DRAWINGS AVAILABLE UPON REQUEST

K. F. BASSLER COMPANY, INC.
PRECISION TOOLING & METAL STAMPINGS
45 John Wilson St. • Attleboro, MA 02703 • (508) 222-1061 • Fax: (508) 226-1605
EST. 1945

MATERIAL CERTIFICATION

CUSTOMER: Texas Instruments Inc. - Attleboro

CUSTOMER ORDER NO.: 5050497078

CUSTOMER PART NO.: 27406-1

REVISION: E

QUANTITY THIS SHIPMENT: 21 000

LOT NO. THIS SHIPMENT: 143

SHIPMENT DATE: 6-25-91

WE CERTIFY THAT THE MATERIAL USED TO PRODUCE THE PRODUCT IN THIS SHIPMENT, NAMELY, AK 1008 CRS, CONFORMS TO TI'S DRAWING AND PURCHASE ORDER REQUIREMENTS.

AUTHORIZED SIGNATURE: Kathleen A. Penkala

Kathleen A. Penkala
Inside Sales Specialist

PMA PRECISION METALFORMING ASSOCIATION

TELEX 601314
FAX 315-336-5510
PHONE 315-336-5500
DUNS 223-3136

ROME STRIP STEEL COMPANY, INC.
530 HENRY ST. BOX 189
ROME, NEW YORK 13440

SALES CODE
08022016

0 1 0 0 0 0 0 0

DATE	INVOICE NO
02/28/91	02786

INVOICE TO: K. F. BASSLER CO., INC.
P. O. BOX 995
ATTLEBORO, MA 02703

SHIP TO: K. F. BASSLER CO., INC.
13TH-JOHN WILLIAM STS
ATTLEBORO, MA

QUANTITY (LBS)	NO. CLS	NO. PADS OR COILS		SHIPPED BY	HT NO	C	MN	P	S	SI
19,636	135	13	PART	PAUL M	466708	07	36	014	008	01

MEETS REQUIREMENTS OF:
CUST. ORDER NO 14474

[redacted] 7MM X 25.40MM — MILL NO 58100 — PREPAID/COLLECT: PREPAID

.04600 X 1.0000 — B 50 MAX — COIL — 200 LBS — 1600 — 21 MI MAX

TOLERANCE
+00050-00050+005 -005 — NO3 SLIT — 200 PIW 16 34

+013 -013MM +127 -127MM — ALUM KILD — C-1006 — 500/096

[redacted]

TEST REPORT (8,907 KG) 19,636

Certificate of Compliance

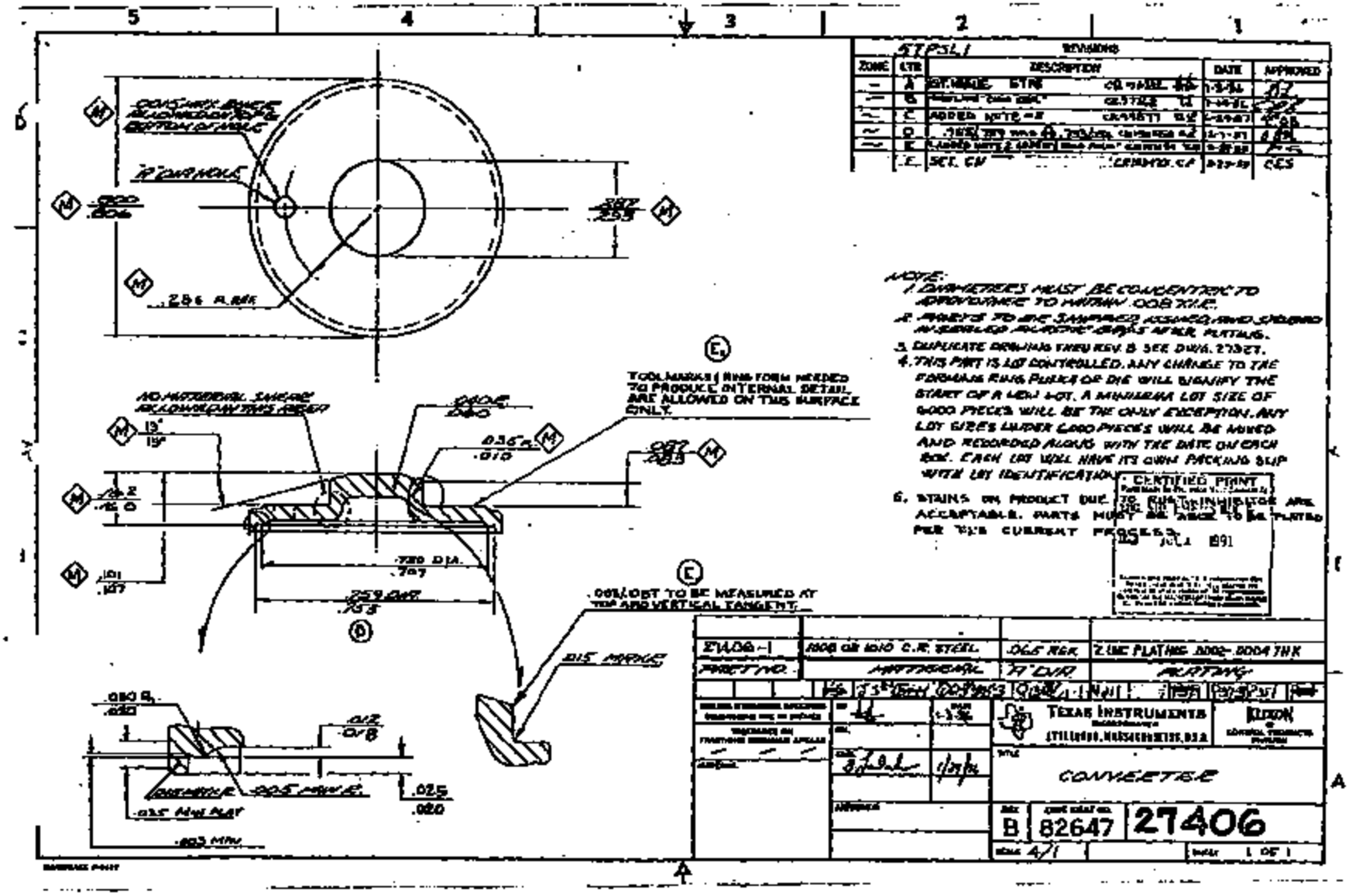
ATTEST:
092 06280 91 030291
Notary Public, Oneida County
My commission expires 7/4/92

DATE 3/1/91

I certify that the above figures are a true and correct copy of those contained in the records of this corporation.

ROME STRIP STEEL CO., INC.

TI-NHTSA 003088



TI-NHTSA 0003069

DRAWINGS AVAILABLE UPON REQUEST

VALENTINE TOOL & STAMPING CO.

111 WEST MAIN ST. NORTON, MASS. 02766
(508) 285-6811

MATERIAL CERTIFICATION

DATE : TUESDAY APRIL 30, 199

CUSTOMER : TEXAS INSTRUMENTS INC

CUSTOMER P.O. NO : [illegible] SUPPLIER INVOICE NO.: [illegible]

PART DESCRIPTION : [illegible] CRIMP RING REV.B

SUPPLIER PJO NO. : [illegible]

QUANTITY SHIPPED : 20,445

SHIPMENT DATE : 04/30/91

WE CERTIFY THAT THE MATERIAL USED
TO PRODUCE THE PRODUCT IN THIS
SHIPMENT, NAMELY
: 5052 AL
CONFORMS TO T.I. DRAWINGS AND
T.I. PURCHASE ORDER REQUIREMENTS.

SIGNED Jeanne Lafleamme
(Supplier Representative)

Jeanne Lafleamme Quality Control Manager

TI-NHTSA 003071

VALENTINE TOOL & STAMPING, INC.

[illegible] NORTON, MASS. 02766
(508) 285-[illegible] 226-0142

CERTIFICATE OF CONFORMANCE

DATE : TUESDAY APRIL 30, '91

CUSTOMER : TEXAS INSTRUMENTS INC

CUSTOMER P.O. NO : 5050837116 SUPPLIER INVOICE NO.: 19319

PART DESCRIPTION : 7475/-1 CRIMP RING REV.B

SUPPLIER P.O NO. : 18573

QUANTITY SHIPPED : 20,449

SHIPMENT DATE : 04/30/91

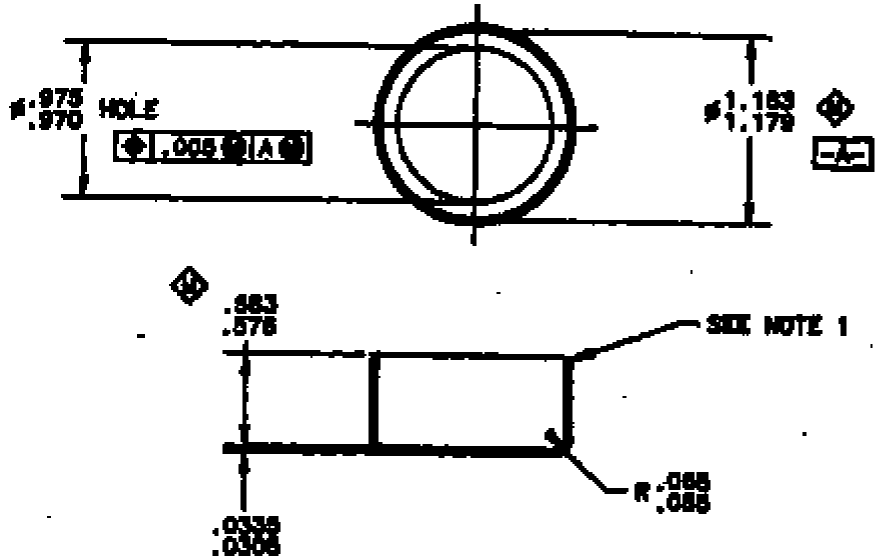
WE CERTIFY THAT ALL ITEMS SHIPPED ON THIS ORDER MEET THE REQUIREMENTS OF THE PURCHASE ORDER AND APPLICABLE DRAWINGS/SPECIFICATIONS. RESULTS OF REQUIRED MECHANICAL, VISUAL, FUNCTIONAL AND CHEMICAL TESTS ARE ON FILE IN OUR QUALITY CONTROL DEPARTMENT.

SIGNED Jeanne Lafleur
Jeanne Lafleur
Quality Control Manager

TI-NHTSA 003072

74797

CRIMP RING | REV. B | 74797



NOTES:
1. PINCH OFF RADIUS ALLOWED.
2. .002 MAX. BURR ALLOWED.
3. PARTS TO BE SHIPPED, ISSUED, AND STORED IN SEALED PLASTIC BAGS.
4. MATERIAL CERTIFICATION REQUIRED WITH EACH SHIPMENT.

CERTIFIED PRINT
Parts Made To This Print Must Conform To
ENG. STD. E9898 REV. E
Date JUL 1 1991

SUPERSEDES DWG. 74797 REV. A DATED 11-2-90

74797-1	ALUMINUM 5052	
PART NO.	MATERIAL	FINISH

BY GREG FLOWERS 11-2-90
CH. 1-30-91
ENG.

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

KLIXON
CONTROL PRODUCTS DIVISION

SIZE A | DWG. NO. 74797

TI-NHTSA 003073

Insulfab PLASTICS, INC.

PLASTIC FABRICATORS DIVISION
185 NO. MAIN STREET FRANKLIN, N.H. 03235
603 934-2770

CERTIFICATE OF CONFORMANCE

TO: TEXAS INSTRUMENTS DATE: JUN 3 1991

ATT: QUALITY CONTROL SUP.

THIS CERTIFIES THAT:

SHIPMENT # 159462

PART # 73958-1 REVISION G

QUANTITY 122,000

MAT'L DESC. Kapton HN

IS IN CONFORMANCE WITH THE REQUIREMENTS, SPECIFICATIONS, AND DRAWINGS

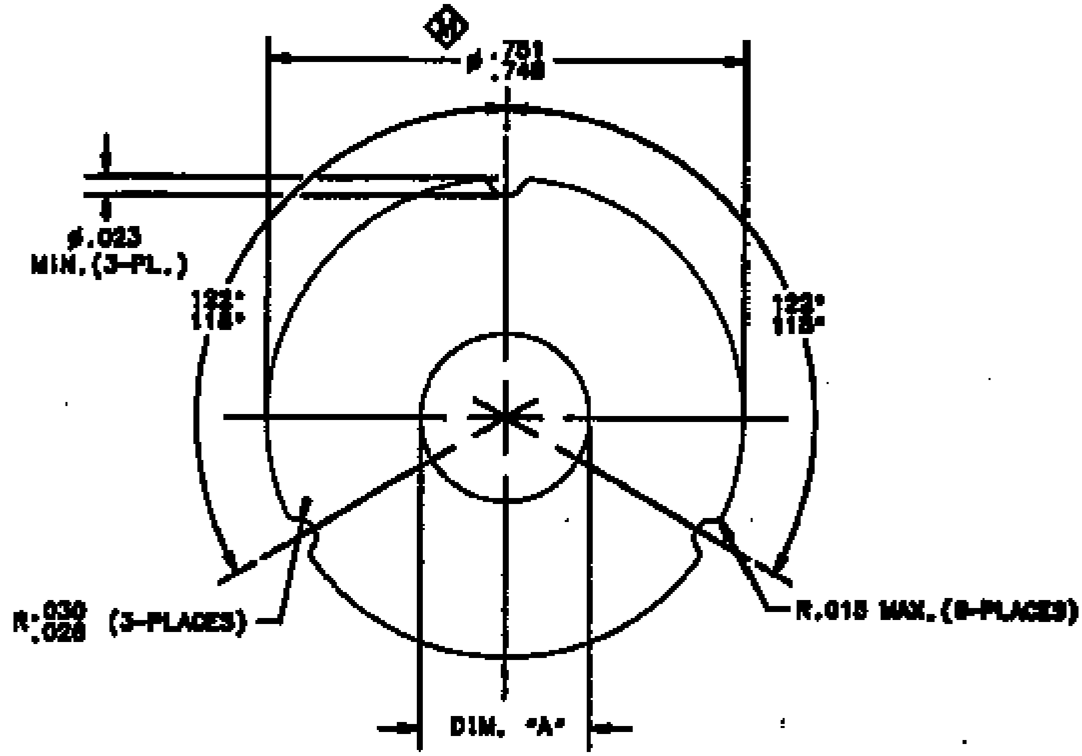
OF YOUR ORDER # 00416820 Rev

BY: INSULFAB PLASTICS
FRANKLIN, NH 03235

Fred Vuyan
QUALITY CONTROL MANAGER

TI-NHTSA 00307

TITLE	REV.	
SPACER	G	73958



NOTES:

1. .001 MAX. BURR ALLOWABLE.
2. PARTS TO BE SHIPPED, ISSUED, AND STORED IN SEALED PLASTIC BAGS.
3. ALL CONTAINERS OF PARTS MUST BE DATE CODED. DATE CODE IS TO REFLECT ANY MATERIAL LOT, TOOL OR PROCESS CHANGE.
3. MATERIAL CERTIFICATION REQUIRED WITH EACH LOT.

CERTIFIED PRINT
ENG. STD. E9898 REV. E
Date JUL 1 1991

PART NO.	MATERIAL	DIM "A"
73958-3	MADE FROM 74224-1 (KAPTON TAPE)	NO HOLE
73958-2	DUPONTS, KAPTON 200H, .0017 - .0023 THICK	NO HOLE
73958-1	KAPTON .0017 - .0023 THICK	.260/.270

THIS DWG. SUPERSEDES 73958 REV. "F" DATED 10-14-85

DR TOM DAIL 10-10-85
CH.
ENG. [signature] 10/16/85

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS

KLIXON

A

DWG. NO. 73958

CODE IDENT NO. 82647

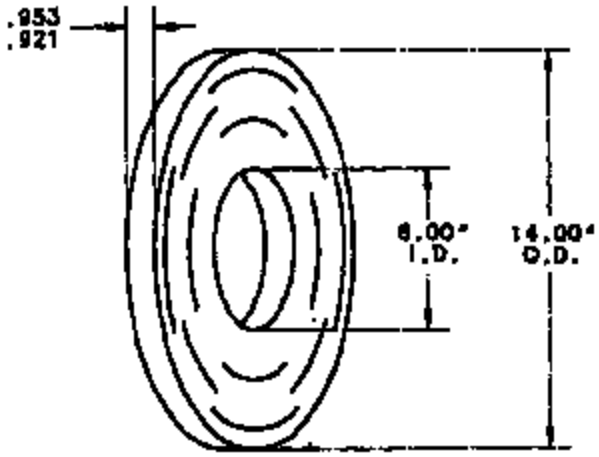
TI-NHTSA 003075

	KAPTON TAPE	REV. F	74224

74224

NOTES:

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



CERTIFIED PRINT
ENG. STD. E9898 REV. E
Date NOV 2 1991

74224-1	DUPONT'S, KAPTON 200H	.0017/.0023	
PART NUMBER	MATERIAL	THICKNESS	

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

BY TOM DAIL 10-14-88	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	KLOCKNER CENTRAL PLASTICS DIVISION	A	74224
CH.				
ENG. Steve Hamel 10-14-90				

MATERIAL

CODE IDENT NO. 82647

TI-NHTSA 003076

Paratech, Inc.
A SUBSIDIARY OF [illegible] OF THE
MINIATURE TECHNICAL CERAMICS
15849 MINNESOTA AVENUE • P.O. BOX 718 • PARAMOUNT, CALIFORNIA 90723
TELEPHONE (213) 633-2048 • FAX (213) 633-0897

MATERIAL CERTIFICATION

DATE: 4-22-91

TEXAS INSTRUMENTS, INC.

ORDER NO.: 505049981

PART NO : 74078-146 REV. NO.: F

QUANTITY THIS SHIPMENT: 75,000

SHIPMENT DATE: 4-22-91

PART DESCRIPTION: PIN

WE CERTIFY THAT THE MATERIAL USED TO PRODUCE THE PRODUCT IN THIS SHIPMENT, NAMELY PIN / STEATITE - L3, CONFORMS TO T.I. DRAWING AND T.I. PURCHASE ORDER REQUIREMENTS.

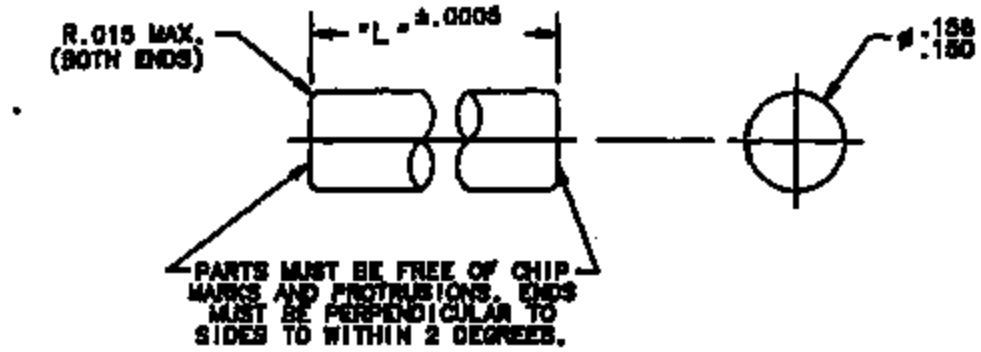
PRODUCTION MANAGER

TITLE: TRANSFER PIN

REV. G

74078

74-078



"L" LENGTH IS DETERMINED BY THE SUFFIX OF THE PART NUMBER IN THOUSANDTHS OF AN INCH. I.E.:

PART NO.	"L"
74078-186	.186
74078-210	.210

VENDOR WILL BE PREPARED TO FURNISH PINS .130 - .250 LONG.

NOTES:

1. FINISHED PARTS TO BE SHIPPED, ISSUED AND STORED IN SEALED PLASTIC BAGS. SEALED PLASTIC BAGS TO CONTAIN 20,000 PINS(OR LESS FOR PARTIAL BAGS). BAGS MUST BE CLEARLY LABELED WITH THE PART NO. AND THE QUANTITY OF PARTS IDENTIFIED ON THE OUTSIDE OF EACH BAG.
2. MATERIAL CERTIFICATION REQUIRED WITH EACH SHIPMENT.

MATERIAL: L-3 GRADE STEATITE (DC-185)
L-3 GRADE STEATITE (DC-144E)

CURE PER SPEC.—— 50502-2

SHRINKAGE SPEC.—— 50501-1

CERTIFIED PRINT
Parts Made To This Print Must Conform To
ENG. STD. E9898 REV. E
Date JUL 1 1991

TI-NHTSA 003078

THIS DWG. SUPERSEDES 74078 REV. "E" DATED 6-4-68

BY	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	KEYDON	A	74078
CH.				
ENG.				

CODE IDENT NO. 82647

[illegible]-6042

TEXAS INSTRUMENTS, INC.
BUILDING 11-18
34 FOREST STREET
ATTLEBORO, MA 02703

PARKER HANNIFIN CORPORATION
JBL DIVISION
WEST CROFT CIRCLE
SPARTANBURG, S.C. 29302
TELEPHONE (803) 573-7332

J.B.L. Division of Parker Seal certifies that the material used to produce the product in this shipment, namely SILICONE/ S7424. Conforms to TI drawing and TI purchase order requirements.

PART TITLE... ENVIRONMENTAL SEAL — SENT/original pkg.

CUST P/N... [illegible] -4 REV [illegible] | DATE SHIPPED | P.O. 50023131

J.B.L. P/N... [illegible] | [illegible] | S/O... 16374

SILICONE COMPOUND... S7424 | | QUANTITY... 14,700

REPLACED with BLUE -4 SEAL

Very Truly Yours,
J.B.L. Division

[signature]

DENNIS T. JOHNSON
Quality Control Manager

DTJ/[illegible]
DTJ

T[illegible]

TEXAS INSTRUMENTS, INC.
P.O. BOX [illegible]
ATTLEBORO, MA [illegible]

PARKER HANNIFIN CORPORATION
[illegible] DIVISION
[illegible] CIRCLE
SPARTANBURG, S.C. [illegible]
TELEPHONE (803) [illegible]

J.B.L. Division of Parker Seal certifies that the material used to produce the product in this shipment, namely SILICONE/ [illegible], Conforms to TI drawing and TI purchase order requirements.

