EA02-025

TEXAS INSTRUMENTS, INC.'S 9/10/03 ATTACHMENT

REQUEST NO. 7

BOX 8

PART A-U

PART H

HILITE INDUSTRIES, INC.
1671 SOUTH BROADWAY
CARROLLTON, TX 75006
PHONE: (214) 242-2116 FAX: (214) 242-2902

TI: Req #1-8

NON-CONFORMING MATERIALS ADVISORY NOTICE

DATE: 1/12/95

HILITE DIVISON: ___ PITTS ___ MAPCO ✓ SURFACES

SUPPLIER: TEXAS INSTRUMENTS

PART NUMBER: 2-06495-00 (F2AC-9F924-AA)

PART DESCRIPTION: SWITCH-

TRACE #: R 3 6 6

THIS ADVISORY IS TO ALERT YOU TO A CONDITION WHICH IS NON-CONFORMING TO SPECIFICATION; YET WE ARE ACCEPTING THE PARTS "AS IS" AT THIS TIME. CORRECTIVE ACTION IS REQUIRED TO PREVENT REJECTION OF THE MATERIAL IN THE FUTURE. YOUR RESPONSE ON THE ATTACHED CORRECTIVE ACTION REPORT IS REQUIRED WITHIN FIVE WORKING DAYS.

LOT NUMBER ASSIGNMENT: 209775

DATE RECEIVED: 9/29/94

SAMPLE SIZE: SKIP NO 6

OF DEFECTIVES IN SAMPLE: 0

QUANTITY RECEIVED: 7616

P.O. NUMBER: 62324

TYPE OF DEFECT: ___ DIMENSIONAL ___ MATERIAL ___ PACKAGING ___ DOCUMENTARY ✓ OTHER

TEST STAND 4 FAILED

DESCRIPTION OF NON-CONFORMING CONDITION(S): REACTION TIME IS EXCESSIVE - FAILED TEST STAND - NORMALLY CLOSED SWITCH - OPEN WHEN PRESSURE APPLIED - REMAIN OPEN AND THEN FINALLY CLOSE - REJECTED IN LAB - SEE ATTACHED RESULTS

G A Comiskey 1/12/95
QA REPRESENTATIVE

8-D.

MANUFACTURING REPRESENTATIVE

ENGINEERING REPRESENTATIVE

TI-NHTSA 011927

F2AC-9F924-AA 7PSL3-1

T.I. Ref.	Reason: D/C	Cust. Cal. Act	Cust. Cal. Rel.	X-Ray		Auto Pr. test Act	Auto Pr. test Rel.	Auto Pr. test Diff.		1-24-95 Life Test Act	Life Test Rel.	Life Test Diff.		
#1	Test Good 4294	140	105			127	92.2	34.7		130	98	32		TNF
2	Test Good 4294	135	105			127	85.9	41.1		130	95	35		TNF
3	Test Good 4295 mounted on fitting	150	125			145.2	111.3	33.9		145	115	30		TNF
4	Test Good 4294	135	100			124.2	86.8	37.4		130	85	45		TNF
5	Test Bad 4294 mounted on fitting	150	–	✓		127.2	84.2	43.0		150	90	60		
										intermittent Rel. Cont. when cycling				
6	Bad 4294	135	105	✓		127.2	91.0	36.2		130	105	25		TNF
7	Bad 4315 mounted on fitting	155	120	✓		144.8	99.4	45.4		150	115	35		TNF
8	Bad 43130	150	115	✓		141.2	95.3	45.9		145	115	30		TNF
	Spec. Act	90-100												
	Rel.	20 min.												
	Quiet													
			Hilite Rej. # R386											
	Case # 1167501													

Rec'd 1-13-95

OPERATING UNIT: Hi Lite Ind. PREPARED BY: Elaine Rose DATE: 1-14-95

UNIVERSAL PLANNING FORM TI-84700

TI-NHTSA 011928

-MSG M#= 460538 FR=GAMY TO=JW02 SENT=01/17/95 06:28 AM
R#=194 ST=C DIV=0050 CC=00149 BY=GAMY AT=01/17/95 06:20 AM

To: Jim Watt JW02

Copy: Chris D. Wagner CDW3 Matthew J. Sellers MJS2
Timothy R Spooner TRS1

From: Elaine Rose GAMY

Subj: ~~RIMFIRE~~ RETURNS

RECEIVED 8 77PSL3-1 FROM GEORGE COMISKY ON 1/13/95 FOR FAILING ON THEIR TEST STAND. TI REF # 1-4 WERE RETURNED AS GOOD; TI REF # 5-8 WERE REPORTEDLY REMAINING OPEN.

ALL DEVICES WERE TESTED ON OUR AUTOMATED EQUIPMENT AND PASSED.

TROUBLE NOT FOUND AT THIS TIME.

REGARDS,

ELAINE

LETS GET THE DESIGN GUYS TO LOOK FOR CLEARANCES/ HYPOT ETC.

TI-NHTSA 011929

-MSG M#= 460538 FR=GAMY TO=COPY SENT=01/17/95 06:28 AM
ST=C DIV=0050 CC=00149 BY=GAMY AT=01/17/95 06:20 AM

To: Jim Watt JW02

Copy: Chris D. Wagner CDW3 Matthew J. Sellers MJS2
Timothy R Spooner TRS1

From: Elaine Rose GAMY

Subj: HILITE RETURNS

RECEIVED 8 77PSL3-1 FROM GEORGE COMISKY ON 1/13/95 FOR FAILING ON THEIR TEST STAND. TI REF # 1-4 WERE RETURNED AS GOOD; TI REF # 5-8 WERE REPORTEDLY REMAINING OPEN.

ALL DEVICES WERE TESTED ON OUR AUTOMATED EQUIPMENT AND PASSED.

TROUBLE NOT FOUND AT THIS TIME.

REGARDS,

ELAINE

-MSG M#= 461662 FR=TRS1 TO=GAMY SENT=01/17/95 07:14 AM
R#=189 ST=C DIV=0050 CC=00134 BY=TRS1 AT=01/17/95 07:14 AM

To: "Rose, Elaine GAMY" (GAMY@mimi)
"Watt, Jim" (JWatt@klixon.itg.ti.com)

Copy: "Amore, Alan 12-29" (alan.amore%aa1@mimi)
"Wagner, Chris 12-29" (chris.wagner%cdw3@mimi)
"Snyder, Gary 12-33" (gary.snyder%gjs1@mimi)
"Sellers, Matthew 12-29" (matthew.sellers%mjs2@mimi)

From: "Spooner, Tim" TRS1 (tspooner@klixon.mo.ti.com)

Subj: RE: HILITE RETURNS

JIM / ELAINE:

DO WE UNDERSTAND MODE OF FAILURE AT CUSTOMER? BEFORE WE RESPOND 'TMF', LET'S BE PREPARED TO WALK GEORGE THROUGH POSSIBLE REASONS FOR HIS FINDING AND HOW HE MIGHT FIX IT. PLEASE LET ME KNOW HOW I CAN HELP WITH THIS PROCESS. MY THINKING IS BASED ON CUSTOMER'S SENSITIVITY TO WORDS TO THE EFFECT OF "IT'S NOT US".

THANKS,
TIM

---

pm: GAMY%mimi
To: tspooner
Subject: HILITE RETURNS
Date: Tuesday, January 17, 1995 6:28AM

-MSG M#= 460538 FR=GAMY TO=TRS1 SENT=01/17/95 06:28 AM
R#=186 ST=C DIV=0050 CC=00149 BY=GAMY AT=01/17/95 06:20 AM

To: Jim Watt JW02

Copy: Chris D. Wagner CDW3 Matthew J. Sellers MJS2
Timothy R Spooner TRS1

From: Elaine Rose GAMY

Subj: HILITE RETURNS

RECEIVED 8 77F8L3-1 FROM GEORGE COMISKY ON 1/13/95 FOR FAILING ON THEIR TEST STAND. TI REF # 1-4 WERE RETURNED AS GOOD; TI REF # 5-8 WERE REPORTEDLY REMAINING OPEN.

ALL DEVICES WERE TESTED ON OUR AUTOMATED EQUIPMENT AND PASSED.

TROUBLE NOT FOUND AT THIS TIME.

REGARDS,

ELAINE

1-25-95

(5013—) D/C

5016 5 pcs.

5019 5 pcs.

5025 10 pcs.

5025A 5 pcs.

PRESSURE SWITCH DATA Form 21605 TEST NO.

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMPL. DATE
97PSL3-1	1-27-95		

PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY
Elaine Rose	1-27-95		

PROJECT TITLE: Release Test Failure

CUSTOMER: HiLite Ind.

PURPOSE OF TEST: Sample finished Goods; test in Life test Various Date Codes

PROCEDURE:

D/C	Act	Rel	Diff	Cont.					
5014	140	120	20	✓					
"	145	122	23	✓					
"	146	122	24	✓					
"	144	122	22	✓					
"	138	115	23	✓					
5019	140	118	22	✓					
"	138	108	30	✓					
"	135	126	9	✓	120/105	135/120	140/110		
"	145	126	19	✓					
"	140	115	25	✓					
5025	130	98	32	✓					
"	138	110	28	✓					
"	145	120	25	✓					
"	140	118	22	✓					
"	138	106	32	✓					
"	138	115	23	✓					
"	134	100	34	✓					
"	136	100	36	✓					
"	134	108	26	✓					
"	130	105	25	✓					
5025A	125	98	27	✓					
"	132	105	27	✓					
"	132	94	38	✓					
"	134	108	26	✓					
"	138	110	28	✓					

TI-NHTSA 011933

(OVER)

-MSG NO- 797998 FR-GAMY TO-COPY SENT-01/25/95 09:42 AM
ST-C DIV-0050 CC-00149 BY-GAMY AT-01/25/95 09:29 AM

To: Chris D. Wagner CDW3 Matthew J. Sellers MJS2
Timothy R Spooner TRS1

Copy: Andrew McGuirk ACM1 Gary J. Snyder GJS1

From: Elaine Rose GAMY

Subj: HILITE RETURNS

WE HAVE RECEIVED ANOTHER 7pcs. FROM GEORGE COMISKY FOR TEST FAILURE. THESE WERE TESTED ALONG WITH THE 8pcs. ORIGINALLY RETURNED, IN LIFE TEST. THERE WAS 1 DEVICE WITH A CONTINUITY ANOMALY. I WINDOWED THE DEVICE & TOGETHER WITH CHRIS, WE CHECKED IT UNDER THE SCOPE. THERE APPEARS TO BE FLUID BETWEEN THE CONTACT & TERMINAL AREA AS WELL AS PARTICLE CONTAMINATION

I HAVE SUBMITTED THE BASE ASSEMBLY TO TSL FOR ANALYSIS.I WILL SEND YOU THE RESULTS AS SOON AS BETH COMPLETES TESTING.

GEORGE COMISKY IS EXPECTING AN 8D ON THESE DEVICES.

REGARDS,

ELAINE

TEXAS INSTRUMENTS INCORPORATED
CORRECTIVE ACTION REPORT

Report Number:	**PSCAR95_XX**
Date Opened:	**01/26/95**
Updated:	**01/26/95**
Customer:	**HILITE INDUSTRIES**
TI p/n (s):	**77PSL3-1**
Customer p/n (s):	**F2AC-9F924-AA**
CAR description:	**UNUSUALLY LOW RELEASE SIGNAL**

#1-8
#9-15

(Step 1) Champion and Team Members

Matt Sellers	Mfg. Engineering (Champion)
Jim Watt	QRA Engineering
Elaine Rose	QRA Technical Support
Chris Wagner	Product Design Engineering

(Step 2) Problem Description

On January 13, 1995, 8 switches were returned to TI Attleboro, with test data for each. From the paperwork submitted, it appears that 4 which had passed Hilite's end of line test and 4 which had exibited unusually low release (out-in) signals were all retested by a man named Doug in Hilite's lab. The results of the retest are included, which 1) confirmed the 4 'normal release' switches as normal and 2) showed 3 of the 4 'low release' switches to be normal. A single device was shown in the lab retest results to have no continuity change on release.

Upon arrival of the 8 switches at TI Attleboro, they were tested on production equipment and were found to meet specification.

On January 23, 1995, 7 additional switches were returned to TI Attleboro for the same problem. There was no lab retest or retest results indicated.

Upon arrival of the 7 additional switches at TI Attleboro, they were tested in the design engineering laboratory and were found to meet specification. The 7 additional switches were then retested on production equipment and again found to meet specification.

The second incidence of the occurrence (at, we believe, the end of Hilite's process) prompted us to retest the first eight switches on January 25, 1995. The single switch which was recorded by the Hilite lab as having no continuity change was again found to operate within specification, with solid continuity change above 20 psi, but some dithering in the continuity signal was observed just below the release point. After cutting a window in side of the switch, a contaminant was observed on the stationary contact surface. This contaminant is now being analyzed for composition at the TI Technical Service Laboratory. We are also subjecting the other returned devices to analysis to ensure no contaminants are present on them.

It is TI's judgement at this time that the end-of-line test anomaly seen is not related to the contamination discovered in the single device. The contamination found must be addressed and permanently eliminated from recurrence. The performance of the single device with dithering on release as observed would not have a negative effect in the vehicle, and the signal would likely improve with repeated contact actuation.

(Step 3) Containment and Short Term Corrective Actions

Samples were removed from finished goods for verification in the design engineering lab. All devices met specification. No anomalous behavior was observed.

COMP

ZPLF ('zero pressure logic failure) fallout samples from the manufacturing line's 100% function test are being reverified as failures and analyzed for failure cause, in search of more containment as a contributor.

1/27/95

(Step 4) Definition and Verification of Root Cause

1) Contamination on the single device: Origin of contamination may be ascertainable after composition is understood.

2) Balance of returns: We do not know why 10 other switches were identified as faulty by Hilite's test. An important fact to consider is that the Hilite lab result and TI lab result matched closely. The Hilite lab test appears to be a good check for the end-of-line process.

(Step 5) Permanent Corrective Actions

TBD following root cause determinations for 1) and 2) above.

(Step 6) Verification of Permanent Corrective Actions

TBD

(Step 7) Prevent Recurrence

TBD

Sellers, Matt

From: Ras, Ann Marie
To: Rocha, Lou; Sellers, Matt; Laplante, Bill W.E.
Subject: Cost Update of Function Tester Upgrades
Date: Monday, April 08, 1996 7:02AM

There will be a meeting to discuss the costing/progress of the 3 pressure tester upgrades on Wednesday, April 5 at 1:00pm in the cafeteria. If the cost information has not been completed at that time, please let me know so that I can reschedule. Thank you.

Ann

Pressure Tester #1 (52PS)
Currently Funded Items:
1) Computer Upgrade
2) Pneumatic Upgrade
3) Conveyor Motor Speed Upgrade
4) Conveyor Belt/Rail Modification
5) O-Ring Station Plug Modification
6) Gaurd Modification
7) Sonalert Addition to O-Ring Station
8) Automatic Defaults for All Unload Stations

Currently Nonfunded Items:
1) Conveyor Unload System
2) Scribe Relocation (numeric symbol 1)
3) Thread Cap Load Station
4) Centralized Database for Bldg 12 Easy access

Pressure Tester #2 (57PS)
Currently Nonfunded Items:
1) 90PS Compatability
   -Seals
   -Programming
   -Pneumatics?
2) Centralized Database for Bldg 12 Easy Access

Pressure Tester #3 (77PS)
Currently Nonfunded Items:
1) O-Ring Station Upgrade
2) Scribe Relocation (numeric symbol 3)
3) Thread Cap Load Station Simplification
4) Conveyor Unload Station
5) Centralized Database for Bldg 12 Easy Access
6) Automatic Defaults for All Unload Stations
7) Guarding Upgrade

52 /57 /77 PRESSURE TESTER UPGRADE PLAN

		COMPL DATE
52DS PRESSURE TESTER		
1. BUILD & INSTALL NEW O'RING CHECK STATION	DAN/DOUG	1/31/95
2. DESIGN, BUILD, INSTALL CRIMP RING SCRATCH STATION	DAN/DOUG	1/31/95
57DS PRESSURE TESTER (S26734)		
1. LAYOUT, DETAIL DWGS & PARTS LIST FOR UNLOAD SYSTEM	DAN/BILL M	1/31/95
STELRON UNLOAD STATION BILL M.		
O'RING STATION DAN		
CAP INSERT STATION BILL M.		
SCRATCH STATION DAN		
CONVEYOR SYSTEM BILL M.		
FRAME DOUG M.		
2. MARK UP ELEC DRAWINGS AND SUBMIT TO S20 FOR SW DES	DOUG	2/10/95
RELEASE WORK ORDER FOR S20 SW DESIGN	ANN	2/10/95
3. BUILD FABRICATED PARTS FOR	DAVE F.	3/31/95
O'RING CHECK STATION,		
CRIMP RING SCRATCH STATION		
CONVEYOR COMPONENTS		
CONVEYOR FRAME REETZ CO.		
4. ORDER ALL COMMERCIAL PARTS FOR ABOVE	DAN/BILL M./DOUG	2/10/95
STELRON UNLOADER		
CONVEYOR MOTOR/CONTROLLER		
VALVES, CYLINDERS		
ELECTRICAL COMPONENTS		
5. ORDER HENDRICK BOWL SYSTEM FOR CAP INSERT	DAN/BILL M.	1/13/95
6. ASSEMBLE STATIONS AND MOUNT ON FRAME	DAN	4/28/95
O'RING CHECK		
CRIMP RING SCRATCH		
CONVEYOR ASSY		
STELRON UNLOADER		
8. SHUT DOWN PRESSURE TESTER AND START INSTALLATION	DAN/DOUG/LOU C	5/1/95
O'RING CHECK		
CRIMP RING SCRATCH		
CONVEYOR ASSY		
STELRON UNLOADER		
9. COMPLETE DEBUG AND RELEASE TO PRODUCTION	DAN/DOUG/LOU C	5/15/95
10. BUILD CAP INSERT STATION	DAN	TBD
11. INSTALL CAP BOWL & INSERT STATION	DAN	TBD
77DS PRESSURE TESTER		
1. UPDATE DWGS FOR NEW O'RING AND SCRATCHER STATION	BILL M.	TBD
2. BUILD O'RING CHECKER AND CRIMP RING SCRATCH STATON	DAVE F.	TBD
3. UPDATE CAP INSERT STATION	DAN	TBD
4. INSTALL O'RING CHECKER AND SCRATCHER STATIONS	DAN	TBD

NOTE:FOR THE 57 UNLOAD CONVEYOR, SINCE THE OPERATOR HAS TO REMOVE BAD O'RING PARTS, WE RECOMMEND THE 52DS CONVEYOR ORIENTATION, NOT THE 77DS ORIENTATION. THIS WILL NECESSITATE MOVING THE ENTIRE SYSTEM ABOUT 2 FEET IN AND 2 FEET LEFT SO THE CONVEYOR DOES NOT OVERLAP EITHER ISLE: ALSO, A SECTION OF ISLE WALL SHOULD BE REMOVED FOR BETTER OPERATOR ACCESS IN AND OUT OF LOAD STATION.

LOU ROCHA, REV A 12/09/95

Sellers, Matt

From:	Sellers, Matt
To:	Rocha, Lou; Laplante, Bill W.A.
Cc:	Rea, Ann AMR2; Sweet, Bill WS4; Arsenault, Stephen SFA2; Mcnamara, Margaret MRMA
Subject:	Hyd PS tester upgrades - status meeting
Date:	Thursday, April 06, 1995 9:56AM

Let's plan to meet as we decided:

Monday April 10 @ 8:00pm in the cafeteria.

We will need to review the following information at this meeting:

Pressure Tester #1 (82PS)

* Timing to complete computer and pnuematic upgrades. (9C95)?.
* Status of oring station flag modification.
* Status of sonalert addition to oring station.
* Status of scribe relocation, (all 3 testers).
* Thread cap installation station. Plan to determine $ and timing.

Pressure Tester #2 (57PS)

* 5/1 installation date OK?
* $ for new unload system on within budget?
* Status of scribe relocation, (all 3 testers).
* Status of centralized data base for defaults. Bldg. 12 access.
* Status of 90PS capability development.

Pressure Tester #3 (77PS)

* Status of oring station build. Have we started building along with tester 2 station?
  We need $/timing to allow for capital/expense arrangements.
* Scope of changes required to thread cap installer to simplify after oring station add.
* Status of scribe relocation, (all 3 testers).
* Status of centralized data base for defaults. Bldg. 12 access.

See you Monday!

Regards,
Matt

Sellers, Matt

From: Rea, Ann Marie
To: Rocha, Lou; Sellers, Matt; Lapierre, Bill W.R.
Subject: Cost Update of Function Tester Upgrades
Date: Monday, April 03, 1995 7:02AM

There will be a meeting to discuss the costing/progress of the 6 pressure tester upgrades on Wednesday, April 5 at 1:00pm in the cafeteria. If the cost information has not been completed at that time, please let me know so that I can reschedule. Thank you.

Ann

Pressure Tester #1 (52PS)
Currently Funded Items:
1) Computer Upgrade
2) Pneumatic Upgrade
~~3) Conveyor Motor Speed Upgrade~~
~~4) Conveyor Belt/Rail Modification~~
5) O-Ring Station Flag Modification
~~6) Guard Modification~~
7) Sonalert Addition to O-Ring Station
8) Automatic Defaults for All Unload Stations

Currently Nonfunded Items:
1) Conveyor Unload System
2) Scribe Relocation (numeric symbol 1)
3) Thread Cap Load Station
4) Centralized Database for Bldg 12 Easy access

Pressure Tester #2 (57PS)
Currently Nonfunded Items:
1) 90PS Compatability
-Seals
-Programming
-Pneumatics?
2) Centralized Database for Bldg 12 Easy Access

Pressure Tester #3 (77PS)
~~Currently Nonfunded Items:~~
1) O-Ring Station Upgrade
2) Scribe Relocation (numeric symbol 3)
3) Thread Cap Load Station Simplification
4) Conveyor Unload Station
5) Centralized Database for Bldg 12 Easy Access
6) Automatic Defaults for All Unload Stations
7) Guarding Upgrade

IP-2 TESTS								
	FORD							
	[illegible]	[illegible]	[illegible]	CHEVROLET	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	POWER STR'G	BRAKE	BRAKE	POWER STR'G	POWER STR'G	BRAKE	POWER STR'G	
	[illegible]	[illegible]	[illegible]	[illegible]				
CALIBRATION	100%	100%	100%	100%				
CREEP CHECK	100%	4/LOT	N/A	100%				
LEAK CHECK	100%	N/A	N/A					
VOLTAGE DROP	2/MO	4/LOT	4/LOT	4/LOT				
CURRENT LEAKAGE	2/MO	4/LOT	4/LOT					
PROOF	2/MO	4/LOT	4/LOT	4/LOT				
BURST	2/MO	4/LOT	4/LOT	4/LOT	6/MONTH			
TERMINAL STRENGTH	2/MO	4/LOT	4/LOT	4/LOT				
VIBRATION	6/MO	1[illegible]/MO	6/MO					
VACUUM	6/MO	6/MO	6/MO					
TEMP CYCLE	6/MO	6/MO	6/MO					
FLUID RESISTANCE	N/A	N/A	[illegible]/MO	N/A				
IMPULSE	6/MO	6/MO	4/MO	4/MONTH				
HUMIDITY	6/MO	6/MO	6/MO					
SALT SPRAY	6/MO	6/MO	6/MO					
TEMP CORRELATION	N/A	N/A	N/A	N/A	WEEKLY			
ISOLATION RESISTANCE	N/A	N/A	N/A	4/LOT				
	*** CURRENT TEST STATUS ***							
CALIBRATION	100%	100%	100%	100%	100%	100%	100%	
CREEP CHECK	100%	100%	N/A	100%	N/A			
LEAK CHECK	100%							
VOLTAGE DROP	PER PILOT	PER PILOT	PER PILOT	PER PILOT				
CURRENT LEAKAGE	PER PILOT	PER PILOT	PER PILOT	PER PILOT			PER PILOT	
PROOF	PER PILOT	PER PILOT	PER PILOT	PER PILOT		PER PILOT	PER PILOT	
BURST	PER PILOT	PER PILOT	PER PILOT	PER PILOT	6/MON	PER PILOT	PER PILOT	
TERMINAL STRENGTH	PER PILOT	PER PILOT	PER PILOT	PER PILOT				
VIBRATION			[illegible]					
VACUUM			[illegible]					
TEMP CYCLE			[illegible]					
FLUID RESISTANCE			[illegible]					
** IMPULSE			[illegible]					
** HUMIDITY			[illegible]					** POST TEST QUAL
** SALT SPRAY			[illegible]					
** TERM. STRENGTH			[illegible]					
TEMP CORRELATION	N/A	N/A	N/A	N/A	---			
ISOLATION RESISTANCE	N/A	N/A	N/A	---	N/A			[illegible]

TL-NHTSA 041041

PRESSURE SWITCH DATA Form 21605 TEST NO. 473-15-35

DEVICE TPS	DATE REQUESTED 9/25/95	REQUESTED BY KEITH MORELLO	REQUESTED COMPL. DATE
PERFORMED BY	DATE STARTED 9/25/95	DATE COMPLETED	APPROVED BY

PROJECT TITLE: TPS VACUUM DEPENDENCY

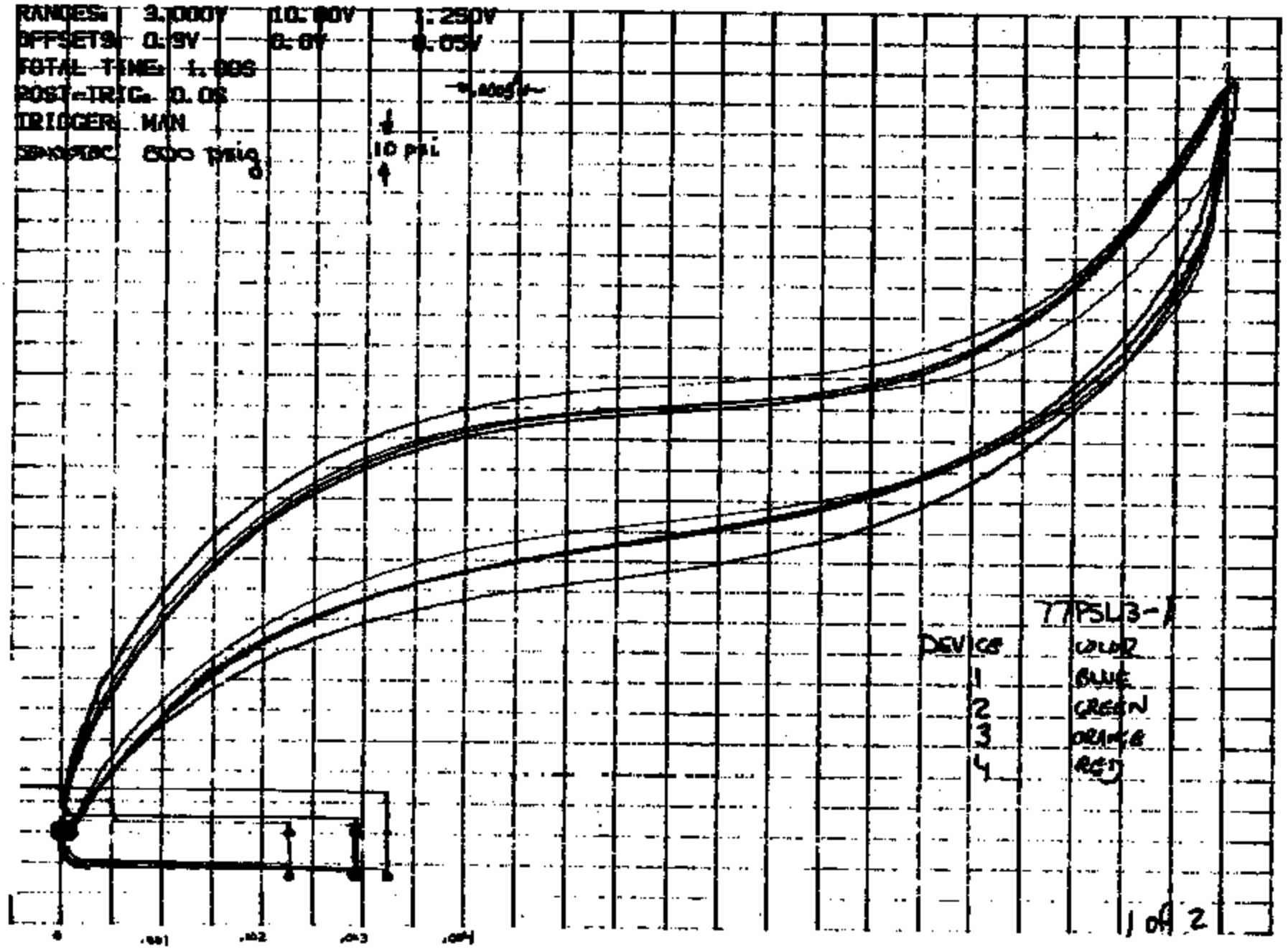
CUSTOMER: —

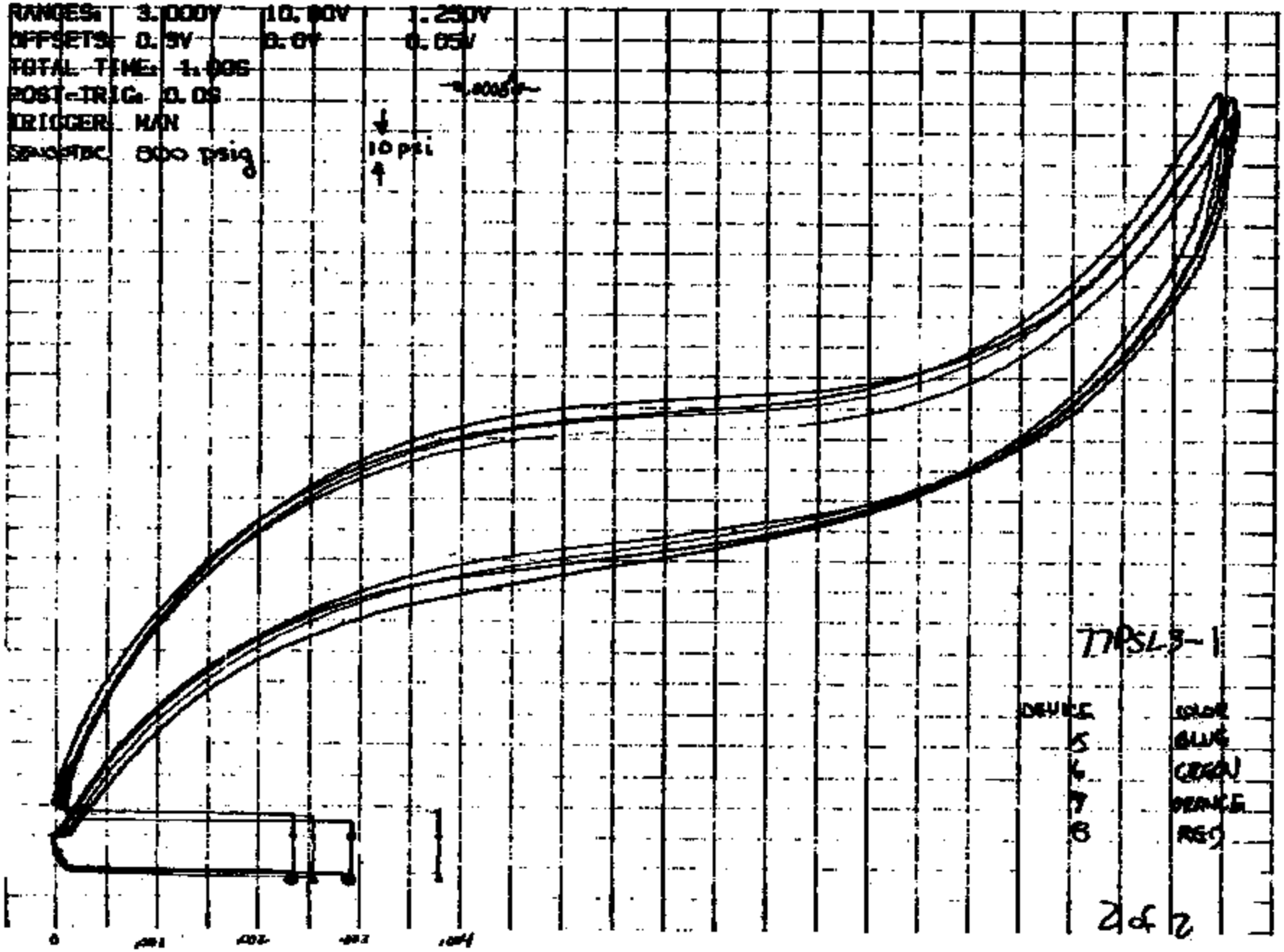
PURPOSE OF TEST: DETERMINE EFFECTIVE PERIOD POST VACUUM OF NORMAL PRODUCTION COMPONENTS

CUP TYPE	-01	-01	-02	-02
PROCEDURE:	3-1	3-2	4-1	6-1

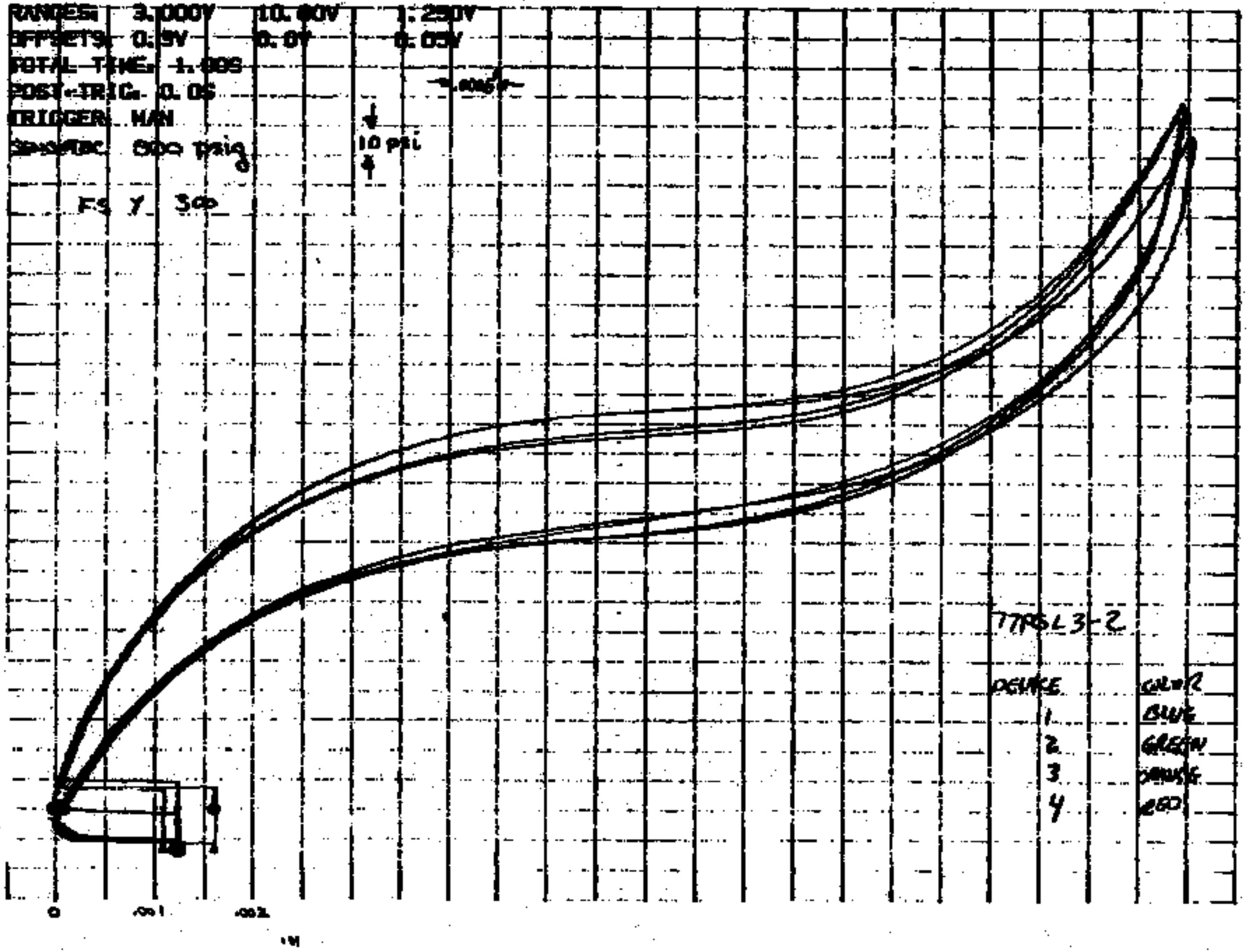
QTY 8 OF EACH.

