EA02025

TEXAS INSTRUMENTS, INC.'S

09/10/03 LETTER TO ODI

REQUEST 9

BOX 12

PART A – O

PART J

Epstein, Sally

From: Watt, Jim [jwatt@email.mc.ti.com]
Sent: Monday, March 01, 1999 3:55 PM
To: Baumann, Russ; Beringhause, Steven; Dague, Bryan; Pechonis, John; Rahman, Aziz; Rowland, Thomas; Douglas, Charles; Pawlowski, Robin; Baker, Gary; O'Neill, ED; Haskell, Beth; Sharpe, Robert; McGuirk, Andy
Subject: RE: FORD P/S TRANSITIONS OF CURRENT INTEREST



Andy,

Below are the files you were requesting:

1. Town Car Switch Usage Sequence:

<<77PStimeline.ppt>>

2. 77PS Suppliers' Request for Engineering Analysis (SREA) history:

<<77PS SREA-ALERT UPDATE.XLS>>

3. Part Number 46515 (77PS Molded Base Material History):

<<77PS Molded Base P.N. 46515 UPDATE.XLS>>

Jim Watt, QRA, msgid: jw02; mail station 12-33; page (508)236-1010, no. (0696)
ph (508) 236-1719;
fax (508)236-3153

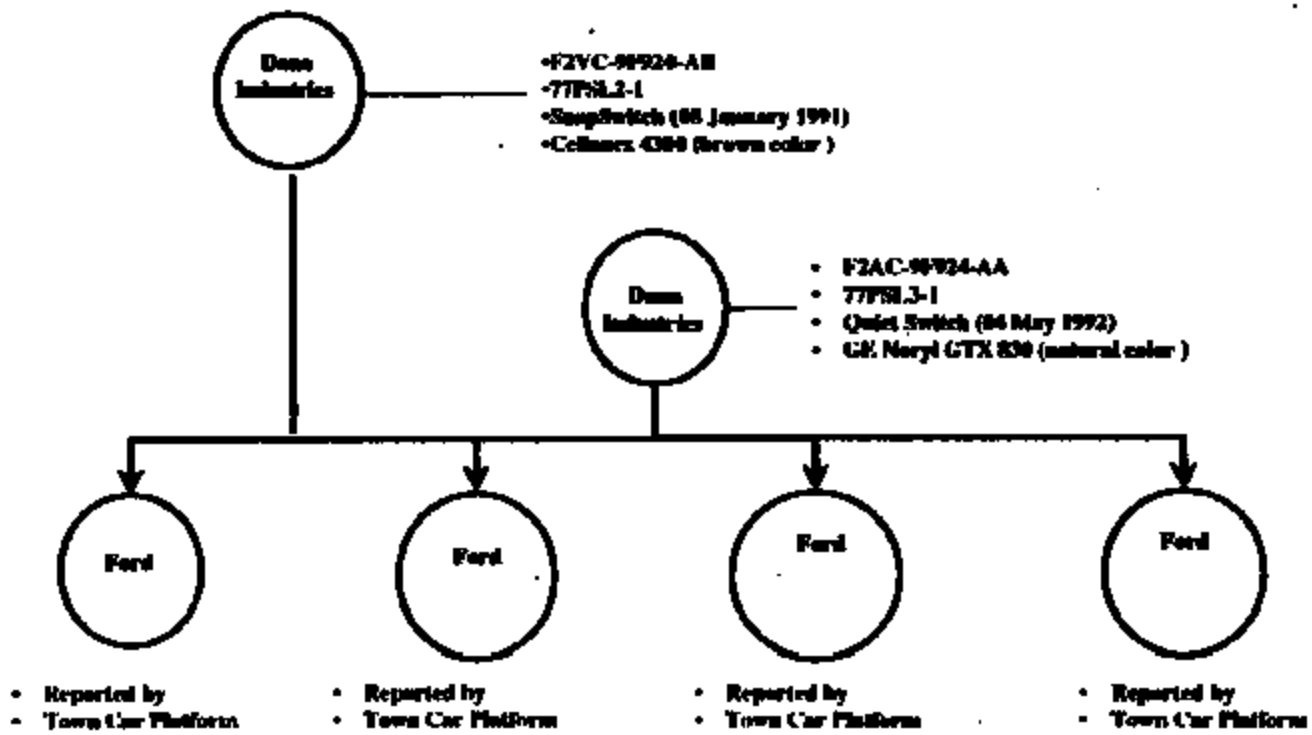
From: McGuirk, Andy
Sent: Monday, March 01, 1999 10:22 AM
To: Baumann, Russ; Beringhause, Steven; Dague, Bryan; Pechonis, John; Rahman, Aziz; Rowland, Thomas; Douglas, Charles; Watt, Jim; Pawlowski, Robin; Baker, Gary; O'Neill, Ed; Haskell, Beth; Sharpe, Robert
Subject: FORD P/S TRANSITIONS OF CURRENT INTEREST

JIM WATT, PLS PULL TOGETHER THE TEAM OF CHARLIE DOUGLAS AND ROBIN PAWLOWSKI AND OTHERS TO RECONSTRUCT THE TIME-LINE OF TI PRESSURE SWITCH 77PS FAMILY.

SPECIFIC AREAS OF INTEREST ARE QUIET SWITCH AND NORMAL SWITCH AS WELL AS GE PLASTIC AND CELENEX PLASTIC AS INSTALLED INTO THE FORD TOWN CAR PLATFORM IN MODEL YEAR '92 AND '93. I UNDERSTAND WE ARE ABLE TO DEFINE THE TIER-ONE CUSTOMERS AND THERE WILL BE A NEED TO CONNECT THEM TO THIS PLATFORM AND YOU SHOULD USE VARIOUS AVENUES TO ACCOMPLISH SAME.

PLEASE PLAN A 'MINI' TEAM MEETING WITH JOHN PECHONIS AND CHARLIE DOUGLAS AND YOURSELF (AND OTHER IF YOU FEEL VALUE IS ADDED) (AT JOHN'S OFFICE) TO REVIEW OUR STATUS LATER TODAY...SAY 4-ISH. IT IS IMPORTANT THIS INFO BE ACCURATE AS WELL AS PROMPT. THE

TOWN CAR SWITCH SEQUENCE ...



RESULTING PRODUCT WOULD BE REVIEWED WITH RUSS TOMORROW MORNING BY ME.

A

AUTOMOTIVE SENSORS AND CONTROLS QRA MANGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 604-2044

Steve LaPorther 3/1/99

93 Tracer - [illegible] part?

Storage Flex. Characteristics - 1 part

Resistance terminals [illegible] hexport
34 - 39 MΩ's

X-rayed - buildup on cup

Steve [illegible] open circuit

Pressure tested it - 0Ω's

- 146psi - open
  Still 0Ω's

held pressure → 500psi - held still 0Ω's
(at 240psi - switch popped
- closed at 62psi

- opened at 148psi again

Terminal's look [illegible]
discolored

water corrosion?

Epstein, Sally

From: LaRouche, Steve (S.) [slarouch@ford.com]
Sent: Tuesday, March 02, 1999 10:56 AM
To: Porter, Fred (F.J.); LaPointe, Norman (N.R.); Reimers, Steve (S.J.); Rahman, Aziz; McCarthy, Shaun (S.L.); LaRouche, Steve (S.)

We have found three switches so far (including the one to be analyzed by the Sci Lab), that will not open electrically when disc is heard to snap under application of air pressure. I sectioned one of these switches and found what appears to be water (it evaporated rather quickly at room temp) and corrosion product. I found that the transfer pin has been stuck in place by the corrosion products. What this means, is that even if the disc snaps, the pin will not pull back, and the contacts will not open. None of these switches showed evidence of diaphragm leakage on the test stand.

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

Epstein, Sally

From: Rahman, Aziz [arahman@email.mc.ti.com]
Sent: Tuesday, March 02, 1999 3:26 PM
To: McGuirk, Andy; Degus, Bryan; Douglas, Charles; Sharpe, Robert; Baumann, Russ; Beringhause, Steven
Subject: FW: Central Lab Analyses

fyi

From: LaRouche, Steve (S.) [SMTP:slarouch@ford.com]
Sent: Tuesday, March 02, 1999 11:56 AM
To: Porter, Fred (F.J.); LaPointe, Norman (N.R.); Reimers, Steve (S.J.); 'A. Rahman'; McCarthy, Shaun (S.L.); LaRouche, Steve (S.)

We have found three switches so far (including the one to be analyzed by the Sci Lab), that will not open electrically when disc is heard to snap under application of air pressure. I sectioned one of these switches and found what appears to be water (it evaporated rather quickly at room temp) and corrosion product. I found that the transfer pin has been stuck in place by the corrosion products. What this means, is that even if the disc snaps, the pin will not pull back, and the contacts will not open. None of these switches showed evidence of diaphragm leakage on the test stand.

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

Epstein, Sally

From: LaRouche, Steve (S.) [slarouch@ford.com]
Sent: Wednesday, March 03, 1999 7:42 AM
To: Rahman, Aziz
Subject: RE: Switches

Aziz: I believe these were the junkyard samples. Two had the connectors fully engaged, while the connector on the third was not fully engaged.

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

-----Original Message-----
From: Rahman, Aziz [mailto:arahman@email.mc.ti.com]
Sent: Tuesday, March 02, 1999 4:28 PM
To: Porter, Fred (F.J.); LaPointe, Norman (N.R.); Reimers, Steve (S.J.); 'Steve LaRouche (Ford)'
Cc: McGuirk, Andy
Subject: RE: Switches

Steve L., what was the condition of the switches as received. Did they have connectors attached to them, or were they open to the elements? Were these from the "junkyard" group or the earlier group?

Regards
Aziz.

-----Original Message-----
From: LaRouche, Steve (S.)[SMTP:slarouch@ford.com]
Sent: Tuesday, March 02, 1999 11:56 AM
To: Porter, Fred (F.J.); LaPointe, Norman (N.R.); Reimers, Steve (S.J.); 'A. Rahman'; McCarthy, Shaun (S.L.); LaRouche, Steve (S.)

We have found three switches so far (including the one to be analyzed by the Sci Lab), that will not open electrically when disc is heard to snap under application of air pressure. I sectioned one of these switches and found what appears to be water (it evaporated rather quickly at room temp) and corrosion product. I found that the transfer pin has been stuck in place by the corrosion products. What this means, is that even if the disc snaps, the pin will not pull back, and the contacts will not open. None of these switches showed evidence of diaphragm leakage on the test stand.

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

Brake Pressure Switch Meeting

3/3/99

	EMAIL		
Steve Raimers	SREIMERS	X03236	AUT/EESE
FRED PORTER	FPORTER	X53722	AVT/EESE
M. P. REESE	MREESE	X77142	CFD LVC
[illegible]	[illegible]	[illegible]	[illegible]
GREG STEVENS	GSTEVEN2	X 36686	AVT MAT'L
NORM LAPOINTE	NLAPOINT	X42686	AVT/DES. [illegible]
STEVE LaROUCHE	SLAROUCHE	54876	CENTRAL LAB
ANDY McGUIRK	a-mcguirk@ti.com	5082363080	TI QRM
[illegible] M. ABRAMCZUK	WABRAMCZ	313 32 23284	A[illegible]

* Steve Beringhause / Bryan Dague from TI on conference call

TI-NHTSA 016702

"War Room" Town Car Weekly Mtg.

<u>Agenda</u>

- Testing Status
- Brake Switch Relocation
- Other Potential Solutions

- 92 Town Car at Proving Grounds (43K) [redacted]
  HCU & ABS, Switch Pressure recording [redacted]
  Switch temp (Air, Fluid) * Many [redacted]
  50 Tests (4 completed). [redacted]
  Samples of Brake Fluid taken (Steve R. has details)
  Switch is 97A24 "B3" (camp) very clean
  Service History → 4 issues, no majors
  (single sample) [Ignited switch base (quickly on) burned to [illegible] but not onto harness
  [illegible] burning harness (lasted longer than switch) once on fire, burned "up" quickly into the connector & base

- Andy
  Reviewed 2/24/99 Potential Thermal Event Theory (w/ Steve Burghauser)
  How is this different than the Gasoline [illegible] incidents? (Rate of corrosion much more [illegible] w/ [illegible])
  (Bill [illegible]) 600 - 1K service hits/mo 15-20% leakage, still think diaphragm degradation is a contributor. Andy → water will degrade Kapton
  (Norm) * Can we get a fire w/out salt (Steve → need ions to drive [illegible]) → sodium/chloride not picked-up in returned analysis (Acrylic acid)
  * Prior in mtg. data from Dupont. Water cited as [illegible] to Teflon, Kapton is teflon coated. Wear over life teflon will [illegible].
  *TI → look at acrylic and impact on Kapton
  → Test w/ Acrylic acid instead of salt

(Fred)
Recent Junk yard returns 1st returns showing evidence of connector breach
Dow stated that the brake fluid is very corrosive to [illegible] contacts

Relocation of Brake Switch to [illegible] (92, 93, 94) (Marty)
More difficult, interference w/ bracket for ABS [illegible]
[illegible] looking @ alternative packaging (existing hole for dump valve)
investigating other suppliers for potential packaging application

(Bill L.) Could we impregnate the cavity with "lube" or Silicon (insulation)
Steve to [illegible]

TI-NHTSA 016703

look at old brake fluid for conductivity

Ext A If we put a fuse for connector, impact to customer

Jay Logel (Ford Legal)

Video tape to clarify specific conditions, helpful to narrow applications. ed format! (helps with confidentiality)

Brake Pressure Switch Meeting

3/3/99

	EMAIL		
Steve Reimers	SREIMERS	X03286	AVT/EESE
FRED PORTER	FPORTER	X53722	AVT/EESE
M. P. REESE	MREESE	X77142	OPD LVC
Rob Sharpe	r6harpe@ti.com	(248) 305-5729	Texas Instruments
GREG STEVENS	GSTEVEN1	x 36686	AVT MAT'L
NORM. LAPOINTE	NLAPOINT	x42686	AVT/DES. link
STEVE LaROCHE	SLAROUCHE	54876	CENTRAL LVC
ANDY McGUIRK	a-mcguirk@ti.com	508 2303080	TI QRA
WILLIAM M. ABRAMCZYK	WABRAMCZ	313 32 23784	ASO

* Steve Beringhause / Bryan Dague from TI on conference call

2/10/99

4P-5:15P Brainstorm w/Lan

- Get Dow on TEAM

~~HAVE~~ ASK THEM HOW FIRE STARTS WITHIN CONSTRAINTS [14 V, Black Substance, 15 AMP MAX CURRENT, VEH. TEMPERATURES.]

- Char'z REAL VEH Brake Pressure.

- " " " " " in ABS & TC EVENT.

- Thermo-couple Brk Pr switch after Veh. Driven & turned off.

- Take Rate of ABS

" " " ABS w/TC

- Are Leaks/Fires common to traction ASSIST.

- Black Substance: Copper, Zinc, Silver, Sulfur, Brake Fluid.

- Understand TC/ABS Pressure Pulse/

+ HISTORY OF ELECTROLYSIS IN Brake Fluid.

3/3/99

"War Room" Town Car Weekly Mtg.

Agenda

- Testing Status
- Brake Switch Relocation
- Other Potential Solutions

- 92 Town Car at Proving Grounds (43K) no traction control
  HCU & ABS, switch Pressure recordings
  switch temp (Air, Fluid) * many parameters
  55 Tests (4 completed)
  Samples of Brake Fluid taken } (Steve R. has details)
  switch is 5F92H "BB" (snap) very clean
  Service History → 6 issues, no majors
  (single event) [self ignited switch base (quickly on) burned to conn but not onto harness
  tried burning harness (hooked lower than switch) once on fire, burned "up" quickly into the connector + base

- Andy
  Reviewed 2/24/99 Potential Thermal Event Theory (w/ Steve Boringhouse)
  How is this different than the Econoline line incidents? (Rate of corrosion much more severe w/ Econoline)
  (Bill Abram) 600 - 1K service hits/mo 15-20% leakage, still thinks diaphragm degradation is a contributor. Andy - water will degrade Kapton
  (Norm) ① Can we get a fire w/out salt (Steve + need ions to drive electrolysis)
  ↳ sodium / chlorine not picked up in returned analysis (Acrylic Acid)
  ② Prior to mtg, data from Dupont. Water cited as non reactant to Teflon
  Kapton is teflon coated. Wear over life teflon will brake down
  #TI → look at acrylic acid impact on Kapton
  → Test w/ acrylic acid instead of salt

  (Fred)
  Recent Junk yard returns 1st returns showing evidence of connector breach
  Dow stated that the brake fluid is very corrosive to term contacts

Relocation of Brake Switch to pedal (92, 93/94) (Marty)
  More difficult, interference w/ bracket for ABS switch (existing)
  Now looking @ alternative packaging (existing hole for dump valve)
  investigating other suppliers for potential packaging application

(Bill A.) Could we impregnate the cavity with "lube" or Silicon (insulation)
  Steve → Us

look at old brake fluid for conductivity

(Bill A) If we pub a fuse for connector, impact to customer

Jay Legal (Ford Legal)

Video tape to clarify specific conditions, helpful to narrow applications. Ed format! (helps with confidentiality)

```
*****************************************************************
*          . Note printed by FPORTER on 4 Mar 1999 at 11:09:33          *
*****************************************************************

From: SLAROUCH--FORDMAI                          Date and time    03/02/99 11:56:31
To: FPORTER --FORDMAIL Porter, Fred (F.J. NLAPOINT--FORDMAIL LaPointe, Norman
    SREIMERS--FORDMAIL Reimers, Steve (S. I2060628--EXTERNAL 'A. Rahman'
    SMCCART3--FORDMAIL McCarthy, Shaun (S SLAROUCH--FORDMAI  LaRouche, Steve (S

From: LaRouche, Steve (S.)
Subject:

We have found three switches so far (including the one to be analyzed by the
Sci Lab), that will not open electrically when disc is moved to [redacted] under
application of air pressure.  I sectioned one of these switches and [redacted]
what appears to be water (it evaporated rather quickly at room temp) [redacted]
corrosion product.  I found that the transfer pin has been stuck in place by
the corrosion products.  What this means, is that even if the disc snaps,
the pin will not pull back, and the contacts will not open.  Some of these
switches showed evidence of diaphragm leakage on the test stand.

Steve LaRouche                                   (SLAROUCH)
Metallurgy Section, Central Laboratory, Room M410
(313) 845-4876                                   (313) 322-1614 FAX
```

Texas Instruments Incorporated

TEXAS INSTRUMENTS

34 Forest Street
P.O. Box 2664
Attleboro, MA 02703-0964
(508) 236-3800

JANET S. BOURGEOIS
Ph : 508-236-3287
FAXED Fax : 508-236-1598

Cindy McGuirk

To : Fred Potter

Re :

Total # Pages = 6

Message : _____

Thanks,
Janet S. Bourgeois

f. HWI
Hot Wire Ignition: expressed in accordance with UL 746 (ASTM D3874). The HWI is expressed as the mean number of seconds needed to ignite standard test specimens wrapped with resistance wire that dissipates a specified level of electrical energy or to burn through the material without ignition. Materials are classified into 6 classes (see Table 1).

g. HAI
High Current Arc Ignition: performance is expressed as the number of arc-rupture exposures (standardized by UL 746A as to electrode type and shape and electric circuit) which are necessary to ignite a material when they are applied at a standard rate, either at the surface of the material or at a specified distance from it. Materials are classified into 5 classes (see Table 1).

h. HVTR
High Voltage Arc Tracking Rate: expressed by UL 746 as the rate in mm/min at which a tracking path can be produced on the surface of the material. The results of the nominal 3mm thickness are considered representative of the material's performance at any thickness. Materials are classified into one of 5 categories (see Table 1).

i. D-495
D-495 Arc Resistance: expressed in accordance with ASTM D-495, is expressed as the number of seconds that a material resists the formation of a conducting path when subjected to an intermittently occurring arc of high voltage and low current characteristics. Materials are classified into one of 8 categories (see Table 1). The results of the nominal 3mm thickness are considered representative of the material's performance in any thickness.

j. CTI
Comparative Tracking Index: CTI as determined by UL 746A is expressed as the voltage which causes tracking on a material after 50 drops of 0.1% ammonium chloride solution have been applied. The results of the nominal 3 mm thickness are considered representative of the material's performance in any thickness. Materials are classified into one of 6 categories (see Table 1).

Table 1: Range of values per Performance Level Class (PLC)

[illegible]	HWI Hot Wire Ignition	HAI High Current Arc Ignition	HVTR High Voltage Arc Tracking Rate	D 495 Arc-Resistance	CTI Comparative Tracking Index
[illegible]	[illegible]	number	mm/min	sec	V
Class [illegible]	[illegible]	≥120	0-10	≥420	≥600
Class [illegible]	[illegible]	60≤120	>10-25.4	360≤420	400≤600
Class [illegible]	[illegible]	30≤60	>25.4-80	300≤360	250≤400
Class [illegible]	[illegible]	15≤30	>80-150	240≤300	175≤250
Class [illegible]	[illegible]	0≤15	>150	180≤240	100≤175
[illegible]	[illegible]	-	-	120≤180	0≤100
[illegible]	[illegible]	-	-	60≤120	-
[illegible]	[illegible]	-	-	0≤60	-

DSM

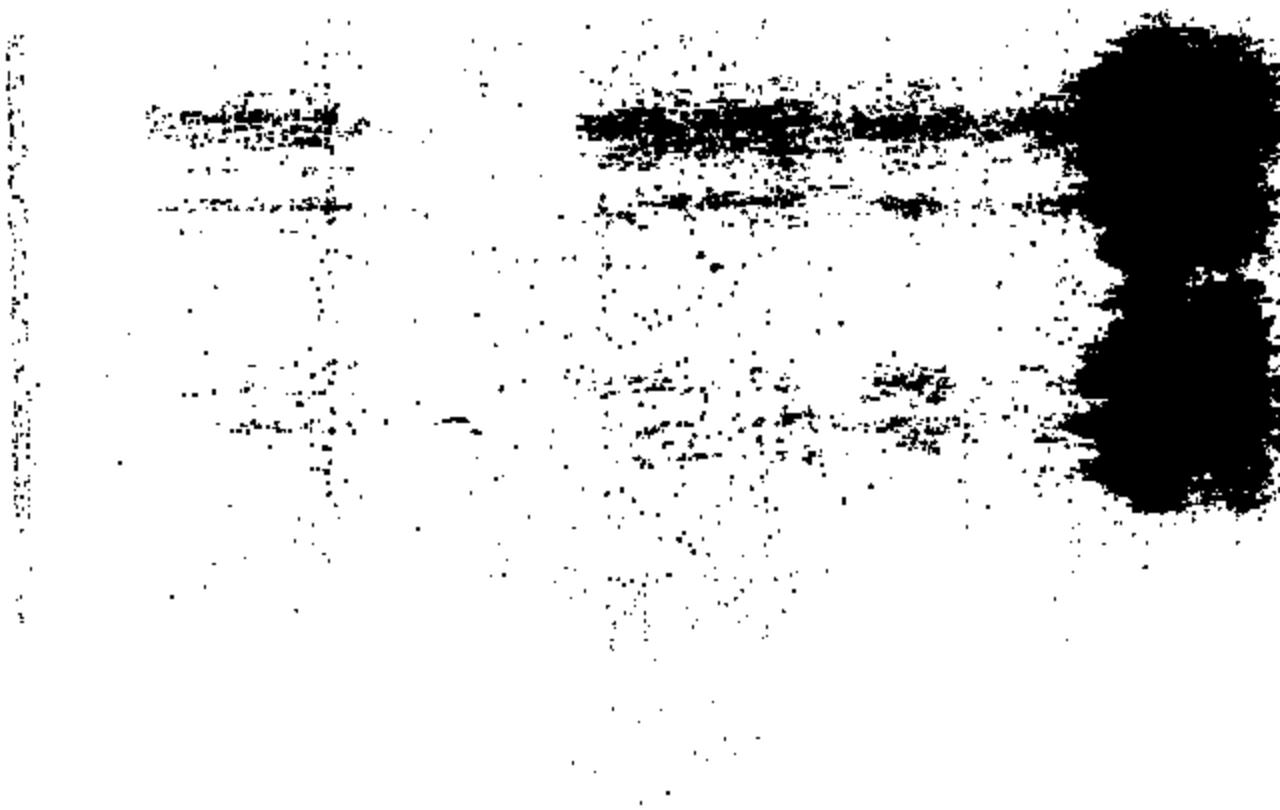
High Ampere Arc Ignition (HAI)

Under certain normal or abnormal operation of electric equipment, insulating materials might be in proximity of arcing. If the intensity and duration of the arcing are severe, the insulating material can become ignited. This test is intended to simulate such a condition

The test method is useful in differentiating among solid insulating materials with regard tot resistance to ignition from arcing electrical sources.

Material are classified based on the mean number of arcs to cause ignition.

Materials are classified into 5 classes (PLC level)



Hot Wire Ignition (HWI)

DSM

Under certain conditions of operation or malfunction, electrical equipment, wires other conductors, resistors, or other parts may become abnormally hot. When these overheated parts are in contact with insulationg materials ignition may occur.

The HWI test according to ASTM D 3874 is intended to determine the relative resistance to ignition under such conditions.

The test resultsmake it possible to provide a relative comparison of various materials according to the time at which the specimn ignites during the application of the ignition source.

The HWI is expressed as the mean number of seconds required to ignite a standard test specimen
(125 * 12,5 mm * thickness as used) wrapped with resistance wire that dissipates a specified level of electrical energy.

Materials are classified into 6 classes (PLC [xxx]), for which UL considers melting through the material without ignition as if ignition occured.

This test method is not valid for determining the ignition behaviour of complete of equipment.

DSM Engineering Plastics Inc.

DSM

STANYL PA 46 GR FR — UL File E173225 — 15 February 1999

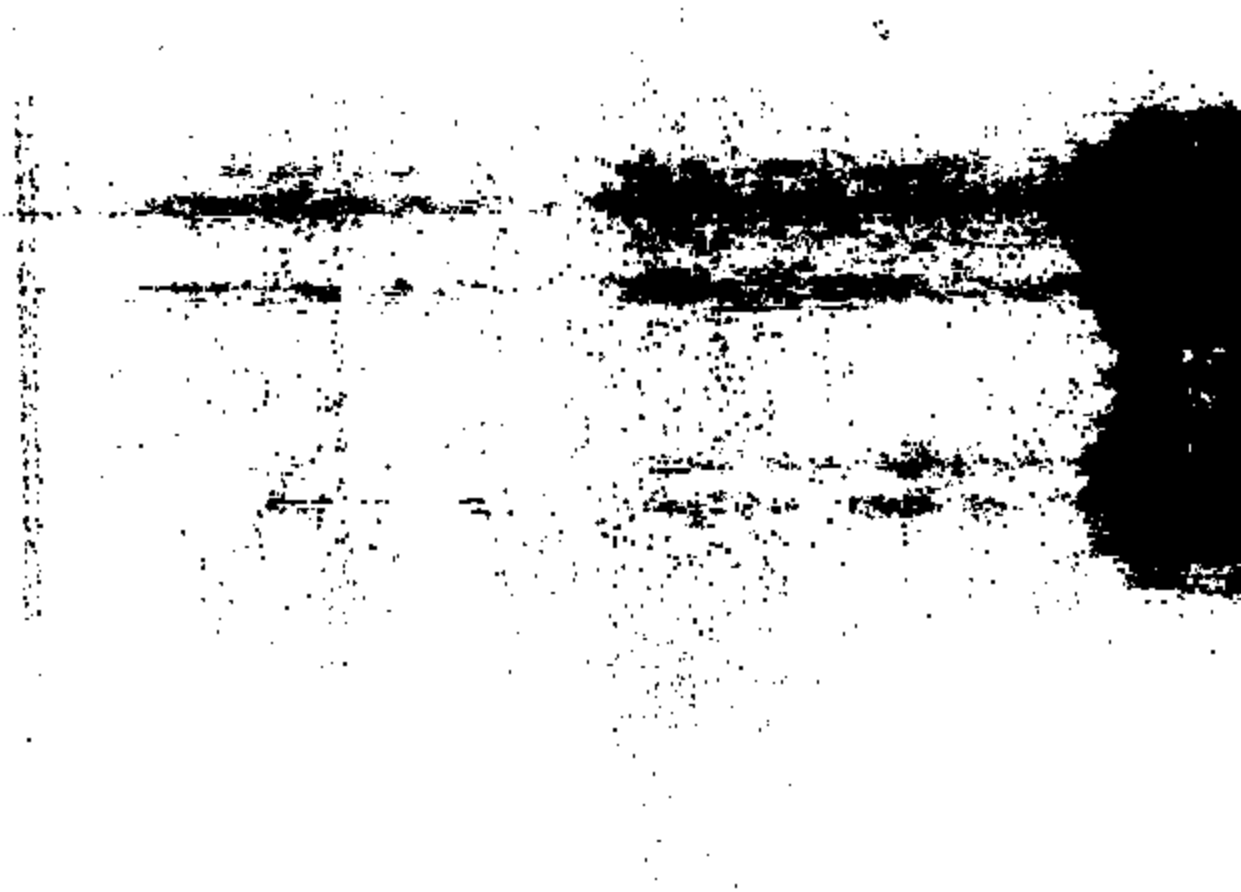
Grade	Col	Min Thick mm	VLN*	RTI °C EL	RTI °C WI	RTI °C WOI	HWI	HAI	HVTR	DSS	CTI
TE250F3	NC, BK	0.8	94V-0	130	110	110	4	0	-	-	-
	NC, BK	1.5	94V-0	130	110	130	2	0	-	-	-
	NC, BK	3.0	94V-0	130	110	130	1	0	1	7	3
TE250F4	NC, BK	0.8	94V-0	130	110	110	4	0	-	-	-
	NC, BK	1.5	94V-0	130	110	130	2	0	-	-	-
	NC, BK	3.0	94V-0	130	110	130	1	0	1	7	3
TE250F6	All	0.38	94V-0	-	-	-	-	-	-	-	-
	All	0.78	94V-0	140	110	130	0	0	-	-	-
	All	1.5	94V-0	140	125	125	0	0	-	-	-
	All	3.0	94V-0	140	130	130	0	0	1	6	2
TE250F6 - 100% REGRIND	All	0.4	94V-0	-	-	-	-	-	-	-	-
	All	0.78	94V-0	-	-	-	-	-	-	-	-
	All	1.5	94V-0	-	-	-	-	-	-	-	-
	All	3.0	94V-0	-	-	-	-	-	-	-	-
TE250F8	All	0.78	94V-0	140	110	130	0	0	-	-	-
	All	1.5	94V-0	140	125	125	0	0	-	-	-
	All	3.0	94V-0	140	130	130	0	0	0	7	3
[redacted]	All	[redacted]									
[redacted]	All	[redacted]									

DSM

DSM Engineering Plastics Inc.

