TEXAS INSTRUMENTS, INC.'S

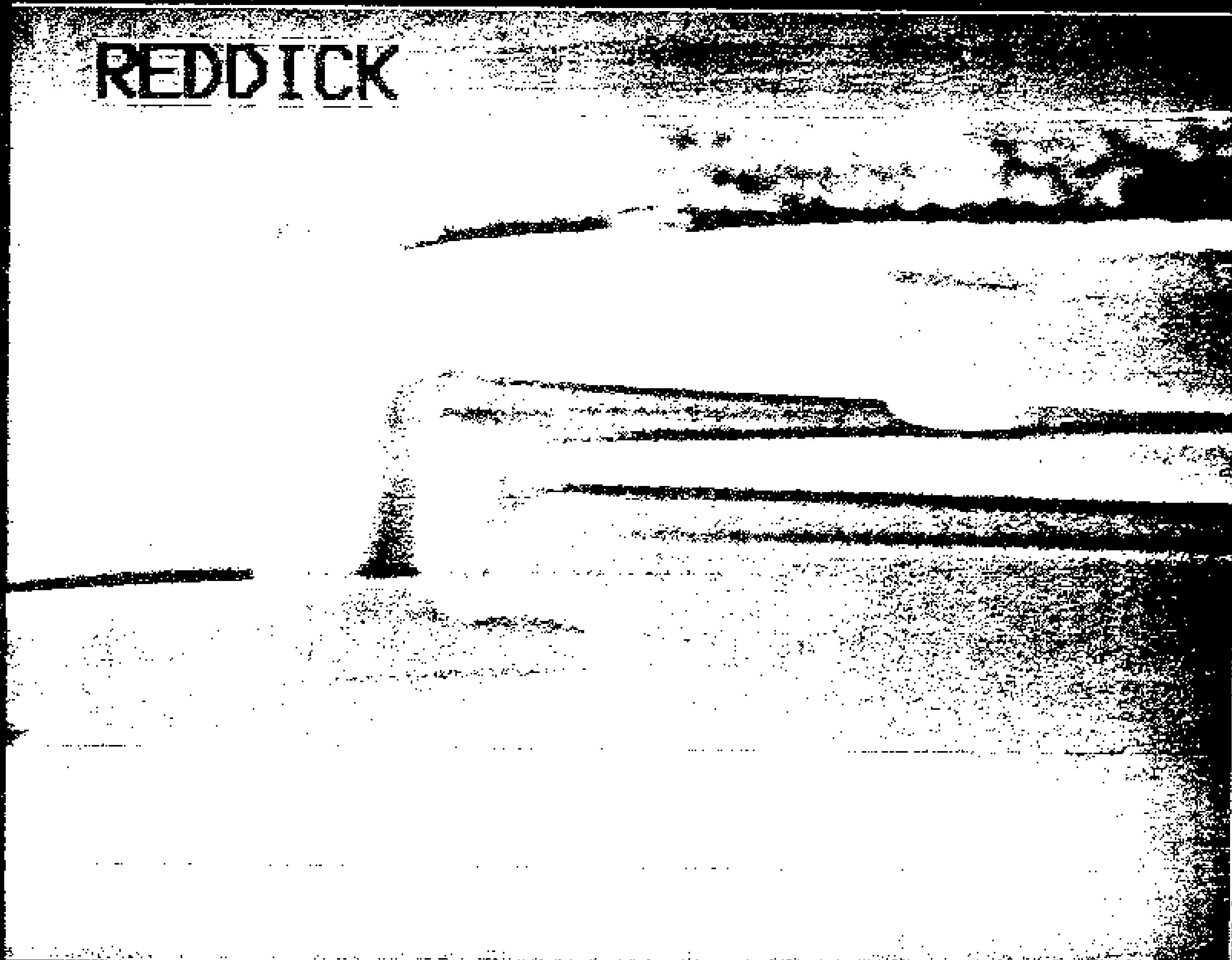
09/10/03

REQUEST 6

BOX 7

PART A-P

PART A



REDDICK

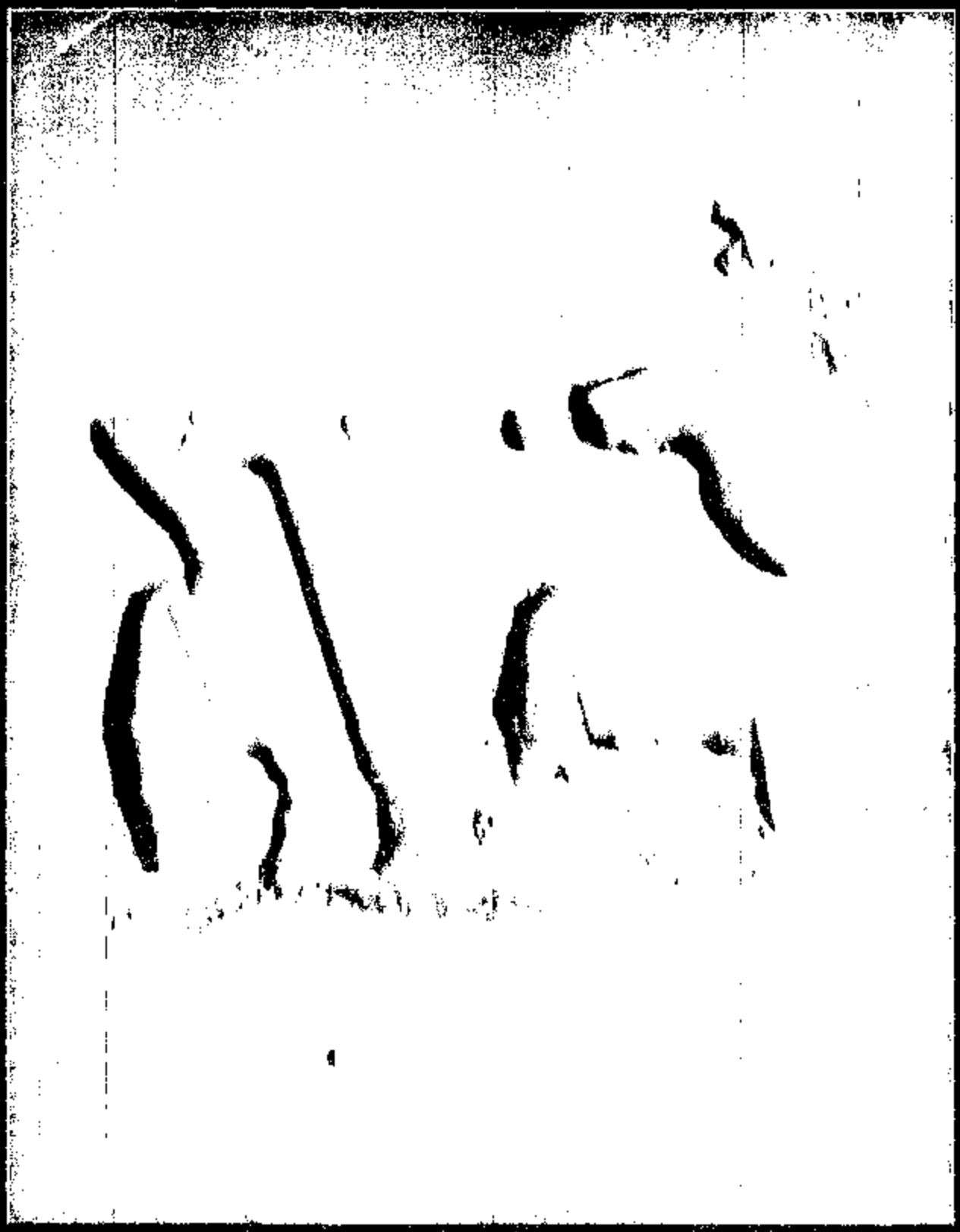
TI-NHTBA 0303

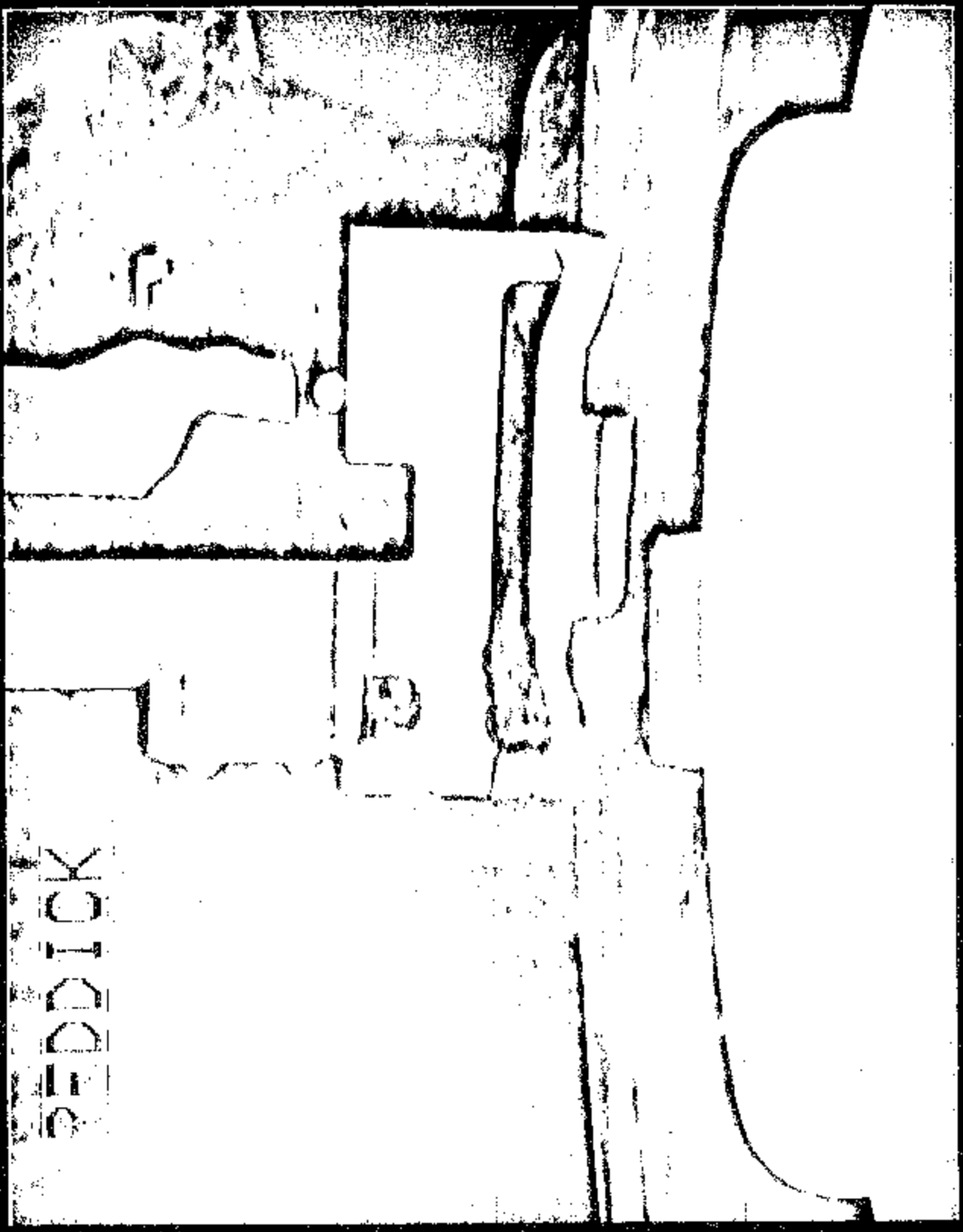
REDDICK

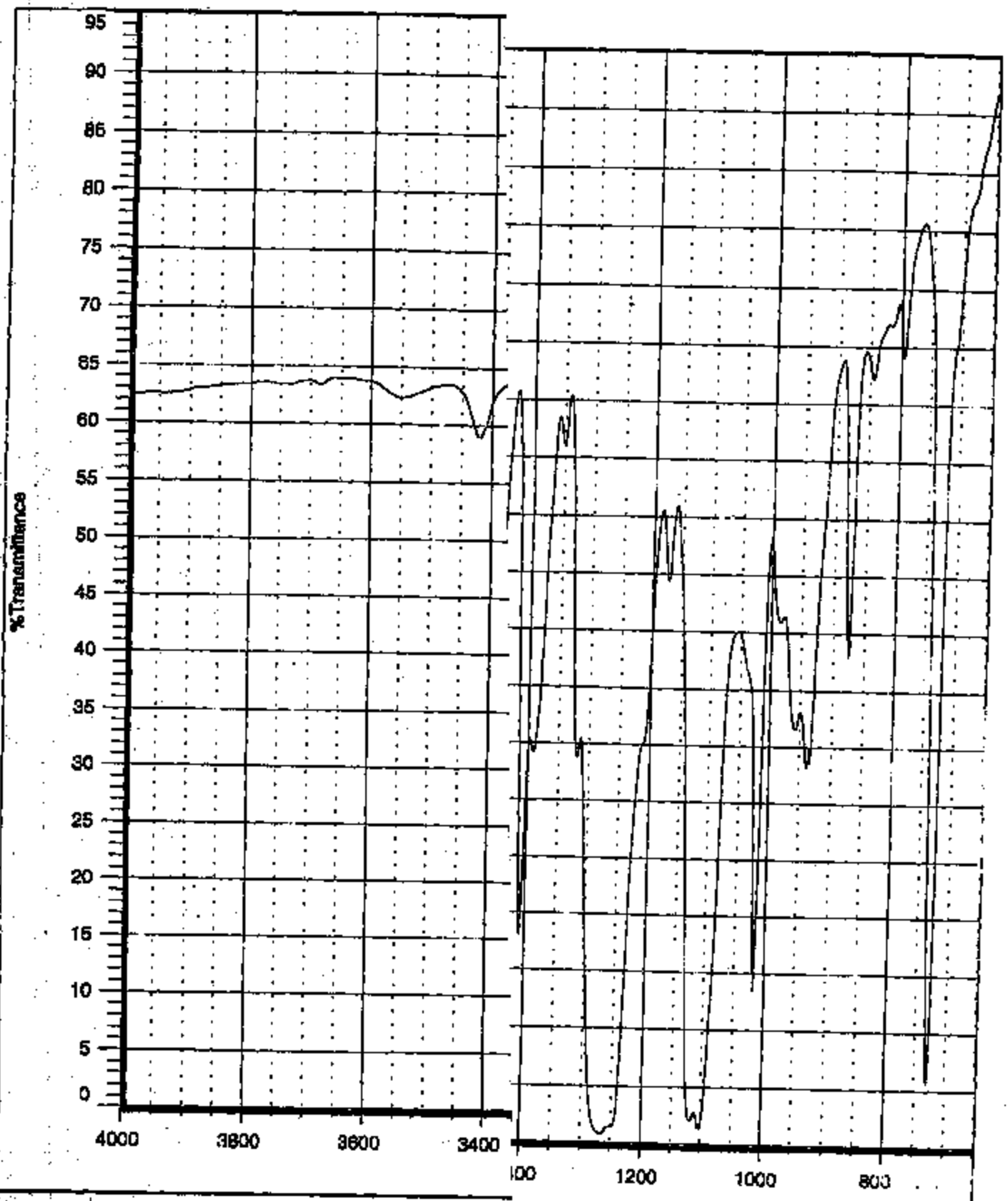
TL-NHTBA 8504

REDDICK

THIHTBA 9695




REAR



Date: Tue Jan 05 14:33:38 1999

Scans: 128

Resolution: 8.000

TI-NHTSA 9568

TECHNICAL SERVICE LABS

LOG NO. _____

TEST NO. 150709

TEST NO. 150709

PCC I.D.	127
REQUESTOR COST CENTER	352
PRODUCT CODE	069
REQUESTOR	OAKLEY
MAIL STATION	12-29
EXTENSION	3274
MSR ID	Dave
DATE SUBMITTED	1/7/99
DATE REQUIRED	1/7/99
NO. OF SAMPLES	1
COMPOSITION	

DESCRIBE YOUR PROBLEM/SAMPLE DESCRIPTION

Failure Analysis of Returned switch.

INFORMATION DESIRED:

→ Try to determine the following:

① Did switch leak?
② Signs of corrosion?
③ Signs of Arcing?
④ other signs of Foreign matter?

REPORT OF RESULTS:

3 MATERIALS.
WASHED IN ACETONE
FILTERED #1 WHATMAN
AIR DRIED

99-033

DATE RECEIVED _____ DATE OUT 1/8/99 cm

TECHNICIAN			
HOURS WORKED			
PROCEDURE USED			

*PCC I.D.

MC=328	TM=431	CLKE=122	FACIL=514
PC=127	WIRE=432	CAN=954	FACIL=521
VERE=186	EPD=621	AD DEV=286	FACIL=531
AFCC=483	PEP=622	EMCD=677	STAFF=555
IMD=430	CBD=635		

TI-NHTSA 9589

Ford 77Ps Recovered Parts Analysis

Make Lincoln

Model Town Car

Year 1992

Date Recovered 1-20-1999

Recovery Location Cycle 4 New Bedford

Mileage TMU

TI Test # F77-1 VIN# 2LMPM74F4NX AB 2124

Technician LEC

Date Tested 1-21-99

Device Photograph

ATTached
Back
Page

Kapton Photograph

ATTached
Back
Page

Ford 77PS Issue Recovered Parts Analysis

External switch condition Fair - Corrosion on hex and partially down threads - insulator clean - slight amount of debris in the inlet

Remove Connector

Terminal Condition Good - Clean with no Corrosion

