EA02-025

FORD

10/27/03

BOOK 26 OF 61

PART 2 OF 4

BOX 23 OF 28

Potential
Failure Mode and Effects Analysis
(Design FMEA)

X System
__ Subsystem
__ Component:
Model Year/Vehicle(s): /
Core Team:

Design Responsibility: [illegible]
Key Date:

FMEA Number:
Page 2 of [illegible]
Prepared by: [illegible]
FMEA Date (Orig.): [illegible] (Rev.): [illegible]

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur	Current Design Controls	Detec	R.P.N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results: Actions Taken	Sev	Occ	Det	R.P.N.
					Latch stress cracks		Stress/strain calculations	[illegible]	[illegible]							
							Dimensional mock-ups									
							Latch strength tests									
					Latch relaxes under heat / vibration		Vibration test	[illegible]	[illegible]							
							Thermal cycling, shock test									
							Temperature / humidity test									
					Lock feature overflexed, will not return to proper position		?	[illegible]	[illegible]							
					Latch projection (s) allow unintentional unlatching		? ?	[illegible]	[illegible]							
					Latch false hook-up		Dimensional distance	[illegible]	[illegible]							
					Sharp edge(s)/insufficient [illegible] to allow operator to fully mate		Maximum [illegible] allowed	[illegible]	[illegible]							
							Design review									
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
Housing secondary lock	Secondary lock fails [illegible]	Secondary lock [illegible] terminals push out when connector used	[illegible]		Inadequate material selected		Trials of different materials ?	[illegible]	[illegible]							
					Secondary lock retention feature(s) dimensions and tolerancing inadequate		Dimensional mock-ups	[illegible]	[illegible]							
					Secondary lock retention feature(s) geometry inadequate		Dimensional mock-ups	[illegible]	[illegible]							
	Secondary lock can only be partially inserted	Connector can not be mated	[illegible]		Excessive force required to insert		Secondary lock insertion force tests	[illegible]	[illegible]							
	Secondary lock can be inserted incorrectly (for ex: 180 degrees out of design position)	Secondary lock not locked into connector	[illegible]		Design allows improper insertion		Dimensional mock-ups	[illegible]	[illegible]							
							Design review									
		Secondary lock moves connector while in use causing high insertion force to mating part			Design allows improper insertion		Secondary lock insertion force tests	[illegible]	[illegible]							
							Dimensional mock-ups									
							Design review									
	Secondary lock can be inserted between terminal and terminal lock finger	Possible terminal push out: Terminal lock finger damaged	[illegible]		Design allows improper insertion		Dimensional mock-ups	[illegible]	[illegible]							
							Design review									
							Secondary lock insertion force test									
							Lock finger damage force test									
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							

Potential
Failure Mode and Effects Analysis
(Design FMEA)

[illegible]

9713 7014

Potential
Failure Mode and Effects Analysis
(Design FMEA)

[illegible]

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur	Current Design Controls	Detec	R.P.N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results: Actions Taken	Sev	Occ	Det	R.P.N.
							[illegible]									
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]							
							[illegible]									
					[illegible]		[illegible]	[illegible]	[illegible]							
							[illegible]									
	[illegible]	[illegible]	[illegible]		[illegible]		?	[illegible]	[illegible]							
					[illegible]		?	[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							
			[illegible]					[illegible]	[illegible]							

[illegible]

3713 7015

Engineering Specification

PART NAME	PART NUMBER
SPECIFICATION - SLV ASSY - WIRE CONNECTOR	ESF33B-14A464-AA

LTR	F	D	D	D	D	D	D	F	D	D	D	E	D	D	D	D	D	D
FR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
LTR	D	D	D	D	D	D	D	D										
FR	19	20	21	22	23	24	25	26										

DATE	LTR	FR	REVISIONS	DR	CK	REFERENCE
91-5-[illegible]	[illegible]	[illegible]	RELEASED COMPLETE	/		
[illegible]			N800-E-10122109-000			PREPARED/APPROVED BY [illegible]
91 11 15	A		REVISED PAGES 3 4 5 6 7 8 9			CHECKED BY / DETAILED BY
			10 11 13, 4 15 16, 17 13, 3 21,			
			22 23 24 25			
911217			NB60-E-10091775-037 (RD)	[illegible]	[illegible]	CONCURRENCE/APPROVAL SIGNATURES
92 20 26	B		REVISED PAGES 2 3 4 5 7 8 9		[illegible]	
			11 12 13 14 16 17			[illegible]
921607			NB60-E-10091775-143 (RD)	[illegible]	[illegible]	
	C	11	REMOVED 111.24 (25 LBS)	[illegible]	[illegible]	DESIGN ENGINEERING MGT.
			NOM (18 LBS) WAS 80N (18 LBS)	[illegible]	[illegible]	
930215			NB60-E-10091775-312 (RD)	[illegible]	[illegible]	[illegible]
	D	ALL	RETYPED & ADDED ONE PAGE			
			FOR CLARIFICATION, WAS [illegible]		[illegible]	[illegible] CONTROL
930920			NB60-E-10091775-322 (RD)	[illegible]	[illegible]	
	E	12	REV REQUIREMENTS ON PULL TEST	[illegible]	[illegible]	PURCHASING
[illegible]			NB60-E-10091775-378 (RD)	[illegible]	[illegible]	
	F	1 8	[illegible]	CH	[illegible]	SUPPLIER QUALITY ASSISTANCE
[illegible]			NB22-E-[illegible]-001 (RD)	CH	[illegible]	[illegible]

FRAME 1 OF 26	REV F	ES-F33B-14A464-AA

PD 3947-a1 (Previous editions may NOT be used)

3713 7016

I. GENERAL

A. This specification replaces ES-F0EB-14A464-AA for Ford electrical connectors, both snap together and bolted, and is an extension of the released drawing on which it is referenced. All requirements of this specification must be met for all connectors designed for Ford applications (whether Ford designed or vendor designed) for the 1990 model year & beyond. Any existing connectors upgraded for a 1990 & beyond application must also comply with this specification. Minimum measures necessary for demonstrating compliance are given in each section.

The engineering test schedule contained within this specification, reflects the minimum values established to provide a regular evaluation of conformance to design intent. The schedule is intended as a supplement to normal material inspections, dimensional checking, and in-process controls; and should in no way adversely influence adherence to other more statistically significant inspection operations.

Preparation and submission of an acceptable Control Plan is the responsibility of the manufacturing source. The Control Plan shall include the inspection process and frequency for dimensional checking and other in-process checks. Control Plan approval according to Q-101 is a prerequisite for initial sample review and approval. The manufacturing source will retain the original of the approved Control Plan and any later revisions per Q-101 and provide a copy to the design responsible PEO.

II. PRODUCTION VALIDATION AND IN-PROCESS TESTS

A. Compliance with all of the requirements in this section must be demonstrated as follows:

1. Production Validation (PV) Tests must be completed satisfactorily with parts from production tooling (and processes where possible) before ISIR approval and authorization for shipment of production parts can be affected. The molding facility must also perform a functional test on each part, using a mating part from each vendor currently sourced by Ford to mold the mating part, prior to final part approval. Parts must be revalidated completely, or per Section V whenever any change is made which could possibly affect part function or performance.

II. PRODUCTION VALIDATION AND IN-PROCESS TESTS - continued

2. In-Process Tests - IP tests must be completed with production parts prior to first shipment and at the specified frequency on a continuing basis. Samples for these tests must be selected on a random basis to represent the entire production population as much as possible. In the event that any portion of these tests are not met, Ford Q101, Section III, paragraph E-3, "ES Test Performance Requirements" shall be invoked with the following exception:

If, after an IP test failure, the suspect lot is not shipped and the problem corrected, normal production can be resumed without notifying Ford Purchasing, SQA or the consuming plant Quality activity.

B. Component Performance Characteristics

The following paragraphs describe the performance requirements for components covered by this specification.

II. PRODUCTION VALIDATION AND IN-PROCESS TESTS

C. Schedule

(1) Test	(2) Test #	PRODUCTION VALIDATION (3) Minimum Sample Size[1]	PRODUCTION VALIDATION (4) Statistical Test Acceptance Criteria	IN-PROCESS TESTS (5) Minimum Sample Size & Frequency[4]	IN-PROCESS TESTS (6) Statistical Test Acceptance Criteria
Thermal Cycling	1	12	P.70 = .90	none	
Salt Spray	2a	8	P.57 = .90	none	
Soap Shower	2b	8	P.57 = .90	none	
Submergible Air Leak	2c	24	P.70 = .95	1/cav. per lot	No Failures
Dielectric Test	2d	24[2]	P.70 = .95	1/cavity per lot	No Failures
Vibration	3	12	P.70 = .90	none	
Mechanical Shock	4	24	P.70 = .95	none	
Terminal Retention	5	24	P.70 = .95	5/cav. per week[3]	No Failures
Housing Retention and Lock Fatigue	6	24	P.70 = .95	none	
Push Nut - Push Out and Turning Force	7	24	P.70 = .95	2/lot	No Failures
Threaded Insert Retention	8	24	P.70 = .95	2/lot	No Failures
Over Torque	9	24	P.70 = .95	2/lot	No Failures
Minimum Assembly Torque	10	12	P.70 = .90	2/week	No Failures
Solder Tail Gauge Test	11	24	P.70 = .95	5% Audit	No Failures
Gasket or Grommet Assurance	12	none		100% Inspection	No Failures
Melt Flow Index	13	5	No Failures	See Sec. III	No Failures
Unmating Force	14	24	P.70 = .95	none	
Terminal Insertion	15	24	P.70 = .95	none	

1 or one sample per connector cavity, whichever is greater.
2 for connectors with more than 20 positions, test a minimum of 8 samples, or 1 per tool cavity, whichever is greater.
3 for connectors with more than 20 positions, test 3/cavity per week.
4 Inspection frequencies for any or all In-process tests may be waived in lieu of an approved statistical process control program which monitors the characteristics listed in the "Process Control Parameter" section of each applicable test (see Ford Continuing Process Control and Process Capability Improvement, order # 80-01-201). Identify these characteristics in the control plan, along with a method to be used for controlling them. The control plan must also include a reaction plan in the event that process capability or control is lost after SPC is initiated. This control plan must be approved by Ford SQA and would supersede any reaction plan called out in this spec. The supplier must first demonstrate that the process is in statistical control and that the process is capable.

III. TEST PROCEDURES AND REQUIREMENTS

Test 1. Thermal Cycling

Purpose

The purpose of this test is to determine the resistance of an electrical connector system to exposures at extremes of high and low temperatures, and to the shock of alternate exposures to these extremes. Physical damage produced during this test results principally from variations in dimensions and other physical properties.

Procedure

1. Apparatus - Separate chambers shall be used for the extreme temperature conditions. The air temperature of each chamber shall be held at the specified temperature by means of air circulation and sufficient hot or cold chamber thermal capacity. The ambient temperature of each chamber shall reach the specified temperature within five minutes after the test samples have been transferred to the appropriate chamber.

2. Mounting - The test samples shall be positioned within the chamber such that there is substantially no obstruction to the flow of air across and around the samples. Any additional mounting instructions shall be specified by the requesting design engineer.

3. Length of Test - Test samples shall be subjected to 40 thermal cycles for the Product Validation (PV) tests, unless otherwise specified by the design engineer.

4. Test Temperatures - Test samples shall be subjected to one of the following test conditions, unless otherwise specified by the design engineer:

Type of Connector	Test Temperature Cycle
High-temp Sealed	-40° ± 2° C (1 hour)/125° ± 2° C (2 hours)
Moderate-temp Sealed	-40° ± 2° C (1 hour)/120° ± 2° C (2 hours)
Unsealed	-40° ± 2° C (1 hour)/100° ± 2° C (2 hours)

   Test samples shall be placed in a separate chamber at 55° ± 2°C with 95-98% Relative Humidity for three hours at the start of the test and after every 7 cycles.

5. For submergible connectors, perform the Submergible Air Leak test (test 2c, Step 4 of this spec) after thermal cycling, in order to check for loss of seal function.

Requirements

The connector shall complete the test successfully. Evidence of deterioration resulting from this test can at times be determined by visual inspection (distortion, cracks, surface delaminations, etc.). However, the effects may be more readily ascertained by measurements or other tests prior to, during, or after thermal cycling. A failure is defined by one or more of the following conditions:

A. Distortions that affect assembly fit and function (unacceptable change in part dimension).

B. Loss of lock function.

C. Visual evidence of cracks and surface delaminations considered harmful to connector function.

D. Loss of seal function as defined in the Submergible Air leak test. (Test 2c of this spec)

E. Other, as specified by the design engineer.

III. TEST PROCEDURES AND REQUIREMENTS - continued

Test 2. Seal Performance

Purpose

The purpose of these tests are to establish the electrical characteristics and evaluate the seal performance for a particular electrical connector assembly when subjected to laboratory salt spray. The electrical characteristics to be established are insulation resistance and total terminal connection resistance. NOTE: There are four different tests for evaluating seal performance, the salt spray test, the soap shower test, the submersible air leak test, and the dielectric test. The design engineer shall specify on the engineering drawing which test is to be performed for each specific application.

Test 2A Salt Spray

Procedure
The salt spray (fog) test shall be performed per ASTM designation B117 latest revision with the following additions:

1. Preparation of Test Samples

1.1 Crimp to each terminal a convenient length of wire. Use the wire with the smallest outer diameter that is called out for the connector being tested.

1.2 Install the terminal/wire subassemblies into the specified connector hardshell test samples. For connectors with more than 20 circuits, instrument a minimum of 20 random locations for this test. These locations must be approved by the Ford design engineer prior to instrumentation of the test. Visually inspect the connector assemblies to make certain that all required gaskets, boots, grommets or insert molded weather seals are properly installed. If specified, apply grease to the terminals. Type and amount of grease to be applied shall be defined by the requesting design engineer. Mate connectors.

1.3 Solder one millivolt drop lead to each connector assembly wire. All millivolt drop leads shall be single conductor, 20 gauge insulated wire. Install heat shrinkable tubing over each millivolt drop lead to wire attachment.

1.4 Secure the connector assemblies to a steel ground plane with a plastic locator or other means of attachment with 4 samples horizontal, 4 samples vertical, and 4 samples at a 45° angle, or as specified by the responsible design engineer.

1.5 Position the ground plane in a salt spray chamber per ASTM B117 paragraph 5.1.1 such that the test samples are directly exposed to the salt spray.

1.6 Except during electrical measurements, continuously apply 14 ± 0.5 VDC across adjacent terminals in each multicavity connector hardshell. For terminals installed in single cavity connector hardshells, apply 14 ± 0.5 VDC across the ground plane and terminal under test.

2. Electrical Measurements

2.1 Measure and record total terminal connection millivolt drop per ampere (contact resistance) at the second hour, twenty-fourth hour, and every 24 hours thereafter, for each test sample. Test current shall be 5.0 ± 0.5 amps. Test current shall be "on" only for the time necessary to take all millivolt drop measurements. The power supply voltage shall not exceed 12.0 volts. Total terminal connection millivolt drop values are obtained by taking the total reading obtained above and subtracting the millivolt drop due to the wire between the test leads (point A. to point B. in figure 1). The contact resistance is calculated by dividing the total terminal connection millivolt drop by the test current.

III. TEST PROCEDURES AND REQUIREMENTS - continued

2. Electrical Measurements - (continued)

2.2 Measure and record insulation resistance (IR) at 100 VDC (unless otherwise specified) across adjacent terminals for each multicavity connector hardshell. For terminals installed in single cavity connector hardshells, measure IR at 100 VDC across the ground plane and terminal under test. During this test, open circuit the millivolt drop leads. Measure IR at the second hour, twenty-fourth hour, and every 24 hours thereafter, for each sample.

2.3 Prior to subjecting test samples to salt spray, measure and record the IR and total terminal connection resistance per paragraphs 2.1 and 2.2 for each test sample.

3. Length of Test

The connector samples shall be subjected to the salt spray test per ASTM designation B117 for a period of 96 hours.

4. Requirements

Evidence of deterioration resulting from this test can be determined by careful visual examination and review of the contact resistance and insulation resistance data. A connector assembly failure is defined by one or more of the following conditions:

A. Total connection contact resistance data and/or insulation resistance data that exceeds the limits in the chart below:

Type of Connector	Contact Resistance		Insulation Resistance
	Before Test	After Test	
Open Housing	.01 ohm	.03 ohm	N/A
Weather Resistant	.002 ohms	.006 ohms	1M ohms
Submersible	.002 ohms	.003 ohms	20M ohms

B. Harmful disintegration of terminal base metal. Tin or tin-plated surfaces may show a light gray oxide but underplate or base metal must not be visible with 10X magnification (excluding edges and sheared surfaces).

C. Formation of cracks in terminal base metal that harmfully affect mechanical characteristics (normal contact forces, etc.).

D. Other, as specified by the design engineer.

Test 3b Soap Shower

A more severe test of water repellency is the soap shower test. The connectors are prepared in the same manner as in the salt spray test and the same electrical measurements are taken. However, the salt spray is replaced by a shower head located 200mm to 300mm above the samples, with a flow rate of 30 gallons per hour. The shower shall spray the samples with a 5% salt, 1% dish soap solution heated to 40°C, with a source pressure of 15 psi (gauge). Subject the samples to the spray for 2 seconds of a 4 second cycle for 450 cycles (total test time, 30 minutes). The requirements are the same as those for the salt spray test. Take all electrical measurements without making any special efforts to remove the residual water.

III. TEST PROCEDURES AND REQUIREMENTS - continued

Test 2c Submersible Air Leak

Purpose

The purpose of this test is to assure that all submersible connectors are free from leaks which may allow water vapor or other harmful substances to enter the connector and corrode the terminals. For potted connectors, such as the 11-way, this test is also used to demonstrate the effectiveness of the potting material.

Procedure

1. Assemble the connector shell, grommets, and terminals. The terminals must be sealed to prevent air from leaking out through the wires. This can be done in a number of ways, such as potting the ends of the wires or double crimping the wires and using the terminals on both ends of the wire in the connector assembly. For direct connectors, the mating components must be specially prepared. The terminal tails should be cut off at the terminal barrel and then potted. The terminal tails should not extend through the potting material. Connectors that rely on potting material to seal the terminals by design shall be tested without modification. Mate the connectors. The process for preparing the connector assembly for this test shall be approved by the responsible design engineer before testing.

2. Remove one of the terminals from either end of the connector assembly, and insert a 2.5 mm O.D. tube through the grommet as in Figure 3.

3. Connect the other end of the tube to a pressure tester, as shown in Figures 3 and 4. Immerse the connector assembly in water. Start with the air regulator closed and slowly open it until the manometer reads 50 KPa (7 psi).

4. Keep the connector submerged for at least 15 seconds while examining it for leaks. If the mating component of a direct connector leaks, it shall be repotted and the test repeated.

5. For the product verification (PV) test only, place the connector assemblies in a temperature chamber and heat age the connectors for 70 to 74 hours at 100° ± 5°C.

6. Remove the assemblies from the thermal chambers and repeat steps 3 through 4, using a pressure of 28 Kpa (4 psi).

Requirements

The snap fit and bolted connectors must both be able to hold 50 Kpa (7 psi) for a minimum of 15 seconds.

Test 2d Dielectric

Purpose

This test is intended to confirm that all submersible connectors are truly submergible and retain their dielectric properties while submerged in water.

III. TEST PROCEDURES AND REQUIREMENTS - continued

SUBMERSIBLE TEST

Procedure

A. Product Validation Test

For connectors with 20 positions or fewer, 24 samples of each assembly part number to be tested are required. For connectors with more than 20 positions, a minimum of 8 samples (or 1 per tool cavity, whichever is greater) of each assembly part number to be tested are required. Each sample must be mated to its appropriate mating connector assembly thus forming a complete electrical connection including all applicable grommets, seals, wedges, and other parts. Each terminal in each connector shall be appropriately attached to a minimum one-half meter length of wire conforming to ESB-M1L85-A or ESB-M1L123-A (to be specified by the responsible design engineer), except in the case of terminals which are part of a direct electrical plug-in component assembly and thus do not attach to vehicle wiring. Half of the test connections should use the largest wire sizes, the remaining half should use the smallest wire sizes.

Divide the samples equally into four groups A-D. Groups A and B should include samples using the largest wire sizes, groups C and D should include samples using the smallest wire sizes.

The test procedure is as follows:

1. For each sample in groups A and C, apply 500 volts D.C. across each pair of adjacent wires using a Biddle Dielectric Test Set, catalog #22005, or equivalent. Measure the shunt resistance, then remove the 500 volt potential.
2. Submerge the samples in groups A-D to a depth of 30 to 40 cm. in a 20° ± 5°C water solution containing 5% salt by volume and 1% dishwasher soap by volume. The exposed ends of the wires must be protected from contamination by the solution and its vapor. When direct plug-in electrical components form part of the electrical connections being tested, any openings in the components that would allow the solution to penetrate to the interior of the connections must be potted. Complete step 3 within 15 minutes of submerging the samples in the solution.
3. For each sample in groups A and C, repeat step 1. For each sample in groups B and D, apply 500 volts D.C. across the solution and every wire in the connection using a Biddle Dielectric Test Set, catalog #22005, or equivalent. Measure the shunt resistance, then remove the 500 volt potential.
4. Leave the samples submerged in the solution for 4 hours. At the end of the submersion period, while the samples are still submerged, repeat Step 3, then remove the samples from the solution.
5. Place the samples in a temperature chamber preheated to 125°C. Heat soak the samples for 4 hours.
6. Immediately transfer the samples to a temperature chamber prechilled to -40°C. Cold soak the samples for 1 hour.
7. Repeat the test sequence given in steps 5 and 6 three more times.
8. Remove the samples from the temperature chamber and let them stabilize at room temperature for 1 hour. Then repeat the test sequence given in steps 2 through 4.
9. Place the samples in a temperature chamber preheated to 125°C. Heat soak the samples for 4 hours.
10. Without allowing the samples to stabilize at room temperature, remove them from the 125°C temperature chamber and immediately plunge them into the solution. Repeat steps 2 through 4.

III. TEST PROCEDURES AND REQUIREMENTS - continued

Requirements

The shunt resistance shall not fall below 20 megohms at any time during the entire procedure.

Process Control Parameter - shunt resistance.

Test 3 Vibration

Purpose

The purpose of this test is to determine the effects on component parts of vibration within the predominant frequency ranges and magnitudes that may be encountered during field service. Most vibration encountered in field service is not of harmonic nature, but test based on vibrations of this type have proved satisfactory for determining critical frequencies, modes of vibration and other data necessary for planning protective steps against the effects of undue vibration. Vibration caused by loosening of parts or relative motion between parts in the specimen can produce objectionable operating characteristics, noise, wear, and physical distortion, and often results in fatigue and failure of mechanical parts.

Procedure

1. Mounting

1.1 The mounting apparatus used to mount the samples on the vibration machine must be free from resonances over the test frequency range, for example as shown in figure 1. For test samples with attached brackets, one of the vibration directions shall be parallel to the mounting surface of the bracket. For connectors mounted directly to an electronic component, one of the vibration directions shall be perpendicular to the circuit board that the connector mates to. Vibration input shall be monitored on the mounting fixture in the proximity of the support points of the test sample.

1.2 All connectors shall be wired in series and connected to a DC power source allowing a current flow of 100 mA to monitor during the entire test phase for electrical discontinuity greater than 1 microsecond.

1.3 The test apparatus must be approved by the responsible design engineer prior to the start of the test.

2. Amplitude and Frequency

2.1 All connectors shall be subjected to a simple, harmonic motion having a displacement of 0.06 inches peak-to-peak. The frequency shall be varied logarithmically between the approximate limits of 10 and 55 Hz.

2.2 All submersible connectors shall also be subject to a simple harmonic motion of 25 g's while varying the frequency logarithmically between 40 and 300 Hz. This test is to be performed in addition to step 2.1.

III. TEST PROCEDURES AND REQUIREMENTS - continued

3. Sweep Time and Duration

3.1 The entire frequency range in step 2.1 of 10 to 55 Hz and back to 10 Hz shall be traversed in 1 minute. The motion shall be applied for a period of 16 hours in each of the three mutually perpendicular directions (total test time 48 hours).

3.2 The entire frequency range in step 2.2 of 40 to 300 Hz and back to 40 Hz shall be traversed in 10 ± 2 minutes. The motion shall be applied for a period of 8 hours in each of the three mutually perpendicular directions (total test time 24 hours).

Requirements

The connector shall complete the test successfully. Evidence of deterioration resulting from this test can at times be determined by visual inspection (distortion, cracks, surface delaminations, etc.). However, the effects may be more readily ascertained by measurements or other tests prior to, during, or after vibration testing. A failure is defined by one or more of the following conditions:

A. Distortions that affects assembly fit and function (unacceptable change in part dimension).

B. Loss of lock function.

C. Visual evidence of cracks and surface delaminations considered harmful to connector function.

D. Loss of electrical continuity for greater than 1 microsecond.

E. Other, as specified by the design engineer.

Test 4 Mechanical Shock

Purpose

This test is for the EEC connector only, to ensure that the connector assembly and mounting hardware can withstand the vehicle shock that normally occurs during driving.

Procedure

Assemble the connector shell, grommets, spacers, terminals, locator, and any other mounting hardware. Solder a blank circuit board to the terminal tails if applicable. Mount the assembly to a fixture using the method of attachment provided by the part. Subject the unit to 3 impulses in a direction parallel to the mounting plane, equivalent to 100 Gs force, for a minimum duration of 10 milliseconds each. Apply 3 more impulses of equal strength and duration in the opposite direction. Repeat the procedure in each of the two mutually perpendicular planes.

Requirements

The connector assembly must remain attached to the fixture for the entire procedure. No visual evidence of cracks or surface delaminations considered harmful to connector function are permissible.

Test 5 Terminal Retention

Purpose

This test ensures that the terminals will not pull out of their cavities when the wire is pulled. This is a required feature of any connector in order to avoid terminal pushouts and intermittent electrical contact during connector assembly and repair.

III. TEST PROCEDURES AND REQUIREMENTS - continued

Procedure

1. A polished, steel gauge should be used to test terminal retention. The gauge shall be constructed to nominal terminal dimensions, except for the locking features, which should be worst case. The terminal gauge used for this test must be approved by Ford engineering prior to testing.

2. Pull on the gauge, to make sure that it is securely locked inside the connector and then insert spacer (if applicable).

3. A digital force gauge, approved by Ford SQA, shall be used for all terminal pull testing. This gauge must be properly sized for the force to be inspected. Attach the connector to the gauge and mount assembly to an engagement machine. The engagement machine shall be a motor-driven screw type pull tester with double, vertical columns. Limit switches are recommended to speed the repetitive testing of connectors using gauges to simulate terminals. Use a 0 - 222.4N (0 - 50 lbs.) force gauge for all force measurements, unless the pull forces are expected to exceed 222.4N (50 lbs.), in which case a 0 - 444.8N (0 - 100 lbs.) force gauge shall be used.

4. Run engagement machine with a rate of 25 mm./min. to 100 mm./min. (1-4 inches/min.) on the connector until the terminal comes out of the connector shell. Record retention forces and calculate the minus three sigma limits for each terminal cavity. (See section IV - STATISTICAL ANALYSIS METHODS)

Requirements

(E) Terminals designed to lock into premolded connector shells shall withstand a pull test of 80 N (18 lbs.). (lower 3 sigma limit)

Process Control Parameter - Pull Force

Test 6 Housing Retention and Lock Fatigue

Purpose

The purpose of this test is to assure that the connector (pair or direct connect) remains mated after it is subjected to wire tension and vibrations. It also serves to test the strength of the locking arms after multiple connect/disconnect cycles.

Procedure

1. Place one of the connector halves (or the module in the case of a direct connect) in a Tinius Olsen, Instron, or equivalent test machine.

   Note: If a vise is used, do not apply excessive force to hold the connector in place. Excessive vise force will create incorrect readings. A machine designed for force testing, as stated above, is the preferred method.

2. Mate the connector halves, with terminals, on the test machine. Using a digital force gauge, disconnect the connector slowly (5 cm./min. ± 1 cm./min.) and record the peak force necessary to fully disconnect the connector. Repeat this procedure 10 times for Pull Apart connectors only, in order to test the fatigue of the locking arms.

3. For all Go-No-Go connectors, the mating force must also be measured. First, take a connector shell with no terminals and mate the connector halves slowly (5 cm./min. ± 1 cm./min.). Using a digital force gauge, measure the force required to fully mate the connector halves. Next, break off the locking arms (or render them inoperative) and insert the full contingent of terminals into each connector shell. Again mate the connectors at the same speed and record the force necessary to fully mate the connector halves. Repeat this procedure 20 times. Calculate the three sigma limits for the first and last mating, for both the connector shell and the terminals.

III. TEST PROCEDURES AND REQUIREMENTS - continued

Requirements

Go-No-Go Ramp Connectors

Mating Force: The lower 3 sigma limit for the connector mating force must be greater than the maximum combined mating force of the terminals. In designs with a gasket or lip seal, the lower 3 sigma limit for the connector mating force must be greater than the sum of the mating force of the terminals plus the force to compress the gasket or overcome the resistance of the lip seal.

Pull Apart Connectors

Disconnect Force: 89N (20 lbs.) minimum initially
67N (15 lbs.) minimum thereafter

Positive Lock Connectors

Disconnect Force: 156N (35 lbs.) minimum

Non-locking Connector Shells

Disconnect Force: 27 - 53N (6 - 12 lbs.) per terminal (detented)
9 - 27N (2 - 6 lbs.) per terminal (non-detented)

Connectors with Amp Positive Locking Terminals

Disconnect Force: 89N (20 lbs.) minimum - 1 to 3 terminals
156N (35 lbs.) minimum - 4 or more terminals

Test 7 **Push Nut - Push Out and Turning Force**

Purpose

This test is for all bolted connectors and ensures that the bolt will withstand the shocks incurred during shipping and assembly without coming loose from the connector shell.

Procedure

A. Push out - Assemble the bolt and retainer to the appropriate connector shells on production equipment. Mount the connector half on a steel fixture (for example, as shown in figure 5) and use a Tinius Olsen machine to push out the bolt. Record the minimum force required to push the retainer off the shaft.

B. Turning - Assemble the bolt and retainer to the appropriate connector shells on production equipment. Mount the connector half on a steel fixture (for example, as shown in figure 5) and use the Tinius Olsen, Instron, or equivalent machine to apply a load of 445N ± 45N (100 ± 10 lbs.) for a 4 mm. bolt or 2.22KN ± 45N (500 ± 10 lbs.) for a 6 mm. bolt to the thread end of the bolt. Slowly turn the bolt in a counter clockwise direction for 10 revolutions.

Requirements

A. The retainer is required to withstand a pushout force of 2.67KN (600 lbs.) for a 6 mm. bolt and 890N (200 lbs.) for a 4 mm. bolt.

B. The 4 mm. bolt is required to remain within ± 0.5 mm (.02 inch) of its original location. The 4 mm. retainer must remain in the undercut of the bolt.

Process Control Parameter - Pushout Force

Test 8 **Threaded Insert Retention**

Purpose

This test is for all bolted connectors and ensures that the threaded insert will withstand the shocks incurred during shipping and assembly without coming loose from the connector shell.

III. TEST PROCEDURES AND REQUIREMENTS - continued

Procedure

A. Push Out - Assemble the threaded insert into the appropriate connector shell and screw in a bolt, engaging all the threads in the insert. Place the assembly into a steel fixture capable of securely holding the connector shell, while allowing room for the threaded insert to push out (for example as shown in figure 6). Using a Tinius Olsen machine, apply a load on top of the bolt head to determine the minimum force required to push the insert out of the connector.

B. Push Through - Assemble the threaded insert into the appropriate connector shell and thread a bolt into the threaded insert from the shoulder end of the connector until all the threads are engaged. Place the assembly on a steel fixture capable of securely holding the connector shell, while allowing room for the threaded insert to push through the shell (for example as shown in figure 7). Apply a load on the top of the bolt head to determine the minimum force required to push the shoulder of the insert through the connector shell.

C. Turning Torque - Modify a production bolt as shown in figure 8, adding a square shoulder at the end of the threads. Hand thread this bolt into the threaded insert until the bolt shoulder contacts the brass bushing. Place this assembly on a steel fixture as in step A. and measure the minimum torque required to turn the brass insert one revolution.

Requirements

The threaded insert must withstand a minimum force depending on the bolt size:

Test Step	6 mm. Bolt	4 mm. Bolt
A.	3.56KN (800 lbs.)	1.78KN (400 lbs.)
B.	7.12KN (1600 lbs.)	4.45KN (1000 lbs.)
C.	19.74 Nm (175 in-lbs.)	5.64 Nm (50 in-lbs.)