ARNITE - PBT GR **UL File E173225** 15 February 1999

Grade	Col	Min Thick mm	UL94	RTI °C EL	RTI °C WI	RTI °C WOI	HWI	HBI	HVTR	DSI	CTI
TV4 241 NA	All	0.75	94V-2	140	130	140	4	0	-	-	-
TV4 241 SN /6	All	1.5	94V-0	140	130	140	3	0	-	-	-
	All	3.0	94V-0	140	140	140	2	0	0	0	3
TV4 [illegible] SN	All	0.75	94V-2	140	130	140	3	4	-	-	-
	All	1.5	94V-0	140	130	140	2	4	-	-	-
	All	3.0	94V-0	140	140	140	1	4	-	-	2



Stanyl®

Glass Reinforced, Flame Retardant, 4/6 Nylon

Values were derived from testing a limited number of lots and should not be used for specification.

PROPERTY DATA

Physical Properties	ASTM	UNIT	TE250F6	TE250F9
Specific Gravity	D792	–	1.68	1.82
Melting Point	D3417	°F	562	562
Water Absorption (equil., 73°F/50% RH)		%	1.6	1.2
Mechanical Properties				
Izod Impact				
notched (dry*)	D256	ft-lbs/in	1.3	1.9
notched (conditioned**)		ft-lbs/in	1.9	2.2
Tensile Strength				
(dry)	D638	psi	25,400	29,000
(conditioned)		psi	18,100	21,800
Tensile Elongation				
(dry)	D638	%	2.5	2.1
(conditioned)		%	3.5	3.0
Tensile Modulus				
(dry)	D638	Kpsi	1,810	2,500
(conditioned)		Kpsi	1,160	1,700
Flexural Strength				
(dry)	D790	psi	37,700	43,500
(conditioned)		psi	27,800	36,300
Flexural Modulus				
(dry)	D790	Kpsi	1,600	2,200
(conditioned)		Kpsi	1,200	1,800
[illegible]				
[illegible]				
Coefficient of linear thermal expansion			V7	
[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Comparative Tracking Index		volts	250	275
Volume Resistivity				
(dry)	IEC 250	ohm-cm	1×10^{15}	1×10^{15}
(conditioned)		ohm-cm	1×10^{13}	1×10^{13}
Surface Resistivity				
(dry)	IEC 250	ohm	1×10^{15}	1×10^{15}
(conditioned)		ohm	1×10^{13}	1×10^{13}

*dry = dry-as-molded

**conditioned to equilibrium at 50% RH, 73°F

All Mechanical tests conducted at 73° F unless otherwise noted. 4/11/95

Headquarters
DSM Engineering Plastics
P.O. Box 1133
2267 West Mill Road
Evansville, IN 47720
Toll Free 800-333-4237
Fax 812-479-7706

DSM

ARNITE®

Property data

ARNITE® TV4 260 SN

(30% Glass Reinforced non-Blooming Flame Retardant PBT)

PROPERTY	UNITS	DATA	TEST
PHYSICAL PROPERTIES			
Density	gm/cm³	1.67	ISO 1183
Melt Flow Rate (235,2.16)	gm/10min	8.4	ASTM D1238
Water Absorption	%	0.20	ASTM D570
Mold Shrinkage ∥	Mil/in	1.5	DSM
Mold Shrinkage ⊥	Mil/in	3.8	DSM
TENSILE & FLEXURAL PROPERTIES			
Tensile Strength at Yield	psi	18,000	ISO 527
Elongation at Break	%	2.2	ISO 527
Tensile Modulus	psi	1,680,000	ISO 527
Flexural Strength	psi	30,000	ISO 178
Flexural Modulus	psi	1,400,00	ISO 178
IMPACT PROPERTIES			
Izod Unnotched Impact @ +23°C	ft-lb/in	8.4	ISO 180/1C
Izod Notched Impact @ +23°C	ft-lb/in	1.2	ISO 180/1A
THERMAL PROPERTIES			
HDT @ 1.8 MPa load (264 psi)	°F	410	ISO 75/A
HDT @ 0.45 load (66 psi)	°F	455	ISO 75/B
Coef. of Linear Thermal Expansion ∥	in/in°F	$0.2x10^{-4}$	DIN 53752
Coef. of Linear Thermal Expansion ⊥	in/in°F	$0.4x10^{-4}$	DIN 53752
Thermal Conductivity	BTU in/hr ft² °F	2.40	DIN 52612
RTI @ 30 Mils (Electrical)	°C	140	UL 746B
RTI @ 30 Mils (Mechanical without impact)	°C	140	[illegible]
RTI @ 30 Mils (Mechanical with impact)	[illegible]	[illegible]	[illegible]
[illegible]			
UL [illegible] mm (30 Mils)	[illegible]	[illegible]	[illegible]
Limiting Oxygen Index	[illegible]	[illegible]	[illegible]
Glow Wire Test [illegible] Time	[illegible]	[illegible]	[illegible]
Glow Wire Test [illegible]	[illegible]	[illegible]	[illegible]
Glow Wire Test [illegible]	[illegible]	[illegible]	[illegible]
Hot Wire Ignition (HWI) @ 30 Mils	UL Class	[illegible]	[illegible]
High Current Arc Ignition (HAI) @ 30 Mils	UL Class	4	[illegible]
Comparative Tracking Index (CTI) @ 118 Mils	UL Class	3	[illegible]
ELECTRICAL PROPERTIES			
Dielectric Strength @ 1.5 mm (30 Mils)	[illegible]	[illegible]	[illegible]
Volume Resistivity	[illegible]	[illegible]	[illegible]
Surface Resistivity	[illegible]	[illegible]	[illegible]
Dielectric Constant @ 50 Hz	[illegible]	[illegible]	[illegible]
Dielectric Constant @ 10^6 Hz	[illegible]	[illegible]	[illegible]
Dissipation Factor @ 50 Hz	—	$1.0x10^{-3}$	[illegible]
Dissipation Factor @ 10^6 Hz	—	$1.5x10^{-2}$	[illegible]

March 1, 1999

* All mechanical tests conducted at 73°F unless otherwise noted.

Headquarters
DSM Engineering Plastics
P.O. Box 3333
2267 West Mill Road
Evansville, IN 47732
Toll Free 800-333-4237

DSM

3/10/99 1

PIN FANOUT MATRIX?

Mike Hardy Quality Center

↳ Possibility of working "off site"

Small group, excess additional to current

F2VC "AB" 7128 From Memphis (Steve has LaRouche)

Fred task with FCSD (Ford Field Service) to help w/ Oasis call

SAA attended

Andy –

(Neal) resistance ?

(Bill A.) stuck pin → details, worried about [redacted] concerns

reliability issue. F-Series report, [redacted] the work

* (CAS) - S. Hermann CAS Spec. "Test" Operating Range does not match graph + drawing graph

- Need CSP Model (Ideas) + contacts @ TI + 3rd Party

Structured Inventive Thinking

Vehicle/Customer Information

Model Year: Make: VIN#: Mileage:

Build Date: Present Vehicle Location: Who owns vehicle now:

Customer Name: Phone: Is it ok for engineering to contact customer:

Incident Info/Vehicle History
Where did fire originate? (engine compartment quadrant, suspect location, or suspect component(s))

What was the vehicle circumstances when the fire was noticed? Was the vehicle running, parked, engine on/off… if off, how long?

Did customer notice anything unusual prior to fire? (specifically… difficulty getting the vehicle out of park, speed control not working, brake warning lamp illuminated, stop lamp inoperative)

Do any underhood relays show evidence of overheat?

Were the underhood fuse links blown?

Were there any fuses that were blown or show evidence of other damage?

Is the correct fuse for the stop lamp switch in the fuse box?

Was there any damage to any wiring in the area where the fire was suspected to start?

Does the air suspension pump show evidence of overheating?

Was there any aftermarket modifications to the vehicle? (specifically car alarm, trailer tow, or remote start)

Was the vehicle involved in a natural disaster/accident that required significant vehicle clean up? If so where was cleanup performed?

What was vehicle repair history?

Parts that we would like from vehicle if possible to acquire
Brake pressure switch (preferably with wire pigtail/connector attached and still attached to prop valve)

Sample of brake fluid at prop valve (in sealed glass container)

Relay pack located on LH fender apron (with as much wiring as possible)

EDIS 6 module located on LH fender

Speed control module located on LH fender

Air suspension compressor located under air filter

Air suspension relay

Other suspect parts

Brake Pressure Switch Meeting

3/3/99

	EMAIL		
Steve Reimers	SREIMERS	X03286	AVT/EESE
Fred Porter	FPORTER	X59722	AVT/EESE
M. P. Reese	MREESE	x77142	OPD LVC
Rex Snorge	rsharpe@ti.com	(248) 305-8729	Texas Instruments
Greg Stevens	GSTEVEN1	x 36686	AVT MAT'L
Norm. LaPointe	NLAPOINT	x 42686	AVT/DES. Int.
Steve LaRouche	SLAROUCHE	54876	CENTRAL LAB
Andy McGuirk	a-mcguirk@ti.com	508 2303080	TI QRA
William M. Abramczyk	WABRAMCZ	313 32 23284	ASO

* Steve Berinhouse / Bryan Dague from TI - on conference call

"War Room" Town Car Weekly Mtg.

Agenda

- Testing Status
- Brake Switch Relocation
- Other Potential Solutions

- 92 Town Car at Proving Grounds (43K) [redacted] l
  new & ABS switch Pressure recordings [redacted]
  switch temp (Air, Fluid) * Many [redacted]
  58 Tests (Incompleted) [redacted]
  Samples of Brake Fluid taken [redacted] details)
  Switch is 4F524 "BB" (temp). very clean
  Service History [illegible] majors
  (single sample) [ignited switch base (quickly) burned to [illegible] but not into harness
  [illegible] burning harness (looked lower than switch) once on fire, burned "up" quickly into the connector + base

- Andy
  Reviewed 2/24/99 Potential Thermal Event Theory (w/ Steve Bringhouse)
  How is this different than the Econoline Line incidents? (Rate of corrosion much more severe w/ Econoline)
  (Bill Baron) 600 - 1K service hits/mo 15-20% leakage, still thinks diaphragm degradation is a contributor. Andy - water will degrade Kapton
  (Norm) ① Can we get a fix w/out salt (Steve - need ions to drive electrolysis)
  ↳ sodium/chlorine not picked up in returned analysis (Acrylic Acid)
  ② Prior to mtg. data from Dupont. Water cited as non-reactant to Teflon
  Kapton is teflon coated. Wear over life teflon will brake down
  *TI → look at acrylic acid impact on Kapton
  → Test w/ acrylic acid instead of salt

(Fred)
Recent Junk yard returns 1st returns showing evidence of connector breach
Dave stated that the brake fluid is very corrosive to term contacts

Relocation of Brake Switch to pedal (92, 93, 94) (Marty)
More difficult, interference w/ bracket for ABS switch (or [illegible])
Now looking @ alternative packaging (existing hole for dump valve)
investigating other suppliers for potential packaging application

(Bill B.) Could we impregnate the cavity with "lube" or Silicon (insulation)
Steve → No

look at old brake fluid for conductivity

(BN A) If we put a fuse for connector, impact to customer

Jay Legal (Ford Legal)

Video tape to clarify specific conditions, helpful to narrow applications. Std format! (helps with confidentiality)

[redacted]

2/19/99

w/ Steve Beimers

* Ask about F2VC, F2AC
C492 Date Codes

ship clutches to Gerry Terino

Excellent choice
like the fact DOC includes both snap and quiet

Very interested in when we Searle the quiet
impact looking/concerned [redacted] ld

Flashed Matrix (reviewed [redacted]
At good tastes (Clerk [redacted] day)

few mentions in Crwn Vic / Grand Marq ← Focus on
Town Car

\+
Pressure Switch others not looked out

Steve / Charlie

Russ
Charlie

Attorney Client opinions
to Russ Client Privilege!

3/17/99 | | Team Review @ Ford

Switch Test Log Rvw. (1-11)
Brake Fluid Flash point 312 F (spark) ≈ 150 C
auto ignition 605 F

Any 92, 93 vehicles checked for actual pressure levels @ switch ?
(Planning to evaluate @ Ford).

Several Master Cylinder (considerable) failures on 92, 93 caused brake leaks/fires. Justify taking @ 92/93 vehicle evaluation

* Do not assume 15 Amp. Fuse protection as [redacted] 5).
This test will be increased with power [redacted]
Joe Nami to look at "spark" input [redacted]

May want to look for any "transient" [redacted] to capacitive discharge)

Need to determine if this is a "durability" event vs. a "single" event (Tom Masters collecting all data). Time select year (initial reports

Brake / Speed control system changed in '96

Any 92-95 Town Car, Crown Vic, Grand Marq will be looked at (from fire incident)

Pressure trace (if not from Texas) ask John Joyce

Told NHSTA today that we will (Ford) take field action within 2 months

Common to see reliability issues begin in specific region (hot, cold, salt area).

Tom Basil → Marty Reese 7-7142 mreese@ford.com
(switch

Friday mtg. (have profile - pressure from '92, containment possibilities, Dow interface)

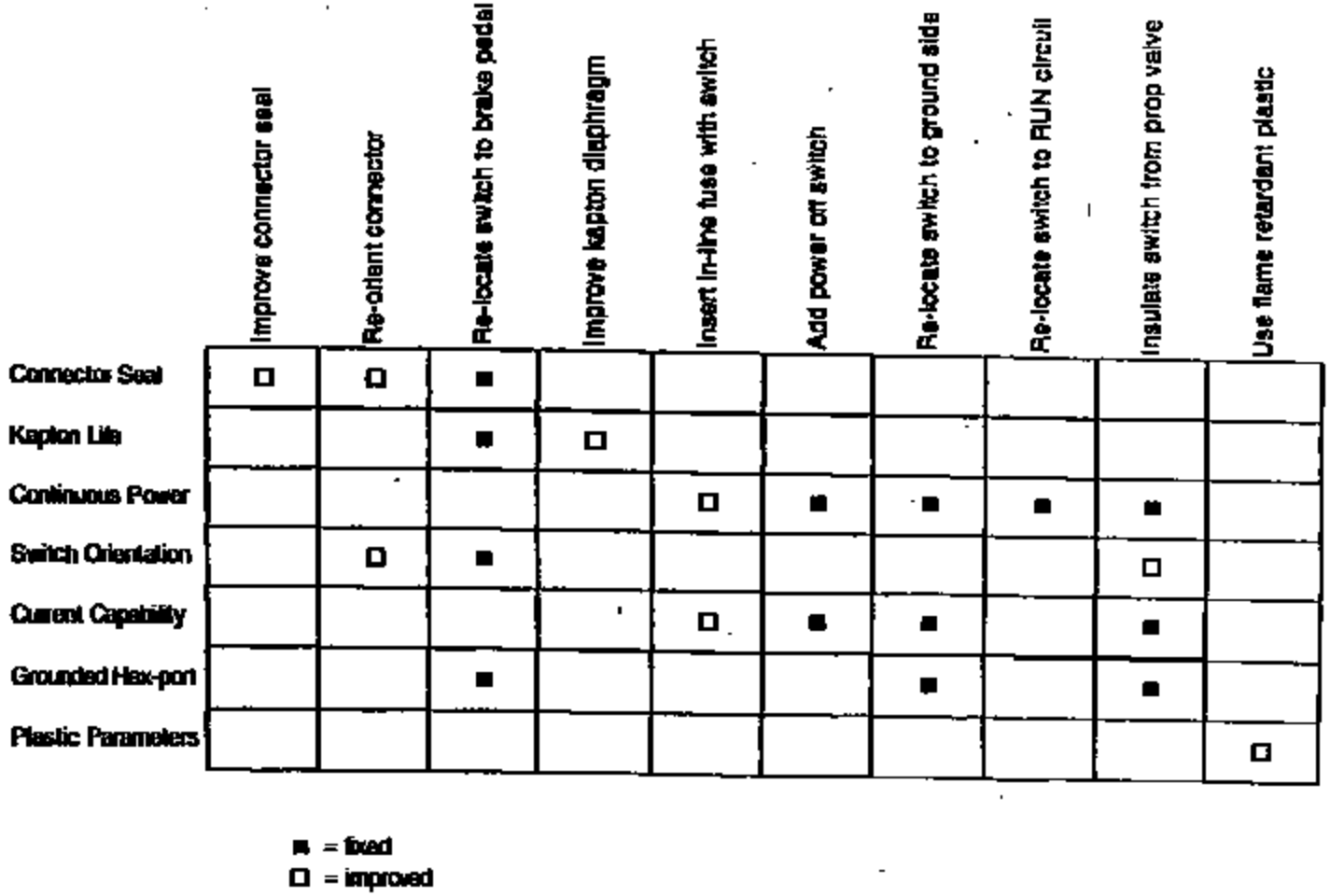
2/10/99

4P-5:15P Brainstorm w/Len

- Get Dow on TEAM
  ~~HAVE~~ ASK: THEM HOW FIRE STARTS WITHIN CONSTRAINTS [14 v, Black Substance, 15 AMP MAX CURRENT, VEH. TEMPERATURES.]
- Char'z REAL VEH Brake Pressure.
- " " " " " in ABS/TC EVENT.
- Thermo-couple Brk Pr switch after Veh. Driven & turned off.
- Take Rate of ABS
  " " " ABS w/TC
- Are Leaks/Fires common to ~~[illegible]~~ traction ASSIST.
- Black Substance: Copper, Zinc, Silver, Sulfur, Brake Fluid.
- Understand TC/ABS Pressure Pulse/
- HISTORY OF ELECTROLYSIS IN Brake Fluid.

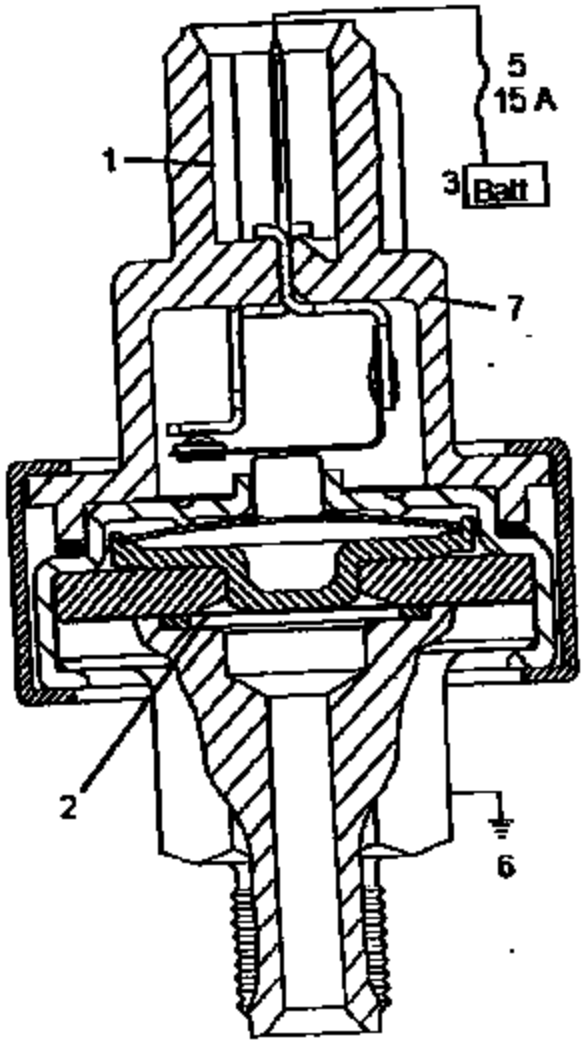
Delivered to Judy M. 3/10/99 by Fan O.

Potential Actions



Delivered to Andy M. 3/10/99 by Ford.

Contributing Factors



1. Connector Seal
2. Kapton Life
3. Continuous Power
4. Switch Orientation
5. Current Capability
6. Grounded Hex-Port
7. Plastic Parameters

AUTOMOTIVE SENSORS AND CONTROLS QRA MANAGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3040
FAX : (508) 236-3745
PAGE: (800) 457-3700 PIN# 604-2044

From: Frederick J. Porter(SMTP:fporter@ford.com)
Sent: Friday, March 12, 1999 9:01 AM
To: a-mcguirk@email.mc.ti.com
Subject: (U) Brainstorming

to: a-mcguirk@email.mc.ti.com

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 FPORTER --DRBN007 03/11/99 17:59 ***
To: N1654584--EXTERNAL

FROM: F. J. Porter USAET(UTC -05:00)
Subject: (U) Brainstorming

Andy,

Attached is a list of ideas that were developed by a group from our research laboratory of potential changes that could be made to the switch that may improve our condition. TI has investigated some of these already.

I would like you to go through each idea and let us know what your feasibility and manufacturing issues are as well as timing for their potential implementation.

1. Coat cup with plastic or other non-conductive coating (like anodizing)
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

2. Make cup of non-conductive material
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

3. Add plastic diaphragm between cup/transfer pin and the spring contact/switch cavity
   Additional layer of isolation between mechanical components and electrical components

4. Place plastic insulator disk on the cup with hole only for the transfer pin

   Reduces surface area exposed between battery and ground

5. Replace kapton membranes with pure teflon membranes
   Increased flexibility of membrane

6. Replace kapton seal with sliding piston seal
   Eliminates wear on kapton

7. Change cup/converter topology
   Spread flexure over greater area of the kapton

Reduce interfaces where extreme flexure occur

8. Replace switch with pressure transducer and semi-conductor switch
   Eliminates kapton seal

9. Design thermal link in power supply side of switch that opens at elevated temperature (one time or cycling)
   Turns off power before heat becomes great enough to cause ignition

10. Reverse polarity of switch contacts
    Removes power from spring contact if it moves out of position

11. Insulate/plastic coat spring except contact area
    Reduces corrosive exposure
    Reduces conductive material to making contact with ground

12. Gold plate spring contact
    Reduces corrosion

13. Fill air gap in switch housing with potting material to seal connector openning
    Seal off connector path of contamination

14. Change switch housing material for improved ignition parameters
    Reduces ability for flame to spread after initial heat source is removed

15. Add another layer to the kapton seal
    Possible increased life of seal before perforations occur

16. Add ground fault interrupter circuit to switch circuit

Turns off power if ground path to case is detected

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

Dague, Bryan

From: St.Pierre, Keith
Sent: Friday, March 12, 1999 3:25 PM
To: Mulligan, Sean; Dague, Bryan; Cambra, Lance
Subject: Test Data

Currey, Pat

From: McGuirk, Andy [a-mcguirk@email.mc.ti.com]
Sent: Friday, March 12, 1999 10:31 AM
To: Beringhause, Steven; Dague, Bryan; Baumann, Russ
Cc: Rowland, Thomas; Pechonis, John
Subject: FW: (U) Brainstorming

AUTOMOTIVE SENSORS AND CONTROLS QRA MANGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 604-2044

From: Frederick J. Porter[SMTP:fporter@ford.com]
Sent: Friday, March 12, 1999 9:01 AM
To: a-mcguirk@email.mc.ti.com
Subject: (U) Brainstorming

to: a-mcguirk@email.mc.ti.com

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 FPORTER --DRBN007 03/11/99 17:59 ***
To: N1654584--EXTERNAL

FROM: F. J. Porter USAET(UTC -05:00)
Subject: (U) Brainstorming

Andy,

Attached is a list of ideas that were developed by a group from our research laboratory of potential changes that could be made to the switch that may improve our condition. TI has investigated some of these already.

I would like you to go through each idea and let us know what your feasibility and manufacturing issues are as well as timing for their potential implementation.

1. Coat cup with plastic or other non-conductive coating (like anodizing)
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

2. Make cup of non-conductive material
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

3. Add plastic diaphragm between cup/transfer pin and the spring contact/switch cavity
   Additional layer of isolation between mechanical components and electrical components

4. Place plastic insulator disk on the cup with hole only for the transfer pin

Reduces surface area exposed between battery and ground

5. Replace kapton membranes with pure teflon membranes
   Increased flexibility of membrane

6. Replace kapton seal with sliding piston seal
   Eliminates wear on kapton

7. Change sup/converter topology
   Spread flexure over greater area of the kapton
   Reduce interfaces where extreme flexure occur

8. Replace switch with pressure transducer and semi-conductor switch
   Eliminates kapton seal

9. Design thermal link in power supply side of switch that opens at elevated temperature (one time or cycling)
   Turns off power before heat becomes great enough to cause ignition

10. Reverse polarity of switch contacts
    Removes power from spring contact if it moves out of position

11. Insulate/plastic coat spring except contact area
    Reduces corrosive exposure
    Reduces conductive material to making contact with ground

12. Gold plate spring contact
    Reduces corrosion

13. Fill air gap in switch housing with potting material to seal connector openning
    Seal off connector path of contamination

14. Change switch housing material for improved ignition parameters
    Reduces ability for flame to spread after initial heat source is removed

15. Add another layer to the kapton seal
    Possible increased life of seal before perforations occur

16. Add ground fault interrupter circuit to switch circuit
    Turns off power if ground path to case is detected

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

Dague, Bryan

From: McGuirk, Andy
Sent: Friday, March 12, 1999 11:31 AM
To: Beringhause, Steven; Dague, Bryan; Baumann, Russ
Cc: Rowland, Thomas; Pechonis, John
Subject: FW: (U) Brainstorming

AUTOMOTIVE SENSORS AND CONTROLS QRA MANAGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3749
PAGE: (800) 467-3700 PIN 604-2044

From: Frederick J. Porter(SMTP:fporter@ford.com)
Sent: Friday, March 12, 1999 9:01 AM
To: a-mcguirk@email.mc.ti.com
Subject: (U) Brainstorming

to: a-mcguirk@email.mc.ti.com

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 FPORTER --DREN007 03/11/99 17:59 ***
To: N1654584--EXTERNAL

FROM: F. J. Porter USAET(UTC -05:00)
Subject: (U) Brainstorming

Andy,

Attached is a list of ideas that were developed by a group from our research laboratory of potential changes that could be made to the switch that may improve our condition. TI has investigated some of these already.

I would like you to go through each idea and let us know what your feasibility and manufacturing issues are as well as timing for their potential implementation.

1. Coat cup with plastic or other non-conductive coating (like anodizing)
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

2. Make cup of non-conductive material
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

3. Add plastic diaphragm between cup/transfer pin and the spring contact/switch cavity
   Additional layer of isolation between mechanical components and electrical components

4. Place plastic insulator disk on the cup with hole only for the transfer pin

Reduces surface area exposed between battery and ground

5. Replace kapton membranes with pure teflon membranes
   Increased flexibility of membrane

6. Replace kapton seal with sliding piston seal
   Eliminates wear on kapton

7. Change cup/converter topology
   Spread flexure over greater area of the kapton
   Reduce interfaces where extreme flexure occur

8. Replace switch with pressure transducer and semi-conductor switch
   Eliminates kapton seal

9. Design thermal link in power supply side of switch that opens at elevated temperature (one time or cycling)
   Turns off power before heat becomes great enough to cause ignition

10. Reverse polarity of switch contacts
    Removes power from spring contact if it moves out of position

11. Insulate/plastic coat spring except contact area
    Reduces corrosive exposure
    Reduces conductive material to making contact with ground

12. Gold plate spring contact
    Reduces corrosion

13. Fill air gap in switch housing with potting material to seal connector openning
    Seal off connector path of contamination

14. Change switch housing material for improved ignition parameters
    Reduces ability for flame to spread after initial heat source is removed

15. Add another layer to the kapton seal
    Possible increased life of seal before perforations occur

16. Add ground fault interrupter circuit to switch circuit
    Turns off power if ground path to case is detected

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

Dague, Bryan

From: Rahman, Aziz
Sent: Wednesday, March 10, 1999 8:03 AM
To: Warner, Pam
Cc: McGuirk, Andy; Dague, Bryan; Beringhause, Steven

> > etc.?
> >
> > Please give me as much information as you can.
> >
> > All the best,
> >
> > Sean P. Mulligan
> >
> > Texas Instruments
> > Automotive Sensors & Controls
> > Mechanical Design
> > Phone (508) 236-2535
> > Fax (508) 236-3586

Dague, Bryan

From: McGuirk, Andy
Sent: Tuesday, June 01, 1999 9:39 AM
To: Pechonis, John; Dague, Bryan; Prola, Stephen; Watt, Jim
Cc: Baumann, Russ
Subject: FW: Ford Core team update

for your background info as we host Steve reimers weds

B

AUTOMOTIVE SENSORS AND CONTROLS QRA MANAGER
34 FOREST ST M/S 23-09
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
MOBILE: (508) 208-6119
PAGE: (800) 467-3700 PIN 604-2044

From: McGuirk, Andy
Sent: Friday, May 28, 1999 3:22 PM
To: 'Frederick J. Porter'
Cc: Beringhause, Steven; Sharpe, Robert
Subject: Ford Core team update

Fred, per our discussions and Rob Sharpe's visit enclosed is our updates...


