

**EA02-025**

**TEXAS INSTRUMENTS, INC.'S**

**9/10/03 ATTACHMENT TO ODI**

**REQUEST #3**

**BOX 5**

**PARTS A - P**

**PART L**

VALENTINE TOOL & STAMPING, INC.

111 WEST MAIN ST. NORTON, MASS. 02766  
(508) 285-6811 226-0240

CERTIFICATE OF CONFORMANCE

DATE : TUESDAY APRIL 23, 1991

CUSTOMER : TEXAS INSTRUMENTS INC

CUSTOMER P.O. NO :

SUPPLIER INVOICE NO.: 18918

PART DESCRIPTION : 74197-1 CRIMP RING REV.B

SUPPLIER P.O. NO. : 18573

QUANTITY SHIPPED : 20,449

SHIPMENT DATE : 04/30/91

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

SIGNED

*Jeanne Leflamine*  
Jeanne Leflamine  
Quality Control Manager

TI-NHTSA 7884

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

<u>PROCESS STEP DESCRIPTION</u>	<u>PRODUCT CHARACTERISTICS</u>	<u>EVALUATION METHOD</u>	<u>CONTROL METHOD</u>	<u>FREQUENCY OF TEST</u>	<u>REACTION PLAN</u>
FINAL ASSEMBLY (AMI AUTOMATION)	CRIMP DIAMETER	CALIPER	X/R	5pc/ Hr.	SOFT SINCE LAST CHECK
	CRIMP HEIGHT	CALIPER	X/R	5pc/ Hr.	SOFT SINCE LAST CHECK
	BASE TORQUE	TORQUE GAGE	X/R	5pc/ Hr.	SOFT SINCE LAST CHECK
	CODE CRIMP RING/ DIAMETER-LEGIBILITY	PLUG-VISUAL	P	5pc/ Hr.	SOFT SINCE LAST CHECK
FUNCTION TESTER (CUSTOM)	ACTUATION/ RELEASE POINTS (Ford Significant Char.)	MASTERS	X/R	EACH SHIFT	TOOL ROOM / ENGINEERING EVALUATIONS
	ACTUATION/ RELEASE POINTS	RAMP THROUGH PRESSURE RANGE	X/R	100%	YIELD TRACKING/ SCRAP CONTROL
Q.C. AUDITS	OUTLINED IN DETAIL IN TEXAS INSTRUMENTS (QAS 208), FMC (THREADS / Ford Significant Char.)				

Revision: D

27 May 1982 MJS/cnr 050-0134

TI-NHTSA 7895

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

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

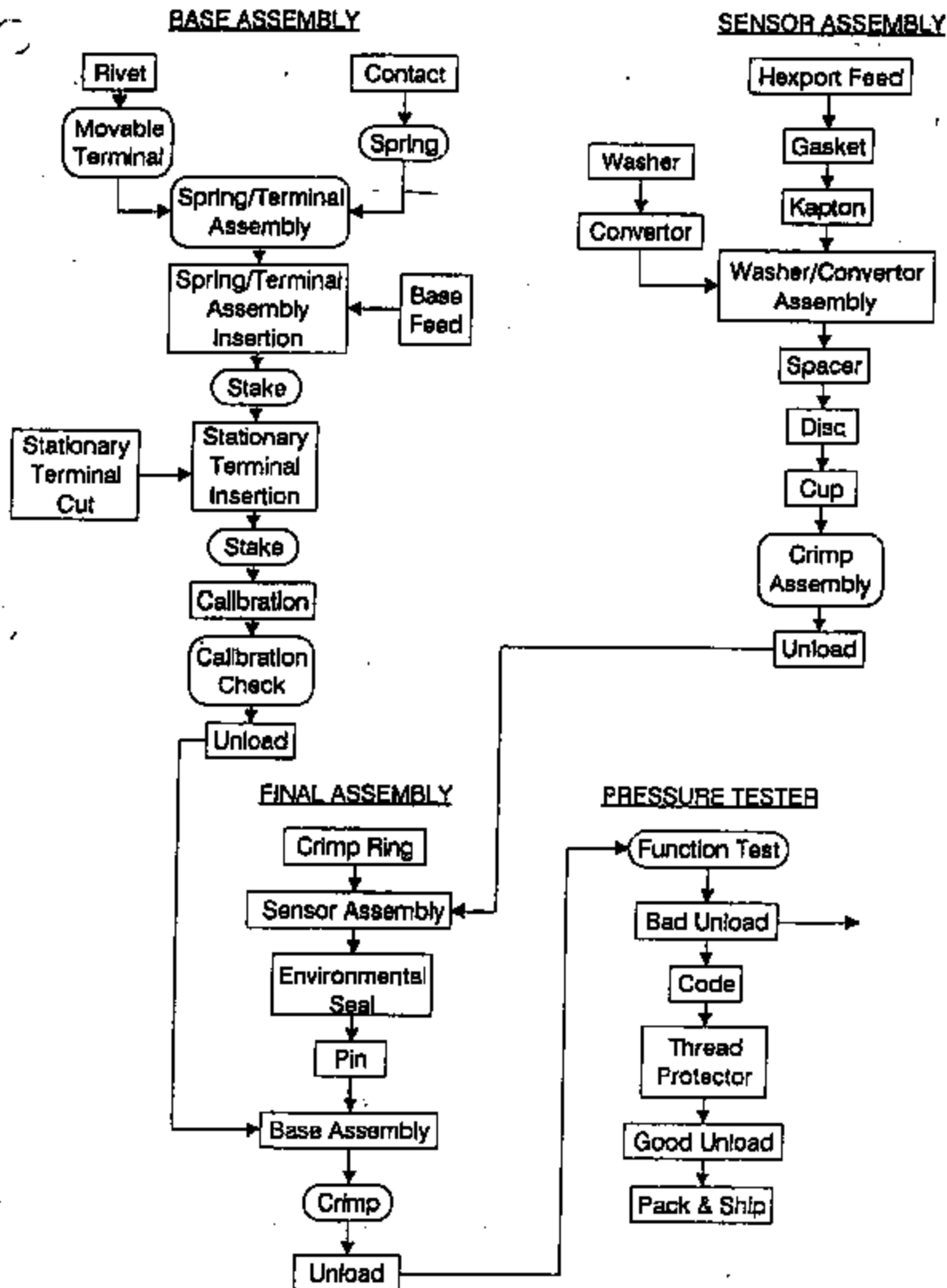
Revision: D

27 May 1992 MJS/cnr 080-0134

TI-NHTSA 7886

# FORD NEXT GENERATION SPEED CONTROL

## PROCESS FLOW CHART 77PSL2-1/2-3



(SPC Operation)

Standard Operation

**FORD SWITCH COMMODITY TEAM VISIT  
CRUISE CONTROL PRESSURE SWITCH**

**BACKGROUND/HISTORY**

- o FORD ENGINEERING CONTACTED TEXAS INSTRUMENTS IN 4Q87 TO DEVELOP BRAKE PRESSURE SWITCH FOR FUTURE ELECTRONIC SPEED CONTROL SYSTEM.
- o FIRST QUARTER 1988, TEXAS INSTRUMENTS DEDICATED A DESIGN ENGINEER TO THE DEVELOPMENT OF CCPS.
  - ENGINEER DEDICATED 3+ YEARS PRIOR TO START OF PRODUCTION.
- o TEXAS INSTRUMENTS HAS CONTINUALLY SUPPLIED PROTOTYPES TO FORD SPECIFICATIONS AND TIMING REQUIREMENTS.
  - INCLUDES DELIVERY ON AS LITTLE AS 24 HOURS' NOTICE.
- o TEXAS INSTRUMENTS HAS CONTINUED TO MEET PROGRAM GUIDELINES AS SET FORTH BY FORD.

CLD/DAA

TI-NHTSA 7888

FORD SWITCH COMMODITY TEAM VISIT  
CRUISE CONTROL PRESSURE SWITCH

CHANGES/IMPACT OF CHANGES TO PROGRAM FOUNDATION

CHANGE	APPROXIMATE	
	TOOLING IMPACT	DEVICE IMPACT
USE OF BASE ASSEMBLY WITH METRI- PACK CONNECTOR NOT ACCEPTABLE TO FORD.		
o MANUAL BASE ASSEMBLY WITH FORD DESIRED TERMINAL ORIENTATION	\$50K	\$ .30
OR		
o AUTOMATED BASE ASSEMBLY WITH FORD DESIRED TERMINAL ORIENTATION	\$250K	
o ELIMINATE CONVERTER		(\$ .06)
o CRIMP RING FROM .025" TO .050"	\$10K	\$ .08
o RE-DESIGN OF TERMINALS TO PROVIDE FORD DESIRED TERMINAL ORIENTATION.	\$50K	\$ .04

CLD/DAA

TI-NHTBA 7889

FORD SWITCH COMMODITY TEAM VISIT  
CRUISE CONTROL PRESSURE SWITCH

CHANGES/IMPACT OF CHANGES TO PROGRAM FOUNDATION

CHANGE	APPROXIMATE	
	<u>TOOLING IMPACT</u>	<u>DEVICE IMPACT</u>
PROOF PRESSURE REQUIREMENT MOVED FROM 2K TO 5K PSI.		
BURST PRESSURE REQUIREMENT MOVED FROM 5K TO 7K PSI.		
o ADDITIONAL PIECE OF KAPTON ADDED TO HANDLE BURST REQUIREMENT.	\$10K	\$.02
o DISC SEAT 40% THICKER TO HANDLE BURST REQUIREMENT.		\$.06
o HEXPORT 40% THICKER TO HANDLE BURST REQUIREMENT.		\$.06

CLD/DAA



**FORD SWITCH COMMODITY TEAM VISIT  
CRUISE CONTROL PRESSURE SWITCH**

CHANGES/IMPACT OF CHANGES TO PROGRAM FOUNDATION

<u>CHANGE</u>	<u>APPROXIMATE</u>	
	<u>TOOLING IMPACT</u>	<u>DEVICE IMPACT</u>
THREAD CAP REQUIRED	\$10K	\$ .02
TOLERANCE DEFINED AS +/-50 PSI		
o PIN GAUGING NECESSARY (ALSO TIED TO CHANGE IN BASE ASSEMBLY)	\$100K	
	-----	-----
TOTAL IMPACT	\$230K	\$ .52
OR		
TOTAL IMPACT	\$430K	\$ .22

CLD/DAA

TI-NHTSA 7891

**FORD SWITCH COMMODITY TEAM VISIT  
CRUISE CONTROL PRESSURE SWITCH**

**CURRENT STATE OF PROGRAM**

**UTILIZING BASE WITH MANUAL TERMINAL ASSEMBLY:**

- o DEVICE PRICE      \$2.27 - \$2.42
- o TOOLING            \$930K - \$1180K

**UTILIZING BASE WITH AUTOMATED TERMINAL ASSEMBLY:**

- o DEVICE PRICE      \$1.97 - \$2.12
- o TOOLING            \$1130K - \$1380K

TI-NHTSA 7892

CLD/DAA

**FORD SWITCH COMMODITY TEAM VISIT  
CRUISE CONTROL PRESSURE SWITCH**

**ENGINEERING INNOVATION/EXPERTISE**

**o TRADITIONAL PRESSURE SWITCH MATERIAL/LABOR BREAK-OUT AS FOLLOWS:**

- MATERIAL: 55% - 60% OF TOTAL COST
- LABOR/OVERHEAD: 40% - 45% OF TOTAL COST

**o CRUISE CONTROL PRESSURE SWITCH MATERIAL/LABOR BREAK-OUT AS FOLLOWS: (GIVEN CURRENT SPECIFICATION)**

- MATERIAL: 72% OF TOTAL COST
- LABOR/OVERHEAD: 28% OF TOTAL COST

**o TEXAS INSTRUMENTS PRODUCES IN EXCESS OF 10KK DISCS/YEAR FOR SNAP ACTING PRESSURE SWITCHES.**

- 20+ YEARS OF DISC MANUFACTURING EXPERIENCE

**o CRUISE CONTROL PRESSURE SWITCH REPRESENTS BREAKTHROUGH IN AUTOMATED NESTING OF TERMINALS.**

- CCPS REPRESENTS STATE OF THE ART IN SNAP ACTING PRESSURE SWITCH DESIGN AND MANUFACTURE.

CLD/DAA

TI-NHTSA 7893

**FORD SWITCH COMMODITY TEAM VISIT  
CRUISE CONTROL PRESSURE SWITCH**

**TIMING ISSUES**

- o IN ORDER TO MEET MY92 PRODUCTION START-UP, IT IS NECESSARY TO ORDER PRODUCTION ASSEMBLY TOOLING NO LATER THAN NOVEMBER.
  - NEED FORD RELEASE TO BEGIN ORDER OF TOOLING.
  
- o TOOLING NEEDS TO BE IN PLACE 3-6 MONTHS PRIOR TO JOB 1.
  - NECESSARY TO HIT IN-PROCESS PHASE 1 REQUIREMENTS.
  - AN 11/89 TOOLING RELEASE WILL RESULT IN TOOLING BEING IN PLACE 2/91.
  - ASSURES ANY NECESSARY DE-BUGGING WILL BE COMPLETE PRIOR TO JOB 1.

CLB/DAA

TI-NHTSA 7894

## QUIET SWITCH - PRELIMINARY STUDIES

TI CONFIDENTIAL  
TI STRICTLY PRIVATE

### I) Plastic connector stability

**Purpose:** To determine the acceptable pin lengths for quiet switch production given that the quiet disc has a smaller pin window. Also to evaluate the effects of a connector material change to increase the pin window so the device could be manufactured cost effectively.

