EA02-025

FORD 10/27/03

APPENDIX N

BOOK 16 OF 61

PART 4 OF 4

CAN A REPLACEMENT CONNECTOR BE CAUSING EXCESS LEAKAGE?

~~[illegible]~~

[illegible] Warranty Data for ?
Eric Bill

Junkyard connector evaluation

E-MAIL WARRANTY DATA TO ANDY

BP Switch My Notes 3/17/99

Mc Connector changes since MY 92/93 (Service Parts).
— In-line relay

— IDEA (Ersa Kohl)
Use BP Switch as relay control that provides power ~~to~~ to speed control clutch.

IDEA (Steve)
— ABS Pedal Travel Switch signal to activate a disconnect device.

Don't understand
— Why aren't we seeing fires in Michigan (Bill)?
Opinion — Its not road salt & we don't have heat & humidity like SOUTH COASTA

A — Old Brake Fluid analysis by TI
What does Ford want?
Conductivity, Content metals (Fe,)

TI next steps
— [illegible] Brake Fluid test
Add perforated diaphram and pulsing pressurized brake fluid.
HEAT THE [illegible] TO ACCELERATE CORROSION.

? Is wire seal / brake fluid compatible? Greg?

? Does ~~Mean~~ arc drive chemical reactions in brake fluid? (DOW & FRL)

? How does Weibull compare Quiet v Snap Disc?

— Kick-off in-line fuse action. (Greg?)

3713 1779

BP Team Meeting

3/17/99

SWITCH

Steve Reimers	03286	JREIMERS	RVT/EESE
John Shore	69789	JShore	PS&L / FCSD
Al Lacek	08877	ALACEK8	FCSD/Recall
Fred Proctor	53722	FPROCTOR	RVT/EESE
William M. Abramchyk	23284	WABRAMCH	ASD
Greg Stevens	36686	GSTEVEN2	EVT MMT's
Tom Bazil	47597	TBAZIL	LVC OPD BRAKES
Joe Evans	23832	JEVANS8	R-VT-CHASSIS
Fred Kohl	21801	FKOHL	Vistecon SpdControl
Tony M Galick	508 236 3080	a-mgalick@ST.com	Test Dept

BP Team Mtg

3/19/99

-- HARDY, Mike QUALITY OFFICE

HELP FACILITATE IS/IS NOT SEARCH FOR ROOT CAUSE.

- John McInerny any more parts from field
- TI
- Brake Switch Relocation
- Brake Fluid w/o inhibitor

~~from Prop. Valve~~

- ~~Brake Pressure Sensitch~~ with Harness attached.
- ~~Speed control Servo with Harness~~
- ~~STOP LAMP FUSE~~

A Contact FCSD to gear-up Field Service reps to the OASIS (Zone Managers)
(Dealerships may not pull-up OASIS for out-of-warranty cars.)

A— Go To Shilling

? - Brake Fluid compatible with the plastics, etc in connectors and wire. Greg Stevens

A — Copy of questionaire

? — Corrosion back-up of Transfer PIN IS RELIABILITY ISSUE FOR ▽ component / Abraincafe ...

No. ▽ is for brake fluid pressure seal (Odinion).

3713 1782

3/3

BP Switch Team Mtg 3/10/99

Steve Reimers RVT EE32 0326 3RSIMER

Fred Porter	RVT EE32	53722	FPORTER
Joe Nemec	LVC Safety	08133	JNEMEC
Steve LaRoche	Cen. Lab	54876	SLAROCH
Tom Babil	LVC-OPD Brakes	47547	TBABIL
Barry Egen	RVT-Chassis	39812	BEGEN
Joe Evans	RVT- Cole Brakes	23832	JEVANS8
Mike Hardie	Quality Center	57279	M HARDIE
William M. Abramczyk	ASD	23284	WABRAMCZ
Rob Sharpe	Texas Instruments	(248) 305-5729	rsharpe@ti.com
Jerry Andritsis	RVT- Application Engineer	248-9524	JANDRITS
Joe Kafati	AVT - EE32	(313) 390-5389	JKAFATI
Andy McGuirk	Texas Instruments QMA	508 236 3080	a-mcguirk@ti.com

2/19/99

NHTSA Session – 2 months to make decision.

Randy McClure Litigation contact

Brake issues rising CB.

A When did SNAP to Quiet Change accur?

2/23/99 Fiber optic measure for are

– Loose metal in Switch Cavity

Accelerated Corrosion of APG MATLS

Iaconelli Performance test group.

Ford Load group

Vehicle Purchase Bill Pfeffer?

* Monitor Brake Pressure Switch actuations during vehicle testing.

Power Steering Switch Usage

92/93 hard ABS erroneous action

OWNER MANUALS Bill Abramczyk

"DOE VARIABLE Pulse Pressure 180 psi 1450

* What Brake Pressure to Turn-on Brake Lamp

3713 1784

2/19/77

ID Combustibles - Brake Fluid
DOW reviewing mat'l list
Meet next Tuesday morning

ID Contaminants & ~~Source~~ - Copper, Zinc, Sulfur, Silver, Brake Fluid.

ID Source - Electrical Terminals + Sulfur TBD

ID Cause of Leak - TI Life Testing
Kapton Diaphragm

ID Heat Source - not yet
DOW help.

Create Event - 55 AMP HEATING

Collect Parts - 13 more from Junkyard (= five.)

Structured Evaluation Process

TI Test Station on-site

OASIS Message by COB.

~~CLOSE~~ TERMINAL - 1 return unit
Potential Short Circuit
~~15 AMPS not~~

2/19/99

- Speed Controls functional
  flyback circuit analysis by Tuesday

- ~~OASIS Message out - by Monday~~

- Test Vehicle Procurement
  Vehicle type IDENTIFIED

- Tests In-Progress
  - FATIGUE WEAR-OUT 900K 729K cycles
  - Leakage current growth 3-5 mA
  - FATIGUE AGING
  - FIELD RETURN ANALYSIS ON-GOING
    JOURNEY SPEED CONTROLS - OK

- DCE @ TI START MONDAY AFTER FATIGUE TEST
  BRAKE FLUID 1M cycles
  " " - WATER completion 3/3/99
  QUIET DISC
  SNAP DISC
  CLUTCH LEAD

- CGIS Variations BRAKE = 47

NOT UH	5	
UH	17	— 5 Brake Sw
U car	12	
UNKNOWN	13	

Give TI Taken 2/19/98

93 CONNECTOR OF

fatigue

#7 728 K → ONE

complete Monday 30 parts total

SNAP every 200K ES life Condit

Preparing DOE Brake Fluid

LIFE TEST

" GROUP OF 10 Brake fluid & water

OF

F2AC-9F529-AA Quiet Disc ~ MY

TEVC-9F SNAP Disc

10 DAYS from MONDAY + CLUTCH LOAD

Will all on Quiet Disc typ 750K

Finite Element

Life N Stress Strain

Pressures
Vacuum
Temp
Environ
WATER

COUNTER CLKN

BRAKE FLUID BORN

Per Greg Stevens

Mike Kit DOW (Louisiana) 2/18/99

- Water in Brake Fluid
  - an effect on conductivity ?
  - no effect on flash point

- how about Salt Water ?

FAX 78256

ILNL

i81	TC Base Exec	ORIGINAL MASTER CYLINDER
M82	TC Sign	
M83	TC Cert	after Nov '91
M84	TC LTJ	with T/C

06-09-1 BRAKES

Performance Test group

2/18/98

Dow ~~Engineer~~ Chem rep is looking at our ~~C~~ materials list and questions. ~~She~~ He will be here by Wed next week.

Brake fluid 312°F flash med spark
600°F auto ignite.

Celanex housing

- Has identified contaminants - need to understand source of sulfur - Do
- Cause

Team Mtg

ATTENDEES

Brake Pressure Switch Mtg 2/17/99

Steve Reimers	ESE/Chassis	73255	SREIMERS
ROB EDELSKI	ESE-ESS		REDELSKI
WILLIAM ABRAMCHIK	ASO	23284	WABRAMCZ
Rob Sharpe	TI	(248) 305-5729	rsharpe@ti.com
STEVE LAROUCHE	CCS	54076	SLAROUCHE
LEN BROWN	AVT chassis	22352	LBROWN
GREG STEVENS	AVT MAT'L	36616	GSTEVENS
MARTY M. P. REESE	OPD BRAKES	27142	MREESE
AZIZ Rahman	TI	248 305-5729	
FRED KOHL	VISTEON	21801	FKOHL
JOE NEME			

2/17/99

DOW no-response

Brass & Copper Electrode

- ~~Re~~ Give 200 hour unit to Caloock for Analysis
- Flash 312°C Auto IGNITION 600°C Do these
- VP DOW to Lee
- IGNITION Transition Transients
- What is the lowest mileage reported? TOM MASTERS
- June 95 earliest reports
- 92 Vehicle Took car after Nov'91 No-WIRING MODS AFTER ABS/TC 25317 Dennis Lark
- ~~Mr~~ Traces for Speed Control examination.
- Pressure Profile & HCU Tests.
- Ill. Joyce Chuck Bannon for ABS Data
- TOM & JOE COME TO MEETING
- Tom CAIS to ABRAMCYZK

3713 1791

2/17/99

- DEALER CANVAS IN SOUTHERN AREA BILL REQUESTED OF TOM MASTERS.

- SOUTHERN AREA MAY JUST BE WORST WEAROUT ENVIRONMENT. OTHERS TO FOLLOW.

- BRAKE FLUID Samples

- T_C. 92 93 ABS/TC UNIT PRIMO from Phoenix Las Vegas Signature LM

FOCUS Tech Review 2/11/99

- MATRIX OF WHAT IT IS / IS NOT
  OPTIONS NOT ENOUGH
- Is Brake Shift Interlock ~~signal~~ ~~off~~ using B00 signal. CAN'T SHIFT OUT OF PARK.
- Geo of Service Replace Parts Sales.
- Success of Kapton in this application
  - Cycle test in Humidity
  - 92-93 Town Car 100% ABS (option TA)
    (CV GM option ABS/TC together only)
    - Is sick Test Pulse) Fluid pure or water contaminated?
    - Measure [illegible] current flow.
    - Circular [illegible] broken switch [illegible] arcing
    - [illegible] ENTRY [illegible]
    - 6 months to act
    - SAE include [illegible] for melted, cracked ---

3713 1793

Brake Pressure Switch Meeting 1/3

3/3/99

	EMAIL		
Steve Reimers	SREIMERS	X03286	AVT/EESA
Fred Porter	FPORTER	X55722	AVT/EESE
M. P. Reese	MREESE	x77142	OPD LVC
Rob Sharpe	rsharpe@ti.com	(281) 305-8729	Texas Instruments
Greg Stevens	GSTEVEN2	x 36686	AVT MAT'L
Norm LaPointe	NLAPOINT	x42686	AVT/DES. ENG.
Steve LaRoche	SLAROUCHE	54876	CENTRAL LVC
Andy McGuire	a-mcguire@ti.com	508 2303680	TI QRA
WILLIAM M. ABRAMCZYK	WABRAMCZ	313 32 25284	ASO

* Steve Beringhause / Bryan Dague from TI on conference call speaker phone.

3/3/99

Test with Oxalic acid. TI

Oxalic sources

DOE with Old Brake Fluid

Conclusion? – o Corrosion from Water intrusion creates an event

o Brake Fluid leakage creates a cell that causes corrosion.

o Somehow corrosion will occur.

IS THERE A NON-CONDUCTIVE HYDRAULIC CONNECTION TO PUT BETWEEN BP SWITCH & PROP-VALVE.

? CLS w Improved connector seal available.

– Constant Feed of Brake fluid to switch under test.

– AA Slo-Blo good enough to limit power?

– Marker that survives a fire

— Different concentrations of ions.

3/3/79

— Test with clutch Load limiting current thru contacts.

— Test with clutch Load & Hex Port isolated from ground.

O.S. Other solns - plugging the switch cavity with silicon Grease (a temporary seal only?)

TI — Test with old brake fluid that is corrosive to metal.

— Fuse / current limit to establish

Note: 2-5 amps, peaks to 10 AMP (IN SALT WATER TEST)

O.S. — Consider the effect of the fuse blowing just because of water - results in customer complaint

O.S. — ADD A BOOT OVER CONNECTOR TO KEEP WATER OUT OF SWITCH CAVITY.

— ADD Grease to connector to seal.

Torake Pressure Switch Mtg 2/24/9[illegible]

Steve Reimers	SREIMERS	x03286	AVT/EESE
Shaun McCarthy	SMCCART3	x21355	FRL
Roe Carter	RCARTER	x31733	FRL
Dave Bauer	DBAUER3	x41756	FRL
Tom S[illegible]	TSCHRODY	x37575	Visteon [illegible]
Greg Stevens	GSTEVEN1	x3668[illegible]	AVT MAT'L
Norm LaPointe	NLAPOINT	X42686	AVT-Des. Anal
Steve LaRouche	SLAROUCH	54876	Central La
Pete Klaas	PKLAAS	21613	Central Lab
Mike Kitt (DOW)	MKITT@DOW.COM	225 353-6545	[illegible]
Ken Gribble	KGribble	38658	AVT Matl
A Z [illegible]	AZZ@TI.com		TI
Rob English	RENGLISH	73225	AVT-SESE
William [illegible] Abbamonte	WABBAMO2	x 23284	ASO
J[illegible]			
[illegible]			
Scott Urbina	SURBINA@Dow.Com	248-[illegible]	Dow Automotive
Fred Porter	FPORTER	(313)84-53722	AVT-EESE

3713 1797

FSW Mtg Notes 2/24/99

[illegible] brake fluid residue?

EC leakage 5 mA

Did brake fluid cause ignition [illegible] from outside?

[illegible] resistive current path

[illegible] mfr process (sintering vs ?)

[illegible] brake fluid [illegible]

? Did Disc [illegible]

[illegible]

SAE [illegible] - Improved corrosion inhibitor in Brake Fluid ([illegible] & Delphi)

[illegible] corrosion path [illegible] after [illegible]

92-94 [illegible] in SW [illegible]

2/=

2/24/77

MA-1 Hopkins & Attebery
↳ samples off Memphis Switch

Are these slo-blo fuses? NO ATO
Does trailer pkg increase fuses ==?

Moisture in switch as built?

Brake Fluid ... Grease? Poly Glycol
Grease not from Brake Fluid" Dow.
Heat curing process uses sulfur.

... Switch to Control what
happens to ... resistance ...

2/24/99

3/3

Look into fire retardant case mtl?