PART TITLE... ENVIRONMENTAL SEAL

CUST P/N... [illegible] REV [illegible] | DATE SHIPPED | P/O... [illegible]

J.B.L. P/N... [illegible] | S/O... [illegible]

SILICONE COMPOUND... [illegible] | [illegible]-91 | QUANTITY... [illegible]

Very Truly Yours,
J.B.L. Division

DENNIS T. [illegible]
Quality Control Manager

[illegible]

TI-NHTSA 003080

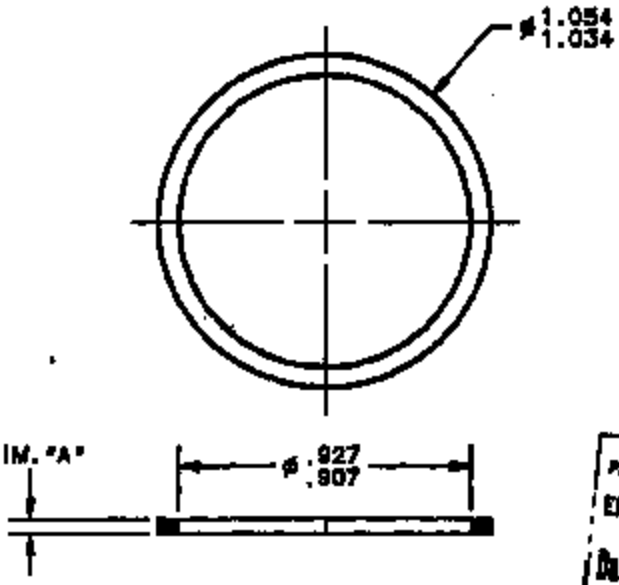
DEVICE # 52/57PS
PROJ. # 3355

TITLE: ENVIROMENTAL SEAL

REV: E

74247

74-7



NOTES:

1. MATERIAL CERTIFICATION REQUIRED WITH EACH SHIPMENT.
2. 74247-3 IS TO BE RED IN COLOR WITH 3 BLACK MARKS ON THE EXTERNAL CIRCUMFERENCE AT 120° INTERVALS.

THIS DWG. SUPERSEDES 74247 REV. "D" DATED 10-14-88

PART NO.	MATERIAL	DUROMETER	COLOR	DIM. "A"
74247-4	SILICONE JBL (T-8-D)	55 - 65	BLUE	.045-.055
74247-3	SILICONE JBL S7424-8	55 - 65	SEE NOTE 2	.045-.055
74247-2	SILICONE JBL S7424-8	55 - 65	RED	.040-.050
74247-1	BUNA N JBL N7014-60	50 - 60	BLACK	.040-.050

REV: 1 ADDED -3,-4 AND NOTE 2. ADDED DIM. "A" TO TABLE. CR. M06667, 10-1-91 CM

02-3 MS-3 013 01 1101 P37-3 P35

DR. TOM DAIL 8-19-91
CH.
ENG. [signature] 9/19/14

TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS 02703

SIZE: A

DWG. NO. 74247

CODE IDENT NO. 82647

752-6042

TEXAS INSTRUMENTS, INC.
BUILDING 11-1?
34 FOREST STREET
ATTLEBORO, MA 02703

PARKER HANNIFIN CORPORATION
JBL DIVISION
WEST CROFT CIRCLE
SPARTANBURG, S.C. 29302
TELEPHONE (803) 573-7332

J.B.L. Division of Parker Seal certifies that the material used to produce the product in this shipment, namely SILICONE/ S7424. Conforms to TI drawing and TI purchase order requirements.

PART TITLE... ENVIRONMENTAL SEAL

CUST P/N... 74047 2 REV D DATE SHIPPED P/O... S00023151

J.B.L. P/N.. 004425 6-26-81 D/N... 17108

SILICONE COMPOUND... S7424 QUANTITY... 23550

Very Truly Yours,
J.B.L. Division

Dennis T. Johnson

DENNIS T. JOHNSON
Quality Control Manager

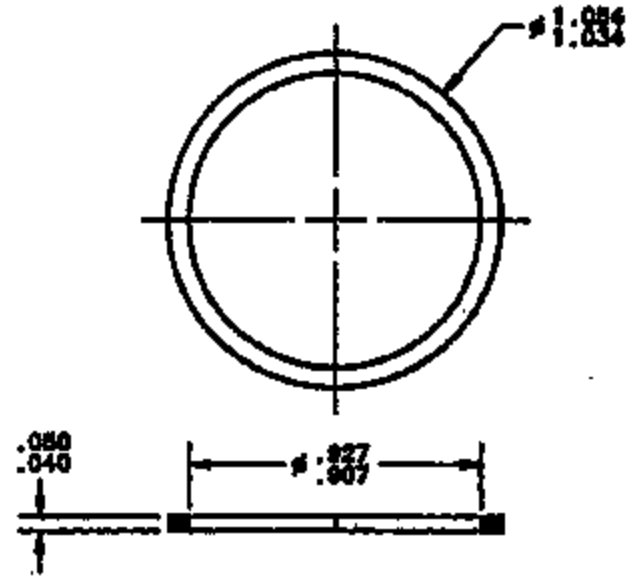
DTJ/MS

DTJ

TI-NHTSA 003082

TITLE	REV.	
ENVIROMENTAL SEAL	D	74247

74247



CERTIFIED PRINT
ENGL STD. E9898 REV. E
Date JUL 1 1991

NOTES:

1. MATERIAL CERTIFICATION REQUIRED WITH EACH SHIPMENT.

THIS DWG. SUPERSEDES 74247 REV. "C" DATED 8-20-88

PART NO.	MATERIAL	DUROMETER	COLOR
74247-2	SILICONE JBL S7424-8	55 - 65	RED
74247-1	BUNA N JBL N7014-50	50 - 60	BLACK

DR TOM DAIL 10-14-88	TEXAS INSTRUMENTS ATTLEBORO, MASSACHUSETTS 02703	KENDON CONTROL PRODUCTS DIVISION	SIZE A	74247
CHK				
ENG C. DeLorenzo 11-18-88				
MATERIAL				

TI-NHTSA 003083

kCap

CERTIFICATE OF CONFORMANCE

TO: TEXAS INSTRUMENTS
ATTLEBORO, MASSACHUSETTS

PURCHASE ORDER NUMBER: 5000237824

CUSTOMER PART NUMBER: 2479-2

PART DESCRIPTION: .595 - 3/8" THK CAP

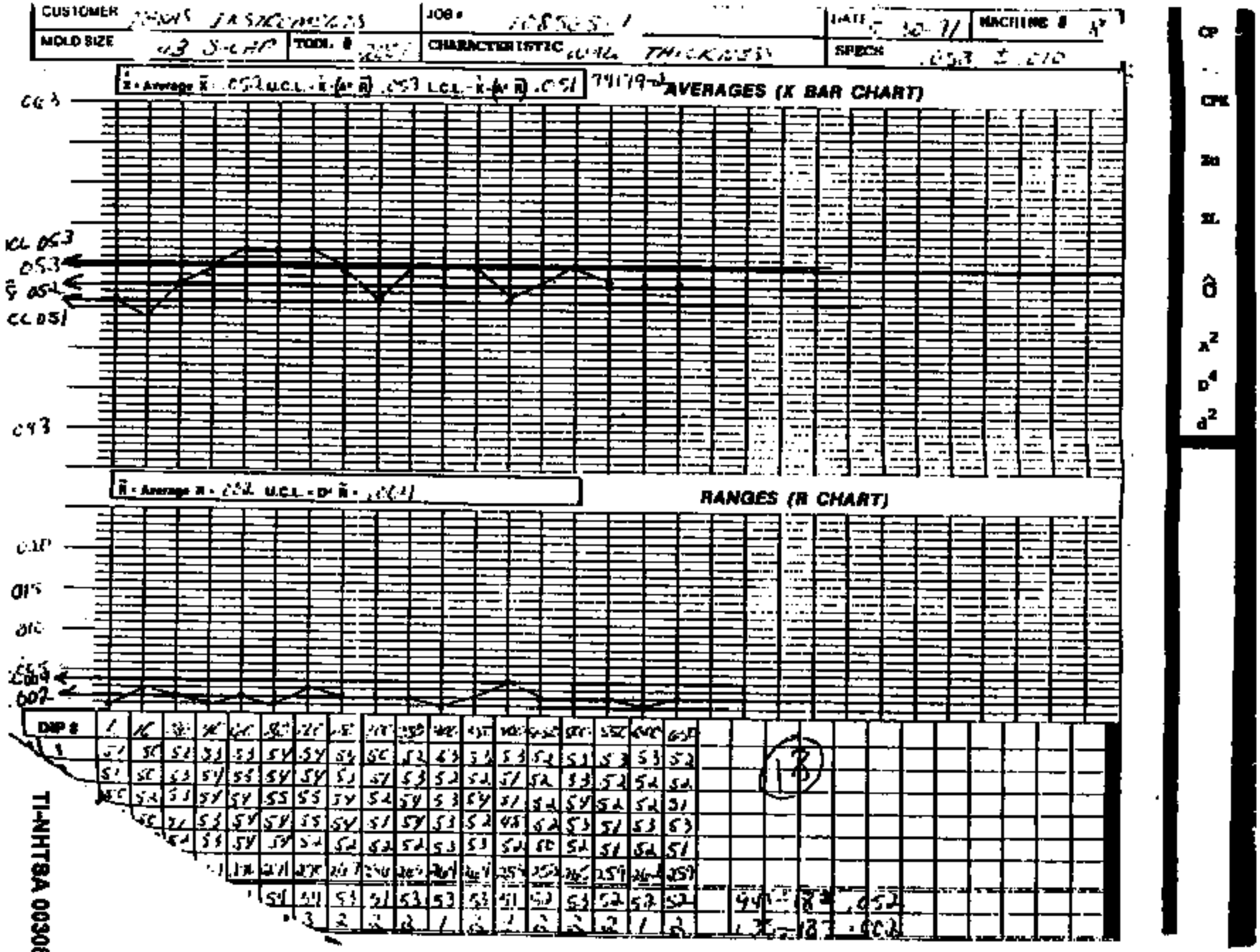
OUR JOB NUMBER: 163505-1

The supplier hereby certifies that adequate data is on file showing that all components and materials used in the article furnished comply with the physical and chemical properties required by our firm.

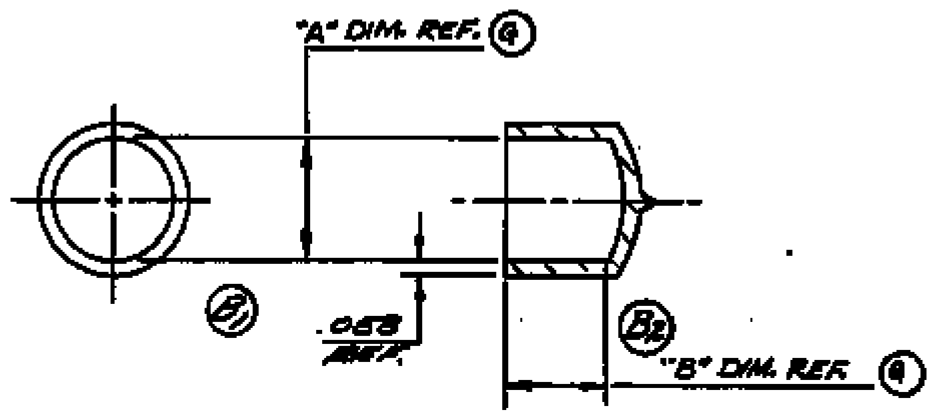
Roger J. Rinkus 5-31-91

Roger J. Rinkus
Quality Assurance Manager

TI-NHTSA 003084


CUSTOMER
JOB #
DATE
MACHINE #
MOLD SIZE
TOOL #
CHARACTERISTIC
SPECS
AVERAGES (X BAR CHART)
RANGES (R CHART)
UCL .053
.053
.052
LCL .051
.053
.002
DIP #
TI-NHT8A 003085
CP
CPK
Zu
XL
X̄
X²
D⁴
d²

	TITLE THREAD CAP	REV. H	74179



NOTE:
1) IDENTIFICATION MEMO MUST ACCOMPANY EACH SHIPMENT STATING THE FOLLOWING:
SINCLAIR RUSH #SC 0.342-6 (4/8"IL)TK 701-1A

(H)

CERTIFIED PRINT
Parts Made To This Print Must Conform To
ENG. STD. E9898 REV. E
Date JUL 1 1991

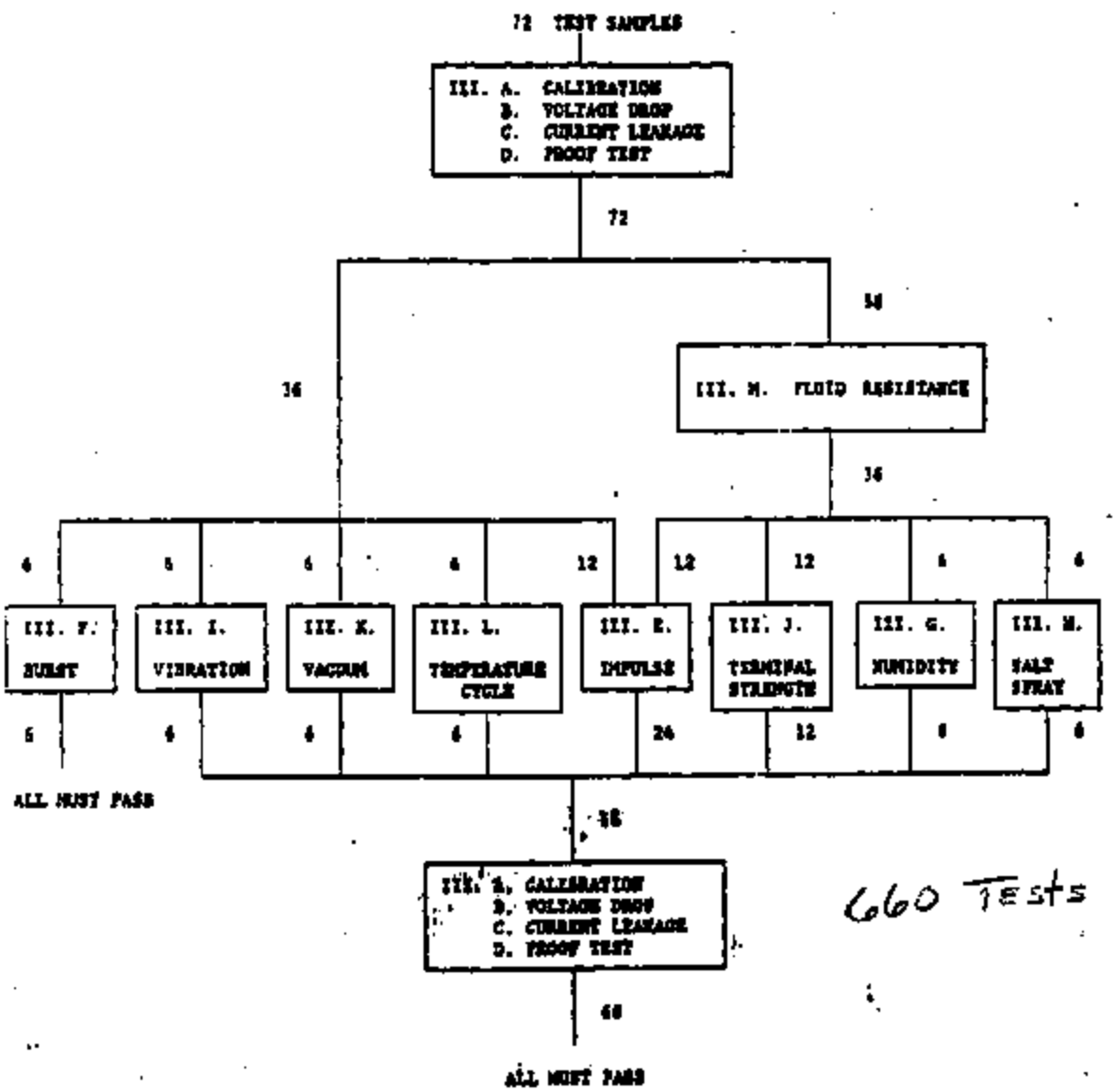
PART N^os.	MATERIAL	DIM. "A"	DIM. "B"	VENDOR	COLOR
74179-2	VINYL	.339/.343	.319/.438	SINCLAIR & RUSH	RED
74179-1	VINYL	.355/.365	.281/.343	MOCAP	RED

Revision record (left margin): 74179; G, H, F, E, C, D; 57PSL

BY Tony Drill 2/3/84	TEXAS INSTRUMENTS INCORPORATED ATTLEBORO, MASS., U.S.A.	KLIXON CONTROL PRODUCTS DIVISION	SIZE A
CH. K. H. Wilson 2/17/84			DRAWING NO. 74179
ENG. D. Stuart 2/13/84			

Engineering Specification

PRODUCTION VALIDATION FLOW CHART



FRAME 4 OF 19	REVISED		VES-P2VC-9B924-AA NUMBER

MAY 1988 PD 3947-a2 (Previous editions may NOT be used)

mat. anal.	19
ES Test	660
Ford FAI	586
	1265

Ford PKG. P/C

P V Test

PIST / PIPE

		Ford
ES Tests: *	1660	FAI: 60
Repeat Imp.	12	90
" El. Resist.	36	65 + 2
" Imp.	12	125 + 1
	720	125 + 2

+ Pist "Base Dim."

K-H FAI: 520 - 15 Oct/Sp

TEXAS INSTRUMENTS

Ford P/C
FAI DATA

DIMENSIONAL ANALYSIS ON PART NUMBER

F2VC-9F924-AB

NOTE: MARKED PRINT DENOTES CAVITY # 1A

	BLUEPRINT SPEC	CAVITY # 2A ACTUAL	CAVITY # 3C ACTUAL	CAVITY # 4C ACTUAL	CAVITY # 5E ACTUAL	CAVITY # 6E ACTUAL	COMMENTS
1	11.92 - 11.60	11.68	11.69	11.69	11.70	11.69	
2	1.49 - 1.24	1.42	1.29	1.33	1.26	[illegible]	
3	19.81 - 19.45	19.62	19.64	19.64	19.60	19.66	
4	16.76 - 16.56	16.62	16.64	16.64	16.64	16.65	
5	[illegible] - 2.94	[illegible]	[illegible]	[illegible]	2.91	[illegible]	
6	11.90 - 11.49	11.78	11.79	11.78	11.77	11.75	
7	[illegible] - 2.79	12.51 2.85	13.93 2.84	12.64 2.85	12.36 2.84	12.84 2.85	
8	8.39 - 8.71	18.43 8.36	18.54 8.37	18.45 8.31	18.[illegible] 8.35	18.30 8.34	
9	[illegible]	OK	OK	OK	OK	OK	
10	2.95 - 2.85	2.695	2.685	2.660	2.705	2.685	TOOL TO BE CORRECTED (60)

count #1 lens marked on print

THE PASS CAR (F2VC-9F924-AB) AND LIGHT TRUCK (F13A-9F24-AA) SWITCHES ARE PRODUCED OFF OF THE SAME PRODUCTION TOOLING.

THE (F3TA-9F924-AA) FULL DIMENSIONAL ANALYSIS FOLLOWS. DIMENSIONS # 1-10 LISTED ABOVE PERTAIN TO THE POLARITY KEY FEATURE WHICH IS DIFFERENT ON THE (F2VC-9F924-AB) SWITCH.

60
90 out of spec.
65
125
135
~~111~~
586

+ P/C = 12
+ LT = 99
= 111

TEXAS INSTRUMENTS INCORPORATED • 34 FOREST STREET • ATTLEBORO, MA [illegible]
[illegible] • TELEX [illegible] TWX [illegible] • CABLE TEXINS

TI-NHTSA 003090

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F3TA-9F924-AA

NOTE: BOXED PRINT DENOTES CAVITY # A1

	BLUEPRINT SPEC	CAVITY # A2 ACTUAL	CAVITY # C3 ACTUAL	CAVITY # C4 ACTUAL	CAVITY # D5 ACTUAL	CAVITY # D6 ACTUAL	COMMENTS
1	13.43-13.83	13.492	13.623	13.602	13.719	13.646	
2	312DEG +/- 2DEG	308DEG 36MIN	312DEG 01MIN	310DEG 49MIN	320DEG 10MIN	320DEG 27MIN	
3	[illegible] - 2.06	2.690	2.669	2.667	2.699	2.692	TOOL TO BE CORRECTED
4	19.02 MAX	18.687	18.663	18.691	18.677	18.636	
5	[illegible]-0.26 2PL	.199 .137	.306 .196	.245 .197	.225 .176	.169 .141	
6	0.59 +/- 0.25	.583 .515	.515 .453	.419 .347	.392 .553	.429 .596	
7	2.75-3.10 2PL	2.900 2.898	2.895 2.896	2.896 2.905	2.902 2.891	2.867 2.895	
8	19.45-19.81	19.60	19.58	19.61	19.57	19.61	
9	16.56-16.76	16.566	16.600	16.589	16.585	16.625	
10	12.80-13.21	13.040	13.066	13.003	12.978	12.956	
11	11.40-11.90	11.770	11.810	11.780	11.790	11.777	
12	2.86 - 3.05	2.925	2.917	2.928	2.930	2.928	
	0.1 A	.094	.013	.019	.004	.032	
13	1.24 - 1.45	1.387	1.294	1.292	1.320	1.326	
14	11.60-11.92	11.742	11.672	11.745	11.680	11.737	

90

TI-NHTSA 003091

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F3TA-9F924-AA

	BLUEPRINT SPEC	CAVITY # A2 ACTUAL	CAVITY # C3 ACTUAL	CAVITY # C4 ACTUAL	CAVITY # 2C ACTUAL	CAVITY # D6 ACTUAL	COMMENTS
15	1.24 - 1.35	1.346	1.334	1.357	1.334	1.322	
16	6.40 - 6.81	6.572	6.678	6.680	6.668	6.667	
17	NO FLAS/BURRS	OK	OK	OK	OK	OK	
18	7.22 - 7.78	7.584	7.646	7.639	7.454	7.425	
	3.78 - 3.41	3.10	3.10	3.10	3.07	3.07	
20	0.87 - 1.30	1.19	1.09	1.102	1.112	1.141	
21	BOTH S PARTS	OK	OK	OK	OK	OK	
22	0.2521 A(-B)	UNABLE TO	MEASURE	BECAUSE	THREADS ARE	ALREADY IN	
	2X0 CHAMFER						
23	13/8-24UNF-2B	OK	OK	OK	OK	OK	
24	1.10 - 1.40	1.220	1.213	1.230	1.224	1.220	
25	12.5 C	.20	.20	.20	.20	.20	
26	0.16 B	.020	.036	.008	.023	.025	
27	41005 - 43000	MEASURED ON	CROSS SECTIONED PIECE				
28	40000 - 50000	MEASURED ON	CROSS SECTIONED PIECE				
29	7.82 - 8.08	7.90 7.91	7.90 7.89	7.89 7.93	7.89 7.88	7.84 7.90	
30	1.50 - 2.04	1.754	1.857	1.831	1.807	1.803	

