144	nlr	nlr	751.1
290	281	Y	165	nlr	n/r	750.7
290	280	Y	148	n/r	n/r	750.4
295	283	Y	93	nlr	n/r	755.3
295	287	Y	116	n/r	n/r	752.1
295	284	Y	107	n/r	n/r	751.6
295	286	Y	96	n/r	nlr	751.5
295	286	Y	115	n/r	nlr	751.4
300		Y	64	nlr	n/r	754.7
300		N	n/a	n/r	n/r	754.8
300	287	Y	79	n/r	nlr	754.9
300	nla	N	n/a	n/r	n/r	755.0
300	295	Y	121	n/r	n/r	755.2
305	nla	N	nla	nlr	nlr	752.9
305	nla	N	nla	n/r	n/r	752.7
305	n/a	N	nla	n/r	n/r	752.5
305	nla	N	nla	nlr	n/r	752.5
305	nla	N	nla	n/r	nlr	750.1

Sample ID: B10FF012
Fluid Type: Albany DOT3 **Brake** Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignitlon	Ignition Delay (s)	Ambient Air Data		
Target	**At Ignition**			**t (C)**	**DP (C)**	**P_{BARR}**
310	nla	N	nla	25.3	8.2	740.1
310	nla	N	nla	nlr	nlr	752.2
310	n/a	N	nla	nlr	nlr	753.5
310	nla	N	n/a	nlr	nlr	753.2
310	nla	N	nla	n/r	n/r	752.8
310	292	Y	50	nlr	nlr	752.9
315	nla	N	n/a	25.6	8.4	740.1
315	297	Y	38	23.8	2.7	7510
315	292	Y	37	24.5	4.1	752.1
315	298	Y	74	24.7	4.0	752.3
315	nla	N	nla	25.9	2.5	752.5
315	nla	N	nla	26.8	2.7	752.6
320	nla	N	n/a	25.7	8.7	740.0
320	nla	N	nla	25.8	9.0	740.2
320	nla	N	nla	26.3	9.1	740.2
320	nla	N	nla	25.6	8.9	740.3
320	n/a	N	nla	26.3	9.2	740.5
325	304	Y	33	25.1	8.1	740.1
325	303		33	23.3	2.9	750.6
325	nla		n/a	22.7	3.3	750.7
325	301	Y	132	24.3	2.8	750.7
325	301	N	38	23.8	2.7	751.0

Y

Sample ID: B10FF012
Fluid Type: Albany DOT3 Brake Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
330	304	Y	22	25.7	2.7	751.8
330	264	Y	4	n/r	nlr	755.4
330	264	Y	4	n/r	nlr	755.5
330	269	Y	3	nlr	nlr	755.5
335	270	Y	3	n/r	n/r	755.7
335	283	Y	4	n/r	n/r	755.8
335	289	Y	5	n/r	n/r	755.6
335	284	Y	4	n/r	n/r	755.6
335	264	Y	2	n/r	nlr	755.6

Appendix B10FF013
Surface Ignition Data
Unused Coastal DOT3 Brake Fluid

Sample ID: B10FF013
Fluid Type: **Coastal** DOT3 Brake Fluid
State: **Unused**
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
265	n/a			n/r	n/r	753.6
265	nla	N	n/a	n/r	n/r	754.0
265	nla	N	n/a	n/r	n/r	753.9
265	nla	N	nla	n/r	n/r	753.9
265	nla	N	nla	n/r	n/r	753.8
270	nla	N	nla	n/r	n/r	747.3
270	nla	N	nla	n/r	n/r	753.6
270	n/a	N	nla	n/r	n/r	753.6
270	nla	N	nla	n/r	n/r	753.7
270	nla	N	nla	n/r	n/r	753.6
275	n/a	N	n/a	n/r	n/r	747.5
275	n/a	N	nla	n/r	n/r	747.3
275	nla	N	n/a	n/r	n/r	747.3
275	nla	N	n/a	n/r	n/r	747.8
275	269	Y	160	n/r	n/r	747.4
280	274	Y	140	n/r	n/r	749.1
280	nla	N	n/a	n/r	n/r	749.0
280	nla	N	n/a	n/r	n/r	749.1
280	273	Y	151	n/r	n/r	740.0
280	nla	N	n/a	n/r	n/r	749.1
285	n/a	N	n/a	n/r	n/r	751.5
285	n/a	N	n/a	n/r	n/r	749.7
285	n/a	N	n/a	n/r	n/r	749.6
285	280	Y	165	n/r	n/r	749.5
285	279	Y	146	n/r	n/r	749.5

Sample ID: B10FF013
Fluid Type: Coastal DOT3 Brake Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
290	nla	N	nla	nlr	nlr	752.6
290	277	Y	100	n/r	n/r	752.5
290	281	Y	131	nlr	nlr	752.4
290	nla	N	nla	nlr	nlr	752.1
290	279	Y	120	n/r	nlr	751.7
295	nla	N	nla	nlr	n/r	752.6
295	283	Y	86	n/r	n/r	752.7
295	283	Y	74	n/r	n/r	752.6
295	284	Y	59	nlr	n/r	752.7
295	283	Y	77	nlr	nlr	752.8
300	283	Y	65	nlr	nlr	752.7
300	285	Y	60	nlr	nlr	752.6
300	nla	N	nla	nlr	nlr	752.6
300	287	Y	86	nlr	n/r	752.6
300	285	Y	84	nlr	nlr	752.6
305	nla	N	nla	n/r	nlr	755.9
305	290	Y	68	nlr	nlr	755.7
305	290	Y	65	nlr	nlr	755 5
305			nla	nlr	n/r	752.3
305	n/a	N	68	nlr	n/r	752.4
305	[illegible]	[illegible]	nla	nlr	n/r	752.6
310	nla	N	nla	nlr	nlr	737.5
310	n/a	N	n/a	n/r	n/r	756.3
310	n/a	N	n/a	n/r	n/r	756.3
310	n/a	N	n/a	n/r	n/r	756.3
310	nla	N	nla	nlr	nlr	756.2

Sample ID: B10FF013
Fluid Type: Coastal DOT3 Brake Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
315	291	Y	26	nlr	n/r	756.5
315	297	Y	41	n/r	n/r	756.5
315	298	Y	55	n/r	n/r	756.5
315	297	Y	53	n/r	nlr	756.4
315	295	Y	36	n/r	n/r	756.4
315	295	Y	36	n/r	n/r	756.4
320	301	Y	49	n/r	nlr	737.4
320	n/a	N	n/a	n/r	nlr	737.4
320	n/a	N	n/a	n/r	nlr	737.4
320	300	Y	44	n/r	nlr	737.9
320	301	Y	46	n/r	nlr	738.4
325	303	Y	28	nlr	nlr	752.3
325	302	Y	30	nlr	nlr	752.7
325	nla	N	n/a	nlr	nlr	753.0
325	302	Y	35	nlr	nlr	753.2
325	nla	N	nla	nlr	nlr	753.4
330	271	Y	3	nlr	nlr	753.4
330	309	Y	29	n/r	nlr	753.7
330	308	Y	31	n/r	nlr	753.8
330	n/a	N	n/a	n/r	n/r	753.8
330	306	Y	27	n/r	n/r	753.9
330	287	Y	4	n/r	n/r	753.9

Sample ID: B10FF013
Fluid Type: Coastal DOT3 Brake Fluid
State: Unused
Test Apparatus: **Cast** Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
335	310	Y	28	nlr	nlr	753.9
335	310	Y	31	nlr	n/r	754.0'
335	312	Y	27	nlr	nlr	754.0
335	309	Y	25	n/r	nlr	754.1
335	307	Y	20	nlr	n/r	754.1
340	282	Y	3	n/r	n/r	753.7
340	313	Y	20	n/r	n/r	753.7
340	314	Y	27	n/r	n/r	756.6
340	313	Y	21	n/r	n/r	756.6
340	292	Y	5	n/r	n/r	756.5
340	309	Y	22	n/r	n/r	756.5

Appendix B1 OFF014
Surface Ignition Data
Unused Valvoline Power Steering Fluid

Sample ID: B10FF014
Fluid Type: Valvoline Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
300	nla	N	nla	24.5	0.8	752.3
300	nla	N	n/a	24.9	1.0	752.5
300	nla	N	n/a	25.2	1.2	752.6
300	nla	N	nla	24.9	1.5	751.7
300	nla	N	nla	24 4	1.8	751.3
305	nla	N	nla	24.6	0.8	763.1
305	nla	N	n/a	24.6	0.9	762.8
305	nla	N	nla	25.2	0.4	762.5
305	nla	N	nla	23.3	0.8	752.9
305	nla	N	nla	24.6	1.0	752.7
310	305	Y	150	25.3	0.7	763.8
310	nla	N	nla	25.7	0.9	763.8
310	nla	N	nla	24.7	1./3	763.4
310	nla	N	nla	25.1	0.5	763.5
310	nla	N	nla	25.1	0.8	763.1
315	305	Y	86	25.0	2.0	753.1
315	312	Y	336	25.7	2.2	753.1
315		N	n/a	25.6	2.4	753.3
315	311	Y	232	23.7	0.1	764.0
315	31[illegible]	Y	135	24 4	0.3	764.2
320	311	Y	100	25.8	3.4	752.6
320	320	Y	344	24.5	2.5	750.9
320	300	Y	29	25.7	3.0	750.7
320	312	Y	79	24.0	3.6	759.2
320	nla	N	nla	24.2	3.1	759.2

Sample ID: B1OFF014
Fluid Type: Valvoline Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
325	316	Y	86	25.1	3.2	759.4
325	311	Y	54	24.5	3.1	759.4
325	305	Y	23	24.7	3.2	759.2
325	314	Y	86	25.3	2.8	758.9
325	313	Y	121	25.3	2.1	758.6
330	312	Y	48	25.1	2.2	758.5
330	306	Y	23	26.9	2.7	758.3
330	305	Y	28	25.9	3.0	757 9
330	313	Y	44	22 8	3.2	755.2
330	310	Y	22	24.7	3.6	755.2

Appendix B10FF015
Surface Ignition Data
Unused Pyroil Power Steering Fluid

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible
Fluid Temperature: 25°C