New Tests

Introduce Chlorine as corrosive

Isolate as corrosive

Continue 300 hour Test

[redacted]

3713 1600

Actions 2/24/89

✓ Go look at cars

OK 30 Prepare to do combustion test on base w/harness attached. Check w/ DSRM L.

✓ Request Battery drain warranty with BT Sw replacement

— Get effective date for Quiet Sw FEAC

✓ Arc monitor with optics Arie

— ~~clear~~ Test loose metal in switch cavity TI

— Check APG for 74/75 Town car

— Look into Power steering usage of [illegible]

— [illegible]

— [illegible]

✓ Team meeting w/DOW

— [illegible]

3713 1801

1992/3 Towncar Underhood Fire NHSTA Inquiry — Draft 2/10/99

Background

- On 11/24/98 NHTSA submitted inquiry PE98-055 alleging 21 reports of underhood fires in 1992/3 Towncars
- On 1/11/99 NHTSA submitted a supplemental inquiry requesting information on all Ford vehicles using
  - F2VC-9F924 brake pressure switches
  - 12A581 wire harness assemblies with a PIA relay center
  - EDIS 8 modules

- Present searches have identified the following:
  - 149 underhood fires or overheating events on 1992 and 1993 Towncars
  - 36 with engine off/vehicle parked, 9 with engine on, and 104 unidentified
  - 5 appear to be related to the brake pressure switch
  - 17 appear to be related to other components

Status

- ASO is collecting requested data to respond to NHTSA
- Task force established to investigate brake pressure switch... meeting weekly
- EESE person identified to lead the engineering investigation

Next Steps

- Identify potential affected vehicles/trends
  - identify Crown Victoria/Grand Marquis vehicles incidents since similar electrical configuration and vehicle package
  - identify potential trends by comparing incidents to vehicle options

- Identify potential root cause(s)
  - establish links to CAC/OGC/FCSD/NHTSA to quickly identify incidents and establish team to quickly investigate
  - perform tasks on brake pressure switch task force work plan
  - investigate other components as appropriate

- Identify potential interim containment actions for vehicles in the field

Work Plan- Brake Pressure Switch

Root Cause Investigation-

Identify flammability characteristics of switch components
- *AVT EESE Materials Engineering* by Thurs

Identify switch contaminants in parts returned from the field
- *Central Lab analysis* by Thurs

Identify potential source of contaminants
- *Central Lab analysis* by Thurs

Identify potential for and possible sources of internal brake switch leaks
- *Central Lab and Texas Instrument* 2 wks

Identify potential ignition sources during switch operation/malfunction
- *AVT EESE Chassis Electronics* Thurs

Simulate potential switch malfunctions in a laboratory environment to evaluate the potential for ignition
- *AVT EESE Chassis Electronics* by Gowin

Collect additional field samples (including connectors) for laboratory analysis
- *LVC Safety*

by Gowin

2/5

9F9-4

Recreate [illegible]

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- Empty shot-out of clutch

[illegible]

just [illegible]

TC. SYSTEM MOD KOM-
MORE - TOM SCHEDDY

Brake Postwreck Questions 2/4/99

✓ Competitive vehicles - How packaged? Team
- Are They Always On? Mfg

✓ WHAT ARE THE DESCRIPTION FROM AWS? CBIS?

✓ Is the base material compatible with Brake Fluid?

✓ FRACAS - DAN BUSHNELL - TO GET PARTS BACK

✓ TI in-process quality indicators

✓ DFMEA FROM TI

✓ ANALYSIS FROM CAMERA LOG

✓ WHO SHOULD ANALYZE PIG TAILS - JOHN LAPOINTE 2/12

✓ IF SWITCH HAVE CONTAMINATION - CAN IT START FIRE?

✓ FLASH POINTS FOR ALL MATERIAL

✓ WHAT HEAT IS CONDUCTED INTERNALLY

✓ COLOR PHOTOS FOR FLOWLINE

✓ DIFFERENCES W BASE MATERIALS

✓ IP TEST FAILURES

✓ MEMPHIS REDESIGN QUESTIONS
CREASE MARKS

✓ MATERIAL CALL OUT FROM 92-93

✓ TESTING W/ CORROSION SIMULATION

✓ BRAKE - DOES IT TAKE TO START A FIRE

3713 1805

Brk PSW 2/9/99

TJ - AZIZ RAHMAN, Rob Sharpe

96 Service Manual shows change

From Prop Valve to Booster mount (96? Master cylinder?

- See? TJ at Test Review?

- TOM BAZIL
  WILL SENSORS SEE ABS/TA MODULATION?
  AT BOOSTER
  AT PROP VALVE

? Pending Failure for Inadv-loss of Brake Fluid.

? FAILURES OF FSTS

? FAILURES OF BOOSTER

? What current to cause event?

? Why fluid in switch

? Is fluid causing event

? What contaminants increase conductivity of brake fluid.

INDICATORS OF LIFE
Contact actuations
Arm "
Diaphragm "

How will you know if FST has failed shorted?

Fred Kohl
- What about Ign Relay in line from Fuse? BPSW?
- ~~What is the~~ timing from FST OFF & BPSW open?

- Call Mtg for Tomorrow
- Put together Paper for Thursday

Multi-Dive Application Very old

Phone & ID for Aziz

2/10/99

4-5:15 P Brainstorm w/ Alan

- Get Dow on TEAM

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

  - Char's REAL VEH Brake Pressure.
  - " " " " " in A
  - Thermo-couple Brk Pr switch after Veh. Driven & turned off.
  - Take Rate of ABS
    " " " ABS w/TC

  Are Leaks/Fires common to ~~the~~ tract

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

  nderstand TC/ABS Pressure Pulse/

  Y OF ELECTROLYSIS IN

Note printed by SREINERS on 11 Feb 1999 at 07:56:08

From: TBASIL --DRBN005 Date and time 02/10/99 13:58:51
To: SREINERS--DRBN007
cc: TBASIL --DRBN005

FROM: Tom Basil USANT(UTC -05:00)
Subject: Brake Pressure Switch Question
DRAFT

[redacted] STANDARD 2/12/99

[redacted]

Have a good day!

Thomas E. Basil (313) 59-47547 Lrg & Lux Car CPD Brake/Veh Supv
Drop 1229-LVC, Cube 24-H16, fax 62-16678, pager (888) 378-6449
*** Forwarding note from SREINERS--DRBN007 02/09/99 18:13 ***
To: TBASIL --DRBN005

FROM: Steve Reiners USANT(UTC -05:00)
Subject: Brake Pressure Switch Question
[redacted]

Steve Reiners building 5 3C043
AVT Chassis S/S System Applications mail drop 5011
59-03286 SREINERS sreiners@ford.com fax 59-03286 ;>

3713 1606

****
* Note printed by SREIMERS on 11 Feb 1999 at 07:57:43 *
****

From: FPORTER --DRRN007 Date and time 02/09/99 18:27:09
To: SREIMERS--DRRN007

FROM: F. J. Porter USART(UTC -05:00)
Subject: CONNECTOR F2AB 14A464 ADA

Regards,
Fred Porter CV - fporter fporter@ford.com
Chassis E/E Systems Applications (313)845-3782
Bldg S - Mail Drop 5030 - Cubicle 320G4 fax: 390-4145
*** Forwarding note from HLAPOINT--DRRN005 02/09/99 14:11 ***
to: JRRUN --DRRN005 JRCIRRON--DRRN005
FGAYELER--DRRN007 HLUNN --DRRN004
FPORTER --DRRN007 WDIRCHZ --DRRN004
TMASTERS--DRRN005 KRNGLI81--DRRN005
cc: JKAPATI --DRRN004 HLAROUCH--FORDMAIL
CTHOMAS--DRRN005 HLAPOINT--DRRN005
CKILGORE--DRRN005

FROM: Norman LaPointe USART(UTC -05:00)
Subject: CONNECTOR F2AB 14A464 ADA

Meeting 2-12-1999 w/UTA, 1:00PM at Central Laboratories, Small Conf. Rm.
Agenda:
1. Obtain drawings for F2AB-14A464-ADA connector & components from UTA.
2. Obtain components for above connector (5 sets).
3. Obtain and discuss FMEA.
4. Discuss sealing details & history of above connector.
5. Obtain the visual characteristics of: water, brake fluid, or other materials that could enter the connector or the wires.
6. Discuss assembly difficulties to seal joint.
7. Hand off 6 press. switch assemblies to UTA.
8. Develop game plan to disassemble and examine the submitted connector from Reddick veh.

FAX copy of above sent to Dan Kulkarni-UTA, Dick Radkey-UTA.

Regards,
Norman LaPointe
PHONE 59-42586 FAX 313-237-8256

2/10/99

ONLY FZVC IS FOR ~~AT THIS~~

149 92', 93' Fire / Thermal Event / Smoke / overheated

36 OFF
9 RUNNING } engine state
104 UNKNOWN }

5 TC 1 GM Brk Sw
17 OTHER COMPONENTS

- AMES OFF WORK PLAN
- DAMAGE LIMITED TO SWITCH ?
- OASIS Msg ~ For Replaced Brk P Sw
- WARRANTY Return Parts Have been Requested
- A→F ANALYSIS
  - Thermal Enviroment
  - Orientation
  - Pressure Enviroment 8D on Econoline
  - Reaction to field occurrence

Wed 2PM Weekly

3713 1810

Team 5 2/10/99

NAME	PROFS	ORG
Steve Reimers	SREIMERS	AVT/EESE
✓ Tom Barr	TBARR01	LVC-OPD BRAKES
✓ John McInerney	JMCINERN	LVC-Safety
Joseph Nemec	JNEMEC	LVC-Safety
Rob English	RENGLISH	AVT-2050-203
Norm LaPointe	NLAPOINT	DES. ANAL. AVT
Steve LaRoche	SLAROCCA	CENTRAL LAB
Dan Budzynski cc	D BUDZYNS	Motion/Power Systems
Paul Stokes cc	PSTOKES	Caterpillar/Speed Control
Stuart Salter	SSALTER	EESE COMPETITIVE AN
Fred Porter	FPORTER	AVT: Chassis Electronics
✓ Tim Schrady	TSCHRADY	
✓ Fred Kohl	FKOHL 21801	

Note printed by SREINERS on 16 Feb 1999 at 08:51:03

From: I2060625--EXTERNAL Date and time 02/09/99 19:04:41
To: FPORTER --FORDMAIL 'Fred Porter (For SREINERS--FORDMAIL 'Steve Reiners (F

From: Rahman, Axis
Subject: Actions from 2/9/99 CRL Visit

To: ''Steve LaRouche (Ford)''<slarouch@ford.com>

1. Provide Steve L with 2 switches from 98/99 Town Cars with varying mileage for Kapton wear study - Axis
2. Complete subjective 'Brittleness' evaluation for above two parts + Memphis part + parts D & F - Steve L
3. Complete Kapton Topography study with Cadeyes on all parts above except Memphis part. - Steve L
4. Obtain update on 2 resistivity tests in progress at TI - Axis
5. Document data to date from Allan Jamotik test - Axis
6. Follow up with Dupont on change in Kapton properties with time/temp in aged Brake Fluid - Axis
7. Assess revising present Allan J. test to expose switch to high temp. - Axis

Regards
Axis

TI testing activity

2/10/99

Ground side switch does not eliminate the possibility of an arc induce event.

3713 1813

Brk PS
2/5/99

CV, GM warranty claims 92, 93

3713 1814

50K → 90K — [illegible] — RELAY PACK — EDAS — [illegible]

14D — ~~Tech Review~~ — 2/4/99

2 → 2.5 M parts per year

pkg orientation? Wiring Differences?

92/93 TC is first application.

? Can the switch act [illegible]

2/12 - UTA Mfg Norm Lapointe

- TI FMEA
- ARE ALL APPLICATIONS HOT IN RUN?
- PART DATE CODES
- Sean McCarthy (Ignition switch) Investigation experience
- Component # is used by competition? How wired?
- DOES TI have any SQA issues?
- HOW MANY Vehicles USE THE SWITCH?

Tom Dotzler
Joe McARNEY

Note printed by SREIMERS on 4 Feb 1999 at 13:21:55

From: SREIMERS--DEBN007 Date and time 02/04/99 11:28:14

To: VPORTER --DEBN007 Frederick J. Porta DGOEL --DEBN005
LBROWN --DEBN005 CSTEVENS--DEBN005
JBEBE --DEBN005 DBUDSTEB--VISTRON
PSTOKES --VISTRON SLABOUCH--FORDMAI
RENGLISI--DEBN005 SSALTER --DEBN005
KLAPOINT--DEBN005 THASTINGS--DEBN005
SREIMERS--DEBN007 Steve Reimers SCOLE1 --DEBN005
JKAFATI --DEBN004

Rod SHARPE TI

FROM: Steve Reimers USART(UTC -05:00)

Requester: Steve Reimers
Date to be scheduled: 02/04/99
Starting time: 2:00PM USART
Ending time: 3:00PM USART

Location: building 5 conf rm 3A039

Subject: Brake Pressure Switch

Purpose: Kick-off meeting for Investigation of Brake Pressure switch in response to NHTSA investigation.
1. Develop work plan
2. Identify addition team players
3. Establish meeting schedule and location.

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

Introductions
Description '92&'93 TC UNDERHOOD
Problem Statement (TC Focus?)
Work Plan -
Containment short Term
long Term
Root Cause
Recreate Fault
Failure Analysis

BRAKE PRESS - SW - INVESTIGATION 2/4/99

✓ DAN BUDENSKI ?
✓ PAUL JEKO } HISTORY
Speed control
Safety off

✓ CRAIG STEVENS - MATERIALS ✓ JOE NEME ✓

SALT IN SOLUTION ? ✓ Central Lab - STEVE LAROCHE

✓ TI - ROB SHARPE (248) 305-5729

SECTIONED SWITCH ✓ RON ELLISON - CCRG

✓ SUE SALTER - BOSCH MORGAN

✓ NORM LAPOINTE - DESIGN ANALYSIS

✓ TOM MASTERS { JOE KAPPEL

BRAKE FLUID IN WIRE ? ✓ ~~[illegible]~~ FRED

Spark from arc of switch

NHTSA INVESTIGATION CC ✓ D GOEL

✓ H WELFER ?

✓ I BROWN

✓ S COLE I

CCRG

R O
I N
T C
E
S

Immediate Actions

Work Plan

✓ C STEVENS

Fwd/NWK!

