EA02-025

TEXAS INSTRUMENTS, INC.'S

9/10/03 ATTACHMENT TO ODI

REQUEST #3

BOX 5

PARTS A - P

PART P

PIST FAE Results

Total - 0.0 sec. ÷

520 ÷ 15 = 505 ÷ 520 = 97%

n/a #29 + 35

Mat. Avail.

19 - 100%

FAE 97%

Mat. Avail. 100%

ES Test ?

PIST

PEST - FAI INFO
Use 4T & P/C data
submitted to Ford
P/C PKG.

mate. anal. 19

ES Test 660

Ford FAI 586

1265

77 PC ISR

- A 1 .. P 46
- A 52 .. P 95
- A 101 .. P 144
- A 150 .. P 195
- A 202 .. P 251

77PSL 3-1, 77PSL 5-2 Validation

T-Cycle Test

Cycle	Cold Fl Temp	Cold Date	Cold Time	Hot Fl Temp	Hot Date	Hot Time
1	-43	8/6	4:25 P	+44	8/6	4:45 P
2	-43	↓	9:35 P	+38	8/7	6:40 A
3	-40	8/7	7:50 A	+40	↓	8:30 A
4	-44	↓	10:30 A	+41		11:00 A
5	-43		12:40 P	+41		1:10 P
6	-40		2:20 P	+44		3:50 P
7	-43		4:15 P	+44	↓	4:40 P
8	-42	↓	6:00 P	+38	8/8	10:20 A
9	-44	8/8	4:00 P	+43	↓	4:25 P
10	-44	8/9	11:30 A	+40	8/9	11:50 A
11	-43	↓	2:05 P	+39	↓	2:05 P
12	-41		4:40 P	+45		5:00 P
13	-42	↓	6:55 P	+45	↓	7:15 P
14	-43	8/10	6:35 A	+41	8/10	6:55 A
15	-40	↓	9:15 A	+44	↓	8:23 A
16	-41		9:45 A	+43		10:10 A
17	-40		11:25 A	+43		11:45 A
18	-40		12:50 P	+40		1:10 P
19	-40		3:15 P	+39		2:50 P
20	-41		4:00 P	+42		4:20 P
21	-41	↓	5:30 P	+39	↓	10:15 P
22	-42	8/11	7:50 A	+45	8/11	8:10 A
23	-40	↓	9:30 A	+41	↓	9:45 A
24	-40		10:55 A	+44		11:15 A
25	-43	↓	12:45 P	+40	●	1:15 P

NOTE: HR SLIGHTLY TO ECCENTRIC THAN OTHERS ON COLD CYCLE

FINAL CHARACTERIZATION – HY POT

DEVICE NO.	POST PRESS	HOT	REL	NVD	TO CASE SW CL	TO CASE SW OPEN	BETWEEN TERMS	TES	TS
99-15-01	PASS	113	42	9.58	1.926	1.798	58.00	BURST PRESS	Top
02	"	107	54	9.24	1.951	1.752	1.907	"	
03	"	113	52	10.16	1.905	1.747	1.903	"	
04	"	119	61	8.66	1.939	1.790	1.954	"	
05	"	112	60	9.18	1.924	1.776	3.300	"	
06	"	107	53	10.31	1.942	1.786	1.949	"	
07	"	116	55	10.11	1.901	1.748	1.906	"	
08	"	121	62	8.97	1.947	1.793	1.958	"	
09	"	120	56	12.41	1.947	1.793	1.941	"	
10	"	119	57	9.49	1.941	1.787	3.302	"	
11	"	110	54	8.37	1.898	1.746	1.972	"	
12	"	110	60	9.47	1.915	1.774	1.980	"	
13	PASS	114	47	8.96	1.933	1.837	1.951	"	Mon S
14	"	122	52	9.41	1.991	1.191	2.050	"	"
15	"	126	53	8.89	1.924	1.825	1.930	"	"
16	"	125	51	9.04	1.905	1.777	1.938	"	"
17	"	129	51	8.50	1.906	1.816	1.934	"	"
18	"	124	52	9.04	1.904	1.783	1.940	"	"
19	"	134	59	9.77	1.928	1.806	1.931	"	"
20	"	129	49	9.05	1.919	1.830	1.977	"	"
21	"	127	51	8.93	1.908	1.782	1.946	"	"
22	"	114	47	9.48	1.979	1.855	1.931	"	"
23	"	121	48	8.93	1.933	1.788	1.925	"	"
24	"	124	55	8.79	1.970	1.851	2.030	"	"
25	PASS	135	54	9.10	1.999	1.817	1.969	"	HVM
26	"	127	54	8.77	2.090	1.877	1.991	"	"
27	"	133	54	10.17	1.976	1.922	1.925	"	"
28	"	135	57	9.55	1.957	1.917	1.978	"	"
29	"	134	54	9.30	1.957	1.926	1.964	"	"
30	"	151	59	9.14	1.918	1.819	1.982	"	"
31	PASS	126	55	9.07	61,100	63,100	65,700	"	Sam S
32	"	127	55	8.65	1.919	1.865	1.932	"	"
33	"	135	57	9.84	4,210	6,350	4,340	"	"
34	"	131	52	9.05	1.842	1.709	1.918	"	"
35	"	126	52	9.85	1.898	1.775	1.879	"	"
36	"	128	53	8.89	6,350	7400	8,300	"	"
37	—	—	—	—	—	—	—	BURST	
38	—	—	—	—	—	—	—	"	
39	—	—	—	—	—	—	—	"	
40	—	—	—	—	—	—	—	"	
41	—	—	—	—	—	—	—	"	
42	—	—	—	—	—	—	—	"	
43	PASS	116 PSIA	43 PSIA	9.11	1.883	1.758	1.929	VIBRATION	
44	"	113	49	8.89	1.864	1.795	1.930	"	
45	"	103	49	8.92	1.870	1.813	1.987	"	
46	"	102	46	9.27	1.894	1.805	1.944	"	
47	"	110	49	8.82	1.894	1.795	1.913	"	
48	"	117	47	8.98	1.922	1.794	1.937	"	
49	PASS	165	61	8.58	1.961	1.815	1.987	VACUUM	
50	"	149	55	9.59	1.942	1.837	1.956	"	
51	"	145	57	9.83	1.963	1.861	1.960	"	
52	"	139	54	9.40	1.972	1.909	1.956	"	
53	"	135	54	9.19	1.972	1.915	1.958	"	
54	"	149	57	8.87	1.982	1.942	1.962	"	

[illegible] Steve

[illegible]

[illegible]

[illegible]

[illegible]

Also -

4. Joe will set up a mtg w/ Purchasing (Amanda etc.) in late this week
   ⇒ he doesn't need us to be there.
5. Sandie / Steve will draft a letter [illegible]
6. What is w/ Ph 2
7. Ford has asked that a [illegible] by April, to review testing, program update, etc. - This is a step prior to our approval & support by us, to happen by mid-July.
   (There are 3 engine groups: 4/r, V6, ecb)

Sept 11th

P/C SEMI-AUTOMATED PROCESS

Spec = 500 K cycles
0-1450 ±50 psi
fluid = 135 ±14 °C
amb = 107°C min

Bld	Test	Qty		
10/90	10/90	24	passed 500 K cycles	(57PS PV TESTING)
		6	Weibull	$\frac{\theta = 1371\ K}{1^{st}\ fail = 790\ K}$
8/91	9/91	6	Weibull	$\frac{\theta = 1132\ K}{1^{st}\ fail = 830\ K}$
8/91	9/91	6	Weibull	$\frac{\theta = 1005\ K}{1^{st}\ fail = 819\ K}$
9/91	9/91	24	passed 500 K cycles	(77PS PV TESTING / REF-TEST)
		6	Weibull	$\frac{\theta =}{1^{st}\ fail = 798\ K}$

also, lot chk on 57 rods hit control.

P/C AUTOMATED PROCESS

Bld	Test	Qty		
7/91	9/91	12	$\frac{\theta = 446\ K}{1^{st}\ fail \simeq 250\ K}$	(77PS ORIG. PV TESTING)
8/91	9/91	6	Weibull $\frac{\theta = 760\ K}{1^{st}\ fail = 541\ K}$	
8/91	9/91	6	Weibull $\frac{\theta = 1169\ K}{1^{st}\ fail \simeq 718\ K}$	
8/91	9/91	6	Weibull $\frac{\theta = 1206\ K}{1^{st}\ fail. = 886\ K}$	

	DEVICE #	BASE	SENSOR	PIN	OFFSET
	6	92.9	46.6	145.0	7.5
	13	91.4	46.9	144.8	6.5
ALIGNMENT NO.	31	92.0	46.7	145.0	6.3
	43	90.7	46.9	145.8	7.6
	52	90.2	47.0	144.8	7.6
ALIGNMENT NO.	59	92.1	46.4	146.0	6.5
		$\bar{X}$ 91.6			

145 PIN
91 BASE
46.5 SENSOR
PRELOAD 7.5

28	89.5	46.5	143.1	7.1
36	89.1	46.7	143.3	7.5
47	88.4	46.3	143.3	8.6
96	88.7	46.5	142.9	7.7
	$\bar{X}$ 88.9			

143 PIN
89 BASE
46.5 SENSOR
PRELOAD 7.5

LOWEST TO HIGHEST SORT BY ACT (in 1052)

47	8.6
36	7.5
58	8.0
45	8.0
42	8.7
4	8.6
65	8.0
62	7.9
92	
49	9.8
91	8.9
32	8.7
78	8.5

CORRECTED MOLD DIMENSIONS

F2VC-9F924-AB

CAVITY #	SPEC. 2.06 - 1.85
A1	1.92
A	1.94
B1	1.985
B	1.99
C1	1.985
C	2.00
D1	1.99
D	1.975

PRESSURE SWITCH DATA Form 21605 TEST NO.

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMPL. DATE
PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY

PROJECT TITLE: 4300 Base Analysis

CUSTOMER: TI - Internal

PURPOSE OF TEST:

PROCEDURE: ① Pre-torque 4300 bases
② Pair up bases w/ "minimum" variance
③ Crimp sensors to bases (Crimp P3i Pre 700# final 700#)
④ Take torque readings
⑤ De-crimp bases from sensors (keep)
⑥ Take torque readings

Device #	Pre-torque Readings	Mated up Readings	CRIMPED Readings	DE-CRIMPED Readings		Δ Pre to Mated
1	.433	.4365	.4335	.4325		-.0005
2	.433	.435	.434	.4315		-.0035
3	.4325	.4305	.433	-.434		-.0005
4	.4325	.434	.4335	.433		-.0005
5	.433	.4346	.4335	.4325		-.0005
6	.4325	.434	.4345	.4335		⊕
7	.4325	.434	.4345	.433		-.0005
8	.4325	.434	.4345	.4335		⊕
9	.433	.4365	.4335	.4325		-.0005
10	.433	.4365	.4345	.4335		-.0005
11	.4325	.4365	.434	.433		⊕
12	.4325	.4355	.434	.433		-.0005

Cpk Index (Bilateral Tolerances)

Sample Number	Enter Values
1	0.34620
2	0.34620
3	0.34620
4	0.34620
5	0.34620
6	0.34620
7	0.34620
8	0.34620
9	0.34620
10	0.34620
11	0.34650
12	0.34650
13	0.34660
14	0.34560
15	0.34560
16	0.34670
17	0.34670
18	0.34670
19	0.34670
20	0.34670
21	0.34680
22	0.34590
23	0.34600
24	0.34600
25	0.34610
26	0.34610
27	0.34610
28	0.34610
29	0.34610
30	0.34610
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	

Device: 38900-1 3A
Measurement Type: J. GAGE-2A

Lower Spec:	0.3430
Upper Spec:	0.3479
Spec Range:	0.0049
Average:	0.3463
Std Dev:	0.0003
Min Reading:	0.3456
Max Reading:	0.3468
Range:	0.0012
Cp:	2.666
Cpl:	3.540
Cpu:	1.792
Cpk:	1.792

ELCO DATA

Cpk Index (Bilateral Tolerances)

Sample Number	Enter Values
1	0.34680
2	0.34730
3	0.34830
4	0.34930
5	0.34830
6	0.34855
7	0.34780
8	0.34730
9	0.34730
10	0.34880
11	0.34930
12	0.34730
13	0.34780
14	0.34880
15	0.34830
16	0.34955
17	0.34855
18	0.34780
19	0.34855
20	0.34855
21	0.34805
22	0.34705
23	0.34780
24	0.34780
25	0.34955
26	0.34805
27	0.34730
28	0.34780
29	0.34780
30	0.34780
31	0.35130
32	0.34755
33	0.34830
34	0.34780
35	0.34880
36	0.34880
37	0.34680
38	0.35005
39	0.34780
40	0.34680
41	0.35030
42	0.34880
43	0.34930
44	0.34780
45	0.34980
46	0.34730
47	0.34880
48	0.34830
49	0.34780
50	0.34905

Device: 36900-1
Measurement Type: J. GAGE SA

Lower Spec:	0.3430
Upper Spec:	0.3479
Spec Range:	0.0049
Average:	0.34829
Std Dev:	0.001
Min Reading:	0.3468
Max Reading:	0.3513
Range:	0.0045
Cp:	0.863
Cpl:	1.864
Cpu:	-0.137

Cpk is the lesser of Cpl and Cpu

Cpk Index (Bilateral Tolerances)

Sample Number	Enter Values
1	0.34680
2	0.34730
3	0.34830
4	0.34930
5	0.34830
6	0.34855
7	0.34780
8	0.34730
9	0.34730
10	0.34880
11	0.34930
12	0.34730
13	0.34780
14	0.34880
15	0.34830
16	0.34955
17	0.34855
18	0.34780
19	0.34855
20	0.34855
21	0.34805
22	0.34705
23	0.34780
24	0.34780
25	0.34955
26	0.34805
27	0.34730
28	0.34780
29	0.34780
30	0.34780
31	0.35130
32	0.34755
33	0.34830
34	0.34780
35	0.34880
36	0.34880
37	0.34680
38	0.35005
39	0.34780
40	0.34680
41	0.35000
42	0.34880
43	0.34930
44	0.34780
45	0.34980
46	0.34730
47	0.34880
48	0.34830
49	0.34780
50	0.34905

Device: 36900-1
Measurement Type: J. GAGE 2A

Lower Spec:	0.3430
Upper Spec:	0.3468
Spec Range:	0.0038
Average:	0.34829
Std Dev:	0.001
Min Reading:	0.3468
Max Reading:	0.3513
Range:	0.0045
Cp:	0.889
Cpl:	1.884
Cpu:	-0.525

Cpk is the lesser of Cpl and Cpu

Cpk Index (Bilateral Tolerances)

Sample Number	Enter Values
1	0.34680
2	0.34730
3	0.34830
4	0.34930
5	0.34830
6	0.34855
7	0.34780
8	0.34730
9	0.34730
10	0.34880
11	0.34930
12	0.34730
13	0.34780
14	0.34880
15	0.34830
16	0.34955
17	0.34855
18	0.34780
19	0.34855
20	0.34855
21	0.34905
22	0.34705
23	0.34780
24	0.34780
25	0.34955
26	0.34805
27	0.34730
28	0.34780
29	0.34780
30	0.34780
31	0.35130
32	0.34755
33	0.34830
34	0.34780
35	0.34880
36	0.34880
37	0.34680
38	0.35005
39	0.34780
40	0.34680
41	0.35030
42	0.34880
43	0.34930
44	0.34780
45	0.34980
46	0.34730
47	0.34880
48	0.34830
49	0.34780
50	0.34905