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	25.8	13.0	747.4
305	n/a	N	n/a	25.6	13.6	747.4
305	n/a	N	n/a	26.0	13.4	747.9
305	n/a	N	n/a	24.8	2.3	754.3
305	n/a	N	n/a	23.3	3.6	753.4
310	n/a	N	n/a	25.0	9.9	745.7
310	nla	N	nla	25.1	8.8	745.3
310	nla	N	nla	25.5	9.9	745.0
310	nla	N	nla	26.1	13.3	748.6
310	n/a	N	n/a	25.8	12.7	748.5
315	306	1	n/a	25.2	9.5	745.4
315	n/a	N	n/a	25.1	9.4	745.6
315	308	1	n/a	25.0	9.2	745.6
315	n/a	N	n/a	25.0	9.7	745.8
315	308	1	nla	25.9	13.0	748.4
315	305	1	nla	25.9	13.0	748.4
315	309	1	214	n/r	n/r	748.0
315	n/a	N	n/a	n/r	n/r	748.2
315	309	1	195	nlr	nlr	747.8
315	303	1	99	nlr	nlr	747.8
315	310	1	256	nlr	nlr	747.8

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible
Fluid Temperature: 25°C

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
320	311	Y	nla	26.0	11.4	743.2
320	316	Y	nla	26.0	11.4	743.2
320	313	Y	nla	25.1	9.8	745.3
320	n/a	N	n/a	26.8	13.3	748.1
320	311	Y	nla	26.3	13.4	748.4
320	nla	N	n/a	25.9	12.7	750.4
320	nla	N	n/a	25.1	10.0	750.5
320	314	Y	n/a	24.6	9.9	750.6
320	309	Y	80	n/r	n/r	753.1
320	310	Y	83	n/r	n/r	753.1
320	305	Y	64	n/r	n/r	750.0
320	301	Y	30	n/r	n/r	747.7
320	305	Y	74	n/r	n/r	747.5
325	318	Y	n/r	25.9	12.7	743.8
325	312	Y	nlr	25.9	12.7	748.8
325	320	Y	nlr	26.0	11.4	743.2
325	n/a	Y	169	22.2	3.5	755.2
325	n/a	Y	120	22.6	3.3	755.4
330	312	Y	35	22.5	3.2	755.4
330	324	Y	124	22.8	3.6	755.5
330	314	Y	64	24.7	3.3	755.4
330	315	Y	33	23.1	2.8	755.0
330	326	Y	185	23.5	3.3	754.9

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible
Fluid Temperature: **25°C**

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
350	331	Y	24	23.9	2.6	744.3
350	329	Y	19	23.8	2.8	744.5
350	328	Y	26	24.0	2.1	744.7
350	329	Y	22	24.1	2.5	744.8
350	329	Y	23	24.5	3.1	745.0
350	329	Y	15	n/r	n/r	747.6
350	330	Y	20	n/r	n/r	747.8
350	316	Y	16	n/r	n/r	747.8
350	327	Y	16	n/r	n/r	747.9
350	332	Y	24	n/r	n/r	747.8
375	348	Y	12	n/r	n/r	747.8
375	351	Y	11	n/r	n/r	747.8
375	349	Y	14	n/r	n/r	746.3
375	334	Y	11	n/r	n/r	746.3
375	355	Y	23	n/r	n/r	746.2
400	354	Y	3	23.5	1.8	754.8
400	371	Y	13	23.9	0.8	755.1
400	368	Y	12	25.1	1.7	755.1
400	365	Y	6	24.7	2.3	755.0
400	367	Y	7	25.5	2.6	754.7
400	367	Y	8	n/r	n/r	746.0
400	362	Y	6	n/r	n/r	745.9
400	373	Y	8	n/r	n/r	746.0
400	358	Y	9	n/r	n/r	746.0
400	366	Y	9	nlr	nlr	746.0

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron **Crucible**
Fluid Temperature: **25°C**

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
425	408	Y	51	n/r	n/r	746.0
425	375	Y	4	n/r	n/r	746.0
425	375	Y	3	n/r	n/r	745.8
425	387	Y	6	n/r	n/r	745.8
425	374	Y	3	n/r	n/r	745.8
450	387	Y	2	25.7	2.9	753.7
450	401	Y	4	22.8	4.1	744.5
450	413	Y	8	23.9	4.5	745.1
450	395	Y	4	25.8	3.5	751.8
450	412	Y	204	26.0	3.4	752.1
450	393	Y	4	n/r	n/r	745.9
450	407	Y	6	n/r	n/r	741.1
450	394	Y	4	n/r	n/r	741.0
450	380	Y	3	n/r	n/r	741.3
450	386	Y	3	n/r	n/r	742.5
475	400	Y	2.5	n/r	n/r	741.5
475	411	Y	3	n/r	n/r	741.5
475	411	Y	4	n/r	n/r	741.5
475	402	Y	3	n/r	n/r	741.4
475	398	Y	2.5	n/r	n/r	741.5
500	420	Y	2	n/r	n/r	741.6
500	422	Y	3.5	n/r	n/r	741.7
500	414	Y	3.5	n/r	n/r	741.8
500	422	Y	2	nlr	n/r	741.5
500	419	Y	4	n/r	nlr	741.8

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible
Fluid Temperature: 50°C

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
300	n/a	N	n/a	25.0	0.2	743.2
300	n/a	N	n/a	22.2	1.9	746.7
300	n/a	N	n/a	24.3	1.9	747.2
300	n/a	N	n/a	25.6	1.9	748.1
300	n/a	N	n/a	25.7	1.6	748.5
305	n/a	N	n/a	24.4	0.4	745.1
305	n/a	N	n/a	23.6	0.4	744.8
305	n/a	N	n/a	24.3	0.7	744.6
305	n/a	N	n/a	23.0	0.6	744.4
305	nla	N	n/a	23.9	0.7	744.0
310	n/a	N	n/a	24.1	0.6	763.9
310	n/a	N	n/a	22.8	-0.6	764.4
310	297	Y	40	23.3	-0.6	764.4
310	302	Y	93	23.2	-0.8	764.4
310	nla	N	nla	23.0	-0.5	764.5
315	305	Y	103	23.8	-0.4	764.7
315	305	Y	81	24.1	-0.3	764.8
315	305	Y	139	24.4	-0.4	764.9
315	297	Y	27	25.1	-0.4	764.7
315	298	Y	39	24.3	-0.2	764.5
320	304	Y	45	24.4	-0.7	761.6
320	n/a	N	n/a	23.3	0.6	745.5
320	312	Y	113	23.6	0.3	745.2
320	307	Y	55	24.1	0.0	745.1
320	308	Y	91	23.7	0.1	745.0

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible
Fluid Temperature: 50°C

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
325	311	Y	65	25.5	1.6	749.2
325	315	Y	72	24.3	1.3	749.3
325	317	Y	100	25.4	0.6	749.4
325	314	Y	62	24.8	0.6	749.5
325	311	Y	42	22.4	-1.4	756.7
330	311	Y	39	23.4	-1.6	756.8
330	323	Y	144	24.3	-1.4	757.4
330	320	Y	68	25.9	-1.2	757.6
330	315	Y	34	24.8	-1.9	757.3
330	317	Y	68	26.0	-2.5	757.4

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible
Fluid Temperature: 100°C

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	nla	N	nla	23.0	2.2	746.2
305	nla	N	nla	22.2	2.9	747.1
305	n/a	N	nla	22.5	2.8	747.3
305	n/a	N	n/a	22.8	2.8	747.5
305	n/a	N	nla	?	?	751.2
310	n/a	N	n/a	2.9	25.4	757.6
310	n/a	N	n/a	25.0	3.3	745.1
310	n/a	N	n/a	24.6	3.3	745.6
310	n/a	N	n/a	24.6	2.1	745.8
310	n/a	N	n/a	25.1	2.3	746.2
315	n/a	N	n/a	25.0	2.5	741.5
315	n/a	N	n/a	25.0	2.5	741.4
315	304	Y	69	25.1	2.3	741.2
315	nla	N	nla	24.9	2.5	741.2
315	nla	N	nla	25.4	2.3	740.8
315	nla	N	nla	25.0	2.3	740.6
315	n/a	N	n/a	25.0	4.5	744.5
320	314	Y	209	25.2	-2.0	757.5
320	303	Y	24	25.7	-2.1	756.5
320	317	Y	121	27.3	-0.9	755.6
320	303	Y	21	24.8	2.3	741.7
320	314	Y	117	25.2	2.0	741.5

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible
Fluid Temperature: 100°C

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
325	318	Y	116	25.2	3.2	741.9
325	n/a	N	n/a	n/r	n/r	751.6
325	316	Y	59	24.5	2.0	754.1
325	316	Y	79	23.7	1.6	754.3
325	311	Y	30	24.5	1.7	754.4
325	312	Y	38	23.2	-1.2	761.5
330	325	Y	127	24.7	-1.2	761.6
330	314	Y	25	25.5	-0.5	761.6
330	318	Y	26	24.5	-0.9	761.7
330	316	Y	28	25.0	-0.5	761.5
330	321	Y	53	25.5	1.1	761.5
330	322	Y	81	26.7	0.3	761.2
335	315	Y	66	26.0	0.8	761.5
335	321	Y	26	25.1	0.7	760.8
335	319	Y	21	25.8	-0.9	759.9
335	319	Y	25	25.5	-0.4	759.0
335	320	Y	61	23.7	3.4	747.3

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible
Fluid Temperature: 150°C

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
300	nla	N	nla	25.8	2.2	751.4
300	nla	N	nla	25.8	2.2	751.4
300	nla	N	n/a	26.4	1.8	751.5
300	nla	N	n/a	21.8	4.5	742.5
300	nla	N	nla	22.7	2.8	742.9
305	nla	N	nla	25.0	3.4	747.4
305	nla	N	nla	24.4	3.5	749.1
305	n/a	N	nla	25.4	3.3	749.1
305	n/a	N	n/a	25.4	2.0	750.9
305	n/a	N	n/a	25.3	2.9	751.1
310	n/a	N	n/a	25.5	1.0	754.6
310	304	Y	162	24.4	2.7	747.2
310	n/a	N	n/a	25.4	3.7	747.6
310	n/a	N	n/a	26.3	3.5	747.7
310	n/a	N	n/a	25.7	3.9	747.9
315	307	Y	47	26.5	3.9	747.7
315	309	Y	98	25.0	4.0	747.4
315	nla	N	nla	26.0	3.7	747.3
315	nla	N	nla	23.6	4.1	747.8
315	309	Y	178	24.1	4.5	747.6

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible
Fluid Temperature: 150°C

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
320	317	Y	117	24.7	4.1	747.5
320	316	Y	116	25.8	4.3	747.1
320	321	Y	217	25.5	4.7	746.5
320	319	Y	126	26.2	3.6	746.4
320	311	Y	57	25.2	4.6	746.2
320	312	Y	28	25.4	4.4	746
325	316	Y	65	25.5	4.9	745.8
325	316	Y	61	24.7	5.1	743.7
325	320	Y	65	24.4	3.6	747.3
325	318	Y	56	23.8	4.3	747.4
325	322	Y	111	24.6	3.3	747.8

