

EA02025

TEXAS INSTRUMENTS, INC.'S

09/10/03 LETTER TO ODI

REQUEST 13

BOX 13

PART A – E

PART D

Subproject Name: HWES Version
 Design Responsibility: Chris Wagner
 Other Areas Involved: Manufacturing Eng, Quality, Marketing

Register and Events Affected:
 Model Year/Version(s): L-Series
 Engineering Release Date:

Prepared by: Chris Wagner
 PWH Date (a-b-c): 15Jan94

Draw: A

Part Name, Number & Description	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C o n t r i b	Potential Cause(s) of Failure	O c c u r r e n c e	Design Verification	D e t e c t	R. F. N.	Recommended Actions	App/Individual Responsible & Completion Date	A C T I O N R E C O R D		S U C C E S S F U L	T S R P N.	
												Actions Taken	Stat.			
Mounts terminals relative to each other and locates terminal blades relative to connector housing	Terminal not located properly	Electrical contacts not located properly causing no or constant continuity	4		Incorrect dimensions or tolerances specified	1	Dimensional studies and tolerance stack up analysis Evaluation of prototype	1	4							
	Terminal blades out of position	Mating electrical connector not fit causing customer yield losses	4		Incorrect dimensions or tolerances specified	1	Dimensional studies and tolerance stack up analysis Confirmation of connector design per HWES-149964-04	1	4							
	Terminal misalign at incorrect height	Insufficient contact area (too short) Mating connector not seated fully causing lack of seal (too long)	6		Incorrect dimensions or tolerances specified	1	Dimensional studies and tolerance stack up analysis Evaluation of prototype	1	5							
Electrically separates terminals	Terminal in electrical contact or inadequately separated	Constant continuity Insufficient dielectric strength	6		Design provides inadequate separation	1	Dielectric strength verified to > 1000 Vac	1	6							
Protects terminals and non-contacts from environment through mechanical strength and sealing features	Contamination ingress from switch	Internal components corrode resulting in a open circuit failure	6		Inadequate sealing surface design Inadequate compression of seals Material not strong enough to withstand environmental attack	1	Confirmation of connector design per HWES-149964-04 Hardness and corrosion testing per customer specification ES 5707-149964-04	1	6							
Align clearance for spring and contact to seat	Contact hang up on base wall	Constant short or open circuit Use of base causing the generation of contamination	6		Base geometry wrong Incorrect dimensions or tolerances specified	1	Dimensional studies and tolerance stack up analysis Validation testing including impulse testing to customer specification ES 5707-149964-04	1	6							
Provides mechanism for stacking of terminals	Terminal can't be stacked	Terminals move causing crimp failure, chatter, or constant open or short circuit Continuity obtained between assembly and terminals	6		Base web thickness incorrect	3	Dimensional studies and tolerance stack up analysis Prototype evaluation Confirmation of stackability from sample builds	2	36							
Properly orient mating electrical connector	Base allows connector to be assembled incorrectly	Terminal blades bent Connector loose or fall off allowing a leak path	4		Improper design of orientation tabs	1	Confirmation of connector design per HWES-149964-04	1	6							
Allow mating electrical connector to lock to mate	Connector loose or falls off	Leak path opened Switch does not signal pressure change to BCM	6		Improper design of locking tabs	1	Confirmation of connector design per HWES-149964-04	1	4							
Provides feature for Equal wrap	Base cracks	Loose crimp allowing a leak path formation Device falls apart Components cover dislodged	6		Improper strength of material Design causes excessive stress concentration	4	Comparison of design with similar product Verify material strength with supplier Prototype evaluation	4	96							
	Crimp ring doesn't fit	Device falls apart Device can't be assembled causing yield losses	4		Dimension of crimping feature incorrect	1	Dimensional studies and tolerance stack up analysis Comparison of design with similar product	1	4							
Provides proper position and location for sensor	Sensor will not sit properly in base Base fit not gaugable	Impossible device Yield loss	4		Geometry of sensor holding feature incorrect Diameter of sensor holding feature too large or small	1	Dimensional studies and tolerance stack up analysis Comparison of design with similar product	1	4							