Switch Pocket Good - Clean with no Fluid or Dust

Remove Crimp Ring

Contact Assembly Clean - No contamination no arcing of contacts - no heat discoloration of contact arm

Sensor Assembly Some corrosion approaching base/sensor gasket and completely around bottom of sensor near hex

Transfer Pin Shows normal wear

Environmental Seal Good Condition

Disassemble Sensor

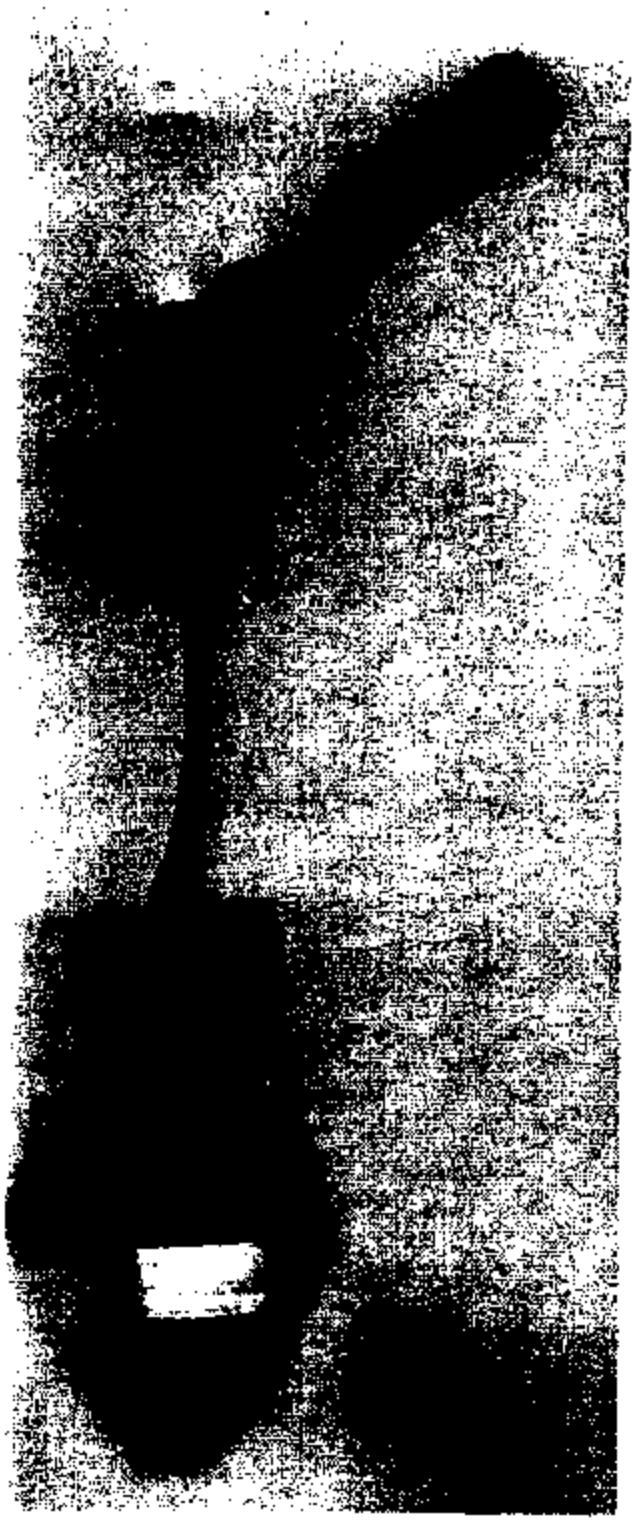
Kapton Condition Good. Some dust from cycling 3rd layer bottom - cracking seen with fluid seepage to 2nd layer bottom - minor splitting [illegible]

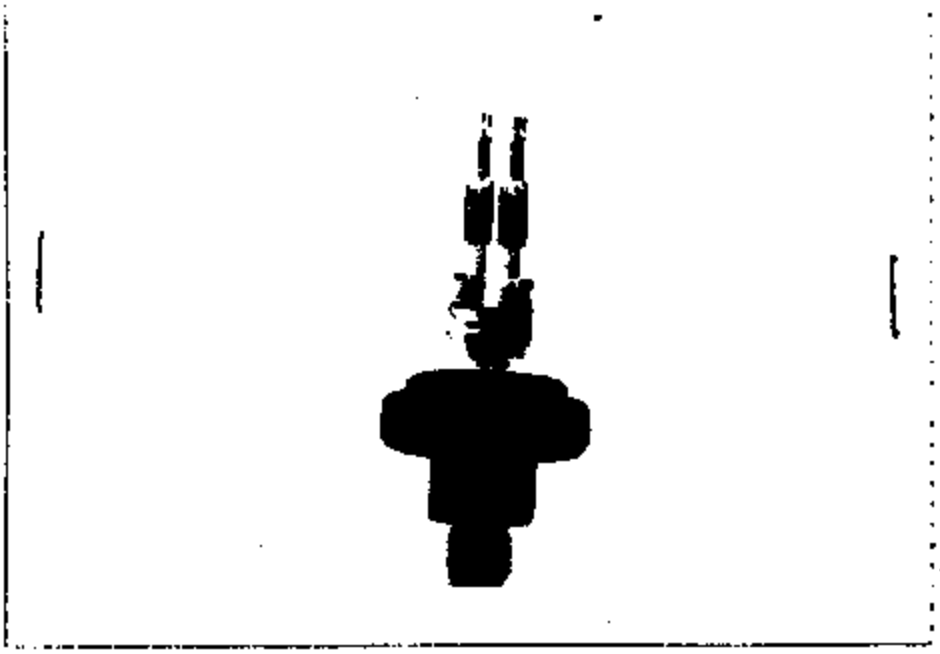
Snap Disc Good - Shows evidence of cycling

Washer Good - Clean

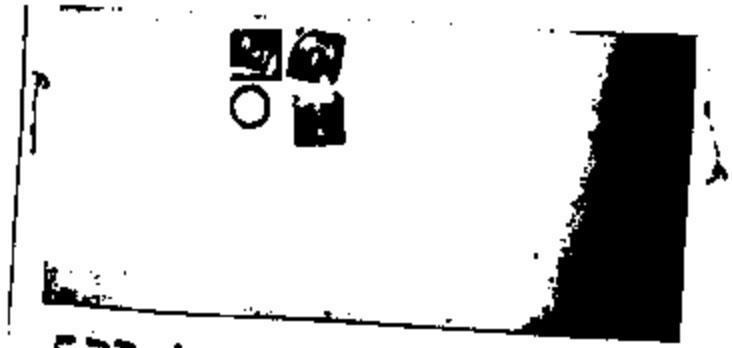
Converter Good - Clean

Hex port Internal Some Corrosion





F77-1



F77-1

Full Test Stopped Due to water Damage

Kapton ONly

Ford 77Ps Recovered Parts Analysis

Make Mercury

Model Grand Marquis

Year 1992

Date Recovered 1-20-99

Recovery Location Sylvia's Auto Parts

Mileage T.M.U.

TI Test # F77-7 V F2VC9F924 AB 2052

Technician LEC

Date Tested 1-25-99

Device Photograph
Attached

Kapton Photograph
Attached

Device OPEN to Elements - Does not work

Tested with connector from F77-5 Device

TI-NHTSA 9594

Actuation	Release	M.V.D.
✓	✓	.30 @ 12ma 0- PSI

Ford 77PS Issue Recovered Parts Analysis

External switch condition Good - Little red Rust - most plating visible - Partial Corrosion on mating surface of seal Clean

Remove Connector — NO CONNECTOR WIRES Remove from case

Terminal Condition Corrosion shown on terminals Due to pressure from connector

Switch Pocket Clean

Remove Crimp Ring

Contact Assembly Water Damage

Sensor Assembly Water Damage

Transfer Pin Shows Normal wear

Environmental Seal Intact

Disassemble Sensor

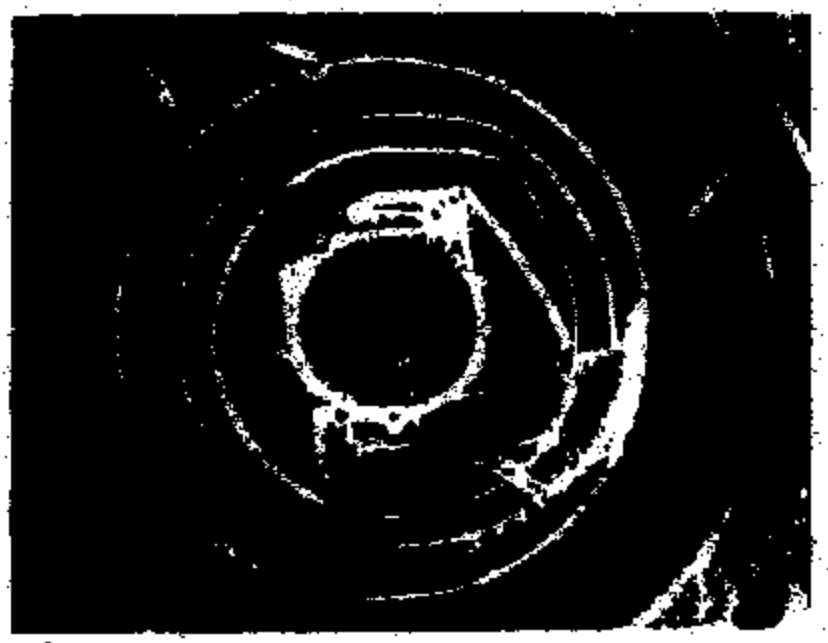
Kapton Condition Starting to show initial signs of De-lamination