Device: 36900-1
Measurement Type: J. GAGE 3A

Lower Spec:	0.3450
Upper Spec:	0.3479
Spec Range:	0.0049
Average:	0.34829
Std Dev:	0.001
Min Reading:	0.3468
Max Reading:	0.3513
Range:	0.0045
Cp:	0.863
Cpl:	1.864
Cpu:	-0.137

Cpk is the lower of Cpl and Cpu

Cpk Index (Bilateral Tolerances)

Sample Number	Enter Values
1	0.34680
2	0.34730
3	0.34830
4	0.34930
5	0.34820
6	0.34855
7	0.34780
8	0.34730
9	0.34730
10	0.34880
11	0.34930
12	0.34730
13	0.34780
14	0.34880
15	0.34830
16	0.34955
17	0.34855
18	0.34780
19	0.34855
20	0.34855
21	0.34805
22	0.34705
23	0.34780
24	0.34780
25	0.34955
26	0.34805
27	0.34730
28	0.34780
29	0.34780
30	0.34780
31	0.35130
32	0.34755
33	0.34830
34	0.34780
35	0.34880
36	0.34880
37	0.34880
38	0.35005
39	0.34780
40	0.34680
41	0.35030
42	0.34880
43	0.34930
44	0.34780
45	0.34980
46	0.34730
47	0.34880
48	0.34830
49	0.34780
50	0.34905

Device: 36800-1
Measurement Type: J. GAGE 2A

Lower Spec:	0.3430
Upper Spec:	0.3468
Spec Range:	0.0038
Average:	0.34829
Std Dev:	0.001
Min Reading:	0.3468
Max Reading:	0.3513
Range:	0.0045
Cp:	0.869
Cpl:	1.864
Cpu:	-0.525

Cpk is the lesser of Cpl and Cpu

Cpk Index (Bilateral Tolerances)

Sample Number	Enter Values
1	0.34680
2	0.34730
3	0.34830
4	0.34930
5	0.34830
6	0.34855
7	0.34780
8	0.34730
9	0.34730
10	0.34880
11	0.34930
12	0.34730
13	0.34780
14	0.34880
15	0.34830
16	0.34955
17	0.34855
18	0.34780
19	0.34855
20	0.34855
21	0.34805
22	0.34705
23	0.34780
24	0.34780
25	0.34955
26	0.34905
27	0.34730
28	0.34780
29	0.34780
30	0.34780
31	0.35130
32	0.34755
33	0.34830
34	0.34780
35	0.34880
36	0.34880
37	0.34680
38	0.35005
39	0.34780
40	0.34680
41	0.35030
42	0.34880
43	0.34930
44	0.34780
45	0.34980
46	0.34730
47	0.34880
48	0.34830
49	0.34780
50	0.34905

Device: 38900-1
Measurement Type: J. GAGE 3A

Lower Spec:	0.3430
Upper Spec:	0.3479
Spec Range:	0.0049
Average:	0.34829
Std Dev:	0.001
Min Reading:	0.3466
Max Reading:	0.3513
Range:	0.0045
Cp:	0.863
Cpl:	1.864
Cpu:	-0.137

Cpk is the lesser of Cpl and Cpu

Cpk Index (Bilateral Tolerances)

Sample Number	Enter Value
1	0.34680
2	0.34730
3	0.34830
4	0.34930
5	0.34830
6	0.34855
7	0.34780
8	0.34730
9	0.34730
10	0.34680
11	0.34930
12	0.34730
13	0.34780
14	0.34880
15	0.34830
16	0.34955
17	0.34855
18	0.34780
19	0.34855
20	0.34855
21	0.34805
22	0.34705
23	0.34780
24	0.34780
25	0.34955
26	0.34805
27	0.34730
28	0.34780
29	0.34780
30	0.34780
31	0.35130
32	0.34755
33	0.34830
34	0.34780
35	0.34880
36	0.34880
37	0.34680
38	0.35005
39	0.34780
40	0.34680
41	0.35030
42	0.34880
43	0.34930
44	0.34780
45	0.34980
46	0.34730
47	0.34880
48	0.34830
49	0.34780
50	0.34905

Device: 36900-1
Measurement Type: J. GAGE 2A

Lower Spec:	0.3430
Upper Spec:	0.3468
Spec Range:	0.0038
Average:	0.34829
Std Dev:	0.001
Min Reading:	0.3468
Max Reading:	0.3513
Range:	0.0046
Cp:	0.669
Cpl:	1.864
Cpu:	-0.525

Cpk is the lesser of Cpl and Cpu

#36900

O&K COMPANY LIMITED

Type & Grade SC-4345 AISI10L10 SAF G.O.A 9341-S
S.O.#14255

1. Specification

	Heat No.	Coil No.	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	B
Chemical Composition Of Steel	D06703	0021 ~ 0022	10	42	7	5	21	1	1	2		PB %X100 25

	Nominal Diameter		Tolerance of Diameter		Tensile Strength		Decarburization	
	in	mm	in	mm	1,000 psi	kg/mm²	Dm-T	Dm-P
Physical Properties	0.565	14.351	± 0.0040	± 0.1016	58.0 MAX	48.5 MAX		MAX

Packing	Coil Weight	
	ABT. 2,142LBS (ABT. 970KGS)	
	WRAPPED WITH POLYPROPYLENE SHEET.	

2. Test Results

Coil No.	Diameter mm	Tensile Strength kg/mm²	Tensile Strength 1,000psi	Sample No.	Diameter mm	Tensile Strength kg/mm²	Tensile Strength 1,000psi
0021	14.43	33.3	47.4				
0022	14.39	33.4	47.5				

DISC LIFE TEST OF .0122" PASSIVATED AND .013" NON-PASSIVATED DISCS

DEVICE #	MATERIAL	DISC INIT ACT	DISC INIT REL	DEV INIT ACT	DEV INIT REL	DEV FINAL ACT	DEV FINAL REL	DISC FINAL ACT	DISC FINAL REL
122-09-01	.0122 PAS	20.4	10.2	109	47	103	52	20.2	10.2
122-09-02	.0122 PAS	21.3	10.8	121	55	112	57	21.3	10.8
122-09-03	.0122 PAS	21.8	11.3	122	62	112	61	21.7	11.5
122-09-04	.0122 PAS	22.6	12.9	122	67	119	68	22.5	12.9
122-09-05	.0122 PAS	22.9	12.8	127	66	122	68	22.8	13.1
122-09-06	.0122 PAS	23.7	13.5	134	73	128	78	23.7	14.1
122-09-07	.0122 PAS	22.5	11.6	131	62	122	66	22.3	11.8
122-09-08	.0122 PAS	23.0	12.9	127	73	125	73	23.0	12.9
122-09-09	.0122 PAS	22.4	11.4	128	63	120	67	22.3	11.7
122-09-10	.0122 PAS	23.6	11.4	130	76	131	76	23.5	14.4
122-09-11	.0122 PAS	28.6	13.6	263	112	260	114	29.1	14.3
122-09-12	.0122 PAS	27.6	13.4	256	112	252	111	28.0	13.6
122-09-13	.0122 PAS	30.2	14.4	277	117	269	115	31.3	14.5
122-09-14	.0122 PAS	26.8	12.8	260	102	245	104	26.9	13.0
122-09-15	.0122 PAS	28.0	13.1	278	112	264	112	28.3	13.4
122-09-16	.0122 PAS	29.6	14.4	276	116	269	114	29.2	14.1
122-09-17	.0122 PAS	29.4	14.4	269	111	263	111	29.6	14.5
122-09-18	.0122 PAS	27.7	12.5	257	97	250	100	28.1	12.6
122-09-19	.0122 PAS	28.8	14.0	271	110	265	112	DAMAGED	
122-09-20	.0122 PAS	28.8	12.9	271	104	263	107	29.0	13.1
122-09-21	.013 NON-PAS	23.5	10.4	126	59	120	57	23.0	10.7
122-09-22	.013 NON-PAS	23.8	11.2	131	61	121	57	23.0	11.1
122-09-23	.013 NON-PAS	23.1	9.9	132	52	116	51	23.0	9.9
122-09-24	.013 NON-PAS	24.0	11.5	127	60	117	56	23.6	11.6
122-09-25	.013 NON-PAS	23.3	11.3	128	54	115	57	22.9	11.0
122-09-26	.013 NON-PAS	29.0	13.3	267	115	261	105	28.6	12.9
122-09-27	.013 NON-PAS	27.8	13.2	250	117	250	99	27.6	13.0
122-09-28	.013 NON-PAS	28.8	13.6	254	122	245	105	28.2	13.0
122-09-29	.013 NON-PAS	28.7	13.2	266	117	261	108	28.2	13.3
122-09-30	.013 NON-PAS	28.2	12.7	257	107	246	102	27.9	10.5

F2VC-9F924-AB

MATERIAL ANALYSIS

PARTS LIST

	PART NAME	PART #	CERTIFIED
1	BASE	46515-2	YES
2	STA.TERM.	36888-1	YES
3	MOVE.CONTACT	74408-1	YES
4	RIVET	74171-1	YES
5	MOVE.TERM.	36887-1	YES
6	SPRING ARM	36889-1	YES
7	GS12 HEYPORT	3A900-1	YES
8	GASKET	74353-1	YES
9	CUP	27715-1	YES
10	SEAL	74176-1	YES
11	KAPTON STRIP	27225-1	YES
12	WASHER	27639-1	YES
13	CONVERTER	27406-1	YES
14	KAPTON TAPE	74224-1	YES
15	SPACER	73958-2/-3	YES
16	CRIMP RING	74797-1	YES
17	TRANSFER PIN	74078-SEL	YES
18	ENVIO.SEAL	74247-2	YES
19	THREAD CAP	74179-2	YES

RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME
****
* WEIBULL SLOPE : 6.00
* CHARACTERISTIC LIFE : 1133.00

NO.	TIME	RELIABILITY(%)	
1	500	99.2641	③ PROD CUP, HL CRIMP

RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME
****
* WEIBULL SLOPE : 7.00
* CHARACTERISTIC LIFE : 760.00

NO.	TIME	RELIABILITY(%)	
1	500	94.8053	⑥ MS CUP, AMI CRIMP

RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME
****
* WEIBULL SLOPE : 5.70
* CHARACTERISTIC LIFE : 446.00

NO.	TIME	RELIABILITY(%)	
1	500	14.6854	⑦ PROD CUP, AMI CRIMP I

RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME
****
* WEIBULL SLOPE : 3.70
* CHARACTERISTIC LIFE : 1371.00

NO.	TIME	RELIABILITY(%)	
1	500	97.6343	④ MS CUP, HL CRIMP (VAL)

RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME
****
* WEIBULL SLOPE : 6.90
* CHARACTERISTIC LIFE : 1208.00

NO.	TIME	RELIABILITY(%)	
1	500	99.7729	② PROD CUP, AMI CRIMP II

RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME
****
* WEIBULL SLOPE : ~~3.00~~ 3.50
* CHARACTERISTIC LIFE : ~~1559.00~~ 1467

NO.	TIME	RELIABILITY(%)	
1	500	~~96.7549~~ 97.73	⑤ PROD CUP, AMI CRIMP NO MACRIMP

RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME
****
* WEIBULL SLOPE : 9.30
* CHARACTERISTIC LIFE : 1005.00

NO.	TIME	RELIABILITY(%)	
1	500	99.8487	① PROD CUP, HL CRIMP W/ AMI MACRIMP

RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME
****
* WEIBULL SLOPE : 6.90
* CHARACTERISTIC LIFE : 1208.00

NO.	TIME	RELIABILITY(%)
1	500	99.7729

(NO CHG)
HEAD CUP, ANN: CRIMP II

RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME
****
* WEIBULL SLOPE : 3.50
* CHARACTERISTIC LIFE : 1469.00

NO.	TIME	RELIABILITY(%)
1	500	97.7258

HEAD CUP, ANN: CRIMP W/O.

(RECORDED PG 1)

IMPULSE SPEC FOR ES IS 70% REL. @ 90% CONF.

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

ESTIMATE AND [illegible] CONFIDENCE INTERVAL
OF [illegible] PERCENTAGE AREA = 100.20

[illegible]	:	70.00 %
[illegible]		90.00 %
[illegible]		99.90 %

TIME VALUES FOR SPECIFIED LEVELS OF RELIABILITY

= WEIBULL SLOPE [illegible]
CHARACTERISTIC LIFE = 341.27

NO.	RELIABILITY (%)	TIME
	90	209.4405

[redacted]

TI PART #	REPORT #	REPORT DATE	ADDENDUM	REPORT DATE
77PSL2-1	PS/91/49	9/20/91	PS/91/49-A	
77PSL2-1	PS/91/25	9/20/91	PS/91/49-A	
77PSL2-3	PS/91/48	9/20/91 (note: salt spray failures)	N/A	
77PSL3-1	PS/92/62	4/13/92		
	PS/92/82	8/17/92		
77PSL3-1	PS/92/62	4/13/92	PS/91/49-A	12/19/91
	PS/91/49	9/20/91		
77PSL3-3	PS/92/80	8/21/92	(-CA ADDENDUM)	
	PS/91/48	9/20/91	N/A	
	PS/92/82	8/17/92	N/A	
77PSL6-2	PS/92/80	8/12/92	N/A	
77PSL6-1	PS/93/32	5/3/93	purple o-ring)	
	PS/93/11	2/12/93		
77PSL3-2	PS/92/80	8/12/92	N/A	
77PSL3-2	PS/92/82	8/17/92	N/A	
77PSL3-3	PS/91/48	9/20/91	PS/92/90	
87PSL11-2	PWR STR'G	Mar-94	PS/93/84	

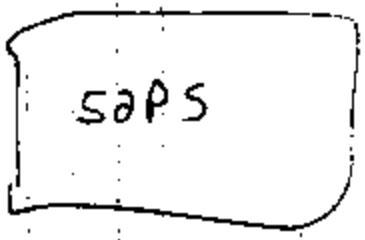
[redacted]

77PSL3-3	BRAKE	Jun-95	TEST GAP -!
87PSF3-3	PWR STR'G	Oct-95	
77PSL3-2	BRAKE	Jan-96	
87PSL2-2	PWR STR'G	Aug-96	
77PSL6-2	BRAKE	Aug-96	
77PSL2-1	BRAKE	Mar-97	
87PSL2-6	PWR STR'G	May-96	
87PSL2-5	PWR STR'G	Jun-96	

PC 088 Tester Strategy

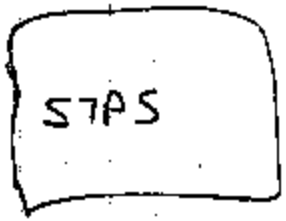
New Programs

* Chrysler MY95
* Honda MY95
* Teves MY?
* APB 90PS
* 82PS MY94.5
  - HPCO
  - DFPS



NOW: *52PS - All

Proposed Additions:
* APB 90PS
* 57PSL7-1 Chrysler
* 57PS - All
* 77PS - SNAP
* 87PS - All



NOW: *57PS - All
* 87PS - All
* 77PS - SNAP (unverified)

Proposed Additions:
* Honda 80PSL2-1
* Chrysler 57PSL7-1 (Done)
* 82PS - HPCO
  - DFPS
* 77PS Quiet
* 52PS - All