FredPortCore.doc


synopsII.doc


TESTLOG9.xls


77PSL2_1.xls

Charlie

Charlie Douglas
(508) 236-3657 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

From: Sullivan, Martha
Sent: Monday, February 08, 1999 9:02 AM
To: McGuirk, Andy
Cc: Douglas, Charles; Beringhause, Steven; Rowland, Thomas
Subject: Ford ISAC Meeting

I am leaving for a Ford ISAC meeting tomorrow. Given reports of executive level exposure on the Town Car issue, I expect some questions. Could you please consolidate the questions we've been asked and our responses to date.

Dague, Bryan

From: McGuirk, Andy
Sent: Monday, February 08, 1999 8:05 AM
To: Baumann, Russ; Beringhause, Steven
Cc: Dague, Bryan; Pechonis, John; Rowland, Thomas; Sullivan, Martha; Baker, Gary; Rahman, Aziz; Sharpe, Robert
Subject: Friday 'eve' Fred Porter telecon 2/5/99

attorney - client privileged communication

I was able to speak with Fred Porter Friday afternoon. We brought Rob Sharpe into a conference call and delivered several points:

- Aziz Rahman was coming into the team to join Fred 10AM Tuesday as a TI Design Engineering resource..."great" was the reaction.
- Andy McGuirk was coming into the team as a mechanism to augment our desire and actions for prompt and complete communication...he has my 24 hour nationwide pager and home tel number should he feel a need to elevate any issue through TI he was told to feel free to contact me and allow a 20 minute response. I could feel Fred trying to explain some of the Ford meeting implied feedback about our support and just re-stated our commitment to be fully supportive of the process.
- Rob helped us lead into a discussion that allowed me to re-enforce that this P/S issue was receiving highest priority inside TI and we were committed to resolving issues/questions/analysis around the application...I spoke of executive and leadership level involvement.
- Fred was very difficult to connect with.... he stated this was the worst week he could recall.... his voice mailbox had become overflowing on Friday. he also stated that our deliverables for Friday could be delivered Monday and again Tuesday during Aziz's first day. I covered some of those on the phone to let him know we had done our homework.
- We arranged to have Steve Beringhause have a conversation Friday afternoon...but Fred implied he was too tired to focus...

AUTOMOTIVE SENSORS AND CONTROLS GBA MANAGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGER (800) 467-3700 PIN 604-2044

Dague, Bryan

From: McGuirk, Andy
Sent: Saturday, February 06, 1999 10:54 AM
To: Baumann, Russ; Rose, Elaine; Watt, Jim
Cc: Beringhause, Steven; Dague, Bryan; Pechonis, John; Rowland, Thomas; Sullivan, Martha; Baker, Gary; Rahman, Aziz; Sharpe, Robert
Subject: 77 p/s 'durability' baseline information

attorney - client privileged communication

Jim and Elaine, as I mentioned in my telecons, I would like us to move forward in quickly assembling data that we can use to help Ford understand our 'sensor' assembly durability baseline in the brake switch package. This, as I see it, would be composed of 3 major sections per below (please feel free to insert your ideas also) and for the most part needs to be delivered early w/o Feb 8th:

A) I want to demonstrate that manufacturing anomalies did not escape to the field in the form of a projection of hydraulic fluid leakers through the supply chain.... and we can help achieve this objective by assembling data that demonstrates our history of hydraulic leak rates in the subject time-frame of MY92 and MY 93 as seen in our factory floor and/or customer feedback. Jim, please take the lead on getting this done ASAP. we should consider customer AIQ spreadsheets and RMR data coupled with 6D's of the time to build a case for the low PPM leak rates of the sensor assembly further protected by downstream supply chain testing at the TIER-one and OEM. Also, there may be an opportunity to integrate manufacturing test data as a validator of that leak rate number as well as using the leak test data from impulse testing as an alternate source. there will be a building need to deliver data and evidence by Tuesday via Aziz and we should consider an alternate path of anecdotal estimate should the records not be readily available. (I know we will need to identify and recall records and that will take time)

B) I want to demonstrate that the sensor assembly is mechanically durable and surpasses the 'expected' life cycles as expressed on the Ford specs....and we can achieve this objective by assembling ES 'impulse' testing data from the timeframe of interest. In an ideal situation we would take this raw data and project into WEIBULL success-testing estimate of cycle capability in the 'accelerated simulated' cyclers used in our process controls. Elaine please coordinate the data collection here. (We will likely turn to reliability experienced quality engineers Paul spaceman and Tushar Parikh to convert the data to information). Again, should we run out of time, we will need to turn to whatever relevant 'recent' data we have to propose our position and support with historical based data once we sort through the files and record recall process. Bryan, please inject any life test data from other qualification platforms here so we have 'test-to-failure' data if available.

Also, we should make a side note of the pressure profile used in the cycler process for future use with Aziz during his upcoming dialogues with Ford.

C) I want to demonstrate that the sensor is chemically resistant per the IP and PPAP testing and surpasses 'expected' exposures per the Ford Specs... and we can achieve this by assembling both relevant IP testing and PPAP results to demonstrate compliance. There may also be other testing history of the period that would convey that durability of the switch assembly in the typical automotive fluid environment of gas-oil-coolant-fluids in the proper orientation and connector protection. Elaine, please assemble this data and we will provide to Aziz to deliver to Ford. Again, should we run out of time, delivery of the readily available records from '95-'96-'97 per your Friday work would suffice as a starting point.

To provide some further clarity, I have included the focal part numbers from Charlie Douglas below. As we assemble data and translate into information please track the differences between 57 and 77 and 87 styles but also integrate the brake sensor assembly data and treat it as a family. As you discover the level of effort and resource needs, pls see John or me for help in getting people assigned or priority provided.

thank you for your continued support here,

a

AUTOMOTIVE SENSORS AND CONTROLS QRA MANAGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3088
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 504-2044

From: Douglas, Charles
Sent: Friday, February 05, 1999 8:43 AM
To: McGuirk, Andy; Rose, Elaine
Subject: 77PS Matrix

Andy / Elaine,

Per our discussion:

Regards,

Charlie

Charlie Douglas
(508) 236-3857 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

Dague, Bryan

From: Douglas, Charles
Sent: Friday, February 05, 1999 11:51 AM
To: Baker, Gary; Dague, Bryan; Rahman, Aziz; Rowland, Thomas; McGuirk, Andy
Cc: Pechonis, John
Subject: FW: Town Car Brake Pressure Switch

fyi,

Charlie

Charlie Douglas
(508) 236-3857 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

From: Sharpe, Robert
Sent: Friday, February 05, 1999 11:45 AM
To: Douglas, Charles
Cc: Beringhause, Steven; Sullivan, Martha; Baumann, Russ; Dodd, Bob
Subject: Town Car Brake Pressure Switch

Yesterday afternoon, I was requested to attend a meeting at Ford in regards to the Lincoln Town Car Fire issue.

Attendee's

Fred Porter, Steve Reimers - Chasis Electronic Systems
Tom Masters - Large/Lux Vehicle Systems & Wiring
Steve LaRouche - Ford Central Labs
Norm LaPointe - AVT Design Analysis
Rob English - Core Electrical
Paul Stokes - Speed (cruise) Control
John McInerny - Large/Lux Vehicle Safety Group
Joe Nemi (sp?) - Large/Lux Vehicle Safety Group

Summary

This issue is one of Ford's top priorities and is gaining Executive Level exposure. Ford does not have a root cause to reply to NHTSA's inquiry. Strong perception that the fires have originated at the pressure switch, based on (1) NHTSA's internal investigation, (2) reports from insurance investigators, (3) incident at Memphis where vehicle fire started in front of mechanic and mechanic noted that only the switch was "burning" (switch was replaced and vehicle returned to owner - same switch that was analyzed in TI-A). Ford stated that the pressure switch should be considered as "guilty" until proven innocent. To this point, TI has been viewed as "cooperative" but not "proactive" (Ford is looking for our help as they consider TI the experts in regards to switch issues).

Ford is concerned that in absence of a "root cause" response to NHTSA, NHTSA will pick the brake switch and demand that all Town Cars with Cruise Control be grounded (recalled). Without a root cause, containment action is unclear. Possible containment includes (1) disengage cruise/speed control option (high impact to customer) or (2) rewire the brake switch to an ignition feed. It was confirmed by the cruise control group that there is no necessity to have the brake switch "hot" (12v) at all times. Both options are under discussion.

Although there is high attention on the brake switch, John McInerny stated that other components must be investigated as well. His comments were based on;

- Data Base search of all MY92/93 Lincoln Town Car fires shows approx. 132 incidents
  Data Base search of all MY92/93 Town Car fires with brake switch identified shows approx 32 incidents
- NHTSA has requested Ford to investigate/respond to the following components;
  - Brake Pressure Switch
  - 42 way connector (beneath the brake fluid fill reservoir)
  - EEC (Controller) wire harness
  - Relay Pack (contains 3 relays (AC Cut off, EEC, fuel pump) and the EEC diode)

Ford is now investigating to verify if other fires, similar in nature, have occurred on other vehicle lines that use this switch. Focus is on the MY92/93 Crown Vic and Grand Marq as they have identical systems.

Ford has requested an "on site" TI representative familiar with this specific brake switch application.

Questions for TI

- What are the flash points for all components/material used in the switch?
- Are the material specs submitted to Ford the same as the material spec's used on the MY92/93 applications?
- Does our DFMEA or PFMEA identify any potential "fire" occurrences?
- How do we control our terminal positioning in production? Any chance for the terminals to "short"?
- Has our IP testing showed any failures or concerns (confirm IP testing results)?
- Are there any material differences between the different colored bases?
- Where are the answers/feedback to the "many" questions asked during the analysis at TI Tech Lab's? (stated many questions were asked, primary was in regards to the cause of the crease mark found on the kapton)
- What testing/investigating is TI doing internally. Are we trying to simulate any conditions that verify a fire potential?
- Do we sell the brake switch outside of Ford applications? If so, is it wired "hot" at all times?
- Ford would like "color" pictures from the Econoline failure analysis report (connector issue).

Actions

(TI) Respond to above questions by early next week
(TI) Respond to Ford request of providing on-site engineer, preferably on 2/5/99
(Ford) Develop a Work Plan to support a 14D and a Tech Review
(Ford) Retrieve additional field samples from the South. All components identified by NHTSA will be collected.
12 additional switches from Houston (hi mileage, no fire) were given to Fred Porter
(Ford) Support meeting with UTA on 2/12/99 to discuss wiring/connector issues
(Ford) Monitor testing of brake switches (@ Bldg5) injected with brake fluid and a 24v supply across terminals (ongoing)

Please contact me if you have questions regarding the information above.

Best Regards,

Rob Sharpe
Texas Instruments
Phone (248) 305-5729
Fax (248) 305-5734

During week 6 or week 7, Stan will be setting up a technical brainstorming meeting where the objective is to look at alternative technical approaches for developing a switch that will be robust to cavitation and meet customer technical performance requirements.

As part of this meet, we are being asked to help define the global market opportunity for pump mount pressure switches. I know we have done some of this analysis in the past so hopefully this request for market information will not be to much of a burden. By way of this msg, I would appreciate it if you could provide the following information by no later than February 5th:

* Breakdown of TI pump mount pressure switch volume in KU by customer for your region for CY00 - CY05
* Breakdown of total known market for pump mount pressure switches in KU for your region for CY00 - CY05

I would also appreciate it if you could include any comments relative to critical customer care-abouts for design criteria relative to your region. A few possible examples are as follows:

* Your customers may require a specific switch logic
* Hex on body may be a necessity
* A minimum switch differential may be a requirement
* Cost / price factors may be a significant issue

Any comments you can offer will help this brainstorming activity.

Please let me know in advance if you do not think you can provide your inputs by February 5th.

Thanks and best regards,

Charlie

Charlie Douglas
(508) 236-3857 (P)
(508) 236-1695 (F)
c-douglas2@ti.com

Dague, Bryan

From: Beringhause, Steven
Sent: Friday, February 05, 1999 6:46 AM
To: Dague, Bryan
Subject: FW: Ford Lincoln Cruise control

From: McGuirk, Andy
Sent: Thursday, February 04, 1999 5:46 PM
To: Sullivan, Martha; Baumann, Russ; Douglas, Charles
Cc: Beringhause, Steven; Baker, Gary; Rowland, Thomas; Pechonis, John
Subject: Ford Lincoln Cruise control

ATTORNEY CLIENT PRIVILEGED INFORMATION

LETS ALL AGREE TO A SHORT ACTION LIST OF THE THINGS WE ARE DELIVERING TO FORD TODAY....FRIDAY FEB 5TH

1) DIFFERENCES BETWEEN THE FORD P/S ON PORTER LIST (ACTIVE PRODUCTION P/N ONLY)
1A) **identify the difference** between these parts specifications .....DAGUE/BERINGHAUSE,
1B) Please **identify the difference** between these parts materials .....DAGUE/BERINGHAUSE
1C)Please **identify the difference** between these parts manufacturing process.....PECHONIS

2) CHANGES ON THE FORD P/N ON THE PORTER LIST (ACTIVE PRODUCTION P/N ONLY)
2A)Also include the **change history** on these components.(SREA HISTORY)..... MCGUIRK

3) OVERVIEW OF PROCESS FLOW (requested an assembly process overview).....DOUGLAS

REGARDS

A

, AUTOMOTIVE SENSORS AND CONTROLS QRA MANGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 504-2044

From: Douglas, Charles
Sent: Thursday, February 04, 1999 1:56 PM
To: Sullivan, Martha; Baumann, Russ; McGuirk, Andy
Cc: Beringhause, Steven; Baker, Gary; Rowland, Thomas
Subject: RE: Ford Lincoln Cruise control

attorney - client privileged information.

As additional and new information. Fred Porter just phoned in and this whole situation appears to be escalating. Ford is very concerned that NHTSA is going to issue a final ruling (with or without Ford input) and that the ruling could literally come down within the next few days. I did not attempt to get into specifics as to implications from a NHTSA ruling.

Rob Sharpe has been called in to attend an emergency meeting at Ford at 2:00 pm today. Only questions Rob will be prepared to answer center around capacity on the 77PS assembly line. Meeting was called by Fred Porter's group.

Fred had several technical requests all of which were deferred to Steve. Fred also requested an assembly process overview. If there are any issues with honoring this request, please let me know asap as I have committed to a response of no later than Friday am.

Regards,

Charlie

Charlie Douglas
(508) 236-3657 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

a

AUTOMOTIVE SENSORS AND CONTROLS QUA MANAGER
34 FORBST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 804-2044

Dague, Bryan

From: Beringhause, Steven
Sent: Thursday, February 04, 1999 3:33 PM
To: Baumann, Russ
Cc: Baker, Gary; Rowland, Thomas; Douglas, Charles; Dague, Bryan; Sullivan, Martha; McGuirk, Andy
Subject: RE: Ford Lincoln Cruise control

attorney - client privileged information.

I spoke with Fred Porter this afternoon. He also told me he is concerned that NHTSA will issue a finding. He said another fire occurred yesterday and this whole thing was heating up.

He feels one solution is to disconnect the switch, he believes that the electricity is involved in the ignition. He believes the switch is at the center of the fire. He is currently running an experiment where he has taken a switch, drilled a hole in the housing and filled it with brake fluid. He has applied 24V to the switch for two days and nothing has happened. The switch is only drawing 0.5ma. He is waiting to see if the current draw increases over time. We discussed that maybe the current driver is occuring elsewhere. He stated that the clutch coil limits the current flow and there is a FET to ground.

We discussed the possibility of adding a fuse to the wire harness but he does not know what current threshold to set the fuse at. We discussed the use of a thermal protection device in the connector and he thought that it might be a possible idea but he is unsure how to do it.

They found copper and zinc on the sensor cup for both leakers and the two very burned switches from fires. He

feels that corrosion of the contact arm is a common thread in leakers and fires.

Fred believes there will be a recall, he hopes that it can be limited to the F2VC part (town car, contenental, etc) and not across the fleet. They are looking at differences in pressure, mounting location etc. as well as warranty reports that may validate this approach.

Fred also requested that TI sends an engineer to Ford for a few weeks to help them with the investigation. The engineer would need to have switch design and process knowledge as well as be a contact to the rest of the TI organization. I told him I would get back to him on this.

Steve

Dague, Bryan

From: Ha, DI
Sent: Thursday, February 04, 1999 11:11 AM
To: Dague, Bryan
Subject: RE: 77PS reports

http://www-pcd.mc.ti.com/pdl/pa/reports/reports.htm

From: Ha, DI
Sent: Thursday, February 04, 1999 10:06 AM
To: Dague, Bryan
Subject: 77PS reports

Here's all I could dig out from the logs:

1995 thru 1998 (on the Web)

<<File: 77report_95 thru 98.xls>>
1991 THRU 1994 (NOT ON WEB)
<<File: 77reports.xls>>

Dague, Bryan

From: Ha, DI
Sent: Thursday, February 04, 1999 10:05 AM
To: Dague, Bryan
Subject: 77PS reports

Here's all I could dig out from the logs:

1995 thru 1998 (on the Web)

77report_95 thru 98.xls

1991 THRU 1994 (NOT ON WEB)

77reports.xls

Dague, Bryan

From: Douglas, Charles
Sent: Wednesday, February 03, 1999 3:10 PM
To: Dague, Bryan
Cc: Beringhause, Steven
Subject: Matrix for Fred Porter

Bryan,

Per our discussion, hopefully the attached will help.

lincoln.doc

Regards,

Charlie

Charlie Douglas
(508) 236-3557 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

REDACTED

Jim

Dague, Bryan

From: St.Pierre, Keith
Sent: Tuesday, March 16, 1999 10:17 AM
To: Dague, Bryan; Mulligan, Sean; Cambra, Lance
Subject: Rain Water.xls


Rain Water.xls

Dague, Bryan

From: McGuirk, Andy
Sent: Saturday, March 13, 1999 9:00 AM
To: Beringhause, Steven; Dague, Bryan; Baumann, Russ
Cc: Rowland, Thomas; Baker, Gary
Subject: FW: (U) Brainstorming

fred and team really like the last one....and it may be a very good solution as it deals with a method of de-powering which is near to our long term input to Ford.....TURN OFF THE POWER. this is done if a fault is detected....

when could we have an idea/concept? should we deploy this to an extended eng'g team outside us for 'invention' - delivery ?

a

REDACTED

REDACTED

REDACTED

REDACTED

Dague, Bryan

From: Hopkins, AL
Sent: Wednesday, January 20, 1999 11:21 AM
To: Dague, Bryan; Baumann, Russell
Cc: McGuirk, Andrew; Andres, Amy
Subject: 99-033: TSL # 150709: ANALYSIS OF MATERIAL REMOVED FROM 77PS THERMAL EVENT

ATTORNEY-CLIENT PRIVILEGED COMMUNICATION

OBJECTIVE:
Determine nature of deposit; in particular, determine if it is consistent with the results from Ford's analysis.

SUMMARY:
The results were very similar to those found by Ford. The main difference is that our EDX detector has a much better low energy cutoff than did the Ford detector. Their detector is unable to detect carbon and oxygen. Our analysis showed large amounts of carbon and oxygen on all three samples.

RESULTS AND DISCUSSION:
All of the samples were comprised of a mixture of different phases that had agglomerated together. A description of our findings is shown below:

BLACK FLAKE FROM TROUGH: We found the following elements which are listed in a very approximate decreasing order of preponderance: copper, oxygen, carbon, chrome, zinc, potassium, sulfur, and silver.

MATERIAL SCRAPPED FROM CUP ASSEMBLY: There were a very large number of glass fibers present which had the composition that is typically used in plastics for reinforcing purposes. In other words, this is almost certainly from thermal decomposition of the plastic base. The EDX detectable elements in these fibers are calcium, aluminum, silicon and oxygen. The rest of the material was very similar in composition to that reported for the above sample although we also detected some phosphorous in this sample.

GREEN MATERIAL ON CUP: This material was similar to that found on the first sample although the amount of chrome was much less.

The data was collected under the guidelines of TSL-S-71, Rev A which can be accessed at http://www-mcd.mc.ti.com/tsl/. SEM-EDX (Scanning Electron Microscope with Energy Dispersive Analysis of X-rays) analysis was used in the above described analysis. The data will be sent through the internal mail.

AL HOPKINS MSG ID: AHOP PHONE: 508/236-3040

harness) could contribute to brake fluid entering into our switch thru the connector.

- NHTSA is investigating this issue independently. Based on their findings, NHTSA could demand a Ford response (recall ?) within 5 days of their response. Fred said NHTSA response could happen 'anytime'.

- Ford has pulled 12 switches from vehicles in Florida with mileage's ranging between 50K - 100K. These switches, which have not experienced any thermal degradation, will be analyzed with switches from thermal events, at Ford. See item 5) from the above requests from Fred Porter.

Charlie, please review this note with the team and inform me of timing in regards to the above 5 requests from Fred. I feel that it would be to our benefit to have a qualified TI representative at Ford during their upcoming analysis of brake switches from both thermal and non thermal events. Again, Ford would like to begin this analysis ASAP (next couple of days) but is waiting for our reply before beginning. Ford is on Holiday today in recognition of Martin Luther King.

Best Regards,

Rob Sharpe
Texas Instruments
Phone (248) 305-5729
Fax (248) 305-5734
rsharpe@ti.com

Dague, Bryan

From: Sharpe, Robert
Sent: Monday, January 18, 1999 9:09 AM
To: Douglas, Charles; Baumann, Russ
Cc: Rowland, Thomas; Baker, Gary; Dague, Bryan; McGuirk, Andy; Dodd, Bob
Subject: Lincoln Town Car Brake Switch

(Ford) Fred Porter contacted me late last Friday (1/15) and had the following requests:

1) A copy of a TI 8D from a previous brake switch (thermal) issue on an Econoline application.

2) A copy of the TI report from the analysis performed at our technical labs (w/Ford) on 1/7/99.

3) Material Specification #'s for all components of the brake switch.

4) Status of any TI internal testing to recreate a thermal event within the switch.

5) Ford has received several additional switches from Lincolns which experienced a thermal event. Fred has invited TI to participate in their analysis at Ford labs. This testing needs to start ASAP but Ford will wait for our response.

** I informed Fred that above items 1) and 3) were submitted to Norm LaPointe on 1/7/99. He asked if we

could provide additional copies to his attention.

In a follow up conversation with Fred, the following items were discussed;

- There is a total of 48 Lincoln Town Car's documented/related to this thermal issue. Fred stated that they are now searching their entire field warranty data base and have found similar issues on a few Crown Vic/Grande Marquee applications. In addition, it appears that the Town Car incidents may not be isolated to the South. This search (on all Ford applications) is still in process.

- Ford legal completed a "sweep" on 1/8/99, collecting all internal Ford documents relating to this issue. A class action suit has been filed against Ford.

- Fred has not issued any internal summary report. As of today, Fred stated that he has not seen any evidence that would point to something "other than the brake switch" as the origin of the thermal issue. However, Fred stated that he has not personally reviewed all of the investigations his team is performing. He added that Bill Bramzick (sp ?), who is the Ford rep responsible for replying to NHTSA inquiry, has been investigating actual field incidents and noted that several vehicles' power distribution boxes (located near the brake switch) also appeared damaged from a thermal event. Fred is also wondering if possible overfill of brake fluid (onto the wire harness) could contribute to brake fluid entering into our switch thru the connector.

- NHTSA is investigating this issue independently. Based on their findings, NHTSA could demand a Ford response (recall ?) within 5 days of their response. Fred said NHTSA response could happen "anytime".

- Ford has pulled 12 switches from vehicles in Florida with mileage's ranging between 50K - 100K. These switches, which have not experienced any thermal degradation, will be analyzed with switches from thermal events, at Ford. See item 5) from the above requests from Fred Porter.

Charlie, please review this note with the team and inform me of timing in regards to the above 5 requests from Fred. I feel that it would be to our benefit to have a qualified TI representative at Ford during their upcoming analysis of brake switches from both thermal and non thermal events. Again, Ford would like to begin this analysis ASAP (next couple of days) but is waiting for our reply before beginning. Ford is on Holiday today in recognition of Martin Luther King.

Best Regards,

Rob Sharpe
Texas Instruments
Phone (248) 305-5729
Fax (248) 305-5734
rsharpe@ti.com

Dague, Bryan

From: Hopkins, AL
Sent: Friday, January 08, 1999 6:12 PM
To: Dague, Bryan; Prola, Stephen; Douglas, Charles
Cc: Andres, Amy
Subject: 99-014: TSL # 150709: 77PS FROM LINCOLN TOWN CAR

Bryan, could you use Ford's x-rays to double check my belief that the movable contact fracture/arc-off occurred within the plastic layer separating the switch cavity from the terminal cavity. For my selective corrosion theory to be reasonable, there has to be some force keeeping a small amount of water up against the terminal leg. I assume that that force has to be capillary attraction. For that to be true, the failure has to occur within that layer of plastic which separates the two cavities.

The data was collected under the guidelines of TSL-S-71, Rev A which can be accessed at http://www-mcd.mc.ti.com/tsl/. SEM-EDAX (Scanning Electron Microscope with Energy Dispersive Analysis of X-rays) analysis was used in the above described analysis. The data will be sent through the internal mail.

AL HOPKINS MSG ID: AHOP PHONE: 508/236-3040

Dague, Bryan

From: Kil, Beth
Sent: Friday, January 08, 1999 3:15 PM
To: Dague, Bryan
Cc: Hopkins, Al
Subject: TSL # 160709, Fluid identification

Objective:
Isolate and identify the fluid samples found in customer returned device.

Results:
First, I rinsed the cap, exoluding the transfer pin hole, with chloroform. I filtered the mixture to remove the solids, and then evaporated the solvent. The remaining residue was identified as brake fluid by FT-IR spectroscopy. The match factor was 89% compared to a reference sample of Nissan brake fluid in my database. Visual comparison of the Nissan fluid to the sample suggests the fluid from the sample contains less water. This may be due to slightly different formulations produced by different manufacturers.

Next, I scanned the samples of fluid, provided by Al, from the transfer pin hole and the converter of this device. The two samples from the transfer pin hole are identical to the fluid rinsed from the cap with chloroform. The fluid from the converter also appears to be brake fluid, but appears to contain slightly more water than the other samples.

I will forward the spectral data to you by internal mail. Please let me know if I can discard the remaining fluid samples, or if you would like me to forward these to you also.

Regards,

Beth

Ext. 3069 MS 10-16 Fax 1670

Dague, Bryan

From: Douglas, Charles
Sent: Wednesday, January 06, 1999 12:09 PM
To: Dague, Bryan
Cc: Baker, Gary; Beringhause, Steven; Hopkins, AL
Subject: FW: Florida Information

Bryan,

I am not sure if you are having any success in working through our suppliers but I think we need to be in a position to provide answers to the questions Fred has asked no later than the meeting tomorrow. Please let me know if you think this will be a problem.

Regards,

Charlie

Charlie Douglas
(508) 236-3657 (P)
(508) 236-1698 (F)
c-douglas2@ti.com

From: Douglas, Charles
Sent: Monday, January 04, 1999 5:23 PM
To: 'Porter, Fred (Ford)'
Subject: FW: Florida Information

Fred,

I was not able to get answers to all of your questions and will pass along what we know right now:

- While the exact melt temperature of the Noryl GTX 830 was not available, we do know that this material is molded in the 540 F - 580 F range.
- Kapton does not melt nor burn. Technically it "chars". While we have not been able to determine the exact char temperature of the Kapton, we do know that it is well above 600 F.
- Our team is working on the information on the gasket --> we need to get this from our supplier.

I have a meeting with Bryan Dague and Al Hopkins first thing in the morning and will raise these questions again with them (Al is only returning from vacation on Tuesday). My concern is that we may be reliant on our suppliers for some of the information that you are requesting. What I will try to understand from Al and Bryan is if we have the capability to run tests to determine these temperatures ourselves (if this is the best way to generate the information).