Process Control Parameter - A. and B. minimum force, C. minimum torque

Test 9 **Over Torque Capability for Male/Female Assy**

Purpose

Automated bolt and screw drivers are subject to over torquing. This test ensures that the connector assembly will resist over torque.

Procedure

A. Take a male and a female connector assembly (complete with terminals, spacers, grommets, etc.) and mate them together. Secure the connector assembly in the fixture used for test 8-A (figure 6) or a bench vise. For a 4 mm. bolt, use a certified CR-1 or equivalent torque wrench and torque the bolt to 25 in-lbs (2.83 Nm). For a 6 mm. bolt, use a certified CR-4 or equivalent torque wrench and torque the bolt to 60 in-lbs (6.77 Nm). Disassemble the connectors using the same torque wrench and visually inspect both parts for damage. Inspect for buckled towers, broken or dislodged push nut retainers, movement of the brass insert, and any other damage that could affect the function of either connector.

B. If, after step A. there is no visible damage, mate the connectors again and torque them down as in step A. Then, continue to torque the bolts slowly until the connector cracks or until 100 in-lbs (11.3 Nm) is reached. Record the torque value at which buckling or cracking occurs if less than 100 in-lbs. (11.3Nm).

Requirements

A. A connector using a 4 mm. bolt must withstand a torque of 25 in-lbs. (2.83Nm) minimum and a connector using a 6 mm. bolt must withstand a torque of 60 in-lbs. (6.77Nm) minimum. No visual damage is allowed beyond a 0.25 mm. movement of the brass bushing and a slight buckling of the tower (less than 3% of the tower diameter).

III. **TEST PROCEDURES AND REQUIREMENTS - continued**

Requirements - cont.

B. The data sheets shall contain the torque required to buckle or crack the connector, if less than 100 in-lbs. (11.3Nm), regardless of whether the connector meets the requirements or not.

Process Control Parameter - Minimum torque to buckle or crack connector

Test 10 **Assembly Torque Required**

Purpose

This test is intended to show that the mating halves of a bolted connector can be easily assembled in production.

Procedure

Take a male and a female connector assembly (complete with terminals, spacers, grommets, etc.) and secure one half of the connector assembly in the fixture used for test 8-A (Figure 4) or a bench vise. Use a torque wrench to assemble the mating halves and record the maximum torque required to fully mate the connector halves.

Requirements

Connector Description	Drawing Number	Range of Assembly Torque
15-way	F2TB-14A464-VA	1.9 ± 0.3 Nm
MCU-TECH 24-way	E1AB-14A439-AD	1.7 ± 0.3 Nm
Bulkhead 24-way	F2TB-14A624-AB	4.8 ± 0.8 Nm
ABS 28-way	F3DB-14A464-LA	4.8 ± 0.8 Nm
EEC-III 32-way	E0AB-14A464-C	4.1 ± 0.7 Nm
38-way	F3DB-14A624-DA	4.8 ± 0.8 Nm
ABS 40-way	F37B-14A464-AC	6.2 ± 1.0 Nm
In-Line 42-way	F2VB-14A624-JA	4.8 ± 0.8 Nm
Bulkhead 53-way	E9SB-14A624-AG	4.8 ± 0.8 Nm
Door 56-way	F6DB-14A439-CA	3.7 ± 0.6 Nm
56-way	F6DB-14A624-FD	8.0 ± 1.2 Nm
EEC-IV 60-way (sealed)	E4LB-14A464-BA	6.3 ± 1.0 Nm
EEC-IV 60-way (unsealed)	E4LB-14A464-BA	3.7 ± 0.6 Nm
66-way	F37B-14A624-SA	8.0 ± 1.2 Nm
Bulkhead 76-way	F2UB-14A624-AC	4.8 ± 0.8 Nm
86-way	F3DB-14A464-EA	8.0 ± 1.2 Nm
EEC 104-way	F4SB-14A464-AJA	6.3 ± 1.0 Nm
120-way (3 40-ways)	F37B-14A615-[illegible]	4.8 ± 0.8 Nm

Other connectors shall have the assembly torque requirements stated on the assembly drawing.

Process Control Parameter - Minimum assembly torque

Test 11 **Solder Tail Gauge Test**

Purpose

This test is for all connectors that mate directly to a circuit board and ensures that the solder pins will always mate to that board, even with worst case conditions.

Procedure

The solder tails are to be installed on the appropriate connector half and then gauged in a true position gauge which has been reviewed by the responsible Ford Motor Co. design engineer. This true position gauge is to be designed so that with worst case conditions, the connector will always mate with the printed circuit board.

III. TEST PROCEDURES AND REQUIREMENTS – continued

Requirements

If any of the solder pins will not mate with the gauge, reject the lot and sort for the identified nonconformance. All nonconforming connectors must be immediately removed from production approved stock and clearly marked for rework or scrap. All stock that has been reworked must pass the gauge test. Since the gauge test must be completed before potting to allow rework, a random sample of connectors with potting must be gauged (1 per tray of 60 pieces). If any of these connectors fail the gauge test, they are to be immediately quarantined for scrap and all remaining pieces in the tray are to be checked.

Test 12 Grommet Assurance Test

All connectors with grommets must be inspected for the presence of the grommet and the correct position of the blanked holes in the grommet relative to the connector hardshell. This test is to be performed at the site where the grommets are installed in the connector shells.

Test 13 Melt Flow Index

Purpose

This test is to be performed by the part fabricator or molder who molds polyester plastic parts. It is basically necessary in order to confirm raw material properties and insure that excessive material degradation does not occur during the molding process.

Procedure

Five samples of the raw material each of sufficient size for testing the material to ASTM D1238 condition "[illegible]", except as noted below for Gafite [illegible], using a Monsanto or Tinius Olsen Indexer or equivalent test equipment shall be selected and tested for Production Validation.

When regrind is used, the molder shall certify that the combination of regrind and raw material still meets the Ford melt flow index requirements for the raw material.

For IP testing, one sample of raw material from each lot of material received shall be tested as specified for Production Validation above. In addition, one sample lot of a sufficient number of finished parts shall be selected and ground up to provide material for testing as specified for Production Validation above. The values obtained for the reground parts shall be compared to the values obtained for the lot of raw material from which the parts were molded.

The testing of the material from finished parts shall be performed as follows:

1) At the start of each production run (samples taken during the first 30 minutes).

2) Each time the molding machine is started up following a shutdown of 4 hours or more.

3) Once per 24 hours.

4) At the end of the production run (samples taken during the last 30 minutes).

Material conditioning (drying, etc.) prior to the test is to be in accordance with the recommendations of the raw material supplier.

III. TEST PROCEDURES AND REQUIREMENTS - continued

Requirements

Material	Melt Index or Flow Rate (grams/10 min.)	
	Raw Material	Regrind of Finished Parts
ESB-M4354-A2 (GAF GAFITE 14632)	8 Max.	2½ times the value obtained for raw material (max.)
(Celanex 4300)	10 Max.	2 times the value obtained for raw material (max.)
ESB-M4D27-A1 (GAF GAFITE 4424B)	8 Max.[2]	2 times the value obtained for raw material (max.)
G. E. Valox 420F[1]	10 Max.	14 Max.
ESB-M4D334-A1 G. E. Valox 420	20 Max.	A maximum of 2 times the value obtained for the raw material, but not over 25
ESB-M4D462-A3 G. E. Valox 308	13 Max.	A maximum of 2 times the value obtained for the raw material.
GAF GAFITE 10322[1]	8 Max.	2 times the value obtained for raw material (max.)
ESB-M4D334-A3 (G. E. Valox 420-SE0)	23 Max.	A maximum of 2 times the value obtained for the raw material but not over 41
ESB-M4D467-A2 (G. E. Valox 430)[1]	12.4 Max.	2 times the value obtained for raw material (max.)
ESB-M4D341-A (Celanex 3300) - Natural/Grey - Black	20 Max. 23 Max.	2 times the value obtained for raw material (max.)
ESB-M4D462-A1 G. E. Xenoy 6240	25 Max.[3]	2 times the value obtained for raw material (max.)

1. Ford material spec to be written and Ford # to be assigned.
2. For this test a 5000 gram load is to be used instead of the normal condition "T" load of 2160 grams.
3. For this test a 5000 gram load and temperature of 510° F is to be used. All other conditions per the ASTM-1238 condition "T" should be followed.

Test 14 Unmating Force

Purpose

This test is for all connectors that incorporate a release feature to unlock the connector shell for servicing. It ensures that the connector shells can be unmated easily after the lock mechanism is released.

Procedure

1. Place the female connector shell (or a module, with the male terminals removed, in the case of a direct connect) in a fixture. The shell should contain all of the grommets, o-rings and seals but no terminals. If necessary, the terminals should be cut off so that they will have no effect on the unmating force.

   Note: Do not apply excessive force to hold the connector in place. Excessive vise force will create incorrect readings.

2. Load the male connector with a couple of terminals, crimped to a convenient length of wire for pulling, and a wedge, if applicable.

3. Mate the connectors fully, then release the locking mechanism. Pull the connector halves apart just enough to keep the lock from reengaging.

III. TEST PROCEDURES AND REQUIREMENTS - continued

Test 14 Unmating Force - continued

4. Using a digital force gauge, measure the force necessary to fully unmate the connectors.

Requirements

All connectors with a front push-to-release lock beam feature (with a go-no-go lock ramp) shall have an unmating force of 15 pounds maximum. Connectors with a rear push-to-release lock beam feature (with a low profile lock ramp) shall have an unmating force of 7 pounds maximum.

Test 15 Terminal Insertion

Purpose

This test is run to ensure that the insertion force required to insert the terminals into the connector cavity is not greater than the column strength of the wire and is also low enough to allow easy and consistent assembly.

Procedure

1. Secure the connector shell in a fixture. If the connector being tested uses a grommet, assemble the grommet and load the connector with terminals, crimped to a convenient length of the correct wire, leaving only one cavity open. This is to compress the grommet to its worst case condition.
2. Crimp terminals on the smallest gauge wire applicable. Grip the wire 1 cm. from the back of the terminals (2 cm. on connectors that require grommets) or as specified by the design engineer. Insert the terminal slowly into the connector shell (25 mm. ± 10 mm./min.).
3. Attach a terminal to a solid rod (or use a terminal gauge) and insert the terminal slowly (25 mm. ± 10 mm./min.) into a new connector shell. Using a digital force gauge, measure the force required to fully insert the terminal into the connector shell.
4. Repeat steps 1 through 3 for each terminal cavity in the connector. The samples used for steps 2 and 3 shall include a minimum of one part from every connector cavity.

Requirements

The terminal should enter the connector shell smoothly, without hanging up or causing the wire to buckle during insertion. The force required to insert the terminal fully into the connector shell must not be greater than 4 lbs. (17.8N).

IV. STATISTICAL ANALYSIS METHODS

The following are methods for reducing test data to determine compliance with the Reliability Acceptance Criterion shown in the Test Schedule, Section II.B.

A. C.xx R.yy

The Reliability Acceptance Criterion (.xx = confidence level, .yy = Reliability) is met if all sample characteristics are within the applicable rating limits.

B. Standard Deviation

1. The standard deviation (sigma) is the square root of the variance. The variance is the sum of the square of the difference between the individual measurements and the average divided by the number of measurements minus 1. The standard deviation is expressed mathematically as:

$$\text{Standard Deviation} = \sqrt{\frac{\sum (X-\bar{X})^2}{N-1}}$$

Where: X = Individual measurement

N = Number of measurements

$\sum$ = Sum

and average = $\bar{X} = \frac{\sum X}{N}$

C. Three Sigma Limits

The three sigma limits are the statistical high and low limits for a set of data. They are calculated by multiplying the standard deviation (sigma) by three and adding or subtracting that from the average, or mean value. For example, to find the lower three sigma limit of this set of 5 numbers:

(30, 32, 33, 30, 31)

calculate $\bar{X}$ (average) = $\frac{\sum X}{N}$ = 31.6

calculate the standard deviation = $\sqrt{\frac{\sum (X-\bar{X})^2}{N-1}}$ = 2.07

three sigma value = standard deviation x 3 = 6.21

lower three sigma limit = mean(average) - three sigma value = 25.39

upper three sigma limit = mean(average) + three sigma value = 37.81

V. **REVALIDATION REQUIREMENTS**

For any change in processing or material the entire Production Validation (PV) program must be successfully completed. No change to processing or material may be allowed without prior engineering approval and successful completion of the PV program. For certain process changes, portions of the PV Program may be waived if approval is obtained from the responsible design engineer, B&CE, prior to revalidation.

VI. **LOT DEFINITION**

A lot shall have been manufactured in a continuous 8 hour time period, on a validated production line, with unchanged process. Lot identification shall be established prior to performing tests. A lot must not overlap a production shift change.

VII. **RECORD AND TEST SAMPLE RETENTION**

A. Samples used to demonstrate compliance with the "In-Process Tests" must be retained by the supplier for at least one month and may not be included in production shipments. Samples subjected only to tests performed on 100% of production stock need not be retained as described above.

B. Data from "In-Process Test" are to be retained for 1 year and be made available to Ford Motor Company representatives upon request.

C. In the event of test failure, appropriate action as outlined in Ford Quality Control Specification Q-101 must be instituted.

VIII. **INSTRUCTIONS AND NOTES**

A. The term "initial production" parts shall mean units which have production level components which have been produced by the production tools and assembled in a sequence and technique equivalent to that used in final production.

B. Test fixture design, installation plans and operations procedures require review by the responsible B&CE Design Engineer. Fixtures made from approved drawings also require review by the responsible B&CE Design Engineer prior to ISIR approval.

C. For Production Validation, samples are to be randomly selected from a minimum lot size of 300 pieces.

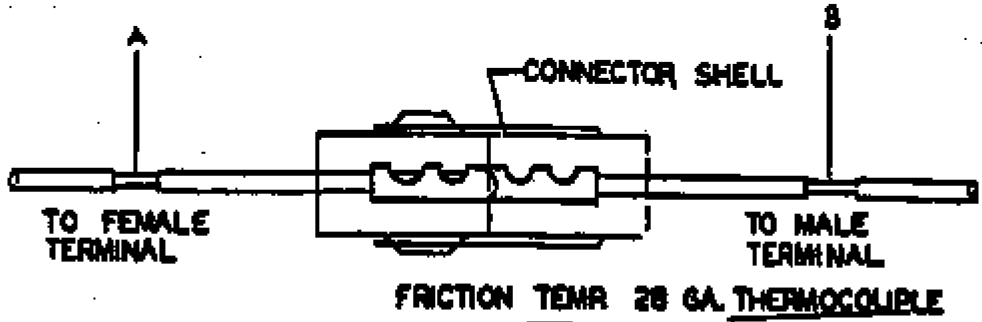

A
B
CONNECTOR SHELL
TO FEMALE TERMINAL
TO MALE TERMINAL
FRICTION TEMP. 28 GA. THERMOCOUPLE

FIG 1

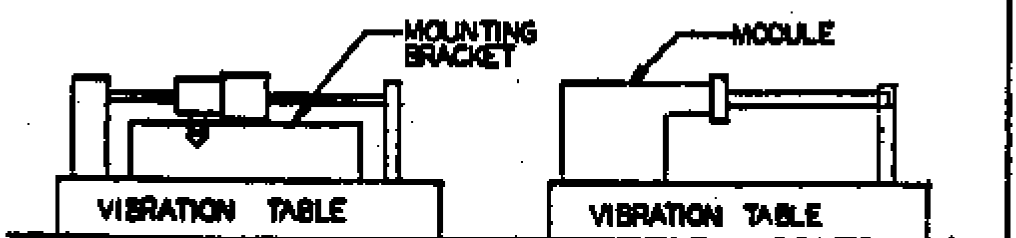

MOUNTING BRACKET
MODULE
VIBRATION TABLE
VIBRATION TABLE

FIG 2

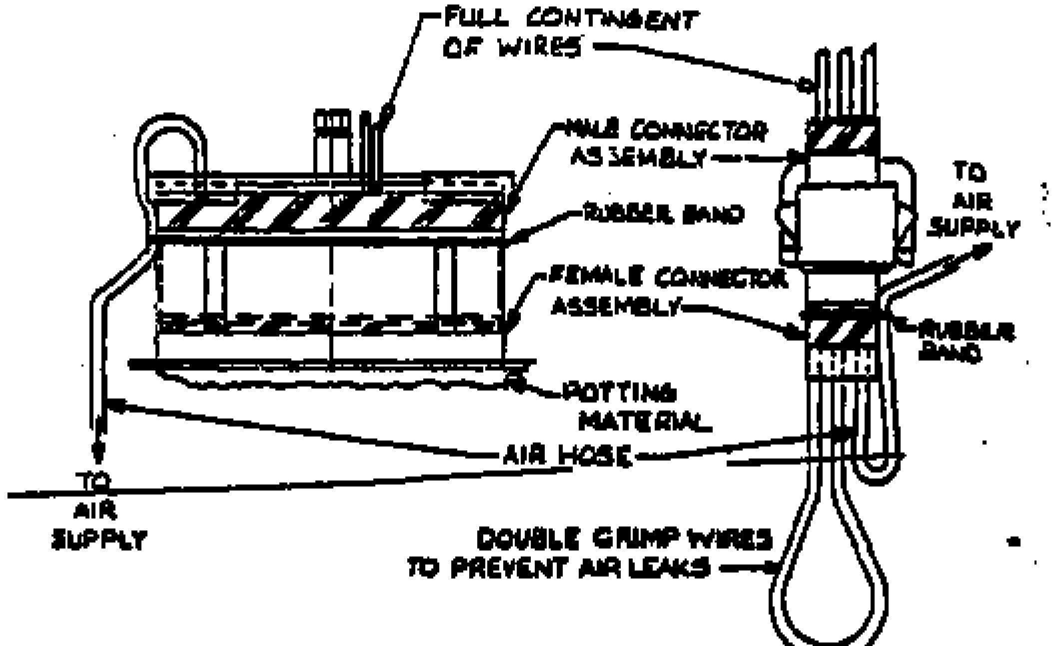


FIGURE 3

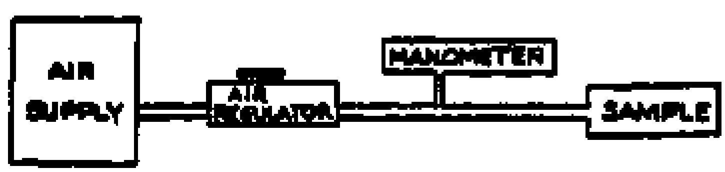


FIGURE 4

FIGURE 5

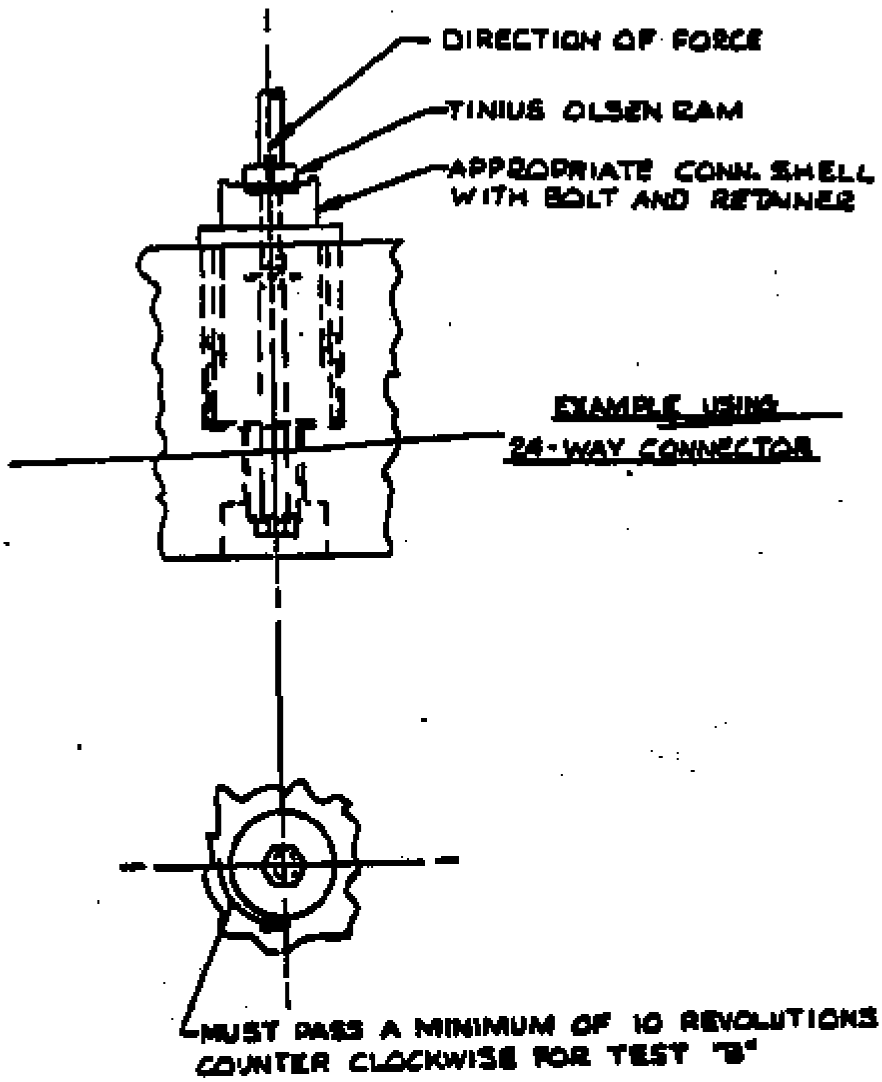
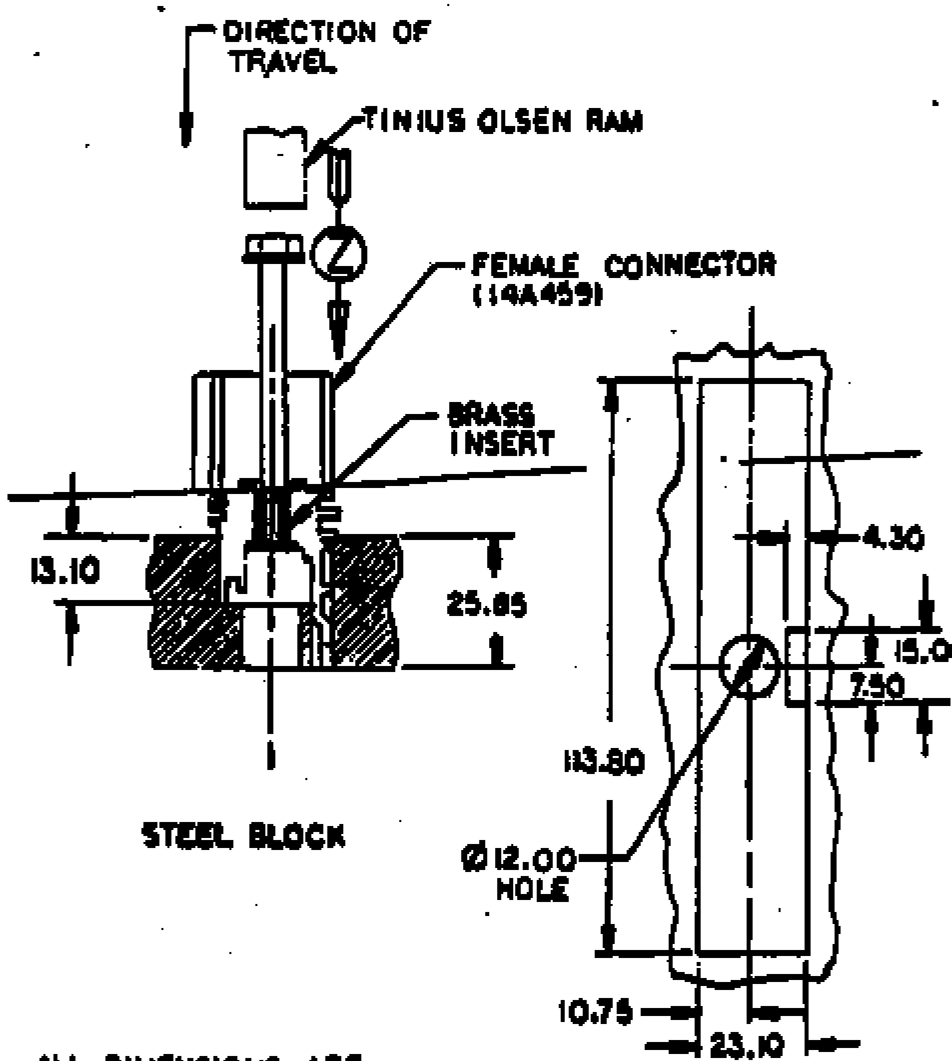

DIRECTION OF FORCE
TINIUS OLSEN RAM
APPROPRIATE CONN. SHELL
WITH BOLT AND RETAINER
EXAMPLE USING
24-WAY CONNECTOR
MUST PASS A MINIMUM OF 10 REVOLUTIONS
COUNTER CLOCKWISE FOR TEST "B"

FIGURE 6
(FOR TEST "A")

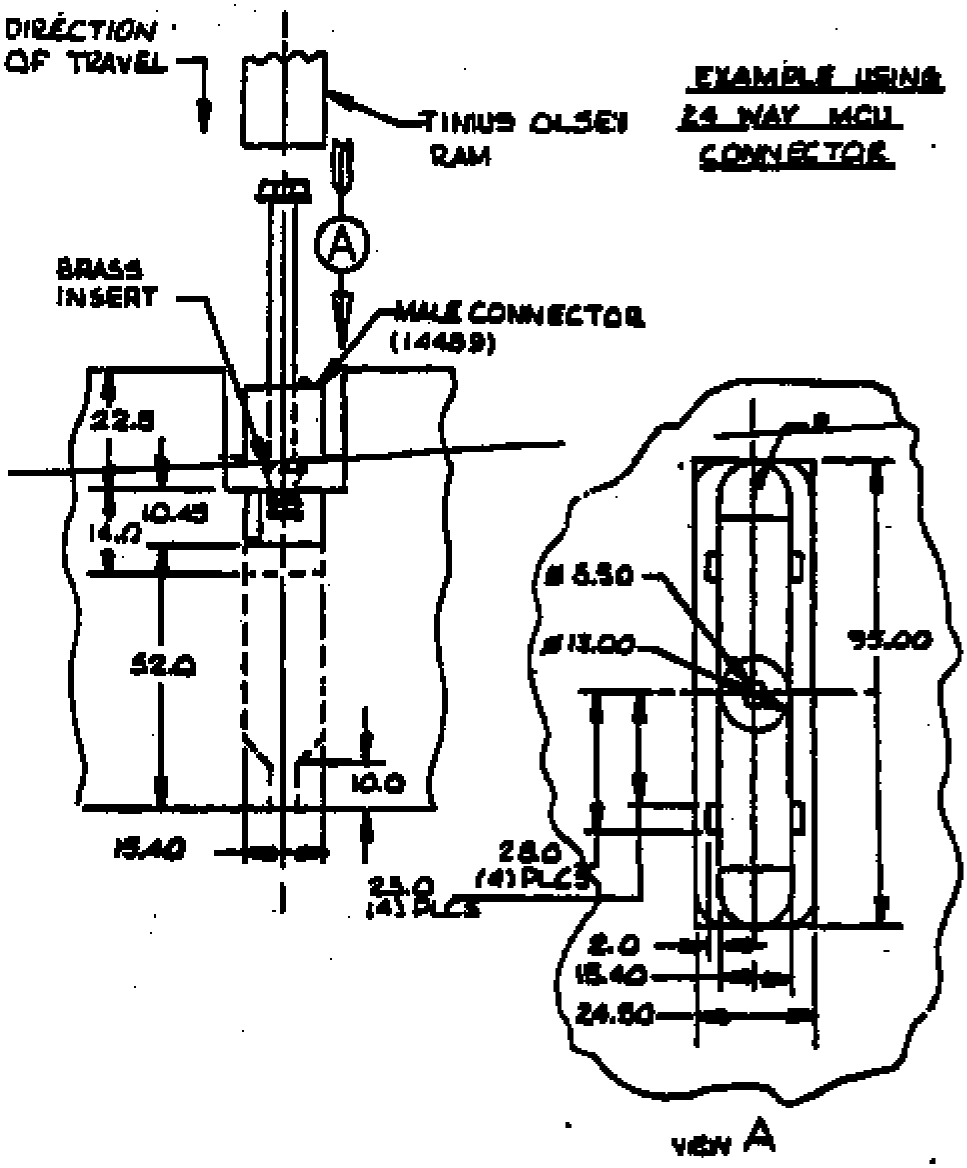
EXAMPLE USING 60 WAY EEC CONNECTOR



VIEW Z

.ALL DIMENSIONS ARE IN MM

FIGURE 7
(FOR TEST "B")

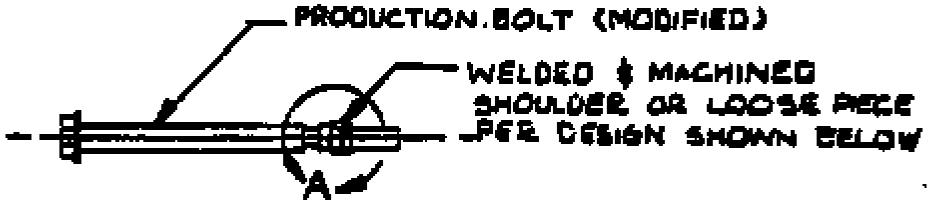


 REVISED NUMBER ES-F33B-14A464-AA

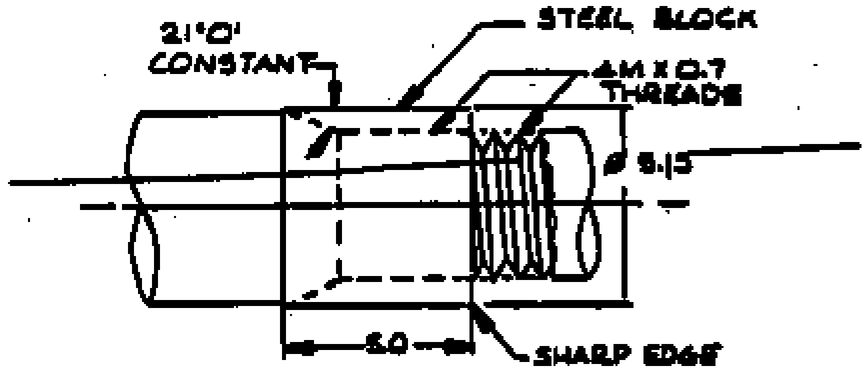
PD 3947-a2

3713 7040

FIGURE 8
(FOR TEST "C")

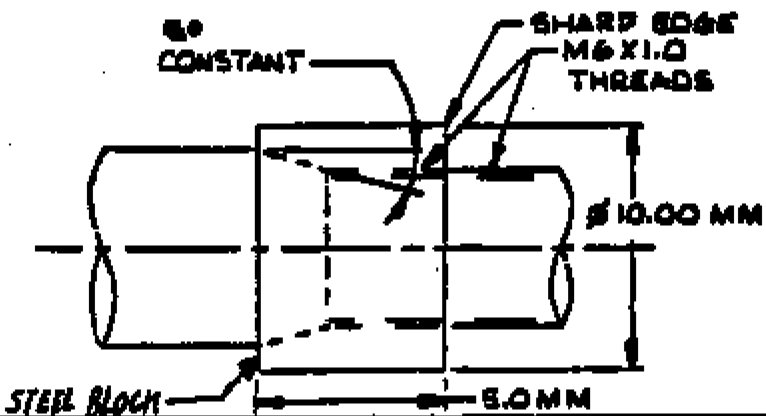


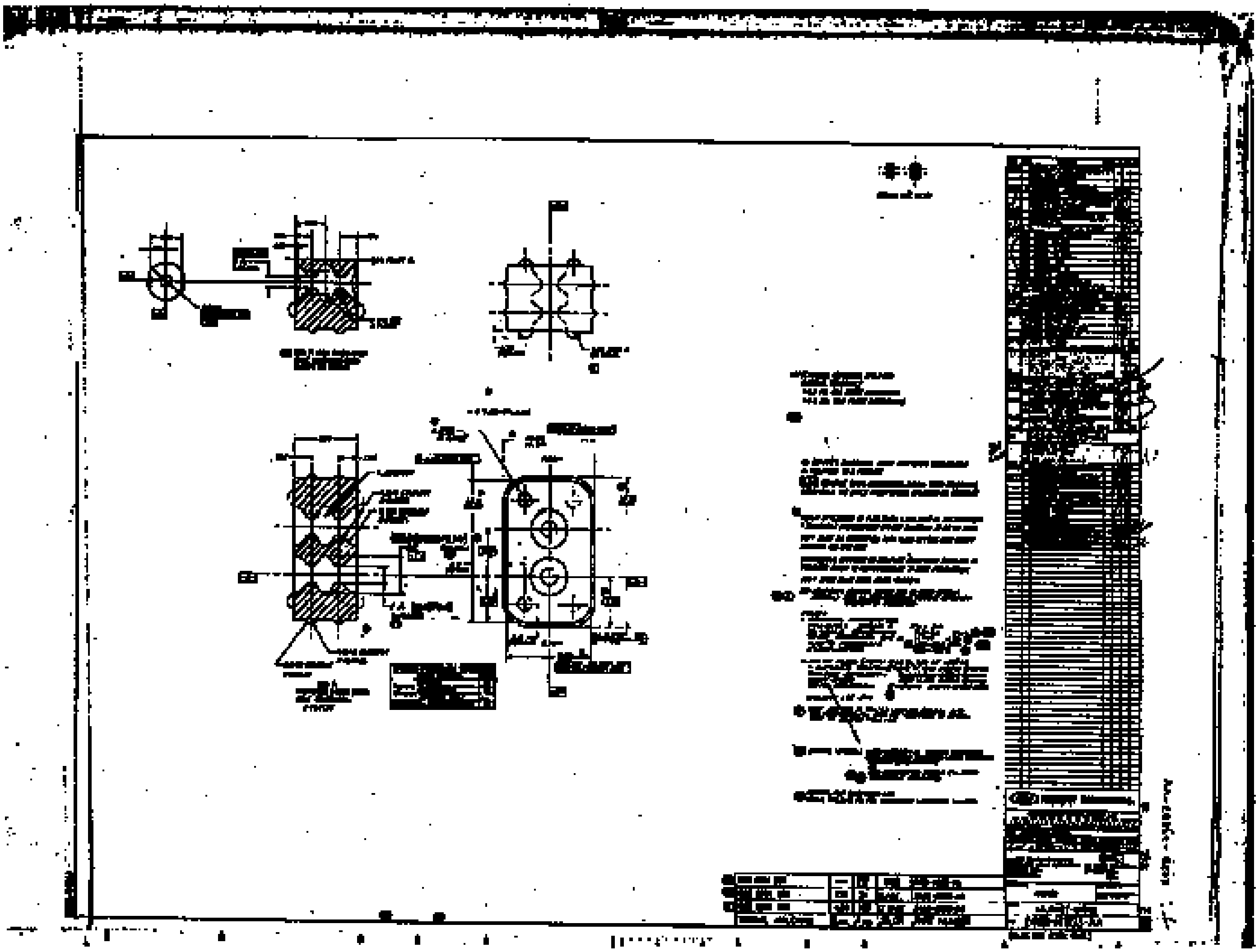
FIXTURE DESIGN – 4 MM BOLT



VIEW A

FIXTURE DESIGN – 6MM BOLT





3713 7045

Legal Request

Drawing Work Request

02/05/1999
Design Analysis

To: MSX International
1464 John Papalas Dr.
Lincoln Park, MI 48146-1460
Attn: Dain Pearson ph: x89530, Teresa Platt ph: x58985
Fax: x57776

From: Design Analysis
406 Parklane Towers West (PTW)
Three Parklane Blvd.
Dearborn, MI 48126
Fax: 84-51811 Phone: 59-42897

PLEASE MAKE 1 XEROX COPIES AND 0 SET(S) OF APERTURE CARDS OF THE BELOW LISTED PART NUMBERS.