NOW: *57PSL - All
* 77PS - All
* 87PS - All

Proposed Additions:
* Teves Quiet Switch
*

TI-NHTSA 8209

FORD P/N: F2VC-9F924-AB

ACTUATION SPEC: 90-160 PSI N=294
RELEASE SPEC: 20 PSI MIN

ACT.	REL.	ACT.	REL.	ACT.	REL.	ACT.	REL.
145.1	59.8	142.9	48.6	138	46.9	144.7	56.4
138.5	48.8	133.7	61.7	140.8	55.6	141.8	57.1
134.4	58.5	142.2	51.4	129.4	51.4	146.2	54.5
135.6	48.2	140.4	50.7	136.2	47.4	135.5	54.4
140.6	53.2	139.8	55.4	151	53.7	143.2	49.6
141.9	51	141.9	52.2	140	49.3	139.3	49.6
143.8	64	137.8	51.8	141.8	54.7	139.9	60.7
133.9	52	132.5	50.7	139	50.4	135	54.1
141.1	52.1	132.5	54.8	141.5	56.8	145.2	50.1
140	53.8	139.2	49.8	130.6	52.3	139.9	61.8
129	45.9	140.1	49.8	137.4	49.3	143.4	50.2
137.4	54.3	144.4	57.8	133.2	64.7	142.1	54
142.8	52.4	141.1	53.9	136.1	55.9	138.2	57.2
135.6	59.2	147.2	55.7	137.2	47.9	150.5	54.6
150.7	46.6	136.1	49	144.9	50	144.6	59.1
133.6	46.7	139.9	55.4	138.4	51.4	137	50.6
140	51.9	137.7	52.3	147.6	56.7	138.2	53.3
142	45.4	139.6	59.7	145.1	54.6	140.1	52.7
141.5	48.6	134.2	53.9	139.2	51.6	141.5	55
138.4	45.8	136.2	57.7	139.3	49.9	131.9	54.9
130.1	55.1	152.6	53.3	136.7	47.6	146.4	52.5
134	48.5	136.7	52.6	142.5	61.4	141.3	57.9
144.6	47.7	140.7	59.2	140.8	47.9	136.5	55.7
136.5	51.2	139	44.6	142	50.5	145.7	55.6
147.9	58.1	141.8	57.1	135.7	56.5	140.9	54.6
137.9	59.3	139.6	52.3	140.8	54.9	146.6	49.5
135.5	53	135.3	51.8	142.6	49.7	139.5	47.6
132.9	54.1	148.1	58.8	140.8	59.1	134.1	45.5
139.8	47.8	147.1	55.3	135	57.7	140.5	54.1
141.2	50.1	136.6	55.2	146.4	53.3	133.8	55
137.8	56.5	139.8	59.1	141.6	50.1	139.8	47.7
140.6	48.5	131.2	53.1	139.3	51.8	138.9	55.1
135.4	59.1	134.8	50.1	136.7	51.1	138.8	52.5
140.9	51.9	139.3	44.8	147.9	52	134.6	57.6
156	57.4	138.4	54.9	140.8	49.1	141.7	59.6
142.1	58.2	145.9	56.7	129.4	54.1	140	50.1
133.1	47.5	142.9	51.8	147.1	49.3	149.1	55.9
136.5	55.2	139.1	50.7	144	53.9	132.7	53.1
140	54	143.8	53.6	138.1	51.4	140.2	51.1
140.3	42.8	145.1	50.1	133.5	48	137	60.9
139	56.1	131.9	51.6	136.9	54.2	135.2	55.5
133.6	50.4	140.1	55	139.5	47.7	126.4	61.2
135.4	55.1	139.9	55.3	142.6	50	145.6	52.2
142.9	58.1	140.9	50.5	140.6	54	142.2	60.3
145.9	57.2	143.6	55.8	127.6	45.1	140.9	53
140.7	50.3	145.4	47.8	137.9	51.1	134.3	59
141.1	54.1	137.7	45.1	136.8	58.4	135.7	54.7
135.2	47.4	139.2	55.3	133.9	56.7	148	49.4
144.9	49	142.1	56	132.6	52.9	137.1	59
136.6	59.6	139.5	46.7	143.6	45	132.4	52.9

149	52	138.2	48.4	139.2	53.2	142.4	55.6
146.6	49.2	130.1	48.4	137.2	56.5	142.9	53.8
*162.1	57.8	139	48.4	144	60.9	138.6	52
149.6	56	141.1	55.7	143.6	55	144.9	57.7
128.9	50.1	138.3	54.6	141.2	49.9	140.7	52.5
144.3	62.5	137.9	55.2	142.6	50.8	144.8	48.2
140.2	46.8	134.6	57.4	142.9	47.8	144.6	52.8
145.3	56.9	136.3	50.2	139.3	43.4	139.9	54.7
138.8	50.4	139.9	56.2	146.9	52.5	136.5	51.2
135.5	52.7	147	53.1	142.1	55.3	149.1	50.2
142.9	52.7	141.8	59.5	143.6	49.2	145.4	60.6
136.4	59	135	43.9	140.9	47.9	135.1	46.2
127.9	51.4	134.7	60.8	144.8	53.9	141.2	61.7
138	53.6	139.8	50.9	138.7	51.9	139.1	53.9
138.7	51.1	143.5	56.7	135.6	54.1	140.4	53.9
138.8	49	133.4	56.4	139.7	52.8	135.6	52.9
137.6	53.3	136.7	48.9	139.7	53	130.2	50.5
143.1	55.6	138.5	48.9	145.3	54.6	149	55.8
141.3	51.1	138.1	57.8	144.8	56.4	138.2	45
141.8	48.7	140.7	50.7	144	51.1	133.2	52.4
145.8	59.4	143.9	47.3	145	49.6	136.7	49.2

* DENOTES HIGH ACTUATION DEVICE: THE AUTO PRESSURE TESTER REJECTED THIS PIECE

FORD P/N: F2VC-9F924-AB

ACTUATION SPEC: 90-160 PSI N=294
RELEASE SPEC: 20 PSI MIN

ACT.	REL.	ACT.	REL.	ACT.	REL.	ACT.	REL.
145.1	59.8	142.9	48.6	138	46.9	144.7	56.4
139.5	48.8	139.7	61.7	140.8	55.6	141.8	57.1
134.4	53.5	142.2	51.4	129.4	51.4	146.2	54.5
135.6	49.2	140.4	50.7	136.2	47.4	135.5	54.4
140.6	53.2	139.8	55.4	151	53.7	143.2	49.6
141.9	51	141.9	52.2	140	49.3	139.3	49.6
143.8	64	137.6	51.8	141.8	54.7	139.9	60.7
139.9	52	132.5	50.7	139	50.4	135	54.1
141.1	52.1	132.5	54.8	141.5	56.8	145.2	50.1
140	53.8	139.2	49.8	130.6	52.3	139.9	61.8
129	45.9	140.1	49.8	137.4	49.3	143.4	50.2
137.4	54.3	144.4	57.8	133.2	64.7	142.1	54
142.8	52.4	141.1	53.9	136.1	55.9	138.2	57.2
135.4	59.2	147.2	55.7	137.2	47.9	150.5	54.6
150.7	46.6	136.1	49	144.9	50	144.6	59.1
138.5	48.7	139.9	55.4	138.9	51.6	137	50.6
143	51.7	137.7	52.3	147.6	56.7	138.2	53.7
142	43.6	138.4	39.7	145.1	54.6	140.1	51.7
140.8	48.6	134.2	53.8	139.2	53.6	141.5	56
133.4	49.3	136.6	57.7	139.9	48.9	141.4	54.5
135.1	59.2	150.4	53.3	136.7	47.8	146.4	51.9
134	49.8	136.7	52.5	148.5	51.4	141.3	57.9
145.5	47.7	140.2	59.2	141.6	48.9	138.2	59.
136.5	51.2	139	44.6	142	50.5	145.7	45.1
137.8	54.1	141.8	57.2	135.9	58.5	140.5	54.6
131.1	52.3	139.6	49.9	140.5	56.9	145.4	48.7
150.5	53	135.9	51.8	142.6	49.7	138.5	47.6
139.8	54.1	148.1	58.8	140.3	59.1	134.1	49.5
139.3	47.5	147.1	55.2	136	57.7	140.5	54.1
142.2	50.1	136.6	55.2	144.4	53.3	133.3	55
137.8	58.5	133.3	58.1	141.6	55.1	139.8	47.7
140.6	48.5	131.2	58.1	139.3	51.3	138.9	55.1
135.4	59.1	136.8	50.7	136.7	51.1	138.8	52.5
140.9	51.9	138.3	56.3	147.9	52	134.6	57.2
153	57.4	132.4	54.9	140.6	49.1	141.7	58.9
142.1	58.2	145.9	56.7	129.4	54.1	140	50.1
138.3	47.3	142.9	51.8	147.1	48.8	144.1	50.9
128.8	59.2	139.1	50.7	144	58.9	142.7	52.1
140	54	143.6	54.4	139.1	51.4	140.2	57.1
140.1	52.3	145.1	50.1	132.8	48	137	50.1
139	58.1	134.9	51.6	146.9	54.2	139.2	51.5
133.6	50.4	140.1	52	139.3	47.7	134.6	54.1
135.8	55.3	139.5	56.5	142.6	54	145.4	49.9
136.2	56.1	140.9	50.9	150.3	54	142.3	48.6
144.7	47.2	143.6	48.6	137.8	50.3	140.9	51
140.7	50.3	148.9	47.5	141.9	51.9	134.3	53
141.7	54.9	137.7	44.4	136.8	58.1	135.2	54.7

137.2	45.4	139.2	53.8	142.9	56.7	148	49.4
134.7	53	142.1	56	132.5	52.3	137.1	59
136.6	59.8	139.3	46.7	133.6	45	132.2	52.9
143	52	138.2	48.4	139.2	53.2	142.4	55.6
146.6	49.2	130.1	48.4	137.2	56.5	142.9	53.8
*162.1	57.8	138	48.4	144	60.9	138.6	52
140.6	56	141.1	55.7	143.6	55	144.9	57.7
128.9	50.1	138.3	54.6	141.2	49.9	140.7	52.5
144.3	62.5	137.9	58.2	142.6	50.8	144.8	48.2
140.2	46.8	134.6	57.4	142.3	47.8	144.8	52.8
145.3	56.9	136.3	50.2	139.3	43.4	139.9	54.7
138.8	50.4	139.9	56.2	146.9	52.5	136.5	51.2
135.5	52.7	147	53.1	142.1	55.3	149.1	50.2
142.9	52.7	141.8	59.5	143.6	49.2	145.4	60.8
136.4	59	135	43.9	140.3	47.9	135.1	46.2
127.9	51.4	134.7	60.8	144.8	53.9	141.2	61.7
138	53.6	139.8	50.9	138.7	51.9	139.1	53.9
138.7	51.1	143.5	56.7	135.6	54.1	140.4	53.9
138.8	49	133.4	56.4	139.7	52.8	135.6	52.9
137.6	53.3	136.7	48.9	139.7	59	130.2	50.5
143.1	55.6	138.5	48.9	145.3	54.6	149	55.8
141.3	51.1	138.1	57.8	144.8	56.4	138.2	45
141.8	48.7	140.7	50.7	144	51.1	133.2	53.4
140.9	59.4	143.9	47.2	145	49.6	134.7	49.2

* DENOTES HIGH ACTUATION DEVICE; THE AUTO PRESSURE TESTER REJECTED THIS PEDAL.

77 PSL2-1 #21-300 File — 77 DATA —

Act	Rel
145.1	59.8
138.5	48.8
134.4	53.5
135.6	48.2
140.6	53.2
141.9	51.0
143.8	64.0
133.9	52.0
141.1	52.1
140.0	53.8
129.0	45.9
137.4	54.3
142.8	52.4
135.6	59.2
150.7	46.6
133.6	48.7
140.0	51.7
> 142.0	45.6
141.8	48.6
20 > 132.4	49.8
135.1	53.2
134.0	48.5
144.6	47.7
138.5	52.2
147.9	58.1
137.8	59.3
135.5	58.0
139.8	54.1
139.3	47.8
142.2	50.1
137.8	58.5
140.6	48.5
135.4	59.1
140.9	51.9
153.0	57.4
> 142.1	58.2
133.3	47.3
38 > 138.5	59.2

Act	Rel
140.0	54.0
140.3	42.8
139.0	58.1
133.6	50.4
135.6	55.1
132.9	58.1
145.7	57.2
140.7	50.3
141.7	54.2
137.2	45.4
134.7	53.0
136.6	59.8
143.0	52.0
146.6	49.2
#9 * 162.1	57.8
140.6	56.0
128.9	50.1
144.3	62.5
140.2	46.8
145.3	56.9
138.8	50.4
135.5	52.7
142.9	52.7
136.4	59.0
127.9	51.4
138.0	53.6
138.7	51.1
138.8	49.0
137.6	53.3
143.1	55.6
141.3	51.1
70 141.8	48.7
142.9	48.6
133.7	61.7
142.2	51.4
140.4	50.7
139.8	55.4
141.9	52.2

Act	Rel
137.8	51.8
132.5	50.7
132.5	54.8
139.2	49.8
140.1	49.8
144.4	57.8
141.1	53.9
147.2	55.7
136.1	49.0
139.9	55.4
137.7	52.3
133.6	39.7
134.2	53.8
136.8	57.7
153.4	53.3
136.7	52.6
140.7	59.2
139.0	44.6
141.8	57.2
139.6	49.5
135.3	51.8
148.1	58.8
147.1	55.2
136.6	55.2
133.3	53.1
131.2	53.1
136.8	50.1
138.3	66.8
138.4	54.9
145.9	56.7
142.9	51.8
139.1	50.7
143.8	53.4
145.1	50.1
131.9	51.6
140.1	53.0
139.8	53.3
140.9	50.9

ACT	REL
143.6	55.8
143.9	47.8
137.7	45.2
139.2	53.8
142.1	56.0
139.3	46.7
138.2	48.4
130.1	48.4
138.0	48.4
141.1	55.7
138.3	54.6
137.9	55.2
134.6	57.4
136.3	50.8
139.9	56.2
147.0	53.1
141.8	59.5
135.0	43.9
134.7	60.8
139.8	50.9
143.5	56.7
133.4	56.4
136.7	48.9
138.5	48.9
138.1	57.8
(140) 140.7	50.7
138.0	46.9
140.8	55.6
129.4	51.4
136.2	47.4
151.0	53.7
140.0	49.3
141.8	54.7
139.0	50.5
141.5	56.8
130.6	52.3
137.4	49.3
133.2	64.7

ACT	REL
136.1	55.9
137.2	47.9
144.9	50.0
138.4	51.6
147.6	56.7
145.1	54.6
139.2	51.6
139.3	48.9
136.7	47.8
143.5	61.4
140.6	48.9
142.0	50.5
135.9	54.5
140.8	56.9
142.6	49.7
140.8	59.1
136.0	57.7
144.4	53.3
141.8	55.1
139.3	51.3
136.7	51.1
147.9	52.0
140.8	49.1
129.4	54.1
147.1	49.3
144.0	53.9
138.1	51.4
133.5	48.0
136.9	54.2
139.5	47.7
142.6	56.0
150.3	54.0
137.8	55.3
141.9	51.3
136.8	58.4
142.9	56.7
132.5	52.3
133.6	45.0

