ADDENDUM TO:
REPORT OF ISR TESTING
FORD PASSENGER CAR
ELECTRONIC SPEED CONTROL
DEACTIVATION PRESSURE SWITCH
PS/91/49-A

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

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS — MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 11-12-19		PAGE 1

FORM 0288

TABLE OF CONTENTS

1.0 **GENERAL**

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

1.2 TI Part Number: 77PSL2-1

1.3 Customer Part Number: F2VC-9F924-AB

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

1.5 Date of Completion : 911218

1.6 Quantity of Units Tested: 48

1.7 Disposition of Tested Units:

1.7.1 All devices are retained under quarantine.

1.8 TI test number: 172-15-24
173-15-24

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

2.0 OBJECTIVE

The original battery of tests reported in TI test report number PS/91/49 dated 910920 was performed to demonstrate the ability of TI P/N 77PSL2-1 to conform to customer specifications given in (delta) ES-F2VC-9F924-AA, in fulfillment of the requirements of the Initial Sample Report. During these original tests, problems were noted with diaphragm life during the Impulse test. It was discovered that these problems were related to the automatic pressure sensor assembly crimper, and furthermore that devices assembled on the manually-loaded crimper had no difficulty with diaphragm life. In the interest of meeting strict ISR deadlines, the Impulse portion of the test was successfully re-run using devices assembled on the manually-loaded crimper. However, these devices did not undergo the Fluid Resistance test due to time constraints. A 90-day Alert, # A10166193, was issued on 911002 (see Appendix 4.1). During this 90-day period, efforts to understand and correct the discrepancies of the automatic equipment have been made. The objective of this addendum is to report on the successful completion of the tests (Fluid Resistance and Impulse) which were compromised in the original ISR, using devices built both on the automatic equipment and the manually-loaded equipment. Crimp dies from the manually-loaded equipment were transferred to the automatic equipment in order to produce the successful test devices. The permanent corrective action will be to produce exact duplicates of these crimp dies for the automatic line.

3.0 TEST PROCEDURES AND RESULTS

All switches were tested to Ford Engineering Specification (delta) ES-F2VC-9F924-AA, sections III. M. (Fluid Resistance) and E. (Impulse), with initial and final characterizations consisting of III. A. (Calibration), B. (Voltage Drop), C. (Current Leakage), and D. (Proof). Raw data is included in Appendix 4.2 and 4.3.

3.1 CALIBRATION

3.1.1 Procedure: Calibration is checked at room temperature using ambient air as the pressure medium. Calibration settings, as specified on the part drawing, are actuation (electrical contacts opening) at 90 - 160 psig, and release (contacts reclosing) at 20 psig minimum. For the purpose of stabilization, actuation values are recorded on the sixth cycle, after subjecting the switch to two (2) pressure cycles to 800 psig minimum and back to zero, followed by three (3) cycles to 1.1 times actuation pressure minimum and back to zero. The change in continuity is measured while conducting 750 +/- 50 milliamps at 13.0 +/- 1.0 volts DC.

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

3.1.3 Initial Results: All 48 devices tested were found to be within specification.

3.1.4 Final Results: All 48 devices tested were found to be within specification.

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 11-17-15		PAGE 6

FORM 5285

3.2 VOLTAGE DROP

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

3.2.2. Initial results: The average voltage drop was 4.5 millivolts, and the standard deviation was 1.5. All values are significantly below the specification of 200 millivolts maximum.

3.2.3 Final results: The average voltage drop was 14.3 millivolts, and the standard deviation was 22.7. All values are significantly below the specification of 200 millivolts maximum.

3.3 CURRENT LEAKAGE

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

3.3.2 Initial results: Measuring terminals to case with switch closed; measuring terminals to case with switch open; and measuring between the terminals: the maximum current leakage observed less than 2 microamps. All values are significantly below the specification of 100 microamps.

3.3.3. Final results: Same three measurements per device as 3.3.2. All current leakage values were consistent with initial results. The maximum observed was 2.7 microamps. All values are significantly below the specification of 100 microamps.

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 91-12-18		PAGE

FORM 9293

3.4 PROOF

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

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

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

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

3.5 FLUID RESISTANCE

3.5.1 Devices tested: 172-15-01 thru -12
173-15-01 thru -12.

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

3.5.3 Results: The 24 devices were subject to the Impulse test following completion of Fluid Resistance.

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE		PAGE 10

FORM 8295

3.6 IMPULSE

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

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

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

3.6.4 Results: All devices passed.

Appendix 4.1
Alert

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

FORM 8295

ALERT DETAIL

PRINT DATE/TIME: 91/10/11 09:59
PAGE: 1

ALERT NUMBER
A10146193

TYPE: (U) USE PPM
ORIGIN ACTIVITY: NCGO CHASSIS PRO (LNCH). DATE: 91/10/02 STATUS: A
ORIGINATOR: PEASE, R. F. PHONE: 32-37955 LOCATION: RM 3001, BLDG#5, D
CPSC: 060405 NOTICE NO: RESOLVING NOTICE:

ALERT DESC: PERMIT TEXAS INSTRUMENTS TO SHIP SPEED CONTROL REDUNDANT DEACTIVATION SWITCH, F2VC-9F924-AG, WITH EXCEPTION TO THE INTENDED MANUFACTURING/ASSEMBLY PROCESS CONSISTING OF

PRODUCTS AFFECTED: 1992 LINCOLN TOWN CAR, CROWN VICTORIA, GRAND MARQUIS WITH NEW GENERATION SPEED CONTROL.

MODEL CODES: CVFA CVFN CVVN MODEL YEAR: 92
PLANTS AFFECTED: NA17
MFG CONCERN CNTRL: ENG CONCERN CNTRL: INVALID:
PROGRAM: EFFECTIVE ID: OUT:
QTY: TIMING: 900 EMISSION CODE: 000 DISP: N
EST INCRM VAR COST: -0.92 EST INCRM TOOL COST: 0 EST INCRM LON COST: 0.00
EST INCRM VND COST: EST INCRM FAC COST: 0 WT EFFECT: 0.000D
UNIT MEASURE: APPEARANCE:
SUPP DOCS:

----------- AFFECTED PARTS ---

AFF PART NO: AFF PART DESC: REL IND: N
CPSC: 060405 NOTICE:
ACT: INTER: SUPPLY/LOCAL: AVAIL: FUNC SEOD:
SUPPLIER:

----------- FURTHER DESCRIPTION/ALERT RESOLUTION/REASON FOR REJECTION ETC. -----------------------------------

USERID: BFP2409 ACTIVITY: NCGO ENTRY DATE: 91/10/02
ALERT DESC:
USING A MANUALLY LOADING SENSOR CRIMPING MACHINE VERSUS THE AUTOMATIC IN LINE LOADED CRIMPER. THE AUTOMATIC CRIMPER HAS BEEN DETERMINED TO HAVE A YET TO BE DEFINED DEFICIENCY THAT RESULTS IN PART FAILURE TO MEET THE REQUIRED NUMBER OF CYCLE IN THE IMPULSE TEST. THE SUPPLIER IS GIVEN A 90 DAY PERIOD TO RESOLVE THE ISSUE. THE MANUALLY CRIMPED PARTS PASS THE ES TEST. THIS DEVIATION PERMITS INCORPORATION OF THE -AG LEVEL SWITCH AND DELETION OF THE INTERIM -9D SWITCH FOR A COST REDUCTION OF $.92. THE -AG SWITCH IS PIA TO END ITEM

USERID: BFP2409 ACTIVITY: NCGO ENTRY DATE: 91/10/03
ALERT DESC:
PROPORTIONING VALVES F2AC-2B091-BA, F2VC-2B091-CC, AND JUNCTION BLOCK F2AC-2C320-CB.

USERID: LAZ0686 ACTIVITY: NCGO ENTRY DATE: 91/10/04
ALERT DESC:
OK, SUPVR, APPROVAL REQ'D, IF FMVSS IS AFFECTED. LAZ

USERID: MJM5368 ACTIVITY: NCGO ENTRY DATE: 91/10/04
ALERT DESC:

- MORE -

TI-NHTSA 004187

ALERT DETAIL

PRINT DATE/TIME: 91/10/17 09:39
PAGE: 2

ALERT NUMBER
A10146193

ORIGIN ACTIVITY: NC00 CHASSIS PED (LOCC)
ORIGINATOR: PEASE, D. F.
CPSC: 868805

TYPE: (N) NSE FPR
DATE: 91/10/02
PHONE: 32-37955
NOTICE #0:

STATUS: A
LOCATION: GM 3801, BLOCK5, D
RESOLVING NOTICE:

---------- /NRINGE DESCRIPTION/ALERT RESOLUTION/REASON FOR REJECTION ETC. ----------

USERID: RJH5348 ACTIVITY: NC00 ENTRY DATE: 91/10/04
ALERT DESC:
FNVES NOT AFFECTED RJH

USERID: JLX1824 ACTIVITY: NC00 ENTRY DATE: 91/10/07
ALERT DESC:
NOTED J SIMMONS 32-37974

---------- APPROVALS ----------

REGION	DEPARTMENT	USERID	ACTIVITY	APPROVER'S NAME	DATE APPROVED	APPROVAL
N	K0647	BFP2409	NC00	PEASE, D. F.	91/10/03	
N	K0667	JLX1824	NC00	SIMMONS, J.L.	91/10/07	Y
N	K0643	LAZ0486	NC00	ZIELINSKI, L.A.	91/10/04	Y
N	K0647	RJH5348	NC00	HAENOFF, R.J.	91/10/04	Y
N	K0660	VSD0378	NC00	DEGHAZIA, V.G. (DEPT	91/10/09	Y
N	K0613	AJY6189	NC00	INNAS, A.J.	91/10/04	Y
N	K0613	HATL	NC00	CHASSIS HATL HATEKEE	91/10/04	Y
N	K0611	FPHALET	NC00	FPH HATEKEEPER-CHASS	00/00/00	
N	K0647	BFP2409	PC00	PEASE, D. F.	91/10/03	
N	K0675	JGV4164	NC00	VANDERKOOI, J.G. (I	00/00/00	

-END-

Appendix. 4.2
Data # 172

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS — MATERIALS & CONTROLS GROUP, ATTLEBORO, MA 02703	DOC.
DATE		PAGE 15

FORM 5288

PRESSURE SWITCH DATA Form 21605 TEST NO. [illegible]

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMPL. DATE
77 PSL 2-4	1/1/91	Steve [illegible]	

PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY
Jeffrey D. [illegible]	1/1/91		

PROJECT TITLE: Ford MY '91 Electronic Speed Control Deactivate PS

CUSTOMER:

PURPOSE OF TEST: Re-run of validation testing which failed the first time

PROCEDURE: Impulse and Fluidless Impulse test per Ford ES Parts Crimped or hand-[illegible]

Device #	Aged [illegible]	[illegible]	[illegible]	Current A	Leakage B	C	Final		
132-[illegible]	[illegible]	111/42	5.9	1.[illegible] mA	1.50 mA	1.1[illegible] mA	Pass		
[illegible]		117/41	5.8	1.8[illegible]	1.46	1.[illegible]			
[illegible]		118/41	2.9	1.9[illegible]	1.44	1.[illegible]			
[illegible]		119/45	4.6	1.[illegible]	1.4[illegible]	1.[illegible]			
[illegible]		115/43	4.7	1.83	[illegible]	1.72		Fluid [illegible]	
[illegible]		110/48	4.2	1.[illegible]	1.51	1.71			
[illegible]		124/43	5.4	1.[illegible]	1.51	1.76		and [illegible]	
[illegible]		113/44	3.1	1.47	1.47	1.72			
[illegible]		125/41	5.6	1.[illegible]	[illegible]	1.[illegible]			
[illegible]		120/47	5.7	1.[illegible]	1.49	1.7[illegible]			
[illegible]		113/50	4.3	1.[illegible]	1.4[illegible]	1.7[illegible]			
[illegible]		124/47	3.3	1.[illegible]	1.47	1.7[illegible]			
133-[illegible]	[illegible]	117/42	2.7	1.5[illegible]	1.34	1.29	Pass		
[illegible]		116/42	4.5	1.[illegible]	1.37	1.37			
[illegible]		125/45	2.7	1.78	1.43	1.71			
[illegible]		111/42	4.4	1.5[illegible]	1.3[illegible]	1.[illegible]			
[illegible]		114/51	2.7	1.58	1.36	1.86			
[illegible]		124/48	3.1	1.6[illegible]	1.4[illegible]	1.8[illegible]			
[illegible]		119/53	2.7	1.6[illegible]	1.37	1.[illegible]		Impulse	
[illegible]		121/47	3.2	1.67	1.38	1.[illegible]			
[illegible]		118/47	3.6	1.6[illegible]	1.46	1.8[illegible]			
[illegible]		124/42	3.2	1.63	1.41	1.79			
[illegible]		119/45	4.1	1.7[illegible]	1.42	1.69			
[illegible]		119/43	3.4	1.74	1.4[illegible]	1.79			

(OVER)

Final Clor

	Pass #	Act/Act	M. Avg	A	B	C
[illegible]	Pass	105/54	12.3	1.61	1.35	1.82
[illegible]		114/57	2.4	1.63	1.36	1.64
[illegible]		105/56	11.6	1.40	1.55	2.72
[illegible]		111/56	3.5	1.45	1.37	1.63
[illegible]		105/58	1.6	1.45	1.40	1.72
[illegible]		111/57	19.0	1.62	1.38	1.75
[illegible]		111/55	2.6	1.58	1.30	1.72
[illegible]		107/56	1.7	1.60	1.39	1.75
[illegible]		111/56	2.1	1.63	1.36	1.81
[illegible]		114/58	2.5	1.62	1.39	1.74
[illegible]		106/60	1.4	1.57	1.33	1.80
[illegible]	↓	114/56	2.1	1.61	1.35	1.67
[illegible]	Pass	105/58	4.9	1.54	1.25	1.68
[illegible]		112/57	3.6	1.48	1.24	1.66
[illegible]		118/62	3.8	1.41	1.25	1.82
[illegible]		111/58	4.2	1.52	1.27	1.75
[illegible]		113/59	6.1	1.52	1.27	1.80
[illegible]		116/60	5.1	1.52	1.28	1.65
[illegible]		113/59	3.7	1.64	1.36	1.74
[illegible]		101/62	3.2	1.72	1.37	1.61
[illegible]		102/58	2.5	1.71	1.39	1.75
[illegible]		116/58	3.9	1.59	1.29	1.65
[illegible]		111/59	2.4	1.43	1.30	1.69
[illegible]	↓	111/58	3.2	1.59	1.32	1.64

Appendix 4.3
Data # 173

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

FORM 8290

PRESSURE SWITCH DATA Form 21605 **TEST NO.** 173-15-24

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMPL DATE
7785L2-1	11/1/81	Steve [illegible]	

PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY
Jeffrey D'Orazio	11/1/81		

PROJECT TITLE: Ford NT '81 Electronic Speed Control Qualification

CUSTOMER:

PURPOSE OF TEST: Rerun of Validation testing which failed the first time

PROCEDURE: Impulse test and Thickness/Impulse test per Ford ES. All parts [illegible] on ART

Device #	[illegible]	Act/Deact	[illegible]	A	B	C	Pass		
173-15-01	9(?)	121/57	3.9	1.96	1.55	1.72	Pass		
.02		124/57	6.3	1.92	1.49	1.72			
.03		123/52	5.1	1.84	1.52	1.71			
.04		123/57	4.5	1.86	1.54	1.79			
.05		119/56	3.6	1.86	1.52	1.77			
.06		120/49	4.1	1.88	1.50	1.74		Ford Rec	
.07		122/59	4.4	1.93	1.51	1.75			
.08		125/59	4.1	1.72	1.48	1.74		and Impulse	
.09		124/52	4.3	1.84	1.60	1.75			
.10		121/57	5.0	1.96	1.51	1.75			
.11		121/54	4.5	1.88	1.54	1.72			
.12		118/53	6.2	1.82	1.58	1.73			
173-15-13	9(?)	123/58	3.9	1.58	1.41	1.74	Pass		
.14		122/57	3.4	1.70	1.44	1.76			
.15		118/61	9.3	1.60	1.36	1.81			
.16		125/61	4.8	1.75	1.46	1.84			
.17		127/55	7.1	1.70	1.41	1.63			
.18		115/50	2.7	1.44	1.34	1.83			
.19		128/57	7.5	1.63	1.42	1.62		Impulse	
.20		120/62	2.7	1.67	1.38	1.82			
.21		112/55	3.4	1.59	1.38	1.79			
.22		119/51	4.0	1.79	1.42	1.75			
.23		117/60	3.7	1.57	1.24	1.62			
.24		119/52	7.8	1.35	1.32	1.70			

(OVER)

TI-NHTSA 004193

Final Clos

	[illegible]	[illegible]	[illegible]	[illegible] A	B	C
[illegible]	Pass	111/60	6.3	2.04mA	1.53	1.67
[illegible]		112/58	2.3	1.55	1.29	1.54
[illegible]		113/57	2.8	1.87	1.91	2.14
[illegible]		116/58	1.8	1.60	1.37	1.67
[illegible]		117/60	5.9	1.71	1.42	1.61
[illegible]		113/53	3.0	1.75	1.95	1.61
[illegible]		114/62	24.5	1.56	1.28	1.65
[illegible]		116/57	1.9	1.53	1.60	1.69
[illegible]		112/57	4.2	1.58	1.72	1.61
[illegible]		113/51	14.2	1.98	1.55	1.71
[illegible]		114/55	4.5	1.68	1.34	1.59
[illegible]		110/53	9.6	1.64	1.35	1.79
[illegible]	Fail	112/57	2.4	1.60	1.47	1.75
[illegible]		112/60	34.2	1.69	1.42	1.59
[illegible]		110/58	1.5	1.61	1.27	1.89
[illegible]		111/54	73.6	1.45	1.25	1.86
[illegible]		115/55	95.9	1.58	1.35	1.71
[illegible]		105/57	2.3	1.55	1.39	1.57
[illegible]		117/59	93.6	1.73	1.28	1.77
[illegible]		115/61	1.9	1.38	1.36	1.79
[illegible]		112/58	21.4	1.73	1.47	1.78
[illegible]		106/55	47.2	1.54	1.16	1.75
[illegible]		111/56	40.2	1.75	1.48	1.70
[illegible]		110/55	25.7	1.61	1.37	1.69

Appendix 4.4
Fluid Resistance

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS — MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 11/12/18		PAGE 23

FORM 6295

Form No. [illegible]

TEST NO. 109832

TECHNICAL SERVICE LABS

TEST NO. 109832

PCC I.D.	127	
REQUESTOR COST CENTER	101	
[illegible]	060	
REQUESTOR	S. [illegible]	
MAIL STATION	12-24	
EXTENSION	1382	
[illegible]	5501	
DATE SUBMITTED	91-11-04	
DATE REQUIRED	91-12-12	
NO. OF SAMPLES	24	
COMPOSITION	MIXED	

STATE YOUR PROBLEM SAMPLE DESCRIPTION:

SAMPLES ARE 77PS PRESSURE SWITCHES W/ LEADS & END PLUGS

INFORMATION DESIRED: 3548

PLEASE PERFORM FLUID RESISTANCE TEST PER FORD MOTOR CO. SPEC ES-F2VC-9F924-AA (ATTACHED)

REPORT OF RESULTS:

DATE RECEIVED 11/5/91 DATE OUT 12-12

TECHNICIAN			
HOURS WORKED			
PROCEDURE USED			

*PCC I.D.

MC=325	TM=431	JOCY=128	FACIL=614
PC=127	WIRE=432	CLXE=122	FACIL=561
VERS=166	EPD=621	CAN=654	FACIL=431
APCC=463	PEP=622	AC DEV=256	STAFF=665
IMD=430	CSD=635	EMCD=677	

DISTRIBUTION: White and Yellow - Lab Pink - Requestor

TI-NHTSA 004196

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

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

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 91-05-20		PAGE

FORM 5995

TABLE OF CONTENTS

1.0 **GENERAL**

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

1.2 TI Part Number: 77PSL2-1

1.3 Customer Part Number: F2VC-9F924-AB

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

1.5 Date of Completion: 910920

1.6 Quantity of Units Tested: 104

1.7 Disposition of Tested Units:

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

1.7.2 All other devices are retained under quarantine.

1.8 TI test series number: 156-15-104

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

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS — MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 91-09-20		PAGE 1

FORM 5209

TI-NHTSA 004200

2.0 OBJECTIVE

This battery of tests was performed to demonstrate the ability of 77PSL2-1 to conform to customer specifications given in (delta) ES-F2VC-9F924-AA, in fulfillment of the requirements of the Initial Sample Report. Units tested were built using fully qualified production components and production assembly equipment.

3.0 TEST PROCEDURES AND RESULTS

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

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

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

3.0 TEST PROCEDURES AND RESULTS, CONTINUED

While analysis and permanent corrective actions are ongoing, it was also learned that the manual assembly equipment which performs the final crimp produces pressure-sensing assemblies which have acceptable life. This equipment was used 4Q90 during validation of F2VC-9F924-BB (TI P/N 57PSL5-3) which uses exactly the same pressure sensing assembly, as well as to produce the rebuilt Impulse devices (157-15-81 thru -104) and will continue to be used until such time as the permanent corrective actions are in place on the automatic equipment and re-validation is completed.

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

3.1 CALIBRATION

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

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

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

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

3.2 VOLTAGE DROP

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

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

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

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

FORM 5201

3.3 CURRENT LEAKAGE

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

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

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

3.4 PROOF

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

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

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

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

3.5 BURST

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

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

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

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

3.6 VIBRATION

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

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

3.6.3 Results: All six switches met the acceptance criteria in the ES (frame 9 of 18; section III. I. 2.).

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE		PAGE 12

FORM 5291

3.7 VACUUM

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

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

3.7.3 Results: All six devices met the acceptance criteria in the ES (frame 10 of 18; section III. K. 2.).

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

FORM 3795

3.8 TEMPERATURE CYCLE

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

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

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

3.9 FLUID RESISTANCE

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

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

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

3.9.3.1 Impulse (3.10), -01 thru -12

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

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

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

3.10 IMPULSE

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

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

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

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

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

3.11 TERMINAL STRENGTH

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

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

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

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

FORM 1288

3.12 HUMIDITY

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

3.12.2 Equipment: Humidity chamber RK model 5S.

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

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

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 11-09-70		PAGE 16

FORM 5201

3.13 SALT SPRAY

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

3.13.2 Equipment: Harshaw salt spray chamber.

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

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 31-08-20		PAGE 13

FORM 3288

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

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS	MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703
DATE 91-08-20		DOC.
		PAGE 20

FORM 5288

Ford **Engineering Specification**

PART NAME	PART NUMBER
SWITCH ASSEMBLY - SPEED CONTROL DEACTIVATE	▽ ES-F2VC-9F924-AA

LET																		
FR																		
LET																		
FR																		

DATE	LET	FR	REVISIONS	DR	CK

REFERENCE

PREPARED/APPROVED BY

CHECKED BY | DETAILED

CONCURRENCE/APPROV SIGNATURES

DESIGN ENGINEERING SUPER

DESIGN ENGINEERING MG

MANUFACTURING ENGR

QUALITY CONTROL

PURCHASING

SUPPLIER QUALITY ASSURA

ELECTRONICS DIVISI

SWITCH ASSEMBLY - SPEED CONTROL DEACTIVATE

I. General

This specification covers the test requirements for the speed control deactivate switch -9F924- used in the electronic speed control system. Design changes on the switch assembly or its components shall not be made without compliance to Section V of this specification and written approval from the releasing Production Engineering Office.

This engineering specification is a supplement to the released drawing on the above part, and all requirements herein must be met in addition to all other requirements of the part drawing. Minimum measures necessary for demonstrating compliance to these requirements are given in each section.

The engineering tests, sample sizes, and test frequencies contained within this engineering specification reflect the minimum requirements established to provide a regular evaluation of conformance to design intent. The engineering test program is intended as a supplement to normal material inspections, dimensional checking and in-process controls, and should in no way adversely influence other inspection operations.

Q1 suppliers may implement different test sample sizes and frequencies providing these changes have been included in an alternate Control Plan approved by the design responsible Product Engineering Office and concurred in by SQA.

II. PRODUCTION VALIDATION AND IN-PROCESS TESTS

- Production Validation (PV) Tests must be completed satisfactorily with parts from production tooling (and processes where possible) before ISIR approval and authorization for shipment of production parts can be effected. Parts must be revalidated completely, or per Section V whenever any change is made which could possibly affect part function or performance.

- In-Process Test Phase 1 (IP-1) - IP-1 tests are used to demonstrate process capability and must be completed using initial production parts from production tooling and processes prior to first production shipment approval. IP-1 tests are to continue in effect until process capability is demonstrated.

- In-Process Tests Phase 2 (IP-2) - IP-2 test program may be implemented only after process capability has been established. Tests must be completed with production parts on a continuing basis. Samples for these tests must be selected on a random basis to represent the entire production population as much as possible. In the event that any of the requirements in these tests is not met, the reaction plan specified in Ford Q101 Section III.E.3, "ES Test Performance Requirements" shall be invoked.