Snap Disc Water Damage

Washer Water Damage

Converter Water Damage

Hex port Internal Slight Corrosion



F77-7

Ford 77Ps Recovered Parts Analysis

Make MERCURY

Model GRAND MARQUIS

Year 1992

Date Recovered 1-20-99

Recovery Location Sylvia's Auto Parts

Mileage 54,691

TI Test # F77-6 F2VC9F924 AB 1347

Technician KFC

Date Tested 1-26-99

Device Photograph
ATTACHED

Kapton Photograph
Attached

ACTUATION 112.5

Release 61.7

M.V.D. .25 mv @ 12 mA

TI-NHTSA 9597

Ford 77PS Issue Recovered Parts Analysis

External switch condition Good - RED Ret on hex and Metric Down Threads - Connector Clean - mating surface Good

Remove Connector

Terminal Condition Clean - no Corrosion - Slight mis-alignment of Terminals

Switch Pocket Clean -

Remove Crimp Ring

Contact Assembly Good - NO ARCING or discoloration Shows normal wear

Sensor Assembly Corrosion UP SIDE UNDER CRIMP RING

Transfer Pin Good - Shows normal wear

Environmental Seal Good -

Disassemble Sensor

Kapton Condition CRACKS And/or Delamination on 1st Layer
2- Normal wear
3- Normal wear

Snap Disc Normal wear

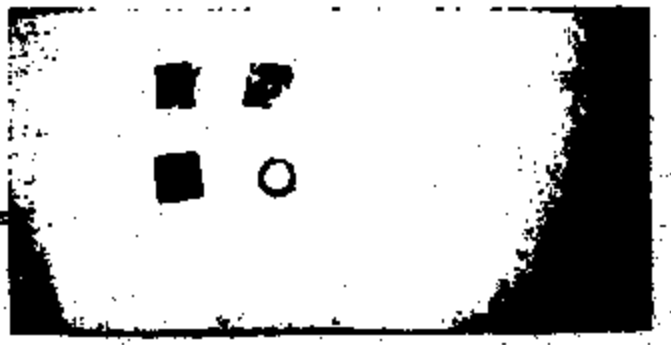
Washer Normal wear

Converter Good - normal wear

Hex port Internal Some Sludge And Corrosion

F77-6

F77-6



Ford 77Ps Recovered Parts Analysis

Make LINCOLN

Model TOWN CAR

Year 1992

Date Recovered 1-20-99

Recovery Location Covette Auto Parts STK# 9072

Mileage T.M.U.

TI Test # F77-S F2VC9F924 AB 1341

Technician [illegible]

Date Tested 1-25-99

Device Photograph
ATTACHED

Kapton Photograph
ATTACHED

TI-NHTSA 9601

ACTUATION
157.2

Release
79.6

M.V.D.
3.1 mv @ 12mA
0-PSI

Ford 77PS Issue Recovered Parts Analysis

External switch condition Fair - Red Rust on hex Port
No Corrosion on Crimp Ring - Partial Corrosion
Down Threads

Remove Connector

Terminal Condition Good - Clean No Fluids or Debris
No Corrosion - Good Allignment

Switch Pocket Clean - No Fluids or Contamination

Remove Crimp Ring

Contact Assembly Good - No Discoloration - No Pitting
Normal Wear

Sensor Assembly Slight Corrosion up side - overall
Good Condition

Transfer Pin Normal Wear

Environmental Seal Good

Disassemble Sensor

Kapton Condition 1- De-laminated with Fluid - not all the way Through
2- Normal
3- Normal

Snap Disc Good - Normal Wear

Washer Deformation in Button area - Causing Misshape in Kapton

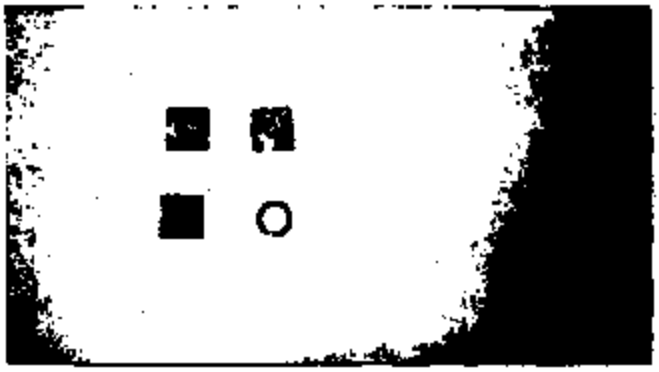
Converter Good - Normal Wear

Hex port Internal mild corrosion and Buildup Gasket good

F77-5

F77-5

F77-5



F77-5

Ford 77Ps Recovered Parts Analysis

Make Lincoln

Model Town Car

Year 1992

Date Recovered 1-20-99

Recovery Location Gayetti Auto Parts STK# 4271

Mileage T.M.U

TI Test # F77-4 F2VC5F924 AB 2079

Technician LCC

Date Tested 1-25-99

Device Photograph
Attached

Kapton Photograph
ATTACHED

ACTUATION
149.6

RELEASE
77.8

M.V.D.
4.23 mA. @ 12 mA
0 - PSI

Ford 77PS Issue Recovered Parts Analysis

External switch condition Red Rust on hex Port - Slight Amount On Crimp Ring - Seal Area good Some Debris on inlet Partial Corrosion Down Threads

Remove Connector

Terminal Condition Good - No Corrosion - Good Alignment

Switch Pocket Clean - No Fluid or Debris

Remove Crimp Ring

Contact Assembly Good - No Discoloration - Normal Wear & No Sign of Arcing

Sensor Assembly Corrosion up side and onto top Wear Pin Area

Transfer Pin Good - Normal Wear

Environmental Seal Slight Lift From Sensor to Gasket From Rust Distorted Shape

Disassemble Sensor

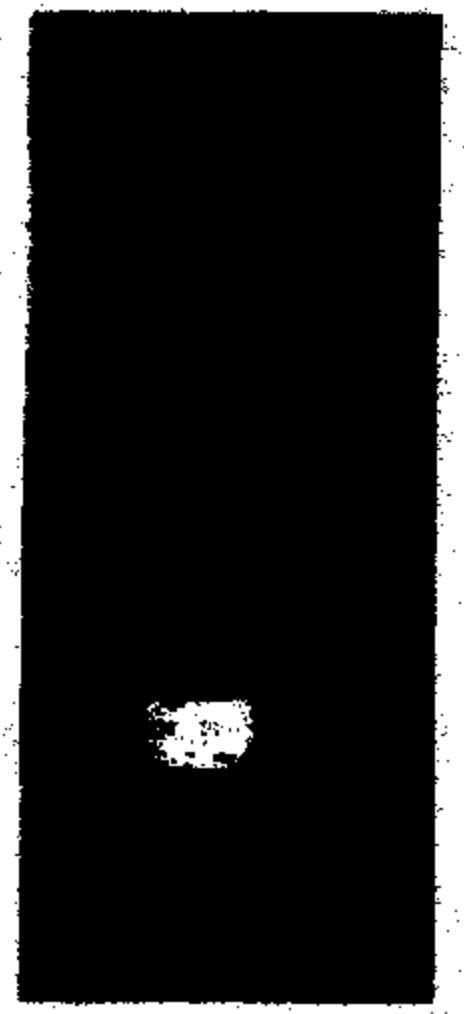
Kapton Condition Print From Gasket Mark on Kapton
1- Delamination Seen 2- Normal Wear - Dry
3- Normal Wear - Dry

Snap Disc Normal Wear Shows Sign of Cycling

Washer Normal Wear

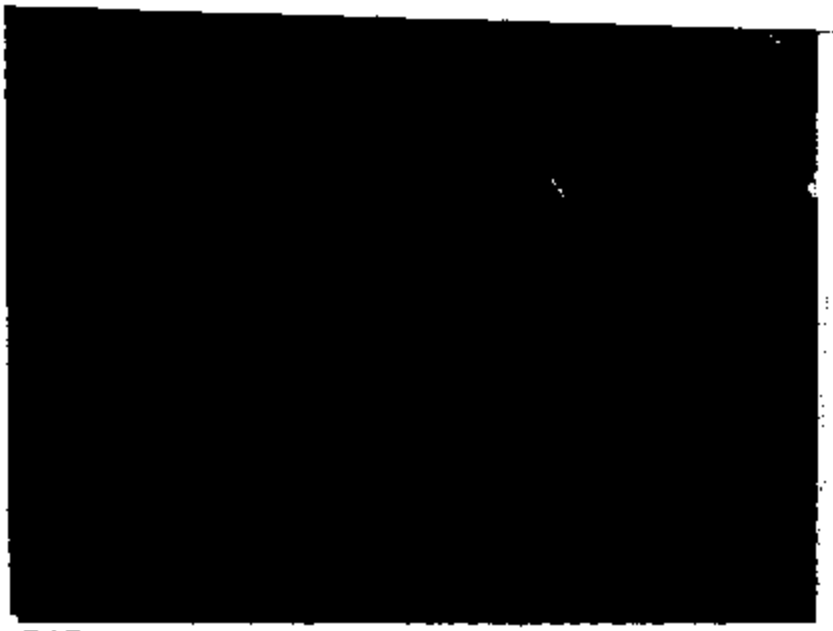
Converter Normal Wear

Hex port Internal Slight Contamination - Debris



F77-9

F77-1



F77-1

Ford 77Ps Recovered Parts Analysis

Make MERCURY

Model GRAND MARQUIS

Year 1992

Date Recovered 1-20-99

Recovery Location HANK ZION'S

Mileage 102,241

TI Test # F77-2 DEVICE # F2VC9F524 AB 3167

Technician LCC

Date Tested 1-22-99

Device Photograph

ATTACHED BACK PAGE

Kapton Photograph

ATTACHED BACK PAGE

INCISION 41.7

RELEASE GTC

MVD

Ford 77PS Issue Recovered Parts Analysis

External switch condition Four - Corrosion on hex and Partially Dimmed Threads and Crimp Ring - Seal Area Good No Contamination seen on inlet of Device

Remove Connector

Terminal Condition Clean No Corrosion - Good Alignment

Switch Pocket Clean - No Fluid or Dust

Remove Crimp Ring

Contact Assembly Good condition - No Sign of Arcing or Short - No heat Discoloration

Sensor Assembly Corrosion to seal - no RED Rust

Transfer Pin Good Shows Normal wear

Environmental Seal Good

Disassemble Sensor

Kapton Condition 1. Fluid side - Shows Delamination of Kapton - Cracks
2. Middle - Normal wear - Dry shows no Seepage
3. Washer side - Good - Normal wear -

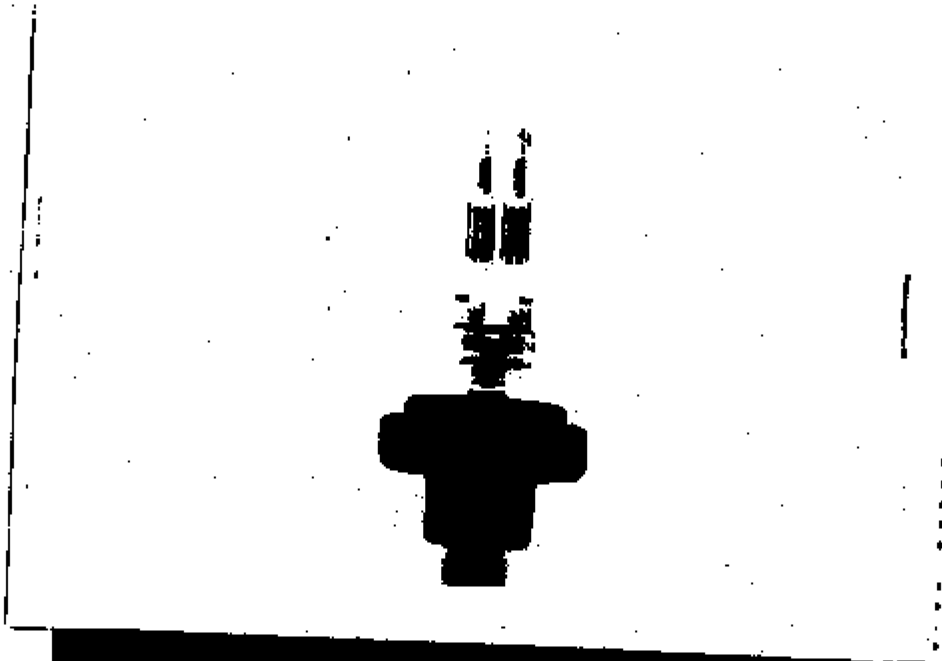
Snap Disc Good - Shows Evidence of Cycling - Dust