- FMEA for shorted switch.
- FMEA for failed BOO functio
- What does competition do? SALTER
- Why a P switch? VISTEON
- Immediate action (Containment)
  - Disconnect Switch (Remove & Repl
  - Re-wire to low-side
  - ~~Short~~ ~~cut~~ Jumper out switch
  -

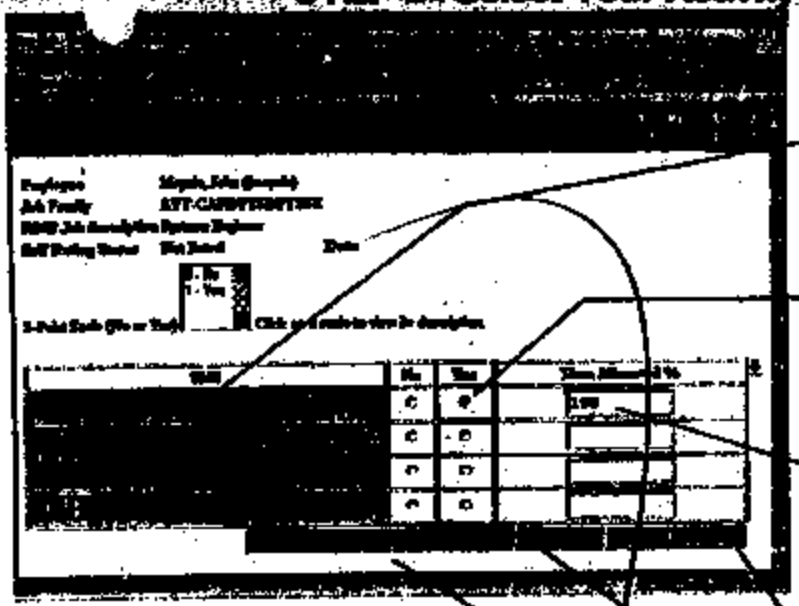
- 14 D
- OTHER 4 TEAM MEM
  VO - TOWNCA

- Competitive Analysis.
- If Redundant SW. DOES CONTEXT USE IT.
- Is it a Redundant SW?
- FMVSS REQUIRE NOT ALL TIME CKT?
- Cut away of switch
- [redacted]

TOM KASTELE

3713 1818

STEP 2: Select Your Activity or CPSC and Input Time Allocated %



The *Rate Skills for Job* screen allows you to record the percentage of time (*Time Allocated %*) spent on relevant engineering activities (or CPSC code activities) defined within a work assignment.

1 **REVIEW** the *Engineering Activities* or *CPSC* list and indicate a percentage for ONLY those activities that apply to your RMS Job Description.

NOTE: To review the definition of a Engineering Activities or CPSC code CLICK on any skill label. When finished CLICK the OK Button to close the Definition Box.

2 **SELECT** each *Engineering Activities* or *CPSC* code that apply to your job by clicking the radio button in the column labeled "YES". For each "YES" indicated.

IMPORTANT: It is not necessary to select "NO" if the Engineering Activity or CPSC does not apply to your RMS Job Description.

3 **ENTER** a *Time Allocated %* value for the *Engineering Activities* / *CPSC* code.

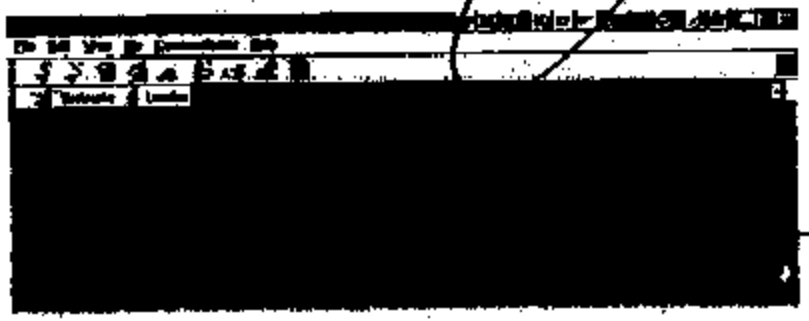
NOTE: *The total of all entered %'s for Engineering Activities or CPSC codes on the work assignment MUST equal 100%. Remember, only enter a value for the activities that apply to what you do.*
IMPORTANT: DO NOT ENTER "0%" FOR ACTIVITIES NOT WORKING ON!!!

4 **Saving Your Work**
You may save your work at any time during this process using the "Save Only" button.

SAVING NOTES

1 The *Cancel Changes* button clears/cancels entries.
2 The *Save Only* button records all screen information and saves for future updating.
3 The *Save and Request Concurrence* button records all screen information and notifies your immediate supervisor that your self-assessment of Time Allocated % is ready for their concurrence.

IMPORTANT: You are not finished until, the total percentages equal 100%, and you SELECT *Save and Request Concurrence* Buttons.



5 **NOTE:** *Repeat the rating process for each Work Assignment you have documented by CLICKING on the, "return to the Work Assignments Listing" link after saving.*

[redacted]

3713 1820

Brake Pressure Switch
On Vehicle Characterization

Updated 2/26/99

Vehicle: 1992 Town Car

With ABS
~~With Traction Control~~
No Major Modifications
No Issues with Brake System

Parameters to be Measured

Pressure Profile at Brake Pressure Switch Mounting Location on Proportioning Valve
Brake Fluid Temperature at same location
Ambient Temperature at same location
Pressure Profile exiting ABS unit prior to entering Proportioning Valve
Brake Pressure Switch circuit (orange wire) voltage.
Vehicle Speed
Brake Pedal ON/OFF switch Voltage
Brake Pedal Effort

- Pressures up to 250 Bar, sampling rate 1000 hz minimum.
- Voltage up to 20 Vdc
- Temperature -10 to 300 F
- Effort 0 to 400 lbs

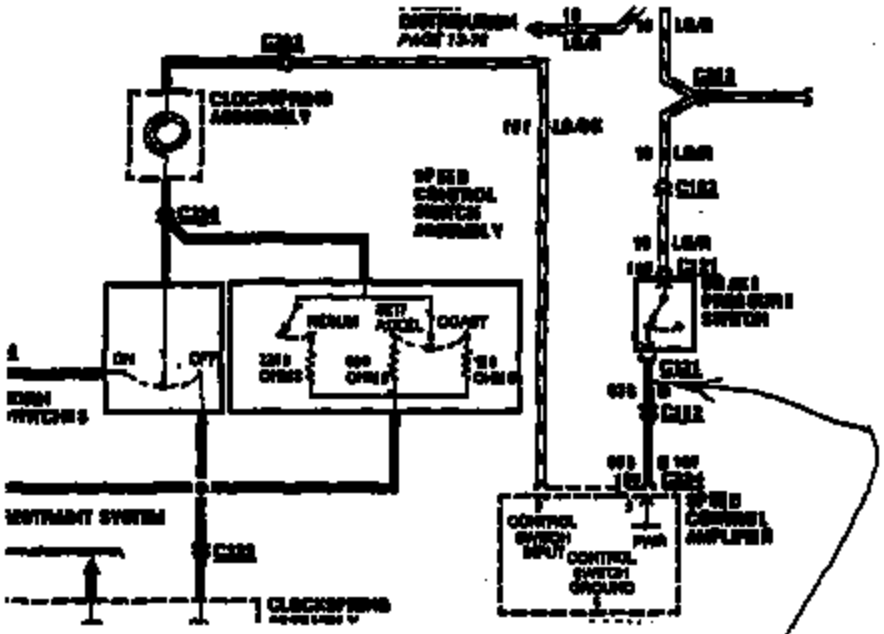
Driving Conditions

DO NOT USE SPEED CONTROL
Traction surface : Dry Asphalt
Loading = 2 Pass weight

	Speed mph	Pedal effort	decel G	repititions	rate/ mile
Normal Braking (no ABS)	0	normal		5	
	30		< 0.3	5	1
	40		< 0.3	10	1
Normal Braking + ABS	30		0.7 - 0.85	5	1
	40		0.7 - 0.85	10	1
Panic Braking (No ABS)	40	agressive		10	1
Panic Braking + ABS	40	agressive		10	1

~~Traction Control On~~
~~Other combinations??~~

Steve Reimers, 313 39 03286
sreimers@ford.com



➲ Component

➲ Connector

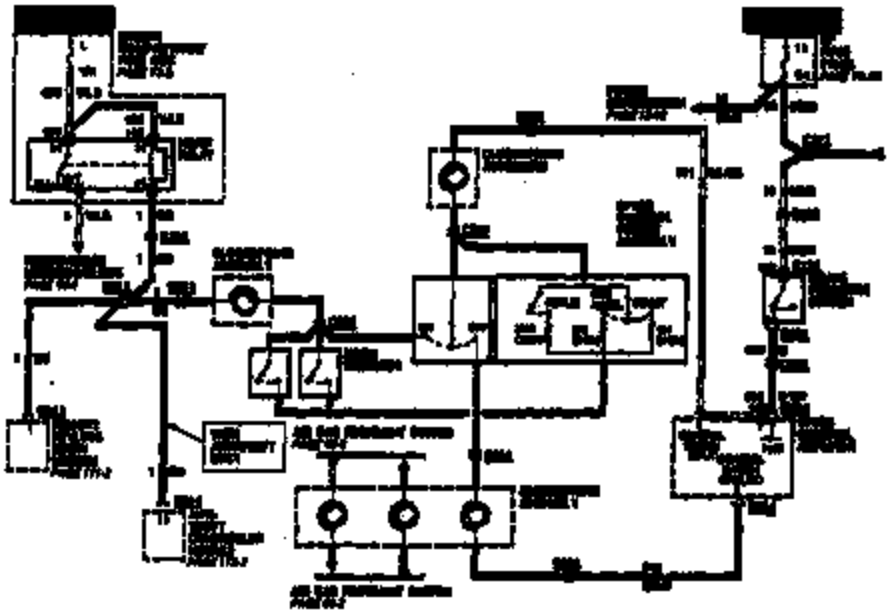
➲ Page

➲ Harness

Measure Voltage on Orange wire. This may require a pull-down resistor to ground. (1kΩ to 10k.

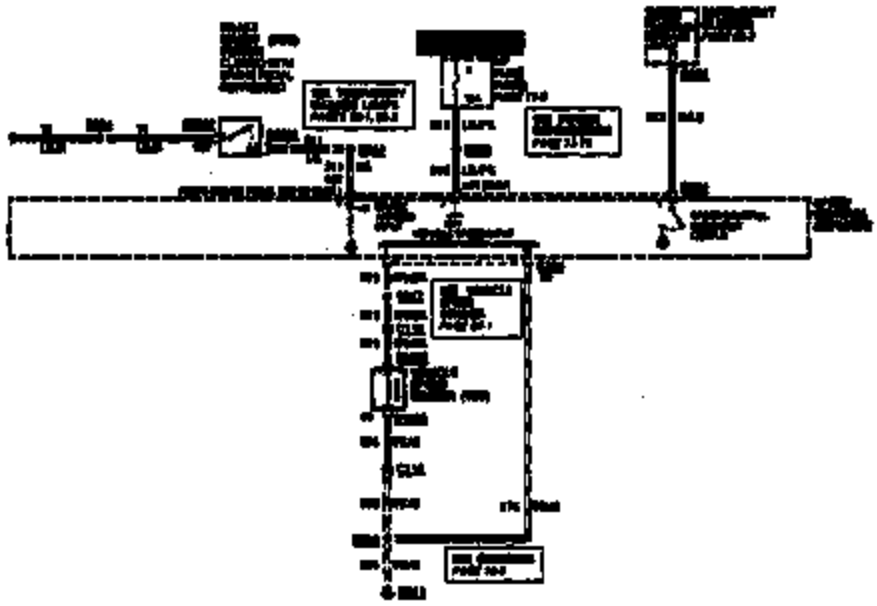
Shows when Brake pressure switch opens & closes.

31-1 Speed Control



- Component
- Connector
- Page
- Harness

31-2 Speed Control

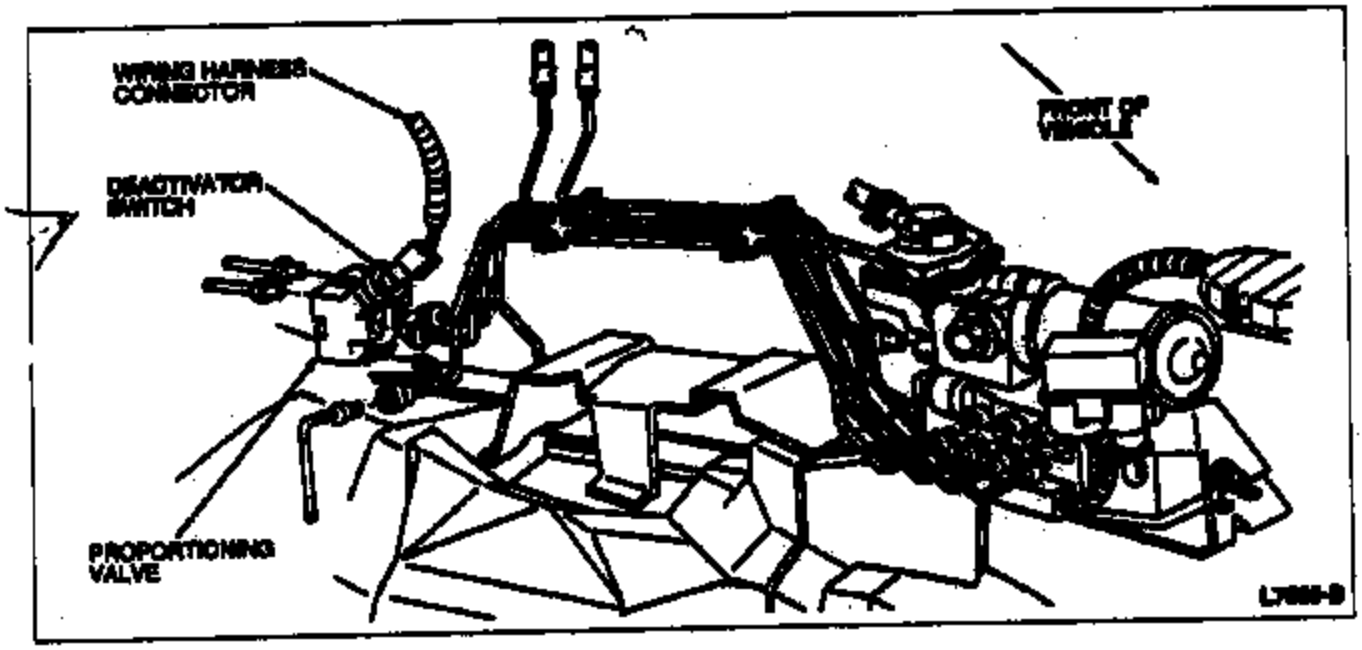


- Component
- Connector
- Ground
- Splice
- Page
- Harness

- How The Circuit Works

Deactivator Switch (Brake Pressure Switch)

The deactivator switch is a normally closed switch and replaces the vacuum dump valve as a redundant safety feature in the system. Normally when the brake pedal is depressed, an electrical signal from the brakelamp circuit to the speed control servo will disengage the system. Under increased brake pedal efforts (5-10 lbs, engine running), the deactivator switch mounted in the brake line will open and remove power to the speed control servo clutch, releasing the throttle independent of the speed control servo control. The deactivator switch is located at the rear brake proportioning valve (ABS brakes) or junction block (Non-ABS brakes) below the brake booster.