**Procedure:** Devices were assembled at various contact preloads (pin lengths) using both celenax and noryl connectors. If the material changes dimensional with temperature it can result in an increased or decreased actuation pressure. The actuation and release pressures were measured at low and high temps.

**Results:** The results for Celenax are shown in Figure 1. Noryl results are shown in Fig 2. The Noryl provided stable actuation and release pressure over a greater pin range. This matches other test results showing greater dimensional stability with noryl. During the test the parts were exposed to temps from -40 to +150, one cycle and there was no visual impact on the material.

### II) Plastic connector stability

**Purpose:** Understand the ability of Noryl material to survive the typical underhood automotive environment.

**Procedure:** Connectors were fully qualified in Noryl material for an underhood Automotive Pressure Transducer (APT). This includes thermal cycling, chemical resistance, dimensional stability, impulse testing, impact strength, etc.

**Results:** The Noryl is fully qualified as a connector to 135C. Long term storage has been acceptable at 150C.

### III) Quiet Disc development

**Purpose:** A lower differential disc was needed to reduce the sound generated when the disc snapped.

**Procedure:** Various discs were developed. The differential was measured by building the disc into a sensor assembly and then measuring the disc deflection vs pressure with an lvdtd(linear variable differential transformer).

**Results:** Figure 3 shows both a noisy production disc and a quiet disc. Note that the differential has been reduce from 100psi to approx 30psi. Correspondingly the available pin window has been reduce from 14.5 mils to 10 mils.

### IV) Switch sound evaluation

TI-NHTSA 7895

**Purpose:** To quantify the sound level from different switch configurations and to identify the source of the sound.

**Procedure:** Switches were mounted on an air calibration stand. An accelerometer was attached to the top of the switch using beeswax. The accelerometer axes was along the long axis of the switch. A microphone was mounted on a "Y" fitting to the switch pressure port. The accelerometer and microphone signal were feed into a spectrum analyzer.

**Results:** The result for a production "noisy" switch is shown in Figure 4 & 5. Figure 4 shows the frequency decay, while figure 5 shows the frequency spectrum or resonant frequency. Figure 6 shows a quiet disc. The quiet disc clearly produces less acceleration and less noise. The same evaluation held true on a hydraulic system.

Pressure shift vs pin length at various temps: CELEMAX

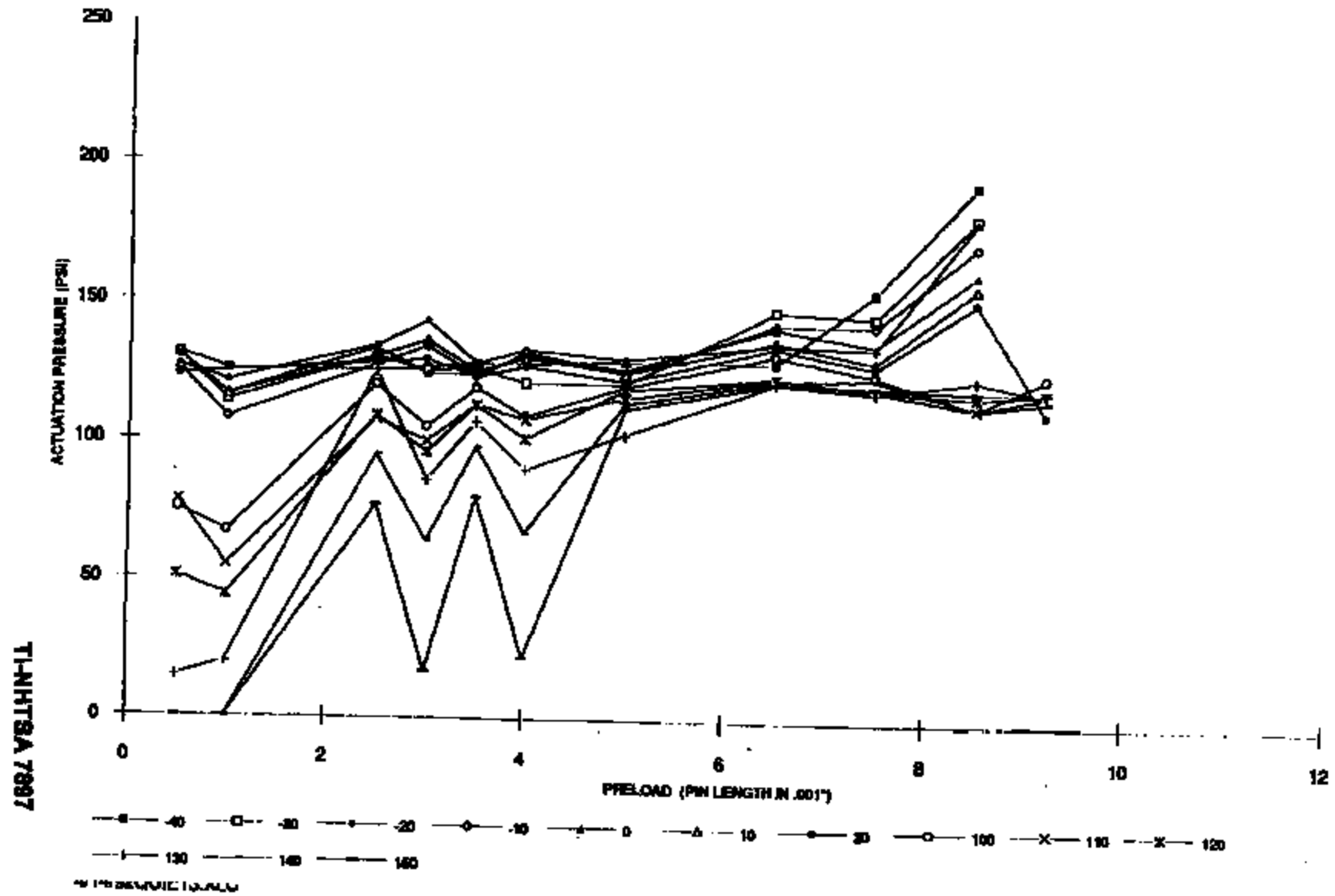
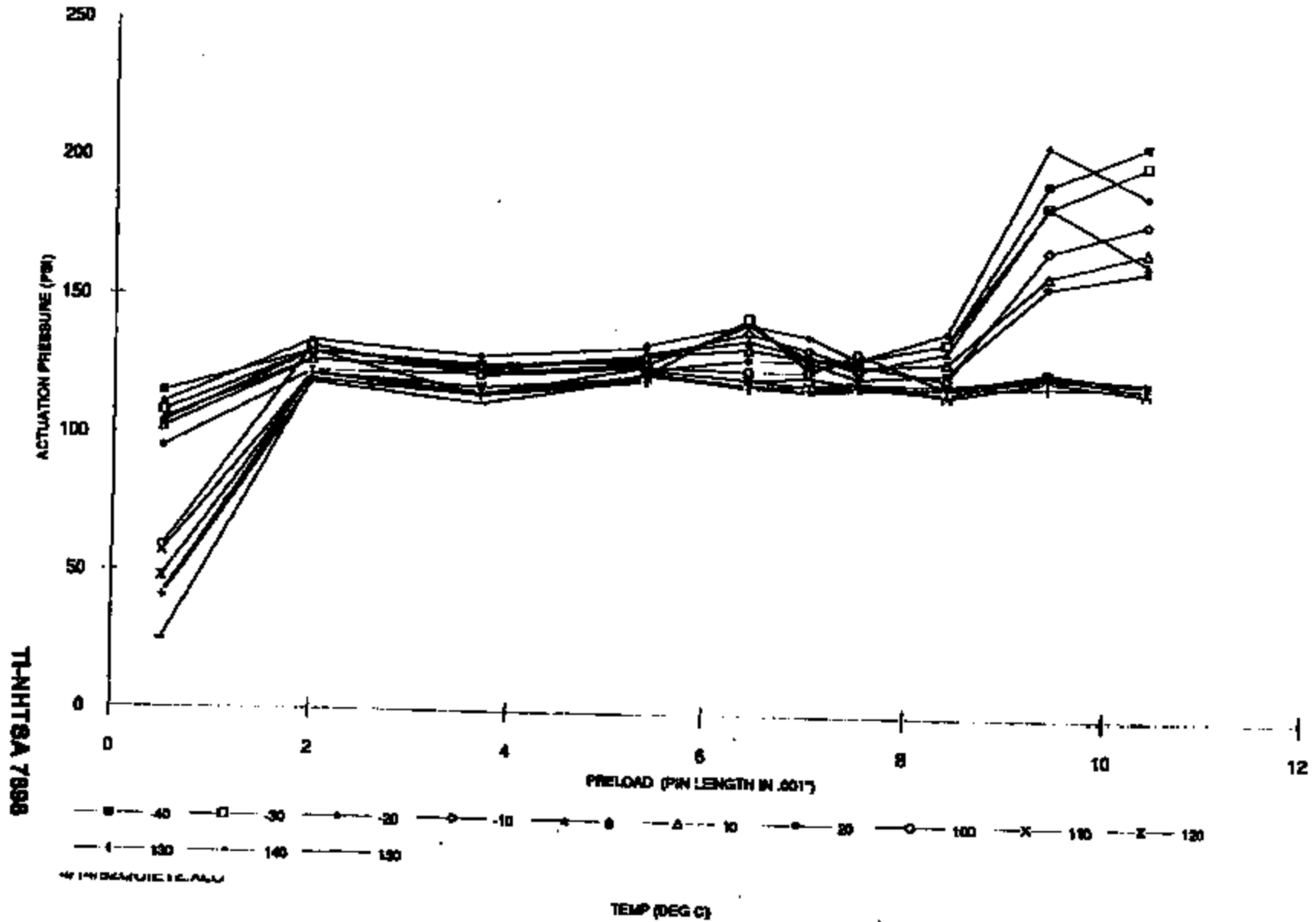


FIG 2

Reverse shift vs pin length at various temps: KRYL



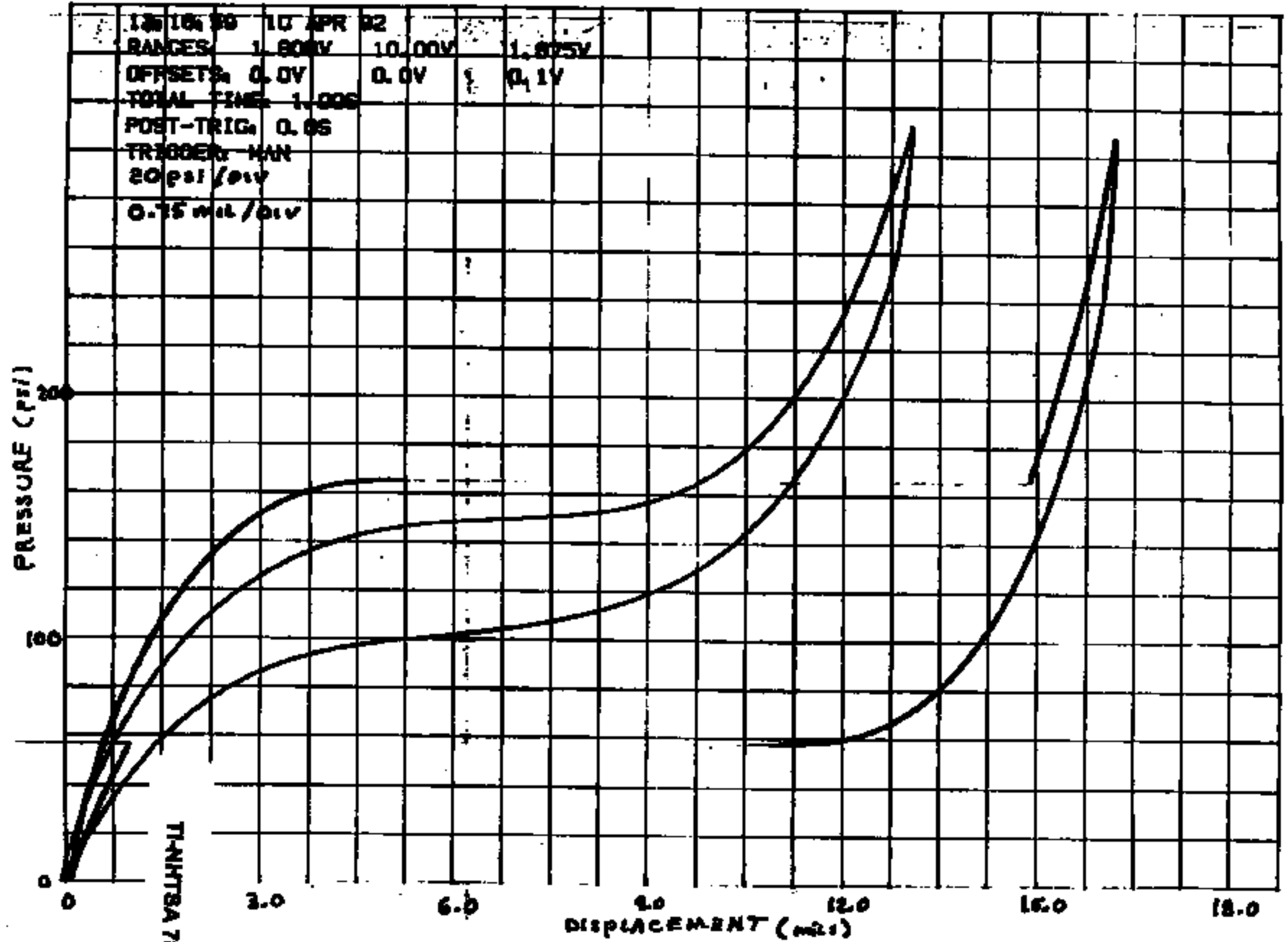
TI-NHTSA 7898

HYDRAULIC PRESS

FIG 4



12516 89 10 APR 82  
 RANGES 1.800V 10.00V 1.875V  
 OFFSETS 0.0V 0.0V 0.1V  
 TOTAL TIME 1.006  
 POST-TRIG 0.05  
 TRIGGER MAN  
 20 psi/div  
 0.75 mil/div