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Hemisphere
Airflow Rate: 0 m/s (0 mph)

t (C)	Ignition
335	N
335	N
335	N
335	N
335	N
335	N
335	N
335	N
335	N
335	N
340	N
340	N
340	N
340	N
340	N
345	N
345	N
345	Y
345	Y
345	Y
350	Y
350	N
350	N
350	N
350	N

t (C)	Ignition
355	N
355	Y
355	Y
355	N
355	Y
360	Y
360	Y
360	Y
360	Y
360	Y
365	Y
365	Y
365	N
365	Y
365	Y
370	Y
370	Y
370	Y
370	Y
370	Y
375	Y
375	Y
375	Y
375	Y
375	Y

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast iron Hemisphere
Airflow Rate: 1.12 m/s (2.5 mph)

t (C)	Ignition
350	N
350	N
350	N
350	N
350	N
400	N
400	N
400	N
400	N
400	N
425	N
425	N
425	N
425	N
425	N
430	N
430	N
430	N
430	N
430	N
435	N
435	N
435	N
435	Y
435	Y

t (C)	Ignition
440	N
440	N
440	N
440	N
440	Y
450	N
450	Y
450	N
450	N
450	N
455	Y
455	Y
455	Y
455	Y
455	N
460	N
460	N
460	Y
460	N
460	N
465	N
465	Y
465	N
465	N
465	Y

t (C)	Ignition
470	Y
470	Y
470	Y
470	Y
470	Y
480	Y
480	Y
480	Y
480	Y
480	Y

Sample ID: B10FF015
Fluid Type: Pyroil Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Hemisphere
Airflow Rate: 2.24 m/s (5 mph)

t (C)	Ignition
500	N
500	N
500	N
500	N
500	N
550	N
550	N
550	N
550	N
550	N
600	N
600	N
600	N
600	N
650	

Appendix B10FF016
Surface Ignition Data
Unused Prestone Power Steering Fluid

Sample ID: B10FF016
Fluid Type: Prestone Power Steering **Fluid**
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	nla	N	n/a	23.3	6.4	754.1
305	nla	N	n/a	237	6 5	754.3
305	n/a	N	nla	24.5	6.3	754 4
305	nla	N	nla	24.8	6.3	754.5
305	nla	N	nla	25.7	6.0	754.6
310	nla	N	nla	25.7	4.2	755.5
310	n/a	N	nla	25.5	4.1	755.4
310	nla	N	n/a	25.5	4.1	755.4
310	nla	N	n/a	23 3	6.0	753.8
310	nla	N	nla	23.3	6.1	754.0
315	nla	N	nla	24.1	3.9	755.2
315	305	Y	88	25.0	3.7	755.4
315	301	Y	42	25.0	3.8	755.5
315	n/a	N	nla	25.2	4.0	755.6
315	nla	N	nla	24.7	4.0	755.6
320	314	Y	135	26.0	6.1	754.6
320	305	Y	42	26.2	6.1	754.6
320	323	Y	103	28.2	5.9	754.6
320	301	Y	33	24.7	6.0	751.9
320	n/a	N	n/a	26.1	6.4	752.0
325	310	Y	57	28.1	6.4	752.1
325	n/a	N	n/a	25.9	6.2	752.2
325	308	Y	30	25.8	8.5	751.8
325	312	Y	91	25.7	8.5	751.8
325	313	Y	58	25.7	8.8	751.7

Sample ID: B10FF016
Fluid Type: Prestone Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
330	323	Y	176	26.5	9.1	751.3
330	313	Y	44	26.1	9.0	751.1
330	320	Y			9.6	751.8
330	308	Y	26		9.6	751.7
330	316	Y	52	26.0	9 7	751.8
335	318	Y	31	26.0	9.5	752.0
335	312	Y	26	26.4	9.7	752.2
335	312	Y	25	26.0	9.2	752.3
335	315	Y	29	26 5	9.5	752.5
335	314	Y	25	26.7	9.3	752.7

Appendix B10FF017

Surface ignition Data

Unused Quaker State Dextron III / Mercon Automatic Transmission Fluid

Sample ID: B10FF017
Fluid Type: Quaker State Dextron III / Mercon Automatic Transmission Fluid
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
295	nla	N	nlr	25.6	10.8	747.3
295	nla	N	nlr	25.8	10.0	747.2
295	nla	N				
295	nla	N	n/r	25.6	10.6	751.6
295	nla	N	nlr	24.2	3.8	753.2
300	nla	N	nlr	24.7	10.6	752.0
300	nla	N			10.0	752.1
300	nla	N	nlr	24.8	9.4	753.8
300	nla	N	n/r	25.7	10.9	747.5
300	nla	N	n/r	26.0	10.8	747.4
305	nla	N	n/r	25.3	8.8	752.0
305	nla	N	nlr	25.5		
305	nla	N	nlr	24 5	8.7	751.9
305	301	Y	nlr	25.2	10.7	746.7
305	nla	N	nlr	25.7	10.8	747.2
310	nla	N	n/r	25.3	8.6	752.3
310	nla	N	n/r	25.1	8.8	752.3
310	311	Y	n/r	25.2	9.1	752.3
310	305	Y	nlr	25.4	10.0	755.2
310	310	Y	nlr	25.1	9.8	755.0
315	n/a	N	n/r	24.8	7.8	751.6
315	nla	N	n/r	24.7	7.8	751.7
315	308	Y	nlr	25.1		751.9
315	nla	N	nlr	24.5	7.9	745.8
315	308	Y	nlr	24.7	10.6	755.0

Sample ID: B10FF016
Fluid Type: Quaker State Power Steering Fluid
State: Unused
Test Apparatus: Cast iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
320	312		nlr	24.4	10.3	750.7
320	312		n/r	25.4	10.3	750.8
320	309		nlr	25.5	10.1	750.4
320	314		n/r	24.1	9.8	753.8
320	310	1	nlr	24.7	10.2	754.5
325	320	1	n/r	25.1	10.7	750.7
325	317	1	n/r	24.7	10.6	750.7
325	316	1	n/r	24.9	10.6	750.8
325	309	1	n/r	23.5	9.7	749.6
325	316	1	n/r	24.9	9.6	748.7

Sample ID: B10FF016
Fluid Type: Quaker State Power Steering Fluid
State: Unused
Test Apparatus: Cast Iron Hemisphere
Airflow Rate: 0 m/s (0 mph)

t (C)	Ignition
320	N
320	N
320	N
320	N
320	N
330	N
330	N
330	N
330	N
330	N
340	N
340	N
340	N
340	N
340	N
345	N
345	N
345	N
345	N
345	N
350	N
350	N
350	Y
350	N
350	N

t (C)	Ignition
355	Y
355	Y
355	Y
355	Y
355	Y
360	Y
360	Y
360	N
360	Y
360	Y
365	Y
365	N
365	Y
365	Y
365	Y
370	Y
370	Y
370	Y
370	Y
370	Y
375	Y
375	Y
375	Y
375	Y
375	Y

Appendix B10FF018
Surface Ignition Data
Unused Sunoco Dextron III / Mercon Automatic Transmission Fluid

Sample ID: B10FF018
Fluid Type: Sunoco Dextron III I Mercon Automatic Transmission **Fluid**
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
300	nla	N	nla	25.9	2.5	754.3
300	nla	N		25.3	2.5	753.3
300	nla	N		25.7	2.5	753.0
300	n/a	N	nla	23.5	4.7	740.3
300	nla	N	nla	24.9	5.7	740.3
305	nla	N	nla	25.9	4.1	756.3
305	n/a	N	n/a	25.2	4.7	756.1
305	n/a	N	nla	25.0	5.1	756.1
305	n/a	N	n/a	25.0	5.3	756.0
305	nla	N	n/a	25.4	4.5	755.4
305	n/a	N	n/a	25.2	4.2	755.2
310	307	Y	221	25.3	4.5	755.0
310	n/a	N	n/a	25.1	4.4	755.2
310	308	Y	265	24.7	4.5	755.2
310	n/a	N	n/a	25.6	4.7	755.4
310	n/a	N	n/a	25.9	3.4	755.9
310	306	Y	445	23.8	4.2	756.3
310	n/a	N	n/a	24.3	4.4	756.4
315	310	Y	158	24.3	5.0	754.6
315	309	Y	189	24.8	4.0	754.8
315	311	Y	162	25.5	4.6	754.9
315	309	Y	187	25.5	4.6	754.9
315	310	Y	167	25.4	4.1	755.0
320	303	Y	25	24.7	6.1	740.1
320	315	Y	76	24.9	6.5	740.0

Appendix B10FF021
Surface Ignition Data
Unused Prestone 51150 Extended life AntifreezelCoolant

Sample ID: B10FF021
Fluid Type: Prestone 51150 Extended life Antifreeze/Coolant
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
600	nla	N	n/a	n/r	nlr	757.5
600	nla	N	n/a	n/r	n/r	757.6
600	n/a	N	n/a	nlr	nlr	757.6
600	nla	N	n/a	n/r	n/r	760.4
600	n/a	N	n/a	n/r	n/r	760.6
605	n/a	N	n/a	n/r	n/r	757.1
605	n/a	N	n/a	n/r	n/r	757.4
605	n/a	N	n/a	n/r	n/r	757.4
605	n/a	N	n/a	n/r	n/r	757.6
605	n/a	N	n/a	n/r	n/r	757.5
610	n/a	N	n/a	n/r	n/r	750.9
610	483	Y	7	n/r	n/r	756.6
610	n/a	N	n/a	n/r	n/r	756.7
610	n/a	N	n/a	n/r	n/r	756.8
610	n/a	N	n/a	n/r	n/r	757.1
615	n/a	N	n/a	n/r	n/r	751.0
615	n/a	N	n/a	n/r	n/r	751.7
615	524	Y	7	n/r	n/r	751.7
615	n/a	N	n/a	n/r	n/r	751.6
615	n/a	N	n/a	n/r	n/r	756.4
620	481	Y	8	n/r	n/r	751.2
620	520	Y	7	n/r	n/r	751.2
620	465	Y	7	n/r	n/r	751.2
620	483	Y	7	n/r	n/r	751.5
620	485	Y	7	n/r	n/r	751.6

