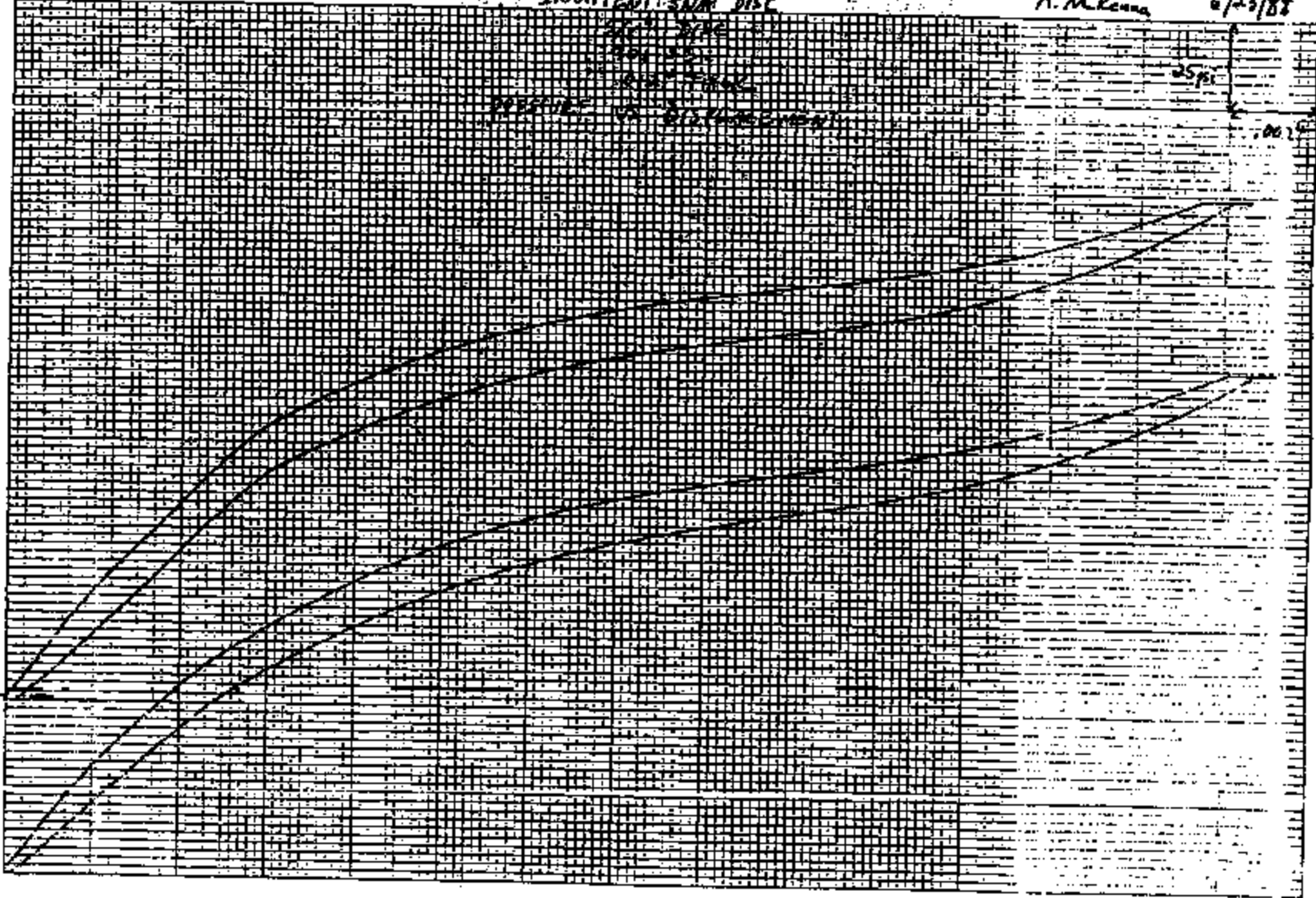


EX 3423

INSIPENT SWR DISC

A. M. Kenna

6/23/88



T-NHTSA 000291



TEXAS INSTRUMENTS *of Jerrinton*
 INCORPORATED
ATTENTION: INSTRUMENTS DEPT

TO <i>ANDY MCKENNA</i>	MAX STATION <i>12-32</i>
F. <i>Ed Rolland</i>	MAX STATION <i>1-37</i>
SUBJECT <i>CRUISE CONTROL SWITCH</i>	DATE <i>6/16/88</i>
MESSAGE	

The Planned Material is *455 SS @ .010 in the "Annotated"*
(Solution Treated) STATE. ESTIMATED .2% Ys 170K P3.

The heat treating the discs to *800° 30 MIN BEFORE FORMING*
 will significantly increase the *.2% Ys* and elongate limits.

I want to split the discs into 2 lots
Part 1 lot at 800° P 30 min, the other 900° P 30 min
 prior to forming.

We will provide additional blanked discs in August 10 days

SIGNED *Ed Rolland*

455 SS samples tested for CCPS

SIGNED

DATE

A PROCEDURE CHANGE IN THE ASSIGNMENT OF DATA SHEET TEST NUMBERS FOR THE 35, 34, AND SBPS PRESSURE SWITCHES IS TO BE IMPLEMENTED FOR IMPROVED DATA ACCESS.

TEST SERIES NUMBERS WILL REMAIN IN THE THREE-PART FORMAT PRESENTLY

E.G. X-Y-Z
719-1-25

THE FIRST NUMBER (X) WILL BE ASSIGNED SEQUENTIALLY BY LOOKING IN THE INDEX OF THE TEST LOG BOOK AND SELECTING A NUMBER ONE HIGHER THAN THE HIGHEST PREVIOUS TEST SERIES NUMBER.

THE THIRD NUMBER (Z) WILL INDICATE THE TOTAL NUMBER OF DEVICES BUILT AND WILL BE USED FOR SERIAL IDENTIFICATION ON EACH OF THE UNITS.

THE SECOND NUMBER (Y) WILL BE USED TO DENOTE EITHER A SAMPLE BUILD OR A CERTIFICATION TEST. A TWO-DIGIT KEY HAS BEEN WRITTEN FOR THE ASSIGNMENT OF THE "Y" SERIES NUMBER (SEE TABLE 1). THE NUMBER "01" WILL BE USED FOR SAMPLE BUILDS. THE NUMBERS "02" THROUGH "14" WILL BE USED FOR SPECIFIC CERTIFICATION TESTS. THE NUMBER "15" WILL BE USED FOR ALL OTHER TESTING WITH THE DESCRIPTION OF THE TEST RECORDED IN THE TEST LOG BOOK AND THE DATA SHEET.

PRESSURE SWITCH DATA FORM
2ND NUMBER KEY

- 01 - SAMPLE BUILD
- 02 - CONTACT LIFE
- 03 - SWITCH (DIAPHRAGM) LIFE
- 04 - BURST PRESSURE
- 05 - CORROSION RESISTANCE
- 06 - PRESSURE SWITCH DIAPHRAGM (60 DAY)
- 07 - PRESSURE AGE CYCLING (15 DAY)
- 08 - VIBRATION
- 09 - SWITCH BODY STRENGTH
- 10 - TERMINAL PUSH-OUT
- 11 - DROP
- 12 - PRESSURE CYCLING (21 DAY)
- 13 - TEMPERATURE EXPOSURE
- 14 - SETTING STABILITY
- 15 - MISCELLANEOUS (SEE TEST DESCRIPTION)

TABLE 1

DEVICES FROM A SAMPLE BUILD THAT ARE CERTIFICATION TESTED ARE TO HAVE THE SAME "X" TEST SERIES NUMBER ON THE SAMPLE BUILD AND CERTIFICATION TEST DATA SHEETS AND DIFFERENT "Y" TEST SERIES NUMBERS. THE "Z" SERIES NUMBER ON A CERTIFICATION TEST WILL INDICATE THE QUANTITY OF DEVICES BEING TESTED.

PLEASE BEGIN USING THIS TEST IDENTIFICATION PROCEDURE EFFECTIVE IMMEDIATELY. IF YOU HAVE ANY QUESTIONS, PLEASE CONTACT ME.

W.L.GDS,
SEN BARBER
jer

TI-NHTSA 000293

PRESSURE SWITCH DATA

FORM 21605

TEST NO. 1 - - 2

DEVICE EK 5423	DATE REQUESTED 3/14/88	REQUESTED BY ANDY MCKENNA	REQUESTED COMPL. DATE
PERFORMED BY A. MCKENNA	DATE STARTED 3/14/88	DATE COMPLETED	APPROVED BY A. J. McKenna

PROJECT TITLE: FORD CRUISE CONTROL PRESSURE SWITCH

CUSTOMER: FORD

PURPOSE OF TEST: TO DETERMINE THE REQUIRED CALIBRATION OF THE 5/8" DISC TO BE USED IN THE EK5423 APPLICATION (ROUGH APPROXIMATION)

PROCEDURE: MEASURE THE FORCE REQUIRED TO ACTUATE A 5/8" DISC (CALIB: 48/245 psig) USING 2 RINGS (TO SIMULATE RING ON CUR):
 $D_1 = .520"$, $D_2 = .440"$

Desired activation: $\approx 150-165$ psi. Button area: $\frac{1}{4}\pi D^2 = \frac{\pi(.508)^2}{4} = 0.202$
 \therefore Actual act. force $F = (160 \text{ psi}) / (.202 \text{ in}^2) = 32.3 \text{ lb}$

Actual Ring dia = .468"

ID	RING DIA. (IN)	ACT. FORCE (LB)
1	.520	58
2	.440	16
EXTRAPOLATE ACT FORCE FOR RING DIA = .468 :		
	.468	29.7

CONCLUSION: WITH RING DIA = .468", FREE SNAP ACT. PRESS = 48 psig
 THE ACT FORCE IS 29.7 lb. REQUIRED ACT FORCE IS 32.3 lb.
 THIS IDEAL DISC WILL HAVE FREE SNAP OF SLIGHTLY GREATER THAN 48 psig, Close 50 psig.

DETERMINE REL. CALIB. WANT RELEASE (DEVICE) OF > 100 psig
 $\therefore \frac{100 \text{ psig (REL)}}{160 \text{ psig (ACT)}} = \frac{? \text{ (REL)}}{58 \text{ psig (ACT)}}$
 REL CALIB ≈ 31.25 psig min

PRESSURE SWITCH DATA

FORM 21605

TEST NO.

DEVICE EX3423 (Modified 57PS DEVICES)	DATE REQUESTED 4/1/88	REQUESTED BY A. McKenna	REQUESTED COMPL. DATE 4/19/88
PERFORMED BY A. McKenna	DATE STARTED 4/1/88	DATE COMPLETED 4/19/88	APPROVED BY A. McKenna

PROJECT TITLE: FORD CRUISE CONTROL PRESSURE SWITCH CUSTOMER SAMPLES

CUSTOMER: FORD

PURPOSE OF TEST: Supply preliminary samples to FORD

- PROCEDURE: ① Build devices using 57PSF3-3 SENSORS WITH SPECIAL DISCS (act. \bar{x} = 16.4, 17.7, 18.4, 20.0) and 97PS12-2 BASE ASSY. (Pin accordingly to eliminate creep)
② Check & Record Calibration & Transfer Times

ID	\bar{x} (act)	Calibration (ps)		TT (ms)	MVD
		Act.	Ref.		
1	16.4	144	103	2.5/2.8 * (2)	.38
2		147	93	2.8/2.7	
3		151	110	2.5/2.0 * (3)	.36
4		144	94	1.4/2.0	
5		146	102	3.5/1.8	
6		135	82	2.8/3.6 * (1)	.38
7		143	87	3.0/1.8	
8		136	91	2.2/2.4	
9		148	93	2.8/1.8	
10	↓	151	109	5.0/1.9	
11	17.7	155	110	3.0/2.7 * (4)	.33
12		157	108	2.3/1.8	
13		158	100	5.9/2.6 * (5)	.61
14		149	106	3.0/1.8	
15		149	105	2.7/1.8	
16		153	108	2.3/1.8	
17		144	105	1.4/1.9	
18		166	103	2.5/2.5 * (6)	.34
19					Snap too quiet to detect
20	↓	153	102	2.3/2.7	

* = shipped
(n) = number as shipped

TI-NHTSA 000295

PRESSURE SWITCH DATA

Form 21605

TEST NO. _____

DEVICE EX3423 (Cruise Control Pressure Switch)	DATE REQUESTED 4/28/88	REQUESTED BY A. McKenna	REQUESTED COMPL. DATE
PERFORMED BY K. Buffi	DATE STARTED	DATE COMPLETED	APPROVED BY A. McKenna

PROJECT TITLE: **SAMPLE BUILD**

CUSTOMER: **FORD**

PURPOSE OF TEST: **X1164**

PROCEDURE: **Build Samples**
Sensor Crimp Pressure: 1250 psi / 2400 psi
 Before building, record force required to crimp & release disc
 (Calculate Effective Area (= Force / (device act pressure))
 Plot Pressure vs. Deflection of each sensor
CRIMP RING CRIMP PRESSURE: 750 psi / 3400 psi
 Take pin gauge measurement

ID	CRIMP ACT/REL (N)	CUT ANGLE RING DIA.	# RANTON	Force (N) Act/Rel	SEANOR Act/REL	Effective Area (m ²)	Pin Gauge	Final Act/Rel	YT (m/s)
1	64.8/53.2	.470	3	30/25.5	145/119	.207/.214	.128/.118	141-119	12.4 - 1.7
2	65.4/54.5		2	29.4-23.8	126-117		.128	131-114	12.2 - *
3	65.4/53.6		1	29.7-23.9	126-115		.140	133-121	12.4 - 5.5
4	65.3/53.7		3	30.0-24.0	142-123		.141	139-119	12.3 - *
5	65.4/54.4		2	29.8-23.4	126-117		.140	134-112	12 - *
6	66.3/55.4	V	1	26.2-25.2	136-120		.1395	131-117	12 - *
7	66.0/54.5	.460	3	26.6-21.1	135-115		.1405	131-112	12 - 4.5.6
8	66.7/55.1	.460	1	27.1-21.8	124-105		.140	122-104	12.3 - *
9	66.2/54.2	.480	3	22.8-25.9	149-120		.137	146-124	12.5 - *

Prototype #1: FREE SNAP, FORCE, PRESSURE, EFFECTIVE AREA 5/2/88

	FREE SNAP (psi)	FORCE (lb)	Pressure Act/Rel (psi)	Effective Area (= Force/Press)
①	52.2 / 42.3	24 / 20		
②	59.2 / 49.4	27 / 23		
③*	64.6 / 54.5	30 / 25.5	145 / 119	.207 in ²

cup ring diam = .470

①	52.2 / 42.3	26.5 / 20.5
②	59.2 / 49.4	21 / 24
③	64.6 / 54.5	32.5 / 25.5

cup ring diam = .480

Note: $\frac{\text{free snap}}{\text{Force}} \approx \frac{2}{1}$

Thus for act of 160 psi, Force = Press(act) * Area = (160)(.207) = 33.12

Free snap $\approx 33.12 \times 2 = 66.24$ psi

Rel of 110 psi \Rightarrow Free snap = 2 * Force = 2(110)(.207) = 45.54

PRESSURE SWITCH DATA

FORM 21605

TEST NO.

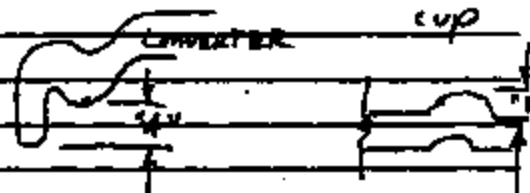
DEVICE EX3423 - PL	DATE REQUESTED 5/31/88	REQUESTED BY A. McKenna	REQUESTED COMPL. DATE
PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY A. J. McKenna

PROJECT TITLE: SAMPLE BUILD & LIFE TEST

CUSTOMER: FORD

PURPOSE OF TEST: TO DETERMINE CYCLE LIFE OF EX3423 WITH CONVERTER DIMENSION "A" - .023" NOMINAL.

PROCEDURE: Build 3 samples,
Record disc calibration,
device calibration dimensions
"A" & "B", # Kapton seals used,
pin length
ANNULAR RING DIA: .470



ID	Pin	DISC		SENIOR		CONV. DIM "A"	CUP DIM "B"	KAPTON SPACER?	# KAPTON SEALS
		ACT	REL	ACT	REL				
-11	138	86.1	65.0	200	125 SLAP	-	-	NO	3
-12	139	76.6	57.1	152	143	.024	.024	YES	2
-13	139	79.5	60.0	174	140	.023	.035	YES	1
-14	139	76.0	56.2	162	123	.023	.025	Y	2
-15	140	76.5	57.4	168	134	.023	.014	Y	2
-16	140	75.4	56.1	170	137	.024	.0145	Y	2
-17	138	76.7	57.1	170	138	.023	.0145	Y	2
-18	139	76.9	58.0	169	136	.0235	.0235	Y	1
-19	141	77.3	57.6	171	135	.023	.014	Y	1
-20	140	77.3	57.7	171	138	.0245	.0145	Y	1
-21	138	77.8	58.2	173	141	.0235	.0135	Y	1

PRESSURE SWITCH DATA

FORM 21605

TEST NO.