71-NHTSA 019292

Subject/Process: STPS Hazards
 Design Responsibility: Chris Wagner
 Other Areas Involved: Manufacturing, Eng. Quality, Marketing

Material and Parts Affected:
 Model Year/Vehicle(s): Unknown
 Engineering Release Date:

Prepared by: Chris Wagner
 PWH Date Orig: 12/28/94

(Rev): 0

Part Name, Number & Description	Potential Failure Mode	Expected Effects of Failure	C O U N T	Potential Cause(s) of Failure	D E S I G N	Design Verification	D E S I G N	Manufactured Action	Area/Individual Responsible & Completion Date	ACTION N Active Index	S E R I A L N O.	S E R I A L N O.	S E R I A L N O.	S E R I A L N O.
<p>---PUSHER THUMB--- (2600)</p> <p>Provides electrical continuity between switch and machine electrical connector</p>	No electrical continuity	ECU does not receive proper pressure signal	6	Insufficient blade of wrong shape or dimension for mating electrical connector Insufficient material thickness	1	Wade design confirmed with regular sample of connector EPH-149048-00	1							
	Excessively high electrical resistance	ECU receives incorrect pressure signal	5	Insufficient material has too great a resistivity Insufficient material too tightly crimped Insufficient blade too thin to provide proper contact force	1	Comparison of design with similar product Voltage method of checking before and after assembly, and salt spray testing Wade design confirmed with regular sample of connector EPH-149048-00	1							
Maintains electrical isolation from ground and stationary terminal when switch open	Continuity in leads with sensor	ECU receives on or incorrect signal	5	Insufficient dimensioning mechanically specified	1	Testing of insulation resistance to > 1000 Ohm	1							
	Continuity in leads with stationary terminal	ECU receives incorrect signal due to incorrect proximity of switch Weld loss	6	Incorrect dimensioning specified	1	Testing of insulation resistance to > 1000 Ohm Function testing of sample and production parts	1							
In an L type device, holds the spring assembly during open position and allows the spring assembly to break away freely in the closed position	Spring assembly bumps up	Crash device Risk of unstable arm and terminal	6	Insufficient clearance from too small Incorrect burr allowance or stamped terminal	1	Insulate and vibration testing per customer specification EPH-149048-00	2							
	Spring assembly pops out of terminal	Switch stuck open or closed causing incorrect signal to ECU	6	Insufficient clearance area too large	1	Insulate and vibration testing per customer specification EPH-149048-00 Prototype evaluation	2							
Provides hinge point arm during operation of both an L and S type switch	Excessive wear at hinge	Contamination generated which causes open circuit condition	6	Material specified inadequately resistant to wear Incorrect burr allowance or stamped terminal	2	Insulate and vibration testing per customer specification EPH-149048-00 Comparison of design with similar product	1							
Interfaces with base to keep in place during stacking	Terminals do not fit into base	Switch does not assemble leading to yield loss	6	Interference keeps too large	2	Dimensional study and tolerance stack up analysis Prototype evaluation and sample builds	1							
	Terminals fall out	Terminals fall out leading to alarm assembly	3	Interference keeps too small	2	Dimensional study and tolerance stack up analysis Prototype evaluation and sample builds	1							
Provides stacking feature to ensure the terminal in the base	Tab not deformed	Terminal not stacked causing a switch stuck open or closed Terminal in contact with sensor Crash or intermittent continuity	6	Insufficient material strength too great for deformation Tab dispersion too short for stacking	2	Review of material property requirements Prototype evaluation and sample builds	2							
	Tab improperly deformed	Terminals loose causing shorting or crash device and low yields	6	Incorrect tab geometry	1	Prototype evaluation Sample builds	1							
	Terminal blade alignment not as specified	Machine electrical connector will not mate or mate with difficulty	5	Incorrect tab design which causes terminal deformation	1	Prototype development and evaluation Sample builds	1							

