EA02-025

TEXAS INSTRUMENTS, INC.'S

9/10/03 ATTACHMENT TO ODI

REQUEST #3

BOX 5

PARTS A - P

PART C

PRESSURE SWITCH DATA Form 21605 **TEST NO.** 349-15-96

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMPL. DATE
7715L3-3	92104	Steve Offner	
PERFORMED BY	**DATE STARTED**	**DATE COMPLETED**	**APPROVED BY**
Jeffrey Oberoi	92105		

PROJECT TITLE: Speed Control Deactivate PS

CUSTOMER:

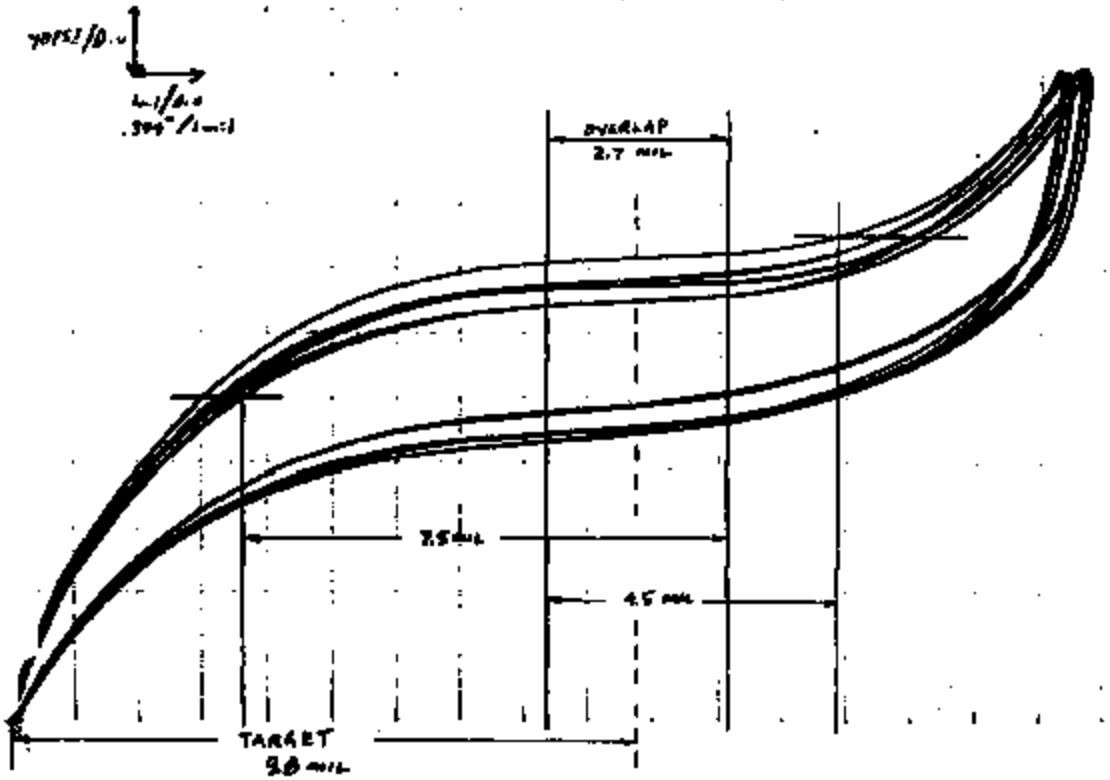
PURPOSE OF TEST: Next Page

PROCEDURE:

Device #	RT Act	RT Rel	-40 Act	-40 Rel	+125 Act	+125 Rel	+150 Act	+150 Rel	+175°C act	+175°C Rel	Init dia	Seated dia	Fin dia	offset
349-15 - 1	250	123	265	193	213	145	178	150						
- 3	249	179	265	196	232	123	223	166						
- 7	226	169	289	193	214	154	199	145						
- 7	236	173	262	189	222	164	207	156	•		98.3	96.2	145.1	
- 7	232	169	288	197	216	161	206	154						
- 6	223	158	269	178	202	150	188	140	169 • 126		98.9	96.6	145.0	
- 7	241	166	293	192	209	156	198	143						
- 8	265	181	285	196	231	130	206	158						
- 9	259	177	273	191	203	142	196	138						
- 10	248	138	262	180	206	167	211	161						
- 11	239	171	285	199	221	166	208	156						
- 12	232	170	290	195	226	166	208	159						
- 13	235	169	289	196	240	167	216	148	190 • 137		98.4	96.9	144.8	
- 17	242	179	289	196	209	132	213	158						
- 15	286	172	283	190	221	169	206	157						
- 16	231	168	298	196	215	165	196	150						
- 17	229	168	294	182	219	166	200	153						
- 18	255	135	311	199	234	169	228	167						
- 19	237	170	276	189	218	161	196	138						
- 21	250	183	303	203	239	178	218	164						
- 21	230	162	296	194	215	159	196	150						
- 23	246	134	263	193	221	170	205	158						
- 25	247	171	258	196	224	173	209	162						
- 27	249	176	260	198	224	169	197	150						
25	255-206		267-217		233-217									
26	267-216		276-217		239-226									
27	243-219		268-222		225-208									

TI-NHTSA 7281

RANGES: 2.600V | 10.00V | 2.500V
OFFSETS: 0.0V | 0.0V | 0.1V
TOTAL TIME: 1.00S
POST-TRIG: 0.0S
TRIGGER: MAN
11:12:08 04 NOV 92



TI-NHTSA 7282

HIGHLIGHTS

Stephen B. Offiler
Week Ending 92-11-06

AUSTRALIA: We have halted efforts on the full-round Kapton diaphragm design. Engineers at FOA and BCIA have basically finalized their decision to remain with the standard diaphragm configuration. This is based on:

- The full-round diaphragm was costly.

- We were (barely) able to demonstrate a 500K cycle life at 90% reliability and 90% confidence in one combined vacuum & Impulse experiment with 6 devices: we have not communicated the fact that repeatability of this test can be rather poor.

- FOA has offered to reduce the cycling pressure to 1000 psi, and we have responded that this will increase our confidence that we can pass Impulse testing.

FOA is asking for a detailed timing chart for completion of ISR, as well as a print update to include a note regarding modification to the ES procedure to combine vacuum and Impulse and to revise the parameters (vac 0.3 - 0.5 mmHg and Impulse at 1000 psi).

FOA has contacted Tim Andresen, who is now aware of the vacuum issue. He has requested that we complete a combined vacuum & Impulse test using the NAAO vacuum level on a low-priority basis. This will be comprehended in the upcoming plans for the CCPS cycler, which will also be occupied with LT and Cupri validation tests.

LT SILENT: We are proceeding with plans to convert all LT production (77PSL2-3 and 77PSL3-3) over to a single part number (L3-3) using a silent disc. Mfg. has completed a production lot of sensors using a truck silent disc. We checked a couple of the pilots on the noise equipment and confirmed they are quiet. We have completed a hatchet-curve study per Dale's technique to determine preload target. The pin window on these is somewhat narrower than the original truck proto's characterized back in April. As a result, some compromise assumptions were made (max. temp decrease to 150 C and upper spec. increase to 325 psi) which provided a more than adequate pin target tolerance. These assumptions have not been communicated to LT Eng. Production has completed a build of 150 devices at this preload (with 100% yield) which we will be using for internal and Ford validation testing. We are performing a low and high temperature characterization on 24 to confirm the preload assumptions. The remainder of the production lot will not be final-assembled until we've completed this confirmation.

For validation LT Eng. is requesting an Impulse test plus a one-time high and low temperature characterization on 96 devices. This will be piggybacked with our temp. char. above; nonetheless, this represents a good deal of effort to complete. Jeff will be working Saturday. We are targeting the LT Eng. visit to Attleboro on Nov 17 for completion of these tests.

During the sensor build, we also constructed some special parts to help determine if the cup mod's on 27713 will also be required on 27288. This work will be conducted as a separate issue - given the 100% yield, with no rattlers identified, the priority is not high.

MISCELLANEOUS Discussion with Dave S[illegible]ey indicates the new laser disc-checking equipment is nearing completion. I have del[illegible]d characterized, known-quiet discs to him to commence correlation work.

TEXAS INSTRUMENTS

Nov. 18, 1992

FACSIMILE TRANSMITTAL

TO:

Name: John Shorkey

Location: Kelsey - Hayes

Mail Station:

Phone Number:

FAX Number: 313 684 5374

FROM: Elaine Rose

TEXAS INSTRUMENTS **MS 12-~~62~~ 27**

Phone Number: (508) 699-1907

FAX Number: (508) 699-3153

Total number of pages (including header page): 2

COMMENTS:

Part Number: E7SC-2N824-AA

Actuation: 350 - 450 PSI
Release: 120 min.
Differential: 50 min.

	ACTUATION	RELEASE	DIFFERENTIAL
	378	168	210
	431	152	279
	414	152	262
	412	154	258
	401	132	269
	413	132	281
	371	165	206
	388	160	228
	374	151	223
	366	172	194
	422	166	256
	425	154	271
	427	136	291
	365	159	206
	436	146	290
	412	164	248
	414	165	249
	423	131	292
	430	155	275
	410	150	260
MIN:	365	131	194
MAX:	436	172	292
STD DEV:	20.0505	11.0093	25.7763

TRANSMISSION REPORT

TTI NO.	3136845374
DATE AND TIME	1[illegible] 98 01:34 PM
DURATION	0
MODE	
PAGE	04
CODE	GOOD

TEXAS INSTRUMENTS

Nov. 18, 1992

FACSIMILE TRANSMITTAL

TO:

Name: JOHN SHORKEY

Location: KELSEY - HAYES

Mail Station:

Phone Number:

FAX Number: 313-684-5374

FROM: ELAINE ROSE (Q.A. TECH.)

TEXAS INSTRUMENTS **MS 12-32**

Phone Number: (508) 699-1907

FAX Number: (508) 699-3153

Total number of pages (including header page): 4

COMMENTS:

PART NUMBER: F2VC-9F924-AB

ACTUATION SPEC: 90 - 180 PSI
RELEASE SPEC: 20 PSI MIN.

	ACTUATION	RELEASE
	138.0	60.1
	143.2	74.8
	146.0	64.5
	143.2	60.6
	144.0	61.6
	138.4	64.5
	137.0	62.8
	137.0	62.2
	131.4	56.7
	138.6	67.1
	136.9	66.3
	142.4	66.6
	132.4	60.9
	135.3	68.6
	139.3	46.2
	150.9	64.3
	146.3	64.6
	136.4	46.2
	141.6	61.7
	134.1	47.2
MIN.	131.4	47.2
MAX.	150.9	74.8
STD DEV:	4.7699	5.9166

PARTS LIST FOR SUPPLIER T095A
TEXAS INSTRUMENTS INC.
Page 1

PART NUMBER	CHARACTERISTIC	CPK	CP
F2TA 9C868 AA			

PART NUMBER	CHARACTERISTIC	CPK	CP
F3TA 9F924 AA	ACTUATION	3.49000	0.18000
	RELEASE	3.05000	0.22000

PART NUMBER	CHARACTERISTIC	CPK	CP
F3TA 9F924 AA	ACTUATION	3.49000	0.18000
	RELEASE	3.05000	0.22000

PART NUMBER	CHARACTERISTIC	CPK	CP
F2VC 9F924 AB	ACTUATION	3.49000	0.18000
	RELEASE	3.05000	0.22000

PART NUMBER	CHARACTERISTIC	CPK	CP
E53C 3N824 AA	ACTUATION	1.60000	2.38000
	RELEASE	4.07000	0.16000

PART NUMBER	CHARACTERISTIC	CPK	CP
E57A 3N824 AA	ACTUATION	3.18000	0.21000
	RELEASE	4.07000	0.16000

PART NUMBER	CHARACTERISTIC	CPK	CP
F3DC 3N824 AA	ACTUATION	3.18000	0.21000
	RELEASE	4.07000	0.16000

PART NUMBER	CHARACTERISTIC	CPK	CP
E80C 2C283 CA	ACTUATION	3.18000	0.21000
	RELEASE	4.07000	0.16000

PART NUMBER	CHARACTERISTIC	CPK	CP
E7SC 3N824 AA	ACTUATION	3.18000	0.21000

PARTS LIST FOR SUPPLIER T095A
TEXAS INSTRUMENTS INC.
Page 2

PART NUMBER	CHARACTERISTIC	CPK	CP
E7SC 3N824 AA	RELEASE	4.07000	6.24 0.16000

PART NUMBER	CHARACTERISTIC	CPK	CP
F3LH T9D594 AB	THREAD PITCH DIA.	2.00000	2.20000
	STEP DEPTH	98.00000	0.00000
	TERMINAL POSITION	98.00000	0.00000
	INSIDE DIAMETER	98.00000	0.00000
	OUTSIDE DIAMETER	98.00000	0.00000
	LOW PRES. CALIBRAT.	4.00000	4.10000
	HIGH PRESS. CALIBR.	4.20000	4.60000
	THRD FIT TO MANIFOLD	98.00000	0.00000
	LEAK RATE	98.00000	0.00000

TEXAS INSTRUMENTS

Nov. 30, 1992

FACSIMILE TRANSMITTAL

TO:

Name: JOHN SHORKEY

Location: KELSEY-HAYES

Mail Station:

Phone Number:

FAX Number: 313-684-5374

FROM:

TEXAS INSTRUMENTS **MS 12-37**

Phone Number: (508) 699-1907

FAX Number: (508) 699-3169

Total number of pages (including header page): 4

COMMENTS:

11-20-92

JOHN,

THIS SHOULD GIVE YOU ENOUGH DATA TO ESTABLISH A GOOD BASE FILE, FOR THE 77AS.

IN REGARDS TO THE 5TAS, THE STORED DATA WE HAVE IS ONLY A FINAL REPORT, AFTER EACH RUN. THIS ALREADY HAS AVERAGES, etc. computed, INDIVIDUAL PIECE DATA IS NOT AVAILABLE.

WE ARE NOT SCHEDULED, AT THIS TIME, TO PRODUCE THESE SWITCHES until JAN '93. AT WHICH TIME I CAN SEND YOU THE DATA YOU REQUIRE.

IF I CAN BE OF ANY FURTHER ASSISTANCE, don't HESITATE TO CALL ME.

Regards,
ELAINE ROSE

Pressure Tester

77PS PRESSURE TESTER

R&M RAMP RATE CHECK & ADJUSTMENT PROCEDURE

1. HAVE OPERATOR SET UP TEST LIMITS AS FOLLOWS WITH PRINT EVERY PIECE TURNED ON AND RUN RAMP RATE MASTERS THROUGH MACHINE.

LOW ACTUATION	300
HIGH ACTUATION	400
LOW RELEASE	150
HIGH RELEASE	200
RAMP RATE	50

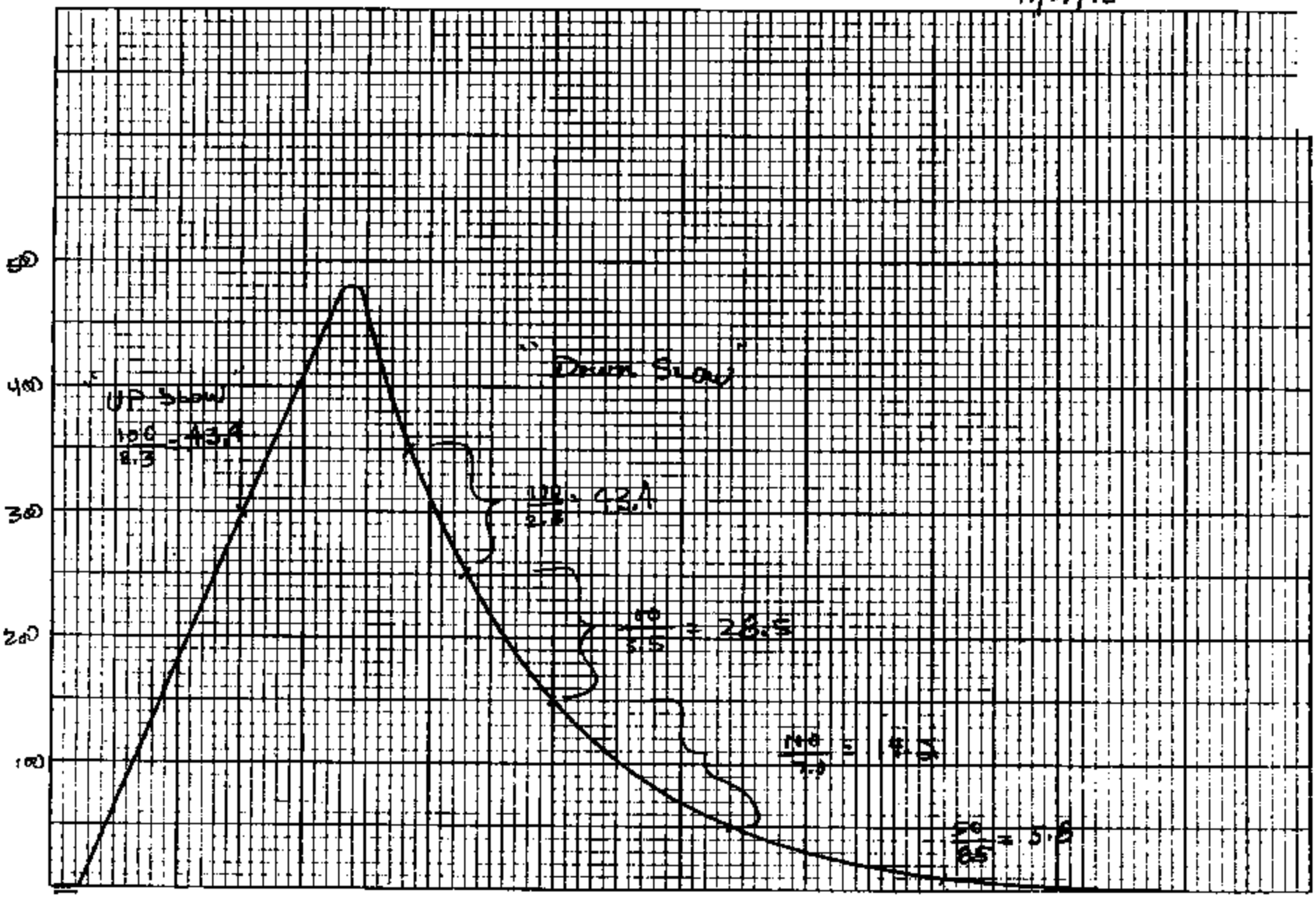
2. THE MRRU (MEASURED RAMP RATE UP) AND MRRD (MEASURED RAMP RATE DOWN) ON THE PRINT EVERY PIECE REPORT SHOULD BE WITHIN 40 TO 50 PSI PER SECOND.
   IF ADJUSTMENT IS NEEDED, ADJUST THE SLOW UP OR SLOW DOWN FLOW CONTROLS AS REQUIRED.