TI-NHTSA 011942

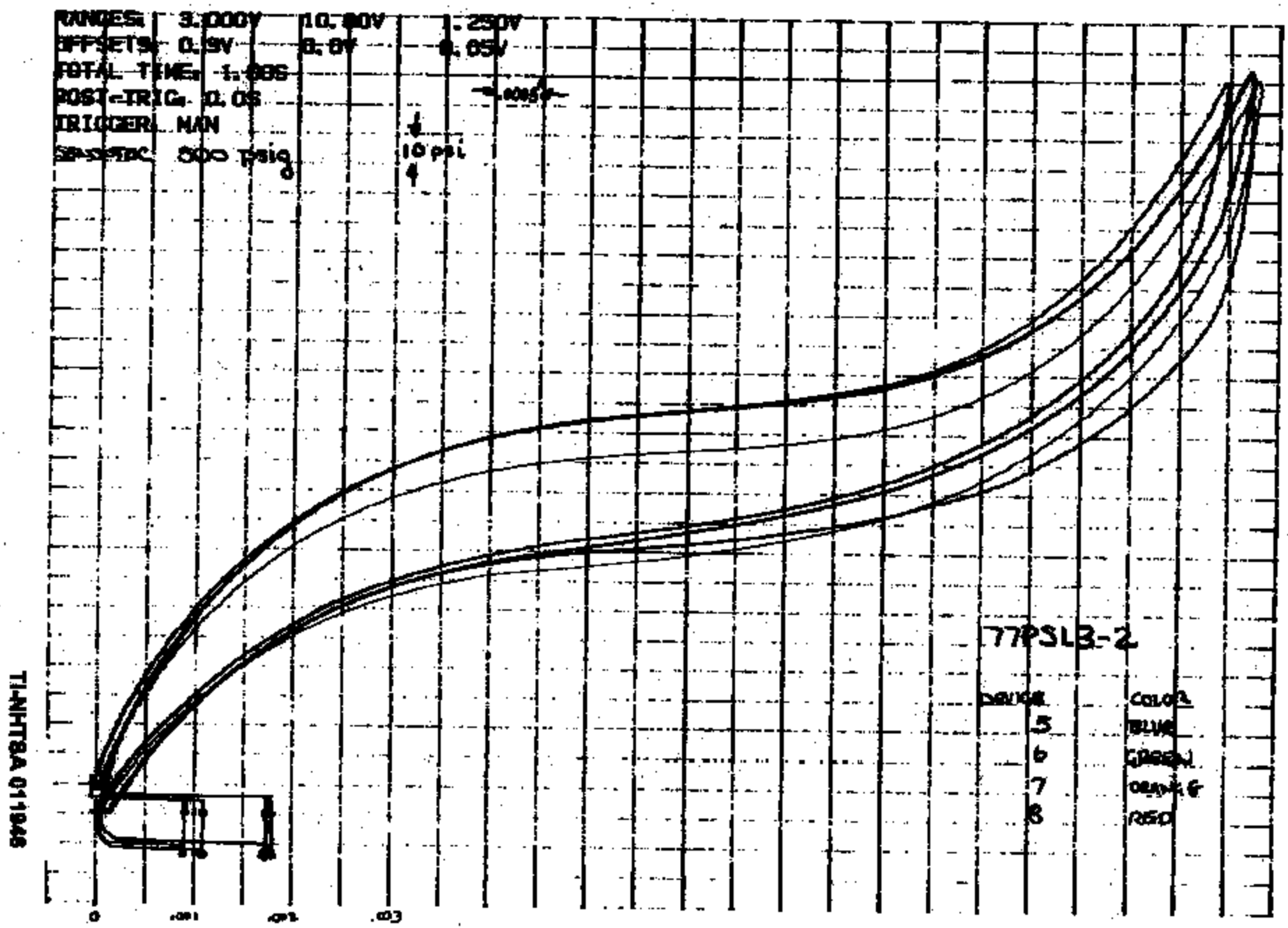

RANGES: 3.000V 10.00V 1.250V
OFFSETS: 0.3V 0.0V 0.05V
TOTAL TIME: 1.00S
POST-TRIG: 0.0S
TRIGGER: MAN
10 PSI
DEVICE
1
2
3
4
77PSL13-1
COLOR
BLUE
GREEN
ORANGE
RED
1 of 2
TI-NHTSA 01945



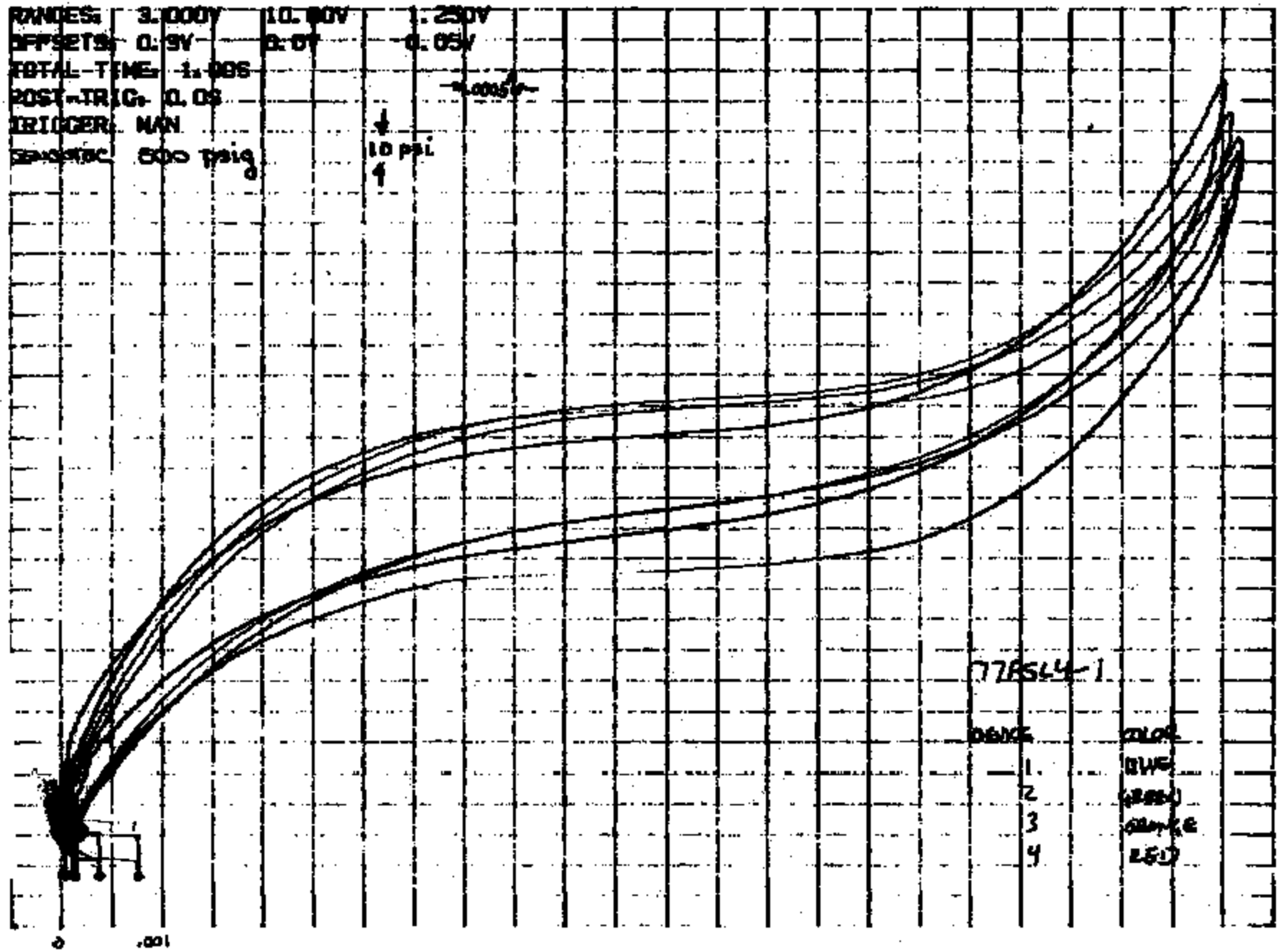
TL-NHTSA 011944

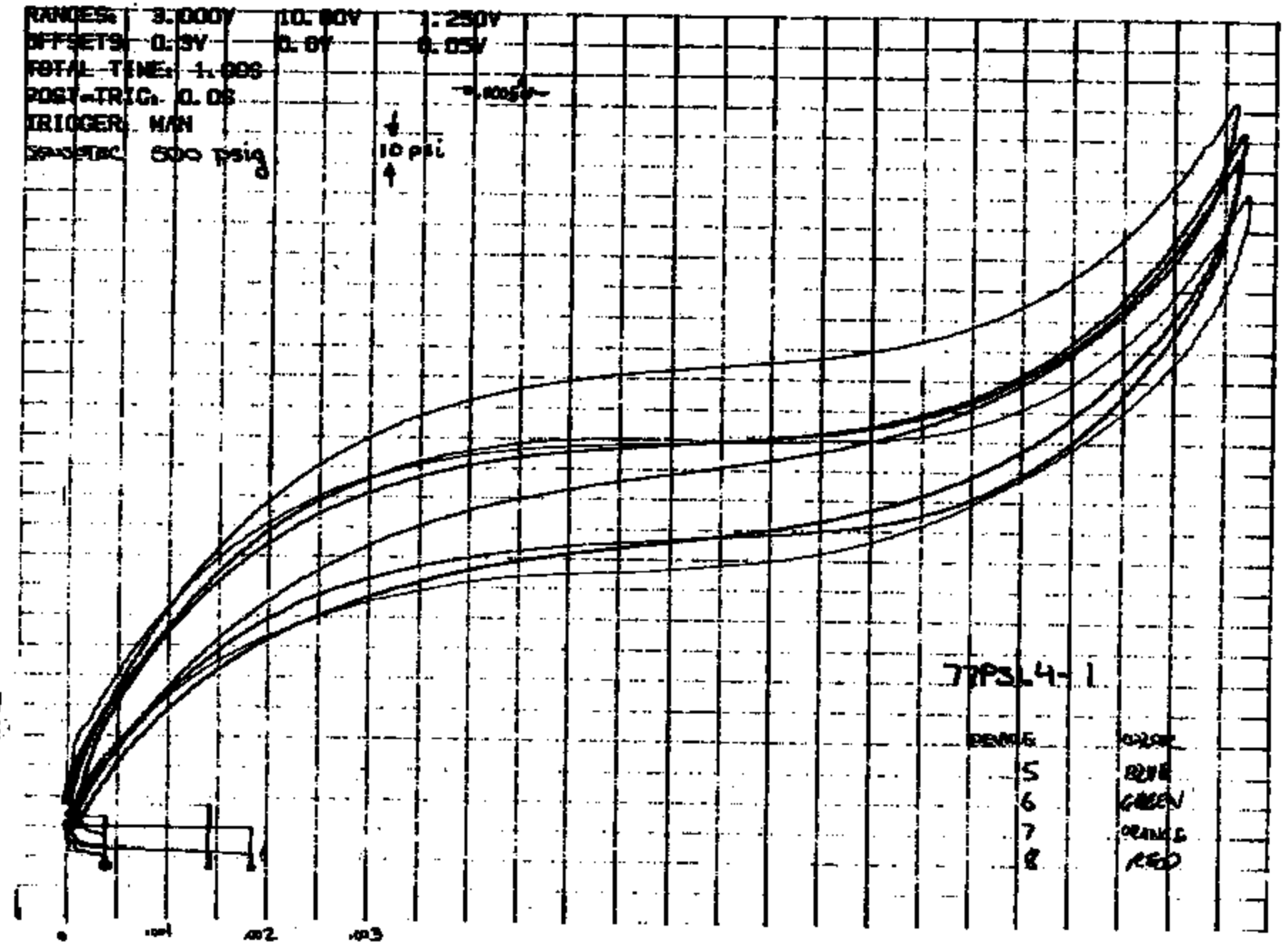


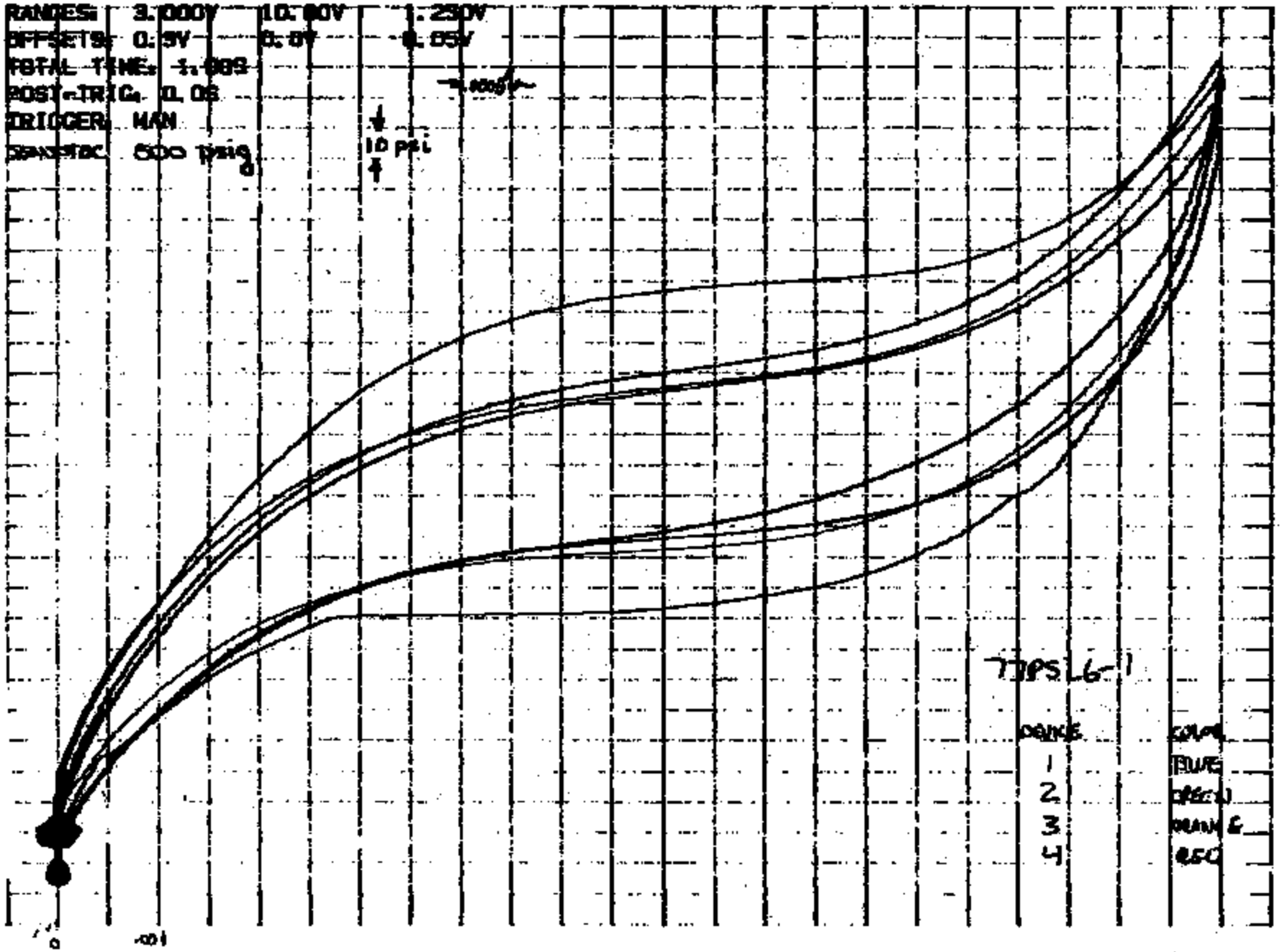
TI-NHTSA 011945



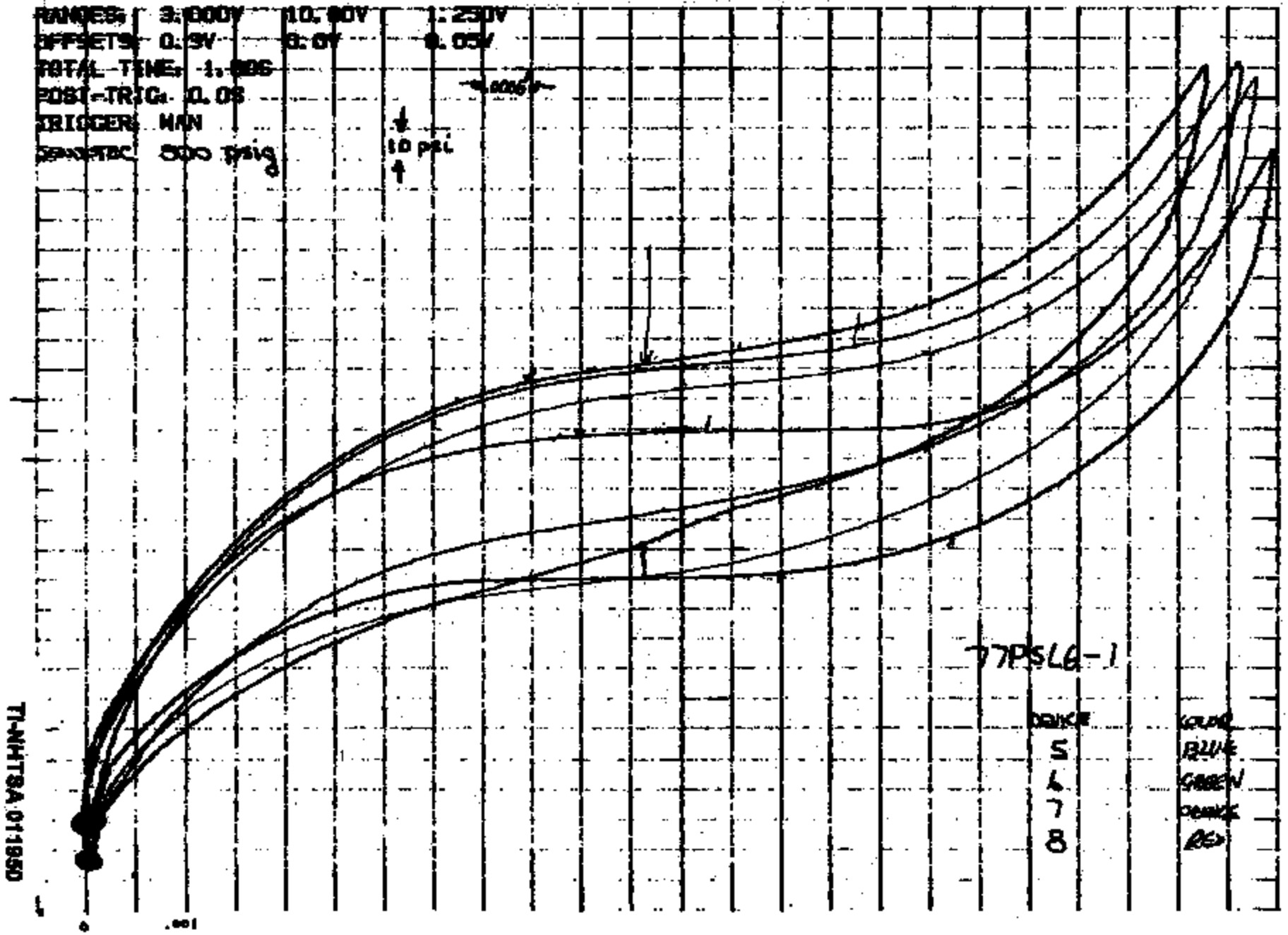
TI-NHTSA 011948

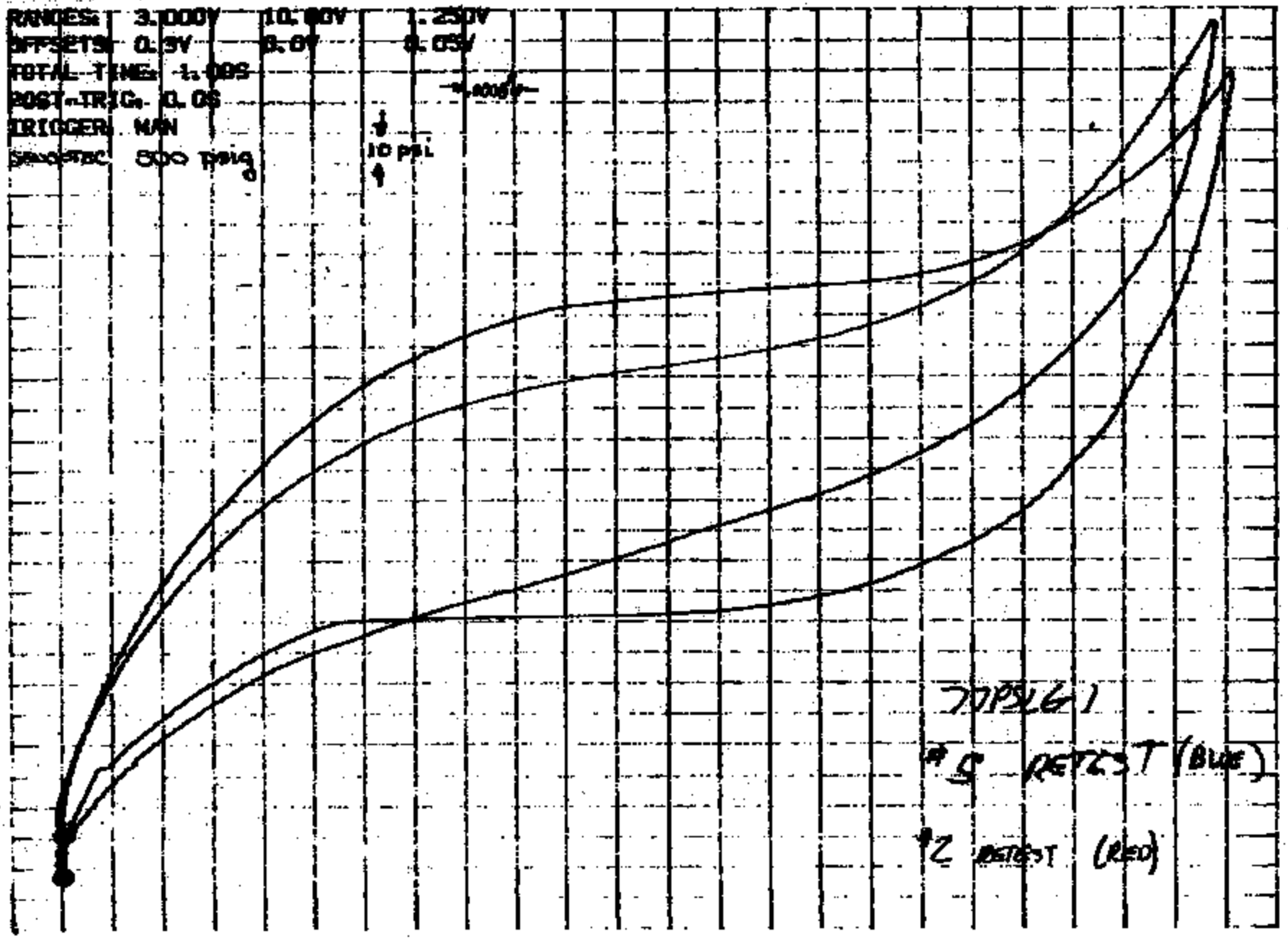






TH-NHTSA 011949


RANGES: 3.000V 10.00V 1.250V
OFFSETS: 0.19V 0.0V 0.05V
TOTAL TIME: 1.000
POST-TRIG: 0.05
TRIGGER: MAN
10 psi
77PSLG-1
DRIVE
5
6
7
8
SOLID
BLUE
GREEN
DASH
TL-MHT8A 011980



TI-NHTSA 011851

DRAWINGS AVAILABLE UPON REQUEST

-MSG M#= 817721 FR=JW02 TO=JSP1 SENT=10/09/95 09:40 AM
R#=035 ST=C DIV=0050 CC=00149 BY=JW02 AT=10/09/95 09:40 AM

TO:	DICK GARIEPY	WWD3	MATT SELLORS	[illegible]
	CHRIS WAGNER	CDW3	PEGGY ALLEN	MRMA
	ELAINE ROSE	GAMY	KEITH ROSIELLO	KROS
	TERRY RODRIGUEZ	TER7	BILL ISAACSEN	WAI
	PAUL FERREIRA	PJF4	ANN REA	AMR1
CC:	GARY SNYDER	GJG1	ANDY MCGUIRK	ACM1
	NORM FREDA	NTF	JOHN PECHONIS	JSP1
	LINDA BARBOZA	BOZA	TOM CHARBONEAU	TC
	MARTHA SULLIVAN	MNS	BRIAN DAGUE	DAGU
	RUSTY STRUBLE	RCS2	JON MAYER	JON5
	JIM WOOD	JWW3		
FM:	JIM WATT	JW02		

SUBJ: ALLIED-SIGNAL GALLATIN, TN 10/05/95 VISIT (77PSL3-3/L3-1PRSW)

Personnel Contacted:

Mike Ross	Supplier Quality Engineer
Mark Holland	Gage Calibration Lab Quality Engineer
Charles Wiley	Manufacturing Engineering Technologist
Lloyd Johnson	Product Engineer
Ray Kosarski	Senior Project Engineer, South Bend, In
Eric Johnson	Gaging Engineer, Johnson Gage Company, Bloomfield, Ct
Jim Watt	Texas Instruments QRA

The Allied -Signal Plant in Gallatin , Tennessee assembles master cylinder brake assemblies for Ford, Chysler, Nissan, and Hyundai. They have a three shift operation, employing approximately 400 people. They plan on QS9000 registration by June '96, but do not currently require their suppliers to be ISO9000 or QS9000 registered.

The 77PSL3-3 cruise control pressure switch is mounted directly onto the master cyclinder port housing assembly for the Ranger/ Explorer cruise control platforms. Total Ranger/Explorer volumes are at 1kk/yr. The 77PSL3-1 switches are used on the Crown Vic series cruise control platforms . Total Crown Vic volumes are at 200k/yr. The pressure switch is initially installed by hand, and finish torqued with an open-end torque wrench . The purpose of the visit was to assess the reported pressure switch installation difficulties onto the mating master cylinder. The master cylinders are drilled at .335 +/- .001" (thru hole), and tapped with H5 taps. Plug gage used to check tapped hole is .3479".

The approximately (25) samples directly off of the Allied -Signal production line L3-3 and L3-1 switches checked with the TI ring gage (3AGO) and torque wrench all passed; specifically, they did not trip the 4.5 in-lbf torque wrench. All of the hexports exhibited drag; none of the samples spinned on freely.

The approximately (25) samples directly off of the Allied-Signal production line L3-3 and L3-1 switches checked with the Allied-Signal ring gage (3AGO, mfg. Almeida) and the TI torque wrench had (4) switches trip the 4.5 in-lbf torque wrench. The Johnson Gage representative subsequently measured some samples that had not been previously gaged that showed .3479"(basic) + .002"

TI-NHTSA 011955

A comprehensive discussion ensued on the origin of the 3A-GO ring gage specification (ANSI B1.1 for plated external threads), as well as the origin for the 4.5 in-lbf applied torque (General Motors 6102 Surface Discontinuities & Finish Irregularities On Bolts & Screws), recommended tap sizes and allowances.