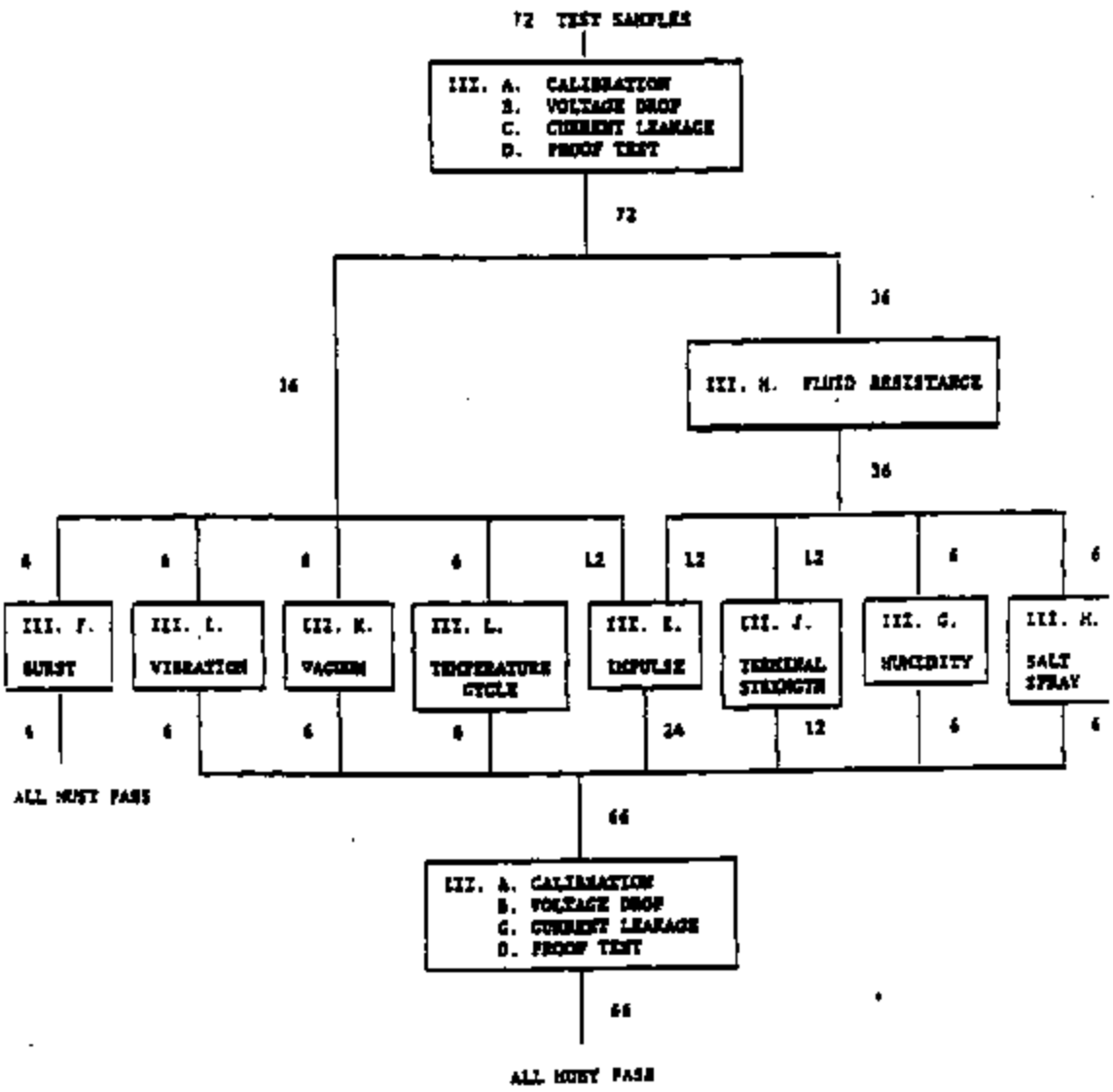
SECTION III. TABLE OF TESTS

Item	Test Name Functional Tests	PRODUCTION VALIDATION Minimum Sample Size	PRODUCTION VALIDATION Statistical Test Acceptance Criteria	IN-PROCESS IP-1 Minimum Sample Size	IN-PROCESS IP-1 Statistical Test Acceptance Criteria	IN-PROCESS IP-2 Minimum Sample Size	IN-PROCESS IP-2 Statistical Test Acceptance Criteria
III.							
▽ A	Calibration	72	P90-.96	100%	All Must Pass	100%	All Must Pass
B	Voltage Drop	72	P90-.96	12/Mo.	P90-.84	4/Lot	" " "
C	Current Leakage	72	P90-.96	3/Mo.	P90-.56	4/Lot	" " "
D	Proof Test	72	P90-.96	12/Mo.	P90-.84	4/Lot	" " "
F	Burst	6	P90-.72	3/Mo.	P90-.56	4/Lot	" " "
I	Vibration	6	P90-.72	3/Mo.	P90-.56	6/6 Mo.	P90 .72
J	Terminal Strength	12	P90-.84	6/Mo.	P90-.72	4/Lot	All Must Pass
K	Vacuum	6	P90-.72	3/Mo.	P90-.56	6/6 Mo.	P90-.72
L	Temperature Cycle	6	P90-.72	3/Mo.	P90-.56	6/6 Mo.	P90-.72
M	Fluid Resistance	36	P90-.94	36/12Mo	P90-.94	36/12Mo.	P90-.94

Durability Tests

Item	Test Name	PV Minimum Sample Size	PV Statistical Test Acceptance Criteria	IP-1 Minimum Sample Size	IP-1 Statistical Test Acceptance Criteria	IP-2 Minimum Sample Size	IP-2 Statistical Test Acceptance Criteria
III.							
E	Impulse	24	P90-.90	12/Mo.	P90-.84	3/3 Mo.	P90-.56
G	Humidity	6	P90-.72	3/Mo.	P90-.56	6/6 Mo.	P90-.72
H	Salt Spray	6	P90-.72	3/Mo.	P90-.56	6/6 Mo.	P90-.72

PRODUCTION VALIDATION FLOW CHART



FRAME 4 OF 18	REVISED		NUMBER VES-F2VC-9F924-AA

III. TEST PROCEDURES AND REQUIREMENTS

▽ A. Calibration

1. Test Requirements

a. Switch calibration is to be checked at room temperature (16°C-35°C) using ambient air or equivalent.

b. Calibration settings shall be specified on the part drawing with the settings checked after 2 or more pressure cycles with ambient air, or equivalent. Pressure cycle range is to be determined by the manufacturer to insure switch calibration stability. The cut-in and differential set points are to be measured while conducting 750 ± 50 milliamperes while 13.0 ± 1.0 volts D.C. is applied. The cut-in point is to be checked with increasing pressure.

c. The cut-out point is to be checked with decreasing pressure, and the differential set point is to be calculated using the cut-in pressure minus the cut-out pressure.

2. Acceptance Requirements

a. Nonconformance is defined as any switch point which falls outside the tolerance band specified on the part drawing.

B. Voltage Drop

1. Test Requirements

a. Voltage drop is to be measured after 2 or more cycles with ambient air or equivalent from 0 to 10,000 ± 172 KPa (1450 ± 25 PSI) while conducting 750 ± 50 milliamps and 13.0 ± 1.0 volts D.C. is applied to the switch. Under these conditions with the switch closed the voltage drop is to be measured. Millivolt connection interface at terminals to be less than 10 millivolts.

2. Acceptance Requirements

a. Nonconformance is defined as a voltage drop in excess of 200 millivolts.

III. TEST PROCEDURES AND REQUIREMENTS (cont'd)

C. Current Leakage

1. Test Requirements

a. Current leakage is to be checked with 500 volts, 60 Hz alternating current.

b. Current leakage is to be checked:

(1) Between the switch leads with the contacts open.
(2) Between the lead and the switch housing with contacts closed.
(3) Between either lead and switch housing with the contacts open.

2. Acceptance Requirements

a. Nonconformance is defined as any leakage current in excess of one hundred (100) microamperes.

D. Proof Test

1. Test Requirements

a. Subject sample switches to Section A to establish their initial switching pressures.

b. Proof test is to be conducted using brake fluid or equivalent as the pressure medium. Test pressure shall be as specified on the part drawing. Test pressure shall be isolated from pressure source and held for not less than 30 seconds.

c. Recheck the switches to Section A.

2. Acceptance Requirements

a. No evidence of fluid leakage, seepage, or drop in test pressure greater than 430 KPa.(62 PSI) is permitted.

b. A change in cut-in and cut-out pressures greater than ± 5% from the initial value is not permitted.

c. The test samples must be destroyed after testing.

III. TEST PROCEDURES AND REQUIREMENTS (cont'd)

E. Impulse

1. Test Requirements

a. Test the switch for a total of 500,000 cycles. Cycle pressure between (low) 0-276 KPa (0-40 psi) and (high) 10,000 ± 345 KPa (1450 ± 50 psi).

1) 0 - 475,00 cycles: 13 ± 1 volts, trace current to monitor function.

2) 475,001 - 500,000 cycles: 13 ± 1 volts D.C., 750 ± 50 ma., per figure A.

b. Brake fluid temperature to be 135 ± 14°C and ambient temperature to be 107°C min.

c. Cycle rate is to be 110-130 cycles per minute.

d. Switch must open and close each cycle.

2. Acceptance Requirements

a. After impulse test check to sections A, B, C, & D using the procedure established in each section.

b. Nonconformance is defined as any switch not meeting the criteria in sections A, B, C, & D.

c. Samples used for this test must be destroyed after all testing is completed.

F. Burst

1. Test Requirement

a. Burst strength is to be checked using brake fluid or equivalent as the pressure medium.

b. Pressurize the switch to 48.3 MPa (7000 PSI) minimum and hold for 30 seconds minimum.

2. Acceptance Requirements

a. Nonconformance is defined as any evidence of fluid leakage or seepage from the switch or threads. Samples used for this test must be destroyed after testing is completed.

III. TEST PROCEDURES AND REQUIREMENTS (Cont'd)

G. Humidity

1. Test Requirements

a. Mount the switch in the test port in a humidity chamber. Currently released mating electrical connector must be installed before start of test.

b. Subject the switch to ten (10) continuous humidity cycles as follows:

(1) Raise temperature to 65 +10/-2 °C over 2.5 hours; at 90-98% relative humidity.

(2) Hold 3 hours at 65 +10/-2 °C at 90-98% relative humidity.

(3) Lower temperature to 25 +10/-2 °C over 2.5 hours; at 80-98% relative humidity.

2. Acceptance Requirements

a. Within 15 minutes after completion of the tenth humidity cycle check the switch to sections A, B, C, D, using the procedure established in each section.

b. Nonconformance is defined as any switch not meeting the criteria in sections A, B, C, or D.

H. Salt Spray

1. Test Requirements

a. Mount the switch in the test port in a salt spray chamber. The currently released mating electrical connector and wiring must be installed prior to start of test.

b. Expose the switch assembly to 72 hours of salt spray per ASTM B-117.

2. Acceptance Requirements

a. After exposure, check the switch to sections A, B, C, D, using the procedure established in each section.

b. Nonconformance is defined as any switch not meeting the criteria in sections A, B, C, or D. Samples used for this test must be destroyed after all testing is completed.

III. TEST PROCEDURES AND REQUIREMENTS (cont'd)

I. Vibration

1. Test Requirements

a. Mount the switch in the test port and attach the currently released mating electrical connector before start of test.

b. Switches are to be vibrated in all 3 planes with electrical continuity being monitored during the entire test. See Figure 1 for switch orientation in the 3 planes. Vibration tests are to be conducted at room temperature using brake fluid, ambient air, or equivalent as the pressure medium.

c. Internal pressure shall be maintained at 0 KPa G. when the switch is in the closed position and 1.1 times max actuation pressure shown on print when the switch is in the open position.

d. Vibrate the switch at 1.5 mm displacement (peak-to-peak) while varying the frequency uniformly from 5 to 50 to 5 Hz over a 5 minute period.

e. Vibrate the switch in alternate one-hour periods in the open and closed positions for a total of 8 hours in each plane. (Total test time is 24 hours).

2. Acceptance Requirements

a. After the entire vibration sequence check the switches to sections A, B, C, or D using the procedure established in each section.

b. Nonconformance is defined as any evidence of leakage or any change in electrical continuity/discontinuity during the vibration cycles, or any switch not meeting the criteria in sections A, B, C, or D. Samples used for this test must be destroyed after all testing is completed.

III. TEST PROCEDURES AND REQUIREMENTS (cont'd)

J. Terminal Strength

1. Test Requirements

a. Mount the switch in the test port.

(1) Apply a 89 ± 9 N axial force to each terminal.

(2) With a pendulum apply a 45 ± 5 N impact force to the switch housing at the connector end, perpendicular to the centerline axis of the switch. See Figure 2 for force application point and direction.

2. Acceptance Requirements

a. Check the switch to sections A, B, C, and D using the procedures established in each section.

b. Nonconformance is defined as any terminal or housing fracture, or any switch not meeting the criteria in sections A, B, C, or D.

K. Vacuum

1. Test Requirements

a. Mount the switch in the test port. Vacuum tests are to be conducted at room temperature using ambient air as the pressure medium.

b. Subject the switch to 5 cycles of vacuum from atmospheric pressure (760 mm Hg) to an absolute pressure of 3-6 mm Hg. Maintain the vacuum for a minimum of 60 seconds.

2. Acceptance Requirements

a. Check the switch to sections A, B, C, and D using the procedure established in each section.

b. Nonconformance is defined as any switch not meeting the criteria in sections A, B, C, and D.

3 mm Hg = 0.058 psi = 0.400 K Pa

6 mm Hg = 0.116 psi = 0.800 K Pa

III. TEST PROCEDURES AND REQUIREMENTS (cont'd)

L. Temperature Cycle

1. Test Requirements

a. Mount switches in test ports; test to be run using currently released brake fluid.

b. Repeat the following procedure 25 times.

(1) Lower the switch and fluid temperature to at least -40°C.

(2) Cycle the switches ten times at 10 seconds/cycles. One cycle consists of a pressure variation from 0 - 276 KPa.G (0-40 psi) to 10,000 ± 345 KPa.G (1450 ± 50 PSI). Note: Switch must open and close each cycle.

(3) Raise switch and fluid temperature to 38°C minimum.

(4) Repeat Step 2.

c. At completion of Step b, check switches per sections A, B, C, and D.

2. Acceptance Requirements

a. Nonconformance is defined as any evidence of switch fluid leakage, seepage, or not meeting the criteria of sections A, B, C, and D.

M. Fluid Resistance

1. Test Requirements

a. Mount the switch in the test port and orient as installed in the vehicle.

b. Install the currently released mating electrical connector (with wire leads) to the switch.

c. Sequentially, immerse the switch into each of the specified fluids, at a temperature of 23 ± 2 °C, for 5 ± 1 second. Remove the switch and drain and store the switch for the specified time at room temperature, prior to immersing into the next fluid.

III. TEST PROCEDURES AND REQUIREMENTS (cont'd)

Fluid	Drain Time	Storage Time
Reference Fuel C ASTM D471	60 ± 5 min.	none
10W40 Engine Oil	24 ± 1 hour	14 days
Ethylene Glycol/ Water 50/50 by Volume	24 ± 1 hour	24 ± 1 hour
Brake Fluid DOT 3	24 ± 1 hour	48 ± 1 hour
Automatic Transmission/ Power Steering Fluid (same) ESP-M2C138-CJ	24 ± 1 hour	14 days
Isopropyl Alcohol/ Water 50/50 by Volume	24 ± 1 hour	none
Reference Fuel C, ASTM D471 with Methyl Alcohol 85/15 by Volume	24 ± 1 hour	none

d. Per the Flow Chart, subject the prescribed number of immersed switches to the post immersion tests specified below:

III. E. Impulse
III. G. Humidity
III. H. Salt Spray
III. J. Terminal Strength

Acceptance Requirements

a. Switches must fully meet the requirements of the specified post immersion test.

b. Nonconformance is defined as any switch not meeting the criteria in sections A, B, C, or D. Samples used for this test must be destroyed after all testing is completed.

IV. STATISTICAL ANALYSIS METHODS

A. For PV, IP-1 and IP-2 tests, all samples tested must pass. Having all the required sample size pass will provide data to support the conclusion that the switch has a minimum reliability R, at a given confidence of C. The notation Po-R is interpreted as minimum reliability equal to R, at a confidence C; thus P90-.80 means a minimum reliability of 80% at 90% confidence.

B. All samples must pass is the statistical test acceptance criteria stated for tests with 100% frequency; or samples from lots, which could have a variable size.

V. REVALIDATION REQUIREMENTS

A. No change in design, material, process or component supplier shall be made without prior approval from the releasing Product Engineering Office. As part of approving a change, the releasing Product Engineering Office will establish the portion of the Product Validation tests required to be run to revalidate the switch. The following table is to be used as a guide in determining the type of tests required for revalidation requirements.

RUNNING CHANGE REVALIDATION

Component	Process or Material Change or New Supplier
1. Terminals, Contacts, or Connector	III, B, C, E, G, H,I. J, L, M.
2. Case or Housing	All Tests
3. Disc or Diaphragm	III, A,D,E,F,I,K,L.
4. Fitting or Fluid Connection	III, D, E, F, H, I, M.

B. Annual revalidation is not required on carryover switches.

VI. LOT DEFINITION

A lot is defined as no more than eight (8) hours of production up to 4,000 pieces. If shifts extend beyond eight (8) hours, or more than 4,000 pieces are produced in a shift, the product must be separated into at least two lots.

VII. RECORD RETENTION

A. Recording and record retention shall conform with Ford Q-101.

B. Production Validation test results and analysis are to be forwarded to the releasing Product Engineering Office before approval for shipment of production parts can be granted.

C. In-Process test results shall be available at the supplier's manufacturing facility for the releasing Product Engineering Office and Ford SQA or its representatives to review on request.

VIII. INSTRUCTIONS AND NOTES

All switches are to be identified with the Ford part number, supplier identification, and a date code indicating final assembly.

All test equipment and test procedures for testing to this specification must be approved by the releasing Product Engineering Office and no change in equipment or procedure may be made without their written concurrence.

Test part configuration is shown in Figure 3.

O-rings, if used in the design, shall be free from cuts, nicks, abrasions or any other damage which would result in a fluid leak.

All switches must have a shipping cap installed over the port threads to prevent contamination. All shipping caps must be approved by the releasing Product Engineering Office prior to production incorporation.

All switches that do not pass the calibration test are to either be readjusted and rechecked, or scrapped. (Salvage of component parts permitted with 100% reinspection).

If product nonconformance occurs for test Sections III. B, C, D, E, F, and J, production shall be stopped and the problems corrected. All production lots shall be sorted 100% prior to shipment. Suspected nonconformance of any shipped parts shall be reported immediately to the releasing Product Engineering Office.

If nonconformance of the statistical acceptance criteria occurs for test Sections III. G, H, I, K, L and M, a cause to recall the subject weeks production and to stop production may result.

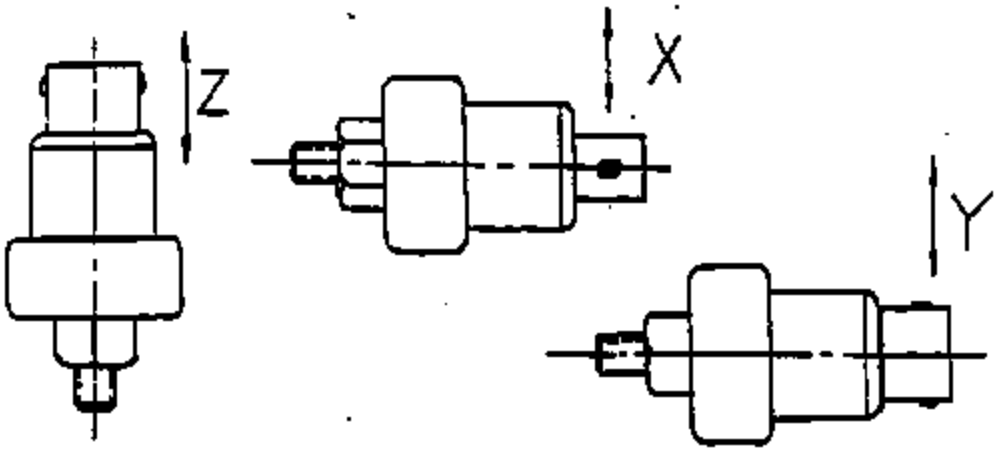
IX. COMPILATION OF REFERENCE DOCUMENTS

ASTM B-117, Salt Spray Testing

Ford Q-101, Quality System Standard - 1993 Edition

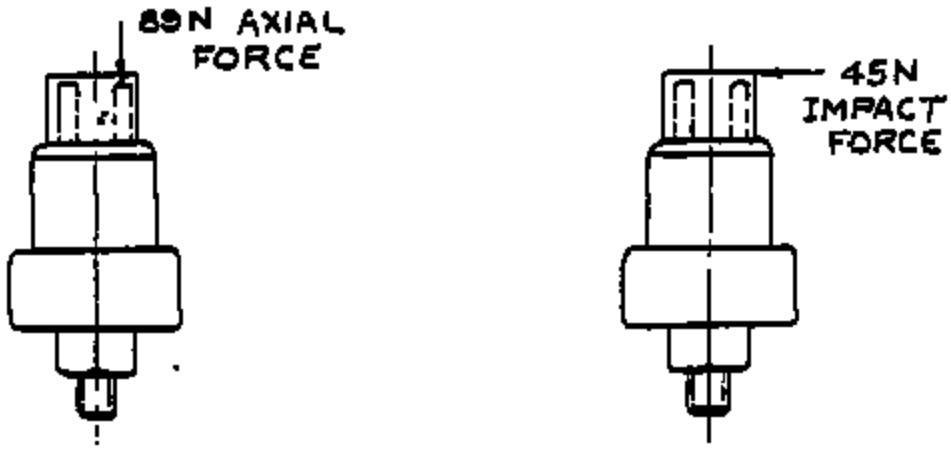
ES-F0EB-14A464-AA, Specification - SLV Assy - Wire Connector

ES-F2VF-9C735-AA, Specification - Servo Assembly Speed Control



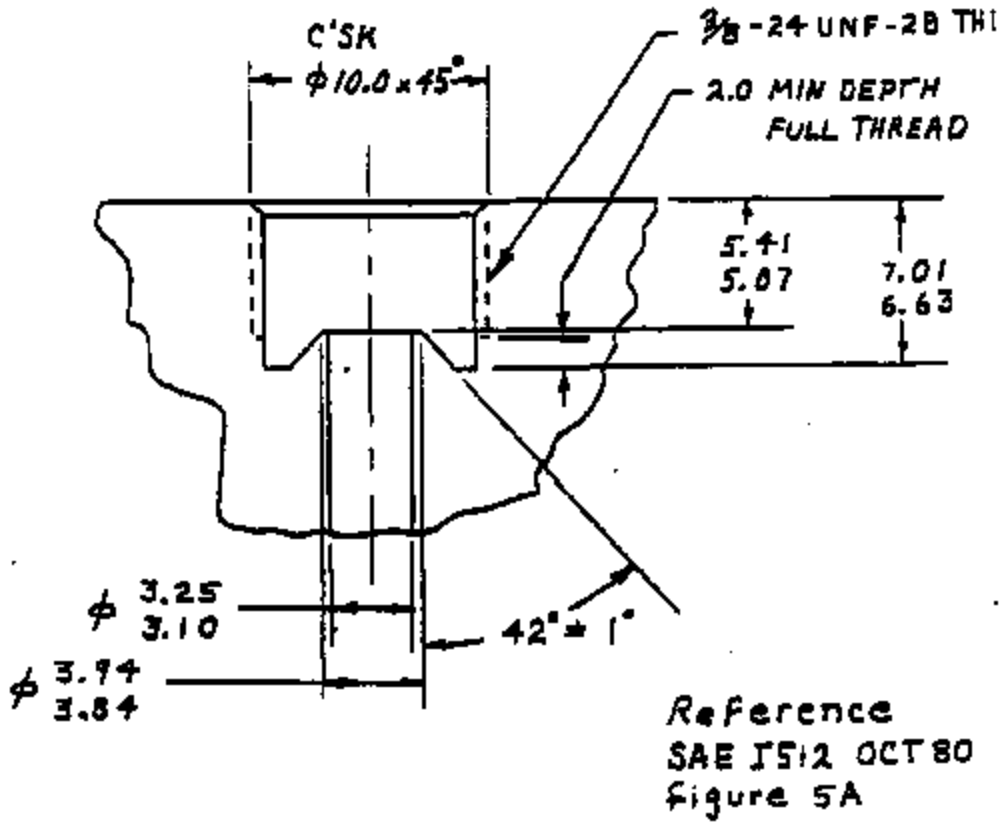
VIBRATION TEST - SWITCH ORIENTATION

FIGURE 1.