3. AT ALL OTHER RANGES THE RAMP RATE DOWN WILL BE LOWER, DEPENDING ON HOW LOW THE LOW RELEASE, THE DOWN RAMP RATE CAN BE AS LOW AS 5 PSI PER SECOND. THIS IS ACCEPTABLE.

11/19/92
11/30/92 REV - CHANGED RELEASE RANGE

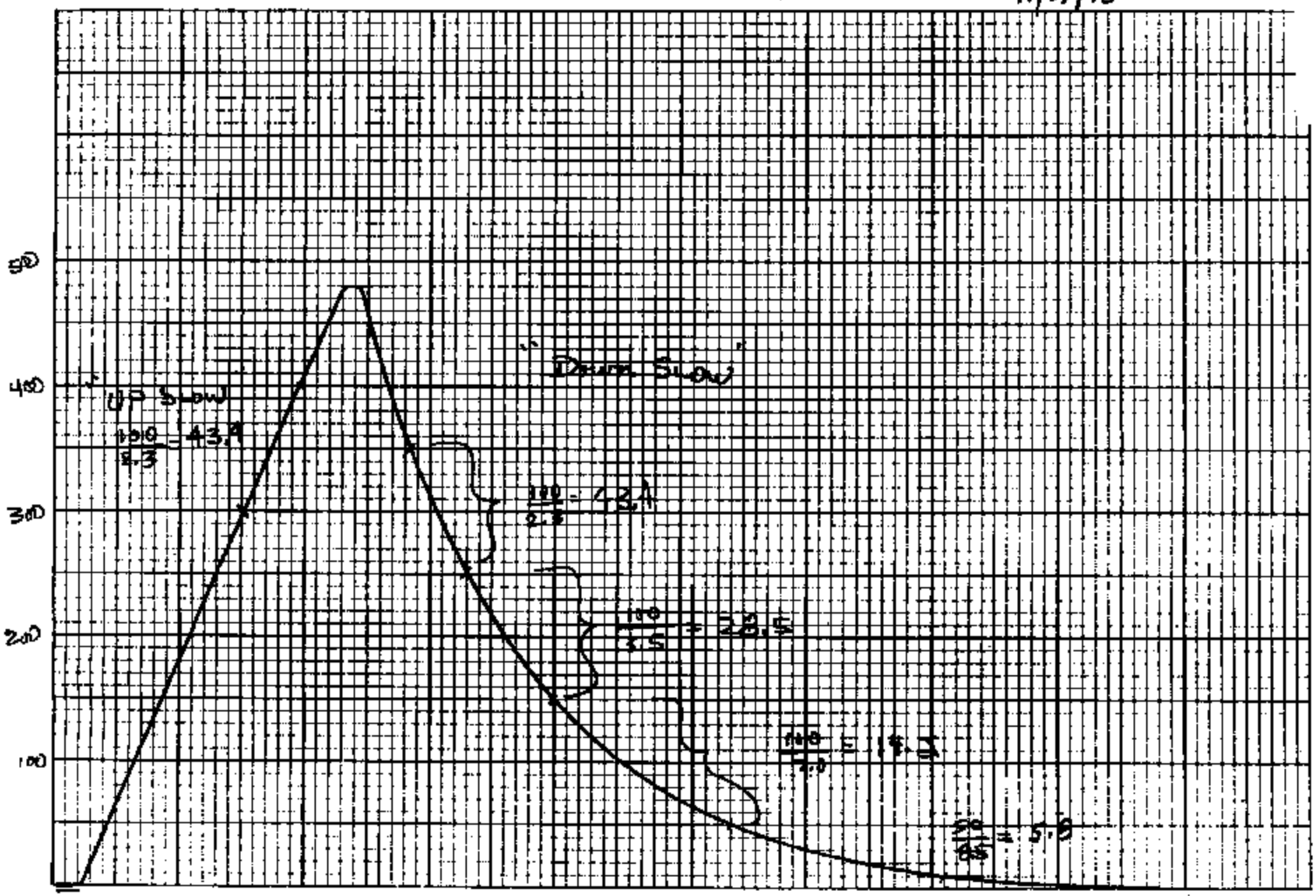
LOU ROCHA

11/19/92



No. XY-1001 - SP 3

11/19/92



TI-NHTSA 7296

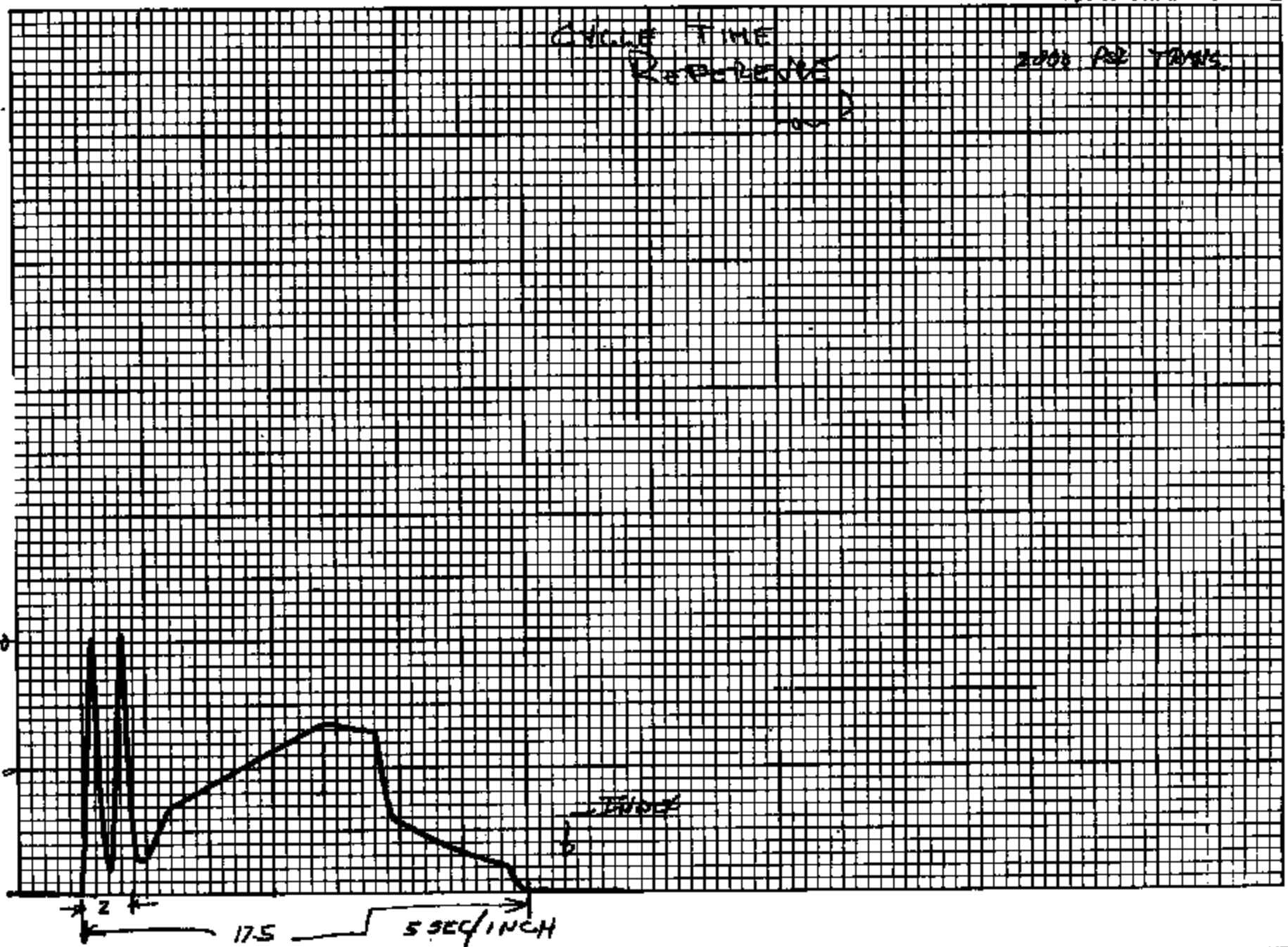
GRAPHIC CONTROLS CORPORATION
BUFFALO, NEW YORK
PRINTED IN U.S.A.

No. XY-1001 - SP 3

5-27-93

#12/1983 77 PS PRES TEST

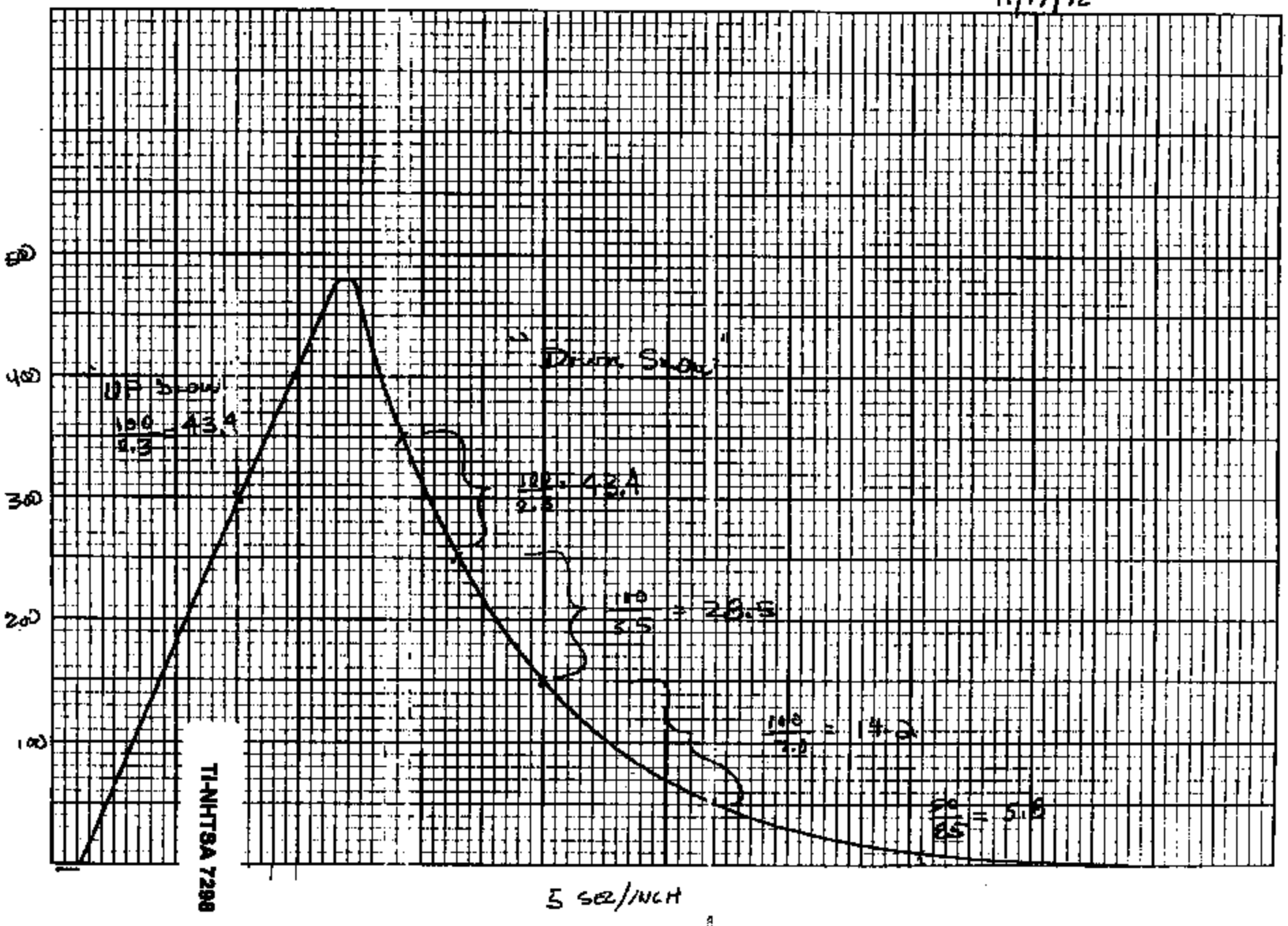
RAMP RATE MASTERS



GRAPHIC CONTROLS CORPORATION
BUFFALO NEW YORK
PRINTED IN U.S.A.

NO. XY-1001 - SP 3

11/19/92



77PS PRESSURE TESTER

R&M RAMP RATE CHECK & ADJUSTMENT PROCEDURE

1. HAVE OPERATOR SET UP TEST LIMITS AS FOLLOWS WITH PRINT EVERY PIECE TURNED ON AND RUN DUMMY PARTS THROUGH MACHINE.

LOW ACTUATION	300
HIGH ACTUATION	400
LOW RELEASE	250
HIGH RELEASE	350
RAMP RATE	50

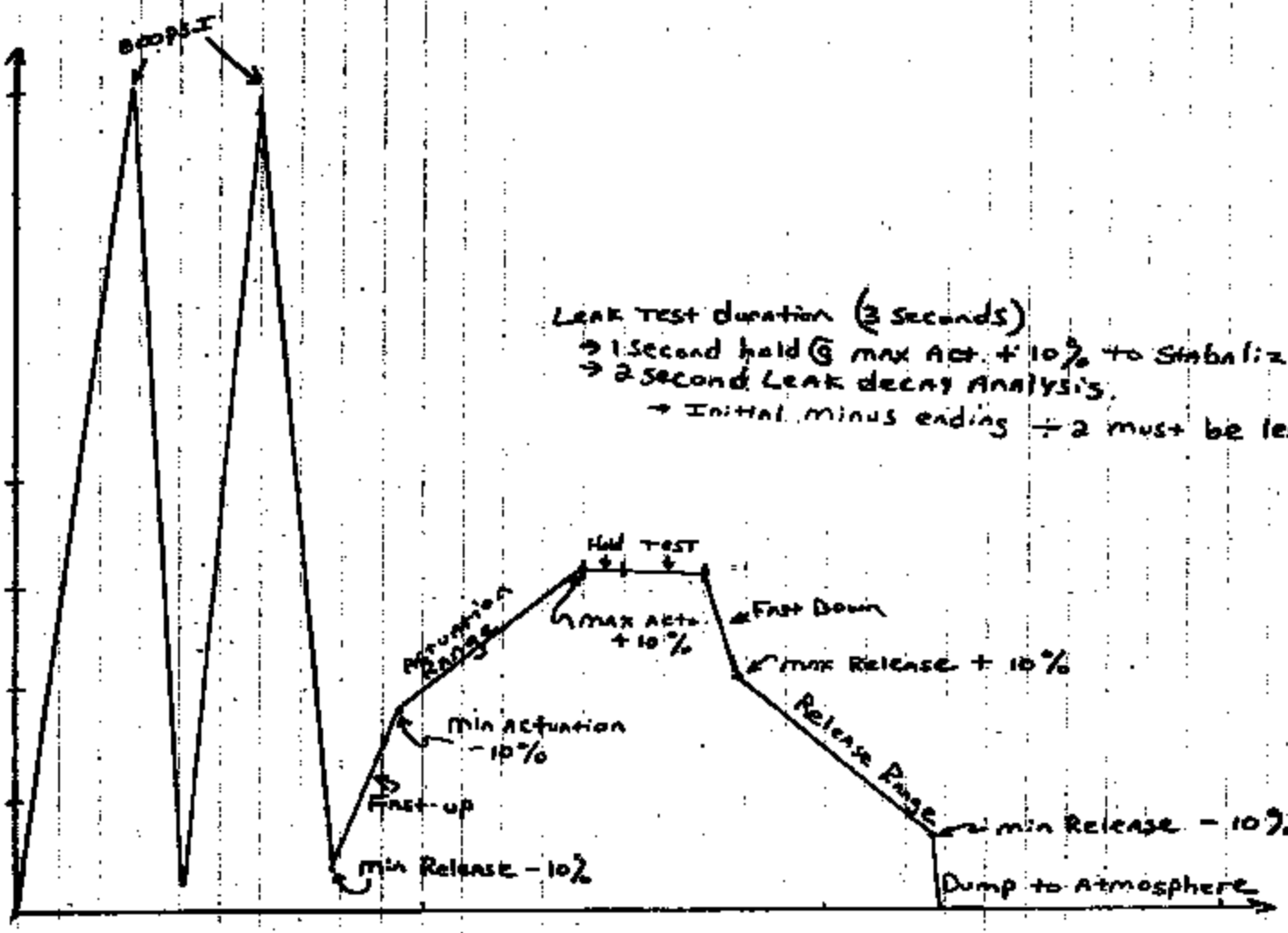
2. THE MRRU (MEASURED RAMP RATE UP) AND MRRD (MEASURED RAMP RATE DOWN) ON THE PRINT EVERY PIECE REPORT SHOULD BE WITHIN 40 TO 50 PSI PER SECOND.
IF ADJUSTMENT IS NEEDED, ADJUST THE SLOW UP OR SLOW DOWN FLOW CONTROLS AS REQUIRED.