Brake Pressure Switch

Deactivator Switch

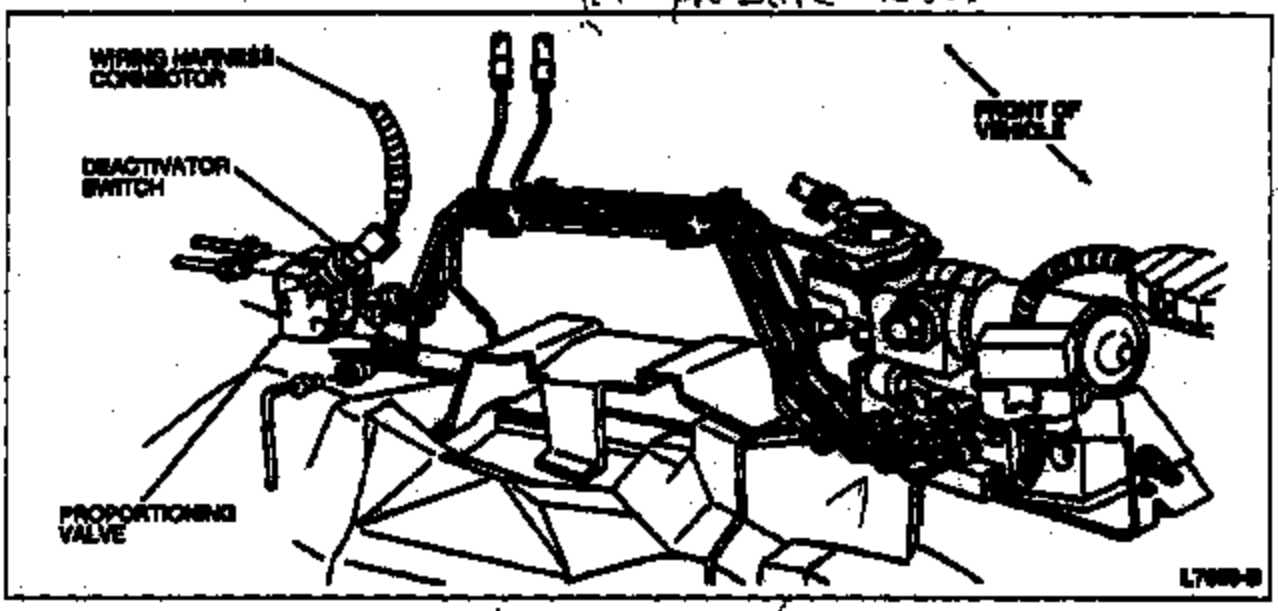
Removal

1. Remove electrical connector from switch.
2. Unscrew switch and remove from brake proportioning valve or junction block.

Installation

1. Screw switch into proportioning valve or junction block. Tighten to 15-20 N-m (12-14 lb-ft).
2. Attach electrical connector.
3. Bleed brake lines as outlined in «Section 06-09» ABS brakes, or «Section 06-06», non-ABS brakes.

Proportioning Valve Location



Junction Block Location

BRAKE SYSTEM BLEEDING

The anti-lock brake system must be bled in two steps:

Tools Required:

- Anti-Lock Test Adapter T80P-50-ALA

1. The master cylinder and hydraulic control unit must be bled using Anti-Lock Test Adapter T80P-50-ALA or equivalent. If this procedure is not followed, air will be trapped in the Hydraulic Control Unit which will eventually lead to a spongy brake pedal.

   To bleed the master cylinder and HCU, disconnect the 55-pin plug from the Electronic Control Unit and install the Anti-Lock Test Adapter to the wire harness 55-pin plug.

   a. Place bleed/harness switch in bleed position.

   b. Turn ignition to ON position. At this point the red OFF indicator should turn on.

   c. Push motor button on adapter down. This starts the pump motor. The red OFF indicator will turn off and the green ON indicator will turn on. The pump motor will run for 60 seconds once the motor button is pushed. If the pump motor is to be turned off for any reason before this 60 seconds has elapsed, push the abort button and the pump motor will turn off.

   d. After 20 seconds of pump motor operation, push and hold the valve button down. Hold valve button for 20 seconds then release.

   e. The pump will continue to run for an additional 20 seconds.

2. The brake lines can be bled in the conventional manner. Refer to «Section 06-06».

   Bleed in the following sequence:

   - RH Rear
   - LH Front
   - LH Rear
   - RH Front

2/18/97

Additional Tests for Matrix

55 AMP wet & dry completed

~~Isolation Resistance Leakage Current~~ Dry, BF, BF + Salt H_2O

~~Dry~~ Dry ---> 20 Meg

BF ≈ 2 Meg

BF + H_2O + NaCl 0.5 → 0.8 Meg

Brake Pressure Switch Test Log, Updated 4/26/99

Category	Test	Location	Test Parameters	Results Update
Lab Simulation of Potential Ignition in Switch	1	TI	Vary water concentrations in 'new' Brake Fluid	250+ hours, Current draw in the 0.8mA to 5mA range
			14Vdc to one terminal, Hexport grounded	Fluid has discolored.
			Water Conc: 0%, 4%, 6%, 10%, 78%	No Significant Temperature Rise. Test Suspended.
				Interval Analysis suspended.
	2	TI	Vary water concentrations in 'new' Brake Fluid	250+ hours. Constant temperature.
			1 Amp through switch terminals	No significant temperature rise with time
				Test Suspended.
	3	AVT	new' Brake Fluid in Switch, 24 VDC to one	> 300 hours into test, max current 7mA
			terminal. Hexport Grounded	No significant change with time. Test ongoing
	4	AVT	new' Brake Fluid in Switch, 24 VDC to one	98 hours into test max current 6mA
			terminal. Hexport Grounded, Ambient at 100 C	No significant temperature rise with time. Test suspended.
	5	AVT	new' Brake Fluid in Switch, 10 Amps	Temperature rise of 20 C above room temp
			Through switch terminals	Delta T reached steady state at 20 C. Test suspended.
	5a	AVT	new' Brake Fluid in Switch approx. 60 Amps	Temperature rose to approx. 270 F. No smoke. No ignition
			through Switch Terminals	Test suspended.
	6	TI	Build heater elements into Switch.	2 tested. Smoke observed, ignition observed on part wheeler
			Heat till failure, include sparking.	See attachment
			With Fluid & Dry	Test complete
			Pure 'new' brake fluid with metal shavings	Brake fluid in cavity slows down heat build-up
			6% brake fluid solution	Smoke observed at 575 F, Base melts and falls off at 600 F
	6a	TI	Create heater by corroding spring arm	One out of 15 devices increased resistance to 5 ohms.
			Salt water solution, 14V between spring	Others either very low resistance or magnificent
			and hexpost	It took about 100 hours to reach the 5 ohm stage.
				The 5 ohm device ignited under conditions similar to test 6.
	6b	TI	Re-run ignition test to understand	Switch ignition with repeated 6% water solution into switch
			repeatability and current path.	Current path is through hexport.
				See plots and video.
				Additional test include tap water, old BF, new BF and other.

3713 1829

Brake Pressure Switch Test Log, Updated 4/26/99

Life Cycle Reliability	7	TI	0-1400 psig pressure pulses at 135C	First leak observed at 728,000 cycles.
of Pressure Switch			per ES	Test Completed. See attached Weibull Chart.
[redacted]				
Diaphragm Wear	8	TI	0-1400 psig pressure pulses at 135C.	Parts withdrawn every 200k cycles, characterized for wear
[redacted]				
Field vs Lab Correlation	9	Central Labs	Field returns, from dealer lots, junkyards	Parts in Central Labs, see Ford spreadsheet
[redacted]				
Design Of Experiments (1)	10	TI	Vary water concentrations in 'new' Brake Fluid	Test Report being written. Investigation continues.
Evaluating Factors			12 snap + 12 quiet switches w/ 0 % water in BF	Suspended at 1.3 million cycles with no leaks observed.
Effecting Diaphragm Wear			12 snap + 12 quiet switches w/ 5 % water in BF	Snap samples suspended at 1.3 million cycles with 2 leaks
Impulse test				observed at 1.3M. Quiet samples suspended at 800k cycles to
				assess [illegible]
[redacted]				
On-Vehicle Characterization	11	AVT	Monitor Pressure and Temperature	Test at AVT... see Ford charts...>500k in car?
of Pressure & Temperature			at Switch Location for ABS and non-ABS	
Profile in Town Car			braking events.	
[redacted]				
Brake fluid analysis	11a	TI	Analyze used brake fluid at the master cylinder	Test complete.
Used fluid at master cylinder.			(UMC), used brake fluid at the caliper (UCA)	UMC: Cu = 416 (ug/ml), Fe = 5.6 (ug/ml), Cr = 0.08 (ug/ml), 1.1 %H2O.
			and new brake fluid (NEW) for metal and water	UCA: Cu = 592 (ug/ml), Fe = 5.5 (ug/ml), Cr = 1.9 (ug/ml), 1.1 %H2O.
			content.	NEW: Cu = <0.01 (ug/ml), Fe = 0.02 (ug/ml), Cr = <.01 (ug/ml), 0.3 %H2O.
[redacted]				
Spark Arc Study	12	Central Labs	Determine if arc/spark forms in switch	Equipment set-up in progress at Central Labs.
			using clutch loads and high speed video.	TI Experimented with no 'significant' sparks observed
			Use dry switches as well as switches with	
			various brake fluid water levels.	
[redacted]				
Characterization of	13	Central Labs	Characterize electrical, mechanical	[illegible] lay and analysis procedure set up complete.
switches retrieved from field,			and chemical aspects of returned switches	Analysis of switches in progress.
junkyards & other sources				
[redacted]				
Fluid Ignition Tests	13a	TI	Repeat ignition simulation with different fluids.	Test complete.
			(2) hour tests:	5% NaCl sample resulted in an ignition.
			5% NaCl in tap water	All brake fluid samples drew less than 3 mAmps. No corrosion
			tap water	visible on brake fluid samples.
			rain water	Rain water and tap water samples drew <10 mAmps and showed
			(48) hour tests:	some signs of corrosion.
			used brake fluid	Chemical anlysis in process.
			used brake fluid w/ 5% H_2O	

3713 1829

Brake Pressure Switch Test Log, Updated 4/26/99

			new brake fluid	
			new brake fluid w/ 6% H_2O	
Design Of Experiments (2)	13b	TI	Vary water concentrations in 'new' Brake Fluid	Test suspended. Analysis in process to assess test failures.
Repeat of test 10			10 snap + 20 quiet switches w/ 0 % water in BF	
			10 snap + 20 quiet switches w/ 6 % water in BF	
Compatibility of Kapton	14	Deposit	Characterize change in properties of Kapton	Report expected from Deposit by 5/3/99.
with Oxalic Acid			with various % oxalic acid in brake fluid.	
Evaluation of Plastic	16	TI	Assess properties and suitability of different	Test suspended.
Materials with Improved			grades of plastic resin with additives	Celanese and Noryl ignited 3/5 and 2/5 trials.
Parameters			to improve plastic part performance	ZYTEL samples tested 1/6 ignitions
Long duration brake fluid	15a	TI		Test in progress. (10) days to date.
ingress test.				Used brake fluid current dropped off to <1/10 mAmp.
				New brake fluid hotspot current remains low
Evaluation of Switch	15b	TI	Assess ignition sensitivity to switch orientation.	Test complete. Ignition is independent of switch orientation.
Orientation			Test vertical versus 45 degree.	simulated switch ignition can occur in vertical or 45 degree angle.
			Test rotational sensitivity.	Ignition appears not sensitive to switch rotational alignment.
Relay Circuit	18	TI	Repeat test 13a in Ford relay circuit for (48) hrs.	Test complete. No ignition. Corrosion rate drastically reduced.
Test			Relay switch to impending ignition in (15) Amp	Insufficient power in circuit to create or move toward ignition in lab
			circuit then place in relay circuit for (18) hrs.	Heater element was warm to the touch.
			Input exist. circuit power into heater on switch.	

3713 1890

Evaluation Process
Brake Pressure switch / Harness

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

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

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

Steve Reimers, 313 280 3295,
swimers@ford.com
file evalproc.xls

original 2/1999
revised tbd

3713 1851

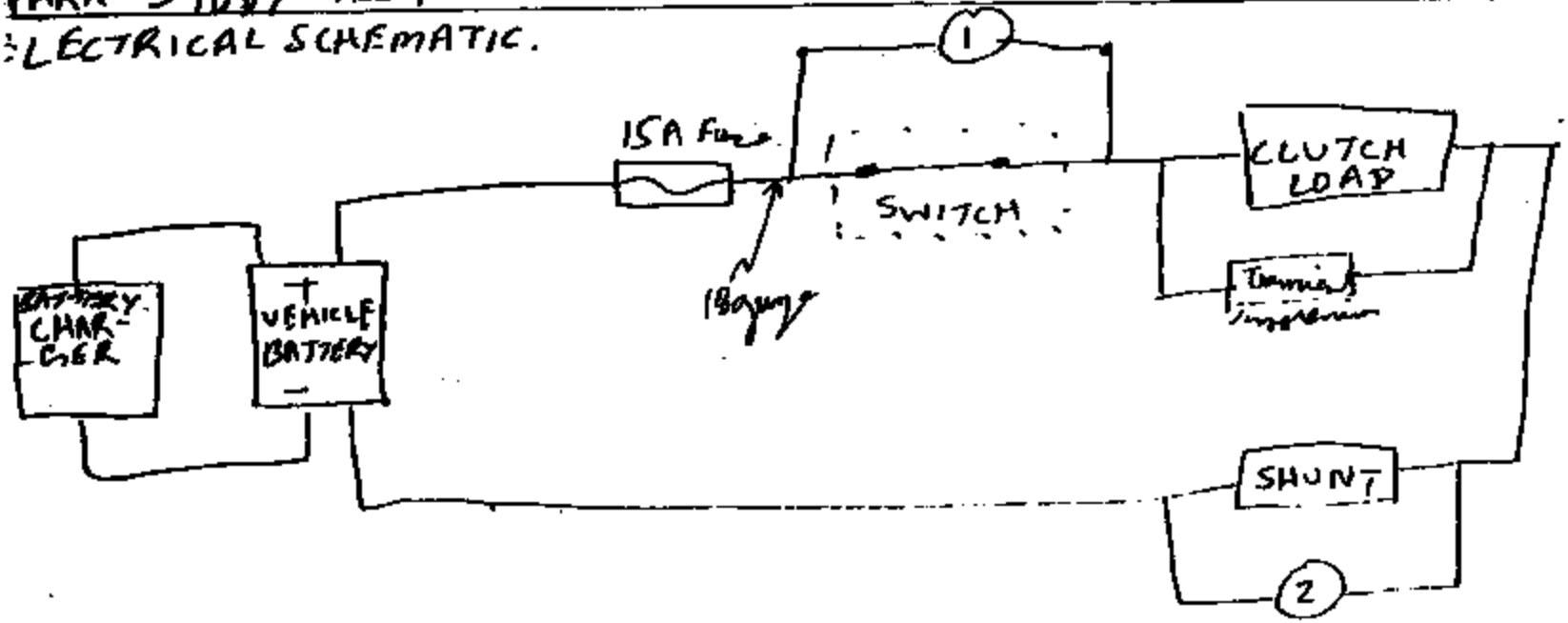
Evaluation Process
Brake Pressure switch / Harness

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

3718 1998

PARK STUDY TEST
ELECTRICAL SCHEMATIC.