TI-NHTSA 7899

FIGURE 3



Bridal & Kjar

Type 2034

Page No.  
60

Sign.:

Name  
Object:

P2 ACUATOR

AIR

Comments:

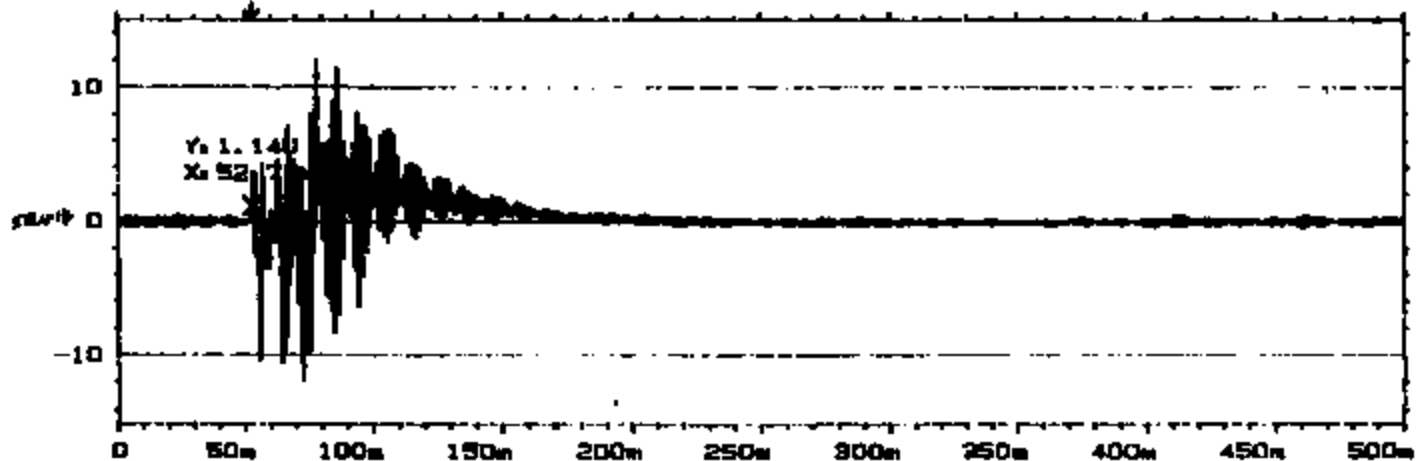
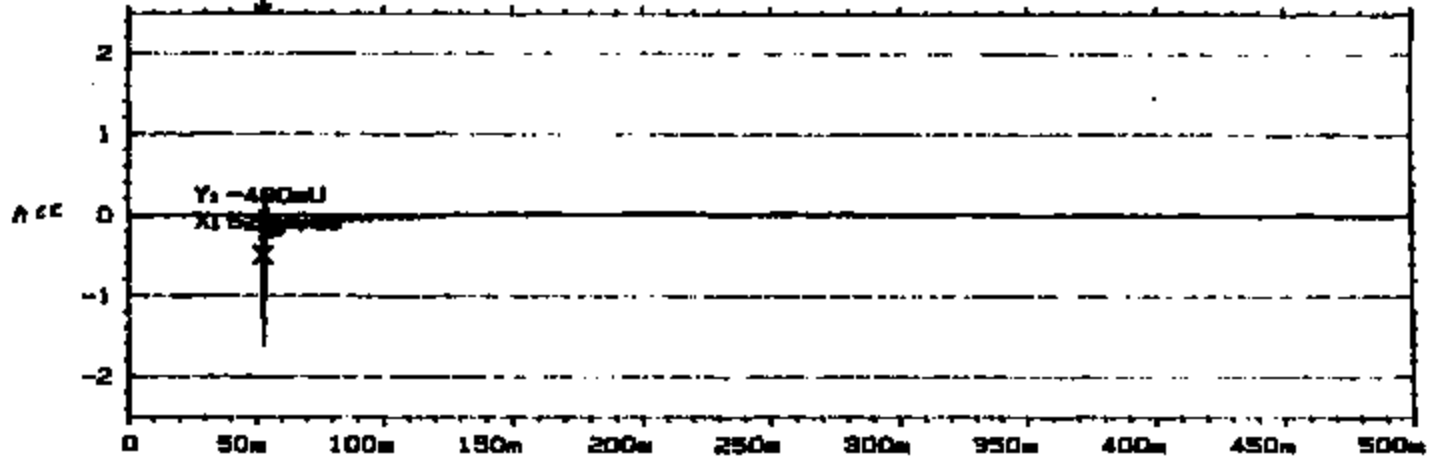
3/13/92 VRS

100V/g

TI-NHTSA 7800

W1 TIME CH. A REAL  
Y: 2.50U  
X: 0.00ms + 500ms  
SETUP W1 OVERLOAD

MAIN Y: -490mU  
X: 52.73ms



W1 TIME CH. B REAL INPUT  
Y: 15.00U  
X: 0.00ms + 500ms  
SETUP W1 OVERLOAD

MAIN Y: 1.14U  
X: 52.73ms

FIG 4



Bridel & Kjaer

Type 2034

Page No.  
39

Sign.:

Meas.  
Object:

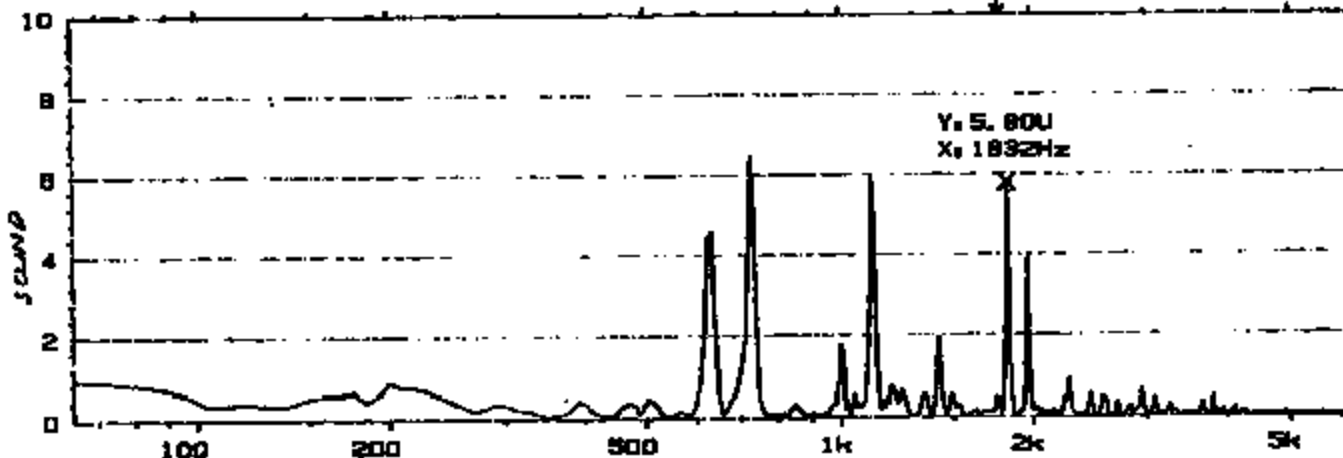
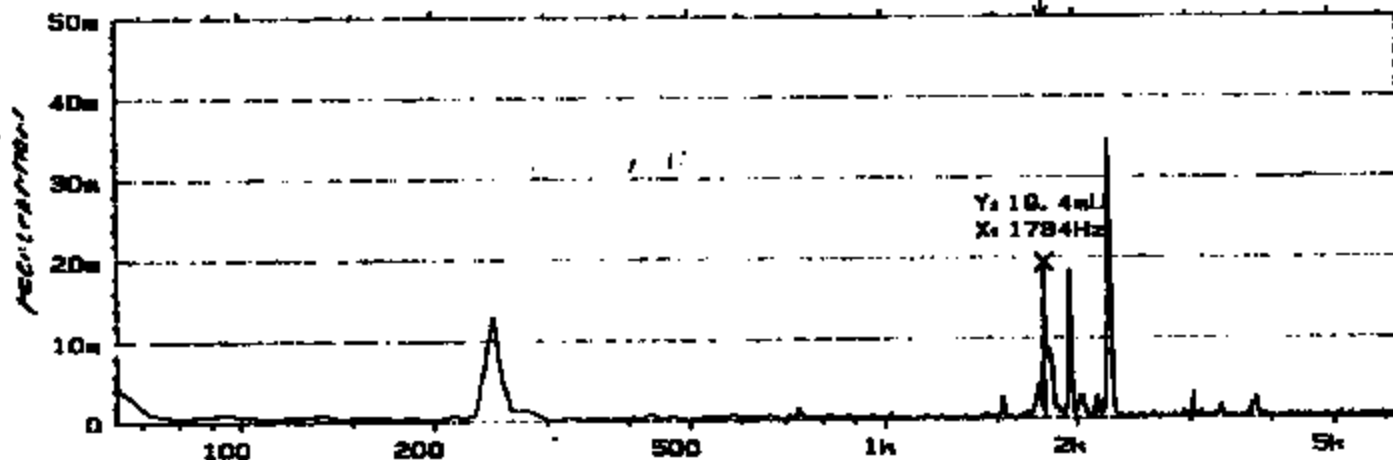
*DE RETURTION  
SLOW RAMP  
ACF = 134 ps;  
REL = 58  
AIR*

Comments:

*A = MICRO 'ACF'  
B = ACCELEROMETER  
LANDAU*

TI-NHTSA 7901

W1 INST SPEC CH. B MAG INPUT MAIN Y: 19.4mU  
Y: 50.0mU RMS LIN X: 1784Hz  
X: 84Hz TO 8.4kHz LOG  
SETUP W1



W1 INST SPEC CH. A MAG MAIN Y: 189mU  
Y: 10.0U RMS LIN X: 1784Hz  
X: 84Hz TO 8.4kHz LOG  
SETUP W1

FIG 5



Brüel & Kjær

Type 2034

Page No.  
45

Sign. :

Meas.  
Object:

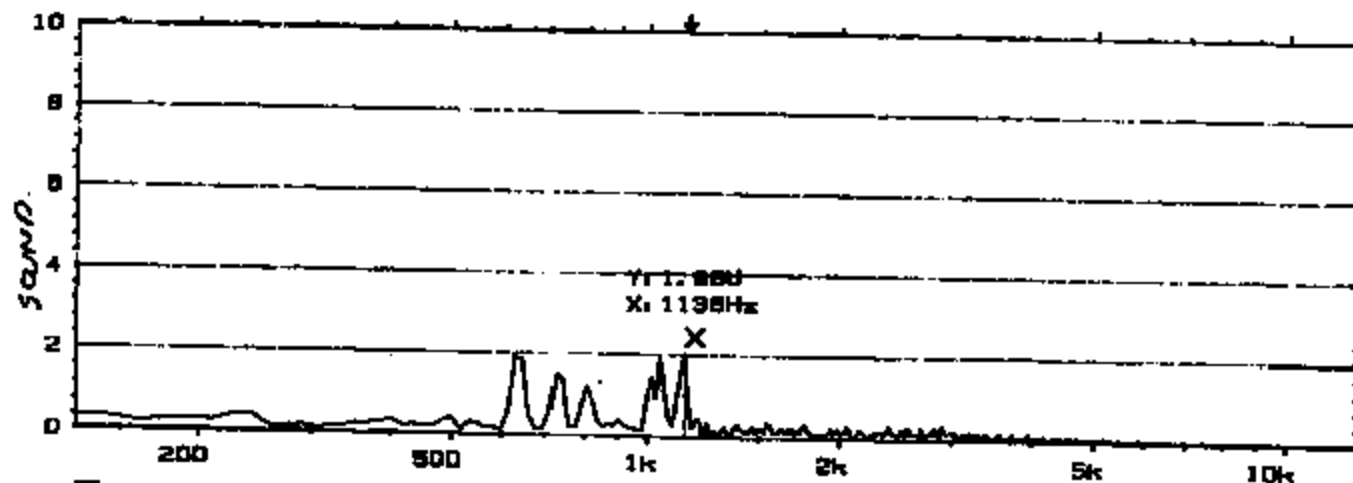
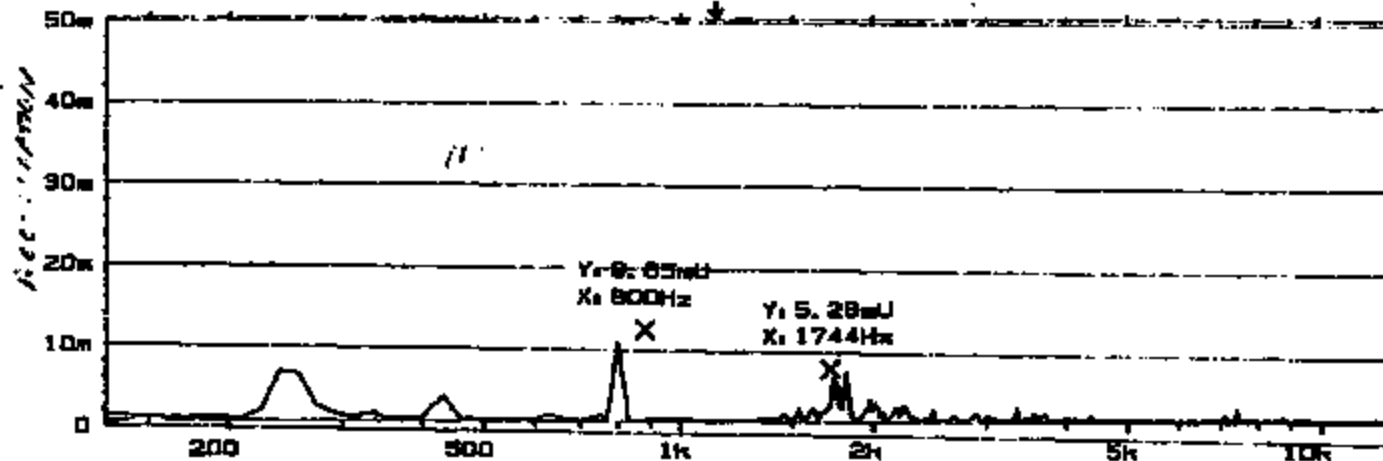
Q3. quiet stiel  
peruntori  
slow ramp  
air  
truck ENG?