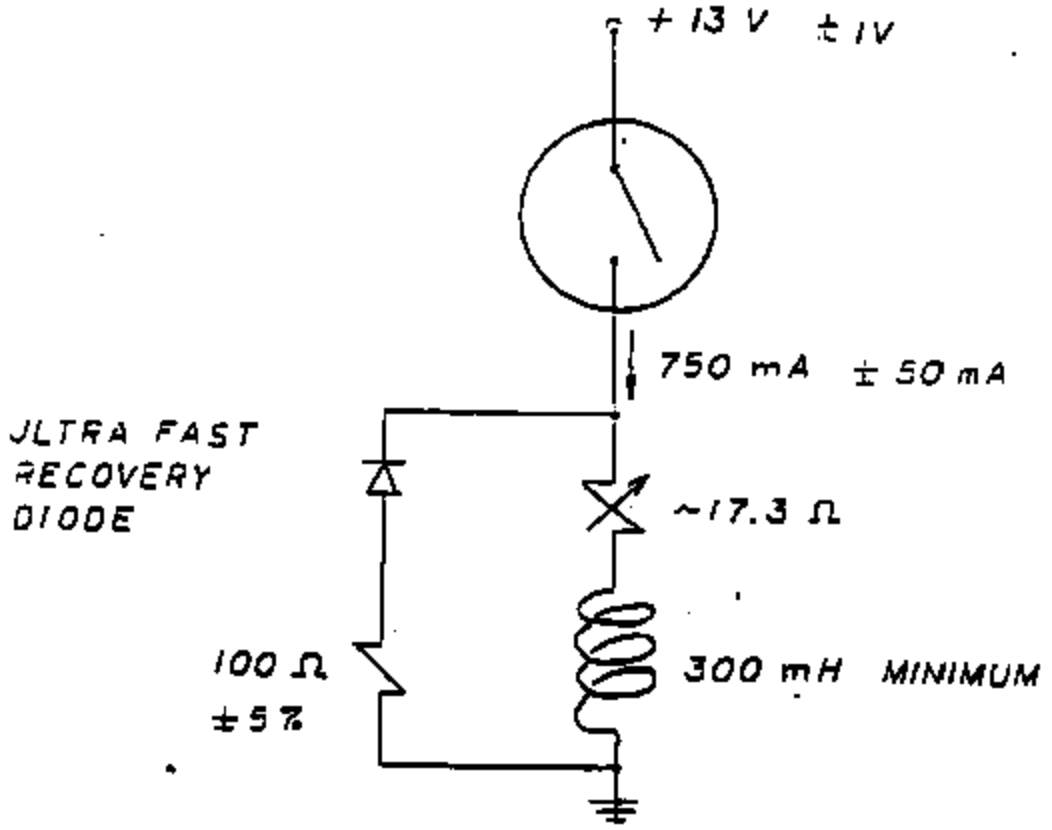
TERMINAL STRENGTH - LOAD ORIENTATION

FIGURE 2.



TEST FIXTURE PORT CONFIGURATION

FIGURE 3



DEACTIVATE SWITCH
TEST SET UP

FIGURE 4

Appendix. 4.2.1
Initial and Final Characterization

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS — MATERIALS & CONTROLS GROUP, ATTLEBORO, MA 02703	DOC.
DATE 91-09-20		PAGE 19

FORM 5288

PRESSURE SWITCH DATA

Form 21405 C

TEST NO. ESL-15-104

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMPL DATE
77PSL2-1			

PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY
Jeffrey DiDomenico	6/14/91		

PROJECT TITLE: Ford MY'9X Electronic Speed Control Deactivate Sw

CUSTOMER: Pass-Car

PURPOSE OF TEST:

Refer to Ford ES

PROCEDURE:

Current leakage

Device #	Act/Rel	-37 mV Drop	Closed contact to housing	Open contact to housing	Between open contacts	Proof	Tests		
15-15-01	127/46	4.9	1.88 nA	1.42 nA	1.37 nA	Good	Fluid res	↓	Impulse
02	129/51	4.7	2.16	1.49	1.50	↓	Fluid res	↓	Impulse
03	124/51	4.8	1.75	1.33	1.62		Fluid res	↓	Impulse
04	128/52	4.4	1.67	1.32	1.29		Fluid res	↓	Impulse
05	124/57	3.1	1.71	1.39	1.48		Fluid res	↓	Impulse
06	130/53	3.2	1.73	1.53	1.59		Fluid res	↓	Impulse
07	124/47	7.2	2.38	1.61	1.60		Fluid res	↓	Impulse
08	120/51	3.6	2.00	1.59	1.82		Fluid res	↓	Impulse
09	122/52	3.0	1.98	1.48	1.57		Fluid res	↓	Impulse
10	118/41	5.5	1.79	1.53	1.71		Fluid res	↓	Impulse
11	122/54	2.9	1.38	1.73	1.85		Fluid res	↓	Impulse
12	126/49	4.9	1.35	1.42	1.81		Fluid res	↓	Impulse
13	122/52	4.2	1.63	1.89	1.66		Fluid res	↓	Temp. Storage
14	124/55	4.6	1.71	1.39	1.75		Fluid res	↓	Temp. Storage
15	131/46	4.5	1.81	1.48	1.47		Fluid res	↓	Temp. Storage
16	125/51	4.7	1.83	1.77	1.70		Fluid res	↓	Temp. Storage
17	127/43	3.7	1.88	1.38	1.74		Fluid res	↓	Temp. Storage
18	133/52	3.0	1.51	1.43	1.37		Fluid res	↓	Temp. Storage
19	133/51	3.7	1.77	1.44	1.82		Fluid res	↓	Temp. Storage
20	127/50	5.0	1.76	1.35	1.70		Fluid res	↓	Temp. Storage
21	127/53	4.2	1.78	1.37	1.79		Fluid res	↓	Temp. Storage
22	133/59	4.3	1.14	1.49	1.57		Fluid res	↓	Temp. Storage
23	131/57	3.3	1.77	1.36	1.62		Fluid res	↓	Temp. Storage
24	134/57	4.8	1.62	1.74	1.63		Fluid res	↓	[illegible]
25	125/48	4.1	1.17	1.27	1.64	↓	Fluid res	↓	Humidity
26	124/50	5.3	1.73	1.29	1.71	Good	Fluid res	↓	Humidity
27	127/46	4.2	1.18	1.25	1.53	↓	Fluid res	↓	Humidity
28	121/45	4.9	1.24	1.33	1.72	↓	Fluid res	↓	Humidity

Current leakage

Device #	Act/Rel	mV Drop	[illegible] to during	after [illegible] to [illegible]	between [illegible]	Func	Tests			
1 [illegible]	121/47	2.7	1.66 mA	1.29 mA	1.49 mA	Good	Fluid ser	6	Humidity	
30	128/50	4.5	1.66	1.25	1.46		Fluid ser	6	Humidity	
31	125/[illegible]	4.7	1.65	1.24	1.61		Fluid ser	6	Salt	Spray
32	129/47	3.9	1.63	1.23	1.46		Fluid ser	6	Salt	Spray
33	131/54	5.2	1.79	1.34	1.70		Fluid ser	6	Salt	Spray
34	145/55	2.2	1.70	1.38	1.67		Fluid ser	6	Salt	Spray
35	121/51	3.4	1.67	1.27	1.77		Fluid ser	6	Salt	Spray
36	123/44	3.8	1.73	1.38	1.61		Fluid ser	6	Salt	Spray
37	125/52	3.9	1.90	1.49	1.59		Burst			
38	119/44	3.5	1.92	1.42	1.59		Burst			
39	134/[illegible]	3.5	1.66	1.31	1.59		Burst			
40	13[illegible]/53	4.9	1.79	1.39	1.56		Burst			
41	15[illegible]/52	4.3	1.64	1.23	1.51		Burst			
42	116/45	3.5	1.67	1.24	1.66		Burst			
43	121/40	3.8	1.68	1.23	1.69		Vibration			
44	127/47	5.7	1.60	1.30	1.65		Vibration			
45	117/43	3.6	1.58	1.23	1.65		Vibration			
46	123/49	3.4	1.59	1.21	1.63		Vibration			
47	135/62	6.3	1.65	1.24	1.63		Vibration			
48	121/35	4.1	1.69	1.32	1.49		Vibration			
49	13[illegible]/65	5.5	1.61	1.21	1.43		Vacuum			
50	117/45	3.5	1.58	1.23	1.47		Vacuum			
51	Not used									
52	117/42	14.5	1.69	1.27	1.69	Good	Vacuum			
53	130/43	5.2	1.60	1.25	1.55		Vacuum			
54	133/50	5.0	1.63	1.29	1.63		Vacuum			
55	129/42	4.7	1.62	1.29	1.69		Vacuum			
56	123/47	5.7	1.63	1.29	1.73		Temp	Cycle		
57	127/52	6.1	1.70	1.29	1.56		Temp	Cycle		
58	121/45	5.2	1.59	1.31	1.55		Temp	Cycle		
59	128/[illegible]	5.4	1.72	1.28	1.49		Temp	Cycle		
60	129/50	6.9	1.73	1.29	1.46		Temp	Cycle		
61	14[illegible]/61	5.1	1.76	1.23	1.46		Temp	Cycle		
62	12[illegible]/56	9.2	1.78	1.24	1.42		Impulse		Stopped @	155
63	124/39	4.8	1.66	1.24	1.44		Impulse		Leak @	350 K
64	1[illegible]/53	5.2	1.63	1.25	1.41		Impulse		Stopped @	255
65	132/55	7.7	1.68	1.25	1.49		Impulse		Leak @	15[illegible]
66	13[illegible]/52	9.7	1.72	1.27	1.45		Impulse		Stopped @	15[illegible]
67	115/51	6.0	1.76	1.31	1.46		Impulse		Stopped @	1[illegible]
68	11[illegible]/41	6.8	1.73	1.30	1.48		Impulse		Leak @	33[illegible] K
69	124/41	10.0	1.78	1.34	1.45		Impulse		Leak @	209 K
70	126/46	2.7	1.74	1.29	1.44		Impulse		Leak @	[illegible]
71	133/45	6.7	1.78	1.26	1.43		Impulse		Leak @	25[illegible]
72	129/56	6.1	1.91	1.23	1.47		Impulse		Leak @	200 K
73	137/57	3.7	1.69	1.27	1.47		Impulse		Leak @	27[illegible] K
74	12[illegible]/43	4.6	1.71	1.27	1.46					
75	129/59	6.3	1.73	1.28	1.50					
76	13[illegible]/53	7.1	1.71	1.29	1.49					
77	128/52	7.2	1.75	1.30	1.47					
78	139/63	6.6	1.73	1.30	1.49					
79	124/42	5.4	1.76	1.23	1.49					
80	12[illegible]/55	5.1	1.75	1.31	1.43					

TI-NHTSA 004238

730 K

Rebuild of Impulse parts/Post Cycle

Device #	Proof	Act/Rel	Hi Dev	Current leakage					
156-5-91	OK	105/53	51	1.81	1.53	1.80			
[illegible]		111/51	131	1.90	1.60	1.77			
[illegible]		113/54	101	2.05	1.64	1.78			
[illegible]		[illegible]/55	47	2.14	1.66	1.90			
[illegible]		111/60	97	1.96	1.56	1.69			
[illegible]		[illegible]/64	56	1.87	1.55	1.90			
[illegible]		112/5[illegible]	57	1.89	1.5[illegible]	1.81			
[illegible]		116/53	114	1.91	1.56	1.70			
[illegible]		110/54	59	1.87	1.57	1.83			
[illegible]		[illegible]/55	42	1.93	1.58	1.74			
[illegible]		113/57	40	2.27	1.69	1.72			
[illegible]		116/60	42	2:03	1.58	1.66			
[illegible]		117/58	76	2.41	1.60	1.66			
[illegible]		115/56	45	2.18	1.64	1.68			
[illegible]		115/55	49	1.82	1.67	1.89			
[illegible]		115/57	125	1.86	1.60	1.79			
[illegible]		118/5[illegible]	111	2.20	1.67	1.78			
[illegible]		112/60	104	1.75	1.52	1.73			
[illegible]		[illegible]/58	178	1.96	1.64	1.75			
[illegible]		[illegible]/57	86	1.93	1.60	1.83			
[illegible]		115/56	108	1.79	1.47	1.73			
[illegible]		117/58	97	2.05	1.61	1.76			
[illegible]		115/53	49	2.16	1.63	1.76			
[illegible]	↓	112/52	132	2.17	1.65	1.73			

Final Char

Device #	Test	Proof	Act/Rel	Hi Dev	Current leakage		
156-15-01	Fluid Res & Intake		Skipped				
02	Fluid Res & Intake						
03	Fluid Res & Intake						
04	Fluid Res & Intake						
05	Fluid Res & Intake						
06	Fluid Res & Intake						
07	Fluid Res & Intake						
08	Fluid Res & Intake						
09	Fluid Res & Intake						
10	Fluid Res & Intake						
11	Fluid Res & Intake						
12	Fluid Res & Intake		↓				
13	Fluid Res & Term Strength	OK	128/57	44	2.07	1.42	1.61
14	Fluid Res & Term Strength		135/62	41	1.62	1.32	1.57
15	Fluid Res & Term Strength		123/53	45	1.71	1.36	1.55
16	Fluid Res & Term Strength		131/58	44	1.83	1.48	1.55
17	Fluid Res & Term Strength		125/49	49	1.62	1.34	1.54
18	Fluid Res & Term Strength		132/61	45	1.81	1.56	1.55
19	Fluid Res & Term Strength		133/60	46	1.90	1.43	1.54
20	Fluid Res & Term Strength		133/58	4.7	1.70	1.38	1.72
21	Fluid Res & Term Strength		137/59	43	1.81	1.44	1.53
22	Fluid Res & Term Strength		131/62	45	1.84	1.47	1.60
23	Fluid Res & Term Strength		135/64	49	1.87	1.36	1.60
24	Fluid Res & Term Strength	↓	135/63	44	1.70	1.40	1.66
25	Fluid Res & Humidity		[illegible]/56	5.1	[illegible]	1.57	1.70
26	Fluid Res & Humidity		131/62	5.0	2:02	1.57	1.71
27	Fluid Res & Humidity		131/53	5.5	2.04	1.65	1.71
28	Fluid Res & Humidity		125/51	10.1	[illegible]	1.91	1.57
29	Fluid Res & Humidity		133/66	5.7	1.82	1.55	1.72
30	Fluid Res & Humidity	↓	131/50	7.1	1.99	1.39	1.59

TI-NHTSA 004239

Device #	Test	S		Proof	Act/Rel	Ms Proof	Current CL-[illegible]	leakage Bl-[illegible]	Bl-Common
1/13-5-31	Fluid Res	Salt Spray		OK	124/41	41	1.68	1.47	1.65
-32	Fluid Res	Salt Spray		↓	137/52	40	1.88	1.61	1.75
-33	Fluid Res	Salt Spray		↓	125/59	42	1.71	1.43	1.64
-34	Fluid Res	Salt Spray		↓	140/70	41	5.31	7.40	7.68
-35	Fluid Res	Salt Spray		↓	125/57	41	1.68	1.48	1.66
-36	Fluid Res	Salt Spray		↓	123/53	42	1.69	1.40	1.65
-37	Burst			7100/152					
-38	Burst			7300					
-39	Burst			7100					
-40	Burst			7700					
-41	Burst			7700					
-42	Burst			7600					
-43	Vibration			OK	121/48	43	2.18	1.75	1.84
-44	Vibration			↓	125/51	41	1.90	1.58	1.83
-45	Vibration			↓	121/50	43	1.89	1.56	1.72
-46	Vibration			↓	123/53	45	1.97	1.61	1.77
-47	Vibration			↓	137/65	43	1.92	1.58	1.71
-48	Vibration			↓	124/50	41	1.92	1.54	1.80
-49	Vacuum			OK	124/67	5.3	1.97	1.60	1.63
-50	Vacuum			OK	128/77	4.1	1.71	1.10	1.99
-51	Not Used								
-52	Vacuum			OK	118/47	17.0	1.85	1.49	1.94
-53	Vacuum			OK	127/49	9.3	1.57	1.31	1.34
-54	Vacuum			OK	121/55	6.5	1.82	1.54	2.18
-55	Vacuum			OK	123/49	5.8	1.62	1.41	2.01
-56	Temp. Cycle			OK	122/63	5.6	1.47	1.27	1.75
-57	Temp. Cycle			OK	128/60	1.7	1.56	1.34	1.79
-58	Temp. Cycle			OK	118/57	5.2	1.68	1.43	1.71
-59	Temp. Cycle			OK	114/52	7.5	1.67	1.32	1.72
-60	Temp. Cycle			OK	115/57	6.6	1.70	1.43	1.71
-61	Temp. Cycle			OK	117/66	5.6	1.57	1.37	1.82
-62	Impulse		aborted						
-63	Impulse		↓						
-64	Impulse		↓						
-65	Impulse		↓						
-66	Impulse		↓						
-67	Impulse		↓						
-68	Impulse		↓						
-69	Impulse		↓						
-70	Impulse		↓						
-71	Impulse		↓						
-72	Impulse		↓						
-73	Impulse		↓						
-74	Not used								
-75	Not used								
-76	Not used								
-77	Not used								
-78	Not used								
-79	Not used								
-81	Not used								

TI-NHTSA 004240

Appendix 4.2.2
Burst data and Weibull

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS — MATERIALS & CONTROLS GROUP, ATTLEBORO, MA 02703	DOC.
DATE 91-05-30		PAGE 14

FORM 6293

ESTIMATE AND TWO SIDED 90 % CONFIDENCE
INTERVALS FOR DISTRIBUTION PARAMETERS
****

SHAPE(BETA) PARAMETER	:	63.735
LOWER LIMIT	:	31.505 ← LOW EXTREME @ 90%
UPPER LIMIT	:	%126.933029174B047
SCALE(THETA) PARAMETER	:	7768.737
LOWER LIMIT	:	7680.740 ← LOW EXTREME @ 90%
UPPER LIMIT	:	7857.741

MEDIAN
MORE VALUES FOR SPECIFIED LEVELS OF RELIABILITY — USING LOW VALUES FOR β AND θ FROM ABOVE
****
* WEIBULL SLOPE :31.50
* CHARACTERISTIC LIFE : 7680.74

NO.	RELIABILITY(%)	MEDIAN
1	72	7414.0854

TI-NHTSA 004243

Appendix 4.2.3
Vibration

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS	MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703
DATE 91-01-24		DOC.
		PAGE

FORM 5355

ENVIRONMENTAL TEST LAB REQUEST FORM

(ONE TEST PER REQUEST)

DATE 8/5/91

REQUESTED BY Jeffrey DiDomenico

REQUIRED COMPLETION DATE 8/9/91

EXTENSION 3149 MS 12-29

DEVICE [redacted], 77956 2-3

CHARGE DEPT. NO. 127 I.O. NO. 101960

REFERENCE SPEC. NO. ES-F2VC-9F911-AA

SOURCE OF TEST SAMPLES Parts Lab

QUANTITY OF TEST SAMPLES [redacted] 12

REPORT NO. 0887-091

TESTED BY Lab

COMPLETION DATE 9-3-91

TEST REQUIREMENTS: (TO BE FILLED IN BY REQUESTOR)

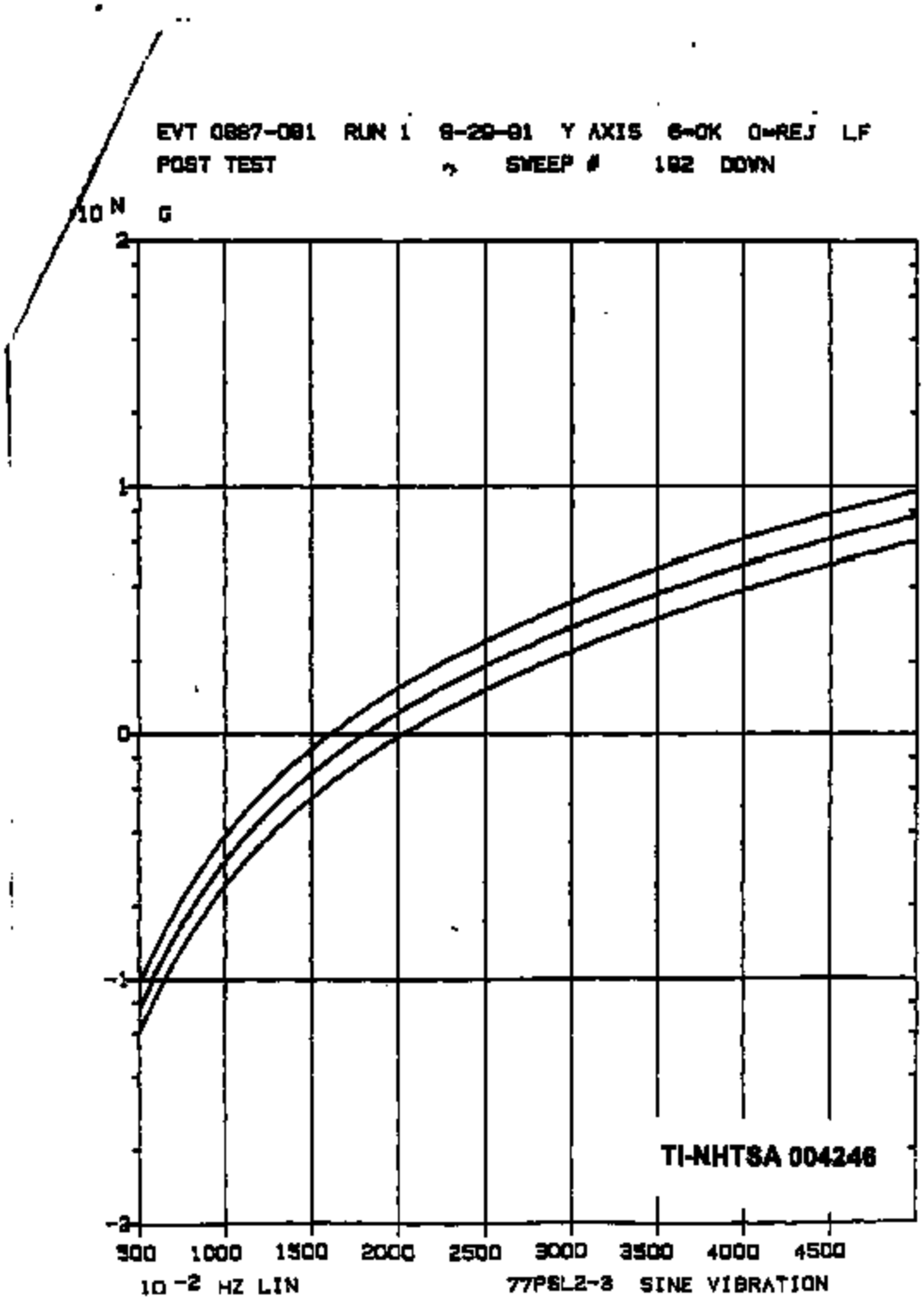
See attached, Vibration.

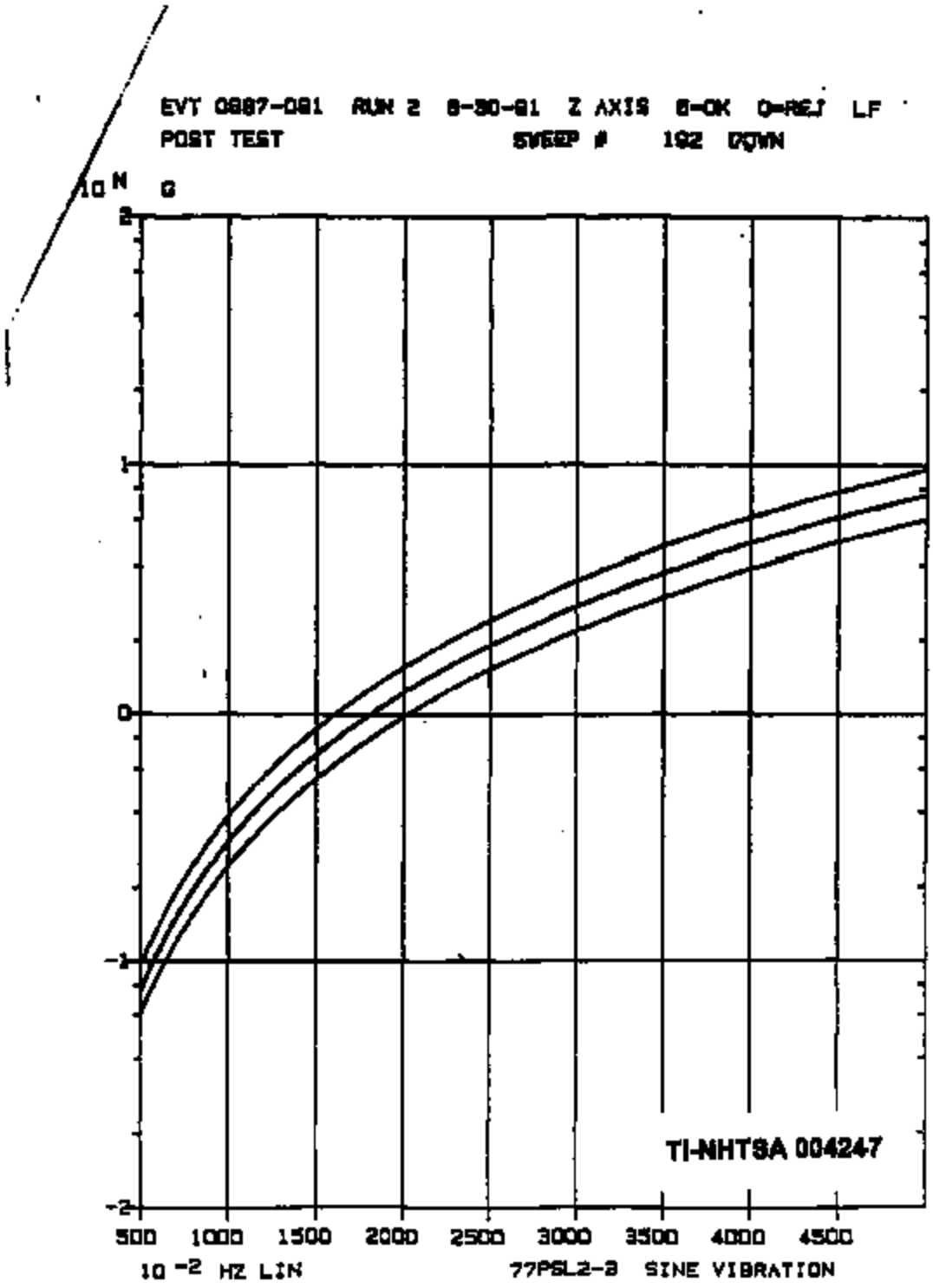
TEST PERFORMED: per attached specification.