TI-NHTSA 019293

Subject/Name: EPPK Urison
 Design Responsibility: Chris Wagner
 Other Break Involvement: Manufacturing Eng. Quality, Marketing

Supplier and Plant: Affected:
 Model Tag/Article#: Urison
 Engineering Release Date:

Prepared by: Chris Wagner
 PBR Date (Orig): 3/16/94
 Chg. #: A

Part Name, Number & Description	Potential Failure Mode	Potential Effects of Failure	S. O. C. I.	C. P. T.	Potential Cause(s) of Failure	O. C. S.	Design Verification	D. O. C.	S. F. N.	Recommended Actions	Assign/Individual Responsible & Completion Date	ACTION REQUIRED	RESOLUTION	STATUS
Provides staking feature to secure the terminal in the base Provides a support feature for staking Is electrically deformed in a non-linear fashion to improve staking	See Nonlinear Terminal													
---SOLDER BRIDGE--- P Type Terminal M228 Provides a mist for the solder to be messy when open	Constant conductivity	ECM unable to verify system pressure	4		Not too small causing the possible area to protect the terminal	1	Dimensional study and tolerance stack up analysis Validation testing including ultrasonic coating per customer specification IS P/N-3828-00	1	10					
Inefficient dielectric strength and inconsistent conductivity		Failure signal sent to ECM Spacing between stationary terminal and movable arm causing arcing or contamination of contact	5		Not too small causing possible area to inadvertently contact the terminal	2	Dimensional study and tolerance stack up analysis Validation testing including ultrasonic coating per customer specification IS P/N-3828-00 Testing of insulation resistance to > 1000 VDC	3	20					
Provides a current carrying member Maintains electrical isolation from sensor and movable terminal when switch open Interfaces with base to aid in base assembly Provides staking feature to secure the terminal in the base Provides a support feature for staking Is electrically deformed in a non-linear fashion to improve staking	See Nonlinear Terminal													
---VARIABLE CONTACT--- (Common, M228) Provides electrical conductivity with low voltage drop when switch closed	High conductivity	ECM unable to verify system pressure due to failed switch	4		Incorrect material selection Incorrect plating specified Incorrect plating thickness specified	1	Short material and plating system designed per industry practices Life and function testing per customer specification IS P/N-3828-00 Comparison of design with similar product	1	6					
	High voltage drop	ECM receives incorrect system pressure signal	5		Incorrect contact material or plating system	1	Short material and plating system designed per industry practices Voltage drop measurements taken before and after validation testing	1	5					
Dissipates heat during high surge current	Contact melting due to heat	Switch goes open circuit Voltage drop increases	6		Inproper design of contact geometry	1	Pulse validation testing per customer specification IS P/N-3828-00 Comparison of design with similar product	1	6					

TI-NHTSA 019295

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Subcontractors: FTS Unicom
 Design Responsibility: Chris Wagner
 Other Areas Involved: Manufacturing Eng, Quality, Marketing

Suppliers and Plants Affected:
 Model Name/Number(s): Various
 Engineering Release Date:

Prepared by: Chris Wagner
 FTS Date: 10/28/94

Class: A

Part Name, Number & Description	Potential Failure Mode	Potential Effects(s) of Failure	S	C	P	Potential Cause(s) of Failure	O	Design Verification	D	I	R	Recommended Actions	Area/Individual Responsibility & Completion Date	ACTION RESULTS					
														W	D	C	D	R	
Resist user wear life	Excessive contact wear	Increased voltage drop Crimp due to change of shape dimensions	5			Too soft a contact material selected	1	Material validation meeting per customer specification EK F20-2482-01 Comparison of design with similar products	1	5									
Slide switch arm to spring	Arm separates from spring	Switch stuck in open or closed position resulting in EMI being unable to monitor system pressure	5			Rivet geometry incorrect for riveting operation Length of rivet too short to provide adequate Form	1	Validation of design per customer specification EK F20-2482-01 Rivet geometry and length defined per manufacturer's recommendations	1	5									
Down and close contacts	Mechanism of spring potential resulting in contacts not opening or closing	Switch stuck in open or closed position resulting in EMI being unable to monitor system pressure	5			Incorrect material specified Incorrect thickness specified	1	Material completely specified on print Validation meeting per customer specification EK F20-2482-01 Detailed testing of spring design	1	5									
Provides proper contact force when switch closed	Contact force too high	Excessive wear on movable contact leading to crimp formation because base shape distortion observed Excessive wear of movable arm and/or transfer tip generating contamination and leading to a failed switch Shift of design validation causing low yields	5			Free spring height too great causing excessive spring preload and contact force Improper specification of material	3	Dimensional study and tolerance stack up analysis Prototype testing of spring material and dimensions including life testing and force deflection analysis Validation testing	2	25									
	Contact force too low	High voltage drop Contact chattering	5			Free spring height too short causing inadequate spring preload and low contact force Improper material specification	2	Dimensional study and tolerance stack up analysis Prototype testing of spring	2	20									
Provides adequate contact gap when open (I type device)	Gap too small	Low dielectric strength Switch chattering	5			Free spring height too short causing inadequate spring preload and low contact gap Improper material specification	2	Dimensional study and tolerance stack up analysis Prototype testing of spring Validation testing	1	10									
	No gap	Switch stuck closed causing EMI to be unable to monitor system pressure	5			Incorrect dimensions or material selection	1	Dimensional studies Prototype testing Validation testing	1	5									
Slide rings break away in an I type device	Rings break away before contact closes	Crimp device causing low yields Device chattering	5			Low hinge force caused by improperly specified free spring dimensions	3	Validation testing of the switch Prototype testing of spring including life testing and force deflection analysis	3	65									
	Rings does not break away or has excessively high hinge force	Excessive wear of transfer tip and movable contact generating contamination and causing an open circuit condition Large change in calibration of switch causing low yields	5			Improper dimension of spring causing excessive hinge friction Improper spring which causes wear and terminal wear	1	Validation testing per customer specification EK F20-2482-01 Prototype testing of spring including life testing and force deflection analysis	2	15									

TI-NHTSA 019298

Reference/Theme: SPK Marine
 Design Responsibility: Chris Magner
 Other Teams Involved: Manufacturing Eng. Quality, Marketing

Supplier and Flight Affected:
 Model: New-40000000
 Manufacturer: Horizon
 Aerospace/Aviation Sector