65 +2

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F37A-7F924-AA

	BLUEPRINT SPEC	CAVITY # A2 ACTUAL	CAVITY # C3 ACTUAL	CAVITY # C4 ACTUAL	CAVITY # D3 ACTUAL	CAVITY # D4 ACTUAL	COMMENTS
31	9.39 - 9.66	9.55	9.55	9.50	9.50	9.50	
32	8.12 MIN	9.22	9.14	9.19	9.22	9.14	
33	14.22 MAX	13.64	13.62	13.58	13.67	13.60	
34	57.15 MAX	55.60	55.60	55.55	55.56	55.52	
35	12.59-13.11	12.85	12.93	12.93	12.90	12.83	
36	11.65-12.17	11.79 11.84	11.89 11.91	11.89 11.84	11.89 11.89	11.91 11.94	
37	1.90-2.21 2PL	1.89	2.02	1.82	1.96	1.80	MEAS. SIDE W/O KEY
38	[illegible] (4pl) MEASURED ON SEPARATE BASE - CROSS SECTIONED:						
39	32.51 MAX	31.61 31.62	31.59 31.72	31.66 [illegible]	31.53 31.65	31.64 31.79	
40	14.02-14.53	14.234	14.221	14.225	14.222	14.221	
41	3.30 - 3.40	3.420 3.413	3.441 3.420	3.455 3.450	3.434 3.420	3.436 3.421	
42	7.22 - 7.37	7.299 7.288	7.340 7.332	7.294 7.284	7.303 7.281	7.309 7.400	
43	5.58 - 5.66	5.604 5.588	5.641 5.642	5.594 5.583	5.610 5.594	5.612 5.580	
44	71.50EG+/-20EG	72DEG 23MIN	72DEG 50MIN	72DEG 30MIN	72DEG 34MIN	72DEG 29MIN	
	(2 PL)	72DEG 24MIN	72DEG 36MIN	71DEG 33MIN	72DEG 43MIN	71DEG 44MIN	
45	1.42-1.63 2PL	1.595 1.572	1.610 1.58[illegible]	1.541 1.544	1.595 1.59[illegible]	1.609 1.53[illegible]	
46	0.35 - 0.66	.571 .557	.545 .575	.550 .573	.562 .556	.530 .562	
	(4 PL)	.562 .560	.580 .550	.562 .544	.565 .560	.576 .571	

1 of 5
+1

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F3TA-9F924-AA

	BLUEPRINT SPEC	CAVITY # A2 ACTUAL	CAVITY # C3 ACTUAL	CAVITY # C4 ACTUAL	CAVITY # B5 ACTUAL	CAVITY # D6 ACTUAL	COMMENTS
47	2.59 - 2.80	L 2.591	L 2.706	L 2.687	L 2.697	L 2.709	
	(2 PL)	R 2.702	R 2.696	R 2.705	R 2.721	R 2.684	
	0.2 @ 0 C	L.022 R.015	L.060 R.075	L.074 R.061	L.081 R.030	L.011 R.154	
	2.465	2.444 2.450	2.463 2.390	2.389 2.384	2.394 2.495	2.476 2.311	
48	0.35 - 0.66	.463 .456	.559 .330	.571 .492	.508 .483	.476 .504	
	(4 PL)	.494 .539	.474 .505	.449 .514	.511 .509	.491 .509	
49	0.84 - 1.17	.985 .995	.959 .942	.968 .989	.990 .953	.987 .955	
	(4 PL)	.942 .952	.996 .959	.975 .923	.955 .934	.960 .974	
50	45DEG +/- 2DEG	44DEG 45MIN	43DEG 56MIN	45DEG 39MIN	45DEG 24MIN	43DEG 59MIN	
	(4 PL)	44DEG 47MIN	44DEG 45MIN	44DEG 05MIN	44DEG 39MIN	45DEG 56MIN	
		45DEG 13MIN	44DEG 37MIN	44DEG 11MIN	45DEG 12MIN	45DEG 54MIN	
		45DEG 06MIN	45DEG 20MIN	44DEG 44MIN	44DEG 23MIN	46DEG 20MIN	
51	0.30-0.72 2PL	0.342 0.450	0.332 0.423	0.344 0.499	0.368 0.429	0.309 0.392	
52	2.15-2.42 2PL	2.180 2.220	2.198 2.153	2.169 2.219	2.161 2.170	2.140 2.194	
53	25DEG +/- 2DEG	24DEG 22MIN	24DEG 10MIN	24DEG 47MIN	24DEG 17MIN	23DEG 37MIN	
	(2 PL)	23DEG 32MIN	23DEG 41MIN	23DEG 50MIN	23DEG 04MIN	22DEG 39MIN	
54	COLOR: BLACK	OK	OK	OK	OK	OK	
55	13-19DEG 2PL	ON CROSS	SECTIONED	PART ON	PRINT		
56	0.66 - 0.87	ON CROSS	SECTIONED	PART ON	PRINT		
57	0.10 - 0.31	.232 .279	.287 .281	.276 .240	.287 .240	.286 .287	
58	0.50 - 0.68	.625 .646	.646 .621	.640 .622	.658 .622	.644 .626	

TI-NHTSA 003094

135 42

PIST - FAI INFO

Use 4/T & P/C data submitted to Ford P/C PKG.

PIST

72 x 4 = 288

36

36

36

66 x 4 = 264

660 - ES Tests

REPORT OF ISR TESTING
FORD PASSENGER CAR
ELECTRONIC SPEED CONTROL
DEACTIVATION PRESSURE SWITCH
P8/91/49

91-09-20

TEXAS INSTRUMENTS INCORPORATED
CONTROL PRODUCTS DIVISION
PRECISION CONTROLS DEPARTMENT
34 FOREST STREET
ATTLEBORO, MA 02703

TABLE OF CONTENTS

1.0 GENERAL

1.1 Customer: Ford Motor Company, Passenger Car Brake Systems Engineering

1.2 TI Part Number: 77PSL2-1

1.3 Customer Part Number: F2VC-9F924-AB

1.4 Specifications: Ford Engineering Specification number (delta) ES-F2VC-9F924-AA

1.5 Date of Completion: 910920

1.6 Quantity of Units Tested: 104

1.7 Disposition of Tested Units:

1.7.1 Devices 156-15-37 thru -42 were destroyed in Burst testing (3.5)

1.7.2 All other devices are retained under quarantine.

1.8 TI test series number: 156-15-104

1.9 TI Pressure Switch test report number: PS/91/49

2.0 OBJECTIVE

This battery of tests was performed to demonstrate the ability of 77F8L2-1 to conform to customer specifications given in (delta) ES-F2VC-9F924-AA, in fulfillment of the requirements of the Initial Sample Report. Units tested were built using fully qualified production components and production assembly equipment.

3.0 TEST PROCEDURES AND RESULTS

All switches were tested to Ford Engineering Specification (delta) ES-F2VC-9F924-AA. A copy of this ES is included in Appendix 4.1. Procedural details are therefore omitted from the presentation of results in most cases. In those instances where the ES procedure methodology is modified, a complete explanation of the actual procedure is presented. For all tests, raw data is included in Appendix 4.2.1.

A flow chart is included in the ES (frame 4 of 18), as follows: All test devices are to be subject to an initial characterization consisting of Calibration, Voltage Drop, Current Leakage, and Proof. Devices are then divided into groups per the flow chart and subject to the indicated tests in the indicated order. Finally, devices are subject to a final characterization. However, it became necessary to deviate from this exact procedure as described below. We believe that this alternate procedure still meets the intent of the ES.

During the first phase of Impulse (3.10) testing (12 virgin devices) it was discovered that the pressure-sensing assemblies were improperly built, resulting in a reduction in life of the diaphragm. During investigation of the root cause of diaphragm problems, it was learned that the final crimp station on the automatic assembly equipment experiences this problem only on this particular part; all other devices built on this equipment are not subject to this. Witness the good results obtained with the Light Truck (F3TA-9F924-AA) version of this test (see data in Appendix 4.2.7), built on the automatic assembly equipment, as supporting evidence.

3.0 TEST PROCEDURES AND RESULTS, CONTINUED

While analysis and permanent corrective actions are ongoing, it was also learned that the manual assembly equipment which performs the final crimp produces pressure-sensing assemblies which have acceptable life. This equipment was used 4Q90 during validation of F2VC-9F924-BB (TI P/N 57PEL5-3) which uses exactly the same pressure sensing assembly, as well as to produce the rebuilt Impulse devices (157-15-81 thru -104) and will continue to be used until such time as the permanent corrective actions are in place on the automatic equipment and re-validation is completed.

To expedite completion of the switch validation, 12 of the rebuilt parts were not subjected to the Fluid Resistance test (3.9). However, this will not affect the results of the Impulse test in any way, since the various fluids do not come into contact with the diaphragm. Invoking similarity with the Light Truck (F3TA-9F924-AA) version of this test which was run simultaneously, all devices undergoing Fluid Resistance in this test easily passed their subsequent Impulse test.

3.1 CALIBRATION

3.1.1 Procedure: Calibration is checked at room temperature using ambient air as the pressure medium. Calibration settings, as specified on the part drawing, are actuation (electrical contacts opening) at 200 - 300 psig, and release (contacts reclosing) at 40 psig minimum. For the purpose of stabilization, actuation values are recorded on the sixth cycle, after subjecting the switch to two (2) pressure cycles to 800 psig minimum and back to zero, followed by three (3) cycles to 1.1 times actuation pressure minimum and back to zero. The change in continuity is measured while conducting 750 +/- 50 milliamps at 13.0 +/- 1.0 volts DC.

3.1.2 Equipment: Custom TI designed and built pressure check station, using Heise Modal CM96365 pressure gage calibrated on a regular quarterly schedule. Continuity change measured on custom TI designed and built equipment meeting the above electrical parameters.

3.1.3 Initial Results: All 72 original devices tested were found to be within specification.

3.1.4 Final Results: 42 surviving original devices were found to be within specification. 6 were destroyed in Burst (3.5), 24 were aborted from Impulse (3.10). 24 additional devices which underwent Impulse but had no initial characterization were also found to be within specification at the completion of testing.

3.2 VOLTAGE DROP

3.2.1 Equipment: Fluke Modal 8020B Digital Multimeter, calibrated quarterly, used in conjunction with the continuity equipment in 3.1.2.

3.2.2. Initial results: The average voltage drop was 4.9 millivolts, and the standard deviation was 1.9. All values are significantly below the specification of 200 millivolts maximum.

3.2.3 Final results: The average voltage drop was 6.4 millivolts, and the standard deviation was 3.5.

3.3 CURRENT LEAKAGE

3.3.1 Equipment: Associated Research HyPot test unit used as power source for 500 VAC, 60 Hz test circuit. Fluke Model 8020B Digital Multimeter, calibrated quarterly, used to measure voltage drop across a series resistance of one megohm (+/- 5%).

3.3.2 Initial results: Measuring terminals to case with switch closed; measuring terminals to case with switch open; and measuring between the terminals: the maximum current leakage observed was 2.3 microamps. All values are significantly below the specification of 100 microamps.

3.3.3. Final results: Same three measurements per device as 3.3.2. All current leakage values were consistent with initial results. All values are significantly below the specification of 100 microamps.

3.4 PROOF

3.4.1 Procedure: Calibration readings were recorded only after proof testing. Test pressure was 3000 psi per the part drawing.

3.4.1 Equipment: Enerpak model P-392 hydraulic hand pump using Enerpak hydraulic fluid as the pressure medium. Hydraulic fluid is removed from the devices using a combination of vacuum and residue-free solvent Sprayon(TM) Hi-Tech 02002 TF Electrical Contact Cleaner. US Gauge #33714 reading to 5000 psig with 100 psi increments, resolvable to 50 psi., calibrated quarterly. Custom TI designed and built safety enclosure.

3.4.2 Initial Results: No evidence of fluid leakage and no drop in test pressure was observed on any device.

3.4.3 Final Results: No evidence of fluid leakage and no drop in test pressure was observed on any device.

3.5 BURST

3.5.1 Devices tested: 156-15-37 thru -42.

3.5.2 Procedure: A pressure of 7000 psig was applied and held for 30 seconds minimum. Pressure was then increased slowly until failure. Failure is typically signalled by a sudden drop in test pressure of several hundred psi, which corresponds with the first point at which some internal component reaches irreversible plastic deformation and causes an increase in internal volume. The peak pressure attained as this occurs is defined as the bursting point.

3.5.3. Equipment: same as 3.4.1., with the addition of Enerpak gauge reading to 10,000 psig with 100 psi increments, resolvable to 50 psi., calibrated quarterly.

3.5.4. Results: All six devices passed 30 seconds at 7000 psig without evidence of fluid leakage or drop in test pressure. The failure point defined in 3.5.2 was recorded, and a Weibull plot generated. See data section 4.2.2. Using the statistical acceptance criteria from the ES (frame 3 of 18), a minimum Weibull slope (beta) of 31.5 and a minimum Characteristic Life (theta) of 7680.7 psi was calculated at 90% confidence. The 0.72 reliability at 90% confidence is 7414 psi. Thus, the parts exceed the burst specification of 7000 psig by 414 psi at the Ford-specified confidence and reliability levels.

3.6 VIBRATION

3.6.1 Devices tested: 156-15-43 thru -48.

3.6.2 Equipment: Vibration table, Ling, model A395 with Hewlett-Packard model 5427 controls. Air tank with 350 psig minimum pressurized Nitrogen used to actuate devices with at least 1.1 times maximum actuation specification on part drawing; 300 psig * 1.1 = 330 psi minimum.

3.6.3 Results: All six switches met the acceptance criteria in the ES (frame 9 of 18; section III. I. 3.).

3.7 VACUUM

3.7.1 Devices tested: 156-15-49, -50, -52 thru -55.

3.7.2 Equipment: Kinney vacuum pump. Sensotec pressure transducer range 0-25 psia calibrated quarterly, with Fluke model 8020B Digital Multimeter readout, calibrated quarterly.

3.7.3 Results: All six devices met the acceptance criteria in the ES (frame 10 of 16; section III. K. 2.).

3.0 TEMPERATURE CYCLE

3.0.1 Devices tested: 156-15-56 thru -61.

3.0.2 Equipment: Thermotron model S-4 Mini-Max environmental chamber capable of -55 C to +200 C, humidity uncontrolled. Custom TI designed and built cycler, utilizing Enerpak integrated hydraulic pressure source, TI315 Programmable Logic Controller, Moog servovalve and controller, Simpson signal generator, and opposing-piston fluid isolators, to produce a hydraulic-fluid flow-type primary with a brake-fluid dead-end-type secondary terminated with a 24-station manifold equipped with internal heaters. Capability to 5 Hz at 0-1450 psig cycle. Custom TI designed and built 24 station Switch Monitor Circuit which automatically stops the cycler in the event of abnormal switch action, defined as continuity change which does not track the signal from the signal generator. Thermocouple readouts calibrated quarterly.

3.0.3 Results: All six devices met the acceptance criteria in ES (frame 11 of 18/ section III. L. 2.). Data sheet in section 4.2.4 shows actual fluid and ambient temperatures attained at each cycle.

3.9 FLUID RESISTANCE

3.9.1 Devices tested: 156-15-01 thru -36.

3.9.2 Equipment: Fluids as called out in ES table (frame 12 of 18); appropriate beakers and storage apparatus; vented hood.

3.9.3 Results: The 36 devices were divided into groups as follows for subsequent testing. Results of these tests are reported below.

3.9.3.1 Impulse (3.10), -01 thru -12

3.9.3.2 Terminal Strength (3.11), -13 thru -24.

3.9.3.3 Humidity (3.12), -25 thru -30.

3.9.3.4 Salt Spray (3.13), -31 thru -36.

3.10 IMPULSE

3.10.1 Devices tested: 156-15-81 thru -104.

3.10.2 Procedure: 24 virgin devices were run as opposed to 12 virgins and 12 from Fluid Resistance. This is discussed in detail in section 3.0. The parameters given in the ES (frame 7 of 18, section III. E. 1.) are followed explicitly.

3.10.3 Equipment: same as 3.8.2 with the addition of a 12-station inductive load bank, per the schematic found in the ES (frame 18 of 18; figure 4.) used in the last 25K cycles.

3.10.4 Results/Discussion: Pre-characterization was not performed. After completion of the 500K cycles, all 24 devices passed the acceptance criteria found in the ES (frame 7 of 18, section III. E. 2).

This test may be regarded as the one of the most rigorous. This test is run at elevated temperature (135 C fluid), elevated pressure (1450 psig, 2 Hz), and total cycles (applying brakes 5 times per mile for 100,000 miles) which exceed conditions typically found in actual motor vehicles.

3.11 TERMINAL STRENGTH

3.11.1 Devices tested: 156-15-13 thru -24.

3.11.2 Equipment: Custom TI designed and built fixtures for gaging terminal movement after force application and for application of impact via a pendulum. This equipment is regularly used on the 57PS/77PS assembly lines in testing to TI Quality Assurance Specifications.

3.11.3 Results: All twelve devices passed the acceptance criteria found in the ES (frame 10 of 18; section III. J. 2.).

3.12 HUMIDITY

3.12.1 Devices tested: 156-15-25 thru -30.

3.12.2 Equipment: Humidity chamber RK model 58.

3.12.3 Results/Discussion: Please note that performing a full characterization per the ES consists of actuation, release, millivolt drop, current leakage, and proof. This battery of tests when performed on six (6) devices takes approximately 2 hours to complete. Therefore "Within 15 minutes..." called out in the ES (frame 8 of 18, section III. G. 2. a.) is an acceptance requirement that is physically impossible to meet. Every effort is made to complete final characterization within the two hour period stated above.

All six devices passed the acceptance criteria found in the ES (frame 8 of 18; section III. G. 2.).

3.13 SALT SPRAY

3.13.1 Devices tested: 156-15-31 thru -36.

3.13.2 Equipment: Harshaw salt spray chamber.

3.13.3 Results: All six devices passed the acceptance criteria found in the EE (frame 8 of 18, section III. H. 2.).

Appendix 4.1
Ford Engineering Specification
(delta) ES-F2VC-9F924-AA

ES Testing

72 devices tested

6 - destroyed in Burst

60 - Passed

---

72 - Cal.
72 MVD
72 current leakage
72 [illegible]

396
+66×4 = 264 + 396 = 660

See flow chart in Test pkg.

Do not count
#29 + 35 in
PIST data

Make note that
these need to
be done on
blanket like
bigger threads

Dim.'s

38 X 6 = 228 + 2 = 230

7 X 6 = 42 + 5 = 47

12 X 6 = 72 + 13 = 85

31 X 6 = + 10 = 196

558

PIST

77 PC ISR

PEST

PIST FAI Results

Total - O.D. jaw. ÷

520 ÷ 15 = 505 : 520 = 97%

n/a #29+35

MAT. Avail.

19 — 100%

FAI 97%

Mat. Avail. 100%

ES Test ?

TEXAS INSTRUMENTS

K-H FAI Pkg Data

DIMENSIONAL ANALYSIS ON PART NUMBER

FZMC-9924-48

	BLUEPRINT SPEC	CAVITY # 1B ACTUAL	CAVITY # 2C ACTUAL	CAVITY # 3C ACTUAL	CAVITY # 4D ACTUAL	CAVITY # 5D ACTUAL	CAVITY # 6B ACTUAL	COMMENTS
1	19.45 - 19.81	19.55	19.61	19.56	19.56	19.57	19.57	
2	16.56 - 16.76	16.59/16.58	16.62/16.64	16.62/16.63	16.58/16.59	16.54/16.56	16.59/16.59	12
3	13.03 - 13.21	12.974	13.051	13.035	13.043	13.078	12.946	
4	11.40 - 11.90	11.788	11.808	11.775	11.773	11.756	11.758	
5	2.84 - 3.05	2.95	2.92	2.92	2.92	2.99	2.93	12
	0.1 R	11.859/0.041	11.920/0.020	11.933/0.033	11.869/0.031	11.895/0.015	11.907/0.013	
6	11.68 - 11.92	11.69/11.71	11.67/11.71	11.72/11.68	11.60/11.63	11.68/11.67	11.68/11.66	24
7	1.24 - 1.45	1.252	1.259	1.280	1.280	1.290	1.245	
8	1.24 - 1.55	1.402	1.397	1.400	1.389	1.397	1.397	
9	1.85 - 2.06	2.004	1.974	1.996	1.984	1.944	1.986	
10	13.43 - 13.65	13.772	13.693	13.800	13.686	13.686	13.556	24
11	30DEG +/- 2DEG	30DEG 5MIN	29DEG 55MIN	30DEG	29DEG 04MIN	29DEG 03MIN	30DEG 08MIN	
12	2.79 - 3.10 2X	2.96/2.89	2.90/2.90	2.90/2.90	2.90/2.90	2.89/2.89	2.90/2.94	12
13	0.26 - 0.76	0.506/0.861	0.480/0.869	0.442/0.473	0.498/0.471	0.490/0.744	0.440/0.757	OUT OF SPEC. 12 -3
14	0.05 - 0.26 2X	0.051/0.069	0.074/0.127	0.140/0.074	0.127/0.135	0.153/0.169	0.0711/0.036	
		0.140/0.147	0.092/0.089	0.096/0.114	0.048/0.081	0.038/0.813	0.137/0.165	
15	0 19.05 MAX	18.44 18.56	18.57 18.46	18.54 18.66	18.60 18.77	18.63 18.71	18.61 18.47	36