DEVICE EX3423-P1	DATE REQUESTED 5/9/68	REQUESTED BY A. McKenna	REQUESTED COMPL. DATE
PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY A. J. McKenna

PROJECT TITLE: **EX3423-P1 Impulse test**

CUSTOMER: **FORD**

PURPOSE OF TEST: **TO DETERMINE CYCLE LIFE OF EX3423-P1 WITH CONVERTER DIMENSION "A" = .023" (NOM.)**

PROCEDURE: **Impulse test to 500K cycles (total) 0-1750 psi. Check & record Calib & T.T. at 0, 250K, and 500K cycles**

ID	0 CYCLES		250 K		500 K	
	Act/Rel	TT	Act/Rel	TT	Act/Rel	TT
-11	180/145	2.3/1.8				
-12	180/147	2.2/1.8	171/129	1.6/1.5		
-13	167/128	1.2/1.8	167/128	2.0/1.9		
-14	162/129	2.2/1.6				
-15	147/130	2.3/1.4				
-16	165/135	1.5/1.4				
-17	167/140	1.2/1.6				
-18	166/133	2.7/2.0				
-19	168/131	2.1/1.4				
-20	167/138	3.0/1.3				
-21	167/147	2.9/1.9				

TESTING DISCONTINUED

(-P1 samples no longer required)

PRESSURE SWITCH DATA

Form 21605

TEST NO.

DEVICE EX3423	DATE REQUESTED	REQUESTED BY <i>Andy McKenna</i>	REQUESTED COMPL. DATE
PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY <i>A. McKenna</i>

PROJECT TITLE: **EX3423 - P1 IMPULSE TEST**

CUSTOMER: **FORD**

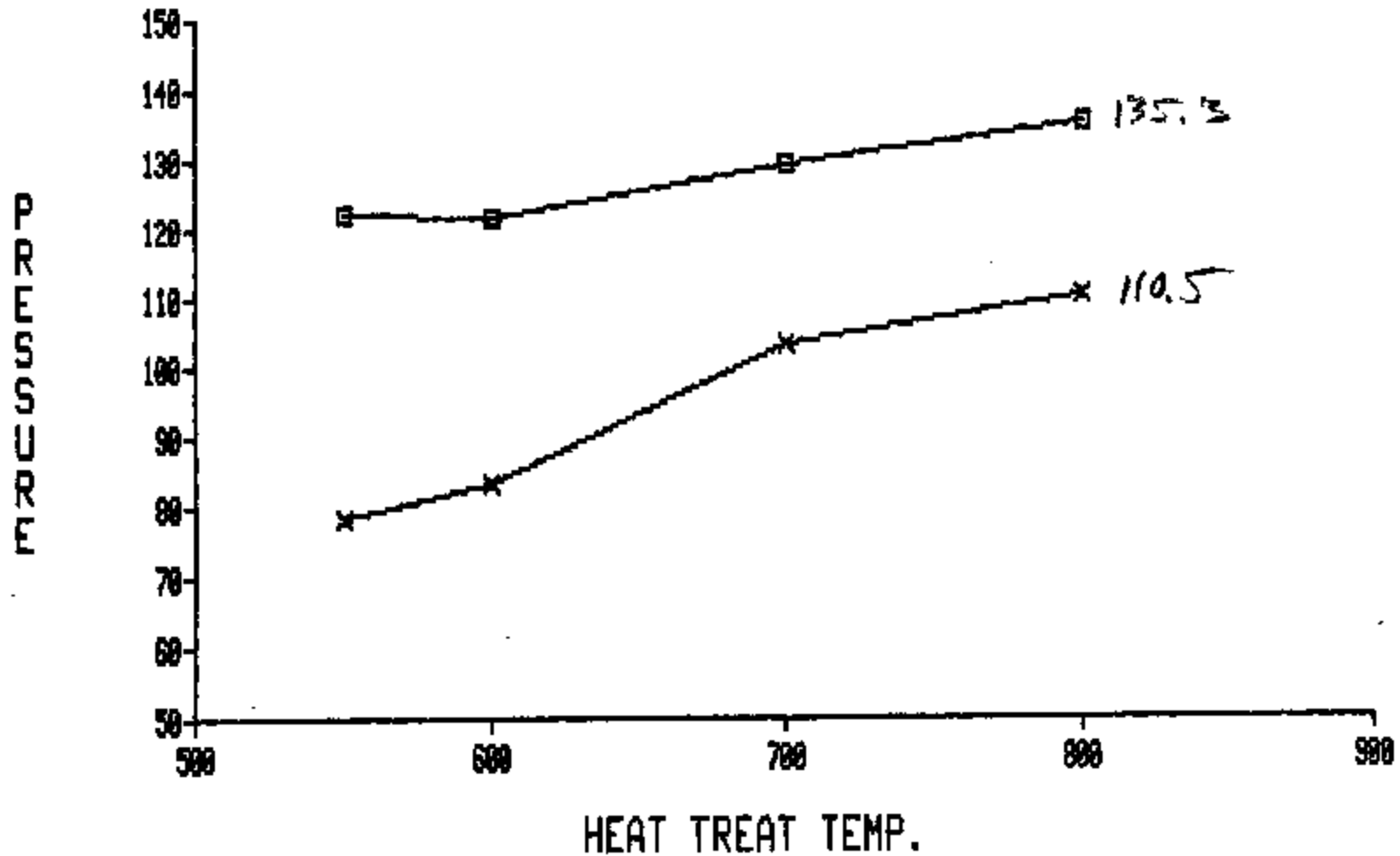
PURPOSE OF TEST: **TO DETERMINE CYCLE LIFE OF FIRST GROUP OF EX3423 PROTOTYPES**

- PROCEDURE:
- ① Measure & Record Calibration of all devices
 - ② Cycle 25K times on impulse tester
 - ③ Repeat ①
 - ④ Continue cycling to 500K, repeating ① at 50K, 100K, 200K, 300K, 400K, 500K

		START	25K	50K	100K	200K	300K	400K	500K
-1	Calib (psi) TT (ms)	143/119	138/103	135/100	132/110	110/93	158/128	170/143	152/120
		12.4/1.7	4.9/1.6	6.7/1.5	5.5/1.6	CA*/CR*	CA*/CR*	CA*/CR*	CA*/CR*
-2		131/114	128/92	120/92	110/102	295/270	312/291	constant	cut
		1.2/CR	CA/804	25.3/CR	CA/CR*	CA*/CR*	CR/CR*	continuity	open
-3		133/111	132/98	132/98	123/97	113/94	235/193	constant	cut
		.4/56.5	1.2/5.1	2.2/5.4	1.1/3.9	CA*/CR*	CA*/CR*	continuity	open
-4		139/119	139/98	140/103	137/106	137/104	142/117	112/97	47/38
		1.3/CR	1.2/3.2	1.1/3.1	1.4/3.1	CA*/CR*	CA*/CR*	CA*/CR*	CA*/CR*
-5		134/112	137/98	128/97	123/98	157/127	250/215	232/207	110/259
		1.2/CR	2.1/5.9	2.0/6.8	1.0/3.2	CA*/CR*	CA*/CR*	CA*/1.5	CA*/1.7
-6		131/117	132/100	132/102	133/95	117/97	121/95	105/94	102/94
		1.3/CR	1.9/22.1	1.8/46.9	1.1/22.6	1.0/31.0	2.1/51.8	2.0/39.2	2.0/CR
-7		131/112	136/105	133/100	133/98	112/95	121/96	133/90	127/93
		1.2/45.6	0.9/54.6	1.0/CR	0.9/57.2	CA*/1.5	CA*/2.6	CA*/54.6	5.7/51.9
-8		122/104	121/96	119/93	121/93	130/106	83/71	76/68	65/55
		1.3/CR	1.2/35	2.1/18.2	2.1/10.0	CA*/CR*	CA*/CR*	CA*/CR*	CA*/CR*
-9		146/127	132/94	123/92	171/120	constant	constant	constant	constant
		1.5/CR	CA*/CR*	CA*/CR	CA*/CR*	continuity	continuity	continuity	CUT OPEN

CCPS DISC STUDY

D=5/8, t=.010, I:.725R, .6705. II:.900R, .722



TI-NHTSA 000301

AJM, 50, 167, 6/21/88

**DRAWINGS AVAILABLE UPON
REQUEST**

GOING TO
DO

QFD? SPECS

FTA? DESIGN

FMEA? PROCESS

MEMORANDUM

18 JULY 1988

TO: KARL ABRAHAMSON 12-37
TED BALLARD 1-37
BUD COOPER 10-13
MARK GERFIN 12-27
BOB HITT 12-37
ED KADISEVSKIS 12-28
JOHN KOURTESIS 12-28
LEO MARCOUX 12-32
ANDY MCKENNA 12-32
CARL SANFORD 12-32

FR: DOUG STROTT 12-32

SJ: CRUISE CONTROL PRESSURE SWITCH DESIGN

The Cruise Control Pressure Switch (CCPS) is designed around 57PS brake line pressure switch components with several exceptions. The switch will use a 5/8 inch snap disc. The spring/contact arm arrangement of the 57PS is replaced by a single contact arm spring similar to the newly designed 32PS. This design is intended to realize a low cost, long life product.

This document describes the design features of the various components of the CCPS and summarizes the next steps required for development. A print package is attached.

BASE - EX3423-10

The base is similar to the 57PS base. The connector cavity has been offset from the switch cavity in order to allow symmetric terminal placement: either terminal may be installed in either position in the base simplifying the assembly operation.

The new base has a shorter length and a slightly smaller diameter. The initial design does not call for an environmental seal. An environmental seal may have to be added later to pass salt spray and humidity testing.

TERMINALS - EX3423-9 (Movable), EX3423-8 (Stationary)

The terminals are similar to 57PS terminals. The staking operation will not change. The terminals are designed for the symmetric mounting slots of the base. The terminals are designed to use an "L"-shaped contact arm which results in less length and closer spacing than 57PS terminals.

CONTACT ARM - EX3423-7

The contact arm is an approximate copy of the 32PS contact arm. It is "L"-shaped to achieve softer compliance and render the contact force less sensitive to tolerance stack-ups. All of the active dimensions used on the 32PS contact arm (p/n 58324 TI Versailles) have been retained. The arm uses a single rivet (like the 57PS spring) instead of the two staking bumps on the 32PS.

TI-NHTSA 000312

The arm also uses a riveted contact (same contact rivet as 57PS) instead of a welded contact. The active dimensions (lengths, widths, and angles) of the 32PS arm have been approximated as nearly as possible. Some dimensional adjustments may be required after prototypes have been evaluated.

DISC SEAT - EX3423-11 (Crimp), EX3423-12 (Crimp ring)

Two disc seats have been designed. One is a unitary disc seat/ crimp ring in which one side crimps to the hexport and the other side crimps to the base. The other requires a crimp ring which sandwiches the hexport, disc seat, and base. Each seat is 0.150 thick to withstand higher proof pressure forces than the 57PS due to the larger gasket diameter. The disc bearing surface profile is the same as the 57PS converter design.

SEAL - EX3423-16

The seal is round Kapton 500F131, 0.005 thick. Only one piece is planned since the seal should experience lower strains than the 57PS seal.

DISC

The disc is currently planned to be a 5/8 direct acting incipient snap disc. Disc material and thickness are to be determined. Candidates include 0.013 and 0.014 stainless steel, and 0.012 455 PH heat treated prior to forming.

GASKET - EX3423-13

The gasket is an ethylene propylene latex cut for brake fluid compatibility. It has a larger inside diameter to accommodate the 5/8 disc and the same cross section as the 57PS gasket.

HEXPORT - EX3423-14 (No crimp ring), EX3423-15 (Crimp ring)

The hexport design is similar to the 57PS design. The flange is 0.150 thick to accommodate the higher proof pressure forces. The snubber has been eliminated, and the -15 design does not have the gasket gland (the gland for this design is in the disc seat).

CRIMP RING - EX3423-17

The crimp ring is the same thickness as the 57PS cup. The thickness may have to increase to accommodate the higher proof pressure forces. The crimp ring is intended to crimp the sensor assembly and the base in one sandwiched assembly. The disc seat has a stop built in to limit the strain on the base flange due to crimping and pressure forces. This design allows the entire assembly to be loaded from one direction and for a single crimping operation to finish the device, instead of two crimping operations.

TRANSFER PIN

Transfer pin lengths are calculated to range from 0.150 to 0.190. Gaging will be required. It is possible that given wider calibration pressure tolerances the pin length accuracy can be opened from 0.001 to 0.003 or 0.005 in order to allow in-line, automated pin gaging.

TI-NHT8A 000313

NEXT STEPS

A print package is available toⁿ solicit more firm production quotes.

Disc development and contact arm durability are the most significant open items at this time. Ted Ballard has recommended we try 435 PH 0.012 stock pre-heat treated at 800°C and 900°C for 1/2 hour and then form, as well as 0.013 and 0.014 301 stainless stock. A matrix of discs should be made and first and fourth cycle pressure-deflection curves measured. To evaluate temperature effects on disc performance, Bud Cooper's area can measure force-deflection at elevated temperatures to obtain rough approximations of temperature-induced drift and to learn whether it is reversible. Additional temperature effect studies must be made using prototype devices tested at elevated temperatures.

The new contact arm should be tooled in the model shop immediately to allow durability evaluations to begin. Additional model shop parts which will be required for life testing are the disc seat and crimp ring. The 57PS base and terminals can probably be modified to allow contact arm testing. Soft tooling the contact arm for production insert switches due in early January should be done at a prospective supplier.

Prototypes from cobbled-up 57PS parts will only be used for internal evaluations.

Regards,
Doug Strott

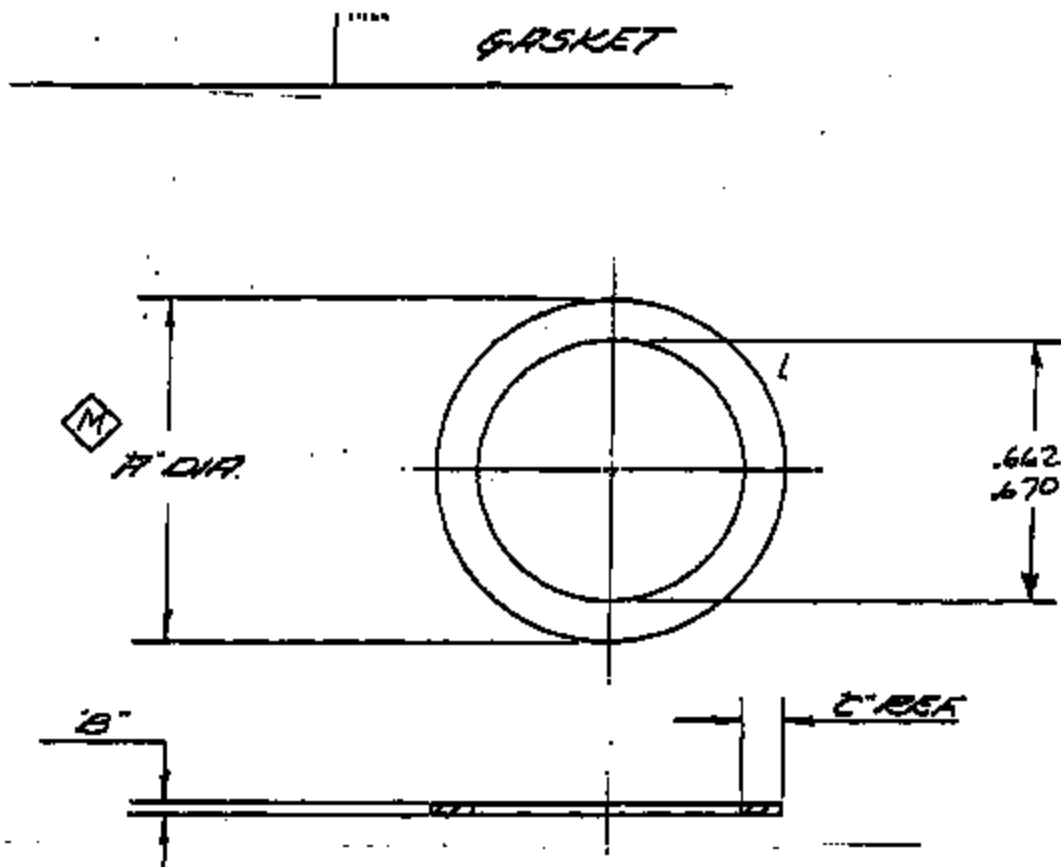
TI-NHTSA 000314

EX3423 -- CRUISE CONTROL PRESSURE SWITCH
SPECIFICATIONS

DESIGN-TO-COST GOAL: \$1.14
ACTUATION PRESSURE: 150+/-50 psig
RELEASE PRESSURE: 100 psig MIN
DIFFERENTIAL PRESSURE: Not Spec'd.
PROOF PRESSURE: 2000 psig
BURST PRESSURE: 4000 psig
TEMPERATURE RANGE (OPERATING): -40 TO 150°C
CYCLE LIFE: 500K cycles @ ?? psig
CONTACT ARRANGEMENT: N.C. 0.7 A, 5 VDC

TI-NHTSA 000315

**DRAWINGS AVAILABLE UPON
REQUEST**



- NOTES:**
1. MATERIAL CERTIFICATION REQUIRED WITH EACH SHIPMENT.
 2. MATERIAL TO BE COMPATIBLE WITH FREON-12 & REFERENCE OIL.
 3. PARTS TO BE SHIPPED, ISSUED & STORED IN SEALED PLASTIC BAGS. AND 30,000 PARTS PER BAG MAX.
 4. ALL CONTAINERS OF PARTS MUST BE MARKED TO REFLECT ANY MATERIAL LOT, TOOL OR PROCESS CHANGE.