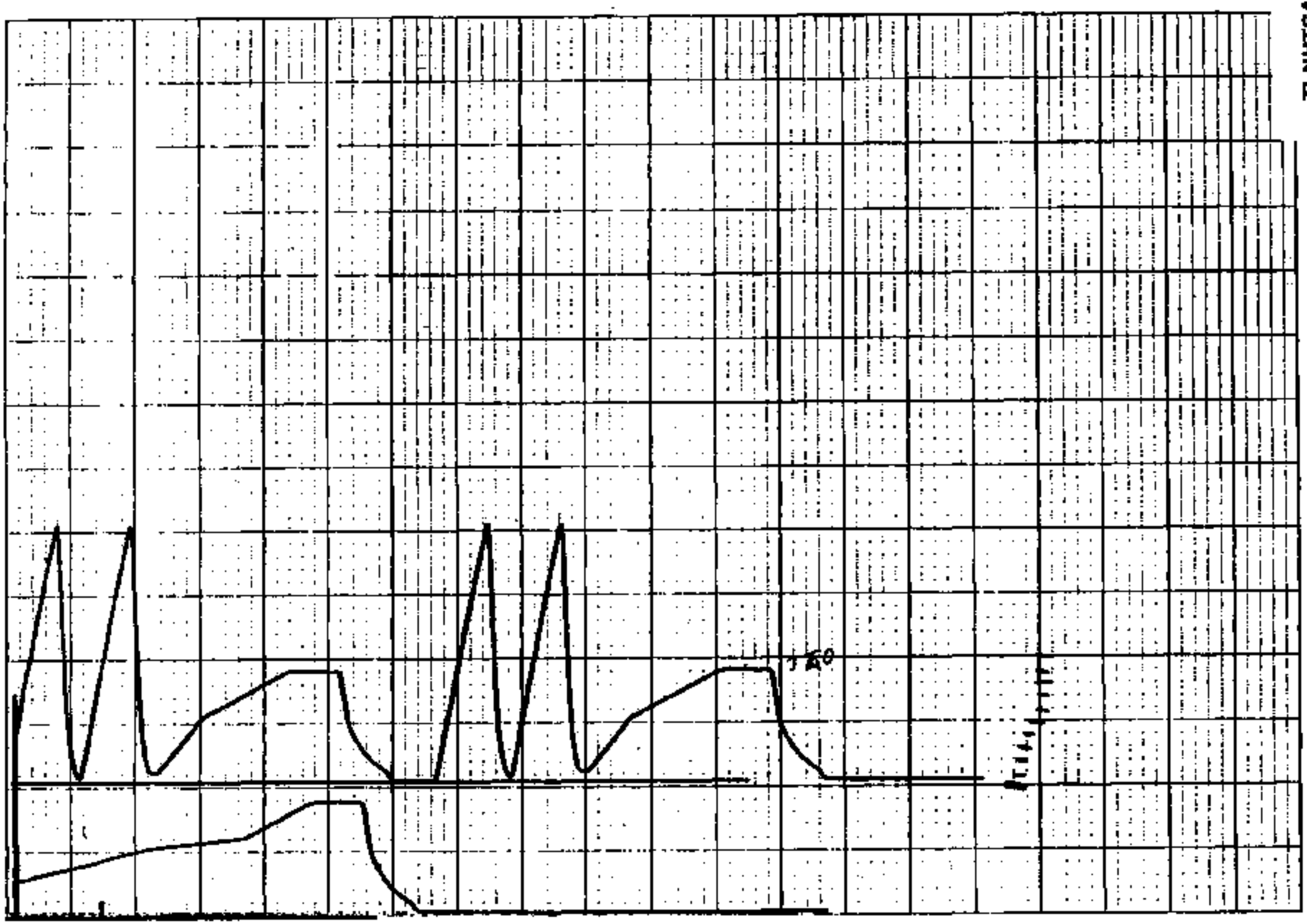
3. AT ALL OTHER RANGES THE RAMP RATE DOWN WILL BE LOWER. DEPENDING ON HOW LOW THE LOW RELEASE, THE DOWN RAMP RATE CAN BE AS LOW AS 5 PSI PER SECOND. THIS IS ACCEPTABLE.

11/19/92

LOU ROCHA

TPS Function Tester Ramp Profile




160

Low, 3/10/92

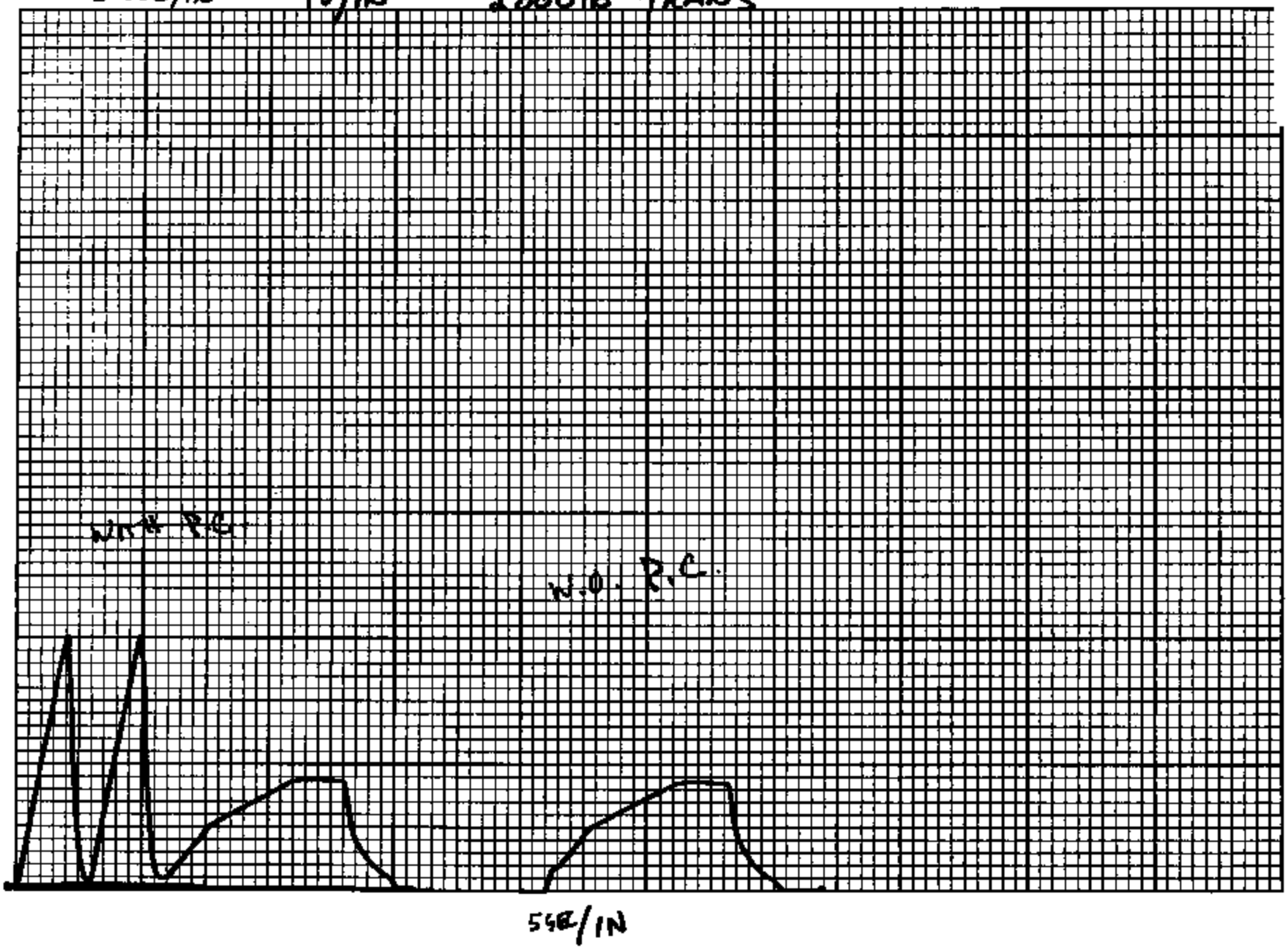
We need to X-Y record the 77PS Function tester during Two different test modes:

(1) Standard 77PSL2-1 Set-up.

(2) 77PSL2-1 Set-up without pre-cycles. ie. Screen set to 0 PSI.

Can we try to get this done this morning.

Thx
MATT


DPSL2-3
5 sec/IN
1V/IN
2000lb TRANS
W/O R.C.
5SE/IN

Department : PREC Expense Type : NORMAL

Name	Week 1	Week 2	Week 3	Week 4	Week 5	Total Hrs	Total $
SECTION ELEC	32	21	0	0	0	53	3,339
PROJECT 253088039	32	21	0	0	0	53	3,339
PCODE 88	32	21	0	0	0	53	3,339
EXPENSE NORM	239	431	285	0	0	955	48,708
DEPT PREC	312	533	405	0	0	1,250	64,576
GRAND TOTALS	1,157	1,536	1,418	0	0	4,111	212,374

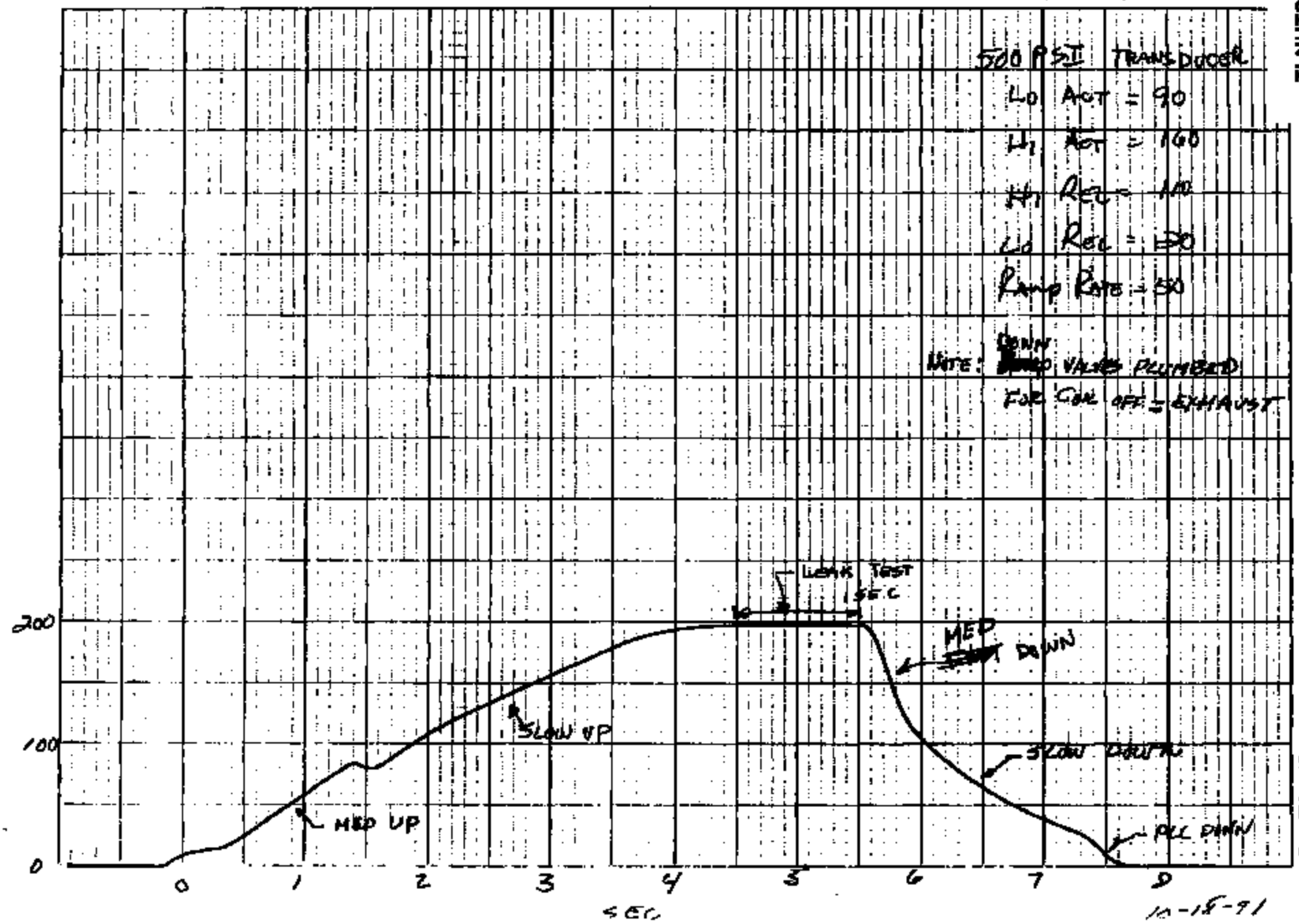
MATT SELLERS -
PLEASE GET WITH JOHN K. TO NEGOTIATE
A FAIR PRICE FOR LOU CAMARA'S TIME ON
THE PRESSURE TESTER. LET ME KNOW WHAT WE'D
SETTLE ON.

THANKS
JOHN P.

Department : PREC Expense Type : NORMAL

Name	Week 1	Week 2	Week 3	Week 4	Week 5	Total Hrs	Total $
PROJECT 8196069	8	1	7	0	0	16	704
PCODE 69	36	98	91	0	0	225	10,622
NAME CSOD	2	0	2	0	0	4	176
SECTION ELEC	2	0	2	0	0	4	176
PROJECT 8196086	2	0	2	0	0	4	176
PCODE 86	2	0	2	0	0	4	176
NAME EKAD	4	4	0	0	0	8	504
SECTION MECH	4	4	0	0	0	8	504
PROJECT 253087010	4	4	0	0	0	8	504
NAME MGIO	0	0	3	0	0	3	189
SECTION ELEC	0	0	3	0	0	3	189
PROJECT 253087015	0	0	3	0	0	3	189
NAME EKAD	0	4	2	0	0	6	378
SECTION MECH	0	4	2	0	0	6	378
PROJECT 253087020	0	4	2	0	0	6	378
NAME CSOD	2	3	0	0	0	5	220
SECTION ELEC	2	3	0	0	0	5	220
NAME EBAT	0	0	7	0	0	7	308
SECTION MECH	0	0	7	0	0	7	308
PROJECT 8196087	2	3	7	0	0	12	528
PCODE 87	6	11	12	0	0	29	1,599
NAME LCAN	32	21	0	0	0	53	3,339

77PSL2-1

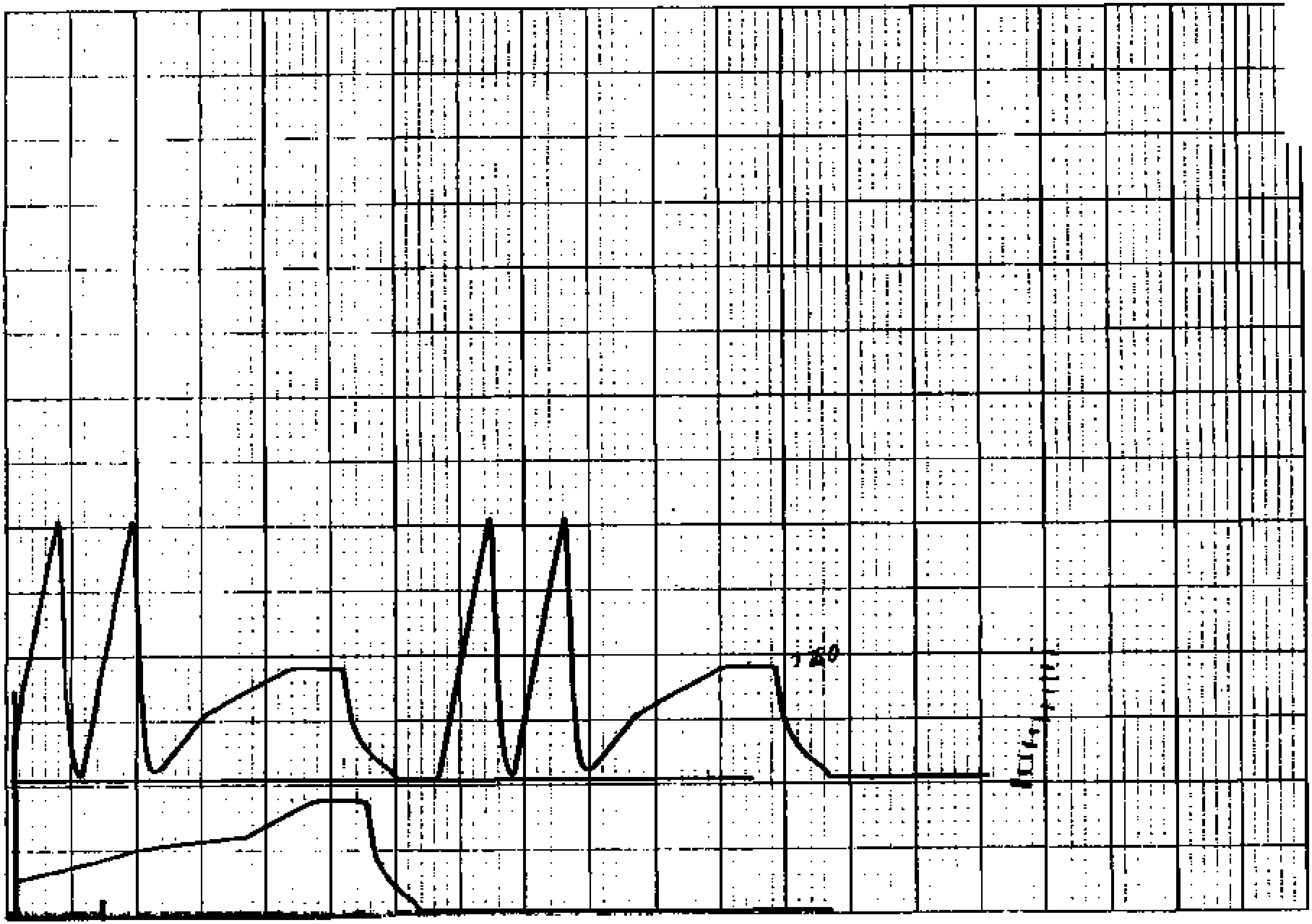


TI-NHT8A 7306

10-18-91

HEWLETT-PACKARD 9270-1006

TI-NHTSA 7307



TIPS Thermal Shift Evaluation 11/30/92

PBT	Base Expansion	Test #
R.T. → 150°C :	+.0058"	209-15-12
R.T. → -40°C :	-.002"	204-15-23
Noryl		
R.T. → 150°C :	+.0030"	302-15-24
R.T. → 182°C :	+.0052"	

77PSL2-1 Yields for 1992

Date	Tested	Good	%
January-92	14341	14209	99.1%
February-92	10589	10467	99.0%
March-92	28771	27980	97.3%
April-92	15827	15476	97.8%
May-92	12018	11138	92.7%
June-92	23443	23133	98.7%
July-92	11835	11673	98.6%
August-92	18836	18253	98.5%
September-92	11683	11562	99.0%
October-92	3838	3827	99.7%
November-92	0	0	0.0%
December-92	15839	15481	97.1%
Total	152478	149010	97.7%

10-Mar-92	4,000	10	-
11-Mar-92	4,000	10	-
12-Mar-92	4,000	10	-
18-Mar-92	4,000	10	-
23-Apr-92	2,000	5	-
2-May-92	2,000	5	-
5-May-92	2,000	5	-
6-May-92	2,000	5	-
14-Sep-92	2,000	5	-
22-Sep-92	4,000	10	-
30-Sep-92	4,000	10	-
7-Oct-92	4,000	10	-
7-Oct-92	4,000	10	-
16-Oct-92	4,000	10	-
21-Oct-92	2,000	5	-
20-Oct-92	4,000	10	-
29-Oct-92	4,000	10	-
29-Oct-92	4,000	10	-
30-Oct-92	4,000	10	-
4-Nov-92	4,000	10	-
10-Nov-92	4,000	10	-
10-Nov-92	4,000	10	-
11-Nov-92	4,000	10	-
17-Nov-92	2,000	5	-
20-Nov-92	4,000	10	-
4-Dec-92	2,000	5	-
9-Dec-92	2,000	5	-
14-Dec-92	2,000	5	-
16-Dec-92	4,000	10	-
16-Dec-92	4,000	10	-
16-Dec-92	4,000	10	-
21-Dec-92	2,000	5	-
21-Dec-92	4,000	10	-
Totals	**265,650**	**665**	**-**

205 pre March FY 92

-MSG M#= 00288465 FR=SBO1 TO=SBO1 SENT=12/02/92 03:24 PM
S#=096 ST=C DIV=0050 CC=00101 BY=SBO1 AT=12/02/92 03:24 PM

TO: Dave Csarn EARN
Matt Sellars MJS2
Jeff DiDomenico DIDO

FR: Steve Offiler SBO1

SJ: Pass-Car Cup Modifications - Update

The plan to verify the Pass Car cup (27713) modification is as follows:

1) Build pilot lot using production equipment (approx. 30 pc)
2) Pressure-test for act/rel characteristics
3) Disassemble switch/sensor
4) Pre- and post-vacuum sensor dim. measurement
5) Determine magnitude of vacuum sensitivity, if any
6) Measure hatchet curve on approx. 6 sensors
8) Build these 6, plus 18 more
9) Perform a standard Impulse test on the 24 devices
10) Disassemble switch/sensor
11) Pre- and post-vac sensor dim measurement
12) Determine if Impulse causes shifts in pre- and/or post-vac measurements

The first five items are complete. The cup change has been observed to cause these devices to actuate at lower pressures. This could be explained by the reduced disc envelope causing the converter bump to sit higher relative to the washer, giving increased effective wetted area and lower act. pressure. The pre- and post-vacuum measurements showed almost no shifts at all. Previous 50-pc test lots (car and truck) showed typically no shift except for a few devices shifting by about 1.7 mils; whereas 1/30 of these shifted by 0.8 mils and the rest exhibited no shift at all.