ACT	REL
139.2	53.2
137.2	56.5
144.6	60.9
143.6	55.0
141.2	49.9
142.6	50.8
142.3	47.8
139.3	43.4
146.9	52.5
142.1	55.3
143.6	49.2
140.3	47.9
144.8	53.9
138.7	51.9
135.6	54.1
139.7	52.8
139.7	53.0
145.3	54.6
144.8	56.4
(210) 144.0	51.1
144.7	56.4
141.8	57.1
146.8	54.5
135.5	54.4
143.2	49.6
139.3	49.6
139.9	60.7
135.0	54.1
145.2	50.1
139.9	61.8
143.4	50.2
142.1	54.0
138.2	57.2
150.5	54.6
144.6	59.1
137.0	50.6
138.2	53.3
140.1	52.7

ACT	Rel
141.5	56.0
131.9	54.9
146.4	52.5
141.3	57.9
136.5	55.7
145.7	55.6
140.8	54.6
146.4	49.9
138.5	47.6
134.1	45.5
140.5	54.1
133.3	55.0
139.8	47.7
138.9	55.1
138.8	52.5
134.6	57.6
141.7	59.8
140.0	50.1
149.1	55.9
132.7	53.1
140.2	51.1
137.0	60.5
139.2	58.5
136.4	61.2
145.4	52.2
142.2	60.3
140.9	53.0
134.3	59.0
135.3	51.7
148.0	49.4
137.1	59.0
132.2	52.9
142.4	55.6
142.9	53.8
138.6	52.0
144.9	57.7
140.7	52.5
144.8	48.2

ACT	Rel
144.8	52.8
139.9	54.7
136.5	51.2
149.1	50.2
145.4	60.8
135.1	46.2
141.2	61.7
139.1	53.9
140.4	53.9
135.6	52.9
130.2	50.5
149.0	55.8
138.2	45.0
133.2	52.4
145.8	59.4
143.9	47.3
145.0	49.6
136.7	49.2

284

38
7
266
+ 18
284
+ 20 (SENT 11.18)
30 + Dummies
1 HH
299

1 HH

yield
98.34

A1 .. 485

*

Low gage

min pre load = min pin - max bore - max sensor
= .1425 - .088 - (.0465 + 3x.0002)
= .0074

max pre load = max pin - min bore - min sensor
= .1435 - .086 - (.046 - 3x.0002)
= .0121

⇒ .00975 ± .00235

High gage

min pre load = .1445 - .090 - (.0465 + 3x.0002)
= .0074

max pre load = .1455 - .088 - (.046 - 3x.0002)
= .0121

∴ Lot U preload - .0074/.0121

① Assume .0074 pre load

Temp Shift in bore at 150°C = -.005
⇒ effective preload = .0024
From Curve pressure = 192

Temp Shift in bore at -40°C = +.002
⇒ effective pre load = .0054
From Curve pressure 290

② Assume .0121 preload

Temp Shift of bare at 150°C = -.005

⇒ Effective preload = .0071

From Curve, pressure = 250

Temp Shift of bare at -40°C = +.002

⇒ Effective preload = .0141

From Curve, pressure = 315

Summary for Lot U

No Temp Effect

Min preload = .0074, pressure = 255

Max preload = .0121, pressure = 295

At 150°C

Effective Min preload = .0024, pressure = 185

At -40°C

Effective Max preload = .0141, pressure = 315

Customer Spec = 200 - 300 psi

To meet Customer spec

Effective Min preload = .0036

Effective Max preload = .0128

⇒ Min preload = .0036 + .005 = .0086

Max preload = .0128 - .002 = .0108

Quiet L3-3 | Lot U | 6

Min preload: .0086
max preload: .0108

Required preload - .0097 ± .0011
Current preload: .00975 ± .00235

TEXAS INSTRUMENTS

TO: JOE JORDAN

FR: CHARLIE DOUGLAS

SJ: FORD SPEED CONTROL DEACTIVATION SWITCH

JOE, THIS IS TO CONFIRM THAT OUR PRESSURE SWITCH WILL CONFORM TO FORD ENGINEERING SPECIFICATION # ES-FQVC-9F924-AA, 30" THE AP PANEL OR VEHICLE OF THE SWITCH WILL BE TESTED TO THE SPEC.

REGARDS CHARLIE

TEXAS INSTRUMENTS INCORPORATED • 34 FOREST STREET • ATTLEBORO, MA 02703
508-699-3800 • TELEX 710601 • CABLE TEXINS

Purity to tag 77 pkgs. prior to shipment first time only

?? QC: pilot samples & final minutes
* → need char. sheet

Addendum to ISC

L/T — P/S

tab dim. — tab dim & PTAC data

* 2 from ea. cavity per device

** submit ilaser

??? Pressured Kapton - seen this before

K-H for Audit (THEY WENT 12, 13, M) Jim re: Dick C. to coordinate?
NOV WE WENT 18, 19, 20

The third Kapton station continues to be problematic; a sensor built for design engineering evaluation was found to have an undersized 3rd diaphragm. The condition is likely due to a misfeed; we need to understand why the sense station is not detecting this.

* CORRECTIVE ACTION FOR KAPTON MISFEED	SELLERS/ KOURTESIS	10/24	
* CALL MTG. TO REVIEW AMI#2 UPGRADE PLANS	KADISEV./ KOURTESIS	10/24	

Base Assembly Machine:

The EA equipment is compressing the thickness of the arm at the bend station, which is an unacceptable condition and needs to be addressed immediately. In general, the EA equipment needs to get a higher priority to get completed, as we're beginning production this week!

* PRIORITIZE WORK ON THE BEND STATION TO ADDRESS THE COMPRESSED THICKNESS	KOURTESIS	10/21	
* PUT PERMANENT CORRECTIONS IN PLACE FOR THE EA EQUIPMENT (e.g., ELIMINATE THE TEMPORARY SHIMS BY FIXING TOOLING MODS., ETC.)	KOURTESIS	10/24	

Final Assembly Machine:

Misc. Manufacturing/QC Equipment:
---

* MAKE QC P-TESTER COMPAT. W/77'S	KOURTESIS	10/10	ORIG.
		10/24	REV.

PV Testing/ISR:

The re-submittal date has been set by the team for 12/20 (delivery). The team has developed a plan for corrective actions to be completed by 10/31/91.

213 P/C switches were shipped to Pitts for their ISR work; the balance will be shipped next week.

* MODIFY BASE MOLD - second iteration	SELLERS	10/14	ORIG.
		10/16	COMP.
* BUILD 300 L2-1'S FOR PITTS FOR THEIR ISR (W/CORRECTED BASES)	BURKE/ SELLERS	10/04	ORIG.
		10/24	REV.
* RECORD PIPC DATA FROM 300 SWITCH LOT	RODRIGUEZ/ ROSE	10/11	ORIG.
		10/24	REV.
(Waiting for balance of order to be made)			
* SUBMIT ADDENDUM TO ISR'S W/CORRECTED BASE DIMENSION - L/T AND P/C (INCLUDE PIST/PIPC DATA FOR P/C)	WATT	10/18	ORIG.
		10/25	REV.
* COMPLETE FAI ON P/C SWITCHES	ROSE	10/31	
. BEGIN RE-VALIDATION OF P/C SWITCH	OFFILER	11/01	
. COMPLETE PV TESTING & REPORT	OFFILER	12/20	

Diaphragm Life:

Impulse testing of the test lots AMI-crimped at various cylinder

pressures has thus far been inconclusive. Each of the 6 lots showed at least 1 failure prior to 500K cycles. All lots were built with the "0-cut" washers. Follow up testing with varied washers is underway. We plan also to swap the AMI and H-L crimp dies and evaluate.

* REPORT ON TESTING OF WASHER LOTS	OFFILER	ONGOING
* SWAP AMI AND H-L CRIMP DIES AND GIVE SENSORS TO DESIGN FOR EVALUATION	SELLERS/ RODRIGUEZ	10/22
* IMPLEMENT SOLUTION TO DIAPHRAGM LIFE	OFFILER	10/31

Miscellaneous:

John Pelkey of L/T has verbally agreed to the 3A post-plate PD; precedence was set by threaded plugs that they purchase from another supplier. Elco, however, has not been able to demonstrate capability to the 3A tolerance after plating to .0003" min.. I've reviewed the issue with Ron Williams (ELCO Q.C. manager) and will update the team at the next meeting.

. IDENTIFY SWITCH MOUNTING LOCATIONS & SIZE REQMTS FOR FUTURE PLATFORMS	SCHUCK	10/10 10/17	ORIG. REV.
. 57 TO 77 CONVERSION: PHASE 1 TESTING	HOMOL	on hold	
. COMPLETE DESIGN FMEA	OFFILER	04/18 10/31	ORIG. REV.
. COMPLETE PROCESS FMEA	SELLERS	07/01 10/31	ORIG. REV.
* P/U WITH JOHN PELKEY	CZARN	10/10 10/17 10/17	ORIG. REV. COMP.
* DETERMINE APPROACH FOR 2A/3A THREAD GAGING ISSUE	CZARN/ MCGUIRK	10/03 10/24	ORIG. REV.

PRODUCTION PLAN BY MONTH (THOUSANDS)

We have 77 P/C releases from Dana (MY92.5 Tier 1) for 15K switches in November and 10K in December. We will continue to provide 57 P/C switches to Pitts (MY92 Tier 1) until we exhaust our inventory of approximately 17K bases; probably through November. We've reached an agreement with Ford B&A to accept their last shipment of 57's on 10/21, meaning that the first production shipment of 77's will be on 10/28. 77 L/T volume is 3K/week through November, and 8K total for the month of December.

	P/C 57PSL5-3	L/T 57PSL5-2	P/C 77PSL2-1	L/T 77PSL2-3
AUG	0	2.3	0	0
SEP	25	9.3	0	0
OCT	17	7	0	3
NOV	0	0	15	13
DEC	0	0	10 min.	8

MILESTONES	PLANNED	ACTUAL
57 L/T ISIR	11/21/90	11/21/90
57 P/C ISIR	01/15/91	01/15/91
77PS ISIR	09/01/91 ORIG.	
	09/20/91 REV.	09/27 - INITIAL

TEXAS INSTRUMENTS, INC. ISIR SUBMISSION
TO PITTS INDUSTRIES
FOR PART NUMBER F2VC-9F924-AB

TEXAS INSTRUMENTS, INC. ISIR SUBMISSION
TO PITTS INDUSTRIES
FOR PART NUMBER F2VC-9F924-AB (77PSL2-1)

		* L2-1			Quiet Disc L3-1			L5-2						
1	BASE	46515-2			46515-3			46515-3						
2	Sta. Term.	36888-1			36888-1			36888-1						
3	Move-Contact	74408-1			74408-1			74408-1						
4	Rivet	74171-1	✓		74916-1	N/A		74916-1	N/A					
5	Move. Term.	36887-1			36887-1			36887-1						
6	Spring Arm	36889-1			36889-1			36889-1						
7	Spr. Mat'l	27716-1			27716-1			27716-1						
8	JS12 Hexport	36900-1	✓	*	36900-1			36997-1	snubber					
9	Gasket	74353-1	✓		74353-1			74353-1						
10	Cup	27713-1	✓		27713-1			27713-1						
11	Seal	74176-1			74176-1			74176-1						
12	Kapton Strip	27225-1			27225-1			27225-1						
13	Washer	27639-1	✓		27639-1			27639-1						
14	Converter	27406-1	✓		27406-1			27406-1						
15	Spacer	73958-2/-3	✓		73958-2/-3			73958-2/-3						
16	Kapton Tape	74224-1	✓		74224-1			74224-1						
17	Cr. Ring	74797-1	✓		74797-1			74797-1						
18	Trunnion Pin	74078-xx	✓		74078-xx			74078-1						
19	Envio. Seal	74247-4	✓		74247-4			74247-4						
20														
21														
22														
23														
24														
25														
26														
27														
28														

OPERATING UNIT: PREPARED BY: DATE:

TI-NHTBA 8225

#36900

O&K COMPANY LIMITED

Type & Grade SC-4345 AISI10L10 SAE

G.C.A 9341-5
S.O # 14255

1. Specification

	Heat No.	Coil No.	C %×100	Mn %×100	Si %×100	P %×1000	S %×1000	Cu %×100	Ni %×100	Cr %×100	Mo %×100	B %×1000000
Chemical Composition Of Steel	D06703	0021 – 0022	10	42	7	5	21	1	1	2		PB %X100 25

	Nominal Diameter		Tolerance of Diameter		Tensile Strength		Decarburization	
	in	mm	in	mm	1,000 psi	kg/mm²	Dm-T	Dm-F
Physical Properties	0.565	14.351	+ 0.0040	+ 0.1016	68.9 MAX	48.5 MAX		MAX

	Coil Weight	
Packing	ABT. 2,142LBS (ABT. 970KGS)	
	WRAPPED WITH POLYPROPYLENE SHEET.	

2. Test Results

Sample No.	Diameter mm	Tensile Strength Kg/mm²	Tensile Strength 1,000psi	Sample No.	Diameter mm	Tensile Strength Kg/mm²	Tensile Strength 1,000psi
0021	14.43	33.3	47.4				
0022	14.39	33.4	47.5				

TI-NHTSA 8226

PIST

77RSL3-1

FAI pg.# 1 17X6 = 102

2 14X6 = 84 + 3 = 87

3 23X6 = 138

327

	FAI	327
	PIPC	600
	MAT. AVAIL.	18
guest aur.	ES TESTS:	888
		1833

QUIET Switch:

NOISE CHECK!

$12 = 6^{x2}$ ea $\begin{matrix} LS\text{-}1 \\ LS\text{-}2 \end{matrix}$

#27639

R

TOLLWAY STEEL CORPORATION
25th Ave. & Main St.
Melrose Park, IL 60160
Phone (708) 681-9190

Customer DIEMASTERS MFG.

ANALYSIS REPORT

ITEM #	ORDER #	PART #	SIZE	GRADE	TEMPER
1.	013652	CR09SAD 1375C	.0985 x 1.375 x c1	C1050	ANNLD
2.			QUALITY CONTROL		
3.			APR 30 1992		

ITEM #	ID#	C	Mn	P	S	Si	Ni	Cr	Al
1.	664332 -	.51	.69	.013	.002	.27			
2.									
3.									

ITEM #	ROCKWELL	TENSILE	YIELD	ELONGATION	OTHER
1.	RB 78				
2.					
3.					

CERTIFIED BY: Thomas E Bulman
THOMAS BULMAN

TEXAS INSP.
27639-1

n/c

__ Quotation Level __ Initial Production Level

HILITE INDUSTRIES INC.

HILITE MANUFACTURING FEASIBILITY SIGN-OFF

SUPPLIER TEXAS INSTRUMENTS INC.
CUSTOMER [redacted]
PART NUMBER & REVISION 82VC-09924-AB
CUSTOMER PART NUMBER & REVISION 777618-1

DEFINITION:
Manufacturing Feasibility is the mutual agreement between product engineering, manufacturing, the supplier, and assembly activities that a proposed design can be manufactured, assembled, packaged and shipped at an acceptable level. A feasible design must permit meeting production volumes and schedules, consistent with the ability to meet engineering requirements and program quality, reliability, investment cost, unit cost and timing objectives.

FEASIBILITY CONSIDERATIONS:
The following list, not intended to be inclusive, identifies major questions which should be considered in performing a feasibility evaluation. The data provided in this request should be used as a basis for analyzing your ability to meet all the specified requirements. Negative answers to the questions must be supported by comments identifying your concerns and/or proposed changes to enable you to meet the specified requirements. Comments, as appropriate, may also be requested on other pertinent considerations not mentioned below. If you require additional space for comments, use an attachment to the form.