AR



Channel (1) = Voltage drop across switch
(2) = Current through switch
(3) = Pressure transducer on manifold

9713 1833

[redacted]

3713 1834

Summary of Brake Switch Analysis

Sample Information		Setup			Switch at 100 psi			Function		
VIN	Condition	Spring Travel to Stat. Term.	Spring Travel to Hotpost	Stat. Term. to Hotpost	Spring Term. to Stat. Term.	Spring Term. to Hotpost	Stat. Term. to Hotpost	Opening Pressure	Closing Pressure	Proof Test at 350psi
[illegible]	Partially burned	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	Burned	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	Burned	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	Burned	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	Apparent leakage	0.4	4.8M	NP	NP	NP	NP	NP	NP	NP
[illegible]	No leaks or other apparent problems	0.5	Infinity	NP	NP	NP	NP	NP	NP	NP

NP = Not Performed
TBP = To Be Performed
TC = Town Car

3713 1835

SM = [illegible] Marquis
CV = [illegible] or Victoria
PC = Police

Summary of Brake Switch Analysis

	Connector/Wires				Switch				
VIN	**Engagement**	**Wires**	**Red Seal**	**Gray Seal**	**Hexport, Washer, Calibrator, Spacer, and Disc**	**Environmental Seal**	**Gasket/Kapton Seals**	**Cup**	**Base, Switch Cavity, Contacts, Terminals**
[illegible]	Could not determine.	Short length (~10 mm); no apparent exterior damage. Oxidation or tarnish [illegible].	Could not determine.	Appears intact. Brake residue in cavity contains elements typically found in dry chemical fire extinguishers.	Black residue containing glycol based material (probably brake fluid) and a metal sulfate. Indicates presence of brake fluid on fluid and switch sides of [illegible].	Intact. Appears to have had good sealing.	Gasket intact; appears to have had good sealing. All Kapton [illegible] fractured and exhibit brittle cracks which most likely formed [illegible] path. Damage appears to have initiated in spot closest to washer. Kapton darkened and embrittled by unknown mechanism.	Green deposits on face of cup contain elements from brass contacts, indicating transfer of contact material to cup, possibly as a result of an electrical arc. Glycol based material (probably brake fluid) also [illegible].	Base separated below crimp ring. Transfer pin and movable arm contact missing. Movable contact melted back; [illegible] possibly due to arcing; appears to have occurred in later stages of event. Black deposit on terminal of movable contact appears to be a sulfur compound. Stationary contact exhibits discoloration, loss of material due to corrosion, and [illegible] corrosion cracking. Green deposit on terminal of stationary contact appears to be a sulfur compound.
[illegible]	Missing	Missing	Missing	Missing	Elements from contact material detected at fitting end of hexport. Silicone also detected.	Missing	Gasket missing. Charred fragments of Kapton seals [illegible].	Deposits on face of cup contain elements from brass contacts, indicating transfer of contact material to cup probably as an oxide, sulfide, or corrosion product.	Base, stationary contact, movable contact, transfer pin, and terminals missing.
[illegible]	Missing	Missing	Missing	Missing	Elements from contact material detected at fitting end of hexport.	Not permitted to disassemble switch.	Not permitted to disassemble switch.	Deposits on face of cup contain elements from brass contacts, indicating transfer of contact material to cup probably as an oxide, sulfide, or corrosion product.	Transfer pin and movable contact missing. Stationary contact exhibits crack in similar location as that in Memphis ([illegible]) sample.
[illegible]	Missing	Missing	Missing	Missing	Elements from contact material detected at fitting end of hexport. [illegible] Residue in cavity contains traces of hydrocarbons and silicone.	Missing	Gasket appears charred. Kapton seals present, but melted together. Could not evaluate for cracking.	Deposits on face of cup contain elements from brass contacts, indicating transfer of contact material to cup probably as an oxide, sulfide, or corrosion product.	Base, stationary contact, movable contact, transfer pin, and terminals missing.
[illegible]	Missing	Missing	Missing	Missing	Black residue in hexport cavity, on washer, and spacer contains glycol based material (probably brake fluid) and a metal sulfate.	Intact and appears to have had good seal.	Gasket intact and appears to have had good seal. Kapton seals exhibit damage similar to that found in Memphis ([illegible]) sample. All three exhibit brittle cracks which probably [illegible].	Dark green deposits on face of cup contain elements from brass contacts indicating transfer of contact material to cup probably as oxide, sulfide, or corrosion product. Liquid in interior and on face is glycol based (probably brake fluid).	Switch cavity and terminal cavity contain glycol based material (probably brake fluid). Contacts appear intact. Dark green deposits on movable and stationary contact contain elements from brass contact material. Terminals are clean (no apparent deposits or corrosion).
[illegible]	Missing	Missing	Missing	Missing	Black residue in hexport contains glycol based material (probably brake fluid) and a metal sulfate. No apparent fluid on components inside cup.	Intact and appears to have had good seal.	Gasket intact and appears to have had good seal. Kapton seals exhibit deformation and cracking similar to that found in Memphis ([illegible]) sample. Crazing on surfaces suggest [illegible] cracking is occurring.	Face and interior of cup appear clean and dry.	Switch and terminal cavities appear clean and dry. No apparent deposits or corrosion on terminals.

NP = Not Performed
TBP = To Be Performed
TC = Tow Car

3713 1636

SM = [illegible] Memphis
CV = [illegible] Vehicle
PC = Police

Summary of Brake Switch Analysis

Sample Information						
VIN	Sample	MY/Vehicle	Prefix/Date Code	Condition	Conclusion/Comments	
[illegible]277	Memphis (Washing)	[illegible] TC	[illegible]	Partially burned	Embrittlement and subsequent cracks in Kapton seal formed leak path for brake fluid to enter switch cavity. Transfer of brass contact material to the cup suggests that an electrical cell formed between the hot (+) contacts and the grounded (-) cup.	Brake fluid in switch cavity may have acted as electrolyte for the cell. Dezincification and stress corrosion cracking of stationary contact indicates that moisture and other corrodents may have been present with brake fluid.
[illegible]	A	[illegible] TC	[illegible]	Burned	Transfer of brass contact material to cup suggests that electrical cell may have occurred. Too badly damaged to determine if Kapton leaked or if brake fluid was present in switch cavity.	
[illegible]	B	[illegible] TC	[illegible]14	Burned	Transfer of brass contact material to cup suggests that electrical cell may have occurred. Too badly damaged to determine if Kapton leaked or if brake fluid was present in switch cavity.	
[illegible]	C	[illegible] TC	[illegible]	Burned	Transfer of brass contact material to cup suggests that electrical cell may have occurred. Too badly damaged to determine if Kapton leaked or if brake fluid was present in switch cavity.	
[illegible]	D	[illegible] CV	[illegible]	Apparent leakage	Embrittlement and subsequent cracks in Kapton seal formed leak path for brake fluid to enter switch cavity. Transfer of brass contact material to the cup suggests that an electrical cell formed between the hot (+) contacts and the grounded (-) cup.	Brake fluid in switch cavity may have acted as electrolyte for the cell. Failure mode appears similar to Memphis switch.
[illegible]	E (411)	TC	[illegible]	No leaks or other apparent problems	No apparent problem with switch other than incipient damage to Kapton seals.	

NP = Not Performed
TBP = To Be Performed
TC = Town Car

8713 1637

GM = [illegible] Marquis
CV = [illegible] Victoria
PD = Police

Summary of Brake Switch Analysis

Sample Information		Switch			Switch at 150 psi			Function		
VIN	Condition	Spring Term. to Std. Term.	Spring Term. to Housing	Std. Term. to Housing	Spring Term. to Std. Term.	Spring Term. to Housing	Std. Term. to Housing	Opening Pressure	Closing Pressure	Proof Test at 500 psi
[illegible]	Apparent leakage	NP	[illegible]	NP	NP	NP	NP	NP	NP	NP
[illegible]	No leaks or other apparent problems	[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	No leaks or other apparent problems	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	No leaks or other apparent problems	[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	[illegible]	No apparent leak

NP = Not Performed
TBP = To Be Performed
TC = Team Car

3713 1838

GM = [illegible]
CV = [illegible]
PD = Police

Summary of [illegible] Switch Analysis

	Connector/Wires				[illegible]				
					Switch				
VIN	Disengaged	Wires	Red Seal	Gray Seal	Hexport, Washer, Connector, Spacer, and Disc	Environmental Seal	Gasket/Kapton Seals	Cup	Base, Switch Cavity, Contacts, Terminals
[illegible]	Missing	Missing	Missing	Missing	Black residue in hexport cavity, on washer, and connector contains glycol based material (probably brake fluid) and a metal particle.	Intact and appears to have had good seal.	[illegible] intact and appears to have had good seal. Kapton seals exhibit damage similar to that found in [illegible] sample. All three exhibit [illegible] which probably formed leak path.	Dark green deposits on face of cup [illegible]. [illegible] brake fluid.	Switch and terminal cavities contain glycol based material (probably brake fluid). [illegible] [~50% of thickness]. No evidence of [illegible] damage. Dark green deposits on contacts [illegible]. Terminals exhibit green deposits [illegible]
[illegible]	Missing	Missing	Missing	Missing	NP	NP	NP	NP	NP
[illegible]	Missing	Missing	Missing	Missing	NP	NP	NP	NP	NP
[illegible]	Missing	Missing	Missing	Missing	NP	NP	NP	NP	NP
[illegible]	Missing	Missing	Missing	Missing	NP	NP	NP	NP	NP
[illegible]	Missing	Missing	Missing	Missing	NP	NP	NP	NP	NP
[illegible]	Missing	Missing	Missing	Missing	NP	NP	NP	NP	NP
[illegible]	Missing	Missing	Missing	Missing	NP	NP	NP	NP	NP
[illegible]	Missing	Missing	Missing	Missing	NP	NP	NP	NP	NP
[illegible]	Missing	Missing	Missing	Missing	NP	NP	NP	NP	NP

NP = Not Performed
TBP = To Be Performed
TC = Town Car

GM = [illegible]
CV = [illegible]
[illegible]

3713 1839

Summary of Brake Switch Analysis

Sample Information						
VIN	Sample	SN/Vehicle	Build/ Date Code	Condition	Conclusion/Comments	
[illegible]	F	TC	[illegible]	Apparent leakage	Establishment and subsequent cracks in Kapton seal formed leak path for brake fluid to enter switch cavity. Transfer of brass contact material to the cup suggests that an electrical cell formed between the hot (+) terminals and the grounded (-) cup.	Brake fluid in switch cavity may have acted as electrolyte for the cell. Stress corrosion cracking of stationary contact indicates that moisture and other corrodants may have been present with brake fluid. Failure mode appears similar to Mangels switch.
[illegible]	3	TC	[illegible]	No leaks or other apparent problems	Delamination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.	
[illegible]	4	TC	[illegible]	No leaks or other apparent problems	Delamination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.	
[illegible]	5	TC	[illegible]	No leaks or other apparent problems	Delamination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.	
[illegible]	6	TC	[illegible]	No leaks or other apparent problems	Delamination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.	
[illegible]	7	TC	[illegible]	No leaks or other apparent problems	Delamination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.	
[illegible]	8	TC	[illegible]	No leaks or other apparent problems	Delamination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.	
[illegible]	9	TC	[illegible]	No leaks or other apparent problems	Delamination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.	
[illegible]	10	TC	[illegible]	No leaks or other apparent problems	Delamination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.	
[illegible]	11	TC	[illegible]	No leaks or other apparent problems	Delamination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.	