Comments:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

W1 INST SPEC CH. B MAG  
Y: 50.0mV RMS LIN  
X: 128Hz TO 12.8kHz LOC  
SETUP W1

MAIN Y: 88.5µV  
X: 1136Hz



W1 INST SPEC CH. A MAG  
Y: 10.0U RMS LIN  
X: 128Hz TO 12.8kHz LOG  
SETUP W1 OVERLOAD

INPUT

MAIN Y: 1.98U  
X: 1136Hz

TI-NHTSA 7902

FIG 6

# INFORMAL R&R RESULTS TESTING ON HYD. SW. NOISE SETUP

	JEFF				HOWARD			RMSD BY AVG	
	1 RUN 2	2 RUN 2	3 AVG	4 DELTA	5 RUN 1	6 RUN 2	7 AVG	8 JULAT DELTA	9 RMSD DELTA
1	671	1000	836	+327	970	1005	1012	+147	+12
2	694	1091	892	+197	1130	994	1062	-136	-29
3	687	1085	831	+348	960	1000	980	+98	-25
4	177	1521	749	+1144	1310	1350	1338	+40	+1
5	775	1182	939	+227	1200	1290	1285	+10	+187
6	173	1020	672	+347	980	1040	1000	+88	-50
7	723	1117	880	+234	825	1123	994	+290	-143
8	707	1256	702	+554	1220	1200	1250	+68	-6
9	665	383	549	-122	1150	1140	1145	-10	N/A
10	715	976	846	+131	1040	1096	1088	+56	+92
11									
12		835/204				1110/134	58.5/111	8.3/95	
13		1186/116					31.9/77		
14	THESE								
15	TAKEN						152/201		
16	ON A			GR AVG			263	285	
17	DIFF.			1108					
18	DAY						263	285	
19	NIG						110 = 23.7%	1108 =	28.8%
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

REPEATABILITY → BASED ON HOWARD'S MEAS. W/ FLYER  
RMSD (AVG) IS 23.7%

REPRODUCIBILITY → JEFF'S SINGLE SET VS. HOWARD'S AVG (JD#9 REMOVED)  
IS 25.8%

A.D. 920515

DATA FOR OPERATOR HOWARD

PART	TRIAL					AVG	RANGE
	1	2	3	4	5		
1	938	1085				1011.5	147
2	1130	994				1062	136
3	960	1000				980	40
4	1310	1350				1330	40
5	1280	1290				1285	10
6	960	1040				1000	80
7	825	1123				974	298
8	1220	1280				1250	60
9	1150	1140				1145	10
10	1040	1096				1068	56
11	$\bar{x} = 1081.5$	$\bar{x} = 1139.8$				NA	0
12						NA	0
13	$\sigma_{n-1} = 161.75$	$\sigma_{n-1} = 125.7$				NA	0
14						NA	0
15						NA	0
16						NA	0
17						NA	0
18						NA	0
19						NA	0
20						NA	0
21						NA	0
22						NA	0
23						NA	0
24						NA	0
25						NA	0

GRND AVG: 1110.55      AVG RNGE: 97.7  
 UCL FOR INDIVIDUAL RANGES 951.5137

ENTER STUDY TITLES IN CELLS A8,A9,A10. MIN/MAX SPEC IN B12. B13  
 NOISE SWITCH PULSE LEVEL

MIN SPEC  
 MAX SPEC  
 TOLERANCE 0

DATA FOR OPERATOR JEFF

PART	TRIAL					AVG	RANGE
	1	2	3	4	5		
1	671	1000				835.5	329
2	694	1091				892.5	397
3	657	1005				831	348
4	177	1321				749	1144
5	775	1102				938.5	327
6	173	1090				631.5	917
7	723	1117				920	394
8	707	1256				981.5	549
9	665	383				524	282
10	715	976				845.5	261
11						NA	0
12						NA	0
13						NA	0
14						NA	0
15						NA	0
16						NA	0
17						NA	0
18						NA	0
19						NA	0
20						NA	0
21						NA	0
22						NA	0
23						NA	0
24						NA	0
25						NA	0

GRND AVG: 814.9      AVG RANGE: 494.8  
 UCL FOR INDIVIDUAL RANGES 951.5137

161-01-30

SAMPLE ORDER

ORDER NO: 0091-73

REQUEST DATE: 07/17/91

CREDIT ACCOUNT: 5902

COST CENTER: 101

PRODUCT CODE: 060

CUSTOMER: FORD MOTOR COMPANY

CUSTOMER P.O. NO: U-62975

TI PART NO: 77PSL2-1

CUSTOMER PART NO: [REDACTED]

QUANTITY: 30

PRICE: \$12.00 EACH

DELIVERY PROMISED: 1 - 6/28/91 (ALREADY DELIVERED)  
18.2+ - 7/17/91 (QTY THIS BUILD)  
3 - 7/17/91 (STAPLS-1 SHIPPED W/ 7/17)

THESE PARTS (DTUNE 1176 - JUNE 25 '91) FOUND IN SHD LPP CARS

BILL TO:  
FORD MOTOR COMPANY  
P.O. BOX 1704  
DEARBORN, MI 48121

SHIP TO:  
FORD MOTOR COMPANY  
2000 ROTUNDA DRIVE  
RM 3001 - BLDG #5  
DEARBORN, MI 48121  
ATT'N: TIM ANDRESEN

XX PRODUCTION SAMPLES

ENGINEERING DEVELOPMENT SAMPLES

CC: ENGINEERING: STEVE OFFILER

PRODUCTION CONTROL: MARIE CROSSLAND

SALES ENGINEER: JOE SCHUCK

Prop.cars ?? LPP

1176

FZUC - 32424-AB  
says "guset" on it

pointed on plastic  
white

TI-NHTSA 7906



Bruce Macroff → CONF CALL

SOP

AB3.... plus proposed AB2 for ENS3  
AB3 for SHD

Data 20K cost at 5B11 (ON STRIKE)  
Prod cap by 13th APRIL @ TI

Sub → prep value for AB5

Data → T-fitting junction block NON-AB5 @ 5% of vol.

Hi activation issue resolution - billion eval → 200ps. costs vs  
Bruce resolving → Data waits in waiting from FORD  
→ issuing alert temporary alert

Tie Data in to running change, new PN etc. agreement in  
system y chg P/N

Access-the-boarder? ASFord get into it later COST ISSUE  
AB5 ENS3 15%  
PN36 100%

Purchasing → Judy talking to buyer;

Build ~ St Thomas or @ Data

What lists not complete? As Input only for next Mon.  
WRITE THIS & FAX TO BRUCE env. but data on May!  
# samples? to this.

On-track for 4/13 provide sw's from prod. pilots

OKAY → 20 PC SHIP OUT TODAY FOR AB2 ENS3.

Parts into St Thomas by Tue A.M. must reach customs  
8-5 on Mon 4/13

OPTION: Send 1,000 for 1st day direct to St Thom

AB3 prog on making part w/ office? Washer supplier  
20K per year more AB2 w/ pressed-in office  
cost is a minor issue Bruce talk to buyer  
MUST WASH VEHICLE → THINGS?.... 50 PC by PROD  
MAN 4/13 2 PP JOB 1 w/ AE SAME 45-90 by CHG

HIT BEFORE THIS IT

22-141  
22-142  
22-143  
22-144





INVEST TO:

FLUT SW'S; WANT DATA ON GND-B-LFC

1. INCLUDE FIRST 5-10 ULTRA-LOW DIFF SWITCHES (A32) BEGINNING 4/7 - TO BE PROD'D TESTED - AND PROVIDE SWITCHES TO MAEROFF FOR EVALUATION ON VEHICLES ON 4/8/92 (BRIF 4/6).  
ACTION: SOGGE/SELLERS

2. COMPLETE PILOT RUN OF DISCS IN VOLUME BY 4/8 AND PROVIDE FEEDBACK TO MAEROFF BY 4/10.  
ACTION: BALLARD/CHEST

3. PILOT PROD'D DEVICES BEGINNING 4/13; FEEDBACK TO MAEROFF REGARDING CAPABILITY.  
ACTION: SELLERS/SWEET

4. BUILD 30 SWITCHES WITH ULTRA-LOW DIFF'L DISCS AND BLACK NORYL BASES.  
- SHIP 20 TO NORM F. ON FRIDAY, 4/3; FOR DELIVERY TO TOM ANDRESON FOR 2PP BUILD ON SHD TAURUS.  
- USE BALANCE FOR TESTING IN ITEM 1.

JEFF.  
- COORD BUND  
OF 40 DISKS  
- BALE SORT  
#20 LOWEST SHIP

5. FIXTURE A SET-UP FOR HI AND LOW TEMP TESTING QUIET SWITCHES.  
ACTION: SOGGE/CZARN

6A. TEMP CHAR. OF NORYL AND ULTEM BASES.

6. REVIEW PERMA -> WHAT ARE WE MISSING?

7. ESTABLISH A PROD'D FLOW CHART AND NOTE WHERE ANY FIXTURING/BPC FILES, ...ETC. ARE NEEDED.  
ACTION: SELLERS/SWEET

8. F31 ON NORYL BASE - VS. ENVELOPE DIMENSION.  
ACTION: WATT

IS THIS GOING TO BE OKAY FOR THIS MAT'L ?? (Jim)

ACTIONS FROM 4/1/92 A.M. MEETING:

• BUILD P/C SWITCHES W/ NORYL AND ULTEM BASES AT VARYING "EFFECTIVE PIN LENGTHS" OR PRE-LOAD; FROM 0 TO 10 MILS.  
- SOGGE/SELLERS

• EVALUATE CHANGE TO CATEGORIZING BASES INTO 2 GROUPS - ONE AT 0 TO +.002; ONE AT 0 TO -.002 (TOLERANCE AROUND NOMINAL).  
- SELLERS

GARDS,  
VE CZARN  
t

DALE -> H & P SIMILAR IN CHAR.

35 MM# 00575561 FR=DT1 TO=SBO1 SENT=04/02/92 07:44 AM  
R#=#36 ST=D DIV=0050 CD=00101 BY=DT1 AT=04/02/92 07:44 AM

APR 2, 1992

: BOB SALLARD ETD  
: CHARLIE DOUGLASS CPPC  
: DICK BARIERY MFPC  
: STEVE OFFILER SBO1  
: MATT GELLERS PCME  
: DALE BOGGE AELB  
: BILL SWEET PCME  
: JIM WATT PCQA

: TOM CHARBONEAU TC  
: GARY SNYDER CPPC

: DAVE ZARN ZARN

: COPS QUIET SWITCH  
: ~~XXXXXXXXXXXXXXXXXXXX~~

SUMMARY OF OUR CONFERENCE CALL WITH BRUCE MAEROFF AND TIM ANDRESON  
FORD P&G, AND OF OUR 4/1/92 MORNING MEETING.

I NEED FOR A QUIET SWITCH HAS BECOME A TOP PRIORITY FOR FORD ON  
EN53 (CROWN VIC/GRAND MARQUIS) PLATFORM WHICH STARTED  
PRODUCTION IN FEBRUARY. IT'S ALSO A PRIORITY FOR SHO TAURUS WHICH  
ARTS UP EARLY 90Q2.

THERE ARE MANY THINGS THAT WE NEED TO DO IN THE NEXT TWO WEEKS TO  
MAKE THIS A SUCCESS.

WE ASKED DALE TO HOLD REGULAR MEETINGS, EVERY ONE OR TWO DAYS.  
PLEASE PROVIDE ALL THE INPUTS AND ASSISTANCE THAT YOU CAN.

SUMMARY OF TELECON:

WE AGREED THAT ULTRA-LOW DIFF'L AND NO SNUBBER WAS PREFERRED.

*F DISCS RE-HEAT-TREAT  
THESE ARE HARD INFO*

WE WILL BE TESTING LOW DIFF'L W/ SNUBBER ON EN53 (CROWN VIC/GRAND  
MAR) BY 4/2/92 AND ULTRA-LOW DIFF'L W/ NO SNUBBER BY 4/3/92.

THIS WILL DECIDE NEAR TERM DIRECTION; ONE OF THESE TWO WILL  
BE REQUIRED IMMEDIATELY.

EN53 ISSUE ELEVATED IN B. MAEROFF'S PRIORITY LIST BECAUSE HIS  
NEPT MFG DRIVE A VEHICLE W/ STD SWITCH AND FOUND IT UNACCEPTABLE.

ALSO, MAEROFF BELIEVES SERVICE DEPT'S WILL REPLACE M/C AND  
NUMBER OF COMPLAINTS ARE MADE BY CUSTOMERS => \$\$.