TI-NHT8A 000322

	ETHYLENE PROPYLENE JBL COMPOUND E 7104-70	70	BLACK	.796 .788	.036 .036	.063
PART NO.	MATERIAL	DIMENSIONS	COLOR	A. M	B. M	C.

Q2-1 DEFENS 125 43-10-1 MW 1/27

D. STROTT 7/12/88



TEXAS INSTRUMENTS
INCORPORATED
ATLSEBORO, MASS., U.S.A.

KLECON
CONTROL PRODUCTS
DIVISION

QWL
SIZE
A

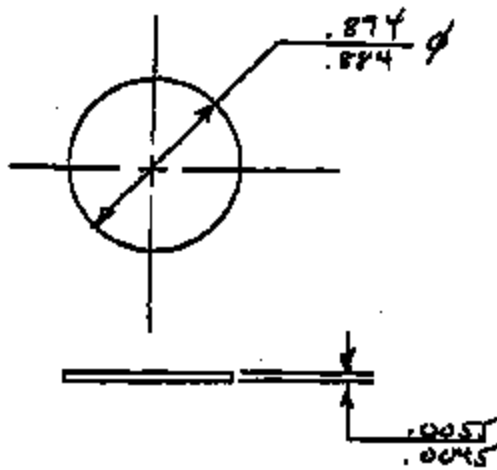
EX3423-13

CORP INSPNT NO. B2647

**DRAWINGS AVAILABLE UPON
REQUEST**

SEAL

EX 3423-16



MAT'L: DUPONT KAPTON 500F131

D. STROTT 7/12/78

4-512 NO SIZE
MAY 1964

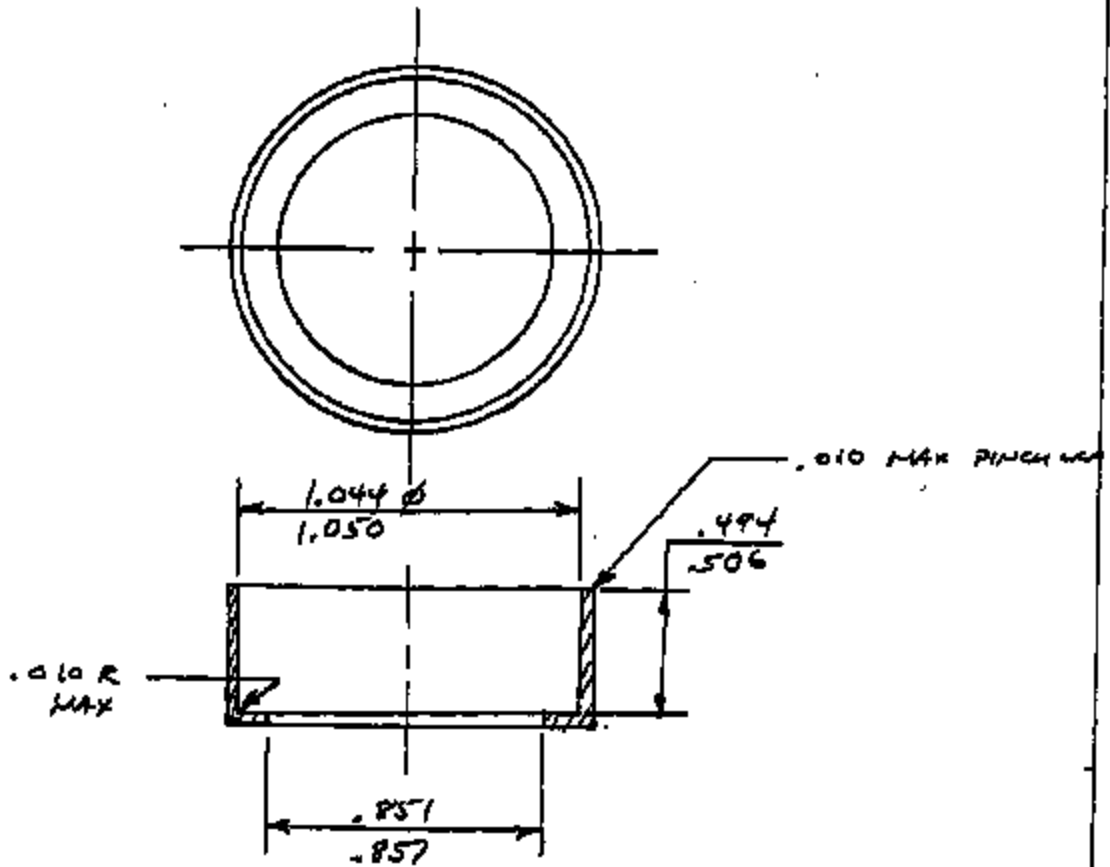
TI-NHT8A 000325

CRIMP RING

EX 3423-17

D. STREET 7/13/48

ALL THE SHEETS
SHOULD BE
CUT TO SIZE



MAT'L: 1006 CRS ZINC PLATE .0002/.0003 W/ YELLOW DIChROMATE
.040/.042 THK

TI-NHTSA 000328

**DRAWINGS AVAILABLE UPON
REQUEST**

HIGHLIGHTS
Stephen B. Offler
Week Ending 12/02/88



FORD MY 91 CRUISE CONTROL PRESSURE SWITCH

OVERVIEW: I am presently coming up to speed on the specific details of the CCPS. However, I recognize the longer-term need to develop broader knowledge of pressure switches. I have been completely through the CCPS information accumulated by Andy McKenna and Doug Stott. I'm working closely with mfg. eng. Carlo Du La Mata to firm up prints and obtain production-representative parts (quantity of 1K) for sample build in January. Carlo is handling the logistics of ordering and receiving these parts.

SAMPLE BUILD: Ford needs 200 parts by the end of January. Until I am more familiar with the build and test procedures, I cannot tell if this is realizable. The specifications for these are based on another Ford brake switch, marked up by Doug and submitted to Ford. However, this spec covers an BCM-connected device, while our application carries 700 mA at 5VDC. I need a better understanding of the exact function of the CCPS. I plan to contact Gary Klingler to discuss his reaction to the marked-up spec, and get a better system understanding.

DESIGN ISSUES:

- Fatigue life and performance of the spring arm
- Disc design
- Impact of tolerance stack-up on transfer pin design and mfg. calibration
- Crimp-ring design for 5000 psi
- Environmental performance

Plans are in place to build approx. 20 prototypes, mocked-up from STPS parts and model shop parts. This is to allow testing of the discs and springs, as well as thicker new crimp rings from Jacques. I've spoken with Dave Brown regarding test fixtures. It looks like some plumbing is needed to prepare a servovalve tester for this program.

COST REDUCTION: Several ideas have been proposed by the various contributors to this program for redesign of various components for cost reductions. These issues will be given priority below the key design issues above.

- Disk Seat: Options include brass or aluminum screw-machine part, zinc or aluminum die casting, or a two-piece stamped design.
- Spring Arm/Movable Terminal: Proposed modification involves stamping bumps into the terminal which take the place of rivets. Precedence for this is a Vermlite switch (32 or 39 77)
- Spring Arm/Contact: Proposed is to replace riveted contact with a plated stamped bump.
- Stationary Terminal: plated vs inlaid contact

TI-NHTSA 000329



HIGHLIGHTS
Stephen B. Oeller
Week Ending 12/09/88

FORD MY 92 CRUISE CONTROL PRESSURE SWITCH

OVERVIEW: Placed foremost on the priority list is the construction of prototypes for testing of the disc and spring. Production-intent design issues are being given second priority. Joe Schuck spoke with Ford this week, and provides the following information:

- This is a MY92 (not MY91) program
- Due to schedule slippage at Ford, the 200 devices may be delivered in February rather than January. Our goal will remain January, but the extra time may be useful to horse the disc or spring.
- The CCPS will carry power to a clutch which links an actuator to the throttle. Switch opening on pressure rise will cause the clutch to disengage and return throttle control to the driver. The electrical specifications of the clutch are:

Voltage:	12.0 +/- 4.0 VDC
Coil Resistance:	30 ohm +/- 5% at room temp. (INDUCTIVE load)
Temperature:	-40 F to +175 F

PROTOTYPE BUILD: Ten proto's made from modified 57PS parts are complete, and ready to begin cycling (500K, 0 to 1450 psi @ 2 Hz, temp. TBD). A spacer on the 57PS line will be employed initially. An isolated, brake-fluid compatible manifold will be constructed for one of our servovalve masters by Tom HH/Don Ekberg on a time-available basis.

CUSTOMER SAMPLE BUILD: Basler has supplied first-article stationary terminals off prototype tooling for our approval. They were found to be acceptable, and our order for 1K will be completed. Basler promises first-article movable terminals next week. Carlo and I plan to visit Dennis Villard next Monday to discuss plating the stationary terminals, since silver-plated material was too time-consuming to obtain.

We are pursuing two avenues for the transfer pin: Duco will ship us green material that we will cut to length and return to Duco for firing; and Valley Design can cut fired pins (.125 dia X .312 long) to our length of about .225. Exact length TBD.

The other major issue for customer sample build is the crimp ring. We are working with R. W. Jacques to get thicker material for burst-test evaluation.

DESIGN ISSUES:

- Fatigue life and performance of the spring arm
- Disc design
- Contact design for new customer specs, inductive load
- Impact of tolerance stack-up on transfer pin design and mfg. calibration
- Crimp-ring design for 5000 psi
- Environmental performance

TI-NHTSA 000930



HIGHLIGHTS
Stephen B. Offler
Week Ending 12/16/88

FORD MY 92 CRUISE CONTROL PRESSURE SWITCH

OVERVIEW: Prototype devices, knuged from modified 57PS parts and production-representative CCPS parts, were built, characterized, and placed on cycle test. The test was conducted on the 57 PS line, 0-1450 psi, 4 Hz, 500,000 cycles. The test was aborted at 52,818 cycles because 4 of the 10 were found to be locking. Crimp rings (.040" 3000 psi base) were found to be failing in the area of the severely formed 90 degree bend. Disassembly showed almost all discs had radial cracks at the edges, always transverse to the strip-roll direction.

PROTOTYPE BUILD: Plans are being put in place to improve the crimp ring design. R. W. Jacques will spin-form 10 prototype crimp rings of .050" material, paying particular attention to minimize thinning at the bend. He will also spin-roll the assembly together, to save the time and effort needed to build crimp tools. These devices will be evaluated by burst-testing. The next step is for Jacques to build a drawing tool for the .050" material since drawing retains more material at the bend. We will build a crimp tool in parallel. The drawn rings will be sized for the production parts, while the initial 10 are sized for the 57PS knuges.

Plans are also being formulated to improve the disc design. Per input from Carl Sanford, the differential on the first discs was much too large (190 act/120 rel). Dave Brown is looking into the availability of the press equipment needed to form new discs. These will be built towards a goal of around 155 +/- 10 actuation and a differential of 20 +/- 5. Insipient creep should be acceptable for this application.

The next prototypes we plan to cycle will be built from production-intent CCPS parts after the holidays. This is due to the lead time necessary to improve the design.

CUSTOMER SAMPLE BUILD: Carlo de la Mata and I met with Denis Villard this week to discuss plating the stationary terminal. This is for prototype customer samples only, since the specified silver-inlaid material was temporarily unavailable. The most expedient route for plating just the contact area (not the whole terminal) is for us to mask the unplated areas with "plater's tape". Jeff DiDomenico has developed a method to quickly mask a quantity of 500 terminals.

E. F. Bessler is presently working on the above stationary terminal, the movable terminal, and the two-part stamping designed to replace the disc seat.

DESIGN ISSUES:

- Crimp-ring design for 5000 psi (w/ safety factor)
- Disc design
- Fatigue life and performance of the spring arm
- Environmental performance
- Contact design for new customer specs, inductive load
- Impact of tolerance stack-up on transfer pin design and rnf. calibration

TI-NHTSA 000331

FIRST ARTICLE REPORT

NO 11775

PART Ex 3423 - 12	MATERIAL 166D Z. Black	PIECES 12	SHEET 1
REASON FOR INSPECTION Hot Job -			NO PCS. SHOT 1
SUBMITTED FOR INSPECTION BY Herb Jacinto		DATE 12/21/88	TIME 10:00 AM

FIRST ARTICLE APPROVED This is your authority to proceed

FIRST ARTICLE REJECTED Correct defects & resubmit article

DISCREPANCY		INSPECTED BY	DATE
		<i>W. H. H.</i>	12-22-88
SPECIFIED	ACTUAL	REASON	
1. 912-930 G.D.	9195	.919 correct gate end	
2. 912-930	9195	.823 opposite gate end	
3. NOTE 6	NONE	is this required (MAT. CERTS.)	
4.			
5.			

RECOMMENDED DISPOSITION/CORRECTIVE ACTION

• Tool built in 2 1/2 weeks - Need 1st piece Rush
 • print attached
 - is characteristic sheet for this part number

Refer To Eng

Refer to Norm Roy

TI-NHTSA 000332

DATE 12/22/88	PRO ENG S.K. White	DATE 12/22/88	NO ENG S. K. White	DATE
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EXPERIMENTAL ENGINEERING ORDER

NON-SCHEDULED PRIMARY OPERATIONS

Nº 23015

NON - STANDARD OPERATIONS ON PURCHASED PARTS

ADDED OPERATIONS ON PRIMARY PARTS ISSUED TO ASSEMBLY

1000 SERIES PARTS

NON - SCHEDULED SMALL ORDERS

PART NUMBER FX3423-10 Rev 2 PART NAME BASE
 PRODUCT CODE 0167 PC 093 DATE REQUIRED 12-15-88 QUANTITY REQ. 140
 INSPECTION REQ'D SUPPLIER APC MEXICO
 AVAILABILITY OF TOOLING _____
 EX. NO. _____ SHOP ORDER _____

ROUTING: [] - [] - [] - [] - [] - [] - [] - [] - [] - []
 DATE COMP. _____

SPECIAL INSTRUCTIONS

COST INT TO EXCEED \$500.00
NO CHARGE AFTER 1/1/89
Mold 1000 Sample bases per print #.
EX 3423-10, 2nd Issue.
Contact Andy McKenna x1164 or Steve Offiler, X1382,
When Complete.

FLAWING PRESS NO. _____
 FORM NO TOOLS _____
 FORMS PROCEDURE _____
 OFF TEMPS _____
 UNUSUAL JOB? _____

DISC SPECIFICATION _____ ACT. HOURS WORKED _____
 QUANTITY REQUIRED _____ CONTACT NUMBER _____
 MATERIAL AND THICKNESS _____ DISC BLANK NO. _____
 TEMPERATURE SET _____ DISC AND CONTACT ASS'Y. _____
 HEAT TREAT _____ FINISHED DISC NUMBER _____

REMARKS
 TEMPERATURE SETS EASILY YES _____ NO _____
 DISCS HOLD THEIR SET TEMPERATURE AFTER CYC YES _____ NO _____
 AUTHORIZED BY [Signature] DATE 11/20/88

OPERATIONS: ANTI-STATIC & ESD CONTROL
 SAFETY: NO OIL, NO FLAME, NO TOXIC MATERIALS

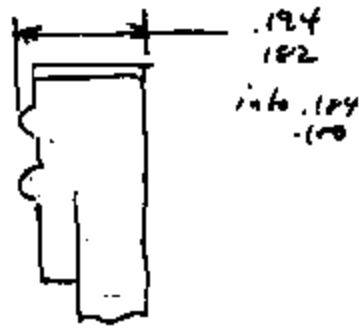
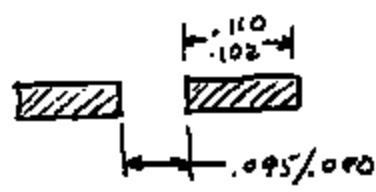
TI-NHTSA 000333