Prepared by: Chris Magner
 SWH Date: 02-15-89

Class: A

Part Name, Number & Description	Potential Failure Mode	Potential Effects of Failure	Criticality	Potential Cause(s) of Failure	OCF	Design Verification	D.U.L.	R.P.L.	Recommended Actions	Assign/Individual Responsibility & Completion Date	ACTION REQUIRED	REGULATORY	UNDESIRABLE	DEFECTIVE
Properly positions movable arm	Spring rate against base during activation	Wear of base and spring Switch sticks in open or closed position Inoperable and does open	5	Spring arm too long for movable arm	1	Dimensional study and tolerance stack up analysis	2	18						
	Spring too far forward of hinge	Arm held against movable terminal with too great a force causing excessive hinge friction and a high hinge force	6	Spring arm too short	1	Dimensional study and tolerance stack up analysis	2	18						
Eliminates intrusion of movable contact and plate	Contact/insert will not fit	Device can't be assembled causing low yields	4	Hole diameter significantly too small	1	Designed according to industry practice and manufacturer's recommendation	1	4						
	Insert not to be placed	Device can't be assembled resulting in yield loss	4	Step too high or low	1	Dimensional study and tolerance stack up analysis Comparison of design with similar product	2	4						
TI-NHTSA 019297	Step where transfer pin	Contaminants generated which cause switch to go open circuit	5	Step geometry inaccurately designed	1	Validation testing including impulse and vibration tests per customer specification MS 2270-3004-00	2	12						
	Flange arm cracks, breaks	Switch sticks open or closed	5	Inoperable material specified Inoperable material thickness specified Inoperable weld size or heat treat specified	1	Validation testing including impulse and vibration tests per customer specification MS 2270-3004-00 Comparison of design with similar product	1	6						
Insert: user at transfer pin contact plate	Transfer pin wears large	Contaminants generated which cause switch to go open circuit	5	Inoperable material selection	1	Validation testing including impulse and vibration tests per customer specification MS 2270-3004-00 Comparison of design with similar product	1	6						
Provides a hinge feature to hold spring in place during life	Spring assembly pops out of movable terminal	Switch sticks open or closed	5	Hinge dimensions not properly specified	1	Dimensional study and tolerance stack up analysis	1	6						
Slider in movable terminal slot in an L type device	Arm hangs up on terminal	Wear of arm and terminal Insulating contamination and causing switch to go open circuit Reduced contact gap leading to reduced dielectric strength	6	Arm dimensions not properly specified	1	Dimensional study and tolerance stack up analysis Dielectric strength testing at > 1000 VDC	1	6						
Provides ears to allow proper positioning of spring	Spring does not fit between ears	Spring out of place causing inoperable switching and excessive hinge and contact forces	6	Ear dimensions not properly specified	1	Dimensional study and tolerance stack up analysis Comparison of design with similar product	1	6						
Provide hole for insertion of movable contact	Contact will not fit	Device can't be assembled leading to low yields	4	Specified hole diameter too small	1	Designed according to industry practice and manufacturer's recommendation	1	4						
Hold spring assembly to movable terminal	Spring loosens over life	Spring assembly comes loose over life causing the switch to go open or closed circuit	6	Inoperable rivet specified Inoperable material specified	1	Designed according to industry practice and manufacturer's recommendation	1	6						
	Pin at does not fit through spring and terminal holes	Can't assemble device leading to yield loss	4	Pin diameter too large	1	Designed according to industry practice and manufacturer's recommendation	1	4						

Subcontractor: SSK Marine
 Design Responsibility: Chris Wagner
 Other Areas Involved: Manufacturing Eng. Quality, Marketing

Supplier and Plant: Affected:
 Model Name/Version: Unknown
 Engineering Release Date:

Prepared by: Chris Wagner
 SWH Date (Orig): 15-Mar-02 (Rev): 0

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Part Name, Number & Description	Potential Failure Mode	Potential Effects of Failure	SEV	Potential Cause(s) of Failure	D	Design Unification	SI	OC	Recommended Actions	Area/Individual Responsible & Completion Date	ACTION	RES	U	V	R	S
	Blunt corners during life and stress out of balance	Spring assembly wears loose over life causing the switch to go open or closed abruptly	6	Blunt bend not properly specified for terminal and spring tabs	1	Design according to industry practices and manufacturer's recommendation Validation testing including impact tests per customer specification in EFW-3000-01	1	6								
—BUCKET SW. SW.— (7000) Prevents foreign matter from entering the hose	Leak path established	Contacts separate causing an open circuit condition	6	Incorrect end dimensions specified Incorrect material specified Incorrect surface finish specified	1	Validation testing including salt spray and humidity tests conducted per customer specification in EFW-3000-01 Comparison of design with similar product	1	6								
—HARD CAP— (7000) Protects threads during shipping and customer handling	Damaged threads	Part difficult or impossible to install Part strips during part threads	4	Improper cap material specified Cap dimensions allow cap to fall off	1	Dimensional study and tolerance stack up analysis Material properties and manufacturer information reviewed	2	6								
—O-RING— (7000) Provides fluid seal between switch male fitting and corresponding female part	Fail to provide adequate seal	Fluid leakage	9	Incorrect O-ring dimensions specified Incorrect material specified	1	Validation testing including impact, burst, thermal cycle and proof tests per customer specification in EFW-3000-01 Comparison with design of similar products Review of material specifications and manufacturer information O-ring dimensions designed per SWH recommendations	1	9								