Sample ID: B10FF021
Fluid Type: Prestone 51150 Extended life AntifreezelCoolant
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
625	nla	N	n/a	n/r	n/r	760.7
625	514	Y	16	n/r	n/r	761.0
625	nla	N	n/a	n/r	n/r	761.0
625	nla	N	nla	n/r	n/r	760.9
625	532	Y	19	nlr	nlr	761.1
630	nla	N	nla	nlr	nlr	761.0
630	nla	N	nla	nlr	nlr	760.8
630	nla	N	nla	n/r	nlr	760.5
630	n/a	N	n/a	nlr	nlr	760.1
630	555	Y	6	n/r	n/r	760.1
635	551	Y	9	n/r	n/r	760.1
635	n/a	N	n/a	n/r	n/r	760.1
635	n/a	N	n/a	n/r	n/r	760.1
635	n/a	N	n/a	n/r	n/r	760.1
635	545	Y	7	n/r	n/r	760.1
640	537	Y	8	n/r	n/r	760.1
640	538	Y	6	n/r	n/r	760.2
640	550	Y	7	n/r	n/r	759.9
640	515	Y	7	n/r	n/r	759.6
640	nla	N	nla	n/r	nlr	759.9
645	577	Y	14	nlr	n/r	758.9
645	553	Y	11	n/r	nlr	750.8
645	nla	N	nla	nlr	nlr	750.4
645	544	Y	7	n/r	n/r	758.2
645	n/a	N	n/a	n/r	n/r	754.8

Sample ID: B10FF021
Fluid Type: Prestone 5/150 Extended life AntifreezelCoolant
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
650	538	Y	7	n/r	n/r	754.4
650	559	Y	4	n/r	n/r	754.3
650	541	Y	4	n/r	n/r	753.9
650	0	N	n/a	n/r	n/r	753.8
650	567	Y	10	n/r	n/r	753.6
655	n/a	N	n/a	n/r	n/r	753.3
655	578	Y	9	n/r	n/r	752.7
655	477	Y	6	n/r	n/r	752.4
655	582	Y	15	n/r	n/r	752.1
655	551	Y	6	n/r	n/r	751.7
660	567	Y	5	n/r	n/r	751.3
660	n/a	N	n/a	n/r	n/r	732.2
660	n/a	N	n/a	n/r	n/r	732.2
660	569	Y	10	nlr	nlr	732.1
660	555	Y	7	nlr	n/r	732.1
665	553	Y	8	n/r	n/r	732.2
665	501	Y	4	n/r	n/r	732.3
665	549	Y	6	n/r	n/r	732.4
665	502	Y	8	n/r	n/r	732.5
665	574	Y	6	n/r	n/r	732.5
670	622	Y	52	n/r	n/r	732.4
670	596	Y	6	n/r	n/r	732.4
670	n/a	N	n/a	n/r	n/r	731.6
670	524	Y	5	n/r	n/r	731.5
670	563	Y	4	n/r	n/r	731.3

Sample ID: B10FF021
Fluid Type: Prestone 5/150 Extended life AntifreezelCoolant
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignitlon Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
675	613	Y	7	nlr	nlr	731.4
675	503	Y	3	nlr	nlr	731.9
675	583	Y	6	nlr	nlr	732.0
675	568	Y	3	nlr	nlr	747.1
675	562	Y	4	nlr	nlr	746.6
680	659	Y	<1	nlr	nlr	746.2
680	564	Y	4	nlr	nlr	734.8
680	569	Y	3	nlr	nlr	735.3
680	542	Y	3	n/r	n/r	735.6
680	581	Y	2	n/r	nlr	735.6

Appendix B10FF022
Surface Ignition Data
Unused Sierra Antifreeze

Sample ID: B1OFF022
Fluid Type: Sierra Antifreeze
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
505	n/a	N	n/a	n/r	n/r	759.5
505	nla	N	nla	nlr	n/r	759.5
505	nla	N	nla	nlr	n/r	759.2
505	nla	N	nla	n/r	n/r	759.1
505	nla	N	nla	nlr	n/r	759.0
510	nla	N	nla	nlr	nlr	760.3
510	nla	N	nla	nlr	nlr	760.2
510	nla	N	n/a	nlr	nlr	760.0
510	nla	N	nla	nlr	nlr	759.9
510	nla	N	nla	nlr	nlr	759.9
515	nla	N	nla	nlr	nlr	756.0
515	nla	N	n/a	nlr	nlr	760.8
515	490	Y	76	n/r	nlr	760.8
515	n/a	N	n/a	n/r	n/r	760.7
515	nla	N	nla	nlr	n/r	760.5
520	nla	N	nla	nlr	nlr	755.5
520	nla	N	nla	nlr	nlr	755.5
520	nla	N	nla	n/r	nlr	755.4
520	nla	N	nla	n/r	n/r	755.5
520	nla	N	nla	n/r	n/r	758.8
525	nla	N	n/a	n/r	n/r	754.0
525	nla	N	nla	n/r	n/r	754.2
525	nla	N	n/a	nlr	nlr	754.5
525	nla	N	nla	nlr	nlr	754.7
525	nla	N	nla	nlr	nlr	755.1

Sample ID: B10FF022
Fluid Type: Sierra Antifreeze
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
530	n/a	N	n/a	n/r	n/r	737.1
530	437	Y	48	n/r	n/r	748.0
530	n/a	N	n/a	n/r	n/r	747.3
530	n/a	N	n/a	n/r	n/r	747.3
530	n/a	N	n/a	n/r	n/r	747.0
530	n/a	N	n/a	n/r	n/r	746.5
535	n/a	N	n/a	n/r	n/r	747.9
535	450	Y	65	n/r	n/r	748.0
535	n/a	N	n/a	n/r	n/r	748.0
535	n/a	N	n/a	n/r	n/r	748.1
535	506	Y	68	n/r	n/r	748.0
540	nla	N	nla	n/r	n/r	747.6
540	506	Y	111	nlr	n/r	747.7
540	433	Y	56	nlr	nlr	747.9
540	460	Y	67	nlr	nlr	748.0
540	514	Y	80	n/r	n/r	748.1
545	484	Y	72	nlr	nlr	739.1
545	508	Y	70	nlr	nlr	747.1
545	n/a	N	n/a	n/r	n/r	747.3
545	515	Y	76	n/r	n/r	747.1
545	515	Y	77	n/r	n/r	747.4
550	467	Y	55	n/r	n/r	737.8
550	430	Y	44	n/r	n/r	738.4
550	526	Y	71	n/r	n/r	738.6
550	491	Y	62	n/r	n/r	738.6
550	484	Y	68	n/r	n/r	739.1

Sample ID: B10FF022
Fluid Type: Sierra Antifreeze
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
555	502	Y	65	n/r	n/r	755.7
555	507	Y	65	n/r	n/r	755.6
555	492	Y	68	n/r	n/r	755.8
555	453	Y	59	n/r	n/r	755.8
555	513	Y	68	n/r	n/r	756.0

Appendix B10FF024
Surface ignition Data
Used Motor Oil

Sample ID: B10FF024
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	n/r	n/r	747.5
305	n/a	N	n/a	n/r	n/r	747.6
305	n/a	N	n/a	n/r	n/r	747.6
305	n/a	N	n/a	n/r	n/r	747.6
305	n/a	N	n/a	n/r	n/r	747.6
310	n/a	N	n/a	n/r	n/r	737.6
310	n/a	N	n/a	n/r	n/r	738.2
310	n/a	N	n/a	n/r	n/r	738.8
310	n/a	N	n/a	n/r	n/r	738.9
310	n/a	N	n/a	n/r	n/r	739.2
315	316	Y	273	n/r	n/r	737.3
315	n/a	N	n/a	n/r	n/r	739.4
315	n/a	N	n/a	n/r	n/r	739.4
315	n/a	N	n/a	n/r	n/r	739.3
315	314	Y	234	n/r	n/r	739.3
320	319	Y	225	n/r	n/r	739.6
320	n/a	N	n/a	n/r	n/r	739.9
320	n/a	N	n/a	n/r	n/r	739.9
320	308	Y	68	nlr	nlr	740.3
320	318	Y	181	nlr	n/r	740.6
325	320	Y	151	n/r	nlr	741.1
325	318	Y	111	n/r	n/r	742
325	316	Y	74	n/r	nlr	742.1
325	313	Y	98	nlr	nlr	742.4
325	314	Y	140	nlr	nlr	742.6

Sample ID: B10FF024
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
330	319	Y	81	n/r	n/r	747.7
330	314	Y	101	n/r	n/r	747.5
330	317	Y	70	n/r	n/r	747.7
330	326	Y	98	n/r	n/r	747.9
330	316	Y	57	n/r	n/r	747.9

Appendix B1 OFF027
Surface Ignition Data
Used Motor Oil

Sample ID: B10FF027
Fluid Type: Motor Oil
State: **Used**
Test Apparatus: Cast **Iron** Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	n/r	n/r	737.3
305	n/a	N	n/a	n/r	n/r	737.3
305	n/a	N	n/a	n/r	n/r	737.1
305	n/a	N	n/a	n/r	n/r	737.1
305	n/a	N	n/a	n/r	n/r	737.4
310	n/a	N	n/a	n/r	nlr	738.9
310	n/a	N	n/a	n/r	nlr	739.2
310	n/a	N	n/a	n/r	n/r	738.3
310	n/a	N	n/a	n/r	nlr	739.1
310	n/a	N	n/a	n/r	nlr	739.1
315	n/a	N	n/a	n/r	n/r	747.6
315	n/a	N	n/a	n/r	n/r	738.5
315	n/a	N	n/a	n/r	n/r	738.9
315	n/a	N	n/a	n/r	n/r	738.7
315	315	Y	296	n/r	nlr	738.6
320	315	Y	221	n/r	n/r	747.7
320	320	Y	110	n/r	n/r	747.5
320	319	Y	350	nlr	n/r	747.3
320	nla	N	nla	n/r	n/r	747.1
320	nla	N	nla	nlr	n/r	747.1
325	318	Y	97	nlr	nlr	746.9
325	318	Y	122	n/r		
325	299	Y	37	n/r	n/r	738.9
325	309	Y	87	n/r	n/r	739.2
325	307	Y	51	n/r	nlr	739.1

Sample ID: B10FF027
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
330	320	Y	86	n/r	n/r	739.1
330	320	Y	160	n/r	n/r	739
330	310	Y	41	n/r	n/r	738.9
330	304	Y	34	n/r	n/r	738.9
330	309	Y	41	n/r	n/r	753.6

Appendix B10FF028
Surface Ignition Data
Used Motor Oil

Sample ID: B1OFF028
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
310	nla	0	nla	n/r	nlr	751.5
310	n/a	0	n/a	n/r	nlr	751.5
310	n/a	0	n/a	n/r	nlr	751.5
310	n/a	0	n/a	n/r	n/r	751.7
310	n/a	0	n/a	n/r	n/r	751.7
315	n/a	0	n/a	n/r	n/r	753.8
315	nla	0	nla	nlr	nlr	753.1
315	nla	0	nla	nlr	n/r	751.8
315	nla	0	nla	nlr	nlr	751.6
315	nla	0	nla	nlr	n/r	751.6
320					n/r	753.9
320	309	1	100	n/r	n/r	753.8
320	315	1	129	n/r	n/r	753.7
320	307	1	75	nlr	n/r	753.4
320	302	1	32	n/r	n/r	753.4
325	308	1	60	n/r	n/r	753.4
325	302	1	29	n/r	nlr	753.2
325	299	1	33	n/r	nlr	753.2
325	315	1	154	n/r	n/r	753.2
325	317	1	100	nlr	n/r	753.1