Dang Stroff
10/3/88

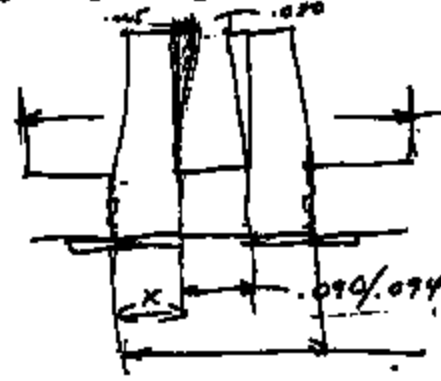
BASE DESIGN EX3423-10

ENR. DWG BLADE SPACING .095/.090
BLADE WIDTH .110/.102

.048/.040 off E



ASSUME .005 BLADE CANT MAX



SLOTS .460 MAX
.458 MIN

$.094 + 2x = .460 \text{ MIN} \rightarrow .173 \text{ MAX}$

NO BUMPS SLOT WIDTH = .183/.179 ±.002

TURN WIDTH = .178/.172 ±.002

MIN SPACING = .090 - 2x.005 = .080

MAX SPACING = .094 + .183x2 = .170x2 = .116

WITH BUMPS SLOT WIDTH = .185/.179

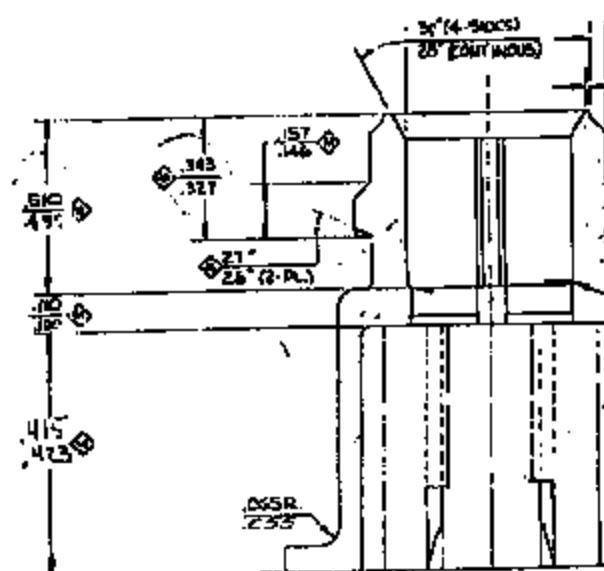
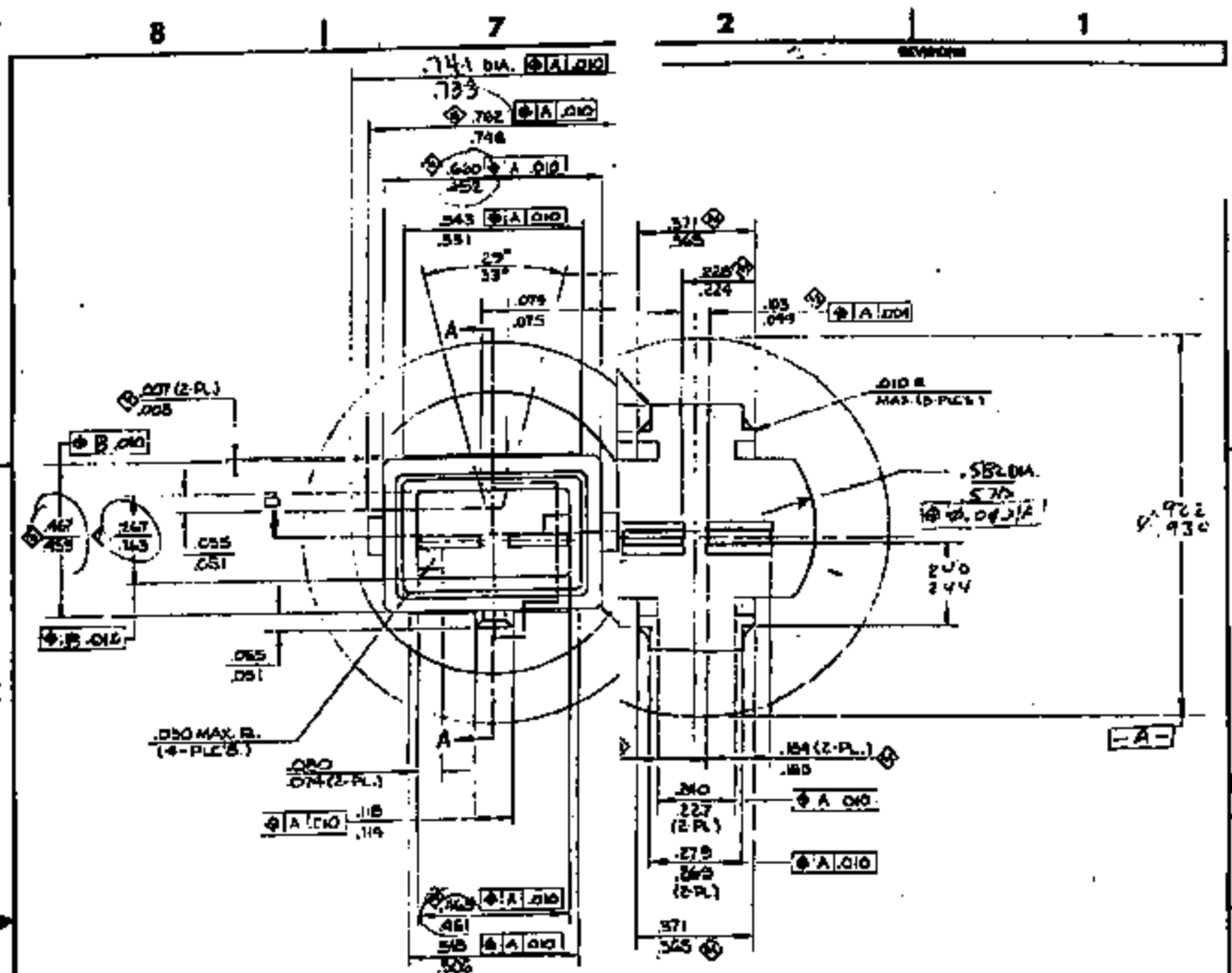
TURN WIDTH = .193/.181

MIN SPACING = .090 - 2x.005 = .080

MAX SPACING = .094 + .183x2 = .171x2 = .098

MAX interference .179 - .173 = .004

43-102 100 BUSHES



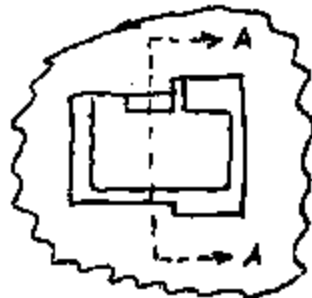
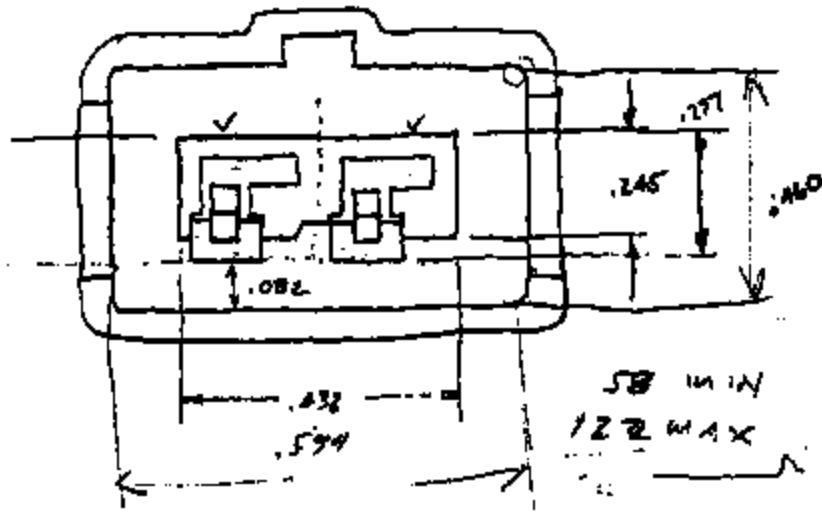
FINISH UNLESS OTHERWISE SPECIFIED.
 DIMS ARE TOTAL OR DIA. UNLESS OTHERWISE SPECIFIED.
 EDGED .007 MAX AND LOCATION TO BE APPROVED BY TI ENG..
 ALLOWED.
 TO BE STORED IN SEALED PLASTIC BAGS.
 MARKED WITH EACH PARTMENT.

CONFIDENTIAL

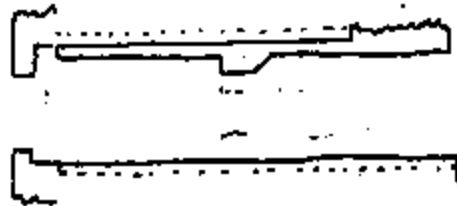
TIC POLYESTER, GARDITE - 1862 E. ORION		BLACK
AL		COLOR
TEXAS INSTRUMENTS DALLAS, TEXAS		EATON CINCINNATI, OHIO
STROTT 7/2/76	TYPE	BASE TI-NHTSA 000335
	CODE IDENT #	82647 EX3423-10
	SCALE (1:1)	SHEET

SECTION B-B

CLASSIFICATION
AND CONTROL
STATEMENTS
20-25X
20-25X
20-25X
20-25X



BOTTOM VIEW
OF TERMINAL SLOT



TI-NHTSA 000338

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HIGHLIGHTS
Stephen B. Offler
Week Ending 12/23/88

FORD MY 92 CRUISE CONTROL PRESSURE SWITCH

OVERVIEW: Efforts are presently being spent to harness the design of the two peeing components: the disc and the crimp ring.

PROTOTYPE BUILD: Dave Brown has worked through several disc iterations to come up with .015" discs around 150/110 psi. This smaller differential, 40 psi vs. the original 70 psi will reduce the internal stresses caused by energy storage. These stresses are blamed for the disc failures observed in the first proto build. Dave has packaged the discs with SEPS parts to allow immediate cycle testing. However, the latest word on cycling is that the weld on the SEPS hexport/crimp ring has fractured after only 10K cycles. Dave is looking into use of a clamping fixture to eliminate the need for a reliable crimp.

R. W. Jacques is presently working on our next-iteration crimp rings, .050" material. He reports that these will not be ready today. They will be ready for assembly and burst test when we return from the holidays. He is also working on a drawing tool for the thicker material, which should be ready the week of Jan. 9.

Jeff DiDonatello has developed a method of sectioning the crimp rings to measure the material thinning at the corner. We have found an average thickness of .026" on the original .040" span rings; .030" on the drawn/span rings; .039" on the opposite end (our crimp); and a low of .022" on the devices that failed after 50K cycles. This method will be employed to evaluate the next iterations from Jacques.

CUSTOMER SAMPLE BUILD: We have masked and silver-plated about 350 of Basler's proto. CCPS stationary terminal. The plating beaded into the masked area a little bit, but overall the parts look quite acceptable.

We have received 1000 CCPS bases from AFCC Molding, 1000 hexports and disc seats from Screw Machines. Carlo will submit them for FAI.

DESIGN ISSUES: (in rough order of priority)

- Crimp ring design for 5000 psi
- Disc design
- Fatigue life and performance of the spring arm
- Environmental performance
- Contact design for new customer specs, inductive load
- Impact of tolerance stack-up on transfer pin design and rfyg. calibration
- Cost reduction issues, including disc seat design and rivet elimination

TI-NHTSA 000339

HIGHLIGHTS
Stephen B. Offler
Week Ending 01/06/89



FORD MY 92 CRUISE CONTROL PRESSURE SWITCH EX 3423

OVERVIEW: Efforts are presently being spent to iterate the design of the two pacing components, the disc and the crimp ring, and to construct spring arms.

DISCS: Dave Brown's efforts continue. He has come up with three clamping fixtures to hold the discs for cycle testing on the 52PS line. The previous iteration was found to have lost all audible snap after 50K cycles. A fixture was created to allow X-Y recorder evaluation, and these discs were found to have significantly reduced actuation and release characteristics.

Dave's present iteration is an inchoicent-snap disc. I am looking at use of the new HP 7090A X-Y recorder which is presently available, to address the inchoicent-snap testing needs.

CRIMP RINGS: R. W. Jacques has three tasks for us: creation of spun .050" crimp rings of the kluge 57PS/CCPS dimension for burst-test evaluation; creation of a drawing tool for .050" rings of production CCPS dimension; and actually building the new rings. He has finished the first (spun) crimp rings, and will help us assemble the burst test parts next Tuesday. (Note that we have no crimp tool for these, hence Jacques will spin them together for us). I estimate, based on his present effort level, that we will have a quantity of production-representative parts by 1/18/89.

Jeff DiDomenico has sectioned a sample of Jacques' spun .050" parts, to compare with previous .040" parts. We found the average material thickness at the bend to be about .040", comparing favorably with the .030" at the bend on the .040" crimp rings. Burst testing will serve to confirm and quantify the strength improvement.

SPRINGS: I am looking into Doug's stress calculations to determine what (if any) heat treat, or mill-hardened material, will be needed to meet our fatigue requirement. Ed McPherson reports that the Model Shop workload is very heavy, with Saturdays and second shift at full-bore. An outside supplier may be needed to produce these parts.

FIXTURES/TESTING: I discovered that, by co-incidence, the crimp tool for the kluge 57PS/CCPS with .040" crimp rings will be a perfect fit for the production CCPS, which is smaller but uses a correspondingly thicker crimp ring. This tool does not have the recommended radius in the base, but neither do any production tools. We can create a tool with a radius on a low-priority basis. Also, the model shop is presently working on an "anvil", used to support the base while staking the terminals.

Due to an urgent Q.C. need, our plans for a cyclor are being re-thought. I've spoken with Dale Sogge regarding his CPS cyclor, and he will let us use it provided it remains adaptable for future CPS use. I plan to have Don Ekberg and Kevin Kennedy work out the details together.

HIGHLIGHTS
Stephen B. Offler
Week Ending 01/13/89



FORD MY 92 CRUISE CONTROL PRESSURE SWITCH (EX3423)

OVERVIEW: Efforts are presently being spent to iterate the design of the three pacing components, the disc, crimp ring, and spring arm.

I spoke with Joe Schuck, who reports that the magnetic clutches we've requested are not available yet. We will obtain some when they do become available. We do not know the inductance of the clutch coil, but found out that a diode is used in the circuit to kill the inductive kick.

NO.

An important issue was raised regarding the connector. It seems that on some calines, the CCPS will be physically located close to a 57PS. The connector design is presently the same on both switches, which will obviously cause assembly-line problems. Ford has suggested use of a 14BT-type connector for production parts. No problem using the 57PS connector on our prototypes.

DISCS: The third iteration of discs (quantity 3) had two which exhibited some snap, and one which did not. The two snap discs were found to have radial cracks (at the burr) after 86K cycles, while the incipient-type was not cracked. Although the sample size is too small to draw conclusions, this supports the concept of moving to an incipient-snap, low-energy-storage design. Dave is pressing new discs, shooting for the incipient-snap characteristic. When he gets three good ones, we will put them on cycle test, using the 52PS line equipment as before. Incipient discs present testing problems during development, since they must be characterized on an X-Y recorder which is time-consuming and subject to equipment availability.

CRIMP RINGS: R.W. Jacques has finished the spun .050" crimp rings. He also assembled three prototypes for us by spinning (note: no crimp tool of the proto size). We burst-test these devices and found an initial yield in the neighborhood of 2000-3000 psi, and all devices actually failed around 3800 psi. The failure mode is still at the 90 degree corner, where material is thinnest. Jacques is in the process of building a drawing tool to make drawn .050" crimp rings, which should be much thicker at the corner. We should have drawn crimp rings by 1/20/89.

SPRINGS: After reviewing Doug's previous stress calculations and coming up to speed on BeCu design principles, I am satisfied that the material specified is a good first choice. This is full-hard, mill-hardened BeCu strip .010" thick (C17200HM, equivalent to Brush-Wellman 190HM). Since the BeCu in stock in the model shop typically carries no hardness information, it is necessary to obtain this directly from B/W. Emil Brodeur in Purchasing is expediting the arrival of sample quantities of 190HM strip in .006", .008", .010", and .012" thickness. The material is expected by 1/17/89, and the model shop will build 25 parts by 1/24/89.

TI-NHTSA 000341

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HIGHLIGHTS
Stephen B. Offler
Week Ending 01/20/89

FORD MY 92 CRUISE CONTROL PRESSURE SWITCH

OVERVIEW: Efforts are presently being spent to finalize the design of the three pricing components, the disc, the crimp ring, and the spring arm. Prototype parts which will allow our first true sample build are due mid-next week. Jack Miller has returned to school to chase an MBA and Jim Wood is taking over Marketing responsibility. Ford has requested 4-6 non-functional physical samples, which we will provide by 01/27/89.

Per discussion at the Program Review, customer acceptance of the spec Doug Stott generated is unclear. Additionally, Jim and I have not been introduced to the engineers at Ford yet. A trip was suggested. (A good time might be to hand-deliver the first batch of samples). Two other customer issues raised were: the liability aspect of this program; and the possible application of QPD as a tool to help firm up the customer spec's.

DISCS: Efforts continue, with Dave Brown giving this program his first priority, taking direction from Carl. I continue to try to learn the principles of disc design as development unfolds. We have begun a log book in Life Test, which will basically follow the systems already in use on other programs.

CRIMP RINGS: Bob Jacques reports that his first attempt to draw the parts was unsuccessful. He needs to do the draw in two separate operations, which means lead time to construct the second tool. We expect the first parts approx. 01/24.

SPRINGS: Material from Brush-Wellman, expedited by Emil Brodeur in Purchasing, arrived on schedule this week. The metal shop is working on 25 prototype springs for the first build. Expect parts mid-next week.

FIXTURES/TESTING: Don Ekberg has received some of the parts needed to construct an isolated cyclor system for this program. Since QC is presently using our cyclor anyway, completion of the system will be drawn out several weeks. I plan to use cyclor equipment on the 57PS line (with careful monitoring) for the near-term.

I am defining necessary stress-testing, based on the present spec., to validate our design before the first customer samples will be shipped. If disc cracking is still a problem at this time, we can periodically replace them while accumulating cycles to test the other questionable components.

CONNECTOR: Joe Schuck reports that Ford is interested in a connector very similar in design to the 14BT. He has sent us a Ford thermistor using this. It has round pins, which are more expensive than our flat terminals, per Bob Hitt. We would rather propose re-orienting our present terminals by 90° (which also allows easier automation), addition of different locking tabs, use of a different color base, or any combination amenable to Ford.