Work Request #: 191278 Due Date: 02/08/1999 Matter: 412052 RAMIREZ ROBERTO
DAE Manager Phone: Allegation: Late Deployment
Contact: RORSELLI Phone: Vehicle Model Lincoln Town Car (Full Siz
Requested by: NLAPOINT Phone: (313)594-3686 Year: 1992

Prefix	Base	Suffix	Comments	Entry Order #
ESP33B	14A464	AA	CONNECTOR ES	1

DAE7.RPT

3713 7048

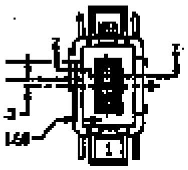


FIG. 2

ALLY SAME AS FIG. 1, EXCEPT 3.50 DIA SLOT IS OFFSET AS SHOWN.

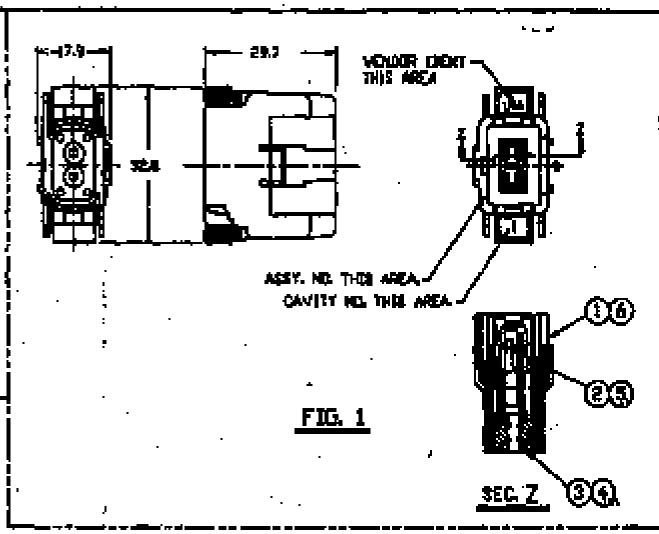


FIG. 1

NAME	COLOR
CONNECTOR-MALE	BLACK
CONNECTOR-MALE	GRAY
CONNECTOR	RED
CONN. (SILICONE)	RED
CONNECTOR (TV)	BLUE
CONNECTOR	GRAY

B	F57B-14A464-ALA
AD	E9EB-14A464-AA
AC	F2AB-14A464-ADA
AB	F3LB-14A464-UA
AA	F47B-14A464-MA
	F5VB-14A464-AA
	PART NUMBER

SLEEVE ASSY.-WIRE CONNECTOR-MALE

F5VB-14A464-AA

SLEEVE ASSY.-WIRE CONNECTOR-MALE 63661

3713 7047

63661

NOTES : UNLESS OTHERWISE SPECIFIED

1. GENERAL TOLERANCES
   ±0.3 ALL ONE PLACE DIMENSIONS
   ±0.10 ALL TWO PLACE DIMENSIONS.
2. USE WITH SPACER No. E9EB-14A468-BA AND TERMINAL No. E9EB-14474-BA.
3. VENDOR - UTA
4. WHEN MATING TO THE APPLICABLE MALE CONNECTOR THE FOLLOWING DATA VALUES SHALL APPLY :
   A. INSERTION MATING FORCE MAXIMUM @ +3 SIGMA IS 27 LBS.
   B. RETENTION FORCE OF MATED CONNECTORS IS 22 LBS MINIMUM @ -3 SIGMA.
5. PARTS MUST BE FREE OF FLASH AND IMPERFECTIONS THAT MAY AFFECT FIT OR FUNCTION.
6. MUST MEET ENGINEERING SPEC. E9F32B-14A464-AA TESTS 1, 2D, 3, 4, 5, 6, 12, 13, 14 & 15.

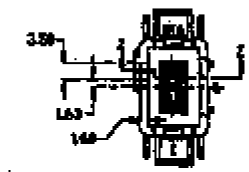
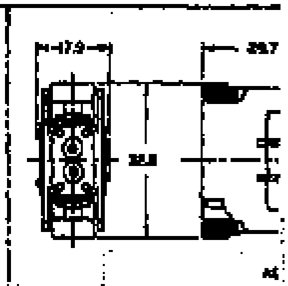


FIG. 2

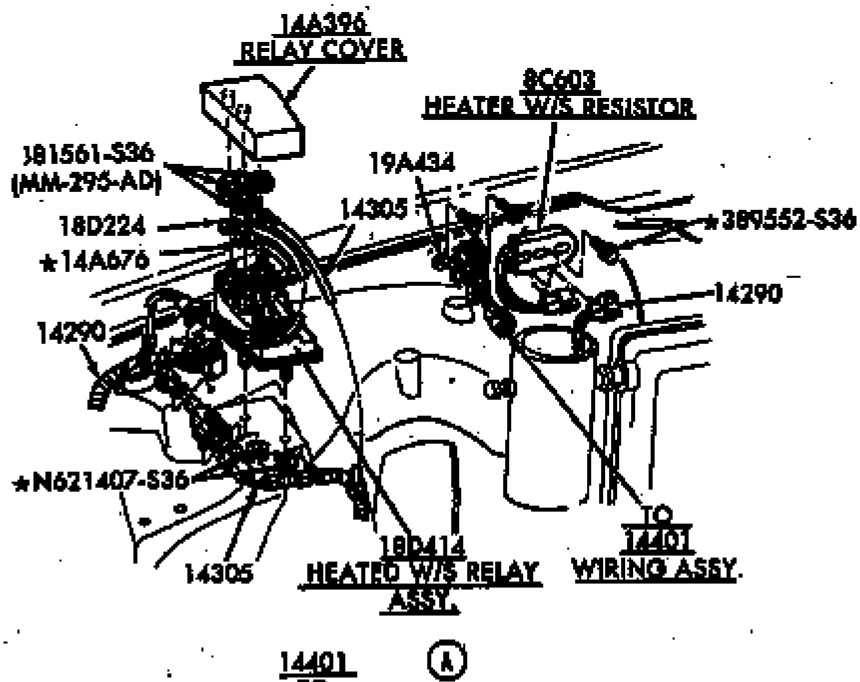
PICTORIALLY SAME AS FIG. 1 EXCEPT ALSO POLARIZING SLOT IS OFFSET AS SHOWN.

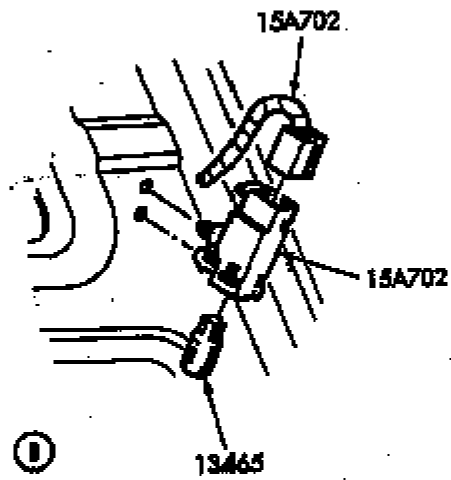


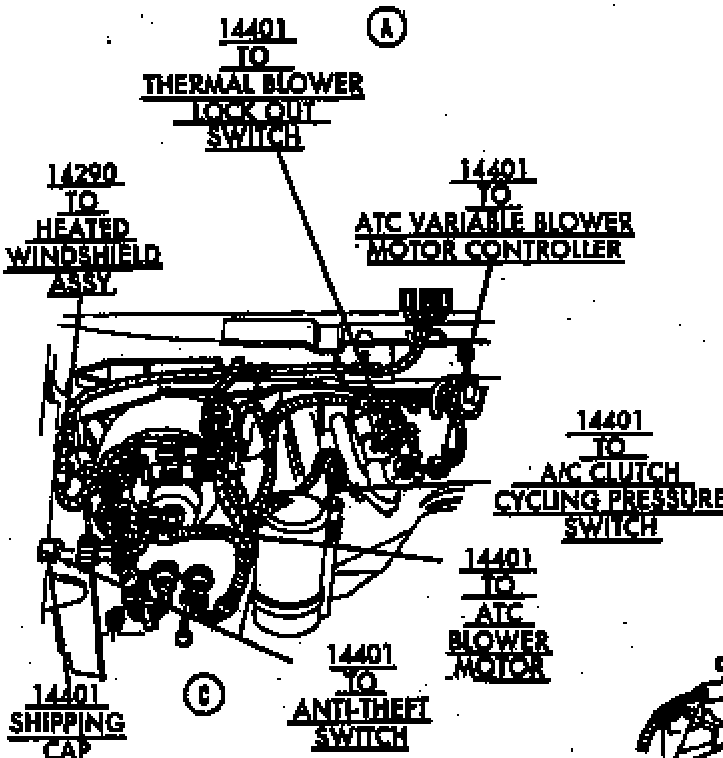
				F57B-14A464-ALA (FIG. 1)	E9EB-14A464-AA (FIG. 1)	F2AB-14A464-ABA (FIG. 2)	F3LB-14A464-LA (FIG. 1)	F4ZB-14A464-MA (FIG. 1)	F5VB-14A464-AA (FIG. 2)	QTY	PART NO.	NAME	COLOR
				●	●		●	●		1	[illegible]	SLEEVE-WIRING CONNECTOR-MALE	BLACK
						●			●	5	[illegible]	SLEEVE-WIRING CONNECTOR-MALE	GRAY
					●	●		●		2	[illegible]	GASKET-WIRING CONNECTOR	RED
				●			●		●	6	[illegible]	GASKET-WIRING CONN. (SILICONE)	RED
				●				●	●	4	[illegible]-14489-AA	GROMMET-WIRING CONNECTOR (TV)	BLUE
					●	●	●			3	[illegible]-14489-AA	GROMMET-WIRING CONNECTOR	GRAY

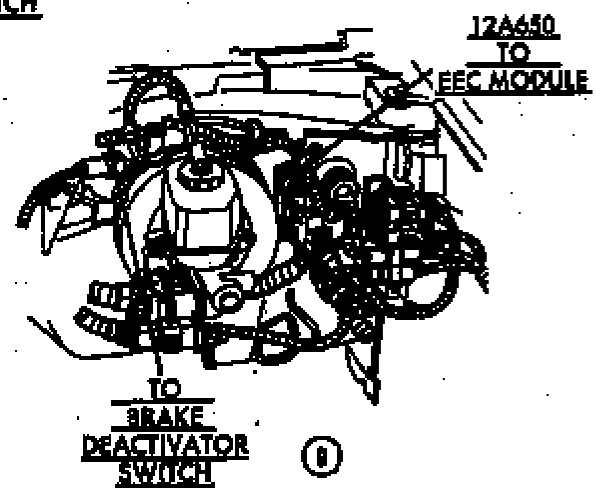
F57B-1
E9EB-1
F2AB-1
F3LB-1
F4ZB-1
F5VB-1
PART

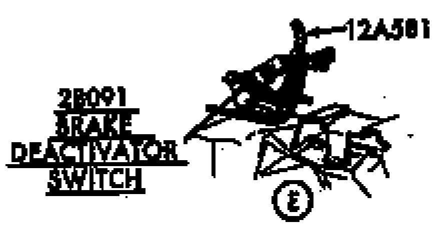
D C B A











•ALSO SUPPLIED IN 12A581 WIRING HARNESS
■ONLY SUPPLIED IN 14290 WIRING HARNESS

P-29535

3713 7049

YEAR	MODEL/RESTRICTIONS	ENG.CYL.	PART NO.	DESCRIPTION	QTY.
	12A581 WIRE ASY. (ENGINE CONTROL SENSOR) Also Refer to Group(s) : 12A289, 12A522, 14289, 9E724 CONT'D				
	Refer to the Cross Reference Section in the front of this Catalog for all I.D. Cross Reference Information.				
	B (TEMPO), MB (TOPAZ) CONT'D				
92/93	B- -w/ sports pkg. or M/T - w/o sports pkg. - 50 states or Canada	6Cyl. 3.0	F33Z 12A581-A		1
92/93	MB- -w/ sports pkg. or M/T w/o sports pkg. - 50 states or Canada	6Cyl. 3.0	F33Z 12A581-H		1
92/93	MB- -w/ sports pkg. or M/T w/o sports pkg. - 50 states or Canada	6Cyl. 3.0	F33Z 12A581-A		1
92/93	B- -w/ sports pkg. or M/T w/o sports pkg. 50 states or Canada	6Cyl. 3.0	F33Z 12A581-A		1
94	B, MB- -50 states, A/T, W/o speed control	6Cyl. 3.0	F43Z 12A581-G		1
94	B, MB- -50 states, A/T, W/speed control	6Cyl. 3.0	F43Z 12A581-E		1
94	B, MB- -Canadian daytime running lamps, A/T	6Cyl. 3.0	F43Z 12A581-F		1
94	B, MB- -M/T 50 states or Canada	6Cyl. 3.0	F43Z 12A581-A		1
90	B, MB- -AWD - w/ A/C		F03Z 12A581-B	LH	1
90	B, MB- -exc. AWD - w/o A/C - w/air bag		★ F03Z 12A581-D	Never incorporated into Production	1
91	B, MB- -2WD - A/T w/air bag, w/o air conditioner		F13Z 12A581-E		1
	DC (LINCOLN CONTINENTAL)				
90	DC- -w/electric windshield defrost	6Cyl. 3.8	F0OY 12A581-B		1
90	DC- -w/o electric windshield defrost	6Cyl. 3.8	F0OY 12A581-A		1
92	DC- -w/ elect windshield defroster	6Cyl. 3.8	F2OY 12A581-B		1
92	DC- -w/o electrical windshield defroster	6Cyl. 3.8	F2OY 12A581-A		1
94	DC	6Cyl. 3.8	F4OY 12A581-A	To be used with R-134A Refrigerant	1
95	DC- -W/ traction assist	8Cyl. 4.6	F5OZ 12A581-BU		
95	DC- -W/o traction assist	8Cyl. 4.6	F5OY 12A581-A		1
96	DC- -w/ TA	8Cyl. 4.6	F6OZ 12A581-BH		1
96	DC- -w/o TA	8Cyl. 4.6	F6OZ 12A581-AH		1
97	DC- -w/ anti-spin traction brakes	8Cyl. 4.6	F7OZ 12A581-BA	Eng# F7OB-12A581-BA	1
97	DC- -w/o anti-spin traction brakes	8Cyl. 4.6	★ F7OZ 12A581-AA		1
97	DC	8Cyl. 4.6	F7OZ 12A581-BC	Eng# F7OB-12A581-BC	1
98	DC	8Cyl. 4.6	F8OZ 12A581-AC		1
99	DC	8Cyl. 4.6	XF3Z 12A581-AA		1
91	DC- -w/electric windshield defrost	All	F1OY 12A581-B		1
91	DC- -w/o electric windshield defrost	All	F1OY 12A581-A		1
93/94	DC	All	F3OY 12A581-A	To be used on vehicles W/o R-134A Refrigerant	1
	DT (LINCOLN TOWN CAR)				
91	DT	8Cyl. 4.6	F1VY 12A581-A		1
92	DT	8Cyl. 4.6	F2VY 12A581-A	F2VB - AK 3A	1
93	DT	8Cyl. 4.6	F3VY 12A581-A	F3VB - AE	1
94	DT	8Cyl. 4.6	F4VY 12A581-C		1
95	DT	8Cyl. 4.6	F5VY 12A581-A		1
96	DT	8Cyl. 4.6	★ F6VZ 12A581-AF ☆ F6VZ 12A581-AG		1 1
97	DT	8Cyl. 4.6	F7VZ 12A581-AC		1
98/	DT	8Cyl. 4.6	* 12A581	**For 12A581 refer to section 140, layout group 14290**	
90	DT- -Calif	8Cyl. 5.0	F0VY 12A581-B		1
90	DT- -exc. Calif	8Cyl. 5.0	F0VY 12A581-A		1

SMMPPDIA Releasing Part Detail 01/04/99 16:22:11
==> Analyst: 1AA

SERVICE PART: F2VY- 12A581-A____ WIR ASY ENG CONTR SNS

PLIER LOCATION:	E778W UNITED TECHNOLOGIES			Supplier Role:	M
Supplier Code:	E778	Demand Analyst:	1AA	PO Effect Dt:	03/10/95
Purchase Ord Nbr:	SC 00976	Buyer:	1B1	PO Estab Dt:	03/09/95
Vendor Part Nbr:					

		Piece/Pkg Value:	430.43	Minimum Run:	0
Lead Time:	120	Overpack Quantity:	0	Minimum Ship:	0
Auth Days:	120	Pallet Quantity:	20	Ship Multiple:	0
Pct of Bus:	100	Package Issue Date:	02/17/98	Buy Quantity:	26
Unit of Iss:	1	Package Eff Date:	05/17/98	Shelf Stock:	0

F1=Help F4=PrevSuplr F5=NextSuplr F9=FabHold F10=ServEngXref
RECORD FOUND PD01572

3713 7051

SMMFBCPA Buyer Contact 01/04/99 16:22:45

==>

SUPPLIER LOCATION: E778W UNITED TECHNOLOGIES

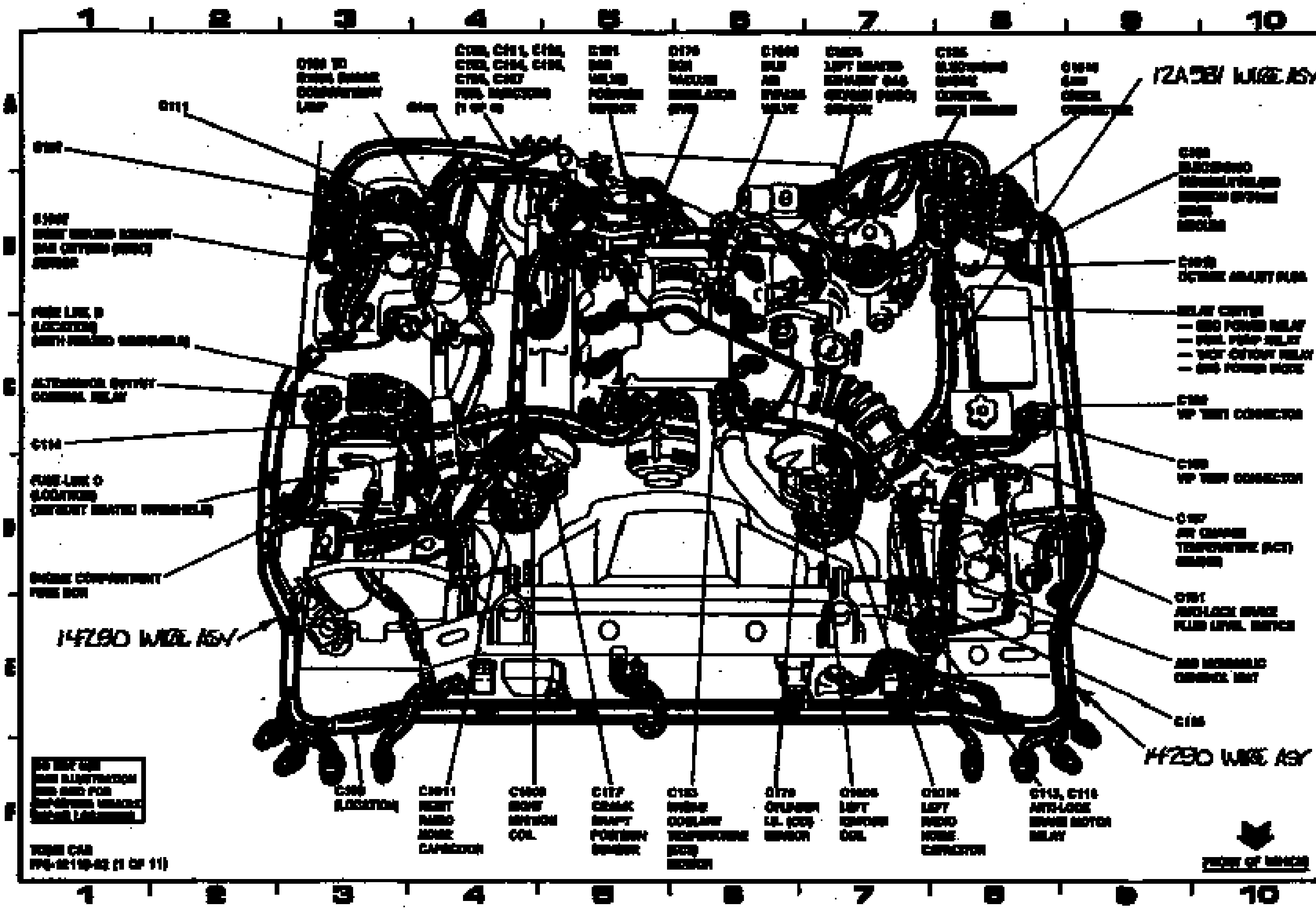
Contact Name: [redacted]
Phone Number:
Fax Number:

Buyer Remarks:

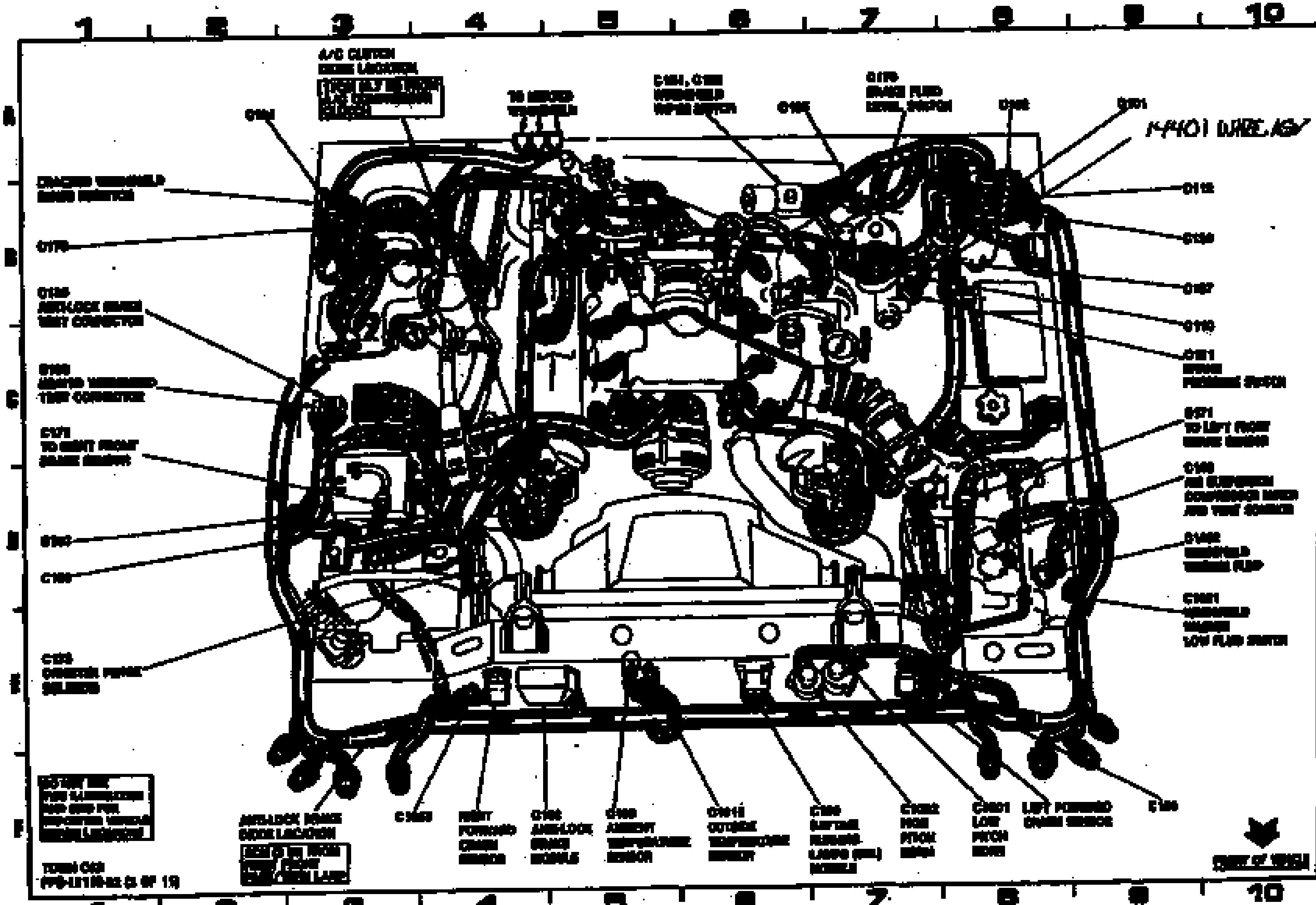
RANDY DREHER FX:614-452-9855 JUDY 593-9171 GARY: 614-452-7541 X235 KRI
JUDY WHITTAKER HANDLES COUNTRY OF MANUFACTURE FOR THIS SITE ONLY.3/98
SERVICE: PAUL TUCKEY 313/240-3041 (7/98)
UPP-JUDY WHITTAKER - SEE #'S ABOVE

F1=Help
RECORD FOUND PD01572

151-1 COMPONENT LOCATION VIEWS



151-3 COMPONENT LOCATION VIEWS



4.6L ENGINE (3 OF 3)

Ford

Ford Motor Company
Environmental and
Safety Engineering

330 Town Center Drive
Dearborn, Michigan 48126

3M EMT™ 9165 TRANSMISSION
TELEPHONE: (313) 594-2268

AUTOMOTIVE SAFETY OFFICE
PRODUCTION VEHICLE SAFETY
AND COMPLIANCE
FAIRLANE PLAZA SOUTH, Suite 500
DEARBORN, MI 48126

DATE: 99-JAN-08

TIME: 8:45 AM

Please deliver to:

Name: NORM LAPOINTE

Organization: ~~[illegible]~~ D/A

Room # and Building:

Telephone:

FAX: 78256

Number of Sheets being Transmitted (including this one): 3

Special Instructions/Notes:

Transmission sent by (Name/Telephone):

WM ABRAMCZYK 23784

3713 7065

EA02-025

FORD

10/27/03

BOOK 26

DRAWING

DRAWINGS AVAILABLE UPON REQUEST

BRAKE SW.

CRUSE CONTROL

FIRE INV.

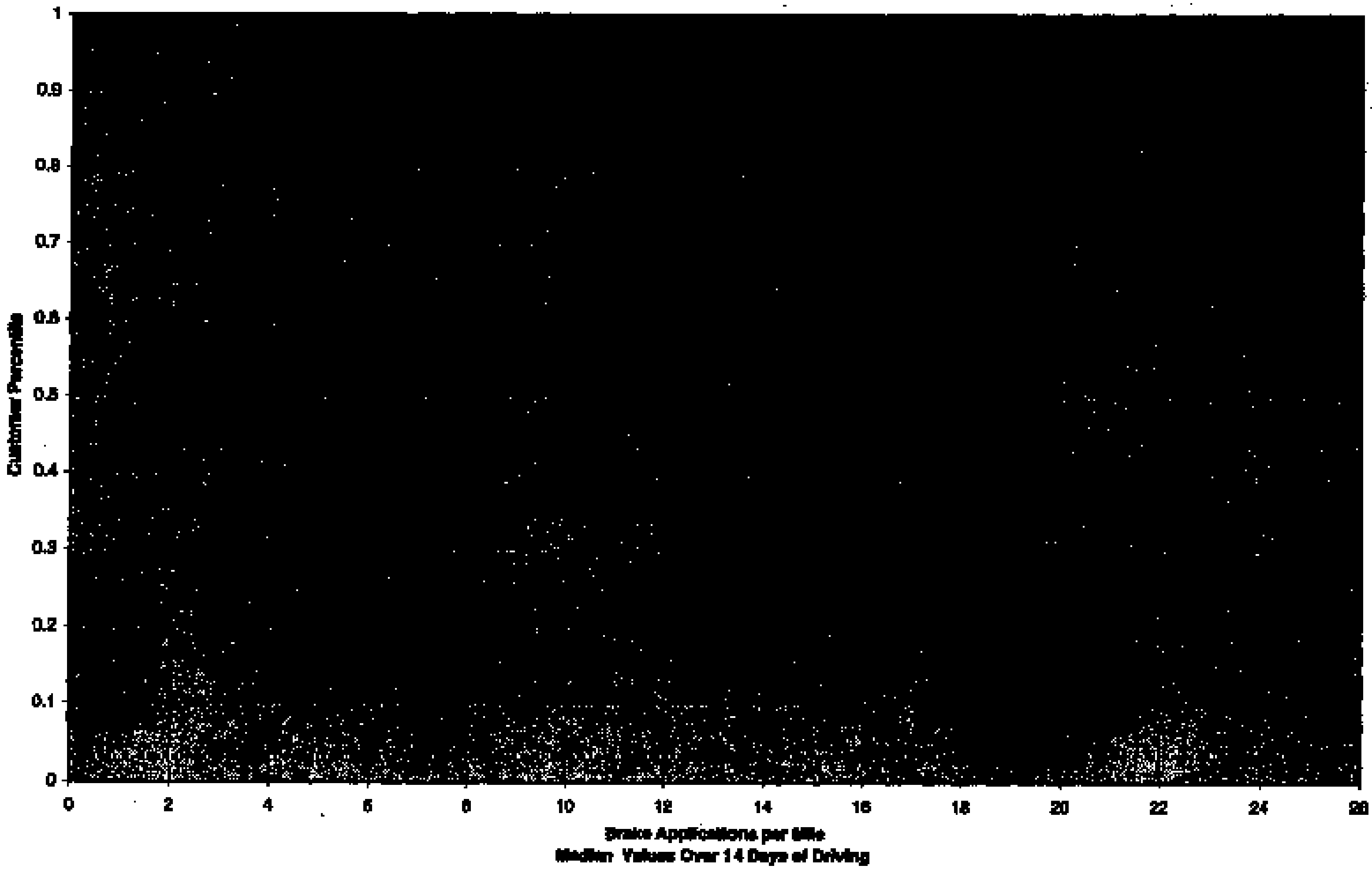
O.D.I. PE98-055

THIS PAGE ACCOUNTS FOR PAGE(s) REMOVED FOR CONFIDENTIAL FILE DOCUMENTS CONTAINED IN FILEROOM

BOX 3713 PAGE(s) 7061-7065 DATE 7/11/2000

Data from 1996 Brake Key Life Test Customer Data Acquisition Study
TO: Q20001

Brake Key Life Test - 1995 C.V., G.M. & T.C.