NP = Not Performed
TBP = To Be Performed
TC = Town Car

3713 1640

GM = Grand Marquis
CV = Crown Victoria
PC = Police

Summary of Brake Switch Analysis

Sample Information		Switch			Switch at 1500 psi			Function		
VIN	Condition	Spring Term. to Stat. Term.	Spring Term. to Hexport	Stat. Term. to Hexport	Spring Term. to Stat. Term.	Spring Term. to Hexport	Stat. Term. to Hexport	Opening Pressure	Closing Pressure	Fluid Type at Hexport
[illegible]	No leaks or other apparent problems	0.1	Infinity	Infinity	0.1	Infinity	Infinity	12[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	0.[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	1[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	0.[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	1[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	0.2	Infinity	Infinity	Infinity	Infinity	Infinity	1[illegible]	[illegible]	No apparent leak
[illegible]	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	No leaks or other apparent problems	0.[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	1[illegible]	[illegible]	No apparent leak
[illegible]	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP	NP

NP = Not Performed
TBP = To Be Performed
TC = Town Car

3713 1841

GM = Grand Marquis
CV = Crown Victoria
PC = Police

Summary of Brake Switch Analysis

	Observations/Findings									
	Connector/Wires				Switch					
VIN	Engagement	Wires	Red Seal	Grey Seal	Hexport, Washer, Converter, Spacer, and Disc	Environmental Seal	Gasket/Kapton Seal	Cap	Base, Switch Cavity, Contacts, Terminals	
[illegible]	CPA/MID side not fully engaged	TBP	Intact. Impression grooves and [illegible]	Intact. Wires and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Black residue in fitting end of hexport. Did not analyze. Apparent rust deposits on [illegible], washer, and disc, as well as on interior surface of cup.	Environmental seal intact, in place, [illegible] to have good adhesion.	Gasket intact and appears to have had good seal. Kapton seal [illegible] hexport exhibits [illegible] and [illegible] in [illegible], but no apparent cracks [illegible] substrate. Other Kapton [illegible] show no tears, cracks, or [illegible]. No apparent [illegible] [illegible].	Face of cup covered with rust colored deposits [illegible]. [illegible] iron and disc (probably corrosion product of cup material). Transfer pin frozen in place by corrosion product. No evidence of a cell [illegible].	Base contains what appears to be moisture ([illegible]) [illegible] appeared to [illegible]. [illegible] contact discolored, but not heavily [illegible] [illegible].	Rest of openings and their bases appear clean. No apparent deposits or corrosion on terminals.
[illegible]	Fully engaged	TBP	Intact. Impression marks and droop all the way around	Intact. Wires and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Black residue in fitting end of hexport. Did not analyze residue. Did not disassemble switch.	Did not disassemble	Did not disassemble	Did not disassemble	Did not disassemble. Terminals clean (no apparent deposits or corrosion).	
[illegible]	CPA wire side of connector not fully engaged.	TBP	Intact. Impression marks and droop all the way around	Intact. Wires and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Black residue with copper or rust colored globules in fitting end of hexport. Did not analyze residue. Did not disassemble switch.	Did not disassemble	Did not disassemble	Did not disassemble	Did not disassemble. Terminals clean (no apparent deposits or corrosion).	
[illegible]	Fully engaged	TBP	Intact. Impression marks and droop ~60% around. Witness marks from damage to edge of switch base.	Intact. Wires and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Rust colored deposit in fitting end of hexport. Did not analyze deposit. Did not disassemble switch.	Did not disassemble	Did not disassemble	Did not disassemble	Did not disassemble. Terminals clean (no apparent deposits or corrosion).	
[illegible]	Missing	Missing	Missing	Missing	Black residue in fitting end of hexport, did not analyze.	Missing	Did not disassemble	Exposed face covered with rust and greenish colored deposits; did not analyze.	Missing	
[illegible]	Fully engaged	TBP	Intact. Impression marks and droop all the way around	Intact. Wires and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Black residue with copper or rust colored globules in fitting end of hexport. Did not analyze residue. Did not disassemble switch.	Did not disassemble	Did not disassemble	Did not disassemble	Did not disassemble. Terminals clean (no apparent deposits or corrosion).	
[illegible]	Missing	Missing	Missing	Missing	[illegible] attached to pump, [illegible] did not disassemble.	Did not disassemble	Did not disassemble	Exposed face covered with rust and greenish colored deposits; did not analyze.	Missing	

NP = Not Performed
TBP = To Be Performed
TC = Town Car

3713 1842

GM = [illegible]
CV = [illegible]
PI = Police

Summary of Brake Switch Analysis

Sample Information					
VIN	Sample	MY/Vehicle	Postal Date Code	Condition	Comments/Comments
[redacted]		4DR-PC	2000	No holes or other apparent problems	Switch did not open when pressurized. Cap appears to have been removed by some means. Transfer pin found in place by corrosion product. No evidence of brake fluid leakage or intrusion of foreign matter.
[redacted]		4DR	2000	No holes or other apparent problems	Examination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.
[redacted]		4DR-PC	2000	No holes or other apparent problems	Examination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.
[redacted]		4DR-TC	2000	No holes or other apparent problems	Examination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.
[redacted]		4DR-TC	77	Undefined fire.	Severely damaged by fire. No further analysis performed.
[redacted]		4DR-PC	2001	No holes or other apparent problems	Examination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.
[redacted]		4DR-TC	2000	Undefined fire.	Severely damaged by fire. No further analysis performed.

NP = Not Performed
TBP = To Be Performed
TC = Town Car

GM = [illegible]
CV = [illegible]
PC = Police

Summary of Brake Switch Analysis

Sample Information		Switch			Switch at 100 psi			Function		
VIN	Condition	Spring Term. to Stat. Term.	Spring Term. to Hsg.	Stat. Term. to Hsg.	Spring Term. to Stat. Term.	Spring Term. to Hsg.	Stat. Term. to Hsg.	Opening Pressure	Closing Pressure	Proof Test at 800psi
[illegible]	No leaks or other apparent problems	1.[illegible]	[illegible]	[illegible]	0.1	>[illegible]K	>[illegible]K	1[illegible]	[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	0.4	Infinity	Infinity	Infinity	Infinity	Infinity	13[illegible]	10[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	0.[illegible]	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	7[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	0.2	[illegible]M	[illegible]M	0.1	Infinity	Infinity	14[illegible]	8[illegible]	No apparent leak
[illegible]	No leaks or other apparent problems	0.2	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	7[illegible]	No apparent leak
[illegible]	Dealership returns, apparent brake fluid leak.	>780K	>[illegible]K	>[illegible]K	>4M	>[illegible]K	>[illegible]K	1[illegible]	10[illegible]	No apparent leak

NP = Not Performed
TBP = To Be Performed
TC = Town Car

3713 1844

GM = Grand Marquis
CV = Crown Victoria
[illegible] = Police

Summary of Brake Switch Analysis

[illegible]	Connector/Wires				Observations/Findings — Switch				
VIN	Engagement	Wires	Red Seal	Gray Seal	Hexport, Washer, Connector, Spacer, and Disc	Environmental Seal	Gasket/Kapton Seals	Cup	Base, Switch Cavity, Contacts, Terminals
[illegible]	Fully engaged	TBP	Intact. Impression seen, but not deep or sharp. Not as pronounced as in other samples.	Intact. Wire and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Still attached to prop. valve. Black residue in hexport cavity; did not analyze. White deposits on washer, connector, disc, and interior of cup; did not analyze - probably corrosion product of zinc plating.	Intact and appears to have had good seal.	Gasket intact and appears to have had good seal. Kapton seal nearest hexport exhibits delamination and possible tear in teflon, but no apparent breaks in substrate. Other Kapton seals show no tears, cracks, or delamination. No apparent leak path.	Face of cup covered with rust and white colored deposits containing iron and zinc (probably corrosion product of cup material). Transfer pin frozen in place by corrosion product. Appears metal [illegible] quantity). No evidence of a [illegible] occurring.	Movable contact discolored, but not heavily corroded near cup. Rest of contacts and [illegible] appear clean. Terminals exhibit minor corrosion.
[illegible]	Fully engaged	TBP	Intact. Impression visible and sharp.	Intact. Wires and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Still attached to prop. valve. Did not disassemble.	Did not disassemble	Did not disassemble.	Did not disassemble.	Did not disassemble. Terminals clean (no apparent deposits or corrosion).
[illegible]	Fully engaged	TBP	Intact. Impression seen and sharp.	Intact. Wires and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Still attached to prop. valve. Did not disassemble.	Did not disassemble	Did not disassemble	Did not disassemble	Did not disassemble. Terminals clean (no apparent deposits or corrosion).
[illegible]	Fully engaged	TBP	Intact. Impression seen and sharp.	Intact. Wires and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Black residue in fitting end of hexport; did not analyze at CL. Disassembled and analyzed by SRL.	Disassembled and analyzed by SRL.	Disassembled and analyzed by SRL.	Disassembled and analyzed by SRL.	Disassembled and analyzed by SRL. Terminals have light deposits on them.
[illegible]	Fully engaged	TBP	Intact. Impression seen and sharp.	Intact. Wires and cavity clean below seal except for traces of oil from seal. Seal left impressions in wire insulation.	Black residue in fitting end of hexport; did not analyze.	Did not disassemble	Did not disassemble	Did not disassemble	Did not disassemble. Terminals clean (no apparent deposits or corrosion).
[illegible]	Missing	Missing	Missing	Missing	Black residue in fitting end contains glycol ether based material (probably brake fluid), an amide, and other material: possibly a hydrocarbon. No apparent trace on connector, washer, or hexport.	Intact and appears to have had good seal.	Gasket is intact and appears to have had good seal. Kapton seals exhibit circumferential tears in Teflon with radial and circumferential cracking in substrate. Appears to have formed leak path. Damage appears similar to that in [illegible] sample.	Face of cup covered with black residue and copper colored platelets. Residue contains glycol based material (probably brake fluid) and possibly a hydrocarbon. Additional analyses of residue pending.	Switch cavity of base contains black sludge. Movable contact appears to have been corroded away. Black residue is present in terminal cavity and at bases of terminals. Terminals appear clean otherwise.

NP = Not Performed
TBP = To Be Performed
TC = Town Car

3713 1845

GM = Grand Marquis
CV = Crown Victoria
PC = Police

Summary of Brake Switch Analysis

Sample Information					
VIN	Sample	TC/Vehicle	?/ Date Code	Condition	Conclusion/Comments
[illegible]	8	TC	[illegible]	No leaks or other apparent problems	Switch did not open when pressurized. Shows current leak path between contacts and ground. Cap has been abraded. Transfer ... in place by corrosion products. Moisture in cavity appears to have formed current leak path. No evidence of material transfer from contacts to cap. No evidence of leak in Kapton seals. Appears to be different failure mode than Memphis switch.
[illegible]	10	CV	[illegible]	No leaks or other apparent problems	Examination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.
[illegible]	11	TC	[illegible]	No leaks or other apparent problems	Examination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.
[illegible]	12	TC	[illegible]	No leaks or other apparent problems	Switch did not open when pressurized. Shows current leak path between contacts and ground. Replaced by [illegible].
[illegible]	[illegible]	TC	[illegible]	No leaks or other apparent problems	Examination, resistance and functional testing revealed no apparent problem with switch. No further analysis performed.
[illegible]	[illegible]	TC	[illegible]	Considerable corrosion, apparent brake fluid leak.	Resistance measurements show current leak path between contacts and between contacts and ground. Kapton seals appear to have allowed leak path for brake fluid to enter switch cavity. Transfer of contact material to cap suggests [illegible] occurred between the [illegible] (+) contacts and the grounded (-) cap. Brake fluid may have acted as an electrolyte. Failure mode similar to Memphis switch.

NP = Not Performed
TBP = To Be Performed
TC = Tower Car

CM = [illegible]
CV = [illegible] Vehicle
TC = [illegible]

Summary of Brake Switch Analysis

Sample Information		Switch			Switch at 150 psi			Function		
VIN	Condition	Spring Term. to Stat. Term.	Spring Term. to Housing	Stat. Term. to Housing	Spring Term. to Stat. Term.	Spring Term. to Housing	Stat. Term. to Housing	Opening Pressure	Closing Pressure	Proof Test at [illegible]
[illegible]	Dealership [illegible], apparent brake fluid leak.	>13[illegible]K	>17K	>[illegible]K	[illegible]K	>140K	>[illegible]K	No [illegible]	No [illegible]	NO apparent leak.
[illegible]	Undetermined [illegible].	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	Undetermined [illegible].	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	Undetermined [illegible].	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	Undetermined [illegible].	NP	NP	NP	NP	NP	NP	NP	NP	NP
[illegible]	No leaks or other apparent problems	0.2	Infinity	Infinity	Infinity	Infinity	Infinity	[illegible]	[illegible]	No apparent leak.

NP = Not Performed
TBP = To Be Performed
TC = Town Car

3713 1847

GM = Grand Marquis
CV = Crown Victoria
PO = Police

Summary of Brake Switch Analysis

PV765158	Connector/Wire				Observations/Findings				
					Switch				
VIN	Engagement	Wires	Red Seal	Gray Seal	Hexport, Washer, Connector, Spacer, and Disc	Encapsulated Seal	Gasket/Kapton Seals	Cup	Base, Switch Cavity, Contacts, Terminals
[redacted]	Missing	Missing	Missing	Missing	Black residue in fitting end of hexport contains glycol based material (probably brake fluid) and an unknown. Copper colored globules also present. No apparent burns on connector, washer, or hexport.	Intact seal appears to have had good seal.	Gasket is intact and appears to have had good seal. Kapton seals exhibit circumferential wear in Teflon with radial and circumferential cracking in substrate. Appears to have formed leak path. Damage appears similar to that in Memphis sample.	Face of cup covered with black residue and copper colored globules. Residue contains glycol based material (probably brake fluid) and possibly a hydrocarbon. Additional analysis of residue pending.	Switch cavity of base contains black sludge with copper colored globules. Mosquito contact appears to have been corroded away. Black residue is present in terminal cavity and on the terminals.
[redacted]	Missing	Missing	Missing	Missing	Black residue in fitting end of hexport. Washer, connector, disc, and exterior of cup are covered with rust colored deposits.	Missing	Gasket missing. Charred fragments of Kapton seals remain.	Face of cup covered with rust colored deposits. Analysis pending.	Missing.
MY739947	Missing	Missing	Missing	Missing	Black residue in fitting end of hexport. Washer, connector, disc, and exterior of cup are covered with rust colored deposits.	Missing	Gasket missing. Charred fragments of Kapton seals remain.	Face of cup covered with rust colored deposits. Analysis pending.	Missing.
MY739941	Missing	Missing	Missing	Missing	Missing	Missing	Missing	Missing	Missing.
MY714589	Missing	Missing	Missing	Missing	TBP	TBP	TBP	TBP	TBP.
PV696885	Fully engaged	TBP	Intact. Impression seen and deep all the way around.	Intact. Wires and cavity close below seal except for trace of oil from seal. Seal bit impressions in wire insulation.	Black residue in fitting end of hexport. Did not analyze.	Did not disassemble	Did not disassemble	Did not disassemble	Did not disassemble. Terminals show no apparent deposits or corrosion.

NP = Not Performed
TBP = To Be Performed
TC = Town Car

3713 1848

GM = Grand Marquis
CV = Victoria
PC = Police

Summary of Brake Switch Analysis

Sample Information					
VIN	Sample	MY/Vehicle	Date Code	Condition	Conclusion/Comments
[illegible]	[illegible]	TC	21[illegible]	Dealership return, apparent brake fluid leak.	Resistance measurements show current leak path between contacts and between contacts and ground. Kapton seals appear to have allowed leak path for brake fluid to enter switch cavity. Transfer of contact material to cap suggests electrolytic cell may occurred between the hot (+) contacts and the grounded (-) cap. Brake fluid may have acted as electrolyte. Failure mode similar to Memphis switch.
[illegible]	EAA	TC	20[illegible]	Underhood fire.	Analysis in process.
[illegible]	EAA	TC	[illegible]	Underhood fire.	Analysis in process.
[illegible]	EAA	Marquis	?	Underhood fire.	Brake fluid only. No switch to analyze.
[illegible]	EAA	GM	?	Underhood fire.	Analysis in process.
[illegible]		1 TC	20[illegible]	No leaks or other apparent problems.	Disassembly, resistance and functional testing revealed no apparent problems with switch. No further analysis performed.