TI-NHTSA 003124

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F2MC-9F924-4B

	BLUEPRINT SPEC	CAVITY # 1D ACTUAL	CAVITY # 2C ACTUAL	CAVITY # 3C ACTUAL	CAVITY # 4D ACTUAL	CAVITY # 5D ACTUAL	CAVITY # 6D ACTUAL	COMMENTS
16	57.15 MAX	55.65	55.70	55.71	55.70	55.69	55.68	
17	12.59 - 13.11	12.74/12.86	12.72/12.84	12.77/12.76	12.76/12.77	12.73/12.81	12.73/12.80	
18	11.65 - 12.17	11.68/11.79	11.85/11.64	11.73/11.79	11.80/11.84	11.78/11.86	11.73/11.80	3a
19	14.23 MAX	13.66	13.65	13.67	13.65	13.65	13.66	
20	9.39 - 9.66	9.39/9.63	9.61/9.66	9.57/9.64	9.49/9.62	9.58/9.74	9.55/9.67	OUT OF SPEC. 18 - a
21	8.13 MIN	8.98/9.29	9.13/9.54	9.12/9.18	8.98/9.56	9.14/9.22	9.11/9.19	
22	1.52 - 2.04	2.040	1.732	1.783	1.727	1.781	1.796	
23	Ø 7.82-8.03	7.94/7.50	7.94	7.97/7.99	7.97	7.98	7.96	
24	6.60 - 6.81	6.640	6.680	6.690	6.647	6.665	6.642	
24A	290DEG+/-20D 4?	29DEG 54MIN	190DEG 24MIN	MEASURED	ON A CROSS	SECTIONED	PART	
		30DEG 57MIN	28DEG 46MIN					34
25	1.80-2.2IR 2?	1.54-1.84	1.84-1.80	1.84-1.84	1.84-1.84	1.84-1.84	1.84-1.84	
26	7.23-7.75	7.74	7.52	7.53	7.54	7.53	7.50	
26A	NO FLASH OR	OK	OK	FLASH	OK	OK	FLASH	24 - a
	BURRS ALLOWED							
	ON SURFACE							
27	2.79-3.41	3.145	3.090	3.140	3.150	3.119	3.107	
28	0.40-1.30	1.115	1.160	1.179	1.140	1.161	1.150	12

TI-NHTSA 003125

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F2VC-MF924-AB

	BLUEPRINT SPEC	CAVITY # 1B ACTUAL	CAVITY # 2C ACTUAL	CAVITY # 3C ACTUAL	CAVITY # 4D ACTUAL	CAVITY # 5D ACTUAL	CAVITY # 6D ACTUAL	COMMENTS
28A	STAMP DATE	INVERTED	DELTA	OMITTED.	HAS SINCE	BEEN	INCLUDED	-6
	CODE & PARTN	IN CODING	OPERATION.					
29	0.25MIN X 40 -	N/A THREADS	HAVE BEEN	ADDED				N/A
	90DEG CHAMFER							
30	9/8-2NUMF-2A	OK	OK	OK	OK	OK	OK	
31	1.10-1.40	1.316	MEASURED	ON A CROSS	SECTIONED	PART		
32	0.15 D	0.051	0.048	0.048	0.009	0.030	0.056	
33	2.5 C	OK	MEASURED	ON A CROSS	SECTIONED	PART		
34	41DEG - 49DEG	41DEG 21MIN	MEASURED	ON A CROSS	SECTIONED	PART		15
35	40-50DEG CHAMF	N/A THREADS	HAVE BEEN	ADDED				N/A
36	32.51 MAX	31.64 31.62	31.46 31.48	31.45 31.46	31.50 31.47	31.46 31.48	31.58 31.58	
37	14.02-14.53NEX	14.11	14.11	14.11/14.13	14.11/14.13	14.12/14.13	14.11/14.12	
38	3.30-3.60	3.45 - 3.46	3.45 - 3.43	3.43 - 3.42	3.45 - 3.46	3.44 - 3.47	3.45 - 3.45	
39	7.23-7.37	7.27 7.28	7.33 7.32	7.39 7.39	7.31 7.27	7.32 7.30	7.37 7.37	46
40	5.58-5.85	5.61 5.68	5.72-5.68	5.64-5.66	5.67-5.70	5.60-5.66	5.61-5.63	
41	71.5DEG +/-	72DEG 30MIN	72DEG 11MIN	72DEG 12MIN	72DEG 2MIN	71DEG 54MIN	72DEG 10MIN	
	ZDEG 2E	72DEG 30MIN	72DEG 14MIN	72DEG 50MIN	72DEG 37MIN	72DEG 11MIN	72DEG 3MIN	24

TI-NHTSA 003126

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F2VC-9F924-AB

	BLUEPRINT SPEC	CAVITY # 1D ACTUAL	CAVITY # 2C ACTUAL	CAVITY # 3C ACTUAL	CAVITY # 4D ACTUAL	CAVITY # 5D ACTUAL	CAVITY # 6D ACTUAL	COMMENTS
42	1.42-1.63 2X	1.62-1.62	1.63-1.63	1.58-1.63	1.63-1.60	1.60-1.59	1.60-1.57	
43	0.35-0.66 4X	1.66-0.65	0.57-0.59	0.57-0.60	0.58-0.58	0.59-0.57	0.57-0.59	
		0.57-0.59	0.59-0.55	0.58-0.57	0.59-0.56	0.56-0.55	0.55-0.56	
44	0.30-0.72 2X	0.43-0.46	0.51-0.44	0.41-0.44	0.42-0.42	0.39-0.47	0.42-0.56	
45	2.15-2.42 2X	2.18-2.21	2.18-2.22	2.20-2.15	2.20-2.16	2.16-2.18	2.23-2.16	#1 OUT OF SPEC 30 - 1
46	250DEG+/-2 2X	240DEG 36MIN	240DEG 41MIN	230DEG 14MIN	230DEG 35MIN	230DEG 09MIN	230DEG 34MIN	
		220DEG 04MIN	230DEG 45MIN	240DEG 31MIN	230DEG 53MIN	230DEG 59MIN	240DEG 24MIN	
47	HOUSING=BROWN	BROWN	BROWN	BROWN	BROWN	BROWN	BROWN	18
48	450DEG+/-2 4X	440DEG 34MIN	460DEG 47MIN	460DEG 09MIN	450DEG 08MIN	450DEG 37MIN	430DEG	
		450DEG 46MIN	450DEG 15MIN	430DEG 20MIN	450DEG 04MIN	440DEG 11MIN	440DEG 05MIN	
		440DEG 45MIN	450DEG 44MIN	440DEG 46MIN	450DEG 16MIN	440DEG 07MIN	440DEG 01MIN	
		450DEG 12MIN	450DEG 23MIN	450DEG 39MIN	440DEG 48MIN	450DEG 34MIN	440DEG 34MIN	24
49	0.86-1.17 4X	0.94-0.95	0.98-1.00	0.97-1.02	0.98-1.02	0.99-1.03	0.99-1.03	
		0.95-0.98	0.94-0.97	0.96-1.00	0.93-1.00	0.97-0.97	0.95-0.96	24
50	0.35-0.66 4X	0.54-0.54	0.45-0.44	0.46-0.48	0.46-0.50	0.45-0.54	0.51-0.49	
		0.48-0.51	0.49-0.52	0.54-0.53	0.52-0.52	0.50-0.54	0.51-0.44	24

TI-NHTSA 003127

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F2VC-9F924-AB

	BLUEPRINT SPEC	CAVITY # 1B ACTUAL	CAVITY # 2C ACTUAL	CAVITY # 3C ACTUAL	CAVITY # 4D ACTUAL	CAVITY # 5D ACTUAL	CAVITY # 6D ACTUAL	COMMENTS
51	2.59-2.80 ZX	2.725	2.710	2.709	2.713	2.710	2.739	
	0.2 m A C	2.393	2.499	2.578	2.482	2.457	2.515	
	D	0.072	0.034	0.113	0.017	0.008	0.050	
	2.39-2.80 ZX	2.698	2.703	2.715	2.703	2.695	2.710	
	0.2 m A C	2.499	2.522	2.380	2.377	2.427	2.443	
	D	0.034	0.057	0.085	0.068	0.038	0.022	3x.
52	113-119DEG ZX	17DEG 23MIN	MEASURED	ON A CROSS	SECTIONED	PART		
		19DEG 49MIN	MEASURED	ON A CROSS	SECTIONED	PART		OUT OF SPEC +49MIN
53	0.66-0.87	0.795	MEASURED	ON A CROSS	SECTIONED	PART		
54	3.10-0.31	0.262	MEASURED	ON A CROSS	SECTIONED	PART		
55	0.58-0.68	0.632	MEASURED	ON A CROSS	SECTIONED	PART		5 -1

TI-NHTSA 003128

520 -15

TEXAS INSTRUMENTS INCORPORATED • 34 FOREST STREET • ATTLEBORO, MA 02703
508-699-6000 • TELEX 94-4700 TWX 710-340-0000 • CABLE TEXINS

#29436 p/A

DRAWINGS AVAILABLE UPON REQUEST

-MSG Nf= 98693 FR=ELB3 TO=PCQA SENT=12/16/91 12:39 PM
Rf=169 ST=C DIV=0050 CC=00101 BY=ELB3 AT=12/16/91 12:39 PM

DECEMBER 16, 1991

TO: JIM WATT PCQA

CC: CHARLIE DOUGLAS CPPC
STEVE OFFILER SBO1

FR: DAVE CZARN ZARN

SJ: 77PSL2-1 ISR SUBMISSION (CCPS P/C SWITCH)

cc: Elaine
FYI / PIST / PIST data?

Jim,
As you know from the start-up meetings, we plan to send to Ford and the Tier 1's the information required to gain full production approval. We've agreed that this information would be sent out on Friday, 12/20/91.

Steve Offiler will give a completed test report to you on Friday.

Please determine what else must accompany the report in order to gain approval, and have it prepared for Friday shipment. This will at least need to include a cover letter that describes what we're submitting. The cover letter should state that the test report qualifies both the partially and fully automated production processes. I'd like you to get Charlie and Steve's inputs with regard to the letter.

Thanks,
Dave Czarn
/dt

TO:

-MSG N#= 122733 FR=EARN TO=PCQA SENT=12/17/91 08:26 AM
R#=193 ST=C DIV=0050 CC=00101 BY=EARN AT=12/17/91 08:26 AM

DECEMBER 17, 1991

TO:	RUSTY STRUBLE	RCS2	CC:	TOM CHARBONEAU	TC
	MIKE DeMATTIA	PCQA		JOHN KOURTESIS	MDES
	CHARLIE DOUGLAS	CPPC		STEVE MAJOR	WHLS
	DICK GARIEPY	MFPC		ANDY McGUIRK	PCQA
	PAUL KOTCH	PRK1		ED O'NEILL	EJON
	JOE LASARE	JMLS			
	STEVE OFFILER	SBO1		GARY SNYDER	CPPC
	MATT SELLERS	PCME		MARTHA SULLIVAN	CPPC
	BILL SWEET	PCME		RAY TOURANGEAU	PCME
	JIM WATT	PCQA		BILL CONGDON	MFPC
	CLAIRE BALTHAZAR	PSWT		STEVE MCCOOEY	MDES
	TERRY RODRIGUES	MFPC		ELAINE ROSE	PCQA

FR: DAVE CEARN EARN

SJ: FORD CRUISE CONTROL PRESSURE SWITCH START-UP MEETING:
12/12/91 MEETING MINUTES

MEETING

THE NEXT MEETING IS SCHEDULED FOR:

DATE: 12/19 (THURSDAY)
TIME: 10:00 - 11:30 AM **********
PLACE: CAFETERIA CUBE *****PLEASE NOTE CHANGE*****
****

77PS

Hexport:

Elco indicated a number of weeks ago that their J512 gage had unacceptable R&R. Matt will follow up to determine where the problem lies and what can be done to improve it.

. REPORT ON ELCO ISSUES FROM 7/22 VISIT - 10521 STEEL/.00015" MIN. PLATE/J512 $	KOTCH	ONGOING
. CORRECT ELCO'S J512 GAGE R&R ISSUE	SELLERS	1/23

Environmental Seal:

Blue seal material has been approved by Ford; seals are included in P/C validation testing. Striped seals will be purged from the line when the blue seals - of the same thickness - are received.

. INCLUDE GASKETS IN P/C RE-VALIDATION	OFFILER	ONGOING
SUBMIT CHANGE NOTICES TO TIER 1'S	DOUGLAS	12/12
* ENSURE THAT P/N 74247-4 IS ORDERED FOR 77PSL2-1 WHEN NEXT ORDER IS PLACED	LASARE	COMP.
* REMOVE -3 AS ALTERNATE FROM P/L	OFFILER	1/30

Production Issues:

. MAINTAIN RUNNING TOTAL OF L/T (L2-3) SWITCHES LEADING TO 100K FOR AMORTIZATION	STRUBLE	ONGOING

8092 pcs. 1/6/92 1/13/92 } Release 6900 Build 9K

TI-NHTSA 003131

Status Date	Total Shipped
Dec. 12	8089

. UPDATE PRODUCTION PLANS FOR ALL SWITCHES	DOUGLAS	ONGOING
* UPDATE PRODUCTION COMPONENT AND ASM. DRAWINGS TO CURRENT DESIGN LEVEL	OFFILER	2/13
* CHANGE FREQUENCY OF RING GAGE CALIB. FROM ONCE/6 WEEKS TO ONCE/QTR; KEEP LOG TO DETERMINE IF GAGES ARE OUR OF CAL.	GARIEPY	1/09

Sensor Assembly Machine:

Automated washer/converter assembly tooling effectivity runs are underway. Attachment to AMI has been delayed to early next year.

* INSTALL WASHER/CONV. STATION ON AMI	SELLERS	(DATE ?)
. CALL MTG. TO REVIEW AMI#2 UPGRADE PLANS	SELLERS	12/19

Base Assembly Machine:

Final Assembly Machine:

Misc. Manufacturing/QC Equipment:

* MAKE QC P-TESTER COMPAT. W/77'S	WATT/ ROCHA	COMP.	
* MAKE QC CURR. LKG. TESTER COMPAT. W/77'S	WATT/ ROCHA	COMP.	

PV Testing/ISR:

Test report will be completed on Friday. Jim will prepare any additional information that is required and will ship out all information on Friday, 12/20.

* SUBMIT ADDENDUM TO PC ISR W/CORRECTED BASE DIMENSION & PIST/PIPC DATA	WATT	10/18 12/20	ORIG. REV.
* STATUS OF L/T APPROVAL	DOUGLAS	11/28 12/19	ORIG. REV.
. COMPLETE PV TESTING & REPORT	OFFILER	12/20	
* SEND SECOND ISR SUBMISSION TO FORD AND TIER 1'S	WATT	[illegible]	

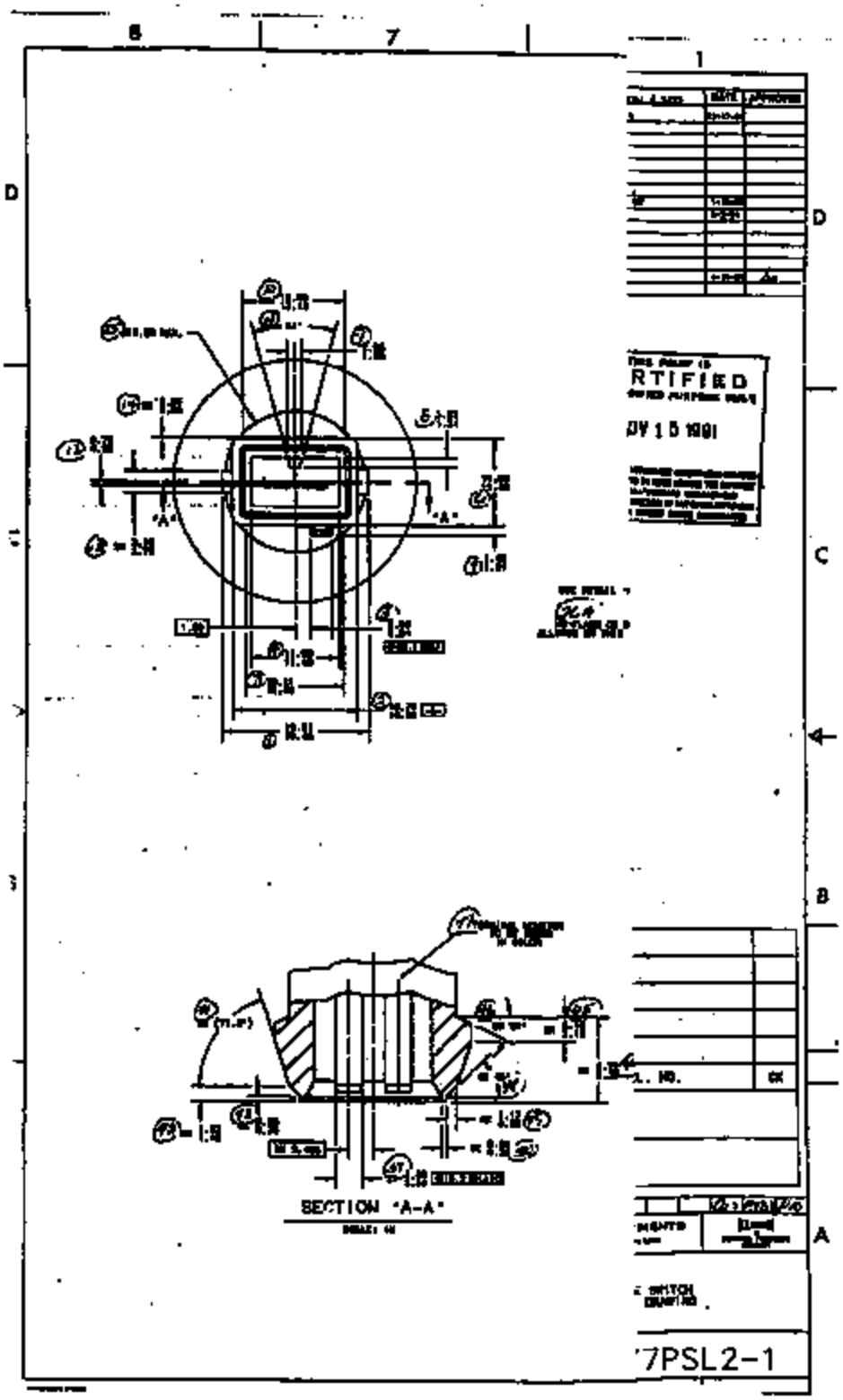
Diaphragm Life:

. IMPLEMENT SOLUTION TO DIAPHRAGM LIFE	OFFILER/ SELLERS	ONGOING
* SET UP MTG TO REVIEW RESULTS OF CRIMP/ DIAPHRAGM LIFE STUDIES	OFFILER	1/09

Miscellaneous:

. 57 TO 77 CONVERSION: PHASE 1 TESTING	OFFILER/ SELLERS	12/19	
. COMPLETE DESIGN FMEA	OFFILER	04/18 02/14	ORIG. REV.
. DETERMINE APPROACH FOR 2A/3A THREAD GAGING ISSUE	CZARN/ MCGUIRK	10/03 11/21	ORIG. REV.

The team resolved this issue; Jim/Dave will draft a letter which will be sent to the appropriate Ford (and GM) personnel, along with


SECTION "A-A"
7PSL2-1

3.9 IMPULSE

3.9.1 Devices tested: 207-15-1 thru -24.

3.9.2 Procedure: Performed per the ES.

3.9.3 Equipment: same as 3.8.3.

3.9.4 Results/Discussion: Four devices (#207-15-1,-5,-9,-11) were found to have a slightly elevated release transfer time (Creep Check, ES frame 9 of 13, section III. M.). Note that other Ford Engineering Specifications which cover hydraulic pressure switches produced by Texas Instruments, specifically ES-E53C-3N824-AA, allow up to 30 milliseconds for transfer time after the Impulse test. The four devices noted fell well within 30 msec. This issue will be addressed by communication with the responsible engineering office at Ford, to determine if a slight increase in transfer time at the end of life should be included in the ES.

92005 4/24/99 E75C 3N824AA

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS — MATERIALS & CONTROLS GROUP, ATTLEBORO, MA 02703	DOC.
DATE		PAGE 14

FORM 5288

4.5 IMPULSE

4.5.1 PROCEDURES:
Per the engineering specification.

4.5.2 EQUIPMENT:
- Thermotron environmental chamber, model S - 4.
- Twenty-four station manifold.
- Mating electrical connectors.
- Trygon Electronics Dual Power Supply, DL40-1A for the loads.
- Acopian power supply, 5E25D-D15E05 for Sensotec transducer.
- Customized designed and built pressure cycler.
- Enerpac hydraulic pump.
- TI 315 Programmable Logic Controller.
- Moog servo valve, 760-552-A.
- Moog controller, MA-X-50.
- Simpson signal generator.
- Sensotec transducer, TJE-744-02, 0-2,500 psig, calibrated semi-annually.
- Nicolet oscilloscope, 310, calibrated semi-annually.

4.5.3 REQUIREMENTS:
At the completion of this test all switches shall meet the Voltage Drop, Current Leakage, and Creep Time requirements outline in the engineering specification (See Appendix 5.1). Additionally, the post-impulse calibration requirements are not define; results of this test will be used to set this requirement.

4.5.4 RESULTS:
All switches met the requirements outlined in the engineering specification. Data is presented in Appendix 5.4.2.

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS — MATERIALS & CONTROLS GROUP, ATTLEBORO, MA 02703	DOC.
DATE 7/16/92		PAGE 11

FORM 9758

3.6 IMPULSE

3.6.1 Devices tested: 172-15-01 thru -24
173-15-01 thru -24.

3.6.2 Procedure: 172-15-13 thru -24 and 173-15-13 thru -24 were run together on the Impulse test per the ES. Devices 172-15-01 thru -12 and 173-15-01 thru -12 were subject to the Fluid resistance test first, then run together on the Impulse test.

3.6.3 Equipment: Thermotron model S-4 Mini-Max environmental chamber capable of -55 C to +200 C, humidity uncontrolled. Custom TI designed and built cycler, utilizing Enerpak integrated hydraulic pressure source, TI315 Programmable Logic Controller, Moog servovalve and controller, Simpson signal generator, and opposing-piston fluid isolators, to produce a hydraulic-fluid flow-type primary with a brake-fluid dead-end-type secondary terminated with a 24-station manifold equipped with internal heaters. Capability to 5 Hz at 0-1450 psig cycle. Custom TI designed and built 24 station Switch Monitor Circuit which automatically stops the cycler in the event of abnormal switch action, defined as continuity change which does not track the signal from the signal generator. Thermocouple readouts calibrated quarterly. 12-station inductive load bank, per the schematic found in the ES (frame 18 of 18; figure 4.) used in the last 25K cycles.

3.6.4 Results: All devices passed.

3.10 IMPULSE

3.10.1 Devices tested: 157-15-01 thru -12 from Fluid Resistance test 3.9 and 157-15-67, -69 thru -74, -76 thru -80 virgin devices.

3.10.2 Procedure: Virgin devices were run separately, before the Fluid Resistance devices. In each case, the procedure given in the ES (frame 7 of 18, section III. E. 1.) was followed explicitly.

3.10.3 Equipment: same as 3.8.2 with the addition of a 12-station inductive load bank, per the schematic found in the ES (frame 18 of 18; figure 4.) used in the last 25K cycles.