Two other areas which will be receiving attention immediately include: analysis of the environmental seal gland area for potential consolidation back to the red env seal; and completion of the "Change Checklist".

Regards, Steve O.

CNC SHOP - ORDER FORM

№ 003508

COST CENTER: 294 PRODUCT CODE: 088 CAPITAL PROJECT #: _____

REQUESTOR: MARY ANN KING PHONE: 3583 M/S: 12/20

CHECK WHICH CATEGORY PART DELIVERY IMPACTS:

_____ BILLING _____ TI CUSTOMER SCHEDULE _____ TI SCHEDULE _____ NON-CRITICAL

DATE REQUIRED: / / SP OT BL MD

DRAWING #: 143434-4 PRINT REV: A CUSTOMER ORDER #: _____

PART DESCRIPTION: ALIGNMENT GAGE QTY: 1

WORK REQUESTED: MIKE POHL HAS PRINTS

105059

TI-NHTSA 7312

SAMPLE NUMBER											SPEC RANGE	MET	EMP
11	10	09	08	07	06	05	04	03	02	01	MIN/MAX	HOD	#
+			.002				.0951				.095		
−													
+			.003				.4838				.483		
−													
							1.224				1.24		
							.1835				.183		
								OK			Inspect		
								OK			16 ± 2 RMS		
								OK			OK		
								OK			Inspect		

TI CNC SHOP - FABRICATION WORKORDER

Dick Gascoyne

WORKORDER: 106059

CUSTOMER: 294/088 DEPT: PC4

CUSTOMER REF#: D03508 REQUESTOR: M KING

JOB DESC: [illegible] PAGE

QUANTITY ORDERED: [illegible] SPARE PART

DRAWING NUMBER: B143[illegible]-4 RA 1/14/92

ORIGINATION DATE: 12/11/92 REVISED DATE: 01/31/93

CIRCLE REQUIRED OPERATIONS AND ENTER ESTIMATED HRS:

BO ___ ED ___ EO ___ HA 04 JG CE BR ML

CIRCLE REQUIRED TREATMENT OPERATIONS:

BA BK CH CR HC HT NO RH TN V.E. ___

ENTER SEQUENCE OF OPERATIONS:

ST VT ST CR

HOURS PER OPERATION: 1 3

105059

MATERIAL REQUIREMENTS:

TOOLING REQUIREMENTS:

VALUE ENGINEERING:

MINUTES SAVED/PC: ____ ORIGINATOR'S EMP#: ____

CHANGES MADE: ____

SPECIAL PLANNING NOTES: ____

TI-NHTSA 7313

DRAWINGS AVAILABLE UPON REQUEST

CNC SHOP - ORDER FORM

№ 003509

PLEASE PRINT

COST CENTER: 294 PRODUCT CODE: 088 CAPITAL PROJECT #: _____

REQUESTOR: Mary Ann King PHONE: 3583 M/S: 12/20

CHECK WHICH CATEGORY PART DELIVERY IMPACTS:

_____ BILLING _____ TI CUSTOMER SCHEDULE _____ TI SCHEDULE _____ NON-CRITICAL

DATE REQUIRED: / / SP OT BL MD

DRAWING #: 143434-5 PRINT REV: A CUSTOMER ORDER #: _____

PART DESCRIPTION: ALIGNMENT GAGES QTY: 1

WORK REQUESTED: MIKE POHL HAS PRINTS

105060

FORM 22453

TI-NHTSA 7315

SAMPLE NUMBER											SPEC RANGE	MET	EMP
11	10	09	08	07	06	05	04	03	02	01	MIN/MAX	RCD	#
+													
+		0002					.1251				.125		
+													
+		003					.5239				.513		
							1.224				1.221		
							.2495				.250		
							OK				MINOR		
							OK				CHAMFER		
							OK				OK		
							OK				1/32 R MIN		

TI CNC SHOP - FABRICATION WORKORDER

WORKORDER: 105060

CUSTOMER: 294/058 DEPT: PC6

CUSTOMER REF#: 003509 REQUESTOR: M KING

JOB DESC: ALIGNMENT GAGE

QUANTITY ORDERED: 1 SPARE PART

DRAWING NUMBER: 14[illegible]-RA 11/4/92

ORIGINATION DATE: 12/11/92 REQUIRED DATE: 01/31/93

CIRCLE REQUIRED OPERATIONS AND ENTER ESTIMATED HRS:

BO ____ ED ____ EO ____ HA ____ MI 4 JG CE BR WL

CIRCLE REQUIRED TREATMENT OPERATIONS:

BA BK CH CR HC HT NO RH TN V.E. ____

ENTER SEQUENCE OF OPERATIONS:

MI/HA/MI/CR

105060

HOURS PER OPERATION:

1 / 3 / / / / / / / / /

MATERIAL REQUIREMENTS:

TOOLING REQUIREMENTS:

VALUE ENGINEERING:

MINUTES SAVED/PC: ____ ORIGINATOR'S EMP#: ____

CHANGES MADE: ____

SPECIAL PLANNING NOTES: ____

DRAWINGS AVAILABLE UPON REQUEST

27713-2 Cup meeting 12/11/92

(1) Dis-Assemble remainder of devices from low act.
23 bakes to be measured

Claire to measure + report.

(2) LS-2 Continuance of prod.

- Increase Hr temp test %
- Learn issues w/ Disc Curve + Continue w/ good curves.

(3.) Cup evals (-2)

2 Cups 27712-1 + 27713-2
2 Discs Low Act + Good/bad curve process

4 x TEST MATRIX
- 20psi (12) 27713-1 (A)
- 20psi (12) 27713-2 (B)
- 25psi (12) 27713-1 (C)
- 25psi (12) 27713-2 (D)
- Hand build
- AMI crimp
- measure sensor $\bar{x}$
- measure p-A curve

→ Evaluate Curves + 5 sigma.
→ use AMI to crimp.

(4) Disc envelope + HT check on 20 lb bad disc lot *

Test Matrix 10/11/92

Group A	20.57 / 11.78	# 27713-1
Group B	20.57 / 11.78	# 27713-2
Group C	25.3 / 16.7	# 27713-1
Group D	25.3 / 16.7	# 27713-2

A

	Sensor Dim
A1	48.0
A2	47.9
A3	48.4
A4	47.8
A5	48.3
A6	47.9
A7	48.3
A8	48.1
A9	48.2
A10	48.1
A11	48.2
A12	48.4

B

	Sensor Dim
B1	47.6
B2	48.7
B3	49.1
B4	48.5
B5	48.2
B6	47.5
B7	48.4
B8	47.7
B9	47.6
B10	47.8
B11	48.7
B12	47.9

C

	Sensor Dim
C1	47.5
C2	47.7
C3	47.3
C4	48.0
C5	47.6
C6	47.5
C7	47.6
C8	47.9
C9	47.5
C10	47.8
C11	47.9
C12	47.5

D

	Sensor Dim
D1	47.0
D2	47.7
D3	47.2
D4	47.0
D5	47.7
D6	48.3
D7	48.7
D8	47.8
D9	47.2
D10	47.6
D11	48.0
D12	48.5

27389-2

~~.101~~	.102
~~.107~~	.103

4-14-2

Certified Part

~~.102~~	.164
~~.158~~	.165

27713-1

5-29-92	~~.013~~ .012	4
	~~.015~~ .013	
4-7-92	.013	4
	.014	
3H	.013	4
	.014	
2-6	.013	4
1-30	.012	4
	.015	
1-28	.014	4
	015	

~~.090~~/.092	.090	4
	.092	
	.090	4
	.091	
	.090	4
	.091	
	.090/.091	4
	.090	4
	.091	
	.090	4
	.091	

Cheryl Bettinger
Bldg 11.

(1) PART number — 27389-2 Converter

Dimensions *.101 /.107 —

* .162 /.168 —

~~need Rec Insp. or Bossler~~ 20 data points

---

(2) part number 27713-1 Cup

Dimensions * .012 /.015

* .090 /.092

~~need Rec. Insp. of Valentine 20 data points~~

Each part take last 25 data points

-MSG NO= 75754 FR=VAGS TO=ZIZ SENT=12/16/92 09:22 AM
R#=072 ST=C DIV=0050 CC=00101 BY=VAGS AT=12/16/92 09:22 AM
TO: GEORGE HOLMAN BS12
PAUL KOTCH PRE1

DAVE CZARN	ZARN	ED O'NEILL	EJON
STEVE OFFILER	SBOI	BILL SWEET	PCME
AZIZ RAHMAN	ZIZ	STEVE FOSTER	SRF

FM: MATT SELLERS PCME

RE: 36888-1 STATIONARY TERMINAL. K.F.BASSLER

GEORGE/PAUL,

THE FOLLOWING IS AN UPDATE TO OUR POSITION ON DIMENSIONAL ISSUES ASSOCIATED WITH THE K.F.BASSLER TERMINAL P/N 36888-1. AS YOU ARE AWARE, AN OSN WAS ISSUED EARLY OCTOBER PROVIDING RELIEF ON 10 OF THE 21 TOTAL DIMENSIONS BASSLER IS REQUESTING RELIEF ON. THE OTHER 11 DIMENSIONS REMAINED UNDER EVALUATION, AND WE NOW HAVE A FINAL RESPONSE ON MOST OF THEM. PLEASE PASS THIS UPDATED INFORMATION TO RICK BASSLER.

AS YOU MAY RECALL, THIS IS HOW I CATEGORIZED THE 21 DIMENSIONS FOR ORGANIZATIONAL REASONS:

CATEGORY (A): IMMEDIATE SPECIFICATION RELIEF TO BASSLER THROUGH OSN AND PRINT CHANGE.

CATEGORY (B): DIMENSIONS WITH POTENTIAL NEGATIVE PROCESS RAMIFICATIONS NOT YET FULLY ANALYZED.

CATEGORY (C): DIMENSIONS WHICH REQUIRE DESIGN ENG. STACK-UP ANALYSIS AND/OR PRINT RE-VAMPING.

CATEGORY (D): DIMENSIONS WHICH WILL REQUIRE FORD INVOLVEMENT FOR SPECIFICATION CONCESSIONS AND/OR CLARIFICATION.

CATEGORY (F): K.F.BASSLER MUST BE STATISTICALLY CAPABLE ON THESE DIMENSIONS.

EVENTUALLY, ALL DIMENSIONS WILL BE EITHER CATEGORY "A" OR CATEGORY "F" - DENOTING A FINAL DECISION. BELOW IS THE LATEST:

CATEGORY (A) DIMENSIONS:

NOTE: AN OSN HAS ALREADY BEEN ISSUED ON THESE, AND IS STILL IN EFFECT AT RECEIVING INSPECTION. PRINT UPDATES PENDING COMPLETION BY STEVE OFFILER.

(1)	.047 - .053	>>>>>>>>>>>>>>>>>>>>	.046 - .055
(4)	.844 - .862	>>>>>>>>>>>>>>>>>>>>	.862 MAX. REF.
(13)	.005 B	>>>>>>>>>>>>>>>>>>>>	DELETE. ADD 90 +/- 2 DEGREES
(17)	.117 - .123	>>>>>>>>>>>>>>>>>>>>	.118 - .125
(23)	.057 - .063	>>>>>>>>>>>>>>>>>>>>	.058 - .063
(24)	.220 - .235	>>>>>>>>>>>>>>>>>>>>	.218 - .233
(25)	.022 - .032	>>>>>>>>>>>>>>>>>>>>	.020 - .030
(26)	.110 - .120	>>>>>>>>>>>>>>>>>>>>	.108 - .118
(29)	.165 - .175	>>>>>>>>>>>>>>>>>>>>	.165 - .175
(30)	.177 - .183	>>>>>>>>>>>>>>>>>>>>	.177 - .185

CATEGORY (B) DIMENSIONS:

NOTE: EVALUATIONS ON "B" DIMENSIONS ARE STILL IN PROCESS.

(38)	.109 - .119	>>>>>>>>>>>>>>>>>>>>	.105 - .120

THIS DIMENSION REQUIRES FURTHER DISCUSSION WITH RICK BASSLER.

I WILL BE CONTACTING RICK SOON TO REVIEW. IS THIS A MEASUREMENT TECHNIQUE ISSUE?

CATEGORY (C) DIMENSIONS:

NOTE: STEVE OFFILER CONTINUES TO EVALUATE THESE DIMENSIONS TO DETERMINE IF CONCESSIONS CAN BE MADE. UPDATES WILL BE MADE TO BASSLER AS THEY ARE AVAILABLE.

(6)	.131 - .137	>>>>>>>>>>>>>>>>>>>>	.132 - .139
(7)	.047 - .053	>>>>>>>>>>>>>>>>>>>>	.046 - .054
(15)	.002 - .006	>>>>>>>>>>>>>>>>>>>>	.002 - .008
(31)	.085 - .095	>>>>>>>>>>>>>>>>>>>>	.078 - .096

CATEGORY (D) DIMENSIONS:

NOTE: THESE DIMENSIONS ARE PRESENTLY ON AN CHANGE REQUEST WITH FORD. RESPONSE BACK FROM FORD IS EXPECTED TO TAKE SOME TIME. UPDATES WILL BE MADE TO BASSLER AS THEY ARE AVAILABLE.

(21)	.004 - .012	>>>>>>>>>>>>>>>>>>>>	.006 - .014
(36)	.026 - .034	>>>>>>>>>>>>>>>>>>>>	.022 - .039

CATEGORY (F) DIMENSIONS:

NOTE: 'F' DIMENSIONS ARE THOSE THAT MUST BE MAINTAINED BY K.F.BASSLER. WE MUST HAVE A STATISTICALLY CAPABLE PROCESS ON EACH OF THESE DIMENSIONS.

		BASSLER REQUEST
(2)	.037 - .043	.035 - .045
(14)	.280 - .286	.280 - .290
(16)	.567 - .575	.565 - .575
(28)	.070 - .076	.071 - .079

REGARDS . . . MATT
X1245

FORD NEXT GENERATION SPEED CONTROL (77PS)
MANUFACTURING CONTROL PLAN

PROCESS STEP DESCRIPTION	PRODUCT CHARACTERISTICS	EVALUATION METHOD	CONTROL METHOD	FREQUENCY OF TEST	REACTION PLAN
BASE ASSEMBLY (AMI AUTOMATION)	TERMINAL HEIGHT	DIAL INDICATOR	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	TERMINAL PUSHOUT	FORCE GAGE/ DIAL INDICATOR	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	TERMINAL SEPERATION/ ALIGNMENT	PLUG GAGE	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	SPRING ANGLE (E)	COMPARATOR	X/R	5pc/ 4 Hr.	SORT SINCE LAST CHECK
	SPRING CONTACT WIDTH	CALIPERS	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	SPRING TORQUE	FORCE GAGE	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	SPRING BUMP HEIGHT (E)	CALIPERS	X/R	5pc/ 4 Hr.	SORT SINCE LAST CHECK
	RIVET HEIGHT	DIAL INDICATOR	X/R	5Pc/ Hr.	SORT SINCE LAST CHECK
	CALIBRATION DEFORMATION	CUSTOM CONTINUITY SYSTEM	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	VISUAL QUALITY	VISUAL	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
SENSOR ASSEMBLY	CRIMP DIAMETER	CALIPERS	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	CRIMP HEIGHT	CALIPERS	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	VISUAL QUALITY	VISUAL	P	5pc/ Hr.	SORT SINCE LAST CHECK

Revision: E

FORD NEXT GENERATION SPEED CONTROL (77PS)
MANUFACTURING CONTROL PLAN

PROCESS STEP DESCRIPTION	PRODUCT CHARACTERISTICS	EVALUATION METHOD	CONTROL METHOD	FREQUENCY OF TEST	REACTION PLAN
FINAL ASSEMBLY (AMI AUTOMATION)	CRIMP DIAMETER (E)	GO/ NO-GO GAGE	P	5pc/ Hr.	SORT SINCE LAST CHECK
	CRIMP HEIGHT (E)	GO/ NO-GO GAGE	P	5pc/ Hr.	SORT SINCE LAST CHECK
	BASE TORQUE	TORQUE GAGE	X/ R	5pc/ Hr.	SORT SINCE LAST CHECK
	CODE CRIMP RING/ DIAMETER-LEGIBILITY	PLUG-VISUAL	P	5pc/ Hr.	SORT SINCE LAST CHECK
FUNCTION TESTER (CUSTOM)	ACTUATION/ RELEASE POINTS (Ford Significant Char.)	MASTERS	X/ R	EACH SHIFT	TOOL ROOM/ ENGINEERING EVALUATIONS
	ACTUATION/ RELEASE POINTS	RAMP THROUGH PRESSURE RANGE	X/ R	100%	YIELD TRACKING/ SCRAP CONTROL
Q.C. AUDITS	OUTLINED IN DETAIL IN TEXAS INSTRUMENTS (QAS 208), FMC (THREADS / Ford Significant Char.)				