Appendix B1OFF029
Surface Ignition Data
Used Motor Oil

Sample ID: B10FF029
Fluid Type: Motor Oil
State: Used
Test Apparatus: **Cast** Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	n/r	n/r	749.4
305	n/a	N	n/a	n/r	n/r	749.4
305	n/a	N	n/a	n/r	n/r	749.5
305	n/a	N	n/a	n/r	n/r	749.5
305	n/a	N	n/a	n/r	n/r	749.4
310	n/a	N	n/a	n/r	n/r	749.4
310	n/a	N	n/a	n/r	n/r	749.3
310	n/a	N	n/a	n/r	n/r	749.1
310	n/a	N	n/a	n/r	n/r	749.1
310	n/a	N	n/a	n/r	n/r	748.9
315	n/a	N	n/a	n/r	n/r	751.6
315	n/a	N	n/a	n/r	n/r	751.7
315	n/a	N	n/a	n/r	n/r	751.8
315	312	Y	172	n/r	n/r	752.6
315	312	Y	181	n/r	n/r	752.3
320	316	Y	198	n/r	n/r	752
320	n/a	N	n/a	n/r	n/r	751.8
320	311	Y	80	n/r	n/r	751.8
320	n/a	N	n/a	n/r	n/r	750.9
320	312	Y	74	n/r	n/r	751.6
325	314	Y	67	n/r	nlr	748.7
325	319	Y	112	n/r	n/r	748.4
325	306	Y	35	n/r	n/r	748.2
325	319	Y	113	n/r	nlr	748.2
325	306	Y	38	n/r	n/r	748.2

Sample ID: B10FF029
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
330	307	Y	32	n/r	n/r	748.2
330	322	Y	120	n/r	n/r	741.9
330	304	Y	25	n/r	n/r	741.9
330	311	Y	80	n/r	n/r	742.2
330	317	Y	85	n/r	n/r	742.3

Appendix B10FF030
Surface Ignition Data
Used Motor Oil

Sample ID: B10FF030
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	nla	N	nla	n/r	nlr	749.2
305	n/a	N	n/a	n/r	n/r	749.9
305	n/a	N	n/a	n/r	n/r	749.9
305	n/a	N	n/a	n/r	n/r	749.9
305	n/a	N	n/a	n/r	n/r	749.8
310	n/a	N	n/a	n/r	n/r	744.9
310	n/a	N	n/a	n/r	n/r	743.6
310	n/a	N	n/a	n/r	n/r	744.4
310	n/a	N	n/a	n/r	n/r	744.9
310	n/a	N	n/a	n/r	n/r	744.9
315	298	Y	57	n/r	n/r	742.9
315	306	Y	90	n/r	n/r	742.6
315	310	Y	339	nlr	nlr	743.4
315	300	Y	42	nlr	nlr	743.4
315	n/a	N	nla	nlr	n/r	744.2
320	320	Y	139	nlr	n/r	745.1
320	301	Y	28	nlr	n/r	749.9
320	296	Y	65	nlr	nlr	750.9
320	307	Y	63	nlr	n/r	750.9
320	313	Y	110	n/r	nlr	751.0
325	311	Y	95	nlr	nlr	750.8
325	309		44	n/r	n/r	750.9
325	316	Y	120	n/r	n/r	751.0
325	307	Y	31	n/r	n/r	751.0
325	319	Y	108	n/r	n/r	751.4

Appendix B1 OFF031
Surface Ignition Data
Used Motor Oil

Sample ID: B10FF031
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
315	n/a	N	n/a	n/r	n/r	745.4
315	n/a	N	n/a	n/r	n/r	745.4
315	n/a	N	n/a	n/r	n/r	745.4
315	n/a	N	n/a	n/r	n/r	745.1
315	n/a	N	n/a	n/r	n/r	745.1
320	n/a	N	n/a	n/r	n/r	745.0
320	n/a	N	n/a	n/r	n/r	744.8
320	n/a	N	n/a	n/r	n/r	744.7
320	n/a	N	n/a	n/r	n/r	744.6
320	n/a	N	n/a	n/r	n/r	744.1
325	313	Y	102	nlr	nlr	744.1
325	323	Y	166	nlr	nlr	744.1
325	303	Y	42	nlr	n/r	737.5
325	320	Y	272	nlr	n/r	737.5
325	321	Y	188	n/r	nlr	737.4
330	325	Y	151	n/r	n/r	737.2
330	n/a	N	n/a	n/r	n/r	737.2
330	n/a	N	n/a	n/r	n/r	737.1
330	323	Y	108	n/r	n/r	736.8
330	323	Y	178	n/r	n/r	736.8
335	313	Y	37	n/r	n/r	736.7
335	318	Y	66	n/r	n/r	736.7
335	323	Y	69	n/r	n/r	736.8
335	310	Y	21	n/r	n/r	736.7
335	317	Y	50	n/r	n/r	736.5

Sample ID: B10FF031
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
340	314	Y	23	n/r	n/r	736.5
340	308	Y	14	n/r	n/r	736.5
340	320	Y	53	n/r	n/r	737.3
340	323			n/r	n/r	737.2
340	327	Y	72	n/r	n/r	737.1

Appendix B10FF032

Surface Ignition Data

Used Royal Purple 10W30 Synthetic Motor Oil

Sample ID: B10FF032
Fluid Type: Royal Purple 10W30 Synthetic Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
315	n/a	N	n/a	n/r	n/r	751.9
315	n/a	N	n/a	n/r	n/r	751.9
315	n/a	N	n/a	n/r	n/r	751.9
315	n/a	N	n/a	n/r	n/r	751.9
315	n/a	N	n/a	n/r	n/r	736.8
320	n/a	N	n/a	n/r	n/r	737.1
320	n/a	N	n/a	n/r	n/r	742.0
320	n/a	N	n/a	n/r	n/r	742.1
320	n/a	N	n/a	n/r	n/r	742.0
320	n/a	N	n/a	n/r	n/r	741.9
325	n/a	N	n/a	n/r	n/r	737.2
325	n/a	N	n/a	n/r	n/r	741.5
325	318	Y	71	n/r	n/r	741.5
325	n/a	N	n/a	n/r	n/r	741.5
325	n/a	N	n/a	n/r	n/r	741.6
330	322	Y	146	n/r	n/r	741.6
330	323	Y	170	n/r	n/r	741.7
330	n/a	N	n/a	n/r	n/r	741.7
330	320	Y	77	n/r	n/r	741.7
330	316	Y	63	n/r	n/r	741.8
335	319	Y	65	n/r	n/r	737.4
335	320	Y	74	n/r	n/r	737.3
335	317	Y	88	n/r	n/r	737.4
335	324	Y	95	n/r	n/r	737.2
335	326	Y	180	n/r	n/r	737.1

Sample ID: B1OFF032
Fluid **Type:** Royal Purple 1OW30 Synthetic Motor Oil
State: Used
Test Apparatus: **Cast** Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
340	309	Y	15	n/r	n/r	471.9
340	317	Y	28	n/r	n/r	741.9
340	316	Y	29	n/r	n/r	742.0
340	323	Y	66	n/r	n/r	742.0
340	329	Y	84	n/r	n/r	742.0

Appendix B10FF033

Surface Ignition Data

Used Mobil One 5W30 Synthetic Motor Oil

Sample ID: B10FF033
Fluid Type: Mobil One 5W30 Synthetic Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
320	n/a	N	n/a	n/r	n/r	751.5
320	n/a	N	n/a	n/r	n/r	747.3
320	nla	N	nla	n/r	nlr	747.3
320	nla	N	nla	nlr	nlr	747.3
320	nla	N	nla	n/r	nlr	747.2
325	nla	N	nla	nlr	nlr	751.8
325	nla	N	nla	n/r	nlr	747.5
325	nla	N	nla	n/r	nlr	747.5
325	nla	N	nla	nlr	nlr	747.9
325	n/a	N	n/a	n/r	n/r	747.9
330	n/a	N	n/a	n/r	n/r	752.6
330	328	Y	182	n/r	n/r	751.7
330	nla	N	nla	n/r	n/r	751.3
330	nla	N	nla	nlr	nlr	751.5
330	n/a	N	nla	nlr	n/r	751.1
335	331	Y	116	nlr	n/r	748.1
335	nla	N	nla	nlr	n/r	748.3
335	334	Y	241	nlr	nlr	748.4
335	nla	N	nla	n/r	n/r	748.4
335	n/a	N	nla	nlr	n/r	748.5
340	nla	N	nla	nlr	n/r	752.6
340	335	Y	193	nlr	nlr	752.3
340	nla	N	nla	n/r	n/r	752.2
340	nla	N	nla	nlr	nlr	752.0
340	nla	N	nla	nlr	nlr	752.8

Sample ID: B10FF033
Fluid Type: Mobil One **5W30** Synthetic Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	**At Ignition**			**t (C)**	**DP (C)**	**P_{BARR}**
345	334	Y	n/r	n/r	n/r	753.3
345	336	Y	198	n/r	n/r	753.3
345	327	Y	162	n/r	n/r	753.2
345	313	Y	18	n/r	n/r	753.3
345	323	Y	38	n/r	n/r	753.4
345	n/a	N	n/a	n/r	n/r	751.7
350	335	Y	64	n/r	n/r	752.6
350	n/a	N	n/a	n/r	n/r	752.5
350	339	Y	98	n/r	n/r	752.4
350	324	Y	33	n/r	n/r	752.2
350	332	Y	61	n/r	n/r	752.2
355	326	Y	25	n/r	n/r	752.0
355	n/a	N	n/a	n/r	n/r	749.3
355	n/a	N	n/a	n/r	n/r	749.4
355	340	Y	62	nlr	nlr	749.4
355	329	Y	31	n/r	n/r	749.3
360	nla	N	nla	nlr	nlr	749.4
360	353	Y	154	nlr	nlr	749.5
360	344	Y	65	nlr	nlr	749.7
360	350	Y	144	nlr	n/r	749.6
360	336	Y	32	nlr	nlr	749.5