Regards,

Charlie

Charlie Douglas
(508) 236-3657 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

From: K. Porter(SMTP:kporter@voyager.net)
Sent: Monday, January 04, 1999 12:16 AM
To: c-douglas2@ti.com
Cc: Fred Porter
Subject: Florida Information


PIC00002.jpg.jpe


PIC00003.jpg.jpe


PIC00004.jpg.jpe


PIC00005.jpg.jpe

Charlie,

Attached are four pictures that I took of the vehicle in Florida.

There was no plastic left on the part and the connector and seal were also gone. According to the analysis, the wires in the wire harness showed no signs of shorting.

Questions that arose:

1) What is the melting point of kapton, the seal and the plastic used in the switch?

2) At what temperature will those three start to burn?

Dague, Bryan

From: Baker, Gary
Sent: Wednesday, January 06, 1999 12:05 PM
To: Prola, Stephen; Douglas, Charles; Hopkins, AL; McGuirk, Andy; Dague, Bryan; Baumann, Russ
Subject: Plastics Flamability

I have had Val get a copy of the UL Standard 94 that relates to Flamability of Plastics. The pressure switch Noryl material is UL rated to Standard 94HB (horizontal burning). Basically, to my reading, to earn UL 94HB rating a test specimin must self-extinguish after being ignited by a Bunsen burner. This should be useful background information for tomorrow's discussion.

I will give this info to Charlie to support the visit.

- Gary

—Original Message—
From: Prola, Stephen
Sent: Wednesday, January 06, 1999 7:52 AM
To: Douglas, Charles; Hopkins, AL; McGuirk, Andy; Baker, Gary; Dague, Bryan; Baumann, Russ
Subject: 77ps.ppt

<< File: 77ps.ppt >>
Here's the "Cause & Effect" diagram we discussed yesterday. Please review and comment. Thanks

Regards,

Steve

Dague, Bryan

From: Prola, Stephen
Sent: Wednesday, January 06, 1999 7:52 AM
To: Douglas, Charles; Hopkins, AL; McGuirk, Andy; Baker, Gary; Dague, Bryan; Baumann, Russ
Subject: 77ps.ppt


77ps.ppt

Here's the "Cause & Effect" diagram we discussed yesterday. Please review and comment. Thanks

Regards,

Steve

Dague, Bryan

From: Hopkins, AL
Sent: Tuesday, January 05, 1999 7:37 PM
To: Dague, Bryan; Prola, Stephen; Douglas, Charles
Cc: Baumann, Russ; Baker, Gary; McGuirk, Andy; Beringhause, Steven; Andres, Amy; Sluzdak, Allan; Pavao, Joe
Subject: 99-003: PROPOSED PROTOCOL FOR DISASSEMBLY AND ANALYSIS OF SWITCH FROM 77PS FROM LINCOLN TOWN CAR

Here's a rough pass, what do you guys think?

PROPOSED PROTOCOL FOR DISASSEMBLY AND ANALYSIS OF SWITCH FROM 7798 FROM LINCOLN TOWN CAR

- Review Ford's Analysis data that they are bringing in.
- Examine threads and determine if it is OK to just chase the threads to get a good seal or should we remove material for analysis.
- Pressure Leak Test the device (15 minute static-hold, air-pressurized test).
- Decide if we should remove any material or try any other analysis before we start disassembling the device.
- Do a practice decap using the below procedure on a deliberately fractured part (to mimic the condition that the returned device will be in) before performing it on the real sample. Bryan, you and I could do this now.
- 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 in one of the two areas indicated on optical photo.
- 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. Examine the following areas
  - Inside surface of crimp ring.
  - Seal area and underside of base
  - Top of cap
- 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 cap. Bryan had originally suggested just using an end mill to remove the cap. I wouldn't, however, go all the way through with the end mill. I would leave some material behind as a shield. I would suggest then bending the cap off.
- Optically document all revealed surfaces starting with cap.
- Meanwhile, start SEM-EDX analysis on top side of cap. 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 cap.
- Non-destructively probe inside of the grommet to determine its resilience which will give us an indication of the temperature that it saw. Another indication might be the depth of the indentations left by the grommet seal rings in the wire.
- Decide if it makes sense to further examine the mating connector or grommet seal.

Regards,

Al

Dague, Bryan

From: Douglas, Charles
Sent: Tuesday, January 05, 1999 4:02 PM
To: Dague, Bryan; Hopkins, AL; Prola, Stephen
Cc: Baumann, Russ; Baker, Gary; McGuirk, Andrew; Beringhause, Steven
Subject: FW: Ford 77PS Town Car Visit

fyi,

Charlie

Charlie Douglas
(508) 236-3657 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

From: Sharpe, Robert
Sent: Tuesday, January 05, 1999 3:59 PM
To: Douglas, Charles
Subject: RE: Ford 77PS Town Car Visit

Hi Charlie,

Norman LaPointe (Ford AVT-Design Analyst) will be on NW Flight 1440, departing Detroit Metro @ 7:00AM on Thursday, 1/7/99. I informed him that you would meet him at the gate as he is departing the plane. In case you need it, his home phone# is (248) 926-9696. I also gave him your home phone# as (401) 274-3588. Norm is scheduled to return to Detroit from Providence on 1/7/99 (NW1441, 7:25pm departure). Casual attire (no ties) was confirmed.

Conversations with Fred Porter confirmed that he will not be participating in the 1/7/99 visit. Fred did state that John McInerney is planning on attending the 1/7/99 visit. John will be flying in Wednesday evening and will be staying at a Holiday Inn in "Marlborough" (?), Mass.. Fred has given your phone# to John who will be calling you for directions.

Norm is hoping to have test results from Ford Central Labs with him. These test results are from small samples removed from the actual device (to be hand carried by Norm) and would include;

- detection of brake fluid traces
- SEM results from 1) white residue (fire extinguisher ?)
  2) green residue (corrosion ?)
  3) switch contacts

In addition, Fred asked that we keep Mike Thomas (Hillte) informed of our findings as Hillte is somewhat involved as the Tier1 supplier. Fred has spoken directly with Mike and stated that TI has been very supportive/cooperative in helping Ford with this investigation. Mike's # is (248) 543-6520.

Best Regards,

Rob Sharpe
Texas Instruments
Phone (248) 305-5729

Fax (248) 305-5734
rsharpe@ti.com

---Original Message---
From: Douglas, Charles
Sent: Tuesday, January 05, 1999 1:25 PM
To: Dague, Bryan; Hopkins, AL; Prola, Stephen
Cc: Baker, Gary; Baumann, Russ; Beringhause, Steven; McGuirk, Andrew; Pechonis, John; Sharpe, Robert
Subject: RE: Ford 77PS Town Car Visit

Team,

Here is the latest update on the visit. Visit will definitely take place on Thursday. When all is said and done, we may only have one visitor from Ford. Fred Porter will not be coming in. Norm LaPointe will definitely be coming in and one additional visitor may also be coming.

Norm will be flying in Thursday morning and leaving on the 7 PM flight. Since Rob cannot make it, I will pick up Norm at the airport. The meeting will start at 9:30 and will be housed in 12-1B.

TI participants should be limited to those directly addressed. Also, at both Norm and Fred Porter's request, no presentations or line tours will take place to start the meeting. Beyond introductions, we will go right into the tear down analysis per the protocol that Al will publish later today.

At this point, unless you hear otherwise, assume casual dress for this visit.

Any questions / issues, please let me know.

Regards,

Charlie

Charlie Douglas
(508) 236-3657 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

From: Douglas, Charles
Sent: Monday, January 04, 1999 2:16 PM
To: Dague, Bryan; Gildea, Robert; Hopkins, AL; Prola, Stephen; Douglas, Charles
Cc: Baker, Gary; Baumann, Russ; Beringhause, Steven; McGuirk, Andy; Pechonis, John; Sharpe, Robert
Subject: RE: Ford 77PS Town Car Visit

As an update, three different people at Ford have made three different sets of reservations for coming out here -- > one flying in Tuesday evening for Wednesday visit, one flying in Wednesday evening for Thursday visit, and one flying in Thursday morning for Thursday visit. The Ford folks are currently working to coordinate their schedules so we may not know until tomorrow morning whether the visit is Wednesday or Thursday though my best guess at this point would be a Thursday visit.

Regards,

Charlie

Charlie Douglas
(508) 236-3657 (P)

(506) 236-1696 (F)
c-douglas2@tl.com

From: Douglas, Charles
Sent: Monday, January 04, 1999 12:17 PM
To: Dague, Bryan; Gildea, Robert; Hopkins, AL; Proia, Stephen
Cc: Baker, Gary; Baumann, Russ; Beringhause, Steven; McGuirk, Andy; Pechonis, John; Sharpe, Robert
Subject: Ford 77PS Town Car Visit

Team,

A quick msg on this subject. There is some question as to whether this visit will take place on Wednesday or Thursday. Rob is currently working to nail this down. Weather in Detroit may be keeping Ford personnel out today or resulting in them getting into the office late today.

Relative to framework for an agenda, we are going to keep it fairly simple. Before actually conducting the tear down analysis, we should present a process overview and take them up to the assembly line. Also, we should have both P and D fmea's available.

Bryan,

Any information we can pull together from the MY92 Econoline excursion will also be of use.

The meeting is going to be housed in 12-1B.

More information will be forthcoming hopefully by late afternoon.

Regards,

Charlie

Charlie Douglas
(506) 236-3657 (P)
(506) 236-1696 (F)
c-douglas2@tl.com

Dague, Bryan

From: Douglas, Charles
Sent: Tuesday, January 05, 1999 1:25 PM
To: Dague, Bryan; Hopkins, AL; Proia, Stephen
Cc: Baker, Gary; Baumann, Russ; Beringhause, Steven; McGuirk, Andrew; Pechonis, John; Sharpe, Robert
Subject: RE: Ford 77PS Town Car Visit

Team,

Here is the latest update on the visit. Visit will definitely take place on Thureday. When all is said and done, we may only have one visitor from Ford. Fred Porter will not be coming in. Norm LaPointe will definitely be coming in and one additional visitor may also be coming.

Norm will be flying in Thursday morning and leaving on the 7 PM flight. Since Rob cannot make it, I will pick up Norm at the airport. The meeting will start at 9:30 and will be housed in 12-1B.

TI participants should be limited to those directly addressed. Also, at both Norm and Fred Porter's request, no presentations or line tours will take place to start the meeting. Beyond introductions, we will go right into the tear down analysis per the protocol that Al will publish later today.

At this point, unless you hear otherwise, assume casual dress for this visit.

Any questions / issues, please let me know.

Regards,

Charlie

Charlie Douglas
(508) 236-3657 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

From: Douglas, Charles
Sent: Monday, January 04, 1999 2:16 PM
To: Dague, Bryan; Gildea, Robert; Hopkins, AL; Proia, Stephen; Douglas, Charles
Cc: Baker, Gary; Baumann, Russ; Beringhause, Steven; McGuirk, Andy; Pechonis, John; Sharpe, Robert
Subject: RE: Ford 77PS Town Car Visit

As an update, three different people at Ford have made three different sets of reservations for coming out here -- > one flying in Tuesday evening for Wednesday visit, one flying in Wednesday evening for Thursday visit, and one flying in Thureday morning for Thursday visit. The Ford folks are currently working to coordinate their schedules so we may not know until tomorrow morning whether the visit is Wednesday or Thursday though my best guess at this point would be a Thureday visit.

Regards,

Charlie

Charlie Douglas
(508) 236-3657 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

From: Douglas, Charles
Sent: Monday, January 04, 1999 12:17 PM
To: Dague, Bryan; Gildea, Robert; Hopkins, AL; Proia, Stephen
Cc: Baker, Gary; Baumann, Russ; Beringhause, Steven; McGuirk, Andy; Pechonis, John; Sharpe, Robert
Subject: Ford 77PS Town Car Visit

Team,

A quick msg on this subject. There is some question as to whether this visit will take place on Wednesday or Thursday. Rob is currently working to nail this down. Weather in Detroit may be keeping Ford personnel out today or resulting in them getting into the office late today.

Relative to framework for an agenda, we are going to keep it fairly simple. Before actually conducting the tear down analysis, we should present a process overview and take them up to the assembly line. Also, we should have both P and D fmea's available.

Bryan,

Any information we can pull together from the MY92 Econoline excursion will also be of use.

The meeting is going to be housed in 12-1B.

More information will be forthcoming hopefully by late afternoon.

Regards,

Charlie

Charlie Douglas
(508) 236-3857 (P)
(508) 236-1598 (F)
c-douglas2@ti.com

REDACTED

REDACTED

REDACTED

REDACTED

REDACTED

Dague, Bryan

From: Watt, Jim
Sent: Wednesday, June 09, 1999 7:11 AM
To: Pawlowski, Robin; Dague, Bryan; Douglas, Charles; Gildea, Robert; Martin, Scott; Milkey, Mary-Jean; Pechonis, John; Prola, Stephen; Watt, James
Subject: FW: Ford STA visit- June 17-18, 1999

fyi for upcoming Ford 77PS visit.
Jim Watt, GRA, msgid: jw02; mail station 12-33; page (508)236-1010, no. (0696)
ph (508) 236-1719;
fax (508)236-3153

From: Sharpe, Robert
Sent: Wednesday, June 09, 1999 8:10 AM
To: Spencer, John; McGuirk, Andy
Cc: Foster, Barbara; DeMattia, Mike; Watt, Jim

- There was considerable concern that the field data set is not complete, and Joe Nemi has been tasked to get a clearer picture of the events breakdown.
- There were strong feelings of "got to do more".
- Fred's statement that "TI Engineering is resident here" elicited a "Good" response.

I met with Fred 2/12 morning to capture his thoughts on follow up actions:
- Need a "raft" of experiments to accelerate kapton wear. Need to **design and execute a DOE** with temperature, moisture, disc energy, contaminants (soap, detergent), # of kapton layers etc as factors. I will close with Bryan on this. We need a plan with timing by next Wednesday.

- Looks like we may need 2 - 3x life. Will **need to establish real application requirement for 10yr/150k miles. 500k is not enough**. What **solutions can TI evaluate and put into place in 2 months**.

- No potential solution should be eliminated for cost reasons.

- Having the switch hot at all times is not a good practice, and Ford will be internally working on a solution for this. I did not get a feeling that this is going to happen in the 2 month time frame established earlier.

- I have the formal workplan that Steve Reimers is coordinating. I will fax it to Andy today. Quite a few of the TI actions have been completed, but are open on the list. I will work with Steve to close these out.

I have a meeting with Central Labs folks at 1.00 today to look at kapton from non-fire, non-leak switches with varying mileage. This will be key in trying to **correlate kapton aging in the field as opposed to lab tests**. Bryan, can we do this with the switches we pulled from the field with known mileage. Can we swap parts in used cars, say at Tasca? Today PM, we will meet with Greg Stevens, materials guy at AVT who has been tasked with getting Dow in the loop.

With Fred out next week, Steve Reimers will be main TI liason. I do plan to continue my field assignment for another week, and will evaluate need for further extensions at the end of next week.

FYI, I have a phone & pager now. Thanks Andy. I felt like "Far From the Maddening Crowd " (Thomas Hardy) without the comm-link!
Phone: 508-208-6119
Pager: 1800-946-4646, pin 604-2042

Regards
Aziz.

Dague, Bryan

From: Baker, Gary
Sent: Friday, February 12, 1999 1:28 PM
To: Rahman, Aziz
Cc: McGuirk, Andy; Beringhause, Steven; Dague, Bryan; Baumann, Russ; Sharpe, Robert; Douglas, Charles; Rowland, Thomas
Subject: RE: 77PS, 2/11/99

Aziz,

Thanks for the update.

On the point that "Having the switch hot at all times is not a good practice", has Ford given us any reaction to our proposal to adding a relay in series with the pressure switch?

It may be important to get Ford on the record on this point.

Best regards,
Gary

From: Rahman, Aziz
Sent: Friday, February 12, 1999 11:28 AM
To: McGuirk, Andy; Beringhause, Steven; Dague, Bryan; Baumann, Russ; Sharpe, Robert; Douglas, Charles; Baker, Gary; Rowland, Thomas
Subject: 77PS, 2/11/99

Main event of the day was the Technical Review. Highlights:

Key participants were:	Jack Pasquee	Chief Engineer, Luxury VC
	Chuck Peeke	Program Engineer, Town Car
	Ann O'Neill	Quality Directory, Luxury VC
	Sam Cole	Manager Large Vehicles Electrical Systems

Next Tech Review: Every Thursday, implies core team prep meeting every Wednesday.

- There is a need to have the ability to implement, whatever solution is decided, **In two months max.**
- Next meeting with NHTSA is next week, as part of their regular quaterly meetings. Town Car underhood fires will be high on the discussion list, and the expectation (hope?) is that Ford will be able to get 2 months time to implement a solution.
- There is a very urgent need to **re-create ignition in the lab**. They kept coming back to this again and again.
- There was considerable concern that the field data set is not complete, and Joe Nemi has been tasked to get a clearer picture of the events breakdown.
- There were strong feelings of "got to do more".
- Fred's statement that "TI Engineering is resident here" elicited a "Good" response.

I met with Fred 2/12 morning to capture his thoughts on follow up actions:
- Need a "raft" of experiments to accelerate kapton wear. Need to **design and execute a DOE** with temperature, moisture, disc energy, contaminants (soap, detergent), # of kapton layers etc as factors. I will close with Bryan on this. We need a plan with timing by next Wednesday.
- Looks like we may need 2 - 3x life. Will **need to establish real application requirement for 10yr/150k miles. 500k is not enough**. What **solutions can TI evaluate and put into place in 2 months**.
- No potential solution should be eliminated for cost reasons.
- Having the switch hot at all times is not a good practice, and Ford will be internally working on a solution for

this. I did not get a feeling that this is going to happen in the 2 month time frame established earlier.
- I have the formal workplan that Steve Reimers is coordinating. I will fax it to Andy today. Quite a few of the TI actions have been completed, but are open on the list. I will work with Steve to close these out.

I have a meeting with Central Labs folks at 1.00 today to look at kapton from non-fire, non-leak switches with varying mileage. This will be key in trying to **correlate kapton aging in the field as opposed to lab tests**. Bryan, can we do this with the switches we pulled from the field with known mileage. Can we swap parts in used cars, say at Tasca? Today PM, we will meet with Greg Stevens, materials guy at AVT who has been tasked with getting Dow in the loop.

With Fred out next week, Steve Reimers will be main TI liason. I do plan to continue my field assignment for another week, and will evaluate need for further extensions at the end of next week.

FYI, I have a phone & pager now. Thanks Andy. I felt like "Far From the Maddening Crowd " (Thomas Hardy) without the comm-link!
Phone: 508-208-6119
Pager: 1800-946-4646, pin 604-2042

Regards
Aziz.

Dague, Bryan

From: McGuirk, Andy
Sent: Friday, February 12, 1999 12:41 PM
To: Watt, Jim; Baumann, Russ; Dague, Bryan
Cc: Beringhause, Steven
Subject: FW: Ford conference call

attorney - client privileged communication

Jim

there is a building desire to be able to characterize switches in different states of life wear and to do so with recent samples.. I get the feeling that we are describing the situation and are not being able to 'show' same to the satisfaction of the receivers at Ford.

pls discuss with Bryan ideas we may have regarding sources of 'old' switches which might be available to aide in this direction in a prompt fashion.

I can guess that Ford will want Aziz or Bryan to 'characterize' samples from the field and this would be a base line for that...

a

AUTOMOTIVE SENSORS AND CONTROLS QRA MANGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 604-2044

From: McGuirk, Andy
Sent: Friday, February 12, 1999 12:09 PM
To: Beringhause, Steven; Baumann, Russ; Rahman, Aziz; Dague, Bryan
Cc: Sullivan, Martha; Reynolds, Steven; Pechanik, John; Douglas, Charles
Subject: Ford conference call

Aziz notified me of a plan for Aziz and Fred Porter to hold a conference call to me at 2:30 Friday today . I am planning to participate and have responded to the positive.

point, as I understand it from Aziz, would be to align the plans for Aziz for next week while Fred is out of the office.

Steve, I would like you to participate in this call with me and invite opinions about other participation.

a

AUTOMOTIVE SENSORS AND CONTROLS QRA MANGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 604-2044

below is Aziz day three feedback

attorney - client privileged communication

From: Rahman, Aziz
Sent: Friday, February 12, 1999 11:28 AM
To: McGuirk, Andy; Beringhause, Steven; Dague, Bryan; Baumann, Russ; Sharpe, Robert; Douglas, Charles; Baker, Gary; Rowland, Thomas
Subject: 77PS, 2/11/99

Main event of the day was the Technical Review. Highlights:

Key participants were:	Jack Pasques	Chief Engineer, Luxury VC
	Chuck Peske	Program Engineer, Town Car
	Ann O'Neill	Quality Directory, Luxury VC
	Sam Cole	Manager Large Vehicles Electrical Systems

Next Tech Review: Every Thursday, implies core team prep meeting every Wednesday.

- There is a need to have the ability to implement, whatever solution is decided, in two months max.
- Next meeting with NHTSA is next week, as part of their regular quaterly meetings. Town Car underhood fires will be high on the discussion list, and the expectation (hope?) is that Ford will be able to get 2 months time to implement a solution.
- There is a very urgent need to re-create ignition in the lab. They kept coming back to this again and again.
- There was considerable concern that the field data set is not complete, and Joe Nemi has been tasked to get a clearer picture of the events breakdown.
- There were strong feelings of "got to do more".
- Fred's statement that "TI Engineering is resident here" elicited a "Good" response.

I met with Fred 2/12 morning to capture his thoughts on follow up actions:
- Need a "raft" of experiments to accelerate kapton wear. Need to **design and execute a DOE** with temperature, moisture, disc energy, contaminants (soap, detergent), # of kapton layers etc as factors. I will close with Bryan on this. We need a plan with timing by next Wednesday.
- Looks like we may need 2 - 3x life. Will **need to establish real application requirement for 10yr/150k miles. 500k is not enough**. What **solutions can TI evaluate and put into place in 2 months**.
- No potential solution should be eliminated for cost reasons.
- Having the switch hot at all times is not a good practice, and Ford will be internally working on a solution for this. I did not get a feeling that this is going to happen in the 2 month time frame established earlier.
- I have the formal workplan that Steve Reimers is coordinating. I will fax it to Andy today. Quite a few of the TI actions have been completed, but are open on the list. I will work with Steve to close these out.

I have a meeting with Central Labs folks at 1.00 today to look at kapton from non-fire, non-leak switches with varying mileage. This will be key in trying to **correlate kapton aging in the field as opposed to lab tests**. Bryan, can we do this with the switches we pulled from the field with known mileage. Can we swap parts in used cars, say at Tasca? Today PM, we will meet with Greg Stevens, materials guy at AVT who has been tasked with getting Dow in the loop.

With Fred out next week, Steve Reimers will be main TI liason. I do plan to continue my field assignment for another week, and will evaluate need for further extensions at the end of next week.

FYI, I have a phone & pager now. Thanks Andy. I felt like "Far From the Maddening Crowd " (Thomas Hardy) without the comm-link!
Phone: 508-208-6119
Pager: 1800-946-4646, pin 604-2042

Regards
Aziz.

Dague, Bryan

From: McGuirk, Andy
Sent: Friday, February 12, 1999 12:09 PM
To: Beringhause, Steven; Baumann, Russ; Rahman, Aziz; Dague, Bryan
Cc: Sullivan, Martha; Reynolds, Steven; Pechonis, John; Douglas, Charles
Subject: Ford conference call

Aziz notified me of a plan for Aziz and Fred Porter to hold a conference call to me at 2:30 Friday today . I am planning to participate and have responded to the positive.

point, as I understand it from Aziz, would be to align the plans for Aziz for next week while Fred is out of the office.

Steve, I would like you to participate in this call with me and invite opinions about other participation.

a

AUTOMOTIVE SENSORS AND CONTROLS DRA MANGER
34 FORBES ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGR: (800) 467-3700 PIN 604-2044

below is Aziz day three feedback

attorney - client privileged communication

From: Rahman, Aziz
Sent: Friday, February 12, 1999 11:28 AM
To: McGuirk, Andy; Beninghause, Steven; Dague, Bryan; Baumann, Russ; Sharpe, Robert; Douglas, Charles; Baker, Gary; Rowland, Thomas
Subject: 77PS, 2/11/99

Main event of the day was the Technical Review. Highlights:

Key participants were:	Jack Pasquee	Chief Engineer, Luxury VC
	Chuck Peske	Program Engineer, Town Car
	Ann O'Neill	Quality Directory, Luxury VC
	Sam Cole	Manager Large Vehicles Electrical Systems

Next Tech Review: Every Thursday, implies core team prep meeting every Wednesday.

- There is a need to have the ability to implement, whatever solution is decided, **in two months max.**
- Next meeting with NHTSA is next week, as part of their regular quarterly meetings. Town Car underhood fires will be high on the discussion list, and the expectation (hope?) is that Ford will be able to get 2 months time to implement a solution.
- There is a very urgent need to **re-create ignition in the lab**. They kept coming back to this again and again.
- There was considerable concern that the field data set is not complete, and Joe Neml has been tasked to get a clearer picture of the events breakdown.
- There were strong feelings of "got to do more".
- Fred's statement that "TI Engineering is resident here" elicited a "Good" response.

I met with Fred 2/12 morning to capture his thoughts on follow up actions:
- Need a "raft" of experiments to accelerate kapton wear. Need to **design and execute a DOE** with temperature, moisture, disc energy, contaminants (soap, detergent), # of kapton layers etc as factors. I will close with Bryan on this. We need a plan with timing by next Wednesday.
- Looks like we may need 2 - 3x life. Will **need to establish real application requirement for 10yr/150k miles. 500k is not enough**. What **solutions can TI evaluate and put into place in 2 months**.
- No potential solution should be eliminated for cost reasons.
- Having the switch hot at all times is not a good practice, and Ford will be internally working on a solution for this. I did not get a feeling that this is going to happen in the 2 month time frame established earlier.
- I have the formal workplan that Steve Reimers is coordinating. I will fax it to Andy today. Quite a few of the TI actions have been completed, but are open on the list. I will work with Steve to close these out.

I have a meeting with Central Labs folks at 1.00 today to look at kapton from non-fire, non-leak switches with varying mileage. This will be key in trying to **correlate kapton aging in the field as opposed to lab tests**. Bryan, can we do this with the switches we pulled from the field with known mileage. Can we swap parts in used cars, say at Tasca? Today PM, we will meet with Greg Stevens, materials guy at AVT who has been tasked with getting Dow in the loop.

With Fred out next week, Steve Reimers will be main TI liason. I do plan to continue my field assignment for another week, and will evaluate need for further extension at the end of next week.

FYI, I have a phone & pager now. Thanks Andy. I felt like "Far From the Maddening Crowd " (Thomas Hardy)

without the comm-link!
Phone: 508-208-6119
Pager: 1800-946-4646, pin 604-2042

Regards
Aziz.

Dague, Bryan

From: Rahman, Aziz
Sent: Friday, February 12, 1999 11:28 AM
To: McGuirk, Andy; Beringhause, Steven; Dague, Bryan; Baumann, Russ; Sharpe, Robert; Douglas, Charles; Baker, Gary; Rowland, Thomas
Subject: 77PS, 2/11/99

Main event of the day was the Technical Review. Highlights:

Key participants were:	Jack Pasques	Chief Engineer, Luxury VC
	Chuck Peake	Program Engineer, Town Car
	Ann O'Neill	Quality Directory, Luxury VC
	Sam Cole	Manager Large Vehicles Electrical Systems

Next Tech Review: Every Thursday, implies core team prep meeting every Wednesday.

- There is a need to have the ability to implement, whatever solution is decided, **in two months max.**
- Next meeting with NHTSA is next week, as part of their regular quaterly meetings. Town Car underhood fires will be high on the discussion list, and the expectation (hope?) is that Ford will be able to get 2 months time to implement a solution.
- There is a very urgent need to **re-create ignition in the lab**. They kept coming back to this again and again.
- There was considerable concern that the field data set is not complete, and Joe Nemi has been tasked to get a clearer picture of the events breakdown.
- There were strong feelings of "got to do more".
- Fred's statement that "TI Engineering is resident here" elicited a "Good" response.

I met with Fred 2/12 morning to capture his thoughts on follow up actions:
- Need a "raft" of experiments to accelerate kapton wear. Need to **design and execute a DOE** with temperature, moisture, disc energy, contaminants (soap, detergent), # of kapton layers etc as factors. I will close with Bryan on this. We need a plan with timing by next Wednesday.
- Looks like we may need 2 - 3x life. Will **need to establish real application requirement for 10yr/150k miles. 600k is not enough**. What **solutions can TI evaluate and put into place in 2 months**.
- No potential solution should be eliminated for cost reasons.
- Having the switch hot at all times is not a good practice, and Ford will be internally working on a solution for this. I did not get a feeling that this is going to happen in the 2 month time frame established earlier.
- I have the formal workplan that Steve Reimers is coordinating. I will fax it to Andy today. Quite a few of the TI actions have been completed, but are open on the list. I will work with Steve to close these out.

I have a meeting with Central Labs folks at 1.00 today to look at kapton from non-fire, non-leak switches with varying mileage. This will be key in trying to **correlate kapton aging in the field as opposed to lab tests**. Bryan, can we do this with the switches we pulled from the field with known mileage. Can we swap parts in used cars, say at Tasca? Today PM, we will meet with Greg Stevens, materials guy at AVT who has been tasked with getting Dow in the loop.