CONFIDENTIAL

Revision: E

16 December 1992 MJS/csr 050-0134

TI-NHTSA 7325

FORD (87PS)
MANUFACTURING CONTROL PLAN

PROCESS STEP DESCRIPTION	PRODUCT CHARACTERISTICS	EVALUATION METHOD	CONTROL METHOD	FREQUENCY OF TEST	REACTION PLAN
BASE ASSEMBLY (AMI AUTOMATION)	TERMINAL HEIGHT	DIAL INDICATOR	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	TERMINAL PUSHOUT	FORCE GAGE/ DIAL INDICATOR	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	TERMINAL SEPERATION/ ALIGNMENT	PLUG GAGE	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	SPRING ANGLE (D)	COMPARATOR	X/R	5pc/ 4 Hr.	SORT SINCE LAST CHECK
	SPRING CONTACT WIDTH	CALIPERS	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	SPRING TORQUE	FORCE GAGE	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	SPRING BUMP HEIGHT (D)	CALIPERS	X/R	5pc/ 4 Hr.	SORT SINCE LAST CHECK
	RIVET HEIGHT	DIAL INDICATOR	X/R	5Pc/ Hr.	SORT SINCE LAST CHECK
	CALIBRATION DEFORMATION	CUSTOM CONTINUITY SYSTEM	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	VISUAL QUALITY	VISUAL	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
SENSOR ASSEMBLY	CRIMP DIAMETER	CALIPERS	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	CRIMP HEIGHT	CALIPERS	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	VISUAL QUALITY	VISUAL	P	5pc/ Hr.	SORT SINCE LAST CHECK

Revision: D

FORD (87PS)
MANUFACTURING CONTROL PLAN

PROCESS STEP DESCRIPTION	PRODUCT CHARACTERISTICS	EVALUATION METHOD	CONTROL METHOD	FREQUENCY OF TEST	REACTION PLAN
FINAL ASSEMBLY (AMI AUTOMATION)	CRIMP DIAMETER (D)	GO/NO-GO GAGE	P	5pc/ Hr.	SORT SINCE LAST CHECK
	CRIMP HEIGHT (D)	GO/NO-GO GAGE	P	5pc/ Hr.	SORT SINCE LAST CHECK
	BASE TORQUE	TORQUE GAGE	X/R	5pc/ Hr.	SORT SINCE LAST CHECK
	CODE CRIMP RING/ DIAMETER-LEGIBILITY	PLUG-VISUAL	P	5pc/ Hr.	SORT SINCE LAST CHECK
FUNCTION TESTER (CUSTOM)	ACTUATION/ RELEASE POINTS (Ford Significant Char.)	MASTERS	X/R	EACH SHIFT	TOOL ROOM/ ENGINEERING EVALUATIONS
	ACTUATION/ RELEASE POINTS	RAMP THROUGH PRESSURE RANGE	X/R	100%	YIELD TRACKING/ SCRAP CONTROL
Q.C. AUDITS	OUTLINED IN DETAIL IN TEXAS INSTRUMENTS (QAS 208), FMC (THREADS / Ford Significant Char.)				

CONFIDENTIAL

Revision: D

16 December 1992 MJS/cnr 050-0134

TI-NHTSA 7327

Engineering Review - 77PS 12/92

Issue: 27713-2 Cup process validation by design eng uncovered issues related to sensor performance and dimensional stability.

	27713-1 Cup (Velcro)	27713-2 Cup
Sensor Dimensional variability	.25 σ Typical	.5 - .6 σ Typical

+/-3σ Base :	+/- 1.0	+/- 1.0
+/-3σ Pin :	+/- 0.5	+/- 0.5
+/-3σ Sensor :	+/- 0.8	+/- 1.8
+/-3σ Total :	+/- 2.3	+/- 3.3

Target pre-load = 6.5 - 7.0
Temp Shift = 4.0 ish? (possible)

Disc Pre-deflection	None observed	Significant Amount = ? since
Actuation mean (side by side)	127 psi typ	106 psi typ.

Engineering Review - 77PS

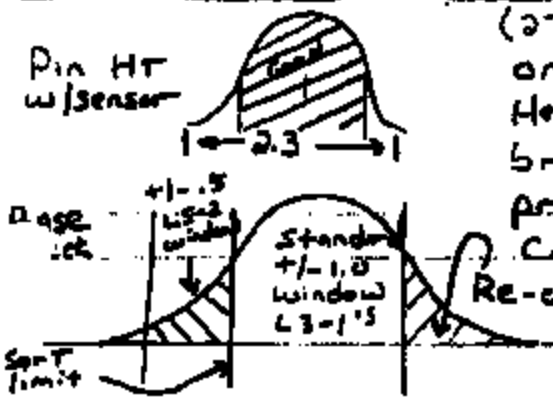
12/16/92
PS 2 of 2

Production outlook :
Volumes

	42-1	43-1	45-2
Dec 92	—	3.1K	1.9K
Jan 93	22.7K	15.5K	3.1K
Feb 93	↓	↓	↓

Device	Proposed Processes
* 77PS42-1 (snap) 77PS43-1 (quiet)	Plan WAS to use (27713-2) Cup - Eliminate loose disc Fallout - Allow Conversion to red env. Seal Proposed plan is to Convert back to (27713-1) Cup and use standard 42-1/43-1 processes. No vacuum Sort For Ω.
77PS45-2	Plan WAS to use (27713-2) cup - Eliminate loose disc Fallout - GIA for vacuum dependancy - Eliminate 100% vacuum Sort - Allow Conversion to red env. Seal Proposed Plan #1 is to revert back to (27713-1) cup and use standard 45-2 processes. Continue vacuum Sort 100%.

For Example



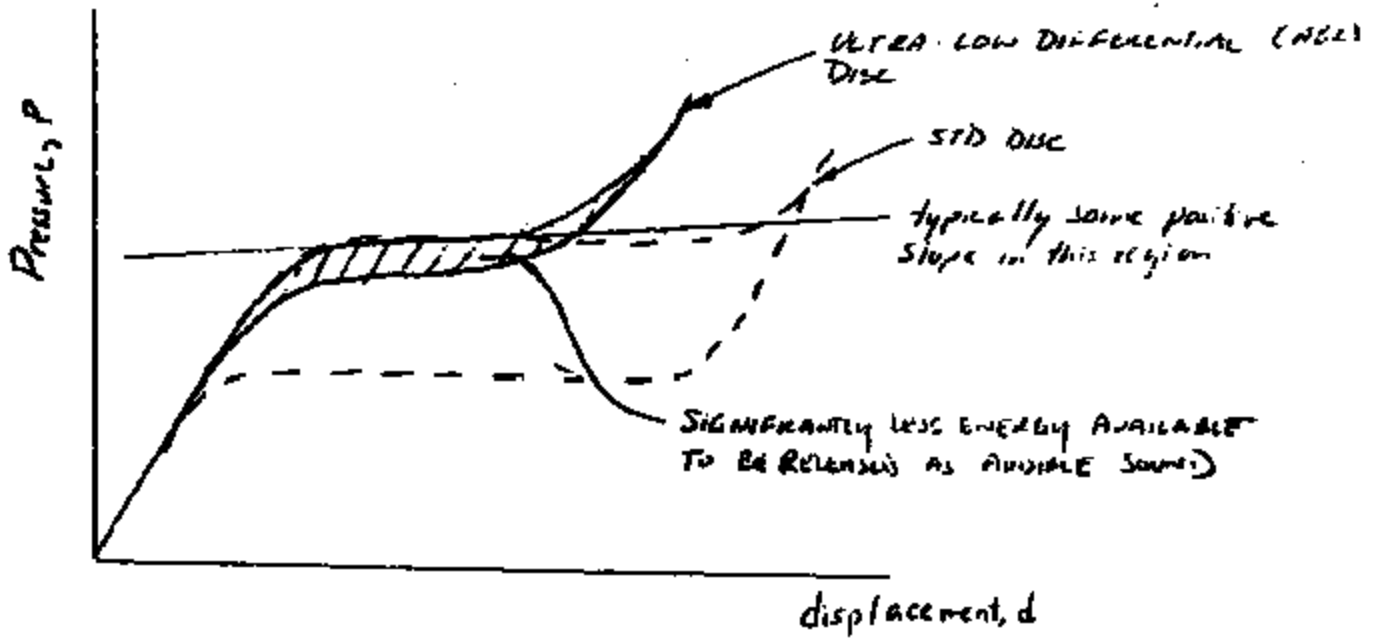
← Proposed Plan #2 is to build with (27713-2) cup Accepting wider 3σ on Sensor, And Compensating with Pin Height and base check Sorters on-line to bring +/- 3σ effective Spring pre-deflection in-line with (27713-1) Cup performance

DRAWINGS AVAILABLE UPON REQUEST

QUIET SWITCH

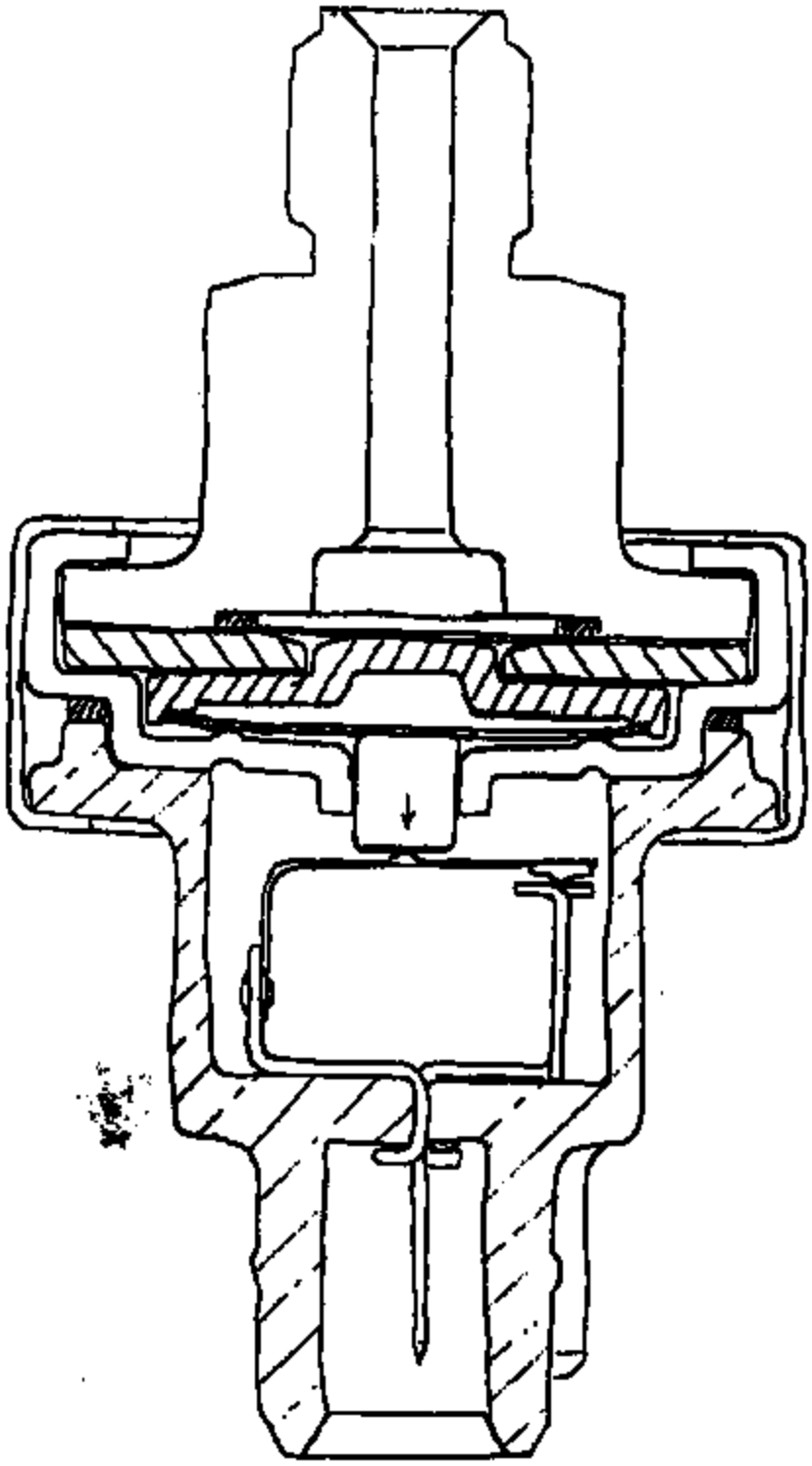
DISC TECHNOLOGY

THROUGH PROPRIETARY DISC TECHNOLOGY, THE HYSTERESIS OR DIFFERENTIAL IS REDUCED TO A MINIMAL VALUE, MAKING THE DISC INAUDIBLE TO OUR STANDARD DISC AND DENCE MEASUREMENT EQUIPMENT.

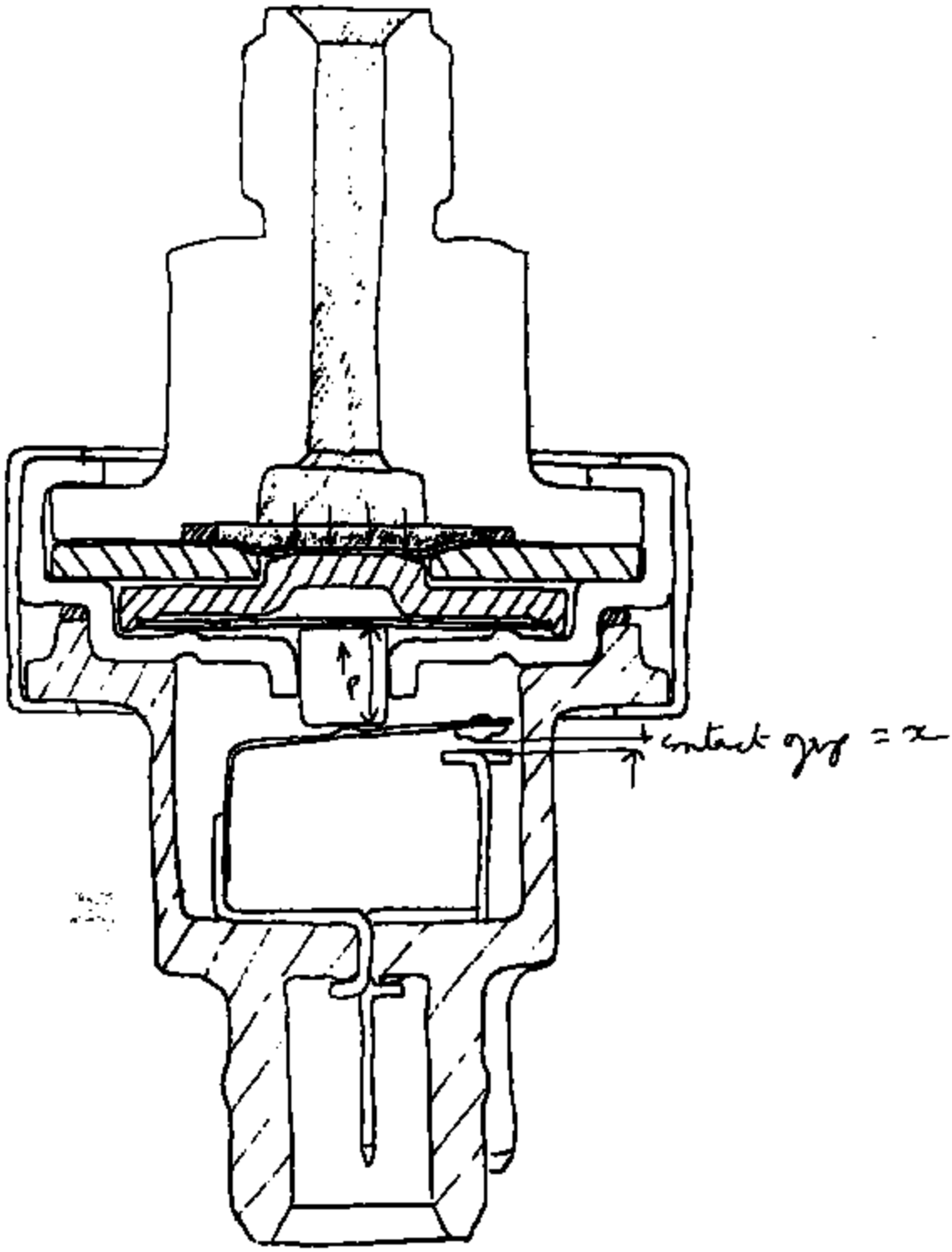


(AZIZ)