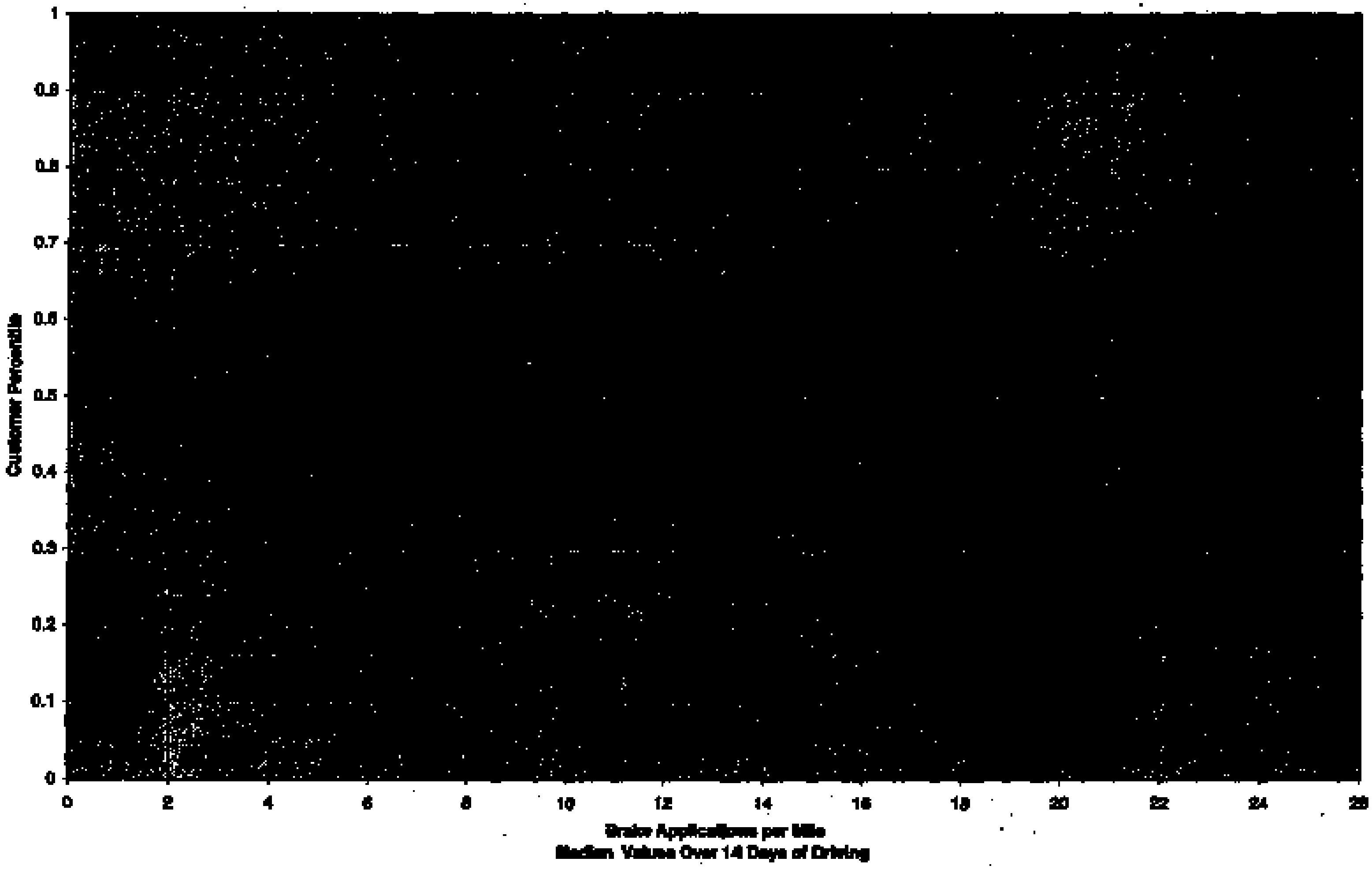


Data from 29 customers total, in cities of Boston, Atlanta Tampa

3713 7066

Data from 1996 Brake Key Life Test Customer Data Acquisition Study
TO: Q20001

Brake Key Life Test - 1996 C.V., G.M. & T.C.

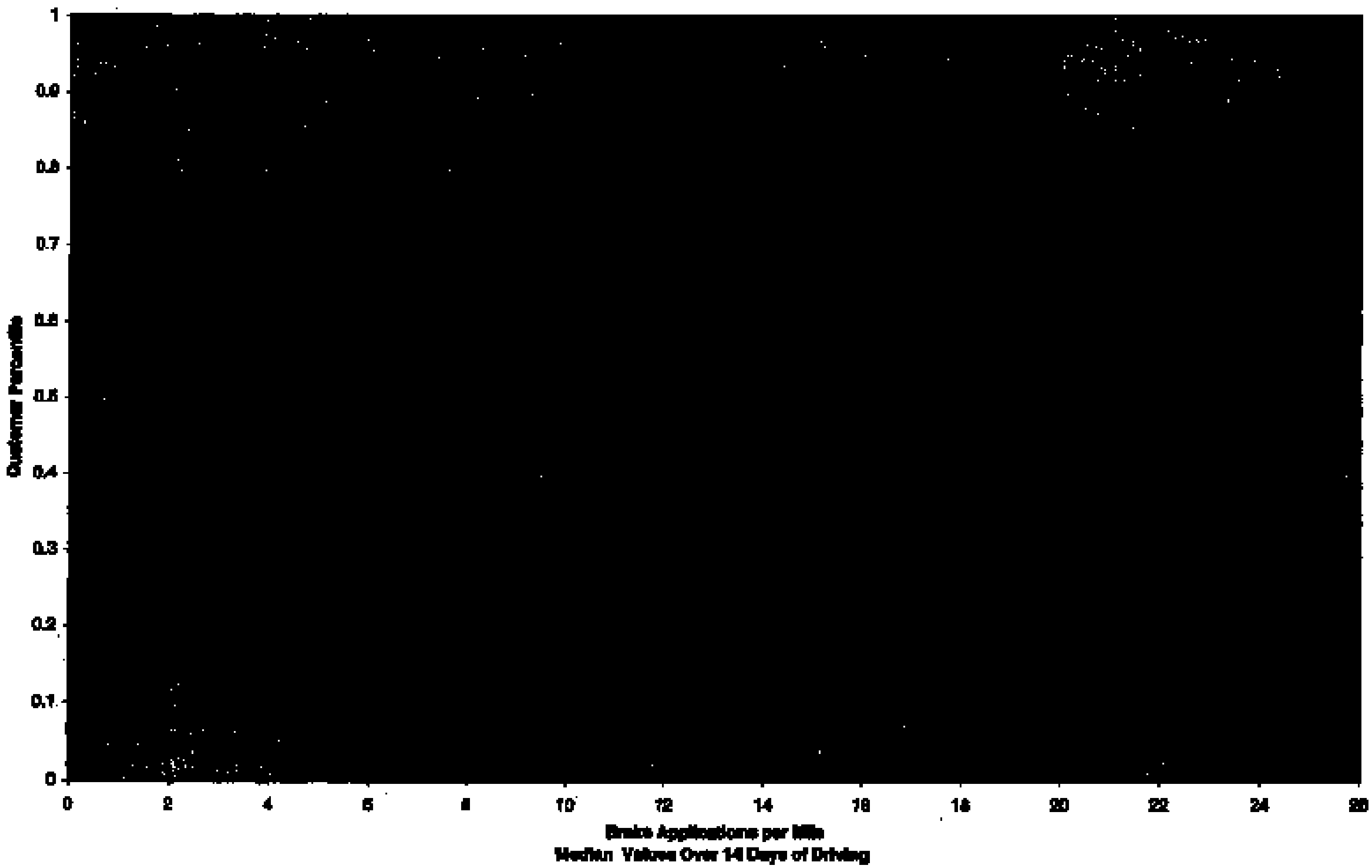


Data from 29 customers total, in cities of Boston, Atlanta Tampa

3713 7067

Data from 1996 Brake Key Life Test Customer Data Acquisition Study
TO: Q20001

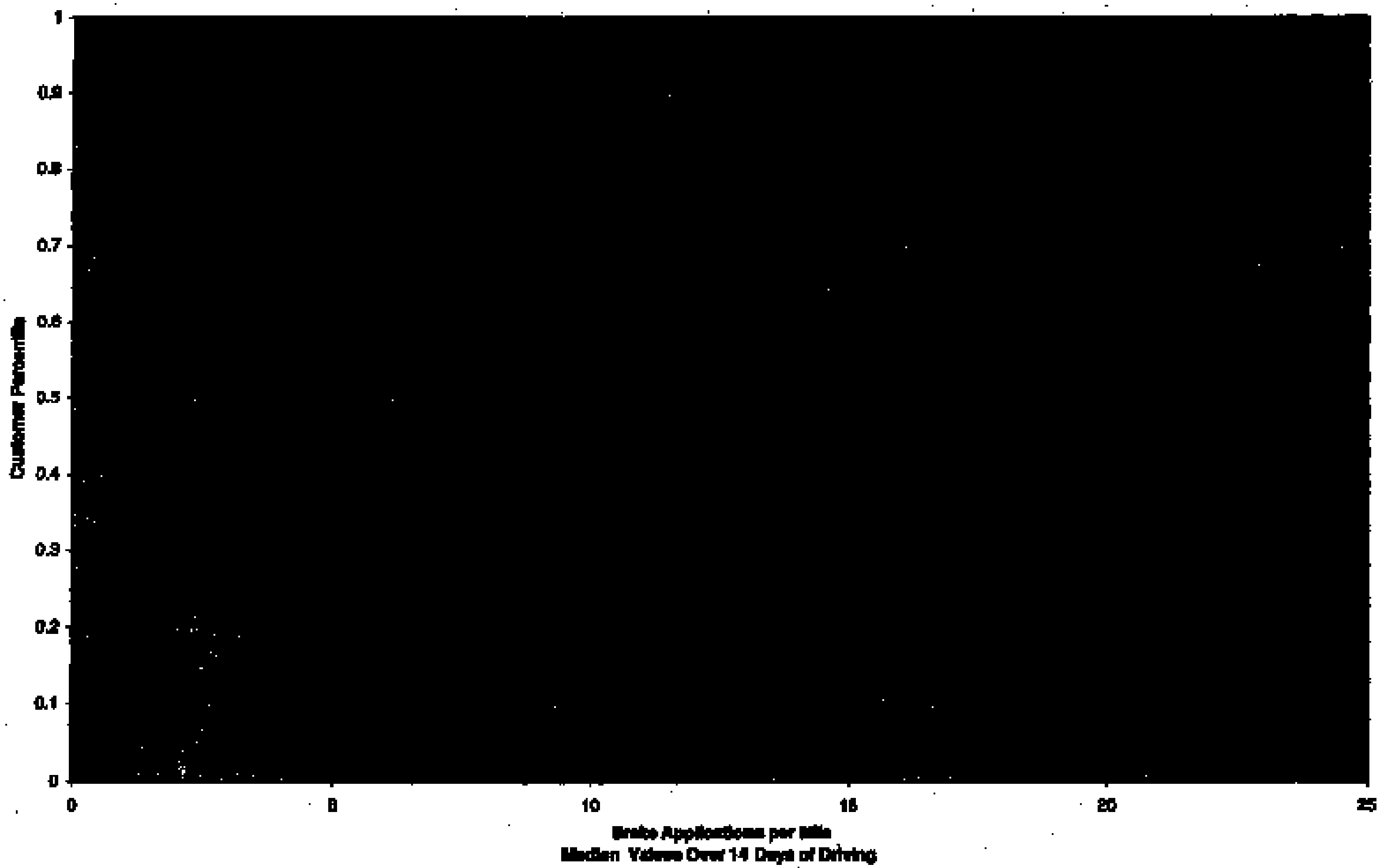
Brake Key Life Test - 1996 C.V., G.M. & T.C.



Data from 29 customers total, in cities of Boston, Atlanta Tampa

Data from 1995 Brake Key Life Test Customer Data Acquisition Study
TO: Q20001

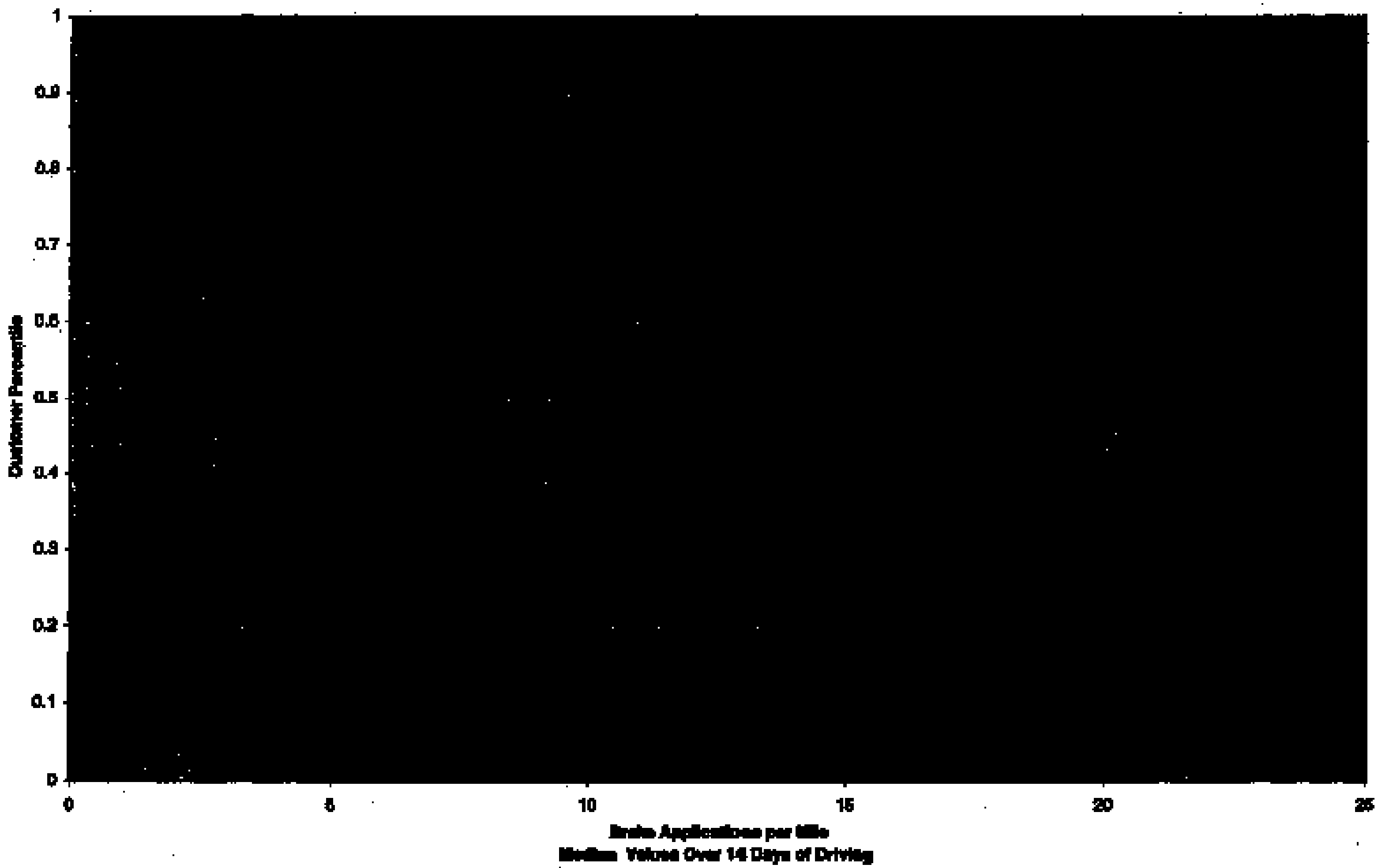
Brake Key Life Test - 1995 C.V., G.M. & T.C.



Data from 29 customers total, in cities of Boston, Atlanta Tampa

Data from 1996 Brake Key Life Test Customer Data Acquisition Study
TO: Q20001

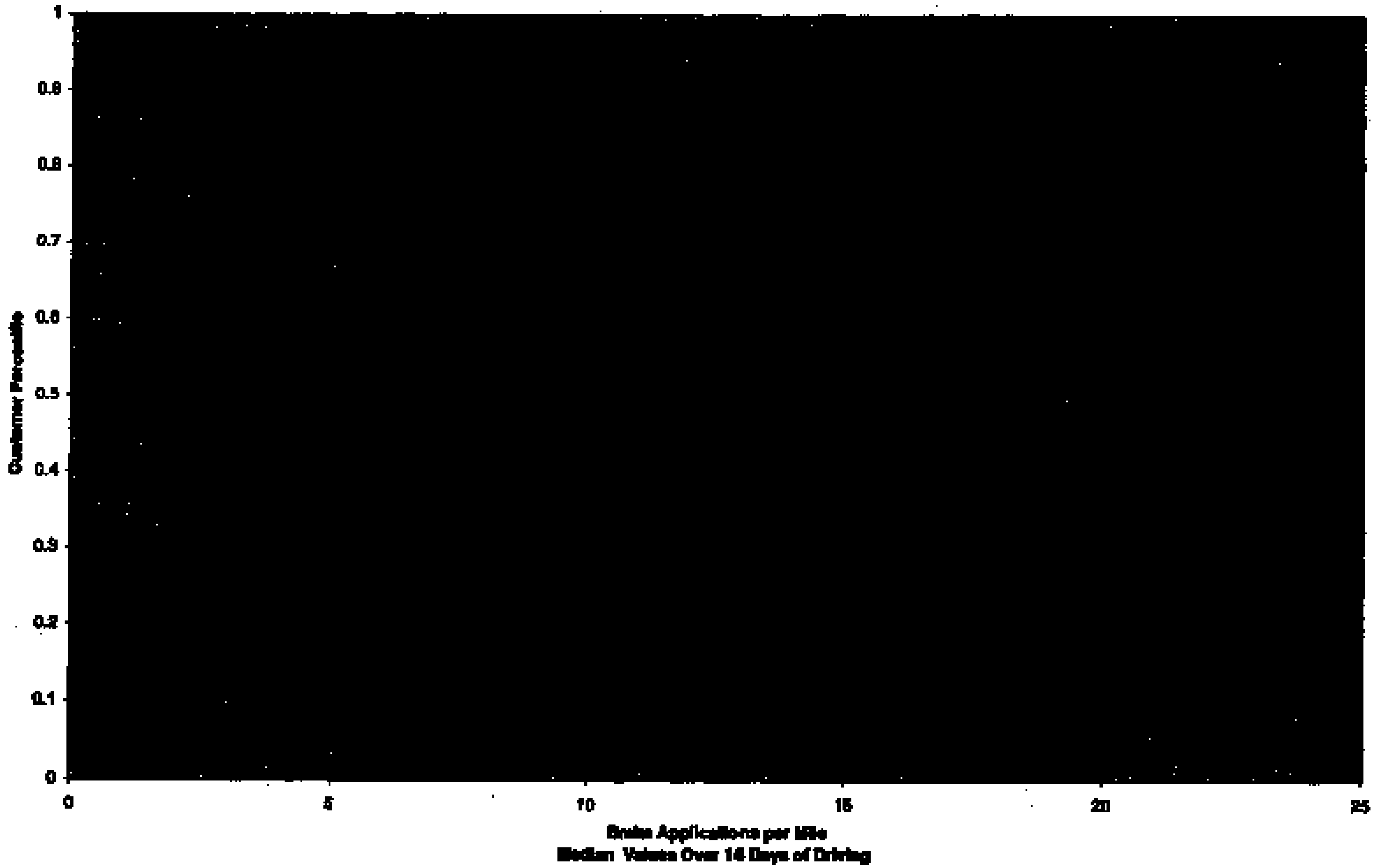
Brake Key Life Test - 1996 C.V., G.M. & T.C.



Data from 29 customers total, in cities of Boston, Atlanta Tampa

Data from 1996 Brake Key Life Test Customer Data Acquisition Study
TO: Q20001

Brake Key Life Test - 1995 C.V., G.M. & T.C.



Data from 29 customers total, in cities of Boston, Atlanta Tampa

3713 7071

Table 33 Mean and Median Parameter List

Number	Description
P1	Average Daily Distance Traveled (miles)
P2	Average Daily Vehicle Speed (V<2) (mph)
P3	Average Maximum Daily Vehicle Speed (mph)
P4	Average Daily Idle Time as a Percentage of Operation Time (%)
P5	Average Daily Number of Brake Events
P6	Average Daily Number of Brake Events (V>2)
P7	Average Daily Brake Duration (sec)
P8	Average Daily Brake Duration Standard Deviation (sec)
P9	Average Daily Time between Brake Events (sec)
P10	Average Daily Time between Brake Events Standard Deviation (sec)
P11	Average Daily Total Time Braking (sec)
P12	Average Daily Total Time Braking (V>2) (sec)
P13	Average Daily Number of Speed Control Applications
P14	Average Daily Number of Speed Control De-activation Using the Brake
P15	Average Daily Brake Energy per Mile (10^3 lb-ft/mi)
P16	Average Daily Brake Energy per Application (10^6 lb-ft/appl)
P17	Average Daily Brake Power per Mile (10^3 hp/mi)
P18	Average Daily Brake Power per Application (10^6 hp/appl)
P19	Average Daily Brake Work per Mile per Ton (10^3 lb-ft/mi-ton)
P20	Median Daily Distance Traveled (miles)
P21	Median Daily Vehicle Speed (V<2) (mph)
P22	Median Maximum Daily Vehicle Speed (mph)
P23	Median Daily Idle Time as a Percentage of Operation Time (%)
P24	Median Daily Vehicle Operation Time (min)
P25	Median Daily Average Brake Events (V>2) per Mile
P26	Median Daily Number of Brake Events
P27	Median Daily Number of Brake Events (V>2)
P28	Median Maximum Daily Outer Brake Pad Temperature (Deg C)
P29	Median Daily Brake Duration (sec)
P30	Median Daily Brake Duration Standard Deviation (sec)
P31	Median Daily Time between Brake Events (sec)
P32	Median Daily Time between Brake Events Standard Deviation (sec)
P33	Median Daily Total Time Braking (sec)
P34	Median Daily Total Time Braking as a Percentage of Operation Time (%)
P35	Median Daily Total Time Braking (V>2) (sec)
P36	Median Daily Total Time Braking (V>2) as a Percentage of Operation Time (%)
P37	Median Daily Number of Speed Control Applications
P38	Median Daily Number of Speed Control De-activation Using the Brake
P39	Median Daily Brake Energy per Mile (10^3 lb-ft/mi)
P40	Median Daily Brake Energy per Application (10^6 lb-ft/appl)
P41	Median Daily Brake Power per Mile (10^3 hp/mi)
P42	Median Daily Brake Power per Application (10^6 hp/appl)
P43	Median Daily Brake Work per Mile per Ton (10^3 lb-ft/mi-ton)
P44	Maximum Daily Maximum Outer Brake Pad Temperature (Deg C)

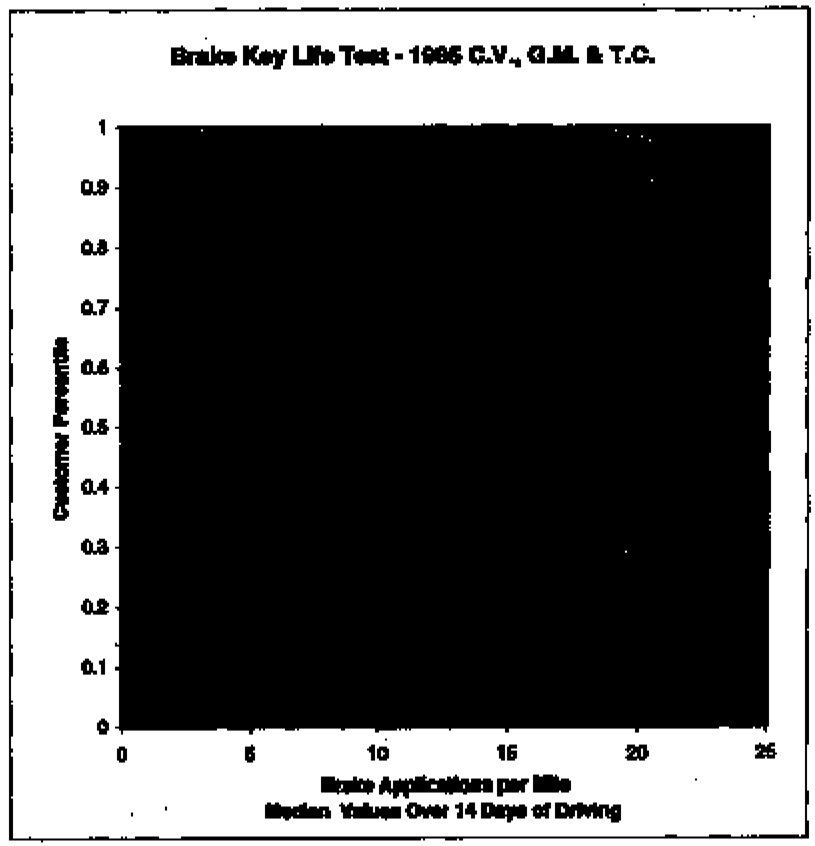
3713 7072

Table 34 Overall Average and Median Summary Results for All Brake Key Life Test Study Participants (Continued)

Participant Number	Type	Site	No. of days of data	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27
1	NC	1	13	134.1	28.59	62.8	13.17	68.5	35.1	35.0	71.0	17.87%	77.1	4.85	227	198
2	R	1	3	137.1	15.16	96.5	10.70	65.5	24.2	31.0	60.0	12.50%	80.7	9.96	329	250
3	N	1	14	338.6	22.80	196.2	13.64	158.9	19.1	21.0	55.0	18.92%	75.1	15.56	436	377
4	R	1	10	192.3	40.38	91.3	18.66	83.6	24.0	31.0	57.5	20.44%	61.0	5.03	140	121
5	N	1	14	230.8	20.86	130.2	11.74	109.9	13.8	25.5	49.5	20.73%	86.0	13.71	274	219
6	N	1	11	322.3	25.27	153.4	11.84	163.9	14.3	20.0	44.0	27.85%	58.7	13.39	200	157
7	R	1	14	121.7	34.03	46.7	12.41	57.7	45.5	34.5	58.5	10.27%	74.3	3.52	180	162
8	N	1	12	249.6	21.74	149.2	12.98	108.5	61.0	31.0	71.0	20.39%	126.5	13.19	674	555
9	R	1	14	243.8	39.06	89.0	13.68	115.2	32.5	27.0	49.6	19.79%	112.9	9.73	276	230
10	NC	1	14	248.5	20.73	160.7	12.65	118.8	15.3	25.0	44.5	13.63%	41.7	12.96	247	172
11	R	2	14	216.3	28.67	77.7	10.04	103.9	20.4	31.0	63.0	22.75%	86.2	8.19	259	186
12	N	2	13	248.8	30.21	103.9	12.76	108.1	43.8	28.0	55.0	23.06%	130.2	8.21	402	349
13	N & R	2	14	228.9	26.37	85.6	9.82	106.1	12.8	25.5	63.0	21.06%	87.2	7.96	157	128
14	R	2	13	219.3	16.08	94.1	7.72	104.4	39.0	28.0	62.0	20.82%	91.7	12.71	423	323
15	NC	2	12	161.8	25.33	91.0	14.63	72.5	55.0	43.0	71.5	9.15%	88.6	5.39	400	346
16	NC	2	13	201.5	29.04	73.4	10.81	67.6	15.6	29.0	56.0	20.56%	49.5	6.32	140	96
17	N	2	11	352.4	37.90	123.5	13.58	167.0	33.6	29.0	60.0	25.66%	126.3	9.27	499	401
18	N	2	13	255.2	32.04	115.6	14.39	121.5	37.8	33.0	67.0	26.96%	69.2	7.86	358	290
19	R	2	6	101.8	29.96	32.3	9.46	48.1	47.8	37.5	60.5	16.78%	98.6	3.56	179	156
20	R	2	11	149.5	36.85	71.7	17.02	71.4	44.1	46.0	77.0	18.20%	70.6	4.22	196	186
21	N	3	14	233.2	42.49	77.1	14.35	110.2	27.6	29.5	66.0	19.23%	79.4	5.58	234	193
22	R	3	6	129.6	34.90	47.4	11.69	61.8	22.9	31.6	59.5	11.72%	51.6	3.99	125	90
23	R	3	14	265.6	26.65	105.4	11.04	121.2	28.1	31.0	67.0	21.79%	70.9	9.15	325	282
24	NC	3	13	178.8	21.86	116.5	11.84	77.7	27.4	23.0	62.0	19.52%	72.2	7.59	229	166
25	N	3	13	240.2	26.60	92.3	10.44	114.3	24.9	29.0	61.0	19.42%	70.9	8.79	372	256
27	R	3	14	186.2	40.18	60.6	16.18	78.0	33.5	41.0	66.5	13.90%	58.7	4.38	189	162
28	R	3	13	250.8	36.92	77.9	11.08	118.8	17.4	28.0	52.0	24.86%	64.0	7.01	180	122
29	N	3	10	248.4	26.44	112.5	10.83	107.9	18.0	26.0	49.0	27.84%	68.6	8.61	248	155
30	N	3	11	269.4	39.08	89.4	13.62	137.7	15.4	31.0	53.0	21.37%	44.8	7.63	195	140