TI-NHTSA 000342

PRESSURE SWITCH DATA

Form 21605

TEST NO. 03-04-08

DEVICE CCPS	DATE REQUESTED 1-23-89	REQUESTED BY SBO	REQUESTED COMPL. DATE
PERFORMED BY	DATE STARTED 1-23-89	DATE COMPLETED 1-24-89	APPROVED BY

PROJECT TITLE: **CCPS**

CUSTOMER:

PURPOSE OF TEST: *To determine burst pressure of .050" thick crimp rings which have been drawn and other which have been drawn and had corner spots*

PROCEDURE: *Assemble and crimp 3 devices (4 drawn rings, 4 1/2 spun corners) and burst them*

Device #	Crimping	Model #	PSI	Burst PSI
01-01-01	Hand	1750-2150		4500
01-01-02		2700-2150		4500
12-01-07		400-2150		4500
01-02-01	Machine	300-2150		4250
02-01-01		1200-2150		4300
01-01-07		1000-2150		4000
01-01-08		1500-2150		4000
				actual burst

TI-NHTSA 000343

SERIES 2-15- (14-15-16)

1-24-89

TOTAL CYCLES	Disc	
10K ✓	OK	VIS. 7/2
40K ✓	OK	FF 2/10
100K ✓	OK	VIS. 2/1
250K ✓	OK	FF 2/10
500 ✓	OK	VISUAL

AFTER EACH CYCLE CHECK, 73B45-2 GASKETS
AND 74133-1 KAPTON SEAL WERE REPLACED.

TI-NHTSA 000344

HIGHLIGHTS
Stephen B. Offler
Week Ending 01/26/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: Dave Brown has arrived upon an incoherent-map disc design which has lasted 500,000 cycles. The model shop has completed 25 prototype BeCu spring arms. R.W. Jacques delivered the first drawn .050" crimp rings, which burst at 3800 psi. Five non-functional prototypes which Ford requested were shipped to Farmington Hills.

Joe Schuck reports that the cruise control engineers at Ford Light Truck are raising a concern over system volume change with disc deflection. There are a number of other customer-related issues that need attention, including: spec. agreement; understanding of Ford's need for 200 prototypes and what they plan to do with them; and the issue of the connector.

DISCS: The parts that lasted 500,000 cycles received special treatment: they had the burrs honed off, and the overtravel set to 0.003". Dave will make a small quantity of these to allow prototype build.

CRIMP RINGS: R.W. Jacques' drawn crimp rings performed marginally better than previous upon attempts. Failure mode is always at the 90° bend. In order to test the strength of our crimped end, we are welding crimp rings to hexports. This should force failure at the crimp. An initial attempt at this using tack-welds actually broke the weld and bent the hexport (at 5800 psi burst) with the crimp still intact. This has led to development of an idea for tooling that allows us to begin with a simple tube and crimp BOTH ends. This idea will be tested over the next couple weeks.

SPRINGS: Carlo de la Mata is taking care of riveting the spring arms to the terminals, and adding the appropriate contact rivet. The upcoming prototype build and test will be the first opportunity to test the spring arm design done by Doug Stott. For iterations, we have various thicknesses of BeCu (HMA condition), and the model shop can turn out parts fairly quickly.

PICTURES/TESTING: After looking at our version of the customer spec., it looks like the following tests should be carried out on prototypes before samples are shipped: calibration, proof, impulse, burst, humidity, salt spray, and vibration. Tests deleted for expediency are: voltage drop, current leakage, terminal strength, vacuum, temperature cycle, and creep. I will coordinate with the Environmental Labs as needed.

TI-NHTSA 000345

PRESSURE SWITCH DATA

FORM 21605

TEST NO. 04-01-10

DEVICE <i>CCPS</i>	DATE REQUESTED <i>1/27/89</i>	REQUESTED BY <i>SBO</i>	RECEIVED COMPL. DATE
INFORMED BY <i>T. P. Dean</i>	DATE STARTED <i>1/27/89</i>	DATE COMPLETED	APPROVED BY

PROJECT TITLE: *Cruise Control Pressure switch*

CUSTOMER:

PURPOSE OF TEST: *To cycle test cruise rings, discs life, ect...*

PROCEDURE: *Assemble 10 balls. Gauge spring force and pin length. Reengage pins with three disk rot.*

One device had a bump in the Kaptan apparently caused by a foreign material on the disc but did not tear a hole. All other parts seem intact upon visual inspection.

u leads #007, others @ +.003

Device #	Initial Spr. Force	Pin Length	Pin Length	Actual Pin Len	Disc No.	Device #	After 500K Rel	After 500K Rel
04-01-01	349	.219	.217	.214	1			
04-01-02	430	.217	.205	.212	2	04-01-01	136	127
04-01-03	362	.217	.210	.212	3	04-01-02	126	132
04-01-04	718	.215	.210	.212	4	04-01-03	143	126
04-01-05	711	.219	.209	.211	5	04-01-04	136	129
04-01-06	350	.215	.210	.213	6	04-01-05	147	132
04-01-07	377	.215	.211	.210	7	04-01-06	141	129
04-01-08	425	.215	.209	.212	8	04-01-07	159	127
04-01-09	372	.219	.216	.219	9	04-01-08	145	131
04-01-10	312	.214	.205	.215	10	04-01-09	137	122
	355 avg					04-01-10	133	125
		.215						
		.003						
Device #	Initial Rel/Rel	After 10K Rel	After 20K Rel	After 40K Rel	After 80K Rel	After 160K Rel	After 320K Rel	After 640K Rel
04-01-01	147/134	155	142	145	132	147	137	127
04-01-02	137/133	126	137	139	129	142	135	129
04-01-03	147/141	146	128	145	133	142	135	131
04-01-04	141/134	139	126	138	137	137	132	129
04-01-05	142/138	140	127	136	122	138	139	132
04-01-06	142/135	144	139	140	131	142	125	131
04-01-07	142/141	148	139	143	139	143	125	127
04-01-08	141/132	140	143	149	139	150	141	132
04-01-09	139/132	143	137	139	138	139	133	128
04-01-10	138/132	138	131	137	125	135	128	124

PRESSURE SWITCH DATA

FORM 21605

TEST NO. 05-04-04

DEVICE CLPS	DATE REQUESTED 1/17/89	REQUESTED BY SBO	REQUESTED COMPL. DATE
PERFORMED BY J. O. Don	DATE STARTED 1/17/89	DATE COMPLETED 2/13/89	APPROVED BY
PROJECT TITLE: Cruise Control Pressure Switch			

CUSTOMER:

PURPOSE OF TEST: To find the burst pressure of the crimped side of our crimp rias

PROCEDURE: 05-04-01 wire tack welded (Hexport to crimp ring) to try to force crimped side to fail. Instead the weld let go and the ferrule side still let go. The other were completely welded together and burst tested. 05-04-02 & 05-04-03. Burst at 500 psi but did see on the welded side. In increased pressure to over 600 psi and the weld held further but the crimp remained in tact. The ferrule wire is being fitted with spring and cured at burst pressure to be cross sectioned. Cross section reveals

Device	Burst pressure	Notes
05-04-01	500 psi	that the initial weld was due to hexport bending
05-04-02	510 psi	
05-04-03	510 psi	
05-04-04	4800 psi	

TI-NHTSA 000348

PRESSURE SWITCH DATA

Form 21605

TEST NO. 06-04-08

DEVICE CCPS	DATE REQUESTED 2/1/89	REQUESTED BY SPO	REQUESTED COMPL. DATE
PERFORMED BY J. Dillon	DATE STARTED 2/1/89	DATE COMPLETED 2/3/89	APPROVED BY
PROJECT TITLE: Cruise Control Pressure Switch			

CUSTOMER:

PURPOSE OF TEST: *Determine burst of Jaguar's newest iteration of crimp rings .050" thick and long enough for new herpills*

PROCEDURE: *Assemble and burst. Devices will not burst. Therefore I brought each one up to a different pressure and examined afterward. Later I brought 4 units to burst.*

Device #	Pressure psi	Status	Burst psi
06-04-01	7000	1 msc	
06-04-02	6500	1 msc	
06-04-03	6000	adly tight	
06-04-04	5500	adly tight	
06-04-05	5000	adly tight	7000
06-04-06			7500
06-04-07			7900
06-04-08			7600

HIGHLIGHTS
Stephen B. Offler
Week Ending 02/03/89



FORD MY91.5 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: Cad visited Ford on CCPS this week while in Detroit. Most of our customer issues were addressed, and revealed large discrepancies between Ford's thinking and TP's. All involved parties seem to agree that a full-day working session is needed critically.

R.W. Jacques' latest crimp ring iteration bursts at 7700 psi. This completes the next design iteration, and prototype build will commence soon.

CUSTOMER: Major areas of concern that were discussed by Cad include specifications, connector, and program schedule. ~~Frank Jancal will draft a one-page spec which directly addresses the spec we created.~~ Ford continues to favor the round-pin, 14BT-type connector (expensive). This is now a MY91.5 program, meaning the development schedule will be aggressive and needs to be firmed up quickly.

DISCS/T-PINS/DISC SEATS: The disc design we plan to use for prototypes requires that overtravel be controlled to only .003". The Model Shop is presently modifying our screw-machined disc seats to accommodate this. This also tightens our pin gaging window. We will shoot for .010 - .012" contact gap, translating to .005 - .006" t-pin movement after loss of continuity. I plan to study the disc characteristic curves to arrive upon a suitable pin length. Cad also suggests that extra-long pins be run in a few of the prototype devices to place maximum deflection and stress on the spring arms, and to help assess the effects of wear. To address our prototype transfer pin needs, a family of different sizes is needed. Jeff DiDomenico is learning to run the ceramic grinding equipment (located in Life Test) to grind production .125 x .240 pins to our custom sizes. He has designed a fixture to hold the pins, which the Model Shop is building.

CRIMP RINGS: The 7700 psi parts are drawn .050", sized to maximize the load-bearing areas, and to use the thicker CCPS-specific hexport. Interestingly, the devices are still failing at the end Jacques forms, not our crimped end. We have about a dozen parts available for use in assembling our next prototypes.

The Model Shop has completed a special crimp tool which will allow use of the dual-crimp concept (we start with a tube and crimp both ends). Based on burst test results, the dual-crimp should be the strongest method available, and should withstand significantly more than 7700 psi. Jacques is presently working to draw the needed tubes.

TI-NHTSA 000350

HIGHLIGHTS
Stephen B. Offler
Week Ending 02/10/89



FORD MY91.5 CRUISE CONTROL PRESSURE SWITCH EX3421

OVERVIEW: The first true CCPS prototypes were constructed this week. (Previous proto's were made from kluged 57PS parts.) These devices are undergoing cycling on the equipment on the 57PS line, and thus far have survived about 400K of the 500K test.

CUSTOMER: Joe Schuck is in the process of setting up a meeting with key people at Ford to address the problem areas uncovered during Carl's trip last week. This will take place, tentatively, next Friday 02/17/89. I have completed a list of customer issues which need attention, three pages in length, and distributed it to Marketing, Manufacturing, and Field Sales.

One issue of particular importance is choice of connector. While Joe works with Ford to uncover possible choices, Carlo and I took a quick trip to Robert's Ford in Attleboro to see some of the designs already in production. While I had hoped to look at newly-designed '89 Thunderbirds and Taureases, the only car available was a Mustang GT. Nonetheless, we found at least two connector designs that will meet our mutual needs. I have Polaroids of these.

DISCS/T-PINS/DISC SEATS: Based on intermediate results of the cycle test, the discs are holding up well. Actuation and release pressures have changed very little thus far. These discs have been honed to eliminate burrs, and overtravel is limited to .003".

The Model Shop has completed a fixture designed by Jeff DiDomenico which allows us to grind our own custom-length transfer pins on the equipment in Life Test. Jeff has created a family of pin sizes for near-term prototype build.

K.F. Basler is taking a look at our next-generation disc seat, a stamped two-piece design to replace the expensive screw-machined part. Based on comments from Basler relating to stampability, this design is undergoing its second iteration on a low-priority basis.

CRIMP RINGS: R.W. Jacques latest iteration, 7700 psi burst, is holding up well under cycling. Previous crimp rings failed at only 50K cycles. Jacques is presently working on our next design iteration, which is called the dual-crimp design. This is basically a tube, which we crimp on both ends. I expect parts next week.

TI-NHTSA 000351

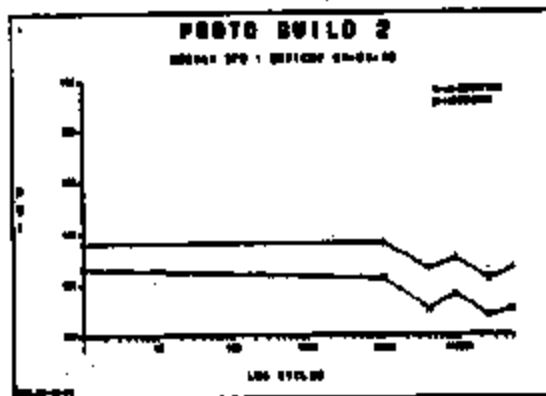
HIGHLIGHTS
Stephen B. Offler
Week Ending 02/16/89



FORD MY91.5 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: The prototype parts have successfully completed 300K cycles at room temperature under no electrical load. The graph to the right shows actuation and release over life for a typical device. None of the ten devices exhibited failure.

Plans are firm for a trip to Ford on Friday, 17 February. I am prepared to discuss all outstanding issues, including the specifications, schedule, connector, and a host of others.



PROTOTYPE DESIGN: Given the successful results of the cycle testing, we move one step closer to gearing-up for construction of customer samples. It is imperative that stress-testing be carried out first, however. Primary is to cycle at the high-temperature extreme under actual electrical load. Secondary is vibration, humidity, and salt spray. Tertiary is the balance of the testing as called out on the preliminary spec, however I do not consider these "stress" tests and may be deleted for expediency.

TESTING/FIXTURES: This program needs an isolated manifold to allow cycling in brake fluid while the pump works in standard hydraulic fluid. Don Ekberg has ordered and received hardware needed to build the isolator portion. At this time the availability of cycling equipment is unclear, given the needs of other programs as well as this one. I have asked Don to take a quick look at what we've got versus what we need, and give a recommendation.

SPRINGS: These proto's represent the first real test of the spring design. We observed an initial average force of 361g ($\sigma=44g$) and a final avg. of 345g ($\sigma=56g$). This amount of relaxation seems quite acceptable.

FORD SPEED CONTROL DEACTIVATE
PRESSURE SWITCH MILESTONES

- 89-02-17 TRIP TO FORD; ENG. DISORDERS KICKED OFF
INCL. DESIGN VAL. REQUIREMENTS, SAMPLE NEEDS,
UNK. PDR. MET W/ PASS-CAR RUBENS WALKER,
DIANA KORNIG & NESC SUV. GARY KUNGLER
- 89-03-XX DESIGN VALIDATION OF DIRECT-DISC DESIGN BASED
ON APPROVED PV FROM ES
- 89-04-XX 87PS-STYLE CONNECTOR W/ ACTUATED PLURALITY
KEY IS PROPOSED TO US BY FORD
- 89-04-28 116 CUSTOMER SAMPLES (87PS-STYLE) SHIPPED TO
TARY K. FIRST SAMPLES.
- 89-05-25 50 77-SWIRL STYLE SAMPLES SHIPPED.
- 89-06-XX FIRST INFO FROM FORD THAT THE ORIGINAL
150 PSI ACT. ASSUMPTION MAY CHANGE, AND
MAY BE DIFF. FOR CAR & TRUCK (THIS
LATER PROVES TO BE TRUE) TEST RANGES
IN SEVERAL DIFFERENT RANGES CONSTRUCTED
TO SUPPORT FORD TESTING.
- 89-06-23 FIRST MET'S W/ NICHOLAS WOOD; JOEL FLARE
ISSUE IS PROPOSED
- 89-07-XX OUR INTERNAL MECHANIZATION PEOPLE ARE
BECOMING INVOLVED - CALIBRATION OF ASSY
VS. PIN CALIBRATION IS PROPOSED AS HIGHER-QUALITY,
LOWER COST, AND MORE AUTOMATABLE
- 89-08-XX P.L.S.T. & A.I.P.L.A. ^{SAMPLES} FOR LIGHT TRUCK
- 89-11-XX FIRST WORD THAT TRUCK SPEC WILL BE
250 & 50; DESIGN DIRECTION CHANGES
PARADIGMATICALLY FROM DIRECT-DISC TO 87PS
CONNECTOR-STYLE SENSOR

CONFIDENTIAL

- 89-12-XX ES NEGOTIATIONS BEGIN; WE ADVISE FORD W/ A MARKED-UP STPS 3082 TO THEM DATES FOR DISCUSS
- 90-01-XX LIGHT TRUCK DECIDES TO USE A STPS VARIANT FOR INITIAL PRODUCTION
- " MAJOR MTS HOLD WITHIN FORD, TO ATTENDING, IN ORDER TO RECONCILE REMAINING ISSUES BETWEEN PAS CAR DRIVE, LT DRIVE, AND NISSA ENG.
- 90-02-XX PAS-CAR STPS WILL BE 125235; INTERNAL CHANGES TO OUR DRIVES TO HIT THIS RANGE ARE BEGUN
- 90-02-08 FIRST WORD OF TORCO MIC FOR LT; ISSUE RAISED IS OVERALL LENGTH (NO DIA. MENTIONED) THEY'D LIKE 1.75"
- 90-02-XX DURING ES NEGOTIATIONS, WE SUPPORT FORD IN SEVERAL WAYS BY SUGGESTING MORE COST-EFFECTIVE / MORE REALISTIC TEST PROCEDURES EX: PULSED IMPULSE TESTS, HAWKEY MIL-STD-883C
- 90-03-XX ES FINALIZED IN CONTENT; ~~WORK IS~~ WORK IS CHANGING TO KOREAN SOURCE IN A COST-EFFECTIVE MANNER FOR THE P/C 125235 STPS.
- 90-05-XX ALL FORD POINTS CONVERTED TO CONFORM TO ANSI Y14.5M-1982 & METRICATED
- 90-06-XX PAS-CAR DECIDES UPON 3012 SERIAL ALSO; FIRST SAMPLES SHIPPED
- 90-07-XX WE ARE IN CONTACT W/ SGA SCOTT KUSCH. DETAILS OF SIR SUBMISSION FOR TRUCK & CAR ARE BEING ADDRESSED.