With Fred out next week, Steve Reimers will be main TI liason. I do plan to continue my field assignment for another week, and will evaluate need for further extensions at the end of next week.

FYI, I have a phone & pager now. Thanks Andy. I felt like "Far From the Maddening Crowd " (Thomas Hardy) without the comm-link!
Phone: 508-208-6119
Pager: 1800-948-4848, pin 604-2042

Regards
Aziz.

Dague, Bryan

From: Rahman, Aziz
Sent: Friday, February 12, 1999 9:20 AM
To: Dague, Bryan; McGuirk, Andy; Beringhause, Steven
Subject: FW: TI action

Bryan, can you send me the lists of tests in progress at TIA. Thanks. Also, any luck with finding the Weibull parts from last year? They are expecting to see them next week. If you can't find those switches, do you have any others that have gone to atleast 500k cycles at temp? Let me know.

Thanks
Aziz.

From: Steve Reimers(SMTP:sreimers@ford.com)
Sent: Thursday, February 11, 1999 7:16 PM
To: Aziz Rahman, Texas
Subject: TI action

Aziz, I will not be in to work on Friday. See you Monday. What is TI doing to try and ignite the brake pressure switch?

Steve Reimers building 5 3C043
AVT Chassis E/E System Applications mail drop 5011
39-03286 SREIMERS sreimers@ford.com fax 39-03286 ;>

Dague, Bryan

From: Watt, Jim
Sent: Thursday, February 11, 1999 4:55 PM
To: 'Baumann, Russ RUSB'; Dague, Bryan; McGuirk, Andy; Beringhause, Steven
Subject: RE: 77PS Diaphragm Wear Out Cause & Effect Diagram - Updated a/o 5:00pm
Sensitivity: Confidential

Ford
77PS(diaphragm).ppt

Jim Watt, QRA, msgid: jw02; mail station 12-33; page (508)236-1010, no. (0696)
ph (508) 236-1719;
fax (508)236-3153

From: Watt, Jim
Sent: Thursday, February 11, 1999 10:10 AM
To: Baumann, Russ RUSB; Dague, Bryan; McGuirk, Andy; Beringhause, Steven; Watt, Jim
Subject: RE: 77PS Diaphragm Wear Out Cause & Effect Diagram - Resend
Sensitivity: Confidential

<<File: Ford 77PS1.ppt>>

Jim Watt, QRA, msgid: jw02; mail station 12-33; page (508)236-1010, no. (0696)
ph (508) 236-1719;
fax (508)236-3153

From: Watt, Jim
Sent: Thursday, February 11, 1999 9:55 AM
To: Baumann, Russ RUSB; Dague, Bryan; McGuirk, Andy; Beringhause, Steven
Subject: RE: 77PS Diaphragm Wear Out Cause & Effect Diagram
Importance: High
Sensitivity: Confidential

The below 77PS Diaphragm Wear Out Cause & Effect Diagram is fyi, comments. ...:

<<File: Ford 77PS1.ppt>>

Jim Watt, QRA, msgid: jw02; mail station 12-33; page (508)236-1010, no. (0696)
ph (508) 236-1719;
fax (508)236-3153

From: McGuirk, Andy
Sent: Wednesday, February 10, 1999 3:05 PM
To: Baumann, Russ RUSB; Dague, Bryan
Cc: Beringhause, Steven; 'Rahman, Aziz ZIZ'; Watt, Jim
Subject: RE: 77PS Design explanation

Attorney Client Privileged Information

overall, an outstanding document draft. I made a number of changes and am on callback to discuss my thoughts.

i think it might be of value to discuss weibull success factor projections from the 'zillions' of 'es' test results we must have? we should also speak to the thunderbird applications ? maybe refer to the econoline issue of '93 with connector issues ?

we need some summary statement as to the ending of this document.....

a
AUTOMOTIVE SENSORS AND CONTROLS QRA ENGINEER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 504-2044

From: Dague, Bryan
Sent: Wednesday, February 10, 1999 1:24 PM
To: Baumann, Russ RUSB
Cc: Beringhause, Steven; Rahman, Aziz ZIZ; McGuirk, Andy
Subject: 77PS Design explanation

Folks,

Here is a summary of how and why the 77PS is designed as it is. Please give me any comments you might have.

Aziz,
Read this and use the information as you see fit, but do not distribute it until we all agree on the wording.

Regards,
Bryan

****

Attorney Client Privileged Information

Brake Fluid Intrusion
2/10/99

TI's 77PS switch family has been specifically designed to operate in an automotive braking system. The pressure cavity of the switch has been designed to seal brake fluid and transmit force and movement to the sensing portion of the switch over the life of the 500,000 cycle specification which in turn translates into an electrical switching reaction used in the automobile system as a redundant safety related cruise control shutoff switch..

Background:

The pressure cavity is composed of the hexport, gasket, and Kapton diaphragms (Called out as "seal" on attachment 1.). The purpose of the gasket is to provide a fluid tight seal between the hexport and diaphragms. The purpose of the Kapton diaphragms is to provide a flexible fluid tight seal between the pressure cavity and the internal components of the switch. Furthermore, the diaphragms are intended to transfer pressure to the converter, and follow the movement of the converter as pressure in the pressure cavity is varied.

There are two different ways that brake fluid may enter the contact cavity of TI's brake switches from the pressure cavity. Brake fluid could potentially leak past an impaired gasket seal, or leak through a damaged or 'worn out' Kapton diaphragm.

The Gasket:
In order to create a fluid tight elastomeric seal, there must be proper compression of the elastomer, sufficient backing of the seal material to prevent movement when pressure is applied, and finally the elastomer must be compatible with the working fluid and expected thermal ranges of the environment and application.

Fluid compatibility is typically established by the use of published tables. These tables list fluid groups and general material types. Lab testing is done with the specific fluid that the customer has specified for the application along with the specific compound formulated by the selected gasket supplier. Etylene Propylene for brake applications is common practice throughout the industry for seal gasket materials , and TI has been using this material in brake applications since 1988.

The gasket compression target was obtained from publish industry standards (see Parker O-ring Handbook). In this particular design a nominal gasket compression of 24% was selected. The depth of the hexport gland shown on attachment #2 controls this attribute. This gland dimension is cut into the hexport at the time of manufacturing. As a result, this dimension in combination with the gasket dimensions determines the final gasket compression when the assembly is crimp together.

Lastly, the movement/position of the gasket when pressure is applied must be controlled and restrained. This design accomplishes this by selecting the outer diameter of the gasket to be slightly smaller than the inner diameter of the gasket gland of the steel plated hexport. Therefore, the hexport gland prevents the gasket from moving outwards when high pressure is applied to the switch.

The DFMEA outlines the types of tests that were selected and run to confirm that all of these parameters are selected correctly. The resulting design was exposed to test conditions that were intended to duplicate actual application conditions, and in some cases go beyond the intended limits to failure. See the DFMEA Document number 503794 and customer specification RS-F2VC-9F924-AA . Specifically, burst testing, impulse testing, and thermal cycle tests were performed to confirm that the gasket performed as intended. The specifics details of these tests and the results can be seen in a number the following PV test reports:

Test Report #	TI Switch Part number	Year Tested
1. PS/91/48	77PSL2-3	1991
2. PS/91/49	77PSL2-1	1991
3. PS/92/49	77PSL3-1	1992
4. PS/92/80	77PSL5-2	1992
5. PS/92/82	77PSL3-1	1992
6. PS/93/11	77PSL6-1	1993
7. PS/93/44	77PSL4-1	1993

also, there are IP-2 tests of 6/95, 10/95, 1/96 and 8 /96 that are readily at hand and show fluid capability resistances

In order to protect TI's customer supply chain from gasket-manufacturing issues there are several preventative actions in place. These actions include: hair nets, protective smocks, and cleaning procedures for the equipment
As a result of the process and product controls, TI's customer return rates including line fallout rates and end of line acceptance tests indicate gasket-manufacturing anomalies are below measurable limits (one leak return in 5 years from master cylinder leak testing or less then 1 ppm). Gasket-manufacturing anomalies can be produced from out of spec gaskets, contamination of the gasket, or sealing surfaces, and as a result, may cause leaks early in life but in our expert opinion not in late life without early leak signs.

Kapton Diaphragms:
A pressure switch diaphragm must seal the pressure cavity, transmit pressures forces to the converter, and follow the converter motion without significantly affecting the switch calibration points. In addition, the diaphragm material must be resistant to chemical attack of the brake fluid.

Basically, a single piece of Kapton in this design consists of a 0.003-inch thick polyimide film laminated on

both sides with a 0.001-inch thick FEP Teflon film. The polymide film has the ability to stretch without breaking (strains on the order of 70% before rupture), and the Teflon film is compatible with a wide range of chemicals. As a result of this layered construction, Kapton was selected for its mechanical and chemical properties. Moreover, TI has been using this material in a wide variety of pressure switch applications since 1981.

To confirm the correct material was selected for this application we refer to the DFMEA. Specifically, this document identifies burst testing, impulse testing, and thermal cycle testing. These tests confirmed the Kapton's capability to meet the specified requirements (see PV reports listed above). Since temperature, chemical exposure, and stress levels all affect the life expectancy of the Kapton diaphragms, additional testing is commonly done. A typical impulse test would include pressure cycles to 1450 psi, constant temperature of 135 C, and a cycle rate of 120 cycles/minute. Depending on the factors listed above, the life expectancy of a TI brake pressure switch is around 1 million cycles **which is well above the 500,000 cycles specified in the Ford (ES-F2VC-9F924-AA)** See Life Testing to Failure (PS/98/14).

In addition, continued conformance testing has been ongoing for many years at TI. The purpose of this testing is to confirm that the components, materials, and processes have remained stable over time and that the design intent is consistently being achieved. See attached IP reports.

While the similar manufacturing anomalies listed above can affect the Kapton diaphragms (see PFMEA Document # 503631), additional factors can cause leakage via the Kapton diaphragm. Material/chemical compatibility and stress/strain concentrations can also cause the Kapton diaphragms to leak. See DFMEA Document number 503796. In order to verify the correct design parameters were selected, the switch was subjected to a number of tests designed to simulate accelerated life testing of the application. See PS reports called out above. Life testing per the customer specification (ES-F2VC-9F924-AA) has shown acceptable performance.

Typically, Kapton fatigue occurs well over 0.5 million full-scale pressure cycles in our history of simulated and accelerated life testing. When Kapton rupture does occur, there are visual signs of de-lamination, cracking, and embrittlement. The Kapton diaphragms break down first in the areas of highest stress and or strain. **In our expert opinion,** the first region to show break down is the circumferential area surrounding the converter button. See Endurance Test (report # PS/98/53). Again, diaphragm life depends on stress levels (pressure magnitude applied), temperature, and chemical exposure.

The above mentioned tests were conducted in TI's Life Test lab with relatively controlled conditions. Water will accelerate the aging of the base polymide. Chemical attach can come from two directions:

1) By entering the contact cavity via the **electrical** connector,
2) By being in solution in the brake fluid and entering the switch via the pressure port.

When water enters the connector it will "age" the Kapton diaphragms and make them appear as though they have reached the end of life. This condition leaves visual clues. Classic signs of chemical attack of the Kapton include de-lamination of the Teflon from the base polymide base, embrittlement, and cracking of the base polymer. See Endurance Test (report PS/98/53).

End of Document.

Dague, Bryan

From: McCurdy, Andy

Sent: Thursday, February 11, 1999 4:48 PM
To: Dague, Bryan; Baumann, Russ; Beringhause, Steven; Douglas, Charles; Rahman, Aziz; Baker, Gary; Hopkins, AL; Sullivan, Martha; Sharpe, Robert
Subject: Aziz cell phone

we provided Aziz a cell phone and pager

cell phone is 508 208 6119

pager is 800 467 3700 pin 604 2042 for numeric..... I sent web page under sep cover to you for alpha page(mobilecomm.com/message)

AL
AUTOMOTIVE SENSORS AND CONTROLS QRA MANAGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3165
PAGE: (800) 467-3700 PIN 604-2044

Dague, Bryan

From: Hopkins, AL
Sent: Thursday, February 11, 1999 4:43 PM
To: Dague, Bryan; Baumann, Russell; Beringhause, Steven; McGuirk, Andrew; Douglas, Charles; Rahman, Aziz; Baker, Gary
Cc: Andres, Amy
Subject: RE: 77PS Day 2, 2/10/99 Summary

My comments are in olive color

Regards,

Al

From: Dague, Bryan
Sent: Thursday, February 11, 1999 1:13 PM
To: Hopkins, Alfred
Subject: FW: 77PS Day 2, 2/10/99 Summary

Al,

I think the answer is yes, but can you add your 2 cents worth??

Bry

From: Rahman, Aziz
Sent: Thursday, February 11, 1999 11:06 AM
To: McGuirk, Andy; Beninghouse, Steven; Baumann, Russ; Dague, Bryan; Douglas, Charles; Sharpe, Robert; Sullivan, Martha; Rowland, Thomas; Baker, Gary
Subject: 77PS Day 2, 2/10/99 Summary

Day 2, 2/10/99 Highlights

Main event of the day was a team meeting to prep for the Executive Technical Review on 2/11. Joe Nemi of Large Vehicle Safety Group led the meeting. There were a lot of participants, including Fred Porter, Tom Masters from Engineering, Norm LaPointe AVT Design Analysis, Steve LaRouche from CRL, Ford legal folks, wiring, connector etc. TI was the only supplier represented.

TI is not invited to the Tech Rev. (whew?!)
Tech Rev will be a high level, broad overview of Town Car Underhood Fires
Numbers Joe has thus far:
149 Underhood Fires, Thermal Anomalies, Thermal Events
39 with engine off, 9 with engine on, no information on the rest
5 possible related to the Brake Pressure Switch (BPS), 17 potential other root causes, no information on the rest
Other root causes from above line : 42 way connector, EEC wire harness, Relay pack.
At this point NHTSA response required on BPS, F2VC part only. Others may follow
Lengthy discussion on approach for the review. General consensus that presentation from technical side should be broad based, since sufficient info is not available for any deep dive.
General consensus that we need a lot more parts back from the field that were involved in these events.Oasis message discussed.
Someone inquired about TI answers to questions from last meeting. I responded that I had provided the information to Fred and Steve Reimers, and they acknowledged. Two other questions for TI:
Does TI sell the switch directly to aftermarket, like auto part stores. I replied that most probably not. We would go through Ford Service Parts for service parts. Is that accurate Charlie?
Does TI have fire experts on site who can determine origin of fires, as in experts who work on structural fires. I replied in the negative, but said I would follow up.

Fran Finnegan used to be involved in a large number of fire/litigation issues for CS&C. He is retired now but I think that they have hired a replacement.

Any inputs? Intent was to answer repeatedly asked question: Do we know where the fire originated. Outside - in, Inside - out,

I think important information can be obtained by x-raying the connector/switch assembly from each fire or otherwise examining the terminals. In particular, the amount of arcing that occurs on the terminals (especially the hot one) will give indications as to whether the fire likely started inside of the device or not. Also, it would be worthwhile to know which fuses were blown in the system. Also was

there any arc ruputure of wire between switch and battery.

what burned first, brake fluid, or plastic base??

If the scenario that this question address is to assume that the switch was the source of the fire, I believe that the brake fluid would be the first thing to burn. Just from my own point of view, it seems to me that it would be kind of tough to get a real fire going without brake fluid to start it. I would guess that charring of the plastic would be more likely without the presence of brake fluid. This should be relatively easy to test, however,

Joe's meeting was followed by a vigorous brainstorming session with Fred, Tom, Norm, Steve & Len. This was all technical and I actively participated.

I reviewed TI report PS/98/14 on weibull life of quiet switch showing first leaker at 900k+ cycles. Gave copy to Norm. Bryan, need weibull data quickly on pass-car snap switch.

I reviewed our finding that the 92 through 97 Town Car, Grand Marquis, Crown Vic platforms had prop valve mounted switches and that in vehicles with ABS option, the prop valve is located downstream of the ABS module.

There was considerable discussion on pressure profile at such a location with Len saying that the switch probably sees full pressure reversals. We agreed that I would contact Teves for more info.

We discussed formation of electrolytic cell with Brake Fluid in the base cavity, and how a low resistance path to ground could be formed. Discussed the wattage available with a 15A fuse and 14Vdc system. Is that sufficient to generate enough heat through the ground path.

Discussed CRL analysis of Memphis part, and gave copy of Al's report to Norm. Bryan, per Norm, Al retained "spoonfuls" of the corrosion residue. Do you know if Al has done any compositional analysis (IR) as opposed to elemental only?

The quantity was more like a dropful than spoonfuls. None the less, the Chem Lab examined the liquid phase that was present in three areas and found that it was almost certainly brake fluid (I have seperately forwarded that memo to Bryan again). It wasn't possible to perform FT/IR analysis of the actual agglomeration of corrosion products and decomposed plastic.

Kept getting back to source of fire. Ford has not yet been able to create a fire in a switch. Team decided that pulling in Dow Chemical was key to understand if we can create a fire with given constraints.

Are they exploring my best guess hypothesis that you need the following components:

- **Heat source within switch caused by high resistance short**
  - **Conductivity caused by brake fluid/water/conductive contamination mixture**
  - **Direct metallic contact (caused by broken arm blade**

for instance)

- Fuel
  - (Air/Heated brake fluid vapors) mixture is the most likely
- Arc source
  - Perhaps the drying out of a conductive, corrosion product bridge caused by resistance heating.
  - Since the above might be a random effect, it might be necessary to separately create an arc in the switch cavity.

I will start exposing the resistivity test here to temperature 2/11.

No phone yet. Andy has arranged for a cellular phone and pager. On the positive side, received invitation from Fred to join his team for a Section Lunch at the Hawaiian Cafe. Should be fun!

More tomorrow.

Regards
Aziz.

Dague, Bryan

From: Janet S. Bourgeois(SMTP:j-bourgeois@ti.com)
Sent: Thursday, February 11, 1999 4:37 PM
To: sberinghause@ti.com; rbaumann@ti.comm; bdague@ti.com; c-douglas2@ti.com; m-sullivan@ti.com; AZIZ@ti.com; g-baker7@ti.com; rsharpe@ti.com
Subject: MobileComm Messaging

ATT42000.htm.html

http://www.mobilecomm.com/message/

To send a short message alpha page to AZIZ while at Ford please enter this web page and use pin number 6042042

Andy

Currey, Pat

From: McGuirk, Andy [a-mcguirk@email.mc.ti.com]
Sent: Friday, March 12, 1999 12:13 PM
To: 'Frederick J. Porter'
Subject: mating connectors

Fred, can you advise when you think I could have some quantity of mating connectors (I'd settle for three dozen ASAP) ? I want them on board during our testing processes.

a

AUTOMOTIVE SENSORS AND CONTROLS ORA MANGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 604-2044

Data Log
Brake Pressure Switch

VIN	Event	Mileage	Term-Hexport Resistance	Leaker?	Kapton #1	Kapton #2	Kapton #3	Present Status
PY622977	Sw. Fire				crack	crack	crack	Analysis Complete
PY685224	Underhood Fire				no info	no info	no info	Analysis Complete
NY745119	Underhood Fire							Sw. not available
NY703705	Underhood Fire							Analysis in Progress
VX145373	Cruise Inop		4.6MEGAOHMS	yes	crack	crack	crack	Analysis Complete
NX768774	Reference		OPEN	no	worn, no crack	worn, no crack	worn, no crack	Analysis Complete
NY760055	Cruise Inop		4MEGAOHM	yes	crack	crack	crack	Analysis Complete
NX762658	Reference	79184	OPEN					
PY724043	Reference	71337	OPEN					
PY628170	Reference	88087	OPEN					
py632329	Reference	99349						Analysis in Progress
py729611	Reference	47325						Analysis in Progress
NX726439	Reference	89922	OPEN					
PX180223	Reference	85614	OPEN					
PX637766	Reference	??	OPEN					
PY689375	Reference	82224	OPEN					
PY726066	Reference	91358	OPEN					
PX685270	Reference	89689	OPEN					
NY740208	Reference	53237	OPEN					
PX623672	Reference	94145	OPEN					
PY695374	Reference	??	OPEN					
SY639984	Reference	97189	OPEN					
PY650225	Reference	72114	OPEN					
PY686795	Reference		OPEN					
PY774255	Reference	87549	OPEN					
PY754575	Reference	42621	OPEN					
PX643615	Reference	43531	OPEN					
??	Reference	??						
PX629934	Reference	68302	OPEN					

ip

PY638680	Reference							
PX153820	Reference	199999						
RX641585	Reference	??						
PX153312	Reference	40642						
PY610384	Reference	73115						
NY724398	Underhood Fire	??						
PY750172	Reference	??						

revised 2/18/99

Epstein, Sally

From: McGuirk, Andy [a-mcguirk@email.mc.ti.com]
Sent: Saturday, March 13, 1999 8:01 AM
To: Beringhause, Steven; Dague, Bryan; Baumann, Russ
Cc: Rowland, Thomas; Baker, Gary
Subject: FW: (U) Brainstorming

fred and team really like the last one....and it may be a very good solution as it deals with a method of de-powering which is near to our long term input to Ford.....TURN OFF THE POWER. this is done if a fault is detected....

when could we have an idea/concept? should we deploy this to an extended eng'g team outside us for 'invention' - delivery ?

a

AUTOMOTIVE SENSORS AND CONTROLS QRA MANGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 604-2044

From: Frederick J. Porter[SMTP:fporter@ford.com]
Sent: Friday, March 12, 1999 9:01 AM
To: a-mcguirk@email.mc.ti.com
Subject: (U) Brainstorming

to: a-mcguirk@email.mc.ti.com

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 FPORTER --DRBW007 03/11/99 17:59 ***
To: N1654584--EXTERNAL

FROM: F. J. Porter USART(UTC -05:00)
Subject: (U) Brainstorming

Andy,

Attached is a list of ideas that were developed by a group from our research laboratory of potential changes that could be made to the switch that may improve our condition. TI has investigated some of these already.

I would like you to go through each idea and let us know what your feasibility and manufacturing issues are as well as timing for their potential implementation.

1. Coat cup with plastic or other non-conductive coating (like anodizing)
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

2. Make cup of non-conductive material
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

3. Add plastic diaphragm between cup/transfer pin and the spring contact/switch cavity
   Additional layer of isolation between mechanical components and electrical components

4. Place plastic insulator disk on the cup with hole only for the transfer pin

   Reduces surface area exposed between battery and ground

5. Replace kapton membranes with pure teflon membranes
   Increased flexibility of membrane

6. Replace kapton seal with sliding piston seal
   Eliminates wear on kapton

7. Change cup/converter topology
   Spread flexure over greater area of the kapton
   Reduce interfaces where extreme flexure occur

8. Replace switch with pressure transducer and semi-conductor switch
   Eliminates kapton seal

9. Design thermal link in power supply side of switch that opens at elevated temperature (one time or cycling)
   Turns off power before heat becomes great enough to cause ignition

10. Reverse polarity of switch contacts
    Removes power from spring contact if it moves out of position

11. Insulate/plastic coat spring except contact area
    Reduces corrosive exposure
    Reduces conductive material to making contact with ground

12. Gold plate spring contact
    Reduces corrosion

13. Fill air gap in switch housing with potting material to seal connector openning
    Seal off connector path of contamination

14. Change switch housing material for improved ignition parameters
    Reduces ability for flame to spread after initial heat source is removed

15. Add another layer to the kapton seal
    Possible increased life of seal before perforations occur

16. Add ground fault interrupter circuit to switch circuit
    Turns off power if ground path to case is detected

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

Epstein, Sally

From: LaRouche, Steve (S.) (slarouch@ford.com)
Sent: Monday, March 15, 1999 1:44 PM
To: Rahman, Aziz

<<chklist.xls>>
Steve LaRouche (SLAROUCH)
Metallurgy Section, Central Laboratory, Room N410
(313) 845-4876 (313) 322-1614 FAX

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

Brake Switch Testing Checklist

INF - INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT RECD AT CEN LAB

			Memphis	A	B	C	D	E	F	I
			PY622677	PY885224	NY745119	NY703705	VX145373	NX758774	NY760055	NX762658
Field Info	1	Log Field Info into Switch Log on	C	C	C	C	C	C	C	C
	2	Photograph Switch	C	C	C	C	C	C	C	NP
	3	Record any unusual external visual observations	C	C	C	C	C	C	C	C
	4	Check for Connector engagement	C	NA	NA	NA	NA	NA	NA	NA
		X-ray if appropriate	C	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	6	Wire 1(GRN)to Wire 2(ORANGE) Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	6	Wire 1(GRN) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	7	Wire 2(ORANGE) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	8	Separate Hardware from Switch	C	NA	NA	C	NA	NA	NA	NA
	9	Modify Connector Seal	C	NA	NA	C	NA	NA	NA	NA
Connector Only	10	Wire 1(GRN) to Wire 2(ORANGE) resistance	NA	NA	NA	NA	NA	NA	NA	NA
	12	Check for full engagement of connector	NA	NA	NA	NA	NA	NA	NA	NA
	13	Check wire position	C	NA	NA	NA	NA	NA	NA	NA
	14	Check wire grip resin	C	NA	NA	NA	NA	NA	NA	NA
	15	Cut wire insulation to check for clearance	C	NA	NA	NA	NA	NA	NA	C
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	NA	NA	NA	NA	C	C	C	0.3
	17	Spring Terminal to Secondary Terminal Resistance	NA	NA	NA	NA	C	C	C	INF
	18	Spring Terminal to Hexport Resistance	NA	NA	NA	NA	C	C	C	INF
	19	Secondary Terminal to Hexport resistance	NA	NA	NA	NA	NA	NA	NA	3.3M
	20	Seal to Hexport Resistance	NA	NA	NA	NA				
Switch External Pressurized	24	Switch Opening Pressure	NA	NA	NA	NA	NA	NA	NA	122
	25	Switch Closing Pressure	NA	NA	NA	NA	NA	NA	NA	59
	26	Proof Test for Leakage	NA	NA	NA	NA	NA	NA	NA	NO LEAK
	27	Repeat from 17 through 20 at 180 psig	NA	NA	NA	NA	NA	NA	NA	C
	17	Spring Terminal to Secondary Terminal Resistance	NA	NA	NA	NA	NA	NA	NA	INF
	18	Spring Terminal to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	INF
	19	Secondary Terminal to Hexport resistance	NA	NA	NA	NA	NA	NA	NA	INF
	20	Seal to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	INF
Switch	28	Remove aluminum crimp ring	C	C	NP	C	C	C	C	NP
	29	Document sprayed surfaces. Photograph	C	C	NP	C	C	C	C	NP
	30	Remove cap	C	C	NP	C	C	C	C	NP
	31	Examine sprayed surfaces. Photograph	C	C	NP	C	C	C	C	NP
Techniques	31	SEM/EDX #TBI base, contacts, terminals	C	C	NP	C	C	C	C	NP
	32	SEM/EDX #TBI cap, hexport, washer seals, etc	C	C	C	C	C	C	C	NP
	33	Metallographic analysis of contacts	C	NA	NP	C	C	C	C	NP
		Lead for evidence of corrosion or acidity	C	NA	NP	C	C	C	C	NP

7/28/99

chklist.xls

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

			3	4	5	6	7	8	9	10
			PY724043	PY628170	PY632329	PY729611	NX728439	PX180223	PX637788	PY669375
Field Info	1	Log Field Info into Switch Log xls	C	C	C	C	C	C	C	C
	2	Photograph Switch	NP	NP	NP	NP	NP	NP	NP	NP
	3	Record any unusual external visual observations	C	C	C	C	C	C	C	C
	4	Check for Connector engagement	NA	NA	NA	NA	NA	NA	NA	NA
		X-ray if appropriate	NA	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	5	Wire 1(LG/R) to Wire 2(ORANGE) Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	6	Wire 1(LG/R) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	7	Wire 2(ORANGE) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	8	Separate Harness from Switch	NA	NA	NA	NA	NA	NA	NA	NA
Connector Only	9	Verify Connector Seal	NA	NA	NA	NA	NA	NA	NA	NA
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance	NA	NA	NA	NA	NA	NA	NA	NA
[redacted]										
	12	Check for full engagement of connector	NA	NA	NA	NA	NA	NA	NA	NA
	13	Check wire insulation	NA	NA	NA	NA	NA	NA	NA	NA
	14	Check wire grey seals	NA	NA	NA	NA	NA	NA	NA	NA
	15	Cut wire insulation to check for corrosion	NA	NA	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	C	C	NA	NA	C	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	0.2	0.3	NA	NA	0.2	0.2	0.2.	2.2
	18	Spring Terminal to Hexport Resistance	INF	INF	NA	NA	INF	INF	INF	INF
	19	Stationary Terminal to Hexport resistance	INF	INF	NA	NA	INF	INF	INF	INF
	20	Base to Hexport Resistance	11.4	1.6M	NA	NA	7.8M	18.5	7.5M	1.4M
[redacted]										
Switch External Pressurized	24	Switch Opening Pressure	134	160	NA	NA	147	132	140	137
	25	Switch Closing Pressure	59	66	NA	NA	70	66	112	60
	26	Proof Test for Leakage	NO LEAK	NO LEAK	NA	NA	NO LEAK	NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through 20 at 160 psig	C	C	NA	NA	C	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	INF	INF	NA	NA	INF	INF	INF	INF
	18	Spring Terminal to Hexport Resistance	INF	INF	NA	NA	INF	INF	INF	INF
	19	Stationary Terminal to Hexport resistance	INF	INF	NA	NA	INF	INF	INF	INF
	20	Base to Hexport Resistance	INF	INF	NA	NA	INF	INF	INF	INF
Switch	28	Remove aluminum crimp ring	NP	NP	C	C	NP	NP	NP	NP
	29	Examine revealed surfaces. Photograph	NP	NP	C	C	NP	NP	NP	NP
	30	Remove cup	NP	NP	C	C	NP	NP	NP	NP
	31	Examine revealed surfaces. Photograph	NP	NP	C	C	NP	NP	NP	NP
Techniques	31	SEM EDX & IR base, contacts, terminals	NP	NP	NP	NP	NP	NP	NP	NP
	32	SEM EDX & IR cup, kapton, sealed seats, etc.	NP	NP	NP	NP	NP	NP	NP	NP
	33	Metallographic analysis of contacts	NP	NP	NP	NP	NP	NP	NP	NP