TI-NHTSA 7910

MARKING OF PARTS SENT TO MAEROFF 4/1/92:

LOW D DIFF' SNUBBER	77PSL5-1	F2VC-9F924-AB1	LOT H DISCS
ULTRA-LOW DIFF'L	77PSL3-1	F2VC-9F924-AB2	LOT P DISCS - NOT TRUE VLD



DATE 5000E 3/27/92

30000 30000 30000  
 30000 30000 30000  
 30000 30000 30000

	DISC			PASSENGER CAR CUP				TRUCK CUP			
	ACT	REL	Δ	ACT	REL	FIN WINDSH	TOTAL TIRROW @ 700PSI	ACT	REL	FIN WINDSH	TOTAL TIRROW @ 700PSI
ULTRA LOW DIFF B-3 TRUCK DISC	27.9	26.5	1.4	168	131	2.1 CAMPER	13.9	28%	220	1.1	21.3
LOW DIFF 3D TRUCK DISC	29.8	27.4	2.4	186	146	3.0	15.3	31%	234	3.0	21.1
LOW DIFF 2D TRUCK DISC	30.0	27.4	2.6	178	138	2.8	12.5	30%	228	3.7	20.0
MODERATE LOW DIFF B1 TRUCK DISC	29.7	25.4	4.3	181	145	4.2	15.6	31%	226	4.2	21.2
PRODUCTION TRUCK DISC											
ULTRA LOW DIFF CAR DISC											
MODERATE LOW DIFF CAR DISC COAST .0125" PROTRUS	22.6	19.6	3.0	136	96	3.3	12.5				
PRODUCTION CAR DISC			11	136	59	5.8	14.5				

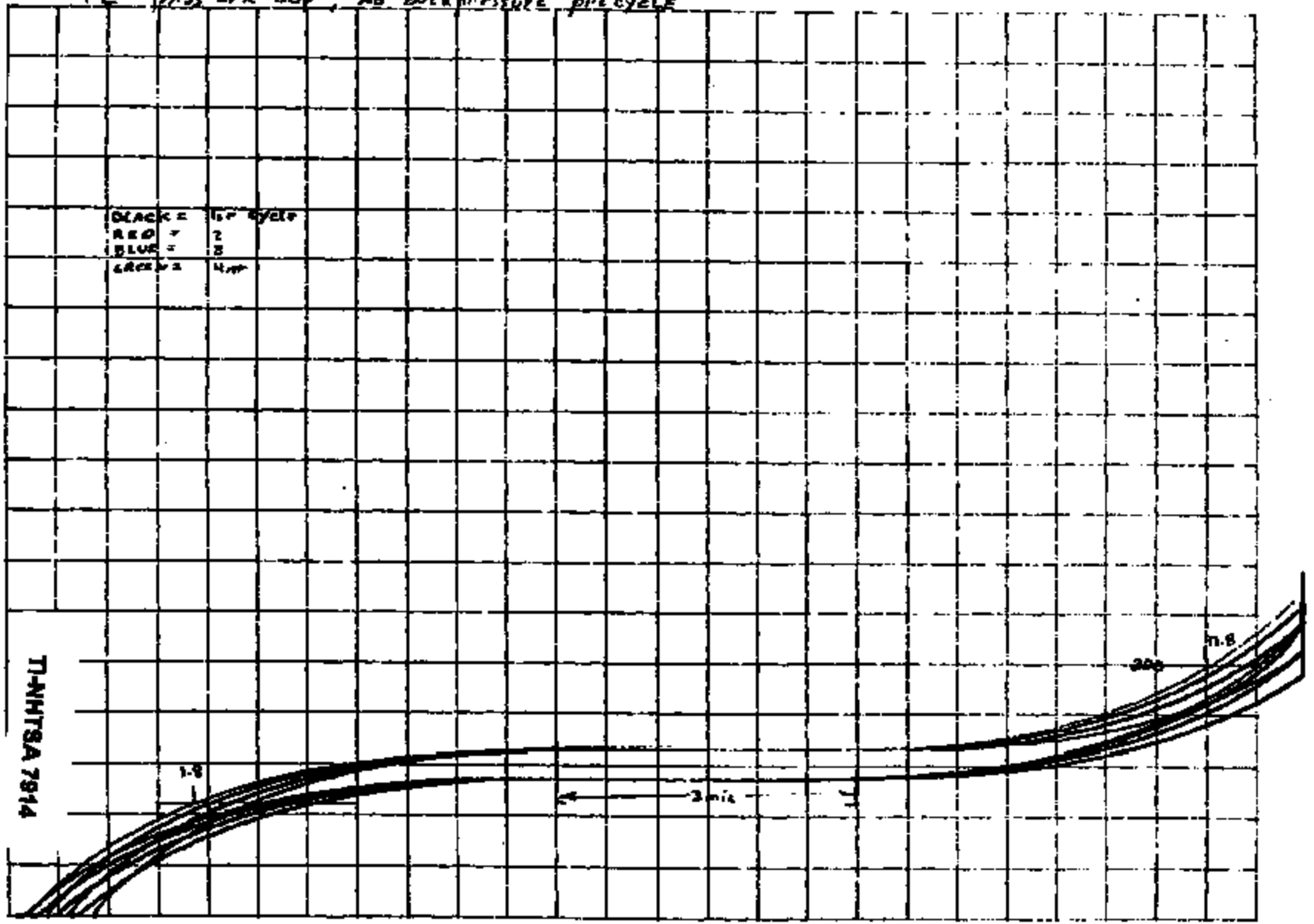
TJ-NHTSA 7012



F2 GAS CRU GUP, NO OVERPRESSURE, PILE CYCLE

BLACK	=	1st cycle
RED	=	2
BLUE	=	3
GREEN	=	4th

TI-NHTSA 7514

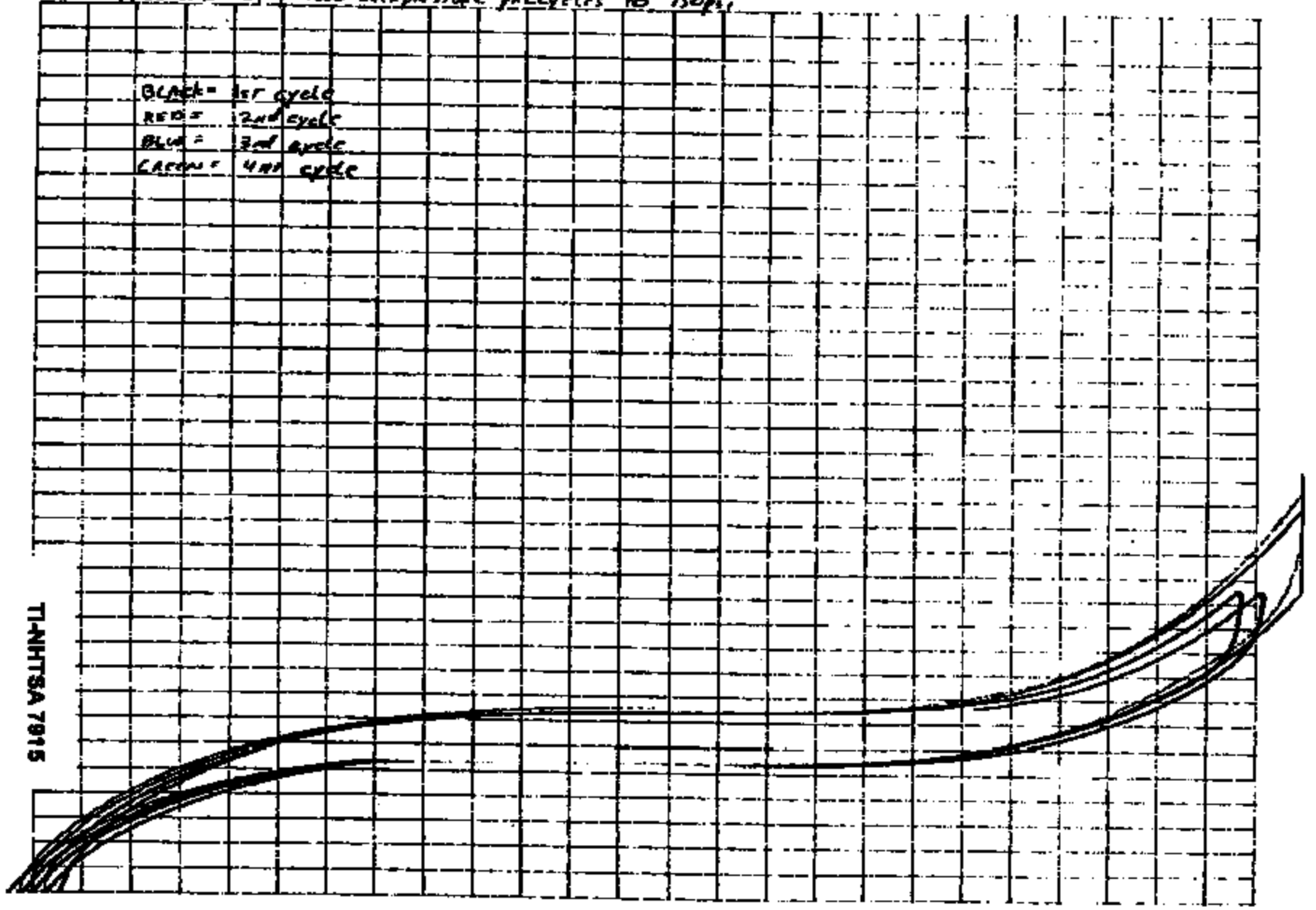




F3 PRESS CAP SUP. TWO DISPERATURE PALCYCLES TO 750psi

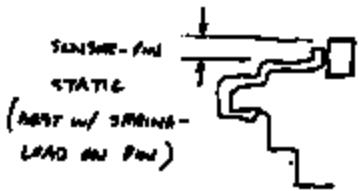
BLACK = 1ST CYCLE  
RED = 2ND CYCLE  
BLUE = 3RD CYCLE  
GREEN = 4TH CYCLE

TI-NHTSA 7915

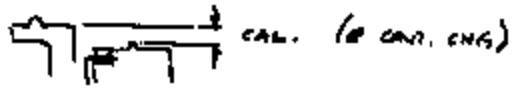


SILENT SW MYS - RALE

SEP. BASE UNLOAD, INSTEAD OF 1:00Z DO -10Z AND +10Z  
 THEN USE 2 PIN LENGTHS 2 MILS APART  
 USE X-Y CURVE, CASE PIN IN SENSOR, USE TO ADJUST



PIN - CAL = OFFSET



CRIMP SHIFT:

INIT IS W/CB, FINAL IS W/CR  
 FINAL - INIT = SHIFT

FINAL THICK, SHIFT NEGATIVE  
 SHIFT ADDS ALGEBRAICALLY TO CAL

8 MILS > BASE  
 BASED ON PI DISC W/O CURVE

PIN (NOTE: INCLUDE A CRIMP-SHIFT ADJUST. TOO!)  
 ↳ W/ NARYL

JIFF BUILDING SAMPS TO GO TO FLA ON WED. 4/1

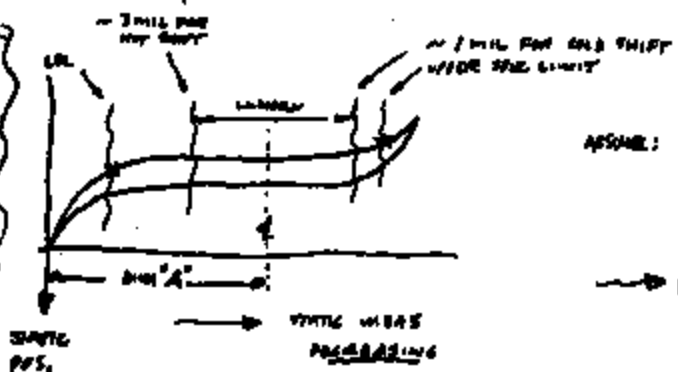
- USE SENSORS (DALE HAS)
- USE NARYL (LOUIS)
- ↳ BOPED USING 'B', CHG CRIMP SHIFT

2 TO FLA.  
 1 TO UGT.  
 1 FOR US  
 BY DR EXC @ 150°C  
 WATT

"SPRING PRELOAD" THIS IS TERMINOLOGY FOR ABOVE CALC.

CODE: FEVC-9F924-AGZ

- 1 CASE RATE
  - 2 ADD SHIFT
  - 3 THIS IS BASE CAL.
  - 4 BASE SENSURE STING
  - 5 H/L IS:
- $(3 + 2) + 2 \times 10^{-4}$



- ASSUME:
- 1: .067
  - 2: -.2
  - 3: .005
  - 4: .059
  - 5: .147 PIN

↳ DIM 'A' IS SPRING PRELOAD

22-141 22-142 22-143 22-144 22-145 22-146 22-147 22-148 22-149 22-150 22-151 22-152 22-153 22-154 22-155 22-156 22-157 22-158 22-159 22-160 22-161 22-162 22-163 22-164 22-165 22-166 22-167 22-168 22-169 22-170 22-171 22-172 22-173 22-174 22-175 22-176 22-177 22-178 22-179 22-180 22-181 22-182 22-183 22-184 22-185 22-186 22-187 22-188 22-189 22-190 22-191 22-192 22-193 22-194 22-195 22-196 22-197 22-198 22-199 22-200

**8 DISCIPLINE REPORT**

8D No. \_\_\_\_\_

**(1) TEAM CONTACT:**

ASSIGNEE: Steve O'Neil, Texas Instruments  
 PHONE No.: (508) 998-1382  
 CRT #:  
 DATE OPENED:  
 DATE CLOSED:  
 STATUS:

YEAR/VEHICLE LINE: MY93 Taurus/SHO  
 INITIATOR: Tom Andressen  
 PLANT:  
 PART NUMBER: F2VC-9F924-AB  
 CRCR #:

**(2) PROBLEM DESCRIPTION & SOURCE/RANK DESCRIPTION:**

**What:** A slight audible noise and tactile feel in brake pedal noted on vehicles with Next-Generation Electronic Speed Control with TI Deactivation Pressure Switch mounted directly into Texas tandem master cylinder.  
**Who, Where, When:** Tom Andressen, Product Design Engineer in Pass Car Brake Eng., contacted TI in writing 911009. At this time he returned a prototype switch to TI which was taken from an SHO Taurus evaluation car in Florida.  
**How:** During prototype evaluations.  
**Why:** Apparently a snap-action, which is a specific designed-in feature of the TI brake pressure switch, is being transmitted through the master cylinder as noise.  
**How Many:** All Taurus/Sable with Electronic Speed Control using direct master-cylinder-mounted pressure switch.