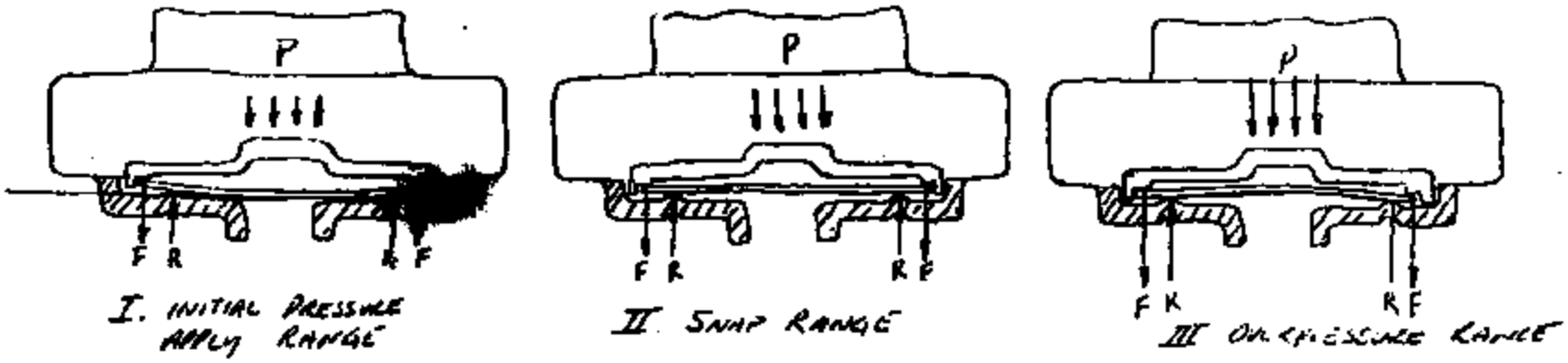
Un-Pressurized
Contacts Closed

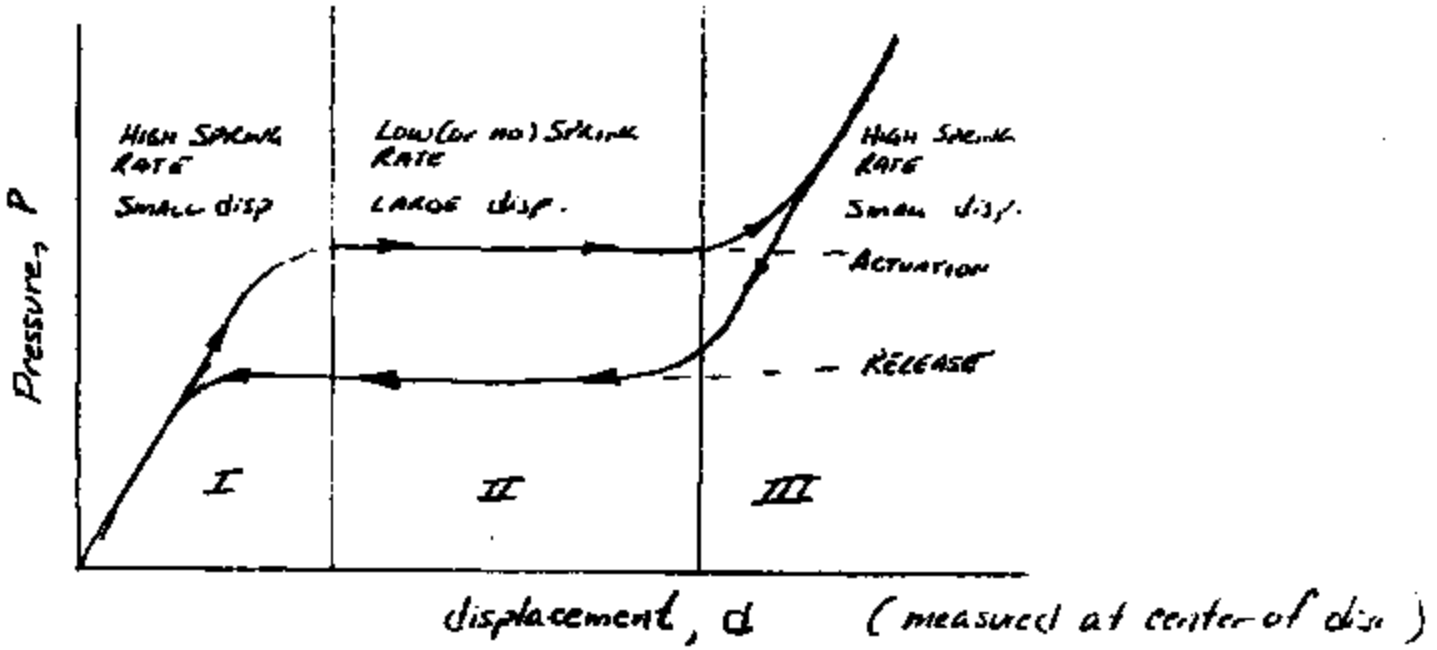


PRESSURIZED
CONTACTS OPEN

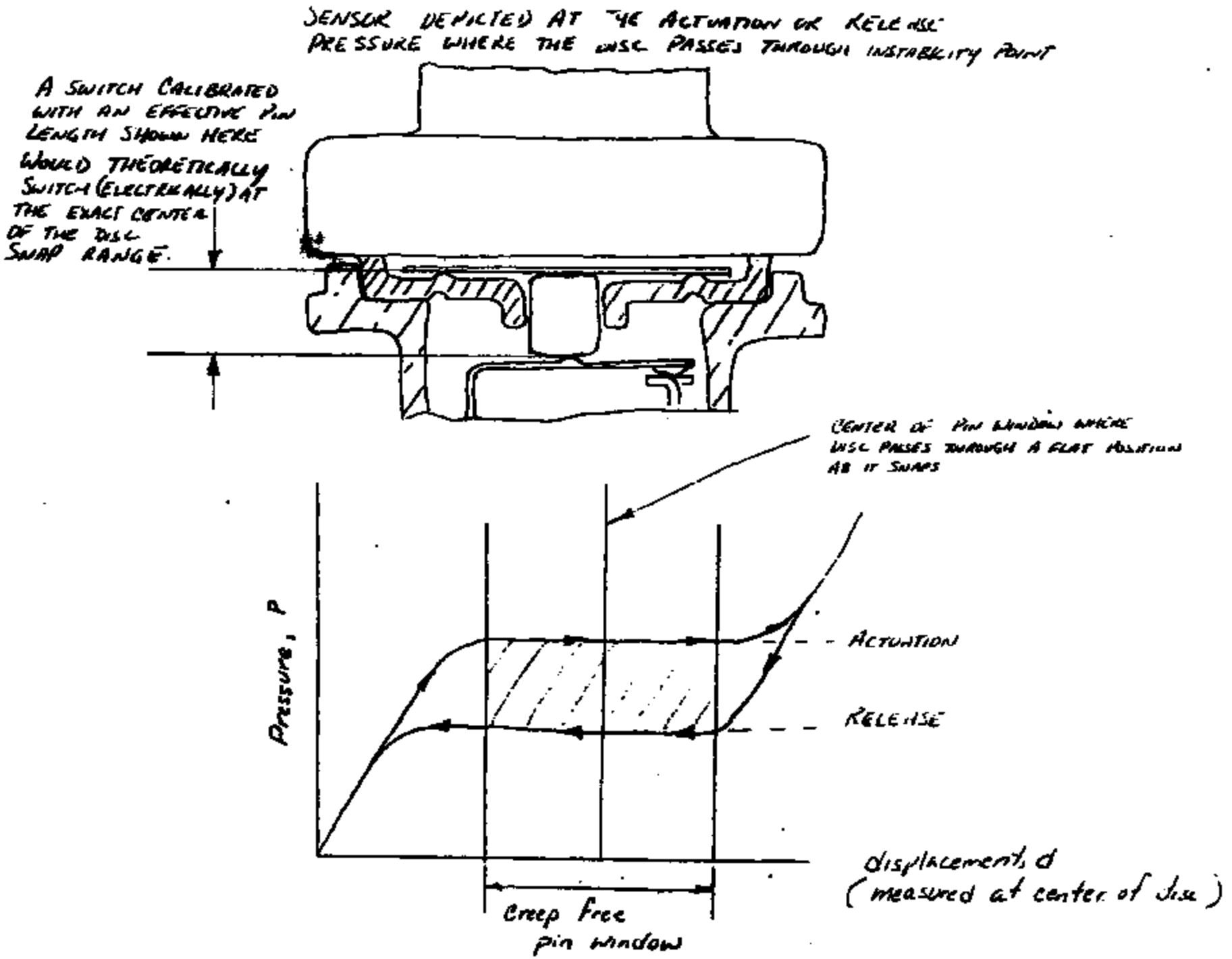


SENSOR ASSEMBLY
PRESSURE VS. DISPLACEMENT





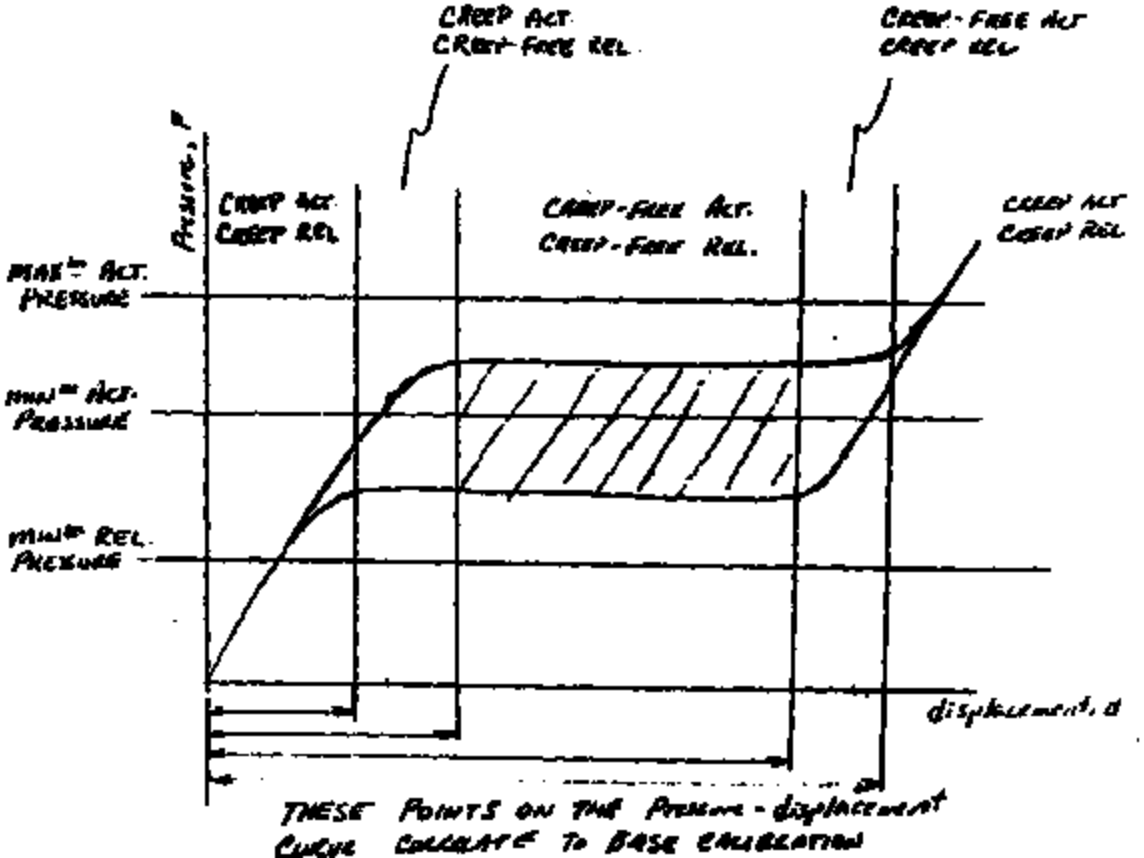
TI-NHTSA 7334


SENSOR DEPICTED AT THE ACTUATION OR RELEASE PRESSURE WHERE THE DISC PASSES THROUGH INSTABILITY POINT
A SWITCH CALIBRATED WITH AN EFFECTIVE PIN LENGTH SHOWN HERE WOULD THEORETICALLY SWITCH (ELECTRICALLY) AT THE EXACT CENTER OF THE DISC SNAP RANGE.
CENTER OF PIN WINDOW WHERE DISC PASSES THROUGH A FLAT POSITION AS IT SNAPS
Pressure, P
ACTUATION
RELEASE
displacement, d (measured at center of disc)
Creep Free pin window

STANDARD (NON-QUIET) SWITCH

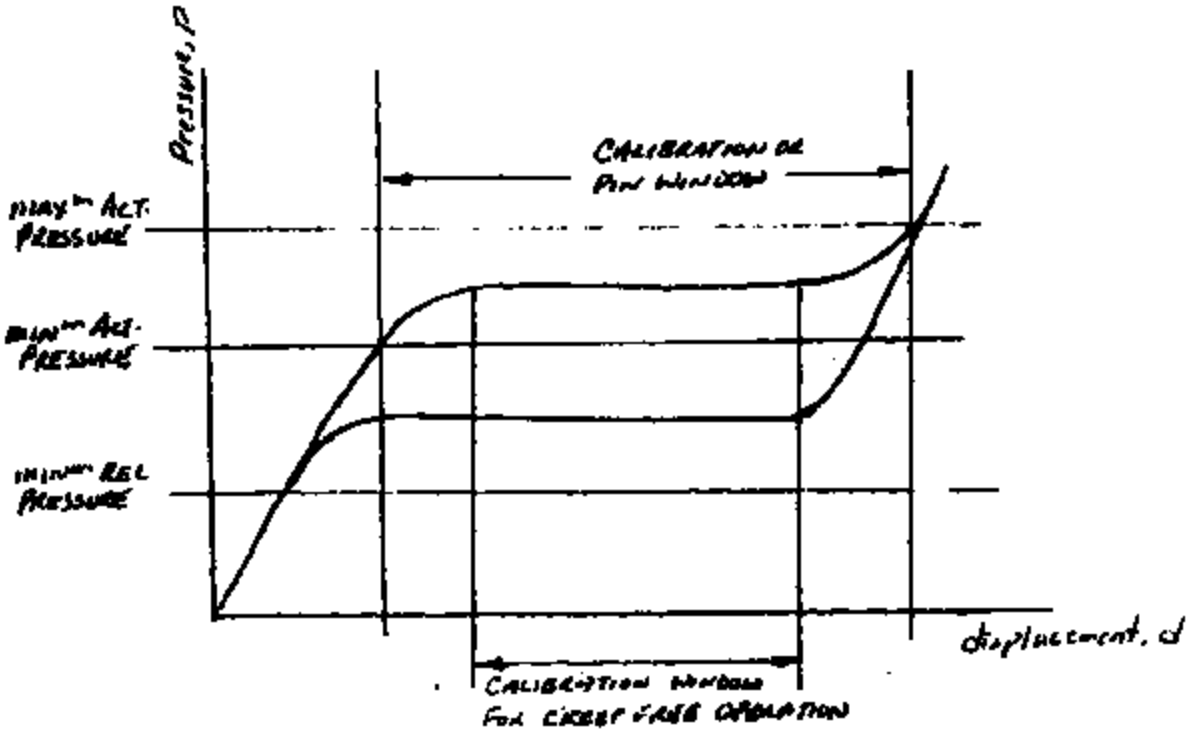
- REGIONS WITHIN THE P-d CURVE ARE CORRELATED TO BASE CALIBRATION USING A "pin window" CALIBRATION
- DISC SNAP IS COMPARED TO CHANGE IN CONTINUITY ON A TIME BASIS

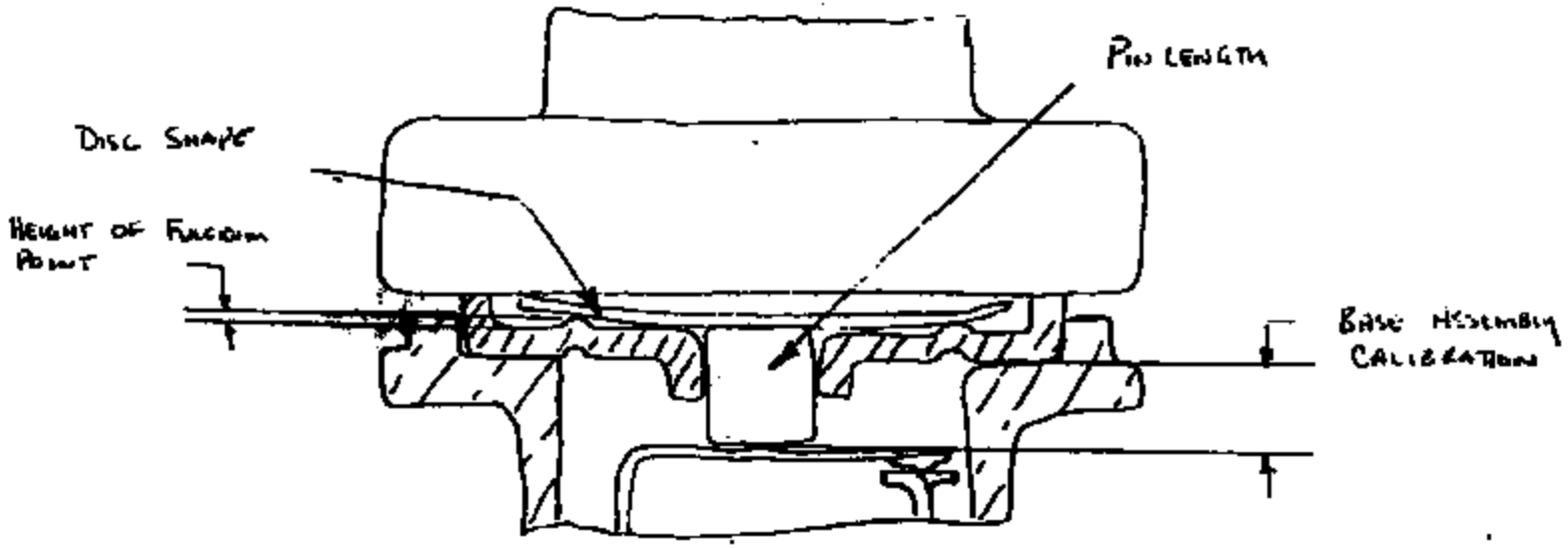
ACTUATION AND RELEASE [redacted] TIME" CORRELATE TO SPECIFIC REGIONS OF THE P-d CURVE



A PREMISE WITH THE NGSC SYSTEM HAS BEEN THAT CREEP FREE OPERATION CONSTRAINTS AREN'T NECESSARY DUE TO THE WAY THE SWITCH OPERATES IN THE SYSTEM.

A WIDER CALIBRATION WINDOW RESULTS; MAKING THE BUILD PROCESS MORE ROBUST TO ASSEMBLY TOLERANCES





CONTRIBUTORS TO ASSEMBLY TOLERANCES INCLUDE:

Component — PIN LENGTH VARIATIONS –

BASE ASM. CALIBRATION – EACH IS CALIBRATED TO A PRESET TARGET VALUE, BUT VARIABILITY EXISTS

DISC SHAPE – CAN VARY FROM CUT TO CUT, USUALLY NOT SIGNIFICANT

HEIGHT OF FULCRUM POINT IN CUP – TYPICALLY SEE LITTLE VARIABILITY WITHIN A CUT, BUT CUT TO CUT VARIABILITY EXISTS.