TI-NHTSA 016784

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

		Look for evidence of corrosion of wiring	NP	NP	NP	NP	NP	NP	NP	NP
			11	12	13	14	15	16	17	18
			PY728088	PX665270	NY740208	PX823872	PY695374	BY639984	PY650225	PY668795
Field Info	1	Log Field Info into Switch Log file	C	C	C	C	C	C	C	C
	2	Photograph Switch	NP	[redacted]						
	3	Record any unusual external visual abnormalities	C							
	4	Check for Connector engagement	NA							
		X-ray if appropriate	NA							
Switch + Connector Assembly	5	Wire 1(LG/R) to Wire 2(ORANGE) Resistance	NA							
	6	Wire 1(LG/R) to Hexport Resistance	NA							
	7	Wire 2(ORANGE) to Hexport Resistance	NA							
	8	Separate Harness from Switch	NA							
Connector Only	9	Verify Connector Seal	NA							
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance	NA							
	[redacted]									
	12	Check for full engagement of connector	NA							
	13	Check wire insulation	NA							
	14	Check wire grey seals	NA							
	15	Cut wire insulation to check for corrosion	NA							
Switch External Unpressurized	16	Assemble Switch to Clearance 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	130							
	25	Switch Closing Pressure	71							
	26	Pool Test for Leakage	NO LEAK							
	27	Repeat Steps 17 through 20 at 100 psig	C							
	17	Spring Terminal to Stationary Terminal Resistance	INF							
	18	Spring Terminal to Hexport Resistance	INF							
	19	Stationary Terminal to Hexport resistance	INF							
	20	Base to Hexport Resistance	INF							
Switch	28	Remove aluminum crimp ring	NP							
	29	Examine revealed surfaces. Photograph	NP							
	30	Remove cup	NP							
	31	Examine revealed surfaces. Photograph	NP							
Techniques	31	SEM EDX FTIR base, contacts, terminals	NP							
	32	SEM EDX FTIR cup, hexport, washer, seals, etc	NP							

TI-NHTSA 018786

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

	33	Metallographic analysis of contacts	NP	[redacted]
		Look for evidence of corrosion or arcing	NP	

			19	20	21	22	23	1	2	3
			PY774258	PY754575	PX643515	??	PX829034	PY838880	PX163820	RX641595
Field Info	1	Log Field Info into Switch Log xls	[redacted]					C	C	C
	2	Photograph Switch						C	C	C
	3	Record any unusual external visual observations						C	C	C
	4	Check for Connector engagement						C	C	C
		X-ray it if appropriate						NA	C	NA
Switch + Connector Assembly	5	Wire 1(LGR) to Wire 2(ORANGE) Resistance						0 3	0 4	0 2
	6	Wire 1(LGR) to Hexport Resistance						INF	INF	INF
	7	Wire 2(ORANGE) to Hexport Resistance						INF	INF	INF
	8	Separate Harness from Switch						C	C	C
Connector Only	9	Verify Connector Seal						C	C	C
	10	Wire 1(LGR) to Wire 2(ORANGE) resistance						INF	INF	INF
[redacted]										
	12	Check for full engagement of connector						C	C	C
	13	Check wire insulation						C	C	C
	14	Check wire grey seals						C	C	C
	15	Cut wire insulation to check for corrosion						TBP	TBP	TBP
Switch External Unpressurized	16	Assemble Switch to Calibration Stand						C	C	C
	17	Spring Terminal to Stationary Terminal Resistance						0 3	0 1	0 2
	18	Spring Terminal to Hexport Resistance						INF	INF	INF
	19	Stationary Terminal to Hexport resistance						INF	INF	INF
	20	Base to Hexport Resistance						5 5	INF	17 7K
[redacted]										
Switch External Pressurized	24	Switch Opening Pressure						158	127	128
	25	Switch Closing Pressure						68	82	64
	26	Proof Test for leakage						NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through 20 at 1000 psig						C	C	C
	17	Spring Terminal to Stationary Terminal Resistance						INF	0 1	INF
	18	Spring Terminal to Hexport Resistance						INF	INF	INF
	19	Stationary Terminal to Hexport resistance						INF	INF	INF
	20	Base to Hexport Resistance						INF	INF	INF
Switch	28	Remove aluminum crimp ring						NP	C	NP
	29	Examine revealed surfaces. Photograph						NP	C	NP
	30	Remove cap						NP	C	NP
	31	Examine revealed surfaces. Photograph						NP	C	NP
Techniques	31	SEM EDX FTIR (look contacts, terminals)						NP	C	NP

TI-NHTSA 016786

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

			4	5	6	7	8	9	10	11
	32	SEM-EDX (FTIR cup, hexport, washer seals, etc.)	[redacted]					NP	C	NP
	33	Metallographic analysis of contacts						NP	NP	NP
		Look for evidence of corrosion or arcing						NP	C	NP
			PX163312	PY610384	NY724366	PY750172	NY733191	PY758158	PX151140	NY757408
Field Info	1	Log Field Info into Switch Log sh	C	C	C	C	C	C	C	C
	2	Photograph Switch	C	C	C	C	C	C	C	C
	3	Record any unusual external visual observations	C	C	C	C	C	C	C	C
	4	Check for Connector engagement	C	C	NA	C	NA	C	NA	C
		X-ray if appropriate	C	NA	NA	NA	NA	C	NA	NA
Switch + Connector Assembly	5	Wire 1(LG/R) to Wire 2(ORANGE) Resistance	NP	0.2	NA	INF	NA	2	0.4	NP
	6	Wire 1(LG/R) to Hexport Resistance	NP	INF	NA	INF	NA	6.0M	INF	NP
	7	Wire 2(ORANGE) to Hexport Resistance	NP	INF	NA	INF	NA	6.1M	INF	NP
	8	Separate Hexport from Switch	C	C	NA	C	NA	C	C	C
Connector Only	9	Verify Connector Seal	C	C	NA	C	NA	C	C	C
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance	NP		NA	INF	NA	INF	INF	NP
[redacted]										
	12	Check for full engagement of connector	C	C	NA	C	NA	C	C	C
	13	Check wire insulation	C	C	NA	C	NA	C	C	C
	14	Check wire gray seals	C	C	NA	C	NA	C	C	C
	15	Cut wire insulation to check for corrosion	TBP	TBP	NA	TBP	NA	TBP	TBP	TBP
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	C	C	NA	C	NA	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	0.1	0.2	NA	0.3	NA	1.5	0.4	0.1
	18	Spring Terminal to Hexport Resistance	INF	INF	NA	INF	NA	8.3M	INF	INF
	19	Stationary Terminal to Hexport resistance	INF	INF	NA	INF	NA	6.4M	INF	INF
	20	Base to Hexport Resistance	INF	160K	NA	453K	NA	0.4	8.6	INF
[redacted]										
Switch External Pressurized	24	Switch Opening Pressure	133	151	NA	136	NA	164	136	135
	25	Switch Closing Pressure	63	62	NA	66	NA	66	106	74
	26	Proof Test for Leakage	NO LEAK	NO LEAK	NA	NO LEAK	NA	NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through 20 at 180 psig	C	C	NA	C	NA	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	INF	INF	NA	INF	NA	0.1	INF	INF
	18	Spring Terminal to Hexport Resistance	INF	INF	NA	INF	NA	~970K	INF	INF
	19	Stationary Terminal to Hexport resistance	INF	INF	NA	INF	NA	~970K	INF	INF
	20	Base to Hexport Resistance	INF	INF	NA	INF	NA	INF	INF	INF
Switch	28	Remove aluminum crimp ring	NP	NP	NP	NP	NP	C	NP	NP
	29	Examine exposed surfaces, Photograph	NP	NP	NP	NP	NP	C	NP	NP
	30	Remove cup	NP	NP	NP	NP	NP	C	NP	NP
	31	Examine exposed surfaces, Photograph	NP	NP	NP	NP	NP	C	NP	NP

TI-NHTSA 016787

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

Techniques	31	SEM EDX / FTIR base, contacts, terminals	NP	NP	NP	NP	NP	C	NP	NP
	32	SEM EDX / FTIR cap, hexport, welder seals, etc	NP	NP	NP	NP	NP	C	NP	NP
	33	Metallographic analysis of contacts	NP	NP	NP	NP	NP	NP	NP	NP
		Look for evidence of corrosion in casing	NP	NP	NP	NP	NP	C	NP	NP

			12	13						
			PY742858	PY7433413	NY734410	PY805626				
Field Info	1	Log Field info into Switch Log	C	C	TBP	TBP				
	2	Photograph Switch	C	C	TBP	TBP				
	3	Record any unusual external visual observations	C	C	C	C				
	4	Check for Connector engagement	C	C	NA	NA				
		X-ray if appropriate	C	NA	NA	NA				
Switch + Connector Assembly	5	Wire 1(LG/R) to Wire 2(ORANGE) Resistance	0.3	0.3	NA	NA				
	6	Wire 1(LG/R) to Hexport Resistance	20.2M	INF	NA	NA				
	7	Wire 2(ORANGE) to Hexport Resistance	21.5M	INF	NA	NA				
	8	Separate Harness from Switch	C	C	NA	NA				
Connector Only	9	Verify Connector Seal	C	C	NA	NA				
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance	INF	INF	NA	NA				
	[redacted]									
	12	Check for full engagement of connector	C	C	NA	NA				
	13	Check wire condition	C	C	NA	NA				
	14	Check wire gray seals	C	C	NA	NA				
	15	Cut wire insulation to check for corrosion	TBP	TBP	NA	NA				
Switch External Unpressurized	16	Assembly Switch to Calibration Stand	C	C	C	C				
	17	Spring Terminal to Stationary Terminal Resistance	0.2	0.2	>700K	>130K				
	18	Spring Terminal to Hexport Resistance	34M	INF	>250K	>17K				
	19	Stationary Terminal to Hexport resistance	30M	INF	>350K	>120K				
	20	Base to Hexport Resistance	63.4K	7.5M	INF	INF				
	[redacted]									
Switch External Pressurized	24	Switch Opening Pressure	148	150	152	NO SOUND				
	25	Switch Closing Pressure	81	70	92	NO SOUND				
	26	Proof Test for Leakage	NO LEAK	NO LEAK	NO LEAK	NO LEAK				
	27	Repeat Steps 17 through 20 at [illegible] psig	C	C	C	C				
	17	Spring Terminal to Stationary Terminal Resistance	0.1	INF	>1.0M	170K				
	18	Spring Terminal to Hexport Resistance	INF	INF	>600K	>140K				
	19	Stationary Terminal to Hexport resistance	INF	INF	>400K	>15K				
	20	Base to Hexport Resistance	INF	INF	INF	INF				
Switch	28	Remove aluminum crimp ring	SCI LAB	NP	TBP	TBP				
	29	Examine unfolded surfaces. Photograph	SCI LAB	NP	TBP	TBP				
	30	Remove cap	SCI LAB	NP	TBP	TBP				

TI-NHTSA 016788

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

	31	Examine revealed surfaces. Photograph	SCI LAB	NP	TBP	TBP				
Techniques	31	SEM EDX /FTIR [illegible] contacts, terminals	SCI LAB	NP	TBP	TBP				
	32	SEM EDX /FTIR cup, hexport, washer seals, etc	SCI LAB	NP	TBP	TBP				
	33	Metallographic analysis of contacts	SCI LAB	NP	TBP	TBP				
		Look for evidence of corrosion in assay	SCI LAB	NP	TBP	TBP				

Field Info	1	Log Field Info into Switch Log sht.								
	2	Photograph Switch								
	3	Record any unusual external visual observations								
	4	Check for Connector engagement								
		[illegible]								
Switch + Connector Assembly	5	Wire 1(GRN) to Wire 2(ORANGE) Resistance								
	6	Wire 1(GRN) to Hexport Resistance								
	7	Wire 2(ORANGE) to Hexport Resistance								
	8	Separate Harness from Switch								
Connector Only	9	Verify Connector Seal								
	10	Wire 1(GRN) to Wire 2(ORANGE) resistance								
	[redacted]									
	12	Check and note for full engagement of connector								
	13	Check wire insulation								
	14	Check wire grey seals								
	15	Cut wire insulation to check for corrosion								
Switch External Unpressurized	16	Assemble Switch to Calibration Stand								
	17	Spring Terminal to Stationary Terminal Resistance								
	18	Spring Terminal to Hexport Resistance								
	19	Stationary Terminal to Hexport resistance								
	20	Base 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 1[illegible] psig								
	17	Spring Terminal to Stationary Terminal Resistance								
	18	Spring Terminal to Hexport Resistance								
	19	Stationary Terminal to Hexport resistance								
	20	Base to Hexport Resistance								
Switch	28	Remove [illegible] crimp ring								
	29	Examine revealed surfaces. Photograph								

TI-NHTSA 016789

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

	30	Remove cup								
	31	Examine revealed surfaces. Photograph								
Techniques	31	SEM/EDX/FTIR base, contacts, [illegible]								
	32	SEM/EDX/FTIR cup, [illegible], [illegible] seals, etc								
	33	Metallographic analysis of contacts								
		Look for evidence of [illegible] or [illegible]								

TI-NHTSA 016790

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

			Memphis	A	B	C	D	E	F	1
			PY622977	PY685224	NY745119	NY703705	VX145373	NX758774	NY760055	NX762858
Field Info	1	Log Field info into Switch Log xls	C	C	C	C	C	C	C	C
	2	Photograph Switch	C	C	C	C	C	C	C	NP
	3	Record any unusual external visual observations	C	C	C	C	C	C	C	C
	4	Check for Connector engagement	C	NA	NA	NA	NA	NA	NA	NA
		X-ray it if appropriate	C	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	5	Wire 1(LG/R) to Wire 2(ORANGE) Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	6	Wire 1(LG/R) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	7	Wire 2(ORANGE) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	8	Separate Harness from Switch	C	NA	NA	C	NA	NA	NA	NA
Connector Only	9	Verify Connector Seal	C	NA	NA	C	NA	NA	NA	NA
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance	NA	NA	NA	NA	NA	NA	NA	NA
	[redacted]									
	12	Check for full engagement of connector	NA	NA	NA	NA	NA	NA	NA	NA
	13	Check wire insulation	C	NA	NA	NA	NA	NA	NA	NA
	14	Check wire gray seals	C	NA	NA	NA	NA	NA	NA	NA
	15	Cut wire insulation to check for corrosion	C	NA	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	NA	NA	NA	NA	NA	NA	NA	C
	17	Spring Terminal to Stationary Terminal Resistance	NA	NA	NA	NA	C	C	C	0.3
	18	Spring Terminal to Hexport Resistance	NA	NA	NA	NA	C	C	C	INF
	19	Stationary Terminal to Hexport resistance	NA	NA	NA	NA	C	C	C	INF
	20	Base to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	3.3M
	[redacted]									
Switch External Pressurized	24	Switch Opening Pressure	NA	NA	NA	NA	NA	NA	NA	122
	25	Switch Closing Pressure	NA	NA	NA	NA	NA	NA	NA	59
	26	Proof Test for Leakage	NA	NA	NA	NA	NA	NA	NA	NO LEAK
	27	Repeat Steps 17 through 20 at 100 psig	NA	NA	NA	NA	NA	NA	NA	C
[illegible]	[illegible]	[illegible]	NA	NA	NA	NA	NA	NA	NA	INF
	[illegible]	[illegible]	NA	NA	NA	NA	NA	NA	NA	INF
	[illegible]	[illegible]	NA	NA	NA	NA	NA	NA	NA	INF
	[illegible]	[illegible]	NA	NA	NA	NA	NA	NA	NA	INF
Switch	28	Remove aluminum crimp ring	C	C	NP	C	C	C	C	NP
	29	Examine revealed surfaces. Photograph	C	C	NP	C	C	C	C	NP
	30	Remove cup	C	C	NP	C	C	C	C	NP
	31	Examine revealed surfaces. Photograph	C	C	NP	C	C	C	C	NP
Techniques	31	SEM EDX of the base, contacts, terminals	C	C	NP	C	C	C	C	NP
	32	SEM EDX of the cup, hexport, washer seals, etc	C	C	C	C	C	C	C	NP
	33	Metallographic analysis of contacts	C	NA	NP	C	C	C	C	NP
		Look for evidence of corrosion or arcing	C	NA	NP	C	C	C	C	NP

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

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT RECD AT CEN LAB

			3 PY724043	4 PY628170	5 PY632328	6 PY729811	7 NX728439	8 PX180223	9 PX637768	10 PY669375
Field Info	1	Log Field Info into Switch Log sht	C	C	C	C	C	C	C	C
	2	Photograph Switch	NP	NP	NP	NP	NP	NP	NP	NP
	3	Record any unusual/ external visual observations	C	C	C	C	C	C	C	C
	4	Check for Connector engagement	NA	NA	NA	NA	NA	NA	NA	NA
		Explain if appropriate	NA	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	6	Wire 1(GR)to Wire 2(ORANGE) Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	6	Wire 1(GR) to Hooper Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	7	Wire 2(ORANGE) to Hooper Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	8	Separate Harness from Switch	NA	NA	NA	NA	NA	NA	NA	NA
Connector Only	9	Study Connector Seal	NA	NA	NA	NA	NA	NA	NA	NA
	10	Wire 1(GR) to Wire 2(ORANGE) resistance	NA	NA	NA	NA	NA	NA	NA	NA
	12	Check for full engagement of connector	NA	NA	NA	NA	NA	NA	NA	NA
	13	Check seal orientation	NA	NA	NA	NA	NA	NA	NA	NA
	14	Check wire gray seals	NA	NA	NA	NA	NA	NA	NA	NA
	15	Cut seal stipulation to check for corrosion	NA	NA	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	C	C	NA	NA	C	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	0.2	0.3	NA	NA	0.2	0.2	0.2	2.2
	18	Spring Terminal to Hooper Resistance	INF	INF	NA	NA	INF	INF	INF	INF
	19	Stationary Terminal to Hooper resistance	INF	INF	NA	NA	INF	INF	INF	INF
	20	Case to Hooper Resistance	11.4	1.6M	NA	NA	7.5M	185	7.5M	1.4M
Switch External Pressurized	24	Switch Opening Pressure	134	160	NA	NA	147	132	140	137
	25	Switch Closing Pressure	59	88	NA	NA	70	68	112	66
	26	Pool Test for Leakage	NO LEAK	NO LEAK	NA	NA	NO LEAK	NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through 26 at 180 psig	C	C	NA	NA	C	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	INF	INF	NA	NA	INF	INF	INF	INF
	18	Spring Terminal to Hooper Resistance	INF	INF	NA	NA	INF	INF	INF	INF
	19	Stationary Terminal to Hooper resistance	INF	INF	NA	NA	INF	INF	INF	INF
	20	Case to Hooper Resistance	INF	INF	NA	NA	INF	INF	INF	INF
Switch	28	Remove aluminum crimp ring	NP	NP	C	C	NP	NP	NP	NP
	29	Examine revealed surfaces. Photograph	NP	NP	C	C	NP	NP	NP	NP
	30	Remove cup	NP	NP	C	C	NP	NP	NP	NP
	31	Examine revealed surfaces. Photograph	NP	NP	C	C	NP	NP	NP	NP
Techniques	31	SEM EDX/FTIR body, contacts, terminals	NP	NP	NP	NP	NP	NP	NP	NP
	32	SEM EDX/FTIR cup, hooper, washer seals, etc.	NP	NP	NP	NP	NP	NP	NP	NP
	33	Metallographic analysis of contacts	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 REC'D AT CEN LAB

		Look for evidence of corrosion or arcing	NP	NP	NP	NP	NP	NP	NP	NP
			11	12	13	14	15	16	17	18
			PY726080	PX885270	NY740208	PX823672	PY895374	BY639984	PY650225	PY668795
Field Info	1	Log Field Info into Switch Log.xls	C	C	C	C	C	C	C	C
	2	Photograph Switch	NP							
	3	Record any unusual external visual observations	C							
	4	Check for Connector engagement	NA							
		X-ray if appropriate	NA							
Switch + Connector Assembly	5	Wire 1(LG/Rd)to Wire 2(ORANGE) Resistance	NA							
	6	Wire 1(LG/R) to Hexport Resistance	NA							
	7	Wire 2(ORANGE) to Hexport Resistance	NA							
	8	Separate Harness from Switch	NA							
Connector Only	9	Visually Connector Seal	NA							
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance	NA							
	12	Check for full engagement of connector	NA							
	13	Check wire damage	NA							
	14	Check wire grey 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	Wire to Hexport Resistance	INF							
Switch External Pressurized	24	Switch Opening Pressure	139							
	25	Switch Closing Pressure	71							
	26	Final Test for Leakage	NO LEAK							
	27	Repeat Steps 17 through 20 at 180 psig	C							
	17	Spring Terminal to Stationary Terminal Resistance	INF							
	18	Spring Terminal to Hexport Resistance	INF							
	19	Stationary Terminal to Hexport resistance	INF							
	20	Wire to Hexport Resistance 1	INF							
Switch	28	Remove aluminum crimp ring	NP							
	29	Examine revealed surfaces -Photograph	NP							
	30	Remove cup	NP							
	31	Examine revealed surfaces -Photograph	NP							
Techniques	31	SEM EDX if BR wear, corrosion, materials	NP							
	32	Add EDX if BR cup, hexport, washer seals, etc	NP							

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

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT RECD AT CEN LAB

				19	20	21	22	23	1	2	3
				PY774256	PY754575	PX643515	??	PX629934	PY638590	PX163920	RX641585
Field Info	1	Log Field Info into Switch Log.xls							C	C	C
	2	Photograph Switch							C	C	C
	3	Record any unusual external visual observations							C	C	C
	4	Check for Connector engagement							C	C	C
		X-ray if appropriate							NA	C	NA
Switch + Connector Assembly	5	Wire 1(LG/R) to Wire 2(ORANGE) Resistance							0.3	0.4	0.2
	6	Wire 1(LG/R) to Hospot Resistance							INF	INF	INF
	7	Wire 2(ORANGE) to Hospot Resistance							INF	INF	INF
	8	Separate Harness from Switch							C	C	C
Connector Only	9	Verify Connector Shell							C	C	C
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance							INF	INF	INF
	12	Check for full engagement of connector							C	C	C
	13	Check wire insulation							C	C	C
	14	Check wire grey seals							C	C	C
	15	Cut wire insulation to check for corrosion							TBP	TBP	TBP
Switch External Unpressurized	16	Assembly Switch to Calibration Stand							C	C	C
	17	Spring Terminal to Stationary Terminal Resistance							0.3	0.1	0.2
	18	Spring Terminal to Hospot Resistance							INF	INF	INF
	19	Stationary Terminal to Hospot Resistance							INF	INF	INF
	20	Base to Hospot Resistance							5.5	INF	17.7K
Switch External Pressurized	24	Switch Opening Pressure							166	127	126
	25	Switch Closing Pressure							68	62	64
	26	Proof Test for Leakage							NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through 20 at 150 psig							C	C	C
	17	Spring Terminal to Stationary Terminal Resistance							INF	0.1	INF
	18	Spring Terminal to Hospot Resistance							INF	INF	INF
	19	Stationary Terminal to Hospot resistance							INF	INF	INF
	20	Base to Hospot Resistance							INF	INF	INF
Switch	28	Remove aluminum crimp ring							NP	C	NP
	29	Examine ram and surfaces. Photograph							NP	C	NP
	30	Remove cap							NP	C	NP
	31	Examine sealed surfaces. Photograph							NP	C	NP
Techniques	31	SEM EDS FTIR base, contacts, terminals							NP	C	NP

	33	Metallographic analysis of contacts	NP
		Look for evidence of corrosion or arcing	NP

TI-NHTSA 016794

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

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT RECD AT GEN LAB

32	[redacted]	NP	C	NP
33	[redacted]	NP	NP	NP
	[redacted]	NP	C	NP

			4	5	6	7	8	9	10	11
			PX153312	PY010384	NY724388	PY750172	NY733191	PY756158	PX151140	NY757408
Field Info	1	Log Field Info into Switch Log.xls	C	C	C	C	C	C	C	C
	2	Photograph Switch	C	C	C	C	C	C	C	C
	3	Record grey wrapped external visual observations	C	C	C	C	C	C	C	C
	4	Check for Connector wiggle/Pivot	C	C	NA	C	NA	C	NA	C
		X-ray if appropriate	C	NA	NA	NA	NA	C	NA	NA
Switch + Connector Assembly	5	Wire 1(LG/Blk Wire 2(ORANGE) Resistance	NP	0.2	NA	INF	NA	2	0.4	NP
	6	Wire 1(LG/R) to Hospot Resistance	NP	INF	NA	INF	NA	6.0M	INF	NP
	7	Wire 2(ORANGE) to Hospot Resistance	NP	INF	NA	INF	NA	6.1M	INF	NP
	8	Duplicate Readings from Switch	C	C	NA	C	NA	C	C	C
Connector Only	9	Verify Connector Seal	C	C	NA	C	NA	C	C	C
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance	NP		NA	INF	NA	INF	INF	NP
		[redacted]								
	12	Check for full engagement of connector	C	C	NA	C	NA	C	C	C
	13	Check wire insulation	C	C	NA	C	NA	C	C	C
	14	Check wire gray seals	C	C	NA	C	NA	C	C	C
	15	Cut wire weldings to check for corrosion	TBP	TBP	NA	TBP	NA	TBP	TBP	TBP
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	C	C	NA	C	NA	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	0.1	0.2	NA	0.3	NA	1.5	0.4	0.1
	18	Spring Terminal to Hospot Resistance	INF	INF	NA	INF	NA	6.3M	INF	INF
	19	Stationary Terminal to Hospot resistance	INF	INF	NA	INF	NA	6.4M	INF	INF
	20	Wire to Hospot Resistance	INF	160K	NA	463K	NA	0.4	6.8	INF
		[redacted]								
Switch External Pressurized	24	Switch Opening Pressure	133	151	NA	136	NA	164	138	135
	25	Switch Closing Pressure	63	82	NA	66	NA	66	109	74
	26	Proof Test for Leakage	NO LEAK	NO LEAK	NA	NO LEAK	NA	NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through 20 at 180 psig	C	C	NA	C	NA	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	INF	INF	NA	INF	NA	0.1	INF	INF
	18	Spring Terminal to Hospot Resistance	INF	INF	NA	INF	NA	~970K	INF	INF
	19	Stationary Terminal to Hospot resistance	INF	INF	NA	INF	NA	~970K	INF	INF
	20	Wire to Hospot Resistance	INF	INF	NA	INF	NA	INF	INF	INF
Switch	28	Remove aluminum comp wrap	NP	NP	NP	NP	NP	C	NP	NP
	29	Examine insulated surfaces. Photograph	NP	NP	NP	NP	NP	C	NP	NP
	30	Remove cup	NP	NP	NP	NP	NP	C	NP	NP
	31	Examine insulated surfaces. Photograph	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

Techniques	31	SEM EDX & FTIR base contacts, [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	32	SEM EDX/FTIR cup, hexport, washer seals, etc.	NP	NP	NP	NP	NP	C	NP	NP
	33	Metallographic analysis of contacts	NP	NP	NP	NP	NP	NP	NP	NP
		Look for evidence of corrosion or arcing	NP	NP	NP	NP	NP	C	NP	NP

			12	13						
			PY742858	PY7433413	NY734410	PY805828				
Field Info	1	Log Field Info into Switch Log [illegible]	C	C	TBP	TBP				
	2	Photograph Switch	C	C	TBP	TBP				
	3	Record any unusual data and visual observations	C	C	C	C				
	4	Check for Connector engagement	C	C	NA	NA				
		X-ray if appropriate	C	NA	NA	NA				
Switch + Connector Assembly	5	Wire 1(LB/BLU) to Wire 2(ORANGE) Resistance	0.3	0.3	NA	NA				
	6	Wire 1(LG/N) to Hexport Resistance	28.2M	INF	NA	NA				
	7	Wire 2(ORANGE) to Hexport Resistance	21.5M	INF	NA	NA				
	8	Separate Harness from Switch	C	C	NA	NA				
Connector Only	9	Verify Connector Seal	C	C	NA	NA				
	10	Wire 1(LG/N) to Wire 2(ORANGE) resistance	INF	INF	NA	NA				
	[redacted]									
	12	Check for full engagement of connector	C	C	NA	NA				
	13	Check wire insulation	C	C	NA	NA				
	14	Check wire grey seals	C	C	NA	NA				
	15	Cut wire insulation to check for corrosion	TBP	TBP	NA	NA				
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	C	C	C	C				
	17	Spring Terminal to Stationary Terminal Resistance	0.2	0.2	>70K	>130K				
	18	Spring Terminal to Hexport Resistance	34M	INF	>250K	>17K				
	19	Stationary Terminal to Hexport resistance	30M	INF	>350K	>120K				
	20	Base to Hexport Resistance	83.4K	7.5M	INF	INF				
	[redacted]									
Switch External Pressurized	24	Switch Opening Pressure	148	150	152	NO SOUND				
	25	Switch Closing Pressure	61	70	92	NO SOUND				
	26	Proof Test for Leakage	NO LEAK	NO LEAK	NO LEAK	NO LEAK				
	27	Repeat Steps 17 through 20 at 1?? psig	C	C	C	C				
	17	Spring Terminal to Stationary Terminal Resistance	0.1	INF	>1.0M	170K				
	18	Spring Terminal to Hexport Resistance	INF	INF	>600K	>140K				
	19	Stationary Terminal to Hexport resistance	INF	INF	>400K	>15K				
	20	Base to Hexport Resistance	INF	INF	INF	INF				
Switch	28	Remove [illegible] crimp ring	SCI LAB	NP	TBP	TBP				
	29	Examine revealed surfaces. Photograph	SCI LAB	NP	TBP	TBP				
	30	Remove cup	SCI LAB	NP	TBP	TBP				

TI-NHTSA 016796

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

	31	Examine revealed surfaces. Photograph	SCI LAB	NP	TBP	TBP				
Techniques	31	SEM EDX FTIR base, contacts, terminals	SCI LAB	NP	TBP	TBP				
	32	SEM EDX FTIR cup, Hexport, washer seals, etc	SCI LAB	NP	TBP	TBP				
	33	Metallographic analysis of contacts	SCI LAB	NP	TBP	TBP				
		Look for evidence of corrosion or arcing	SCI LAB	NP	TBP	TBP				

Field Info	1	Log Field Info onto Switch Log ds								
	2	Photograph Switch								
	3	Record any unusual external visual observations								
	4	Check for Connector engagement								
		X-ray if 4 appropriate								
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								
	10	Wire 1(LG/R) to Wire 2(ORANGE) resistance								
	[redacted]									
	12	Check seal seat for full engagement of connector								
	13	Check wire insulation								
	14	Check wire gray seals								
	15	Cut wire insulation to check for corrosion								
Switch External Unpressurized	16	Assemble Switch to Calibration Stand								
	17	Spring Terminal to Stationary Terminal Resistance								
	18	Spring Terminal to Hexport Resistance								
	19	Stationary Terminal to Hexport resistance								
	20	Base 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 [illegible] psig								
	17	Spring Terminal to Stationary Terminal Resistance								
	18	Spring Terminal to Hexport Resistance								
	19	Stationary Terminal to Hexport resistance								
	20	Base to Hexport Resistance								
Switch	28	Remove aluminum crimp ring								
	29	Examine revealed surfaces. Photograph								

TI-NHTSA 018797

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

	30	Remove cup								
	31	Examine evaluated surfaces. Photograph								
Techniques	31	SEM-EDX-FTIR base, contacts, terminals								
	32	SEM-EDX-FTIR cup, lanyard, washer seals, etc								
	33	Metallographic analysis of contacts								
		Look for evidence of overstress or arcing								

TI-NHTSA 016798

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

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT RECD AT CEN. LAB.