3.10.4 Results/Discussion: All twenty-four devices passed the acceptance criteria found in the ES (frame 7 of 18; section III. E. 2.).

This test may be regarded as the one of the most rigorous. This test is run at elevated temperature (135 C fluid), elevated pressure (1450 psig, 2 Hz), and total cycles (applying brakes 5 times per mile for 100,000 miles) which exceed conditions typically found in actual motor vehicles.

3.10 IMPULSE

3.10.1 Devices tested: 156-15-81 thru -104.

3.10.2 Procedure: 24 virgin devices were run as opposed to 12 virgins and 12 from Fluid Resistance. This is discussed in detail in section 3.0. The parameters given in the ES (frame 7 of 18, section III. E. 1.) are followed explicitly.

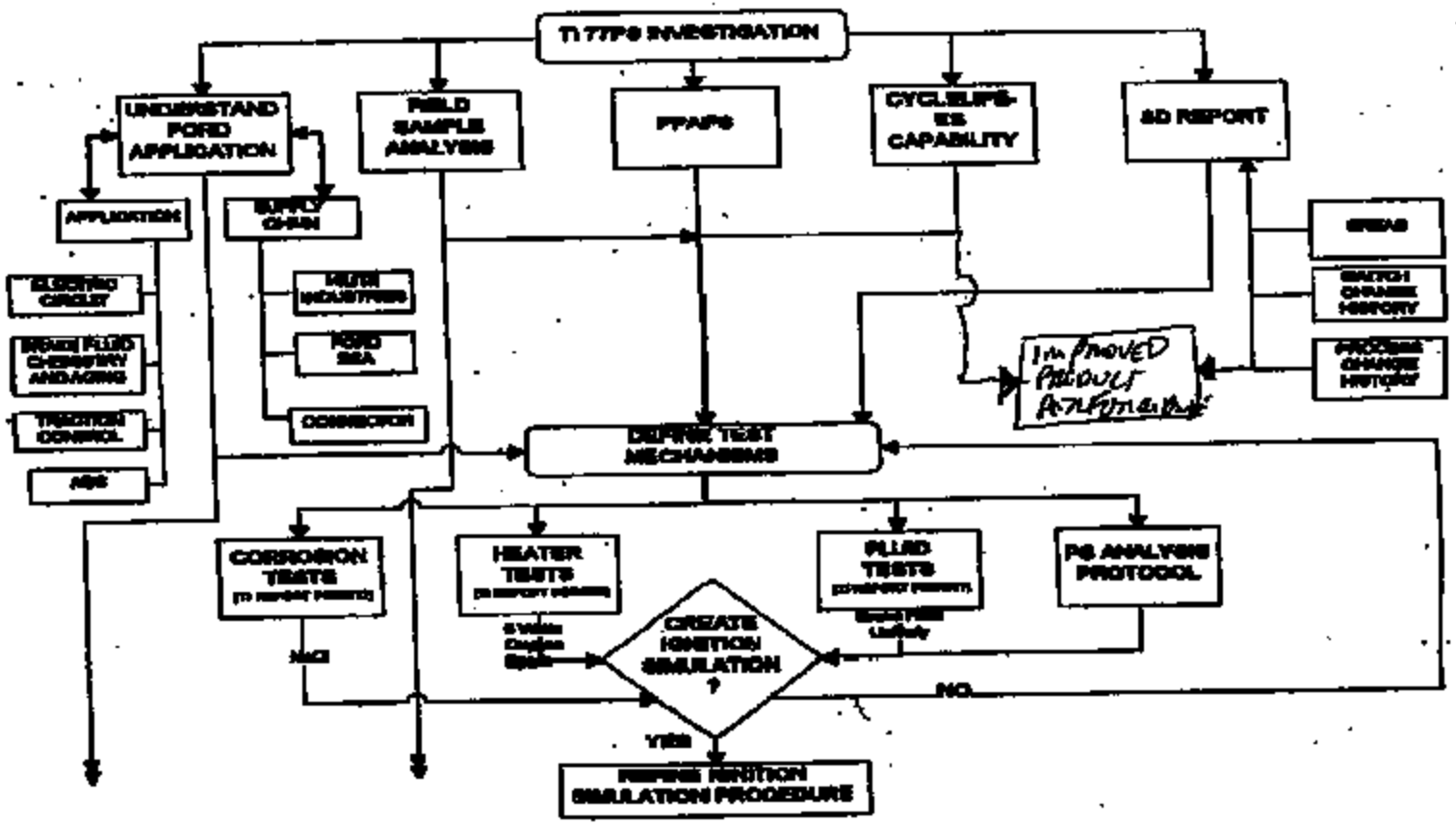
3.10.3 Equipment: same as 3.8.2 with the addition of a 12-station inductive load bank, per the schematic found in the ES (frame 18 of 18; figure 4.) used in the last 25K cycles.

3.10.4 Results/Discussion: Pre-characterization was not performed. After completion of the 500K cycles, all 24 devices passed the acceptance criteria found in the ES (frame 7 of 18, section III. E. 2).

This test may be regarded as the one of the most rigorous. This test is run at elevated temperature (135 C fluid), elevated pressure (1450 psig, 2 Hz), and total cycles (applying brakes 5 times per mile for 100,000 miles) which exceed conditions typically found in actual motor vehicles.

Brake Pressure Switch
Potential Thermal Event Theory Profile 5/20/99

TEXAS INSTRUMENTS

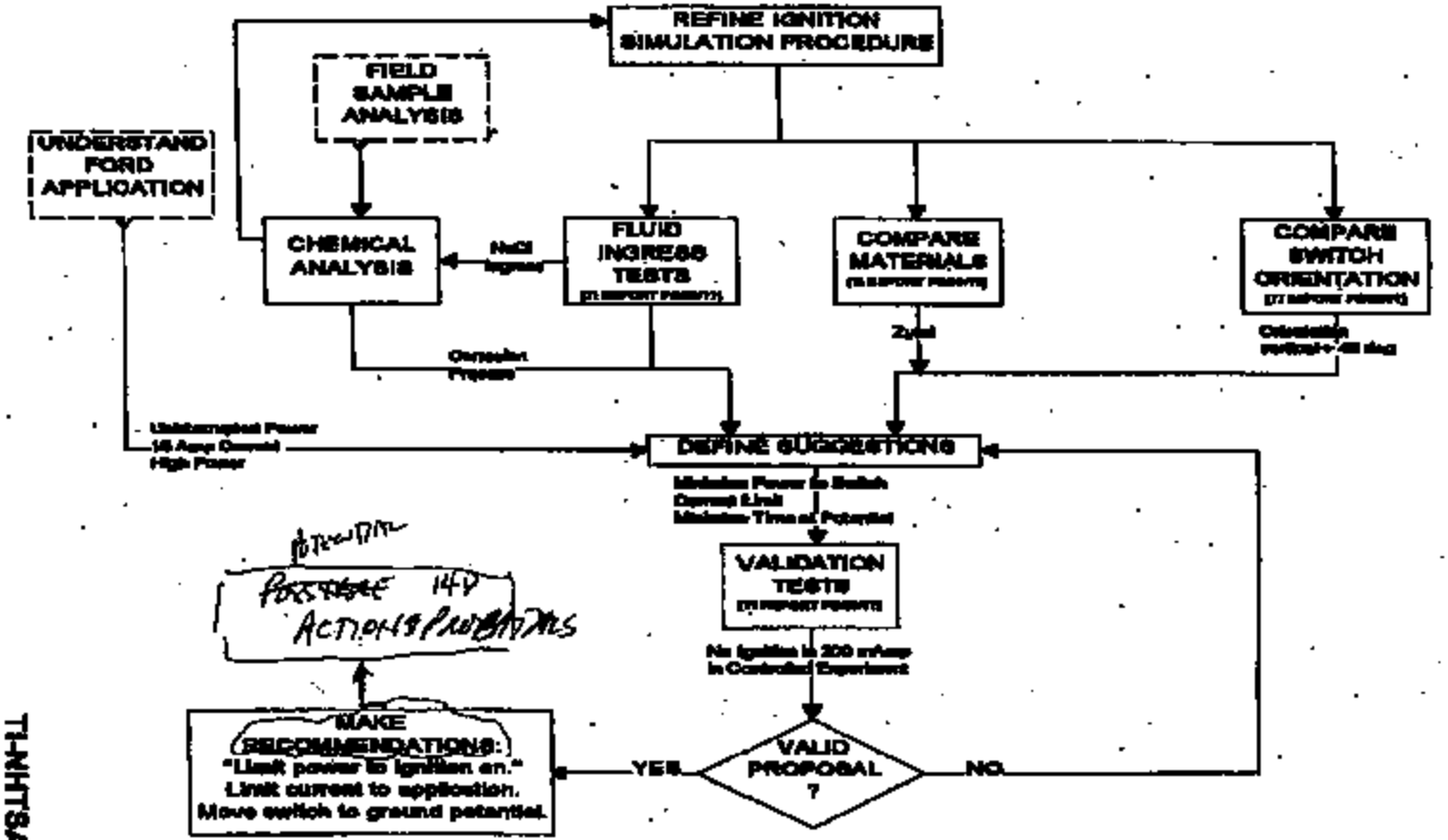


TI-NHTSA 003139

C:\MsOffice\99presentation\Ford

Attachment

Brake Pressure Switch
Potential Thermal Event Theory Profile 5/20/99



TI-NHTSA 003140

C:/McGuirk/Presentations/Ford

Attachment

'93, '94 Town Car brake switches to consistently exceed "cycle life specification" of 500,000 pressure cycles. TI Weibull reports of pressure switches tested in '1999 conservatively demonstrate 95% reliability to 1 million cycles (with confidence intervals greater than 50%) while success testing records of some 666 ES units shows zero leakage at 500,000 cycles during the 1991 - 1992 period (11/91 - 12/92).

Conclusion to date: 1992 period switches met specification. 1999 switch meets or exceeds specification

We have developed and delivered a model of accelerated plastic based ignition resulting from fluid in the switch cavity coupled with the constant power application of the speed control circuit. This model was used to help define the containment and countermeasure programs in the Ford overall program. Theories from the model suggest that fluids in the switch cavity could corrode and might create a plastic base ignition path.

Conclusion to date: Constant speed control power allows long term corrosion

We have been open and forthright in our communications and delivery of information and we believe we have been instrumental in helping Ford address the underhood fire concern issue.

In this regard, we think it is appropriate at this point that our active participation in the diagnostic journey of the vintage 1992 product move towards a timely conclusion. The 1992 test records we recently forwarded clearly demonstrate the product met specification. We are committed to fulfilling your request for a site visit and long term fluid exposure tests but would like to come to a mutual agreement on a near term milestone or time frame for concluding our effort.

Our prime focus at this time is in rapidly supplying Ford with 225,000 units in support of the field actions.

Regards,

- RETURN TEST ANALYSIS
- OPTIMIZE PROCESS CONTROLS
- PARTICIPATE IN ROBUST SYSTEM ARCHITECTURE

Andrew C. McGuirk
QRA Manager
Texas Instruments

Texas Instruments Incorporated
Materials and Controls Group

TEXAS INSTRUMENTS

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

May 21, 1999

Mr. Fredrick J. Porter, Supervisor
E/E Systems Engineering
Building 5, Mail Drop 5011
20000 Rotunda Drive, Rm 3E004
Dearborn MI 48121-2053

Dear Fred:

I want to review our recent support of the Ford core team to assure we do not have any misunderstandings regarding our pressure switch performance and our contribution to the team.

For six months the Texas Instruments Automotive Sensors & Controls Team has been supporting the Ford Core Diagnostic Team with technical facts, data, and analysis regarding our brake pressure switch product applied in the Ford cruise control deactivation circuit.

A senior TI pressure switch engineer was in residence at Ford for three weeks to assist with switch related issues in the system diagnostic process. Senior TI leadership participation has also been involved in virtually every Ford Core Team meeting delivering facts, data, and technical support year-to-date '99.

We also investigated switch capability, and using agreed upon accelerated simulation life testing techniques, demonstrated the ability of the model year '92, '93, '94 Town Car brake switches to consistently exceed "cycle life specification" of 500,000 pressure cycles. TI Weibull reports of pressure switches tested in '1999 conservatively demonstrate 95% reliability to 1 million cycles (with confidence intervals greater than 50%).

Additionally "success testing records" of some 685 ES units that were tested during the 1991 - 1992 (11/91 - 12/92) showed 0 leakage at 500,000 cycles.

Conclusion to date: 1992 period switches met specification. 1999 switch meets or exceeds specification

We have developed and delivered a model of accelerated plastic based ignition resulting from fluid in the switch cavity coupled with application as designed in

of consistent

TI-NHTSA

Texas Instruments
Automotive Sensors & Controls

8D Report

Concern Title: 77 PS Thermal Events T.I. CAR Report Number: CAR 99-28	Open Date: 3/9/99 Updated: 3/15/99 4/14/99
Status Date: Vehicle: Lincoln Model: Town Car Plant: Various	Part Name: Electric Speed Control Deactivation Pressure S Part No: 77PS l2-1
1. Team: S. Beringhause B. Dague A. Rahman A. McGuirk C. Douglas G. Baker T. Rowland	2. Problem Description: Under hood car fires

3. Containment Action(s): CONSIDERING DISABLING SPEED CONTROL SYSTEM Under review	% Effectiveness:	Implementation Date

4. Root Cause: See attachment 1, IS - IS NOT Table, P	% Contribution:
(Theories of 3/15/99) - Water enters pressure switch thru connector - Continuous power drives corrosion - Corrosion creates high resistance - Resistance creates local heating - Several exposures over time (?) - Local heating ignites pressure switch and connector plastic - OPERATIVE LUBRICATION PROTOCOLS	Unknown

5. Chosen Permanent Corrective Action: See attachment 2,3,4	Verification:	% Effectiveness:
Under Review: - Contain fire - Create ground fault protector - Improve connector seal - Eliminate constant power - Change P/S orientation - Provide power fuse / POWER REDUCTION - Modify plastic parameters - OPTIMIZE POLARITY - MOVE TO GROUND POTENTIAL	TBD by lab experiments	Unknown

6. Implemented Permanent Corrective Actions:	Implementation:
7. Action(s) to Prevent Recurrence ELIMINATE CONSTANT POWER, REDUCE POWER TO FUNCTION ONLY SET LOGIC AFTER "INITIAL" ELECTRICAL FUNCTION	Implementation:

8. Congratulate Team	Close Date:	Reported By: A. McGuirk Dept. Name: QRA Manager Telephone No.: (508) 236-3080

TI-NHTSA 003143

-MSG M#= 260814 FR=SBO1 TO=PCQA SENT=09/26/91 07:15 AM
R#=043 ST=C DIV=0050 CC=00101 BY=SBO1 AT=09/26/91 07:15 AM

w/ Elaine, Fyi/[illegible]

TO:	Joe Schuck	WHLE		
CC:	Tom Charboneau	TC	Charlie Douglas	CPPC
	Dave Czarn	SARN	Steve Major	WHLE
	Mike DeMattia	PCQA	Gary Snyder	CPPC
	Jeff DiDomenico	ELS	Jim Watt	PCQA
FR:	Steve Offiler	SBO1		

SJ: Additional Information on 77PSL2-1 Pass Car ISR Failures

Joe: Per our phone conversation, the following message attempts to answer the questions posed by Bruce Kaeroff (Supv. Pass Car Brake Eng.) with factual detail. I caution you to use this wisely, as this is decidedly sensitive information.

1) Describe the problem in more detail, including a description of the actual failure mode.

Answer: This is limited to Pass Car product which is crimped on the automatic assembly equipment. Light Truck product does not have this problem regardless of assembly technique, nor does Pass Car product which is crimped on the manual equipment. The problem is ruptured Kapton diaphragms during Impulse testing at Ford spec. parameters (temperature, pressure, and time) which significantly exceed actual conditions: five brake applications per mile for 100,000 miles to a pressure of 1450 psi at a fluid temp. of 135 C. Ruptured diaphragms result in brake-fluid leakage, as the diaphragm is the fundamental design element (along with the gasket) which contains and separates the brake fluid from the pressure-sensing elements. The rupture occurs in the area which experiences maximum strain. The type and location of the rupture we are seeing is very normal for diaphragms cycled to the end of their life. The problem may be viewed as diaphragms which have a characteristic life which falls short of Ford's conservative specification.

2) Specifically how many cycles to failure ?

Answer: Eight of 12 virgin devices originally undergoing ES testing failed due to leakage at the following points: one at 270K, at 290K, at 325K, at 350K, four at 388K, and four surviving removed from test at 388K. The other 12 devices, which subsequently returned from the Fluid Resistance test, were placed under quarantine, where they remain.

(Trying to Keep Things in Perspective: Weibull failure analysis of this data shows that Ford's specified reliability and probability (P90-.90, see ES, page 3) gives a minimum value of 214K cycles, which seems logical in light of the first failure occuring at 270K. 214K is only 43% of the spec, and is meaningless to Ford regardless because it is based on failure testing, whereas the spec assumes success testing throughout: "For PV... all samples tested must pass" (ES, page 13, section IV. A.) It is, nonetheless, two extremely hard brake applications per mile for 100,000-plus miles.)

3) Why is this happening ?

TI-NHTSA 003144

Answer: We are still investigating a number of hypotheses, and at this point none has clearly emerged as most probable. These include: crimp parameters (pressure/time relationship in air cylinders), possible geometrical differences in crimp dies, slight elastic deformation of internal components due to crimp which is undetectable on disassembled devices, bad lot of Kapton, damage to Kapton or its Teflon layer on the automatic equipment, etc. We have built many test lots, and cycled scores of devices to failure for characteristic life analysis; these efforts are continuing at present with high priority.

4) What are our interim corrective actions?

Answer: Build pressure-sensing subassemblies with manual crimp. This is the configuration we Impulse tested successfully (albeit without Fluid Resistance) for this ISR.

5) What are our long-term corrective actions and plans?

Answer: We must first complete the analysis of the cause of the problem, and convince ourselves that we have a thorough understanding by demonstrating that we can turn the problem on and off. At this point, whatever process controls, SPC checks, etc. that are needed to ensure permanency will be determined and implemented. Then we will be ready to rebuild parts on the automatic equipment which will undergo the Fluid Resistance test and the Impulse test per the specification, and submit these results as an addendum to the ES test report. The timetable for these actions is unfortunately open-ended, because of the amount of time required to "complete" (cycle to death) any given test-lot, and we've still got a few to go.

6) Miscellaneous additional thoughts:

** Mark Scholler has told us that Bruce Pease must write an "alert" which will be good for a 90-day extension; we must re-ISR the automated crimp within 90 days. (Joe, this info comes from your MSG 1053402.) Ford cannot dictate our production process. It is our prerogative to choose our process and ISR it as such. At this point we have done exactly that - we've chosen the manual sensor asm. and submitted the ISR for it (with the slight deviation regarding Fluid Resistance). Of course, from a profit standpoint it is in our own best interests to get the automatic sensor asm. equip. on-line and ISR'ed ASAP, but as far as I can tell they have no grounds to hold us to the stated 90 days.*

** Diaphragm life will improve significantly with reduction in either pressure or temperature. We have cycled 24 Pass Car devices built on the automatic equipment to 500K with no failures using 800 psi at 121 C; and we've cycled another 10 devices to 500K with no failures using the full 1450 psi but at roughly 35-40 C.*

** QC cycles a sampling of devices from every lot, to the full 500K, which ensures that once we get our corrective actions in place that we'll be able to hold the gains.*

Regards,
Steve O.

-MSG M#= 265291 FR=SBO1 TO=PCQA SENT=09/26/91 04:26 PM
R#=096 ST=C DIV=0050 CC=00101 BY=SBO1 RT=09/26/91 04:26 PM

TO:	Claire Balthaser	PSWT		Dick Gariepy	MFPC
	Tom Burke	MFPC		Dave Paripoli	PCNE
	Dave Czarn	SARM		Elaine Rose	PCQA
	Mike DeNattia	PCQA		Joe Schuck	WELE
	Jeff DiDomenico	ELE		Matt Sellers	PCNE
	Charlie Douglas	CPPC		Ed Smith	PCQA
	Marge Garanito	MFPC		Jim Watt	PCQA

FR: Steve Offiler SBO1

SJ: Ford CCPS Part Number Codes

We have recently been informed by Ford that the stamped part number that appears on our crimp ring MUST include an inverted delta symbol preceding the rest of the Ford part number. This should be something as close as possible to an equilateral triangle with the point downwards, similar in height to the rest of the characters.

This applies to:

57PSLS-2 (F2TA-9C888-AA)
57PSLS-3 (F2VC-9F924-BB)
77PSL2-1 (F2VC-9F924-AB)
77PSL2-3 (F3TA-9F924-AA)

Would the appropriate individual please expedite an order for this character immediately? Contact me if you have any questions.

Regards,
Steve O. X1382 NS12-29

INITIAL SAMPLE WARRANT

No. 112384

PART INFORMATION

Part Name NEXT GENERATION SPEED CONTROL DEACTIVATION PRESSURE SWITCH Part Number F2VC-9F924-AB

Control Item ☐ Yes ☐ No Engineering Change Level _____ Date _____

Engineering Change Authorization Bruce Pease Date _____

Shown on Drawing No. F2VC-9F924-AB Part Weight .062 lb

Reason for Initial Sample:

- ☒ Initial Submission
- ☐ Engineering Change(s)
- ☐ Tooling Transfer
- ☐ Other — Please Specify _____
- ☐ Change in Optional Construction or Material
- ☐ Additional, Replacement, or Refurbished Tooling
- ☐ Correction of Discrepancy (Resubmission No. ____)
- ☐ Process Change
- ☐ Change in Subcontractor or Source
- ☐ Parts Produced at Additional Location

SUPPLIER INFORMATION (Manufacturing Location)

Supplier Name TEXAS INSTRUMENTS Street Address 34 Forest St.

City Attleboro State Mass. Postal Code 02703 Country USA

Supplier Mfg. Location Code – DUNS T097K Customer Assigned Ford Motor Co. EED

CUSTOMER INFORMATION

Customer Name FORD MOTOR CO. EED Buyer Fred Hendershot Buyer Code 165

Purchase Order Number _____ Sample Acceptance Level _____

Application NEXT GENERATION SPEED CONTROL

RESULTS

The results for dimensional measurements ☐, material tests ☐, and functional (ES) tests ☐ meet all drawing and specification requirements ☐ Yes ☐ No

Submission Checklist

- ☒ Checked Print
- ☐ Auxiliary Drawings/Sketches
- ☒ Correct Number of Samples
- ☒ Dimensional Results
- ☒ Material Test Results
- ☒ Certifications
- ☒ Functional (ES) Test Results
- ☐ Product Engineering Approval
- ☒ Control Plan
- ☒ Process Capability Results
- ☒ Process Flow Diagram
- ☒ Gage (Measurement) Studies

Supporting data for all requirements are available upon request.