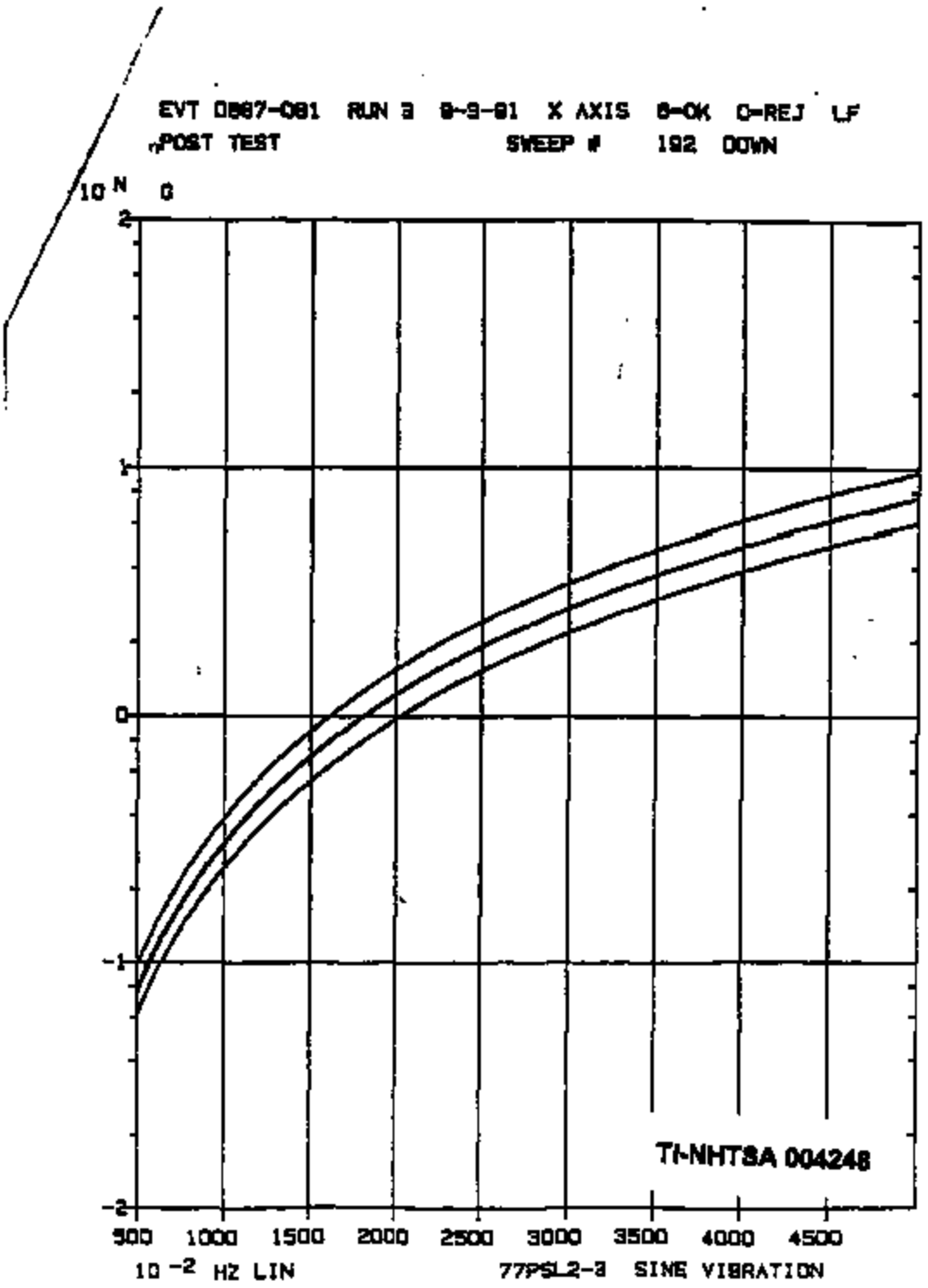
TEST RESULTS:

See attached sheets.

EQUIPMENT USED: CALIBRATION DATE: NEXT DUE DATE:


EVT 0887-091 RUN 1 9-29-91 Y AXIS 6=OK 0=REJ LF
POST TEST SWEEP # 192 DOWN
10 N G
2
1
0
-1
-2
500 1000 1500 2000 2500 3000 3500 4000 4500
10 -2 HZ LIN
77PSL2-3 SINE VIBRATION
TI-NHTSA 004246


EVT 0887-001 RUN 2 8-30-01 Z AXIS 0=OK 0=REJ LF
POST TEST SWEEP # 192 DOWN
10 N G
2
1
0
-1
-2
500 1000 1500 2000 2500 3000 3500 4000 4500
10 -2 HZ LIN
77PSL2-3 SINE VIBRATION
TI-NHTSA 004247


EVT 0867-081 RUN 3 8-9-81 X AXIS G-OK O-REJ LF
POST TEST SWEEP # 192 DOWN
10 N G
2
1
0
-1
-2
500 1000 1500 2000 2500 3000 3500 4000 4500
10 -2 HZ LIN
77PSL2-3 SINE VIBRATION
TI-NHTSA 004248

Appendix 4.2.4
Thermal Cycle Day/Time/Temp

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 91-05-10		PAGE 53

FORM 9256

77 PS Validation Testing

Temp. Cycle Test

(Low Setpt -42°C)

		1 Ambient Temp	2 Actual Temp	3 Time	4 Date	5	6 Ambient Temp	7 Actual Temp	8 Time	9 Date	10	11	12	13
Cycle	1	+40	+43	11:45	8/7/91		-43	-45	11:35	8/7/91				
	2	43	43	1:05	"		-40	-46	2:10	"				
	3	41	42	3:45	"		-42	-44	4:10	"				
	4	40	40	7:35	"		-42	-44	9:15P	"				
	5	41	40	7:35A	8/8/91		-41	-47	8:45	8/8/91				
	6	39	41	9:30	"		-41	-44	10:35	"				
	7	43	45	11:45	"		-42	-44	12:50	"				
	8	41	42	1:30	"		-42	-44	3:00P	"				
	9	40	43	3:20	"		-40	-45	4:40P	"				
	10	42	43	5:05P	"		-42	-44	6:50P	"				
	11	42	42	7:35P	"		-43	-44	9:35P	"				
	12	40	45	7:50A	8/9/91		-41	-44	9:05	8/9/91				
	13	42	42	9:30A	"		-40	-44	10:40	"				
	14	42	43	11:15A	"		-42	-41	2:40	"				
	15	42	42	1:10P	"		-40	-44	3:25	"				
	16	41	43	3:45	"		-40	-44	4:00	"				
	17	40	43	4:35	"		-40	-44	5:35	"				
	18	41	42	11:40A	8/10/91		-43	-44	2:35P	8/10/91				
	19	41	42	3:00P	"		-42	-44	4:35	"				
	20	40	42	5:20P	"		-42	-44	7:15P	"				
	21	43	42	8:40A	8/11/91		-43	-44	4:50P	8/11/91				
	22	43	42	5:15	"		-41	-44	6:45	"				
	23	40	42	7:50	8/12/91		-40	-44	9:05	8/12/91				
	24	40	43	9:50	"		-40	-45	11:05	"				
	25	40	43	11:50	"		-40	-44	1:05	"				
	26													
	27													
	28													
	29													
	30													
	31													

Appendix 4.2.5
Fluid Resistance Test

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS — MATERIALS & CONTROLS GROUP, ATTLEBORO, MA 02703	DOC.
DATE 11-09-20		PAGE 41

FORM 5288

FORM NO. 16000 1/80

TEST NO. 107831 **TECHNICAL SERVICE LABS** TEST NO. 107831

LEGEND CHARGE	
CALL NO.	
REQUESTOR	
MAIL STATION	15-37
EXTENSION	3777
DATE REQUIRED	8/8/91
NO. OF SAMPLES	72
COMPOSITION	Fiber

REPORT OF RESULTS:

complete

DATE RECEIVED 8/8/91 DATE OUT 9-5

EMPLOYEE NO.									
JOB NO.									
NO. ANALYZED									
HOURS WORKED									

Appendix 4.2.6
Humidity

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 93-09-20		PAGE 56

FORM 5288

Form 3419

ENVIRONMENTAL TEST LAB REQUEST FORM

(ONE TEST PER REQUEST)

DATE 9/6/91

REQUIRED COMPLETION DATE 9/11/91

DEVICE 77F5L2-1; 77F5L2-3

CHARGE DEPT. NO. 127 I.O. NO. 101060

REFERENCE SPEC. NO. ES-F2VC-19934-AA

SOURCE OF TEST SAMPLES Ford Lab

QUANTITY OF TEST SAMPLES 4

REQUESTED BY Jeffrey DiBenedetto

EXTENSION 2144 - MS 46-11

9/6/

REPORT NO. 0933-091

TESTED BY LAB

COMPLETION DATE 9-20-91

TEST REQUIREMENTS: (TO BE FILLED IN BY REQUESTOR)

Please run humidity test per attached.

TEST PERFORMED:

START 9-16-91 16:00 CHAMBER MALFUNCTION (SHUT DOWN)

RESTART 9-18-91 0830 HOURS

STOP 9-20-91 1630 HOURS

TEST RESULTS:

EQUIPMENT USED: CALIBRATION DATE: NEXT DUE DATE:

Appendix 4.2.7
Salt Spray

TEST LOT NO.	TEST	DEVICE
TESTED BY		
APPROVED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	DOC.
DATE 91-05-20		PAGE 58

FORM 8295

Form 9414

ENVIRONMENTAL TEST LAB REQUEST FORM
(ONE TEST PER REQUEST)

DATE 9/6/91

REQUESTED BY Jeffrey DiDomenico

REQUIRED COMPLETION DATE 9/10/91

EXTENSION 3144 MS# 12-21

DEVICE 77PSLJ-1 ; 77PSLJ-2

CHARGE DEPT. NO. 111 I.O. NO. 101060

REPORT NO. 0934-091

REFERENCE SPEC. NO. ES-F3VC-9F139-AA

TESTED BY Lab

SOURCE OF TEST SAMPLES Delco Lab

COMPLETION DATE 9-9-91

QUANTITY OF TEST SAMPLES 12

TEST REQUIREMENTS: (TO BE FILLED IN BY REQUESTOR)

Please run salt Spray Test per attached.

TEST PERFORMED:

IN: 1430 9-6-91

Out: 1430 9-9-91

TEST RESULTS:

to be determined by requestor.

EQUIPMENT USED: CALIBRATION DATE: NEXT DUE DATE:

Appendix 4.2.8
Light Truck F3TA-9F924-AA Data

TEST LOT NO.	TEST	DEVICE
TESTED BY	TEXAS INSTRUMENTS MATERIALS & CONTROLS GROUP ATTLEBORO, MA 02703	
APPROVED BY		DOC.
DATE 91-05-20		PAGE 60

FORM 5208

PRESSURE SWITCH DATA

Form 21605

TEST NO. [illegible]-15-160

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMPLETION DATE
77PS12-3			

PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY
Jeffrey A. Domenico	6/27/91		

PROJECT TITLE: Ford MY'92 Electronic Speed Control Deactivate PS

CUSTOMER: LT

PURPOSE OF TEST:

Refer to Ford ES

PROCEDURE:

Current Leakage

Device #	Act/Rel	ΔP Drop	[illegible]	[illegible]	[illegible]	Visual	Tests		
12-15-01	281/184	4.5	1.65 mA	1.32 mA	1.64 mA	Good	Fluid Res	I	Insula[illegible]
02	267/186	4.9	1.60	1.31	1.47		Fluid Res	I	Insula[illegible]
03	264/171	4.7	1.60	1.33	1.49		Fluid Res	I	Insulat[illegible]
04	281/188	4.6	1.69	1.35	1.47		Fluid Res	I	Insulat[illegible]
05	260/187	3.9	1.68	1.31	1.45		Fluid Res	I	Insulat[illegible]
06	270/191	6.0	1.60	1.33	1.46		Fluid Res	I	Insulat[illegible]
07	262/187	4.0	1.57	1.30	1.47		Fluid Res	I	Insulat[illegible]
08	263/185	6.3	1.76	1.29	1.70		Fluid Res	I	Insulat[illegible]
09	264/176	4.1	1.59	1.48	1.57		Fluid Res	I	Insulat[illegible]
10	283/180	4.7	1.62	1.37	1.58		Fluid Res	I	Insulat[illegible]
	257/170	4.5	1.75	1.36	1.40		Fluid Res	I	Insulat[illegible]
[illegible]	246/175	3.6	1.76	1.27	1.42		Fluid Res	I	Insulat[illegible]
[illegible]	Not Acted								
[illegible]	250/181	4.1	1.55	1.39	1.53	Good	Fluid Res	I	Temp [illegible]
15	277/191	7.1	2.00	1.52	1.64		Fluid Res	I	Temp [illegible]
16	257/186	4.9	1.90	1.45	1.65		Fluid Res	I	Temp [illegible]
17	265/175	5.1	1.73	1.31	1.50		Fluid Res	I	Temp [illegible]
18	283/200	4.7	1.61	1.31	1.57		Fluid Res	I	Temp [illegible]
[illegible]	271/177	5.5	1.76	1.39	1.46		Fluid Res	I	Temp [illegible]
[illegible]	243/188	6.2	1.81	1.30	1.43		Fluid Res	I	Temp [illegible]
	263/196	4.1	1.79	1.29	1.45		Fluid Res	I	Temp [illegible]
[illegible]	260/193	5.2	1.53	1.39	1.55		Fluid Res	I	Temp [illegible]
[illegible]	267/194	3.4	1.91	1.35	1.50		Fluid Res	I	Temp [illegible]
[illegible]	251/192	4.2	1.62	1.37	1.77		Fluid Res	I	Temp [illegible]
[illegible]	259/184	4.4	1.65	1.27	1.60		Fluid Res	I	Temp [illegible]
[illegible]	261/180	6.4	1.89	1.42	1.59	Good	Fluid Res	I	Humid[illegible]
[illegible]	259/192	4.6	1.51	1.42	1.57		Fluid Res	I	Humid[illegible]
[illegible]	270/195	4.7	1.69	1.39	1.67		Fluid Res	I	Humid[illegible]

Current Leakage

Device #	Act/Rel	ΔV Drop	[illegible]	[illegible]	[illegible]	Perf	Test
[illegible]	266/193	5.6	1.82 mA	1.36 mA	1.54 mA	Good	Fluid Age & Humidity
[illegible]	263/196	4.5	1.76	1.34	1.58		Fluid Age & Humidity
[illegible]	241/179	6.8	1.74	1.32	1.51		Fluid Age & Humidity
[illegible]	267/199	6.2	1.76	1.36	1.64		Fluid Age & Salt Spray
[illegible]	248/171	4.3	1.65	1.29	1.61		Fluid Age & Salt Spray
[illegible]	267/193	6.4	1.69	1.31	1.69		Fluid Age & Salt Spray
[illegible]	250/195	5.2	1.75	1.34	1.62		Fluid Age & Salt Spray
[illegible]	NOT USED						
[illegible]	266/199	6.4	1.79	1.32	1.73	Good	Fluid Age & Salt Spray
[illegible]	140/111	7.7					
[illegible]	256/189	3.9	1.67	1.27	1.65	Good	Fluid Age & Salt Spray
[illegible]	254/194	4.8	1.95	1.52	1.61		Burst
[illegible]	254/185	5.6	1.76	1.32	1.65		Burst
[illegible]	266/179	4.7	1.69	1.27	1.60		Burst
[illegible]	NOT USED						
[illegible]	258/175	4.9	1.73	1.29	1.66	Good	Burst
[illegible]	266/195	4.4	1.62	1.27	1.60		Burst
[illegible]	261/182	5.0	1.75	1.32	1.67		Burst
[illegible]	260/189	6.1	1.72	1.32	1.62		Vibration
[illegible]	264/184	7.5	1.77	1.39	1.53		Vibration
[illegible]	257/181	3.5	1.77	1.35	1.62		Vibration
[illegible]	262/190	11.0	1.90	1.29	1.77		Vibration
[illegible]	NOT USED						
[illegible]	268/186	6.1	1.65	1.37	1.56	Good	Vibration
[illegible]	264/181	5.1	1.73	1.31	1.52	Good	Vibration
[illegible]	NOT USED						
	257/186	5.1	1.79	1.32	1.58	Good	Vacuum
[illegible]	255/179	5.5	1.77	1.33	1.49		Vacuum
[illegible]	248/182	3.4	1.73	1.26	1.49		Vacuum
[illegible]	261/191	7.9	1.80	1.35	1.49		Vacuum
[illegible]	256/190	5.0	1.74	1.36	1.44		Vacuum
[illegible]	260/185	4.5	1.72	1.39	1.57		Vacuum
[illegible]	252/184	5.1	1.72	1.33	1.49		Temp Cycle
[illegible]	248/178	6.0	1.82	1.26	1.48		Temp Cycle
[illegible]	262/188	4.7	1.85	1.28	1.50		Temp Cycle
[illegible]	256/180	5.5	1.88	1.34	1.62		Temp Cycle
[illegible]	255/189	4.0	1.87	1.37	1.57		Temp Cycle
[illegible]	257/183	4.3	1.91	1.35	1.45		Temp Cycle
[illegible]	254/187	2.7	1.90	1.35	1.48		Impulse
[illegible]	NOT USED						
[illegible]	251/173	5.0	1.82	1.36	1.45	Good	Impulse
[illegible]	249/186	4.6	1.80	1.32	1.45		Impulse
[illegible]	258/183	4.0	1.83	1.41	1.50		Impulse
[illegible]	262/189	4.0	1.83	1.37	1.46		Impulse
[illegible]	254/182	5.6	1.81	1.36	1.45		Impulse
[illegible]	261/184	4.3	1.86	1.41	1.51		Impulse
[illegible]	NOT USED						
[illegible]	[illegible]/181	7.4	1.84	1.41	1.51	Good	Impulse
[illegible]	257/189	5.1	1.76	1.34	1.47		Impulse
[illegible]	257/182	3.4	1.75	1.35	1.48		Impulse
[illegible]	256/188	5.1	1.79	1.34	1.49		Impulse
[illegible]	252/189	4.9	1.79	1.35	1.46		Impulse

TI-NHTSA 004259

Final Characterizations

Device #	TESTS	Proof	Act/Rel	% Drop	[illegible]	[illegible]
[illegible]-01	Fluid Age & Torque	OK	237/180	5.5	1.91	1.47
02	Fluid Age & Torque	OK	237/180	4.3	1.61	1.37
03	Fluid Age & Torque	OK	238/181	44.3	1.64	1.37
04	Fluid Age & Torque	OK	241/172	44.3	1.57	1.37
05	Fluid Age & Torque	OK	236/181	2.7	1.72	1.41
06	Fluid Age & Torque	OK	240/180	6.3	1.71	1.44
07	Fluid Age & Torque	OK	[illegible]/185	2.5	1.72	1.38
08	Fluid Age & Torque	OK	180/179	2.3	1.48	1.39
09	Fluid Age & Torque	OK	237/180	2.4	1.59	1.35
10	Fluid Age & Torque	OK	240/183	8.3	1.52	1.32
11	Fluid Age & Torque	OK	232/180	2.2	1.49	1.31
12	Fluid Age & Torque	OK	232/177	3.3	1.49	1.27
13	Not Used					
14	Fluid Age & Temp [illegible]	OK	250/180	41	1.86	1.47
15	Fluid Age & Temp [illegible]		235/186	41	1.65	1.43
16	Fluid Age & Temp [illegible]		236/184	42	1.65	1.41
17	Fluid Age & Temp [illegible]		246/176	42	1.65	1.41
18	Fluid Age & Temp [illegible]		265/202	40	1.74	1.43
19	Fluid Age & Temp [illegible]		237/182	[illegible]	1.66	1.39
20	Fluid Age & Temp [illegible]		245/190	40	1.76	1.37
21	Fluid Age & Temp [illegible]		260/181	–	1.66	1.38
22	Fluid Age & Temp [illegible]		[illegible]/185	41	1.63	1.39
23	Fluid Age & Temp [illegible]		222/18[illegible]	41	1.75	1.40
24	Fluid Age & Temp [illegible]		[illegible]	40	1.72	1.35
25	Fluid Age & Temp [illegible]		[illegible]	[illegible]	1.54	1.31
26	Fluid Age & Humidity	OK	[illegible]	6.3	2.11	1.70
27	Fluid Age & Humidity		241/18[illegible]	4.3	2.18	1.74
28	Fluid Age & Humidity		[illegible]	4.1	2.0[illegible]	1.61
29	Fluid Age & Humidity		[illegible]	6.7	1.66	1.45
30	Fluid Age & Humidity		279/18[illegible]	5.9	2.00	1.65
31	Fluid Age & Humidity		[illegible]	5.9	2.00	1.65
32	Fluid Age & Salt Spray		[illegible]/184	40	306.00	4.39
33	Fluid Age & Salt Spray		254/18[illegible]	40	2.11	1.7[illegible]
34	Fluid Age & Salt Spray		260/183	40	310.00	44.00
35	Fluid Age & Salt Spray		[illegible]	40	310.00	307.00
36	NOT USED					
37	Fluid Age & Salt Spray	OK	[illegible]	40	39.6	37.4
38	NOT USED					
39	Fluid Age & Salt Spray	OK	237/183	40	307.00	306
40	[illegible]	[illegible]				
41	[illegible]	[illegible]				
42	[illegible]	[illegible]				
43	NOT USED					
44	[illegible]	[illegible]				
45	[illegible]	[illegible]				
46	[illegible]	[illegible]				
47	Vibration	OK	258/18[illegible]	11.6	1.53	1.26
48	Vibration	OK	262/189	41	1.19	1.40
49	[illegible]	OK	[illegible]	3.7	1.47	1.32
50	[illegible]	OK	[illegible]	14.5	1.37	1.15
51	NOT USED					
52	[illegible]	OK	253/175	6.5	1.35	1.14
53	[illegible]	[illegible]	262/18[illegible]	[illegible]	1.37	[illegible]
54	NOT USED					
55	Vacuum	OK	262/179	5.4	1.57	1.31
56	Vacuum	OK	253/178	5.3	1.64	[illegible]
57	Vacuum	OK	253/186	6.3	1.57	1.46

Device #	Tests			Proof	Act/[illegible]	% Drop	[illegible]	[illegible]	[illegible]
15-15-58	Vacuum			OK	218/198	9.9	1.69	1.46	1
59	Vacuum			OK	213/191	9.3	1.66	1.44	1.3
60	Vacuum			OK	260/190	7.7	1.71	1.47	1.2
61	Temp Cycle			OK	248/192	5.3	1.59	1.14	1
62	Temp. Cycle			OK	234/179	5.2	1.57	1.33	1
63	Temp. Cycle			OK	253/187	5.9	1.59	1.37	1
64	Temp. Cycle			OK	245/178	6.8	1.66	1.38	1
65	Temp. Cycle			OK	245/175	9.8	1.69	1.34	1
66	Temp. Cycle			OK	246/182	13.3	1.58	1.34	[illegible]
67	Tensile			Pass	254/181	1.9	1.24	1.59	1
68	Not Used								
69	Tensile			Pass	235/179	3.7	1.97	1.46	1
70	Tensile			Pass	290/181	3.0	1.96	1.49	1
71	Tensile			Pass	242/184	1.9	1.77	1.69	1
72	Tensile			Pass	250/185	2.0	2.01	1.67	2
73	Tensile			Pass	249/186	1.9	2.11	1.72	1
74	Tensile			Pass	293/181	1.9	2.10	1.71	2
75	Not used								
76	Tensile			Pass	254/184	1.9	1.89	1.47	1
77	Tensile			Pass	248/188	19.1	1.72	1.36	1
78	Tensile			Pass	248/181	5.3	1.94	1.54	1
79	Tensile			Pass	251/184	1.9	1.88	1.60	1
80	Tensile			Pass	301/114	1.8	182 - A	76.8	3

TJ-NHTSA 004261

TEXAS INSTRUMENTS

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

December 20, 1991

Attn: Mr. Mark Scheller

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

Ref: Initial ISR Submission

Dear Mark,

Enclosed, please find our supplemental sample warrant for NOSC deactivation switch, Ford part number F2VC-9F924-AB. The warrant includes reference to the alert no. A101&6193 providing conditional approval of switches utilizing manually crimped parts.