Sample ID: B10FF033
Fluid Type: Mobil One 5W30 Synthetic Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		ignition	ignition Delay (s)	Ambient Air Data		
Target	At ignition			t (C)	DP (C)	P_{BARR}
365	342	Y	38			749.6
365	338	Y	27	n/r	n/r	749.6'
365	342	Y	41	n/r	n/r	749.3
365	339	Y	30	n/r	n/r	749.2
365	349	Y	67	n/r	n/r	749.2
370	335	Y	16	n/r	n/r	749.1
370	324	Y	8	n/r	n/r	748.8
370	334	Y	6	n/r	n/r	748.8
370	324	Y	6	n/r	n/r	750.4
370	348	Y	42	n/r	n/r	750.3

Appendix B1 OFF034
Surface Ignition Data
Used Dextron III Automatic Transmission Fluid

Sample ID: B10FF034
Fluid Type: Dextron III Automatic Transmission Fluid
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
300	n/a	N	nla	23.3	0.9	744.7
300	n/a	N	nla	23.0	0.8	744.5
300	n/a	N	n/a	23.3	1.3	743.8
300	n/a	N	n/a	23.0	3.3	742.9
300	n/a	N	n/a	22.8	3.4	743.1
305	n/a	N	n/a	22.0	0.2	744.9
305	n/a	N	n/a	21.7	0.2	744.8
305	n/a	N	n/a	21.9	0.5	744.5
305	n/a	N	n/a	22.3	0.5	744.6
305	n/a	N	n/a	22.6	0.8	744.5
305	n/a	N	n/a	23.2	3.5	744.0
305	n/a	N	n/a	23.4	3.4	744.7
305	n/a	N	n/a	23.7	3.3	746.2
310	304	Y	228	22.6	-0.2	736.7
310	n/a	N	n/a	21.6	-0.1	737.0
310	n/a	N	n/a	22.9	0.7	737.0
310	nla	N	n/a	21.7	0.6	744.9
310	304	Y	91	21.7	0.6	745.0
315	308	Y	125	21.5	-0.3	738.4
315	309	Y	169	22.2	-0.8	738.2
315	311	Y	207	21.9	-0.9	737.3
315	308	Y	159	21.9	-1.5	737.2
315	311	Y	210	23.3	-0.5	736.9

Sample ID: B10FF034
Fluid Type: Dextron III Automatic Transmission Fluid
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
320	310	Y	4	23.7	3.3	746.9
320	305	Y	88	24.2	3.0	746.5
320	302	Y	33	24.2	2.8	746.4
320	310	Y	134	21.9	-0.5	739.4
320	303	Y	64	22.4	-0.1	739.0

Appendix B10FF035
Surface ignition Data
Unused Prestone Antifreeze-Water (1:1)

Sample ID: B10FF035
Fluid Type: Prestone Antifreeze-Water (1:1)
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
610	n/a	N	n/a	24.1	3.7	735.3
610	n/a	N	n/a	25.9	3.8	735.3
610	n/a	N	n/a	24.8	4.3	735.6
610	n/a	N	n/a	25.7	3.4	735.8
610	n/a	N	n/a	25	2.9	736.3
640	n/a	N	n/a	25.8	2.7	737.3
640	n/a	N	n/a	26.5	-0.5	755.2
640	n/a	N	n/a	25.3	-0.2	756.7
640	n/a	N	n/a	24.3	-0.3	767.7
640	nla	N	nla	25	0.1	767.7
640	nla	N	nla	25	0.9	767.9
645	n/a	N	nla	27.4	0.3	752.3
645	n/a	N	nla	25.3	-0.5	753.3
645	nla	N	nla	27.7	-1.3	753.6
645	nla	N	nla	25.3	-2.0	754.3
645	n/a	N	nla	25.7	-1.6	754.6
650	538	Y	54	25.2	3.3	737.1
650	nla	N	nla	25.3	2.6	738.3
650	564	Y	48	23.9	1.3	753.7
650	533	Y	52	25.1	1.6	754.1
650	n/a	N	n/a	24.3	1.2	754.0
660	552	Y	55	25.3	1.4	754.4
660	556	Y	55	24.7	1.4	754.4
660	565	Y	47	25.4	1.3	754.5
660	n/a	N	n/a	24.8	1.3	754.6
660	528	Y	51	25.2	1.3	754.8

Sample ID: B1OFF035
Fluid Type: Prestone Antifreeze-Water (1:1)
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
665	575	Y	50	24.6	0.4	749.5
665	578	Y	48	25.9	0.9	749.8
665	536	Y	50	24.5	1.1	750.7
665	550	Y	49	26.9	1.0	751.2
665	573	Y	50	25.4	0.0	752.1
670	557	Y	50	25.3	1.6	755.1
670	578	Y	51	24.7	2.1	754.9
670	581	Y	51	26.8	1.5	754.8
670	559	Y	39	24.9	2.1	754
670	554	Y	46	25.9	1.1	753.7

Appendix B10FF036

Surface Ignition Data

Unused Sierra Antifreeze-Water (1:1)

Sample ID: B1OFF036
Fluid Type: Sierra Antifreeze-Water (1:1)
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
515	n/a	N	nla	26.1	-6.2	746.8
515	n/a	N	nla	26.3	4.1	746.7
515	n/a	N	n/a	26.1	-3.0	746.7
515	n/a	N	n/a	23.4	-3.8	750.2
515	n/a	N	nla	23.8	-3.6	750.2
520	n/a	N	n/a	25.1	-3.6	746.5
520	n/a	N	n/a	25.6	-5.0	746.4
520	n/a	N	n/a	25.2	-5.2	746.4
520	n/a	N	n/a	26.3	-5.8	746.6
520	n/a	N	n/a	26.1	-6.4	746.7
525	nla	N	nla	25.3	-3.4	753.1
525	503	Y	143	25.5	4.1	752.9
525	nla	N	n/a	25.6	-4.1	752.9
525	nla	N	nla	24.1	-2.2	746.8
525	nla	N	nla	25.1	-3.1	746.7
530	n/a	N	nla	24.4	-2.5	753.6
530	505	Y	119	23.9	-2.4	753.8
530	n/a	N	nla	25.0	-2.8	753.8
530	502	Y	124	25.2	-2.7	753.7
530	490	Y	144	24.6	-2.6	753.4
535	446	Y	104	23.9	-2.2	753.0
535	nla	N	nla	23.7	-1.8	753.3
535	516	Y	142	24.1	-1.8	753.4
535	nla	N	nla	24.1	-2.3	753.5
535	471	Y	122	24.0	-2.8	753.6

Sample ID: B10FF036
Fluid Type: Sierra Antifreeze-Water (1:1)
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
540	n/a	N	n/a	24.2	-2.9	750.4
540	447	Y	113	24.5	-2.1	750.2
540	514	Y	138	25.2	-1.7	750.1
540	464	Y	103	25.8	-2.1	750.1
540	n/a	N	n/a	23.4	-2.4	753.1
545	n/a	N	n/a	24.6	-0.3	745.5
545	517	Y	123	24.8	-0.6	745.6
545	517	Y	121	24.0	-2.2	749.6
545	441	Y	n/r	24.3	-1.9	749.7
545	512	Y	120	24.2	-2.2	749.6
545	n/a	N	n/a	24.3	-2.6	749.7
550	n/a	N	nla	24.7	1.6	753.1
550	440	Y	111	24.2	-3.5	749.7
550	n/a	N	n/a	24.9	-3.3	749.9
550	454	Y	114	23.9	-3.0	750.2
550	n/a	N	n/a	24.5	-3.1	750.2
555	441	Y	90	24.7	2.3	744.4
555	433	Y	98	24.0	0.9	744.4
555	519	Y	104	24.5	0.3	744.5
555	517	Y	105	24.8	0.6	744.9
555	427	Y	98	24.2	0.6	745.3
560	527	Y	129	25.1	0.6	752.8
560	498	Y	108	24.1	0.6	752.2
560	n/a	N	n/a	23.9	0.6	752.1
560	509	Y	111	24.3	0.3	752.3
560	453	Y	94	23.9	0.3	752.1

Sample ID: B10FF036
Fluid Type: Sierra Antifreeze-Water (1:1)
State: Unused
Test **Apparatus:** Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
565	n/a	N	n/a	23.6	0.8	752
565	n/a	N	n/a	23.8	1.0	751.8
565	512	Y	104	24.3	0.7	751.6
565	525	Y	113	24	0.9	751.3
565	459	Y	98	25.9	0.6	751.2
570	528	Y	99	24.2	1.2	750.7
570	n/a	N	n/a	23.7	1.2	749.8
570	512	Y	92	23.9	-0.1	749.7
570	497	Y	80	24.5	-0.1	749.8
570	467	Y	92	25.1	-0.1	749.8
575	513	Y	203	24.1	1.3	753.1
575	524	Y	95	23.9	0.5	749.6
575	540	Y	112	24.4	0.4	749.3
575	518	Y	85	25.1	0.9	749.2
575	437	Y	78	24.6	0.6	749.4
580	483	Y	98	24.4	0.4	749.1
580	512	Y	109	25	0.4	749.1
580	495	Y	78	23.8	0.4	747.4
580	483	Y	90	24.2	1.5	742.4
580	437	Y	n/r	24.7	1.8	742.5
580	462	Y	61	24.5	2.3	742.9

Appendix B10FF037
Surface Ignition Data
Used Motor Oil

Sample ID: B10FF037
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	n/r	n/r	751.9
305	n/a	N	n/a	n/r	n/r	752.1
305	n/a	N	n/a	n/r	n/r	752.2
305	n/a	N	n/a	n/r	n/r	752.3
305	n/a	N	n/a	n/r	n/r	752.4
310	n/a	N	n/a	n/r	n/r	752.4
310	n/a	N	n/a	n/r	n/r	752.4
310	n/a	N	n/a	n/r	n/r	752.9
310	n/a	N	n/a	n/r	n/r	752.8
310	n/a	N	n/a	n/r	n/r	752.8
315	307	Y	199	n/r	n/r	750.3
315		N	n/a	n/r	n/r	750.4
		N	n/a	n/r	n/r	750.4
		Y	157	n/r	n/r	750.4
		Y	275	n/r	n/r	750.4
315	n/a	N	n/a	n/r	n/r	750.4
320	n/a	N	n/a	n/r	n/r	750.2
320	310	Y	109	n/r	n/r	750.4
320	312	Y	138	n/r	n/r	750.5
320	n/a	N	n/a	n/r		750.5
320	n/a	N	n/a			750.4
320	308	Y	82			750.5

Sample ID: B10FF037
Fluid Type: Motor Oil
State: Used
Test Apparatus: **Cast** Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
325	309	Y	50	n/r	n/r	750.4
325	309	Y	62	n/r	n/r	752.9
325	310	Y	54	n/r	n/r	753.0
325	308	Y	47	n/r	n/r	753.0
325	308	Y	47	n/r	n/r	753.0
330	316	Y	63	n/r	n/r	753.0
330	314	Y	54	n/r	n/r	753.0
330	317	Y	76	n/r	n/r	753.0
330	316	Y	98	n/r	n/r	753.1
330	313	Y	47	n/r	n/r	753.1