NP = Not Performed
TBP = To Be Performed
TC = Town Car

GM = Grand Marquis
CV = Crown Victoria
C = Police

9713 1849

C = C[illegible]PLETE
NA [illegible]PPLICABLE
TBP [illegible]E PERFORMED

Brake Switch Testing Checklist

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

		[illegible]	A	B	C	D	E	F	T
		PY[illegible]77	PY[illegible]24	NY745119	NY[illegible]	VX[illegible]73	NX[illegible]74	NY[illegible]	NX[illegible]
Field Info	1 [illegible]	C	C	C	C	C	C	C	C
	Condition	FIRE	FIRE	FIRE	FIRE	BF LEAK	NO FIRE/LEAK	BF LEAK	NO FIRE/LEAK
	2 [illegible]	C	C	C	C	C	C	C	NP
	3 [illegible]	C	C	C	C	C	C	C	C
	4 [illegible]	C	NA	NA	NA	NA	NA	NA	NA
	[illegible]	C	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	5 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	6 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	7 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	8 [illegible]	C	NA	NA	C	NA	NA	NA	NA
Connector Only	9 [illegible]	C	NA	NA	C	NA	NA	NA	NA
	10 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	11 [illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	12 [illegible]	C	NA	NA	NA	NA	NA	NA	NA
	14 [illegible]	C	NA	NA	NA	NA	NA	NA	NA
	15 [illegible]	C	NA	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16 [illegible]	NA	NA	NA	NA	NA	NA	NA	C
	17 [illegible]	NA	NA	NA	NA	0.4	0.2	NP	0.3
	18 [illegible]	NA	NA	NA	NA	4.8[illegible]	INF	[illegible]	INF
	19 [illegible]	NA	NA	NA	NA	NP	NP	NP	INF
	20 [illegible]	NA	NA	NA	NA	1.1	[illegible]	NP	[illegible]
Switch External Pressurized	24 [illegible]	NA	NA	NA	NA	NA	NA	NA	[illegible]
	25 [illegible]	NA	NA	NA	NA	NA	NA	NA	[illegible]
	26 [illegible]	NA	NA	NA	NA	NA	NA	NA	NO LEAK
	27 [illegible]	NA	NA	NA	NA	NA	NA	NA	C
	17 [illegible]	NA	NA	NA	NA	NA	NA	NA	INF
	18 [illegible]	NA	NA	NA	NA	NA	NA	NA	INF
	19 [illegible]	NA	NA	NA	NA	NA	NA	NA	INF
	20 [illegible]	NA	NA	NA	NA	NA	NA	NA	INF
Switch	28 [illegible]	C	C	NP	C	C	C	C	NP
	29 [illegible]	C	C	NP	C	C	C	C	NP
	30 [illegible]	C	C	NP	C	C	C	C	NP
	31 [illegible]	C	C	NP	C	C	C	C	NP
Techniques	31 [illegible]	C	C	NP	C	C	C	C	NP
	32 [illegible]	C	C	C	C	C	C	C	NP
	33 [illegible]	C	NA	NP	C	C	C	C	NP
	[illegible]	C	NA	NP	C	C	C	C	NP

3713 1880

C = C[illegible]PLETE
NA [illegible]PPLICABLE
T[illegible] [illegible]E PERFORMED

Brake Switch Testing Checklist

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

			3	4	5	6	7	8	9	10
			P17240A3	P1[illegible]170	P1[illegible]	P17288[illegible]1	NX7[illegible]	PA1[illegible]	P[illegible]	P[illegible]
Field Info	1	[illegible]	C	C	C	C	C	C	C	C
		[illegible]	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK
	2	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP
	3	[illegible]	C	C	C	C	C	C	C	C
	4	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
		[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	5	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	6	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	7	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	8	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
Connector Only	9	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	10	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	12	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	13	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	14	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
	15	[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16	[illegible]	C	C	NA	NA	C	C	C	C
	17	[illegible]	0.2	0.3	NK [illegible]	NK 0.9	0.2	0.2	0.2	[illegible]
	18	[illegible]	INF	INF	NK INF	NK INF	INF	INF	INF	[illegible]
	19	[illegible]	INF	INF	NK INF	NK INF	INF	INF	INF	INF
	20	[illegible]	11.4	1.[illegible]	NK INF	NK INF	7.[illegible]	[illegible]	7.[illegible]	1.[illegible]
Switch External Pressurized	21	[illegible]	1[illegible]	[illegible]	NA	NA	147	[illegible]	14[illegible]	[illegible]
	22	[illegible]	[illegible]	[illegible]	NA	NA	70	[illegible]	112	[illegible]
	23	[illegible]	NO LEAK	NO LEAK	NA	NA	NO LEAK	NO LEAK	NO LEAK	NO LEAK
	24	[illegible]	C	C	NA	NA	C	C	C	C
	17	[illegible]	INF	INF	NA	NA	INF	INF	INF	INF
	18	[illegible]	INF	INF	NA	NA	INF	INF	INF	INF
	19	[illegible]	INF	INF	NA	NA	INF	INF	INF	INF
	20	[illegible]	INF	INF	NA	NA	INF	INF	INF	INF
Switch	25	[illegible]	NP	NP	C	C	NP	NP	NP	NP
	26	[illegible]	NP	NP	C	C	NP	NP	NP	NP
	27	[illegible]	NP	NP	C	C	NP	NP	NP	NP
	28	[illegible]	NP	NP	C	C	NP	NP	NP	NP
Techniques	29	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP
	30	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP
	31	[illegible]	NP	NP	NP	NP	NP	NP	NP	NP
		[illegible]	NP	NP	NP	NP	NP	NP	NP	NP

3718 1851

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

Brake Switch Testing Checklist

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

			11	12	13	14	15	16	17	18
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Field Info	1	Log Field Info into Switch Log.xls	C	C	C	C	C	C	C	C
		[illegible]	NO FIRE/LEAK	[redacted]						
	2	Photograph Switch	NP							
	3	Record any unusual external/internal observations	C							
	4	Check for Connector engagement	NA							
		[illegible]	NA							
Switch + Connector Assembly	5	[illegible]	NA							
	6	[illegible]	NA							
	7	[illegible]	NA							
	8	Separate Harness from Switch	NA							
Connector Only	9	[illegible]	NA							
	10	[illegible]	NA							
	[redacted]									
	11	Check for full engagement of connector	NA							
	12	[illegible]	NA							
	14	[illegible]	NA							
	15	[illegible]	NA							
Switch External Unpressurized	16	[illegible]	C							
	17	[illegible]	0.3							
	18	[illegible]	INF							
	19	[illegible]	INF							
	20	[illegible]	INF							
	[redacted]									
Switch External Pressurized	24	[illegible]	159							
	[illegible]	[illegible]	71							
	[illegible]	[illegible]	NO LEAK							
	27	[illegible]	C							
	17	[illegible]	INF							
	18	[illegible]	INF							
	19	[illegible]	INF							
	[illegible]	[illegible]	INF							
Switch	[illegible]	[illegible]	NP							
	[illegible]	[illegible]	NP							
	[illegible]	[illegible]	NP							
	[illegible]	[illegible]	NP							
Techniques	[illegible]	[illegible]	NP							
	[illegible]	[illegible]	NP							
	33	[illegible]	NP							
		[illegible]	NP							

PX653K-7

0.3
INF
INF
17K

3713 1882

C = CO[illegible]PLETE
NA [illegible]PPLICABLE
TBP [illegible]E PERFORMED

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLD = NOT RECD AT CER. LAB.

		19	20	21	22	23	1	2	3
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Field Info	[illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	[illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NO FIRE/LEAK	NO [illegible]/LEAK	NO FIRE/LEAK
	2 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	3 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	4 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	[illegible]	C
	[illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NA	[illegible]	NA
Switch + Connector Assembly	5 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[illegible]	0.4	0.2
	6 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	7 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	8 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
Connector Only	9 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	10 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	12 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	13 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	14 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	15 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	TBP	TBP	TBP
Switch External Unpressurized	16 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	[illegible]	C
	17 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	0.3	0.1	0.2
	18 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	19 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	20 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	4.5	INF	17.7K
Switch External Pressurized	24 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[illegible]	127	[illegible]
	25 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[illegible]	[illegible]	[illegible]
	26 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NO LEAK	NO LEAK	NO LEAK
	27 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	C	C	C
	17 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	0.1	INF
	18 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	19 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
	20 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	INF	INF	INF
Switch	28 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	29 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	30 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	31 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
Techniques	32 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	33 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP
	34 [illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	NP	NP
	[illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NP	C	NP

3713 1053

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

Brake Switch Testing Checklist

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

		4	5	6	7	8	9	10	11
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Field Info	1 [illegible]	C	C	C	C	C	C	C	C
	[illegible]	NO FIRE/LEAK	NO FIRE/LEAK	FIRE	NO FIRE/LEAK	FIRE	NO FIRE/LEAK	NO FIRE/LEAK	NO FIRE/LEAK
	2 [illegible]	C	C	C	C	C	C	C	C
	3 [illegible]	C	C	C	C	C	C	C	C
	4 [illegible]	C	C	NA	C	NA	C	NA	C
	[illegible]	C	NA	NA	NA	NA	C	NA	NA
Switch + Connector Assembly	5 [illegible]	NP	0.2	NA	INF	NA	2	0.4	NP
	6 [illegible]	NP	INF	NA	INF	NA	[illegible]	INF	NP
	7 [illegible]	NP	INF	NA	INF	NA	[illegible]	INF	NP
	8 [illegible]	C	C	NA	C	NA	C	C	C
Connector Only	9 [illegible]	C	C	NA	C	NA	C	C	C
	10 [illegible]	NP		NA	INF	NA	INF	INF	NP
	[redacted]								
	12 [illegible]	C	C	NA	C	NA	C	C	C
	13 [illegible]	C	C	NA	C	NA	C	C	C
	14 [illegible]	C	C	NA	C	NA	C	C	C
	15 [illegible]	TBP	TBP	NA	TBP	NA	TBP	TBP	TBP
Switch External Unpressurized	16 [illegible]	C	C	NA	C	NA	C	C	C
	17 [illegible]	0.1	[illegible]	NA	0.3	NA	1.6	0.4	0.1
	18 [illegible]	INF	INF	NA	INF	NA	[illegible]	INF	INF
	19 [illegible]	INF	INF	NA	INF	NA	[illegible]	INF	INF
	20 [illegible]	INF	140K	NA	[illegible]	NA	0.4	[illegible]	INF
	[redacted]								
Switch External Pressurized	21 [illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	22 [illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	74
	23 [illegible]	NO LEAK	NO LEAK	NA	NO LEAK	NA	NO LEAK	NO LEAK	NO LEAK
	24 [illegible]	C	C	NA	C	NA	C	C	C
	17 [illegible]	INF	INF	NA	INF	NA	[illegible]	INF	INF
	18 [illegible]	INF	INF	NA	INF	NA	[illegible]	INF	INF
	19 [illegible]	INF	INF	NA	INF	NA	[illegible]	INF	INF
	20 [illegible]	INF	INF	NA	INF	NA	INF	INF	INF
Switch	25 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	26 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	27 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	28 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
Technique	29 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	30 [illegible]	NP	NP	NP	NP	NP	C	NP	NP
	31 [illegible]	NP	NP	NP	NP	NP	NP	NP	NP
	[illegible]	NP	NP	NP	NP	NP	C	NP	NP

3713 1854

C = C[illegible]PLETE
NA [illegible] APPLICABLE
TB[illegible] [illegible]E PERFORMED

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLB = NOT RECD AT [illegible] LAB.

		12	13	OASIS	OASIS	EAA	EAA	EAA	EAA
		P[illegible]	P[illegible]33415	N[illegible]	P[illegible]	P[illegible]	N[illegible]	N[illegible]	N[illegible]
Field Info	1 [illegible]	C	C	C	C	D	C	C	C
	Condition	NO FIRE/LEAK	NO FIRE/LEAK	BF LEAK	BF LEAK	FIRE	FIRE	FIRE	FIRE
	2 [illegible]	C	C	C	C	C	C	NA	TBP
	3 [illegible]	O	C	C	C	C	C	NA	TBP
	4 [illegible]	C	D	NA	NA	NA	NA	NA	NA
	[illegible]	O	NA	NA	NA	NA	NA	NA	NA
Switch + Connector Assembly	5 [illegible]	0.3	[illegible]	NA	NA	NA	NA	NA	NA
	6 [illegible]	[illegible]M	INF	NA	NA	NA	NA	NA	NA
	7 [illegible]	[illegible]M	INF	NA	NA	NA	NA	NA	NA
	8 [illegible]	C	C	NA	NA	NA	NA	NA	NA
Connector Only	9 [illegible]	C	C	NA	NA	NA	NA	NA	NA
	10 [illegible]	INF	INF	NA	NA	NA	NA	NA	NA
[redacted]									
	12 [illegible]	C	C	NA	NA	NA	NA	NA	NA
	13 [illegible]	C	C	NA	NA	NA	NA	NA	NA
	14 [illegible]	C	C	NA	NA	NA	NA	NA	NA
	15 [illegible]	TBP	TBP	NA	NA	NA	NA	NA	NA
Switch External Unpressurized	16 [illegible]	C	C	D	C	NA	NA	NA	NA
	17 [illegible]	4.2	4.5	>700K	>[illegible]K	NA	NA	NA	NA
	18 [illegible]	3.4M	INF	>[illegible]K	>47K	NA	NA	NA	NA
	19 [illegible]	3[illegible]M	INF	>[illegible]K	>[illegible]K	NA	NA	NA	NA
	20 [illegible]	[illegible]K	7.5M	INF	INF	NA	NA	NA	NA
[redacted]									
Switch External Pressurized	24 [illegible]	[illegible]	[illegible]	[illegible]	NO SOUND	NA	NA	NA	NA
	25 [illegible]	[illegible]	70	[illegible]	NO SOUND	NA	NA	NA	NA
	26 [illegible]	NO LEAK	NO LEAK	NO LEAK	NO LEAK	NA	NA	NA	NA
	27 [illegible]	C	C	C	C	NA	NA	NA	NA
	17 [illegible]	[illegible]	INF	>1.[illegible]M	170K	NA	NA	NA	NA
	18 [illegible]	INF	INF	>[illegible]K	>[illegible]K	NA	NA	NA	NA
	19 [illegible]	INF	INF	>[illegible]K	>[illegible]K	NA	NA	NA	NA
	20 [illegible]	INF	INF	INF	INF	NA	NA	NA	NA
Switch	28 [illegible]	SCI LAB	NP	C	C	C	C	NA	TBP
	29 [illegible]	SCI LAB	NP	C	C	D	D	NA	TBP
	30 [illegible]	SCI LAB	NP	C	C	O	O	NA	TBP
	31 [illegible]	SCI LAB	NP	C	C	C	C	NA	TBP
Techniques	31 [illegible]	SCI LAB	NP	TBP	TBP	TBP	TBP	NA	TBP
	32 [illegible]	SCI LAB	NP	TBP	TBP	TBP	TBP	NA	TBP
	33 [illegible]	SCI LAB	NP	NA	NA	NA	NA	NA	TBP
	[illegible]	SCI LAB	NP	C	D	C	C	NA	TBP

3718 1855

C = COMPLETE
NA = APPLICABLE
TBF = BE PERFORMED

Brake Switch Testing Checklist

INF = INFINITY (OPEN)
NP = NOT PERFORMED
NRCLB = NOT RECD AT CSN. LAB.