Assembly — SENSOR CRIMPING OPERATION – CAN AFFECT THE DIMENSION FROM THE CUP REFERENCE SURFACE TO THE CENTER OF THE DISC

FINAL CRIMPING OPERATION – CAN AFFECT THE "EFFECTIVE PIN LENGTH" (SENSOR-TO-CASE CRIMP)

ADDITIONALLY, THE CENTERING OF THE ACTUATION & RELEASE PRESSURES ARE DEPENDANT UPON DISC CALIBRATION AND PRESSURE-TO-FORCE AMPLIFICATION RATIO.

Quiet Switch

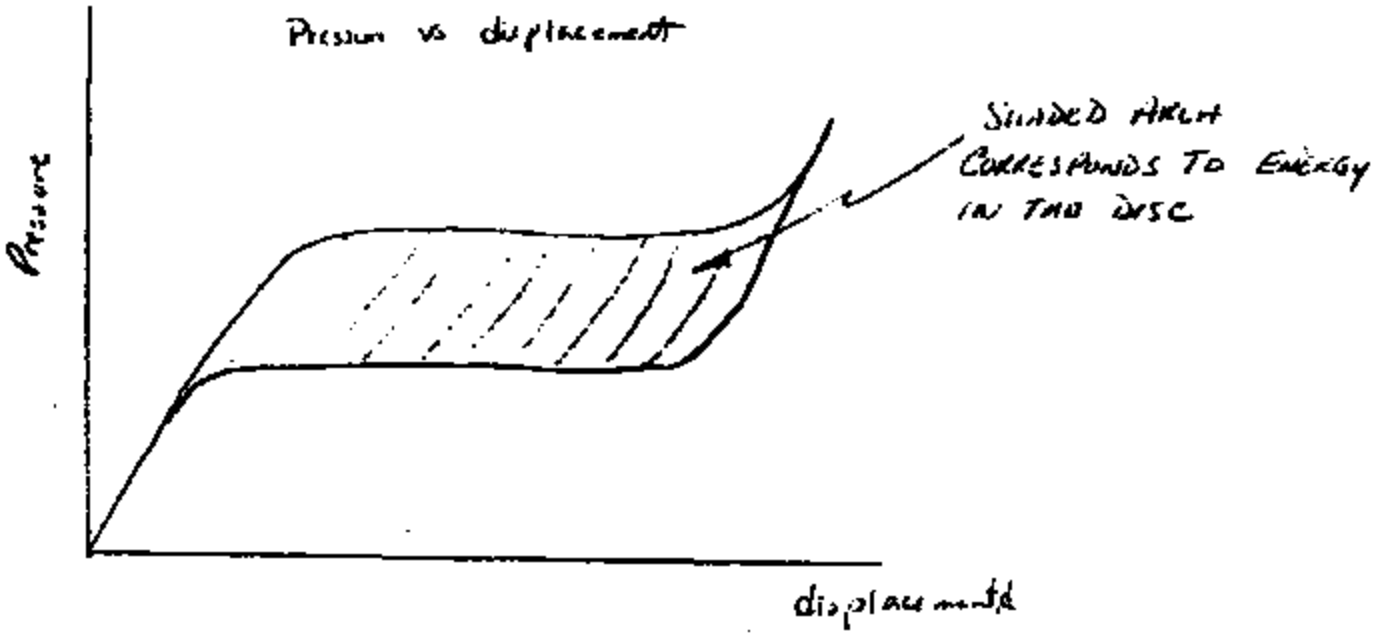
Disc Technology

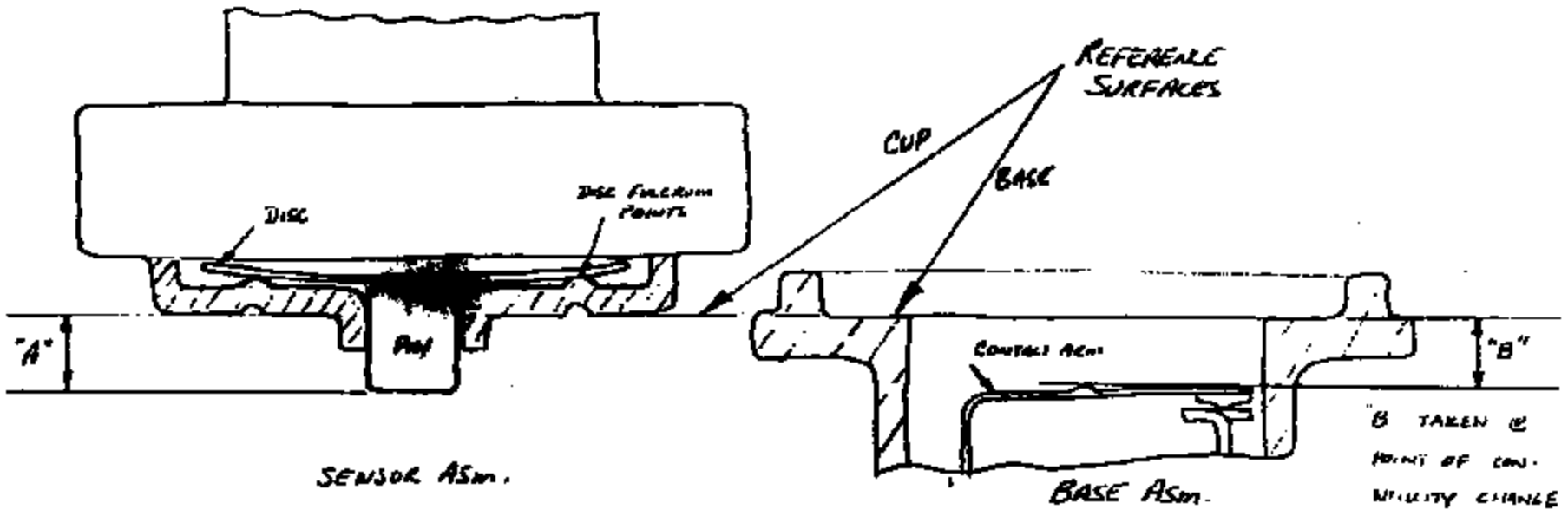
Discs used in Standard (non-quiet) switches have a built in hysteresis which provides a relatively large difference in switch actuation and release pressure.

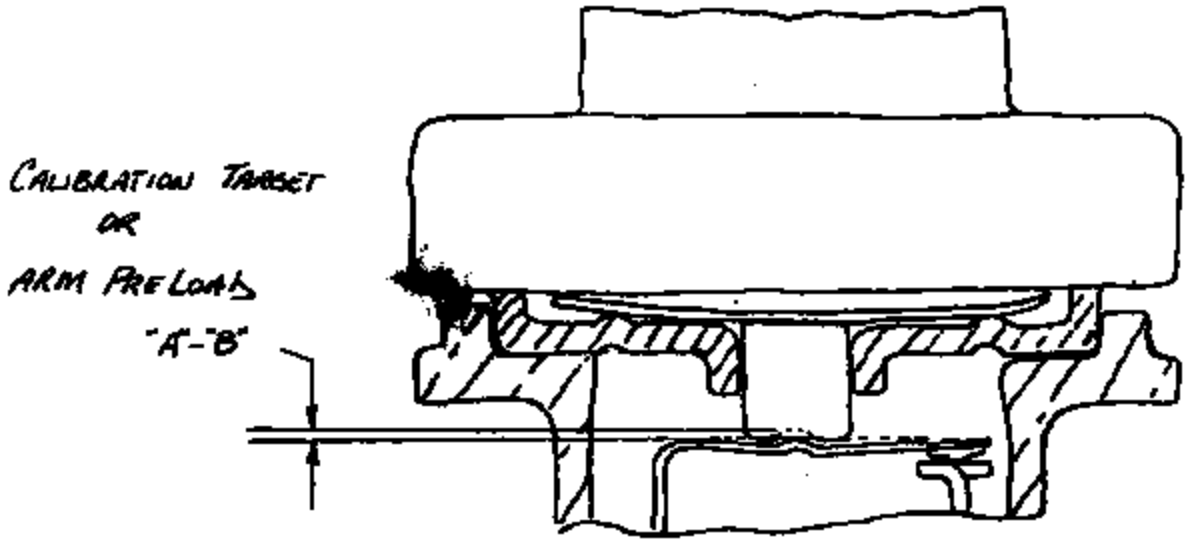
The hysteresis or differential – also provides for a relatively large calibration or pinning range.

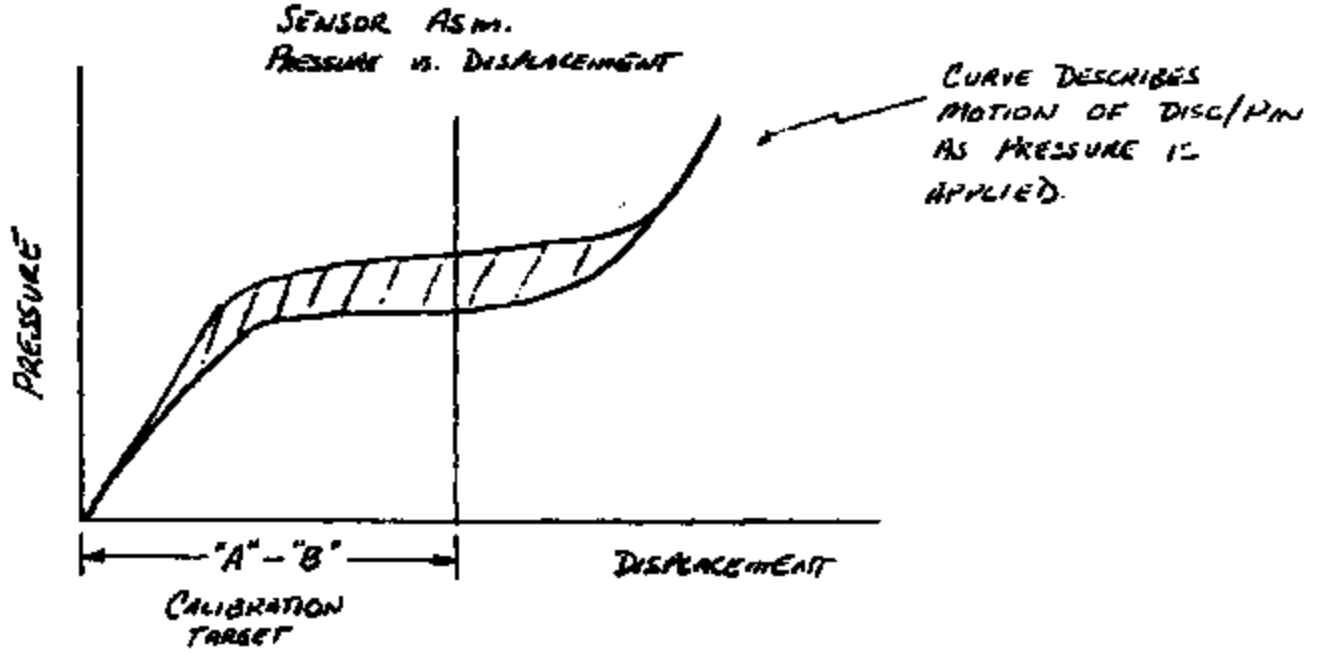
The area under the Red curve is indicative of the energy released as audible noise during the snap.

Standard Disc

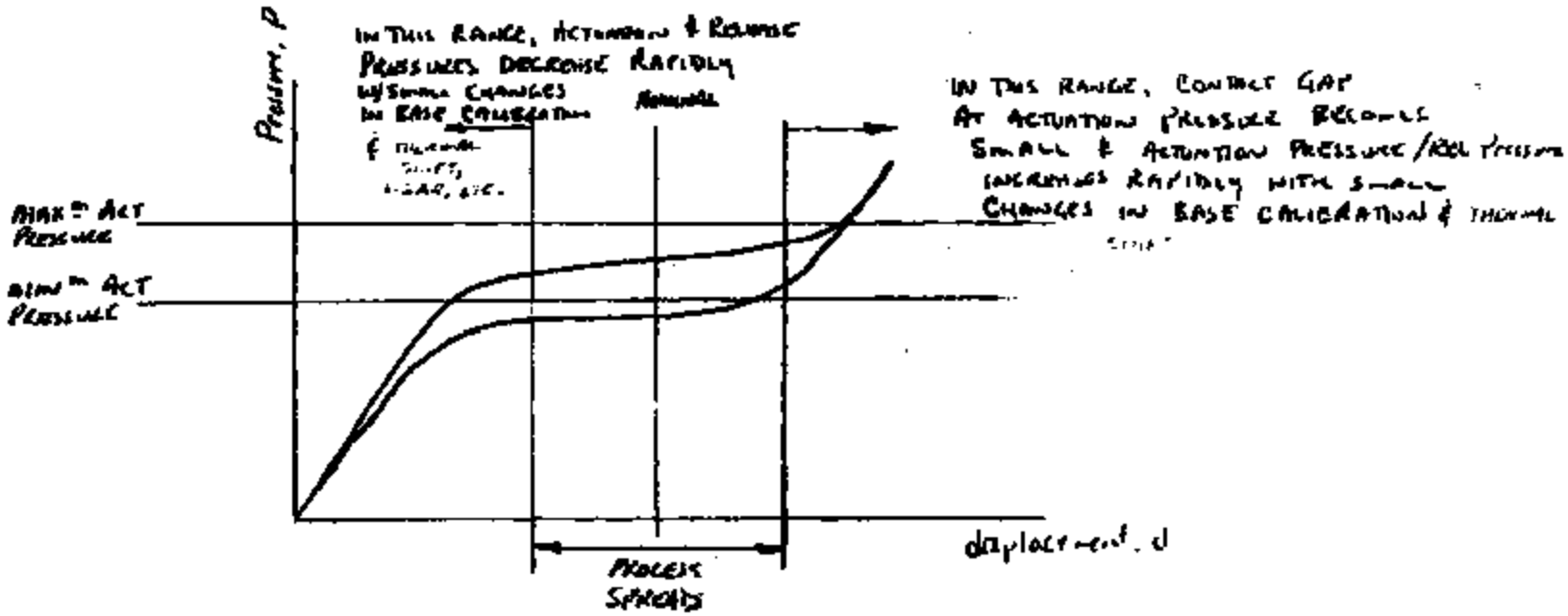



REFERENCE SURFACES
CUP
BASE
DISC
DISC FULCRUM POINTS
PAD
"A"
SENSOR ASSY.
CONTROL ARM
"B"
"B" TAKEN @ POINT OF CONTROL ARM
BASE ASSY.


CALIBRATION TARGET
OR
ARM PRELOADS
"A"-"B"


SENSOR ASM.
PRESSURE VS. DISPLACEMENT
CURVE DESCRIBES MOTION OF DISC/PIN AS PRESSURE IS APPLIED.
PRESSURE
"A"-"B"
CALIBRATION TARGET
DISPLACEMENT

Qk r Switch



Qu SWITCH

WITH WHAT WE KNOW OF THE QUIET SWITCH TODAY, THERE ARE SEVERAL KEY AREAS TO ITS SUCCESS:

(1) PRODUCING THE DISC ITSELF, WHICH IS NO LONGER AVAILABLE

(2) PRODUCING SWITCHES WITH THE REDUCED CALIBRATION WINDOW.

(3) DETERMINING WHAT THE CALIBRATION WINDOW IS, BECAUSE THE STD. PROCEDURE - WHICH RELIES ON "HEARING" A DISC SNAP - NO LONGER APPLIES

(4) MINIMIZING ASSEMBLY TOLERANCES TO MAXIMIZE THE NUMBER OF SWITCHES PRODUCED WITHIN THE CALIBRATION WINDOW.

(5) MAXIMIZING THE STABILITY OF THE CALIBRATION IN SERVICE; IE. CHANGING TO A MORE STABLE BASE MATERIAL

(6) PROVING THROUGH TESTING THAT:

a. SWITCHES ARE, IN FACT, INAUDIBLE IN THE VEHICLE

b. THE CHECKS IN PLACE IN PRESENT MANUFACTURING PROCESS ARE SUCCESSFUL IN PROVIDING SWITCHES THAT MEET ALL OTHER PERFORMANCE REQUIREMENTS

Date	Tested	Good	%	Failure Modes	
Dec-92					
12/19	19	19	100.0%		
	220	211	95.9%		
	1685	1491	88.5%	cont 6	achl 188
	50	46	92.0%		
12/15	1044	1042	99.8%		
	708	707	99.9%		
	1084	1082	99.8%		
	1028	1027	99.9%		
12/19	409	371	90.7%	cont 1	achl 37
	50	50	100.0%		
	1378	1258	91.3%	cont 7	achl 113
12/15	640	640	100.0%		
	424	423	99.8%		
	824	822	99.8%		
	50	50	100.0%		
	932	930	99.8%		
	476	476	100.0%		
	228	228	100.0%		
	72	72	100.0%		
	50	50	100.0%		
	252	251	99.6%		
	632	632	100.0%		
	640	640	100.0%		
12/16	1500	1499	99.9%		
	260	260	100.0%		
	436	436	100.0%		
	179	179	100.0%		
12/3	50	44	88.0%	rlcr 6	
	719	645	89.7%	cont 2	rlcr 72
Total	**15939**	**15481**	**97.1%**		

QUIET DEVICES

* Cup changes:

The Change Checklist is being used to track this change. The DIPFMEA's need to be updated, including the new knowledge of failure modes (vac shift, therm shift, wear shift...); 27713 needs some very minor updates for the sake of clarity; parts lists L3-1, L3-2, L5-2, L6-1 need updates for the -2 cup and -2 env seal. In addition, efforts to verify the -2 cup are still underway. It is known that -2 cups cause disc predeflection, which in turn increases sensor sigma, and pulls down the act & rel pressures. We also know that holed-Kapton shows a "disc float" of about 3 mils, and the force applied to the converter button by the Kapton diaphragm is substantial enough to cause some disc deflection. We are prototyping a reduction of the button height to limit the force applied to the disc, as well as backing off on the cup change from the present .0034" back to about .0025". The concern here is that we're working on minute changes ("m-eye-noot", not "minit") which are quite a bit smaller than the typical print tolerances; any shifts at all will completely wash out any gains we manage to make. We need a much better understanding of the disc envelope, including the design geometry and variability, the process-induced variability, and the balance of forces which come into play (diaphragm versus disc F-d curve). The one thing we might be able to do, to make all the troubles disappear, is to develop a silent disc with larger throw (maybe a thinner material, 455SS ? ....)