Appendix B10FF040
Surface Ignition Data
Used Sunfill SJ SAE 5W-30 Motor Oil

Sample ID: B10FF040
Fluid Type: Sunfill SJ SAE 5W-30 Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
310	n/a	N	n/a	23.3	5.1	759.5
310	n/a	N	n/a	23.4	5.7	759.2
310	n/a	N	n/a	23.9	6.4	759.2
310	n/a	N	n/a	22.1	5.3	756.5
310	nla	N	nla	22.4	5.0	756.5
315	n/a	N	nla	23.7	5.6	758.4
315	n/a	N	n/a	23.6	5.5	759.1
315	n/a	N	n/a	23.2	5.3	759.8
315	nla	N	n/a	23.4	5.4	759.8
315	nla	N	nla	23.7	5.4	759.7
320	310	Y	134	24.7	9.7	744.8
320	nla	N	nla	24.9	9.9	744.7
320	nla	N	nla	24.7	10.3	743.7
320	308	Y	n/a	24.4	9.7	743.6
320	nla	N	nla	22.4	4.3	757.6
320	n/a	N	n/a	22.8	4.3	758.0
325	nla	N	nla	25.8	10.5	747.3
325	nla	N	nla	25.8	10.3	746.7
325	322	Y	209	25.4	10.0	746.4
325	318	Y	103	25.9	10.3	746.2
325	nla	N	n/a	22.0	2.5	754.2
325	n/a	N	n/a	23.1	3.2	752.0
330	308	Y	39	25.2	10.4	748.1
330	n/a	N	n/a	24.2	9.5	744.9
330	322	Y	164	24.8	9.8	744.9

Sample ID: B10FF040
Fluid Type: Sunfill SJ SAE 5W-30 Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
335	325	Y	446	24.3	9.7	748.8
335	299	Y	15	24.7	9.9	748.4
335	335	Y	59	25.5	10.3	748.3
335	319	Y	36	25.1	9.7	745.1
335	309	Y	25	25.4	10.0	744.6
340	312	Y	25	23.2	5.6	756.2
340	314	Y	26	23.6	5.5	755.8
340	316	Y	34	24.8	5.8	755.5
340	317	Y	32	24.2	5.7	755.2
340	312	Y	29	21.5	2.6	754.1

Appendix B10FF041
Surface Ignition Data
Used Motor Oil

Sample ID: B10FF041
Fluid Type: Motor **Oil**
State: **Used**
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
T300et	At Ignition			t (C)	DP (C)	P_{BARR}
		N	nla	nlr	nlr	748.4
300				nlr	n/r	748.3
300	n/a	N	[illegible]	n/r	nlr	748.2
300	n/a	N	n/a	n/r	nlr	748.1
300	nla	N	nla	nlr	nlr	748.0
305	n/a	N	nla	n/r	nlr	755.0
305	nla	N	n/a	n/r	n/r	755.1
305	n/a	N	n/a	n/r	n/r	755.1
305	n/a	N	n/a	n/r	n/r	755.2
305	n/a	N	n/a	n/r	n/r	755.2
305	n/a	N	n/a	n/r	n/r	755.2
310	293	Y	46	n/r	n/r	755.0
310	n/a	N	n/a	n/r	n/r	755.0
310	nla	N	nla	nlr	nlr	754.9
310	nla	N	n/a	nlr	nlr	754.9
310	nla	N	nla	nlr	nlr	754.9
315	309	Y	167	n/r	nlr	754.9
315	291	Y	26	n/r	n/r	755.0
315	301	Y	58	n/r	nlr	754.7
315	315	Y	309	n/r	nlr	754.7
315	315	Y	325	nlr	nlr	754.6
320	305	Y	49	n/r	nlr	747.8
320	315	Y	151	nlr	n/r	747.8
320	312	Y	236	n/r	nlr	747.7
320	305	Y	55	nlr	nlr	747.0

Sample ID: B10FF041
Fluid Type: Motor Oil
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
300	nla	N	nla	nlr	nlr	748.4
300	n/a	N	n/a	n/r	n/r	748.3
300	n/a	N	nla	n/r	n/r	748.2
300	n/a	N	nla	n/r	n/r	748.1
300	nla	N	nla	nlr	nlr	748.0
305	nla	N	nla	nlr	n/r	755.0
305	n/a	N	n/a	n/r	n/r	755.1
305	n/a	N	n/a	n/r	n/r	755.1
305	n/a	N	n/a	n/r	n/r	755.2
305	n/a	N	n/a	n/r	n/r	755.2
305	n/a	N	nla	n/r	n/r	755.2
310	293	Y	46	nlr	nlr	755.0
310	nla	N	nla	nlr	nlr	755.0
310	nla	N	nla	nlr	n/r	754.9
310	nla	N	nla	nlr	nlr	754.9
310	n/a	N	nla	nlr	n/r	754.9
315	309	Y	167	nlr	nlr	754.9
315	291	Y	26	nlr	nlr	755.0
315	301	Y	58	nlr	nlr	754.7
315	315	Y	309	nlr	nlr	754.7
315	315	Y	325	n/r	n/r	754.6
320	305	Y	49	nlr	n/r	747.8
320	315	Y	151	nlr	n/r	747.8
320	312	Y	236	nlr	n/r	747.7
320	305	Y	55	nlr	nlr	747.0

Appendix B1 OFF047
Surface Ignition Data
Used Mobile One SAE 5W-30 Synthetic Motor Oil

Sample ID: B10FF047
Fluid Type: Mobile One SAE 5W-30 Synthetic Motor **Oil**
State: **Used**
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
325	n/a		n/a	25.5	9.7	754.3
325	n/a		n/a	23.8	8.8	752.2
325	nla	N	n/a	23.6	9.0	752.2
325	nla	N	nla	24.4	11.3	750.7
325	nla	N	n/a	24.6	11.7	750.7
330	nla	N	nla	24.3	6.0	754.2
330	n/a	N	n/a		8.2	754.7
330	n/a	N	n/a	24.0	8.6	754.7
330	nla	N	nla	24.7	9.2	754.6
330	n/a	N	nla	25.9	9.4	754.5
335	nla	N	nla	23.4	6.7	754.2
335	317	Y	38	24.4	7.0	754.2
335	n/a	N	n/a	23.7	6.9	754.2
335	nla	N	n/a	23.5	7.6	754.7
335	314	Y	41	23.6	7.4	754.7
340	326	Y	59	24.0	5.5	754.1
340	327	Y	99	25.0	5.6	753.4
340	323	Y	68	25.1	5.4	752.8
340	325	Y	62	25.1	6.0	752.7
340	319	Y	43	25.2	5.5	752.4
345	337	Y	110	23.5	6.2	754.1
345	331	Y	32	25.4	11.5	749.7
345	330	Y	62	25.5	11.8	749.6
345	335	Y	102	25.7	11.8	749.0
345	330	Y	66	23.3	7.0	744.5

Appendix B10FF049
Surface Ignition Data
Used Engine Coolant

Sample ID: B10FF049
Fluid Type: Engine Coolant
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
500	nla	N	n/a	24 6	3.6	746.4
500	n/a	N		24.3	3.6	746.4
500	nla	N	nla	n/r	n/r	746.3
500	nla	N	n/a	n/r	n/r	746.3
500	nla	N	nla	nlr	nlr	746.3
545	nla	N	nla	25.1	2.8	754.3
545	n/a	N	nla	25	2.1	754.6
545	n/a	N	n/a	24.5	3	754.8
545	n/a	N	n/a	24.4	2.1	755.1
545	nla	N	nla	25	2.5	755.4
550	nla	N	nla	24.5	3.8	750.3
550	nla	N	n/a	25.4	3.8	750.3
550	n/a	N	nla	24.8	3.8	750.7
550	nla	N	n/a		3.7	750.6
550	nla	N	nla	24.7	3.6	750.6
590	n/a	N	n/a	24.3	5.9	734.5
590	n/a	N	nla	24.5	6.2	733.3
590	nla	N	n/a	25.2	6.7	733.7
590	n/a	N	n/a	24.6	6.5	733.1
590	n/a	N	n/a	25	6.6	732.8
595	nla	N	n/a	24.9	3	755.6
595	n/a	N	n/a	25.2	3.8	756.6
595	nla	N	nla	25.9	2.6	756.5
595	nla	N	nla	25.1	3.1	756.8
595	nla	N	nla	25.6	3.6	756.6

Sample ID: B10FF049
Fluid Type: Engine Coolant
State: Used
Test Apparatus: Cast Iron **Crucible**

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
600	511	Y	72	25.4	3.6	750.4
600	n/a	N	n/a	25.3	3.4	750.2
600	n/a	N	nla	26	3.8	749.8
600	n/a	N	nla	25.8	3.7	750.3
600	n/a	N	n/a	25.8	4.3	750.3
605	nla	N	n/a	26.4	2.4	757.9
605	496	Y	74	23.4	2.6	758.3
605	n/a	N	n/a	26.4	3.6	758.4
605	505	Y	63	24.9	2.1	756.6
605	nla	N	n/a	24	3	754.1
610	539	Y	78	25.6	1.6	756.6
610	532	Y	65	24.3	1.7	756.6
610	521	Y	62	24.6	2	757.2
610	517	Y	57	25	2.4	757.4
610	nla	N	n/a	24.2		
615	515	Y	61	24.8		
615	453	Y	62	24.4		754
615	547	Y	88	24.9	2.3	754.1
615	534	Y	53	24.4	3.3	754.1
615	n/a	N	n/a	24.3	3.4	754.1
620	n/a	N	n/a	26.3	3.8	754.3
620	547	Y	63	24.8	2.8	754
620	528	Y	51	25.1	3.7	754.1
620	517	Y	58	25.2	4.4	753.3
620	521	Y	58	26.1	4.9	753.3

Sample ID: B10FF049
Fluid Type: Engine Coolant
State: Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
625	525	Y	55	26.4	3.8	740.3
625	548	Y	47	26.6	n/r	740.7
625	534	Y	62	n/r	n/r	740.9
625	525	Y	51	n/r	n/r	741.3
625	515	Y	54	24.6	1	765.5
630	536	Y	58	24.9	5.4	752.9
630	500	Y	49	24.2	2.2	753.5
630	525	Y	47	25.1	2.7	753.6
630	552	Y	46	24.7	2.3	753.9
630	531	Y	51	26	3.1	754.1
650	554	Y	36	25.1	4.4	736.9
650	n/a	Y		25	3.4	738.5
650	549	Y	44	26.8	4.3	738.7
650	562	Y	38	25.4	3.8	739.6
650	561	Y	43	26.4	3.8	740.2