Though Allied Signal now understands what the pressure switch print specification means, they were not receptive to the specifications, specifically the 4.5 in-lbf torque allowance based upon a GM 6102 document.

The following actions were agreed to on 10/05/95:

1. TI-A and Allied Signal need to agree on a consistent method to assess threads. (The timing of this action is TBD based upon Allied-Signal's discussions with Ford Engineering on thread specifications.)- TBD

2. Allied- Signal will develop a plan by 10/09/95 to generate variable data on the master cylinder pitch diameter tapped hole. - Mike Rose (AS) 10/09/95

3. TI-A to recommend to Allied Signal a tap size and pitch diameter limits to avoid installation difficulties attributable to threads, with the current provisions of 3A-GO ring gage allowance and 4.5 in-lbf torque. - Brian Dague/ Jim Watt - 10/09/95

4. TI-A to communicate the .3479" tolerance specification call-out issue to Ford Engineering, John Pelkey. - Jim Watt 10/09/95

5. Characterize pitch diameter with variable data on Allied-Signal samples. Measurement of (24) sample L3-3 hexports shows pitch diameter average = .34799, cpk= .027 ; without using the 4.5 in-lbf. - Ann Rea (completed)

6. Follow-up and follow-on actions with Allied Signal will be based upon the above results.- Jim Watt 10/15/95

A sample master cylinder for the Light Truck (L3-3) switch and one for the Pass Car (L3-1) were brought back to TI-A for engineering evaluation.

Summary Points:

1. Hexport supplier (Elco Industries) is not capable to the 3/8 x 24 UNF Thread Standard.

2. 4.5 in-lbf torque allowance is a GM 6102 standard; not Ford or ANSI.

3. TI-A is meeting the current specification and gaging method on print.

Please let me know if anyone has any questions on the visit.

Regards,

Jim Watt ext 1719 msgid: JW02 ms 12-27

PS REPORT LOG - 1995

REPORT	DESCRIPTION	TESTED BY	DATE

1998 PRESSURE SWITCH REPORT INDEX

REPORT	DESCRIPTION	TESTED BY
PS/98/14	LIFE TESTING (TO FAILURE) OF 77PS STYLE DEVICE	HA
PS/98/15	PV TEST REPORT - 77PSL3-4 LANDROVER CLUTCH PRESSURE SWITCH	HA
PS/98/28	PV Test Report- John Hassall, Inc. Rivet (PN 74916-1) used in 77PS, 87PS	Mech
PS/97/14	HYDRAULICS IP-2 TEST SUMMARY 77PS	WATT
PS/97/23	77PS DERINGER CLAD CONTACT PV TEST REPORT	HA
PS/97/28	77PS DERINGER CLAD CONTACT PV TEST REPORT	HA
PS/96/01	IP-2 77PSL3-2 TEST SUMMARY	J.WATT
PS/96/50	77/87 SPRING ARM ANOMOLY STUDY	ROSIELLO
PS/96/59	RDA FORD AUSTRALIA 77PSL4-1 CORE# 1948275	HA
PS/96/62	IP2- 77PSL5-2 TEST SUMMARY	WATT
PS/96/63	IP-2 77PSL(3-3) test summary	WATT
PS/96/72	Elimination of vac dep. continuity loss on 77PS cruise control switch	ROSIELLO

DATE

4/8/96
4/8/96
6/20/96

4/4/97
5/5/97
5/5/97

1/31/96
3/8/96
7/10/96
8/16/96

5/5/95
10/13/95

Device12 Failed @ 2,728,196 cycles

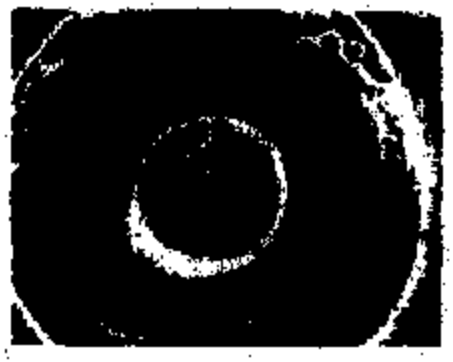
Diaphragm #1 (Fluid Side)

Diaphragm #2 (Middle Layer)

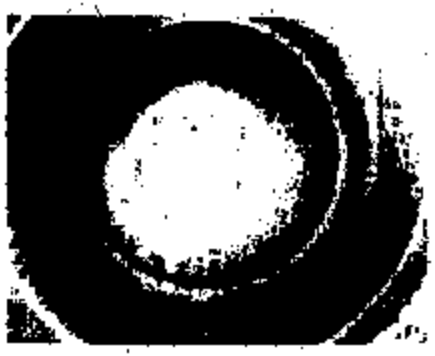
Diaphragm #3 (Washer/Converter Side)

Device 2 Pass 3,000,000 cycles

Diaphragm #1 (Fluid Side)



Diaphragm #2 (Middle Layer)



Diaphragm #3 (Washer/Converter Side)

Device 7 Failed @ 2,990,866 cycles

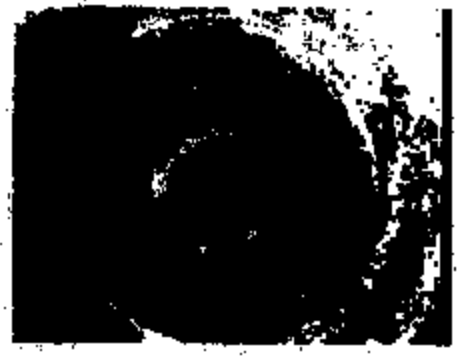
Diaphragm #1 (Fluid Side)

Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

Device 5A Failed @ 2,925,825 cycles

Diaphragm #1 (Fluid Side)



Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

Device 12A Failed function test after 3,008,608 cycles. Number of cycles til leakage unknown.

Diaphragm #1 (Fluid Side)

Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

Device 3A Pass 3,000,000 cycles

Diaphragm #1 (Fluid Side)

Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

Device 4A Failed @ 2,985,000 cycles

Diaphragm #1 (Fluid Side)

Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

TI-NHTSA 011963

Device 1A Failed @ 2,962,662 cycles

Diaphragm #1 (Fluid Side)

Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

Device 2A Pass 3,000,000 cycles

Diaphragm #1 (Fluid Side)

Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

TI-NHTSA 011964

Device #4B Failed @ 2,999,015 cycles

Diaphragm #1 (Fluid Side)

Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

Device 6B Failed @ 2,725,000 cycles

Diaphragm #1 (Fluid Side)

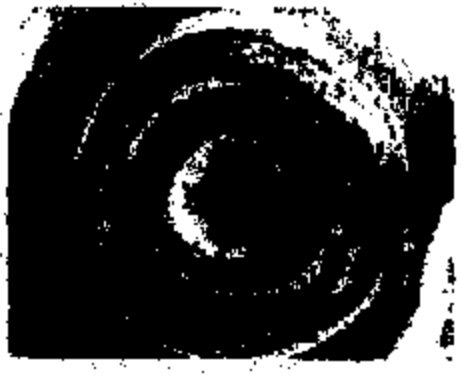
Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

TI-NHTSA 011965

Device 2B Pass 3,000,000 cycles

Diaphragm #1 (Fluid Side)



Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

Device 3B Pass 3,000,000 cycles

Diaphragm #1 (Fluid Side)

Diaphragm #2 (Middle Layer)

Diaphragm #3 (Washer/Converter Side)

TLHHTBA 011998

Texas Instruments Incorporated

Texas Instruments

34 Forest Street
P.O. Box 2964
Attleboro, MA 02703-0964
(508) 236-3800

November 14, 1995

Mr. Bob Manavi
Ford Oakville Assembly
P.O. Box 1300
Oakville, On L6J5C9
Canada

Subject: Vacuum Dependent Continuity Loss of 77PS Cruise Control Switches.

Dear Mr. Manavi,

Thank you very much for your assistance, it was a pleasure working with you. Your effort and timely response enabled us, as a team, to promptly bring closure to this issue.

Per our telephone conversation on Friday November 3, 1995, I have summarized the results of the investigation into your recent experience with the phenomena of vacuum dependent continuity loss.

The switches returned to T.I. were analyzed and tested according to the Ford Specification ES-F2VC-9F24-AA. The test results show all returned devices to be TNF (Trouble Not Found). Ford Oakville's investigation established that the continuity loss fallout at final test was probably caused by a dry-fill of the brake system. The corrective action implemented at Ford Oakville eliminates vacuum dependent continuity loss fallout, supports the root cause determination and brings this issue to a close.

Once again thank you for your assistance and cooperation. I look forward to working with you on future projects and strengthening our strategic partnership.

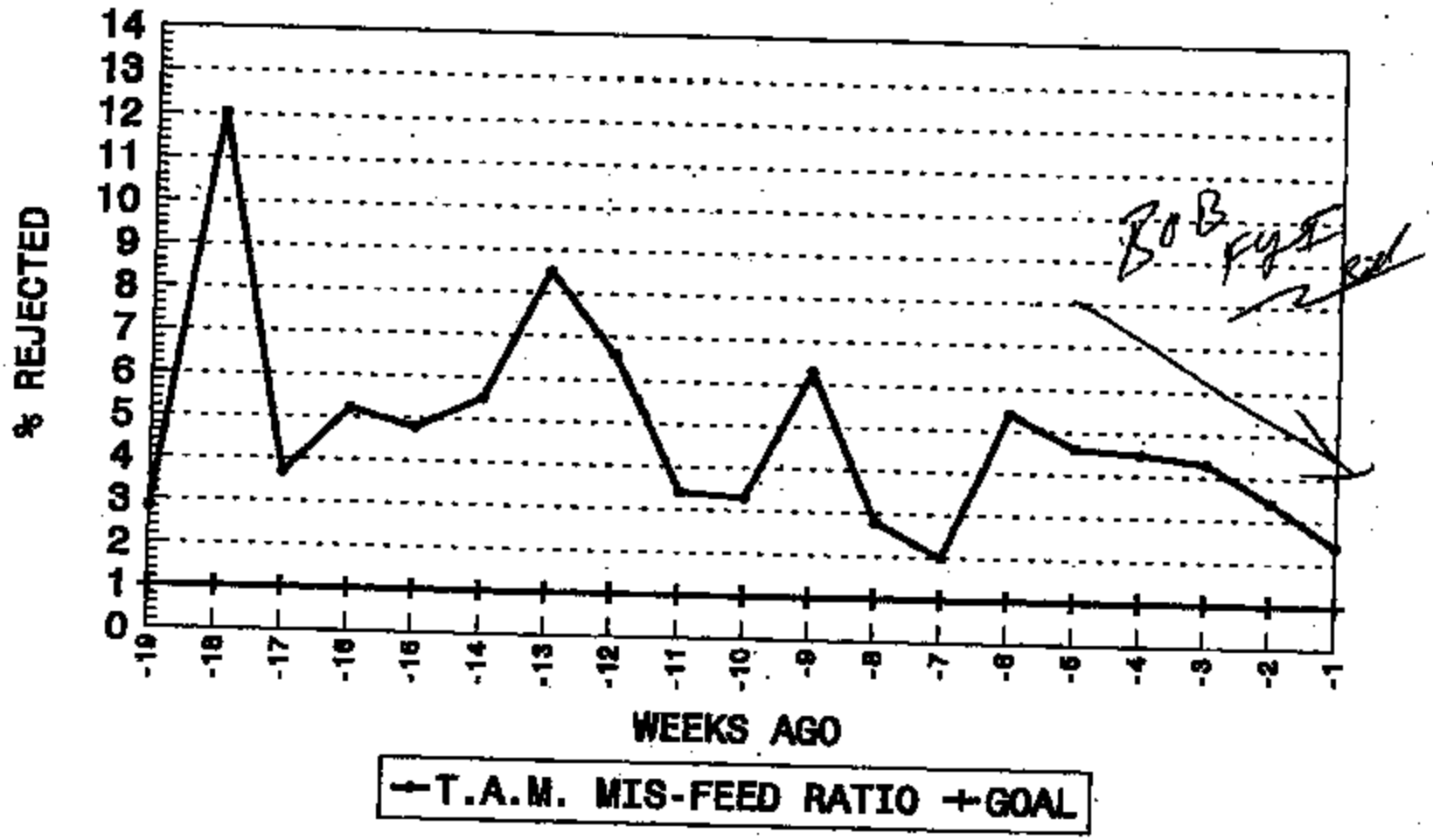
Sincerely,

Keith Rosiello
Design Engineering
Precision Controls

cc: Bryan Dague TI
John Pechionis TI
Steve Proia TI

TERMINAL ASSEMBLY MACHINE (T.A.M.)

% REJECT AT B.A.M.

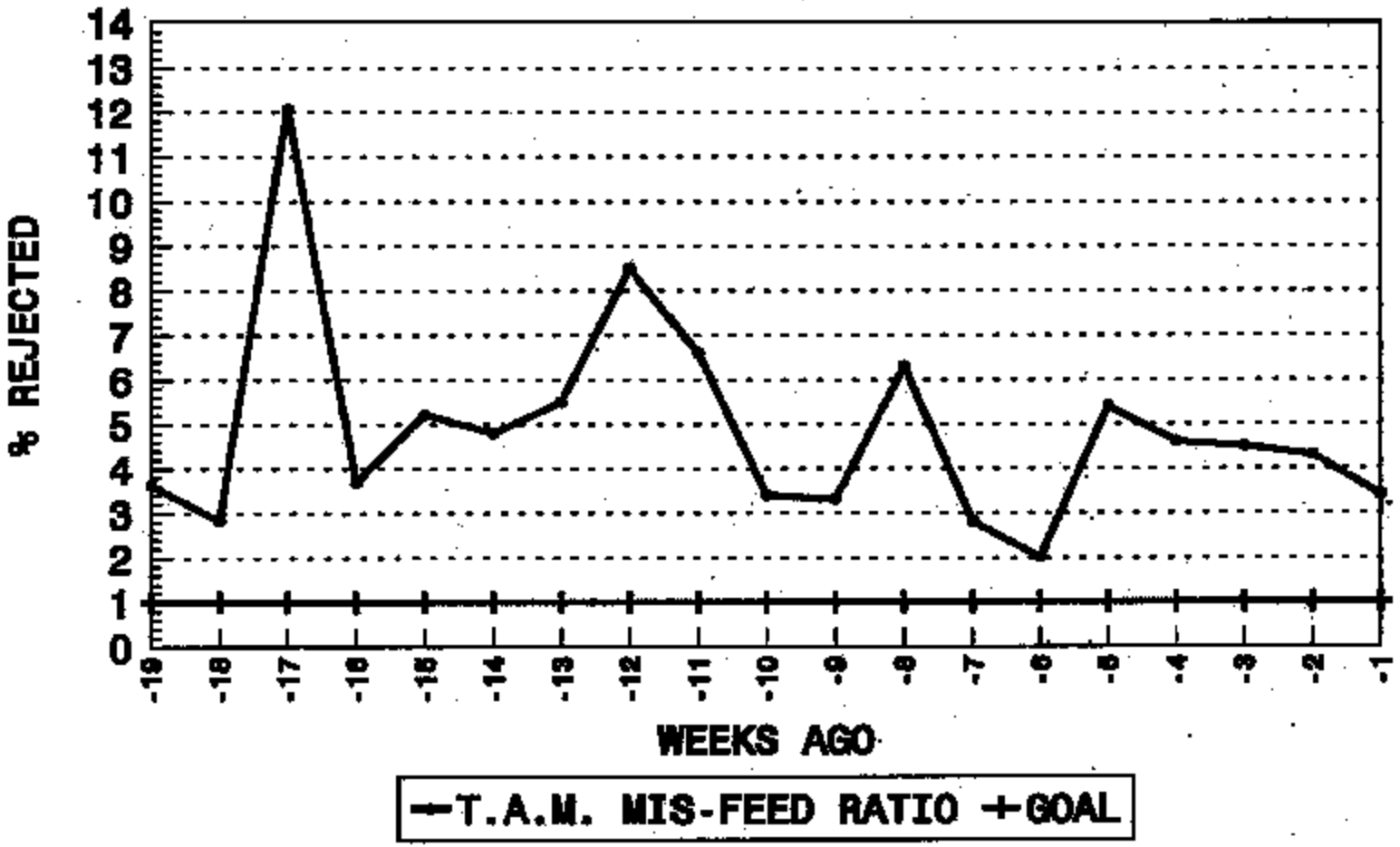


FILE

TERMINAL ASSEMBLY MACHINE (T.A.M.)

% REJECT AT B.A.M.

TI-NHTSA 011969



Rose, Elaine

From: postmaster
To: erose
Subject: ACTION COMPLETED - SEE RESPONSE
Date: Friday, December 29, 1995 9:17AM

```
-MSG M#=    12948 FR=GAMY TO=GAMY   SENT=12/29/95  09:16 AM
     R#=115 ST=C DIV=0050 CC=00149 BY=GAMY AT=12/29/95 09:16 AM
TO: ELAINE S ROSE                    GAMY    <<  CUSTOMER ACTION REQUEST  >>
FR: ELAINE S ROSE                    GAMY    <<   C U S T O M E R   # 1   >>
                                                    TI Internal Data
CC: *PRIA

RE: ACTION COMPLETED - SEE RESPONSE

    Action Subject: CONTINUITY                          Action #: 969464
    Customer Name : HILITE IND.                          Status: CONF
    Request Date  : 06/20/94                              Added: 06/20/94
 14:22      Priority      : NORMAL                                 Type: R/FA
                                                        Org/LSE: PRECA
                                                       ProdType: PC88-77
                                                     Device: 77PSL2-1

Sender Request by    : ELAINE S ROSE              Userid: A66877
---------------
  TI REF # 72       RETURNED FROM WIXOM PLANT !!!

PARAMETERS
 Customer part number     C F2VC-9F924-AB
 TI part number           C 77PSL2-1
 Unit price               C 2.21
 Mark (S.R.)              C N/A
 Date code/serial number  Q 3363
 Reason for return        Q NO CONTINUITY
 Customer count pcs       Q 1
 TI count pcs             Q 1
 # defective              Q 1
 Inspection findings      Q NO CONTINUITY
 Returned as received     N 0
 Rework-return to cust    N 0
 Rework-return to stock   N 0
 Return to stock          N 0
 Replace                  N 0
 Scrap                    N 0
 Hold for disposition     N 0
 Customer location        C WIXOM
 Customer contact         C N/A
 Phone number             C N/A
 Customer rejection#      C QC REQUEST
 Sold to #                C 616128
 Ship to #                C 616136
 Bill to #                C 616128
 P.O. #                   C VARIOUS
 TI order #               C 0
 Date returned            C 06/20/1994
 Return type (R/P/D/P)    Q P
 Cust C/A required?(Y/N)  Q Y
 Cust C/A date due        Q
 Root cause               Q TRAPPED DISC
```

Corrective action	Q	
C/A complete date	Q	
Defect code	Q	G01
Quality return	Q	1
Unjustified return	Q	0
Service quality return	Q	0
Marketing return	Q	0
Document type	C	A

********** END OF MESSAGE **********

Rose, Elaine

From: postmaster
To: erose
Subject: ACTION COMPLETED - SEE RESPONSE
Date: Friday, December 29, 1995 9:34AM

```
-MSG M$=    13428 FR=GAMY TO=GAMY   SENT=12/29/95  09:32 AM
     R#=139 ST=C DIV=0050 CC=00149 BY=GAMY AT=12/29/95 09:32 AM
TO: ELAINE S ROSE                    GAMY    <<  CUSTOMER ACTION REQUEST  >>
FR: ELAINE S ROSE                    GAMY    <<   C U S T O M E R   # 1   >>
                                                    TI Internal Data
CC: *PR1A

RE: ACTION COMPLETED - SEE RESPONSE

    Action Subject: ELECTRICAL RETEST                    Action #: 1103464
    Customer Name : PITTS                                  Status: COMP
    Request Date  : 11/08/94                                Added: 11/08/94
 13:22     Priority      : NORMAL                                   Type: R/FA
                                                          Org/LBE: FRECA
                                                         ProdType: PC88
                                                       Device: 77PSL3-1

Sender Request by    : ELAINE S ROSE              Userid: A66877
---------------
  TI REF # B6
        HAVE BEEN LOST IN A WAREHOUSE SOMEWHERE !!!
  DID NOT PRINT

PARAMETERS
 Customer part number     C 21006064951/F2AC-9F924-AA
 TI part number           C 77PSL3-1
 Unit price               C 2.36
 Mark (S.R.)              C MA
 Date code/serial number  Q 4160A
 Reason for return        Q ELECTRICAL RETEST; POSSIBLE WASHER/CONVERTER
                            BINDING ISSUE
                            (16 BOXES @ 238 EA)
 Customer count pcs       Q 3808
 TI count pcs             Q 3808
 # defective              Q 0
 Inspection findings      Q
 Returned as received     N 0
 Rework-return to cust    N 0
 Rework-return to stock   N 0
 Return to stock          N 0
 Replace                  N 0
 Scrap                    N 0
 Hold for disposition     N 0
 Customer location        C DALLAS, TX
 Customer contact         C CHARLENE
 Phone number             C 214-242-2116 EXT. 175
 Customer rejection#      C
 Sold to #                C 616128
 Ship to #                C 616136
 Bill to #                C 616128
 P.O. #                   C
 TI order #               C 0
 Date returned            C 10/27/1994
```

Return type (R/F/D/P)	Q	P
Cust C/A required?(Y/N)	Q	Y SEE CAR 94_18 DOC. DATED 6/21/94
Cust C/A date due	Q	
Root cause	Q	
Corrective action	Q	
C/A complete date	Q	
Defect code	Q	
Quality return	Q	0
Unjustified return	Q	0
Service quality return	Q	0
Marketing return	Q	0
Document type	C	A

********** END OF MESSAGE **********

Rose, Elaine

From: postmaster
To: erose
Subject: ACTION COMPLETED - SEE RESPONSE
Date: Friday, December 15, 1995 12:08PM

```
-MSG M#=   645234 FR=GAMY TO=GAMY   SENT=12/15/95  12:07 PM
     R#=058 ST=C DIV=0050 CC=00149 BY=GAMY AT=12/15/95 12:07 PM
TO: ELAINE S ROSE                  GAMY    <<  CUSTOMER ACTION REQUEST  >>
FR: ELAINE S ROSE                  GAMY    <<   C U S T O M E R   # 1   >>
                                                  TI Internal Data
CC: *PR1A

RE: ACTION COMPLETED - SEE RESPONSE

    Action Subject: CALIBRATION                          Action #: 1267501
    Customer Name : HILITE INDUSTRIES                      Status: COMP
    Request Date  : 01/14/95                                Added: 01/14/95
 14:06     Priority      : NORMAL                                   Type: R/FA
                                                          Org/LEN: PRECA
                                                         ProdType: PC88
                                                       Device: 77PSL3-1

Sender Request by   : ELAINE S ROSE              Userid: A66877
--------------
  TI REF # 1-8

PARAMETERS
 Customer part number    C F2AC-9F924-AA
 TI part number          C 77PSL3-1
 Unit price              C 2.36
 MarK (S.R.)             C MA
 Date code/serial number Q 4294-4313B
 Reason for return       Q FAILED CALIBRATION; 4PASSED;4FAILED;
                           CUSTOMER WANTS ANALYSIS  & 8D REPORT ||
 Customer count pcs      Q 8
 TI count pcs            Q 8
 # defective             Q 1
 Inspection findings     Q 1PC HAD INT. CONTINUITY.7 WERE TROUBLE NOT FOUND
 Returned as received    N 0
 Rework-return to cust   N 0
 Rework-return to stock  N 0
 Return to stock         N 0
 Replace                 N 0
 Scrap                   N 0
 Hold for disposition    N 0
 Customer location       C DALLAS, TX
 Customer contact        C GEORGE CONLSKY
 Phone number            C 214-242-2902
 Customer rejection#     C R386
 Sold to #               C 616128
 Ship to #               C 616136
 Bill to #               C 616128
 P.O. #                  C 62324
 TI order #              C 2435778
 Date returned           C 01/13/1995
 Return type (R/F/D/P)   Q P
 Cust C/A required?(Y/N) Q Y
 Cust C/A date due       Q 01/26/1995
```

Root cause	Q	CONTACT CONTAMINATION (MINERAL OIL/CARDBOARD FIBERS)
Corrective action	Q	CLEANLINESS IMPROVEMENT
C/A complete date	Q	
Defect code	Q	C18
Quality return	Q	1
Unjustified return	Q	7
Service quality return	Q	0
Marketing return	Q	0
Document type	C	A

********** END OF MESSAGE **********

Pechonis, John

From: Rea, Ann Marie
Sent: Wednesday, February 14, 1996 5:23 AM
To: Pechonis, John
Cc: Sellers, Matt
Subject: RE: Highlights Week Ending 2/14/96

AMI2 Improvements

The kapton spacer station is still waiting modification of one part. It is currently at Precision Products and is expected by the end of this week. Bill Laplante is planning on assembling and mechanically testing the station by next week. The station will not be installed, though, until the floor has built enough inventory to sustain them during the shutdown.

The crimp table unload conveyor has been designed to improve hexport handling. The assembly should be ready for installation next month.

Parts for the standardization of the three kapton feed stations are 70% complete but still must be hardened. This should eliminate the possibility of the kapton feed problems we were experiencing in December.

#2 Pressure Tester

Lou Camara has made several programming changes to improve the cap feed station. The changes have helped, but the bowl must still be moved above the conveyor table to allow the operator to clear jams. We have scheduled the mechanical improvements to the #2 cap feed station for the first week in March. The line will not have use of the tester from March 2 through March 7. This should improve access to the bowl and reduce the jamming that is occuring. The line is not currently running the bowl consistantly. Most of the parts have been completed by the toolroom.

The material has been ordered for the new contact probes on the #2 tester. This will eliminate the false ZPLF readings we are experiencing on all devices. Tooling should be complete by March.

Hexport ID Station

The mechanical tooling for the hexport ID station is expected in-house within 2 weeks. The programmable controller will not be complete until the beginning of April. Once all validation testing has been completed, Jim Wood will be notifying strategic customers. After this has happened, we will be changing over to the new design regardless of whether the tooling is installed.

QS9000

Claire Balthazar and I have been helping Jim Wood to develop the documentation linkage program.

PS/96/20

INVESTIGATION OF 77PS / 87PS SWITCHES BUILT WITH ANOMALOUS SPRING ARMS

GENERAL INFORMATION

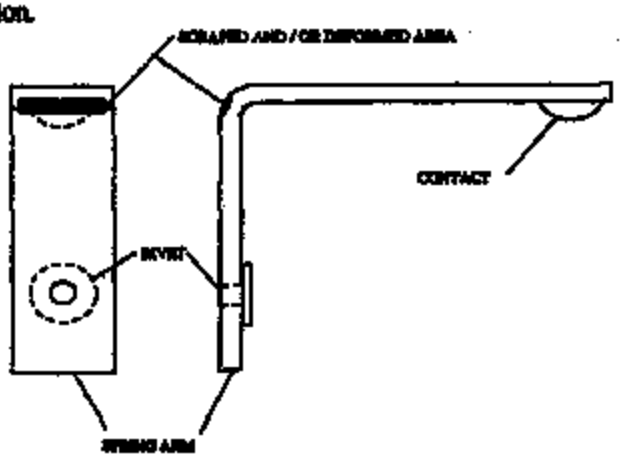
Customer:	Ford
TI P/N:	77PS, 87PS
TI Test Series Number:	497 - 15 - 24

OBJECTIVE

The objective of this study was to determine the risk associated with shipping devices containing anomalous spring arms. The devices are used in brake systems for cruise control de-activation and in power steering systems for high steering load idle-up activation.

DESCRIPTION OF PROBLEM

The spring anomaly is best described as a scoring or scraping, and/or material necking of the spring at the bend location.



ROOT CAUSE

The spring arm anomaly was created during the bending operation. It was caused by a loose tooling fixture. The problem was sporadic in nature. At times the tooling fixture was correctly aligned producing "good springs". At other times the tool was mis-aligned creating various levels of spring arm scoring, scraping, and necking.

DESCRIPTION OF TESTING

TYPE OF TEST	REMARKS
Production Impulse Testing	10 Hz rate // 0 -1500 psig cycle Fluid: ATF
Endurance Testing	Per Ford Spec ES-F2VC-9F924-AA 2 Hz rate // 0 - 1600 psig cycle Fluid: ATF, no electrical load
Determination of Spring Arm Stiffness	Group 1 - normal production springs with no cycles Group 2 - normal production springs with 400K cycles on impulse tester Group 3 - anomalous springs with 400K on endurance test Group 4 - anomalous springs with 400K on impulse tester

CUSTOMER: Ford	[illegible]	PAGE 1 OF 1
[illegible]	TEXAS INSTRUMENTS INCORPORATED	[illegible]
[illegible]	MATERIALS & CONTROLS GROUP	[illegible]
DATE: March 1, 1996	ATTLEBORO, MASSACHUSETTS 02703	[illegible]

TABLE 1 SWITCH BUILD DESCRIPTION

QTY	DEVICE	ACT / Min. REL	TEST	SPRING CONDITION
10	77PSL3-1	150 / 20 (quiet)	Production Impulse	anomalous
10	77PSL3-1	150 / 20 (quiet)	Production Impulse	good
8	77PSL3-1	150 / 20 (quiet)	Endurance	anomalous
10	87PSL11-2	450 / 200 (snap)	Production Impulse	anomalous
10	87PSL11-2	450 / 200 (snap)	Production Impulse	good
8	87PSL11-2	450 / 200 (snap)	Endurance	anomalous
10	87PSL2-3	350 / 120 (snap)	Production Impulse	anomalous
10	87PSL2-3	350 / 120 (snap)	Production Impulse	good
8	87PSL2-3	350 / 120 (snap)	Endurance	anomalous
10	87PSL2-3	350 / 120 (snap)	Noise (control grp.)	good

- All switches were assembled on the production floor using standard build practices.
- Spring arm stiffness tests were completed using three piece samples from the above groups.

TEST PROCEDURE

1. All switches were subjected to an overpressure of 1300 psi during the sensor build on the AML.
2. All switches were subjected to a function test consisting of two cycles of 0-800 psi, followed by a calibration cycle.
3. All switches were backfilled with ATF and mounted on a manifold.
4. The switches were cycled on either the production impulse tester or endurance test setup in lifetest.
5. The switches were check for proper function every 100K cycles, all switches were tested for a total of 400K cycles.

   Results from above test are shown in Table 2

6. The switches from all groups were disassembled and visually inspected for excessive spring wear, spring fatigue, and crack propagation.
7. Force / deflection curves were taken on three samples of each test group.
8. The spring arms from each of the anomalous groups were studied to determine if they were representative of a worst case condition.

   Results from above test are shown in Table 3

[illegible] Paul	[illegible]	Sheet 2 of 8
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
DATE March 1, 1996	[illegible]	[illegible]

TABLE 2 SUMMARY OF IMPULSE AND ENDURANCE TEST RESULTS

DEVICE	TEST	SPRING CONDITION	POST 400K FUNCTION TEST	REMARKS
77PSL3-1	Production Impulse	anomalous	100 % PASS	
77PSL3-1	Production Impulse	good	100 % PASS	
77PSL3-1	Endurance	anomalous	100 % PASS	
87PSL11-2	Production Impulse	anomalous	60 % PASS	1 of 10 had broken spring post 100K 3 of remaining 9 had broken spring post 400K
87PSL11-2	Production Impulse	good	100 % PASS	
87PSL11-2	Endurance	Anomalous	100 % PASS	
87PSL2-3	Production Impulse	anomalous	60 % PASS	1 of 10 had broken spring post 200K 1 of remaining 9 had broken spring post 300K 2 of remaining 8 had broken spring post 400K
87PSL2-3	Production Impulse	good	100 % PASS	
87PSL2-3	Endurance	anomalous	88 % PASS	1 of the 8 broke a spring between 155K - 280K

- Function test consisted of checking calibration and transfer time.