TI-NHTSA 000354

90-08-17 FORD ADDS A FLUID-RESISTANCE TEST
REQUIREMENT TO ES @ 11 TH HOUR
(IN TERMS OF ISIR EFFORTS) WE ACCEPT IT.
ALSO, WE REDSIGN INTERNAL COMPONENTS
TO MINIMIZE INTERNAL VOLUME & REDUCE
TRAPPED AIR POTENTIAL. MR. FORD.

90-09-XX THE COST-EFFECTIVENESS OF ADOPTING A
J512 CHAMBER W/ STANDARD ± 0.02 TOLERANCE
BECOMES A MAJOR ISSUE, EVENTUALLY LEADING
TO A COMPARISONIVE PAPER STUDY FOLLOWED
BY A VALIDATION TEST AND VERBAL BLESSING
FROM THE SAE J512 COMMITTEE.

90-09-18 FORD VISITS TIA ; IGATE, RANDALL, KLINGLUE.

90-11-XX LIGHT TRUCK PRODUCTION VALIDATION (STPS)
IS COMPLETED; ISIR PACKAGE SUBMITTED

90-12-XX PASS-CAR ENG OKAYS THE MODIFIED J512
PASS-CAR PRODUCTION VALIDATION / ISIR IS
COMPLETED
WE INVENT A METHOD TO CASE THE J512
CHAMBER

91-02-XX LIGHT TRUCK OKAYS THE MODIFIED J512
TRUCK / T1J CORRESPONDENCE PERINS

T1 MECHANIZATION IS NEARLY COMPLETE. IF AUTO-
MATION TOOLING, INSTANT CALIBRATION DEVICE
IS VERY SUCCESSFUL

91-03-XX NICKEL-PLATE TEST SAMPLES, SHIPD:

WE ARE SUPPORTING T102-1'S IN THEIR MOD-
J512 VALIDATION TESTING

91-04-XX AUDIBLE NOISE ON WINDS ADOPTS FORD, ENG.
OF POSSIBLE FRAYS; WE IMMEDIATELY OBTAIN DEV-
OPMENT OF RUST DEVICE & SAMP SAMPLES.

PRESSURE SWITCH DATA

FORM 31605

TEST NO. 07-15-05

DEVICE <u>CCPS</u>	DATE REQUESTED <u>2/22/89</u>	REQUESTED BY <u>SBO</u>	REQUESTED COMPL. DATE
PERFORMED BY <u>J. L. America</u>	DATE STARTED <u>2/22/89</u>	DATE COMPLETED <u>2/27/89</u>	APPROVED BY
PROJECT TITLE: <u>Cruise Control Pressure Switch</u>			

CUSTOMER: Ford

PURPOSE OF TEST: To test the difference between using kaptan spacers to limit disc over travel as opposed to machining down disc seat

PROCEDURE: Assemble 5 devices as per sketch 3 will have kaptan spacers, 2 will have disc seats. Cycle 500K continuous. Recheck all parameters compare.

Device #	Disc #	Disc #	Force	P.A. length TACO	P.A. length 901				
			500	"	"				
07-15-01	Spacer	11	357	.216"	.219"				
07-15-02	Spacer	12	305	.219"	.217"				Mistake in Assembly
07-15-03	Spacer	13	495	.211"	.219"				
07-15-04	Machined	14	250	.209"	.211"				
07-15-05	Machined	15	300	.205"	.211"				

Calibrated

Device #	Initial Act	901	AFTER 500K Act	901
07-15-01	140	131	135	119
07-15-02	186	183	177	172
07-15-03	147	139	142	124
07-15-04	145	142	120	123
07-15-05	135	136	132	116

AFTER K Cycling

Device #	Initial TACO	Initial 901	Force						
07-15-01	.216	.219	345						
07-15-02	X X X X	X X X X	X X	X X X X X X X X	X X X X X X X X	X X X X X X X X	X X X X X X X X	X X X X X X X X	X X X X X X X X
07-15-03	.215	.219	455						
07-15-04	.109	.212	285						
07-15-05	.205	.211	297						

HIGHLIGHTS

Stephen B. Offiler
Week Ending 02/24/89

FORD MY92 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: Several issues were covered during last Friday's trip to Dearborn, including schedule, Design Validation testing, connector, specification, etc. See trip report for details. We are gearing up for proto build, test, and sample build to intercept 03/31. Pacing items are crimp ring and spring arm. Designs for both have been tested and confirmed - construction of 350 crimp rings and 1000 springs arms from soft tooling is progressing on a tightly compressed schedule.

SPRINGS ARMS: Prototype springs hand-made in the model shop performed well in cycling (at room temp.) This design will be used for the upcoming build. We are working with Mfg. Eng. to get a BeCu spring supplier who can turn out prototypes by 03/07. Mfg. Eng. prefers Peck Spring, Instrument Specialties, and a third company. I spoke to Dan Pimentel, since this spring is somewhat similar to a choke spring. He mentioned K.F. Bassler and Metropolitan Machine locally. I spoke with Bassler personally, and they seem to have resources immediately available to jump on this. Final decision is to be reached on Monday morning, 02/27.

→ WEISS - AU

CRIMP RINGS: I have spoken with Bob Jacques, and he will be able to provide 50 crimp rings, drawn and lathe-finished, by 03/03. He will then build blanking tooling to more efficiently produce another 150 by 03/17 and 150 by 03/31. We are limiting the size of the crimp ring order because they are relatively expensive, due to the low-volume nature of Jacques' business.

DISCS: Dave Brown will press a few hundred discs using the same parameters as those discs that passed cycling. Jeff DiDomenico will hone the burrs off of these as was done on the prior proto build.

FIXTURES/TESTING: Don Ekberg is handling construction of a dedicated cyclor for this program on a time-available basis. Most parts for the brake-fluid isolated system are ordered or in stock. A Blue-M oven which requires some maintenance is available in Life Test. Jeff DiDomenico will handle this. The cyclor is needed by 03/20/89 to perform the 500K Impulse test (70 hours duration) and is also needed for thermal cycling if a refrigerated chamber is available.

I am working to develop a reasonable test plan which will adequately stress-test our customer sample design. Ford wants basically the entire Production Validation (PV) test procedure done. This is too large in scope to test prototypes still undergoing design iterations, and takes much too long.

LANC (in file) →

Step Off

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TI-NHTSA 000357



HIGHLIGHTS
Stephen B. Offler
Week Ending 03/03/89

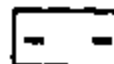


FORD MY92 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: We are presently working to build and test parts that will become customer samples. A "Design Validation" test plan has been worked out based on Ford's "Production Validation" spec. and our available time and resources. This will be communicated to Ford. Due to the lead time needed to stamp spring arms, our sample delivery schedule was forced to stretch by one week. Sample delivery date of 04/07/89 was approved by Gary Klingler.

SPRING ARM: Mfg. Eng. has decided to use Peck Spring for the required prototypes. They have a good track record, their volume quote is competitive, and they agreed to deliver soft-tooled parts ASAP. To meet a sample ship date of 03/31, we needed a minimum of 50 springs by 03/07. Peck is "shooting" for this date but committed to 03/14. This is one of the reasons for the one-week slip in our schedule.

CONNECTOR: Joe Schuck has visited Ron Proates, a connector guru at Ford. They've decided that a 57PS-type connector, with changes to tab locations and color, will suffice. This will require a new mating connector. Ford plans to meet with their supplier, United Technologies (UTC) to discuss this.



PRESENT



PROPOSED

Per inputs from Mfg. Eng., it will be very beneficial from an automation standpoint if we can design our terminals as shown "Proposed." We'd like to relay this at the meeting between Ford and UTC.

SHORT CIRCUIT: Gary Klingler raised a concern about the possible damage to our device if a short-circuit were to take place; whereby our device would pass a fairly large current (magnitude TBD). Concerns focus on when/if our contacts would weld; and the possibility of brake fluid leakage if our device were to melt under heavy current. Joe has requested us to take a look at this and draft a one-page abbreviated FMEA.

CRIMP RINGS: R.W. Jacques delivered the first 50 crimp rings one day ahead of schedule. They are now at plating. Jacques will now build a piercing tool to streamline the build of 300 additional crimp rings. After DV testing, we will begin to pursue high-volume houses for this part.

TESTING/FIXTURES: Joe reports that our clutches are on the way to Attleboro, expected early next week. These will be used in testing as representative of the actual electrical load.

Plans seem to be in order for the construction of a dedicated cyclor. Parts are presently being obtained. The hydraulic unit (expedited) is expected around 03/15, another reason for the one-week slip in schedule.

The one outstanding issue is the temperature cycle test. I spoke with Doug Strout, who did PV for the 57PS. He told me dedicated equipment was built and has since been dismantled. He also told me that the 57PS originally failed this test to highlight its significance. I have a couple of options: negotiate with other programs for use of a refrigerated chamber; or talk to the APT people since they already have equipment which performs a similar function.

HIGHLIGHTS
Stephen B. Offler
Week Ending 03/10/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: Component parts, Design Validation test plans, and test equipment is coming together to intercept an 04/07 ship date of 105 customer samples, if all goes well. A written report of DV testing will accompany the samples.

PARTS: We've received 50 crimp rings from Plating. We await spring arms from Peck Spring, presently being expedited, expected 03/14.

Conversation with Bob Bishop and Doug Strott reveals that leakage of the gasket at low temps (57PS experience) and/or at high temps (APT experience) could be a significant failure mode of the planned DV test. Bob has given me the names of the two suppliers he considers having "the best" EPDM gasket material available, Acushnet and Minnesota Rubber. As a back-up to our Parker O-rings, I plan to pursue samples from these vendors.

DV TEST PLANS: Ford would like to see the entire Production Validation procedure followed, but an abbreviated version is needed to meet the schedule. I am proposing that we follow the 57PS PV Flow Chart with the following modifications: deletion of the Crimp Test and Terminal Strength tests, reduced sample size, and a change to the Thermal Cycling test necessitated by the available equipment. A detailed schedule has been worked out, which is quite compressed to meet 04/07.

TEST EQUIPMENT: The clutches promised by Ford have arrived. They will be used during various tests to represent the actual electrical load. Jeff DiDomenico is building this equipment now. We have a good supply of mating connectors from Pete Corriveau.

We are expecting the hydraulic pump for the Impulse Tester soon. Don Elberg is handling construction of this equipment. We have an oven available (needs minor work) to dedicate to this tester, a 19" rack-mount cabinet was retrieved from the Mansfield Warehouse, and most other items are readily available. The schedule requires that it be ready by 03/22 at the very latest. Our fall-back solution would be to conduct the Impulse test on the 57PS line, but this means compromise of test procedures which reduces the severity of the test.

The Thermal Cycling test will be performed on existing APT equipment. Due to the design of its controller, we must define a temperature profile (ramp rates and dwell times) that will attempt to mimic the Ford spec. Also, we must switch our devices continuously, which will be somewhat more severe than the spec, which only requires switching when temperature extremes are reached.

S.B. Offler

TI-NHTSA 000359

HIGHLIGHTS
Stephen B. Offler
Week Ending 03/17/89



FORD MV92 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: We continue to prepare to build parts for the Design Validation testing and subsequent customer samples. A tight schedule has been laid out which allows delivery of samples 04/07/89, if all goes well.

For the Program Review, we plan to hold a full-blown Design Review as soon as possible after completion of DV testing. Tentative date looks like 04/21. Also, we plan to give long-term scheduling some attention, specifically to apply hard-tooling lead time estimates from Mfg. Eng.

PARTS: We expect the first 30 soft-rolled springs to arrive from Peck Spring today, 3 days behind schedule. The very first assembly operations are attaching contact rivet and riveting spring to movable terminal, operations which Carlo de la Mata co-ordinates. I'll need quick response in order to prevent any further slip in the schedule.

We presently have about 120 discs, and need about 230 more short-term. Dave Brown did the development work on these, and I'll need to utilize his expertise. I understand he reports to Dale Sogge temporarily, and I'll co-ordinate this with them.

TEST PLANS/TEST EQUIPMENT: As pointed out in the Prog. Rev. the CCPS sees far fewer current-break cycles than it sees mechanical cycles. Gary Kilgler and I arrived at 12,000 cycles as being realistic and conservative. During the Impulse Test portion of the Design Validation testing we will get 25,000 electrical cycles on the switches, distributed throughout the 500,000 mechanical cycles.

To get more time for the build of our dedicated cyclor, I've shuffled the schedule so this test is performed last. Absolute drop-dead date for cyclor completion is 03/29. It looks like I'll need to have Don Elberg do this on overtime. This shuffle also means I'll need to borrow the APT (Bendix) thermal cycling equipment sooner, which I'll co-ordinate thru Bob Bishop.

Jeff D. has finished the test equipment which provides actual clutch load to 12 devices for use in DV testing, and he has also finished a conductivity checker using the actual clutch as well.

Miscellaneous testing planned to fill any hull in the DV testing includes a transient test to determine the magnitude of the voltage spikes out of the clutch coil; and an overcurrent test to determine the effects of a possible short-circuit conducted through our device.

TI-NHTSA 000360

PRECISION CONTROLS DESIGN ENGINEERING
DESIGN REVIEW - 18 MAY 1989
MY92 CRUISE CONTROL PRESSURE SWITCH

OVERVIEW

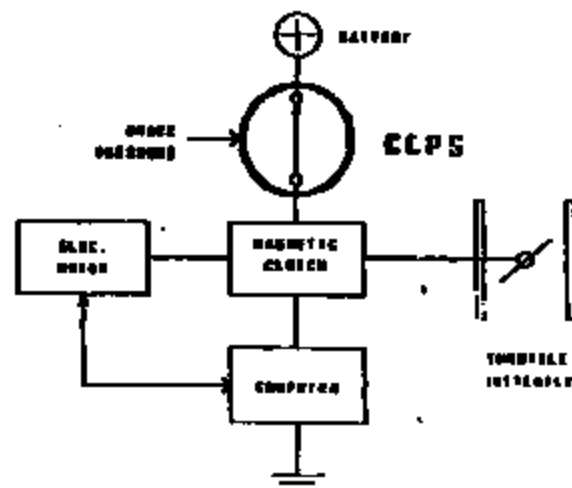
THE CCPS IS A REDUNDANT SAFETY DEVICE IN A NEW, VACUUM-LESS ELECTRONIC CRUISE CONTROL DESIGNED BY FORD.

FUNCTIONALLY, IT REPLACES THE PRESENT VACUUM DUMP VALVE BY DE-ENERGIZING A CLUTCH WHICH CONNECTS THE THROTTLE TO AN ELECTRIC ACTUATOR.

IT IS PLUMBED INTO THE BRAKE LINE. WHEN THE DRIVER APPLIES PRESSURE TO THE BRAKE PEDAL, THE NORMALLY-CLOSED SWITCH OPENS, DISCONNECTING THE ACTUATOR FROM THE THROTTLE BUTTERFLY.

SPECIFICATIONS:

ACTUATION: 150 PSI +/- 50
RELEASE: 100 PSI MIN.
BURST: 7000 PSI
CYCLES: 500K, 0 - 1450 PSI, 2 Hz
VOLTAGE: BATTERY
CURRENT: 0.75 AMP



TI-NHTSA 000361

17 May 89 SBO 50-167

PRESSURE SWITCH DATA

FORM 21605

TEST NO. 8-15-40

DEVICE <u>CCPS</u>	DATE REQUESTED <u>3-10-89</u>	REQUESTED BY <u>SBO</u>	REQUESTED COMPL. DATE
PERFORMED BY <u>J. J. Domencio</u>	DATE STARTED <u>3-10-89</u>	DATE COMPLETED <u>5/1/89</u>	APPROVED BY
PROJECT TITLE: <u>Crucial Control Pressure Switch</u>			

CUSTOMER: Ford

PURPOSE OF TEST: To satisfy the design validation test

PROCEDURE: Outlined in the design validation booklet

Device #	Pres (psi)	P.A. (in Hg)	Act	Rel	Wt Drop	Pres Test	
08-15-01	225	215	136	131	3.0	Pass	Current Leakage
08-15-02	220	219	135	130	2.9	Pass	
08-15-03	225	216	145	139	3.0	Pass	
08-15-04	235	212	123	129	3.3	Pass	
08-15-05	235	215	123	133	3.2	Pass	
08-15-06	230	217	141	136	3.7	Pass	
08-15-07	250	216	127	131	3.9	Pass	
08-15-08	225	216	141	136	4.4	Pass	
08-15-09	225	219	136	131	4.1	Pass	
08-15-10	250	216	120	125	9.5	Pass	
08-15-11	250	213	Dead				Vibration
08-15-12	195	219	140	139	2.8	Pass	
08-15-13	243	216	141	135	3.7		
08-15-14	215	217	Dead				
08-15-15	225	216	141	136	4.3	Pass	
08-15-16	235	216	128	134	3.7	Pass	
08-15-17	190	213	129	135	4.7	Pass	
08-15-18	225	215	129	139	3.2	Pass	
08-15-19	262	215	144	129	3.7	Pass	
08-15-20	220	215	128	129	3.9	Pass	
08-15-21	225	212	125	121	2.6	Pass	
08-15-22	240	219	126	121	4.0	Pass	
08-15-23	220	213	136	131	3.9	Pass	
08-15-24	255	212	121	128	3.2	Pass	
08-15-25	245	215	127	131	3.9	Pass	
08-15-26	195	215	127	125	4.8	Pass	
08-15-27	203	211	128	122	4.0	Pass	
08-15-28	260	217	121	126	3.8	Pass	

Vacuum

Temp. Cyl.