YES	NO	CONSIDERATIONS
✓		Can the part be manufactured as specified on the attached drawings? . Compatibility of specifications to accepted manufacturing standards . Containability of tolerance stack-up. . Special equipment requirements. . Adequacy of part definition to enable feasibility evaluations.
✓		Can you meet the Engineering Specification (ES) as written? . Containability of all ES requirements.
✓		Can you meet the quality control requirements of Q-101? . Establishment of process capability at required volume levels. . Maintenance of required quality system controls.
✓		Can you meet all specified requirements at the projected volume levels? . Adequacy of capacity.
✓		Does the design allow use of conventional efficient material handling equipment techniques? . Attainability of shipping densities.
✓		Can the part be manufactured without incurring any unusual costs (capital equipment, tooling or piece costs)? . Product improvement proposals. . Cost reduction alternatives.
✓		Can you maintain production capacity on the related part until incorporation of new/ revised design (for current suppliers only)?

FEASIBILITY ASSESSMENT:

__ Feasible – Part can be produced as specified with no revisions.
__ Changes Required – Design revision required to produce part within the specified requirements.
✓ Changes Recommended – Feasible but can be improved or less costly if proposed revision is incorporated. Note change revision reverse side.

Notes

- Rivet mod's. ⇒ if rivet feeding proves to be a problem
  - larger head ø
  - square under head ⟸ ⇒ (Stunging)
  - longer shank (?)

77PSL/51PSL line loads CY92

	J	F	M	2Q92	3Q92	4Q92
77PS L2-1	28.4	30.4	30.4	77.8	74.9	76.8
L2-3	8.0	9.1	9.1	25.1	106.4	35.[illegible]
57L's				288.3	255.3	330.4
Total	36.4	39.5	39.5	391.2	436.6	442.4

[redacted]

Summary

- W/ Dave Perzichi input, we couldn't conclude that riveting was really a problem in recent past.
- John K will assign mech. technician to the line starting 1/2; assignment is to document problems, fix what he can, report to John & Steve each day

Summary

- Ramp up from 3k/mo to 5k/mo. for 1st 2 wks of January; ramp up to 7-10k/mo. will depend on Thor results.

  target is 27.5k/mo for 3Q & 4Q 92 projected volumes.

- agreed to continue to procure welded arm. John / Steve will put together a rough timing schedule for implementation

- Matt will determine if we need to add vane tumbling requirement to rivet print. Rivets are vane tumbled by Milford, but not called out [redacted] print, so it's not checked when we rec[redacted]. One lot of rivets was received recently [redacted] sequencing - and maybe (?) without vane - and they did not feed well.

- log book @ Easton equipment → will be added immediately

Dupont Plastics

AUTO SENSOR & SOLENOID APPLICATION TEAM FORMED TO ....

- BETTER UNDERSTAND COMPONENT FUNCTION & REQUIREMENTS TO BETTER GUIDE MANUFACTURERS IN MATERIAL SELECTION AND PART DEVELOPMENT
- DEVELOP AND FORMULATE IMPROVED RESINS FOR APPLICATION
- DEVELOP PROCESSING AND DESIGN EXPERTISE SPECIFIC TO SENSORS AND SOLENOIDS
- DEVELOP KNOWLEDGE BASE THAT HELPS CUSTOMER TO SHORTEN DEVELOPMENT TIME AND REDUCE DEVELOPMENT COSTS
- MAKE DU PONT THE PREFERRED RESIN SUPPLIER AND DEVELOPMENT PARTNER FOR SENSOR/SOLENOID MANUFACTURERS

AUTO SENSOR MARKET

MARKET GROWTH	**10 - 15 % PER YR**
AVERAGE COST PER SENSOR	**$ 3 - $ 6**
AVERAGE RESIN CONTENT PER SENSOR	**20 - 60 GRAMS**
AVERAGE RESIN COST PER SENSOR	**$ 0.20 - $ 0.40**
	(5 % - 15 %)

10 sensors/car

KEY ACCOUNTS IN SEGMENT

System Suppliers

Delphi E&E
Visteon
Siemens
LucasVarity-Kelsey-Hayes
Bosch
Denso
ITT Automotive
Breed

Component Suppliers

Hi-Stat
Texas Instruments
Motorola
CTS Corp.
Wabash Magnetics
Philips Technologies
SSI Technologies
Motorola
Honeywell Microswitch
Accutex

Custom Molders

Baker Electric (GP/ Hay)
Syncro (Toney)
PNC (Solenberger)
Thermotec (Treff)
Multicraft (Boyer)
Fasco (Tobar)
Huron Plastics (Fisher)
UFE (Treff)
ATS (Canada)
ITW Insert Molded (Al-Aseer)

RESIN REQUIREMENTS UNIQUE TO SENSORS

- THERMAL CYCLING DURABILITY
- PREVENTING FLUID INTRUSION - LEAKAGE
- ADHESION BETWEEN PREMOLD AND OVERMOLD
- ADHESION TO POTTING COMPOUND OR GASKET MATERIALS
- KNIT LINE STRENGTH
- LOW PRESSURE MOLDING
- DIMENSIONAL STABILITY OVER WIDE TEMPERATURE RANGE
- INSERT LOADING AND CAPTURING
- RETRACTABLE PIN TECHNIQUES

DU PONT TECHNOLOGY AND RESOURCES FOR SENSORS

RESIN DEVELOPMENT AND SELECTION - FIRST SUPPLIER TO DEVELOP AND FOCUS EXCLUSIVELY ON SENSOR APPLICATION MATERIALS

- HIGH FLOW
- WIRE FRIENDLY (COPPER WIRE CORROSION)
- LOW PRESSURE MOLDING
- IMPROVED ADHESION TO INSERTS

PROCESSING TECHNIQUES

- OVERMOLDING / INSERT MOLDING GUIDELINES
- OPTIMIZING MOLDING CONDITIONS AND EQUIPMENT TO REDUCE DOWN TIME AND SCRAP
- MOLDING CONDITIONS TO MINIMIZE INSERT MOVEMENT

DESIGN PRINCIPLES

- GUIDELINES FOR OPTIMUM DIMENSIONAL STABILITY AND PART PERFORMANCE
- INCORPORATE PART FEATURES THAT OPTIMIZE MOLDABILITY
- CONCEPTS AND RECOMMENDATIONS FOR PART INTEGRATION
- FINITE ELEMENT ANALYSIS TO PREDICT INSERT MOVEMENT

TOOL DESIGN

- IN-HOUSE PROTOTYPING TO DEMONSTRATE TECHNIQUES AND RESINS
- DESIGN GUIDELINES TO INSURE OPTIMUM RESIN FLOW IN MOLD
- GUIDELINES ON SPECIAL FEATURES SUCH AS RETRACTABLE PINS, CORE DESIGN AND INSERT PLACEMENT

Wire Friendly & High Flow Sensor Resins

Zytel® FE5382 BK276 - 33%gr 6,12 w/ organic stabilizer & carbon black ("wire friendly")

Zytel® FE5355 BK031 - 33%gr 6,12 w/ HS and dye

Zytel® FE5389 BK276 - 33%gr 6,6 w/ organic stabilizer and carbon black ("wire friendly")

Zytel® FE5406 BK276 - 33%gr 6,6 w/ HS and carbon black

Zytel® FE5414 BK276 - 13%gr high flow 6,6 nylon w/HS and carbon black

Rynite® RE5231 BK533 - 35% glass/mica, high flow PET

Crastin® HR5015 & HR5030 - 15% gr PBT modified for improved hydrolysis resistance and high flow

Zytel® HTN 51G35 HSL - 35% gr high temperature nylon

Zenite® 6130 - 30% gr liquid crystal polymer

TWO VISIONS OF RESIN SUPPLIER AND THEIR CONSEQUENCES

TREAT RESIN AS COMMODITY AND DO TROUBLESHOOTING - REACTIVE

VERSUS

WORK CLOSELY WITH OEM AND MOLDER DURING ALL PHASES - PROACTIVE

- **RESIN SELECTED BASED ON COST OR PRIOR EXPERIENCE LEADING TO WRONG CHOICE**
- **TIME AND RESOURCES EXPENDED TO EVALUATE MANY RESINS**
- **PART DESIGN DOES NOT TAKE INTO ACCOUNT RESIN CHARACTERISTICS, HANDLING OR MOLDABILITY**
- **DITTO WITH MOLD DESIGN**
- **END USE TESTING RESULTS IN PART FAILURES DUE TO RESIN DEFICIENCIES**
- **IMPROPERLY SIZED MOLDING MACHINE, INJECTION UNIT, OR SCREW**
- **IMPROPER TYPE OF HOT RUNNER SYSTEM, COOLING LINE LAYOUT, RUNNER AND GATE DESIGN, VENTING, ETC**
- **PRODUCTION MOLDING SET UP GIVES OUT OF SPEC PARTS DUE TO DIFFERENCES WITH PROTOTYPE MOLD**
- **PRODUCTION PARTS INCONSISTENT BECAUSE PROCESSING WINDOW VERY NARROW OR EQUIPMENT IS INAPPROPRIATE**

HUNDREDS OF THOUSANDS OF DOLLARS ARE LOST THIS WAY EVERY YEAR !!

TEXAS INSTRUMENTS, INC. ISIR SUBMISSION
TO PITTS INDUSTRIES
FOR PART NUMBER F2VC-9F924-AB

TEXAS INSTRUMENTS, INC. ISIR SUBMISSION
TO PITTS INDUSTRIES
FOR PART NUMBER F2VC-9F924-AB (77PSL2-1)

ISIR Submission
Pitts Industries
P/N F2VC-9F924-AB
Next Generation Speed Control Deactivation Switch
(77PSL2-1)

		*			Quiet Disc									
		L2-1			L3-1			L5-2						
1	BASE	46515-2			46515-3			46515-3						
2	Sta. Team.	36888-1			36888-1			36888-1						
3	Move. Contact	74408-1			74408-1			74408-1						
4	Rivet	74171-1	✓		74916-1	N/A		74916-1	N/A					
5	Move. Team.	36887-1			36887-1			36887-1						
6	Spring Arm	36889-1			36889-1			36889-1						
7	Spr. Mat'l.	27716-1			27716-1			27716-1						
8	JS12 Hexport	36908-1	✓	*	36900-1			36997-1	snubber					
9	Gasket	74353-1	✓		74353-1			74353-1						
10	Cup	27713-1	✓		27713-1			27713-1						
11	Seal	74176-1			74176-1			74176-1						
12	Kapton Strip	27225-1			27225-1			27225-1						
13	Washer	27639-1	✓		27639-1			27639-1						
14	Connector	27406-1	✓		27406-1			27406-1						
15	Spacer	73958-2/-3	✓		73958-2/-3			73958-2/-3						
16	Kapton Tape	74224-1	✓		74224-1			74224-1						
17	Ce. Ring	74797-1	✓		74797-1			74797-1						
18	Transfer Pin	74078-XX	✓		74078-XX			74078-1						
19	Envir. Seal	74247-4	✓		74247-4			74247-4						
20														
21														
22														
23														
24														
25														
26														
27														
28														

OPERATING UNIT: PREPARED BY: DATE:

TI-NHTSA 8240

MSG 050 134 PCME MDES-2 MFPC CPPC ZARN

TO: [redacted] SWEET PCME
[redacted] CZARN ZARN
STEVE OFFILER SBO1
DALE SOGGE FFUN
CLAIRE BALTHAZAR PCME

FR: MATT SELLERS MJS2

SJ: 77F9L3-1 CALIBRATION SHIFT STUDY

ATTACHED ARE TEST RESULTS FROM A STUDY TO DETERMINE THE CAUSE OF CALIBRATION SHIFTING THE LINE HAS BEEN EXPERIENCING ON THE NEW 77F9L3-1 QUIET SWITCH.

IN ALL, 15 TEST LOTS WERE SET UP; EACH WERE MADE FROM THE SAME COMPONENT LOTS. MANUFACTURING VARIABLES ARE OUTLINED ON THE ATTACHED SHEETS.

WE HAD EXPECTED THAT AN INCREASE IN DISC PRE-DEFLECTION WOULD POTENTIALLY INCREASE ACTUATION AND RELEASE VALUES. ACTUALLY WE SAW THE OPPOSITE. LOTS 'B' AND 'G' REPRESENT TWO ATTEMPTS TO INCREASE DISC PRE-DEFLECTION. 'B' HAD 2 SPACERS WHILE 'G1', 'G2', AND 'G3' HAD THE STEPPED DOWN WASHERS AT INCREASING LEVELS. IN ALL CASES ACTUATION AND RELEASE VALUES DROPPED FOR LOTS 'B' AND 'G'. DOES THE PROBLEM LIE IN PLACING EXCESSIVE PRE-DEFLECTION ON THE DISC? IF SO THERE SEEMS TO BE A VERY NARROW WINDOW BETWEEN LOOSE (RATTLING DISC) AND EXCESSIVE PRE-DEFLECTION. THE DESIGN LAB CRIMPED PARTS AS EXPECTED WERE SUBSTANTIALLY HIGHER IN ACTUATION AND RELEASE VALUES.

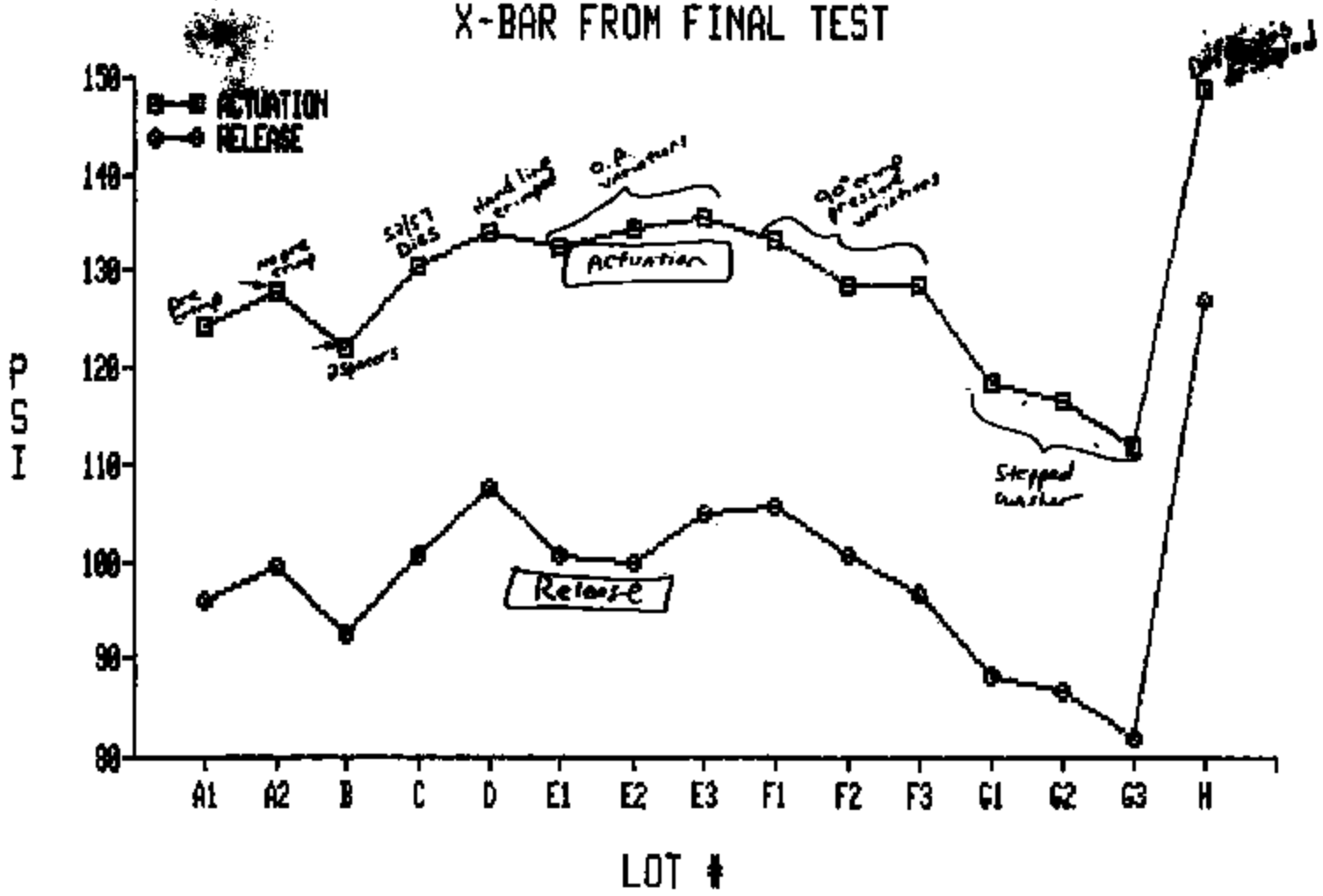
PLEASE REVIEW AND ADD YOUR COMMENTS.