<u>SOURCE/RANK</u>		<u>INSP.</u>	<u>FOCUS EVAL.</u>		<u>FIELD</u>	<u>RANK</u>
<u>OWN</u>	<u>MAN</u>	<u>PROBE</u>	<u>STUDY</u>	<u>WARRANTY</u>	<u>FLEET</u>	<u>FIRST RUN</u>
					<u>LIASON</u>	<u>OTHER</u>
						<u>(1-8)</u>

**(3) ROOT CAUSES:**

The noise issue seems to be rooted in the overall hydraulic system, and results from the snap-action of the pressure-sensing elements of the TI pressure switch. The amount of noise actually generated in the passenger compartment is highly dependent on the hydraulic system and the placement of the pressure switch within that system. The present snap-acting switch has been validated to meet all of the requirements of Ford E3-F2VC-9F924-AA, and was not initially designed to an audible noise criteria. This concern has also been raised at St Thomas Assembly Plant, and it was discovered that ENE3's with ABS do not seem to exhibit this issue, theoretically due to the fairly remote placement of the switch relative to the master cylinder. Experiments conducted at TI on a MY92 Sable equipped with MY85 Texas ABS tandem master cylinder, into which the switch mounts directly, showed that noise was an issue. Benchtop testing of the switches does not show any evidence of noise, further supporting the belief that this is a system-related issue.

**(4A) ACTIONS**

Identify as Interim (I)  
 Permanent (P)/Service (S):

ACTION DATE  
TAKE EFF. DATE

**(B) VERIFICATION (Interim-Permanent): BEFORE AFTER**  
SHOW DATE, MEAS. & VARIATION  
INDICATORS:

(I) No specific interim containment actions have been identified. Bob Montgomery at STAP requests a Job 1 '93 permanent fix for ENE3. Any changes to the switch are fundamental in nature and require development. The present snap-action switch meets all Ford E3 requirements.

Prototypes of both of the permanent corrective actions have been shown to eliminate the noise issue in testing at TI and at STAP. Also, the stubber configuration has been used successfully on Ford FAN E76C-3N824-AA and E80C-2C283-CA which are also brake pressure switches.

(P) Two potential solutions are being pursued. Both employ manufacturing technology which serves to reduce the energy which is released as audible noise. One solution combines this with a stubber which is a small orifice in the fluid passage which slows the rate of fluid flow hence noise transmission. The other solution reduces the energy (snap noise) to a point that the stubber is not needed.

**(7) PREVENTION:**

With the exception of the Taurus/SHO and WNE6, all switches provided to Ford during all pre-production evaluation phases have contained a distinct snap-action feature. Reduced snap-energy prototypes have been in development for the exceptions noted. Evaluation of pre-production devices by Ford in a timely manner is required to prevent further issues in production.

**(8) CONGRATULATE YOUR TEAM:**

[ Denotes change/new item

Date Revised: 920331

**OTHER CURRENT/FORWARD MODELS AFFECTED (YES/NO). Blank = Not Analyzed**

Escort	Tracer	Tarp/Tpz	Tau/SHO	Tau/SHO	Cougar	Mustang	Conti	Mark VII	Twn Car	CVRGM	ENE3	FN10	FN74
F-Series	Bronco	Ranger	Explorer	Econ	Aerostar	VN88	WNE6						

TI-NHT8A 7917

# TEXAS INSTRUMENTS



## FACSIMILE TRANSMITTAL

Before sending any material via facsimile machine:

- Call the recipient to advise you will be transmitting material to them.
- Verify correct telephone number so the recipient will know where to pick up the material.
- Total number of pages being sent.
- Determine type of equipment to be used so adjustments can be made, if necessary.

TO	FROM	DATE	TIME	NO. OF PAGES
NORMA FREDA	STEVE O.			1
TO	FROM	DATE	TIME	NO. OF PAGES
TO	FROM	DATE	TIME	NO. OF PAGES

BRUCE MAEROFF

COMPANY NAME/LOCATION:

FORD

MAIL STATION:

TELEPHONE NUMBER:

FACSIMILE PHONE NUMBER:

313-523-1924

From:

NAME:

STEVE OFFILER

COMPANY NAME/LOCATION:

TI ATTLEBORO

MAIL STATION:

12-29

TELEPHONE NUMBER:

508-699-1382

FACSIMILE PHONE NUMBER:

508-699-3153

Total Number of Pages  
(Including Header Page):

2

Additional Information:

BD



SALES AND SERVICE  
POLICE  
22-141

@ ST THOMAS FRI 7/20

LISTENED TO GRAND MARQUIS DESCRIBED AS A  
LITTLE WORSE THAN AVG - NOISE VERY OBVIOUS  
IN PASS COMP. ; SPRT SHOWED GREAT NOISE ON SW  
& INTERFERED NOISE W/ SW.

ALL LINE - WEATH. BRACE BLOCKS W/ AIR SW (ON ~~ASS?~~)  
DUAL PROP-VALUE (NON-~~ASS?~~) PITTS?  
FRAC2 (309) BA  
THIS CAR NON-ASS

CHASSIS LINE:

ABS VEHICLE USING DUAL PROP VALUES, WE ARE IN UNIT  
W/ THE RIGHT-REAR PROP VALUE; ALSO, NOTED STEEL-BRARD  
FLX-LINES COMING OFF W/C (TRAIL)  
ABS SOUND INAUDIBLE; VERY SILENT FUEL

→ NON-ABS VEHICLES, SPLIT F/R, WE ARE IN "T" FRONT WEATH.  
WHICH IS FRONT LINE - SINGLE LOOP FOR COMPLIANCE  
RATHER THAN STEEL BRARD  
W/C LOOKS LIKE TRAIL, W/ INTERNAL W/C PROP VALUE  
FRONT 1/2 OF W/C IS FRONT AXLE'S BENDIX

NON ABS SOUND AUDIBLE

BOB MONTGOMERY PURSUE NON-ABS @ W/C

HAVE A CONCERN - "BD" EXISTS BOB IN TODAY  
TO PLAN MONT 3/21/93 CHG

- DOING AN IMPROVEMENT

- STUDY ~~W/C~~ WILL HAVE PROP - HAVE "CONCERN"

WERS CONCERN - NEED COST ESTIMATE → RELEASE:  
JUDY SIMONS

W/COM - TRACER - ALL TS'S HAVE ABS

DEVICES TESTED MAN TO PERSONNEL AVAILABLE

TI-NHTSA 7920

MSS M#: 0247219A CR=FFUN TO=SEC1 SENT=03/27/92 04:26 PM  
R#=127 ST#0 DIV=0050 CD=00101 PR=FFUN RT=03/27/92 04:26 PM

TO: Ted Hilland  
CC: Dave Grant  
Steve Offler  
DA: Dale Sogge  
SUB: Outlet Disc Panic Schedule

Ted has just supplied us with 500 discs heat treated at 600deg. These should have an ultra low differential (<2psi). He has also supplied 30pcs heat treated at 500deg with a 3psi differential. Both of these operate in right range for passenger car us. Thanks Ted.

Since we have made a preliminary determination that we need a 4mil dia window we do not expect these discs will be usable. Window checking on these will take place on 3/30.

Assuming we can't use them, we need to develop a new approach to obtain large throw with low differential. Ted and Karl Komb have suggested the following:

- .) Thicker disc stock to reduce the ringing at snap.
- .) Thinner disc stock to allow more travel for a given pressure.
- .) Change to a 455ss from 301ss. The 455 is soft and may not ring as much.
- .) Remove some of the disc material on the edges or center so that there is less material to give up energy during the snap.

I propose the following urgent timetable in order to meet the customer's needs. Ted, tell me if you can't make any of these dates.

- |   |      |      |
|---|------|------|
| .) approx 13psi actuation disc with 4psi differential- 500pcs                             | TED  | 4/2  |
| .) thick disc, approx 22psi act   | TED  | 4/2  |
| .) Thin disc,   | TED  | 4/6  |
| .) 455ss disc   | TED  | 4/6  |
| .) check sound from two equal temp discs with and without holes, if ok proceed with #6-Q. | Dale | 3/31 |
| .) supply blank discs for model shop to EDM   | TED  | 4/1  |
| .) EDM hole in disc   | DALE | 4/8  |
| .) Form discs with hole   | TED  | 4/10 |

Regards,  
ole

TI-NHTSA 7821

SILENT

PAUL MAEROFF

170'S ; TOLD B.M. ?? THIS

BD ON WIPY SW ....

Q WHY ? A USE THIS FORMAT

LIKE FAX TALKING (PRODM) TO NORM MOON  
FORMAL (MEMO)

313-553-1673

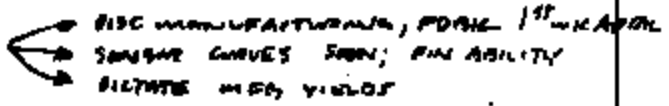
- DISK ; HOW FROM SUPPORTED
- SOURCE IS DISK SNAP
- WHAT WE'RE DOING ... (3)

OTHER SW'S TST ? RICH SATLITE

BD MENTION OTHER TWO ; "QUIET" VS "QUIETEST"

TRYING NOT TO PROMISE SOMETHING WE CAN'T DELIVER

- ULD TRYING TO ACHIEVE
- GIVE NO FIVE SLLS



NOT LOTS DISC / DUNKS THAT WRS

Φ's : 156 & 202 TOOL ST THOMAS OKAY

TEST PARTS 6-8 WRS

VAL - PASS IT DOWN TO

RECEIVED BY  
DATE  
TIME  
BY



BD

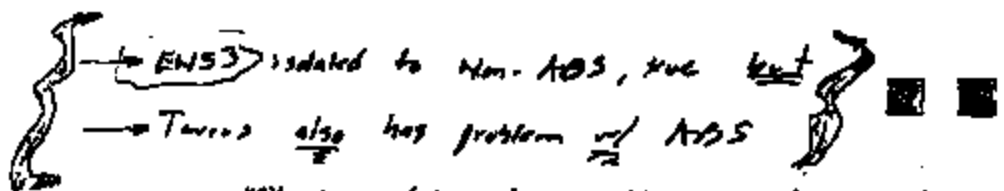
Macroff  
Norm → CD → us

✓ Format: we can create one, follow the fixed one

We're not admitting problem; just following Ford procedure/instr

...? try to make brief enough to fit on new format

Help Bruce M. reduce/revise his report pressure



Milestones / checkpoints disc processing + device processing  
given schedule makes assumptions to be validated @ given checkpoints

We've got a "SHO" stopper (!) for Taurus, not for EN53

July 29<sup>th</sup> for EN53..... comp of show, then move to EN53 + others — this date is \_\_\_\_\_

Val report's real att'n — our plan is impulse only; Ford?

\* (SEND POLICY VIA MEMO REQUESTS & PRINTS)

BD: Came across as system-related issue

next system needs by day sw

Switch presently fully needs ES

TI-NHTSA 7023

\* Remove - reduce implications of AOS/non AOS, include only to support "system" related issue (in Root Cause)

Include SHO Taurus

Verification remove undesirable side effects, intentional this eval for comp + MVA why w/o perf compromise we know on vehicle? we need to know the prof's why



# CONCERN ANALYSIS REPORT

Status Date: 920327

Concern/PCR No.	CR No.	Concern Title:	Date Opened	Assigned To
(2) Defense Concern ISSUE: A SLIGHT ANGLE HIT AND DAMAGE TO THE FRONT ENDAL AREA OF THE "BOMB" VEHICLES WITH NEARLY COMPLETE LOSS OF CONTROL.		Data Completed	Vehicle ENS3	Engine/Trans/Axle
S/S: WABCO, WABCO: AIR SYSTEM, SERVICE & BRAKE SYSTEMS; AND THE INSTRUMENTS, AIRLINE SYSTEMS, AT THE FRONT ASSEMBLY PLANT, FURTHER NOTES FROM THE TROOP.		Concern Code	Sold Date	Sold Date
S/S: S/S: WABCO: AIR SYSTEM, SERVICE & BRAKE SYSTEMS; AND THE INSTRUMENTS, AIRLINE SYSTEMS, AT THE FRONT ASSEMBLY PLANT, FURTHER NOTES FROM THE TROOP.			(1) Team/Activity - Phone DAVE CLARK (708) 699-3758 STONE OFFICE - 1805 PALE STREE - 1791 BAIT TELLERS - 1445 CHARLIE SCAMMEL - 1657 TIM WATT - 1719	

(3) Containment/ (4) Corrective Action (See Manual, S&A, etc) CONTAINMENT: THE EXISTING MEASURES OF THE JUNE TESTS IN FULLY WARE. AT THE TIME, THIS CONTINUED TO BE ONLY, NO SIGNIFICANT CONTAINMENT ACTIONS AND MEASURES, AND SIGNIFICANTLY AVOIDS A JUNE '93 ASSEMBLY COLLECTION.  CORRECTIVE ACTION: IT IS CURRENTLY WORKING ON THE DEFENSE INTERNAL SOLUTIONS. THE MAIN PROBABILITY SOURCE IS TO BRING A "BOMB" WHICH IS A SMALL DEVICE THAT INTO THE FRONT END PASSAGE, THROUGH THE AREA OF SLIGHT ANGLE HIT DAMAGE TRANSMISSION. THE MAIN PROBABILITY SOURCE IS TO REMOVE THE SHIP-ACTUAL PARTS.	% Solved	Effective Date	
		Supply	S&A