TABLE 3 SUMMARY OF SPRING ARM STIFFNESS TEST RESULTS

DEVICE	SPRING CONDITION	VISUAL INSPECTION	SPRING ARM STIFFNESS	VERIFICATION OF SPRING ARM ANOMALY
87PSL2-3	good	N/A	CONTROL GRP.	N/A
77PSL3-1	anomalous (impulse)	Normal wear	No reduction in stiffness	anomalies present
77PSL3-1	good (impulse)	Normal wear	No reduction in stiffness	No anomalies present
77PSL3-1	anomalous (endurance)	Normal wear	No reduction in stiffness	anomalies present
87PSL11-2	anomalous (impulse)	Normal wear	No reduction in stiffness	anomalies present
87PSL11-2	good (impulse)	Normal wear	No reduction in stiffness	No anomalies present
87PSL11-2	anomalous (endurance)	Normal wear	No reduction in stiffness	anomalies present
87PSL2-3	anomalous (impulse)	Normal wear	No reduction in stiffness	anomalies present
87PSL2-3	good (impulse)	Normal wear	No reduction in stiffness	No anomalies present
87PSL2-3	anomalous (endurance)	Normal wear	No reduction in stiffness	anomalies present

- Verification of the anomaly was done by over-bending the spring arm through 100° rotation until failure. Failure within two cycles verified the presence of an anomaly.

- Force - deflection plots are shown in Appendix A.

GENERAL STATISTICAL RISK ANALYSIS OF 87PS DEVICES

- 8 of 20 (40 %) 87PS devices broke spring arms during production impulse testing (400K total cycles), the earliest failure was post 100K.
- 1 of 16 (6 %) 87PS devices broke it's spring arm during endurance testing at about 200K
- Based upon a Honda power steering trace (T.S. # 75-15-05), switch actuation will most often occur during parking lot situations characterized by no vehicle movement and near full lock turning.
- Assuming a 10 year vehicle life and that the vehicle is driven 365 days / year.
  - 400K cycles / 10 yr life = 110 cycles per day
  - 200K cycles / 10 yr life = 55 cycles per day
  - 100K cycles / 10 yr life = 27 cycles per day
- The two possible failure modes would be a continuous high idle condition caused by a broken spring arm, or a no idle-up condition caused by the broken spring arm bridging the gap between the terminals. The no idle-up condition may allow the vehicle to stall under high steering load conditions.

CONCLUSIONS

The results of this study show that there is no risk associated with using 77PS devices containing anomalous spring arms. The results also show that there is very little risk associated with using 87PS devices containing anomalous spring arms. The lack of a reduction in spring arm stiffness indicates that the spring is being cycled within it's elastic range. Consequently, the fatigue limit of the spring arm remains high enough to withstand the full life cycle of the switches.

77PS DEVICES

- The 77PS devices are used in brake systems for cruise control de-activation.
- The results show that the spring anomaly causes no difference in function between the control and test groups.
- The results also show that the spring anomaly causes no reduction in spring stiffness or switch life.

87PS DEVICES

- The 87PS devices are used in power steering systems for high steering load idle-up activation.
- The results show that in the vast majority of the devices the spring anomaly causes no difference in function between the control and test groups.
- The results also show that the spring anomaly causes no reduction in spring stiffness and that the switch life is not significantly compromised.

[illegible]	[illegible]	PAGE 4 OF 5
[illegible]	TEXAS INSTRUMENTS INCORPORATED	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

APPENDIX A

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

PS/96/

ANALYSIS OF SENSOR CUP'S HEIGHT EFFECT ON VACUUM DEPENDENT DISPLACEMENT

OBJECTIVE

This study investigates whether or not changing the sensor cup height will alleviate the problem of vacuum dependent displacement. In addition, this report will address the feasibility of implementation.

DESCRIPTION OF PROBLEM

At the customer site, a vacuum is pulled during their routine evacuation and fill of the brake cylinders. The pulling of the vacuum causes the Kapton diaphragm to "snap" and pull away from the converter/washer. The converter, washer, spacer, and disc are then free to displace in the same direction as the Kapton. In cases of a high vacuum, the looseness of the components would cause the spring arm to unload and result in an open circuit condition. The device will return to normal operation after a light positive pressure is applied.

The corrective action was to decrease the cup step height, thereby allowing less movement of the components under high vacuum. Two sensor cup types with varying step heights are presently being used:

Part Number	Cup Step Height (in)
27713-1	.090-.092
27713-2	.086-.088

The -2 cup solved the problem of vacuum dependent displacement but resulted in disc preload. In addition, the devices exhibited lower actuation and widero's on the actuation and sensor dimensions.

PREVIOUS EXPERIMENTATION

Engineering Test Report PS/95/72 studies vacuum dependent displacement as a function of cup step height. Cup step heights from 0.086 to 0.092 were created using shims between the washer and the ??. The study showed that as step height increased, so did the vacuum displacement. It was determined that a cup step height of 0.087 to 0.089 would eliminate vacuum dependent continuity loss without causing disc preload.

A new tool was made by Valentine Tool & Stamping to manufacture the 27713-3 cup, with a cup step height of 0.087-0.089.

CUSTOMER: Ford	TITLE: Vacuum Dependent Displacement	PAGE: 1 of 3
TESTED BY: Paul Arruda	TEXAS INSTRUMENTS INCORPORATED	DEVICE: 77PS
APPROVED BY: Di T. Ha	MATERIALS & CONTROLS GROUP	DOC.: PE/96/
DATE: March 11, 1996	ATTLEBORO, MASSACHUSETTS 02703	FILE NAME: PE_96_

Note: The study described in PS/95/72 was performed using stack-ups from Ford Oakville returned devices.

TEST PROCEDURE & RESULTS

Test #1: Repeat Keith Rosiello's previous study on vacuum dependency (see Eng Test Report PS/95/72) using -2 sensor cups with Oakville stack-ups.

- A single 27713-2 cup with a step height of 0.0869" was used in the first phase of testing. Shims were made of .001" and .002" thickness to simulate step heights ranging from 0.0869 (no shim) to 0.0899). Sensor crimp was simulated using a lab test fixture.

Results:

The results summarized in the table below show that an effective cup step height of 0.0879" will eliminate vacuum dependent continuity loss without causing disc preload. A cup step height of 0.0889" exhibits too much vacuum displacement and could possibly lead to continuity loss.

P/N	Cup Step Height w/o Shim (in)	Total Shim Thickness (in)	Effective Cup Step Height (in)	Exp. Vacuum Displacement (in)
77PSL3-2	0.0869	0	0.0869	0.0006 (some preload)
77PSL3-2	0.0869	0.001	0.0879	0.0016
77PSL3-2	0.0869	0.002	0.0889	0.0031
77PSL3-2	0.0869	0.003	0.0899	0.0041

Note: Used -2 cup #1

Test #2: Using results from Test #1, a -2 cup with a measured cup step height of 0.087" + 0.001" shim was built on the production line (production crimp) into a sensor assembly using Ford Oakville stack-ups. This was then compared with a 77PSL3-2 sensor assembly in inventory. PD curves were generated twice for each case.

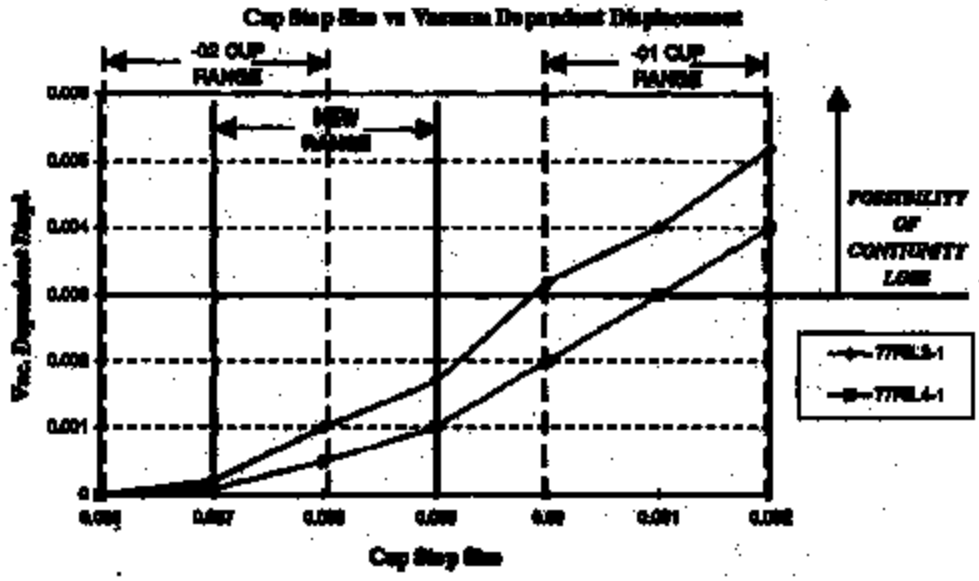
Results:

P/N	Cup Step Height w/o Shim (in)	Total Shim Thickness (in)	Effective Cup Step Height (in)	Exp. Vacuum Displacement (in)
77PSL3-2 Trial 1 Trial 2		N/A		 0.001 0.001
77PSL3-2 Trial 1 Trial 2	0.087	0.001	0.088	 0.028 0.028

TABLE 2 Correlation Between Cup Step Height and Vac. Dependent Displ.

P / N	STEP HEIGHT w/o SHIM	TOTAL SHIM THICKNESS	EFFECTIVE CUP STEP HEIGHT	EXP. VAC DISPL
77PSL3-1 # 5	0.086	0	0.086	0 (Preloaded)
77PSL3-1 # 5	0.086	0.001	0.087	0.0001
77PSL3-1 # 5	0.086	0.002	0.088	0.0005
77PSL3-1 # 5	0.086	0.003	0.089	0.0010
77PSL3-1 # 5	0.086	0.004	0.090	0.0020
77PSL3-1 # 5	0.086	0.006	0.092	0.0040
77PSLA-1 # 4	0.086	0	0.086	0 (Preloaded)
77PSLA-1 # 4	0.086	0.001	0.087	0.0002
77PSLA-1 # 4	0.086	0.002	0.088	0.0010
77PSLA-1 # 4	0.086	0.003	0.089	0.0017
77PSLA-1 # 4	0.086	0.004	0.090	0.0052
77PSLA-1 # 4	0.086	0.005	0.091	0.0040
77PSLA-1 # 4	0.086	0.006	0.092	0.0052

- Preloading refers to the disc being initially deformed by forces created during the assembly process.



CONCLUSIONS

The results of this study show that a cup step height of 0.087 to 0.089 will eliminate vacuum dependent continuity loss without causing disc preload.

PS/95/72

THE ELIMINATION OF VACUUM DEPENDENT CONTINUITY LOSS ON 77PS CRUISE CONTROL SWITCHES

GENERAL INFORMATION

Customer:	Ford
TI P/N:	77PS
TI Test Report Number:	PS/95/72
TI Test Series Number:	478-15-35

OBJECTIVE

The objective of this study was to determine the cup step height which eliminates vacuum dependent continuity loss without causing disc preload.

SENSOR BUILD DESCRIPTION

QTY	T.I. PART NUMBER	CUP PART NUMBER	CUP STEP HEIGHT RANGE
8	77PSL3-1	27713-01	.090 - .092
15	77PSL3-2	27713-01	.090 - .092
8	77PSL4-1	27713-02	.086 - .088
8	77PSL6-1	27713-02	.086 - .088

- All sensors were built on the AMI using standard production procedures.

TEST PROCEDURE

Determine Vacuum Dependent Displacement in Production Sensors.

1. All sensors were probed with a torrington pin to determine diaphragm position.

2. All sensors were function tested using two cycles of 0-600 psi.

3. All sensors were exposed to an increasing vacuum level to 2 mbar maximum and held for 60 seconds. Simultaneously, the vacuum dependent displacement was monitored and plotted, as shown in Appendix A.

4. Immediately after the vacuum cycle described in step 3, a positive pressure cycle of 0 - 300 psi was applied to the sensor and plotted as shown in Appendix A.

5. Representative sensors from each product group were disassembled and their components measured using a dial indicator.

Determine Correlation Between Cup Step Height and Vacuum Dependent Displacement.

6. A sensor cup, P/N 27713-02, with the minimum step height of .086" was located and labeled.

7. Sensors were assembled in a test fixture using the cup identified in step 6 and the components measured in step 5.

8. The test fixture clamping force was correlated to the AMI crimping station as shown in Appendix B.

9. The repeatability of the test method, specifically the clamping together of components, was verified, as shown in Appendix B.

10. Several shims of different thickness were produced to enable cup step height variation.

11. Steps 1 through 4 were repeated using sensors made from various thickness shims to create sequential cup step heights. All other sensor components and parameters remained constant. results are shown in Appendix C.

RESULTS

TABLE 1 Component Measurements

P / N	CUP BUMP HEIGHT	CUP BUMP TO STEP HEIGHT	CONV / SPACER / DISC HEIGHT	THEORETICAL VAC DISPL	EXP. VAC DISPL
77PSL3-1 # 3	0.0145	0.090	0.0850	0.0050	0.0025
77PSL3-1 # 5	0.0135	0.092	0.0850	0.0070	0.0040
77PSL3-2 # 3	0.0140	0.090	0.0850	0.0050	0.0015
77PSL3-2 # 8	0.0145	0.090	0.0850	0.0050	0.0020
77PSL3-2 # 70	0.0145	0.092	0.0850	0.0070	0.0050
77PSL3-2 # 71	0.0145	0.092	0.0850	0.0070	0.0065
77PSL3-2 # 72	0.0145	0.092	0.0850	0.0070	0.0050
77PSL3-2 # 73	0.0145	0.092	0.0850	0.0070	0.0050
77PSL3-2 # 74	0.0145	0.092	0.0850	0.0070	0.0050
77PSL3-2 # 75	0.0145	0.092	0.0850	0.0070	0.0040
77PSL3-2 # 76	0.0145	0.092	0.0850	0.0065	0.0065
77PSL4-1 # 4	0.0135	0.087	0.0850	0.0020	0.0000
77PSL4-1 # 6	0.0140	0.089	0.0850	0.0040	0.0020
77PSL6-1 # 1	0.0135	0.087	0.0850	0.0020	0.0000
77PSL6-1 # 5	0.0135	0.087	0.0850	0.0020	0.0000

- Theoretical vacuum displacement = Effective cup step height - (Effective converter height + Spacer thickness + Effective disc height).

- Experimental vacuum displacements were obtained from the plots provided in Appendix A.

PS/96/

ANALYSIS OF SENSOR CUP'S HEIGHT EFFECT ON VACUUM DEPENDENT DISPLACEMENT

OBJECTIVE

This study investigates whether or not changing the sensor cup height will alleviate the problem of vacuum dependent displacement. In addition, this report will address the feasibility of implementation.

DESCRIPTION OF PROBLEM

At the customer site, a vacuum is pulled during their routine evacuation and fill of the brake cylinders. The pulling of the vacuum causes the Kapton diaphragm to "snap" and pull away from the converter/washer. The converter, washer, spacer, and disc are then free to displace in the same direction as the Kapton. In cases of a high vacuum, the looseness of the components would cause the spring arm to unload and result in an open circuit condition. The device would return to normal operation after a light positive pressure is applied.

The initial corrective action was to decrease the cup step height, thereby allowing less movement of the components under high vacuum. Two sensor cup types with varying step heights are presently being used:

Part Number	Cup Step Height (in)
27713-1	.090-.092
27713-2	.086-.088

The -2 cup solved the problem of vacuum dependent displacement but resulted in disc preload. In addition, the devices exhibited lower actuation and widerc's on the actuation and sensor dimensions.

PREVIOUS EXPERIMENTATION

Engineering Test Report PS/95/72 studies vacuum dependent displacement as a function of cup step height. Cup step heights from 0.086 to 0.092 were created using shims between the washer and the ??. The study showed that as step height increased, so did the vacuum displacement. It was determined that a cup step height of 0.087 to 0.089 would eliminate vacuum dependent continuity loss without causing disc preload.

A new tool was made by Valentine Tool & Stamping to manufacture the 27713-3 cup, with a cup step height of 0.087-0.089.

CUSTOMER: Ford	TEST: Vacuum Dependent Displacement	PAGE 1 of 4
TESTED BY: Paul Arruda	TEXAS INSTRUMENTS INCORPORATED	DEVICE: 77PS
APPROVED BY: Di T. Ha	MATERIALS & CONTROLS GROUP	DOC.: PS/96/
DATE: September 11, 1996	ATTLEBORO, MASSACHUSETTS 02703	FILE NAME: PS_96_

Note: The study described in PS/95/72 was performed using stack-ups from Ford Oakville returned devices.

TEST PROCEDURE & RESULTS

Test #1:
Repeat Keith Rosiello's previous study on vacuum dependency (see Eng Test Report PS/95/72) using -2 sensor cups with Oakville stack-ups.
A single 27713-2 cup with a step height of 0.0869" was used in the first phase of testing. Shims were made of 0.001" and 0.002" thickness to simulate step heights ranging from 0.0869" (no shim) to 0.0899". Sensor crimp was simulated using a lab test fixture.

Results:
The results summarized in the table below show that an effective cup step height of 0.0879" will eliminate vacuum dependent continuity loss without causing disc preload. 0.088" is the optimal nominal cup step height. A cup step height of 0.0889" exhibits more vacuum displacement, is closer to the pinning window, and may lead to continuity loss.

P/N	Cup Step Height w/o Shim (in)	Total Shim Thickness (in)	Effective Cup Step Height (in)	Exp. Vacuum Displacement (in)
77PSL3-2	0.0869	0	0.0869	0.0006 (some preload)
77PSL3-2	0.0869	0.001	0.0879	0.0016
77PSL3-2	0.0869	0.002	0.0889	0.0031
77PSL3-2	0.0869	0.003	0.0899	0.0041

Note: Used -2 cup #1

Test #2:
Using results from Test #1, -3 cups with a measured cup step height of 0.0872 were built on the production line (production crimp) into a sensor assembly using Ford Oakville stack-ups. Since the -3 cup was measured on the low side of dimensional spec, a 0.001" shim was used in one of the devices. PD curves were generated twice for each case to ensure repeatability.

Results:
The results from this test corroborate results from Test #1. A cup step height of 0.0872 results in very little vacuum dependent displacement, but causes disc preload. A cup step height of 0.0882" exhibits vacuum dependent displacement within the allowable limits such that the disc is not preloaded and continuity loss is not possible.

P/N	Cup Step Height w/o Shim (in)	Total Shim Thickness (in)	Effective Cup Step Height (in)	Exp. Vacuum Displacement (in)
77PSL3-2 Trial 1 Trial 2	0.0872	N/A	0.0872	 0.0005 (Preload) 0.0005 (Preload)

77PSL3-2 Trial 1 Trial 2	0.0872	0.001	0.00882	 0.022 0.022

Test #3:
Up to this point all testing of parts were performed using Ford Oakville stack-ups. Current production parts from August 96 were obtained and built into sensor assemblies. Six P/N 27713-3 cups were built into sensor assemblies on the production linecrimper.

Results:
All six sensor assemblies exhibited no vacuum dependent displacement, but did exhibit extensive preload. These results varied greatly from those in Test #2. It appears that component stack-up can cause great variation in results.

DIMENSIONAL STACK-UP ANALYSIS

Theoretical:

All components located in the sensor cup were examined to look at dimensional stack-up. Results showed that the total stack-up of components could vary as much as 0.0065".

Component	Dimension (in)
Diaphragm Seal (3 layers)	0.015 ± 0.0015
Washer	0.099 ± 0.002
Converter	0.165 ± 0.003
Spacer	0.002 ± 0.0003
Disc	Info not available on detail drawing
Total:	0.281 ± 0.0065

Looking at just those components (converter, spacer, disc) that sit in the cup step area, the dimensional variation would be 0.167± 0.0033".

Experimental:

Stack-up differences were measured using a micrometer to compare the stack-ups between the Ford Oakville stack-ups and the current production lot. Results are summarized in the table below.

	Converter/Spacer /Disc Stackup	Washer Thickness	Washer Concavity
Ford Oakville Samples			
#1	0.09100	0.10000	0.0009

CUSTOMER: Ford	TEST: Vacuum Dependent Displacement	PAGE 3 of 4
TESTED BY: Paul Arruda	TEXAS INSTRUMENTS INCORPORATED MATERIALS & CONTROLS GROUP ATTLEBORO, MASSACHUSETTS 02703	DEVICE: 77PS
APPROVED BY: Di T. Ha		DOC. #: PS/96/
DATE: September 11, 1996		FILE NAME: PS_96_

#2	0.08040	0.10020	0.0011
#3	0.08120	0.10010	0.0013
#4	0.08085	0.09960	0.0006
#5	0.08120	0.09995	0.0012
AVERAGE:	**0.08093**	**0.09997**	**0.0011**
Current Production Samples			
#1	0.08440	0.10175	0.0014
#2	0.08360	0.10080	0.0006
#3	0.08225	0.10115	0.0008
#4	0.08210	0.10065	0.0013
#5	0.08250	0.10010	0.0011
AVERAGE	**0.08297**	**0.10089**	**0.0012**
Δ in Averages:	**0.00204**	**0.00092**	

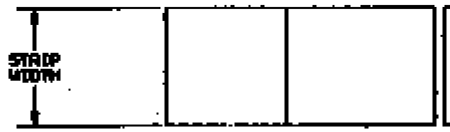
+ 0.00296

CUSTOMER: Ford	TEST: Vacuum Dependent Displacement	PAGE 4 of 4
TESTED BY: Paul Arruda	TEXAS INSTRUMENTS INCORPORATED MATERIALS & CONTROLS GROUP ATTLEBORO, MASSACHUSETTS 02703	DEVICE: 77PS
APPROVED BY: D. T. Ha		DOC.: PS/96/
DATE: September 11, 1996		FILE NAME: 96_96_

5	4	3	2	1

REVISIONS

ZONE	LTR	DESCRIPTION PROJ.# 3355	DATE	APPROVED
	AA	1: -1 AND -2, MATERIAL WAS DUPONT FN131 CHANGED, CPF	4-8-98	G.V.

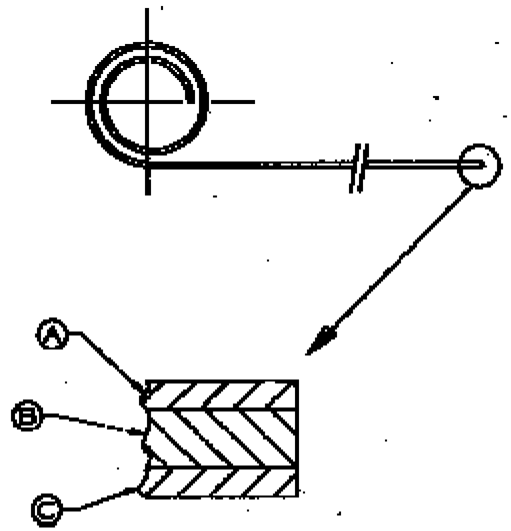


ENG. UTILITIES REV. E

Date AUG 15 1996

NOTES:

1. STRIP TO BE INSPECTED FOR TEFLON COATING, THICKNESS, DEFORMITIES, BUBBLES, AND LAMINATE SEPARATION.
2. EACH KAPTON STRIP ROLL MUST BE LABELED WITH T.I. PART NO. ON INSIDE OF CORE.
3. NO MORE THAN 2 SPLICES PER COIL PERMITTED. SPLICES TO BE CLEARLY MARKED WITH YELLOW MYLAR.
4. MATERIAL CERTIFICATION REQUIRED WITH EACH SHIPMENT.
5. ROLLS SLITTED FROM END OF MASTER COIL NOT ACCEPTABLE.
6. BUCKLING OF THE CORE ALLOWED UP TO 1/4" MEASURED RADIALLY AWAY FROM THE CORE.
7. DENT RIP OR JAGGED EDGES ON MATERIAL NOT ALLOWED.
8. ROLLS ARE TO BE SHIPPED WITH PROTECTIVE INSERT CORES IN THE PACKING BOX.
9. ROLLS TO BE SHIPPED IN CLOSED PLASTIC BAGS.
10. END OF REEL TO HAVE A 6" OPAQUE TAPE END-OF-REEL MARKER.
11. MATERIAL SUPPLIED FOR THIS PRINT MUST MEET T.I. MATERIAL SPECIFICATION #75851.



PART NO.	MATERIAL (SEE NOTE [1])	THICKNESS (MILS)	TEFLON FEP (A)	KAPTON TYPE H (B)	TEFLON FEP (C)	STRIP WIDTH (IN.)	PAD PUT UP (I.D.)(O.D.) (IN.)	CORE MATERIAL
			CONSTRUCTION (MILS)(SEE NOTE 2)					
27225-5	DUPONT 500HN MONOLITHIC KAPTON	.5 ±.5 MILS	0.0	5	0.0	.952-.984	6 x 9 1/2	PLASTIC (WHITE)
27225-4	DUPONT 300HN MONOLITHIC KAPTON	3 ±.3 MILS	0.0	3	0.0	.734-.766	6 x 9 1/2	PLASTIC (WHITE)
27225-3	DUPONT 300 FN929	3 ±.4 MILS	0.5	2	0.5	.952-.984	3 x 9 1/2	PLASTIC (WHITE)
27225-2 (NOTE 10)	DUPONT 500 FN131L	5 ±.5 MILS	1	3	1	.952-.984	6 x 9 1/2	PLASTIC (WHITE)
27225-1	DUPONT 500 FN131L	5 ±.5 MILS	1	3	1	.734-.766	6 x 9 1/2	PLASTIC (WHITE)

THIS DWG. SUPERSEDES 27225 REV."Y" DATED 5-15-95

01= F37

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DRAWN CHAS. FLEURANT	DATE 8-5-94
TOLERANCES ON FRACTIONS DECIMALS ANGLES	ENGINEER G. VERRAS	8-5-94
MATERIAL	CHECKED J.H. BALE	8-5-94
	APPROVED	
	SIGNATURES ON FILE. REFER TO ELECTRONIC CHANGE NOTICE.	

TEXAS INSTRUMENTS

KLIXON

TITLE

KAPTON STRIP SPECIFICATION

SIZE	CAGE IDENT NO.	
B	82647	27225

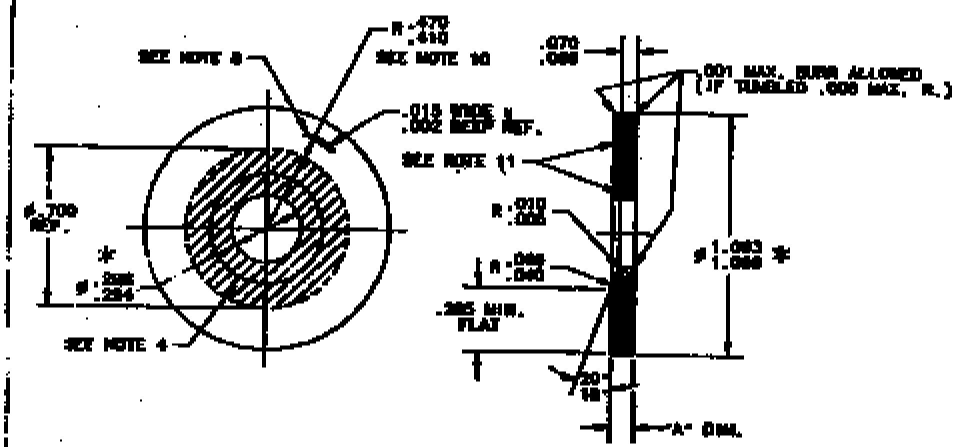
TI-NHTSA 011992

5	4	3	2	1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	[illegible]	1: "SEE NOTE 4" WAS "SEE NOTE 3" 2: "SEE NOTE 8" WAS "SEE NOTE 6" 3: "SEE NOTE 10" WAS "SEE NOTE 11" 4: "SEE NOTE 11" WAS "SEE NOTE 12" CN 180050 C.F.	[illegible]	[illegible]

FOR [illegible]
CHECK [illegible]
Parts Made to [illegible] Must Conform To
ENG. STD. [illegible] REV. E
Date AUG 1 5 1996



NOTES:

1. PART MUST BE FLAT TO WITHIN .006 T.I.R..
2. DIAMETERS MARKED WITH * MUST BE CONCENTRIC TO WITHIN .004 T.I.R..
3. PARTS TO BE SHIPPED, ISSUED, AND STORED WITH APPLIED RUST PREVENTIVE BEFORE PLATING. AFTER PLATING, PARTS TO BE SHIPPED, ISSUED, AND STORED IN SEALED PLASTIC BAGS.
4. NO TOOL MARKS ALLOWED IN THE SHADED AREA ON BEVELED SIDE OF WASHER.
5. THE PARTS HARDNESS IS MEASURED AFTER A .005-.010 THICK SKIN IS REMOVED.
6. THIS PART IS LOT CONTROLLED. ANY PRESS CHANGE, NEW SETUP, PUNCH CHANGE, MAJOR TOOL WORK OR MATERIAL LOT CHANGE WILL SIGNIFY START OF A NEW LOT. NO MINIMUM LOT SIZE. EACH BOX WILL HAVE A LOT NUMBER. EACH LOT WILL HAVE IT'S OWN PACKING SLIP WITH LOT IDENTIFICATION.
7. MATERIAL CERTIFICATION REQUIRED WITH EACH SHIPMENT.
8. STAMP IDENTIFICATION CODE AS REQUIRED TO IDENTIFY SUPPLIER TOOL. CODE SHALL BE CLEARLY VISIBLE AFTER PLATING. NO BURR OR SHARP EDGES PERMITTED. (-6 ONLY)
9. DIM. "A" TO BE MEASURED WITH STANDARD WASHER GAUGE.
10. IDENTIFICATION MARKS ALLOWED BETWEEN .410-.470R..
11. THESE SURFACES MUST BE SMOOTH AND FREE OF ANY PLATING ASPERITIES OR INCLUSIONS. (i.e. NO FROSTED EFFECTS OR PARTICULATE CONTAMINATION IN THE PLATING.)

THIS DWG. SUPERSEDES 27639 REV. "D" DATED [illegible]

PART NO	MATERIAL	FINISH	HEAT TREAT	"A" DIM.
27639-1	1050 CRS	ZINC PLATE .0002 - .0005 THK	HEATTREAT TO ROCKWELL C40-50	.097 - .101

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	DR [illegible]	DATE [illegible]	TEXAS INSTRUMENTS
TOLERANCE ON [illegible]	CK		
MATERIAL	ENG Stan Hamel	06-11-96	TITLE WASHER
	APPROVED [signature]		SIZE B · CODE IDENT NO. 82647 · 27639
			SCALE · SHEET

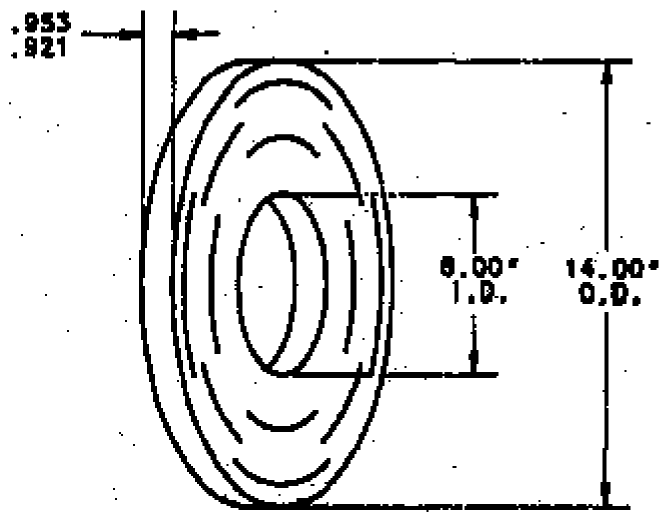
TI-NHTSA 011903

74224

KAPTON TAPE | REV. F | 74224

NOTES:

1. ROLLS SLITTED FROM ENDS OF MASTER COIL NOT ACCEPTABLE.
2. BUCKLING OF THE CORE ALLOWED UP TO 1/4" MEASURED RADIALLY AWAY FROM THE CORE.
3. DENTS, RIPS, OR JAGGED EDGES ON MATERIAL NOT ALLOWED.
4. ROLLS ARE TO BE SHIPPED WITH PROTECTIVE INSERT CORES IN THE PACKING BOX.