			Memphis	A	B	C	D	E	F	I
			PY622977	PY665224	NY745119	NY703705	VX145373	NX758774	NY760055	NX762858
Field Info	1	Log Field Info into Switch Log.xls	C	C	C	C	C	C	C	C
	2	Photograph Switch	C	C	C	C	C	C	C	NP
	3	Record any unusual external visual observations	C	C	C	C	C	C	C	C
	4	Check for Connector engagement	C	NA	NA	NA	NA	NA	NA	NA
		X-ray if it appropriate	C	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	5	Wire 1(BLUE)to Wire 2(ORANGE) Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	6	Wire 1(BLUE) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	7	Wire 2(ORANGE) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	8	Separate Harness from Switch	C	NA	NA	C	NA	NA	NA	NA
Connector Only	9	Verify Connector Seal	C	NA	NA	C	NA	NA	NA	NA
	10	Wire 1(BLUE) to Wire 2(ORANGE) resistance	NA	NA	NA	NA	NA	NA	NA	NA
	12	Check for full engagement of connector	NA	NA	NA	NA	NA	NA	NA	NA
	13	Check wire insulation	C	NA	NA	NA	NA	NA	NA	NA
	14	Check wire gray seals	C	NA	NA	NA	NA	NA	NA	NA
	15	Cut wire insulation to check for corrosion	C	NA	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	NA	NA	NA	NA	NA	NA	NA	C
	17	Spring Terminal to Stationary Terminal Resistance	NA	NA	NA	NA	C	C	C	0.3
	18	Spring Terminal to Hexport Resistance	NA	NA	NA	NA	C	C	C	INF
	19	Stationary Terminal to Hexport resistance	NA	NA	NA	NA	C	C	C	INF
	20	Base to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	3.3M
Switch External Pressurized	24	Switch Opening Pressure	NA	NA	NA	NA	NA	NA	NA	122
	25	Switch Closing Pressure	NA	NA	NA	NA	NA	NA	NA	69
	26	Proof Test for Leakage	NA	NA	NA	NA	NA	NA	NA	NO LEAK
	27	Repeat Steps 17 through 20 at 150 psig	NA	NA	NA	NA	NA	NA	NA	C
	17	Spring Terminal to Stationary Terminal Resistance	NA	NA	NA	NA	NA	NA	NA	INF
	18	Spring Terminal to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	INF
	19	Stationary Terminal to Hexport resistance	NA	NA	NA	NA	NA	NA	NA	INF
	20	Base to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	INF
Switch	28	Remove stainless steel ring	C	C	NP	C	C	C	C	NP
	29	Examine revealed surfaces. Photograph	C	C	NP	C	C	C	C	NP
	30	Remove cap	C	C	NP	C	C	C	C	NP
	31	Examine revealed surfaces. Photograph	C	C	NP	C	C	C	C	NP
Techniques	31	SEM-EDX dFTIR base, corrosion, terminals	C	C	NP	C	C	C	C	NP
	32	Optical-EDX dFTIR cap, hexport, washer seals, etc.	C	C	C	C	C	C	C	NP
	33	Metallographic analysis of contacts	C	NA	NP	C	C	C	C	NP
		Look for evidence of corrosion or arcing	C	NA	NP	C	C	C	C	NP

chklist.xls

3/15/99

TI-NHTSA 016799

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

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT RECD AT CEN. LAB.

			3	4	5	6	7	8	9	10
			PY724043	PY628170	PY632329	PY729611	NX728439	PX180223	PX637768	PY689375
Field Info	1	Log Field Info Into Outlook Log.xls	C	C	C	C	C	C	C	C
	2	Photograph Switch	NP	NP	NP	NP	NP	NP	NP	NP
	3	Record any unusual external visual observations	C	C	C	C	C	C	C	C
	4	Check for Connector engagement	NA	NA	NA	NA	NA	NA	NA	NA
		X-ray if appropriate	NA	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	5	Wire 1(LG/R)to Wire 2(DR/WH/BR) Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	6	Wire 1(LG/R) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	7	Wire 2(DR/WH/BR) to Hexport Resistance	NA	NA	NA	NA	NA	NA	NA	NA
	8	Separate Harness from Switch	NA	NA	NA	NA	NA	NA	NA	NA
Connector Only	9	Verify Connector Seal	NA	NA	NA	NA	NA	NA	NA	NA
	10	Wire 1(LG/R) to Wire 2(DR/WH/BR) resistance	NA	NA	NA	NA	NA	NA	NA	NA
	12	Check for full engagement of connector	NA	NA	NA	NA	NA	NA	NA	NA
	13	Check wire insulation	NA	NA	NA	NA	NA	NA	NA	NA
	14	Check wire grip seals	NA	NA	NA	NA	NA	NA	NA	NA
	15	Cut wire insulation to check for corrosion	NA	NA	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	C	C	NA	NA	C	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	0.2	0.3	NA	NA	0.2	0.2	0.2	2.2
	18	Spring Terminal to Hexport Resistance	INF	INF	NA	NA	INF	INF	INF	INF
	19	Stationary Terminal to Hexport resistance	INF	INF	NA	NA	INF	INF	INF	INF
	20	Case to Hexport Resistance	11.4	1.6M	NA	NA	7.6M	16.5	7.6M	1.4M
Switch External Pressurized	24	Switch Opening Pressure	134	168	NA	NA	147	132	140	137
	25	Switch Closing Pressure	59	58	NA	NA	70	66	112	66
	26	Proof Test for Leakage	NO LEAK	NO LEAK	NA	NA	NO LEAK	NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through 26 at 180 psig	C	C	NA	NA	C	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	INF	INF	NA	NA	INF	INF	INF	INF
	18	Spring Terminal to Hexport Resistance	INF	INF	NA	NA	INF	INF	INF	INF
	19	Stationary Terminal to Hexport resistance	INF	INF	NA	NA	INF	INF	INF	INF
	20	Case to Hexport Resistance	INF	INF	NA	NA	INF	INF	INF	INF
Switch	28	Remove aluminum crimp ring	NP	NP	C	C	NP	NP	NP	NP
	29	Examine revealed surfaces. Photograph	NP	NP	C	C	NP	NP	NP	NP
	30	Remove cap	NP	NP	C	C	NP	NP	NP	NP
	31	Examine revealed surfaces. Photograph	NP	NP	C	C	NP	NP	NP	NP
Techniques	31	SEM-EDX/FTIR base, connector, laminate	NP	NP	NP	NP	NP	NP	NP	NP
	32	SEM-EDX/FTIR cap, Hexport, washer seals, etc.	NP	NP	NP	NP	NP	NP	NP	NP
	33	Metallographic analysis of contacts	NP	NP	NP	NP	NP	NP	NP	NP
		Look for evidence of corrosion or arcing	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 RECD AT CEN. LAB.

			11	12	13	14	15	16	17	18
			PY725068	PX885270	NY740206	PX823672	PY885374	BY639984	PY660225	PY688795
Field Info	1	Log Field Info into Switch Logsht	C	C	C	C	C	C	C	C
	2	Photograph Switch	NP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NRCLS	[illegible]
	3	Record any unusual external visual observations	C							
	4	Check for Connector engagement	NA							
		X-ray if Appropriate	NA							
Switch + Connector Assembly	5	Wire 1(LGR)to Wire 2(ORANGE) Resistance	NA							
	6	Wire 1(LGR) to Hexport Resistance	NA							
	7	Wire 2(ORANGE) to Hexport Resistance	NA							
	8	Separate Harness from Switch	NA							
Connector Only	9	Visally Connector Seal	NA							
	10	Wire 1(LGR) to Wire 2(ORANGE) resistance	NA							
	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							
Switch External Pressurized	24	Switch Opening Pressure	139							
	25	Switch Closing Pressure	71							
	26	Proof Test for Leakage	NO LEAK							
	27	Repeat Steps 17 through 20 at 150 psig	C							
	17	Spring Terminal to Stationary Terminal Resistance	INF							
	18	Spring Terminal to Hexport Resistance	INF							
	19	Stationary Terminal to Hexport resistance	INF							
	20	Base to Hexport Resistance	INF							
Switch	28	Remove aluminum snap ring	NP							
	29	Examine reversal surfaces, Photograph	NP							
	30	Remove cup	NP							
	31	Examine reversal surfaces, Photograph	NP							
Techniques	31	SEM-EDX/FTIR base, contacts, terminals	NP							
	32	SEM-EDX/FTIR cup, hexport, washer seals, etc.	NP							
	33	Metallographic analysis of contacts	NP							
		Look for evidence of corrosion or arcing	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.

			19	20	21	22	23	1	2	3
			PY774266	PY754575	PX643516	??	PX629934	PY638990	PX183920	RX641595
Field Info	1	Log Field info into Switch Log.xls	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	C	C	C
	2	Photograph Switch						C	C	C
	3	Record any unusual external visual observations						C	C	C
	4	Check for Connector engagement						C	C	C
		Comply if if appropriate						NA	C	NA
Switch + Connector Assembly	5	Wire 1(LGR)to Wire 2(ORANGE) Resistance						0.3	0.4	0.2
	6	Wire 1(LGR) to Hosport Resistance						INF	INF	INF
	7	Wire 2(ORANGE) to Hosport Resistance						INF	INF	INF
	8	Separate Harness from Switch						C	C	C
Connector Only	9	Modify Connector Seal						C	C	C
	10	Wire 1(LGR) to Wire 2(ORANGE) resistance						INF	INF	INF
	12	Check for full engagement of connector						C	C	C
	13	Check wire insulation						C	C	C
	14	Check wire gray seals						C	C	C
	15	Cut wire insulation to check for corrosion						TBP	TBP	TBP
Switch External Unpressurized	16	Assemble Switch to Calibration Board						C	C	C
	17	Spring Terminal to Stationary Terminal Resistance						0.3	0.1	0.2
	18	Spring Terminal to Hosport Resistance						INF	INF	INF
	19	Stationary Terminal to Hosport resistance						INF	INF	INF
	20	Base to Hosport Resistance						6.5	INF	17.7K
Switch External Pressurized	24	Switch Opening Pressure						158	127	126
	25	Switch Closing Pressure						68	62	64
	26	Perform Test for Leakage						NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through 20 at 160 psig						C	C	C
	17	Spring Terminal to Stationary Terminal Resistance						INF	0.1	INF
	18	Spring Terminal to Hosport Resistance						INF	INF	INF
	19	Stationary Terminal to Hosport Resistance						INF	INF	INF
	20	Base to Hosport Resistance						INF	INF	INF
Switch	28	Remove aluminum oxide dog						NP	C	NP
	29	Examine revealed surfaces. Photograph						NP	C	NP
	30	Remove cap						NP	C	NP
	31	Examine revealed surfaces. Photograph						NP	C	NP
Techniques	31	SEM-EDX/FTIR base, corrosion, staining						NP	C	NP
	32	SEM-EDX/FTIR cap, tongue, washer seals, etc.						NP	C	NP
	33	Metallographic analysis of contacts						NP	NP	NP
		Look for evidence of corrosion or arcing						NP	C	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.

			4	5	6	7	8	9	10	11
			PX183312	PY610384	NY724368	PY750172	NY733191	PY758158	PX151140	NY757408
Field info	1	Log Field Info into Switch Log.xls	C	C	C	C	C	C	C	C
	2	Photograph Switch	C	C	C	C	C	C	C	C
	3	Record any unusual external visual observations	C	C	C	C	C	C	C	C
	4	Check for Connector engagement	C	C	NA	C	NA	C	NA	C
		X-ray if appropriate	C	NA	NA	NA	NA	C	NA	NA
Switch + Connector Assembly	5	Wire 1(LGRN) to Wire 2(ORANGE) Resistance	NP	0.2	NA	INF	NA	2	0.4	NP
	6	Wire 1(LGRN) to Hexport Resistance	NP	INF	NA	INF	NA	6.0M	INF	NP
	7	Wire 2(ORANGE) to Hexport Resistance	NP	INF	NA	INF	NA	6.1M	INF	NP
	8	Separate Harness from Switch	C	C	NA	C	NA	C	C	C
Connector Only	9	Verify Connector Seal	C	C	NA	C	NA	C	C	C
	10	Wire 1(LGRN) to Wire 2(ORANGE) resistance	NP		NA	INF	NA	INF	INF	NP
	[redacted]									
	12	Check for full engagement of connector	C	C	NA	C	NA	C	C	C
	13	Check wire insulation	C	C	NA	C	NA	C	C	C
	14	Check wire grip seals	C	C	NA	C	NA	C	C	C
	15	Cut wire insulation to check for corrosion	TBP	TBP	NA	TBP	NA	TBP	TBP	TBP
Switch External Unpressurized	16	Assemble Switch in Calibration Stand	C	C	NA	C	NA	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	0.1	0.2	NA	0.3	NA	1.5	0.4	0.1
	18	Spring Terminal to Hexport Resistance	INF	INF	NA	INF	NA	6.3M	INF	INF
	19	Stationary Terminal to Hexport resistance	INF	INF	NA	INF	NA	6.4M	INF	INF
	20	Base to Hexport Resistance	INF	160K	NA	463K	NA	0.4	6.6	INF
	[redacted]									
Switch External Pressurized	24	Switch Opening Pressure	133	161	NA	136	NA	164	136	135
	25	Switch Closing Pressure	63	82	NA	66	NA	66	108	74
	26	Proof Test for Leakage	NO LEAK	NO LEAK	NA	NO LEAK	NA	NO LEAK	NO LEAK	NO LEAK
	27	Repeat Steps 17 through 20 at 140 psig	C	C	NA	C	NA	C	C	C
	17	Spring Terminal to Stationary Terminal Resistance	INF	INF	NA	INF	NA	0.1	INF	INF
	18	Spring Terminal to Hexport Resistance	INF	INF	NA	INF	NA	~670K	INF	INF
	19	Stationary Terminal to Hexport resistance	INF	INF	NA	INF	NA	~670K	INF	INF
	20	Base to Hexport Resistance	INF	INF	NA	INF	NA	INF	INF	INF
Switch	28	Remove aluminum crimp ring	NP	NP	NP	NP	NP	C	NP	NP
	29	Examine revealed surfaces. Photograph	NP	NP	NP	NP	NP	C	NP	NP
	30	Remove cup	NP	NP	NP	NP	NP	C	NP	NP
	31	Examine revealed surfaces. Photograph	NP	NP	NP	NP	NP	C	NP	NP
Techniques	31	SEM-EDX /FTIR base, contacts, terminals	NP	NP	NP	NP	NP	C	NP	NP
	32	SEM-EDX /FTIR cup, hexport, rubber seals, etc.	NP	NP	NP	NP	NP	C	NP	NP
	33	Metallographic analysis of contacts	NP	NP	NP	NP	NP	NP	NP	NP
		Look for evidence of corrosion or arcing	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	13	[illegible]	[illegible]				
			PY742858	PY7433413	NY734410	[illegible]				
Field Info	1	Log Field info into Switch Log.xls	C	C	TBP	TBP				
	2	Photograph Switch	C	C	TBP	TBP				
	3	Record any unusual external visual observations	C	C	C	C				
	4	Check for Connector engagement	C	C	NA	NA				
		X-ray if appropriate	C	NA	NA	NA				
Switch + Connector Assembly	5	Wire 1(LGR) to Wire 2(ORANGE) Resistance	0.3	0.3	NA	NA				
	6	Wire 1(LGR) to Hexport Resistance	20.2M	INF	NA	NA				
	7	Wire 2(ORANGE) to Hexport Resistance	21.5M	INF	NA	NA				
	8	Separate Harness from Switch	C	C	NA	NA				
Connector Only	9	Verify Connector Seal	C	C	NA	NA				
	10	Wire 1(LGR) to Wire 2(ORANGE) resistance	INF	INF	NA	NA				
	[redacted]									
	12	Check for full engagement at connector	C	C	NA	NA				
	13	Check wire insulation	C	C	NA	NA				
	14	Check wire grey seals	C	C	NA	NA				
	15	Cut wire insulation to check for corrosion	TBP	TBP	NA	NA				
Switch External Unpressurized	16	Assemble Switch to Calibration Stand	C	C	C	C				
	17	Spring Terminal to Stationary Terminal Resistance	0.2	0.2	>700K	>130K				
	18	Spring Terminal to Hexport Resistance	34M	INF	>250K	>17K				
	19	Stationary Terminal to Hexport resistance	30M	INF	>350K	>120K				
	20	Base to Hexport Resistance	63.4K	7.6M	INF	INF				
	[redacted]									
Switch External Pressurized	24	Switch Opening Pressure	146	150	152	NO SOUND				
	25	Switch Closing Pressure	61	70	92	NO SOUND				
	26	Proof Test for Leakage	NO LEAK	NO LEAK	NO LEAK	NO LEAK				
	27	Repeat Steps 17 through 20 at 150 psig	C	C	C	C				
	17	Spring Terminal to Stationary Terminal Resistance	0.1	INF	>1.0M	170K				
	18	Spring Terminal to Hexport Resistance	INF	INF	>600K	>140K				
	19	Stationary Terminal to Hexport Resistance	INF	INF	>400K	>15K				
	20	Base to Hexport Resistance	INF	INF	INF	INF				
Switch	28	Remove aluminum crimp ring	SCI LAB	NP	TBP	TBP				
	29	Examine revealed surfaces. Photograph	SCI LAB	NP	TBP	TBP				
	30	Remove cup	SCI LAB	NP	TBP	TBP				
	31	Examine revealed surfaces. Photograph	SCI LAB	NP	TBP	TBP				
Techniques	31	SEM-EDX /FTIR base, contacts, terminals	SCI LAB	NP	TBP	TBP				
	32	SEM-EDX /FTIR cup, hexport, washer seals, etc.	SCI LAB	NP	TBP	TBP				
	33	Metallographic analysis of surfaces.	SCI LAB	NP	TBP	TBP				
		Look for evidence of corrosion or arcing	SCI LAB	NP	TBP	TBP				

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

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLS = NOT RECD AT CEN. LAB.

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							
		Re-key if appropriate							
Switch + Connector Assembly	5	Wire 1(LG/Blk)to wire 2(ORANGE) Resistance							
	6	Wire 1(LBR) to Hexport Resistance							
	7	Wire 2(ORANGE) to Hexport Resistance							
	8	Disperse Harness from Switch							
Connector Only	9	Verify Connector Seal							
	10	Wire 1(LG/Blk to wire 2(ORANGE) resistance							
	12	Check red seal for full engagement of connector							
	13	Check wire insulation							
	14	Check wire gray seals							
	15	Cut wire insulation to check for corrosion							
Switch External Unpressurized	16	Assemble Switch to Calibration Stand							
	17	Spring Towshaft to Stationary Terminal Resistance							
	18	Spring Towshaft to Hexport Resistance							
	19	Stationary Terminal to Hexport resistance							
	20	Base to Hexport Resistance							
Switch External Pressurized	24	Switch Opening Pressure							
	25	Switch Closing Pressure							
	26	Proof Test for Leakage							
	27	Repeat Steps 17 through 20 at 180 psig							
	17	Spring Towshaft to Stationary Terminal Resistance							
	18	Spring Towshaft to Hexport Resistance							
	19	Stationary Terminal to Hexport resistance							
	20	Base to Hexport Resistance							
Switch	28	Remove aluminum crimp ring							
	29	Examine revealed surfaces. Photograph							
	30	Remove cup							
	31	Examine revealed surfaces. Photograph							
Techniques	31	SEM-EDX /FTIR base, contacts, terminals							
	32	SEM-EDX /FTIR cup, hexport, washer seals, etc.							
	33	Metallographic analysis of contacts							
		Look for evidence of corrosion or arcing							

Epstein, Sally

From: sreimers@ford.com
Sent: Monday, March 15, 1999 8:29 AM
To: Rahman, Aziz
Subject: File SWITCHLO.XLS_PC

DRAWINGS AVAILABLE UPON REQUEST

Epstein, Sally

From: Steve Reimers [sreimers@ford.com]
Sent: Monday, March 15, 1999 8:30 AM
To: Rahman, Aziz
Subject: PC File(s) sent to you...

I haven't updated this since 2/19/99.

Steve Reimers building 5 3E008
AVT Chassis E/E System Applications mail drop 5011
39-03286 SREIMERS sreimers@ford.com fax 39-03286 ;>

Epstein, Sally

From: LaRouche, Steve (S.) [slarouch@ford.com]
Sent: Monday, March 15, 1999 12:26 PM
To: Rahman, Aziz
Subject: RE: Updates

Aziz: I am sending you the updated testing checklist under a separate note. We have found three switches which appear to contain water corrosion only (no brake fluid and no evidence of a cell). Two have been analyzed by Central Lab; one is being analyzed by Ford Scientific Research Lab. We have also received two switches from the OASIS which appear to be leakers. We will open these in TI's presence per wishes of A. McGuirk.

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

-----Original Message-----
From: Rahman, Aziz [mailto:arahman@email.mc.ti.com]
Sent: Monday, March 15, 1999 8:50 AM
To: 'Steve LaRouche'
Subject: Updates

From: Rahman, Aziz
Sent: Monday, March 15, 1999 8:47 AM
To: 'Steve Reimers'; 'Steve LaRouche'
Subject: Updates

Hi Steve R and Steve L

I am limping back to normalcy here!

Could you please send me updates of the Switch Log (Steve R.) and the Analysis Results Log (Steve L.) files?

Thanks
Aziz.

Currey, Pat

From: McGuirk, Andy [a-mcguirk@email.mc.ti.com]
Sent: Thursday, March 18, 1999 2:14 PM
To: Beringhause, Steven; Dague, Bryan; Proia, Stephen
Cc: Pechonis, John; Bartosh, Bob; Baumann, Russ; Rowland, Thomas
Subject: FW: (U) Brainstorming

I would suggest a two 'bucket' approach.....

one bucket as to technical difficulty (consider: "A"....easy, known technology, can think of ways to do so, have relevant experience, little risk; "B"....moderate, have some pretty good ideas, little relevant experience, some risk, might need parallel paths, risky; and "C" .... tough, almost no idea as to how to accomplish, no experience, very risky,) and one bucket as to lead time to production level components (consider 2-4 months, 6-12 months, 12-24 months).

we should perform 'triage' by Friday afternoon and advise Fred of the a and c and 12-24 month items....and ponder the others for a more refined approach to deliver Monday.

a

AUTOMOTIVE SENSORS AND CONTROLS QRA MANGER
34 FOREST ST M/S 23-05
ATTLEBORO, MA 02703
TEL : (508) 236-3080
FAX : (508) 236-3745
PAGE: (800) 467-3700 PIN 604-2044

From: Frederick J. Porter[SMTP:fporter@ford.com]
Sent: Friday, March 12, 1999 9:01 AM
To: a-mcguirk@email.mc.ti.com
Subject: (U) Brainstorming

to: a-mcguirk@email.mc.ti.com

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 FPORTER --DRBN007 03/11/99 17:59 ***
To: N1654584--EXTERNAL

FROM: F. J. Porter USAET(UTC -05:00)
Subject: (U) Brainstorming

Andy,

Attached is a list of ideas that were developed by a group from our research laboratory of potential changes that could be made to the switch that may improve our condition. TI has investigated some of these already.

I would like you to go through each idea and let us know what your

feasibility and manufacturing issues are as well as timing for their potential implementation.

1. Coat cup with plastic or other non-conductive coating (like anodizing)
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

2. Make cup of non-conductive material
   Lengthens corrosive path to ground
   Insulates from broken spring switch contacting ground

3. Add plastic diaphragm between cup/transfer pin and the spring contact/switch cavity
   Additional layer of isolation between mechanical components and electrical components

4. Place plastic insulator disk on the cup with hole only for the transfer pin

   Reduces surface area exposed between battery and ground

5. Replace kapton membranes with pure teflon membranes
   Increased flexibility of membrane

6. Replace kapton seal with sliding piston seal
   Eliminates wear on kapton

7. Change cup/converter topology
   Spread flexure over greater area of the kapton
   Reduce interfaces where extreme flexure occur

8. Replace switch with pressure transducer and semi-conductor switch
   Eliminates kapton seal

9. Design thermal link in power supply side of switch that opens at elevated temperature (one time or cycling)
   Turns off power before heat becomes great enough to cause ignition

9a. terminal - fuse combination built into switch managing switch power

10. Reverse polarity of switch contacts
    Removes power from spring contact if it moves out of position

11. Insulate/plastic coat spring except contact area
    Reduces corrosive exposure
    Reduces conductive material to making contact with ground

12. Gold plate spring contact
    Reduces corrosion

13. Fill air gap in switch housing with potting material to seal connector openning
    Seal off connector path of contamination

14. Change switch housing material for improved ignition parameters
    Reduces ability for flame to spread after initial heat source is removed

15. Add another layer to the kapton seal
    Possible increased life of seal before perforations occur

16. Add ground fault interrupter circuit to switch circuit
    Turns off power if ground path to case is detected

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

March 19, 1999

Mr. Tim F. Donovan, Manager
E/E Systems Engineering
Building 5, Mail Drop 5017
20000 Rotunda Drive, Rm 1A043
Dearborn MI 48121-2053

Dear Tim,

Thank you for taking the time to visit with me on Wednesday, March 17, 1999.

For four months, the Texas Instruments Inc. Automotive Sensors & Controls Team has been supporting the Ford Core Diagnostic Team with technical facts, data, and analysis regarding our brake pressure switch product.

A senior TI pressure switch engineer was in residence at Ford for three weeks to assist with any switch related issues in the system diagnostic process. Senior TI participation has also been involved in the last six consecutive Ford Core Team meetings.