Inplace Test

HIGHLIGHTS
Stephen B. O'Hara
Week Ending 03/23/89



FORD MYS2 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: Forty CCPS prototypes have been built for Design Validation testing. Initial characterization is complete. Parts are beginning to undergo the actual tests. In parallel, efforts are being spent to update inventory for build of customer samples. Unanticipated situations within other programs are straining resources and forcing schedule slips.

TEST PLANS/TEST EQUIPMENT: Initial characterization of the 40, including Calibration, Voltage Drop, Current Loadings, and Proof, is complete. Two devices failed during characterization. The suspect cause is excessively long spring arms, which touch the base and stick. The design of the spring arm will be analyzed and modified.

The next phase of DV is the following tests: Temperature Cycle, Impulse, Humidity, Salt Spray, and Vibration. The cycler we are building for this program will not be complete in time; however I have co-ordinated with Bob Bishop to borrow his APT cycling equipment which is capable of performing both Temp. Cycle and Impulse. These tests will be run serially, commencing Monday 03/27 if all goes well.

The other three tests are performed by the Environmental Lab. George O'Leary reports that the vibration test cannot be run until 04/03/89, due to recent outages in other programs. Given this recent input, we will not be able to ship customer samples for 04/07/89. The slip will be communicated to Ford.

The final phase of DV will be re-characterization to compare with initial values; and finally burn. A test report will be drafted and supplied to Ford with samples.

DESIGN REVIEW: We plan to hold the review two weeks after completion of DV testing. At this point, the dynamic nature of the DV schedule makes it difficult to pinpoint the date for the Design Review.

Carlo de la Mata and I are planning to hold several preparatory meetings prior to the review. In this manner, Carlo is brought into the design process as soon as feasible, so Mfg. inputs can help direct the design.

Stephen B. O'Hara

HIGHLIGHTS
Stephen B. Offler
Week Ending 03/31/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: Prototypes are undergoing various Design Validation tests. The Thermal Cycle test is complete; all devices passed. However, the Impulse test has turned up 6 failures out of 10 after 178K cycles (out of 500K). The gasket is extruding and falling apart. A corrective plan will be developed and put in place ASAP. This could definitely affect delivery of customer samples.

CUSTOMER SAMPLE BUILD: Until the gasket problem surfaced, the pacing item was the spring arm from Peck Spring. They missed their promised ship date of 03/28, although Carlo de la Mata has gotten them to agree to overnight ship 150 as soon as they become available. We could have the parts as soon as tomorrow.

Several actions will be pursued to correct the gasket problem. I have spoken with Bob Bishop, and will contact his recommended EPDM suppliers. Per Carl's recommendation, we will look into higher durometer material, pay attention to the flatness of the sealing surfaces, look at gland geometry, and consider a teflon back-up ring *only as a stop-gap solution* to allow parts to ship for the Ford fleet test.

TESTING: Don Ekberg has begun to scrutinize the layout of the dedicated cyclers for this program. He recommends that we purchase the proper size cabinet from Equipto rather than use the smaller Bud cabinet in our possession. We have identified an available oven for this cycler (and located the missing door for it). The oven we previously planned to use is saturated with spilled fluids, and needs to be reconditioned or junked. I spoke with Blue-M and they gave me a ballpark price of \$400 assuming all it needs is insulation replacement.

We have been borrowing Bob Bishop's cycler for Temp Cycle and Impulse. Now that failures have occurred, we will require additional testing time. We need to co-ordinate with Bob, since he indicates a need for it too. The sooner our own cycler is built, the better.

Leo contacted George O'Lear in order to boost our priority in his queue. I expect the three Environmental Labs tests (Humidity, Salt Spray, and Vibration) to be complete by early next week.

DESIGN REVIEW: Carlo conducted a meeting with Mechanization to discuss the proposed process flow, to get some direction on a calibration method, and to get a new tooling quote from them. The meeting was very productive, and will provide information necessary for the Design Review. Date is still TBD.

Stephen B. Offler

TI-NHTSA 000365

PRESSURE SWITCH DATA

FORM 21605

TEST NO. 09-01-55

DEVICE <u>CCPS</u>	DATE REQUESTED <u>4-4-89</u>	REQUESTED BY <u>SBO</u>	REQUESTED COMPL. DATE
PERFORMED BY <u>J. D. America</u>	DATE STARTED <u>4-4-89</u>	DATE COMPLETED <u>5/12</u>	APPROVED BY

PROJECT TITLE: Cruise Control Pressure Switch

CUSTOMER: Ford

PURPOSE OF TEST: Prepare SS devices for shipment to Ford

PROCEDURE: Same as ~~test~~ w/d Kapton seals

Device #	Force (g)	$l^2 \cdot s^{-1} \cdot m^{-3}$	Disc	Proof	ACT	REL	M/D/W
01-01-01	200	219	LOT 3	PASS	127	130	5.9
02	215	217	LOT 1	PASS	128	127	7.2
03	215	218	LOT 2	PASS	129	123	5.8
04	200	215	LOT 3	PASS	128	129	5.5
05	175	216		PASS	135	129	5.8
06	210	212		PASS	129	127	5.7
07	235	219		PASS	131	126	5.3
08	185	216		PASS	133	127	5.1
09	210	215		PASS	135	128	5.6
10	230	215		PASS	130	124	5.3
11	115	210		PASS	136	124	5.5
12	200	216		PASS	130	125	5.3
13	190	208		PASS	128	124	6.2
14	175	219		PASS	131	125	6.2
15	240	219		PASS	131	131	7.6
16	235	219		PASS	130	125	4.8
17	220	212		PASS	133	130	5.1
18	210	215		PASS	129	129	4.8
19	185	210		PASS	131	126	5.9
20	255	220		PASS	127	128	5.5
21	220	209		PASS	127	128	5.1
22	210	216		PASS	126	129	5.5
23	215	213		PASS	127	125	5.1
24	185	215		PASS	134	128	5.5
25	190	215		PASS	137	122	5.5
26	215	214		PASS	135	127	5.8
27	180	216		PASS	128	128	5.2
28	185	212		PASS	139	130	4.7

TI-NHTSA 000366

HIGHLIGHTS
Stephen B. Offler
Week Ending 04/07/89



FORD MYS2 CRUISE CONTROL PRESSURE SWITCH EK3423

OVERVIEW: The move to the new second floor area was completed this week. An action plan to correct the gasket problem was developed, and Ford was contacted to determine how the leakage problem will affect their schedule. We need to get parts to Gary Klingler by May 1. The Environmental Labs has completed the Vibration test and the Salt Spray test, but has fallen behind schedule on the Humidity test.

GASKET: A quick analysis of four possible corrective routes yielded two obvious choices. These are presently being pursued. They are: 1) minor iteration of the present design, including radiusing the edges of the gasket gland and using a higher durometer material to resist extrusion; and 2) attempting to eliminate the gasket completely and rely on the Teflon-coated-Kapton seal. This idea has been prototyped on the STPS with good results at room temperature.

There will be some lead time for both ideas. J-B-L Div. of Parker Seal is working to create higher-duro gaskets for us, which should be here by about 04/19. The metal shop is modifying disc seats and hexports to prototype the gasket-elimination idea, which should be available by 04/14.

CONNECTOR: The meeting between Ford and UTC, their connector supplier, took place this week. Joe Schuck reports that there is great resistance to our idea of rotating the terminals, which would facilitate automation of our assembly process. Ford is basically sold on the idea of using the STPS-type connector with altered alignment tabs and a different color (not blue or white). I am presently looking into the availability of colors for our base molding compound, and how a color change will affect material properties and cost. Carlo is looking into the economic impact of hand-assembly of the terminals.

DESIGN REVIEW: No real progress this week. A preparatory meeting scheduled with Ted Ballard to organize our thoughts on the disc design did not take place and was rescheduled to next week.

Stephen B. Offler



HIGHLIGHTS
Stephen B. Offler
Week Ending 04/14/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: Three parallel paths are being pursued to correct the gasket problem, to allow shipment of customer samples for 05/01. Ford and Surfaces (their proportioning-valve supplier) have requested Ganits to comprehend our sampling capabilities, for their own scheduling purposes. Joe Schuck reports that Ford Light Truck has moved a step closer to buying into this cruise control system, which would boost volume and justify Marketing projections.

SAMPLE REQUIREMENTS:	Quantity	Date
Texas police fleet test	50	04/28
Surfaces	75	04/28
Mustang build	50	04/28
Test units/spares	100	05/19

GASKET: The three paths being pursued are: 1) Iteration of the gasket design according to JBL recommendations and published info; 2) Elimination of the gasket, using the Teflon-coated Kapton as a seal; and 3) Placing a second piece of Kapton above the present gasket to prevent extrusion (this is a fall-back solution since it is not production-representative). Lead times at JBL and test equipment availability are pacing items.

TESTING: The dedicated cyclor for this program is will be under construction for the next few weeks; hence it will not be available to do the testing required to validate the gasket design change. I have contacted Bob Bishop to borrow APT equipment again. He has to look at his schedule and will negotiate. I need the APT equipment for about 100 testing hours: Thermal Cycle (30 hrs) and Impulse test (70 hrs).

CONNECTOR: Carlo has calculated that the additional labor cost, if we do not rotate the terminal design (hence do not automate) will be 18 cents per device. This remains a significant issue with the customer. Also, at Ford's request, we have officially decided upon the color for the device: Black. Ford did not want Blue or White since these are 57PS brake-switch colors.

1247

HIGHLIGHTS
Stephen B. Offler
Week Ending 04/14/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH BX3423

OVERVIEW: Three parallel paths are being pursued to correct the gasket problem, to allow shipment of customer samples for 05/01. Ford and Surfaces (their proportioning-valve supplier) have requested Goetts to comprehend our sampling capabilities, for their own scheduling purposes. Joe Schuck reports that Ford Light Truck has moved a step closer to buying into this cruise control system, which would boost volume and justify Marketing projections.

SAMPLE REQUIREMENTS:	Quantity	Date
Texas police fleet test	50	04/28
Surfaces	75	04/28
Murray build	50	04/28
Test units/spare	100	05/19

→ Leakers @ Slide !! NG

GASKET: The three paths being pursued are: 1) Iteration of the gasket design according to JBL recommendations and published info; 2) Elimination of the gasket, using the Teflon-coated Kapton as a seal; and 3) Placing a second piece of Kapton above the present gasket to prevent extrusion (this is a fall-back solution since it is not production-representative). Lead times at JBL and test equipment availability are pacing items.

TESTING: The dedicated cycler for this program is will be under construction for the next few weeks; hence it will not be available to do the testing required to validate the gasket design change. I have contacted Bob Bishop to borrow APT equipment again. He has to look at his schedule and will negotiate. I need the APT equipment for about 100 testing hours: Thermal Cycle (90 hrs) and Impulse test (70 hrs).

CONNECTOR: Carlo has calculated that the additional labor cost, if we do not rotate the terminal design (hence do not automate) will be 18 cents per device. This remains a significant issue with the customer. Also, at Ford's request, we have officially decided upon the color for the device: Black. Ford did not want Blue or White since those are 57PS brake-switch colors.

Handwritten signature

PRESSURE SWITCH DATA

Form 21605

TEST NO. 10-15-10

DEVICE <u>COPS</u>	DATE REQUESTED	REQUESTED BY <u>SBO</u>	REQUESTED COMPL. DATE
PERFORMED BY <u>J. V. Deenice</u>	DATE STARTED <u>7/17/99</u>	DATE COMPLETED <u>7/16/99</u>	APPROVED BY
PROJECT TITLE: <u>CBUSE Control Pressure Switch</u>			

CUSTOMER: Ford

PURPOSE OF TEST: To test the idea of using the kapton to seal the pressure cavity and eliminate the gasket altogether

PROCEDURE: First, modifications to the disc seat end tangs are required. Assembly is almost the same except that the kapton seal covers the entire disc seat and the gasket is eliminated

Further information in Lab Notebook assigned to Jeff Deenice p. 39

11 discs - Lot II

Device #	Force (lb)	P. a. x 9	Kapton seals	Act	Rel
<u>10-15-01</u>	<u>185</u>	<u>212</u>	<u>1</u>	<u>all OK</u>	
<u>02</u>	<u>230</u>	<u>214</u>	<u>1</u>		
<u>03</u>	<u>205</u>	<u>214</u>	<u>1</u>		
<u>04</u>	<u>195</u>	<u>216</u>	<u>1</u>		
<u>05</u>	<u>215</u>	<u>211</u>	<u>1</u>		
<u>06</u>	<u>245</u>	<u>215</u>	<u>2</u>		
<u>07</u>	<u>210</u>	<u>213</u>	<u>2</u>		
<u>08</u>	<u>230</u>	<u>214</u>	<u>2</u>		
<u>09</u>	<u>250</u>	<u>216</u>	<u>2</u>		
<u>10</u>	<u>175</u>	<u>212</u>	<u>2</u>		

TI-NHTSA 000371

PRESSURE SWITCH DATA

FORM 21605

TEST NO. 11-15-10

DEVICE CCPS	DATE REQUESTED 4-19-99	REQUESTED BY SPO	REQUESTED COMPL. DATE
PERFORMED BY J. DiNemico	DATE STARTED 7-19-99	DATE COMPLETED	APPROVED BY
PROJECT TITLE: CRUISE CONTROL Pressure Switch			

CUSTOMER: **Ford**

PURPOSE OF TEST: **To test Steve's second seal idea as a remedy for Gasket nibbling**

PROCEDURE: **Assemble as usual with modified disc seat but add a kapton washer (919 kapton) just before hex part. This should stop the gasket from pushing out under the hex part**

Revision	Pressure (psi)	P.S. ± 3	D.S.C	Act	Rel	W.P.P	Proof	Service Interval
11-15-01	166	213	Lot 1	139	139	5.2	Pass	705
02	170	214	Lot 1	139	138	5.3	Pass	705
03	200	214	Lot 2	138	134	5.9	Pass	705
04	205	216	Lot 1	138	133	5.2	Pass	705
05	236	218	Lot 1	138	141	5.1	Pass	705
06	250	218	Lot 1	139	129	4.9	Pass	
07	287	219	Lot 1	139	130	4.5	Pass	
08	285	219	Lot 2	136	127	4.6	Pass	
09	288	218	Lot 2	140	135	5.0	Pass	
10	300	218	Lot 2	134	134	5.0	Pass	

Leakers 12,500 cycles powered
 67,576 unpowered
 80,076 cycles total

ABORT TEST

HIGHLIGHTS
Stephen B. Offler
Week Ending 04/21/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: In order to ship customer samples by 05/01, the 57PS fail-back solution is being pursued. One of the three CCPS gasket-leak stations has failed; however the other two have very good chances for success. The program is undergoing two personnel changes: Keith Roberts is taking over Mfg. Eng. responsibilities from Carlo de la Mata, and Charles Douglas is taking over Marketing from Jim Wood.

57PS SAMPLES: Gary Klingler at Ford has indicated a preference for use of proven 57PS's for his May fleet builds (Texas police fleet and Wisconsin Mustang fleet, I believe). This is understandable, since his goal is to test the entire system, not to prove out individual components. We need to ship 100 57PS's which provide CCPS functionality by 05/01.

In order to do this, we need a quantity of discs which provide CCPS act/rel characteristics. Andy McKenna previously designed a disc to do this and the disc department is able to build them. The outstanding issue is the fact that 500K cycle life has not been proven on these devices. I have communicated with Jeff Malton in the disc department, who indicates that these discs can be created by 04/26. In parallel, I am running a 500K impulse test on the 57PS line to prove disc life. If disc life turns out to be a problem, we will have to re-contact Klingler and offer him whatever the lower-risk solution seems to be.

CCPS SAMPLES: We had been pursuing three parallel paths to cure the leakage problem on the actual CCPS parts. One, the idea of eliminating the gasket and relying on the Kapton does not look good. The devices leaked air significantly during initial characterization. They did withstand hydraulic fluid during the 5000 psi proof test, but the assembly was found quite loose when pressure was removed.

J-B-L Div. of Parker Seal has slipped on a commitment. Iterated gaskets were due today, 04/21. Speaking with J-B-L's Tom Richards (who handles all TI accounts) he seemed to try to straddle the slip to our Purchasing Dept. I issued the Request for Purchase nearly two weeks ago. Speaking with Tim Durkin in Purchasing I learned that there was confusion because the RP contained no part number. These are experimental gaskets therefore no part number exists! The responsibility falls to Mr. Richards at J-B-L who assured me he would give this matter personal attention. I need to re-contact him to get a revised ship date.

The third idea, which is to include a piece of Kapton above the gasket to block extrusion, is ready to assemble and test.