A copy of the supplemental ISR testing addressing diaphram life during impulse testing. FIST information is also enclosed. Finally, (8) samples of bases with the corrected 1.85 - 2.05 base cavity mold dimension are enclosed.

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

Regards,

Jim Watt
QRA Engineer
Precision Controls Department
Control Products Division

cc: Dave Czarn, MS 12-29; Charlie Douglas, MS 12-33
Andy McQuirk, MS 12-27
Steve Majors, TI Farmington Hills, Michigan

encl: ISR Supplement, ISR Warrant, Sample corrected bases

TI-NHTSA 004282

INITIAL SAMPLE WARRANT

No. 112384

PART INFORMATION

Part Name: NEXT GENERATION SPEED CONTROL — Part Number: F2VC-9F924-AB

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

Engineering Change Authorization: BRUCE PEASE — Date: _____

Shown on Drawing No.: F2VC-9F924-AB — Part Weight: 062 kg

Reason for Initial Sample:

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

SUPPLIER INFORMATION (Manufacturing Location)

Supplier Name: TEXAS INSTRUMENTS — Street Address: 34 FOREST STREET

City: ATTLEBORO — State: MA — Postal Code: 02703 — Country: USA

Supplier Mfg. Location Code — DUNS: T097E — Customer Assigned: FORD MOTOR CO - EED

CUSTOMER INFORMATION

Customer Name: FORD MOTOR CO - EED — Buyer: FRED HENDERSHOT — Buyer Code: 165

Purchase Order Number: _____ — Sample Acceptance Level: _____

Application: NEXT GENERATION SPEED CONTROL

RESULTS

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

Submission Checklist

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

Supporting data for all requirements are available upon request.

COMMENTS:

ISR SUPPLEMENT WITH ADDITIONAL TESTING TO CLOSE OUT ALERT NO. A10166193;

ALSO, CORRECTED BASE MOLD DIMENSIONS.

DECLARATION

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

Authorized Signature: Jim Watt — Date: 12/20/91

Print Name: JIM WATT — Title: QA ENGINEER — Phone No.: 508-699-1719

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

Signature: _____ Date: _____

CORRECTED MOLD DIMENSIONS

F2VC-9F924-AB

CAVITY #	SPEC. 2.06 - 1.86
A1	1.92
A	1.94
B1	1.985
B	1.99
C1	1.985
C	2.00
D1	1.99
D	1.975

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F2VC-9F924-AB

NOTE: MARKED PRINT DENOTES CAVITY # 1A

#	BLUEPRINT SPEC	CAVITY # 2A ACTUAL	CAVITY # 3C ACTUAL	CAVITY # 4C ACTUAL	CAVITY # 5B ACTUAL	CAVITY # 6C ACTUAL	COMMENTS
1	11.92 - 11.68	11.68	11.69	11.69	11.70	11.69	
2	1.45 - 1.24	1.42	1.29	1.33	1.26	1.31	
3	19.81 - 19.45	19.62	19.64	19.64	19.60	19.66	
4	16.76 - 16.56	16.62	16.64	16.64	16.64	16.65	
5	3.05 - 2.84	2.91	2.91	2.91	2.91	2.90	
6	11.90 - 11.68	11.78	11.79	11.78	11.77	11.78	
7	3.10 - 2.79	2.84 2.85	2.83 2.84	2.84 2.85	2.86 2.86	2.85 2.85	
8	0.38 - 0.22	0.43 0.36	0.54 0.57	0.45 0.31	0.31 0.35	0.30 0.34	
9	COLOR : BROWN	OK	OK	OK	OK	OK	
10	2.90 - 1.89	2.695	2.689	2.668	2.705	2.685	TOOL TO BE CORRECTED

THE PASS CAR (F2VC-9F924-AB)AND LIGHT TRUCK (F7TA-9F24-AA)SWITCHES ARE PRODUCED OFF OF THE SAME PRODUCTION TOOLING.

THE (F7TA-9F924-AA) FULL DIMENSIONAL ANALYSIS FOLLOWS. DIMENSIONS # 1-10 LISTED ABOVE PERTAIN TO THE POLARITY KEY FEATURE WHICH IS DIFFERENT ON THE(F2VC-9F924-AB) SWITCH.

DIMENSIONAL ANALYSIS ON PART NUMBER

F3TA-9F924-AA

NOTE: MARKED PRINT DENOTES CAVITY # A6

	BLUEPRINT SPEC	CAVITY # A2 ACTUAL	CAVITY # B3 ACTUAL	CAVITY # C4 ACTUAL	CAVITY # D5 ACTUAL	CAVITY # B6 ACTUAL	COMMENTS
1	13.43-13.95	13.692	13.623	13.602	13.719	13.646	
2	51DEG +/- 2DEG	50DEG 36MIN	51DEG 01MIN	50DEG 49MIN	52DEG 16MIN	52DEG 27MIN	
3	1.85 - 2.06	2.690	2.669	2.667	2.699	2.692	TOOL TO BE CORRECTED
4	19.05 MAX	18.689	18.663	18.691	18.677	18.636	
5	0.05-0.26 2PL	.199 .137	.208 .194	.245 .197	.225 .176	.169 .161	
6	0.50 +/- 0.25	.583 .510	.515 .453	.419 .347	.392 .553	.429 .596	
7	2.74-3.10 2PL	2.900 2.898	2.898 2.896	2.896 2.900	2.902 2.891	2.867 2.899	
8	19.45-19.81	19.60	19.58	19.61	19.57	19.61	
9	16.58-16.76	16.566	16.608	16.585	16.585	16.625	
10	12.85-13.21	13.040-	13.006	13.003	12.978	12.956	
11	11.40-11.90	11.770	11.810	11.788	11.798	11.777	
12	2.84 - 3.05	2.925	2.917	2.923	2.920	2.920	
	0.1 A	.094	.013	.019	.004	.032	
13	1.24 - 1.45	1.397	1.294	1.292	1.320	1.326	
14	11.60-11.92	11.742	11.672	11.745	11.680	11.737	

TI-NHTSA 004266

TEXAS INSTRUMENTS INCORPORATED • 34 FOREST STREET • ATTLEBORO, MA 02703
[illegible] • TELEX [illegible] TWX [illegible] • CABLE TEXINS

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

FSTA-9F924-AA

	BLUEPRINT SPEC	CAVITY # A2 ACTUAL	CAVITY # C3 ACTUAL	CAVITY # C4 ACTUAL	CAVITY # D5 ACTUAL	CAVITY # D6 ACTUAL	COMMENTS
15	1.24 - 1.55	1.340	1.336	1.337	1.354	1.323	
16	6.40 - 6.81	6.579	6.678	6.680	6.665	6.667	
17	NO FLASH/BURRS	OK	OK	OK	OK	OK	
18	7.23 - 7.75	7.549	7.646	7.639	7.454	7.425	
	2.79 - 3.41	3.10	3.10	3.10	3.07	2.07	
20	0.87 - 1.30	1.096	1.096	1.102	1.112	1.141	
21	DATE & PART#	OK	OK	OK	OK	OK	
22	0.25P1# 40-50	UNABLE TO	MEASURE	BECAUSE	THREADS ARE	ALREADY IN	
	DEG CHAMFER						
23	3/8-24UNF-2A	OK	OK	OK	OK	OK	
24	1.10 - 1.40	1.220	1.213	1.220	1.234	1.320	
25	2.5 C	.20	.20	.20	.20	.20	
26	0.16 D	.020	.036	.008	.022	.025	
27	41DEG - 43DEG	MEASURED ON	CROSS SECTIONED PIECE				
28	40DEG - 50DEG	MEASURED ON	CROSS SECTIONED PIECE				
29	7.62 - 8.03	7.90 7.91	7.90 7.89	7.89 7.93	7.89 7.88	7.86 7.90	
30	1.50 - 2.04	1.734	1.837	1.831	1.807	1.807	

TI-NHTSA 004267

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F3TA-9F924-AA

	BLUEPRINT SPEC	CAVITY # A2 ACTUAL	CAVITY # C3 ACTUAL	CAVITY # C4 ACTUAL	CAVITY # D5 ACTUAL	CAVITY # D6 ACTUAL	COMMENTS
31	9.35 - 9.66	9.53	9.53	9.50	9.50	9.58	
32	9.12 MIN	9.22	9.14	9.19	9.22	9.14	
33	14.22 MAX	13.64	13.62	13.58	13.67	13.60	
34	57.15 MAX	55.60	55.60	55.55	55.56	55.52	
	12.85-13.15	12.89	12.88	12.89	12.89	12.89	
36	11.65-12.17	11.79 11.84	11.89 11.91	11.99 11.84	11.89 11.89	11.91 11.94	
37	1.90-2.21 2PL	1.89	2.02	1.92	1.90	1.90	MEAS.SIDE W/O KEY
38	(90DEG +/- 2DEG)(4pl) MEASURED ON SEPARATATE BASE - CROSS SECTIONED)						
39	32.51 MAX	31.61 31.69	31.59 31.72	31.66 31.79	31.58 31.68	31.64 31.79	
40	14.03-14.53	14.221	14.221	14.225	14.222	14.221	
41	3.30 - 3.60	3.420 3.413	3.441 3.429	3.435 3.450	3.434 3.428	3.436 3.421	
42	7.23 - 7.37	7.299 7.281	7.340 7.302	7.294 7.284	7.303 7.281	7.309 7.400	
43	5.50 - 5.65	5.604 5.585	5.641 5.642	5.594 5.585	5.610 5.591	5.612 5.580	
44	71.50DEG+/-2DEG	72DEG 29MIN	72DEG 50MIN	72DEG 30MIN	72DEG 54MIN	72DEG 29MIN	
	(2 PL)	72DEG 24MIN	72DEG 56MIN	71DEG 33MIN	72DEG 43MIN	71DEG 44MIN	
45	1.42-1.63 2PL	1.595 1.572	1.610 1.581	1.541 1.544	1.595 1.597	1.609 1.580	
46	0.35 - 0.66	.571 .557	.545 .579	.556 .572	.562 .556	.530 .582	
	(4 PL)	.582 .544	.580 .533	.562 .564	.545 .549	.576 .571	

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F9TA-9F924-AA

	BLUEPRINT SPEC	CAVITY # A2 ACTUAL	CAVITY # C3 ACTUAL	CAVITY # C4 ACTUAL	CAVITY # B5 ACTUAL	CAVITY # B6 ACTUAL	COMMENTS
47	2.59 - 3.80	L 2.681	L 2.705	L 2.687	L 2.697	L 2.709	
	(2 PL)	R 2.701	R 2.696	R 2.705	R 2.721	R 2.684	
	0.2 ± A D	L.021 R.019	L.000 R.075	L.076 R.061	L.081 R.038	L.011 R.154	
	2.445	2.444 2.450	2.465 2.390	2.389 2.384	2.384 2.495	2.476 2.311	
48	0.35 - 0.66	.463 .456	.539 .530	.571 .492	.508 .483	.476 .504	
	(4 PL)	.494 .536	.474 .505	.469 .514	.511 .509	.491 .509	
ref	0.86 - 1.17	.989 .995	.939 .942	.968 .989	.990 .993	.987 .938	
	(4 PL)	.943 .952	.996 .959	.975 .923	.955 .934	.980 .974	
50	45DEG +/- 2DEG	44DEG 52MIN	43DEG 50MIN	45DEG 39MIN	45DEG 26MIN	43DEG 58MIN	
	(4 PL)	44DEG 47MIN	44DEG 45MIN	44DEG 08MIN	44DEG 59MIN	45DEG 5MIN	
		45DEG 13MIN	44DEG 37MIN	44DEG 11MIN	45DEG 12MIN	45DEG 54MIN	
		45DEG 0MIN	45DEG 20MIN	44DEG 44MIN	44DEG 23MIN	44DEG 20MIN	
51	8.30-8.72 2PL	8.542 8.458	8.382 8.423	8.364 8.499	8.365 8.429	8.509 8.392	
52	2.15-2.42 2PL	2.180 2.220	2.199 2.153	2.169 2.219	2.161 2.170	2.189 2.194	
53	25DEG +/- 2DEG	24DEG 22MIN	24DEG 10MIN	24DEG 47MIN	24DEG 17MIN	23DEG 37MIN	
	(2 PL)	23DEG 22MIN	23DEG 41MIN	23DEG 58MIN	23DEG 04MIN	23DEG 39MIN	
54	COLOR: BLACK	OK	OK	OK	OK	OK	
55	12-19DEG 2PL	ON CROSS	SECTIONED	PART ON	PRINT		
	0.44 - 0.87	ON CROSS	SECTIONED	PART ON	PRINT		
57	0.10 - 0.31	.252 .278	.287 .251	.276 .260	.287 .250	.280 .257	
58	0.58 - 0.68	.625 .646	.646 .621	.648 .622	.656 .622	.644 .626	

800-000-0000 • TELEX 00-7700 TWX 710-000-0000 • CABLE TEXINS

PRESSURE SWITCH DATA Form 21605 TEST NO. 188-03-24

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMP DATE
CCPS	12/20/91	Stephen Offiler	
PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY
Jeffrey O'Brien	1/9/92		

PROJECT TITLE: Ford MY '93 Electronic Speed control Deactivate PS

CUSTOMER

PURPOSE OF TEST: 1) To determine if round Kapton parts last longer because of shape or Kapton lot
2) Test Japanese Kapton equivalent

PROCEDURE: Build date 1/8/92; Crimp on AMI
Standard impulse test

– Counter reset @ 990K

Device #	Kapton Origin	Kapton Shape		Cyc. to Failure		Cyc. to Sunset
188-03-01	Hoechst	Square		1215K		
-02				972K	6/6	
-03				545K	DEAD	
-04				1024K	920114	
-05				778K		
-06				874K		
188-03-07	Single-Sheet	Square		939K		
-08				1004K	5/6	
-09				1176K	DEAD	
-10				1726K		
-11				493K	920124	
-12				1260K		
188-03-13	Single-Sheet	Round		[illegible]K		
-14				1795K	6/6	
-15				1722K	dead	
-16				1232K		
-17				910K	920128	
-18				1722K		
188-03-19	Japanese	Square		1510K		
-20				414K	6/6	
-21				1016K	DEAD	
-22				416K	920122	
-23				1293K		
-24				661K		

TI-NHTSA 00427

KAPTON MATERIAL TEST TEST 188-03-24 JAD 920212

DEVICE #	KAPTON	CYC. TO FAILURE
188-03-01	FROM HAND LINE	1215K
188-03-02		932K
188-03-03		545K
188-03-04		1034K
188-03-05		778K
188-03-06		824K
188-03-07	FROM SAMPLE SHEET	939K
188-03-08	CUT INTO SQUARES	1004K
188-03-09		1186K
188-03-10		1726K
188-03-11		993K
188-03-12		1260K
188-03-13	FORM SAMPLE SHEET	1406K
188-03-14	CUT INTO CIRCLES	1795K
188-03-15		1722K
188-03-16		1232K
188-03-17		970K
188-03-18		1922K
188-03-19	JAPANESE POLYIMIDE	1520K
188-03-20	FILM) SQUARE	414K
188-03-21		1016K
188-03-22		466K
188-03-23		1293K
188-03-24		661K

PRESSURE SWITCH DATA Form 21605 **TEST NO.** 188-03-24

DEVICE	DATE REQUESTED	REQUESTED BY	REQUESTED COMPL. DATE
CCPS	12/30/91	Stephen Offiley	

PERFORMED BY	DATE STARTED	DATE COMPLETED	APPROVED BY
Jeffrey D'Amarico	1/9/92		

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

CUSTOMER:

PURPOSE OF TEST: 1) To determine if round Kapton parts lived longer because of shape or Kapton lot.
2) Test Japanese Kapton equivalent

PROCEDURE: Build date 1/8/92, Crimp on AMI
Standard impulse test

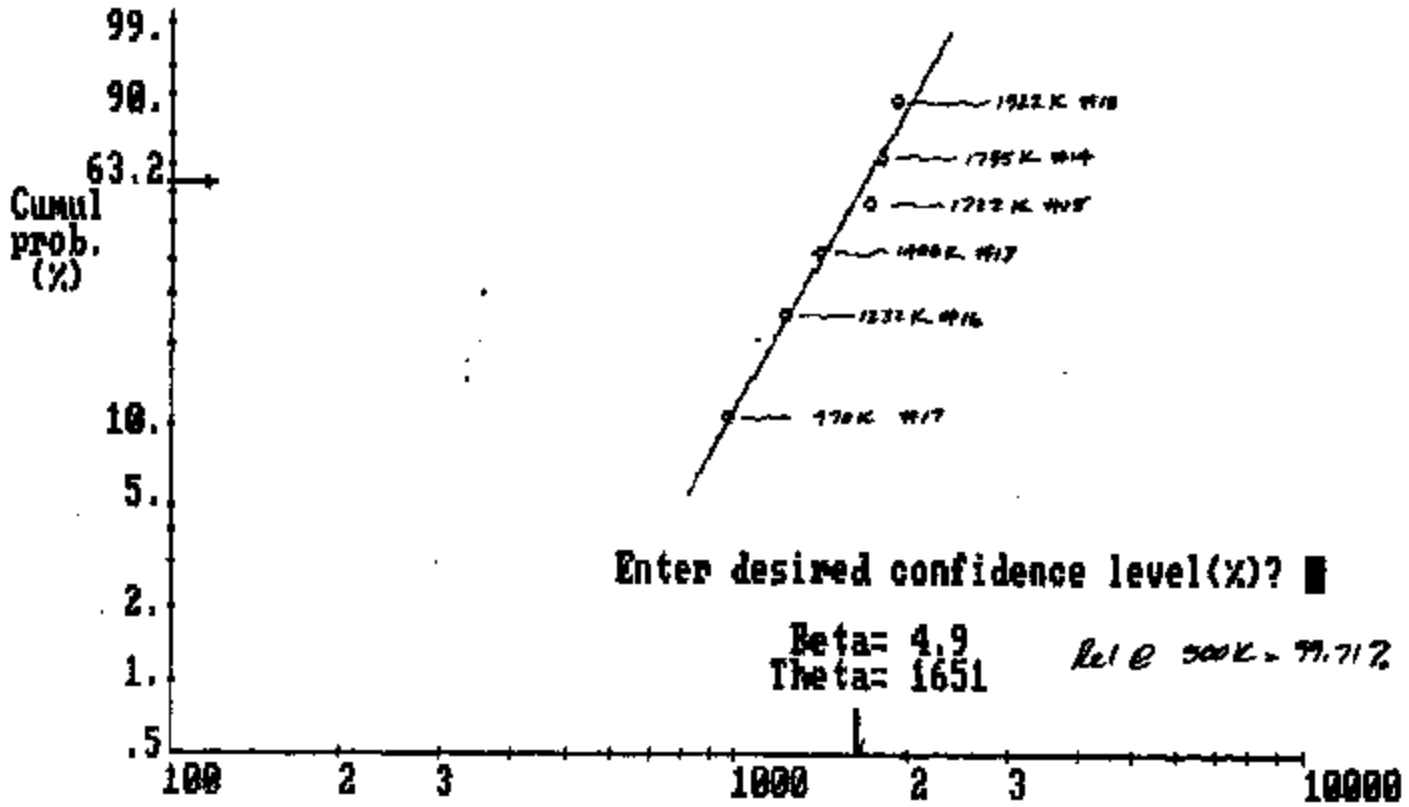
– Counter reset @ 990K

Device #	Kapton Origin	Kapton Shape		Cyc. to Failure		Cyc. To Sound			
188-03-01	Hard-kap	Square		✓ 1215K					
-02				✓ 932K	6/6				
-03				✓ 545K	DEAD				
-04				✓ 1024K	920119				
-05				✓ 770K					
-06				✓ 824K					
188-03-07	Single-Sheet	Square		✓ 464K					
-08				✓ 1004K	6/6				
-09				✓ 1174K	DEAD				
-10				✓ 1724K					
-11				✓ 943K	920124				
-12				✓ 1260K					
188-03-13	Single-sheet	Round		✓ [illegible]K					
-14				✓ [illegible]K	6/6				
-15				✓ [illegible]K	Dead				
-16				✓ [illegible]K	920128				
-17				✓ [illegible]K					
-18				✓ 1322K					
188-03-19	Japanese	Square		✓ 1520K	6/6				
-20				✓ 414K					
-21				✓ 1016K	DEAD				
-22				✓ 416K	920123				
-23				✓ 1243K					
-24				✓ 661K					