REGARDS . . . MATT
X1245

[redacted] - HIGHER ACT/REL - SMALLER "A" CONV. DIMP LOWER?? / ADJT WASHER - NO NEW REV

INCR PRE-D, DECREASE ACT/REL ARE YOU SAYING HIGHER PRE-D REL TO LAB ?

77PS CRIMP MATRIX STUDY



crimp matrix Study

ST	LOT	SENSOR CRIMP LOW	SENSOR CRIMP HIGH	SENSOR RANGE	SENSOR DIAM LOW	SENSOR DIAM HIGH	SENSOR RANGE	SENSOR	FINISHED DEVICE PULL	FINISHED DEVICE PEL	FINISHED DEVICE ST
	A	[illegible]	0.2827	0.0047	[illegible]	1.1624	0.0039	0.0469	124.4	95.8	25.
	A2	[illegible]	0.2847	0.0058	[illegible]	[illegible]	0.0024	0.0471	127.7	99.5	23
	B	[illegible]	0.2849	[illegible]	[illegible]	[illegible]	[illegible]	0.0472	121.9	92.9	23.
	C	[illegible]	0.2814	[illegible]	[illegible]	[illegible]	0.0040	0.0474	100.-	100.5	0
	D	[illegible]	0.2871	0.0035	[illegible]	[illegible]	0.0029	0.0471	131.9	107.6	24.
	E	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0049	[illegible]	112.4	100.0	11.
	E1	0.2797	0.2840	[illegible]	[illegible]	[illegible]	0.0043	0.0473	134.3	99.7	34.
	E2	[illegible]	0.2862	0.0067	[illegible]	[illegible]	0.0028	0.0474	135.5	104.8	30.
	F1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0020	0.0474	133.2	105.5	27.
	F2	[illegible]	0.2848	0.0045	1.1612	1.1642	0.0030	0.0472	128.6	100.5	28.
	F3	[illegible]	0.2845	0.0055	[illegible]	1.1645	0.0035	0.0475	129.8	96.8	32.
	G1	[illegible]	[illegible]	0.0045	1.1607	[illegible]	0.0115	0.0472	118.5	88.2	30.
	G2	[illegible]	0.2797	0.0047	[illegible]	1.1675	0.0063	0.0473	116.7	86.8	29.
	G3	[illegible]	0.2815	0.0055	1.1617	1.1722	0.0105	0.0477	112.0	82.0	30.
	I	[illegible]	0.2891	0.0026	1.1598	1.1653	0.0055	0.0472	148.9	127.0	21.
JBL	BAR	0.2795	0.2842	0.0047	1.1599	1.1959	0.0048	0.0473			

A, AMI w/pre-crimp

A2 AMI w/pre-crimp

B Two [illegible]rs

	0.2735	0.2840	0.0105	1.1595	1.1700	0.0040	0.0466	121.5	75.5	37.5
	0.2795	0.2805	0.0040	1.1600	1.1640	0.0040	0.0469	132.1	100.1	31.9
	0.2805	0.2850	0.0045	1.1565	1.1650	0.0085	0.0470	121.5	96.1	25.3
	0.2750	0.2805	0.0055	1.1550	1.1565	0.0005	0.0467			DUMMY
	0.2805	0.2865	0.0060	1.1640	1.1685	0.0045	0.0471	121.9	84.4	37.5
								120.5	93.4	27.0
								130.2	95.7	34.5
								134.1	93.4	40.7
								130.5	85.0	45.5 DFHI
										DFLF
								128.4	107.1	21.3
								119.4	92.4	26.9
								117.2	84.4	32.8
								128.0	101.0	26.9
								119.9	86.3	33.6
								125.1	94.0	31.0
								128.1	101.1	27.0
								127.4	94.1	33.3
								124.4	101.1	23.3
								124.4	107.1	17.3
								124.4	98.4	26.0
								119.9	98.4	21.5
								126.1	93.4	32.7
								119.4	86.4	33.0
SAR	0.2782	0.2829	0.0047	1.1785	1.1824	0.0039	0.0469	124.4	95.9	28.6
SMA	0.0022	0.0024	0.0009	0.0031	0.0041	0.0027	0.0001	4.3332	6.1439	6.3578
	0.2750	0.2840	0.0090	1.1615	1.1670	0.0055	0.0474	127.3	100.0	27.3
	0.2800	0.2850	0.0050	1.1625	1.1650	0.0025	0.0472	129.1	100.3	28.8
	0.2810	0.2835	0.0025	1.1620	1.1645	0.0025	0.0471	126.2	99.2	27.0
	0.2785	0.2850	0.0065	1.1590	1.1600	0.0010	0.0470	133.3	97.9	45.5 DFHI
	0.2800	0.2860	0.0060	1.1600	1.1655	0.0055	0.0469	137.6	111.4	26.2
								125.3	92.0	33.2
								125.3	103.1	22.1
								130.1	93.6	36.6
								126.6	104.4	22.1
								130.1	100.2	29.9
								130.7	99.7	31.0
								124.4	106.1	18.3
								128.9	100.1	28.8
								131.7	106.0	25.7
								124.6	129.7	DFLO(5.1)
								127.5	99.7	27.8
								119.3	95.7	23.6
								132.3	80.0	52.3 DFHI-CA
								131.9	94.7	37.2
								129.4	104.3	25.1
								119.1	93.7	25.3
								125.5	95.3	30.2
								126.9	96.3	30.6
								122.4	92.8	29.7
SAR	0.2789	0.2847	0.0058	1.1610	1.1644	0.0034	0.0471	127.7	99.5	29.7
SMA	0.0021	0.0009	0.0021	0.0013	0.0024	0.0018	0.0002	4.2068	6.9964	7.3578

Lot A1
- AMI pre-crimp
- AMI Low pin probe

Lot A2
- AMI crimped
(No pre-crimp)
(No low pin probe)

DE	#	TEMP LOW	TEMP HIGH	RANGE	DIAM LOW	DIAM HIGH	RANGE	SENSOR	ACT	REL	DIFF	
	1	[illegible]	[illegible]	0.0040	[illegible]	[illegible]	[illegible]	[illegible]	114.1	[illegible]	[illegible]	
	2	[illegible]	0.2850	0.0045	[illegible]	[illegible]	[illegible]	0.0471	124.2	86.3	37.9	
	3	[illegible]	0.2845	0.0035	[illegible]	[illegible]	0.0015	0.0473	115.0	68.4	46.6	
	4	[illegible]	[illegible]	0.0055	[illegible]	[illegible]	0.0020	0.0471	113.0	92.9	22.1	
	5	[illegible]	0.2855	0.0030	[illegible]	[illegible]	0.0045	0.0469	127.9	102.5	25.5	
	6								125.9	97.4	28.6	
	7								127.9	86.1	41.9	
	8								124.4	87.5	36.9	
	9								122.4	94.2	28.2	
	10								116.5	99.2	17.2	
	11								129.6	103.1	26.5	
	12								119.0	93.2	25.8	
	13								118.6	94.9	23.7	
	14								122.5	94.7	27.9	
	15								124.7	99.3	25.4	
	16								124.0	101.4	22.6	
	17								128.3	98.6	29.7	
	18								125.4	78.8	46.6	DFHI-CR
	19								112.0	89.4	22.5	
	20								124.0	94.9	29.1	
	21								116.7	85.4	31.4	
	22								124.2	94.8	29.4	
	23								127.6	81.0	46.5	DFHI
	24								115.1	69.9	25.2	
BAR		0.2342	0.2374	0.0039	1.0366	0.7678	0.0022	0.0472	121.9	92.6	29.3	
CMA		0.1047	0.1062	0.0011	0.4910	0.4329	0.0013	0.0002	5.1756	6.2559	7.4587	

Lot B
- Lot A, with 2 speed S
- AMI crimped

DE	#	TEMP LOW	TEMP HIGH	RANGE	DIAM LOW	DIAM HIGH	RANGE	SENSOR	ACT	REL	DIFF	
	21	0.[illegible]	0.2790	0.0046	1.1660	1.1678	0.0055	1.0471	141.3	94.3	47.0	DFHI
		0.[illegible]	0.1928	0.0040	1.1305	1.1660	0.0055	0.0476	133.6	102.1	31.5	
		0.[illegible]	0.1900	0.0025	1.1600	1.1650	0.0050	0.0474	132.1	103.4	28.7	
		0.[illegible]	0.1880	0.0060	1.1595	1.1655	0.0060	0.0471	132.5	103.9	28.6	
		0.[illegible]	0.1820	0.0055	1.1595	1.1615	0.0020	0.0479	118.1	99.0	19.1	
									116.7	100.8	15.9	
									115.2	100.8	14.4	
									114.2	97.7	16.5	
									118.5	97.8	20.7	
									128.5	99.2	29.3	
									131.2	85.1	46.1	DFHI
									140.3	110.2	30.1	
									143.7	103.7	40.0	
									141.4	110.4	31.0	
									130.4	104.4	25.7	
									126.4	100.4	26.0	
									130.4	106.0	24.4	
									128.0	98.6	29.4	
									124.9	106.7	17.7	
									133.3	96.3	37.0	
									123.8	104.8	19.0	
									136.1	104.1	32.0	
									132.5	100.1	32.4	
AVR		0.2775	0.1914	0.0039	1.1900	1.1651	0.0046	0.0474	130.4	100.5	29.9	
SMA		0.0006	0.0017	0.0017	0.0010	0.0020	0.0015	0.0003	5.9716	0.0678	6.8147	

Lot C
- Lot A2
- Arms crimped with 5015795 dies vs. 7795 dies.

[illegible]	[illegible] LOW	[illegible] HIGH	RANGE	DIAM LOW	DIAM HIGH	RANGE	SENSOR	ACT	REL	DIFF	
	[illegible]	[illegible]	[illegible]	1.1590	[illegible]	0.0040	0.0473	152.7	141.2	11.5	ACHI=CA
	[illegible]	[illegible]	0.0015	1.1590	[illegible]	[illegible]	0.0472	[illegible]	[illegible]	[illegible]	
	[illegible]	0.2345	0.0040	1.1580	[illegible]	[illegible]	0.0470	133.0	116.5	17.5	
	0.2540	0.2865	0.0045	1.1590	[illegible]	[illegible]	0.0476	135.5	110.1	25.4	
5	[illegible]	0.2825	0.0020	1.1600	[illegible]	0.0020	0.0470	139.3	106.[illegible]	32.4	
								133.5	105.2	28.3	
								131.[illegible]	109.[illegible]	22.0	
8								128.2	74.7	53.5	DFHI
								[illegible]	108.3	[illegible]	
								147.2	124.1	23.1	
											ACLO=0
								142.0	118.1	23.9	
								119.7	78.3	41.4	
14								134.9	107.7	[illegible]	
								134.2	106.6	27.6	
								[illegible]	109.5	23.6	
								134.0	110.5	23.5	
								120.4	94.0	26.4	
								124.9	[illegible]	22.0	
								[illegible]	[illegible]	[illegible]	
								130.8	[illegible]	[illegible]	
								126.0	105.8	20.2	
								134.4	[illegible]	28.1	
								[illegible]	105.6	27.4	
.AR	[illegible]	[illegible]	0.0035	1.1590	[illegible]	[illegible]	0.0473	133.9	107.5	26.1	
SMA	[illegible]	0.0025	0.0015	0.0006	[illegible]	0.0012	0.0009	8.5918	[illegible]	[illegible]	

Lot D
- Lot A?
- Hand line crimped with 77PS dies.

TIRE	#	DIAM LOW	DIAM HIGH	RANGE	DIAM LOW	DIAM HIGH	RANGE	SENSOR	ACT	REL	DIFF	
E1	1	1.2735	1.2845	0.0090	1.1580	1.1665	0.0045	0.0472	135.2	102.1	33.7	
	2	1.2840	1.2875	0.0035	1.1570	1.1600	0.0030	0.0476	130.7	102.4	28.3	
	3	1.2810	1.2850	0.0040	1.1585	1.1620	0.0035	0.0481	119.9	98.1	21.8	
	4								127.1	104.6	22.5	
	5								126.2	98.1	28.1	
	6								134.4	103.8	30.6	
	7								133.4	101.3	32.1	
	8								131.2	105.0	26.2	
	9								127.8	89.8	37.9	
	10								126.6	101.6	25.0	
	11								143.0	105.8	37.2	
	12								133.2	95.5	37.7	
AVR		0.2812	0.2857	0.0045	1.1572	1.1615	0.0043	0.0476	132.4	100.6	31.7	
SMA		0.0022	0.0013	0.0011	0.0006	0.0011	0.0010	0.0004	5.7035	4.2447	5.6588	
E2	1	0.2750	0.2805	0.0055	1.1575	1.1630	0.0055	0.0477	134.5	96.8	37.7	
	2	0.2740	0.2775	0.0035	1.1575	1.1625	0.0050	0.0471	134.6	99.6	35.1	
	3	0.2805	0.2840	0.0035	1.1605	1.1650	0.0045	0.0471	135.1	101.5	33.6	
	4								130.6	101.5	29.1	
	5								139.7	107.9	31.8	
	6								133.4	102.1	31.3	
	7								132.1	107.6	24.5	
	8								140.5	101.7	38.8	
	9								139.0	100.9	38.1	
	10								129.4	96.3	33.1	
	11								142.4	100.9	41.5	
	12								120.3	80.3	40.0	
AVR		0.2765	0.2840	0.0055	1.1585	1.1628	0.0043	0.0473	134.3	99.7	34.6	
SMA		0.0019	0.0029	0.0043	0.0014	0.0025	0.0013	0.0003	5.7400	6.7490	4.7542	
E3	1	0.2795	0.2840	0.0045	1.1590	1.1625	0.0035	0.0477	122.9	97.8	25.1	
	2	0.2790	0.2875	0.0085	1.1575	1.1610	0.0035	0.0472	137.8	109.8	28.0	
	3	0.2800	0.2870	0.0070	1.1595	1.1610	0.0015	0.0473	138.8	107.1	31.7	
	4								135.8	107.1	28.7	
	5								138.5	109.4	29.1	CR
	6								137.5	103.9	33.6	
	7								123.7	94.3	29.4	
	8								142.3	106.1	36.2	
	9								138.1	100.4	37.7	
	10								130.7	99.4	31.3	
	11								140.7	109.0	31.7	
	12								139.1	112.4	26.7	
AVR		0.2795	0.2842	0.0067	1.1587	1.1615	0.0028	0.0474	135.5	104.8	30.7	
SMA		0.0004	0.0015	0.0016	0.0008	0.0007	0.0009	0.0002	6.0728	5.2453	3.5791	