COMMENTS:

_____

_____

DECLARATION

I affirm that the samples represented by this warrant are representative of our parts and have been made to the applicable customer drawings and specifications from specified materials, on regular production tooling with no operations other than the regular production process.

Authorized Signature _____ Date 9/26/94

Print Name JIM MATT Title QRA Eng'r Phone No. 508-699-1712

APPROVAL (when required by customer procedure) ☐ Approved ☐ Rejected

Signature _____ Date _____

Quality Form 292c

TI-NHTSA 003147

PRESSURE SWITCH DATA Form 21605 **TEST NO.** 165-03-27

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMPL. DATE
77PSL2-1	9/26/91	Steve Offiler	
PERFORMED BY	**DATE STARTED**	**DATE COMPLETED**	**APPROVED BY**
Jeffrey DiDomenico	9/27/91		

PROJECT TITLE: Ford MY'92 Electronic speed control deactivate PS

CUSTOMER:

PURPOSE OF TEST: Impulse devices to failure and obtain Weibull data

PROCEDURE: Return parts from Validation testing to Impulse test and cycle to failure

#1-6 : no cycles yet
#62,64,66,67: 394K cycles before this test
Tests started with 547K on counter
#7-19 : 0 cycles – Counter @ 555 K when started
COUNTER RESET @ 933K

Device #	ORIGIN	Total Cycles to failure	
165-03-01	From the same lot as	739 K	
-02	the parts cycled on	604 K	
-03	Ford cycles and built	431 K	
-04	under reduced pressure	639K	
-05	Hand assembled	546 K	
-06	AMI Crimp; no preset	493 K	
	910913 – finished devices		
165-05-62	original validation	518 K	
-64	parts	429 K	
-66	devices	402 K	
-67	910717	397 K	
165-03-07	Production parts 100%		Suspended @
-08	made by accident on		
-09	AMI. Cycling to see		
-10	if they are good	969 K	
-11	or not		
-12	Build Date 910926		
			1118K
165-03-13	Same as 7-12 except	1077 K	
-14	these have been run	994 K	on 9/10/11
-15	through the head-line		
-16	crimper after being	778 K	
-17	crimped on AMI	997 K	
-18	Build Date 910926	776 K	

TI-NHTSA 003148

[illegible] LIFE EXPERIMENT 159-03-44 JAN 9/26/91

DEVICE #	CUP	CRIMP	PRE-CRIMP	ORIGIN	STOPPED AT	STOPPED FOR
159-03-01	27713	HAND-LINE	NO	HAND BUILT	896K	CUP FLEX
159-03-02	27713	HAND-LINE	NO	FOR THIS TEST	830K	LEAK
159-03-03	27713	HAND-LINE	NO		861K	LEAK
159-03-04	27713	HAND-LINE	NO		1086K	LEAK
159-03-05	27713	HAND-LINE	NO		1186K	LEAK
159-03-06	27713	HAND-LINE	NO		1435K	LEAK
159-03-07	B/S	AMI	YES	PRODUCTION BUILT	714K	LEAK
159-03-08	B/S	AMI	YES	FOR THIS TEST	589K	LEAK
159-03-09	B/S	AMI	YES		719K	LEAK
159-03-10	B/S	AMI	YES	-	541K	LEAK
159-03-11	B/S	AMI	YES		830K	CUP FLEX
159-03-12	B/S	AMI	YES		861K	LEAK
159-03-13	27713	AMI	YES	JIPS VALIDATION	504K	LEAK
159-03-14	27713	AMI	YES	PARTS: UNUSED	504K	CUP FLEX
159-03-15	27713	AMI	YES		307K	LEAK
159-03-16	27713	AMI	YES		307K	LEAK
159-03-17	27713	AMI	YES		424K	CUP FLEX
159-03-18	27713	AMI	YES		423K	LEAK
159-03-19	B/S	HAND-LINE	NO	JIPS VALIDATION	790K	CUP FLEX
159-03-20		HAND-LINE	NO	PARTS; USED FOR	1016K	LEAK
159-03-21		HAND-LINE	NO	VACUUM TEST	1051K	LEAK
159-03-22		HAND-LINE	NO		1659K	LEAK
159-03-23		HAND-LINE	NO		1236K	LEAK
159-03-24		HAND-LINE	NO		1973K	SUSPENDED
159-03-25	27713	AMI	YES	NORMAL AMI	1590K	SUSPENDED
159-03-26	27713	AMI	YES	OPERATION; TO	1590K	SUSPENDED
159-03-27	27713	AMI	YES	RECREATE FAILURE	1025K	LEAK
159-03-28	27713	AMI	YES		886K	LEAK
159-03-29	27713	AMI	YES		1106K	LEAK
159-03-30	27713	AMI	YES		1186K	LEAK
159-03-31	27713	AMI	NO	NORMAL AMI	718K	LEAK
159-03-32	27713	AMI	NO	OPERATION; STOP	1360K	LEAK
159-03-33	27713	AMI	NO	BEFORE PRE-CRIMP	1590K	SUSPENDED
159-03-34	27713	AMI	NO		1340K	LEAK
159-03-35	27713	AMI	NO		1190K	LEAK
159-03-36	27713	AMI	NO		1480K	LEAK
159-03-37	27713	HAND-LINE	YES	NORMAL AMI	819K	LEAK
159-03-38	27713	HAND-LINE	YES	OPERATION; REMOVED	1180K	LEAK
159-03-39	27713	HAND-LINE	YES	BEFORE FINAL CRIMP	918K	LEAK
159-03-40	27713	HAND-LINE	YES	AND CRIMPED ON	819K	LEAK
159-03-41	27713	HAND-LINE	YES	HAND-LINE	988K	LEAK
159-03-42	27713	HAND-LINE	YES		988K	LEAK

TON LIFE EXPERIMENT 159-03-46 JAB 9/26/91

159-03-43	27713	AMI	80	CONTROL LOT	501K	SUSPENDED	
159-03-44	27713	AMI	80	FOR 49 - 60	501K	SUSPENDED	
159-03-45	27713	AMI	80		501K	SUSPENDED	
159-03-46	27713	AMI	80		501K	SUSPENDED	
159-03-47	27713	AMI	80		501K	SUSPENDED	
159-03-48	27713	AMI	80		501K	SUSPENDED	
159-03-49	27713	AMI	80	WASHER THICKNESS	501K	SUSPENDED	
159-03-50	27713	AMI	80	REDUCED BY .006";	501K	SUSPENDED	
159-03-51	27713	AMI	80	HIGHER CONVERTER	501K	SUSPENDED	
159-03-52	27713	AMI	80	DUMP RESULTING	501K	SUSPENDED	
159-03-53	27713	AMI	80		501K	SUSPENDED	
159-03-54	27713	AMI	80		501K	SUSPENDED	
159-03-55	27713	AMI	80	.005" STEP IN	501K	SUSPENDED	
159-03-56	27713	AMI	80	WASHER; PRE-DEFLECTED	501K	SUSPENDED	
159-03-57	27713	AMI	80	DISC RESULTING	501K	SUSPENDED	
159-03-58	27713	AMI	80		501K	SUSPENDED	
159-03-59	27713	AMI	80		501K	SUSPENDED	
159-03-60	27713	AMI	80		501K	SUSPENDED	
159-03-67	27280	AMI	TO5	TYPE VALIDATION	722K	LEAK	
159-03-69	27280	AMI	TO5	PARTS; USED IN	703K	LEAK	
159-03-70	27280	AMI	TO5	IMPULSE TEST	684K	LEAK	
159-03-71	27280	AMI	TO5		621K	LEAK	
159-03-72	27280	AMI	TO5		621K	LEAK	
159-03-73	27280	AMI	TO5		810K	LEAK	

PRESSURE SWITCH DATA Form 21605 **TEST NO.** 165-03-10

DEVICE	DATE REQUESTED	REQUESTED BY		REQUESTED COMPL. DATE
77PSL2-1	9/26/91	Steve Offiler		
PERFORMED BY	**DATE STARTED**	**DATE COMPLETED**	**APPROVED BY**	
Jeffrey DiDomenico	9/26/91			

PROJECT TITLE: Ford MY'91 Electronic speed control deactivate PS

CUSTOMER:

PURPOSE OF TEST: Impulse devices to failure and obtain Weibull data

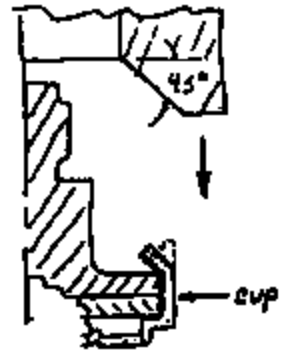
PROCEDURE: Return parts from validation testing to impulse test and cycle to failure

#1-6 : no cycles yet
12,14,15,17: 299K cycles before this test

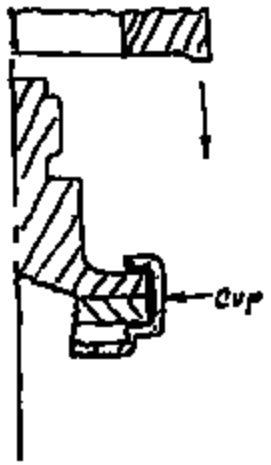
Device #	ORIGIN	Total Cycles to failure
165-03-01	From the same lot as	
-02	the parts cycled on	
-03	Ford cycles and that	
-04	[illegible]	
-05	Hand assembled	
-06	[illegible]	
165-05-62	original validation	
-69	parts	
-66		
-66		

TI-NHTSA 003151

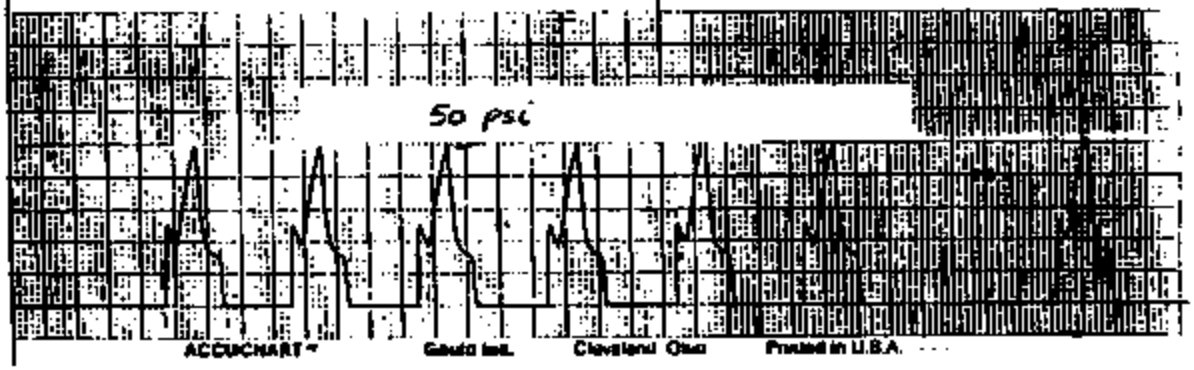
CRIMP PRESSURES - SEMI AUTOMATED



INITIAL CRIMP

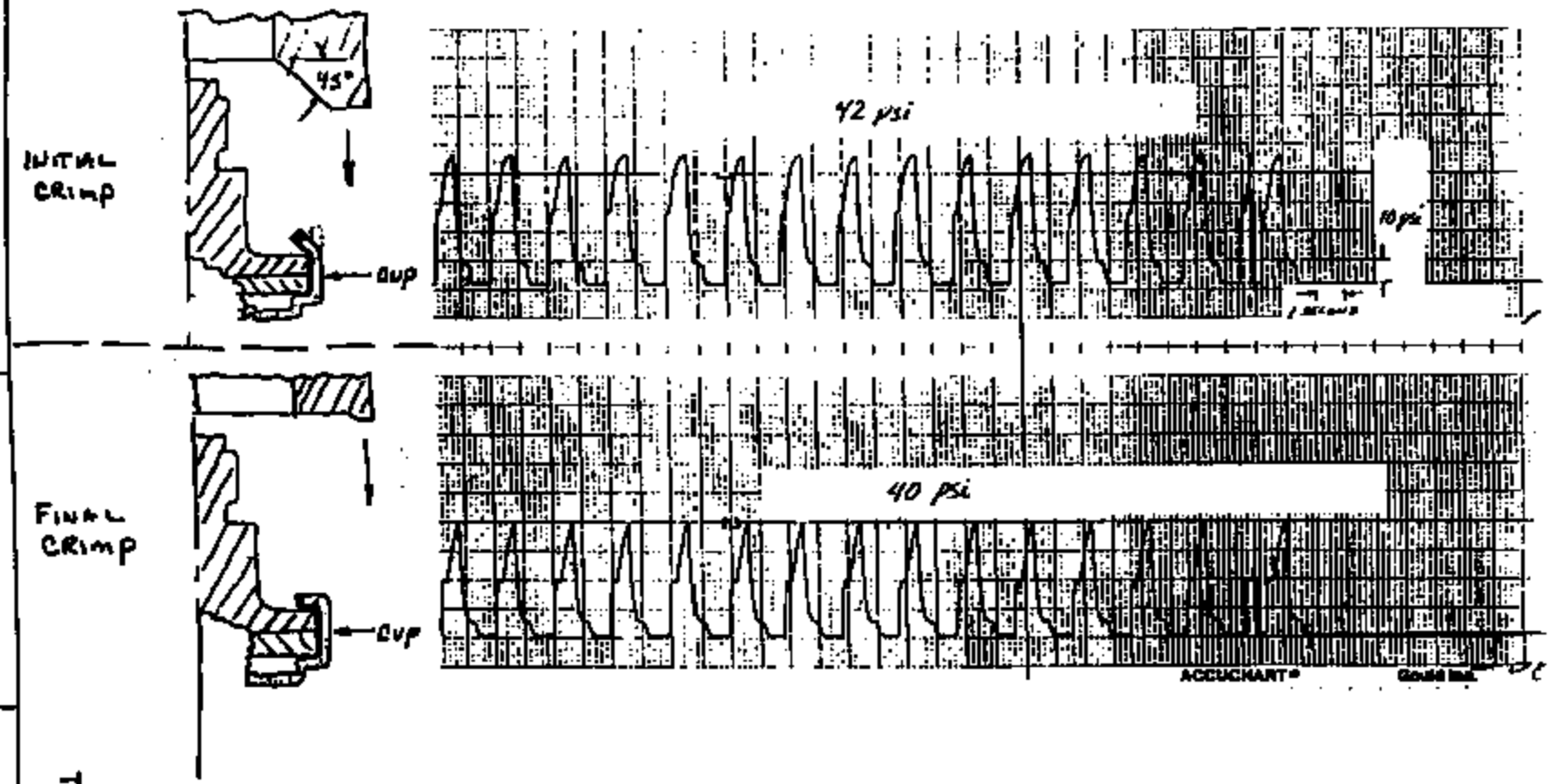


FINAL CRIMP

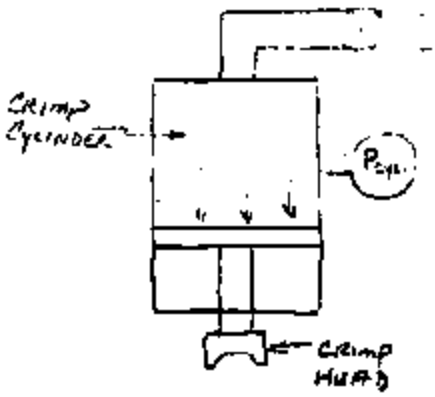


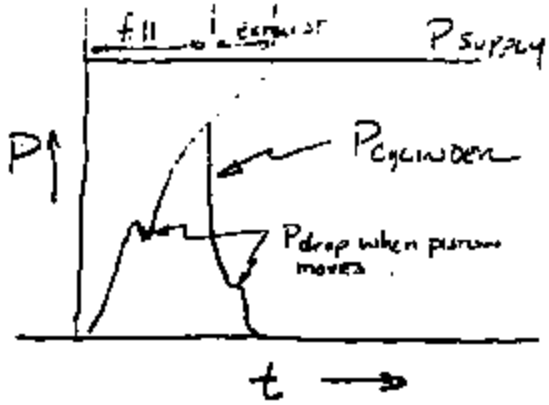
TI-NHTSA 003152

CRIMP PRESSURES - FULLY AUTOMATED (A.M.I.)



TI-NHT8A 003153



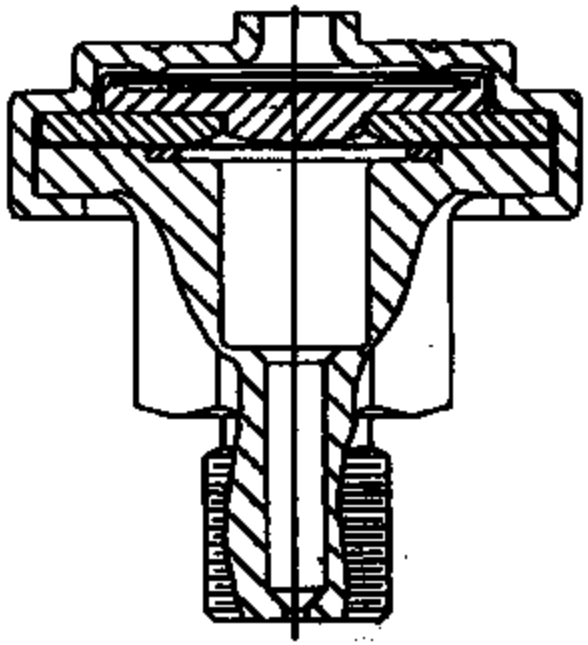


215 psi / sec

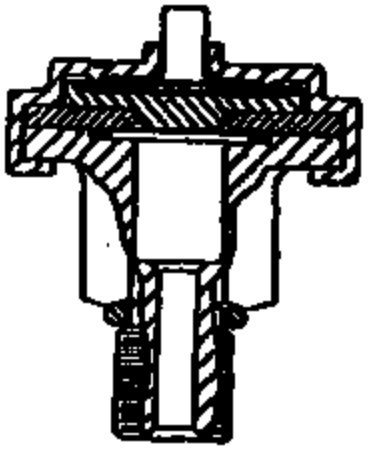
$\frac{1\ cycle}{1.2\ sec} \times \frac{60\ sec}{1\ min} = 50\ cpm$