TI-NHTSA 004272

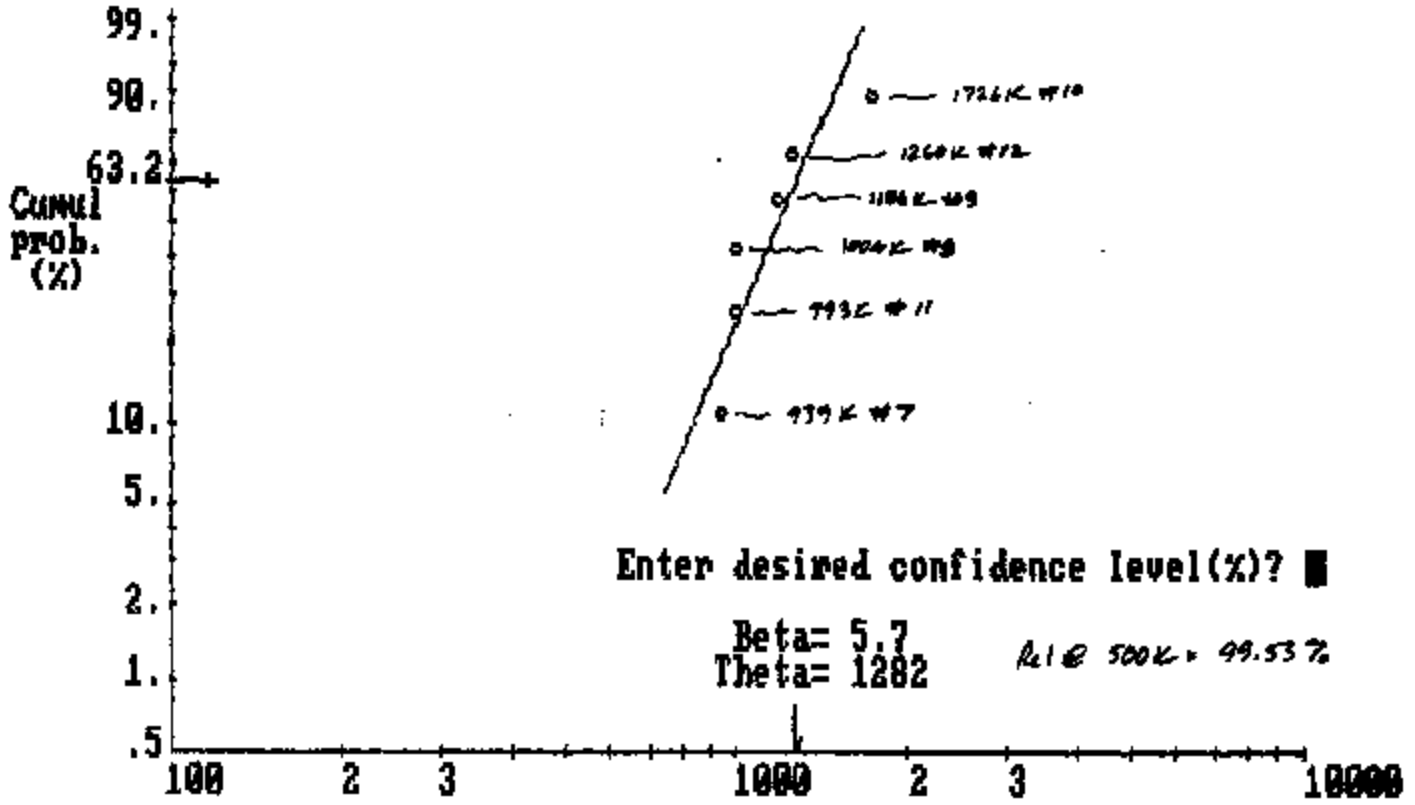
SAMPLE SHEET ROAD KAYON

TEST 188



SAMPLE SHEET HAND-OUT SQ KAPTAN

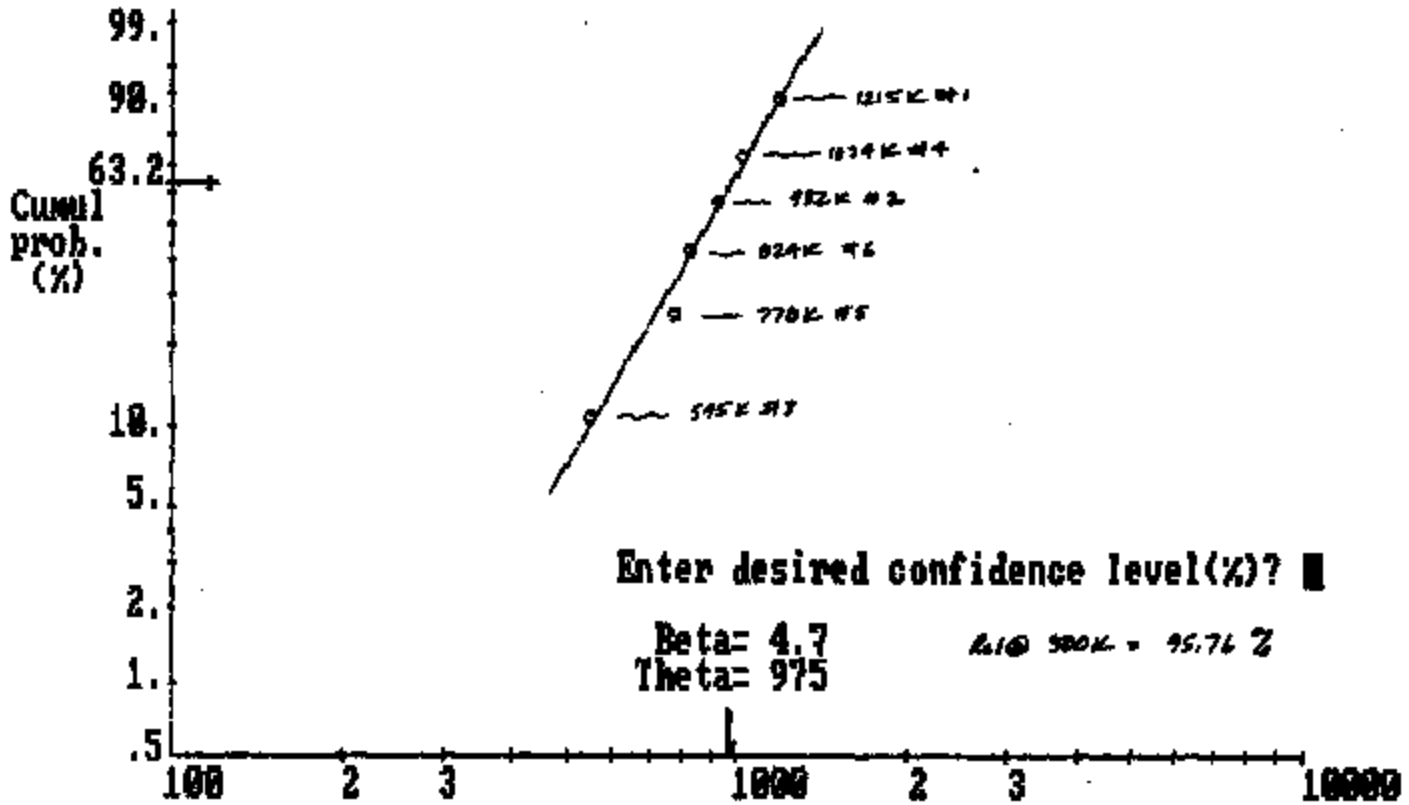
TEST #100



TI-NHTSA 004274

PRODUCTION SATISFACTION (H-L)

TEST 108



TL-NHTSA 004275

HIGHLIGHTS

Stephen B. Offiler
Week Ending 91-12-20

FORD MY'92 ELECTRONIC SPEED CONTROL, DEACTIVATE PS

DIAPHRAGM LIFE:
All devices from the round Kapton test have finally failed (except one, expected to go any second now). Results are as follows:

Control lot, square Kapton	Beta=5.3	Theta=1369K Rel @ 500K=99.52%
All round Kapton lots	Beta=9.2	Theta=2350K Rel @ 500K=99.9999%

The only questionable aspect of the above test is that the round Kapton came from a different lot of material, possibly produced in a lab process, and therefore it possibly has greater mechanical properties which help account for the increased life. We plan a test using square versus round Kapton from the same material lot.

We plan to consolidate all recent knowledge gained from various design and process testing, and hold a meeting in early January.

VALIDATION:
The Pass Car revalidation has been completed successfully, and the addendum to the original test report has been written, bound in TI test report format, and delivered to QRA for submission to Ford. The 90-day alert expires on 91-12-31. We ran two test lots in parallel: crimped on Hand Line, and crimped on AMI using HL tools. All of these devices passed 500K cycles with flying colors. The writeup includes both test lots, such that we will be approved for both processes *using HL crimp dies*.

57 TO 77 CONVERSION:
The lifetest of 10 devices (L8-1 sensors, 77 switches) has been aborted at 6KK cycles, with 2 devices remaining. A rough draft development schedule has been assembled, which shows that we can begin shipping new devices as early as 03/92 if all goes well, and high priority is placed on completion of all internal and customer validation testing. This also assumes red-tape (customer envelope prints into Ford's system, TI parts lists, all ISR paperwork, etc. etc.) is handled efficiently.

DFMEA:
Work is progressing fairly smoothly. Since we recently began the serious attempt at completing this task, we've experienced only minor scheduling snags. Additional meetings have been scheduled in order to continue on a path to intercept mid-February completion. At this point, this effort is occupying significantly more than the 8-10 hours/week I previously estimated, and this is likely to continue.

Ford

INITIAL SAMPLE WARRANT

No. I12384

PART INFORMATION

Part Name: NEXT GENERATION SPEED CONTROL — Part Number: ▽F2VC-9F924-AB

Control Item: ☒ Yes ☐ No — Engineering Change Level: G — Date: 4-11-91

Engineering Change Authorization: ~~WRITE-RELEASE~~ — Date:

Shown on Drawing No.: F2VC-9F924-AB — Part Weight: 062 kg

Reason for Initial Sample:

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

SUPPLIER INFORMATION (Manufacturing Location)

Supplier Name: TEXAS INSTRUMENTS — Street Address: 34 FOREST STREET

City: ATTLEBORO — State: MA — Postal Code: 02703 — Country: USA

Supplier Mfg. Location Code – DUNS: TQ97K — Customer Assigned: FORD MOTOR CO - EED

CUSTOMER INFORMATION

Customer Name: FORD MOTOR CO - EED — Buyer: FRED HENDERSHOT — Buyer Code: 165

Purchase Order Number: _____ — Sample Acceptance Level: 2

Application: NEXT GENERATION SPEED CONTROL

RESULTS

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

Submission Checklist

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

Supporting data for all requirements are available upon request.

COMMENTS:

ISR SUPPLEMENT WITH ADDITIONAL TESTING TO CLOSE OUT ALERT NO. A10166193;

ALSO, CORRECTED BASE MOLD DIMENSIONS. PART PREVIOUSLY APPROVED ON ISR # I12384, DATED 9/27/91

DECLARATION

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

Authorized Signature: Jim Watt — Date: 12/20/91

Print Name: JIM WATT — Title: QA ENGINEER — Phone No.: 508-699-1719

APPROVAL (when required by customer Assembly Plant) ☒ Approved ☐ Rejected

Signature: _____ — Date: 1/14/92

Form 299c Version Operations 304

TI-NHTSA 004277

TEXAS INSTRUMENTS

DIMENSIONAL ANALYSIS ON PART NUMBER

F2AC-9F924-AA

ENVELOPE DIMENSIONS TO BASE ONLY

	BLUEPRINT SPEC	CAVITY # A ACTUAL	CAVITY # B ACTUAL	CAVITY # C ACTUAL	CAVITY # D ACTUAL
1	11.40 - 11.90	11.806	11.817	11.817	11.794
2	16.56 - 16.76	16.639	16.652	16.671	16.673
		16.661	---	16.680	16.668
3	19.45 - 19.8	19.752	19.754	19.787	19.799
4	2.84 - 3.05	2.930	2.93	2.944	2.951
5	1.95 - 2.06	1.927	1.966	1.969	1.978
6	1.24 - 1.55	1.365	1.387	1.423	1.400
7	1.24 - 1.45	1.269	1.268	1.275	1.308
8	11.60 - 11.92	11.768	11.768	11.753	11.777
		11.729	11.740	11.789	11.747
9	0.25 - 0.75	0.490 0.475	0.519 0.523	0.573 0.635	0.618 0.593
10	2.79 - 3.10	2.900	2.909	2.912	2.908
	2 PL	2.903	2.915	2.913	2.911
11	19.05 MAX	18.667	18.709	18.671	18.704
		18.701	18.748	18.565	18.757
12	12.59 - 13.11	12.800	12.829	12.802	12.819
		12.829	12.800	12.842	12.824

TEXAS INSTRUMENTS INCORPORATED • 34 FOREST STREET • ATTLEBORO, MA 02703
508-699-8800 • TELEX 95-7705 TWX 710-346-0896 • CABLE TEXINS

TEXAS INSTRUMENTS

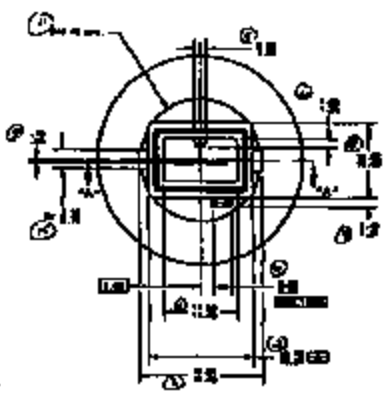
DIMENSIONAL ANALYSIS ON PART NUMBER

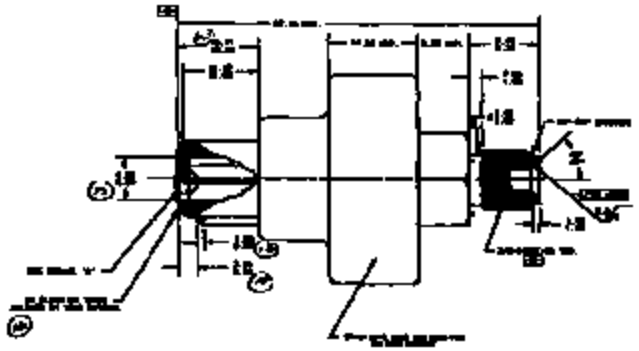
F2AC-9F924-AA

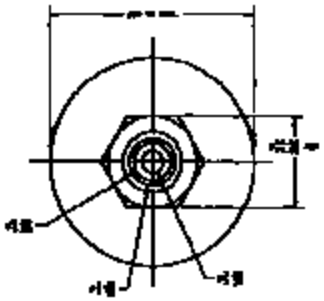
	BLUEPRINT SPEC	CAVITY # A ACTUAL	CAVITY # B ACTUAL	CAVITY # C ACTUAL	CAVITY # D ACTUAL
13	0.68 - 1.30	1.085	1.105	1.122	1.175
14	2.79 - 3.41	3.076	3.061	3.152	3.109
15	6.60 - 6.81	6.701	6.673	6.715	6.677
16	NO FLASH/BURRS	SLIGHT	FLASH ON	EDGES	@ 10X
17	8.30-8.72 2X	8.535	8.553	8.484	8.578
		8.726	8.512	8.570	8.519
18	25DEG +/- 4DEG	24DEG 25MIN	24DEG 56MIN	24DEG 47MIN	24DEG 06MIN
		24DEG 10MIN	24DEG 14MIN	24DEG 06MIN	24DEG 43MIN
19	(71.5DEG) 2X	72DEG --	71DEG 31MIN	71DEG 20MIN	72DEG 01MIN
		71DEG 07MIN	72DEG --	72DEG 10MIN	71DEG 12MIN
20	TERM. HOUSING NATURAL	BLACK ONLY	AVAILABLE	TO QUALIFY	MOLD

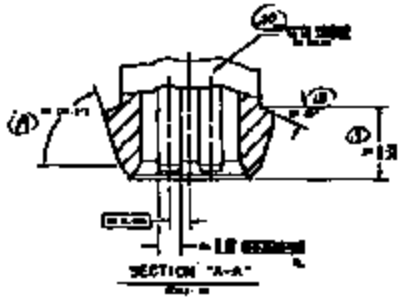
TI-NHTSA 004279

TEXAS INSTRUMENTS INCORPORATED • 34 FOREST STREET • ATTLEBORO, MA 02703
508-699-2800 • TELEX 94-3799 TWX 710-349-0966 • CABLE TEXINS









SECTION "A-A"

DETAIL "A"

CERTIFIED

METRIC

PRESSURE SWITCH
ENVELOPE DRAWING

D 02647 77PSL3-1

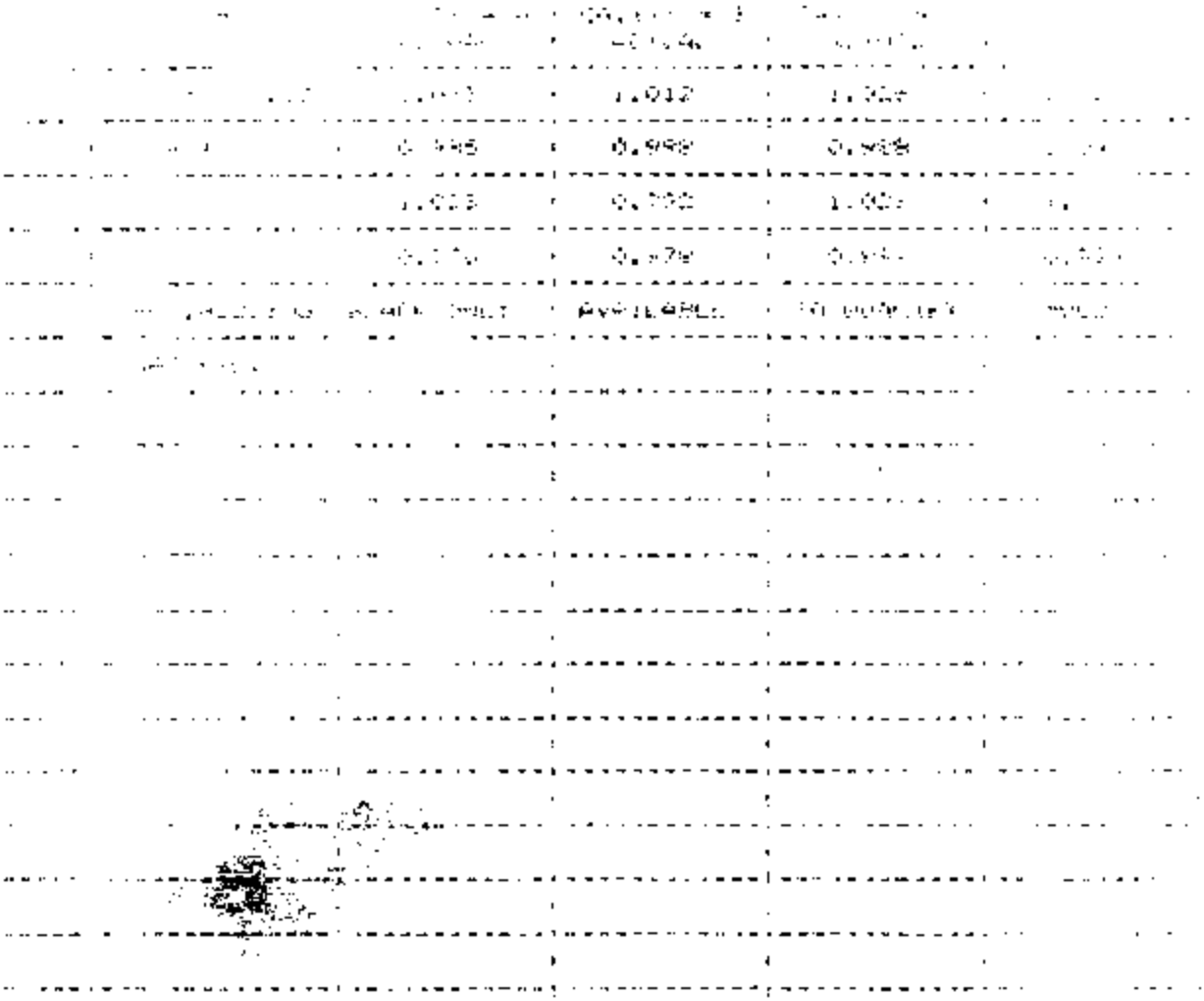
TI-NHTSA 004280

TEXAS INSTRUMENTS

TEXAS INSTRUMENTS

TEXAS INSTRUMENTS

TEXAS INSTRUMENTS



TEXAS INSTRUMENTS INCORPORATED • 34 FOREST STREET • ATTLEBORO, MA 02703

PROCESS POTENTIAL AND QUALITY INDEXES SUMMARY DATA SHEET

PART #: F2VC-9F924-AB
SUPPLIER: Texas Instruments
CODE: T097K
ADDRESS: 34 Forest St.
Attleboro, MA 02703
VEHICLE BUILD: EP VP FB OTHER

SUPPLIER CONTACT: Jim Hart
CONTACT PHONE: 1-508-699-1719
PART DESCRIPTION: Next Generation Speed Control
SQA CODE: (Mark Schaller)
VEHICLE PROGRAM: Ford Car

CHARACTERISTIC TYPE

∇ = FORD CRITICAL CHARACTERISTICS

S.C. = FORD OR SUPPLIER SIGNIFICANT CHARACTERISTICS

NUMBER OF CRITICAL AND SIGNIFICANT CHARACTERISTICS:

1:	Actuation Pressure	TYPE:	SC	Cp =	**	Cpk = **
2:	Release Pressure	TYPE:	SC	Cp =	**	Cpk = **
3:	3/8-24UNF-2A Thread	TYPE:	SC	Cp =	A*	Cpk = A*
4:		TYPE:		Cp =		Cpk =
5:		TYPE:		Cp =		Cpk =
6:		TYPE:		Cp =		Cpk =
7:		TYPE:		Cp =		Cpk =
8:		TYPE:		Cp =		Cpk =
9:		TYPE:		Cp =		Cpk =
10:		TYPE:		Cp =		Cpk =
11:		TYPE:		Cp =		Cpk =
12:		TYPE:		Cp =		Cpk =
13:		TYPE:		Cp =		Cpk =
14:		TYPE:		Cp =		Cpk =
15:		TYPE:		Cp =		Cpk =

PIST = 1265/1265 x 100 = 100 %

$PIPC_{Cp}$ = N/A x 100 = _____ % $PIPC_{Cpk}$ = N/A x 100 _____ %

COMMENTS:

** Calibration check is done 100 percent. parts tested 300; defective 0 percent of defect 0.

A* threads are checked on a Go/none gage.

PREPARED BY:

Elaine Rose DATE: 12/20/91

DRAWINGS AVAILABLE UPON REQUEST

-MSG M#= 2113339 FR=FFUN TO=COPY SENT=12/30/91 01:01 PM
ST=C DIV=0050 CC=00167 BY=FFUN AT=12/30/91 01:01 PM

DR691-54

To: DAVE CZARN
CHARLIE DOUGLAS
MAT SELLERS
STEVE OFFILIER
TOM CHARBONEAU

FR: DALE SOOOE

SJ: DOWNSIZED 77PS - STATUS REPORT 12/30/91

CUSTOMER REQUIREMENTS FOR MY 94

EVALUATION PROTOTYPES	NOW
VERIFICATION PROTOTYPES	JUL 92
ISIR (FULL PRODUCTION TOOLING & TEST REQUIRED)	DEC 92
START OF PRODUCTION	JUN 93

TI SCHEDULE

CONCEPT DEVELOPMENT- 1ST REVIEW	12/91
FEA OF HEX- RAY	1/10/91
SUPPLIER INPUT ON HEX	1/7/91
MODEL SHOP HEXB DUE	EST= 1/10/91
TEST HEX TORQUE WITHSTAND	1/14/91
DECISION TO CONTINUE OR ABANDON APPROACH	1/15/91
PRESENTATION TO CUSTOMER/APPROVAL	?
SOFT TOOL	?
TEST	?
CUSTOMER APPROVAL TO PRODUCTION TOOL	?
PRODUCTION TOOLING COMPLETE	?

THE DESIGN APPROACH CONSISTS OF SLIDING A HEX SHAPED METAL BODY OVER THE BASE WHICH IS KEYED TO THE CRIMP RING. THE CRIMP RING IS KEYED TO THE HEXPORT. THIS PROVIDES THE EXTERNAL HEX IN LESS THAN 22MM. THE BODY WOULD REMAIN AT 31MM, THEREFORE IT WOULD REQUIRE SIDE ASSEMBLY TO CLEAR THE RESERVOIR. CLEARANCE WOULD BE 7.25MM BETWEEN TOP OF CRIMP RING AND THE RESERVOIR FLANGE PRIOR TO THREADING. IT SHOULD BE POSSIBLE TO PUT THE SWITCH IN THE SOCKET AND THEN SWING THE SOCKET IN SIDEWAYS BEFORE PUSHING DOWN AND THREADING.

CRITICAL ISSUES:

1) CAN THE HEX BODY WITHSTAND THE TORQUE? HANDBOOK CALCULATIONS SHOWS THAT A COMMERCIAL STEEL HAS INSUFFICIENT STRENGTH. DISCUSSION WITH HEADING SUPPLIERS WILL CONTINUE AS THE HEADING PROCESS MAY INCREASE THE STRENGTH SUFFICIENTLY. THE GRAIN ORIENTATION FROM HEADING OR EXTRUDING LOOKS FAVORABLE. A FEA MODEL WILL ALSO BE COMPLETED.

TESTING OF MODEL SHOP PIECES WILL ALSO TAKE PLACE TO GET A FEEL FOR THE BREAKING POINT. WE MAY ABLE TO USE THIS DESIGN IF THEY RELAX THE OVER TORQUE REQUIREMENT.

WE COULD ALSO GO TO EXOTIC MATERIALS AND A SCREW MACHINED PART TO OBTAIN THE STRENGTH. THIS COULD STILL BE THE CHEAPEST SOLUTION IN THE LONG RUN.

2) CAN THE HEX TRANSMIT THE TORQUE TO THE CRIMP RING AND CAN THE

CRIMP RING TRANSMIT THE TORQUE TO THE HEX PORT. FEA MODEL REQUESTED. MODEL SHOP PARTS ON ORDER FOR TESTING TEST.

FALLBACK OPTIONS:
A) IF HEX IS STRONG ENOUGH, WELD TO CUP AND ELIMINATE CRIMP RING. I AM WORKING ON A SPIN TEST OF CUP TO HEXPORT.

B) GO WITH SINGLE PIECE HEX AND 5/8 DISK. BUILD ON HAND ASSEMBLY LINE. THIS IS VERY RISKY BECAUSE OF INSUFFICIENT TIME TO PRODUCTION TOOL THE HEXPORT BEFORE ISIR.

ANY COMMENTS OR SUGGESTION ARE WELCOMED.
DALE

RADCLIFF WIRE INC.

FLAT, SQUARE AND SHAPED WIRE

RONZO ROAD • P.O. BOX 603 • BRISTOL, CONNECTICUT 06011-0603
TELEPHONE: 203 / 583-1305 • FAX: 203 / 583-8563

ORDER NUMBER 54450

MATERIAL CERTIFICATION

SOLD TO
MILFORD RIVET
857 BRIDGEPORT AVE.
MILFORD, CT 06460

SHIP TO

VIA

YOUR ORDER NO.	DATE ENTERED	DATE WANTED	DATE PROMISED	F.O.B.
1456-2	12/23/91	1/17/92 OS		BRISTOL

QTY/WEIGHT ORDERED	SIZE/TOLERANCE		SHAPE
200 LBS.	.057 P/H .001 DIA.		ROUND

TEMPER	MATERIAL	EDGE	FINISH
1/2 HARD	OFHC COPPER 102		

SPECS	TENSILE	
	45-52,000 PSI	[redacted]

SPECIAL CONDITIONS
CERTS/MAT'L

SPOOL-COIL

SHIPPING RECORD

DATE	QUANTITY	PACKAGING	TEST
5-92	197#	1 - Barrel	52,000 psi

HEAT	C	MN	SI	S	P	Cr	Ni	Cu	B	Fe	Al
HARDNESS	TI	CB + TA	Co	MO	V	Mg	Ca	N	Zn	Pb	
TENSILE STR.	ZA	CB	TA	Sn	Be						

This is to certify that the above wire was processed from raw material and was found to be in compliance with the specifications of your PO #1456-2.