TESTING: To validate the CCPS we need to do the impulse test (0 to 1450 psi at 121 C) on the iterated parts. The APT cyclers we used before is no longer available; however Bob Bishop has offered the use of an APT intensifier cycler. This will be quite acceptable; the only drawback being a maximum cycle rate 1/2 of what I need which will double the length of the test from 3 days to 6 days running continuously.

PRESSURE SWITCH DATA

Form 21605

TEST NO. 12-15-10

DEVICE CCPS	DATE REQUESTED	REQUESTED BY JAO	REQUIRED COMPL. DATE
PERFORMED BY J. V. Domenico	DATE STARTED 7/25/99	DATE COMPLETED	APPROVED BY
PROJECT TITLE: CRUISE CONTROL PRESSURE SWITCH			

CUSTOMER: **Ford**

PURPOSE OF TEST: **To see if higher diameter buckets and radiused edge on disc seat will solve bucket nibbling problem**

PROCEDURE: **Assemble as usual with modified disc seats and 90 Race Gaskets. Cycle in APT Cycle**

Device #	Force (lb)	Pin #3 Inch	DISCS	ACT	REL	IN/Day	Proof	Pressure Setting
12-15-01	155	212	LOT 2	120	135	45	Pass	100
02	180	214	LOT 2	128	134	50	Pass	100
02	205	211	LOT 2	131	126	42	Pass	100
04	230	212	LOT 2	142	139	45	Pass	100
04	215	215	LOT 2	141	136	45	Pass	100
05	220	216	LOT 3	121	118	37	Pass	100
07	165	205	LOT 3	126	121	38	Pass	100
08	220	215	LOT 3	134	129	39	Pass	100
09	195	217	LOT 3	127	124	16.0	Pass	100
10	200	219	LOT 3	144	139	49	Pass	100

Leakets 12,500 Cycles powered
 67,576 unpowered
 80,076 Cycles total

ABORT

HIGHLIGHTS
Stephen B. O'Flair
Week Ending 04/28/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH BXG423

OVERVIEW: Customer samples built from modified 57PS's will go out today to Joe Schack for hand-delivery to Gary Klingler at Ford on Monday, 05/01, the due date. Everything has come together regarding the gasket-leakage problem on the true CCPS, and inserted parts are back on test. Preliminary results due 05/05, final results due 05/19.

57PS SAMPLES: Joe contacted me with the information that Ford requires a total of 123 parts. This was formerly thought to be 100. The disc department delivered, on schedule, 300 custom 3/4" discs which give CCPS spec. act/rel. Discs very similar to these underwent a 230K cycle test with good results. 150 parts were built on the 57PS line, and added to 30 that Andy McKenna had built several months ago. Unfortunately, a yield problem cropped up, where the release value of the finished devices had a very wide sigma. This necessitated 100% test and sort. Release varied from about 115 psi to about 80 psi; spec. is 100 psi minimum. We ended up with 116 good parts out of the 180, which were shipped. I am awaiting instructions from Joe on how to handle the outstanding 9 parts.

CCPS SAMPLES: The new, higher-chronometer gaskets arrived, a few days behind schedule. Ten test parts were built up. These, along with ten other test parts built using a second piece of Kapton to prevent gasket extrusion, have begun to undergo the Impulse test. This is the test that turned up gasket failures at 178K cycles on the previous iteration. If all goes well, the devices still have to pass a thermal cycle test which will test the low-temperature performance of the gaskets. Also, I am waiting for devices undergoing Humidity testing in the Environmental Lab. When all this is complete, we will have completed the Design Validation procedure and will be able to ship actual CCPS samples to the customer. Ship date is presently estimated at 05/26/89 if all goes well.

TESTING: With cooperation from Bob Bishop and others, CCPS parts have begun the 500K Impulse test on a running APT Intensifier cyclor which is plumbed thru a "T" into an adjacent AMPT oven. This equipment runs a maximum of 1 or so Hz, meaning this test will take about 6 days to complete. Then, the thermal cycle test will commence using the same equipment. This will take up to 10 days to complete, because the chamber we're in is not programmable and the cycling control will need to be done manually.

TI-NHTSA 000375

PRESSURE SWITCH DATA

Form 21605

TEST NO. 13-15-20

DEVICE CCPS	DATE REQUESTED 5/1/99	REQUESTED BY SBO	REQUESTED COMPL. DATE
PERFORMED BY S. DiDomenico	DATE STARTED 5/1/99	DATE COMPLETED 5/11/99	APPROVED BY
PROJECT TITLE: CRUISE control Pressure switch			

CUSTOMER: **Ford**

PURPOSE OF TEST: **To stop out Kaptan seals for ripping & loading**

PROCEDURE: **Assemble 10 devices w/2 seals and 10 devices w/3 seals. Disc seals must be suitably modified. IMPULSE TEST**

* All devices with 70 parameter Gaskets have Kaptan washer (second seal)

* All discs from Lot 3

Device #	Force (psi)	P.A.P. result	AL7	REL	ml Drop	Proof	seal/terminal	Seals	Gasket Data
13-15-01	230	216	123	119	1.6	Pass	Pos	2	70
01	195	213	128	120	6.2	Pass	NEG	3	70
02	245	212	127	125	6.3	Pass	Pos	2	70
04	190	214	129	124	6.3	Pass		2	70
05	200	213	132	127	7.0	Pass		2	70
06	210	211	135	130	6.3	Pass	Pos	2	90
07	190	214	129	124	6.2	Pass	NEG	2	70
08	225	212	133	127	6.5	Pass	NEG	2	90
09	215	213	138	133	6.6	Pass		2	90
10	200	214	139	129	6.1	Pass		2	90
11	215	211	142	135	6.1	Pass	Pos	3	70
12	205	214	137	125	6.3	Pass	NEG	3	70
13	200	213	140	132	6.4	Pass	Pos	2	70
14	240	213	138	130	7.1	Pass		2	70
15	210	214	139	129	6.4	Pass		2	70
16	190	213	140	137	7.3	Pass	Pos	3	90
17	145	212	137	119	6.4	Pass	NEG	?	90
18	190	212	140	137	6.6	Pass		3	90
19	210	213	130	122	6.8	Pass		2	90
20	240	211	135	128	7.3	Pass		2	90

PRESSURE SWITCH DATA

FORM 21605

TEST NO. 15-15-15

DEVICE <i>CCPS</i>	DATE REQUESTED <i>5/31</i>	REQUESTED BY <i>SBO</i>	REQUESTED COMPL. DATE
PERFORMED BY <i>J. P. DOMENICO</i>	DATE STARTED <i>5/31</i>	DATE COMPLETED <i>5/31/89</i>	APPROVED BY
PROJECT TITLE: <i>Cruise Control Pressure Switch</i>			

CUSTOMER: *Ford*

PURPOSE OF TEST: *Fast over pressure to deform kapton seals to their final position*

PROCEDURE: *Build 15 Devices (2 Pc. Kapton)*
- First 5, ~900 PSI (fast) once, take next 9 readings
- Next 5, ~900 PSI (fast) three times, take next 7 readings
- Last 5, take 10 readings w/ no over pressure

* 9/1 discs Lot 20

Device #	Pressure (bars)	Time (s)	900psi	Proof	MV Drop
15-15-01	295	209	once	pass	9.0
02	210	214	once		9.7
03	195	214	once		7.7
04	190	210	once		8.6
05	200	211	once		8.9
06	245	210	3		7.5
07	230	211	3		7.9
08	210	213	3		8.1
09	205	215	3		8.7
10	170	215	3		9.6
11	210	218	0		7.6
12	200	219	0		7.3
13	210	215	0		7.0
14	195	214	0		6.7
15	255	215	0	pass	6.5



HIGHLIGHTS
Stephen B. Offler
Week Ending 05/03/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH EX3421

OVERVIEW: 57PS customer samples went out last week; true CCPS samples are still underway on the Impulse test. This time is being spent to organize with the new Mfg/Mkt team, to prepare the Design Validation test write-up, and to prepare for the Design Review.

CUSTOMER NEWS: Charlie Douglas had a meeting with Gary Klingler last week at Ford. Issues included: terminal rotation; updated sampling schedule; short-circuit test; and actuation tolerance information.

It looks like Ford needs to tool up a mating connector *anyway* due to the large volume projections, so we will probably get our terminals rotated after all. This area is receiving significant attention. The sample needs have swelled from 275 to 500, over the foreseeable future. Charlie and Joe are working to better define needs and dates. Inventory of component parts will need to be refreshed. Gary has expressed an interest in re-running the short-circuit test under a different set of conditions. I plan to contact him directly to completely define the test procedure. He's also interested in better understanding what our true tolerance capabilities are; is +/- 50 psi artificially too wide? We will explain to him that true, finished-part tolerances are affected by many variables and must be characterized statistically once we have production-representative parts and processes. Until then, we can only shoot for a given range.

CCPS SAMPLES: We had two lots of 10 undergoing the Impulse test - however, this test turned up significant leakers at about 80K cycles. Inspection revealed torn Kapton seals. New devices were built, using 2 and 3 pieces of Kapton. As a result, there are now four lots of 5 back underway on the Impulse test. To date, they have passed 100K cycles without problem. Passing this test will give us enough confidence to begin building sample quantities for the customer. Devices will not ship, however, until the Thermal Cycle test is completed too. Ship date still looks like 05/26 if all goes well.

TESTING: We are still waiting for the completion of the Humidity test. I've spoken with George O'Lear and I expect this to be done soon. It is becoming increasingly difficult to get cycler time for the Impulse test and the Thermal Cycle test; we have piggy-backed off an APT intensifier-cycler running another test, and have plumbed into a chamber borrowed from the AMPT. If all goes well, Don Ekberg will be able to complete our dedicated cycler by the end of May.

Stephen B. Offler

TI-NHT8A 000379



HIGHLIGHTS

Stephen B. Offler
Week Ending 05/12/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH EX3423

OVERVIEW: CCPS samples continue to chug away on the Impulse test. They have now completed about 2/3 of the 500K test with no failures. We're gearing up to build a quantity for Ford by the end of May. Per the Program Review, a preliminary Design Review will be held ASAP.

CUSTOMER NEWS: As planned, I contacted Gary Klingler to discuss his requested Short Circuit test and act/rel tolerances. Gary wants the Short Circuit test to help allay fears from others at Ford who are concerned with brake system failure modes. 3-4 weeks is okay with him. Between us we agreed upon a procedure: run devices at 125 °C ambient while pressure-cycling, and increase current to failure (contacts weld/contacts erode/leakage).

Joe will take the next step in the connector issue: to close with Diana Koenig regarding tooling a new connector. Charlie will begin to define steps needed to finalize our spec with Ford.

CCPS SAMPLES: Four different configurations, five of each, are being tested at present. These are: 80-duro gaskets w/ two or three Kapton seals; Kapton-backed 70-duro gaskets w/ two or three Kapton seals. In the event all pass, my preferred configuration is the 80-duro gasket with two seals (min parts count).

Short-term, we owe Gary Klingler 50 devices for the Northern Fleet Test. Diana does not need the balance of the short shipment we sent her. A little farther out (TBD) Ford needs a quantity of 300 parts for another fleet test.

DESIGN REVIEW: Charlie, Keith and I have agreed upon goals, agenda, date & time, and guest list. The review will cover two basic areas: status of the design, and status of the mfg. process. This review is considered preliminary in nature; inputs received will be used to revamp the schedule, prints, cost estimate, etc. which will be re-reviewed at a later date.

TESTING: Don Ekberg is making significant progress on the construction of the cyclor for this program.

After chatting with Tony Sabetti, I've designed a worst-case experiment to explore the inductive spike that occurs when switching. The clutch is run at -40°C where Cu resistance is lowest and magnetic permeability (therefore inductance) is highest. We are monitoring voltage across the contacts and current flow in the circuit. We're also experimenting with diodes for arc suppression.

A handwritten signature in blue ink, appearing to read "Stephen B. Offler".

TI-NHTSA 000380

HIGHLIGHTS
Stephen B. Offler
Week Ending 05/19/89



FORD MYS2 CRUISE CONTROL PRESSURE SWITCH ECG423

OVERVIEW: Devices have successfully completed the Impulse testing. We are building customer samples now. They will be ready to ship before the promised date, 05/26, quantity 50. A Design Review was held this week; many good ideas were generated.

DESIGN REVIEW: Major issues arising from the Design Review focused on the base, the disc seat, and the crimp ring. The base is important because the connector selection is not yet firm-ed-up; this dictates terminal design which impacts assembly method and calibration technique, and is the longest-lead item to tool. The disc seat is important because it is presently the highest-cost item and has greatest potential for cost-reduction. The crimp ring is important because it is most directly related to device burst which is THE key failure mode. There remains significant work to be done to finalize the design and the process, after which another Design Review will be held.

FMEA: Mark Garfin will be supporting us on this. We plan to kick it off next week, and hold regular weekly meetings.

CUSTOMER SAMPLES: All four lots passed the Impulse test, which accidentally ran 651K instead of 500K. These were a matrix of 80-duro gaskets or 70-duro w/ a Kapton washer backup; two or three Kapton seals. We found no device failures; however, the 70-duro gaskets showed nibbling (but not to the point of failure) and the devices with two Kapton seals all showed tearing of the wetted piece. The 80-duro gaskets looked excellent after the test, and the three-seal devices showed no tearing. The thermal cycle test remains to be completed... it looks like I'll need to negotiate again with Bob Bishop for use of his programmable chamber.

CUSTOMER NEWS: Joe Schuck reports that Ford has requested we update our envelope drawing and provide a firm cost estimate by 05/25. This presents obvious problems since the connector is up in the air, and the tooling and process costs we have are ballpark for the most part. However, it appears, tentatively, that Ford will allow us to choose a connector design.

Handwritten signature: S.B. Offler

PRESSURE SWITCH DATA

Form 21605

TEST NO. 19-01-25

DEVICE CCPS	DATE REQUESTED 5/14/89	REQUESTED BY SBO	REQUESTED COMPL. DATE 5/15/89
PERFORMED BY J. DiAmerica	DATE STARTED 5/15/89	DATE COMPLETED 5/16/89	APPROVED BY
PROJECT TITLE: Cruise Control Pressure Switch			

CUSTOMER: **Ford Pressure Valve Division**

PURPOSE OF TEST: **To show costumer samples**

PROCEDURE: **Build 15 devices w/ 80 dure gaskets, two Keplar seals, and approximately modified disc seals. Characterize and check for Ene Schack (NO O-Rings)**

*** all discs Lot IV**

Device #	Force	Trans Pin #	Proof	ACT	REL	ΔV Drop
01	200	215	Pass	130	125	4.8
02	215	217	Pass	120	124	4.4
03	240	218	Pass	127	131	4.6
04	190	212	Pass	140	138	3.9
05	185	210	Pass	130	125	4.2
06	195	214	Pass	123	128	2.5
07	205	215	Pass	126	121	4.3
08	215	211	Pass	133	127	3.8
09	215	212	Pass	131	127	4.1
10	200	213	Pass	135	129	4.1
11	215	214	Pass	129	124	3.8
12	190	213	Pass	130	127	3.8
13	165	212	Pass	130	125	4.1
14	250	215	Pass	138	131	4.1
15	165	213	Pass	140	132	3.1
16	230	214	Pass	134	127	4.3
17	180	211	Pass	128	126	3.8
18	200	214	Pass	140	133	3.7
19	250	213	Pass	130	125	3.9
20	200	212	Pass	131	126	4.1
21	205	215	Pass	129	122	4.3
22	215	213	Pass	130	121	4.2
23	226	212	Pass	127	118	3.9
24	240	215	Pass	134	129	4.1
25	205	212	Pass	125	128	3.8

TI-NHTSA 000382

HIGHLIGHTS
Stephen B. Offler
Week Ending 05/23/89



FORD MY92 CRUISE CONTROL PRESSURE SWITCH EK3423

OVERVIEW: Fifty customer samples were shipped earlier this week, destined for a fleet test. Twenty-five more have been requested, destined for the proportioning-valve manufacturer. These should ship tomorrow. The team has been paying significant attention to two areas: overall planning to get perspective on all interrelated design/cost/mfg. issues; and we have kicked off the P/MEA process.

ISSUES: It looks like we're getting the green light from Ford to dictate changes to the connector. Martha has requested that we get this in writing. Ford asked for a firm cost estimate and tooling quote as well as a drawing of our proposed connector changes by 05/26. Charlie has drafted a letter addressing our ability to provide firm numbers in 4-6 weeks, and I have made preliminary changes to the envelope drawing which reflect the new terminal orientation.

I have outlined all possible design configurations given the present state of the design. This has helped to identify key questions to be answered in order to boil the list down to a manageable 2-3 configurations. These include automation vs. manual base assembly; calibration by pin-sort vs. deformation of the stationary terminal; possible elimination of the gasket. Once thru this exercise, we will be able to generate very realistic quotes on parts and process tooling. A design review is planned for this time as well.

We will be giving attention to a schedule of program milestones, which will show us where we stand vs. the customer's need for various samples, validation testing, etc. This will also comprehend tooling lead times and other internal factors. This will also help identify a need for resources.

SAMPLES: We will be updating our parts inventory as necessary to prepare for upcoming sample needs, which includes 300 parts for a Taurus/Sable fleet test TBD. Additionally, we will determine the actual cost of samples, which may change the present charge of \$50/each to the customer.

TESTING: Jeff has been taking care of miscellaneous wiring, etc. on the cyclor under construction for this program. We should be up and running fairly soon after Don Ekberg returns from vacation.