ENG. STD. E5558 REV. E
Date AUG 2 9 1995

74224-1	DUPONTS, KAPTON 200H	.0017/.0023
PART NUMBER	MATERIAL	THICKNESS

THIS DWG. SUPERSEDES 74224 REV."E" DATED 10-14-88

BY TOM DAIL 10-14-88
CH.
ENG. [signature] 10-16-90

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

KLIXON
CONTROL PRODUCTS DIVISION

DWG. SIZE A | DWG. NO. 74224

Wagner, Chris

From: Kill, Elizabeth[SMTP:ekill@stealth.mo.ti.com]
Sent: Friday, September 13, 1996 7:33 AM
To: Wagner, Chris
Subject: TSL # 140396, Examine etched Kapton

Objective:

Determine what has attacked the Kapton in a APT during cyclic salt spray testing.

Results:

FT-IR spectroscopy confirmed that the undamaged edge of the Kapton seal is a polyimide material. The top match from the spectral library was with a reference sample of Kapton with a match factor of 89.8%.

The spectrum of the blackened Kapton gives a very trace. The top match is with "polyamide-imide" at 70.6%. This is quite different than the polyimide alone. There is also some evidence of hydrolysis, as you suspected. I mathematically subtracted the water peaks from the spectrum, but came up with the same match. It is possible that this is a degradation product of the polyimide.

I attempted to scrape the surface on the blackened area to isolate the attacking compound, but there were no strong matches from the library. The top match is shown as "Nast (Nujol)" at 61%. This is another name for mineral oil. You will see in the spectral printout that it is not a good match. The surface of the degraded Kapton is probably a mixture of materials making identification of the individual components difficult. This is why we aren't getting any strong matches with any one compound.

Al's message mentioned a high level of iron and chloride, so I scanned a sample of iron chloride for comparison. It does not match any of the spectra from the Kapton sample.

I will forward the spectral data by internet mail. Please call if you have any questions.

Regards,

Beth x3069

September 24, 1996

TEXAS INSTRUMENTS

FACSIMILE TRANSMITTAL

TO:	**Name:**	**Ed McKenzie**
	Location:	**DuPont Circleville**
	Mail Station:	**N/A**
	Phone Number:	**(614) 474-0730**
	FAX Number:	**(614) 474-0689**
FROM:	**Chris Wagner**	
	TEXAS INSTRUMENTS MS 12-29	
	Phone Number:	**(508) 236-3170**
	FAX Number:	**(508) 236-3596**

Total number of pages (including header page): 9

COMMENTS:
Ed:

Attached are the FTIR scans performed here at TI. We did several scans, in two different runs. The sample descriptions are below.

The first battery of scans were run on the switch as TI Attleboro received it. (Switch # 22-2 was received.)

Undamaged edge of Kapton as a control.
Blackened edge of Kapton.
Blackened debris scrapped from the Kapton

TI-NHTSA 011996

We then removed the disc from the disc seat and continued the analysis. We analyzed

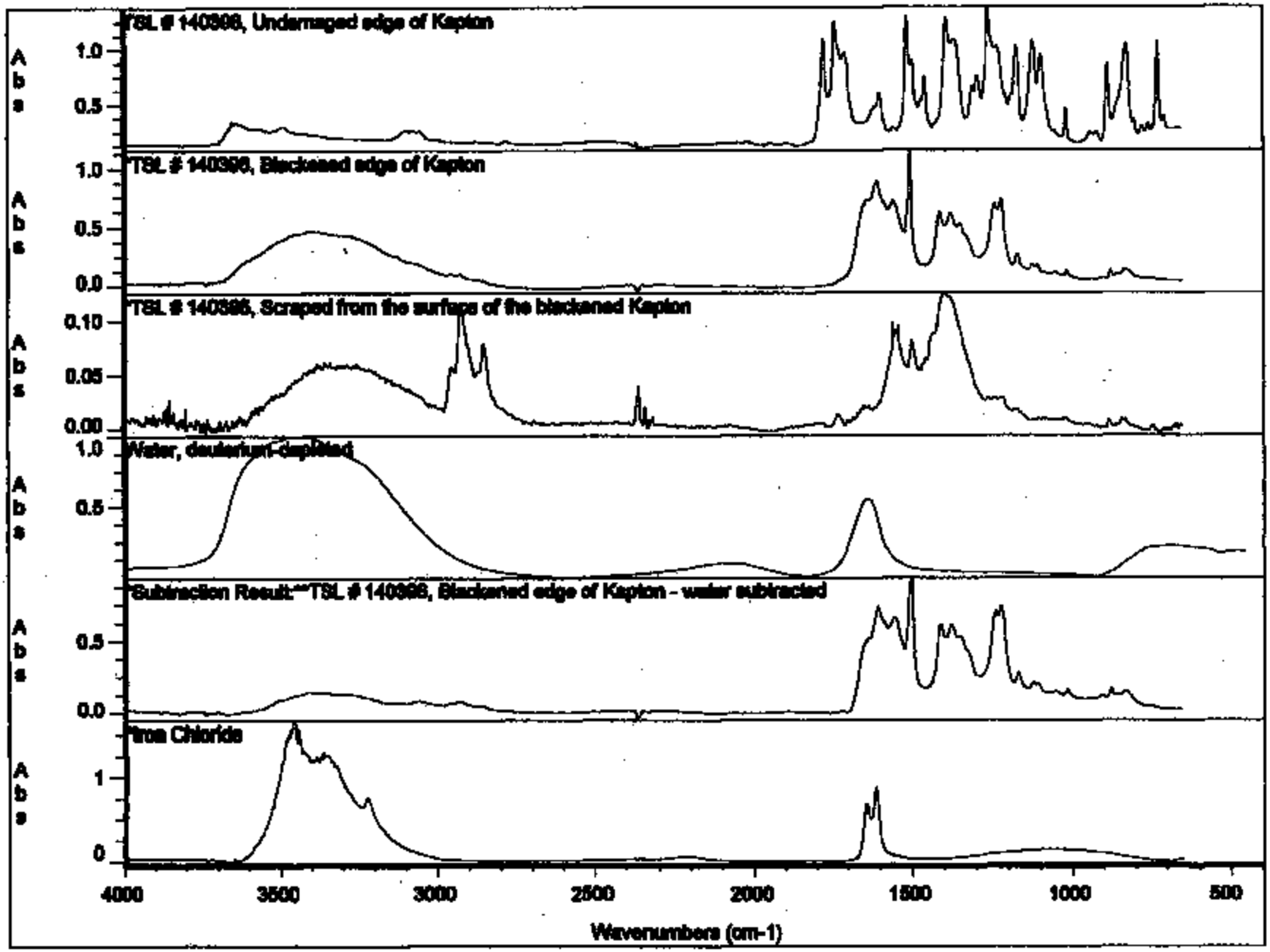
Debris which fell from the switch when the disc was removed.
Debris under the disc in the assembly.

Please review the scans and provide your opinion. If you would like the data sent electronically, please let me know. Thanks for your help in this matter.

Best Regards,

Chris D. Wagner
Mechanical Design
Design Engineering Department

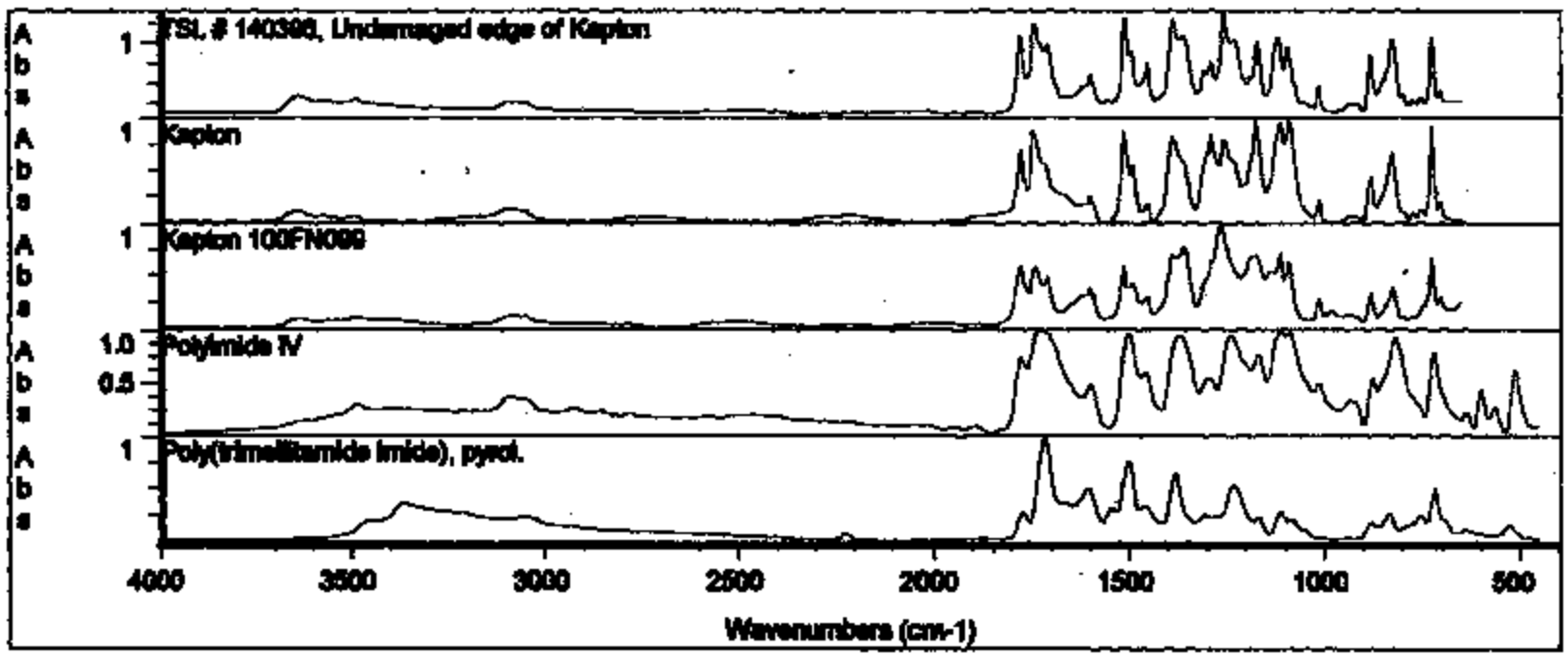
TEXAS INSTRUMENTS INCORPORATED * PO BOX 2964 * 34 FOREST STREET * ATTLEBORO, MA 02703



TI-NHTSA 011906

OMNIC Search

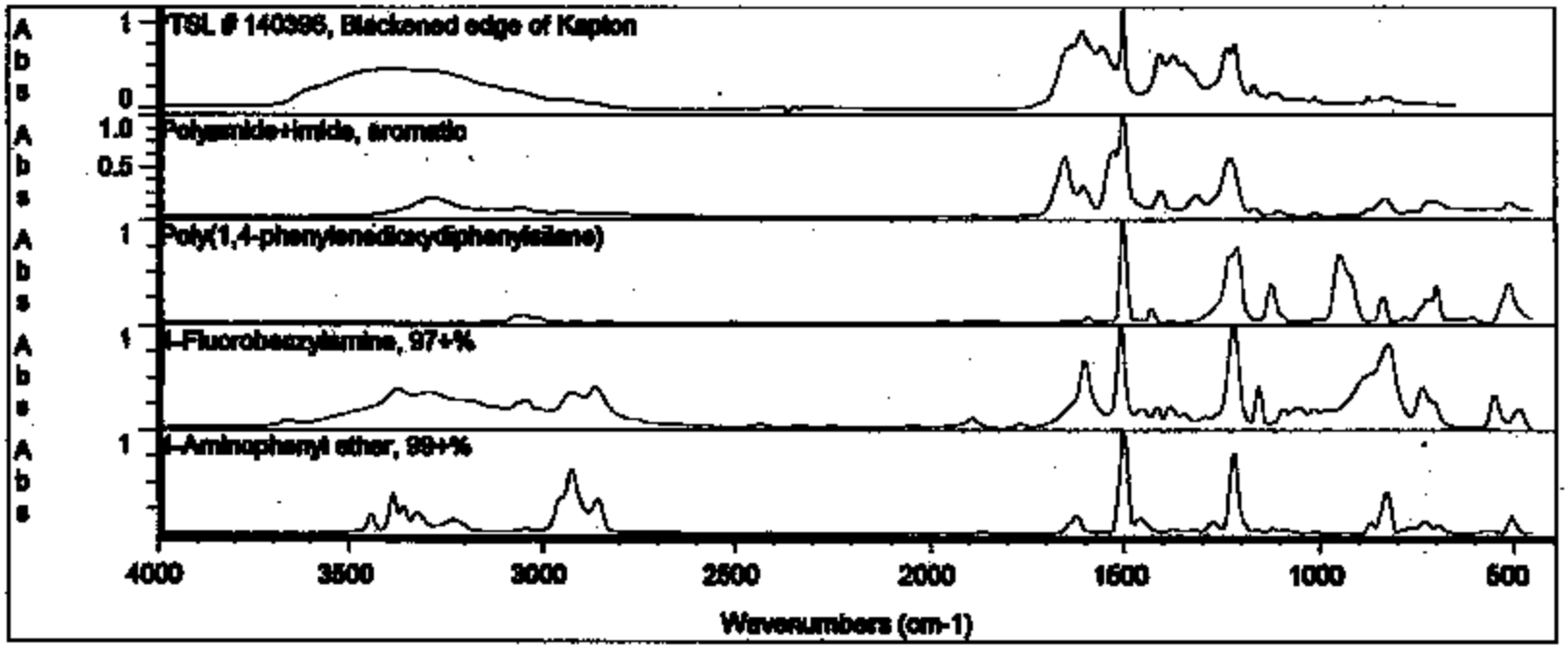
Spectrum: TSL # 140396, Undamaged edge of Kapton
Thu Sep 12 10:00:48 1996
Region: 3995.85 649.98
Search type: Correlation
Comment:



Index	Match	Compound name	Library
14	89.89	Kapton	TSL
39	79.07	Kapton 100FN099	TSL
1870	76.77	Polyimide IV	Hummel Polymer and Additives
274	47.67	Poly(trimellitamide imide), pyrol.	Hummel Polymer and Additives
504	46.42	Poly(phenylphthalein diphenylether)	Hummel Polymer and Additives
1241	46.26	4,4'-Isopropylidenediphenol, Bisphenol A	Hummel Polymer and Additives
471	46.12	Epoxy resin ester, 40% ester oil acids	Hummel Polymer and Additives
1781	46.02	4,4'-Isopropylidenediphenol	Hummel Polymer and Additives
1089	44.98	Polyimide	Hummel Polymer and Additives
748	43.95	Poly(4-hydroxystyrene)	Hummel Polymer and Additives

OMNIC Search

Spectrum: *TSL # 140396, Blackened edge of Kapton
Thu Sep 12 09:42:35 1996
Region: 3995.85 649.98
Search type: Correlation
Comment:

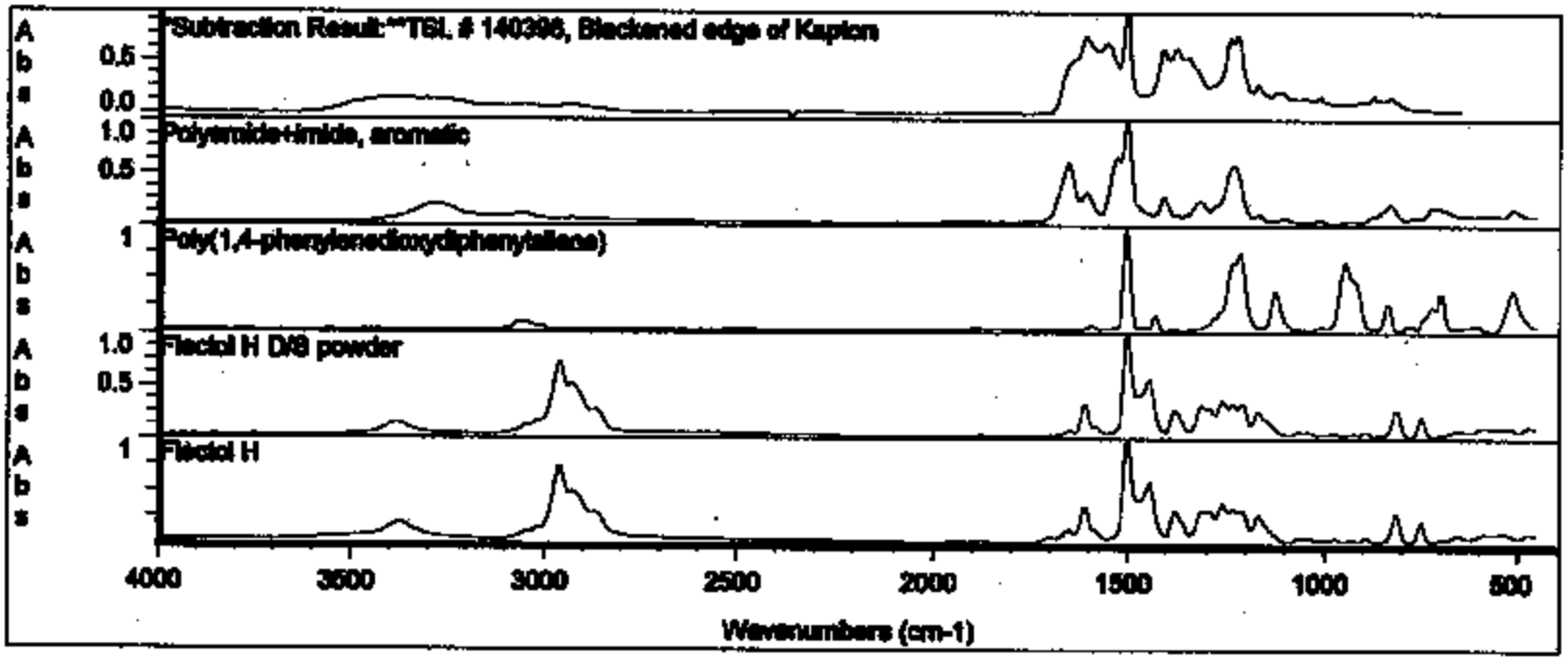


Index	Match	Compound name	Library
919	70.59	Polyamide+imide, aromatic	Hummel Polymer and Additives
901	61.70	Poly(1,4-phenylenedioxydiphenylsilane)	Hummel Polymer and Additives
3490	55.70	4-Fluorobenzylamine, 97+%	Aldrich Condensed Phase
3183	55.40	4-Aminophenyl ether, 99+%	Aldrich Condensed Phase
3823	54.59	4-Fluorophenyl isothiocyanate, 98%	Aldrich Condensed Phase
920	53.64	Polyamide+imide, aromatic	Hummel Polymer and Additives
720	53.35	Poly(4-fluorostyrene)	Hummel Polymer and Additives
342	53.30	Poly(trimellitamide imide)	Hummel Polymer and Additives
1048	52.26	Poly(3-oxybenzoylisophthalamide)	Hummel Polymer and Additives
344	52.18	Poly(trimellitamide imide)	Hummel Polymer and Additives

OMNIC Search

Spectrum: *Subtraction Result:**TSL # 140396, Blackened edge of Kapton
Thu Sep 12 10:07:05 1996
Region: 3995.85 649.98
Search type: Correlation
Comment:

(water subtracted)

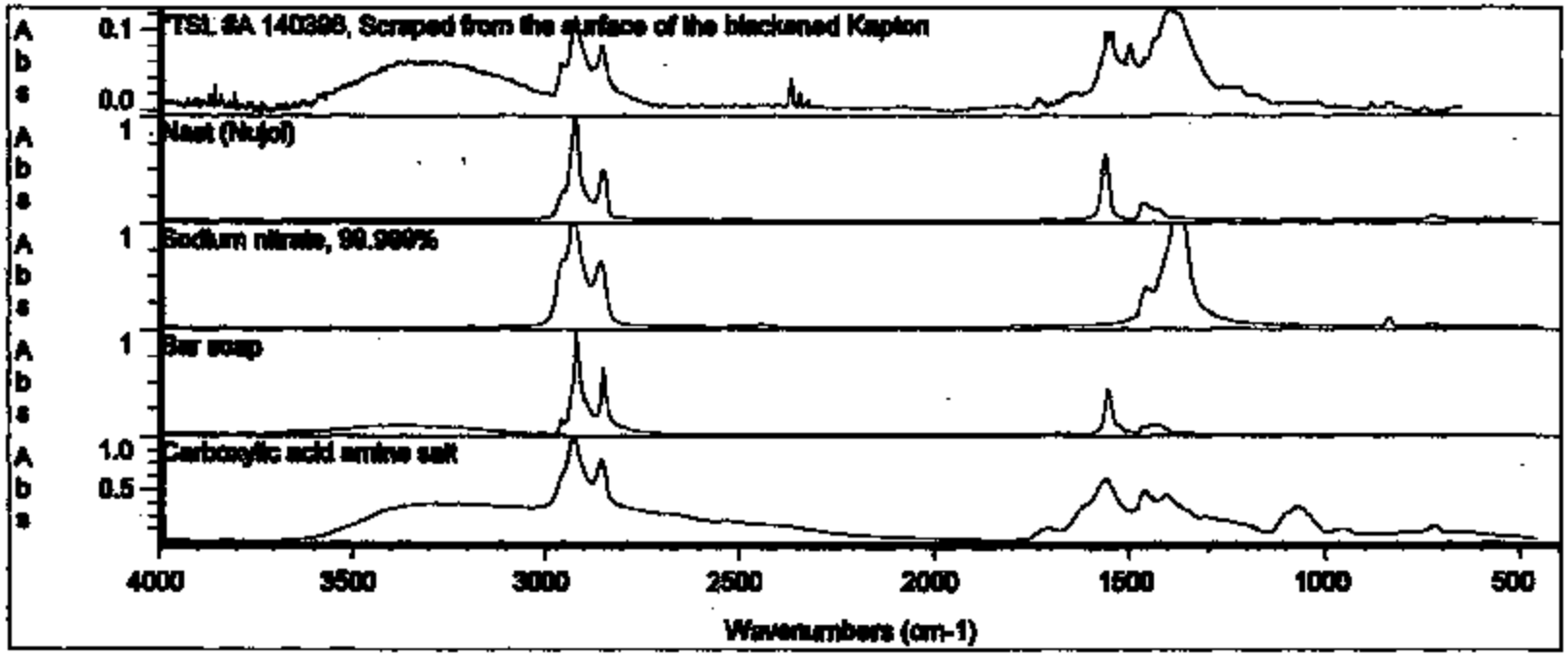


Index	Match	Compound name	Library
919	69.19	Polyamide-imide, aromatic	Hummel Polymer and Additives
901	55.50	Poly(1,4-phenylenedioxydiphenylsilane)	Hummel Polymer and Additives
1097	52.83	Flexlol H D/S powder	Hummel Polymer and Additives
201	50.76	Flexlol H	Rubber Compounding Materials
344	50.52	Poly(trimellitimide imide)	Hummel Polymer and Additives
5751	49.43	4-Aminohippuric acid, sodium salt 3H2O,	Aldrich Condensed Phase
342	49.33	Poly(trimellitimide imide)	Hummel Polymer and Additives
3322	49.28	2-Chloro-1,4-phenylenediamine sulfate, 9	Aldrich Condensed Phase
920	49.26	Polyamide-imide, aromatic	Hummel Polymer and Additives
3823	48.70	4-Fluorophenyl isothiocyanate, 98%	Aldrich Condensed Phase

TI-NHTSA 012001

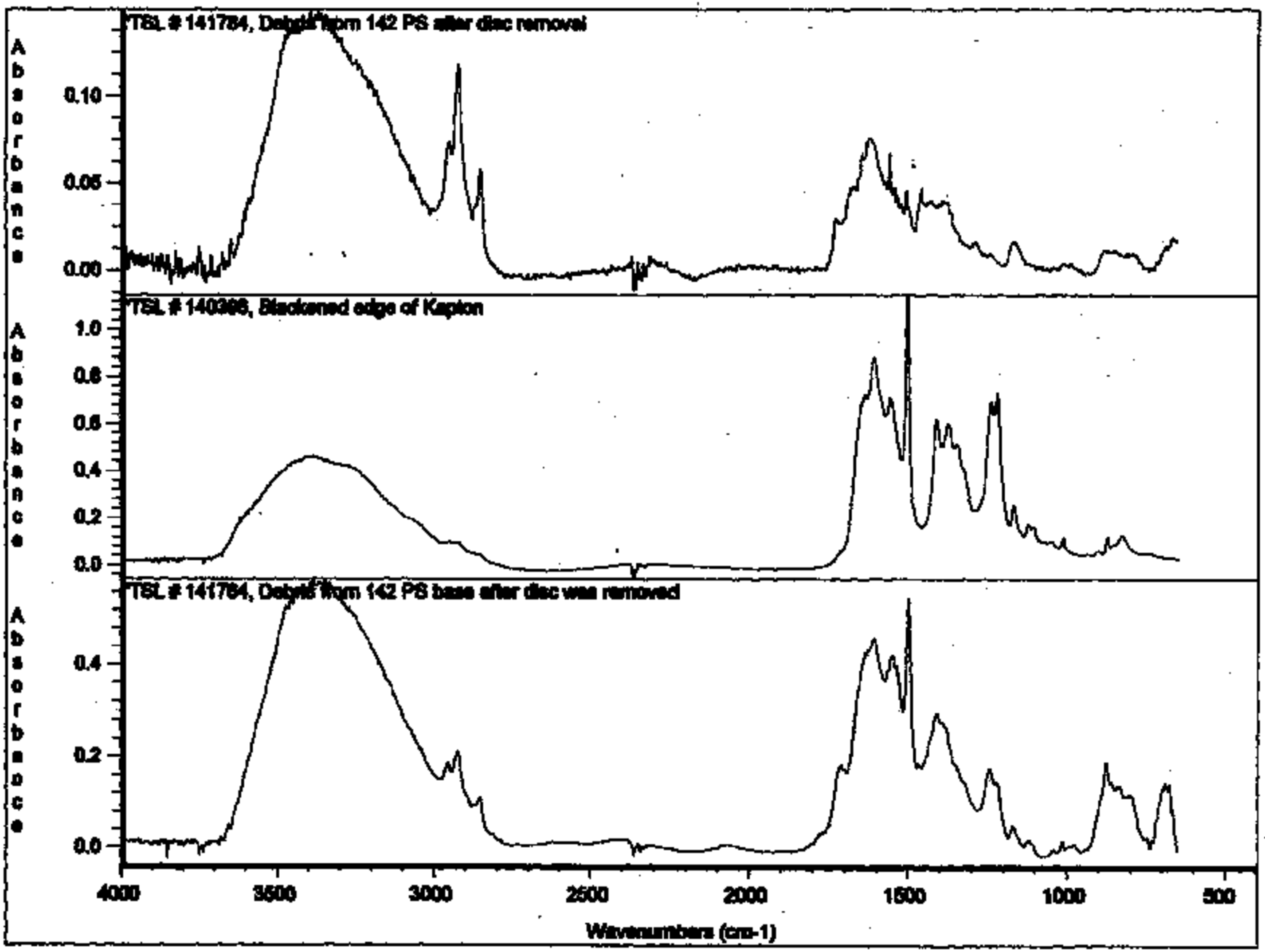
OMNIC Search

Spectrum: *TSL #A 140396, Scraped from the surface of the blackened Kapton
Thu Sep 12 09:50:50 1996
Region: 3995.85 649.58
Search type: Correlation
Comment:



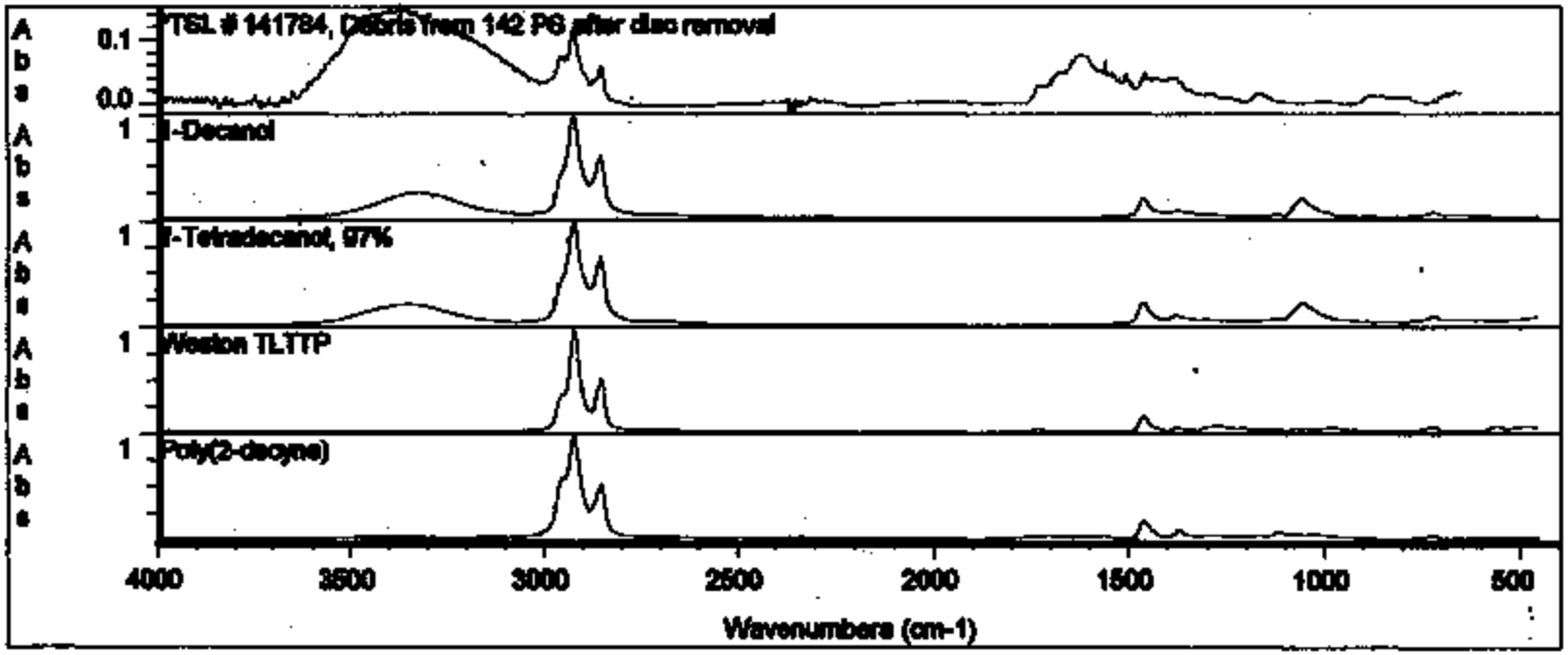
Index	Match	Compound name	Library
1	61.41	Nast (Nujol)	Customized Materials Polypropylene Additives
9535	61.07	Sodium nitrate, 99.999%	Aldrich Condensed Phase
75	60.09	Bar soap	TSL
788	59.48	Carboxylic acid amine salt	Hummel Polymer and Additives
339	59.00	Poly(ethylenepropylene:diene)	Hummel Polymer and Additives
328	58.17	Poly(ethylenepropylene:diene)	Hummel Polymer and Additives
491	57.58	Poly(ethylene-4-methyl-1-pentene),77942	Hummel Polymer and Additives
337	57.48	Poly(ethylenepropylene:ethylidenenorbor	Hummel Polymer and Additives
9486	57.46	Manganese(II) acetate 4H2O, 99.99%	Aldrich Condensed Phase
329	56.97	Poly(ethylenepropylene:ethylidenenorbor	Hummel Polymer and Additives

TI-NHTSA 012002



OMNIC Search

Spectrum: *TSL # 141784, Debris from 142 PS after disc removal
Sat Sep 14 16:12:53 1996
Region: 3995.85 649.98
Search type: Correlation
Comment:



Index	Match	Compound name	Library
1898	72.11	1-Decanol	Hummel Polymer and Additives
854	71.45	1-Tetradecanol, 97%	Aldrich Condensed Phase
92	71.13	Weston TLTTP	Rubber Compounding Materials
609	71.07	Poly(2-decyne)	Hummel Polymer and Additives
345	70.95	Naugatuck Antioxidant 451	Rubber Compounding Materials
9286	70.92	Tungstic acid	Aldrich Condensed Phase
1522	70.53	Decylamine	Hummel Polymer and Additives
1111	70.49	Poly(1-octene)	Hummel Polymer and Additives
1509	69.92	2-Undecanol	Hummel Polymer and Additives
1931	69.45	1-Bromooctadecane	Hummel Polymer and Additives

TI-NHTBA 012004

Kill, Elizabeth

From: Kill, Elizabeth
To: Wagner, Chris CDW8
Cc: Su, Rose RSU; Hopkins, Al
Subject: TSL # 141784, Debris from 142 PS base
Date: Tuesday, September 17, 1998 4:24PM

Objective:

Identify the debris that fell from the device as the disc was removed.