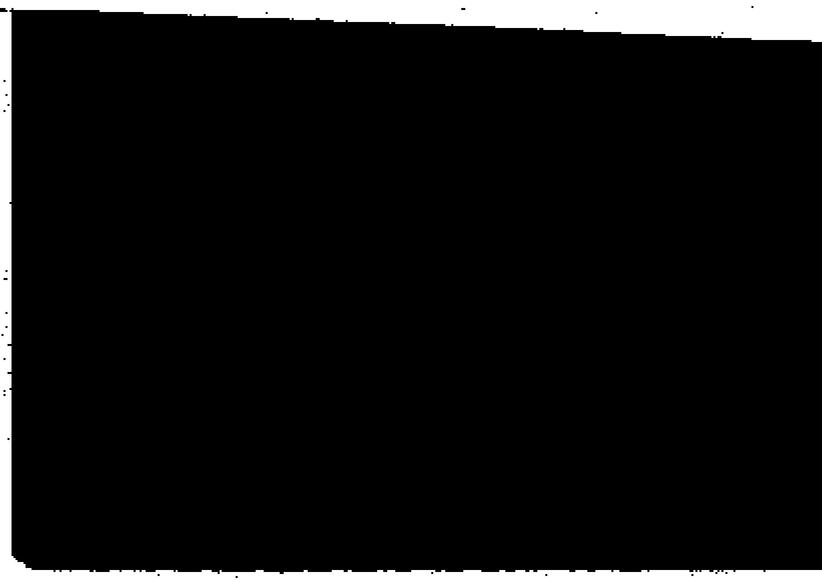
Washer Good - Shows Evidence of Cycling - Dust

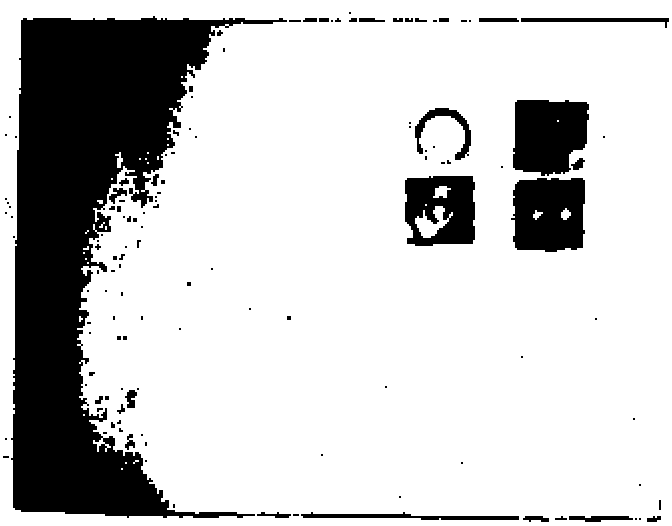
Converter Good - Visible Contact good

Hex port Internal Light Amount of Debris - Gasket Good

TI-NHTSA 9810







Ford 77Ps Recovered Parts Analysis

Make FORD

Model CROWN VICTORIA

Year 1992

Date Recovered 1-20-99

Recovery Location HANK ZION'S

Mileage TMU

TI Test # F77-3 F2VC9F924 NB 1330

Technician EEC

Date Tested 1-22-99

Device Photograph
ATTACHED TO BACK

Kapton Photograph
ATTACHED TO BACK

TI-NHTSA 9613

ACTUATION 121.6

Release 61.8

M.V.D.
.13 MV @ 12 MA LOAD
0 PSI

Ford 77PS Issue Recovered Parts Analysis

External switch condition Fair - Red Rust Showing on Hex Port - Typical Dust + oil Buildup - Light Corrosion on Heads Seal Surface Good - Bulge on Crimp Ring Near Hexport Side

Remove Connector

Terminal Condition Good - No Corrosion - Good Alignment

Switch Pocket Clean / DRY

Remove Crimp Ring

Contact Assembly Good - No Debris or Fluids - Contacts Show Normal Wear - No Discoloration - No Pitting of Contact Area

Sensor Assembly External Corrosion - Heavy Deposits Between Sensor + Base - Internal Area Clean + DRY

Transfer Pin Normal Wear -

Environmental Seal Good Condition, Slight Ingress of Corrosion

Disassemble Sensor

Kapton Condition Layer 1 - Delaminated Kapton Fluid Penetration
Layer - 2 - Starting to Delaminate -
Layer - 3 - Normal Wear - No Delamination

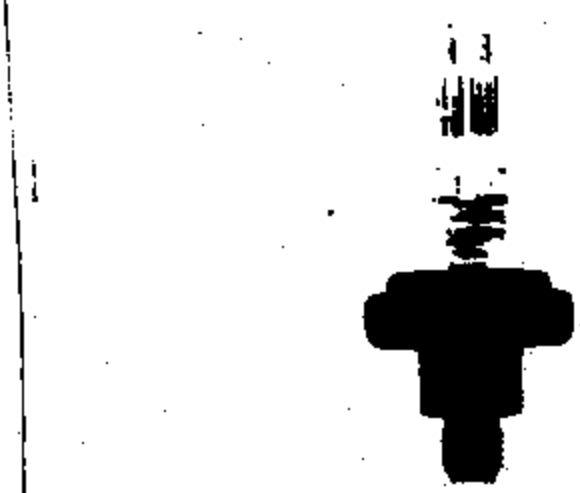
Snap Disc Good - Normal Wear

Washer Good - Normal Wear

Converter Good - Normal Wear

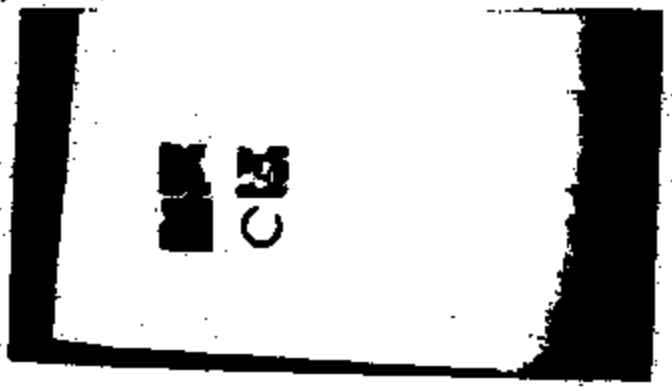
Hex port Internal Gasket Good - Some Internal Corrosion

F 77-3



F77-2

F77-3



F77-3

Kill, Beth

From: Kill, Beth
Sent: Friday, January 08, 1999 3:15 PM
To: Dague, Bryan
Cc: Hopkins, Al
Subject: T&L # 150709, Fluid Identification

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

Results:
First, I rinsed the cap, excluding the transfer pin hole, with chloroform. I filtered the mixture to remove the solids, and then evaporated the solvent. The remaining residue was identified as brake fluid by FT-IR spectroscopy. The match factor was 69% compared to a reference sample of Nissan brake fluid in my database. Visual comparison of the Nissan fluid to the sample suggests the fluid from the sample contains less water. This may be due to slightly different formulations produced by different manufacturers.

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

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

Regards,

Beth

Ext. 3069 MB 10-16 Fax 1670

TECHNICAL SERVICE LABS

TEST NO. 150709

LOG NO. _____

TEST NO. 150709

*PCC I.D.	127
REQUESTOR COST CENTER	357
PRODUCT CODE	069
REQUESTOR	DAGUE
MAIL STATION	12-29
EXTENSION	3234
MSG ID	Dague
DATE SUBMITTED	1/7/99
DATE REQUIRED	1/7/99
NO. OF SAMPLES	1
COMPOSITION	

STATE YOUR PROBLEM/ SAMPLE DESCRIPTION

Failure Analysis of Returned switch.

INFORMATION DESIRED:

→ Try To determine the following:

① Did switch leak?
② signs of corrosion?
③ signs of arcing?
④ other signs of fire ignition?

REPORT OF RESULTS:

DATE RECEIVED _____ DATE OUT _____

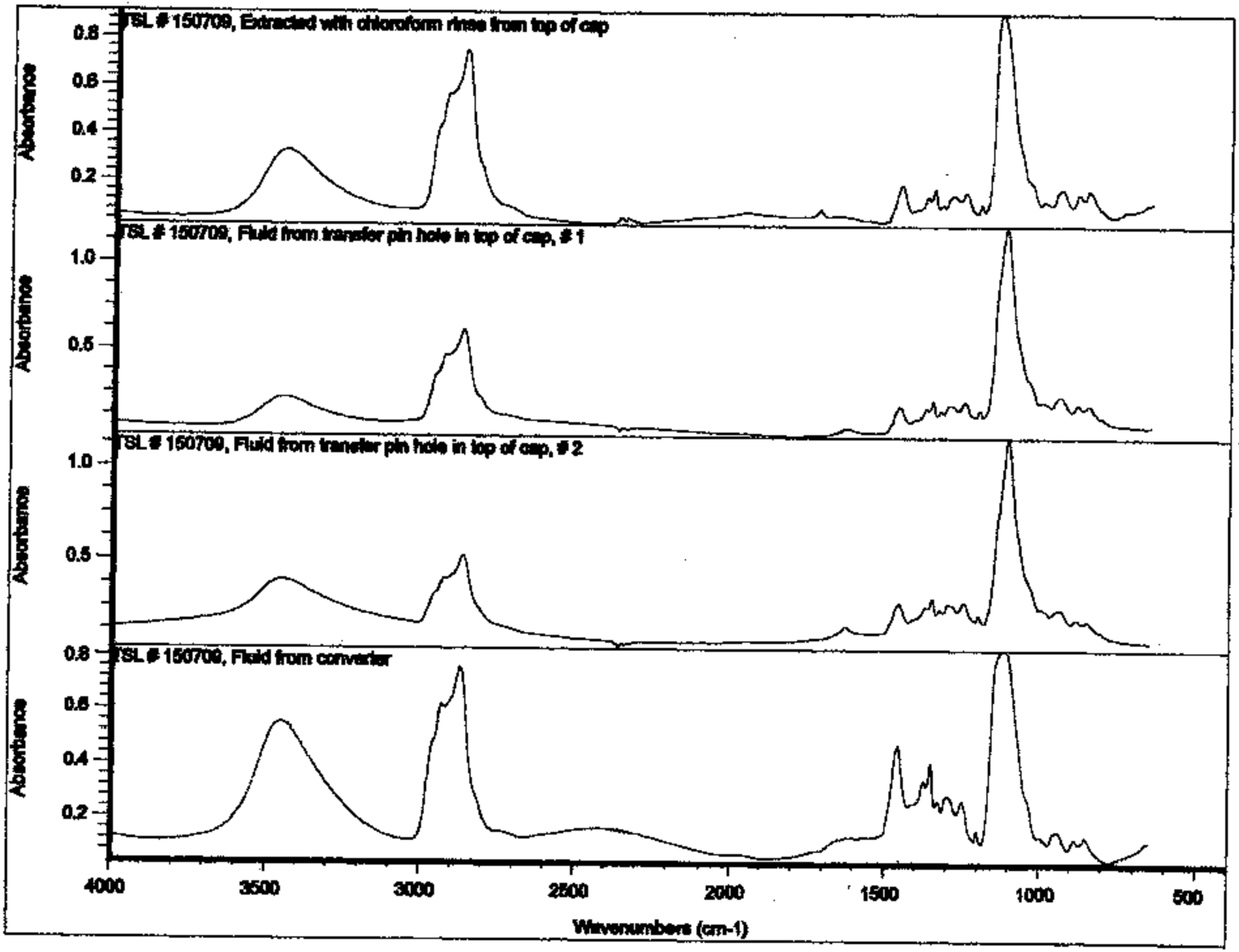
TECHNICIAN			
HOURS WORKED			
PROCEDURE USED			

*PCC I.D.

MC=325	TM=431	CLKE=122	FACIL=514
PC=127	WIRE=432	CAN=954	FACIL=521
VERS=166	EPD=621	AD DEV=286	FACIL=531
AFCC=483	PEP=622	EMCD=877	STAFF=855
IMD=430	CSD=635		

DISTRIBUTION: White and Yellow - Lab Pink - Requestor

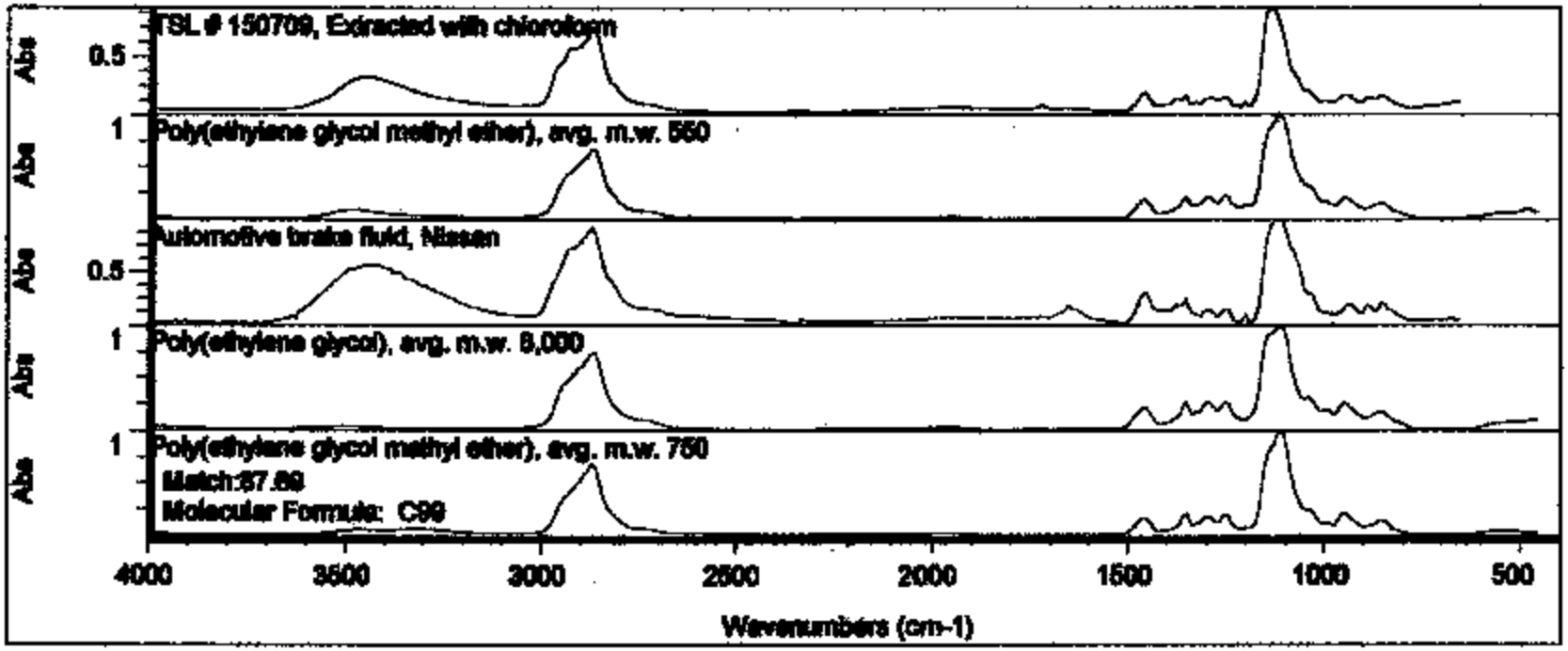
TI-NHTSA 9618



TI-NHTSA 9619

OMNIC Search

Spectrum: TSL # 150709, Extracted with chloroform
Fri Jan 08 11:18:42 1999
Region: 3995.85 649.98
Search type: Correlation
Comment:



Index	Match	Compound name	Library
10394	90.09	Poly(ethylene glycol methyl ether), avg.	Aldrich Condensed Phase
90	89.55	Automotive brake fluid, Nissan	TSL
10392	87.98	Poly(ethylene glycol), avg. m.w. 8,000	Aldrich Condensed Phase
10395	87.69	Poly(ethylene glycol methyl ether), avg.	Aldrich Condensed Phase
9540	87.10	Brij 99; Polyoxyethylene(20) oleyl ether	Aldrich Condensed Phase
9613	86.38	Brij 35; Polyoxyethylene(23) lauryl ethe	Aldrich Condensed Phase
9539	84.80	Brij 78; Polyoxyethylene(20) stearyl eth	Aldrich Condensed Phase
10393	83.20	Poly(ethylene glycol methyl ether), avg.	Aldrich Condensed Phase
9535	83.05	Tetraethylene glycol diethyl ether, 98%	Aldrich Condensed Phase
10388	82.99	Poly(ethylene glycol), avg. m.w. 600	Aldrich Condensed Phase

TL-NHTSA 0220

Epstein, Sally

From:	Hopkins, AL [ahopkins@email.mc.ti.com]
Sent:	Friday, January 15, 1999 5:08 PM
To:	Lincoln, Maureen
Cc:	Dague, Bryan; Proia, Stephen; McGuirk, Andy; Chura, Stephen; Pavao, Joe
Subject:	99-030: TSL # 150366: HIGH FALLOUT RATE ON ASSEMBLY LINE DUE TO N O-CONTINUITY: Status Report

OBJECTIVE:
Perform SEM analysis on Terminal 2 stationary contact to check for contamination.

RESULTS AND DISCUSSION:
The original samples were from a lot that was giving high fallout. I examined all the samples visually and only found one that gave indications to me that there was a significant amount of contamination present. SEM-EDX analysis of this sample showed mainly particles of the PPS plastic base and the glass fibers that are used to reinforce the plastic.

At this point I asked Maureen to send over some known failures. She sent over four samples and out of this group, one had a visible particle on the contact and another had a plastic fiber on it. We removed the large particle on the first sample and determined that it was again PPS. Do you want us to have the Chem Lab determine the identity of the plastic fiber on the second sample?

We also examined one of the devices that didn't have any optically detectable (by me) contamination on it. Again, we found that particles of the casing plastic and fragments of glass reinforcing fibers were the main constituents.

This is not to say that there weren't other species present on the above devices. We found sodium, chlorine, titanium, potassium, etc; the amounts, however, weren't large enough to explain the problem.

We will be looking at the last of this group of 4. Maureen, you also had sent over a base that was still attached to the brass hex; it didn't come apart easy. I don't know if I caused damage during my disassembly or if all those drill holes were the cause. Please let me know more about this particular sample. Also, could I have a schematic of the device?

The data was collected under the guidelines of TSL-5-71, Rev A which can be accessed at http://www-mod.mc.ti.com/tsl/. SEM-EDAX (Scanning Electron Microscope with Energy Dispersive Analysis of X-rays) analysis was used in the above described analysis. The data will be sent through the internal mail.

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

Dague, Bryan

From:	Hopkins, AL
Sent:	Wednesday, January 20, 1999 11:21 AM
To:	Dague, Bryan; Baumann, Russell
Cc:	McGuirk, Andrew; Andres, Amy
Subject:	99-033: TSL # 160706: ANALYSIS OF MATERIAL REMOVED FROM 77PS THERMAL EVENT

ATTORNEY-CLIENT PRIVILEGED COMMUNICATION

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

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

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

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

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

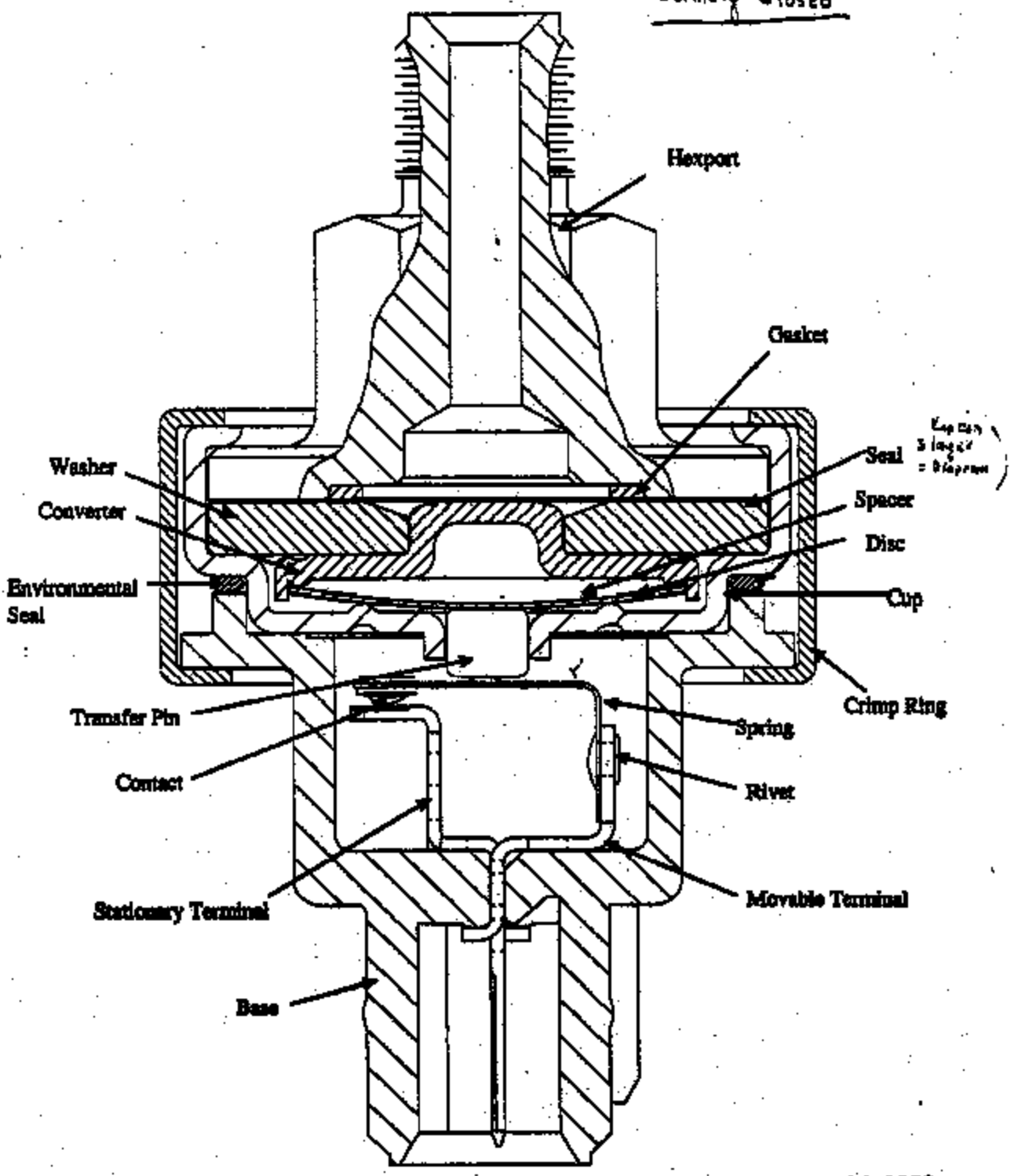
GREEN MATERIAL ON CUP: This material was similar to that found on the first sample although the amount of chrome was much less.

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

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

Hydraulic Pressure Switch Cross Section

Normally Closed



TI-NHTSA 0623

Hopkins, AL

From: Hopkins, AL
Sent: Wednesday, January 20, 1999 11:21 AM
To: Dague, Bryan; Baumann, Russ
Cc: McGuirk, Andy; Andres, Amy
Subject: 98-033: TSL # 150709: ANALYSIS OF MATERIAL REMOVED FROM 77PS THERMAL EVENT

ATTORNEY-CLIENT PRIVILEGED COMMUNICATION

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

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

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

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

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

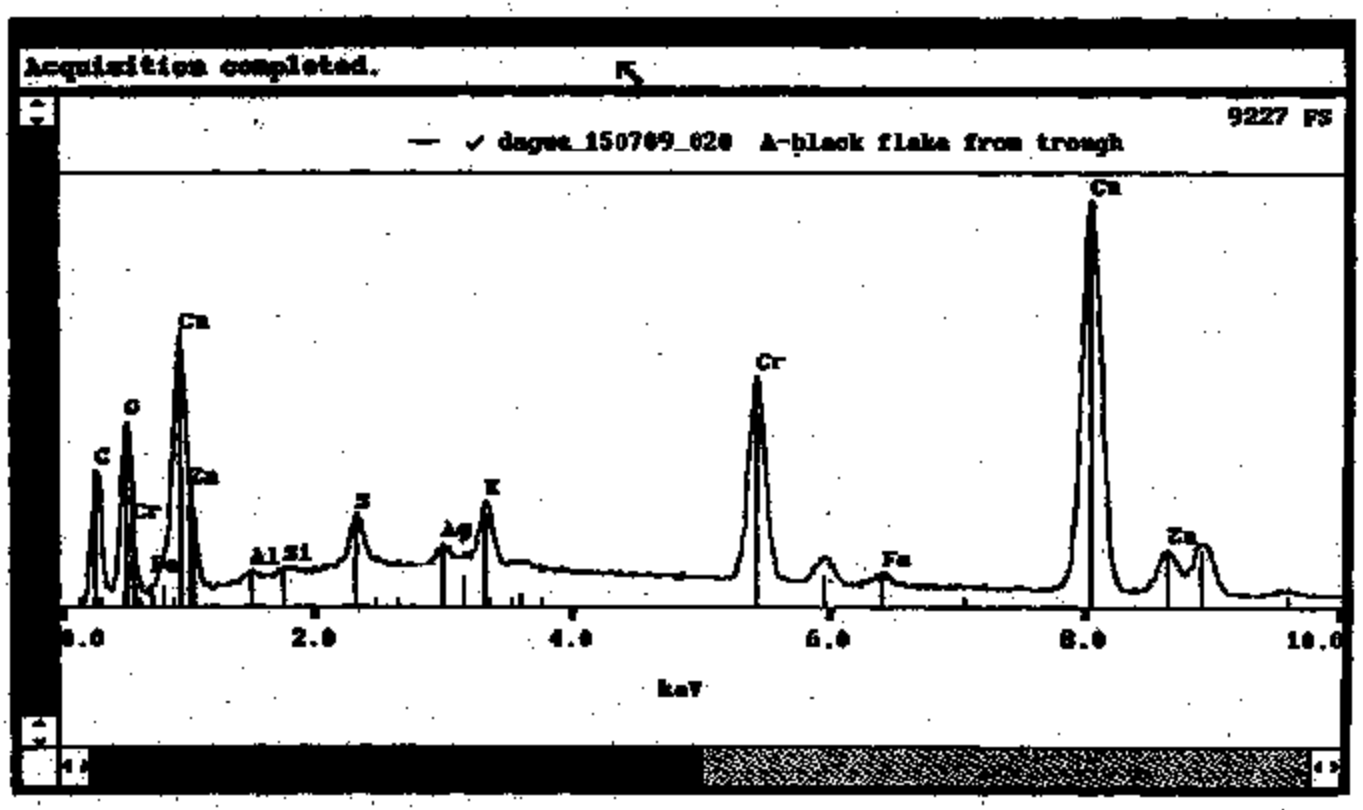
GREEN MATERIAL ON CUP: This material was similar to that found on the first sample although the amount of chrome was much less.