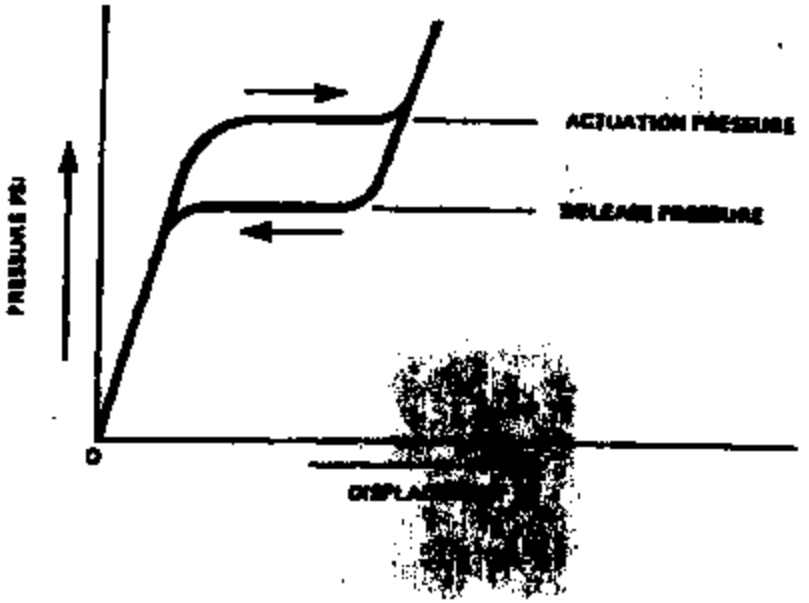
SENSOR ASSEMBLY

- O - CUP
- O - 3/4 FORMED DISC
- O - KAPTON SPACER
- O - CONVERTER
- O - WASHER
- O - KAPTON
- O - GASKET
- O - HEXPORT

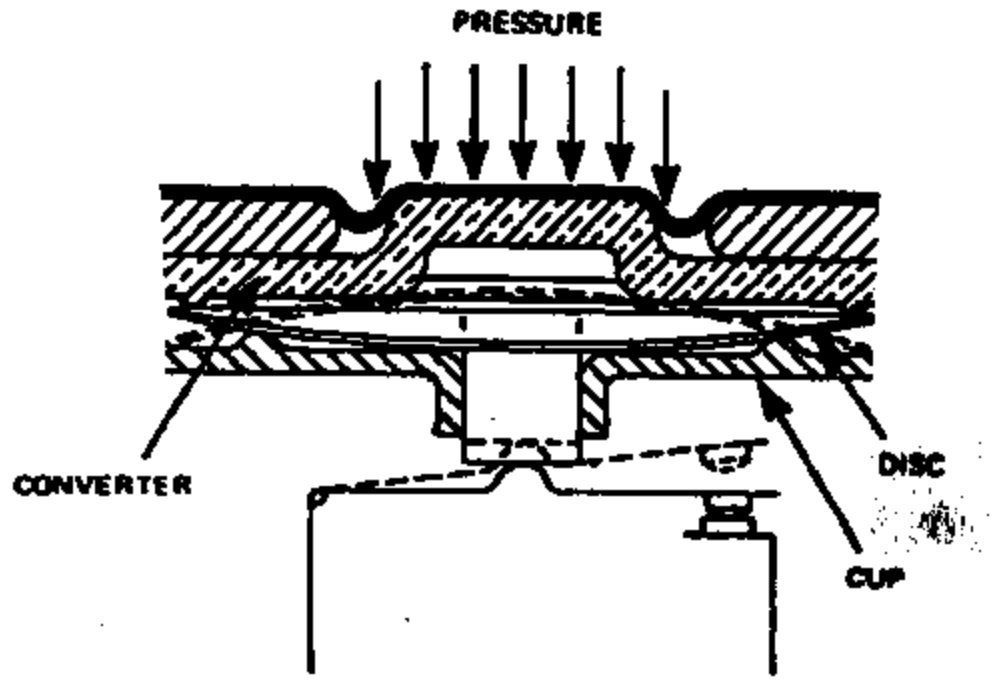


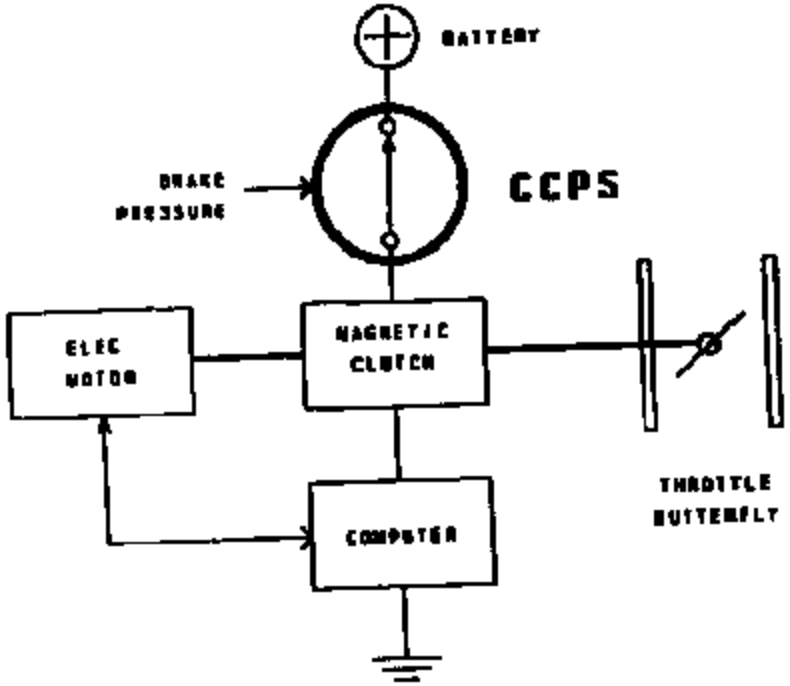
DISC CHARACTERISTIC CURVE

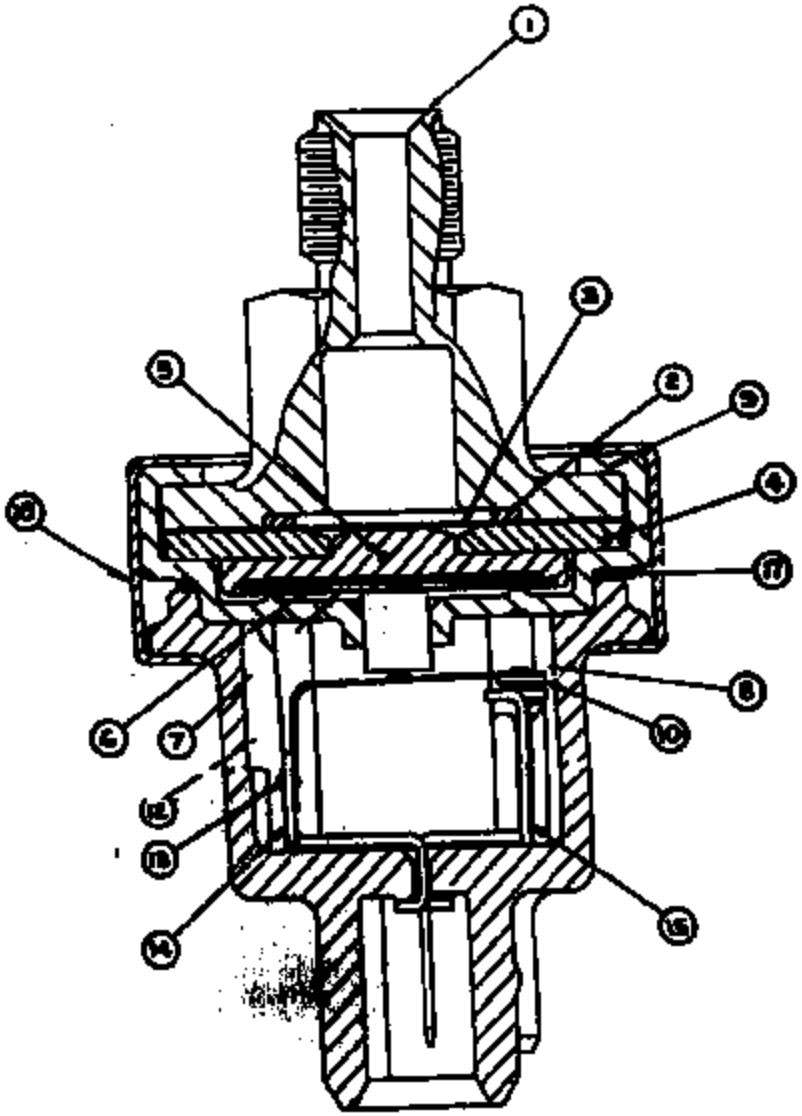




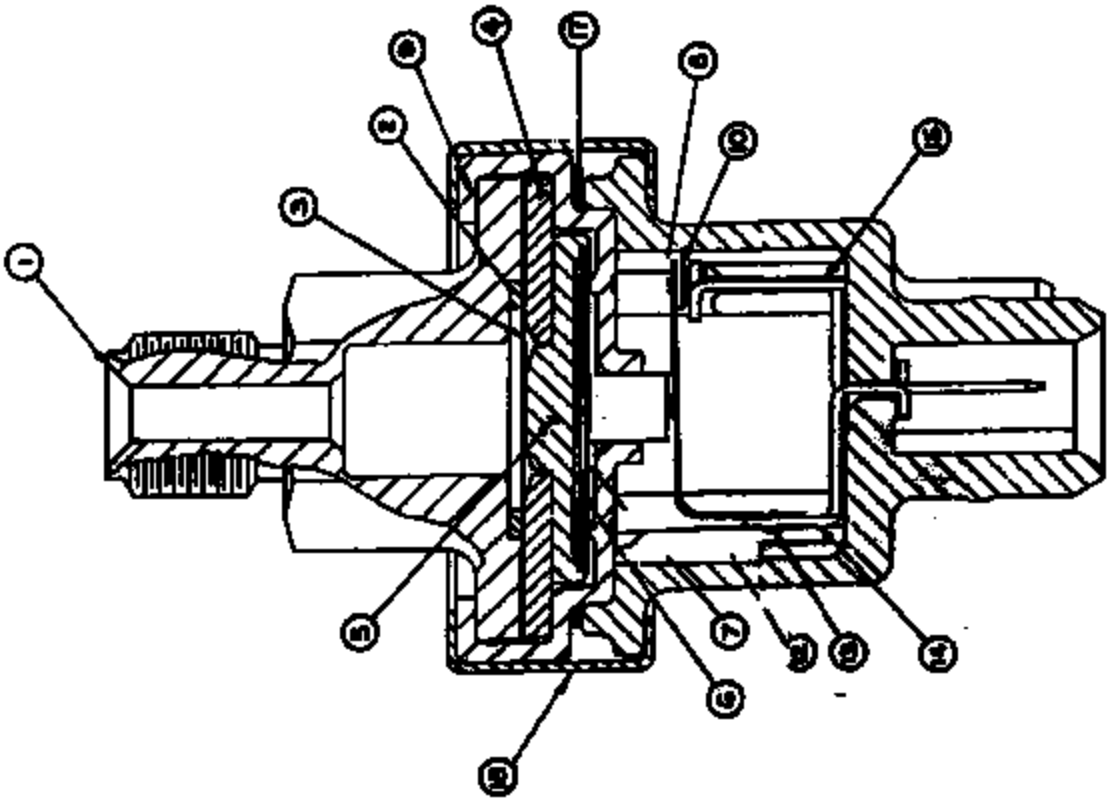
TRANSDUCER OPERATION
SNAP ACTING



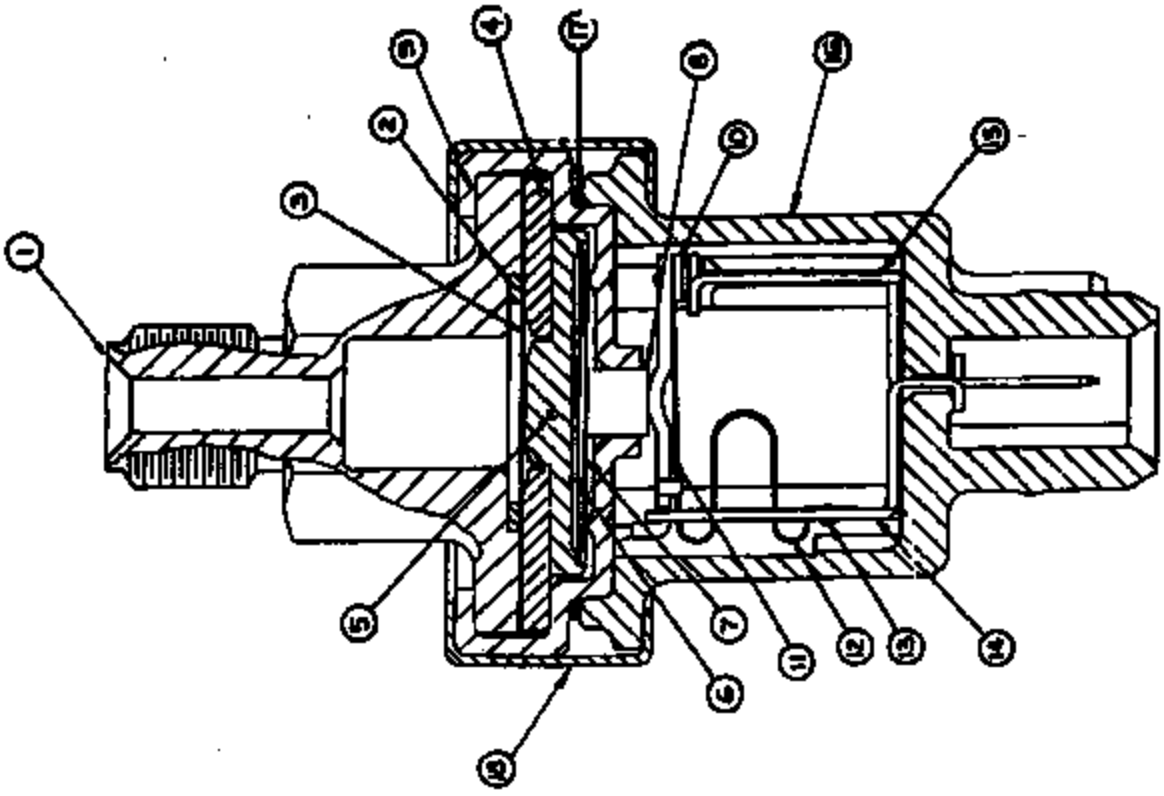

BATTERY
BRAKE PRESSURE
CCPS
ELEC MOTOR
MAGNETIC CLUTCH
COMPUTER
THROTTLE BUTTERFLY



77PS



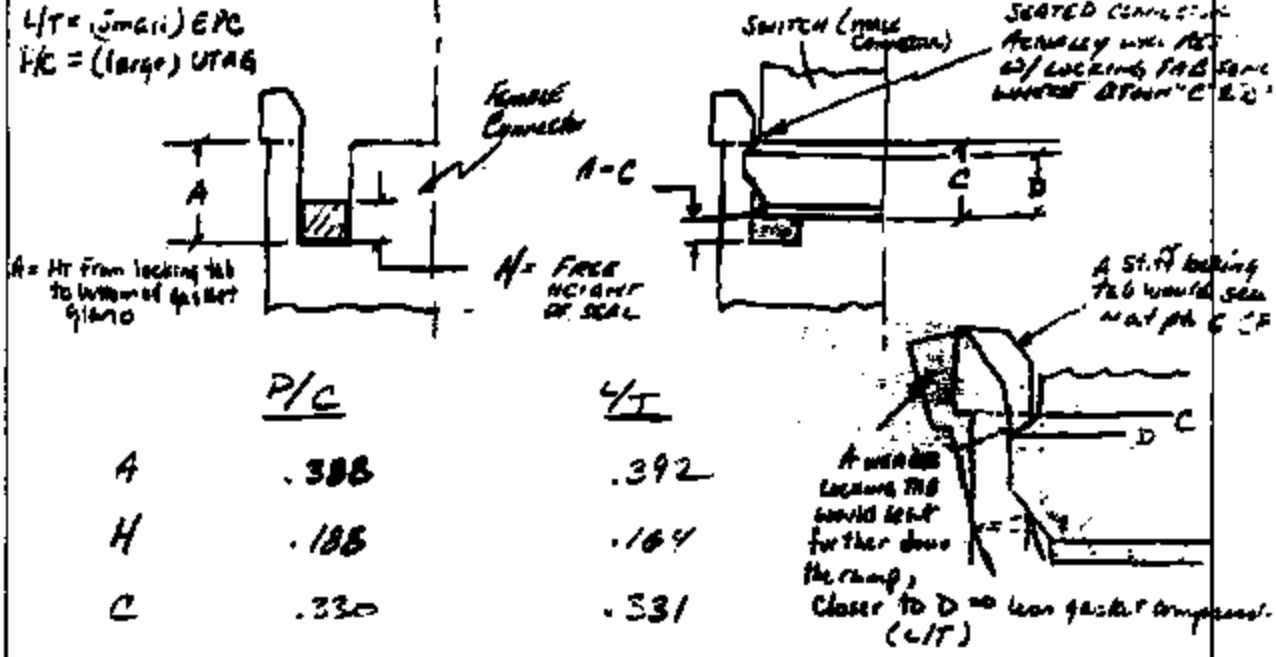
77PS



57PS

4T & P/C MATING CONNECTOR COMPARISON

4T = (small) EPC
P/C = (large) UTAS



	P/C	4T
A	.388	.392
H	.188	.164
C	.330	.331
D	.308	.309
A - C	.058	.061
A - D	.088	.083
H - (A-C)	.130	.103
H - (A-D)	.108	.081
% Comp C	69 %	63 %
% Comp D	53 %	49 %

Estimated P/C % Gasket Compression

Estimated 4T % Gasket Compression

Comp. is very localized around rectangular lip of switch connector

$$\%\,Comp_C = \frac{H_{final} - H_{limit}}{H_{limit}} = \frac{H - (A-C)}{H}$$ Assuming Dim "C" Determine compressed gasket ht.

$$\%\,Comp_D = \text{" "} = \frac{H - (A-D)}{H}$$ Assuming Dim "D" Determine compressed gasket ht.

% Comp C ≐ applies if the locking tabs on the mating connector hold @ the base of the ramp of the switch connector

% Comp D ≐ " @ the tip of the ramp . . .

Disc Diff 4.5 ± 1.5 psi

Expected Amplification of diff. from disc-to-Device = 12–15

Disc Diff	Amp	Device Diff
3.0	12	36
	15	45
4.5	12	54
	15	67.5
6.0	12	72
	15	90

max = device diff'l: 90 psi

⇒ translate to max = disc if device diff'l alone was spec'ed:

90/min amp = 90/12 = 7.5

⇒ Use 100 max diff:

100/12 = 8.3.

∴ It's expected that if 100 psi max diff'l is spec'ed and the amplification ratio remains as expected in a range of 12–15, a max = of 8.3 psi diff'l disc could be used.

If a 90 psi max diff'l is spec'ed, max disc diff'l is 7.5

Need to determine if 7.5 and 8.3 are acceptable in application.

Low Diff Disc

Disc Diff: 3.5 ± 1.5 psi

⇒ 5 psi max

Device Pr = 250 ± 50

~~Minimum setting 200 psi~~

What is the minimum expected to be w/ low diff disc?

Min detach = 200 psi.
Max disc diff = 5 psi

Amplification of diff'l from disc between 13.5

200 − (5×13.5)
= 200 − 67.5
= 132.5

Spec is 40 psi min

Combo spec a max = diff'l

Disc Diff'l	Amp	Device Diff'l
2	13.5	27
5	13.5	67.5
6	13.5	81
6	14	84
6	15	90
7	13.5	94.5
7	14	98
7	15	105

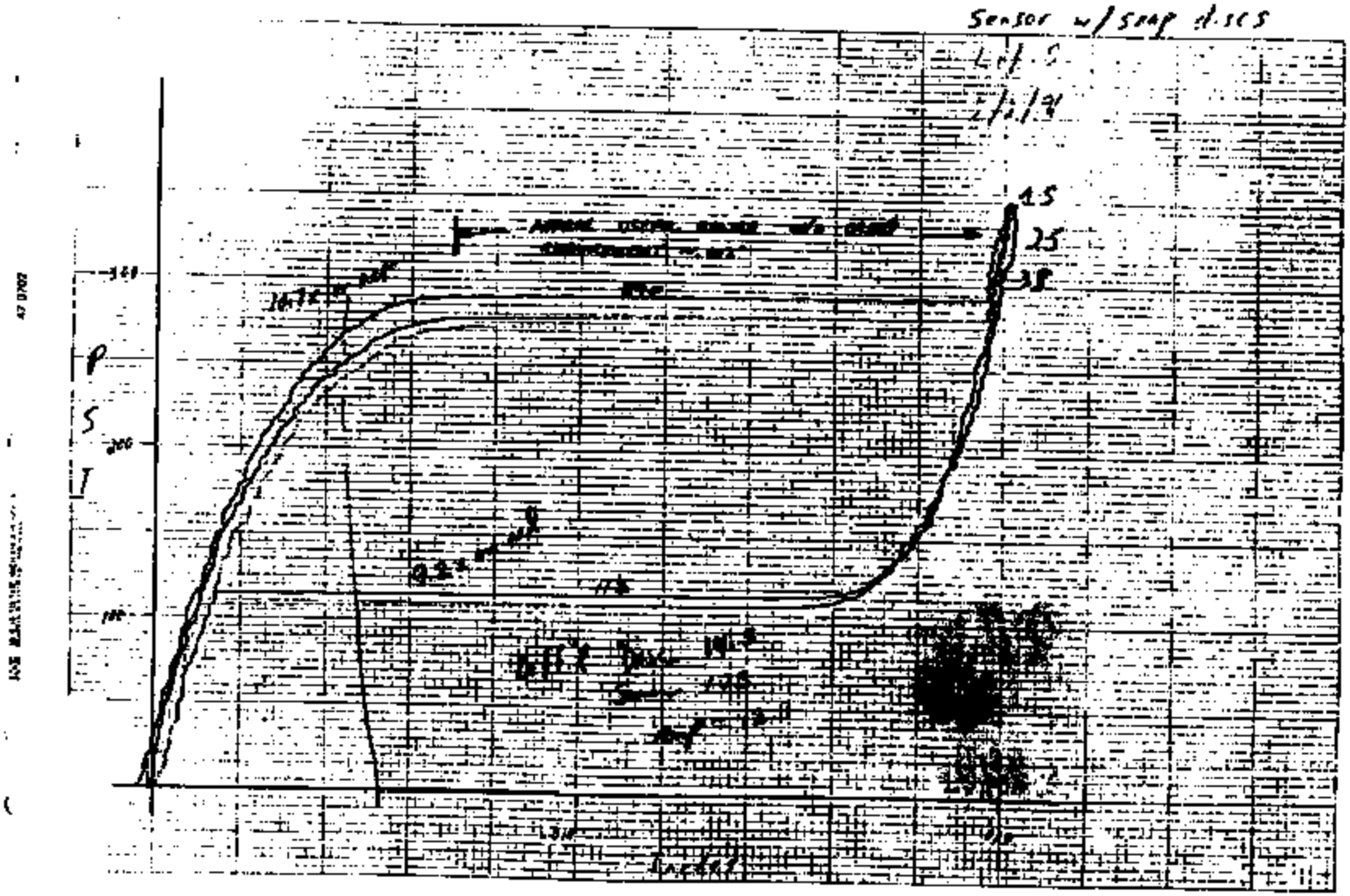
If worst case diff'l is specified @ 100 psi
& amp. ratio assumption 12-15 psi on diff'l
what is max allowable disc diff'l?