RADCLIFF WIRE, INC.

Judy Belanger
Judy Belanger Quality Control Inspector

TI-NHTSA 004290

[illegible] 31086A FR=?AGG TO=ZALF SENT=[illegible]
[illegible] DIV=[redacted] [illegible]

[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	
[illegible]	[illegible] DOUGLAS	[illegible]	
	DAVE CZARN	[illegible]	
[illegible]	[illegible]	[illegible]	

[illegible] PENDING 3?PSL TO 7?PSL CONVERSION

FORD HAS GIVEN POSITIVE SIGNALS THAT THE BULK OF OUR 3?PSL BUSINESS COULD BE CHANGED OVER TO 7?PSL STYLE BASE CONNECTORS BY APRIL 1, [illegible]. THIS WILL INCREASE THE 7?PS MONTHLY LINE LOAD FROM CURRENT AVERAGE OF [illegible]K TO 160K/170K.

[illegible] MEET IN THE MARKETING CONFERENCE ROOM TUESDAY 12/31/91 IN [illegible] 12 AT 9:00am. PLEASE CALL IF ANY CONFLICTS.

AT THE MEETING I WOULD LIKE TO DISCUSS THE FOLLOWING:

CURRENT EQUIPMENT WEAK POINTS & SOLUTIONS
- STAKING
- EASTERN AUTOMATION RIVETING
- EASTERN AUTOMATION SPRING FORMING
- SEAL LOADER
- PIN LOADER

- SPARE PARTS BUILD-UP STATUS

- 2ND SHIFT ADDITION AND ASSOCIATED R&M COVERAGE

- COMPLETION OF REMAINING ITEMS ON THE EFFECTIVITY MEETING MINUTES

- ETC . . .

I REALIZE THAT [redacted] ARE ALREADY BEING ADDRESSED. HOWEVER, WE MAY [redacted] WHAT WE ARE DOING AND HOW WELL THE TIME SC[redacted] THIS MAJOR LINE LOAD INCREASE.

I'LL BRING RECENT COPIES OF THE EFFECTIVITY MINUTES ALONG WITH DETAILED LINE LOAD FORECAST.

REGARDS . . . MATT
[illegible]

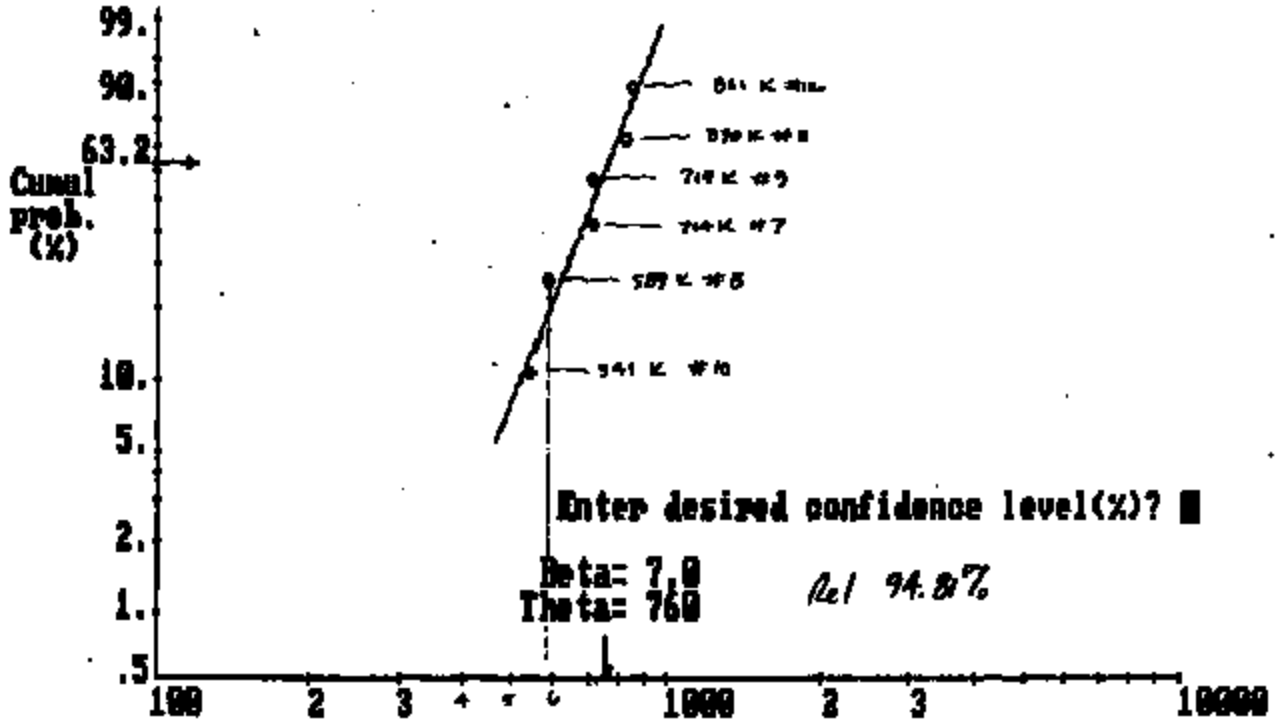
12/31
- @ 3k/day now
Plan - w/c 1/3
ramp up to 5k/day

MODEL SHOP CUP

AMI CRIMP

6/6 FAIL

TEST 159

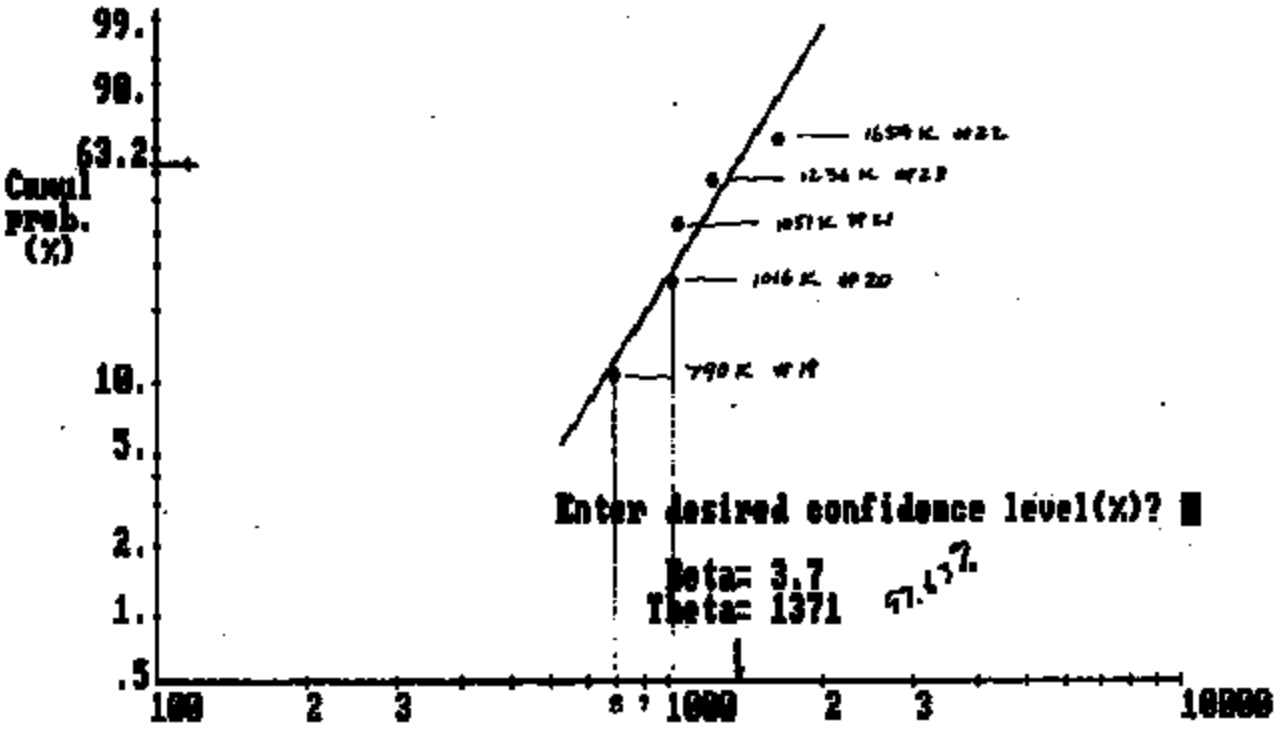


M/S RETURN CUP (ORIGINAL STDS VAL)

HAND-LINE CRIMP

5/6 FAIL

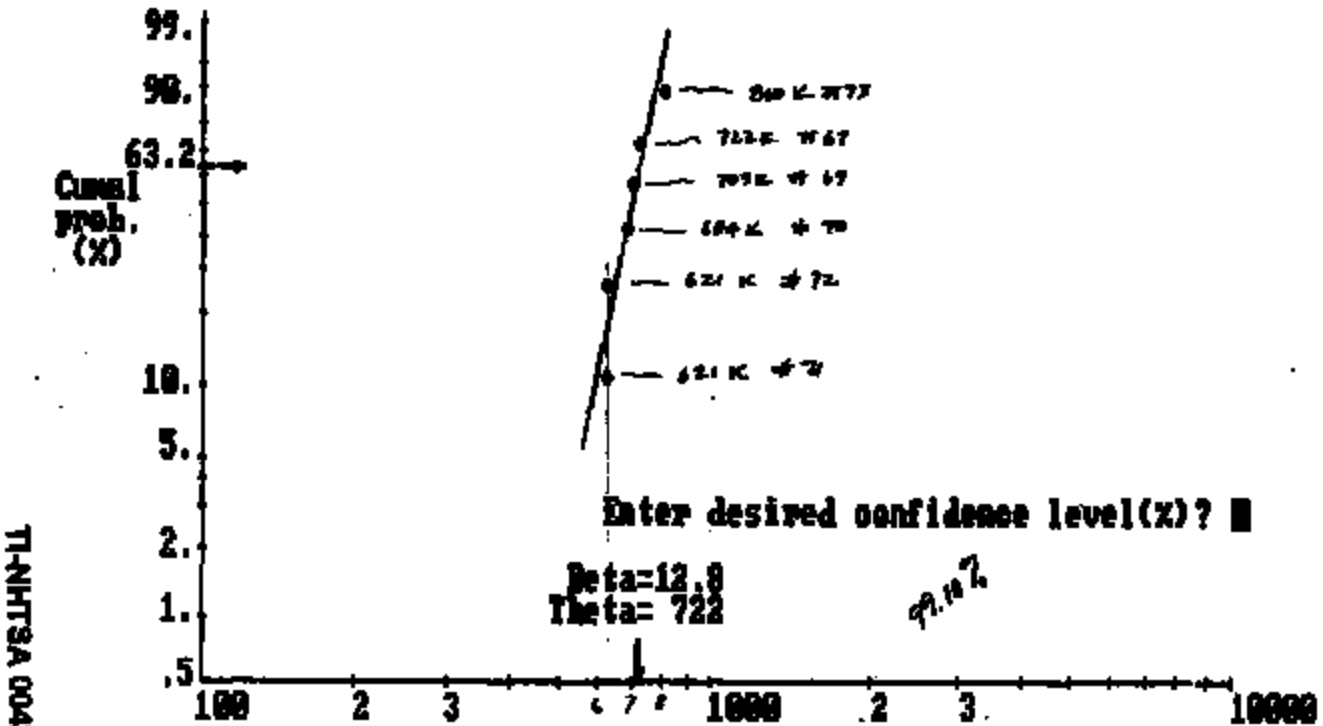
1 SUSPENDED @ 1975 K TEST 159



TI-NHTSA 004283

LT VALIDATION PARTS

BUILT ON AMI JULY '91 TEST 159



TL-NHTSA 004284

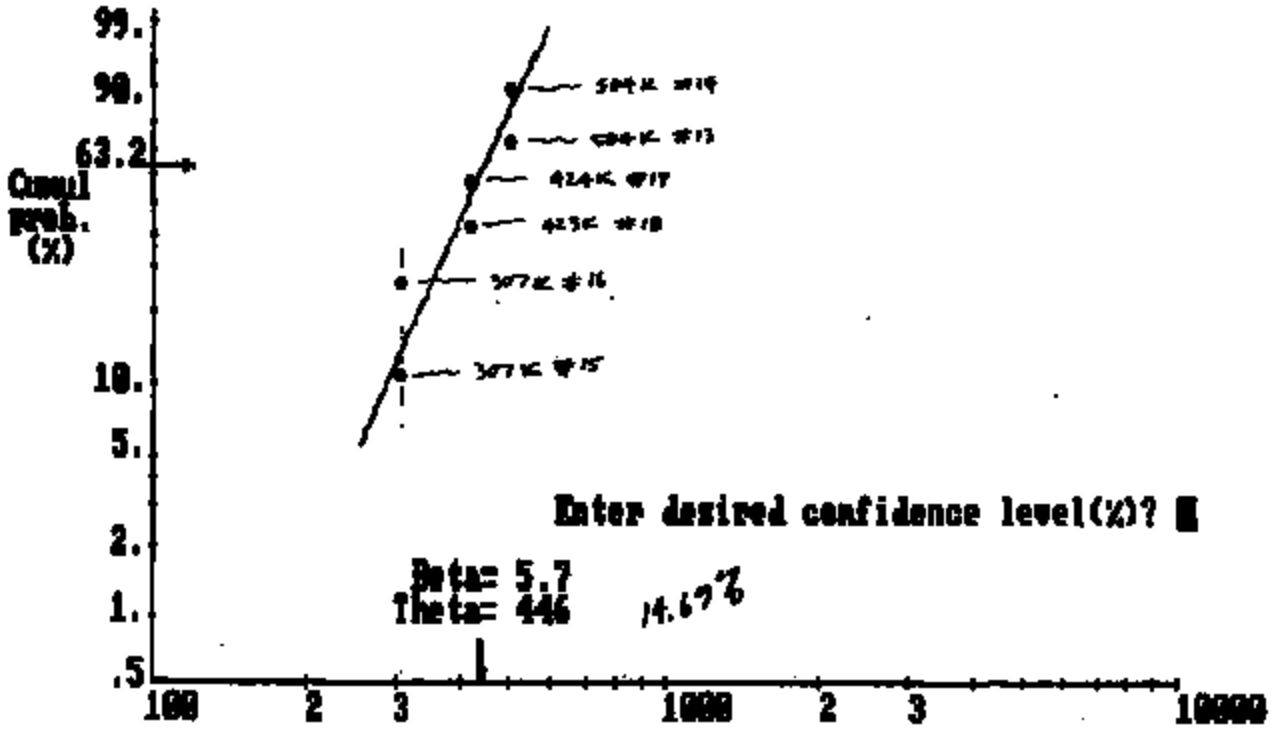
RELIABILITY LEVELS FOR SPECIFIED VALUES OF TIME

** WEIBULL SLOPE = 12.80

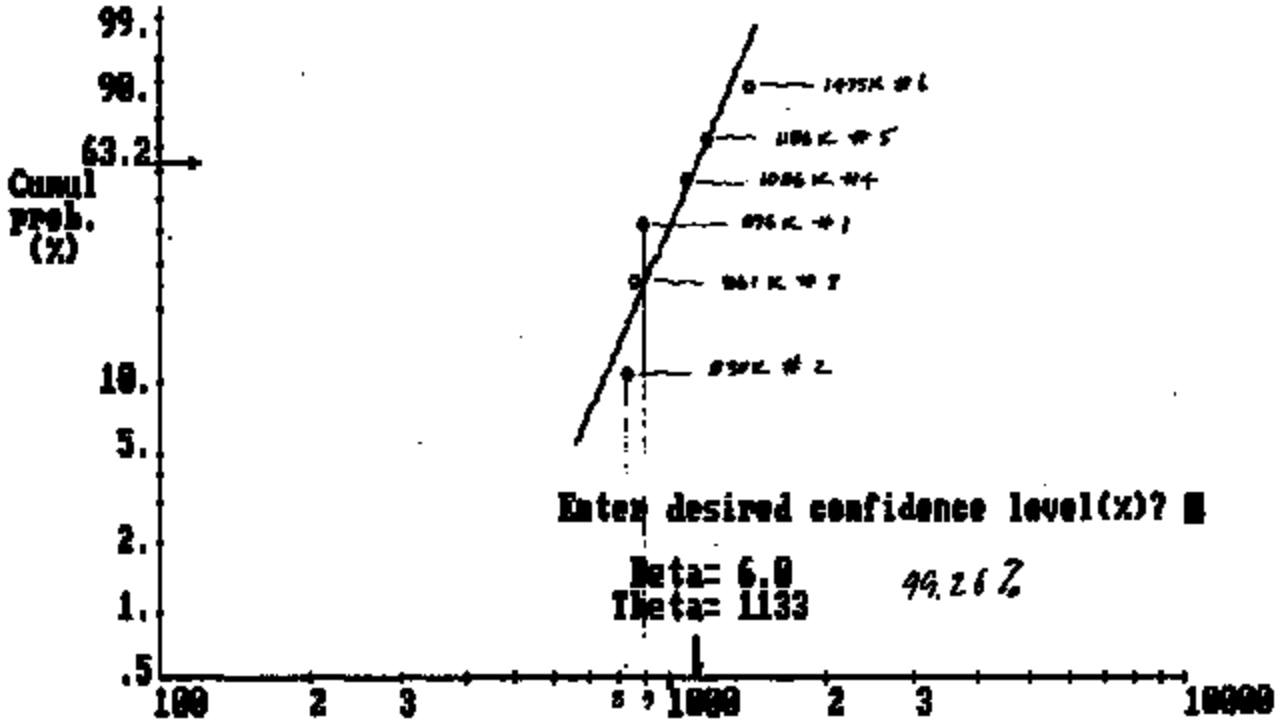
** CHARACTERISTIC LIFE = 722.00

NO.	TIME	RELIABILITY(%)
1	500	99.0972

PRODUCTION CUP
AMI CRIMP
6/6 FAIL
TEST 159
BUILT PWR 77/5 VAL (ORIGINAL)