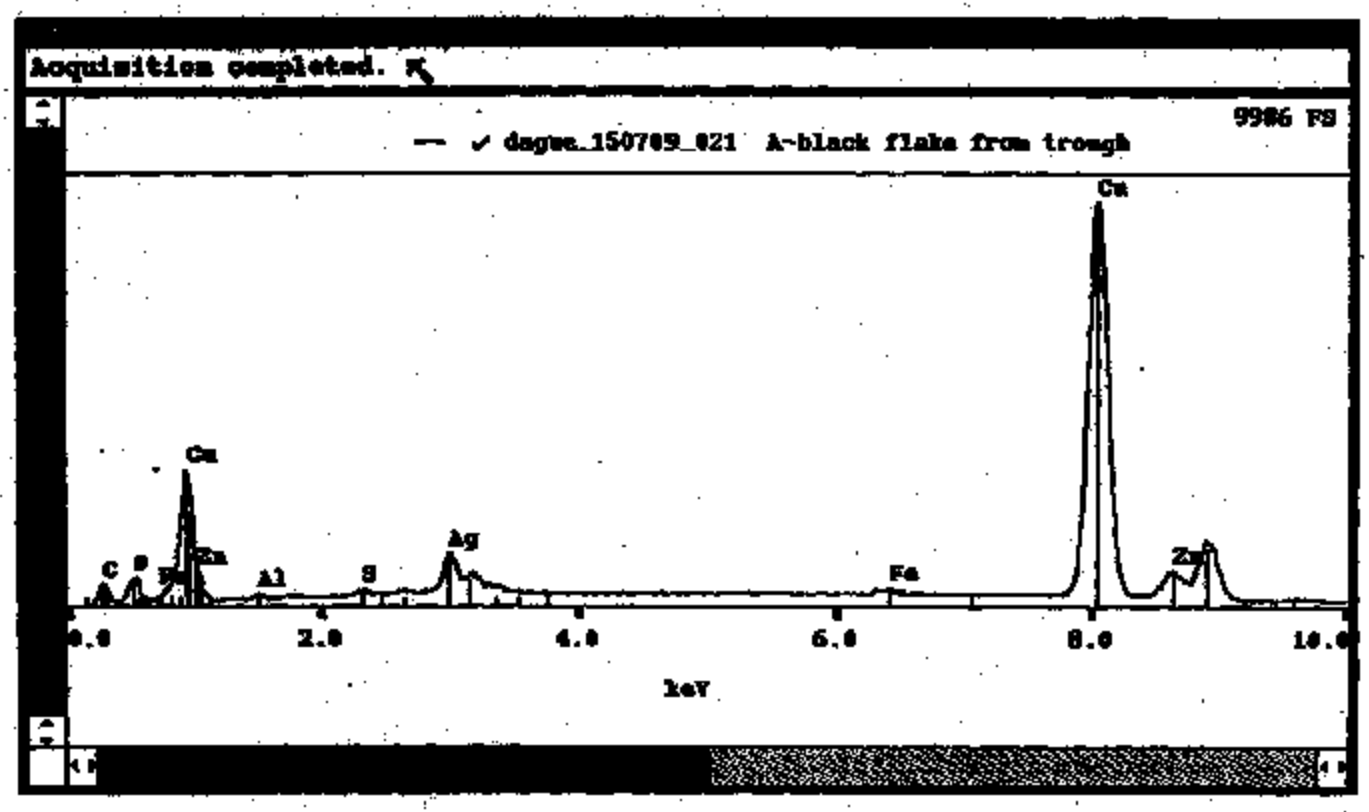
The data was collected under the guidelines of TSL-S-71, Rev A which can be accessed at http://www-mod.mc.ti.com/tsl/. SEM-EDX (Scanning Electron Microscope with Energy Dispersive Analysis of X-rays) analysis was used in the above described analysis. The data will be sent through the internal mail.

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

TL-NHTBA 9625

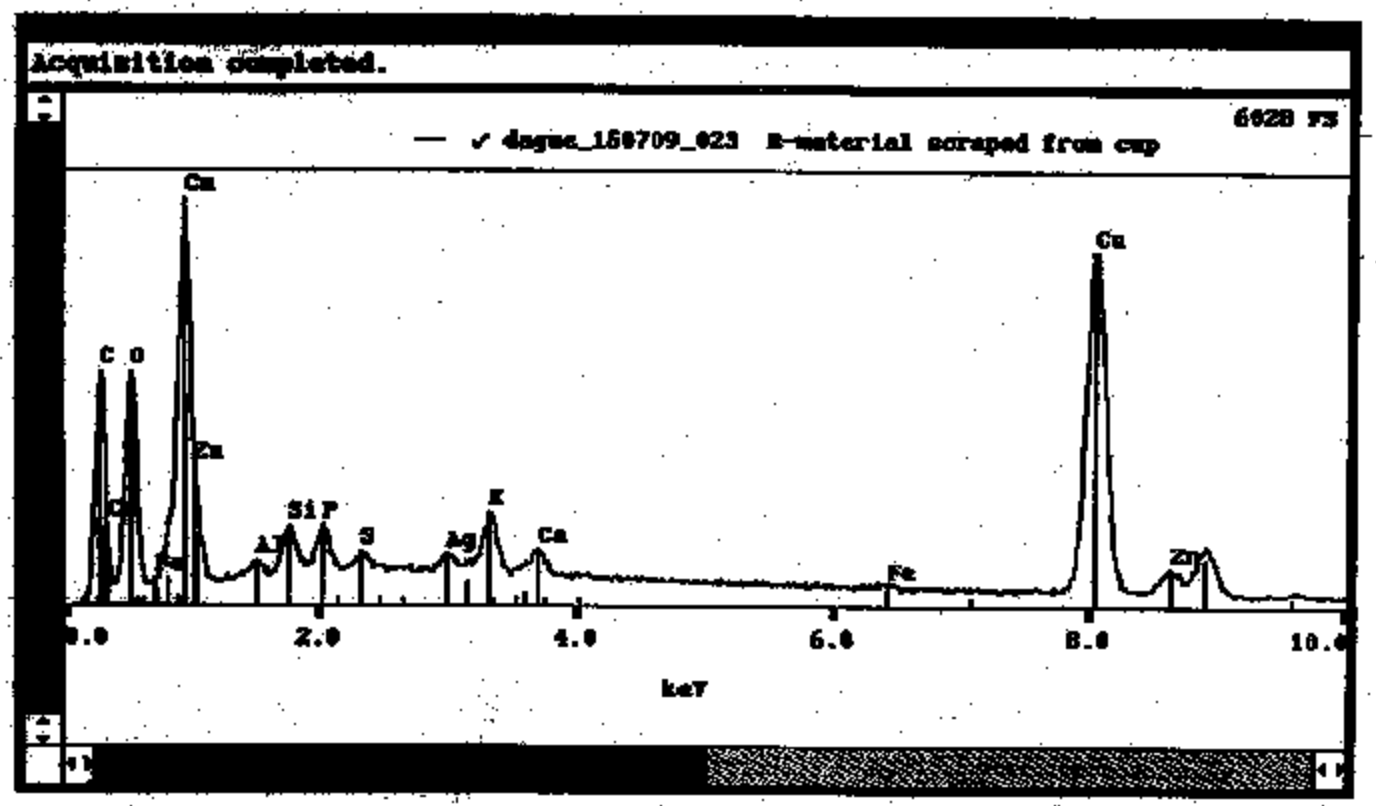
150709 A-black flake from trough, 50x base 20