100 / 11 = 9
100 psi / 12 = 8.3
100 / 15 = 6.7

90/11 = 8.2
90/12 = 7.5
90/15 = 6.0

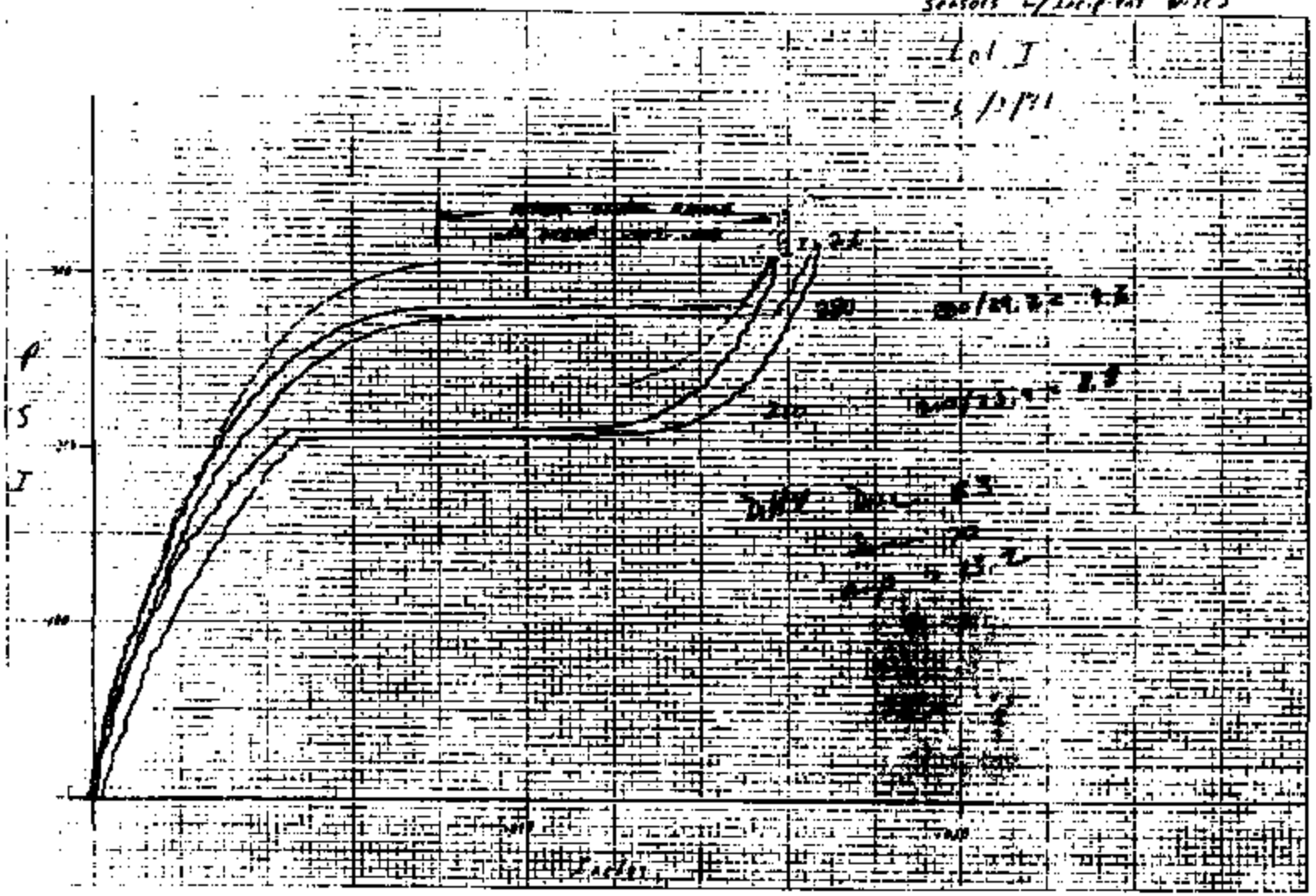
DRAWINGS AVAILABLE UPON REQUEST

SENSORS w/ 27.0/12.5 kS

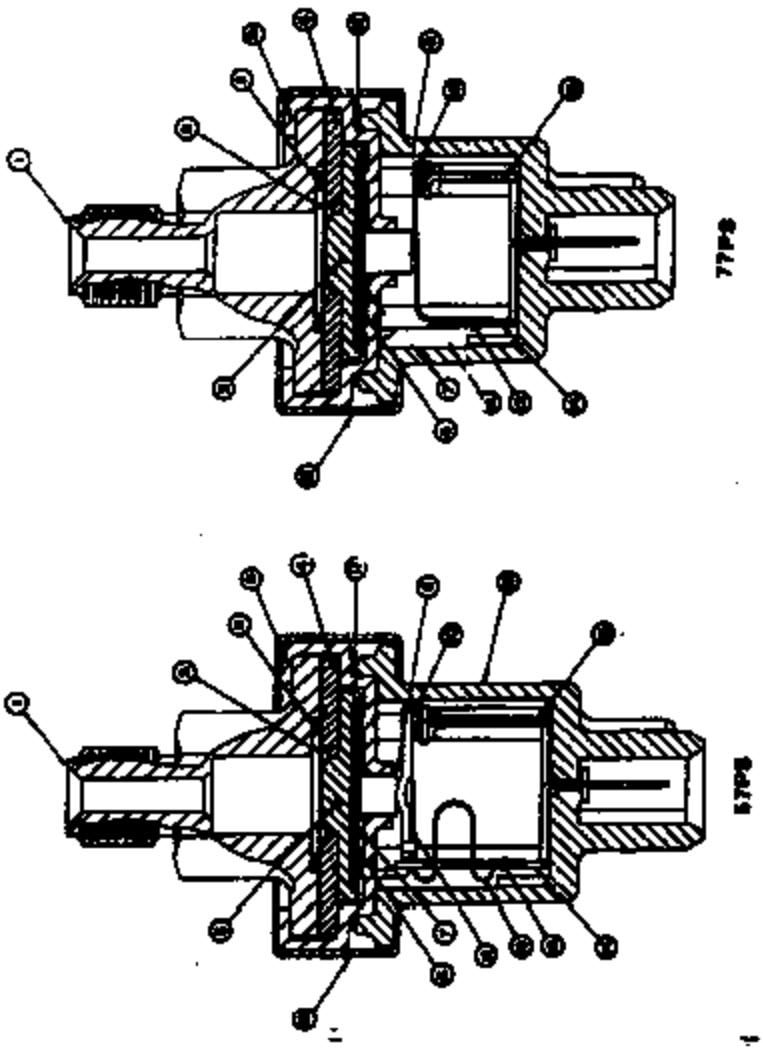


SENSORS BUILT W/ 29.2/23.9 DISCS

SUBJECTIVELY, THESE ARE VERY QUIET BUT NOT SILENT



DRAWINGS AVAILABLE UPON REQUEST



cc = [illegible]
FYI/Comment
Th

Kelsey-Hayes Company
4475 Center Road
Fenton, Michigan 48430

September 27, 1991

Attn: Mr. Steve Moffett

Subj: Initial ISR Submission
Ford Part Number F2VC-9F924-AB
Pass Car Series

Dear Steve,

Enclosed, please find our initial ISR submission for the NGSC deactivation switch, Ford part number F2VC-9F924-AB. The submission includes complete product validation testing which is enclosed with the documentation.

We noted one discrepancy during the dimensional analysis. Dimension 1.85 - 2.06 was inadvertantly transferred in error from the envelope drawing to the component drawing, resulting in the one out of dimension measurement (2.699). Sample bases with the corrected dimension will be forwarded to you within three weeks.

We noted that the pass car print does not indicate any significant characteristics, and therefore, no PIST/PIPC data is required. However, we intend to provide PIST/PIPC data on actuation, release, and thread specifications, and forward the data to you.

Please let me know if you have any questions or if I may be of any further assistance.

Regards,

Jim Watt
QRA Engineer
Precision Controls Department
Control Products Division

cc: Dave Czarn, MB 12-29; Charlie Douglas, MB 12-33
Andy McGuirk, MB 12-27
Joe Schuck, TI Farmington Hills, Michigan

encl: ISIR Submission

KELSEY-HAYES™ GROUP

MN12 Program INITIAL SAMPLE READINESS CHECKLIST (Plan car)

Supplier Texas Instr. Supplier Contact ~~Hyun Chamberlain~~ Charlie Douglas

Supplier Address 34 Forest St.

City, State, Zip Attleboro, MA Phone (508) 699-3012 Fax (508) 699-1591

Part or Product pressure switch Date 9-9-91

Kelsey-Hayes Group _____ Kelsey-Hayes Contact _____

P/N 12604301 Released version S/P dated 4-9-91

The following items have been prepared and/or approved. Items marked with an asterisk (*) are to be completed prior to ISIR date.

K-H Required	Item	Available by Supplier (Note: initial and date each item)	K-H Disposition
___	*Manufacturing feasibility signoff	_____	_____
___	*Design FMEA	_____	_____
X	*Process flow diagram	_____	_____
X	*Process FMEA	_____	_____
X	*Designated characteristics list	_____	_____
___	*Pre-launch control plan	_____	_____
X	Gage R&R studies	_____	_____
X	Short term process capability studies	_____	_____
X	*Process control plan	_____	_____
___	Inspection instructions	_____	_____
___	Set-up instructions	_____	_____
___	Operations instructions	_____	_____
X	ES testing requirements	_____	_____
___	Packaging and identification approval	_____	_____
X	Functional testing	_____	_____

L/T
Fold
L/C
K-H
Fold

traced
10-4-91

UPS
delivered to K-H
on 11-20 91
signed for By -
P. Orrington

214070

TEXAS INSTRUMENTS

Ford Motor Company
17000 Oakwood Blvd.
P.O. Box 1586-D-2015
Dearborn, Michigan 48121

September 27, 1991

Attn: Mr. Mark Scholler

Subj: Initial ISR Submission
Ford Part Number F2VC-9F924-AB
Pass Car Series

Ref: My September 20, 1991 Telephone Call

Dear Mark,

Enclosed, please find our initial ISR submission for the NOSC deactivation switch, Ford part number F2VC-9F924-AB. The submission includes complete product validation testing which is enclosed with the documentation.

We noted one discrepancy during the dimensional analysis. Dimension 1.85 - 2.06 was inadvertantly transferred in error from the envelope drawing to the component drawing, resulting in the one out of dimension measurement (2.699). Sample bases with the corrected dimension will be forwarded to you within three weeks.

We noted that the pass car print does not indicate any significant characteristics, and therefore, no PIST/PIPC data is required. However, we intend to provide PIST/PIPC data on actuation, release, and thread specifications similar to what was provided on the F3TA-9F924-AA light truck ISIR submission, and forward the data to you.

Please let me know if you have any questions or if I may be of any further assistance.

Regards,

Jim Watt
QRA Engineer
Precision Controls Department
Control Products Division

cc: Dave Czarn, MS 12-29; Charlie Douglas, MS 12-33
Andy McGuirk, MS 12-27
Joe Schuck, TI Farmington Hills, Michigan

encl: ISIR submission

TI-NHTSA 003177

HIGHLIGHTS

Stephen B. Offiler
Week Ending 91-09-27

FORD MY'92 ELECTRONIC SPEED CONTROL DEACTIVATE PS

VALIDATION, PASS CAR:
Test reports were finalized late last Friday, and fax'ed to Joe Schuck in preparation for a call first-thing Monday morning to Bruce Pease to solicit his support for a conditional ISR. Because he was about to leave on business for several days, he asked us to approach his supervisor, Bruce Macroff, with a concise explanation of the situation. Apparently Mr. Pease did not prepare Mr. Macroff, because the deviation from procedure, using hand-line built parts without Fluid Resistance testing to pass Impulse, has caused quite a commotion. Joe is very critical of our reluctance to approach Ford up-front when the problems began. At this point, SQA Mark Scholler has asked for Bruce P. to write an "alert" at which point Mark will enter a 90-day extension. We'd like to understand Ford's position relative to holding us to only 90 days, because this simply might not be enough time to get the Kapton rupture issue cleaned up to Ford's liking, which includes at least a re-run of Fluid Resistance and Impulse. A complete explanation of the Kapton issue has been forwarded to Joe, to arm him with more facts for use in dealing with Ford.

VALIDATION, LIGHT TRUCK:
A different set of problems to deal with at Light Truck. Here, salt-spray failures occurred which were attributed to the mating connector. Our validation was run with EPC connectors, which are an older design and not very robust. This has raised questions such as which connector LT actually plans to use, which we do not know. They may in fact choose (-or-have chosen) the UTAG connector, which we used successfully on Pass Car. We have tried to claim similarity in the ISR writeup, which at this point has not been well received. There has been talk of re-running the whole thing with UTAG connectors, which is ridiculous.

KAPTON LIFE:
Cycling of the various test lots continues. At this point, we have, generally, 4 or more failures of 6 in each lot, enabling decent Weibulls to be calculated. For the modified-converter-travel lots, we have learned that there is no difference between the control lot, the lot with .006" reduced washers to raise the converter bump, and the lot with .005" stepped washer to pre-deflect the disc and limit travel. All three have Beta's between 4.4 and 5.1, and Theta's between 1073 and 1148. Note that these AMI-built parts actually performed atypically well in terms of characteristic life (Theta), although Beta's are typical. For the lot with the stepped hexport to move the Kapton clamp diameter outward, we found the test lot significantly worse than the control lot. The Beta & Theta for the control lot was 4.0 & 711, versus 2.8 & 573 for the test lot. Maybe we actually need to bring the clamp diameter inward, as Stan Hemol has suggested. We're also analyzing the hand-line built Pass Car validation parts, and have found a Beta of 7.2 and Theta of 1080, very typical numbers for hand-line product (compares with 6.0 and 1133 previously).

Presently, we have on test the AMI-built validation attempt which was run in Stan's cycler at reduced pressure (different parts from same lot), and two lots of parts being run to support production. These two lots are part of a 1500-pc Pass Car lot accidentally built on the AMI, and we are now cycling them to determine if they are, by chance, actually good. We have six straight off the AMI, and another 6 which were crimped on AMI then crimped again on the hand-line, which may expose a potential salvage technique.

Mfg. Eng. has exposed a key piece of information in the crimp puzzle. Actual pressure-transducer measurements of the crimp cylinder pressures has shown that the AMI was running significantly lower in pressure on both stages of crimp. This data was collected before some maintenance (cleaning filters, etc) was done on AMI, so the plan is to repeat the measurements to obtain the present status. Furthermore, a test is planned by Mfg. Eng. with our support where devices will be built with pressures on AMI at lower values, and at values matching the hand-line. Controls will be built on the hand-line as well. These will be cycled to failure in our cycler for direct comparison with all previous data, as soon as manifold positions begin to open up early next week. We also plan to build a couple from each lot with Fuji pressure-sensitive film.

MECHANIZATION:
Mfg. Eng. and Mechanization have spent significant efforts to correct the problems noted with the EA and the AMI. This includes the spring-bending tool, which was leaving score marks, bending to an insufficient angle, and the bottom die was found to be chipped. On AMI, the cutoff stations for both terminals have been upgraded to ensure that asymmetric cutoff cannot occur, which combined with a new, lower calibrator target should help avoid broken stationary terminals. We plan to begin testing with devices calibrated .005 lower and using the corresponding pin (.146 -.005 = .141).

The Final Asm Machine and the pressure tester have been moved from B20 to B12, and are presently being set-up and connected to utilities. The Base Asm Machine and the EA machine are in the process of being moved. It will be several days before we can even power-up the machines, at which point several more days will be needed to get them back to their status before the move.

SAMPLES:
The schedule for the 300-pc lot of 77PS's requested by Pitts for ISR work has been successfully moved forward by Marketing, pending the correction to the base mold, which also co-incides with the completion of the machine move. They are expecting parts around 911007.

For the Ford Australia samples, I have updated the metric hexport dwg EX3423-61 to include the correct thread, M10 x 1.0 - 6g. I have also reviewed the ISO tolerancing technique and calculated the correct pre-plate major and pitch diameters for the thread, which have been placed on the print. The specified 6H (internal) and 6g (external) thread tolerances correspond with our 2B and 2A respectively; while the metric standard actually provides about 13% more tolerance. The EX has been forwarded to Mike McHugh for creation on the CNC lathe.

-MSG M#= 327038 FR=CZRN TO=PCQA SENT=09/28/91 08:13 AM
R#=146 ST=C DIV=0050 CC=00101 BY=CZRN AT=09/28/91 08:13 AM

SEPTEMBER 28, 1991

TO:	RUSTY STRUBLE	RCS2	CC:	TOM CHARBONEAU	TC
	MIKE DeMATTIA	PCQA		JOHN KOURTESIS	MDES
	CHARLIE DOUGLAS	CPPC		STEVE MAJOR	WHLZ
	DICK GARIEPY	MFPC		ANDY McGUIRK	PCQA
	PAUL KOTCH	PRK1		ED O'NEILL	EJON
	JOE LAZARZ	JML8		JOE SCHUCK	WHLZ
	STEVE OFFILER	SBO1		GARY SNYDER	CPPC
	MATT SELLERS	PCME		MARTHA SULLIVAN	CPPC
	BILL SWEET	PCME		RAY TOURANGEAU	PCME
	JIM WATT	PCQA		BILL CONGDON	MFPC
	TOM BURKE	MFPC		~~STEVE MCCOOEY~~	MDES
	CLAIRE BALTHAZAR	PSWT		ELAINE ROSE	PCQA
	MARGA GARANITO	MFPC			

FR: DAVE CZARN ZARN

EJ: FORD CRUISE CONTROL PRESSURE SWITCH START-UP MEETING:
09/26/91 MEETING MINUTES

MEETING

THE NEXT MEETING IS SCHEDULED FOR:

DATE: 10/03 (THURSDAY)
TIME: 10:00 - 11:30 AM
PLACE: MARKETING CONFERENCE ROOM

PLEASE CALL ME IF YOU ARE NOT ABLE TO ATTEND

* = ITEMS THAT ARE NEW OR HAVE BEEN REVISED OR COMPLETED SINCE PREVIOUS MEETING

57 L/T (L5-2)	WHO	WHEN	
Hexport:			
. REPORT ON ELCO ISSUES FROM 7/22 VISIT - 10B21 STEEL/.00015" MIN. PLATE/J512 $	KOTCH	ONGOING	
57 P/C (L5-3)			
Environmental Seal:			
* RELEASE SAMPLE LOT (1K PCS) OF BLUE P/C SEALS	SELLERS	10/02	
77PS			
Production Issues:			
. PROD. LINE SET-UP (RTE CARDS, ETC)	BALTHAZAR	ONGOING	
. UPDATE PRODUCTION PLANS FOR ALL SWITCHES	DOUGLAS	ONGOING	
. REPORT ON WEEKLY MFG. START-UP MTGS.	SELLERS	ONGOING	
. UPDATE PARTS LISTS TO ADD AMI-PRODUCED SPACER AS ALTERNATE	OFFILER	10/10	
* LAB IMPULSE TEST LOT W/FAILED SPRINGS (ALL SWITCHES PASSED)	OFFILER	09/20 09/20	ORIG. COMP.

Bldg. 5/L5

* MATRIX OF SWITCHES THAT ADDRESS SPRING AND CONTACT FAILURES - FWD TO ELAINE	SELLERS	09/27	
* IMPULSE TEST SWITCHES FROM ABOVE MATRIX	ROSE	10/03	
PV Testing/ISR:			
* COMPLETE TESTING AND REPORT	OFFILER	09/16	ORIG.
		09/20	REV.
		09/23	COMP.
* FAI ON 6 L/T AND 6 P/C SWITCHES	WATT	09/12	ORIG.
		09/20	REV.
		09/20	COMP.
* GAGE R&R STUDIES	WATT	07/15	ORIG.
		09/20	REV.
		09/23	COMP.
* COMPLETE ISR PACKAGE FOR 09/20 DELIVERY	WATT	09/19	ORIG.
	L/T	09/24	COMP.
	P/C	09/26	COMP.
* MODIFY BASE MOLD	SELLERS	10/02	
* BUILD 300 L2-1'S FOR PITTS FOR THEIR ISR (W/CORRECTED BASES)	BURKE/ SELLERS	10/04	* Use for PIR/PA
* GIVE 6 OF THE 300 TO JIM FOR FAI'S	SELLERS	10/04	
* COMPLETE FAI/SUBMIT ADDENDUM TO P/C ISR	WATT	10/18	New Drawing for out of spec dim
Manufacturing Equipment:			
* EQUIP. MOVE TO B12	SELLERS	09/12	ORIG.
		09/27	COMP. to Ford ASP
* MAKE QC P-TESTER COMPAT. W/77'S	KOURTESIS	10/10	
* PRIORITIZE 3rd KAPTON CHK. STA. REDESIGN	SELLERS	10/01	
* REVISE 3rd KAPTON CHK. STATION	KOURTESIS	10/??	
* DOCUMENT PROCEDURE TO DETERMINE IF KAPTON CHK. STATION IS WORKING	SELLERS	09/23	ORIG.
		09/23	COMP.
* DOCUMENT PROCEDURE FOR H-L P/C SENSOR BUILD	SELLERS	09/23	ORIG.
		10/10	REV.
* CHARACTERIZE H-L AND AMI CRIMPERS	SELLERS	09/26	ORIG.
		09/26	COMP.
* BUILD TEST MATRIX; H-L CRIMP, AMI CRIMP @ H-L CRIMP PRESSURES, AMI CRINP - STD.	SELLERS	10/01	
* TEST-TO-FAILURE ABOVE MATRIX	OFFILER	ONGOING	
Miscellaneous:			
. IDENTIFY SWITCH MOUNTING LOCATIONS & SIZE REQMTS FOR FUTURE PLATFORMS	SCHUCK	10/10	device
. 57 TO 77 CONVERSION: PHASE 1 TESTING	HOMOL	05/30	ORIG.
		09/--	REV.
* COMPLETE DESIGN FMEA	OFFILER	04/18	ORIG.
		09/30	REV.
* COMPLETE PROCESS FMEA	SELLERS	07/01	ORIG.
		09/30	REV.
* DETERMINE APPROACH FOR 2A/3A THREAD GAGING ISSUE	CZARN/ MCGUIRK	10/03	

DISCUSSION

MATT HAS IMPLEMENTED AN INTERIM PROCEDURE TO VERIFY THAT THE KAPTON CHECK STATION IS WORKING. EACH 1/2 HOUR, THE 3RD KAPTON STATION WILL BE DISABLED, SO AT LEAST TWO CONSECUTIVE PARTS ARE BUILT WITHOUT THE 3RD PIECE OF KAPTON. IF THE AMI DETECTS THE MISSING

KAPTON, PRODUCTION WILL RESUME. IF NOT, THE PREVIOUS 1/2 HOUR'S PARTS WILL NEED TO BE SCRAPPED/SALVAGED. NO PROBLEMS FOUND YET.

TERMINAL FRACTURE: THE CAL. ANVIL HAS BEEN MODIFIED SUCH THAT IT BEARS ON THE APPROPRIATE PART OF THE TERMINAL WHEN CALIBRATING. THE AMI CUT-OFF STATIONS FOR BOTH TERMINALS HAVE BEEN UPGRADED TOENSURE THAT ASYMME TRIC CUT-OFF DOES NOT OCCUR. ALSO, A LOWER CALIBRATION TARGET IS BEING EVALUATED (= LESS DEFORMATION OF THE STATIONARY TERMINAL, AND CLOSER TO A 90 deg ARM BEND WHEN CONTACT IS MADE).

SPRING FRACTURE: THE SPRING ANGLE WAS BROUGHT INTO SPEC. TOOLING WAS CORRECTED TO ELIMINATE MARKING OF THE ARM. ALSO, AS DESCRIBED ABOVE, THE CALIBRATOR TARGET WAS LOWERED.

A TEST MATRIX OF PARTS WAS DEVELOPED TO DETERMINE IF THESE FIXES WILL ELIMINATE THE EARLY SPRING AND TERMINAL FRACTURES (BASED ON PRODUCTION IMPULSE TEST RESULTS).

ALL OF THE MACHINES HAVE BEEN MOVED FROM B20 TO B12.

THE PLANNED VOLUME OF PRODUCTION PARTS WERE NOT IN B20 PRIOR TO THE MOVE DUE TO THE FRACTURED SPRINGS AND TERMINALS, AS WELL AS A DIMENSIONAL ISSUE ON THE BASE. THE VOLUMES WERE PUSHED OUT INTO OCTOBER AS SHOWN IN THE SCHEDULE BELOW. THE FIRST NEED FOR PARTS IS ~10/07 (PITTS - P/C), THE NEXT IS 10/21 FOR L/T.

MILESTONES	PLANNED	ACTUAL
57 L/T ISIR	11/21/90	11/21/90
57 L/T JOB 1	09/03/91	
57 P/C ISIR	01/15/91	01/15/91
57 P/C JOB 1	06/03/91	
77PS ISIR	09/01/91 ORIG.	
	09/20/91 REV.	09/27 - INITIAL
77PS SOP (TI)est.	10/91	

PRODUCTION PLAN BY MONTH (THOUSANDS)

	P/C 57PSL5-3	L/T 57PSL5-2	P/C 77PSL2-1	L/T 77PSL2-3
JUL	0	2.3	0	0
AUG	0	2.3	0	0
SEP	25	9.3	0	0
	equipment move to B12 starting last week of September			
OCT	0	7	15	12.4
NOV	0	0	25	13
DEC	0	0	25	13

REGARDS,
DAVE CZARN \39-FORD