3713 7073

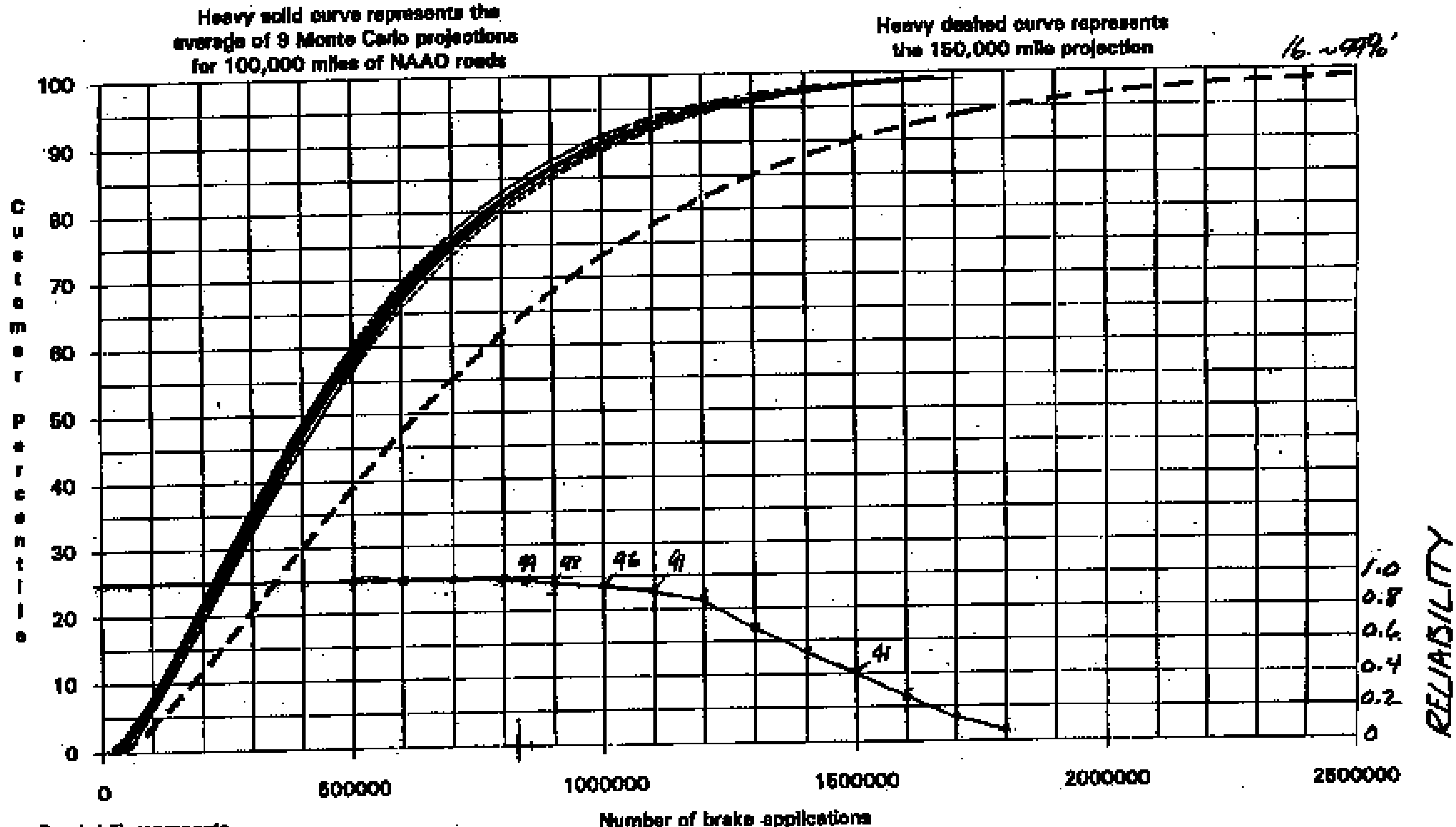
Participant	p20 b-app	p26 miles	b-app./mi	rank	order
19	47.6	179	3.74477	0.02381	1
7	43.5	180	4.137931	0.057823	2
20	44.1	196	4.444444	0.091837	3
22	22.9	125	5.458515	0.12585	4
27	33.5	189	5.641791	0.159864	5
4	24	140	5.833333	0.193878	6
1	35.1	227	6.467236	0.227891	7
15	55.6	400	7.194245	0.261905	8
24	27.4	229	8.357664	0.295918	9
21	27.6	234	8.478261	0.329932	10
9	32.5	276	8.492308	0.363946	11
16	16.8	140	8.880759	0.397959	12
12	43.8	402	9.178082	0.431973	13
18	37.8	358	9.470899	0.465986	14
28	17.4	180	10.34483	0.5	15
23	26.1	325	12.45211	0.534014	16
13	12.6	157	12.46032	0.568027	17
30	15.4	195	12.66234	0.602041	18
11	20.4	259	12.69608	0.636054	19
14	33	433	13.12121	0.670068	20
8	51	674	13.21569	0.704082	21
2	24.2	329	13.59504	0.738095	22
29	18	248	13.77778	0.772109	23
6	14.3	200	13.98601	0.806122	24
17	33.6	498	14.82143	0.840136	25
25	24.9	372	14.93976	0.87415	26
10	15.3	247	16.14379	0.908163	27
5	13.8	274	19.85507	0.942177	28
3	19.1	436	22.82723	0.97619	29



file/BSwCU/nil/ 2-18-99

3713 7074

1991 Thunderbird 5.0L, AOD
NAAO Customer Usage Spectrum



Bandwidth represents variability of 9 Monte Carlo projections for 744 Thunderbird owners

AGP/RWG W37.XLC 8/8/94

3719 7076

Order	Cycle	Rank
1	994232	0.038043
2	994232	0.092391
3	1131102	0.146739
4	1131102	0.201087
5	1302691	0.255435
6	1325190	0.309783
7	1344673	0.36413
8	1359659	0.418478
9	1359659	0.472826
10	1403522	0.527174
11	1403522	0.581522
12	1403522	0.63587
13	1418250	0.690217
14	1418250	0.744565
15	1472621	0.798913
16	1488221	0.853261
17	1511726	0.907609
18	1587659	0.961957

@ ~ 725000 | 0.01

Corr. Curve 100,000mi
@ 99% 1.6×10⁶ Brake Appl.
∴ 16 Brake Appl./mi

Reddick Veh ~ 51,500mi

∴ B.A. = $\frac{16}{mi}$(51,500) = 824,000. ~ 82%

Weibull Curve
@ 824,000 cycles ⇒ 2.2% Fx

High Cycle count > Diaphragm Fx > Brake Fluid Leakage > Mech Concept for cause

ABS Effect (?) → High Cycle count

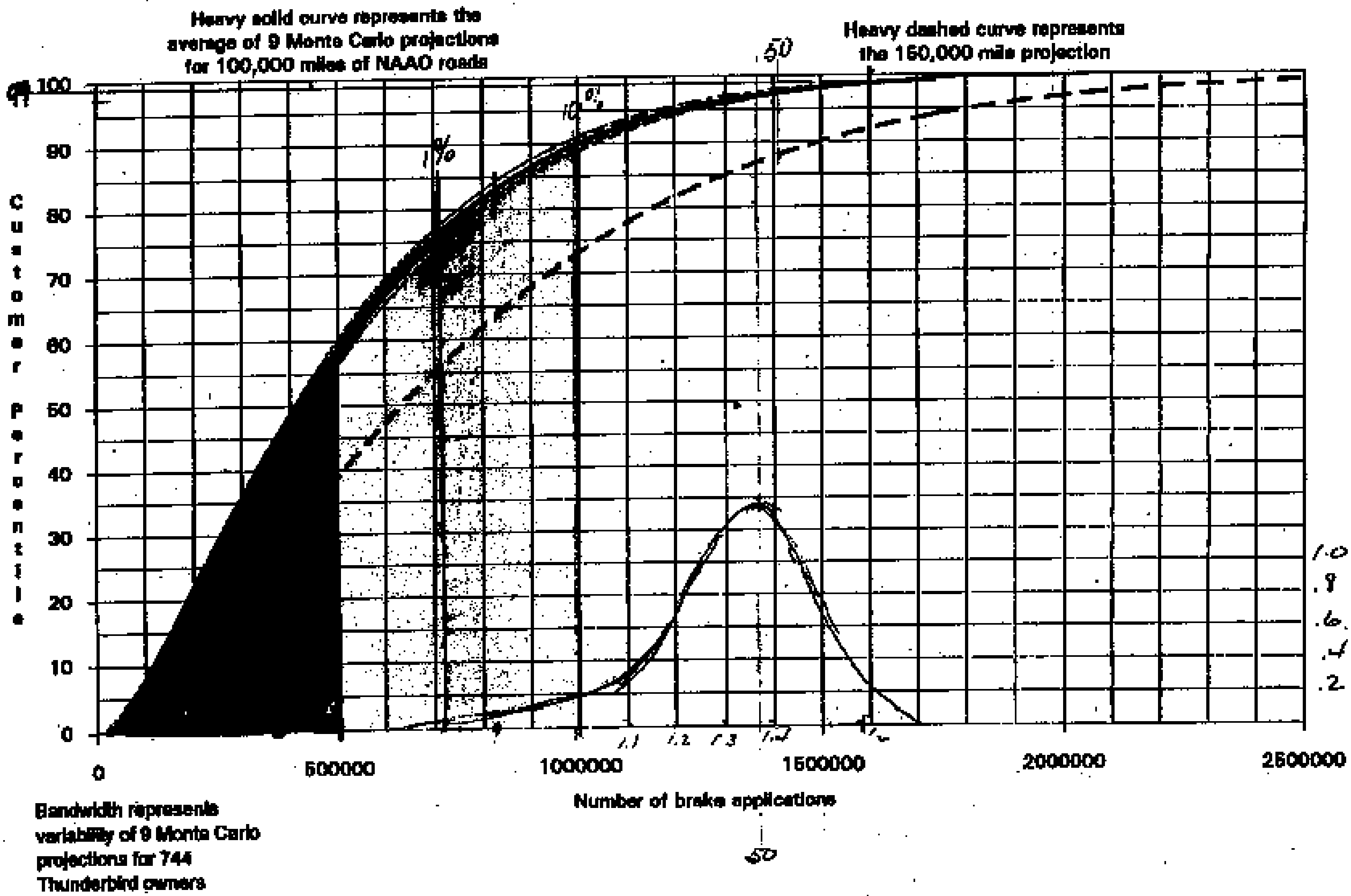
Contaminants (?) → Diaphragm Fx

Southern Environmental: Temp, Salt, Humidity (?) → Diaphragm Fx

External accumulation? → Brake Fluid Leakage

? TI & Ford unable to verify mode

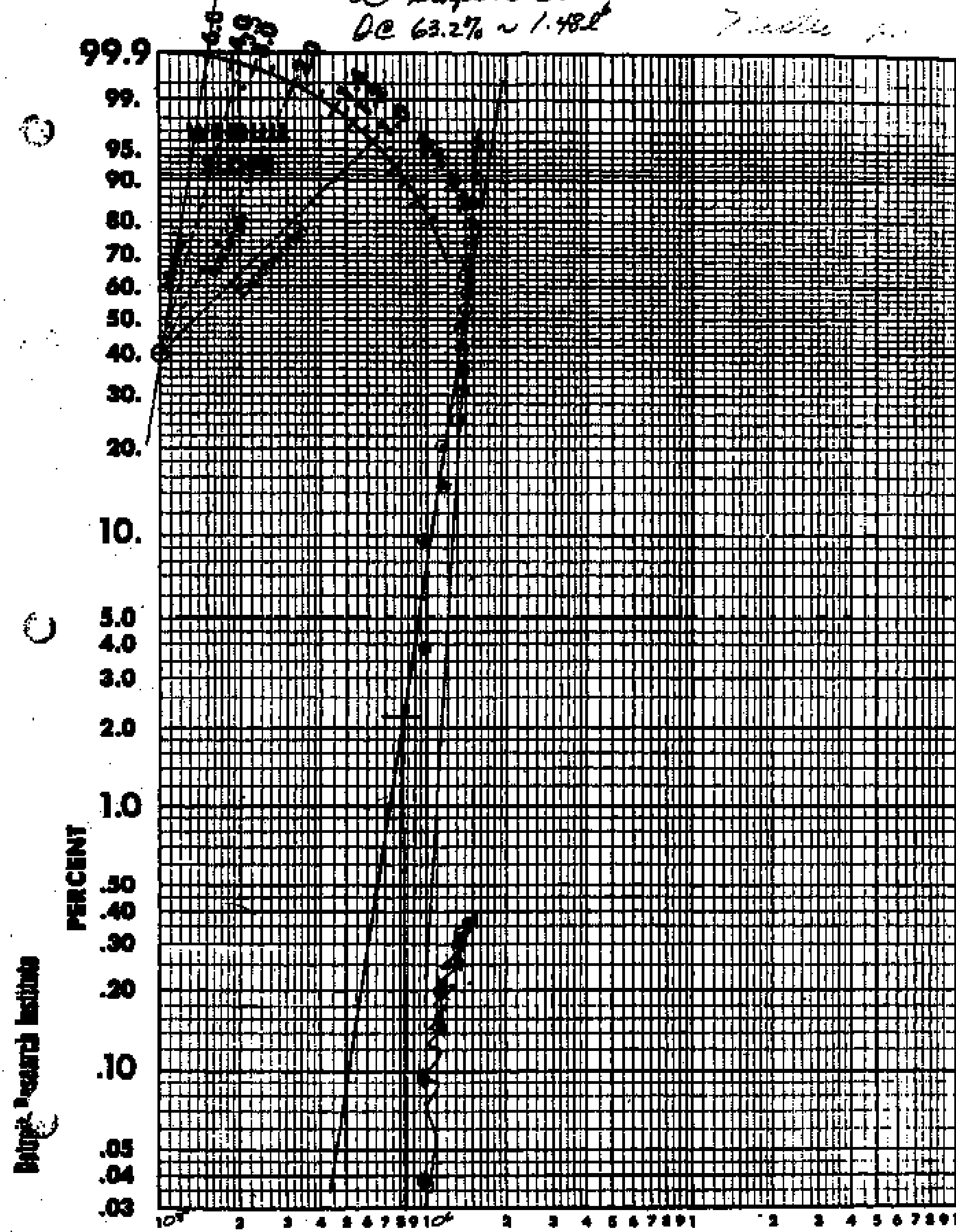
1991 Thunderbird 5.0L, AOD
NAAO Customer Usage Spectrum



AGP/RWG W27.XLC 6/6/94

3713 7077

α ~ slope ~ 6.
D@ 63.2% ~ 1.48



3713 7078

2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data or "Minimum life" input value is altered

[redacted]

[illegible]	
[illegible]	
1151102	
[illegible]	
[illegible]	
[illegible]	
1344673	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
1511725	
[illegible]	
[illegible]	•
[illegible]	•
[illegible]	•
[illegible]	•
[illegible]	•
[illegible]	•

[illegible]

[redacted]

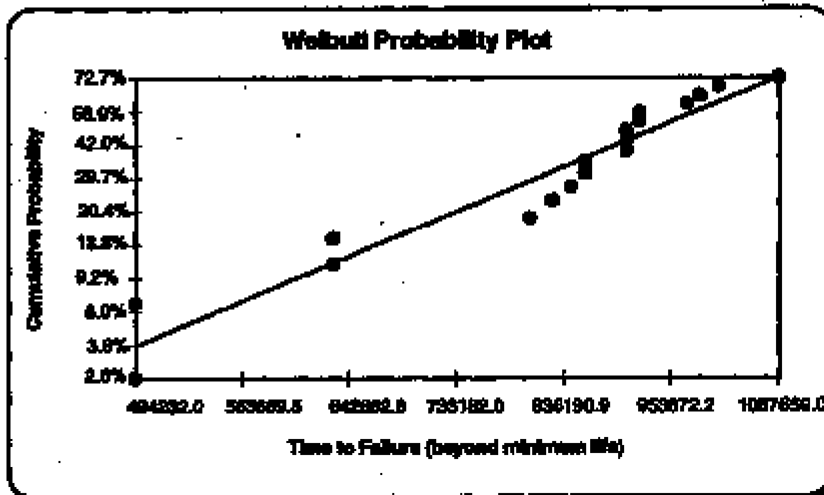
[illegible] 95%

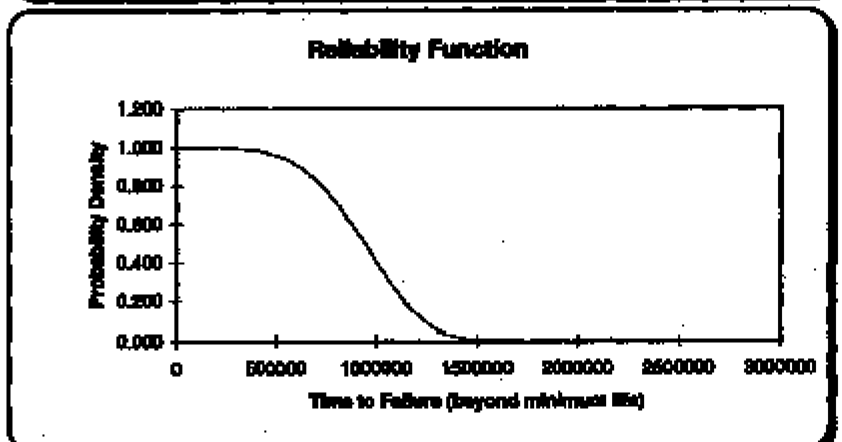
[redacted]

[illegible] 851658.3591

Calculated Outputs

[redacted]



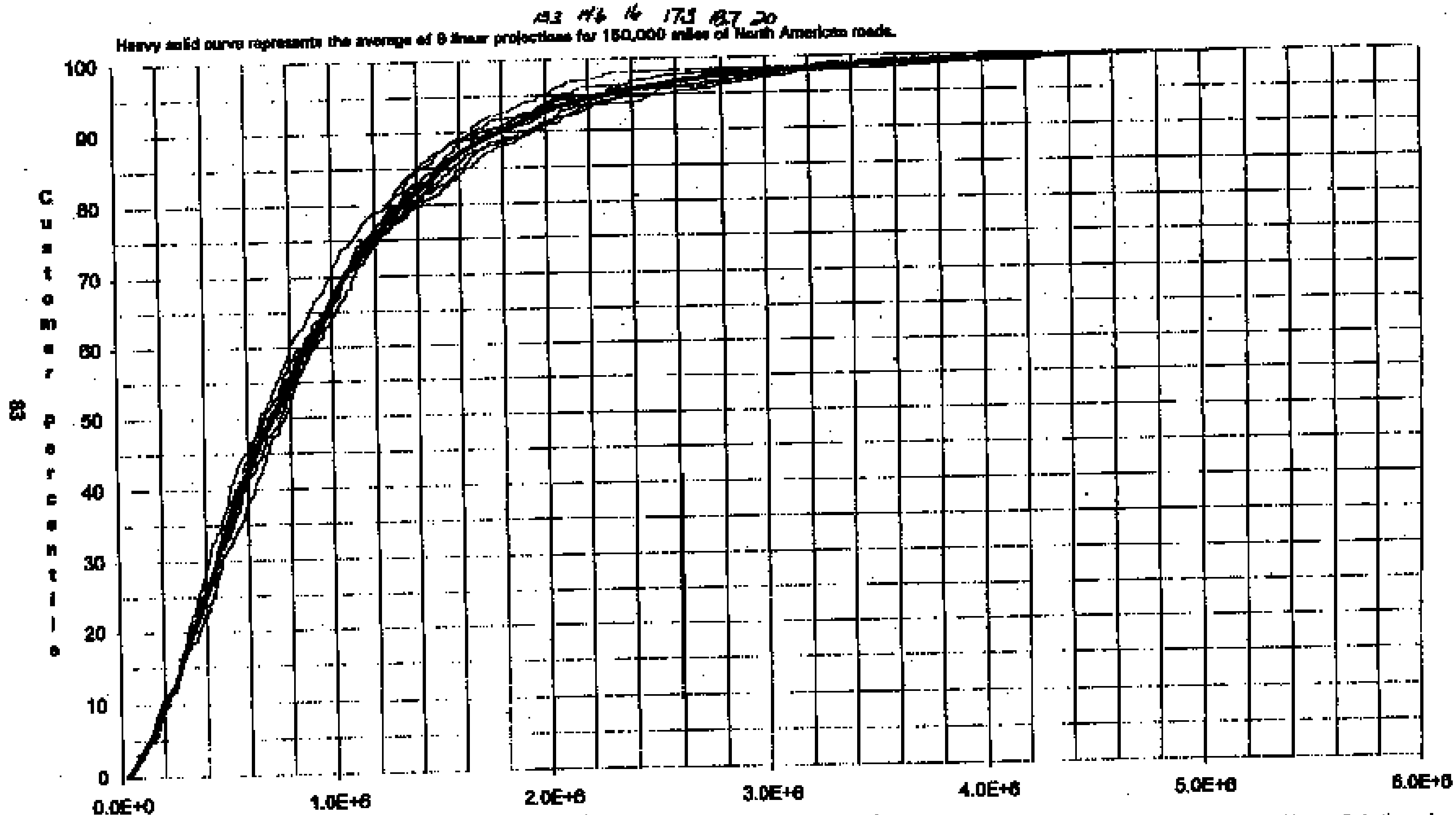


NOTES:

3713 7079

1992 CROWN VICTORIA (4.6L, AODE)
NORTH AMERICAN POWERTRAIN CUSTOMER USAGE SPECTRUM

Heavy solid curve represents the average of 9 linear projections for 150,000 miles of North American roads.



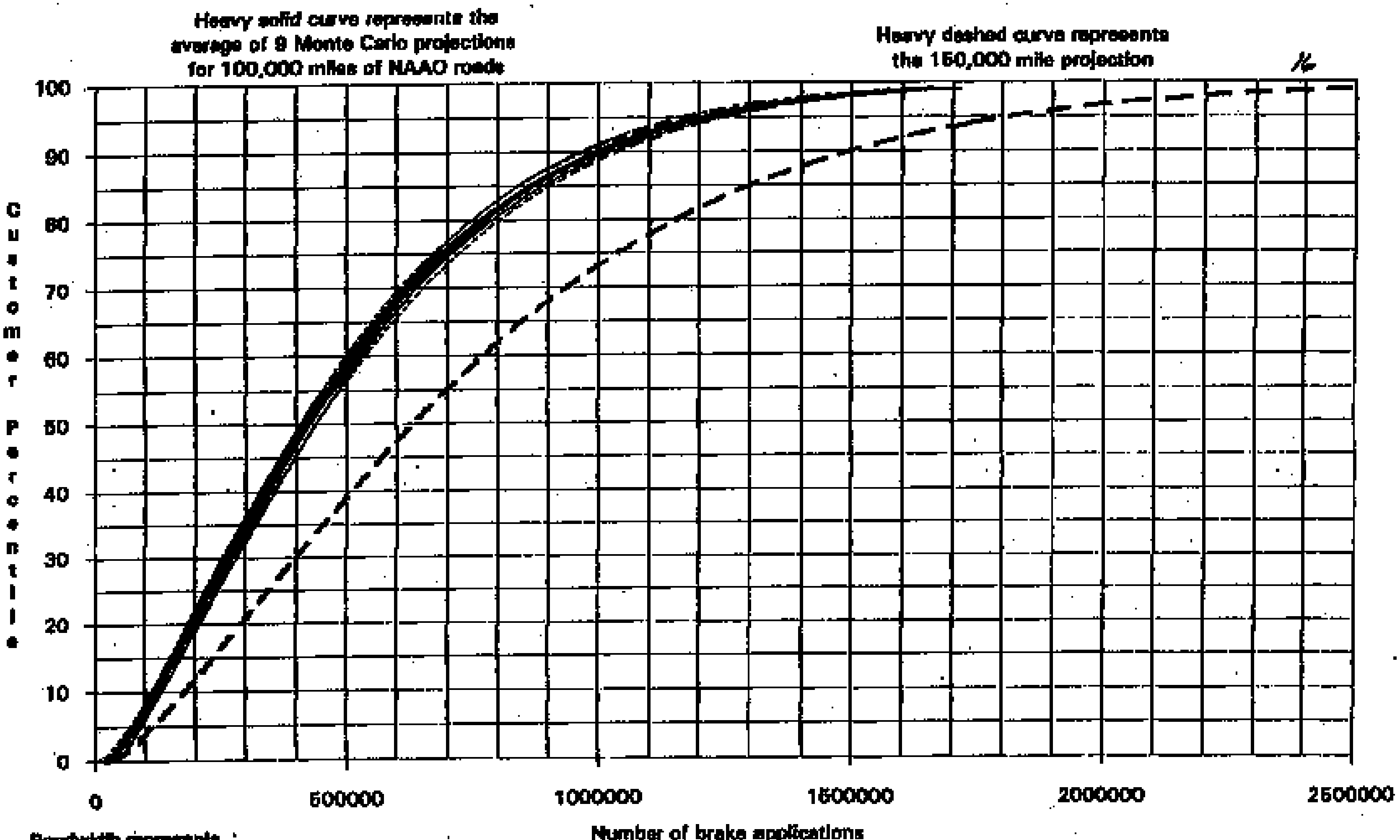
Bandwidth represents variability of 9 linear projections of 402 Crown Victoria/Grand Marquis owners

Customer usage spectra are subject to limitations of road data collection and customer survey responses.

1992 Crown Victoria North American Powertrain Customer Correlation
GTO - Customer Correlation - U.S.
Issued: March 1992

3713 7080

1991 Thunderbird 5.0L, AOD
NAAO Customer Usage Spectrum



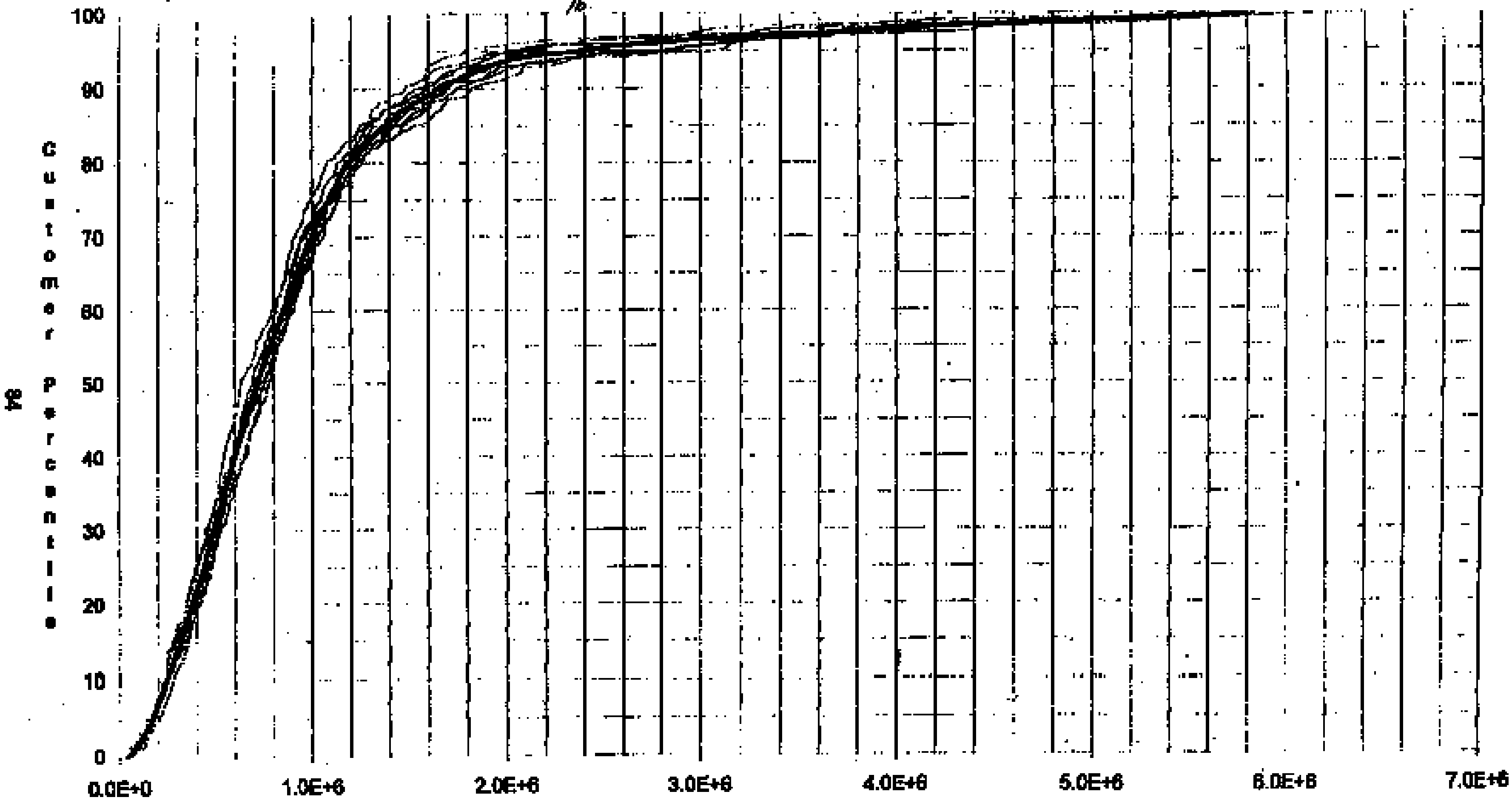
Bandwidth represents variability of 9 Monte Carlo projections for 744 Thunderbird owners

AGP/RWG W37.XLC 6/6/94

3713 7081

1992 TAURUS (3.0L, AXODE)
NORTH AMERICAN POWERTRAIN CUSTOMER USAGE SPECTRUM

Heavy solid curve represents the average of 9 linear projections for 150,000 miles of North American roads.



Bandwidth represents variability of 9 linear projections of 400 Taurus/Sable owners

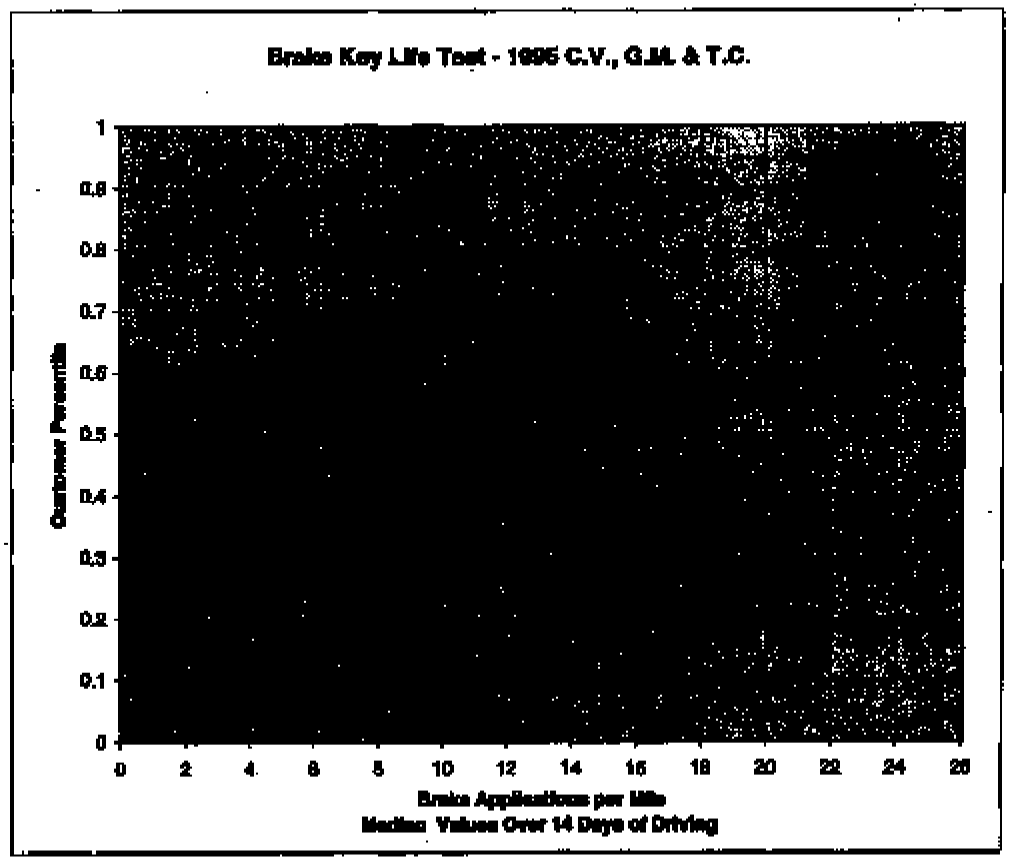
Number of brake applications

Customer usage spectra are subject to limitations of road data collection and customer survey responses.