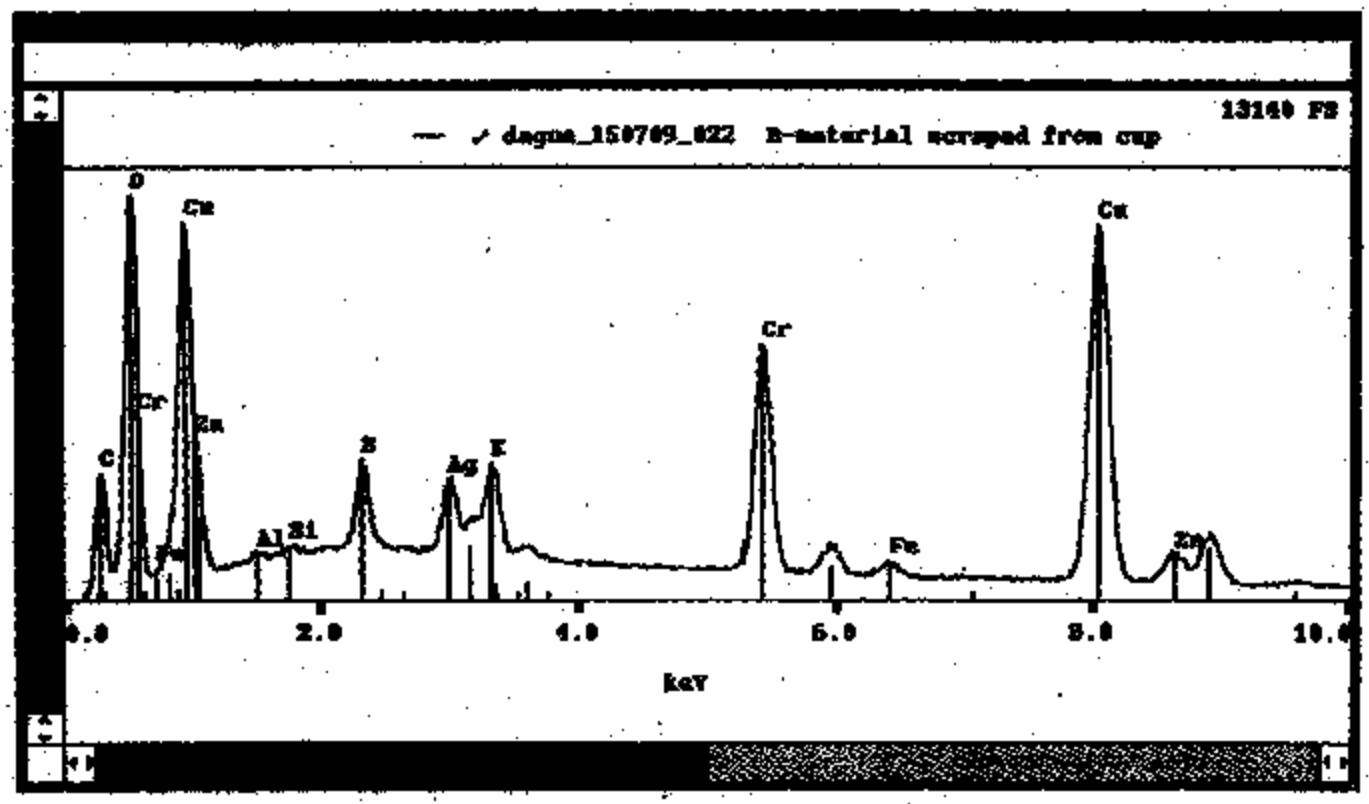


150709 B, material scraped from cup assembly, 50x bse 21

TI-NITSA 9028



THNHTBA 9628



TI-NITON 9630

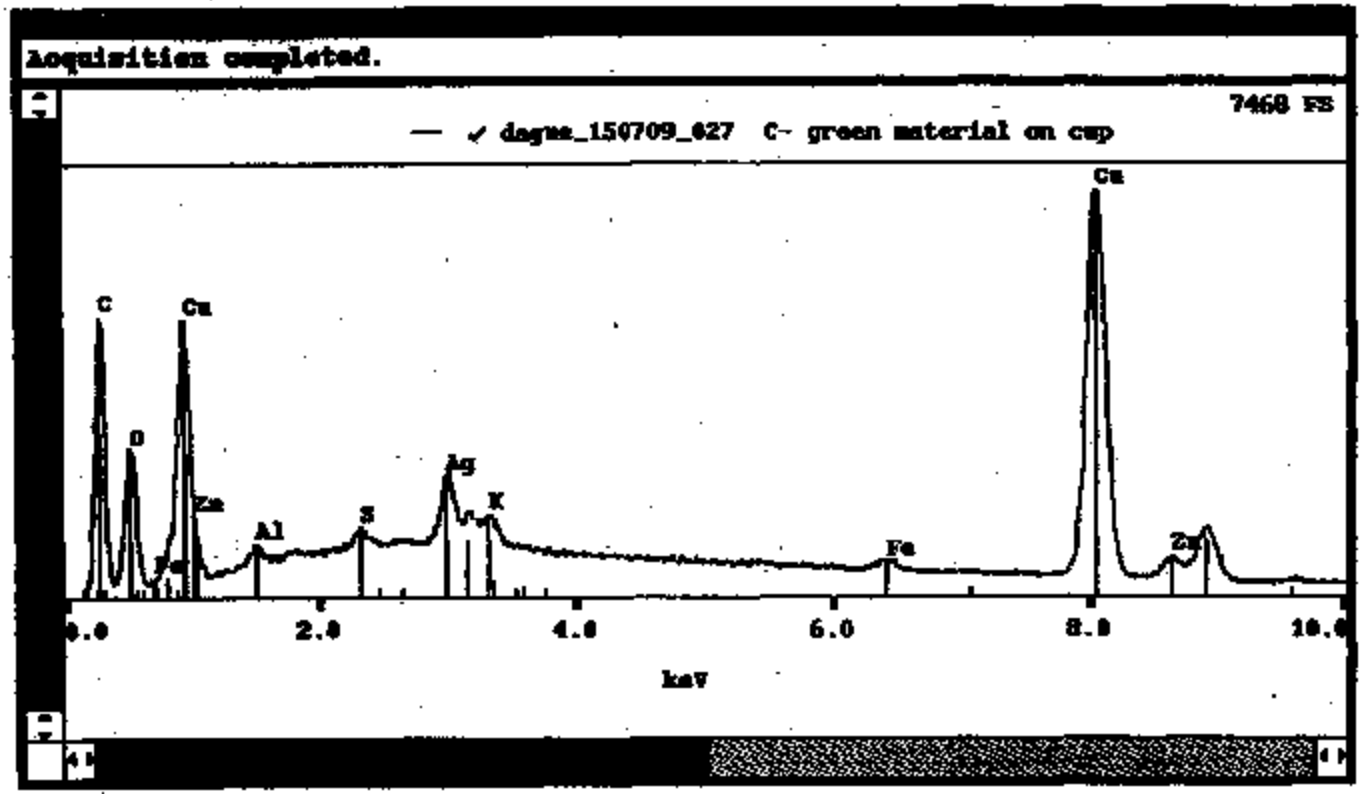
THNHTBA 9631

TI-NHTSA 9632

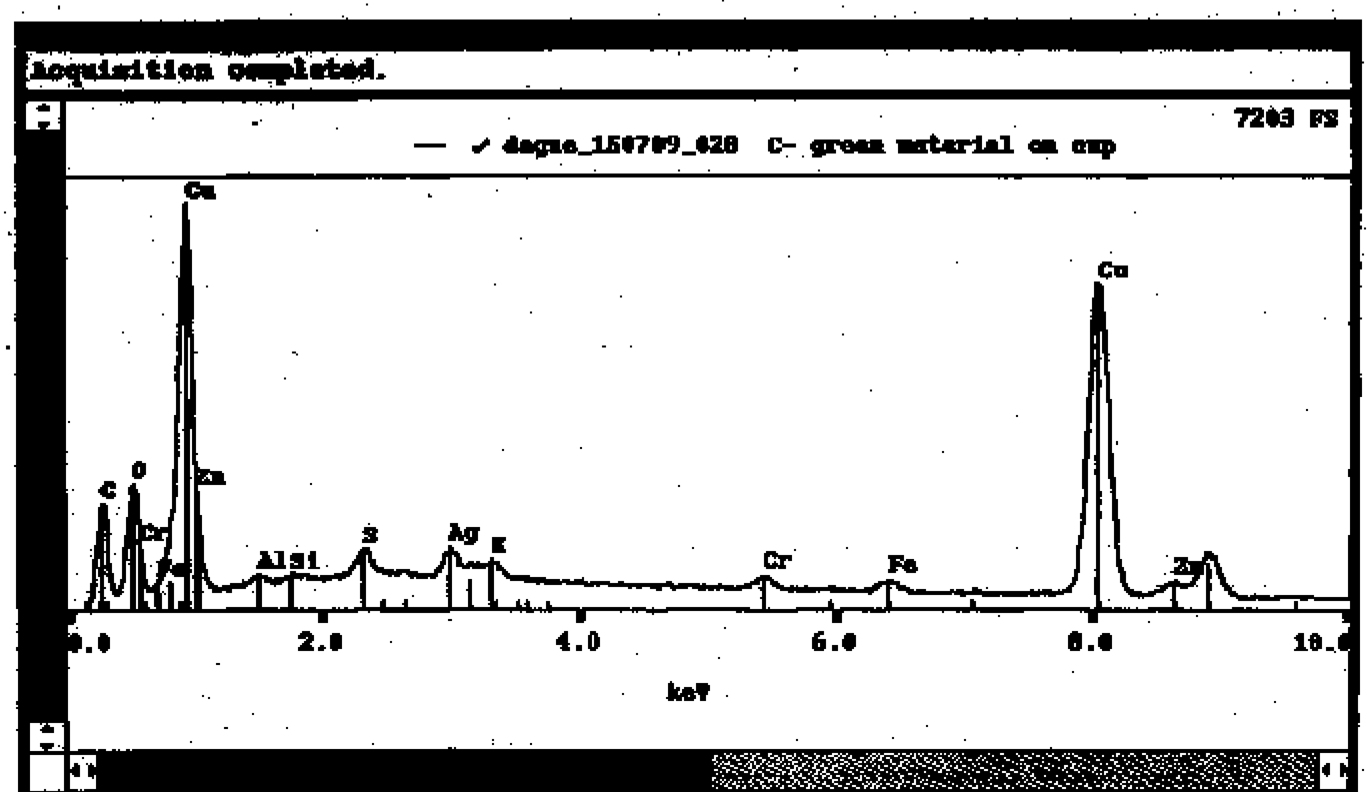
TI-MHTSA 9033

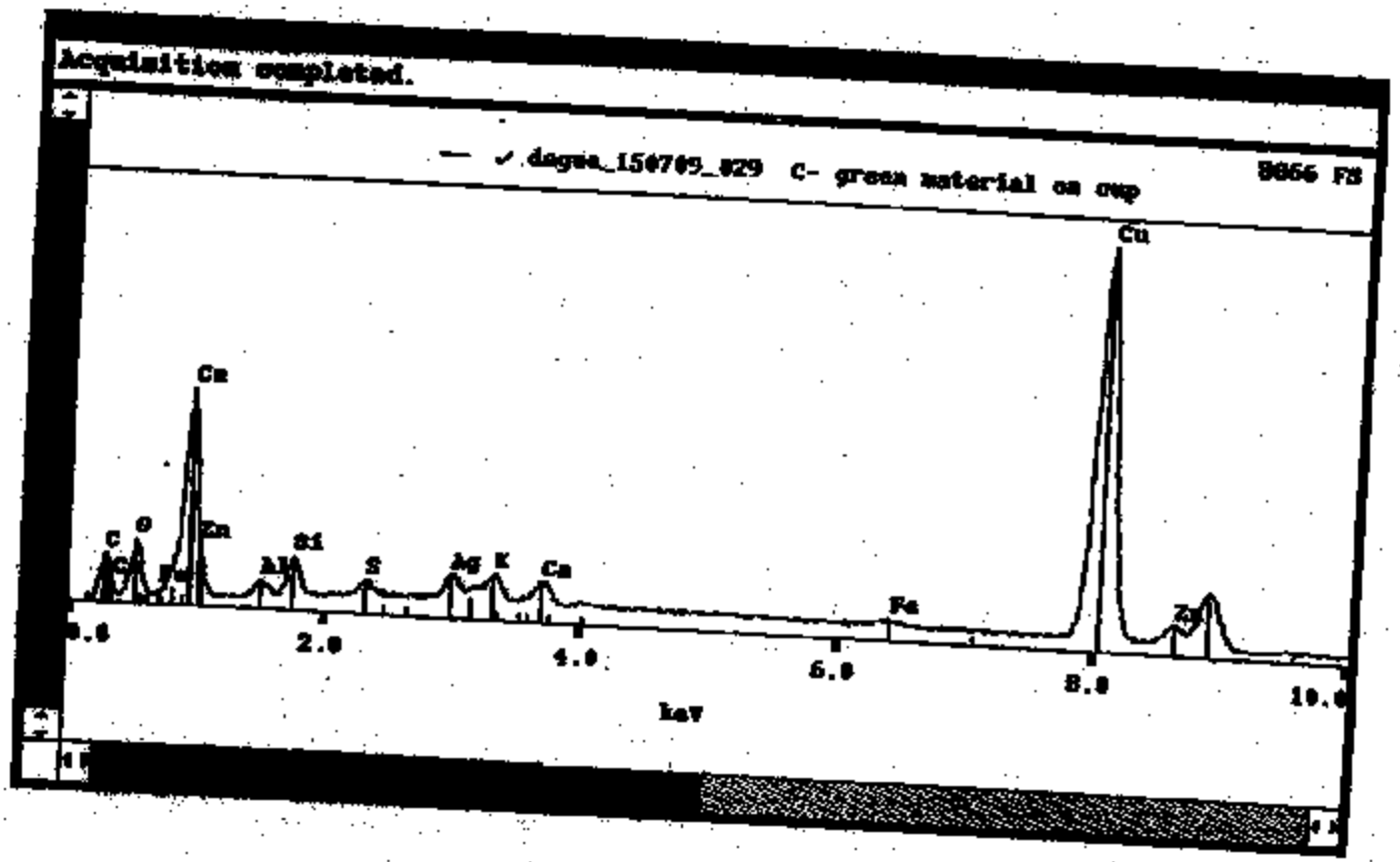
I50709 C, green material on cup, 50x bse 22

TI-NHTSA 0634



TL-NHISA 9635




Acquisition completed.
dagua_150705_029 C- green material on cup
9866 Fs
Cu
Cu
C
O
Zn
Si
Al
S
Ag
K
Ca
Fe
Cu
Zn
2.0
4.0
6.0
8.0
keV

TH-NTSA 0637

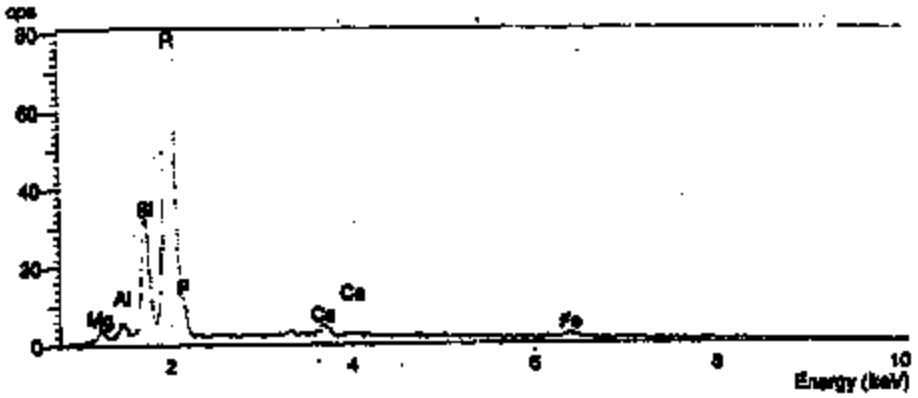


Figure 6: EDS X-ray spectrum of one of three samples of the white powder taken from the connector cavity below the wire seal.

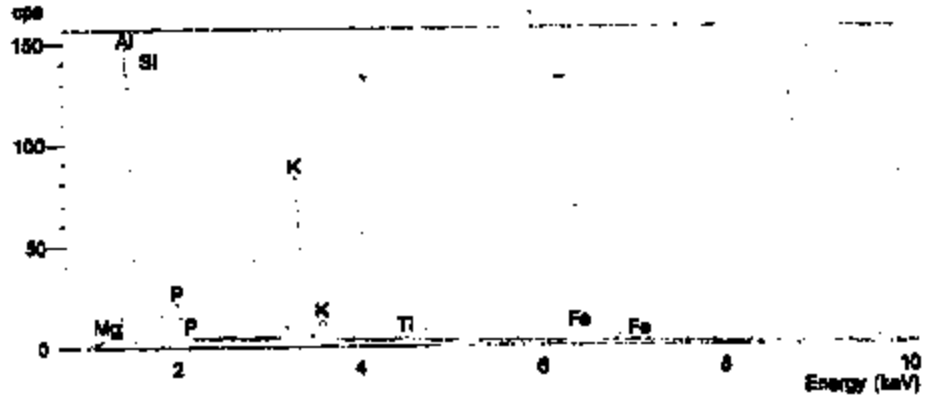


Figure 7: EDS X-ray spectrum of the second of three samples of the white powder.

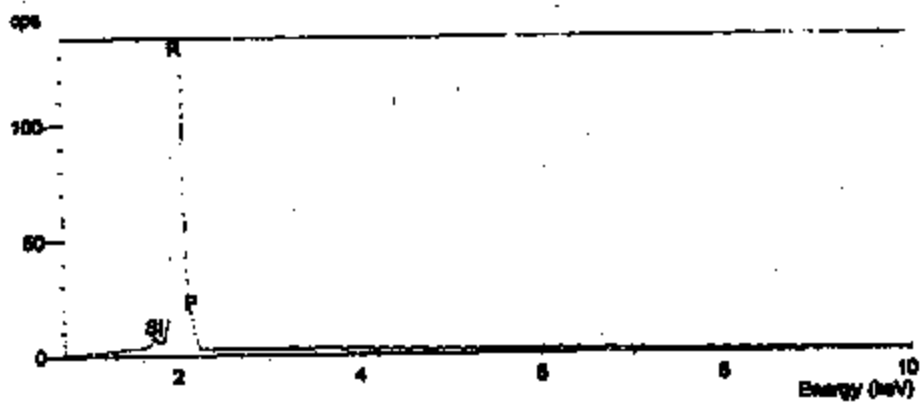


Figure 8: EDS X-ray spectrum of the third of three samples of the white powder.

Note: Nominal magnifications given for photomicrographs.

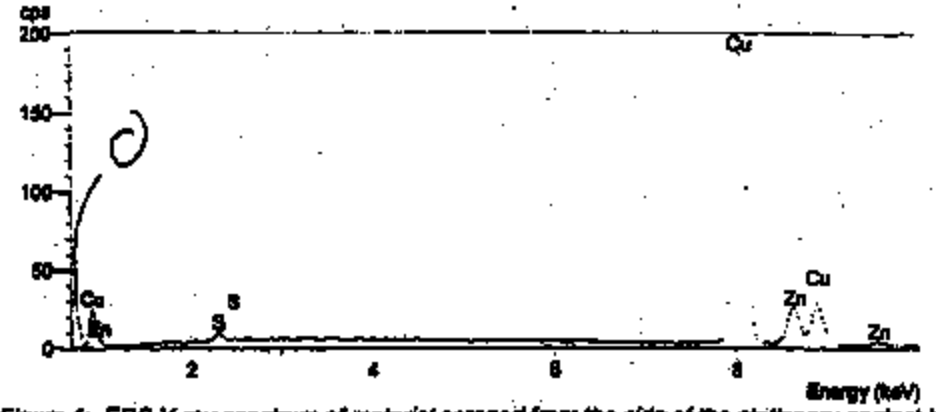


Figure 1: EDS X-ray spectrum of material scraped from the side of the stationary contact body.