IRODUCTION CUP
HAND- CRIMP (FIRST MATRIX)
6/6 FAIL
TEST 157



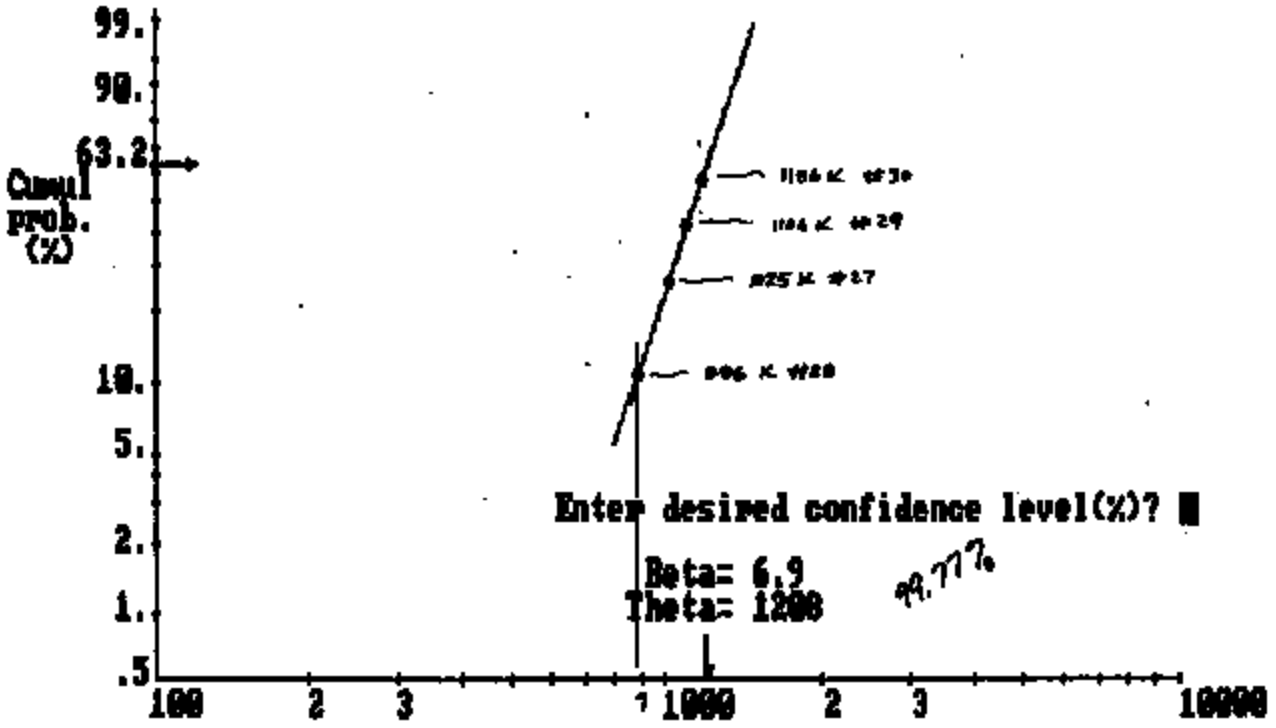
TI-NHTSA 004280

PIPED CUP

AMI BUILT 910828 W/ PRE-CRIMP

4/6 FAIL TEST 159

2 SUSPENDED @ 1590K

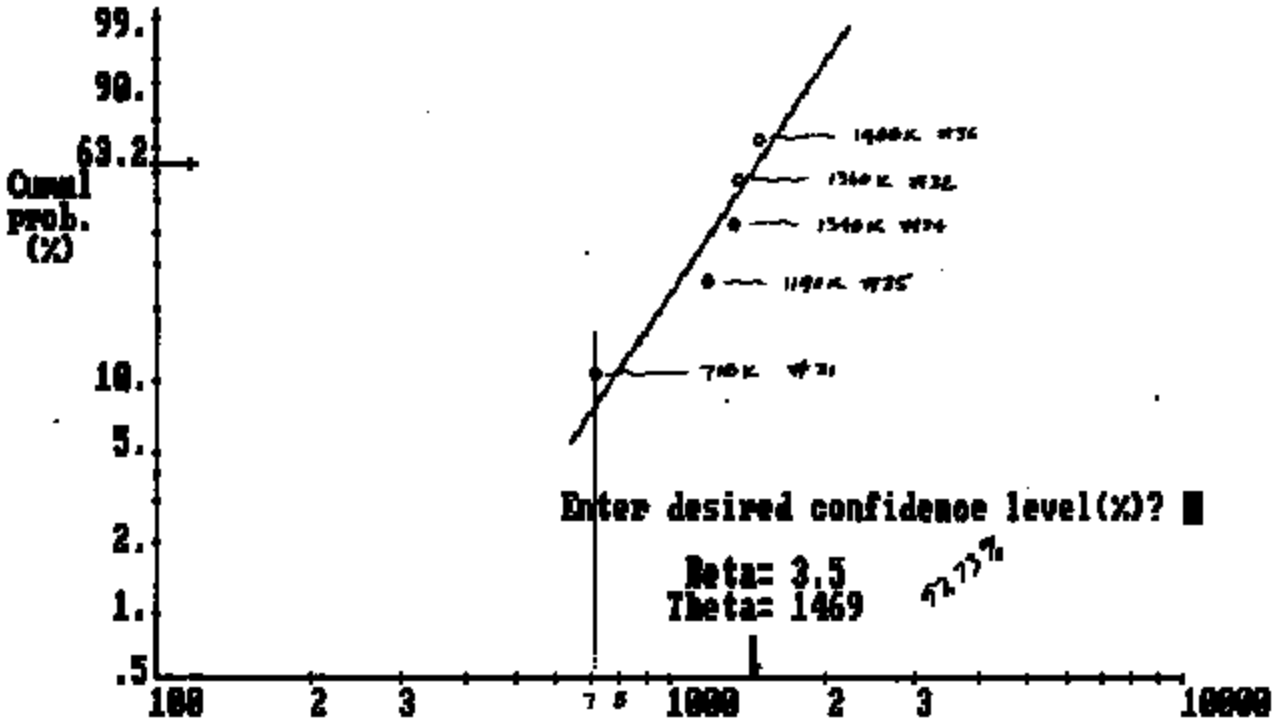


PROD CUP

AMI CRIMP W/O IRRIMP

5 OF 6

#33 SUSP. @ 1590 K TEST 159

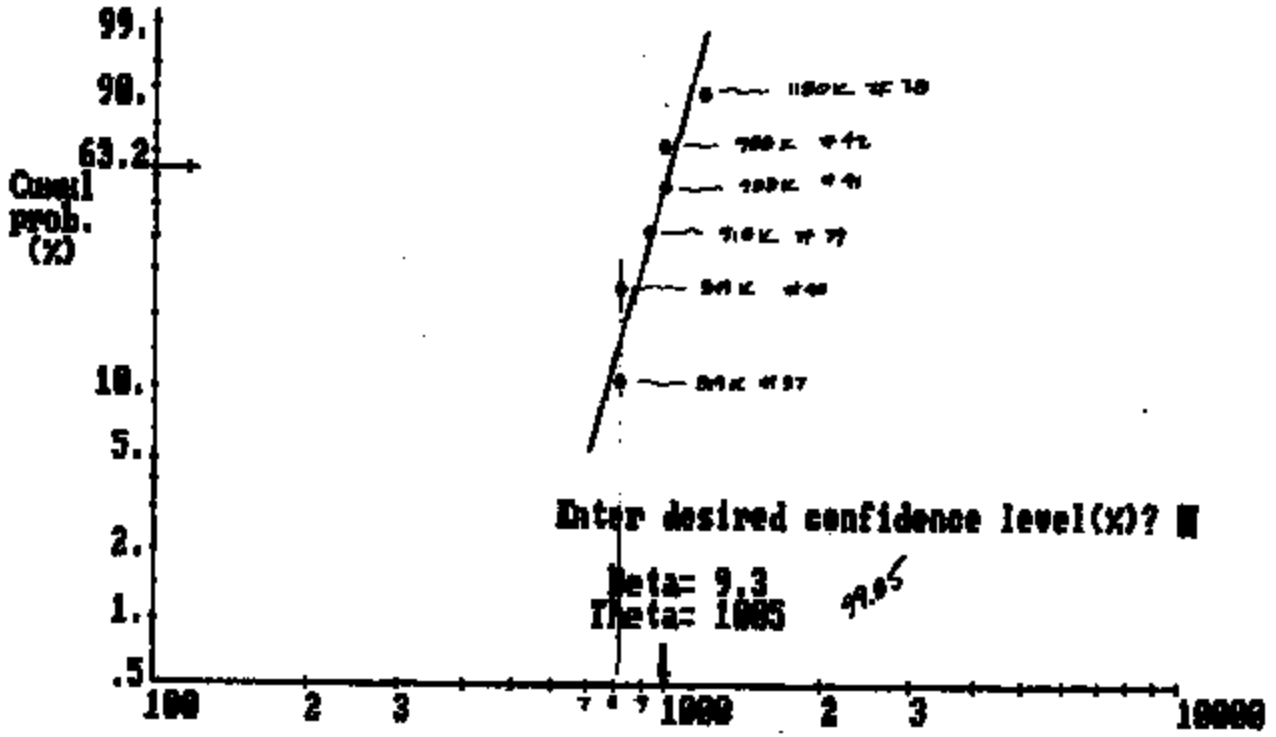


TI-NHTSA 004298

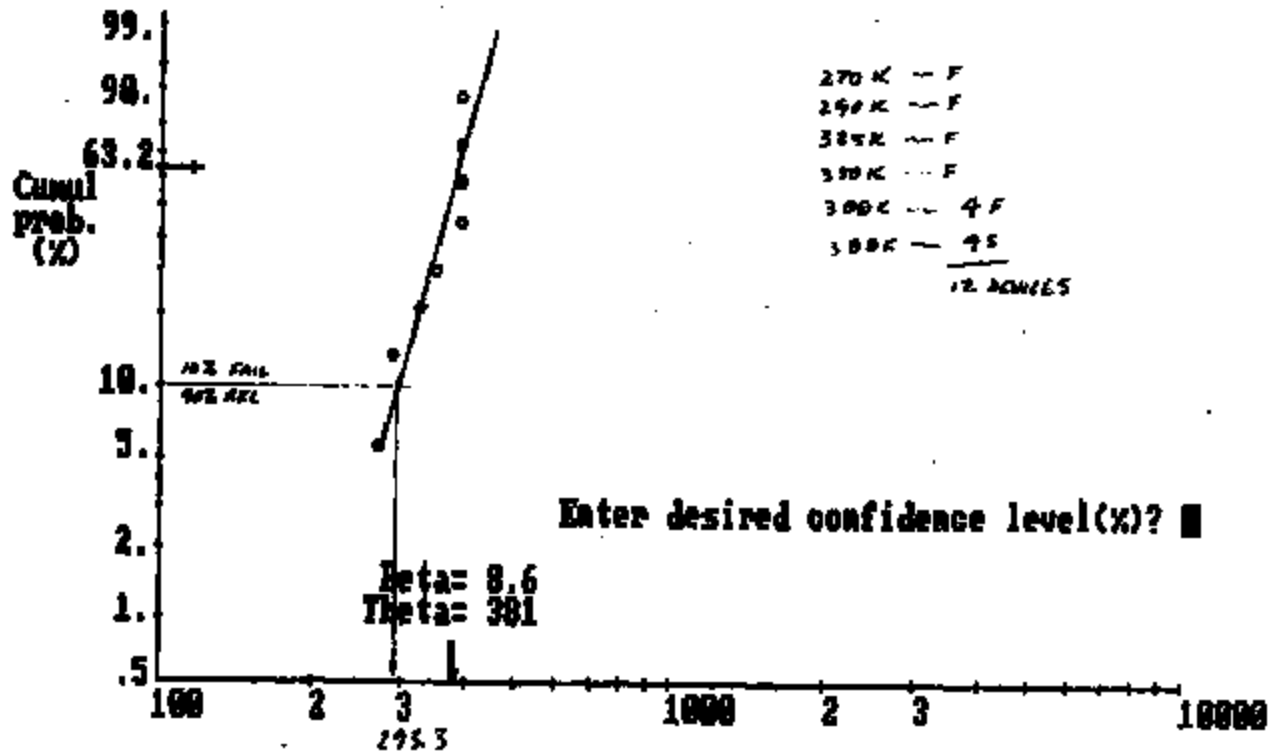
PROD CUPS

HAND-LINE CRIMP

W/ AMI PRECRIMP TEST 159

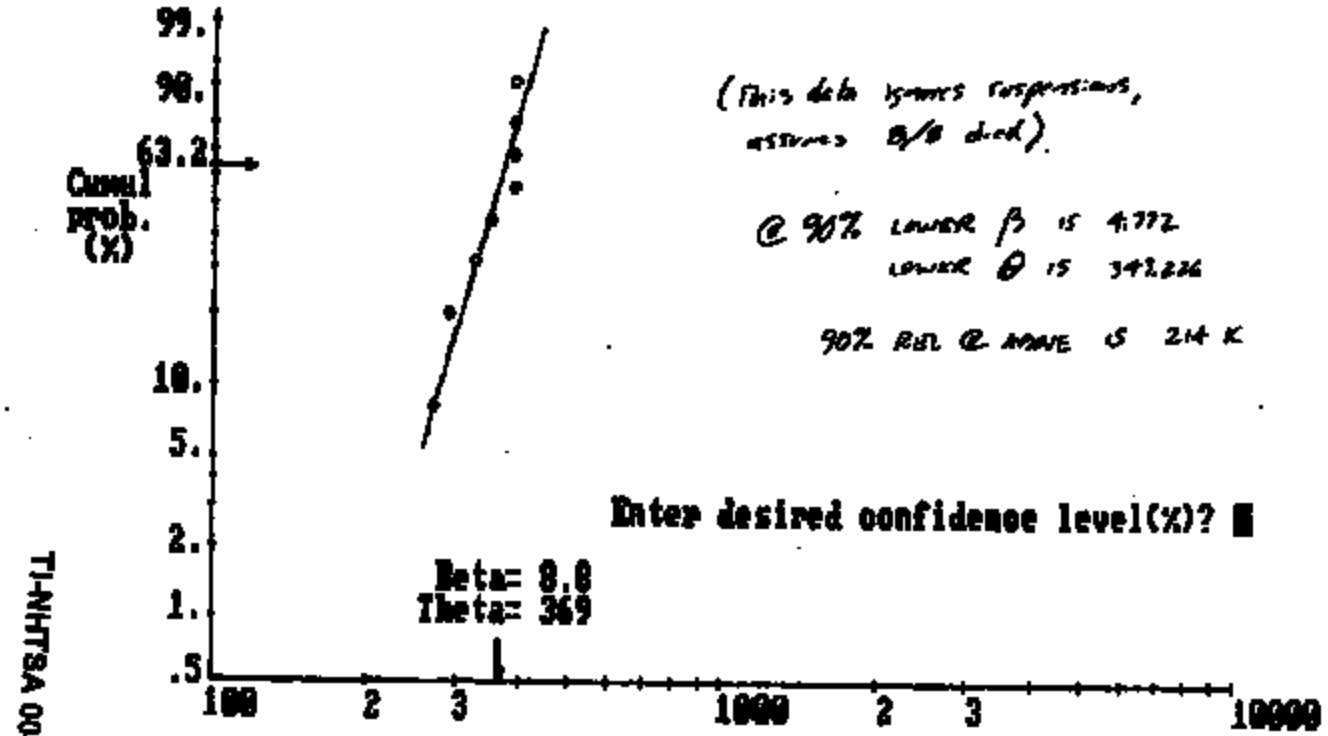


ACTUAL VALIDATION FAILURES PC TABLE-1



270 K — F
240 K — F
325 K — F
350 K — F
300 K — 4 F
300 K — 95
12 CYCLES

TI-NHTSA 004300

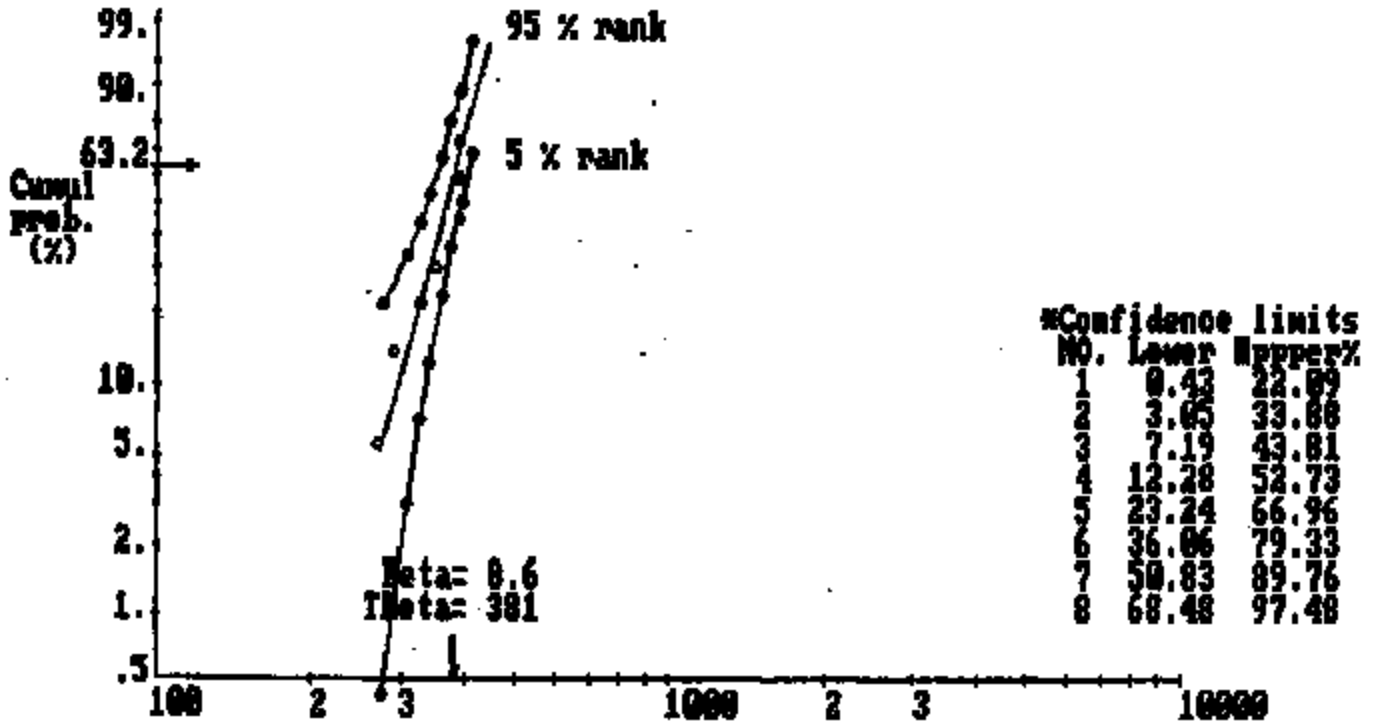


(This data ignores suspensions, assumes 0/0 died)

@ 90% LOWER β IS 4.772
LOWER θ IS 342.226

90% REL @ MMAE IS 214 K

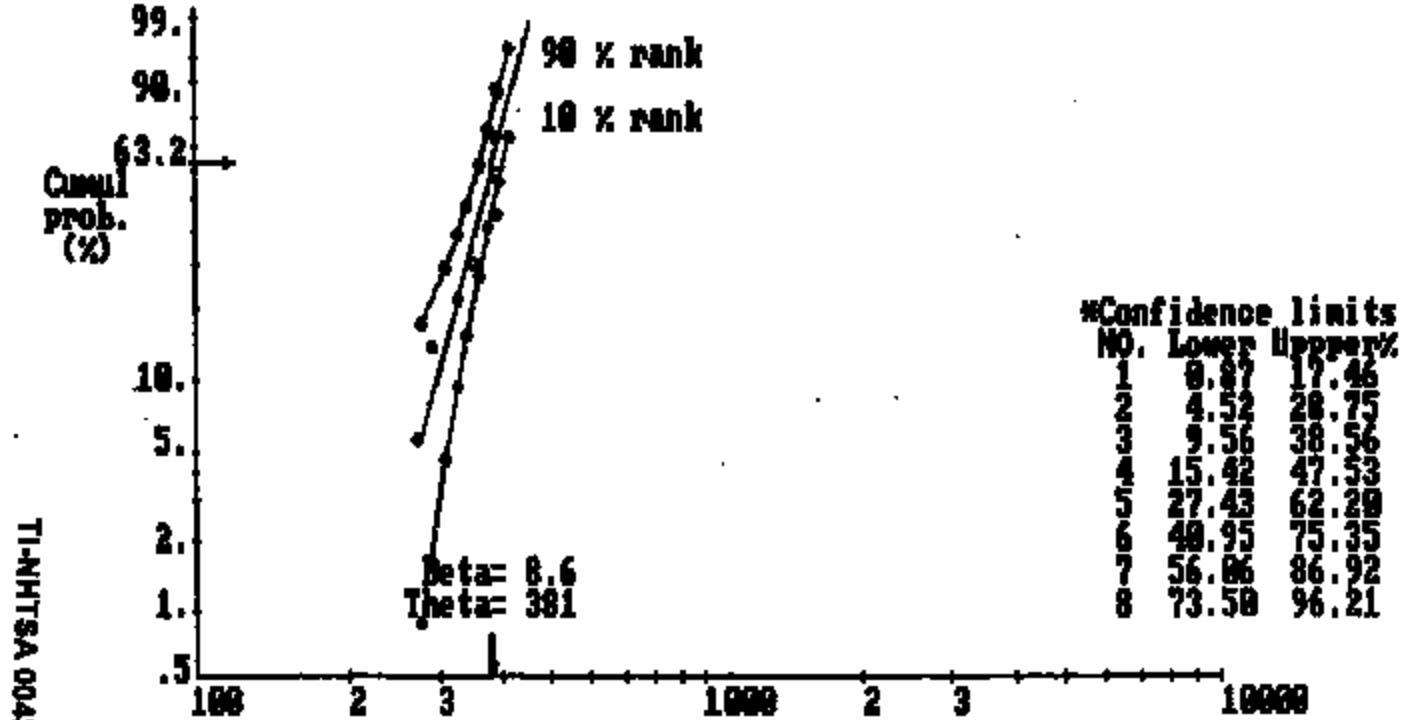
TI-NHTSA 004301



%Confidence limits		
NO.	Lower	Upper%
1	0.43	22.09
2	3.65	33.66
3	7.19	43.81
4	12.28	52.73
5	23.24	66.96
6	36.06	79.33
7	50.83	89.76
8	68.48	97.48

Press return to continue! ■

TI-NHTSA 004302


99.
90.
63.2
Cumul prob. (%)
10.
5.
2.
1.
.5
90 % rank
10 % rank
Beta= 8.6
Theta= 381
100
2
3
1000
2
3
10000
%Confidence limits
NO. Lower Upper%
1 0.87 17.46
2 4.52 28.75
3 9.56 38.56
4 15.42 47.53
5 27.43 62.20
6 40.95 75.35
7 56.86 86.92
8 73.50 96.21
TI-NHTSA 004303
Press return to continue!

77PS

IMPULSE TEST LOG SHEET

DISC LOT	DEVICE	START	STOP	DATE
11-2/11-1	77PS L2-3	4 00 PM	5 [illegible] AM.	11-07-91 (Thu
11-3	77PS L2-3	6:05 AM.		11-8-91
11-4	77PS L2-2	11:00 AM		11-12-91
11-7/11-6	77PS-	3'30. PM	4:3[illegible] AM	11-19-91 11-20 91
11-5	DDPS L2-3	5:45 AM		11-20 91
11-8/11-11	77PS L2-1	6:45 P.M.	8:10 AM	11-25-91 11-26 91
11-9/11-10	77PS L2-1	11:45 AM	10:30PM	11-26-91 11-26-91

77PS

IMPULSE TEST LOG SHEET

DISC LOT	DEVICE	START	STOP	DATE
12-1 / 12-2	77PS 2-1	8.00 AM	9 30 PM	12/5/91
12-3 / 12-4	77PS L2-1	9'30 P.M	11:00 AM ⇔	12-5-91 12/6/91
12-6 / 12-8	77PS L2-1	8:10 A.m	7:55 AM ⇔	12/7/91 12/9/91 12-9-91
12-5	77PS L2-1	8:00 AM		
12-10 / 12-11	77PS L2-1	6'00 PM	7:30 AM ⇔	12-11-91 12-11-91 12-11-91
12-7 / 12-9	77PS L2-1	8:00 AM		
12-12 / 12-13	77PS L2-1	5:30 PM	6:50 AM	12-12-91 12-13-91 12-13-91
12-14 / 12-15	77PS L2-1	8:30AM	⇔	
12-16 / 12-17	77PS L2-1	10:05 PM		12-13-91
12-18 / 12-19	77PS L2-1	1:00 AM	1:10 PM	12-16-91 12-19-91
12-23	57PS-E3-5	4:50 PM		

77PS

IMPULSE TEST LOG SHEET

DISC LOT	DEVICE	START	STOP	DATE
1-16/1-17	77PSX2-1	10:25 PM	11:45 AM	1-1-92 1-2-92
1-1/1-2	77PSL2-1	4:30 PM	5:30 AM	1-2-92 1-3-92
1-5/1-6	77PSX2-1	10:20 PM	11:45 AM	1-5-92 1-6-92
1-3	77PSL2-1	2:30 PM	3:30 AM	1-6-92 1-7-92
1-7/1-8	77PSX2-1	11:17 PM	12:45 PM	1-7-92 1-8-92
1-9/1-10	77PSL2-1	12:50 PM	2:00 AM	1-8-92 1-9-92
11-20/11-21	77PS F3.3	6:00 PM	7:25 AM	1-10-92
1-11/1-12	77PSL2-1	10:30 a.m.	12:05 AM	1-14-92 1-15-92
1-15/1-16	77PSL2-1	12:16 AM	1:45 PM	1-15-92 1-15-92
1-17/1-18	77PSL2-1	2:00 PM	77PSX 3:30 AM	1-15-92
1-14	77PSL2-1	11:50 a.m.	1:45 AM	1-20-92 1-20-92

77PS

IMPULSE TEST LOG SHEET

DISC LOT	DEVICE	START	STOP	DATE
1-22	L2-1	4'45 PM	1:15	1-20-92 1-31-92
1-23	L2-1	〃	〃	1-31-92
1-21	L2-1	4:00 PM	6:30 AM	2-1-92
1-24/1-25	L2-1	9:25 AM	10'45	2-4-92
1-26/1-27	L2-1	11:00 PM	12:20 PM	2-4-92 2-5-92
1-28/1-29	L2-1	1:15 PM		2-5-92
2-4/2-3	L2-1	12:00 PM	1:00 AM	2-10-92 2-11-92
2-5/2-6	L2-1	1:45 AM		2-11-92
2-9/2-10	L2-1	8:00 AM	9:20 PM	2-12-92
2-7/2-8	L2-1	9:35 PM	11:00 AM	2-12-92 2-13-92
2-12/2-11	L2-1	6:15 PM	7:50 AM	2-13-92 2-14-92

77PS

IMPULSE TEST LOG SHEET

DISC LOT	DEVICE	START	STOP	DATE
2-13 / 2-14	77PS	8:00 AM	9:30 PM	2-14-92
2-6 / 2-15	L2.2	10:00 PM		2-14-92
2-1 / 2-16	X2-3 / L2-1	4:25 AM		2-17-92
2-5 / 2-19	L2.3 / L2-1	6:45 PM	8:00 AM	2-17-92 2-18-92
2-3 / 2-4	L2-3	8:10 AM		2-18-92
2-6	X2-3	10:00 PM	11:45 AM 1:15 AM	2-22-92
2-20 / 2-21	L2.1	3:30 PM		2-22-92
1-20	X2-3	1:20 AM		2-24-92
2-26 / 2-27	77PS	2:40 PM	3:55 PM	2-25-92
2-24 / 2-25	DMPS L2-1	3:55 AM		2-26-92
2-28 / 2-29	77PS L2-1	11:45 AM	Approx. 1:00 AM	2-27-92 2-28-92

77PS
IMPULSE TEST LOG SHEET

DISC LOT	DEVICE	START	STOP	DATE
5-26/5-27	L3-1	3:30 PM	5:05 AM	5-27-92 5-28-92
3-24/3-25	L2-3	9:00 AM	11:00 PM	6-02-92 6-2-92
3-26/5-30	L2-3 / L3-1	11:00 PM	12:05 PM	6-2-92 6-03-92
5-31	L3-1	4:45 PM		06-3-92
6-2 & 6-3	L2-3	11:30 AM	4:30 AM	06-04-92 6-5-92
6-4	L2-3	11:30 AM	12:30 AM	06-05-92 6-6-92
5-29/5-32	L3-1	7:50 AM	9:00 PM	06-09-92
6-6	L3-3	2:00 PM	5:00 AM	06-10-92 6-7-92
6-8/6-9	L3-3	6:15 PM	8:05 AM	06-18-92 06-19-92
6-10/6-9	L3-3	9:00 PM	10:00 AM	6-22-92 6-23-92
6-11/6-12	L3-3	9:00 AM		6-25-92

TI-NHTSA 004309

77PS

IMPULSE TEST LOG SHEET

DISC LOT	DEVICE	START	STOP	DATE
6-13 & 6-14	L3-5	9:00 AM	10:10 PM	6-29-92
6-14	L3-3	6:23 PM	11:10 AM	6-29-92 6-30-92
6-16	+ 5 PCS ENG. SAMPLE L3-3	3:25 PM		6-30-92
		3:25 PM		6-30-92
7-3 /7-2	L2-3	2:00 PM	approx 3:30 PM	7-08-92 7-9-92
7-4	L2-3	4:45 AM		7-9-92
100 /102	L3-1	8:45 AM		7-23-92
101/103	L2-3	10:30 PM 9:50 PM	11:55 PM	7-24-92
103 / 104	L3-1	12:40 PM		7-24-92
105 /101	L3-1	9:10 AM		7-27-92
109/ 111	L3-1	9:00 AM		7-28-92

77PS

IMPULSE TEST LOG SHEET

DISC LOT	DEVICE	START	STOP	DATE
112 / 113	L3-1	8:15 AM		7-29-92
114	L3-1	10:22 PM	1:50 PM	7-29-92 7-30-92
115 / 116	L3-1	2:00 PM	5:50 AM	8-04-92 8-5-92
117 / 118	L2-3 / L3-3	6:30 PM	8:00 AM	8-5-92 8-06-92 8-6-92
119 / 120	L3-1	5:45 PM	7:30 AM	8-07-92
121 / 122	L3-3 / L2-3	3:15 PM	5:00 AM	8-10-92 8-11-92
123 / 124	L2-3 /	5:20 PM	4:00 AM	8-11-92 8-12-92
126 / 130	L3-3 / L3-1	5:30 PM	7:00 AM	8-12-92
129	L3-1	7:00 AM		8-12-92
128 / 133	L3-3 / L3-1	2:25 PM		8-19-92
134	L3-1	5:00 AM		8-20-92

77PS

IMPULSE TEST LOG SHEET

DISC LOT	DEVICE	START	STOP	DATE
241	L2-3	7:15 PM	9:16 AM	10-26-92 / 10-27-92
250A / 251A	L3-3	3:30 PM	5:15 AM	10-27-92
253 / 254	L2-1	2:30 PM	3:45 AM	10-29-92 / 10-30-92
252 / 255	L2-1	3:50 AM		
256 / 257	L3-3	8:00 PM	7:25 PM	10-29-92 / 10-30-92
258 / 259	L3-3	7:45 AM		10-30-92
260	L2-3	6:00 PM	1:10 AM	11-3-92 / 11-4-92
262 / 261	L2-1	3:30 PM	5:3:48	
263	L5-2	5:16 AM		11-4-92
265 / 266	L3-3	7:00 PM	8:05 AM	11-5-92 / 11-6-92
267 / 268	L3-3	7:00 PM	8:16 AM	11-05-92 / 11-06-92