Appendix B10FF051
Surface ignition Data
Pooled Used Power Steering Fluid

Sample ID: B10FF051
Fluid Type: Power Steering Fluid
State: Pooled Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	23.4	0.5	756.8
305	n/a	N		24.8	2.3	756.6
305	n/a	N	n/a	23.7	0.1	756.0
305	n/a	N	n/a	22.1	1.3	755.1
305	n/a	N	n/a	22.9	3.9	755.2
310	n/a	N	n/a	21.7	0.4	755.8
310	n/a	N	n/a	22.3	0.4	755.3
310	n/a	N	n/a	22.3	1.1	756.5
310	n/a	N	n/a	23.9	3.5	756.9
310	n/a	N	n/a	23.4	2.8	756.8
315	311	Y	222	23.2	7.2	744.1
315	n/a	N	n/a	23.7	7.5	744.1
315	n/a	N	n/a	23.0	7.4	744.1
315	n/a	N	n/a	21.9	0.7	755.4
315	n/a	N	n/a	21.9	0.4	755.8
320	n/a	Y	n/a	23.1	2.9	751.9
320	n/a	N	n/a	21.7	2.9	752.4
320	n/a	N	n/a	22.3	3.3	752.8
320	n/a	N	n/a	23.5	6.6	745.1
320	n/a	N	n/a	23.3	6.9	744.8
325	n/a	N	n/a	23.2	4.9	743.2
325	n/a	N	n/a	23.8	5.2	740.7
325	320	Y	32	23.6	5.6	740.5
325	n/a	N	n/a	23.2	3.5	743.1
325	n/a	N	n/a	23.7	3.5	743.3
325	n/a	N	n/a	22.8	3.9	743.6

Sample ID: B10FF051
Fluid Type: Power Steering Fluid
State: Pooled Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
330	n/a	N	n/a	22.8		743.6
330	n/a	N	n/a	23.5	4.3	743.9
330	n/a	N	n/a	22.4	4.0	744.4
330	320	Y	122	23.3	4.3	744.6
330	322	Y	146	23.1		744.6
335	329	Y	162	23.3		
335	317	Y	37	22.8		744.6
335	325	Y	71	23.1	2.0	751.8
335	331	Y	187	22.4	3.0	752.1
335	321	Y	67	22.2	3.5	752.7
340	314	Y	10	21.8	0.5	755.9
340	n/a	N	n/a	22.3	0.8	755.7
340	321	Y	29	22.5	0.2	756.5
340	321	Y	27	22.2	0.4	756.6
340	321	Y	67	22.1	0.5	755.0
340	319	Y	30	21.6	0.5	755.0
345	335	Y	78	[illegible]	0.8	755.4
345	326	Y	29	[illegible]	0.4	755.4
345	322	Y	19	21.8	0.4	755.4
345	326	Y	18	22.8	0.6	755.5
345	325	Y	15	24.0	10	755.3
350	336	Y	34	23.1	2.3	746.3
350	329	Y	29	22.8	2.5	746.5
350	333	Y	46	22.9	2.1	746.5
350	333	Y	46	23.3	2.3	746.8
350	331	Y	32	23.7	2.3	746.9

Appendix B10FF052
Surface Ignition Data
Pooled Used DOT3 Brake Fluid

Sample ID: B10FF052
Fluid Type: DOT3 Brake Fluid
State: Pooled **Used**
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
265	n/a	N	nla	23.0	5.6	757.4
265	n/a	N	n/a	23.6	5.6	757.6'
265	n/a	N	nla	24.2	4.8	757.7
265	n/a	N	nla	23.7	4.7	757.8
265	n/a	N	n/a	23.5	6.4	757.0
270	n/a	N	n/a	24.1	3.0	748.5
270	n/a	N	n/a	23.4	4.8	756.3
270	n/a	N	n/a	23.5	5.0	756.7
270	n/a	N	n/a	23.1	5.5	757.2
270	n/a	N	n/a	22.8	5.5	757.5
275	n/a	N	n/a	23.4	4.3	748.4
275	n/a	N	n/a	23.2	3.7	748.4
275	n/a	N	n/a	24.2	3.7	748.5
275	n/a	N	n/a	23.7	2.9	748.5
275	274	Y	123	23.2	5.1	756.2
280	n/a	N	n/a	24.1	3.8	751.7
280	n/a	N	n/a	23.7	3.2	751.7
280	n/a	N	n/a	24.7	2.7	750.9
280	n/a	N	n/a	23.0	3.7	747.8
280	n/a	N	n/a	23.1	3.9	748.0
285	n/a	N	n/a	23.1	4.3	752.6
285	276	Y	128	23.5	4.3	752.6
285	274	Y	174	23.3	4.8	752.6
285	n/a	N	n/a	23.7	4.3	752.4
285	274	Y	79	23.6	3.7	752.2

Sample ID: B10FF052
Fluid Type: DOT3 Brake Fluid
State: Pooled Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
290	275	Y	80	25.4	5.3	735.8
290	nla	N	nla	25.7	4.4	736.7
290	280	Y	133	25.2	5.4	736.7
290	nla	N	nla	23.8	4.2	752.4
290	280	Y	74	23.4	4.5	752.3
295	nla	N	nla	25.4	6.5	735.0
295	n/a	N	nla	25.0	5.9	734.9
295	n/a	N	nla			735.4
295	n/a	N	nla	25.2	6.0	735.5
295	n/a	N	n/a	25.1	5.6	735.7
300	n/a	N	n/a	23.0	4.1	750.7
300	n/a	N	nla	23.1	3.8	750.4
300	283	Y	n/r	23.4	3.7	750.3
300	285	Y	45	24.7	6.9	733.7
300	nla	N	n/a	25.0	6.6	733.7
305	287	Y	43	22.5	4.4	751.8
305	292	Y	76	23.0	4.9	751.7
305	290	Y	54	22.7	4.9	751.6
305	n/a	N	n/a	22.9	5.0	751.4
305	n/a	N	n/a	23.6	5.0	751.0
310	Y	Y	38	27.0	6.5	751.7
310	n/a	N	nla	25.6	7.4	751.6
310	n/a	N	nla	25.3	8.1	749.6
310	n/a	N	n/a	23.6	6.3	753.2
310	n/a	N	nla	23.7	5.9	753.1

Sample ID: B1OFF052
Fluid Type: DOT3 Brake Fluid
State: Pooled Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
315	n/r	Y	n/r	24.9	8.0	750.4
315		Y	33	24.9		750.3
315	nla	N	n/a	23.6	6.9	753.3
315	295	Y	38	23.6	7.1	753.2
315	nla	N	nla	23.9	5.6	755.1
320	298	Y	29	23.3	5 3	754.6
320	300	Y	27	23.1	5.5	750.7
320	305	Y	36	22.9	5.5	755.0
320	n/a	N	n/a	23.2	5.5	755.0
320	nla	N	nla	23.1	5.3	755.0
325	n/a	N	n/a	24.2	5.9	754.8
325	nla	N	n/a	24.0	6.5	754.7
325	n/a	N	nla	23.6	5.0	752.8
325	n/a	N	nla	23.1	5.0	753.0
325	nla	N	nla	23.5	4.6	753.4
330	307	Y	18	23.5	5.6	755.0
330	305	Y	15	24.5	6.5	754.7
330	n/a	N	nla	23.5	5.0	753.5
330	312		21	23.4	5.0	753.8
330	309	Y	24	23.6	5.1	753.8
335	n/r	Y	4	24.4	5.2	753.8
335	n/a	N	nla	24.2	5.0	758.8

Sample ID: B10FF052
Fluid Type: DOT3 Brake Fluid
State: Pooled Used
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
340	326	Y	59	24.0	5.5	754.1
340	327	Y	99	25.0	5.6	753.4
340	323	Y	68	25.1	5.4	752.8
340	325	Y	62	25.1	6.0	752.7
340	319	Y	43	25.2	5.5	753.4
345	337	Y	110	23.5	6.2	754.1
345	331	Y	32	25.4	11.5	749.7
345	330	Y	62	25.5	11.8	749.6
345	335	Y	102	25.7	11.8	749.0
345	330	Y	66	23.3	7.0	744.5

Appendix B1 OFF053
Surface Ignition Data
Unused Goodwrench Power Steering Fluid - Cold Climate

Sample ID: B10FF053
Fluid Type: Goodwrench Power Steering Fluid - Cold Climate
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)	DP (C)	P_{BARR}
305	n/a	N	n/a	23.8	4.2	751.6
305	n/a	N	n/a	24.6	4.7	751.5
305	n/a	N	n/a	25.1	5.0	751.2
305	n/a	N	n/a	24.6	5.1	750.9
305	n/a	N	n/a	24.9	5.2	750.1
310	n/a	N	n/a	23.3	3.5	752.0
310	n/a	N	n/a	23.1	3.3	751.9
310	n/a	N	n/a	23.8	3.2	752.1
310	n/a	N	n/a	23.7	3.3	752.1
310	n/a	N	n/a	23.9	4.2	751.9
315	n/a	N	n/a	23.4	6.1	743.9
315	n/a	N	n/a	23.8	5.8	743.7
315	n/a	N	n/a	24.0	5.7	743.7
315	309	Y	212	22.8	3.4	753.2
315	n/a	N	n/a	22.4	3.4	753.3
320	315	Y	233	23.0	5.3	743.3
320	n/a	N	n/a	23.5	5.8	743.2
320	n/a	N	n/a	23.5	5.2	742.6
320	316	Y	94	22.6	3.5	753.4
320	n/a	N	n/a	22.6	3.5	753.3
320	308	Y	82	23.0	2.6	753.2
325	312	Y	62	23.4	5.1	742.1
325	322	Y	204	22.3	3.7	742.4
325	314	Y	55	22.5	3.2	742.6
325	320	Y	243	22.9	2.7	742.9

Sample ID: B10FF053
Fluid Type: Goodwrench Power Steering Fluid - Cold Climate
State: Unused
Test Apparatus: Cast Iron Crucible

t (C)		Ignition	Ignition Delay (s)	Ambient Air Data		
Target	At Ignition			t (C)		P_{BARR}
330	322	Y	88	22.5	2.6	743.7
330	322	Y	133	23.0	2.8	744.0
330	317	Y	50	22.9	2.7	744.1
330	314	Y	55	23.6	2.6	744.2
330	318	Y	83	23.7	2.5	744.3
335	325	Y	96	21.9	3.4	752.5
335	317	Y	39	22.2	3.0	752.7
335	325	Y	106	23.2	3.0	753.0
335	318	Y	46	22.3	3.6	753.1
335	320	Y	44	22.4	3.3	753.1