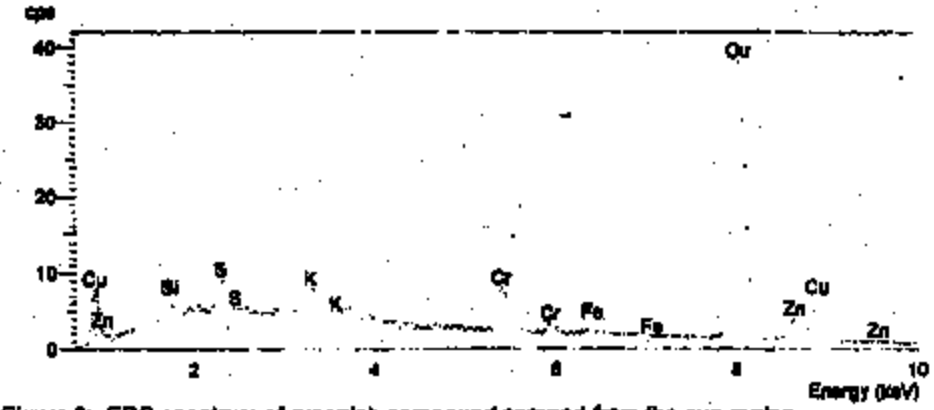


Figure 2: EDS spectrum of greenish compound scraped from the cup region.

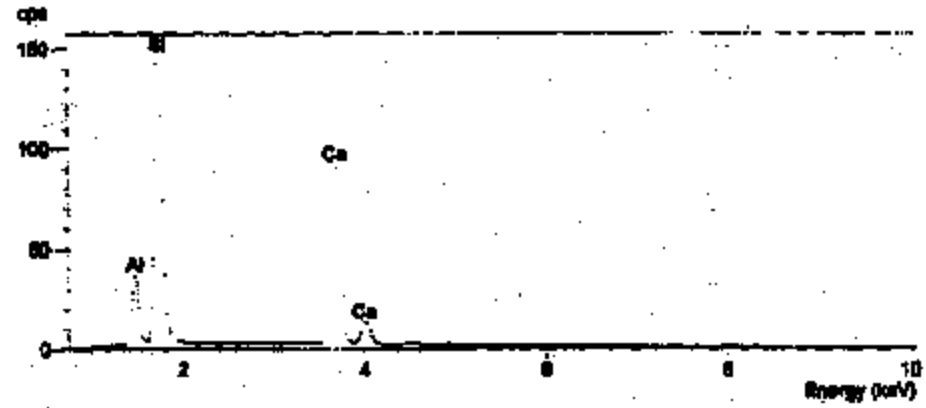


Figure 3: EDS X-ray spectrum of fibrous material scraped from the cup region.

Note: Nominal magnifications given for photomicrographs.

Post-it® Fax Note 7671	Date 2/5/99	# of pages ▶ 1
To Charlie Douglas	From Rob Sharpe	
Co./Dept. TI - Attleboro	Co.	
Phone # (508) 236-3657	Phone #	
Fax # (508) 236-1598	Fax #	

AS TO 92463656734 P.01/01

January 15, 1999

The cup is partially covered with a greenish residue. Residue appears to be primarily an oxide of the brass contact material with possibly a sulfur compound. This suggests transfer of oxide or corrosion product from the brass contacts to the cup.

The stationary contact exhibits intergranular cracks which indicate stress corrosion cracking (SCC). SCC is caused by combination of a specific corrosive environment and a sustained tensile stress (can be localized). Ammonia, ammonia compounds, sulfur compounds, and moisture are known to cause SCC in brass. The contact material has been reported to be 360 brass, which is highly susceptible to SCC.

The presence of brake fluid on the switch side of the diaphragm has been determined. Black residues in the fuse pod and on the cap, connector, and disc appear to be compounds which may have formed from a reaction between decomposition products (oxide) of the polyester base, the brake fluid, and metals in the switch. This suggests that the brake fluid was present on both sides of the diaphragm during the thermal event. BLACK RESIDUE BRAKE FLUID & AN EXPLOSIVE OR METAL

All three diaphragms exhibit what appears to be mechanical damage. The damage does not match up with any mating parts of the switch. This suggests that damage may have occurred prior to assembly. The diaphragm has become brittle and cracked in the vicinity of the damage. Brake fluid has become entrained between the layers (Teflon and capton) of the diaphragms.

The post of the movable contact melted back into the bulkhead between the switch and terminal cavities of the base. There is also arc damage (localized melting) to one corner of the bridge of the stationary contact. This damage appears fresh (surfaces bright and shiny) which suggests that it may have occurred in the later stages of the thermal event.

The terminals exhibit deposits which appear to be primarily sulfur compounds of the terminal material (tin plated brass). Although these deposits appear visually similar to the deposit found on the cup, they appear to be of different composition.

The white residue found in the connector cavity contains elements found in dry chemical fire extinguishers (Muscovite and phosphorus)

Steve LaRoucha

Ford Motor Company
77PS Style
Pressure Switches

 # Events - by year of return

Root Cause Analysis(Corrective Action Reports)

	1994	1995	1996	1997	1998	Total Events
Contaminated Terminals	0	0	0	0	1	1
Continuity Anomaly	1	0	0	1	0	2
Wrong Parts Shipped	0	0	3	3	0	6
Damaged Threads/ Hexport	0	5	1	0	0	6
Noisy Switch	0	0	1	0	0	1
Cracked Bases	0	0	1	0	0	1
Vacuum Dependancy	0	1	0	0	0	1
Device Leak	0	1	0	0	0	1
Incorrect Code	0	1	0	0	0	1
Low Release Calibration	0	1	0	0	0	1
(Total)	1	9	6	4	1	

Root Cause Analysis(Return Device Analysis)

	1994	1995	1996	1997	1998	
Failure Due To Customer	n/a	n/a	0	0	0	0
Contaminated Terminals	n/a	n/a	0	1	0	1
Trouble Not Found	n/a	n/a	0	1	3	4
Damaged Base	n/a	n/a	0	1	0	1
(Total)	n/a	n/a	0	3	3	

(n/a= not available)

Total 1994 Ford Motor (77PS) customer returns: 1

Total 1995 Ford Motor (77PS) customer returns: 9

Total 1996 Ford Motor (77PS)year to date customer returns: 6

Total 1997 Ford Motor (77PS) customer returns: 7

Total 1998 Ford Motor (77PS) customer returns: 4

Total 1999 Ford Motor (77PS) customer returns year to date: none

Prepared by Jim Watt 2/5/99

TI-NHTSA 9941

Graveline, Dora

From: Hopkins, AL
Sent: Thursday, February 11, 1999 1:58 PM
To: Dague, Bryan
Cc: Baumann, Russell
Subject: FW: TSL # 160709, Fluid Identification

This is the work that Beth had done to show that the fluid from the switch from the Lincoln Town car fire was almost certainly brake fluid.

Regards,

Al

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

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

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

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

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

Regards,

Beth

Ext. 3069 MS 10-16 Fax 1670

Epstein, Sally

From: DAGU%mimi@magic.itg.ti.com
Sent: Thursday, February 11, 1999 2:47 PM
To: Rahman, Aziz
Subject: FW: TSL # 150709, Fluid identification

-MSG MS= 985122 FR=DAGU TO=ZIZ SENT=02/11/99 02:39 PM TYPE=N
R#=067 ST=C DIV=0050 CC=00357 BY=DAGU AT=02/11/99 02:39 PM

To: Rahman <Rahman>
Aziz ZIZ ZIZ

From: "Dague, Bryan" <bdague@smail.mc.ti.com>

Subj: FW: TSL # 150709, Fluid identification

From: Hopkins, AL
Sent: Thursday, February 11, 1999 1:58 PM
To: Dague, Bryan
Cc: Baumann, Russell
Subject: FW: TSL # 150709, Fluid identification

This is the work that Beth had done to show that the fluid from the switch from the Lincoln Town car fire was almost certainly brake fluid.

Regards,

Al

From: Kill, Beth
Sent: Friday, January 08, 1999 3:15 PM
To: Dague, Bryan
Cc: Hopkins, Al
Subject: TSL # 150709, Fluid identification

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

Results:
First, I rinsed the cap, excluding the transfer pin hole, with chloroform. I filtered the mixture to remove the solids, and then evaporated the solvent. The remaining residue was identified as brake fluid by FT-IR spectroscopy. The match factor was 69% compared to a reference sample of Nissan brake fluid in my database. Visual comparison of the Nissan fluid to the sample suggests the fluid from the sample contains less water. This may be due to slightly different formulations produced by different manufacturers.

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

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

Regards,

Beth
Ext. 3069 MS 10-16 Fax 1670

Epstein, Sally

From: Beringhause, Steven [sberinghause@email.mc.tl.com]
Sent: Wednesday, February 17, 1999 6:45 AM
To: Rahman, Aziz
Subject: FW: 98-005: PROPOSED PROTOCOL FOR DISASSEMBLY AND ANALYSIS OF SWI TCH FROM 77PS FROM LINCOLN TOWN CAR

Aziz,
Here was Al's first pass proposal. I am not sure if the final process changed. I will find out today, but I do not think it did. Bryan is not in yet, my guess is he is still sick. I will follow up with Al or Bryan at home.

Steve

PROPOSED PROTOCOL FOR DISASSEMBLY AND ANALYSIS OF SWITCH FROM 77PS FROM LINCOLN TOWN CAR

* Review Ford's Analysis data that they are bringing in.
* Examine threads and determine if it is OK to just chase the threads to get a good seal or should we remove material for analysis.
* Pressure Leak Test the device (15 minute static-hold, air-pressurized test).
* Decide if we should remove any material or try any other analysis before we start disassembling the device.
* Do a practice decap using the below procedure on a deliberately fractured part (to mimic the condition that the returned device will be in) before performing it on the real sample. Bryan, you and I could do this now.
* Procedure to remove aluminum crimp ring
* Use aluminum foil (or plastic if Ford prefers) to mask the analysis surface.
* Also create a paper/tape shield to further reduce chance of contamination during cutting of crimp ring.
* Place a piece of tape over the area to be cut.
* Cut crimp ring using jewelers saw or Dremel cutoff wheel in one of the two areas indicated on optical photo.
* Cut corners of ring at 180 degree orientation
* Unfold crimp ring
* Optically examine revealed surfaces. Take optical photographs (Digital camera with macro lens plus instant microphotography) and document observations where appropriate. Examine the following areas
  * Inside surface of crimp ring.
  * Seal area and underside of base
  * Top of cap
* Start SEM-EDX (Scanning Electron Microscope with Energy Dispersive Analysis of X-rays) analysis on the inside of the ring and on various surfaces of the plastic base.
* Reprotect the top surface and remove the cap. Bryan had originally suggested just using an end mill to remove the cap. I wouldn't, however, go all the way through with the end mill. I would leave some material behind as a shield. I would suggest then bending the cap off.
* Optically document all revealed surfaces starting with cap.
* Meanwhile, start SEM-EDX analysis on top side of cap. Particularly focus in on the edges of the ceramic pin guide and on the indented ring that lines up with interior wall of the switch cavity. Particularly look for evidence of corrosion or arcing.
* Decide if we should try to flake off any of the overlaying debris to try to examine the underlying metal surface.
* Proceed to perform SEM-EDX analysis on other component surfaces revealed by removal of cap.
* Non-destructively probe inside of the grommet to determine its resilience which will give us an indication of the temperature that it saw. Another indication might be the depth of the indentations left by the grommet seal rings in the wire.
* Decide if it makes sense to further examine the mating connector or grommet seal.

Regards,

Al

Hopkins, AL

From: Hopkins, AL
Sent: Wednesday, April 14, 1999 9:48 AM
To: 'FORD- Rock Carter'
Subject: Electronic Image Versions of Photos that had been Faxed on 4/13/99

Rock,

This is the text of the FAX that I sent you yesterday. The Fax was acting up yesterday so I had to send it in three separate pieces. You should have pages 1-41.

Rock, this data was accumulated while Ford Engineering was present. They took copies of this data and all the actual parts of the sample. They had, however, left the small amounts of debris for our Chem Lab to perform FT/IR analysis to check if there was brake fluid present. In fact, the FT/IR analysis showed that this was the case.

As you know, we subsequently were requested to send this small amount of debris (wrapped in aluminum foil) back to Ford. I would think that it would be much more useful to examine the actual switch itself.

In any case, this is the key to the data. I am going to try to E-mail you the photos electronically tomorrow. If you have any questions, feel free to call me at 508-236-3040.

Sample	Pages	Photos	Spectra
Top Surf of Cup After Degreasing	1-14	01-05	001-009
Terminal Cavity after Disassembly	15-28	06-15	010-013
"A" -Black Flake from Trough	29-31	20	020-021
"B" - Material Scraped from Cup Assembly	32-37	21	022-026
"C" - Green Material on Cup	38-41	22	027-029

The following images are Windows PCX bit maps. They don't have any annotation on them but you can probably read that off of the faxed copy. The last two digits on the file names are the photo numbers.

If you have any questions, feel free to call. There aren't many spectra from the Terminal Cavity After Disassembly

because I couldn't avoid shadowing without additional disassembly that Ford Engineering didn't want to do at the time.

Regards,

Al