Field Info	1								
	2								
	3								
	4								
	5								
Switch + Connector Assembly	6								
	7								
	8								
	9								
Connector Only	10								
	11								
	12								
	13								
	14								
Switch External Unpressurized	15								
	16								
	17								
	18								
	19								
	20								
Switch External Pressurized	21								
	22								
	23								
	24								
	25								
	26								
	27								
	28								
	29								
Switch	30								
	31								
	32								
	33								
Techniques	34								
	35								
	36								
	37								

3713 1999

Data Log
Brake Pressure Switch

Log Updated [illegible]

Sw #	Sw Date Code	Vehicle	VIN	Event	Mileage	Term-Hexport Resistance	Leaker?	Kapton #1	Kapton #2	Kapton #3	Present Status
[illegible]	2059	Town Car	PY[illegible]	Str. Fire				crack	crack	crack	Analysis Complete
A	[illegible]	Town Car	PY[illegible]	Underhood Fire				no info	no info	no info	Analysis Complete
B	2114	Town Car	NY745119	Underhood Fire							Sw. not available
C	[illegible]	Town Car	NY[illegible]	Underhood Fire							Analysis in Progress
D		Crown V PCar	VX1[illegible]	Cruise Inop		4.6MEG	yes	crack	crack	crack	Analysis Complete
E	2137	Town Car	NX[illegible]774	Reference		OPEN	no	worn, no crack	worn, no crack	worn, no crack	Analysis Complete
F	2128	Town Car	NY7[illegible]	Cruise Inop		4MEGA	yes	crack	crack	crack	Analysis Complete
1	[illegible]	Town Car	[illegible]	Reference	79184	OPEN					
3	[illegible]	Town Car	PY724[illegible]	Reference	71327	OPEN					
4	[illegible]	Town Car	PY[illegible]	Reference	[illegible]	OPEN					
5	[illegible]	Town Car	py[illegible]	Reference	[illegible]						Analysis in Progress
6	[illegible]	Town Car	py7[illegible]	Reference	[illegible]						Analysis in Progress
7	[illegible]	Town Car	[illegible]	Reference	[illegible]	OPEN					
8	[illegible]	Town Car	PX1[illegible]	Reference	[illegible]	OPEN					
9	[illegible]	Town Car	P[illegible]	Reference	??	OPEN					
10	[illegible]	Town Car	PY[illegible]	Reference	[illegible]	OPEN					
11	[illegible]	Town Car	PY7[illegible]	Reference	[illegible]	OPEN					
12	[illegible]	Town Car	P[illegible]	Reference	[illegible]	OPEN					
13	[illegible]	Town Car	NY7[illegible]	Reference	[illegible]	OPEN					
14	[illegible]	Town Car	P[illegible]	Reference	[illegible]	OPEN					
15	[illegible]	Town Car	PY[illegible]	Reference	??	OPEN					
16	??	Town Car	[illegible]	Reference	[illegible]	OPEN					
17	??	Town Car	PY[illegible]	Reference	72114	OPEN					
18	[illegible]	Town Car	PY[illegible]	Reference		OPEN					
19	??	Town Car	PY7[illegible]	Reference	[illegible]	OPEN					
20	??	Town Car	PY7[illegible]	Reference	[illegible]	OPEN					
21	??	Town Car	P[illegible]	Reference	[illegible]	OPEN					
22	[illegible]	??	??	Reference	??						
23	??	Town Car	P[illegible]	Reference	[illegible]	OPEN					
to 2/12, John [illegible] Group											
1	[illegible]	Town Car	PY[illegible]	Reference							
2	[illegible]	Crown V PCar	PX1[illegible]	Reference	[illegible]						
3	[illegible]	Grand Marquis	[illegible]	Reference	??						
4	[illegible]	Crown Vic	PX1[illegible]	Reference	[illegible]						
5	[illegible]	Town Car	PY[illegible]	Reference	73115						
6	??	Town Car	NY72[illegible]	Underhood Fire	??						
7	[illegible]	Town Car	PY7[illegible]	Reference	??						

3713 1557

Steve [illegible], 313 59 [illegible],
[illegible]@ford.com,
file SwitchLog.xls

revised [illegible]

Data Log
Brake Pressure Switch

Car #	Sw Date Code	Vehicle	VIN	Event	Mileage	Term-Hsport	Leaker?	Kapton #1	Kapton #2	Kapton #3	Present Status
8	2045	Town Car	NY[illegible]	Underhood Fire	10??10						
9	[illegible]	Town Car	PY7[illegible]	Reference	??						
10	2272	Crown Vic	PX161140	Reference	72814						
11	2115	Town Car	NY7[illegible]	Reference	??						
12	2095	Town Car	PY7[illegible]	Reference	??						
13	[illegible]	Town Car	PY7[illegible]	Reference	10??49						

[illegible], 343 39 [illegible],
[illegible]@ford.com,
file SwitchLog.xls

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revised [illegible]

Visteon

Laboratory Test Data
Visteon Product Engineering Office

Date: 2-19-99 S

Dave Porter

Items Tested: PSC Actuators from TownCars & Crown Victorias

Tests: Parts from Ramp Vehicle Teardowns

Page No. / Vin No.	Type Veh. / Miles	Visual Test	Failure Mode	Clutch Ω	Remarks / Clutch Flyback Resistor / Diode Drop
311 FY788154	93 TCar ? MI	OK	—	26.65Ω	78.6Ω .512v
312 FX181140	93 Cr Vic 72,614 MI	OK	—	26.54Ω	98.41Ω .508v
313 FY743413	93 TCar 105,046 MI	OK	—	26.66Ω	78.69Ω .512v
314 FY742858	93 TCar ? MI	OK	—	26.36Ω	82.67Ω .507v
315 FY638880	93 TCar ? MI	OK	—	26.72Ω	78.84Ω .513v
316 FX183220	93 Cr Vic 199,999 MI	Fail	Water entry at amp baseplate & cable seal	26.13Ω	78.0Ω .519v
317 RX841868	94 Cr Vic ? MI	OK	—	23.58Ω	83.29Ω .514v
318 NY733181	92 TCar 106,810 MI	Fail **	Amplifier partially melted by fire—Wirebonds broken	26.78Ω	78.69Ω .508v Amplifier & case burned by fire

** Mechanical actuator still functional, but amplifier partially melted, baseplate loose, screw parts' solder reflowed, and wirebonds broken.

To Fred Kohl

Test Veh matrix

FEB 22 '99 8:37 03286 3133223529 PAGE.01

** TOTAL PAGE.01 **

3713 1869

NGSC

****
* Note printed by SREIMERS on 22 Feb 1999 at 14:01:49 *
****

From: DPORTER1--VISTEON Date and time 02/22/99 13:45:46
To: SREIMERS--FORDMAIL Steve Reimers
cc: FKOHL --FORDMAIL Fred Kohl (E-mail)

From: Porter, David (D.L.)
Subject: RE: Speed Control Report

The failure of part #318 was a functional failure, that is, speed control would not function. The clutch function was OK, but pulley and clutch rotation was looked at the zero throttle position by the (melted) pulley cover. Once the melted pulley cover was removed, the actuator function was normal, although the motor was almost rusted enough to fail to function, due to water entry. Presumably fire extinguisher entered through the partially melted amplifier. Part #316 failed due to water entry, but the clutch was not engaged, and clutch coil resistance was normal. Note that coil resistance is the same whether the clutch is engaged or not.
Dave Porter dporter1@Visteonet.com Phone: 313-390-8674 Fax 313-322-3529

> -----Original Message-----
> From: Steve Reimers SMTP:sreimers@gw.ford.com
> Sent: Monday, February 22, 1999 12:42 PM
> To: dporter1@visteon.com
> Subject: Speed Control Report
>
> Thanks for the quick response. Did any of the FAILED units have a clutch
> stuck
> in the energized state? What does FAIL mean for this test?
> thanks,
>
> Steve Reimers building 5 3C043
> AVT Chassis M/E System Applications mail drop 8011
> 39-03286 SREIMERS sreimers@ford.com fax 39-03286 ;>

3713 1660

****
* Note printed by SREIMERS on 17 Feb 1999 at 09:55:50 *
****

From: SLAROUCH--FORDMA1 Date and time 02/17/99 09:51:51
To: SREIMERS--FORDMAIL Reimers, Steve (S.

From: LaRouche, Steve (S.)
Subject: RE: (U)

We detected the same elements in the corrosion products in switch F as in the other switches. Right now, our best guess is that a cell has been set up between the contacts and the steel cup, with the brake fluid and possible contamination (source unknown) acting as the electrolyte. I gave Norm and Fred a spreadsheet summarizing our findings to date at the last meeting, but I don't think they have distributed it yet.

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

-----Original Message-----
From: Steve Reimers mailto:sreimers@gw.ford.com
Sent: Wednesday, February 17, 1999 9:45 AM
To: slarouch@mail.ford.com
Subject: RE: (U)

What caused the corrosion?

Steve Reimers building 5 3C043
AVT Chassis E/E System Applications mail drop 5011
39-03286 SREIMERS sreimers@ford.com fax 39-03286 ;>
*** Forwarding note from SLAROUCH--FORDMA1 02/17/99 08:18 ***
To: SREIMERS--FORDMAIL Reimers, Steve (S.

From: LaRouche, Steve (S.)
Subject: RE: (U)

Steve: The switch in question is switch F. The copper-berylium arm of the movable contact separated from the brass base. Now that we have had a chance to look at it in closer detail, it appears that the arm separated due to a loss of material thickness from corrosion. We have also found evidence of stress corrosion cracking in the stationary contact. We did not see any evidence of heat or arc damage in this switch. It looked like the arm separated, fell away, and stuck to the wall of the switch cavity.

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

-----Original Message-----
From: Steve Reimers mailto:sreimers@gw.ford.com
Sent: Tuesday, February 16, 1999 6:13 PM
To: jnemec@gw.ford.com; nlapoint@gw.ford.com; rnevi@gw.ford.com; slarouch@mail.ford.com; Aziz Rahman, Texas
Subject: (U)

Can you help me get smart regarding the "LOOSE METAL PART" mentioned above?

Steve Reimers building 5 3C043
AVT Chassis E/E System Applications mail drop 5011
39-03286 SREIMERS sreimers@ford.com fax 39-03286 ;>
*** Forwarding note from SCOLE1 --DRBN005 02/16/99 18:04 ***
To: SREIMERS--DRBN007
cc: DGOEL --DRBN005

From: Sam L. Cole USART(UTC -05:00)
Subject: (U)
THE PREVIOUS CONCERN OF THE 'LOOSE METAL PART' WAS MENTIONED IN THE LAST MEETING WITH JACK. HE WILL WANT A FOLLOW UP ON THIS AT THIS FRIDAY'S MEETING. PLEASE GET UP TO SPEED ON THE HISTORY OF THIS CONCERN. IF IT TURNS OUT THAT THIS MAY BE A CAUSE, THEN WE WILL NEED TO KNOW WHEN THE ISSUE WAS IN THE FIELD, WHEN IT WAS FIXED AND HOW MANY ARE OUT THERE TO BE CONCERNED ABOUT. THANKS.

Thank You,
Sam
Ext. 21959
BLDG. 2, 2273I - MD# 1220 - SCOLE1@FORD.COM
*** Forwarding note from SREIMERS--DRBN007 02/16/99 16:52 ***
To: SCOLE1 --DRBN005 DGOEL --DRBN005

FROM: Steve Reimers USART(UTC -05:00)
Subject: (U)
I have the part to show and a take-apart version too. I am not familiar with t
he previous problem but a loose metal part in the switch cavity is definitely a
 potential cause of this concern.

Steve Reimers building 5 3C043
AVT Chassis E/E System Applications mail drop 5011
39-03286 SREIMERS sreimers@ford.com fax 39-03286 ;>
*** Forwarding note from DB7ANAYR--DRBN007 02/16/99 13:41 ***
Subject: ANAY Facility/VM messages
This note was generated by the ANAY Facility/VM 5799-FLP (c)IBM Corp.
DO NOT REPLY TO THIS NOTE

ANA110I This mail item is being routed to you from SCOLE1 at DRBN005 on behalf of FPORTER at DRBN007.

To: FPORTER --DRBN007
cc: TMASTERS--DRBN005 TDONOVAN--DRBN005
DGOEL --DRBN005

From: Sam L. Cole USART(UTC -05:00)
Subject: (U)
I UNDERSTAND THAT THERE WILL BE A FOLLOW UP MEETING WITH JACK PASKUS THIS FRIDAY ON THE TOWN CAR INVESTIGATION. I MET WITH JACK TODAY FOR A 1 ON 1, AND HE REQUESTED SOME SPECIFIC INFO. AT FRIDAYS MEETING, PLEASE BRING A SAMPLE SWITCH TO SHOW JACK.

ALSO, HE IS INTERESTED IN KNOWING OUR PROGRESS AND INVESTIGATING IF THE PREVIOUS PROBLEM WITH THE INTERNAL COMPONENTS BREAKING LOOSE IS A POTENTIAL CAUSE OF THIS CONCERN. PLEASE BE PREPARED TO DISCUSS THIS ON FRIDAY. THANKS.

Thank You,
Sam
Ext. 21959
BLDG. 2, 22J31 - MD# 1220_- SCOLE16FORD.COM