* Disc Dept. Automatic Disc Checker II correlation

The new ADC II is in final debug stages, and production discs are being supplied from it. We have 20 individually identified discs with ADC printouts. The goal is to run disc curves on our equipment to attempt correlation with the ADC readings, as well as build into sensors and run curves.

* Complete analysis of Atlanta returns

We still don't know exactly why the devices are open-circuit on the car. Since we know "Vacuum-Dependent" devices open under vac and reset with positive pressure, it follows that vacuum must exist within the master cylinder. We have constructed a test buck and plan to try to replicate the failure on parts known-bad from Atlanta. Following this, we plan to disassemble the devices in order to measure the sensor vacuum-shift, as well as determine the post-assembly preload. Then, some sensors should be opened by hexport-cutting technique which allows diaphragm inspection in the crimped condition. This could be extremely interesting, because the Kapton in vacuum-dependent parts is bi-stable, and actually "snaps" like a disc upon vacuum-reset.

* Preload Measurement Uncertainties Experiment
* Wear shift characterization - per 87PS discovery
* Updates to 77PS ES and internal TI Q.A.S. for quarterly In-Process noise audits

F-SERIES LIGHT TRUCK

L3-3

* Pelkey high ambient Impulse test
  This test was recently run at John Pelkey's request, using the ES 135 C brake fluid temperature but increasing from the ES ambient (121 C) to 149 C = 300 F. We passed 500K successfully and completed a report. However, running to failure would provide potentially valuable diaphragm life information.

* Hank Karzun PN96 Tokico samples; need PIST/PIPC; due Feb 8
  Charlie is checking on this - they may have already been shipped.

* Changeover L2-3 and L3-3 snap to L3-3 silent, due 11 Jan 93
  Customer-requested validation / ISW work completed. The change involves replacing the snap disc with a silent disc, and updating the customer PIN to CA. The preload target has been determined to be 9.5 - 10.0 mils. Pilots have been run successfully. No vacuum shifts have been detected. No dimensional changes to the cup have been indicated. We must still determine the temperature to run the in-process high-temp continuity audit.

* Visit from Pelkey, Modi, and sup'v Jim Ritz scheduled for 11 Jan 93

FORD USA BRAKE (77PSL2-1, 77PSL3-1, 77PSL5-2)

* First Cycle Snydrome
  The fact that our device requires a couple of cycles to stabilize readings is well-known, even to the point where it is documented in the ES. However, the permanence of the stabilization is a question: apparently there is some storage "reset" taking place which means the stabilization goes away after a while. How much, how long, require characterization. Certain customers only check our device once (w/o stabilization cycles) and report instances where the 160 psi max. act. reads upwards of 200 psi. We have had RMR's for this. A Band-Aid solution implemented on some products is a non-symmetric print spec, reading 125 psi +75/-35, which accounts for 40 psi worth of first-cycle syndrome.

WIN88 (77PSL3-2)

* Program [redacted]:
  We [redacted] owe Ford an envelope drawing - TBD. The drawing with snubber exists. We are trying to back them away from the snubber. Charlie has recently delivered test parts which are actually production L3-1's. We expect they'll find these undetectable in their system. The ISW strategy should be comprehended.

CAPRI (77PSL6-1)

* Spec negotiation (Impulse pressure/temperature) and note on print

We learned at the 11th hour that the vacuum exposure during evac-and-fill is extremely high relative to the NAAO ES. We checked some parts and discovered the diaphragm wrinkling under this vacuum, which indicated a possible life issue. We did a major vacuum-life test, and found the vacuum parts performing worse than the controls but all parts surviving the ES 500K cycles. Ford Australia now wants us to delete the ES Impulse and Vacuum procedures, and replace them with a combined vacuum-Impulse test. They want a note on the envelope drawing explaining this. They have examined the master cylinder ES and field requirements, and determined our ES pressures and temperatures exceed these requirements. I began a campaign to negotiate lower Impulse pressures and temperatures, and they have responded by lowering the pressure from 1450 psi to 1000. I am of the opinion that temperature has a much stronger influence on diaphragm life, but negotiation seems to have stalled. I am withholding their requested print update pending completion of this negotiation.

* Schedule for L6-1 Validation:

Build val parts (new cup, new O-ring), init char	18 Jan-22 Jan
Approval of similarity claims	TBD
Impulse, TC, misc tests, similarity claims	25 Jan-12 Feb
Compl final char	15 Feb-19 Feb
Report writeup	22 Feb-25 Feb
Ship ISR package	26 Feb 93
ISR MRD @ BCIA	12 Mar 93

FALCON (77PSL4-1)

* Program Issues

The ISW package is due in Australia on 930604. There will be a requirement for approx. 50 VP OTS (Verification Prototype, Off Tool Samples). We need to put an entire system in place to deal with the M10 X 1.0 hexport thread, including production prints, tooling the hexport supplier, obtaining manifolds for Lab and In Process testing, gaging, QC equipment. Status of envelope drawing and parts list should be checked.

THERMAL ISSUES

* High-temperature sensor study

We have not really placed much emphasis on thermal shifts which are sensor-related rather than base-related. One test measuring the ref dim at room and high temp was conducted, which suggested a couple of mils of shift. A better study might be in order. Also, we don't really understand the influence of temperature on the shape of the hatchet curve. It has been proposed that we could characterize the influence of temperature on act and rel by building snap-type devices, and listening for the snap while running the test devices in an environmental chamber.

* Study of low-temp performance using line rejects for high-act

The concern receiving the most focus is the high-temp shifts which tend to make the device go open-circuit, which is an annoyance but is actually failsafe. If low-temp shifts were sufficient to prevent the device from opening on pressure rise, this would be a safety issue. If devices end up pinned statistically too high, they are typically the ones rejected by the pressure tester for high-actuation. Taking some of these and performing low-temperature experiments would help characterize this effect.

* Addition of thermal information to FMEA

DIAPHRAGM LIFE

* Life Test for Tim Andresen w/ 3 mmHg vacuum (ES)

Australia contacted Tim and informed him of the fact that we were concerned about diaphragm life after high-vacuum exposure. Tim asked us the obvious question - what kind of effect did the ES vacuum have? We are running 6 parts w/ ES vac and 6 controls. We told Tim this could be done roughly by the holidays. Presently, 5/6 vac. parts are dead at 913, 1068, 1074, 1194, and 1196 Kcycles. 2/6 controls are dead at 988 and 1170.

* Rubber diaphragm development

We need to formulate a big-picture strategy in order to justify development efforts. One is to characterize noise with rubber, to work towards snubber elimination. A molded diaphragm supplier, Dia-Com, needs to be contacted. We have prototyped with a lathe-cut design, and produced exemplary diaphragm life results but found the sensor yields are poor due to wide actuation sigma's. This is possibly linked to inconsistent diaphragm compression characteristics.

* Additional diaphragm ideas

Dupont experimental material, PEEK (mat'l Andy McKenna - Japan), Dixon polyetherimide, Allied-Apical competitor to Kaptop, Ultem film...

John Brennan's work to characterize film properties under various aging conditions, including saturated brake fluid and trans. fluid...

* Addition of info to DFMEA - leakers begin by going closed-ckt

PRINTS/DRAFTING

Silent PC P/L	chg to 27713-2 and 74247-2; (does not apply yet to 77PSL2-1)
All 77/87 P/L	new rivet 74776
27713 Cup:	all updates, silent disc predeflection chg's
36888 Terminal	Bassler issues
46515 Base:	complete revamp, .083-.095, chg/remove envelope dimension too ?, new radius to address cracking ?
36889 Spring:	rivet hole shape, bump dim's and visual, make this print FLAT
36897 Mv term asm:	key spring dim's (bent) onto this print
74797 Al cr ring:	add wax details
36952 Final asm:	correct ht & dia for aluminum crimp ring
36887 Mv term:	update cutoff dim
27639 Washer:	add radius callout (feeder uses it)

MISCELLANEOUS and CREATIVE BACKLOG (FOR BRAINSTORMING)

* Obtain Ford factory-fill brake fluid in 55 gal drum
* Any diff between Ford factory-fill fluid and off the shelf DOT 3 ??
* F2VC spec - add verbage on prod cycler like PS spec's
* Effective area curves - lab crimp vs. production crimp
  - F/d - Pete S. equipment
  - P/d - fixturing for PSM equip rec'd
* Phone-in cycler test status ??
* Stan's stepped hex idea - pinch diaphragm just outside gland
* Hystat power-steer switch, Chrysler - obtain (show John K)
* Dale idea for confirmation of correct pin: F/d with continuity signal
* Silent device: UCON gel to fill cavity for dampening (Norm Freda - source?)
* Testing of sensor crimping process influence on disc envelope (Mfg Eng)
* Eliminate environmental seal, chg base to match sensor, elim. cracking
* Go to larger radius on base flange - elim cracking; better therm stability?

M#= :58 FR=VAGS TO=ZIZ SENT=12/21/92 02:10 PM
R#= C DIV=0050 CC=00101 BY=VAGS AT=12/21/92 02:10 PM

TO: 77PS T MFPC
TOM B AKE MFPC
DICK GARIEPY MFPC

: BILL SWEET WS4
DAVE CZARN ZARN
AZIZ RAHMAN ZIZ
TED BALLARD ETB
TED BREDIKIN TBTV
RUSTY STRUBLE RCS2

FR: MATT SELLERS MJS2

RE: 36656-35/36656-41 DISC LOTS

FROM NOW ON THE DISC DEPARTMENT WILL BE CHECKING THE 36656 DISC ON A NEW PIECE OF TEST EQUIPMENT CALLED THE AUTOMATIC DISC CHECKER (ADC). FRAN AND I HAVE ALREADY PERFORMED SOME TEST AND HAVE DETERMINED WHAT THE NEW DISC PRESSURES WILL BE WITH THIS NEW ADC SYSTEM. THE PRESSURES MAY HAVE CHANGED SLIGHTLY DUE TO DIFFERENCES BETWEEN THE OLD CHECKER AND THIS NEW ONE. WE FOUND THE FOLLOWING:

CUP PART NUMBER	DISC PART NUMBER	APPROXIMATE DISC ACTUATION MEAN
27713-1 (OLD)	36656-35	22.1 PSI
27713-2 (NEW)	36656-35	26.0 PSI
27288-1	36656-41	25.5 PSI

NOTE: RELEASE MEANS ARE "AS REQUIRED" TO MAKE A QUIET DISC.

PLEASE ENSURE THAT THE PROPER KAN BAN CARDS ARE IN PLACE TO ALLOW THESE DISC PRESSURES TO BE ORDERED, AND PLACE ORDERS TO FILL THEM ASAP.

ALWAYS BE AWARE OF WHICH CUP YOU ARE USING OF THE 27713 VARIETY. RIGHT NOW YOU ARE BACK TO USING THE 27713-2 ON THE 77PSL5-2 DEVICE, AND ARE STILL USING THE 27713-1 CUP ON 77PSL3-1'S & 77PSL2-1'S. AS YOU CAN SEE FROM THE CHART ABOVE THE CUP DASH NUMBER CAN HAVE A BIG IMPACT ON ACTUATION MEAN.

REGARDS . . . MATT
X1245

-MSG M#= 131268 F 08 TO=ZIZ SENT=12/18/92 02:13 PM
R#=077 ST=C DI 50 CC=00101 BY=VAGS AT=12/18/92 02:13 PM

TO: TED BALLARD ETB
TED BREDIKIN TBTV
DAVE VARNEY VRNY

BILL SWEET PCM2
STEVE OFFILER SB01
DAVE CZARN ZARN
AZIZ RAHMAN ZIZ

FR: MATT SELLERS MJS2

RE: FIRST ISSUE, ADC CHECKED DISC LOTS

WE HAVE COMPLETED PILOTING ONE BOX OF DISC THAT WERE SAMPLED ON THE NEW AUTOMATIC DISC CHECKER. WE USED THIS ONE BOX TO PERFORM PILOTS ON THE LIGHT TRUCK QUIET SWITCH (77PSL3-3), AND THE PASS CAR QUIET SWITCH (77PSL3-1). WE FOUND THE FOLLOWING RESULTS.

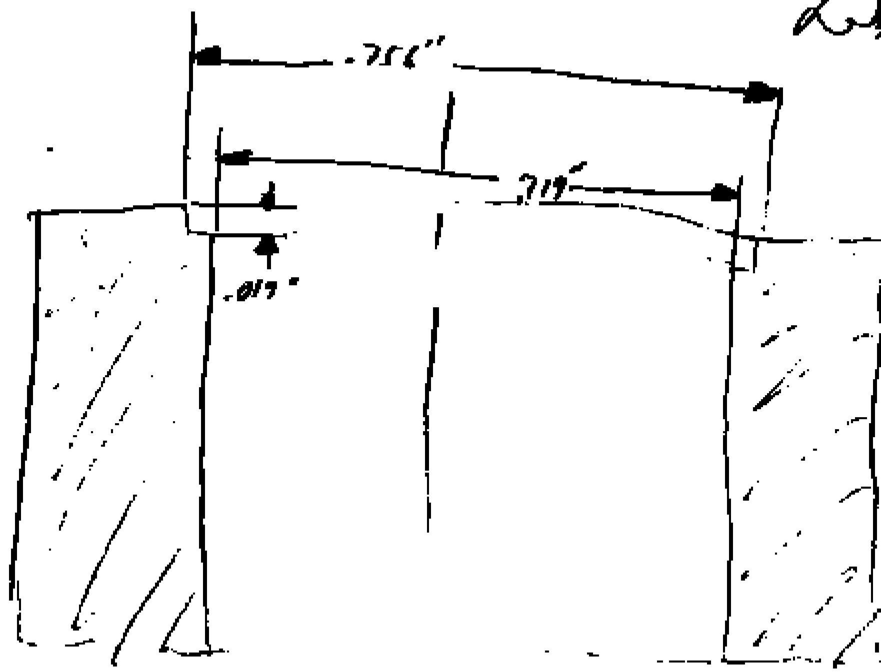
	77PSL3-1 QUIET PASS CAR	77PSL3-3 QUIET LIGHT TRUCK
DISC ACT. MEAN (ADC)	25.9	25.9
DEVICE ACT. MEAN (PROD.)	149.3	253.8
AMPLIFICATION	5.8	9.8
DESIRED ACT. MEAN (PROD.)	127.5	250.0
APPX DESIRED DISC ACT. MEAN (ADC)	22.1	25.5

I WILL INSTRUCT THE SMNT TO PLACE ORDERS FOR 36656-35'S WITH AN ACTUATION MEAN OF 22.1 PSI - RELEASE AS REQUIRED TO MAKE A QUIET SWITCH), AND 36656-41'S WITH AN ACTUATION MEAN OF 25.5 - (RELEASE AS REQUIRED TO MAKE A QUIET SWITCH). NOTE THAT THE DISC WE ALREADY HAVE IN HOUSE WILL MAKE ACCEPATBLE -41'S.

I WOULD ASK THAT YOU MAKE ANY ADJUSTMENTS NECESSARY TO KAN BAN CARDS TO MAKE THESE ACTUATION MEAN ORDERS POSSIBLE.

REGARDS . . . MATT
X1245

Lab Fixture



TI-NHTSA 7352

DRAWINGS AVAILABLE UPON REQUEST

10-Mar-92	4,000	10	-
11-Mar-92	4,000	10	-
12-Mar-92	4,000	10	-
18-Mar-92	4,000	10	-
23-Apr-92	2,000	5	-
2-May-92	2,000	5	-
5-May-92	2,000	5	-
6-May-92	2,000	5	-
14-Sep-92	2,000	5	-
22-Sep-92	4,000	10	-
30-Sep-92	4,000	10	-
7-Oct-92	4,000	10	-
7-Oct-92	4,000	10	-
16-Oct-92	4,000	10	-
21-Oct-92	2,000	5	-
20-Oct-92	4,000	10	-
29-Oct-92	4,000	10	-
29-Oct-92	4,000	10	-
30-Oct-92	4,000	10	-
4-Nov-92	4,000	10	-
10-Nov-92	4,000	10	-
10-Nov-92	4,000	10	-
11-Nov-92	4,000	10	-
17-Nov-92	2,000	5	-
20-Nov-92	4,000	10	-
4-Dec-92	2,000	5	-
9-Dec-92	2,000	5	-
14-Dec-92	2,000	5	-
16-Dec-92	4,000	10	-
16-Dec-92	4,000	10	-
16-Dec-92	4,000	10	-
21-Dec-92	2,000	5	-
21-Dec-92	4,000	10	-
Totals	**265,659**	**665**	**-**

205 per March 5 LD 92

Date	Tested	Good	%		Failure Modes
Dec-92					
12/19	19	19	100.0%		
	220	211	95.9%		
	1685	1491	88.5%	cont 6	achl 188
	50	46	92.0%		
12/15	1044	1042	99.8%		
	708	707	99.9%		
	1064	1062	99.8%		
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12/19	409	371	90.7%	cont 1	achl 37
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	824	822	99.8%		
	50	50	100.0%		
	932	930	99.8%		
	476	476	100.0%		
	228	228	100.0%		
	72	72	100.0%		
	50	50	100.0%		
	252	251	99.6%		
	632	632	100.0%		
	640	640	100.0%		
12/16	1500	1499	99.9%		
	280	280	100.0%		
	436	436	100.0%		
	179	179	100.0%		
12/3	50	44	88.0%	rlcr 6	
	719	645	89.7%	cont 2	rlcr 72
Total	16839	16481	97.1%		

77PSL2-1 Yields for 1992

Date	Tested	Good	%
January-92	14341	14209	99.1%
February-92	10589	10487	99.0%
March-92	28771	27980	97.3%
April-92	16827	16476	97.9%
May-92	12018	11136	92.7%
June-92	23443	23133	98.7%
July-92	11835	11673	98.6%
August-92	18535	18253	98.6%
September-92	11683	11562	99.0%
October-92	3839	3827	99.7%
November-92	0	0	0.0%
December-92	15939	15461	97.1%
Total	159478	148010	97.7%