Results:

FT-IR spectroscopy did not produce any strong matches for this material. It's spectrum is close to that of the blackened Kapton seal examined under TSL # 140398.

I reviewed the series of photos and SEM-EDAX spectrums from the base. I did not see strong evidence of organic contamination present there. I don't see any benefit in taking any additional FT-IR scans. But I will, if you want them. Just let me know.

We discussed sending the FT-IR spectra of this material to DuPont for analysis. Have you had any feedback from them on the format they would prefer? Printouts or diskette?

Regards,

Beth x3089

Kill, Elizabeth

From: Kill, Elizabeth
To: Wagner, Chris CDWS
Subject: TSL # 140396, Examine etched Kapton
Date: Friday, September 13, 1996 10:33AM

Objective:

Determine what has attacked the Kapton in a APT during cyclic salt spray testing.

Results:

FT-IR spectroscopy confirmed that the undamaged edge of the Kapton seal is a polyimide material. The top match from the spectral library was with a reference sample of Kapton with a match factor of 89.8%.

The spectrum of the blackened Kapton gives a very trace. The top match is with "polyamide-imide" at 70.6%. This is quite different than the polyimide alone. There is also some evidence of hydrolysis, as you suspected. I mathematically subtracted the water peaks from the spectrum, but came up with the same match. It is possible that this is a degradation product of the polyimide.

I attempted to scrape the surface on the blackened area to isolate the attacking compound, but there were no strong matches from the library. The top match is shown as "Nest (Nujol)" at 61%. This is another name for mineral oil. You will see in the spectral printout that it is not a good match. The surface of the degraded Kapton is probably a mixture of materials making identification of the individual components difficult. This is why we aren't getting any strong matches with any one compound.

Al's message mentioned a high level of iron and chloride, so I scanned a sample of iron chloride for comparison. It does not match any of the spectra from the Kapton sample.

I will forward the spectral data by internal mail. Please call if you have any questions.

Regards,

Beth x3069

...CAL SERVICE LABS

LOG NO. 7406

TEST NO. 140396

REPORT OF RESULTS:

DATE RECEIVED _____ DATE OUT 9-13-96 7406

TECHNICIAN	CK		
HOURS WORKED			
PROCEDURE USED	TSL-C-060		
	FTDR#2	96-7406.sea	

*PCC I.D.

MC=325	TM=431	CLKE=122	FACIL=514
PC=127	WIRE=432	CAN=454	FACIL=521
VERS=168	EPD=621	AD DEV=298	FACIL=531
AFCC=463	PEP=622	EMCD=877	STAFF=555
IMD=490	CSD=635		

TI-NHTSA 012007

DISTRIBUTION: White and Yellow - Lab · Pink - Requestor

[redacted]

Memo

To: Chris Wagner
Texas Instruments

From: Ed McKenzie
DuPont

Date: September 19, 1996

Re: 300HN Kapton®

Chris: attached please find results of the analysis of sample diaphragms sent to Toray-DuPont Corp. By TI-Japan.

Basically while unable to identify a possible material, TDC felt that evidence of chemical attack was present, especially since another plastic part (PBT) in the construction also showed evidence of attack.

Please review and lets discuss when you get the chance. I will be out of the office tomorrow, Friday 9/20, but back in all next week.

Regards,

Ed

DUPONT

Date 9-19-96

CIRCLEVILLE PLANT
P.O. Box 69
Circleville, OH 43113
HPF - SP Resin

FACSIMILE TRANSMISSION COVER SHEET

ADDRESSEE(S):

NAME	COMPANY/BUSINESS/GROUP	FAX NUMBER
CHRIS WAGNER	TEXAS INSTR. MS 12-29	

SENDER:	BUSINESS SECTOR	LOCATION
ED McKENZIE	DUPONT	CIRCLEVILLE OH

Total Number of Pages (Including Cover Sheet) 3

DuPont, Circleville HPF - SP Resin Fax No. - 614-474-8680, Verification No. 614-474-8443

SPECIAL INSTRUCTIONS/INFORMATION TO RECIPIENT:

*** CONFIDENTIALITY NOTE ***

From: YOKOYAH --YOVX00 Date and time 09/17/96 08:37:50
To: MCKENZEC--ISCDCVM5

From: YOKOYAH --YOVX00 TKKVKP::A1::YOKOYAH
Subj: TI Claim

From: NAME: Hirokazu Yokoyama
FUNC: TOKAI KAPTON
TEL: 81-52-603-5181 <YOKOYAH AT A1 AT TKKVKP>
To: See Below
CC: See Below

Ed, the following is my report to TI-Japan. Please let me know your comment and recent your communication with TI in the U.S.. I think we did everything in TDC site. If the discussion advances to the process condition, this is your turn. I can support the communication but you should be involved more with TI-Japan.

Our analysis revealed that Kapton* was hydrolysed by a strong base even though no suspect material was found in the assembly.
FT-IR of Kapton* in the diaphragm showed carboxylic acid group with a lot of volume. And a white powder in the connector was identified as a terephthalic acid salt which might be a degradation of PBT. The connector was made with PBT and it is very stable toward any solvents but alkali and boiled water. This is also the reason why a strong base was existed at the assembly.
Not only Kapton* but also PBT was hydrolysed.
Other investigation for the claim is to check the pH. But everything is normal. 5%NACl solution: pH6.0-6.7 NaCl powder was dissolved with distilled water as 5% solution:pH5.8-6.7 ATF oil: couldn't measure pH.
Water extraction for every parts in the assembly was conducted and MS analysis was applied to the analysis. Only Na+ and Cl- were detected. No NH4+, a little K+ but the majority was Na+ and Cl-

	pH	Na+ (micron-g/g)	Na+ (m-mol/g)	Cl- (m-g/g)	Cl- (m-mol/g)	Na+/Cl- (mole/mole)
Connector	8.79	340	14.8	230	6.48	2.3
Sensor	7.16	360	15.7	190	5.35	2.9
O-ring	7.40	18	0.78	14	0.39	2.0
Body(stainless)	6.45	17	0.74	25	0.70	1.1

Excess Na+ at connector and sensor might indicate alkali solution as theoretical number of Na+/Cl- = 1.0 but a suspect material couldn't be caught by our analysis.

Regards,

...Hiro

To Distribution List:

MCKENZEC@ISCDCVM5@CDCILL@YOVX00@MRGATE@YOVX00

Form 5615

ENVIRONMENTAL TEST LAB REQUEST FORM

(ONE TEST PER REQUEST)

DATE Aug 27 1996

REQUESTED BY Chris Wagner

REQUIRED COMPLETION DATE Sept. 4, 1996

EXTENSION 3170 M/S 12 29

DEVICE Kepton diaphragm strips

CHARGE DEPT NO. 127 I.O. NO. 10160

REFERENCE SPEC. NO. ASTM B117

SOURCE OF TEST SAMPLES Design Eng.

QUANTITY OF TEST SAMPLES 20

REPORT NO. 0524-08C

TESTED BY Lab

COMPLETION DATE 9-4-96

TEST REQUIREMENTS: (TO BE FILLED IN BY REQUESTER)

Please conduct the salt spray test ASTM B117 on these samples until the morning of Sept 4, 1996.

TEST PERFORMED:

IN: 0930 8-28-96 BJO

out: 1000 9-4-96

TEST RESULTS:

EQUIPMENT USED: **CALIBRATION DATE:** **NEXT DUE DATE:**

Attachment 2 to ZEL-E-0001

ENVIRONMENTAL TEST LABORATORY
TEST SET-UP DOCUMENTATION

EVT NUMBER 0524-086
SET-UP DATE 8-28-96

	ID/CTRL #	CAL DATE	OVER DUE	OPERATOR
DYNAMIC TEST EQUIPMENT				
VIBRATION TABLE				
VIBRATION CONTROLLER				
ACCELEROMETER				
CHARGE AMPLIFIER				
SHOCK TABLE				
ROTARY ACCELERATOR				
CLIMATIC TEST EQUIPMENT				
TEMPERATURE CHAMBER				
DIGITAL THERMOMETER				
TEMPERATURE RECORDER				
SALT FOG				
SALT SPRAY	4099	8-8-96	3-97	JPS
ALTITUDE				
HUMIDITY CHAMBER				
OTHER EQUIPMENT				
DIGITAL MULTIMETER				
OSCILLOSCOPE				
OSCILLOGRAPH				
POWER SUPPLY				
FFT ANALYZER				
FORCE GAGE				
SHUNT				

Form 6515

ENVIRONMENTAL TEST LAB REQUEST FORM

(ONE TEST PER REQUEST)

DATE Aug 27 1996

REQUESTED BY Chris Wagner

REQUIRED COMPLETION DATE Sept. 4, 1996

EXTENSION 3170 M/S 12 29

DEVICE Kapton diaphragm strips

CHARGE DEPT NO. 127 I.O. NO. 10180

REFERENCE SPEC. NO. 2960Z-P6H, pg 18/18

SOURCE OF TEST SAMPLES Design Eng.

QUANTITY OF TEST SAMPLES 20

REPORT NO. 0526-08C

TESTED BY Lab

COMPLETION DATE 9-4-96

TEST REQUIREMENTS: (TO BE FILLED IN BY REQUESTER)

Please conduct the salt spray test per page 18/18 on the attached Honda specification 2960Z-P6H. Please conduct only 7 cycles or as many as can be completed by Sept 4.

TEST PERFORMED:

Start 07:30 8-29-96

out: 1000 9-4-96

TEST RESULTS:

EQUIPMENT USED: **CALIBRATION DATE:** **NEXT DUE DATE:**

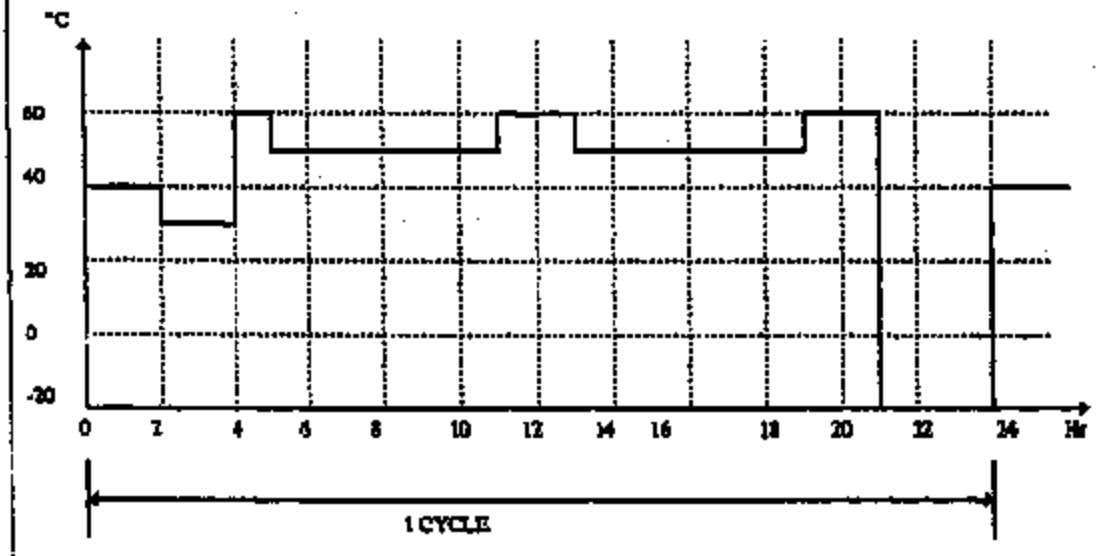
3.4 ENDURANCE PERFORMANCE

11: SALT SPRAY

AFTER TEST THE ROLLOWING SHALL BE SATISFIED:

1. GENERAL PERFORMANCE EXCEPT TEMPERATURE PERFORMANCE
2. STRENGTH PERFORMANCE

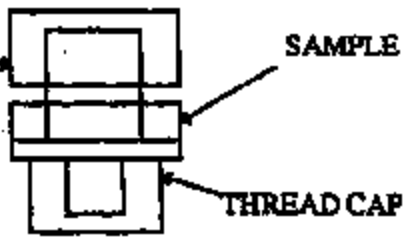
CYCLE TEST: 60 CYCLES



TEST MODE

WET	SST	DRY	WET	DRY	WET	DRY	SOAK
40°C	35°C	60°C	50°C	60°C	50°C	60°C	-20°C
95%RH	-	-	95%RH	-	95%RH	-	-
2 Hr	2 Hr	1 Hr	6 Hr	2 Hr	6 Hr	2 Hr	3 Hr

WATER PROOF CONNECTOR



TEST AS SHOWN

TI-NHTSA 012014

FORM TESTSET.DOC

Attachment 2 to TEL-E-0001

ENVIRONMENTAL TEST LABORATORY TEST SET-UP DOCUMENTATION		EVT NUMBER 0526-08C SET-UP DATE 8-29-96		
	ID/CTRL #	CAL DATE	OVER DUE	OPERATOR
DYNAMIC TEST EQUIPMENT				
VIBRATION TABLE				
VIBRATION CONTROLLER				
ACCELEROMETER				
CHARGE AMPLIFIER				
SHOCK TABLE				
ROTARY ACCELERATOR				
CLIMATIC TEST EQUIPMENT				
TEMPERATURE CHAMBER				
DIGITAL THERMOMETER				
TEMPERATURE RECORDER				
SALT FOG				
SALT SPRAY				
ALTITUDE				
HUMIDITY CHAMBER #4	5031	7-9-96	11-96	gjs
OTHER EQUIPMENT				
DIGITAL MULTIMETER				
OSCILLOSCOPE				
OSCILLOGRAPH				
POWER SUPPLY				
FFT ANALYZER				
FORCE GAGE				
SHUNT				

2000 PROGRAMMING FORM

DESCRIPTION _____

INITIAL VALUE 1 40 INITIAL VALUE 2 95

INTERVAL	FINAL VALUE 1	FINAL VALUE 2	INTERVAL TIME	CONTINUE DEVIATION	AUX.	NEXT INTERVAL	LOOPS
1	40°C	95%	~~2:30~~ 1:30			2	
2	40°C	95%	2:00			3	
3	60°C	15%	00:10	≠		4	
4	60°C	15%	~~00:50~~ 00:50			5	
5	50°C	95%	00:10			6	
6	50°C	95%	05:50			7	
7	60°C	15%	00:10			8	
8	60°C	15%	00:50			9	
9	50°C	95%	00:10			10	
10	50°C	95%	05:50			11	
11	60°C	15%	00:10			12	
12	60°C	15%	00:50			13	
13	-20°C	15%	00:30			14	
14	-20°C	15%	02:30			15	
15	40°C	95%	00:30			1	100

TI-NHTSA 012018

1) SST of teflon coated K.

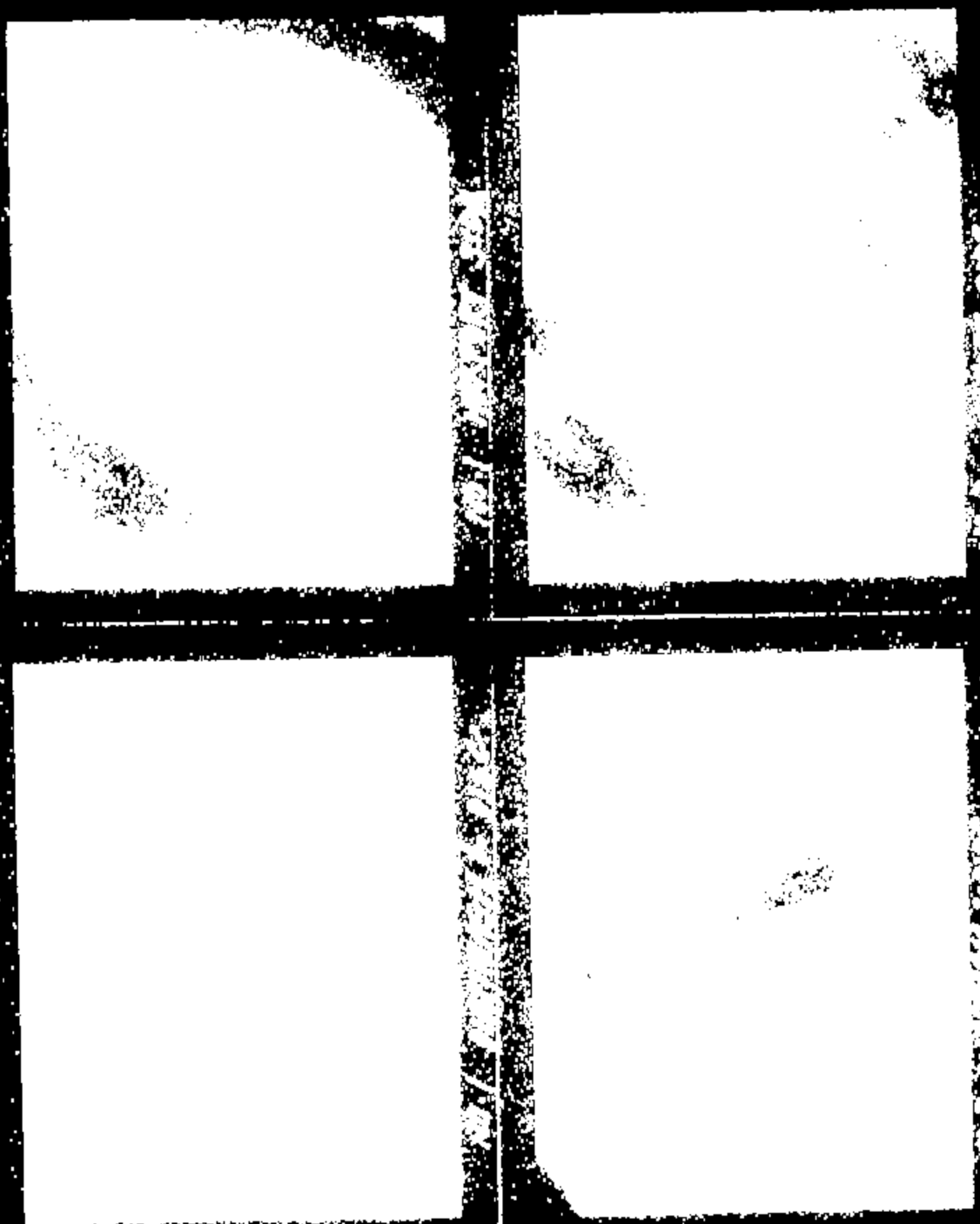
2) Dupont - H_2O & Kapton

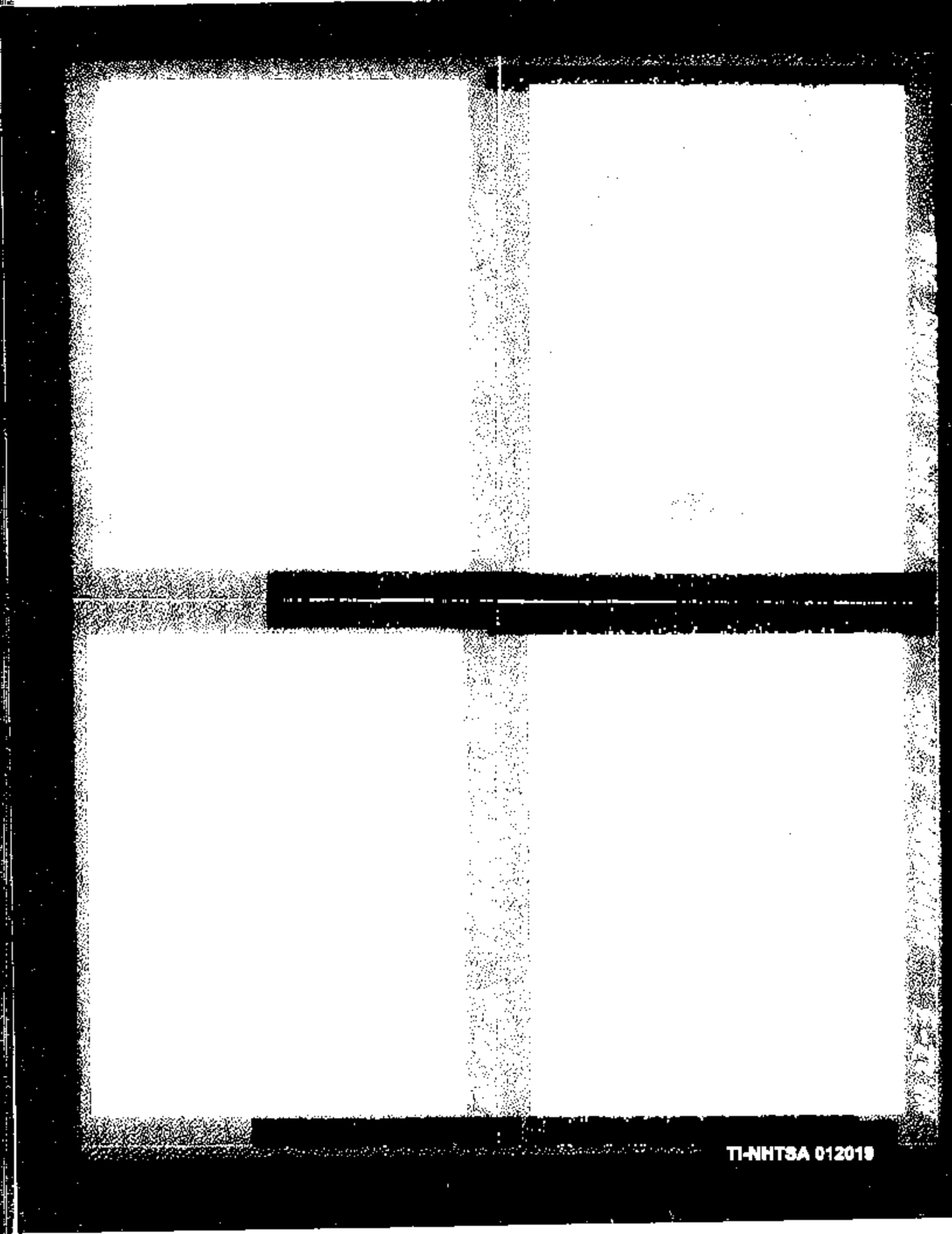
~~Dave Crane this?~~

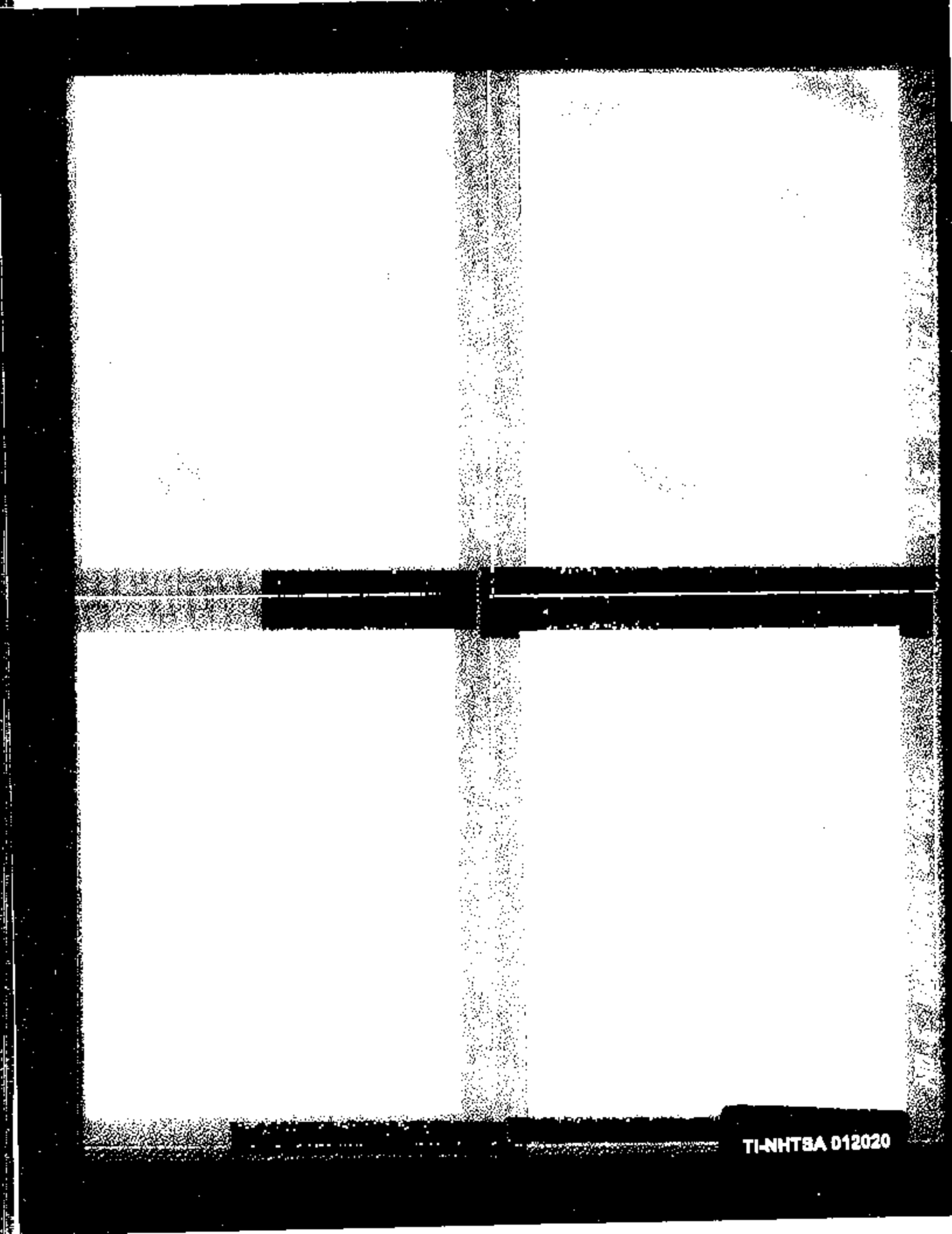
- Acrylic

When Ed calls back.

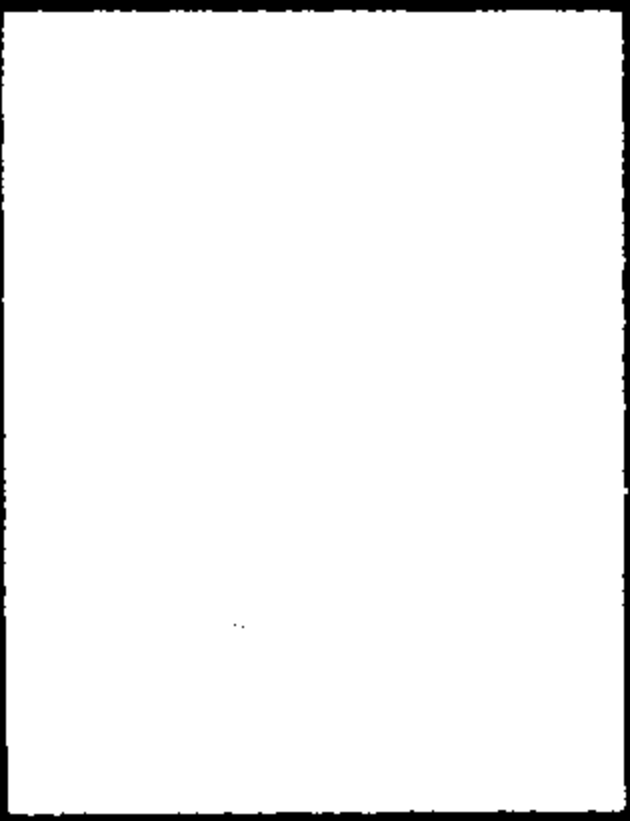
- What does cause chemical attack?

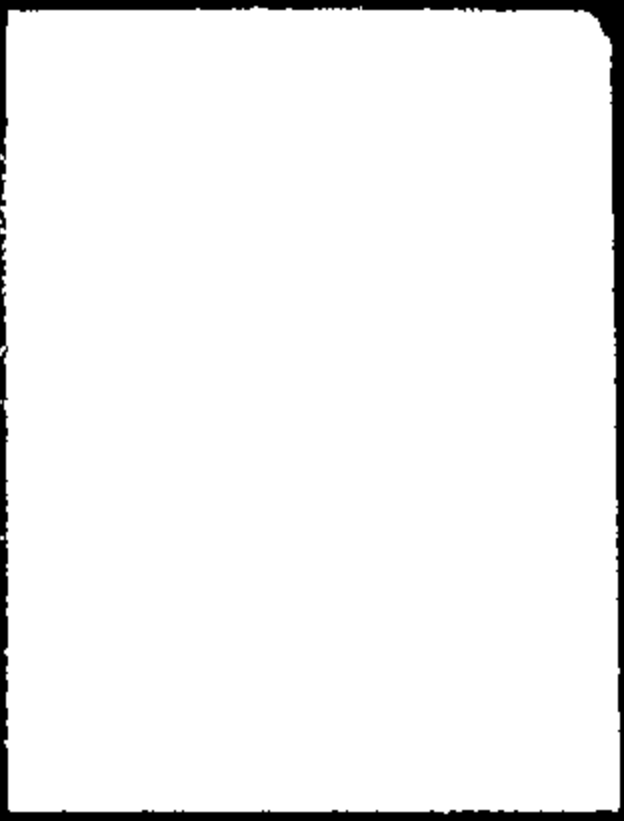


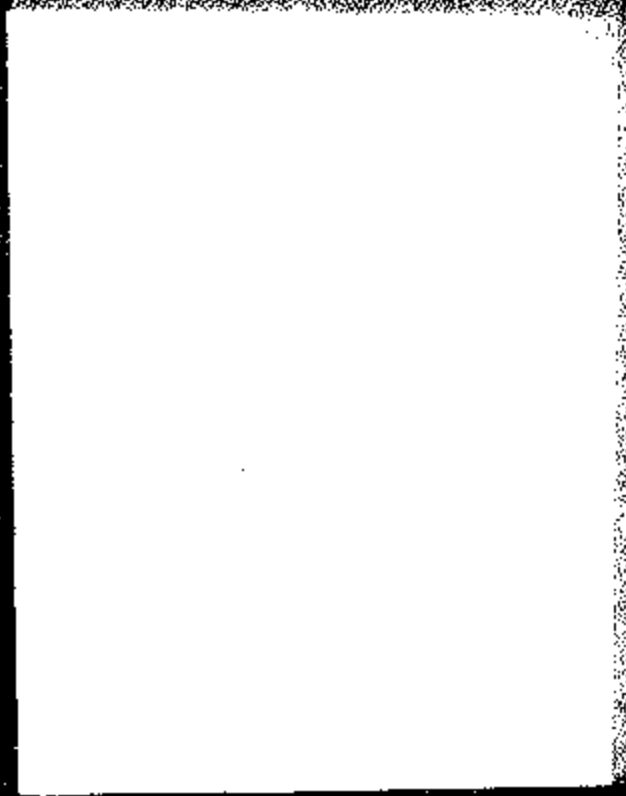


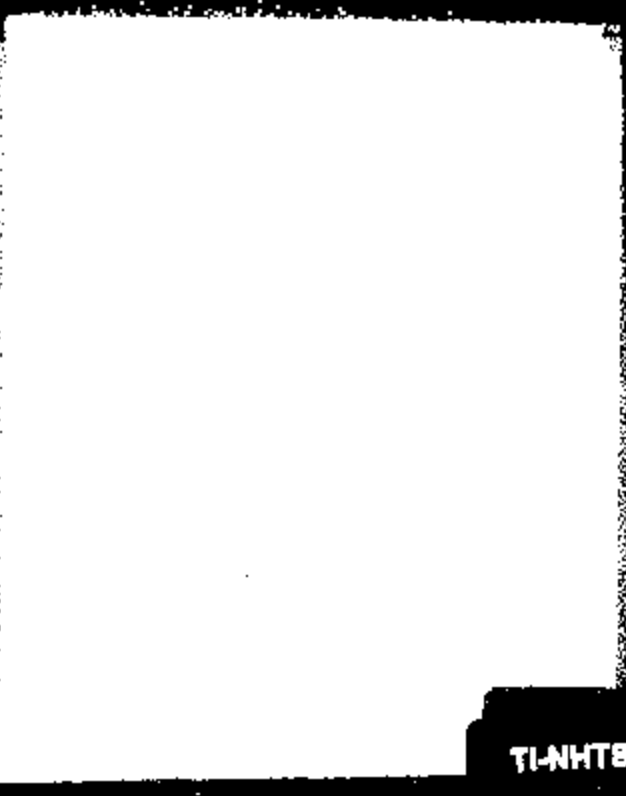


<GCT TEST>









<CCT TEST[redacted]>

Wagner, Chris

From: AHOP%mlml@magic.ltg.ti.com[SMTP:AHOP%mlml@magic.ltg.ti.com]
Sent: Thursday, September 12, 1996 5:45 PM
To: Wagner, Chris
Subject: RE: 142PS BASE ASM FROM TIJ: TSL # 141784

-MSG.M#= 993605 FR=AHOP TO=CDW3 SENT=09/12/96 04:08 PM
R#=191 ST=C DIV=0050 CC=00673 BY=AHOP AT=09/12/96 04:08 PM

MEMORANDUM:
96-679

TO: CHRIS WAGNER CDW3

CC: AMY ANDRES AMY
ROSE SU RSU
GEORGE OLEAR AETL
BETH KILL EKIL
HANK GRIFFIN HG1
BRYAN DAGUE DAGU
JOHN BRENNAN U2JB
TOM CHARBONEAU TC1

FR: AL HOPKINS AHOP

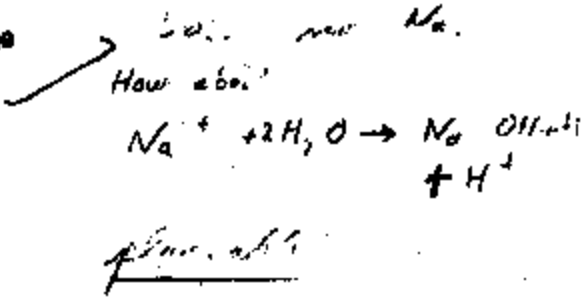
SUBJECT: RE: 142PS BASE ASM FROM TIJ: TSL # 141784

After receiving your request for inputs on my MSG, I realized that I had focused too narrowly on answering the original objective that you posed. The following are some additional observations.