PCR AREA, TEL/TER Number -

(4) Define Root Cause: THE JUNE TESTS TO BE DONE IN THE SHIP-ACTUAL AREA OF THE FRONT ENDAL AREA, BUT THE AMOUNT OF MORE AIRLINE AVAILABLE IN THE ASSEMBLY CONTAINMENT IS ONLY DEPENDENT ON THE INTERNAL BRIDGE HYDRAULIC SYSTEM AS SUPPORTED BY THE LOSS OF ANY AIRLINE IN THE SERVICE AREA. FURTHERMORE, VARIOUS ACTIVITIES WHICH WERE DONE IN ITS QUANTITY BEING FOUND TO HAVE VARIOUS DEGREES OF HIT WHICH IN-FLUENCED BY A VEHICLE, PLACING SIGNIFICANT THE WABCO FLOOR WAS A SYSTEM-RELATED EFFECT. THIS ALSO POINTS AT THE NEED FOR AN AIRLINE BRIDGE SYSTEM (AS, AN ACTUAL ONE) TO CARRY OUT ASSEMBLY WORK AT IT'S ATLAS, WABCO FACILITY.	Root Cause Code	Current Date	Completion Date	Transfer Code	% Contribution (SEE COLUMN)
--	-----------------	--------------	-----------------	---------------	-----------------------------

TI-NHTSA 7924

If additional analysis is required include completion dates

(6) Verification of Containment/Corrective Actions  
 AT THE TIME RECEIVED OF AFTER IMPLEMENTATION LISTED IN IT'S CORRECTIVE ACTIONS NONE HAVE BEEN FULLY VERIFIED AT THIS TIME WITH POSITIVE RESULTS. ALSO, THE "BOMB" INVESTIGATION HAS BEEN USED SUCCESSFULLY AS WELL AS THE S&A-2004-01 AND S&A-2004-02 WHICH ARE ALSO BEING RESOLVED SYSTEMS. AN UNDESIRABLE SIDE EFFECT OF BRIDGE USE IS THE LIKELIHOOD OF AIR BURSTMENT AT THE BRIDGE IS ALSO AVOIDED IN SERVICE WITHOUT UNDERSTANDING VARIOUS ASPECTS. THIS SHALL BE ADDRESSED BY THE FULL OF SERVICE AREA AT ADDITIONAL COST. AN UNDESIRABLE SIDE EFFECT OF SHIP-ACTUAL ASSEMBLY IS THE BRIDGE ELEMENT OF THE INTERNAL BRIDGE, POSITIVE CHECK ALL INFORMATION AND SERVICE, ADDITIONALLY, THE BRIDGE IS HIGH LEVEL CHALLENGING TO MANUFACTURE.

(7) Action to Prevent Recurrence  
 ALL SERVICES ADVISED TO FIND THE INFORMATION BEING ALL AIR-RELATED AND WITHIN THE SHIP-ACTUAL PARTS, THEREFORE, THE ISSUE HAS BEEN RESOLVED ON ALL VEHICLES SERVICE, VARIOUS: A) NO AIR-RELATED WORK WITH THROUGHOUT EVALUATED -02- C) THE ISSUE IS ONLY BE MADE IN WORKS THAT IT HAS BEEN MADE WITH NEW.

Containment Action Date				Corrective Action Date			
Committed		Completion		Committed		Completion	
Define				Define			
Verify				Verify			
Implement				Implement			
Reporting Engineer	Date: Status/Class	Compliance Supervisor	Date				
<i>John Offin</i>	STATUS OF 920327	<i>ACTIA PR D. CLARK</i>	920327				

IN COMMUNICATE YOUR TEAM

MSG #4= 554710 FR-DT1 TO-BTB SENT-03/12/92 08:03 AM  
R#-533 ST-C DIV-0050 CC-00101 BY-DT1 AT-03/12/92 08:03 AM

MARCH 12, 1992

TO: TED BALLARD BTB  
JOHN KOURTESIS JKOU  
STEVE OFFILER SBOI  
MATT SELLERS PCME  
BILL SWEET PCME

CC: TOM CHARBONEAU TC  
CHARLIE DOUGLAS CPFC  
ED KADISEVSKIS EKAD  
GARY SNYDER CPFC  
DALE SOGGE AALE  
RICH TURNER RLE

FR: DAVE CERN ZARN

RE: CCPS SILENT SWITCH DEVELOPMENT

*Dale*  
↓  
*red*

EFFECTIVE IMMEDIATELY, DALE SOGGE WILL CHAMPION THE SILENT SWITCH DEVELOPMENT EFFORT. THE CHARTER WILL BE TO LAY THE GROUND WORK FOR STARTING PRODUCTION IN LOW VOLUME FOR MY93 AND HIGH VOLUME FOR MY94 AND BEYOND. IT WILL INCLUDE FINALIZING THE DESIGN REQUIREMENTS AND IDENTIFYING THE NEEDS FOR DISC AND DEVICE PRODUCTION.

ONE THOUGHTS THAT I HAVE ON THE SUBJECT:

DISC SPEC/DESIGN ISSUE

DOES IT MEET NEEDS; I.E., DOES IT REMAIN "QUIET" OVER LIFE? WILL LOWER DIFFERENTIAL MEAN LOWER CROWN HEIGHT AND LOSS OF PRE-LOAD IN SENSOR? WILL IT RESULT IN FEEDING PROBLEMS; OR DIFFICULTY IN DETECTING INVERTED DISCS?

*Yes Differential will increase in any direction.*  
*Crown height est. .027/.028"*  
*Device effect will be larger than is loss pin window*

ISC/SENSOR TESTING

OBJECTIVE SHOULD BE TO KEEP IT AS SIMPLE AS POSSIBLE; I.E., TAKE STATIC MEASUREMENTS (VS. P-d OR P-d CURVES) IF POSSIBLE.

*1. Can we have a simple way to detect nominal disc. MIN OR NO*  
*lost model*

DEVICE TESTING

NOT KNOWING WHERE THE DEVICE IS "PINNED" WILL AMPLIFY THE "NO CONTINUITY AT ELEVATED TEMP" PROBLEM; NEED A WAY TO SKEW TOWARDS CREEP RELEASE SIDE OR, BETTER YET, SOLVE THE NO CONTINUITY PROBLEM.

GENERAL

NEED TO ARRIVE AT A SOLUTION FOR LOW VOLUME MY93 PRODUCTION (<20K, SHO TAURUS). THIS MAY OR MAY NOT BE THE LONGER TERM SOLUTION FOR MY94 AND BEYOND.

NEED TO DEVELOP A PLAN WHICH ADDRESSES THINGS LIKE

DISC SPEC FINALIZATION/VERIFICATION  
DISC MEASUREMENT TECHNIQUE

TI-NHTSA 7925

MSG NO= 00554710 FR=DT1 TO=SBD1 SENT=03/12/92 08:03 AM  
R#-067 ST=C DIV=0050 CC=00101 BY=DT1 AT=03/12/92 08:03 AM

MARCH 12, 1992

D: TED BALLARD ETS  
JOHN KOURTESIS JKOU  
STEVE OFFILER SSO1  
MATT SELLERS PCME  
BILL SWERT PCME

J: TOM CHARBONEAU TC  
CHARLIE DOUGLAS CPPC  
ED KADYBEVSKIS EKAD  
GARY SNYDER CPPC  
DALE SOGGE AELS  
RICH TURNER ELB

V: DAVE CZARN ZARN

J: CCPB SILENT SWITCH DEVELOPMENT

EFFECTIVE IMMEDIATELY, DALE SOGGE WILL CHAMPION THE SILENT SWITCH DEVELOPMENT EFFORT. THE CHARTER WILL BE TO LAY THE GROUND WORK FOR STARTING PRODUCTION IN LOW VOLUME FOR MY93 AND HIGH VOLUME FOR MY94 AND BEYOND. IT WILL INCLUDE FINALIZING THE DESIGN REQUIREMENTS AND IDENTIFYING THE NEEDS FOR DISC AND DEVICE PRODUCTION.

THE THOUGHTS THAT I HAVE ON THE SUBJECT:

DISC SPEC/DESIGN ISSUE

-----  
DOES IT MEET NEEDS, IE., DOES IT REMAIN "QUIET" OVER LIFE? WILL LOWER DIFFERENTIAL MEAN LOWER CROWN HEIGHT AND LOSS OF PRE-LOAD IN SENSOR? WILL IT RESULT IN FEEDING PROBLEMS; OR DIFFICULTY IN DETECTING INVERTED DISCS?

DISC/SENSOR TESTING

-----  
OBJECTIVE SHOULD BE TO KEEP IT AS SIMPLE AS POSSIBLE, IE., TAKE STATIC MEASUREMENTS (VS. F-d OR P-d CURVES) IF POSSIBLE.

DEVICE TESTING

-----  
NOT KNOWING WHERE THE DEVICE IS "PINNED" WILL AMPLIFY THE "NO CONTINUITY AT ELEVATED TEMP" PROBLEM; NEED A WAY TO SKEW TOWARDS CREEP RELEASE SIDE OR, BETTER YET, SOLVE THE NO CONTINUITY PROBLEM.

GENERAL

-----  
NEED TO ARRIVE AT A SOLUTION FOR LOW VOLUME MY93 PRODUCTION (<20K, SHD TAURUS). THIS MAY OR MAY NOT BE THE LONGER TERM SOLUTION FOR MY94 AND BEYOND.

NEED TO DEVELOP A PLAN WHICH ADDRESSES THINGS LIKE

DISC SPEC FINALIZATION/VERIFICATION  
DISC MEASUREMENT TECHNIQUE  
DEVICE MEASUREMENT TECHNIQUE

TJ-NHTSA 7926

4

WANT TO GET FROM COST AND TIMING INFO ASAP. L/T HAS REQUESTED  
MY93 CHANGEOVER FOR ALL SWITCHES; HOWEVER, NO L/T SWITCHES ARE  
MOUNTED UNTIL MY94, SO WE SHOULD BE ABLE TO NEGOTIATE A MY94  
CHANGEOVER TO THE SLOWLY SWITCH. PRESUMABLY, WHEN WE GIVE L/T  
A COST QUOTE FOR THE CUST ADDR, THEY WILL RE-THINK THE MY93  
REQUEST.

FRANCO,  
AMT 12/28/88  
12

TI-NHTSA 7927

MSG MW= 00439164 FR=SBC1 TO=SBC1 SENT=04/15/92 10:53 AM  
S#=100 DT=0 DTM=0050 CC=C0101 BY=SBC1 AT=04/15/92 10:53 AM

01	Yed Bellard	ETE	Norm Freca	WHL
	Dave Czern	ZARN	Matt Sellers	PONC
	Charlie Douglas	CMP:	Dale Gogge	STUN
02	Tom Charboneau	TC	Gary Snyder	BUS:
	Steve Major	SM:	Bill Sweet	WBA
03	Steve Offiler	SBC:		

\* INTO PLANNER

04: NOTES FROM MTG W/ BRUCE MAEROFF, APRIL 13 & 14

\*\*\*\* GENERAL \*\*\*\*

a need to quickly develop some kind of benchtop test to determine sound levels in a fluid system. Dale will work on a system with a high frequency transducer (hydrophone) to "listen" for the pressure waves associated with the sound/feel. We may begin with a Kistler piezo transducer for expediency. I owe a status report on this development to Bruce on 920424. The general methodology will be to compare the present quiet devices #330 and F2AC with standard snap devices until we are satisfied that we have identified the correct parameters to measure. Then, using this knowledge, work to further control and minimize the phenomenon will commence. Ford indicates that they can provide only very limited development assistance, because they are vamped with larger issues including new platform development and a couple F recalls. They can help by providing hardware as needed for test stand master cylinders, boosters, pedal assemblies, etc). We should not bother them until our internal testing indicates we've made significant progress. We can submit these for evaluation.

I will propose modifications to the verbiage of the ES to include checks for sound using whatever equipment is ultimately developed and concurred by Ford. It will include sound on In-Process tests quarterly. Snap devices will be exempted from this testing using a note on the print.

Leaking downstream of HCU (Hydraulic Control Unit) on ABS vehicles seems to affect the switch action. One hypothesis is that the solenoid valves in the HCU include rubber diaphragms which may help dampen pressure/sound wave transmission.

Will need to perform First Cycle Syndrome evaluations; a key concern is whether the "reset" occurs within 6 hours (= 1 tank of gas)

Temperature concern. The fact that the spec says 121C (=250F) is inconsequential, since typically the spec's are written or evolved before actual testing is conducted or without knowledge of same. 150C (=302F) is an internal Ford bogey based on the boiling point of QDT3 fluid at 3% moisture absorption.

I supplied the following samples which were hand-carried back to Detroit: (1) modified 37F5FS-3ra with actuation around 700 psi for evaluation of system performance (not related to DCFB); (2) 77PSL5-2 of which 2 will go to Tim Andresser to complete a need for 10, 10 to Mike Spears, Taurus Cross; (3) log Ngr to carry to Atlanta? to replace the pressed-in snubber protoid #1, and the remaining 8 for use by the brake department for evaluations; and (4) 10 of 77PSL5-1 for Bruce to Fedor to dealerships as needed when they call according to a recently released service bulletin for SN50.