1992 Taurus North American Powertrain Customer Correlation
GTO - Customer Correlation - U.S.
Issued: February 199?

W67.XLC
RWB
3/1/96

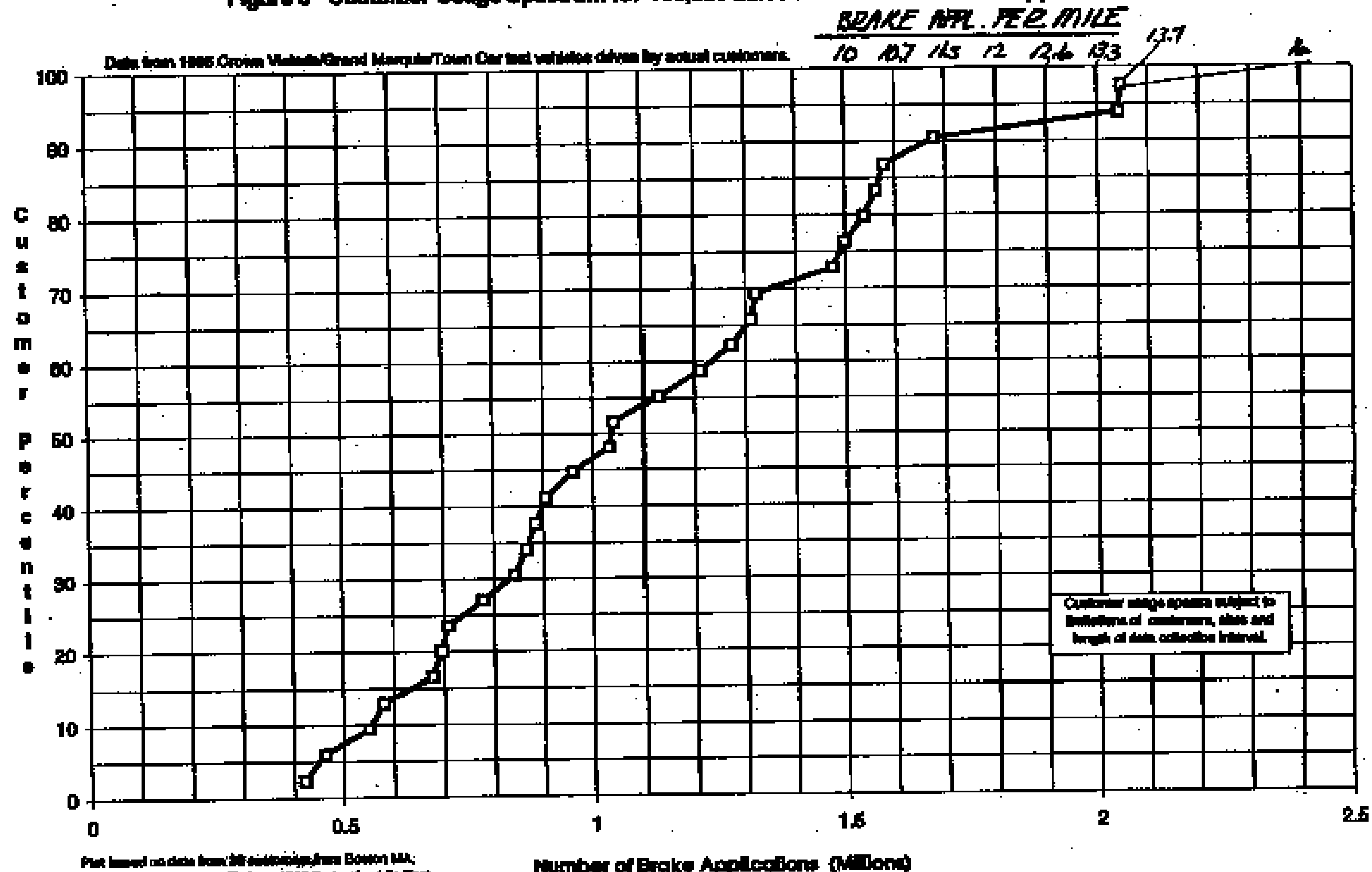
Participant	p20 b-app	p20 miles	b-app./mi	rank	order
19	47.8	179	3.74477	0.02381	1
7	43.5	180	4.137931	0.057823	2
20	44.1	196	4.444444	0.091837	3
22	22.9	125	5.458515	0.12585	4
27	33.5	189	5.641791	0.159864	5
4	24	140	5.833333	0.193878	6
1	35.1	227	6.467236	0.227891	7
15	55.6	400	7.194245	0.261905	8
24	27.4	229	8.357664	0.295918	9
21	27.6	234	8.478261	0.329932	10
9	32.5	276	8.492308	0.363946	11
16	15.8	140	8.860759	0.397959	12
12	43.8	402	9.178082	0.431973	13
18	37.8	358	9.470899	0.465986	14
28	17.4	180	10.34483	0.5	15
23	26.1	325	12.45211	0.534014	16
13	12.6	157	12.46032	0.568027	17
30	15.4	195	12.66234	0.602041	18
11	20.4	259	12.69608	0.636054	19
14	33	433	13.12121	0.670068	20
8	51	674	13.21569	0.704082	21
2	24.2	329	13.59504	0.738095	22
29	18	248	13.77778	0.772109	23
6	14.3	200	13.98601	0.806122	24
17	33.6	498	14.82143	0.840136	25
26	24.9	372	14.93976	0.87415	26
10	15.3	247	16.14379	0.908163	27
5	13.8	274	19.85507	0.942177	28
3	19.1	436	22.82723	0.97619	29



file/BSwCU/mV 2-18-99

3713 7083

Figure 8 Customer Usage Spectrum for 150,000 Miles for Number of Brake Applications



Plot based on data from 38 customers/sites Boston MA; Atlanta GA, and Tampa FL from 1993 Brake Key Life Test Customer Data Acquisition Study.

Figure 10 Customer Usage Spectrum for 150,000 Miles for Number of Brake Applications (V>2) per Mile

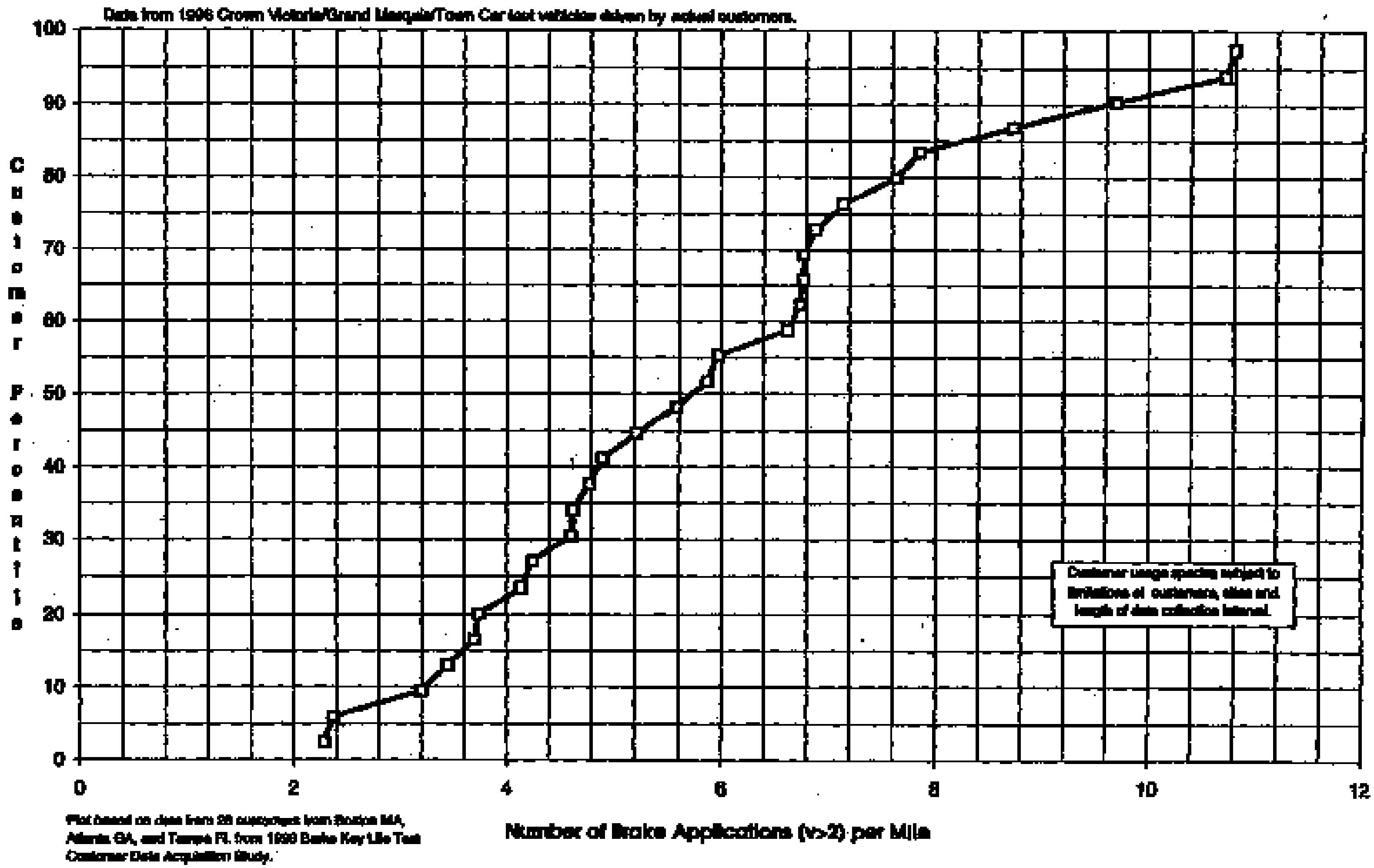
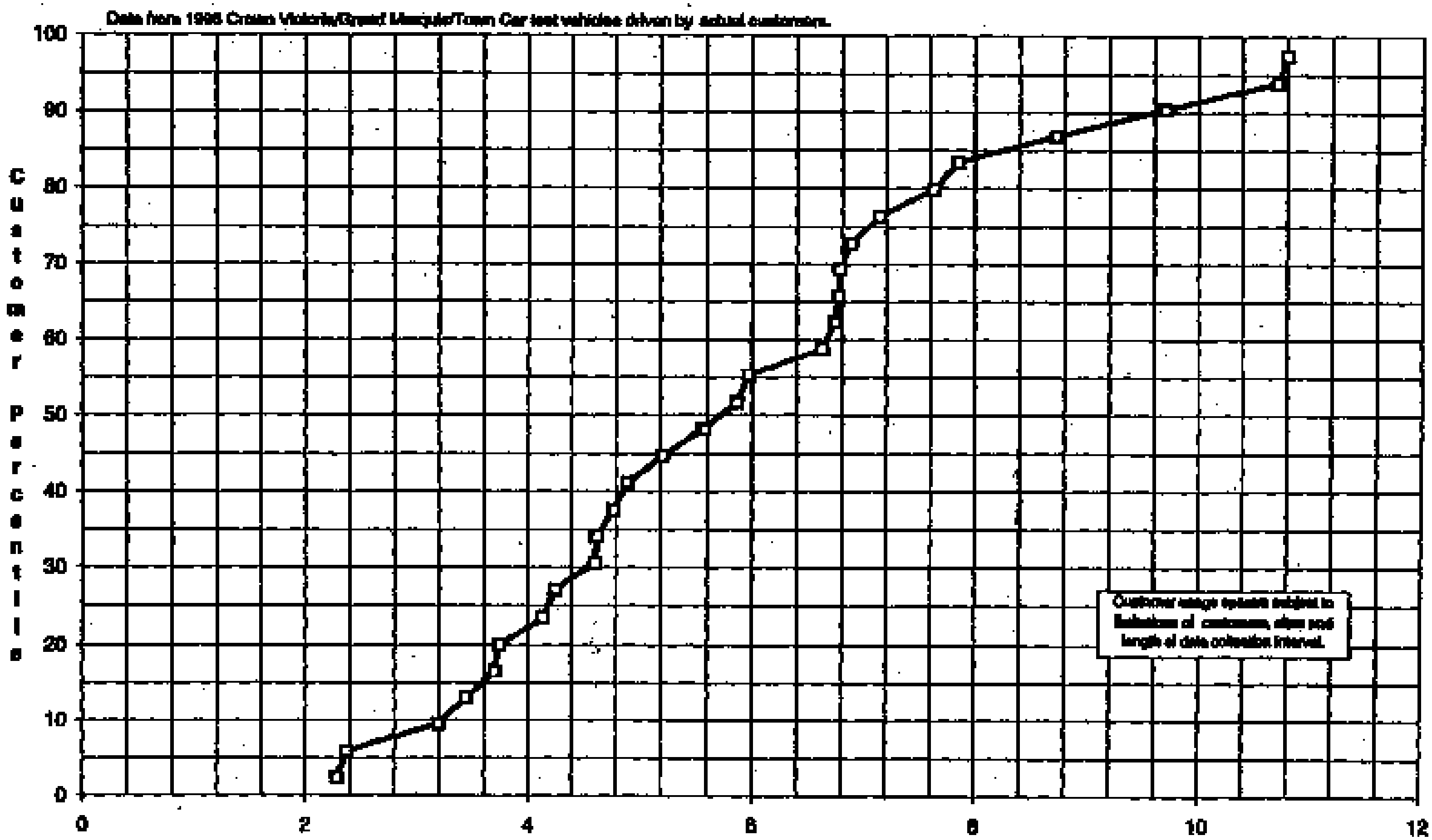


Figure 10 Customer Usage Spectrum for 150,000 Miles for Number of Brake Applications (V>2) per Mile

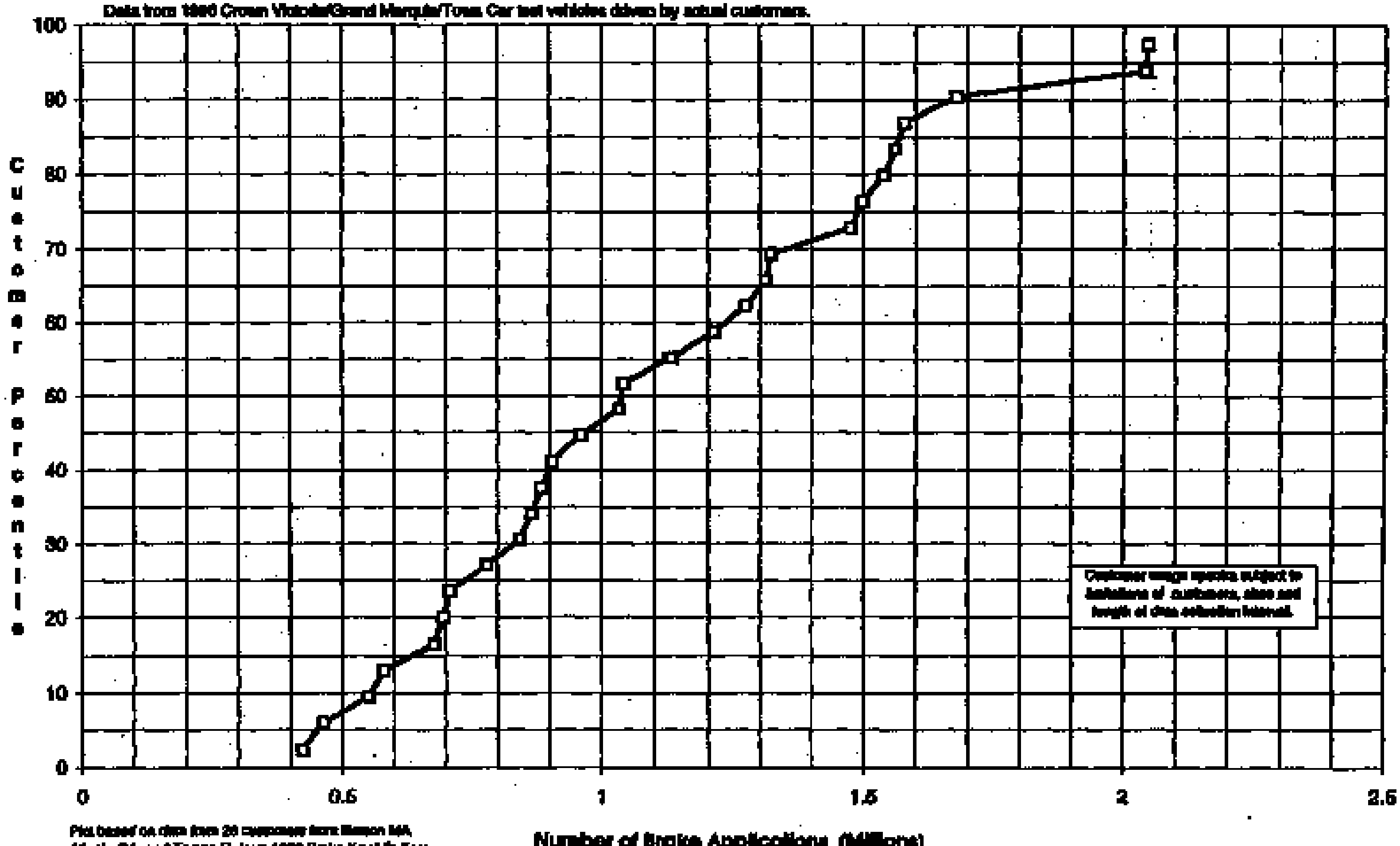


Plot based on data from [illegible] customers from Boston MA, Atlanta GA, and Tampa FL from 1996 Brake Key Life Test Customer Data Acquisition Study.

3713 7096

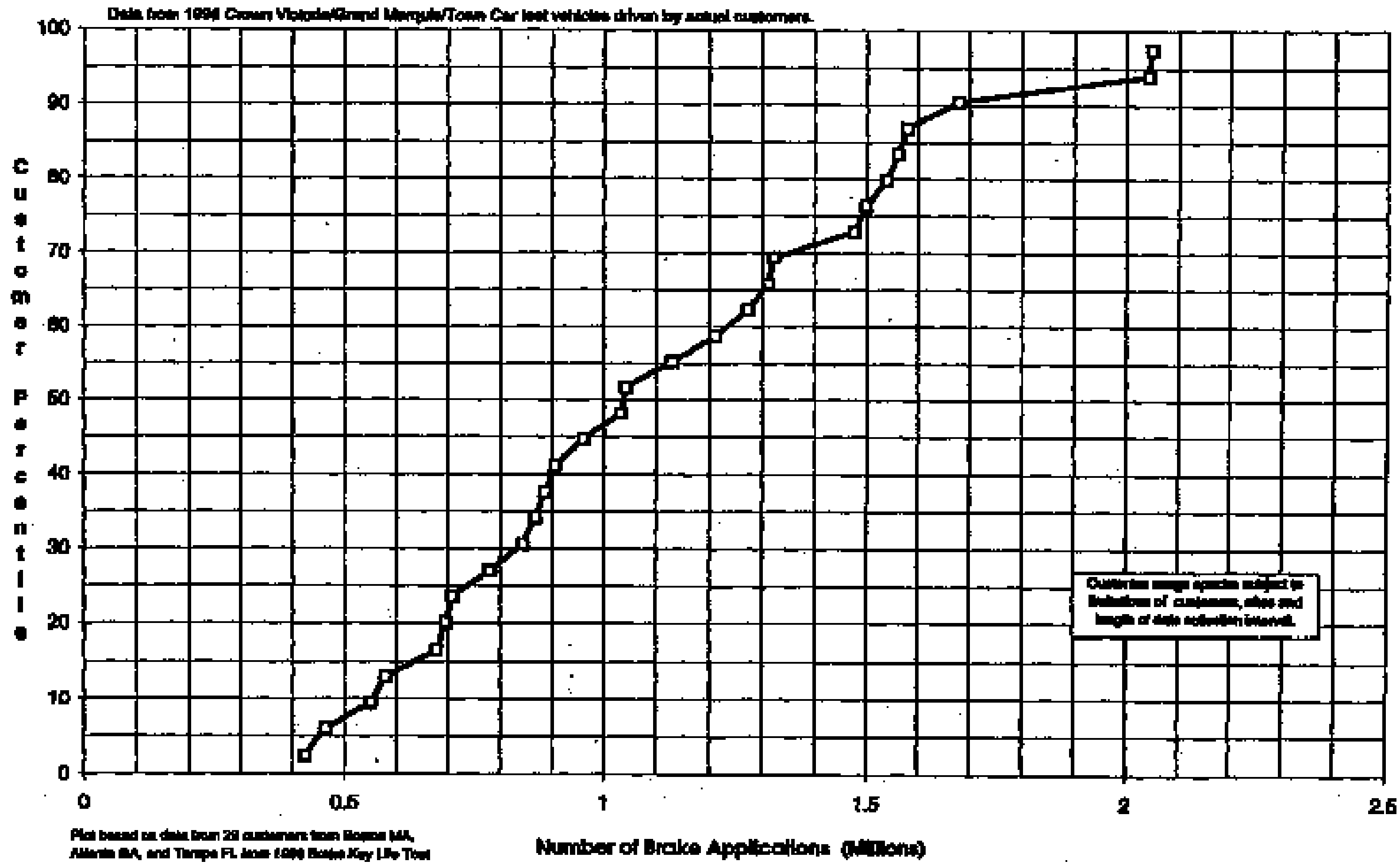
Figure 6 Customer Usage Spectrum for 150,000 Miles for Number of Brake Applications

Data from 1996 Crown Victoria/Grand Marquis/Town Car test vehicles driven by actual customers.



Plot based on data from 26 customers from [illegible] MA, Atlanta GA, and Tampa FL from 1996 Brake Key Life Test Customer Data Acquisition Study.

Figure 6 Customer Usage Spectrum for 150,000 Miles for Number of Brake Applications



Plot based on data from 29 customers from Boston MA, Atlanta GA, and Tampa FL from 1996 Brake Key Life Test Customer Data Acquisition Study.

2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data or "Minimum life" input value is altered

[redacted]

[illegible]	
[illegible]	
1131102	
1131102	
[illegible]	
1325108	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
1416250	
1416250	
[illegible]	
[illegible]	
1511720	
[illegible]	•
[illegible]	•
[illegible]	•
[illegible]	•
[illegible]	•
[illegible]	•

[illegible]

[redacted]

[redacted]

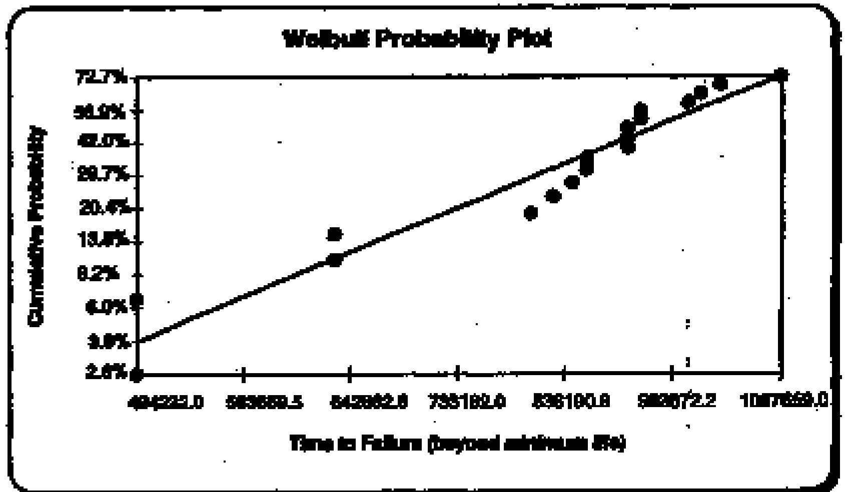
[illegible] 5%

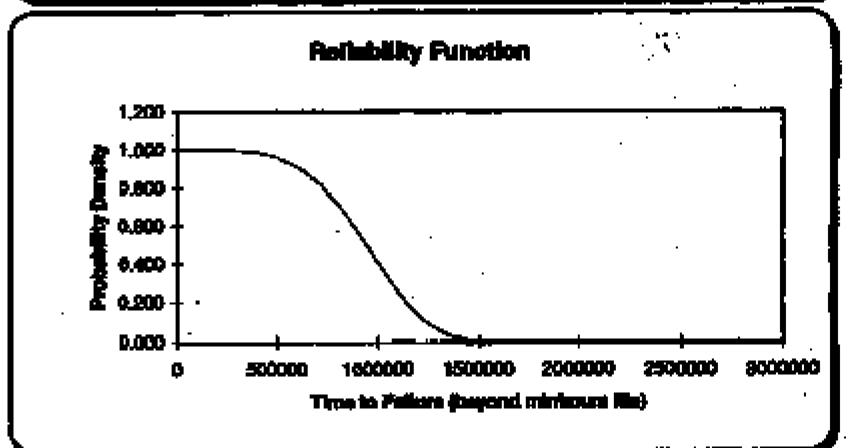
[redacted]

[illegible] 861658.3581

Calculated Outputs

[redacted]





NOTES:

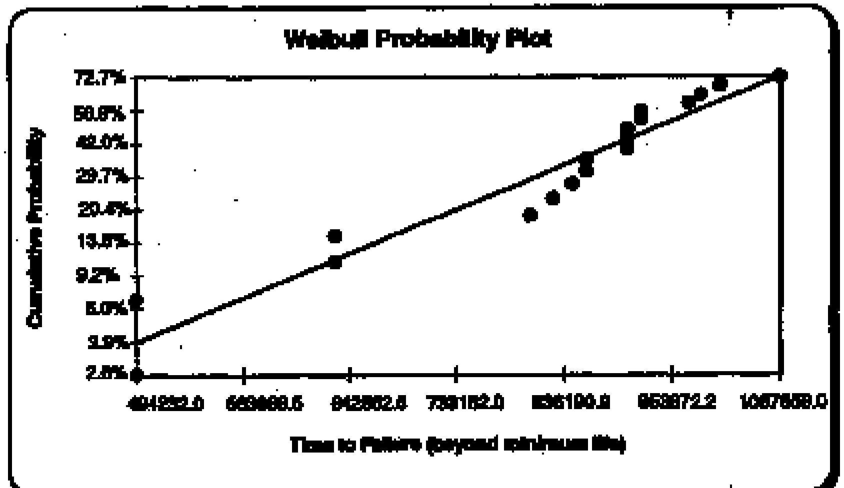
3713 7069

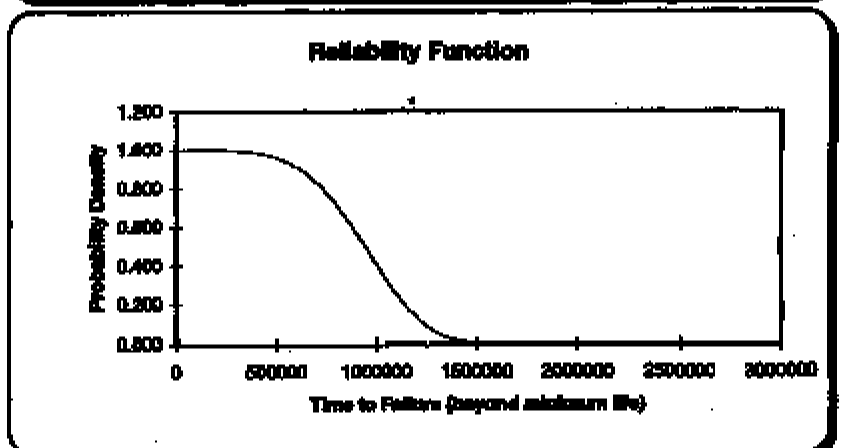
2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data or "Minimum life" input value is altered

[illegible]		[illegible]	
[illegible]			
1131102			
1151102			
[illegible]			
[illegible]		[illegible]	95%
[illegible]			
[illegible]		[illegible]	851658.3581
[illegible]			
[illegible]			
[illegible]			
[illegible]			
[illegible]			
[illegible]			
[illegible]			
[illegible]			
[illegible]			
[illegible]			
[illegible]	s		
[illegible]	s		
[illegible]	s		
[illegible]	s		
[illegible]	s		
[illegible]	s		

Calculated Outputs





NOTES:

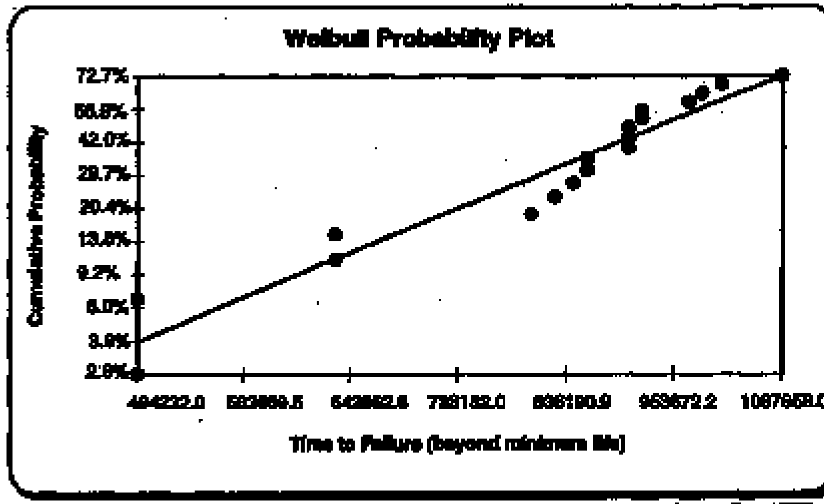
3713 7090

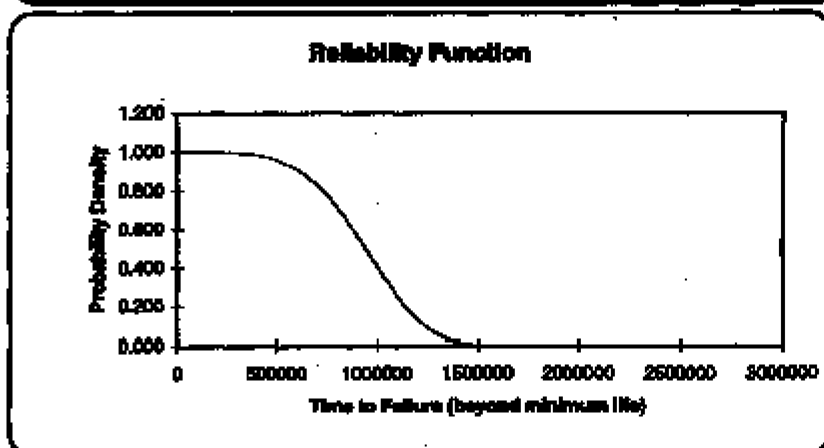
2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data
or "Minimum life" input value is altered

994232		500000
994232		
1151102		
1151102		
1302991		
1325190		1000000 / 95%
1384673		
1395559		
1395559		[illegible] % / 861658.3581
1403522		
1403522		
1403522		
1416250		
1416250		
1472521		
[illegible]		
1511729		
[illegible]		
1654821	s	
1654821	s	
1654821	s	
1654821	s	
1654821	s	
1654821	s	

Calculated Outputs





NOTES:

3713 7091

2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data or "Minimum life" input value is altered

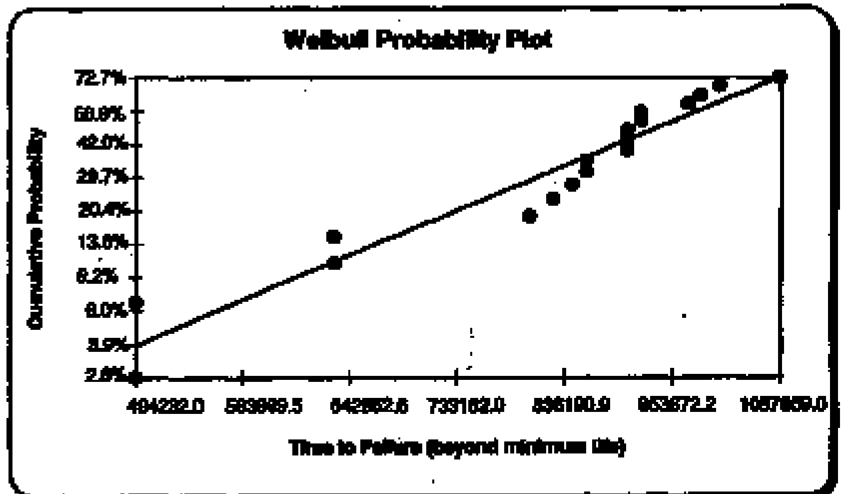
[illegible]	
[illegible]	
1131162	
1131162	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
1416250	
1416250	
[illegible]	
[illegible]	
1511725	
[illegible]	
[illegible]	■
[illegible]	●
[illegible]	●
[illegible]	■
[illegible]	■
[illegible]	●

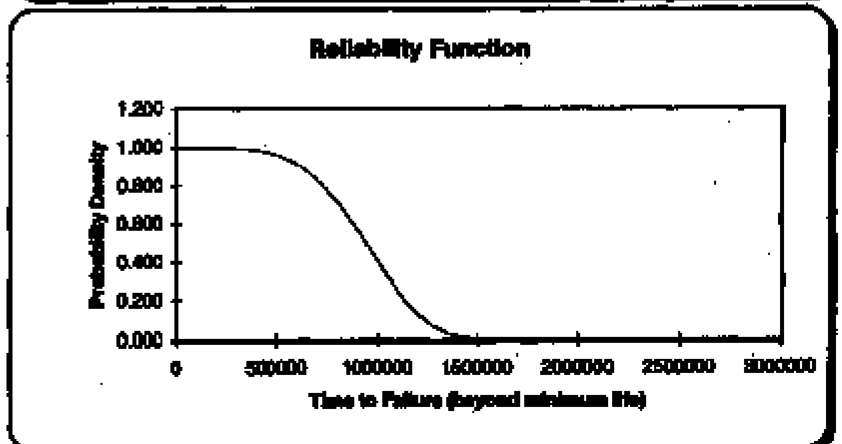
500000

[illegible]	95%

[illegible]	951555.3551

Calculated Outputs





NOTES:

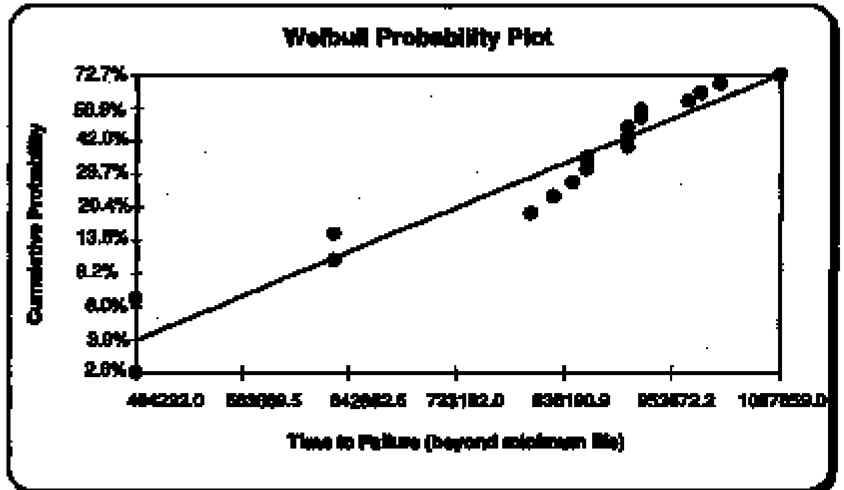
3713 7092

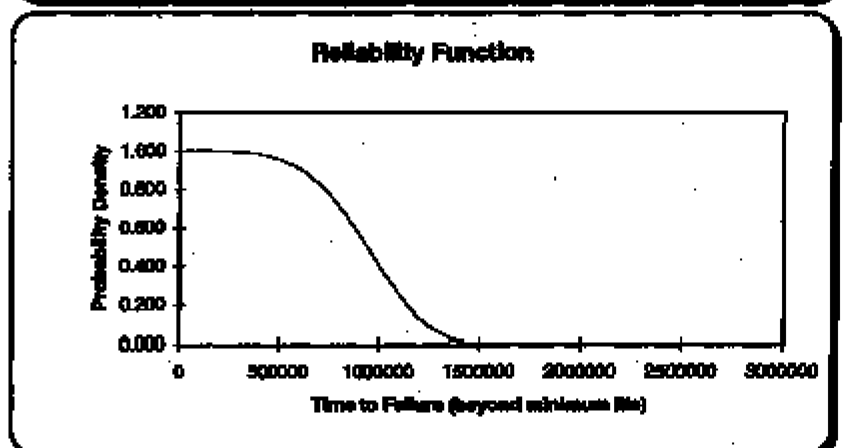
2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data or "Minimum life" input value is altered

[redacted]

594232		500000	
594232			
1131102			
1131102			
1305591		[redacted]	
1325190		1000000	41%
1344573			
1388889		[redacted]	
1388889		50%	861856.3581
1403522			
1403522			
1403522		Calculated Outputs	
1418250		[redacted]	
1418250			
1472521			
1496221			
1511728			
1567659			
1634921	s		
1634921	s		
1634921	s		
1634921	s		
1634921	s		
1698221	s		





NOTES:

3713 7093

2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data
or "Minimum life" input value is altered

[redacted]

994232	
994232	
1131102	
1131102	
1302091	
1325193	
1348873	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
1418250	
1418250	
1472521	
[illegible]	
1511728	
[illegible]	
[illegible]	s
[illegible]	s
[illegible]	s
[illegible]	s
[illegible]	s
[illegible]	s

[illegible]

[redacted]

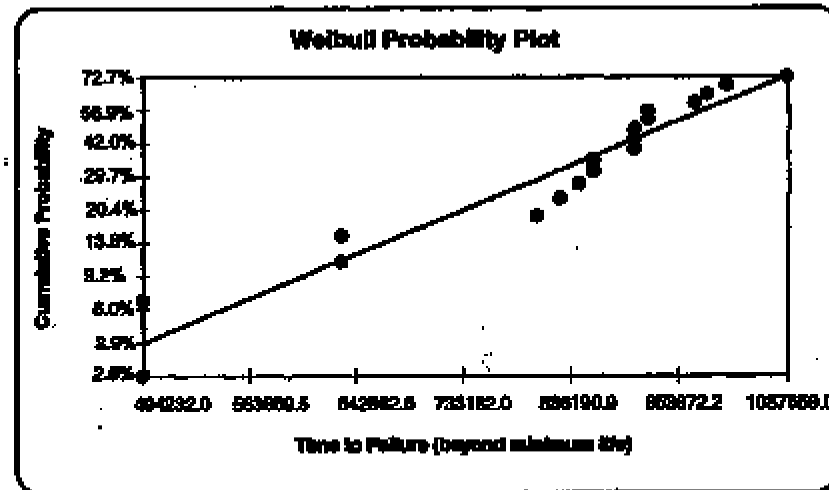
[illegible]	81%

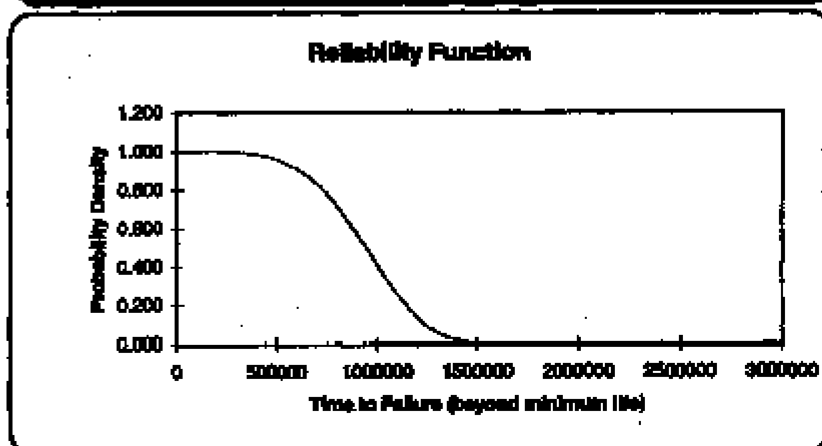
[redacted]

[illegible]	994744.3378

Calculated Outputs

[redacted]





NOTES:

3713 7094

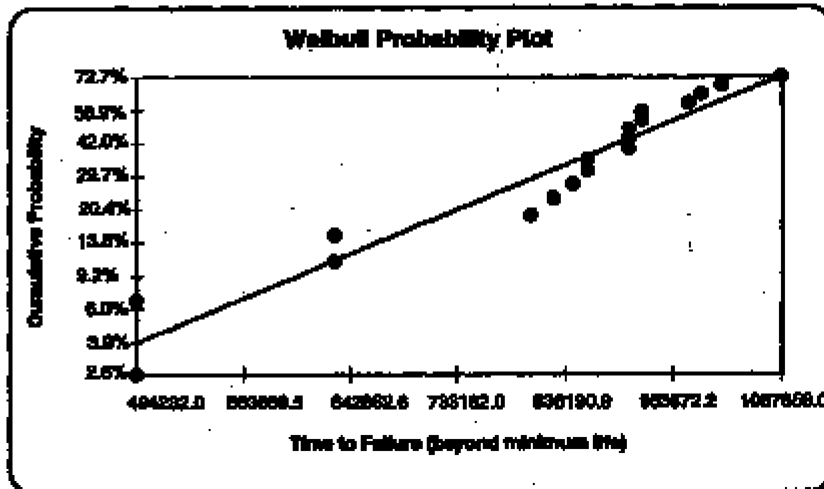
2 and 3 parameter WEIBULL FAILURE ANALYSIS

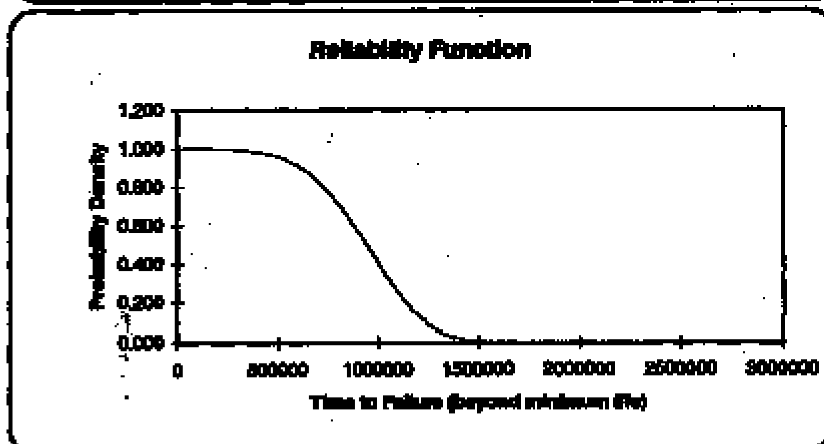
CLICK here to recalculate if failure data or "Minimum life" input value is altered

[illegible]	
[illegible]	
1131102	
1191102	
[illegible]	
1325100	
1344673	
[illegible]	
[illegible]	
1405822	
1405822	
1405822	
1418250	
1418250	
[illegible]	
[illegible]	
1611743	
[illegible]	
[illegible]	s
[illegible]	s
[illegible]	s
[illegible]	s
[illegible]	s
[illegible]	s

[illegible] 500000	
[illegible]	100%
90%	1115347.013

Calculated Outputs





NOTES:

3713 7096

2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data
or "Minimum life" input value is altered

[redacted]

[illegible]	
[illegible]	
1131102	
1131102	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	

[illegible]

[redacted]

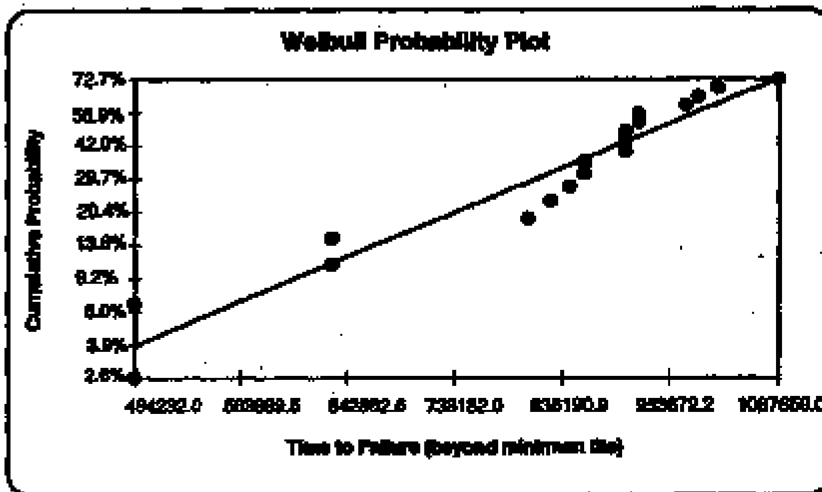
[illegible] 100%

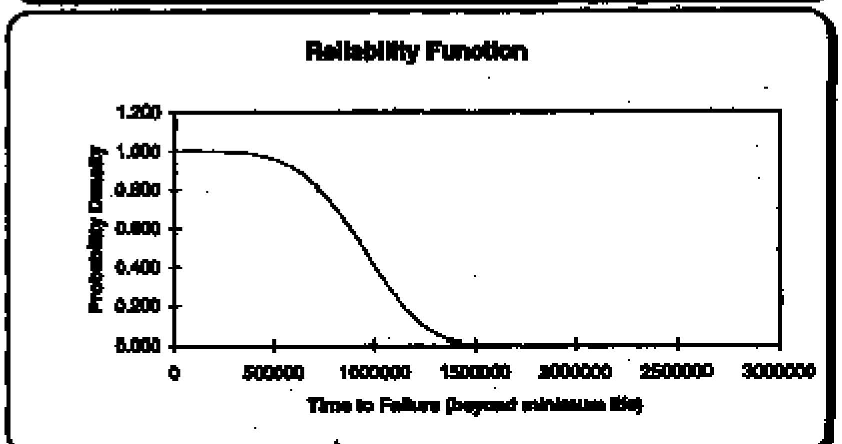
[redacted]

[illegible] 1022000.407

Calculated Outputs

[redacted]





NOTES:

3713 7096

2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data or "Minimum life" input value is altered

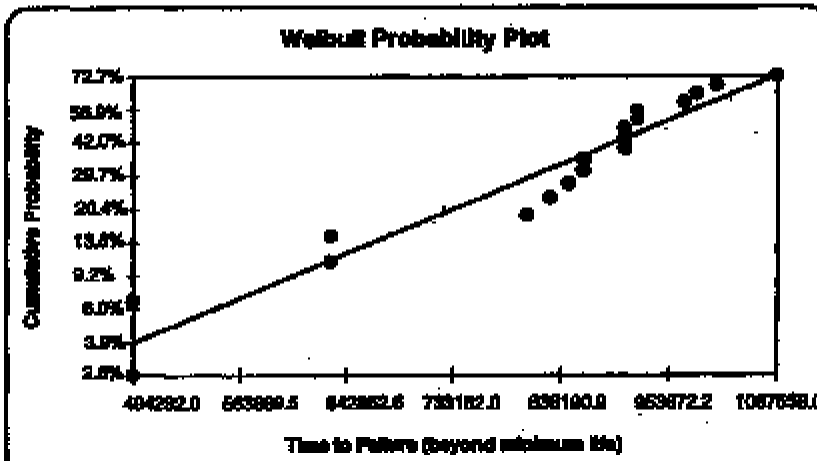
[redacted]

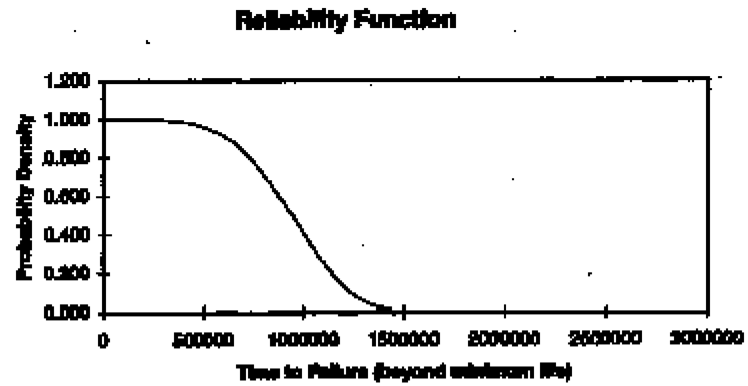
[redacted] 98%

[redacted] 908509.6814

Calculated Outputs

[redacted]





NOTES:

3713 7097

2 and 3 parameter WEIBULL FAILURE ANALYSIS

CLICK here to recalculate if failure data
or "Minimum life" input value is altered

[redacted]

[illegible]	
[illegible]	
1151102	
1151102	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	●
[illegible]	●
[illegible]	●
[illegible]	●
[illegible]	●
[illegible]	●

[redacted]

[redacted]

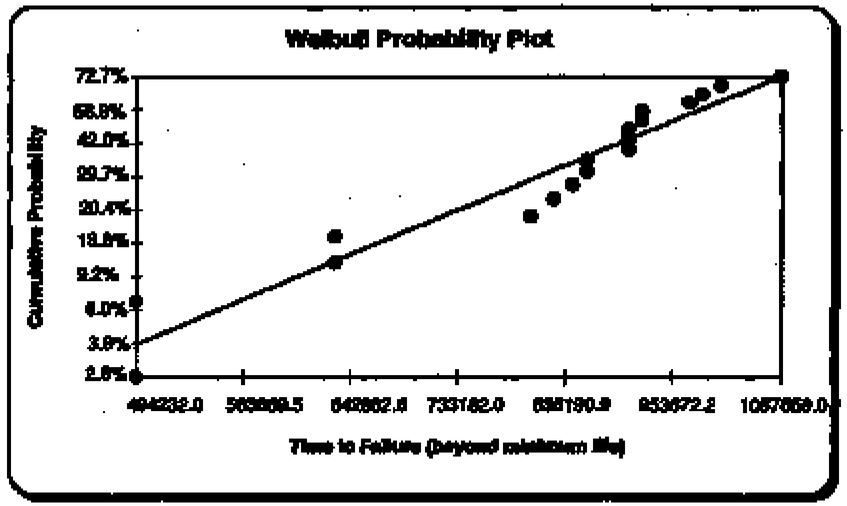
[illegible] 100%

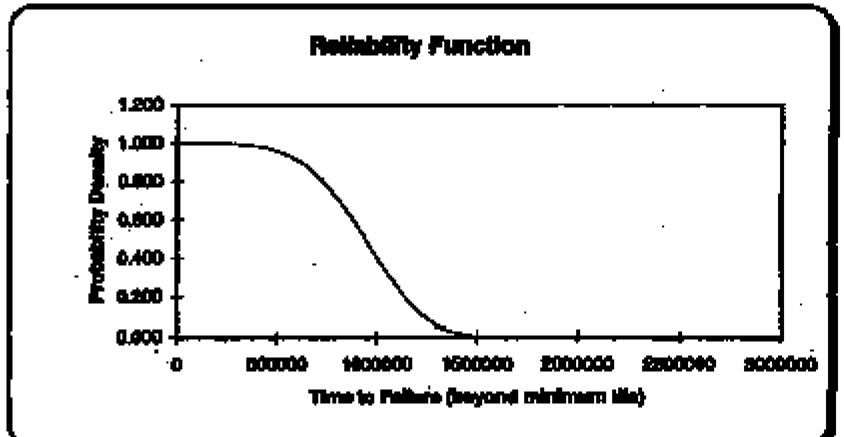
[redacted]

[illegible] 1115347.613

Calculated Outputs

[redacted]

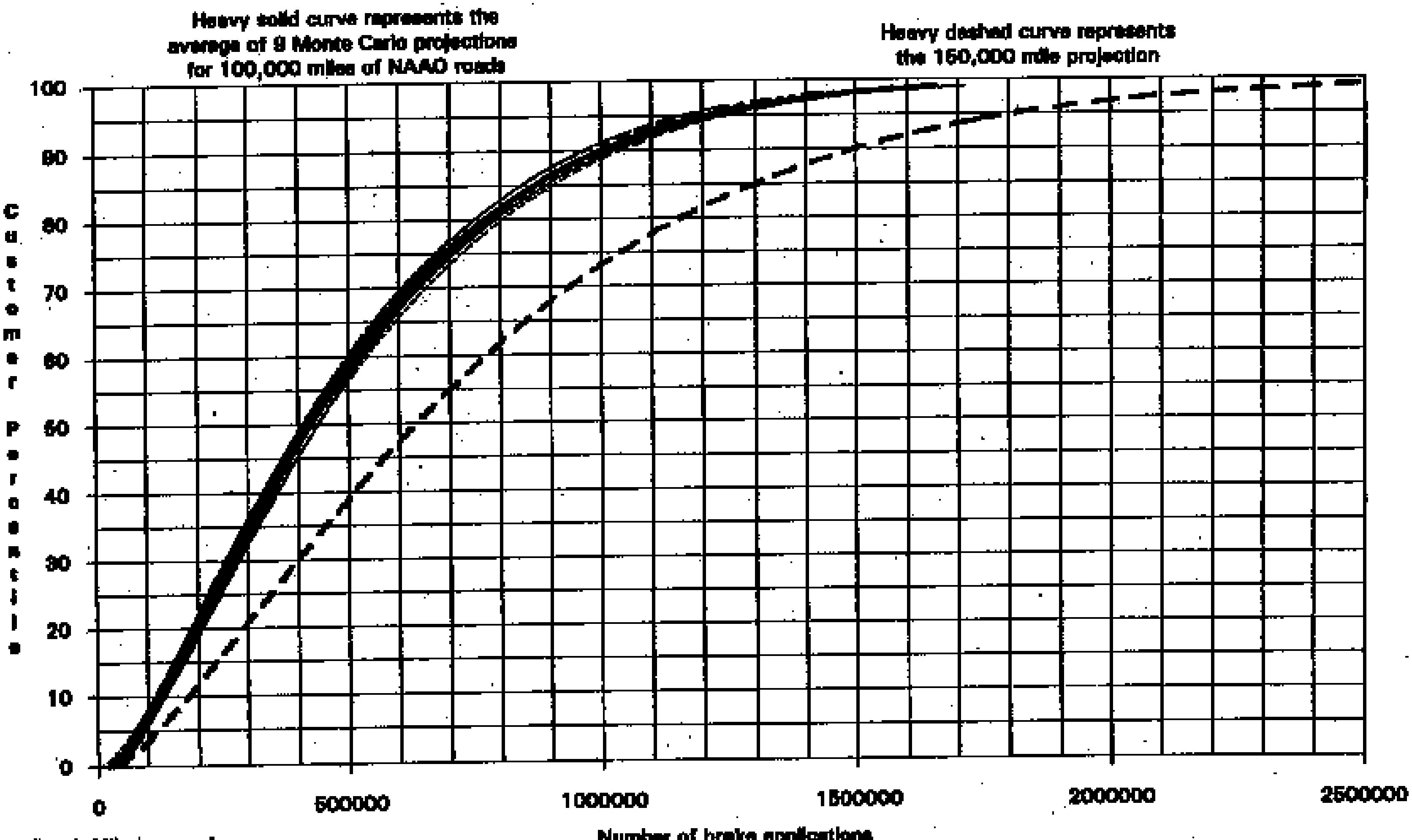




NOTES:

3713 7098

1991 Thunderbird 5.0L, AOD
NAAO Customer Usage Spectrum



Bandwidth represents variability of 9 Monte Carlo projections for 744 Thunderbird owners

AGP/RWG W37.XLC 6/6/94

3719 7099

```
*****************************************************************************
*       Note printed by NLAPOINT on 19 Apr 1999 at 15:15:08                 *
*****************************************************************************
```

From: FPORTER --DRBN007   Date and time   04/16/99 20:15:11
To: SLAROUCH--FORDNA1
cc: NLAPOINT--DRBN005   SREIMERS--DRBN007
    PKLAAS --FORDNA1

FROM: F. J. Porter   USAET(UTC -04:00)
Subject: Brake Switches

For clarification:

When you are done with the testing, do the switches from EAA show signs of a cell being formed?

Is there, or could there be, evidence of corrosion occuring on the EAA switches similar to the junkyard switches.

Regards,
Fred Porter   OV - fporter   fporter@ford.com
Chassis E/E Systems Applications   (313)845-3722
Bldg 5 - Mail Drop 5030 - Cubicle 3E004   fax: 390-4145
*** Forwarding note from SLAROUCH--FORDNA1 04/16/99 17:14 ***
To: FPORTER --FORDMAIL Porter, Fred (F.J.
cc: NLAPOINT--FORDMAIL LaPointe, Norman (PKLAAS --FORDNA1 Klaas, Pete (P.F.)
    SLAROUCH--FORDNA1 LaRouche, Steve (S

From: LaRouche, Steve (S.)
Subject: Brake Switches

Fred: I had a meeting this afternoon with two gentlemen (one was Roc Carter) from Scientific Research Laboratories to discuss brake switches. I showed them the results I have so far, and they felt that our testing was pretty comprehensive and that there was really not any more that they could contribute in terms of testing. We tried to come up with possible scenarios that would tie our findings to a cause of fire, but couldn't come up with anything. Here is a quick summary of our findings at Central Lab:

There appear to be two modes of failure occurring: One involving leakage of brake fluid through the Kapton seal and an apparent cell being set up between the contacts and steel cup. The other involving ingression of water into the switch cavity, with no brake fluid leakage, and no evidence of a cell:

The Memphis switch and all of the leakers analyzed so far show a leak path through the Kapton seals. The cup faces show transfer of the brass contact material to them which suggests that a cell has occurred between the hot contacts and the grounded cup. In addition to brake fluid, the Memphis switch shows evidence (dezincification of the brass contact) that some moisture may have also been present. We found no evidence that road salt had entered the switches.

The completely burned switches also show probable transfer of contact material to the cups, indicating a possible cell. No evidence of road salt detected. Could not determine if brake fluid leakage occurred.

Three of the junk yard switches (including the one analyzed by SRL) showed corrosion of the cups suggesting ingression of water into the switch cavities. This appears to be a different mode of failure in that there was no evidence of a cell occurring between the contacts and cup. Again, there was no evidence of road salt in the switch cavities. Although there is some damage to the Kapton seals, there appears to have been no leak path or leakage of brake fluid.

I have received two switches from the OASIS which were both leakers. Testing is pretty much complete on these switches and so far we have found nothing different from the other leakers we analyzed.

I have also received three switches from EAA which were completely burned. These switches are in various stages of analysis, but so far do not appear to be different from the completely burned switches we analyzed previously.

The brake fluids in the Memphis switch and all the leakers (including those from the OASIS) contain oxalates. The brake fluid from the car you have cut at MPG does not. The guys from SRL suggested that we analyze brake fluids from old vehicles for oxalates and other contaminants, as well as measure conductivity. So far, we have received no brake fluid samples for this.

This is what we have so far: We have found several conditions which may have contributed to a fire, but have not been able to link any of them to a definate cause. I don't think that additional testing on switches is going to be beneficial. I would like to complete the testing that is in progress and wrap this up. Let me know how you want us to proceed.

Steve LaRouche (SLAROUCH)
Metallurgy Section, Central Laboratory, Room N410
(313) 845-4876 (313) 322-1614 FAX

```
**************************************************************************
*         Note printed by NLAPOINT on 14 Apr 1999 at 09:02:14           *
**************************************************************************
```

From: SLAROUCH--FORDMA1   Date and time   03/18/99 16:59:33
To: NLAPOINT--FORDMAIL LaPointe, Norman (

From: LaRoucha, Steve (S.)
Subject: FW: Brake Switch Analysis - Junk Yard Part

Steve LaRoucha   (SLAROUCH)
Metallurgy Section, Central Laboratory, Room N410
(313) 845-4876   (313) 322-1614 FAX

-----Original Message-----
From: Shaun Mccarthy mailto:smccart3@gw.ford.com
Sent: Thursday, March 18, 1999 3:47 PM
To: fporter@gw.ford.com
Cc: smccart3@gw.ford.com; slarouch@mail.ford.com; rcarter@pobox.srl.ford.com
Subject: Brake Switch Analysis - Junk Yard Part

We have disassembled the switch you gave me that showed corrosion inside the switch area. Inorganic analysis of the material has been completed. The reddish material is FeO(OH) and the whitish material is 2ZnCO3-3Zn(OH)2. Extensive photos have been taken through out the disassembly. Our conclusion by examining the path or location of corrosion is that fluid entered through the connector area for this sample.
We would be glad to meet with you and show you the photos and discuss our conclusions.
Analysis is still underway regarding the material from the "Memphis" switch.

Regards,
SHAUN McCarthy__SRL Room 1339 Mail Stop 1170
32-21358 FAX 32-31129

Data Log
Brake Pressure Switch

Log Updated 3/30/1999

Sw ID	Sw Date Code	Vehicle	VIN	Event	Mileage	Term-Hsgport Resistance	Leaker?	Kapton #1	Kapton #2	Kapton #3	Present Status	Parts Received
Memphis	2089	Town Car	PY [redacted]	Sw. Fire				crack	crack	crack	Analysis Complete	
A	2281	Town Car	PY [redacted]	Underhood Fire				no info	no info	no info	Analysis Complete	
B	2114	Town Car	NY [redacted]	Underhood Fire							Sw. not available	
C	2903	Town Car	NY [redacted]	Underhood Fire							Analysis in Progress	
D		Crown Vic Police Car	VX [redacted]	Codes Insp		4.0MEGAOHMS	yes	crack	crack	crack	Analysis Complete	
E	2157	Town Car	NX [redacted]	Reference		OPEN	no	worn, no crack	worn, no crack	worn, no crack	Analysis Complete	
F	2185	Town Car	NY [redacted]	Codes Insp		4MEGAOHM	yes	crack	crack	crack	Analysis Complete	
1	2906	Town Car	NX [redacted]	Reference	79184	OPEN						
2	3016	Town Car	PY [redacted]	Reference	71387	OPEN						
4	2048	Town Car	PY [redacted]	Reference	80087	OPEN						
5	2864	Town Car	PY [redacted]	Reference	68549						Analysis in Progress	
6	3026	Town Car	PY [redacted]	Reference	47325						Analysis in Progress	
7	2059	Town Car	NX [redacted]	Reference	88022	OPEN						
8	3025	Town Car	PX [redacted]	Reference	88814	OPEN						
9	2250	Town Car	PX [redacted]	Reference	??	OPEN						
10	2281	Town Car	PY [redacted]	Reference	86224	OPEN						
11	3028	Town Car	PY [redacted]	Reference	81588	OPEN						
12	2259	Town Car	PX [redacted]	Reference	68080	OPEN						
13	2980	Town Car	NY [redacted]	Reference	83237	OPEN						
14	2871	Town Car	PX [redacted]	Reference	84145	OPEN						
15	2881	Town Car	PY [redacted]	Reference	??	OPEN						
16	??	Town Car	BY [redacted]	Reference	87039	OPEN						
17	??	Town Car	PY [redacted]	Reference	72114	OPEN						
18	2329	Town Car	PY [redacted]	Reference		OPEN						
19	??	Town Car	PY [redacted]	Reference	87549	OPEN						
20	??	Town Car	PY [redacted]	Reference	42821	OPEN						
21	??	Town Car	PX [redacted]	Reference	43831	OPEN						
22	2274	??	?? [redacted]	Reference	??							
23	??	Town Car	PX [redacted]	Reference	88942	OPEN						
From TX trip of 2/10 to 2/12, John McInerney Group												
1	2028	Town Car	PY [redacted]	Reference								
2	2053	Crown Vic Police Car	PX [redacted]	Reference	100989							
3	2886	Grand Marquis	RX [redacted]	Reference	??							
4	3025	Crown Vic	PX [redacted]	Reference	48842							
5	2053	Town Car	PY [redacted]	Reference	73115							
6	??	Town Car	NY [redacted]	Underhood Fire	??							
7	3081	Town Car	PY [redacted]	Reference	??							

Steve Reimers, 313 39 03293,
sreimers@ford.com,
file SwitchLog.xls

printed 04/07/1999 1:08 PM
uncontrolled document

revised 2/15/99

3713 7103

Data Log
Brake Pressure Switch

8	3046	Town Car	[redacted]	Underhood Fire	106810						
9	3096	Town Car	[redacted]	Reference	??						
10	2272	Crown Vic	[redacted]	Reference	72814						
11	2116	Town Car	[redacted]	Reference	??						
12	3065	Town Car	[redacted]	Reference	??						
13	3069	Town Car	[redacted]	Reference	106048						
OASIS											
Baton Rouge, LA	3062	Town Car	[redacted]	Dealership Return	65003	yes	crack	crack	crack	Analysis in Progress	Switch
Memphis, TN	2128	Town Car	[redacted]	Dealership Return	158606	yes	crack	crack	crack	Analysis in Progress	Switch
EAA											
Davenport, FL	2080	Town Car	[redacted]	Underhood Fire	100000+	?				Analysis in Progress	Switch
Aurora, IL	2089	Town Car	[redacted]	Underhood Fire	?	?				Analysis in Progress	Switch, #12 15A Fuse
Naples, FL	?	Lincoln	[redacted]	Underhood Fire	79926	?	crack	crack	crack		Brake Fluid Only

3713 7104

C = CO[illegible]
NA = NOT APPLICABLE
TBP = TO BE PERFORMED

Brake Switch Tes[illegible]cklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLB = NOT REC'D AT CEN. LAB.