Both the "Coppery" appearing area on the brass and "Degraded Kapton" area on the disc are areas of wholesale corrosion while the area that looked like oxidized brass wasn't (it was only surface oxidized).

Corrosion of brass often occurs by a dezincification mechanism (Bob Babolan would know more details). The zinc has to go somewhere, and it often winds up on the surface. In other words, it wasn't surprising that we saw so much zinc on the surface, what was surprising to me is that the deposit looked "coppery".

Just as the zinc can be seperated from the copper in the brass, chlorine can separate from sodium if the starting point is sodium chloride. In particular, the majority of the iron-rich corrosion deposit on the disc showed large amounts of chlorine, iron and oxygen but it didn't show clear-cut evidence of any sodium.



The situation on the "coppery" appearing brass is more difficult to discern because the secondary line of zinc obscures the only line of

sodium. Overall, the ratio of the two peaks of zinc seems to show that just zinc and not sodium is present but we can't rule out the possibility of some sodium being present. After I sent out the first MSG I asked Ross to go back and do a painstaking search for any areas that we could say definitely had sodium present. She was only able to find a few small crystals over the whole surface. Surprisingly, she also found some calcium in these crystals that were mainly sodium chloride.

If there are any other points that need clarification, please let me know.

ORIGINAL MSG FOLLOWS:

****

From: "Wagner, Chris" <cwagner@email.mc.ti.com>
To: "Olear, George" <AETL@meg.itg.ti.com>,
"Kill, Elizabeth"
<EKIL@meg.itg.ti.com>,
"Griffin, Hank HG1" <HG1@meg.itg.ti.com>,
"Degus, Bryan" <bdegus@email.mc.ti.com>,
"Brennan, John"
<a750286@pen.mc.ti.com>
Cc: "Hopkins, Al" <a825009@mail.mc.ti.com>,
"Charbonneau, Tom"
<t-charbonneau@email.mc.ti.com>
Subject: FW: 142PS BASE ASM: TSL # 141784
Date: Thu, 12 Sep 1996 10:36:12 -0400
Encoding: 55 TEXT

Ladies and Gents,

When we took the Kapton off the discs sent on the salt spray/etched Kapton
return from TIJ, it had some colored "rings" on it, concentric with the disc.
Al has taken a look at the rings and his results are below. Any thoughts?

Chris

From: AHOP%mimi@maglc.itg.ti.com[SMTP:AHOP%mimi@maglc.itg.ti.com]
Sent: Thursday, September 12, 1996 9:57 AM
To: Wagner, Chris
Subject: 142PS BASE ASM: TSL # 141784

-MSG MI#= 900761 FR=AHOP TO=CDW3 SENT=09/12/96 08:51 AM
RI#=199 ST=C DIV=0060 CC=00673 BY=AHOP AT=09/12/96 08:51 AM

MEMORANDUM:
96-579

TO: CHRIS WAGNER CD3

CC: AMY ANDRES AMY
ROSE SU RSU

FR: AL HOPKINS AHOP

SUBJECT: 142P6 BASE ASM: TSL # 141784

OBJECTIVE:

Determine composition of areas marked on photograph.

CONCLUSIONS:

The area that appeared to have a normal, oxidized brass color was oxidized brass. We saw copper, zinc, lead and a small amount of oxygen (editorial correction).

The area that appeared coppery in color contained very large amounts of chlorine and oxygen. Surprisingly, we actually saw more zinc than copper in this areas; also we saw a small amount of iron.

The area which you had thought might be kapton actually showed mostly iron, chlorine, and oxygen. We also, however, saw some tin and zinc.

The data will be sent by Bernadette Maynard through the internal mail.

AL HOPKINS X3040 MS: 10-16 FAX: 1670

Wagner, Chris

From: AHOP%mimi@magic.ltg.ti.com[SMTP:AHOP%mimi@magic.ltg.ti.com]
Sent: Thursday, September 12, 1996 9:57 AM
To: Wagner, Chris
Subject: 142PS BASE ASM: TSL # 141784

-MSG M#= 900761 FR=AHOP TO=CDW3 SENT=09/12/96 08:51 AM
R#=166 ST=C DIV=0050 CC=00673 BY=AHOP AT=09/12/96 08:51 AM

MEMORANDUM:
96-579

TO: CHRIS WAGNER CD3

CC: AMY ANDRES AMY
ROSE SU RSU

FR: AL HOPKINS AHOP

SUBJECT: 142PS BASE ASM: TSL # 141784

OBJECTIVE:

Determine composition of areas marked on photograph.

CONCLUSIONS:

The area that appeared to have a normal, oxidized brass color was oxidized brass. We saw copper, zinc, lead and a small amount of lead.

The area that appeared coppery in color contained very large amounts of chlorine and oxygen. Surprisingly, we actually saw more zinc than copper in this areas; also we saw a small amount of iron.

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AL HOPKINS X3040 MS: 10-16 FAX: 1670

FORM

TECHNICAL SERVICE LABS

LOG NO. 7406

TEST NO. 140396

TEST NO. 140396

*PCC I.D.	127	STATE YOUR PROBLEM/ SAMPLE DESCRIPTION	INFORMATION DESIRED:
REQUESTOR COST CENTER	101	The sample has been etched.	Please determine what etched the Kapton. FTIR
PRODUCT CODE	88		
REQUESTOR	C. Wagner		
MAIL STATION	12/29		
EXTENSION	3170		
MSG ID	CDW3		
DATE SUBMITTED	Sept 9/96		
DATE REQUIRED	ASAP		
NO. OF SAMPLES	1		
COMPOSITION	Kapton: Polyimide Film		

REPORT OF RESULTS:

DATE RECEIVED ____________ DATE OUT 9-13-96 7406

TECHNICIAN	EK		
HOURS WORKED			
PROCEDURE USED	TSL-C-060		
	FTIR#2	96-7406.spg	

*PCC I.D.

MC=325	TM=431	CLKE=122	FACIL=514
PC=127	WIRE=432	CAN=954	FACIL=521
VERS=168	EPD=621	AD DEV=286	FACIL=531
AFCC=483	PEP=622	EMCD=677	STAFF=655
IMD=430	CSD=635		

TI-NHTSA 012027

Kill, Elizabeth

From: Kill, Elizabeth
To: Wegner, Chris CDW3
Subject: TSL # 140396, Examine etched Kapton
Date: Friday, September 13, 1996 10:33AM

Objective:

Determine what has attacked the Kapton in a APT during cyclic salt spray testing.

Results:

FT-IR spectroscopy confirmed that the undamaged edge of the Kapton seal is a polyimide material. The top match from the spectral library was with a reference sample of Kapton with a match factor of 89.8%.

The spectrum of the blackened Kapton gives a very trace. The top match is with "polyamide-imide" at 70.8%. This is quite different than the polyimide alone. There is also some evidence of hydrolysis, as you suspected. I mathematically subtracted the water peaks from the spectrum, but came up with the same match. It is possible that this is a degradation product of the polyimide.

I attempted to scrape the surface on the blackened area to isolate the attacking compound, but there were no strong matches from the library. The top match is shown as "Nast (Nujol)" at 61%. This is another name for mineral oil. You will see in the spectral printout that it is not a good match. The surface of the degraded Kapton is probably a mixture of materials making identification of the individual components difficult. This is why we aren't getting any strong matches with any one compound.

Al's message mentioned a high level of iron and chloride, so I scanned a sample of iron chloride for comparison. It does not match any of the spectra from the Kapton sample.

I will forward the spectral data by internal mail. Please call if you have any questions.

Regards,

Beth x3069

142 PS Salt Spray

Pretest work done - what ... it?

Better definition of test (Salt used)

color etc?

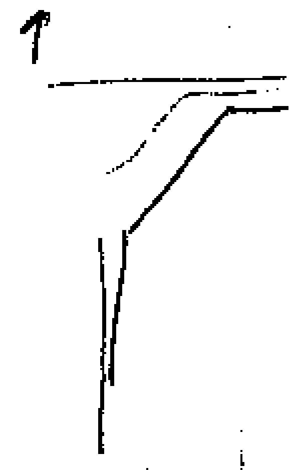
bubble: why: solvent: shrink smoke
heat & contract

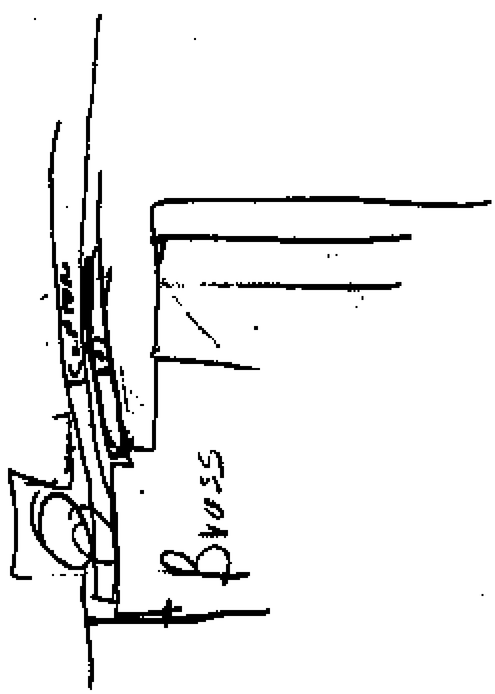
cut hole - any fluid?

organic?

T/J: Why from [illegible]tor.

Solution Ph





NO-1 DIAPHRAGM & DISC.

NO-1 HEXPORT SIDE.

NO.3 DIAPHRAGM & DISC.

NO-3 HEXPORT SIDE.

NO. 22-2. DIAPHRAGM & DISC.

NO. 22-2: HOUSING SIDE.

NO. 22-3 . . DIAPHRAGM & DISC.

NO. 22-3 HOUSING SIDE.

NO.4 DIAPHRAGM & DISC.

NO.4 EXPORT SIDE.

NO.5 DIAPHRAGM & DISC.

NO.5 EXPORT SIDE.


1

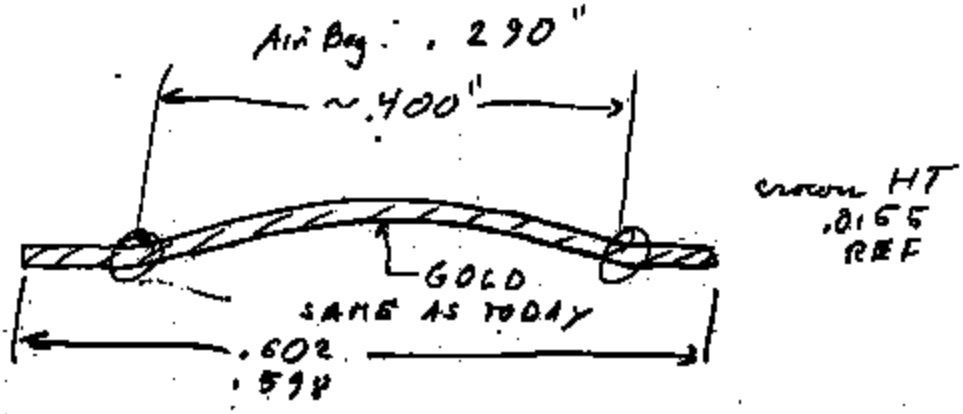

2


3-22


1-22

<CCT TEST後外観写真>

current design vs disc capabilities.



Air Bag: .492
.469

PRESSURES (ACT, REL) likely.

OD

FORM O.

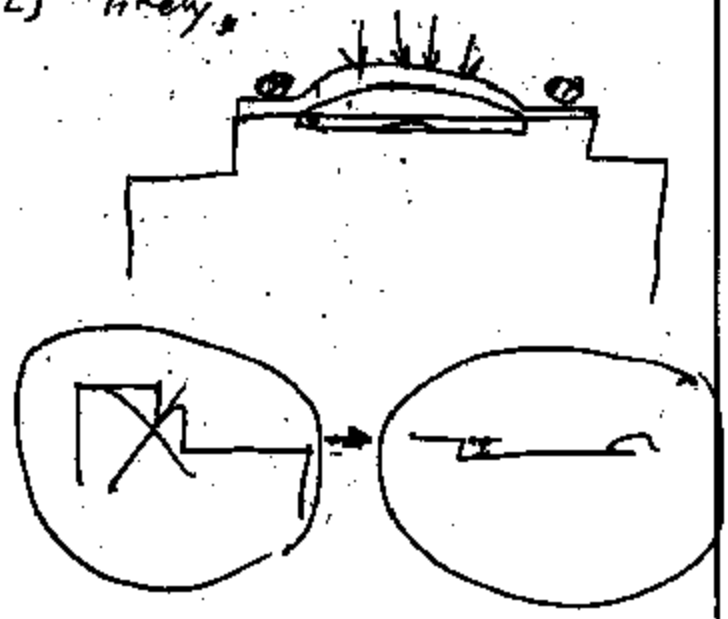
~~LIFE~~

THICKNESS

LIFE

- CYCLES TO FAL
- FAILURE MODE
- DRIFT OVER LIFE

MAT'L 17-7 OK



- 20K for new disc act
- 1¼ 9/8 or 3/4

Air Bag P/N: 75839-1

142 PS Salt Spray Test

George O'Leary
27-Aug-96

- pH 6.5-7.2 - salt spray spec
- > 11 pH for this reaction (confirm)

- Salt Spray test - water in
  - leach out
  - pull in on leach
  - relation to time ⟹ any change

- Dissolving Kapton
  - high pH (~ > 11 pH)
  - result fog high
  - high once in switch.
  - based in other equipment (humidity)

- Test Questions
  - what salt
  - concentration
  - Power
  - Any damage before.

142 PS – Salt Spray

Call w/ John B.

Aug 27, 1996

From photos

- Not hydrolisis
- Mat'l appears degraded, then dissolved
- DuPont info correct

Suggestions.

- Run salt spray @ 60°C.
- Try NaOH @ 60°C

Wagner, Chris

From: Charboneau, Tom
Sent: Tuesday, August 13, 1996 9:06 AM
To: Sweet, Bill
Cc: Dague, Bryan; Wagner, Chris
Subject: FW: TIJ INFO for 142PS ISSUE AT HONDA

Bill, we should ask TIJ to send photos of the parts including the kapton. Also, it doesn't sound like they have the mating connectors (caplers). These would have evidence of leakage if they were at fault as we suspect.

Still not clear to me why the kapton would be broken.

Tom

From: Sweet, Bill
Sent: Tuesday, August 13, 1996 8:46 AM
To: Snyder, Gary; Kost, Don; Pechonis, John; Buckler, Jim; Charboneau, Tom; Dague, Bryan; Wagner, Chris; Butler, Stephen; Sweet, Bill
Subject: RE: TIJ INFO for 142PS ISSUE AT HONDA

Ryo's response FYI....
Bill x-3489 pager-0650

From: IWA%mimi@magic.ltg.ti.com@MHP:IWA%mimi@magic.ltg.ti.com
Sent: Tuesday, August 13, 1996 8:28AM
To: Sweet, Bill
Subject: 142PS ISSUE AT HONDA

To: BILL SWEET W94

Copy: TAKESHI TANAKA JATO OSAMI KUSHIDA KUSI
KAZUHIKO NAKANISHI KAZN

From: RYO IWASAKI IWA

Subj: 142PS ISSUE AT HONDA

I HAVE TELEPHONED TO SEVERAL PERSONS OF ENGINEER/MARKETING/FSE WHO ARE ALL IN SUMMER VACATION, AND I COULD CONTACT OUR FSE WHO IS REPORTING TO ME AND HAD A TALK WITH HIM.

THIS PROBLEM WAS HAPPENED AT THE MEETING ON 142PS QUALITY ISSUE RELATING TO A KAPTON FAILURE ON AUGUST 9.

FOLLOWINGS ARE THE TEST RESULT OF 142PS AT HONDA

FACT 1. HONDA TESTED 7 UNITS OF 142PS (N=7)
IN CASE OF OIL PRESSURE IS ZERO, THRERE IS CONTINUITY.
2. WE CAN SEE SOME WET INSIDE CAPLER OF 142PS

3. WE CAN SEE A BROKEN KAPTON, AND THE ROOM AROUND CONTACT TURNED INTO BLACK COLOR, AFTER WE CHECKED THE DAMAGED SAMPLE WHICH WAS GIVEN BY HONDA.

4. WE CANNOT SEE ANY LIQUID INDICATION WHICH RAN INTO A SPACE BETWEEN DISK SHEET AND HEXPORT.

OUR ENGINEER'S VIEW ON THE FAILURES ARE;

VIEW 1. SOME SALT WATER COULD BE ENTERED INTO THE SPACE OF CAPLER RUNNING THROUGH A BALANCE HOLE OF CONNECTOR ASSY OF 142PS DUE TO SOME FAILURE OF CAPLER WATER PROOF.

2. BASED ON FACT 4, SILICON SEALANT SEEMS KEEPING HERMATIC, HOWEVER WE NEED TO RECONFIRM IT.

WHAT OUR ENGINEER IS GOING TO DO ARE;

A, SPECIFY THE REASON WHY SALT WATER RAN INTO THE ROOM OF SWITCH FUNCTION TO SPECIFY THE REASON, WE NEED TO CLARIFY THE ROUTE THROUGH WHICH SALT WATER RAN INTO THE ROOM OF SWITCHING FUNCTION.

- SALT WATER RUNNING ROUTE CAN BE ESTIMATED AS FOLLOWINGS ;

(a) FAILURE OF CAPLER SEAL --> CAPLER --> BALANCE HOLE --> ROOM OF SWITCH FUNCTION.

(b) FAILURE OF SILICON SEALANT --> THE SPACE BETWEEN HEXPORT AND DISK SHEET --> ROOM OF SWITCH FUNCTION.

(c) FAILURE OF SILICON SELANT --> THE SURFACE SETWEEN DISK SHEET AND CONNECTOR

IN ORDER TO CLARIFY SALT WATER RUNNING ROUTE INTO THE ROOM OF SWITCHING FUNCTION, FOLLOWINGS THOUGHTS WAS CONSIDERED BY OUR ENGINEER.

THOUGHT 1. WE CAN SAY THE ABOVE (b) OF SALT WATER RUNNING ROUTE CANNOT BE HAPPENED AS THE RESULT OF ANALYSIS THAT SAYS NO CORROSION CAN BE SEEN IN THE SPACE BETWEEN HEXPORT AND DISKSHEET

THOUGHT 2. IN ORDER TO PROVE THAT THE ABOVE (c) CANNOT BE HAPPENED, WE NEED THE TEST BY PUTTING A PRESSURE ON THE KAPLER.

THOUGHT 3. IN CASE WE CAN CONFIRM THAT THOUGHT 1 AND 2 ARE NOT THE CAUSE OF SALT WATER RUNNING ROUTES, WE CAN SPECIFY THAT THE SALT WATER RUNNING ROUTE COULD BE THE ABOVE (a)

THOUGHT 4. NEED CCT TEST THE SEALING OF 142PS USING PERFECT SAMPLE WHOSE CAPLER SEALING IS PERFECT FOR THE CONFIRMATION.
CCT: CYCLIC CORROSION TEST (HONDA'S TEST METHOD)

THROUGH 5. START SALT SPRAY TEST (5% NaCL) UNDER 60 DEG. TO CONFIRM A DAMAGE OF KAPTON.

OUR ENGINEERS SCHEDULE FOR THE ANALYSIS.

WHAT	WHO	WHEN
A.CCT ANALYSIS		
- MEASURE THE INSULATION RESISTANCE AT THE OFF TIMING.	O.KUSHIDA	TBD(9/19)
- KAPTON SEALING(10KG/CM2 PRESSURE BY ATF)	O.KUSHIDA	TBD(9/19)

- SILICON SEALING (PUT PRESSURE FROM KAPLER)

B. CCT TEST (PERFECT HERMETIC/SEALING) HONDA 9/30/98

C. KAPTON IN THE SALT WATER O.KUSHIDA TBD(9/19)

OUR ENGINEERS' RECOMMENDATION TO HONDA AT PRESENT WILL BE;

RECOMMENDATION 1. WE WILL CHANGE KAPTON MATERIAL FROM H-TYPE KAPTON TO F-TYPE KAPTON WHICH IS COVERED TEFLON COATING

RECOMMENDATION 2. WE WILL PUT SOME MATERIAL ON THE BALANCE HOLE THROUGH WHICH AN AIR CAN RUN THROUGH BUT LIQUID CANNOT BE RUN.

BILL, THANK YOU FOR YOUR ATTENTION ON OUR ISSUE AT HONDA. THIS IS ALL I COULD GET CONTACTING OUR FSE BY PHONE.I HOPE THIS MSG HELP YOU TO UNDERSTAND OUR CRI-CAL SITUATION OF 142PS AT HONDA.YOUR ANY RECOMMENDATION OR SUGGESTIONS OR IDEAS ARE VERY MUCH APPRECIATED. REGARDING THE DAMAGED SAMPLE (KAPTON FAILURE) OF 142PS WHICH WAS GIVEN BY HONDA, WE CANNOT SEND IT NOW SINCE OUR ENGINEER WAS TOLD BY HONDA TO SHOW IT TO HONDA EARLY NEXT WEEK. IN FACT OSAMI KUSHIDA BROKE IT INTO PARTS IN ORDER TO CHECK HOW MUCH KAPTON IS DAMAGED.

THANK YOU AND BEST REGARDS,
RYO IWASAKI IWA

-MSG MS= 448529 FR=IWA TO=EVE SENT=09/12/98 08:39 PM
RS=152 ST=C DIV=0072 CC=05622 BY=WS4 AT=09/12/98 01:46 PM

Thank you for attending today's meeting. We brainstormed potential causes and laid out areas for further investigation. Summary below.

Ryo,

Our understanding is that it is CONFIRMED that the part leaked through the vent hole. Potential causes:

1> Leak past the connector seal
Is base housing to print with good surface finish
Is connector & connector seal to print?
Are there any cracks in connector or housing

2>Leak down wire - If the wire lead from the connector is in the salt bath or has any type of splice or connection in the bath we have seen significant amounts of water drawn into the switch THROUGH THE WIRES.

3> Leak past the wire grommet in the connector
Part to print and not under strain?

We would like to understand more about the "failures".

A> How did they fail? Did they leak or did they fail one or more of the other general characteristics required after salt spray such as current leakage, dielectric, sealability, calibration, etc.

B> Were the parts tested under electrical current load?

C> What is the part orientation during the test? Conn up/conn down?

D> What did Takeshi mean when he noted the Kapton was melted? Does it have holes that might be evidence of chemical attack or is it wrinkled? Could it have leak IN the port and OUT the connector vent?

E> Could TIJ send TIA one failed part for our analysis?

There are two problems in these failures. First the Kapton degradation but more importantly that the part leaked at all. It is very important that we separate these issues As Soon As Possible. Laminated Teflon can be used as a barrier on the Kapton such as 1-3-1 or .5-2-.5 to improve resistance to water but the part will still fail electrically. Chris Wagner at TIA will investigate the imporved resistance of teflon coated Kapton against salt water. However, the goal needs to be to fix the leak and avoid providing Sagtronic with the possible differentiator of "No Kapton".

We often see such water intrusion due to test set up problems, particularly cause #2 above. Based on the limited info we have today that appears to be a high possibility. Please send us a failed sample as soon as possible to allow a more thorough failure analysis here at TIA.

Regards,
Bill x-3469 Pager-0650 MSG - WS4

Wagner, Chris

From: Sweet, Bill
Sent: Monday, August 12, 1996 2:48 PM
To: Tanaka, Takeshi; Iwasaki, Ryoichi; Nakanishi, Kazu
Cc: Snyder, Gary; Koet, Dan; Pechonis, John; Buckler, James; Charboneau, Thomas; Dague, Bryan; Wagner, Chris; Butler, Stephen
Subject: 142PS Failure Brainstorming

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E> Could TIJ send TIA one failed part for our analysis?

There are two problems in these failures. First the Kapton degredation but more importantly that the part leaked at all. It is very important that we separate these issues As Soon As Possible. Laminated Teflon can be used as a barrier on the Kapton such as 1-3-1 or .5-2-.5 to improve resistance to water but the part will still fail electrically. Chris Wagner at TIA will investigate the improved resistance of teflon coated Kapton against salt water. However, the goal needs to be to fix the leak and avoid providing Saginomia with the possible differentiator of "No Kapton".

We often see such water intrusion due to test set up problems, particularly cause #2 above. Based on the limited info we have today that appears to be a high possibility. Please send us a failed sample as soon as possible to allow a more thorough failure analysis here at TIA.

Regards,

Bill x-3469 Pager-0650 M8G - WS4

From: Sweet, Bill
Sent: Friday, August 09, 1996 1:47PM
To: Charbonneau, Tom; Dague, Bryan; Wagner, Chris; Butler, Stephen
Cc: Snyder, Gary; Kost, Don; Pechonis, John; Buckler, Jim
Subject: 142P8 Mtg Mon @ 1PM
Importance: High

Gentlemen,

Takeshi called me at lunch time to pass along that 6/6 parts failed HGT's salt spray testing. HGT's spec is quite agressive calling for salt spray cycling between salt spray and drying at 60 degrees C.

All parts failed with salt water entering into the contact zone apparently through the vent hole. Takeshi noted that the Kapton was also "melted" or "dissolved" where the water reached the Kapton. Honda is very concerned with the Kapton degredation. Salt in the contact will fail the device but Kapton failure will cause a transmission leak. Note that Saginomia's approach is a welded disc design w/ no Kapton.

Takeshi has asked that our engineering group draw together and brainstorm potential solutions and forward to Ryo early next week. TU has a F/YU mtg at HGT on 9/6.

PLEASE PLAN TO MEET MONDAY 9/12 AT 1:00 PM IN CONF ROOM 12-1B TO DEVELOP A RESPONSE>

Please be prepared to discuss:
- The salt spray test spec (wagner)
- What type of Kapton is used (wagner)
- Brainstorm potential cause / fix (team)

Regards, Bill x-3469 pager-0650

From: JATO%mimi@mogic.ltg.ti.com@MTP:JATO%mimi@mogic.ltg.ti.com)
Sent: Friday, August 09, 1996 1:26PM
To: Sweet, Bill
Subject: 142P8

To: BILL SWEET WS4
Copy: RYO IWASAKI IWA
From: TAKESHI TANAKA JATO
Subj: 142P8

BILL, SORRY FOR BAD NEWS. PLEASE ADVISE RYOICHI ON THIS. I HAVE A PERSONAL APPOINTMENT FROM 09/12 THRU 09/16 AND UNABLE TO BE IN CONTACT WITH YOU DURING THE PERIOD.

REGARDS, TAKESHI TANAKA

Wagner, Chris

From: Sweet, Bill
Sent: Friday, August 09, 1996 1:46 PM
To: Charbonneau, Thomas; Dague, Bryan; Wagner, Chris; Butler, Stephen
Cc: Snyder, Gary; Kost, Dan; Pechonis, John; Buckler, James
Subject: 142PS Mtg Mon @ 1PM
Importance: High

Gentlemen,

Takeshi called me at lunch time to pass along that 6/6 parts failed HGT's salt spray testing. HGT's spec is quite agressive calling for salt spray cycling between salt spray and drying at 60 degrees C.

All parts failed with salt water entering into the contact zone apparently through the vent hole. Takeshi noted that the Kapton was also "melted" or "dissolved" where the water reached the Kapton. Honda is very concerned with the Kapton degredation. Salt in the contact will fail the device but Kapton failure will cause a transmission leak. Note that Saginomia's approach is a welded disc design w/ no Kapton.

Takeshi has asked that our engineering group draw together and brainstorm potential solutions and forward to Ryo early next week. TIJ has a F/YU mtg at HGT on 9/6.

PLEASE PLAN TO MEET MONDAY 8/12 AT 1:00 PM IN CONF ROOM 12-1B TO DEVELOP A RESPONSE>

Please be prepared to discuss:

- The salt spray test spec (wagner)
- What type of Kapton is used (wagner)
- Brainstorm potential cause / fix (team)

Regards,
Bill x-3469 pager-0660

From: JATO%mimi@magic.ltg.ti.com@MITI:JATO%mimi@magic.ltg.ti.com)
Sent: Friday, August 09, 1996 1:26PM
To: Sweet, Bill
Subject: 142PS

-MSG MS= 4099514 FR=JATO TO=WS4 SENT=08/09/96 11:47 AM
RS=084 ST=C DIV=0072 OO=08629 BY=JATO AT=09/10/96 01:44 AM

To: BILL SWEET WS4

Copy: RYO IWASAKI IWA

From: TAKESHI TANAKA JATO

Subj: 142PS

BILL, SORRY FOR BAD NEWS. PLEASE ADVISE RYOICHI ON THIS. I HAVE A PERSONAL APPOINTMENT FROM 09/12 THRU 09/15 AND UNABLE TO BE IN CONTACT WITH YOU DURING THE PERIOD.