10/23/88

10/23/88 includes in our partial ISR package documentation of all testing noted to date on Noryl, whether internal lab tests, Ford spec tests, or even. I have a copy of Steve Butler's report comparing several plastics; plastics which need quick whiteups of thermal evaluations conducted by Ford.

Need to update our envelope drawing for parts destined for Dana to include part #75/-85 in order to comprehend First Cycle Syndrome. Dana makes the stion block for EN53 which will be getting the silent/no snub 77PSL3-1. I've discussed the same update for 77PSL3-2, silent/snub for SHD - yes, I'm unsure of our rationale for this... has Teves indicated a PCB re? how about Parts (77PSL2-1)? Also, Bruce indicates a strong preference for nylon prints, not valium as we've been supplying.

## SHD TAURUS ##

Current SHD device (not flow snubber, 77PSL5-1, 77020024AA) is NOT OPTARLE long term, however, they're going to have to build with these for SHD. The flow in the 8 pressed-in snubbers has been evaluated in detail and found to be 2 on sound but only 7 on feel. The goal of this test should be to improve on the feel issue - again, these tests were on only one single prototype.

John's opinion is that the switch should be removed from the Master Index. HOWEVER, he indicates this will be a major battle with S&A. One issue seems to be that if mounted on a prop valve, service will require pin removal (!)

SHD 2PP build (NOT SALABLE) is now scheduled for 4/21 (program timing chart dated 920001 shows 4/10; Into Plant Date is 7 calendar days prior; being updated 2PP IPD of 4/14). We assume the 8 pressed-in snubber parts produced made their way to Teves, and Teves intercepted the 4/14 IPD date. As of now, these pressed-in snubber parts are on M/C's in Atlanta to be shipped 4/21. → *Reese Matthews of Teves visited Atlanta to swap in our press-fit snub devices*

SHD IPD for FEU build (SALABLE) is 5/4, meaning we'll need to get production representative parts to Teves by 4/27. Ideally these snubber hexports will be Elco produced; fallbacks include 1) Elco blanks finished here or 2) parts produced here on CNC equipment.

*ATTENDING TEVES CAN BEG W/ 2-WEEK*

Should speak with Cathy Hamborg at Teves to see about including our switch in their HCL life testing; get a copy of whatever spec they test to (not necessarily a Ford CS, since Teves markets a black box system and accepts warranty responsibility.)

TI-NHTSA 7029

## ATLANTA PREPARATION ## HANK CASINELLI - LAUNCH TEAM LEADER

Will be potentially meeting with plant management, the launch team, the test engineer, the launch leader, etc. Their concern is whether the problem is solved. They don't care about how, or the development required, etc. Technical details should be presented in layman's terms. They will want:

1. explanation of how the problem got all the way to the assembly plant, proof that the problem is fixed.

2. proof that a plan is in place to ensure it stays fixed, which will probably encompass the test fixture Dale is proposing.

3. discussion of partial ISR and plans for full ISR including combination of EN53 and SHD per the rough plan I've already laid out, also including





### Plans for Noise Control in Volume Production

(Please note that these plans are still under development and subject to change, pending receipt of the necessary transducer hardware, actual construction of test equipment, and performance of various comparative tests of switch designs previously confirmed by in-car tests to be "quiet" or "noisy".)

Bruce Maeroff, Supv. of Pass. Car Brake Systems Eng. Dept., has instructed TI to develop a method of testing pressure switch devices which will allow comparative measurement of the audible noise and tactile pedal feel phenomenon.

The system under development is composed of a Kistler high-resolution hydraulic pressure transducer with range 0-300 psi and resolution to .005 psi; a manifold to mount this transducer in close proximity to the device under test; a means of evacuating and filling the setup; and a means of applying a carefully controlled and reasonably noise-free pressure signal, using an air-over-oil intensifier unit fed by a feedback controlled air pressure regulator. Suitable isolation from the environment, possibly including shock mounting and/or acoustic protection, is to-be-determined.

Once suitable test equipment exists, the next phase is to characterize "known" devices including: normal snap-action; reduced snap devices found to be quiet in air but noisy in the actual application; and devices found suitable by Ford. This will allow establishment of control parameters. These parameters will be included in an addition to the ES, which will include PV, IP-1, and IP-2 tests.

Once the update to the ES is mutually agreed upon by Ford and TI, a partial ISR test will be conducted of this specific parameter; or, alternately, this will be included in the full ISR if time permits.

For the purpose of switch manufacturing process control, above studies will be correlated with disc (pressure-sensing element) characteristics which are controlled in the disc manufacturing process. The IP-2 testing for the noise parameter will be conducted on a quarterly basis per inputs from Bruce Maeroff.

*As* 920022

Plans for Noise Control in Volume Production

*(Please note that these plans are still under development and subject to change, pending receipt of the necessary transducer hardware, actual construction of test equipment, and performance of various comparative tests of switch designs previously confirmed by in-car tests to be "quiet" or "noisy".)*

Bruce Maeroff, Supv. of Pass. Car Brake Systems Eng. Dept., has instructed TI to develop a method of testing pressure switch devices which will allow comparative measurement of the audible noise and tactile pedal feel phenomenon.

The system under development is composed of a Kistler high-resolution hydraulic pressure transducer with range 0-300 psi and resolution to .005 psi; a manifold to mount this transducer in close proximity to the device under test; a means of evacuating and filling the setup; and a means of applying a carefully controlled and reasonably noise-free pressure signal, using an air-over-oil intensifier unit fed by a feedback controlled air pressure regulator. Suitable isolation from the environment, possibly including shock mounting and/or acoustic protection, is to-be-determined.

Once suitable test equipment exists, the next phase is to characterize "known" devices including: normal snap-action; reduced snap devices found to be quiet in air but noisy in the actual application; and devices found suitable by Ford. This will allow establishment of control parameters. These parameters will be included in an addition to the ES, which will include FV, IP-1, and IP-2 tests.

Once the update to the ES is mutually agreed upon by Ford and TI, a partial ISR test will be conducted of this specific parameter; or, alternately, this will be included in the full ISR if time permits.

For the purpose of switch manufacturing process control, above studies will be correlated with disc (pressure-sensing element) characteristics which are controlled in the disc manufacturing process. The IP-2 testing for the noise parameter will be conducted on a quarterly basis per inputs from Bruce Maeroff.

*As* 91422

### Interim Containment Actions

Pressure and force vs. deflection characteristic curves are routinely plotted as a development tool for the pressure sensing elements. Generally speaking, these curves are indispensable for the information they provide, yet they are somewhat time- and labor-intensive, not easily automatable, and require interpretation.

The nature of the curves describing the parts which have been deemed acceptable for DM5 are well-known from testing during development.

In order to control the manufacturing process in the short-term, the above curves are re-run on every lot, under the direction of a TI Member of Technical Staff, and compared with the curves for the parts which are known to be acceptable.

To date, seven separate lots have been produced and tested as above with very good correlation and repeatability, indicating the disc manufacturing process is presently under control.

This interim process control strategy will remain in effect until such time as a more suitable strategy, using hydraulic-disturbance equipment which is under development, can be implemented; in conjunction with development and correlation of a simple static pressure-deflection check, which will obtain a few of the key points on the characteristic curve and can be used for manufacturing process control.

*So* 920422

### Interim Containment Actions

Pressure and force vs. deflection characteristic curves are routinely plotted as a development tool for the pressure sensing elements. Generally speaking, these curves are indispensable for the information they provide, yet they are somewhat time- and labor-intensive, not easily automatable, and require interpretation.

The nature of the curves describing the parts which have been deemed acceptable for DN5 are well-known from testing during development.

In order to control the manufacturing process in the short-term, the above curves are re-run on every lot, under the direction of a TI Member of Technical Staff, and compared with the curves for the parts which are known to be acceptable.

To date, seven separate lots have been produced and tested as above with very good correlation and repeatability, indicating the disc manufacturing process is presently under control.

This interim process control strategy will remain in effect until such time as a more suitable strategy, using hydraulic-disturbance equipment which is under development, can be implemented; in conjunction with development and correlation of a simple static pressure-deflection check, which will obtain a few of the key points on the characteristic curve and can be used for manufacturing process control.

*So* 920422

D

C

B

A

REVISION		DATE	APPROVED
ISSUE	DESCRIPTION		
1	CR. MODALS. DS	8-24-91	Lo

APPROVED MANUFACTURING PROCESS.  
 FREE OF DENTS, NICKS, SCRATCHES, AND  
 IMPING.  
 \*) TO BE 1.265 / 1.218 AFTER CRIMPING.  
 MIN. MUST BE .860 MAX.  
 - 10 IN. LB TORQUE APPLIED BETWEEN  
 SERIES CUT PER PROCESS SPEC. AND MUST  
 TS.  
 WITH CUSTOMER PART NO. PER 13098-2.

(BX)

**CERTIFIED PRINT**  
 Parts Made to This Print Must Conform To  
**ENG. STD. E9898 REV. E**  
**Date APR 22 1992**

NO PART OF THIS PRINT MAY BE REPRODUCED OR  
 TRANSMITTED IN ANY FORM OR BY ANY MEANS  
 WITHOUT THE WRITTEN PERMISSION OF TEXAS  
 INSTRUMENTS INC. OR ANY OF ITS AFFILIATED  
 COMPANIES OR TRADING ORGANIZATIONS.

DATE	TX TEXAS INSTRUMENTS		12/3/92
8-24-91	ATTORNEY GENERAL'S OFFICE		12/3/92
10-22-91	TITLE		
	FINAL ASM. (N.C.)		
	TI-NHTSA 7935		
SIZE	CODE	IDENT. NO.	
3/4" x 7/8"	C	82647	36952-1
SCALE: 4X			SHEET 1 OF 1

				Apr 92			May 92			
				6	13	20	27	4	11	18
		Start Date	Finish Date							
1	OBTAIN U.L. DIFF. DISCS	4/ 6/92	4/ 7/92	▣						
2										
3	PILOT BUILDS	4/ 6/92	4/13/92	▨						
4										
5	IMPULSE TEST	4/ 8/92	4/13/92	▨						
6										
7	SUBMIT DETAIL PRINT	4/ 6/92	4/ 7/92	▣						
8										
9	PROD. COST/TOOL EST.	4/ 8/92	4/ 8/92	■						
10										
11	OBTAIN BASE MATERIAL	4/ 8/92	4/ 8/92	■						
12										
13	START OF PRODUCTION	4/13/92	4/13/92	■						
14										
15	SUBMIT VAL. TEST PLAN	4/ 8/92	4/ 9/92	▣						
16										
17	PARTIAL ISIR	4/13/92	5/ 1/92	▨						
18										
19	FULL ISIR	4/13/92	5/22/92	▨						

Noncritical  Critical   
 Slack  Milestone   
 Project: EN53 Date: Apr 8, 1992 10:55 AM

10/20/57/92/5  
 ASSIGNED TO TRACK  
 NAME ~ 6/2/92

SILENT SWITCH  
 PROGRAM SCHEDULE  
 EN53

TI-NHTSA 7936

FARMINGTON HILLS

TO 915086993153

P001

### VEHICLE EVALUATION RATING SYSTEM

	UNACCEPTABLE				BORDER LINE	ACCEPTABLE				
RATING INDEX	1	2	3	4	5	6	7	8	9	10
EVALUATION OF VEHICLE COMPONENT PERFORMANCE	PRODUCTION REJECT				BORDER LINE	BARELY ACCEPTABLE	FAIR	GOOD	VERY GOOD	EXCELLENT
	POOR		CUSTOMER COMPLAINT							
CONDITION NOTED BY	ALL CUSTOMERS		AVERAGE CUSTOMER		CRITICAL CUSTOMER			TRAINED OBSERVER	NOT PERCEPTIBLE	
NOISE, VIBRATION, HARDNESS, SHAKE, ETC.	NOT ACCEPTABLE		CONCERNING	REQUIRES IMPROVEMENT	MEDIUM	LIGHT	VERY LIGHT	TRACE	NOT NOTICEABLE	

D.

697-3153

FARMINGTON HILLS

TO 915086993153

PO01

### VEHICLE EVALUATION RATING SYSTEM

	UNACCEPTABLE				BORDER LINE	ACCEPTABLE				
RATING INDEX	1	2	3	4	5	6	7	8	9	10
EVALUATION OF VEHICLE COMPONENT PERFORMANCE	PRODUCTION REJECT				BORDER LINE	BARELY ACCEPTABLE	FAIR	GOOD	VERY GOOD	EXCELLENT
	POOR		CUSTOMER COMPLAINT							
CONDITION NOTED BY	ALL CUSTOMERS		AVERAGE CUSTOMER		CRITICAL CUSTOMER		TRAINED OBSERVER		NOT PERCEPTIBLE	
NOISE, VIBRATION, HARSHNESS, SHAKES, ETC.	NOT ACCEPTABLE		OBJECTIONABLE	REQUIRES IMPROVEMENT	MEDIUM	LIGHT	VERY LIGHT	TRACE	NOT NOTICEABLE	

D.

699-3153



### VEHICLE EVALUATION RATING SYSTEM

	UNACCEPTABLE				MARGINAL		ACCEPTABLE			
<b>ACTING AGENT</b>	1	2	3	4	5	6	7	8	9	10
<b>EVALUATION OF VEHICLE COMPONENT PERFORMANCE</b>	PRODUCTION SEAT				DASH LAMP	SEAT FOOTREST	FMR	DOOR	TRAILER LAMP	MIRROR
	POOR		AVERAGE							
<b>REASON CODE BY</b>	ALL		AVERAGE		SPECIAL		TRAILER		MIR	
<b>REASON CATEGORY, DAMAGE, ETC.</b>	OFF ACCEPTABLE		MARG. VEHICLE		MARGINAL		LIMIT		NOT ACCEPTABLE	

To: Steve O.  
 FAX 508-699-3153