1/ LOT E1 - LOT A; 950 psi o.pressure

2/ LOT E2 - LOT A; 1200 psi o-pressure

3/ LOT E3 - LOT A; 1400 psi o-pressure

LE. *	DIAM LOW	[redacted]	RANGE	DIAM LOW	DIAM HIGH	RANGE	SENSOR	ACT	REL	DIFF	
F1	1.2800	0.2880	0.0080	1.1620	1.1645	0.0025	0.0470	122.5	101.0	21.5	CONT
	1.2815	0.2855	0.0040	1.1630	1.1645	0.0025	.0475				
	1.2810	0.2870	0.0060	1.1590	1.1600	0.0010	0.0476	123.5	99.0	27.9	
								117.8	110.6	7.2	
								120.1	111.5	8.6	
								119.2	110.6	8.6	
								139.5	108.4	31.1	
								133.1	105.8	27.3	
								130.1	100.8	29.3	
								126.8	102.6	24.2	
								125.3	105.4	20.0	
								129.4	108.6	20.8	
SAR	0.2805	0.2855	0.0050	1.1610	1.1630	0.0020	0.0474	122.2	105.5	27.7	
SNA	0.0005	0.0008	0.0008	0.0014	0.0021	0.0007	0.0003	4.1592	4.3872	4.1660	
F2	1.2800	0.2960	0.0060	1.1580	1.1620	0.0040	0.0472	128.5	95.4	33.1	
	1.2795	0.2840	0.0045	1.1625	1.1655	0.0030	.0472	127.7	99.6	28.1	
	1.2800	0.2830	0.0030	1.1630	1.1650	0.0020	0.0472	128.7	107.4	21.3	
								127.4	108.1	19.3	
								128.3	103.1	25.2	
								128.5	110.1	18.4	
								121.4	95.7	25.7	
								117.0	95.7	21.3	
								126.4	102.6	23.8	
								130.1	115.7	14.4	
								130.8	102.2	28.6	
								132.1	102.6	29.5	
BAR	0.2798	0.2843	0.0045	1.1612	1.1642	0.0030	0.0472	128.6	100.5	28.1	
SNA	0.0002	0.0012	0.0012	0.0022	0.0015	0.0008	0.0000	5.1521	5.3079	4.3712	
F25	0.2790	0.2840	0.0050	1.1605	1.1620	0.0015	0.0474	125.2	95.6	29.4	
	0.2820	0.2855	0.0035	1.1605	1.1660	0.0055	0.0478	133.5	100.9	32.6	
	0.2760	0.2840	0.0080	1.1620	1.1655	0.0035	0.0474	133.9	96.3	37.6	
								131.1	99.6	31.5	
								126.8	100.1	26.7	
								125.3	95.6	29.7	
								130.4	94.7	35.7	
								124.7	93.3	31.4	
								125.0	91.8	33.2	
								134.8	108.4	26.4	
								130.0	89.8	40.2	
								120.3	89.8	30.5	
BAR	0.2790	0.2845	0.0055	1.1610	1.1645	0.0035	0.0475	128.8	96.8	32.1	
SNA	0.0024	0.[redacted]	0.0019	0.0007	0.0016	0.0016	0.0002	4.7089	5.1446	3.9534	

Lot F1 - Lot A2 - 55psi 90° crimp

Lot F2 - Lot A2 - 60 psi 90° crimp

Lot F3 - Lot A2 - 65psi 90° crimp

TEST #	CRMP LOW	CRMP HIGH	RANGE	DIAM LOW	DIAM HIGH	RANGE	SENSOR	ACT	REL	DIFF	
31	0.2760	0.2820	0.0060	1.1610	1.1730	0.0120	0.0472	112.0	85.6	26.4	
32	0.2760	0.2900	0.0140	1.1610	1.1750	0.0140	0.0471	110.3	83.9	26.4	
33	0.2760	0.2820	0.0060	1.1600	1.1660	0.0060	0.0473	110.6	84.1	26.5	
								114.6	87.0	27.6	
								121.5	88.4	33.1	
								119.7	92.2	27.5	
								114.9	86.8	28.1	
								115.2	90.6	24.6	
								120.6	86.2	34.4	
								118.6	91.0	27.6	
								112.3	87.9	24.4	
:BAR	0.2790	0.2835	0.0045	1.1607	1.1722	0.0115	0.0472	116.5	88.1	30.2	
:GMA	0.0015	0.0004	0.0014	0.0006	0.0027	0.0023	0.0001	5.2333	4.2847	5.7029	
34	0.2760	0.2810	0.0050	1.1600	1.1655	0.0055	0.0472	112.0	86.6	25.1	
35	0.2740	0.2765	0.0025	1.1615	1.1690	0.0075	0.0479	108.1	81.5	26.6	ACLO
36	0.2750	0.2815	0.0065	1.1620	1.1680	0.0060	0.0473	115.9	85.5	30.4	
								112.0	81.1	30.9	
								107.1	81.6	25.5	ACLO
								110.7	79.3	31.4	
								120.7	86.6	34.5	
								118.8	76.7	42.1	
								120.5	89.4	31.1	
								115.4	88.8	26.6	
								129.0	100.6	28.4	
								117.4	91.3	26.1	
:BAR	0.2751	0.2797	0.0047	1.1612	1.1678	0.0066	0.0473	116.7	86.8	29.9	
:GMA	0.0008	0.0022	0.0016	0.0008	0.0019	0.0009	0.0000	5.6640	5.7276	4.6218	
25	0.2785	0.2820	0.0035	1.1595	1.1730	0.0135	0.0473	114.7	87.4	27.3	
26	0.2730	0.2900	0.0070	1.1695	1.1710	0.0075	0.0489	111.7	87.5	24.2	
27	0.2765	0.2825	0.0060	1.1620	1.1725	0.0105	0.0476	107.5	74.8	32.7	ACLO
								107.5	75.3	32.2	ACLO
								113.6	83.4	30.2	
								122.2	86.2	36.0	
								125.9	94.4	31.5	
								118.1	81.1	37.0	
								99.7	75.8	23.9	ACLO
								104.7	77.0	27.7	ACLO
								111.3	84.2	27.1	
36								109.9	79.4	30.5	ACLO
:BAR	0.2760	0.2815	0.0055	1.1617	1.1722	0.0105	0.0477	112.0	82.0	30.0	
:GMA	0.0029	0.0011	0.0015	0.0016	0.0008	0.0024	0.0004	6.5827	5.3224	3.9948	

Lot 61
- Lot A3
- Step master.

Lot G2
- lot A3
- Step master

Lot G3
- lot A3
- Step master

[illegible]	CRMP LOW	CRMP HIGH	RANGE	DIAM LOW	DIAM HIGH	RANGE	SENSOR	ACT	REL	DIFF	
[illegible]	[illegible]	0.2395	0.0025	1.1590	[illegible]	0.0075	0.0472	148.[illegible]	[illegible]	21.9	
[illegible]	[illegible]	0.2390	0.0015	1.1610	1.1650	0.0040	0.0472	142.4	123.[illegible]	19.3	
[illegible]	[illegible]	[illegible]	0.0025	1.1520	1.1575	0.0055	0.0472	148.5	[illegible]	[illegible]	
[illegible]	0.2860	0.2885	0.0025	1.1630	1.1660	0.0030	0.0472	156.4	134.8	21.7	ACHI
[illegible]	0.2860	0.2885	0.0025	1.1615	1.1630	0.0015	0.0471	153.7	133.0	20.7	ACHI
[illegible]	0.2695	0.2710	0.0015	1.1575	1.1625	0.0050	0.0472	149.1	127.9	21.2	
[illegible]	0.2855	0.2895	0.0040	1.1560	1.1620	0.0060	0.0472	136.7	119.7	17.0	
8	0.2850	0.2870	0.0020	1.1600	1.1670	0.0070	0.0473	148.6	124.7	23.9	
[illegible]	0.2830	0.2865	0.0035	1.1570	1.1655	0.0085	0.0472	152.7	128.5	24.1	ACHI
10	0.2365	0.2395	0.0030	1.1610	1.1675	0.0065	0.0471	153.7	134.8	18.9	ACHI
[illegible]								146.8	128.0	18.8	
[illegible]								152.4	128.3	24.1	ACHI
[illegible]								143.7	123.4	20.3	
[illegible]								134.1	110.2	23.9	
[illegible]								148.0	127.1	20.9	
[illegible]								150.9	129.1	21.8	ACHI
[illegible]								154.1	132.5	21.6	ACHI
[illegible]								150.0	130.6	19.4	ACHI
[illegible]								148.3	127.2	21.1	
[illegible]								149.2	125.9	23.3	
[illegible]								150.3	126.6	23.7	ACHI
[illegible]								153.1	129.3	23.8	ACHI
[illegible]								152.5	133.8	18.7	ACHI
[illegible]								151.2	129.3	21.9	ACHI
[illegible]AN	0.2866	0.2891	0.0026	1.1596	1.1653	0.0055	0.0472	148.9	127.0	21.9	
[illegible]MA	0.0020	0.0017	0.0008	0.0022	0.0020	0.0020	0.0001	5.1993	5.7551	1.7997	

1/

Lot H
- Lot A2
- Design tab crimped

TO: Dave Czarn
Matt Sellers
Steve Offiler
Bill Sweet

drs92-46

CC: Tom Charbonneau

FR: Dale Sogge

s|: 77ps3-1 preload capability: VSA

In the process of correcting the preload for the quiet disc I wanted to understand the tolerance range we could hold on preload. The results show that the design was not even capable as toleranced on the prints.

I MADE THE ASSUMPTION THAT WE ARE TARGETING PRELOAD TO ZERO +/- .002"

PRINT CAPABILITY
Disc preload is defined by the print dimension shown in figure 1, assuming no crimp shifts. If the print tolerances represent three sigma limits, which they must by contract, then the stack capability can be calculated by root sum square method (assuming all parts have a normal distribution). Since there is no tolerance on the disc height, actual measurements are used.

Disc	.0198 +/-.0007
Kapton	.0020 +/- .0003
Convertor bump to convertor diaphragm surface (CONVTOP)	.1650 +/-.003
Convertor diaphragm surface to washer surface (CONVMID)	.1040 +/-.003
Cup washer surface to bump (CUPBUMP)	.0910 +/-.001

SQRT (.0007^2+.0003^2+.003^2+.003^2+.001^2) = +/-.0044

THIS IS A RANGE OF 8.8 MILS, FAR IN EXCESS OF THE TARGET!! CLEARLY NOT A CAPABLE DESIGN.

In addition there is a crimp shift effect. By measuring 7 cross sections I found the shift is an average of .0026 +/-0.0023". Adding this to the above tolerances gives:

SQRT (.0007^2 + .0003^2 + .003^2 + .003^2 + .001^2 + .0023^2) = +/-.0050

These two calculations show that based on prints the design does not work since the preload spread leaves no room for our production pinning tolerance.

ACTUAL CAPABILITY

As a check on the real capability; actual data from the suppliers on the critical dimensions was used in a Variational Simulation Analysis (VSA). VSA was chosen because root sum square is an inaccurate estimate; because it assumes that all tolerances are normally distributed and that they are all perfectly centered about the mean. VSA gives a more accurate picture by accounting for the low probability of all tolerances being at the worst case simultaneously and accounting for non-normal distributions (cup is non-normal). If you have more than two assemblies it is highly unlikely that they will all be at worst case at the same time, so VSA provides a greater tolerance zone.

Variational Simulation analysis (VSA) of the design without the crimp shift effect shows that the mean preload is -.0085" with a three sigma spread of 0.014" (figure2). The disc contributes 97% of the variation (figure 3).

VSA of the design with the crimp shift effect gives a mean= -.0058 and three sigma range = .0054" (figure 4). The crimp is now the key contributor (figure 5 & 6).

VSA with shear bumps added to the convertor to increase preload by 4.5 mils gives a mean of -.0014" and 3-sigma range of .0054". (figures 7-9).

VSA with the cup bumped up higher gives the same mean and spread as changing the convertor. You would expect the range to decrease because the cup has a smaller sigma, but the cup skewness causes the results to be the same.

The analysis also reveals that we can be 95% confident that somewhere between 22.1 and 28.6 % of the product will be out of spec and our CPK will be only 0.2263.

This high percentage out of spec raises the question; "Is plus/minus .002 really required." I believe the answer is yes, because our prod pinning tolerance plus temp shift puts the preload at 150C at 1.5 mils or less. Therefore we can't give up more than two mils of the disc throw.

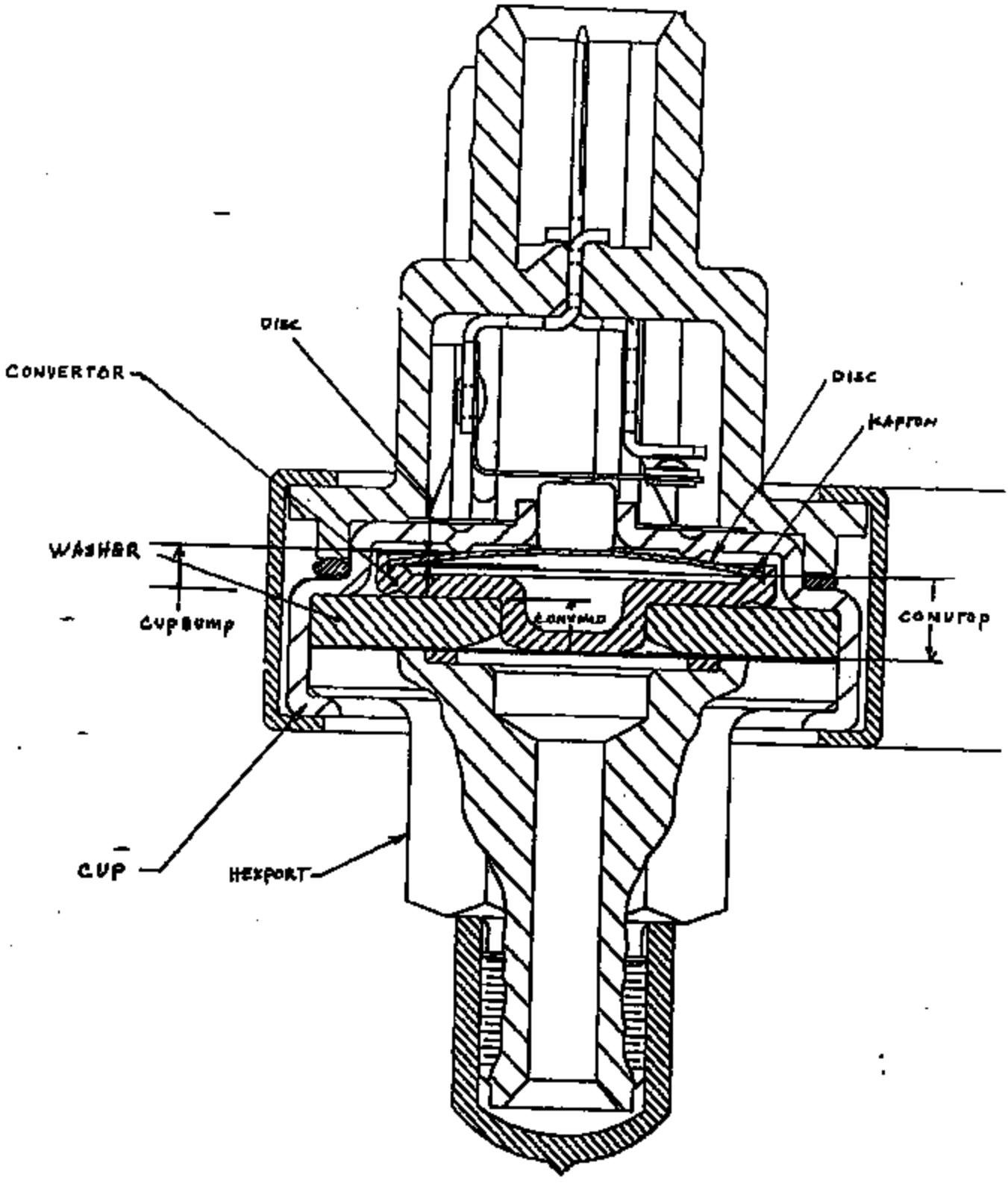
I have purposely not centered the preload because I believe the crimp shift effect can be larger than my limited sample revealed and I believe that we can tolerate some that are two mils loose (The Kapton will probably take up the two mil difference).