		[illegible]	A	B	C	D	E	F	I
		P[redacted]	P[redacted]	NY[redacted]	NY[redacted]	VA[redacted]	NA[redacted]	NY[redacted]	NK[redacted]
Field Info	1 [illegible]	C	C	C	C	C	C	C	C
	Condition	FIRE	FIRE	FIRE	FIRE	BF LEAK	NO FIRE/LEAK	BF LEAK	NO FIRE/LEAK
	2 Photograph Switch	C	C	C	C	C	C	C	NP
	3 [illegible]	C	C	C	C	C	C	C	C
	4 [illegible]	C	NA	NA	NA	NA	NA	NA	NA
	[illegible]	C	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	5 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	6 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	7 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	8 [illegible]	C	NA	NA	C	NA	NA	NA	NA
Connector - Only	9 [illegible]	C	NA	NA	C	NA	NA	NA	NA
	10 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	[redacted]								
	12 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	13 [illegible]	C	NA	NA	NA	NA	NA	NA	NA
	14 [illegible]	C	NA	NA	NA	NA	NA	NA	NA
	15 [illegible]	C	NA	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16 [illegible]	NA	NA	NA	NA	NA	NA	NA	C
	17 [illegible]	NA	NA	NA	NA	6.4	0.2	NP	0.3
	18 [illegible]	NA	NA	NA	NA	4.[illegible]M	INF	2M	INF
	19 [illegible]	NA	NA	NA	NA	NP	NP	NP	INF
	20 [illegible]	NA	NA	NA	NA	1.1	[illegible]	NP	[illegible]
	[redacted]								
Switch External Pressurized	24 Switch Opening Pressure	NA	NA	NA	NA	NA	NA	NA	[illegible]
	25 Switch Closing Pressure	NA	NA	NA	NA	NA	NA	NA	[illegible]
	26 Proof Test for Leakage	NA	NA	NA	NA	NA	NA	NA	NO LEAK
	27 [illegible]	NA	NA	NA	NA	NA	NA	NA	C
	[redacted]	NA	NA	NA	NA	NA	NA	NA	INF
		NA	NA	NA	NA	NA	NA	NA	INF
		NA	NA	NA	NA	NA	NA	NA	INF
		NA	NA	NA	NA	NA	NA	NA	INF
Switch	28 [illegible]	C	C	NP	C	C	C	C	NP
	29 [illegible]	C	C	NP	C	C	C	C	NP
	30 Remove cap	C	C	NP	C	C	C	C	NP
	31 [illegible]	C	C	NP	C	C	C	C	NP
Techniques	32 [illegible]	C	C	NP	C	C	C	C	NP
	33 [illegible]	C	C	C	C	C	C	C	NP
	34 [illegible]	C	NA	NP	C	C	C	C	NP
	[illegible]	C	NA	NP	C	C	C	C	NP

3713 7105

C = CO[illegible]TE
NA = NOT APPLICABLE
TBP = TO BE PERFORMED

Brake Switch Te[illegible]ecklist

INF = INFINITY (OPE[illegible]
NP = NOT PERFORMED
NRCLS = NOT REQ'D AT CEN LAB

			3	4	5	6	7	8	9	10
			PY[redacted]	PY[redacted]	PY[redacted]	P[redacted]	XX[redacted]	PX[redacted]	PX[redacted]	PY[redacted]
Field Info	1	[illegible]	C	C	C	C	C	C	C	C
		[illegible]	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK
	2	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP
	3	[illegible]	C	C	C	C	C	C	C	C
	4	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
		[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	5	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	6	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	7	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	8	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
Connector Only	9	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	10	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	[redacted]									
	12	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	13	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	14	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	15	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16	[illegible]	C	C	NA	NA	C	C	C	C
	17	[illegible]	[illegible]	0.3	NA	NA	0.2	0.2	0.2	2.2
	18	[illegible]	INF	INF	NA	NA	INF	INF	INF	INF
	19	[illegible]	INF	INF	NA	NA	INF	INF	INF	INF
	20	[illegible]	11.4	[illegible]	NA	NA	[illegible]	[illegible]	[illegible]	[illegible]
	[redacted]									
Switch External Pressurized	24	[illegible]	134	180	NA	NA	147	[illegible]	140	[illegible]
	25	[illegible]	[illegible]	[illegible]	NA	NA	70	[illegible]	112	[illegible]
	26	[illegible]	NO LEAK	NO LEAK	NA	NA	NO LEAK	NO LEAK	NO LEAK	NO LEAK
	27	[illegible]	C	C	NA	NA	C	C	C	C
	[redacted]		INF	INF	NA	NA	INF	INF	INF	INF
			INF	INF	NA	NA	INF	INF	INF	INF
			INF	INF	NA	NA	INF	INF	INF	INF
			INF	INF	NA	NA	INF	INF	INF	INF
Switch	28	[illegible]	NP	NP	C	C	NP	NP	NP	NP
	29	[illegible]	NP	NP	C	C	NP	NP	NP	NP
	30	[illegible]	NP	NP	C	C	NP	NP	NP	NP
	31	[illegible]	NP	NP	C	C	NP	NP	NP	NP
Techniques	31	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP
	32	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP
	33	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP
		[illegible]	NP	NP	NP	NP	NP	NP	NP	NP

C = COMPLETE
NA = NOT APPLICABLE
TBP = TO BE PERFORMED

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT REQ'D AT CEN. LAB

			11	12	13	14	15	16	17	18
			PY[redacted]	P[redacted]	N[redacted]	PA[redacted]	PY[redacted]	B[redacted]	PY[redacted]	P[redacted]
Field Info	1	Log Field Info into Switch Log	C	C	C	C	C	C	C	C
		Condition	NO FIRE/LEAK	[redacted]						
	2	Photograph Switch	NP							
	3	Record any unusual external observations	C							
	4	[illegible]	NA							
		[illegible]	NA							
Switch + Connector Assembly	5	[illegible]	NA							
	6	[illegible]	NA							
	7	[illegible]	NA							
	8	Separate Connector from Switch	NA							
Connector Only	9	[illegible]	NA							
	10	[illegible]	NA							
	[redacted]									
	12	Check for full engagement of connector	NA							
	13	Check wire insulation	NA							
	14	Check wire gray seals	NA							
	15	Cut wire insulation to check for corrosion	NA							
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	C							
	17	Spring Terminal to Stationary Terminal Resistance	0.2							
	18	Spring Terminal to Hexport Resistance	INF							
	19	Stationary Terminal to Hexport Resistance	INF							
	20	Base to Hexport Resistance	INF							
	[redacted]									
Switch External Pressurized	24	Switch Opening Pressure	[illegible]							
	25	Switch Closing Pressure	71							
	26	Proof Test for Leakage	NO LEAK							
	27	Repeat Steps 17 through 20 at [illegible] psig	C							
	[redacted]		INF							
			INF							
			INF							
			INF							
Switch	28	[illegible]	NP							
	29	[illegible] Photograph	NP							
	30	Remove cap	NP							
	31	[illegible] Photograph	NP							
Techniques	31	SEM-EDS [illegible]	NP							
	32	SEM-EDS [illegible]	NP							
	33	[illegible] analysis of contacts	NP							
		[illegible]	NP							

			19	20	21	22	23	1	2	3
			P1[redacted]	P1[redacted]	P2[redacted]	77	P2[redacted]	P[redacted]	P2[redacted]	F3[redacted]
Field Info	1	Log Field Info into Switch [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
		Question	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK
	2	Photograph Switch	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	3	Record any unusual external visual observations	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	4	Check for Connector engagement	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C.	C
		X-ray if appropriate	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NA	C	NA
Switch + Connector Assembly	5	Wire 1[illegible] Wire 2[illegible] Resistance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	0.8	0.4	0.2
	6	Wire 1[illegible] to Hexport Resistance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	7	Wire 2[illegible] to Hexport Resistance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	8	Separate Harness from Switch	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
Connector Only	9	Verify Connector Seal	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	10	Wire 1[illegible] to Wire 2[illegible] resistance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	12	Check for full engagement of connector	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	13	Check wire insulation	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	14	Check wire-gasket seals	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	15	Cut [illegible] to check for corrosion	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	TBP	TBP	TBP
Switch External Unpressurized	16	Secure the Switch in Calibration Stand	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	17	Spring Terminal to stationary Terminal Resistance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	0.8	0.1	0.2
	18	Spring Terminal to Hexport Resistance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	19	Stationary Terminal to Hexport resistance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	20	Base to Hexport Resistance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	0.8	INF	17.7K
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Switch External Pressurized	24	Switch Opening Pressure	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	156	157	139
	25	Switch Closing Pressure	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	68	62	64
	26	[illegible] Test for Leakage	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	0.1	INF
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
Switch	28	Remove [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	29	Examine exposed surfaces, Photograph	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	30	Remove cap	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	31	Examine exposed surfaces, Photograph	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
Techniques	34	SEM-EDX, FTIR [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	32	SEM-EDX, FTIR e.g. [illegible], etc.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	33	Metallographic analysis of contacts.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	NP	NP
		Look for evidence of [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP

C = C[illegible]E
NA = NOT APPLICABLE
TBP = TO BE PERFORMED

Brake Switch Te[illegible]ecklist

INF = INFINITY (OPEN[illegible]
NP = NOT PERFORMED
NRCLS = NOT REC'D AT CEN. LAB.

		4	5	6	7	8	9	10	11
		PA[redacted]	PY[redacted]	NY[redacted]	PY[redacted]	NY[redacted]	PY[redacted]	PA[redacted]	NY[redacted]
Field Info	1 [illegible]	C	C	C	C	C	C	C	C
	Duration	NO FIRE/LEAK	NO FIRE/LEAK	FIRE	NO FIRE/LEAK	FIRE	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK
	2 [illegible]	C	C	C	C	C	C	C	C
	3 [illegible]	C	C	C	C	C	C	C	C
	4 [illegible]	C	C	NA	C	NA	C	NA	C
	[illegible]	C	NA	NA	NA	NA	C	NA	NA
Switch + Connector Assembly	5 [illegible]	NP	0.2	NA	INF	NA	2	8.4	NP
	6 [illegible]	NP	INF	NA	INF	NA	6.0M	INF	NP
	7 [illegible]	NP	INF	NA	INF	NA	6.1M	INF	NP
	8 [illegible]	C	C	NA	C	NA	C	C	C
Connector Only	9 [illegible]	C	C	NA	C	NA	C	C	C
	10 [illegible]	NP		NA	INF	NA	INF	INF	NP
[redacted]									
	12 [illegible]	C	C	NA	C	NA	C	C	C
	13 [illegible]	C	C	NA	C	NA	C	C	C
	14 [illegible]	C	C	NA	C	NA	C	C	C
	15 [illegible]	TBP	TBP	NA	TBP	NA	TBP	TBP	TBP
Switch External Unpressurized	16 [illegible]	C	C	NA	C	NA	C	C	C
	17 [illegible]	0.1	0.2	NA	0.3	NA	1.8	8.4	0.1
	18 [illegible]	INF	INF	NA	INF	NA	6.3M	INF	INF
	19 [illegible]	INF	INF	NA	INF	NA	6.4M	INF	INF
	20 [illegible]	INF	180K	NA	480K	NA	0.4	8.5	INF
[redacted]									
Switch External Pressurized	24 Switch Opening Pressure	139	151	NA	135	NA	164	139	139
	25 Switch Closing Pressure	69	62	NA	66	NA	69	108	74
	26 Final Test for Leakage	NO LEAK	NO LEAK	NA	NO LEAK	NA	NO LEAK	NO LEAK	NO LEAK
	27 [illegible]	C	C	NA	C	NA	C	C	C
	[redacted]	INF	INF	NA	INF	NA	4.1	INF	INF
		INF	INF	NA	INF	NA	~670K	INF	INF
		INF	INF	NA	INF	NA	~670K	INF	INF
		INF	INF	NA	INF	NA	INF	INF	INF
Switch	28 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	29 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	30 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	31 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
Techniques	31 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	32 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	33 [illegible]	NP	NP	NP	NP	NP	NP	NP	NP
	[illegible]	NP	NP	NP	NP	NP	C	NP	NP

C = COMPLETE
NA = NOT APPLICABLE
TBP = TO BE PERFORMED

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT REC'D AT CEN. LAB.

			12	12	OASIS	OASIS	EAA	EAA	EAA	
			P[redacted]	P[redacted]	N[redacted]	P[redacted]	P[redacted]	N[redacted]	N[redacted]	
Field Info	1	[illegible]	C	C	C	C	C	C	C	
		[illegible]	NO FIRE/LEAK	NO FIRE/LEAK	BF LEAK	BF LEAK	FIRE	FIRE	FIRE	
	2	[illegible]	C	C	C	C	C	C	NA	
	3	[illegible]	C	C	C	C	C	C	NA	
	4	[illegible]	C	C	NA	NA	NA	NA	NA	
		[illegible]	C	NA	NA	NA	NA	NA	NA	
Switch + Connector Assembly	5	[illegible]	0.3	[illegible]	NA	NA	NA	NA	NA	
	6	[illegible]	20.2M	INF	NA	NA	NA	NA	NA	
	7	[illegible]	21.5M	INF	NA	NA	NA	NA	NA	
	8	[illegible]	C	C	NA	NA	NA	NA	NA	
Connector Only	9	[illegible]	C	C	NA	NA	NA	NA	NA	
	10	[illegible]	INF	INF	NA	NA	NA	NA	NA	
[redacted]										
	12	[illegible]	C	C	NA	NA	NA	NA	NA	
	13	[illegible]	C	C	NA	NA	NA	NA	NA	
	14	[illegible]	C	C	NA	NA	NA	NA	NA	
	15	[illegible]	TBP	TBP	NA	NA	NA	NA	NA	
Switch External Unpressurized	16	[illegible]	C	C	C	C	NA	NA	NA	
	17	[illegible]	[illegible]	4.2	[illegible]	>100K	NA	NA	NA	
	18	[illegible]	[illegible]	INF	[illegible]	>17K	NA	NA	NA	
	19	[illegible]	[illegible]	INF	>300K	>120K	NA	NA	NA	
	20	[illegible]	[illegible]	[illegible]	INF	INF	NA	NA	NA	
[redacted]										
Switch External Pressurized	24	[illegible]	140	180	152	NO SOUND	NA	NA	NA	
	25	[illegible]	[illegible]	70	[illegible]	NO SOUND	NA	NA	NA	
	26	[illegible]	NO LEAK	NO LEAK	NO LEAK	NO LEAK	NA	NA	NA	
	27	[illegible]	C	C	C	C	NA	NA	NA	
	[redacted]		4.1	INF	>1.0M	[illegible]	NA	NA	NA	
			INF	INF	[illegible]	[illegible]	NA	NA	NA	
			INF	INF	[illegible]	[illegible]	NA	NA	NA	
			INF	INF	INF	INF	NA	NA	NA	
Switch	28	[illegible]	SCI LAB	NP	C	C	TBP	TBP	NA	
	29	[illegible]	SCI LAB	NP	C	C	TBP	TBP	NA	
	30	[illegible]	SCI LAB	NP	C	C	TBP	TBP	NA	
	31	[illegible]	SCI LAB	NP	C	C	TBP	TBP	NA	
Techniques	[illegible]	[illegible]	SCI LAB	NP	TBP	TBP	TBP	TBP	NA	
	[illegible]	[illegible]	SCI LAB	NP	TBP	TBP	TBP	TBP	NA	
	[illegible]	[illegible]	SCI LAB	NP	TBP	TBP	TBP	TBP	NA	
		[illegible]	SCI LAB	NP	TBP	TBP	TBP	TBP	NA	

C = COMPLETE
NA = NOT APPLICABLE
TBP = TO BE PERFORMED

Brake Switch Test Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT REC'D AT CEN. LAB.

Field Info	1	Log Field Info into Switch Log-in								
	2	Photograph Switch								
	3	Record any unusual external visual observations								
	4	[illegible] Connector engagement								
	5	X-ray if appropriate								
Switch + Connector Assembly	6	[illegible] Resistance								
	6	[illegible] Resistance								
	7	[illegible] Resistance								
	8	Remove Harness from Switch								
Connector Only	9	Verify Connector Seal								
	10	[illegible] resistance								
[redacted]										
	12	Check and mark typical engagement of connector								
	13	Check wire insulation								
	14	Check wire grip marks								
	15	Cut wire insulation [illegible]								
Switch External Unpressurized	16	Assemble Switch in Calibration Stand								
	17	Spring Terminal to Stationary Terminal Resistance								
	18	Spring Terminal to Hexport Resistance								
	19	Stationary Terminal to Hexport resistance								
	20	Case to Hexport Resistance								
[redacted]										
Switch External Pressurized	24	Switch Opening Pressure								
	25	Switch Closing Pressure								
	26	Proof Test for Leakage								
	27	Repeat Steps 17 through 20 at test [illegible]								
[redacted]										
Switch	28	Remove aluminum crimp ring								
	29	Examine [illegible]. Photograph								
	30	Remove cap								
	31	Examine [illegible]. Photograph								
Techniques	32	[illegible] FTIR [illegible]								
	33	[illegible] FTIR [illegible], etc.								
	33	Metallographic analysis of [illegible]								
		Look for evidence of corrosion or arcing								

3713 7111

Evaluation Process
Brake Pressure switch / Harness

Brake Pressure Switch   Plan Updated 2/18/99
Evaluation Plan for Field Returns.

Sw #		Date of update	
Mileage		Sw Date Code	
Sw P/N			

Category	Step #	Action	Notes/Data	Comments
Field Info	1	Log Field Info into Switch Logude		
	2	Photograph Switch		
	3	Record any unusual external visual observations		
	4	Check for Connector engagement		If not correct conduct X-Ray to determine fit-up between base lip and red seal
Switch + Connector Assembly	5	Wire 1(LG/R) to Wire 2(ORANGE) Resistance		
	6	Wire 1(LG/R) to Hexport Resistance		
	7	Wire 2(ORANGE) to Hexport Resistance		
	8	Separate Harness from Switch		
Connector Only	9	Verify Connector Seal		Visual check of Red Seal, Dirt lines, Indentation mark.. Indentation mark must be 360 degrees.
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance		
	11	Current Leakage Wire 1(LG/R) to Wire 2(ORANGE)		
	12	Check for full engagement of connector		Visual check of dirt lines on mated switch base
	13	Check wire insulation		
	14	Check wire gray seals		
	15	Cut wire insulation to check for corrosion		Cut insulation longitudinally to check for wicking along wires. If signs of corrosion, identify color, save samples for chem Ld.
Switch External Unpressurized	16	Assemble Switch to Calibration Stand		
	17	Spring Terminal to Stationary Terminal Resistance		Stationary Terminal is closest to the outside connector keying tab.
	18	Spring Terminal to Hexport Resistance		
	19	Stationary Terminal to Hexport resistance		
	20	Base to Hexport Resistance		
	21	Current Leakage Spring Terminal to Hexport		

Steve Reimers, 313 390 2295,
sreimers@ford.com
file evalproc.xls

printed 02/19/1999 4:55 PM
uncontrolled document

original 2/16/99
revised tbd

Evaluation Process
Brake Pressure switch / Harness

	22 Current Leakage Stationary Terminal to Hexport	
	23 Voltage drop at 750 mA	
Switch External Pressurized	24 Switch Opening Pressure	Do not perform on parts from underhood fires, as may disturb diaphragm/other condition
	25 Switch Closing Pressure	Do not perform on parts from underhood fires, as may disturb diaphragm/other condition
	26 Proof Test for Leakage	Do not perform on parts from underhood fires, as may disturb diaphragm/other condition
	27 Repeat Steps 17 through 23 at 150 psig	
Switch Internal	Procedure to remove aluminum crimp ring	
	Use aluminum foil (or plastic if Ford prefers) to mask the analysis surface.	
	Also create a paper/tape shield to further reduce chance of contamination during cutting of crimp ring.	
	Place a piece of tape over the area to be cut.	
	Cut crimp ring using jewelers saw or Dremel cutoff wheel	
	Cut corners of ring at 180 degree orientation	
	Unfold crimp ring	
	Optically examine revealed surfaces. Take optical photographs (Digital camera with macro lens plus instant microphotography) and document observations where appropriate.	
	Inside surface of crimp ring.	
	Seal area and underside of base	
	Top of cup	
Analytical Techniques SEM/EDX/IR	Assess Need for Analytical Techniques	
	Start SEM-EDX (Scanning Electron Microscope with Energy Dispersive Analysis of X-rays) analysis on the inside of the ring and on various surfaces of the plastic base.	
	Reprotect the top surface and remove the cup	
	Optically document all revealed surfaces starting with cup.	
	Meanwhile, start SEM-EDX analysis on top side of cup. . Particularly look for evidence of corrosion or arcing	
	Particularly focus in on the edges of the ceramic pin guide and on the indented ring that lines up with interior wall of the switch cavity	
	Particularly look for evidence of corrosion or arcing	
	Decide if we should try to flake off any of the overlying debris to try to examine the underlying metal surface.	
	Proceed to perform SEM-EDX analysis on other component surfaces revealed by removal of cup.	
Data Entry	Log All data from this sheet into Switch Log	
	Photographs, Elemental maps etc must be retained and referenced by Switch #	

3713 7113

Evaluation Process
Brake Pressure switch / Harness

Brake Pressure Switch Plan Updated 2/18/99
Evaluation Plan for Field Returns

Sw #		Date of update	
Mileage		Sw Date Code	
Sw P/N			

Category	Step #	Action	Notes/Date	Comments
Field Info	1	Log Field Info into Switch Log.xls		
	2	Photograph Switch		
	3	Record any unusual external visual observations		
	4	Check for Connector engagement		If not correct conduct X-Ray to determine fit-up between base lip and red seal
Switch + Connector Assembly	5	Wire 1(LG/R)to Wire 2(ORANGE) Resistance		
	6	Wire 1(LG/R) to Hexport Resistance		
	7	Wire 2(ORANGE) to Hexport Resistance		
	8	Separate Harness from Switch		
Connector Only	9	Verify Connector Seal		Visual check of Red Seal, Dirt lines, Indentation mark.. Indentation mark must be 360 degrees.
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance		
	11	Current Leakage Wire 1(LG/R) to Wire 2(ORANGE)		
	12	Check for full engagement of connector		Visual check of dirt lines on mated switch base
	13	Check wire insulation		
	14	Check wire gray seals		
	15	Cut wire insulation to check for corrosion		Cut insulation longitudinally to check for wicking along wires. If signs of corrosion, identify color, save samples for chem I.d.
Switch External Unprocessed	16	Assemble Switch to Calibration Stand		
	17	Spring Terminal to Stationary Terminal Resistance		Stationary Terminal is closest to the outside connector keying tab.
	18	Spring Terminal to Hexport Resistance		
	19	Stationary Terminal to Hexport resistance		
	20	Base to Hexport Resistance		
	21	Current Leakage Spring Terminal to Hexport		

Steve Reimers, 313 390 3285,
sreimers@ford.com

Evaluation Process
Brake Pressure switch / Harness

	22 Current Leakage Stationary Terminal to Harport	
	23 Voltage drop at 750 mA	
Switch External Pressurized	24 Switch Opening Pressure	Do not perform on parts from underhood fires, as may disturb diaphragm/other condition
	25 Switch Closing Pressure	Do not perform on parts from underhood fires, as may disturb diaphragm/other condition
	26 Proof Test for Leakage	Do not perform on parts from underhood fires, as may disturb diaphragm/other condition
	27 Repeat Steps 17 through 23 at 180 psig	
Switch Internal	Procedure to remove aluminum crimp ring	
	Use aluminum foil (or plastic if Ford prefers) to mask the analysis surface.	
	Also create a paper/tape shield to further reduce chance of contamination during cutting of crimp ring.	
	Place a piece of tape over the area to be cut.	
	Cut crimp ring using jewelers saw or Dremel cutoff wheel	
	Cut corners of ring at 180 degree orientation	
	Unfold crimp ring	
	Optically examine revealed surfaces. Take optical photographs (Digital camera with macro lens plus instant microphotography) and document observations where appropriate.	
	Inside surface of crimp ring.	
	Seal area and underside of base	
	Top of cup	
Analytical Techniques SEM/EDX/IR	Assess Need for Analytical Techniques	
	Start SEM-EDX (Scanning Electron Microscope with Energy Dispersive Analysis of X-rays) analysis on the inside of the ring and on various surfaces of the plastic base.	
	Reprotect the top surface and remove the cup	
	Optically document all revealed surfaces starting with cup.	
	Meanwhile, start SEM-EDX analysis on top side of cup. . Particularly look for evidence of corrosion or arcing	
	Particularly focus in on the edges of the ceramic pin guide and on the indented ring that lines up with interior wall of the switch cavity	
	Particularly look for evidence of corrosion or arcing	
	Decide if we should try to flake off any of the overlaying debris to try to examine the underlying metal surface.	
	Proceed to perform SEM-EDX analysis on other component surfaces revealed by removal of cup.	
Data Entry	Log All data from this sheet into Switch Log	
	Photographs, Elemental maps etc must be retained and referenced by Switch #	

3713 7115

Steve Reimers, 313 390 3296,
sreimers@ford.com
file evalproc.xls

printed 02/16/19994:53 PM
uncontrolled document

original 2/16/99
revised tbd

Evaluation Process
Brake Pressure switch / Harness

Brake Pressure Switch Plan Updated 2/16/99
Evaluation Plan for Field Returns

Sw #		Date of update	
Mileage		Sw Date Code	
Sw P/N			

Category	Step #	Action	Notes/Data	Comments
Field Info	1	Log Field Info into Switch Log.xls		
	2	Photograph Switch		
	3	Record any unusual external visual observations		
	4	Check for Connector engagement		If not correct conduct X-Ray to determine fit-up between base lip and red seal
Switch + Connector Assembly	5	Wire 1(LG/R) to Wire 2(ORANGE) Resistance		
	6	Wire 1(LG/R) to Hexport Resistance		
	7	Wire 2(ORANGE) to Hexport Resistance		
	8	Separate Harness from Switch		
Connector Only	9	Verify Connector Seal		Visual check of Red Seal, Dirt lines, indentation mark.. Indentation mark must be 360 degrees.
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance		
	11	Current Leakage Wire 1(LG/R) to Wire 2(ORANGE)		
	12	Check for full engagement of connector		Visual check of dirt lines on mated switch base
	13	Check wire insulation		
	14	Check wire grey seals		
	15	Cut wire insulation to check for corrosion		Cut insulation longitudinally to check for wicking along wires. If signs of corrosion, identify color, save samples for chem I.d.
Switch External Unpressurized	16	Assemble Switch to Calibration Stand		
	17	Spring Terminal to Stationary Terminal Resistance		Stationary Terminal is closest to the outside connector keying tab.
	18	Spring Terminal to Hexport Resistance		
	19	Stationary Terminal to Hexport resistance		
	20	Base to Hexport Resistance		
	21	Current Leakage Spring Terminal to Hexport		

3713 7116

Steve Reimers, 313 390 3256,
sreimers@ford.com
file evalproc.xls

printed 02/18/1999 4:53 PM
uncontrolled document

original 2/16/99
revised tbd

Evaluation Process
Brake Pressure switch / Harness

	22 Current Leakage Stationary Terminal to Hexport	
	23 Voltage drop at 750 mA	
Switch External Pressurized	24 Switch Opening Pressure	Do not perform on parts from underhood fires, as may disturb diaphragm/other condition
	25 Switch Closing Pressure	Do not perform on parts from underhood fires, as may disturb diaphragm/other condition
	26 Proof Test for Leakage	*Do not perform on parts from underhood fires, as may disturb diaphragm/other condition*
	27 Repeat Steps 17 through 23 at 150 psig	
Switch Internal	Procedure to remove aluminum crimp ring	
	Use aluminum foil (or plastic if Ford prefers) to mask the analysis surface.	
	Also create a paper/tape shield to further reduce chance of contamination during cutting of crimp ring.	
	Place a piece of tape over the area to be cut.	
	Cut crimp ring using jewellers saw or Dremel cutoff wheel	
	Cut corners of ring at 180 degree orientation	
	Unfold crimp ring	
	Optically examine revealed surfaces. Take *optical photographs* (Digital camera with macro lens plus instant microphotography) and document observations where appropriate.	
	Inside surface of crimp ring.	
	Seat area and underside of base	
	Top of cup	
Analytical Techniques SEM/EDX/IR	Assess Need for Analytical Techniques	
	Start SEM-EDX (Scanning Electron Microscope with Energy Dispersive Analysis of X-rays) analysis *on the inside of the ring and on various surfaces of the plastic base.*	
	Reprotect the top surface and remove the cup	
	Optically document all revealed surfaces starting with cup.	
	Meanwhile, start SEM-EDX analysis on top side of cup. . Particularly look for evidence of corrosion or arcing	
	Particularly focus in on the edges of the ceramic pin guide *and on the indented ring that lines up with interior wall of the switch cavity*	
	Particularly look for evidence of corrosion or arcing	
	Decide if we should try to flake off any of the overlaying debris to try to examine the underlying metal surface.	
	Proceed to perform SEM-EDX analysis on other component surfaces revealed by removal of cup.	
Data Entry	Log All data from this sheet into Switch Log	
	Photographs, Elemental maps etc must be retained and referenced by Switch #	

3713 7117

Steve Bearinghouse
Brian

Impulse Test
0 - 1450 ~~Imp.~~ 2 Hz
135°C 500,000 - N_f

91-92
Crimp

90 psi ~ ripple ?

~~Issue~~ could be brake fluid & water
i → corrosion (multiple modes)

process change

4 levels of Kapton → unknown
solid state devices for high cycles

Nov ~~91~~ → Nov 92 Recall ~~Tele~~ | T.C | C.V | S.M

150,000 initial sw. 60% o/H before recall

replace sw w/replacement of sw.
& connector shell w/ silicone seal material of foam seal.
Campaign start ~ May 30, 1999
Cost → FC50 ~ $ ______.

UTA → Shell
T.I. → B- Switch

3713 7118

Options 3-30-99

1. Brake Pedal - no sw. yet

2. Shroud to protect/fuse in sw.

3. pilot relay → limit current to 200ma from 12v
sw on gnd side NOT hot all the time. Does not eliminate sw corrosion. F6AB-14B192-AA

4. Drip loop / ground isolation - no plastic/rubber device yet avail.

To shut off the speed Control:

1 Driver off

2 Brake to ~~[illegible]~~ ≤10 mph

3 B " " " " 25 mph

B - sw Base material across existing fuel ~ the same

Action Plan

· Start studying the iso-relay fix @ 200 ma @ 1 amp @ 2 amp w/ a 1 amp fuse.

Towing package on veh?

fuse change (15A)?
type of fuse (slow-blow maxi)?
bad

Engine Clean up from floods, etc.
hurricanes

Oxyalate is NOT part of brake fluid.

no Sulphur in brake fluid.
↓
possible hose (rubber) curing

DOW
SAE report of brake fluid corrosion
Carbide & Delphi rept.
[illegible] ([illegible]at) fluid

T.I.

508-2

401-2

9:30 a mee

NW 734

MEETING

Texas Instruments

Jody McGuirk [illegible]
ASQ Certified Quality Engineer
Quality Assurance Manager
Automotive Sensors & Controls

[illegible]
[illegible] Fax
[illegible] Pager Pin # [illegible]
[illegible]

Texas Instruments Incorporated
34 Forest Street, MS 23-[illegible]
P.O. Box 2964
Attleboro, MA 02703-[illegible]

Texas Instruments

[illegible]
Member, Group Technical Staff
Design Engineering Supervisor
Automotive Sensors & Controls

[illegible]
[illegible] Fax
[illegible]

Texas Instruments Incorporated
34 Forest Street, MS 23-[illegible]
P.O. Box 2964
Attleboro, MA 02703-[illegible]

Dan Kulkarni, P.E.
Principal Engineer, Liaison Engineering
Electrical/Electronic Products
Electrical Systems - Americas

UT Automotive
A United Technologies Company

United Technologies Automotive, Inc.
5200 Auto Club Drive
Dearborn, Michigan 48126-2659
313-593-3766 Fax: 313-593-9259
Mobile Phone: 313-401-0530
E-Mail: dkulkarni@uta.com

Texas Instruments

Charlie Douglas
Marketing Supervisor
Automotive Sensors & Controls

[illegible]
[illegible] Fax
c-douglas[illegible]

Texas Instruments Incorporated
34 Forest Street, MS 23-01
P.O. Box 2964
Attleboro, MA 02703-0964

Texas Instruments

[illegible]
Supervisor, Design Engineering
[illegible]

[illegible]
[illegible] Fax
[illegible]

Texas Instruments Incorporated
34 Forest Street, MS 12-[illegible]
P.O. Box 2964
Attleboro, MA 02703-0964
[illegible] 12

Texas Instruments

Stephen [illegible]
Manufacturing Engineering Supervisor
Automotive [illegible] Business Unit
Control Products Division

[illegible]
[illegible] Fax
[illegible]

Texas Instruments Incorporated
34 Forest Street, MS 12-[illegible]
P.O. Box 2964
Attleboro, MA 02703-0964

Texas Instruments

[illegible]
Automotive Account Leader
[illegible] & Controls

9980 (H)
517 552 9897 (H)

[illegible]
[illegible] Fax
[illegible] Car
[illegible]

Texas Instruments Incorporated
[illegible]
Suite [illegible]
Novi, MI [illegible]

3713 7121

TEXAS INSTRUMENTS

Steve [illegible]
Design Engineering Manager
Materials & Controls Group

Texas Instruments Incorporated
34 Forest Street, MS [illegible]
P.O. Box [illegible]
Attleboro, MA [illegible]

[illegible]
[illegible] Fax

Ford Motor Company

John T. McInerney
Technical Specialist - SAFETY
Large & Luxury Car Vehicle Center
OPD Safety/Police Engineering

Large Vehicle Center - West #1
Mail Drop 1124/Cube 1GB056
Dearborn, MI 48121-2053 USA

Tel: 313 [illegible]
Fax: 313 390-6002
Pager: 800 759-7243
Pin: 601-4266
JMCINERN

Ford Motor Company

Thomas L. Masters
Supervisor Large/Lux Car & Truck
Systems & Wiring OPD
AVT ESSE - OPD

20000 Rotunda Drive MD 5017
Rm. 2A024, Bldg. #5
Dearborn, MI 48121-2053 USA

Tel: 734 [illegible]
Fax: 313 317-9156

3713 7122