REGARDS,
TAKESHI TANAKA

Wagner, Chris

From: Wagner, Chris
Sent: Monday, August 26, 1996 11:23 AM
To: Nakanishi, Kazuhiko KAZN; Kushida, Osami KUSI; Tanaka, Takashi JATO
Cc: Dague, Bryan; Sweet, Bill; Buckler, James JBUC; Butler, Stephen; Charboneau, Tom; Brennan, John; Stander, Richard ELB
Subject: 142PS Kapton and Salt Spray Test

Nakanishi-san,

Thank you for calling me today regarding the Honda salt spray test - Kapton failure. My notes on our call are below. Please let me know if there is anything I missed.

BACKGROUND

Honda ran the same test on earlier designs of the switch. Earlier designs passed. The only difference is the vent or balance hole in the base.

The test was run with the mating connector installed. The wires on the connector were at least 1 mm long.

The Kapton was black when the switches were taken apart. It looked like they had been burned. A sample will be sent tomorrow. Dupont of Japan is analyzing.

The next meeting with Honda is September 5.

TIA COMMENTS

The photos do not look like hydrolysis alone was the failure mode. The Kapton looked dissolved which is not typical of hydrolysis. The black color is also unusual.

TIA would like to ask Honda some questions about the test.

1. Were the switches pressure cycled during the test? If yes, what were the cycle parameters:
   - cycle pressure
   - number of cycles
   - temperature while cycling
   - cycling fluid
   - cycle rate and pressure wave description

2. How fast did the switch change temperature during the test? The temperature profile calls out 0 time for temperature change. How much time did it take for the switch to go from:
   - 40 to 35?
   - 35 to 80?
   - 80 to 50?
   - 50 to 80?
   - 60 to -20?
   - -20 to 40?

3. What was the condition of the salt water solution?
   - What was the solution pH?

What was the quality of the incoming water?
Were any chemicals besides salt added to the water?
What salt was used?

4. How long were the wires on the mating electrical connector?
   You said they were at least 1 mm long. Could you find out please?
   Were the wire ends in the chamber or out?
   Does TIJ have a theory explaining how the water entered the switch?

I think #1 and #4 are the two most important questions.

In regards to question 4, TIA knows that if the ends of the wires are in the salt spray chamber, water will enter the switch. Capillary action will draw water through the wires to the crimp at the coupler. Pressure differences will pump the water into the switch from the wires. The test MUST be run with the wire ends OUT of the salt spray chamber.

During the conversation, you asked our (TIA) opinion for a countermeasure. Although I suggested Teflon coated Kapton, I STRONGLY URGE that we do not propose ANY countermeasures to Honda until the root cause is identified. Without a root cause known, we can not guarantee a solution. It would be very embarrassing to fail this test again.

You asked if TIA thought the vent hole could be eliminated or moved. TIJ data shows that the hole is needed for calibration stability. I can not now think of a better place for it. I also recommend NOT putting a filter in it.

ACTIONS

Salt spray test Kapton	TIA
Ask Honda questions 1-4 above	TIJ
Evaluate failed Kapton	Dupont of Japan
Send failed Kapton sample to TIA	TIJ
Arrange next phone call	Kazu

I look forward to talking with you again soon. I will keep you updated on TIA progress.

Regards,
Chris

14285 PS SALT SPRAY

CCI

- Dupont noted NaOH
- George O.
  - added to make PrpH correct. (0.1%) 6.5 – 7.2
    dilute NaOH
  - some labs need this due to poor H_2O "Quality"

$NaOH \rightarrow OH^- + Na^+ + H_3O^+ \rightarrow$ ~~$H_2O + H$~~ $2H_2O$ Na^+

Na^+ & $-$ ion associate/dissociate.

- Honda: What is your test like?
  - Salt Sol PpH
  - ~~Resistivity~~ of incoming water. (Resistivity) (siemens, Ohms)
  - Quality of incoming H_2O ⇒
  - Salt Re-agent.
  - What was Ramp Rate of T.
  - Was the Sea. Cycled
    - Parameters.

Bkg

- Dupont has TDC Tura Dupont ~~[illegible]~~
  - TIJ met w/ them
- Background of 142PS
  - " of test
- Kapton ~~[illegible]~~ meltout w/ black
  - no pressure
  - " wire form
- Check pH of NaOH 5% . ?
- " ATF
- Check structure of assembly
  - could you get a base at when in solution.
- white crystal in connector

Why NaOH attacks Kapton
Breaking Polymer to: a

- polyimide acid in H_2O.
- Kapton not ~~[illegible]~~ really effected by NaCl.
  - used in military navy
  - no real affect.

Literature talks of XOH
- OH the important radical ?
- T & ~~[illegible]~~ of increases etching
- alcohol seems to accelerate 80/20 Al/H_2O !
- " is catalyst.

Potassium OH ; ~~[illegible]~~ ~~[illegible]~~
1 normal solution

- NaOH concentration
- ~~What is~~ Will pH 7.2 etch.
- Send Photos
- Test Parameters.
- Can it be color?

~~Vette~~

85 FS Salt Spray

When Dupont Calls

- What info do you have?
  - copy of fax?
- Do they want photos?
- What is it about $Na\,OH$ that attacks Kapton.
- If more basic, more prone to attack.

Also

Will .2 mil meet it

could do it, but ~~Lapcote~~ depends on volume.
maybe under something out.

automotive films get special ~~tint~~ flags
need to negotiate.

Hydrolytic Stability

Kapton® polyimide film is made by a condensation reaction; therefore, its properties are affected by water. Although long-term exposure to boiling water, as shown in the curves in Figures 3 and 4, will reduce the level of film properties, sufficient tensile and elongation remain to ensure good mechanical performance. A decrease in the temperature and the water content will reduce the rate of Kapton® property reduction, whereas higher temperature and pressure will increase it.

Figure 3. Tensile Strength After Exposure to 100°C (212°F) Water, Type HN Film, 25 µm (1 mil)

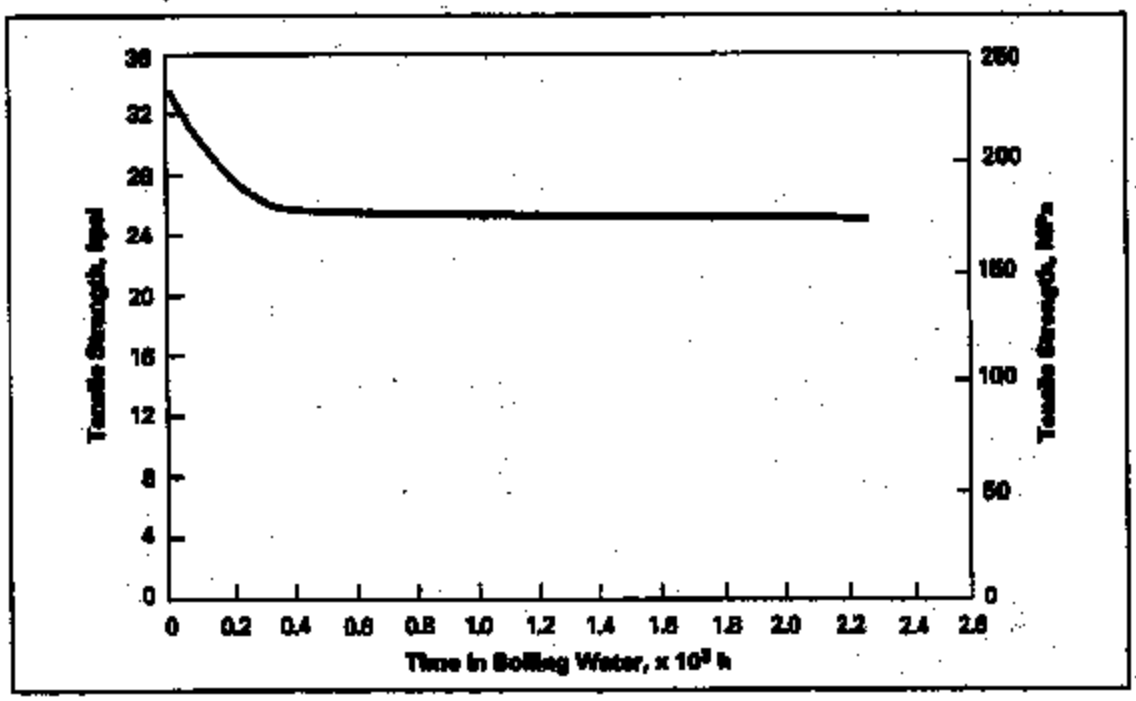
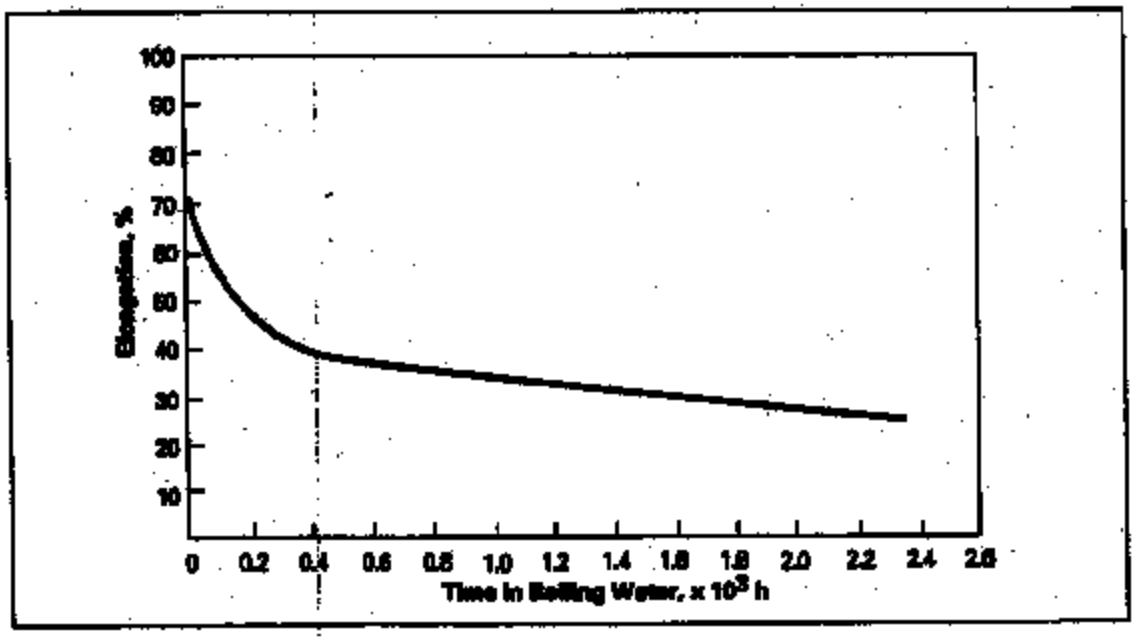


Figure 4. Ultimate Elongation After Exposure to 100°C (212°F) Water, Type HN Film, 25 µm (1 mil)

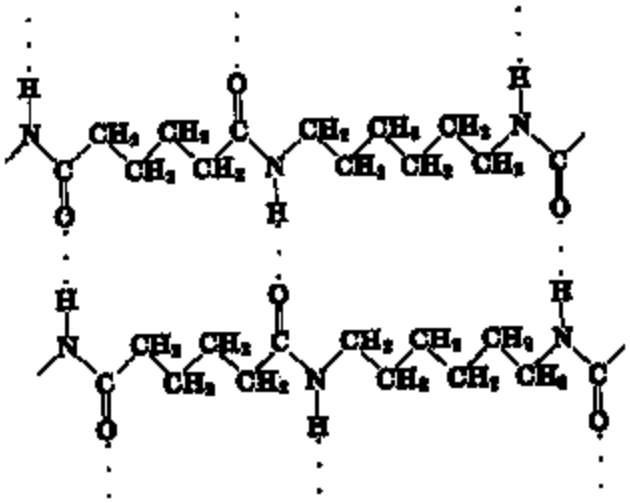


1½ PS Salt Spray Failure

Generally Mo-Fe to hydrolysis.

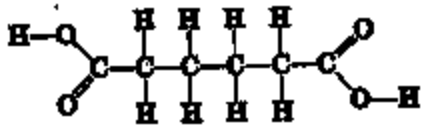
- do not expect in water
- stress & mild accelerate.
- perhaps other damage. burr/edge. etc.

- if stressed, can crack from just hydrolysis
- unlikely that Na Cl accelerated.

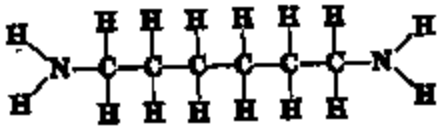


Hydrogen bonds link the chains by connecting $\rangle C{=}O$ with $\rangle N{-}H$ of different chains. Since nylon has no bulky side chains, the molecules can pack closely together, giving the resulting fiber the characteristics of silk.

Nylon is made from the six-carbon dicarboxylic acid, adipic acid,



and hexamethylenediamine,

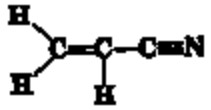


This acid and amine react to form nylon salt (see Section 16) which is polymerized with the evolution of water into g molecules or polyamides. The polyam is melted, extruded, and hardened cooling.

Nylon fibers are strong and elas Those fibers, made extra strong stretching, are used for tire cord other industrial uses. Regular nylon ment yarns are used for lightwe dense, wind resistant apparel. Special ment nylon yarns with extra bulk prepared for knit goods and carpet while nylon monofilaments are use sheer hosiery.

NITRILES

20. Nitriles. *Nitriles* are alkyl deri tives of hydrogen cyanide, HCN. Th have the general formula RCN. Acry nitrile,



Test ID #	Description	Part Number	YC #	Date
521-15-5	AIR CALIBRATE MARKETING SAMPLES	87PSL11-2	R. Spencer	11/1/96
522-15-31	Ford IP-2 Tests	77PSL2-1	E. Rose	11-4-96
523-01-26	87PS Sample - Production Parts	87PSL11-2	R. Studer	12-2-96
527-15-12	87PSL2-2 P-Q curves	87PSL2-2	K Brown	6-26-97
525-15-20	87PSL2-2 Calibration	87PSL2-2	K Brown	7/3/97
526-15-39	Derringer Clad Contact Validation	77PS	K Brown	8/10/97
527-15-45	Derringer Clad Contact Validation	87PS	K Brown	8/10/97
528-15-20	Special Sample Order TF Holland MI	87PS	K Brown	8/29/97
529-01-04	Sample build Ford Cruise control Prius	77PSL32	K Brown	8/29/97
530-01-10	Sample build Ford Cruise Control Tmp	77PSL3-2	K Brown	9/23/97
531-05-200	Quiet Disc Evaluation	87PSL2-5	K Brown	10/2/97
632-15-70	Quiet Disc Evaluation Δ Pin heights	87PSL2-5	K Brown	10/2/97
533-01-40	Quiet Disc Sample Order 97-097	87PSL2-5	K Brown	10/2/97
534-12-25	Impulse Data comparison w/ Production Line	87PSL	K Brown	10/11/97
535-01-35	Sample BSL PO# 97-79	77PSL3-3	K Brown	10/16/97
536-01-20	Sample Order 97-051	87PS spec.	K Brown	10/20/97
537-01-02	Sample Order *CD97-71 Ford Motor Co	77PSL3-2	K Brown	11/6/97
538-05-10	Ford IP-2 Test	77PSL3-3	D. Hay	11/12/97
539-01-205	Sample Order *CD97-81 PTG	87PSL2-5	K Brown	11/18/97
540-01-30	Sample # 97-82 TMI/Land Rover 18 pc. start	87PS spec	D. Hay	11/19/97
541-12-30	Impulse testing / Quiet disc development	87PS	KB	12/25/97
542-13-20	Air Cal @ Hi, Low temp	87PSL2-5	KB	12/13/97
543-13-44	Air Cal @ Hi low from Daryl	87PSL2-5	KB	12/17/97
544-15-01	Air Cal @ Room & Hi temp Return	77PSL3-2	KB	12/2/97
545-12-28	Impulse per 87PSL2-5 Quiet Disc Test Plan	87PSL2-5	KB	1/6/98
546-01-10	87PSL11-2 Sample Order * CD98-01	87PSL11-2	KB	1/11/98

Test ID #	Description	Part Number	YC #	Date
547-01-46	Sample Order # 98-01	87PS Quit	[illegible]	1/4/98
548-15-28	TAM I Validation Control	77PS	KB	1/13/98
549-15-28	TAM I: Validation Control	87PS	KB	1/13/98
550-15-64	TAM II Validation	87PS	KB	1/14/98
551-07-12	TAM II Validation Temp Cycling	87PS	KB	1/14/98
552-12-36	TAM II Val. Impulse	87PS	KB	1/14/98
553-08-12	TAM II Val. Vibration Test	77PS	KB	1/14/98
554-12-36	TAM II Val. Impulse	77PS	KB	1/14/98
555-01-40	Land Rover Replacement Samples 77PSL3-3 w/ ong	77PS	DH	2/1/98
556-01-44	LR Replacement Samples 77PSL3-3 w/ ong [illegible]	77PS	[illegible]	2/13/98
557-01-20	Replacement Switch	87PS	MS	2/25/98
558-01-4	Sample Build	87PS	MS	3/[illegible]/98
559-15-24	Land Rover Impulse Test	77PS	MS	3/12/98
560-01-25	Sample Order #797 77PSL2-3 (25)	77PS	[illegible]	3/24/98
561-15-18	Validation of New Raw Mat'l Supplier for Al Crimp Rings	77PS	LM	3/30/98
562-01-60	Sample order # 791 77PSL3-4	77PS	MS	4/6/98
563-01-14	87PSL2-5 PV Impulse Test	87PSL2-5	[illegible]	4/17/98
564-15-40	87PSL2-5 order # 836		MS	4/24/98
[illegible]	[illegible]	[illegible]	MS	[illegible]
565-15-11	87PSL2-5 Production Validation Impulse Test	87PSL2-5	MS	5/6/98
566-15-56	Sample order # 839	77PSL3-4	MS	5/7/98
[illegible]	[illegible]			
567-15-60	IP-2 Testing	77PSL3-3	D. [illegible]	5/21/98
568-15-[illegible]	Hascall Rivet + Contact Validation Test Switch Part # 7916-1	77PSL3-3	M. S.	6/2/98
569-01-02	77PSL3-4 Angle for IT	77PSL3-4	[illegible]	6/12/98
570-15-1	Land Rover Return	77PS	MS	7/6/98

Test ID #	Description	Part Number	YC #	Date
571-15-18	Validation of New Raw Matl Supplier - Crimp Cup	87PS	LM	8/21/98
572-01-35	ITT - Ford Expedition Samples of M10x1.0 Imprint 77PS	77PS	DH	11/30/98
573-01-35	ITT - Ford Expedition Samples 77PSL3-3 3rd Lot	77PSL3-3	DH	11/2/98
574-01-04	ITT Ford " " 77PS3-4	77PSL3-4	DH	3/9/99
575-15-16	- Impulse Test	77PSL3-2	XC	3/19/99
576-15-60	IP-2 Testing 77PSL3-3	77PSL3-3	DAL	4/6/99
577-15-60	Ford 77PS Current Leakage w/brake fluid in base test		Duba	5-19-99
578-15-20	FORD 77PSL3-3 ±P2 PROOF TEST	77PSL3-3	ECK	6/1/99

Test ID #	Description	Part Number	YC #	Date

Test ID #	Description	Part Number	YC #	Date

		77PS IP-2 TESTS			SAMPLE SIZE: 84PCS.			
	FORD BRAKE SPEC. # (INVERTED DELTA) 98-F2VC-2F224-AA							
PRE-TESTING:				TEST ACCEPTANCE:		AMT.		WHERE:
	III - D PROOF			A.S.M.P.		ALL		QA INSP.
	III - A CALIBRATION:			100%		ALL		L.T. /S.12
		AOT						
		REL						
	III - MVD			A.S.M.P.		ALL		L.T. /S.12
	III - CURRENT LEAKAGE			A.S.M.P.		ALL		QA INSP.
IP-2 TESTS:				POST TESTS:				
	III - I VIBRATION			A,B,C,D		6PCS	# 1-6	ETL /S.10
	III - K VACUUM			A,B,C,D		6PCS	# 7-12	ETL /S.10
	III - L TEMP CYCLING			A,B,C,D		6PCS	# 13-18	L.T. /S.12
	III - M FLUID RESISTANCE			E,G,H,J	POST TESTS:		# 19-54	TSL /S.10
		**III - E IMPULSE			A,B,C,D	12PCS	# 19-30	L.T. /S.12
		**III - J TERMINAL STRENGTH			A,B,C,D	12PCS	# 31-42	QA INSP.
		**III - G HUMIDITY			A,B,C,D	6PCS	# 43-48	ETL /S.10
		**III - H SALT SPRAY			A,B,C,D	6PCS	# 49-54	ETL /S.10

TI-NHTSA 012059

SP-2 TESTS								
	FORD							
	ES-TEST #	ES-TEST #	ES-TEST #	CHRYSLER	GM-[illegible]	[illegible]	HONDA [illegible]	
	[illegible]-AA	[illegible]-AA	[illegible]-AA	[illegible]	[illegible]	[illegible]	[illegible]	
	POWER STR'G	BRAKE	BRAKE	POWER STR'G	POWER STR'G	BRAKE	POWER STR'G	
	[illegible]	6/PS	7/PS	[illegible]				
CALIBRATION	100%	100%	100%	100%				
CREEP CHECK	100%	4/LOT	N/A	100%				
LEAK CHECK	100%	N/A	N/A					
VOLTAGE DROP	3/6MO	4/LOT	4/LOT	4/LOT				
CURRENT LEAKAGE	3/6MO	4/LOT	4/LOT					
PROOF	3/6MO	4/LOT	4/LOT	4/LOT				
BURST	3/6MO	4/LOT	4/LOT	4/LOT	6/MONTH			
TERMINAL STRENGTH	3/6MO	4/LOT	4/LOT	4/LOT				
VIBRATION	6/6MO	1/6MO	6/6MO					
VACUUM	6/6MO	6/6MO	6/6MO					
TEMP.CYCLE	6/6MO	6/6MO	6/6MO					
FLUID RESISTANCE	N/A	N/A	[illegible]	N/A				
IMPULSE	3/6MO	3/6MO	3/6MO	4/MONTH				
HUMIDITY	6/6MO	6/6MO	6/6MO					
SALT SPRAY	6/6MO	6/6MO	6/6MO					
TEMP.CORRELATION	N/A	N/A	N/A	N/A	WEEKLY			
ISOLATION RESISTANCE	N/A	N/A	N/A	4/LOT				
	*** CURRENT TEST STATUS ***							
CALIBRATION	100%	100%	100%	100%	100%	100%	100%	
CREEP CHECK	100%	100%	N/A	100%	N/A			
LEAK CHECK	100%							
VOLTAGE DROP	PER PILOT	PER PILOT	PER PILOT	PER PILOT				
CURRENT LEAKAGE	PER PILOT	PER PILOT	PER PILOT	PER PILOT			PER PILOT	
PROOF	PER PILOT	PER PILOT	PER PILOT	PER PILOT		PER PILOT	PER PILOT	
BURST	PER PILOT	PER PILOT	PER PILOT	PER PILOT	6/MON	PER PILOT	PER PILOT	
TERMINAL STRENGTH	PER PILOT	PER PILOT	PER PILOT	PER PILOT				
VIBRATION			3/14/95					
VACUUM			3/17/95					
TEMP.CYCLE			[illegible]					
FLUID RESISTANCE			[illegible]					
** IMPULSE			[illegible]					
** HUMIDITY			[illegible]					** POST TEST
** SALT SPRAY			[illegible]					QUAL.
** TERM. STRENGTH			[illegible]					
TEMP.CORRELATION	N/A	N/A	N/A	N/A	------			
ISOLATION RESISTANCE	N/A	N/A	N/A	***	N/A			[illegible] / 6-8-95

TEST WORKSHEET

P/N:	77PSL2-1	DATE:	12/8/98
A. CALIBRATION SPEC		POST TEST	
ACT	90-160	A.S.M.P.	
REL	20 MIN	A.S.M.P.	LAB TEST # 522-16-64
B. MILLIVOLT DROP	< 200	A.S.M.P.	
C. CURRENT LEAKAGE		A.S.M.P.	
D. PROOF	3000psi	A.S.M.P.	

PRE TESTS:						IP-2 TEST		POST TESTS:
DEVICE #	PROOF	ACT	REL	MVD	CUR.LK	VIBRATION		A,B,C,D
1	OK	137.6	51.2	0.06	OK	#1-6		
2	OK	131.3	46.8	0.06	OK			
3	OK	136.4	69	0.05	OK			
4	OK	131.2	60	0.06	OK			
5	OK	129.9	61.1	0.06	OK			
6	OK	136.3	52.4	0.06	OK			
7	OK	131.8	69.4	0.06	OK	VACUUM		A,B,C,D
8	OK	139.9	66.4	0.11	OK	#7-12		
9	OK	121.4	54.4	0.1	OK			
10	OK	120.2	63.2	0.06	OK			
11	OK	128.8	66.4	0.06	OK			
12	OK	129.2	61.2	0.06	OK			
13	OK	128.2	66.6	0.06	OK	TEMP.CYCLE		A,B,C,D
14	OK	132.2	63.3	0.07	OK	#13-18		
15	OK	131.3	68.4	0.06	OK			
16	OK	121.2	59.7	0.06	OK			
17	OK	134.4	69.4	0.06	OK			
18	OK	131.9	66.4	0.07	OK			
19	OK	127.3	63.4	0.06	OK	FLUID RES.	E,G,H,J	
20	OK	123.7	56.8	0.07	OK	#19-54	IMPULSE	A,B,C,D
21	OK	128.2	68.6	0.06	OK		#19-30	
22	OK	133	65.4	0.06	OK			
*23A	OK	130.6	66.4	0.06	OK			
24	OK	130.7	65.5	0.06	OK			
25	OK	134.4	69.5	0.06	OK			
26	OK	129.9	69.9	0.07	OK	*23A & 30A	REPLACEMENT PCS.	
27	OK	130.2	63.4	0.06	OK	DUE TO TEST SET-UP ERROR		
28	OK	123.8	66.4	0.06	OK			
29	OK	128.8	67.1	0.07	OK			
*30A	OK	134.8	70.4	0.06	OK			
31	OK	128.1	64	0.06	OK		TERM.STR	A,B,C,D
32	OK	133.3	69.6	0.06	OK		#31-42	
33	OK	127.2	64.3	0.06	OK			
34	OK	127.9	69.6	0.06	OK			
35	OK	123.6	60.4	0.06	OK			
36	OK	139.9	49.8	0.06	OK			
37	OK	128.1	67.7	0.06	OK			
38	OK	139.2	68.1	0.07	OK			

TEST WORKSHEET

P/N: DATE:

A. CALIBRATION SPEC	POST TEST
ACT	A.S.M.P.
REL	A.S.M.P.
B. MILLIVOLT DROP	A.S.M.P.
C. CURRENT LEAKAGE	A.S.M.P.
D. PROOF	A.S.M.P.

PRE TESTS: (F-S TEST POST TESTS:

DEVICE #	PROOF	ACT	REL	MVD	CUR.LK		
39	OK	126	57.8	0.05	OK		
40	OK	127.9	64.1	0.06	OK		
41	OK	128.8	61.2	0.06	OK		
42	OK	132.6	66.1	0.06	OK		
43	OK	134.6	63.4	0.06	OK	HUMIDITY	A,B,C,D
44	OK	127.4	59.9	0.05	OK	#43-48	
45	OK	132.2	60.1	0.07	OK		
46	OK	129.1	60.1	0.17	OK		
47	OK	129.9	60.4	0.06	OK		
48	OK	139.4	64.4	0.06	OK		
49	OK	124.5	62.3	0.05	OK	SALT SPRAY	A,B,C,D
50	OK	131.6	66.3	0.06	OK	#49-54	
51	OK	136.1	62.1	0.07	OK		
52	OK	135.5	61.6	0.09	OK		
53	OK	131.6	56.4	0.05	OK		
54	OK	131.1	58.5	0.06	OK		

POST TESTS

P/N:	77PSL2-1		DATE:	1/14/97
A. CALIBRATION SPEC		POST TEST		
ACT	90-180	A.S.M.P.		
REL	20 MIN	A.S.M.P.	LAB TEST #	522-16-64
B. MILLIVOLT DROP	< 200	A.S.M.P.		
C. CURRENT LEAKAGE		A.S.M.P.		
D. PROOF	3000psi	A.S.M.P.		

POST TESTS:						IP-2 TEST		POST TESTS:
DEVICE #	PROOF	ACT	REL	MVD	CUR.LK	VIBRATION		A,B,C,D
1	OK	134	59.6	0.19	OK	# 1-6		
2	OK	121.4	56.9	0.32	OK			
3	OK	134.7	69.9	0.21	OK			
4	OK	131.8	76.4	0.21	OK			
5	OK	129.4	60.4	0.22	OK			
6	OK	131.3	61.3	0.25	OK			
7	OK	133.8	65.4	0.29	OK	VACUUM		A,B,C,D
8	OK	134.4	58.7	0.21	OK	# 7-12		
9	OK	125.6	60	0.29	OK			
10	OK	122.4	65.3	0.22	OK			
11	OK	127.6	69.6	0.21	OK			
12	OK	124.7	62.8	0.19	OK			
13	OK	113.8	57.5	0.19	OK	TEMP.CYCLE		A,B,C,D
14	OK	123.4	59.7	0.26	OK	# 13-18		
15	OK	128.4	54.4	0.41	OK			
16	OK	116.9	60.6	0.19	OK			
17	OK	121.9	61.9	0.21	OK			
18	OK	118.5	63.2	0.25	OK			
19	OK	120.1	66.4	0.27	OK	FLUID RES.	E,G,H,J	N/A.1/YR.ONLY
20	OK	114.4	64.8	0.24	OK	# 19-54	IMPULSE	A,B,C,D
21	OK	114.8	61.2	0.25	OK		#19-30	
22	OK	117.1	63.1	0.53	OK			
23	OK	114.4	66.1	1.16	OK			
24	OK	117.4	63.4	0.83	OK			
25	OK	118.2	65.8	5.71	OK			
26	OK	114.5	64.4	0.3	OK			
27	OK	114.5	57.6	0.36	OK			
28	OK	110.6	66.6	0.31	OK			
29	OK	112.9	66.4	0.34	OK			
30	OK	123.8	72.6	0.32	OK			
31	OK	130.8	66.6	0.31	OK		TERM.STR	A,B,C,D
32	OK	134.8	66.9	0.24	OK		#31-42	
33	OK	128.9	60.2	0.22	OK			
34	OK	131.6	63.4	0.22	OK			
35	OK	128.1	66.9	0.27	OK			
36	OK	121.6	54.6	0.58	OK			
37	OK	124.4	56.6	0.23	OK			
38	OK	137	63.9	0.37	OK			

POST TESTS

P/N: DATE:

A. CALIBRATION SPEC	POST TEST
ACT	A.S.M.P.
REL	A.S.M.P.
B. MILLIVOLT DROP	A.S.M.P.
C. CURRENT LEAKAGE	A.S.M.P.
D. PROOF	A.S.M.P.

PRE TESTS: IP-2 TEST POST TESTS:

DEVICE #	PROOF	ACT	REL	MVD	CURLK		
39	OK	132.2	61.4	0.19	OK		
40	OK	136.4	70.1	0.22	OK		
41	OK	132.8	69.6	0.26	OK		
42	OK	136.9	67.4	0.19	OK		
43	OK	141.4	70.3	0.6	OK	HUMIDITY	A,B,C,D
44	OK	141.1	53.3	0.21	OK	#43-48	
45	OK	140.2	68.3	0.27	OK		
46	OK	132.4	66.6	0.32	OK		
47	OK	136.8	62.2	0.23	OK		
48	OK	154.4	68.7	0.23	OK		
49	OK	123.7	59.7	0.19	OK	SALT SPRAY	A,B,C,D
50	OK	133.4	58.1	0.53	OK	#49-54	
51	OK	146.6	48.9	0.51	OK		
52	OK	141.2	54.6	0.26	OK		
53	OK	130.4	60.4	0.23	OK		
54	OK	144.3	66.4	0.22	OK		