CONCLUSION
We are missing 5.8mils of preload. There is a large spread in ability to hit the target preload. Because of the spread and other factors the new target should be -1.4mils. This can be achieved by modifying the cup, convertor, washer or however else MFG Engr decides.

We are not capable and have a long way to go to be plus minus six sigma capability, as our new corporate philosophy directs.

VSA performed at an earlier stage in the project would have focused us on the magnitude of the problem much sooner and possible redirected our solution.

Dale



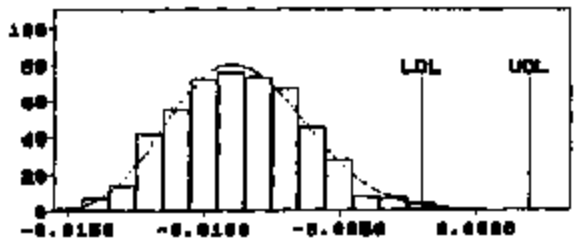
LABELS USED

FIGURE 1

Campaign: SD-020807-135959

PRELOAD2 / GAP BETWEEN DISC AND BUMP ON TTP6L3-1 649 samples

Nominal :	-0.0056
Mean :	-0.0056
Standard Deviation :	0.0024
Lower Design Limit :	-0.0120
Upper Design Limit :	0.0008
Cp :	0.8877
Cpk :	N/A
Distribution :	Pearson-Beta



	Actual	Est		Actual	Est*
% < Low Limit	88.2888	88.8183	Low	-0.0148	-0.0148
% > High Limit	0.0000	0.0000	High	-0.0000	-0.0000
% Out of Spec	88.2888	88.8183	Range	0.0148	0.0138

95% C.I. for % Out of Spec : 88.8448 to 88.8864 * Est Range : 88.7388

NO CRIMP SHIFT

FIGURE 2

Session: ID-000007-135000

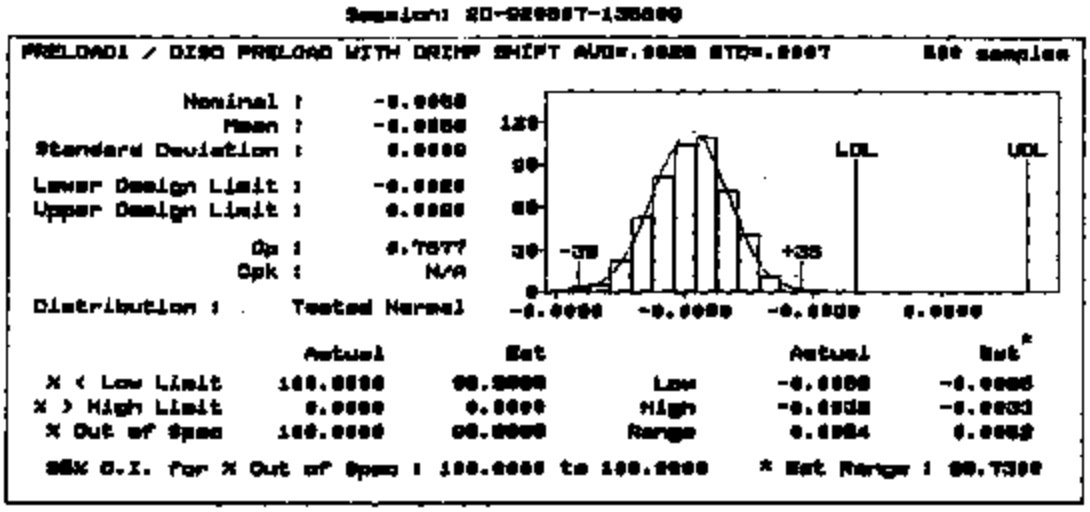
PRELOAD2 / GAP BETWEEN DISC AND BUMP ON TTPSL3-1

Nominal at Median : -0.0005
RSM Variance : 0.484E-06

High-Low-Median Study

Tolerance		Effect
DISC1	LINEAR Pearson XYWRKPLN at 0.0000	97.26%
CONVEXD1	LINEAR Normal 0.000000 XYWRKPLN at 100.0000	1.92%
		99.18%
3 additional contributor(s) <1.0% each		0.82%

FIGURE 5



WITH CRIMP SHIFT

FIGURE 4

Session: 2D-020807-135003

PRELOAD1 / DISC PRELOAD WITH CRIMP SHIFT AVG=.0020 STD=.0007

Nominal at Median : -0.4058
MLN Variance : 6.7511E-05

High-Low-Median Study

Tolerance			Effect
CRIMP	LINEAR Normal 0.002000 XYWRKPLN at 0.0000		78.01%
DONUMID	LINEAR Normal 0.001870 XYWRKPLN at 100.0000		11.28%
DISC	LINEAR Pearson XYWRKPLN at 0.0000		6.27%
CUPBUMP	LINEAR Pearson XYWRKPLN at 100.0000		3.21%
KAPTON	LINEAR Normal 0.000300 XYWRKPLN at 0.0000		1.33%
DONUTOP	LINEAR Normal 0.000270 XYWRKPLN at 0.0000		1.46%
			100.00%

WITH CRIMP SHIFT
FIGURE 5

Session: 20-[illegible]-139000

Tolerance Summary

Name	Distrib	Nominal	Tolerance	Sig	Source
CONVMID	Normal	0.1042	0.0009	3	Manf
CONVMID1	Normal	0.1042	0.0009	3	Manf
CONUTOP	Normal	0.1048	0.0003	3	Manf
CONUTOP1	Normal	0.1048	0.0003	3	Manf
CRIMP	Normal	0.0020	0.0003	3	Manf
CUPBUMP	Pearson	0.0000	NA	NA	Manf
CUPBUMP1	Pearson	0.0000	NA	NA	Manf
DISC	Pearson	0.0100	NA	NA	Manf
DISC1	Pearson	0.0100	NA	NA	Manf
KAPTON	Normal	0.0020	0.0003	3	Dsgn
KAPTON1	Normal	0.0020	0.0002	3	Dsgn

DISC $\bar{X}$ = .0198 σ = .06239 skew = .06 kurt = -.22

cupbump $\bar{X}$ = .0001127 σ = .00015 skew = -1.71 kurt = 12.38

without #'s used for figure 2 & 3, no crimp

with #'s used for figure 4 & 5, with crimp

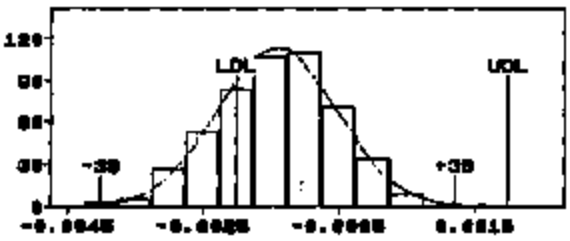
with crimp shift

FIGURE 6

DISC PRELOAD WITH CONVERTOR HEIGHT INCREASED BY
4.5MILS ASSUMING TOLERANCE REMAINS SAME AS CONVMID
Session: SD-920807-184718

PRELOAD1 / DISC PRELOAD WITH CRIMP SHIFT AVG=.0028 STD=.0007 589 samples

Nominal :	-0.0014
Mean :	-0.0014
Standard Deviation :	0.0009
Lower Design Limit :	-0.0028
Upper Design Limit :	0.0028
Cp :	0.7078
Cpk :	0.2263
Distribution :	Tested Normal



	Actual	Est		Actual	Est*
% < Low Limit	25.4669	24.9831	Low	-0.0041	-0.0040
% > High Limit	0.0000	0.0000	High	0.0013	0.0012
% Out of Spec	25.4669	24.9831	Range	0.0054	0.0052

95% C.I. for % Out of Spec : 22.1973 to 28.0887 * Est Range : 99.7298

with shear bumps 4-5 mils high

FIGURE 7

DISC PRELOAD WITH CONVENTOR HEIGHT INCREASED BY
4.5MILS ASSUMINGTOLERANCE REMAINS SAME AS CONVMID
Session: 2D-920907-184718

PRELOAD1 / DISC PRELOAD WITH CRIMP SHIFT AVG=.0020 STD=.0007

Nominal at Median : -0.0014
HLM Variance : 8.7511E-06

High-Low-Median Study

Tolerance			Effect
CRIMP	LINEAR Normal 0.002000 XYWRKPLN at 0.0000		78.51%
CONVMID	LINEAR Normal 0.000070 XYWRKPLN at 100.0000		11.06%
DISC	LINEAR Pearson XYWRKPLN at 0.0000		6.97%
CUPRIMP	LINEAR Pearson XYWRKPLN at 100.0000		3.61%
KAPTON	LINEAR Normal 0.000300 XYWRKPLN at 0.0000		1.33%
CONVTOP	LINEAR Normal 0.000270 XYWRKPLN at 0.0000		1.06%
			100.00%

with shear bumps
FIGURE 8

DISC PRELOAD WITH CONVERTOR HEIGHT INCREASED BY
4.5MILS ASSUMING TOLERANCE REMAINS SAME AS CONUMID
Session: SD-020807-164716

Tolerance Summary

Name	Distrib	Nominal	Tolerance	Sig	Source
CONUMID	Normal	0.0007	0.0009	3	Manf
CONUMID1	Normal	0.1042	0.0009	3	Manf
CONUTOP	Normal	0.1545	0.0003	3	Manf
CONUTOP1	Normal	0.1545	0.0003	3	Manf
SHIMP	Normal	0.0035	0.0003	3	Manf
CUPBUMP	Pearson	0.0000	NA	NA	Manf
CUPBUMP1	Pearson	0.0000	NA	NA	Manf
DISC	Pearson	0.0195	NA	NA	Manf
DISC1	Pearson	0.0195	NA	NA	Manf
KAPTON	Normal	0.0020	0.0003	3	Dsgn
KAPTON1	Normal	0.0020	0.0003	3	Dsgn

Reflect reduced value from shrink Bumps.

with shrink Bumps

FIGURE 9

KELSEY-HAYES SUPPLIER MANUFACTURING CHANGE REQUEST

PART NAME: Pressure Switch	REQUEST NUMBER:	BUYER: Rita Gunia	DATE: 12/18/
PART NUMBER: 12590701	PRODUCT LINE:	P.O.C.N. NUMBER:	B/P LEVEL: A
SUPPLIER: Texas Instruments Inc	K-H USING PLANT: Milford	SUPPORTING DATA ATTACHED?	☒YES ☐NO

REASON FOR CHANGE/PURPOSE: 1.) Update and correct Kelsey-Hayes drawing to reflect correct Ford part number and Ford ES specification number.

2.) Kelsey-Hayes ECN No. 25136 (9/5/91) created error.

ECN No. 25136 copy is attached.

ORIGINATOR: Jim Watt TITLE: QPA Engr. CONCURRENCE: Charlie Douglas TITLE: Prod. Speci:

DESCRIPTION: Kelsey-Hayes drawing no. 12590701-A should be changed to reflect:

1.) Ford Motor Co. Part No. ▽ F2VC-9F924-AB

2.) Ford Motor Co. Specification No. ▽ ES-F2VC-9F924-AA

PLAN FOR VERIFICATION & TESTING: Validation of these changes made with Ford Motor Co.

DISPOSITION - BY KELSEY-HAYES

APPROVE	REJECT	DISTRIBUTION	INSTRUCTIONS, QUALIFICATIONS AND/OR REASON FOR REJECTION:
		K-H PURCHASING	
		PLANT MANUFACTURING ENGINEERING	
		PLANT QUALITY CONTROL	
		K-H PRODUCT ENGINEERING	
		K-H SALES	
		PROCUREMENT or DIVISIONAL QUALITY ASSURANCE	

TI-NHTSA 8263

PPAP LEVEL REQUIRED: ☐NONE ☐1 ☐2 ☐3

#27639

R

TOLLWAY STEEL CORPORATION
25th Ave. & Main St.
Melrose Park, IL 60160
Phone (708) 681-3190

Customer DIEMASTERS MFG.

ANALYSIS REPORT

ITEM #	ORDER #	PART #	SIZE	GRADE	TEMPER
1.	033632	CROSSAD 1375C	.0985 x 1.375 x cl	C1050	ANSLD
2.					
3.					

QUALITY CONTROL
APR 30 1992

ITEM #	ID#	C	Mn	P	S	Si	Ni	Cr	Al
1.	664332	.51	.69	.013	.002	.27			
2.									
3.									

ITEM #	ROCKWELL	TENSILE	YIELD	ELONGATION	OTHER
1.	RB 78				
2.					
3.					

CERTIFIED BY: Thomas E Bulwan
THOMAS BULWAN

TEXAS INSP
27639-1

TI-NHTSA 8264

#36900

O&K COMPANY LIMITED

Type & Grade SC-4345 AIS110L10 SAF B.C.A 9341-5
S.O.# 14255

1 Specification

	Heat No.	Coil No.	C % × 100	Mn % × 100	Si % × 100	P % × 1000	S % × 1000	Cr % × 100	Ni % × 100	Cu % × 100	Mo % × 100	B % × 10000
Chemical Composition Of Steel	D06703	0021 – 0022	10	42	7	5	21	1	1	2		PB %X100 25

	Nominal Diameter		Tolerance of Diameter		Tensile Strength		Decarburization	
	in	mm	in	mm	1,000 psi	kg/mm²	Dm-T	Dm-T
Physical Properties	0.565	14.351	± 0.0040	± 0.1016	88.9 MAX	48.5 MAX	MAX	

	Coil Weight	
Packing	ABT. 2,142LBS (ABT. 970KGS)	
	WRAPPED WITH POLYPROPYLENE SHEET.	

2. Test Results

Sample No.	Diameter mm	Tensile Strength kg/mm²	Tensile Strength 1,000psi	Sample No.	Diameter mm	Tensile Strength kg/mm²	Tensile Strength 1,000psi
0021	14.43	33.3	47.4				
0022	14.39	33.4	47.5				