Below is a very brief recap of activities leading us to several conclusions:

Preliminary dealer and salvage yard samples have produced pressure switches with brake fluid leakage supporting a theory that switches were leaking in the field application. Certain switches evidenced wear-out due to exposure to many pressure cycles (there appears to be a vehicle application cycle quantity issue).

Conclusion to date: Some switches exhibit end-of-life wear-out & leak brake fluid and appear to be "beyond life"

We also investigated switch capability, and using agreed upon accelerated simulation life testing techniques, demonstrated the ability of the model year '92-'93-'94 Town Car brake switches to consistently exceed "cycle life specification" of 500,000 pressure cycles. TI Weibull reports of pressure switches tested in '99 conservatively demonstrate 95% reliability to 1 million cycles (with confidence intervals greater than 50%) while success testing records of some 7,500 ES units shows zero leakage at 500,000 cycles

Conclusion to date: Switch meets or exceeds specification.

Initially it was theorized that brake fluid leakage through the pressure switch contributed to thermal events but both TI and Ford have been unsuccessful in recreating thermal events with brake fluid inside the switch even under extreme conditions. Efforts are still continuing with TI currently experimenting with switch tests using "old" brake fluid to create more knowledge regarding combinations of "old" brake fluid and water in the switch cavity under powered conditions.

Conclusion to date: Brake fluid leakage in switch cavity does not cause thermal events.

Based upon extensive analysis of failed switches (and previous experience) we have developed and delivered a model of accelerated plastic base ignition using the constant power of the speed control circuit and conductive fluids (ionic enhanced water). This model used the 15-amp/14 volt DC power available in the speed control circuit (not the 1-amp load required by the clutch application) and created ignition using water induced corrosion based products (not brake fluid) in the switch cavity. TI understands the model sufficiently to re-create ignition in a laboratory environment.

Conclusion to date: Continuous speed control power allows long term corrosion if conductive fluids are present in the switch cavity.
Electrical current in excess of 1-amp clutch application needs supports corrosion process and allows excessive power dissipation through the corroded terminals.

We would like to review the scientific problem solving process and discuss the findings to assist in accelerating our joint understanding and actions. Enclosed is a copy of the resulting "theory based significant factors" we have delivered to the Core Team to assist in the system understanding and diagnostics. Please consider a meeting with our General Manager and Design Engineering Manager to achieve this result.

Regards,

Andrew C. McGuirk
QRA Manager
Texas Instruments

C: Thomas E. Masters - Ford
Frederick J. Porter - Ford
Thomas Rowland - Texas Instruments
Steve Beringhause - Texas Instruments

Carney, Pat

From: Warner, Pam [pwarner@email.mc.ti.com]
Sent: Monday, May 24, 1999 8:26 AM
To: McGuirk, Andy
Subject: March 19, 1999

Andy,
Here is the current letter you gave to Fred. Let me know if I can be of any further help to you.

<<FredPorter52199b.>>

May 21, 1999

Mr. Fredrick J. Porter, Supervisor
E/E Systems Engineering
Building 5, Mail Drop 5011
20000 Rotunda Drive, Rm 3E004
Dearborn MI 48121-2053

Dear Fred:

I want to review our recent support of the Ford core team to assure we do not have any misunderstandings regarding our pressure switch performance and our contribution to the team.

For six months the Texas Instruments Automotive Sensors & Controls Team has been supporting the Ford Core Diagnostic Team with technical facts, data, and analysis regarding our brake pressure switch product applied in the Ford cruise control deactivation circuit.

A senior TI pressure switch engineer was in residence at Ford for three weeks to assist with switch related issues in the system diagnostic process. Senior TI leadership participation has also been involved in virtually every Ford Core Team meeting delivering facts, data, and technical support year-to-date '99.

We also investigated switch capability, and using agreed upon accelerated simulation life testing techniques, demonstrated the ability of the model year '92, '93, '94 Town Car brake switches to consistently exceed "cycle life specification" of 500,000 pressure cycles. TI Weibull reports of pressure switches tested in '1999 conservatively demonstrate 95% reliability to 1 million cycles (with confidence intervals greater than 50%).

Additionally "success testing records" of some 665 ES units that were tested during the 1991 - 1992 (11/91 - 12/92) showed 0 leakage at 500,000 cycles.

Conclusion to date: 1992 period switches met specification. 1999 switch meets or exceeds specification

We have developed and delivered a model of accelerated plastic based ignition resulting from fluid in the switch cavity coupled with application of constant power as designed in the speed control circuit. Theories from the model suggest that

fluids in the switch cavity could corrode and might create a plastic base ignition path in the presence of uninterrupted power.

Conclusion to date: Constant speed control power allows long term corrosion

We have been open and forthright in our communications and delivery of information and we believe we have been instrumental in helping Ford address the underhood fire concern issue.

In this regard, we think it is appropriate at this point that our active participation in the diagnostic journey of the vintage 1992 product move towards a timely conclusion. The 1992 test records we recently forwarded clearly demonstrate the product met specification.

We are preparing to fulfill your request for hosting a site visit, supporting campaign field return device analysis, and participating in robust system brainstorming moving toward conclusion in July, as well as reviewing the optimization of our product line process controls.

Our prime focus at this time is in rapidly supplying Ford with 225,000 units in support of the field actions.

Regards,

Andrew C. McGuirk
QRA Manager
Texas Instruments

attachments: 1992 Testing History
TI 77PS Test synopsis
TI 77PS Investigation Flow Diagram

[illegible]

From:	Werner, Pam [[illegible]]
Sent:	Friday, March 19, 1999 12:[illegible] PM
To:	Sharpe, Robert
Subject:	Tim Donovan letter

Tim Donovan_FORD.doc

Rob,

Here is the Tim Donovan letter from Andy McGuirk.

<<Tim Donovan_FORD.doc>>

Attorney - Client Privileged Communication

March 19, 1999

Mr. Tim F. Donovan, Manager
E/E Systems Engineering
Building 5, Mail Drop 5017
20000 Rotunda Drive, Rm 1A043
Dearborn MI 48121-2053

Dear Tim,

Thank you for taking the time to visit with me on Wednesday, March 17, 1999.

For some four months the Texas Instruments Automotive Sensors & Controls Team has been supporting the Ford Core Diagnostic Team with technical facts, data, and analysis regarding our brake pressure switch product.

A senior TI pressure switch engineer was in residence at Ford for three weeks. Senior TI participation has been delivered in the last six consecutive Ford Core Team meetings (and we intend to continue in this role???).

Below is a recap of activities leading us to several conclusions

Initially it was theorized that brake fluid leakage through the pressure switch contributed to thermal events and both TI and Ford were unsuccessful in recreating thermal events with brake fluid inside the switch. During the next two weeks TI will experiment with "old" brake fluid using our most recent test model.

Conclusion: Brake fluid does not cause thermal events

Preliminary dealer and salvage yard samples have produced several pressure switches with brake fluid leakage and there is some evidence that the switches are worn out. Some of these switches evidence being worn out due to exposure of many cycles and there appears to be a vehicle application cycle quantity issue.

Conclusion: Some switches are worn out

We also investigated switch capability, and using agreed upon accelerated simulation life testing techniques, demonstrated the ability of the 92-93-94 Town Car brake switches to consistently exceed "cycle life specification"

Conclusion: Switch meets or exceeds specification

We have developed and delivered a model of accelerated plastic based ignition using the constant power of the speed control circuit and conductive fluids.

Conclusion: Speed control power allows long term corrosion

We would like to review the scientific problem solving process and discuss the findings to assist in accelerating our joint understanding and actions. Please consider a meeting with our General Manager and Design Engineering Manager to achieve this result.

Regards,

Andrew C. McGuirk
QRA Manager
Texas Instruments

ACM/paw

C: Thomas E. Masters - Ford
Frederick J. Porter - Ford
Thomas Rowland - Texas Instruments
Steve Beringhause - Texas Instruments

Currey, Pat

From: Warner, Pam [pwarner@email.mc.ti.com]
Sent: Monday, March 22, 1999 9:45 AM
To: Watt, Jim
Cc: McGuirk, Andy
Subject: RE: foils for presentation 3/24/99

Jim,
Thank you for your quick response and for attaching the files. Some of us send the information and then realize we forgot to attach any information with it. Thanks again and have a good week.

From: Watt, Jim
Sent: Monday, March 22, 1999 10:34 AM
To: Warner, Pam
Cc: McGuirk, Andy
Subject: RE: foils for presentation 3/24/99

Below are the updated files for 77PS:

<<File: Ford 77PS(diaphragm).ppt>>

<<File: Ford 77PS(thermalevents)switch.ppt>>

<<File: Ford 77PS(thermalevents)i2r.ppt>>

Jim Watt, QRA, msgid: jw02; mail station 12-33; page (508)236-1010, no. (0696)
ph (508) 236-1719;
fax (508)236-3153

From: Warner, Pam
Sent: Monday, March 22, 1999 8:38 AM
To: Watt, Jim
Cc: McGuirk, Andy
Subject: foils for presentation 3/24/99

Jim,
Attached are the foils you sent to andy mcguirk (electronically) for his presentation on 3/17. Will you please update for his presentation on Wednesday, March 24th and send them back to my attention by early Tuesday, March 23 so I can electronically send them for his meeting. Thanks Jim. If you have any questions, please call me on extension 2324 or send me an email.

Currey, Pat

From: Watt, Jim [jwatt@email.mc.ti.com]
Sent: Monday, March 22, 1999 9:34 AM
To: Warner, Pam
Cc: McGuirk, Andy
Subject: RE: foils for presentation 3/24/99

Below are the updated files for 77PS:

<<Ford 77PS(diaphragm).ppt>>

<<Ford 77PS(thermalevents)switch.ppt>>

<<Ford 77PS(thermalevents)i2r.ppt>>

Jim Watt, QRA, megid: jw02; mail station 12-33; page (508)236-1010, no. (0696)
ph (508) 236-1719;
fax (508)236-3153

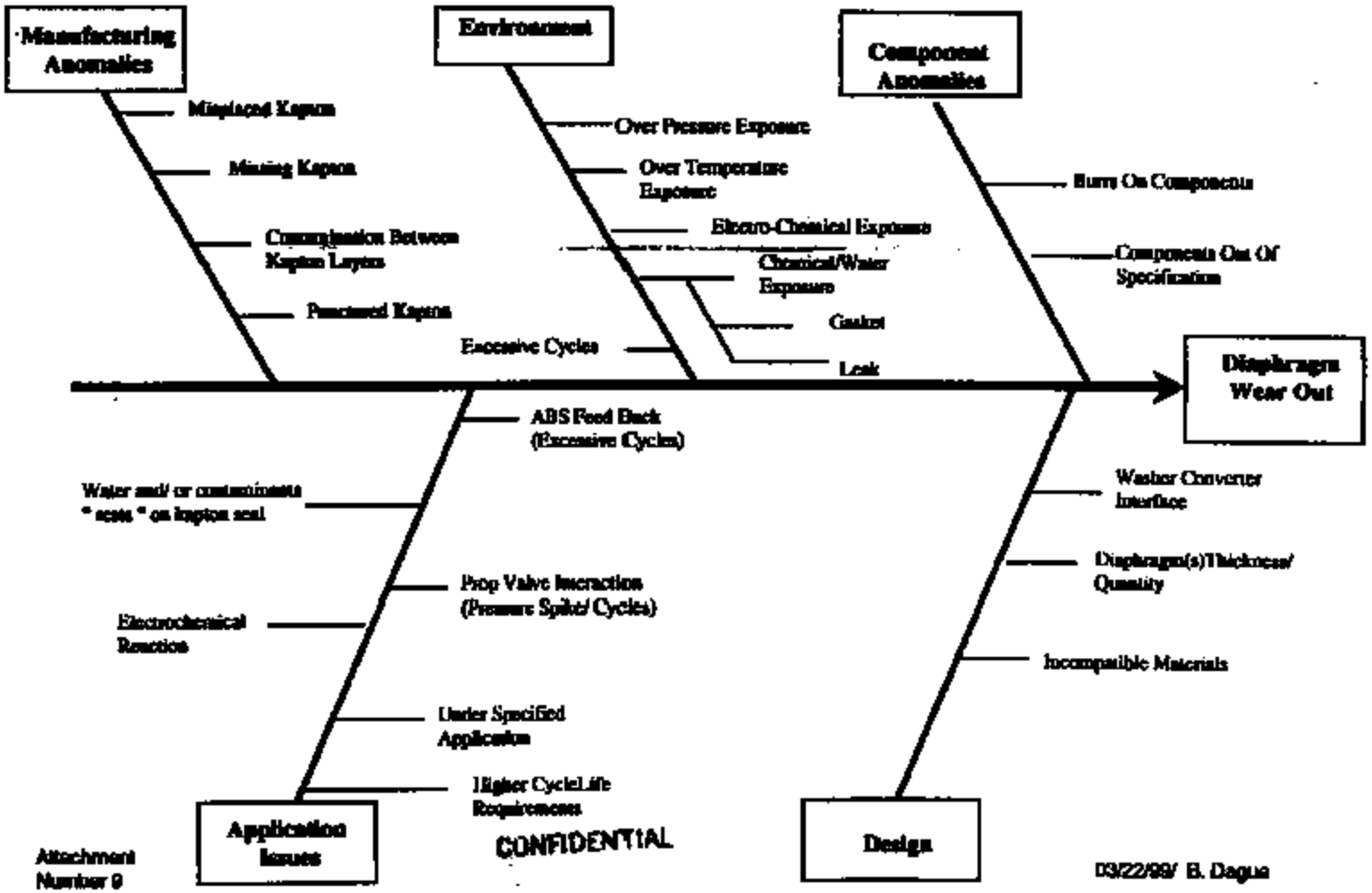
From: Warner, Pam
Sent: Monday, March 22, 1999 8:38 AM
To: Watt, Jim
Cc: McGuirk, Andy
Subject: foils for presentation 3/24/99

Jim,
Attached are the foils you sent to andy mcguirk (electronically) for his presentation on 3/17. Will you please update for his presentation on Wednesday, March 24th and send them back to my attention by early Tuesday, March 23 so I can electronically send them for his meeting. Thanks Jim. If you have any questions, please call me on extension 2324 or send me an email.

CONFIDENTIAL

TEXAS INSTRUMENTS

Ford Electronic Speed Control Deactivation Pressure Switch
TI P/N 77PSL Series
Wear Out Fishbone



CONFIDENTIAL

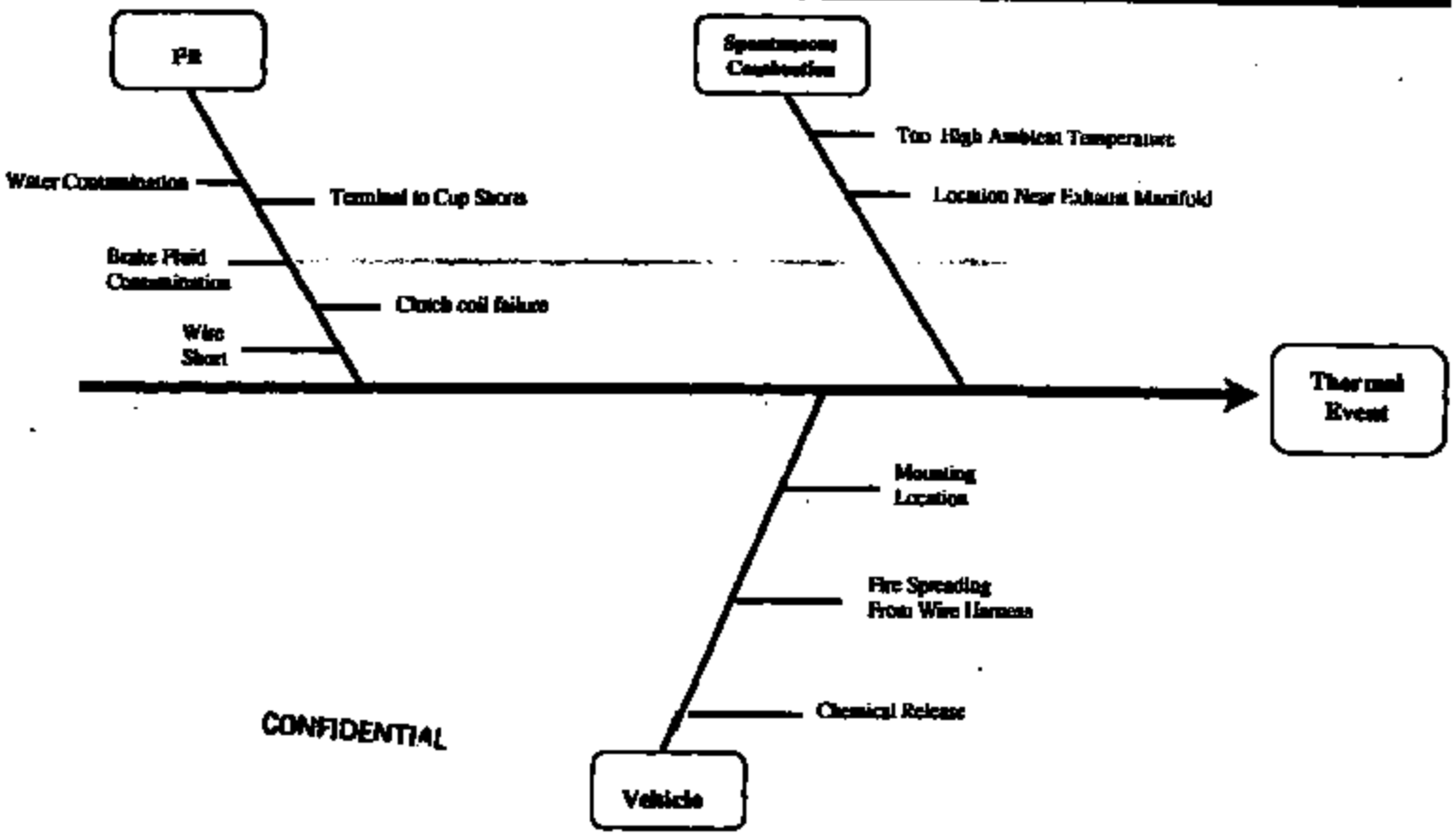
Attachment Number 9

03/22/99/ B. Dagua

TI-NHTSA 016824

TEXAS INSTRUMENTS

Ford Electronic Speed Control Deactivation Pressure Switch
TI P/N 77PSL Series
Thermal Event



CONFIDENTIAL

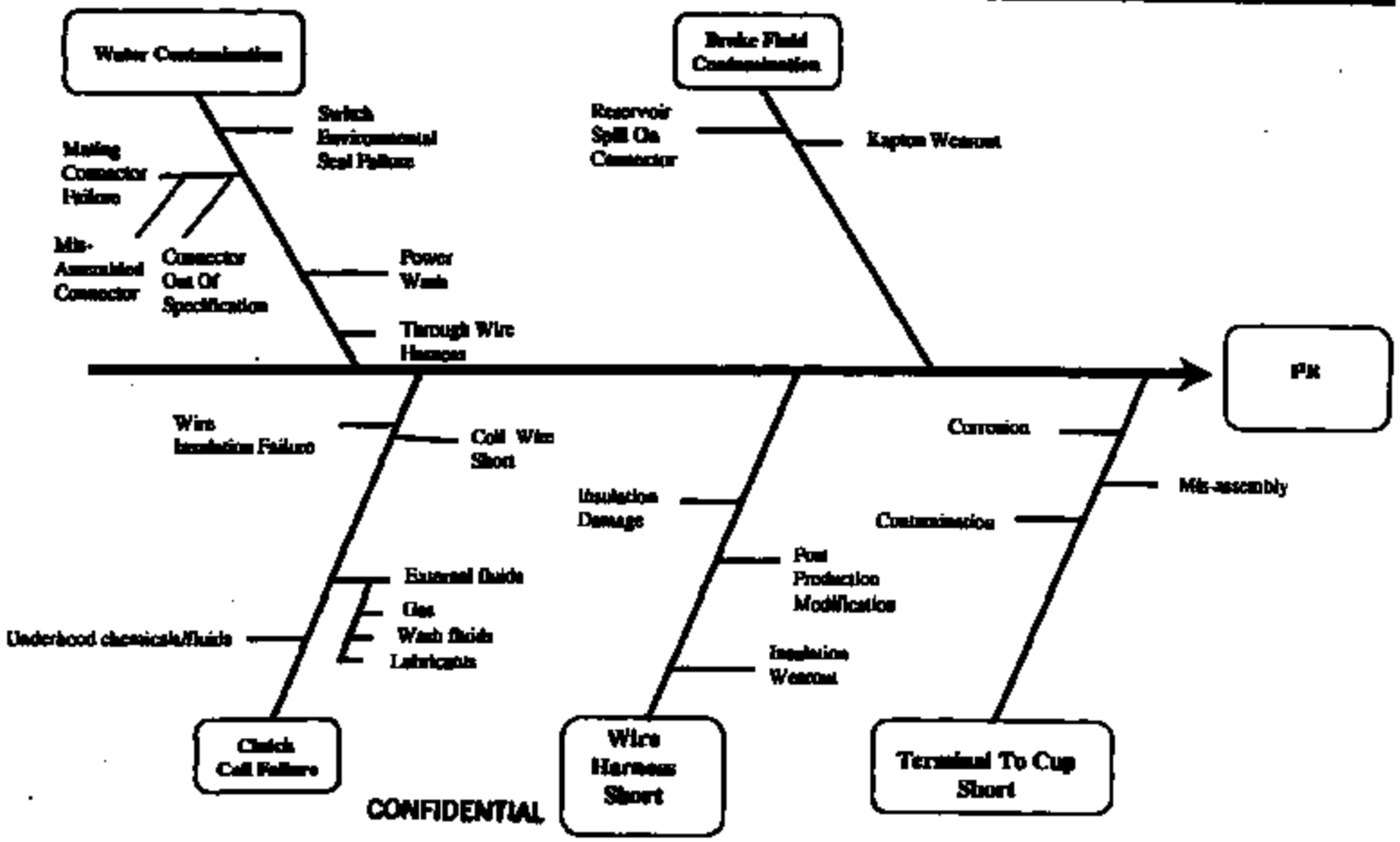
Attachment
Number 10

03/22/99/ B. Dague

TI-NHTSA 016825

TEXAS INSTRUMENTS

Ford Electronic Speed Control Deactivation Pressure Switch
TI P/N 77PSL Series
Thermal Event



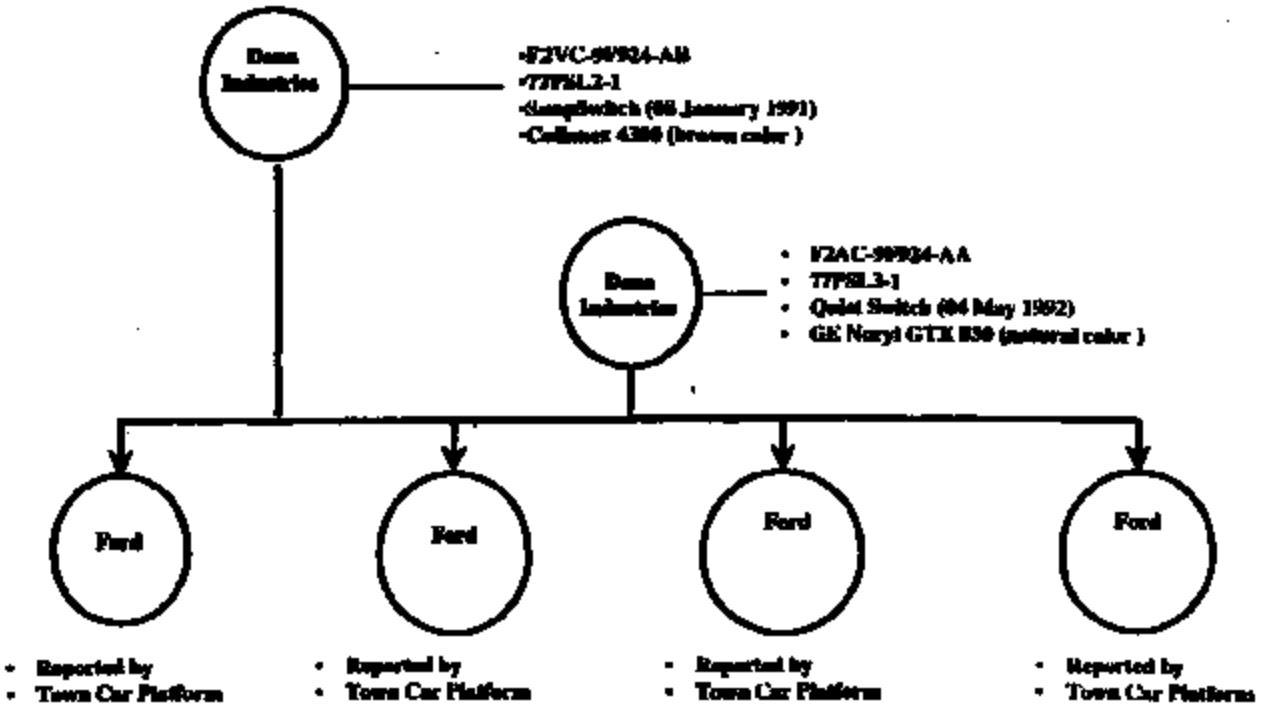
CONFIDENTIAL

Attachment Number 11

03/22/99/ S. Dague

TI-NHTSA 016826

TOWN CAR SWITCH SEQUENCE ...



Currey, Pat

From: Frederick J. Porter [fporter@ford.com]
Sent: Monday, March 22, 1999 5:43 PM
To: McGuirk, Andy
Subject: (U)

to: a-mcguirk@ti.com

Andy,

On Charlie's list of components, which use Celanex and which use Noryl?

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

Carrey, Pat

From: Steve Reimers [sreimers@ford.com]
Sent: Wednesday, March 24, 1999 7:59 AM
To: McGuirk, Andy; Rahman, Aziz; Porter, F.J.; slarouch@ford.com
Subject: RE: Brake Fluid Shipping addresses

FYI.

Steve Reimers building 5 3E008
RVT Chassis E/E System Applications mail drop 5011
39-03286 SREIMERS sreimers@ford.com fax 39-04145 ;>
*** Forwarding note from O2421WP1--EXTERNAL 03/24/99 07:56 ***
To: SREIMERS--FORDMAIL 'Steve Reimers'
cc: ONOZLQ9P--EXTERNAL Urbiha, Scott (SA)

From: Kitt, Michael (MB)
Subject: RE: Brake Fluid Shipping addresses

From: "Kitt, Michael (MB)"<mkitt@dow.com>
cc: "Urbiha, Scott (SA)"<surbiha@dow.com>

Steve,
Samples of the components used to make brake fluid were shipped to TI today. The blend should be produced by adding two (2) gallons of material from the container labeled as Dowanol 237 to the entire content of the container labeled Dowanol 236.
Please call me if you have any questions.
Mike Kitt

> ----------
> From: Steve Reimers[SMTP:sreimers@ford.com]
> Sent: Tuesday, March 16, 1999 4:37 PM
> To: mkitt@dow.com
> Subject: Brake Fluid Shipping addresses
>
> TO: mkitt@dow.com
>
> please ship the 5 gallons of Ford formula brake fluid without
> inhibitors to:
> **********
> *******
> URGENT: Gerry Terino(508-236-3009)
> Texas Instruments Incorporated
> 34 Forest Street, MS-12-37
> Attleboro, Massachusetts 02703
> **********
> *******
> and 5 gallons to:
> Ford Motor Co.
> Central Laboratory
> 15000 Century Drive
> Commerce Park North
> Dearborn, MI 48120
> Attn: S. LaRouche
> **********
> ********
> Please reply to this email so I may set-up an ID for you.
> thanks,
>
> Steve Reimers building 5 3E008
> AVT Chassis E/E System Applications mail drop 5011

> 39-03286 SREIMERS sreimers@ford.com fax 39-03286 />
>

Carrey, Pat

From: sreimers@ford.com
Sent: Thursday, March 25, 1999 12:07 PM
To: McGuirk, Andy
Subject: File BRAKE_1.JPG


BRAKE PRESSURE
SWITCH AND
HARNESS 3-01-99

Currey, Pat

From: Steve Reimers [sreimers@ford.com]
Sent: Thursday, March 25, 1999 12:09 PM
To: McGuirk, Andy
Subject: BP switch Photo and Note

Here are the best photos I found of the switch installed underhood on a 92 Town
car. What info do you want from the warranty data and decision matrix?

Steve Reimers building 5 3E008
RVT Chassis E/E System Applications mail drop 5011
39-03286 SREIMERS sreimers@ford.com fax 39-04145 ;>


BRAKE PRESSURE
SWITCH AND
HARNESS
3-01-99

Currey, Pat

From: Steve Reimers [sreimers@ford.com]
Sent: Thursday, March 25, 1999 12:19 PM
To: McGuirk, Andy
Subject: Two More Photos

Thees two were taken after the instrumentation was installed. The BP switch is
still in the same orientation but has moved away from the prop-valve about 2 i
nches alond the hexport axis.

Steve Reimers building 5 3E008
RVT Chassis E/E System Applications mail drop 5011
39-03286 SREIMERS sreimers@ford.com fax 39-04145 />

1