TI-NHTSA 010298

**POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)**

PREPARED BY: MATT SELLERS

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERS/MANN REA

FMEA DATE (ORIG.) 4/25/88

MODEL YEAR(S)/VEHICLE(S): 84/87/77/83/87PS

DESIGN/QUALITY RESPONSIBILITY: KEITH ROSELLLO / JIM WATT / PEGGY ALLEN

FMEA REVISION: B

Item	Process Step/Requirement	Potential Failure Mode	Potential Effect(s) or Failure	S	C	P	Potential Cause(s) or Mechanism(s) of Failure	D	Current Process Controls	D P C	R F N	Recommended Action(s)	Responsibility & Target Completion Date	Action Results			
														Done	Y	O	R
1	FEED AND ASSEMBLE HEXPORT TO NEST.	DOES NOT FEED	NO SUBSEQUENT ASSEMBLY PERMISSIBLE YIELD LOSS	3			MACHINE ERROR	1	PREVENTATIVE MAINT. 100% PRESENCE CHECK VERIFY OPERATION OF CHECK PROBE	1	5						
		DOES NOT NEST PROPERLY	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5			DEBRIS IN NEST; MACHINE ERROR	1	PREVENTATIVE MAINT. 100% PRESENCE CHECK	1	5						
		LOADS MULTIPLE HEXPORT	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5			MACHINE ERROR	1	PREVENTATIVE MAINT. 100% PRESENCE CHECK	1	5						
2	CONFIRM HEXPORT PRESENCE AND STYLE.	FAILS TO IDENTIFY OUT OF RANGE HEXPORT	MODIFIED HEXPORT	5			SET-UP ERROR	1	SET-UP MASTERS	1	5						
3	FEED AND ASSEMBLE GASKET TO HEXPORT BLAND.	MISPLACED GASKET	LEAK	5			MACHINE ERROR	1	100% FUNCTION TEST	1	5						
			BURST RESISTANCE DEGRADATION	5			OPERATOR INTERVENTION	1	CONTINUITY PROBE CYCLING AUDITS	1	5						
		NO GASKET	LEAK BURST RESISTANCE DEGRADATION	5			MACHINE ERROR OPERATOR INTERVENTION	1	100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS	1	5						
4	CONFIRM GASKET PRESENCE.	MULTIPLE GASKET	LEAK BURST RESISTANCE DEGRADATION YIELD LOSS	5			OPERATOR INTERVENTION	1	100% FUNCTION TEST	1	5						
		FAILS TO IDENTIFY MISSING OR OUT OF PLACE GASKET	LEAK	5			MACHINE ERROR	1	SET-UP MASTERS	1	5						
6	BLANK AND ASSEMBLE (2) BEALS	ONLY (1) BEAL LOADED	REDUCED DIAPHRAGM LIFE	5			OPERATOR DOES NOT TURN ON 3RD STATION	1	PROCESS SPECS MACHINE SET-UP MATERIAL FITTING	1	5						

TI-NHTSA 019299

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERS/ANN REA

FMEA DATE (ORIG.) 4/28/08
FMEA REVISION: B

MODEL YEAR(S)/VEHICLE(S): 08/07/08/07/09

DESIGN/QUALITY RESPONSIBILITY: KEITH ROSIELLO / JIM WATT / PEGGY ALLEN

Step	Process Function Description	Potential Failure Mode	Potential Consequence of Failure	S	O	D	Potential Cause/Requirement(s) of Failure	I	Current Process Controls	D	C	P	Recommended Actions	Responsibility & Target Completion Date	Action Results				
															Severity	Occurrence	Detectability	Pass	Fail
6	CONFIRM (3) SEALS PRESENCE.	NO SEAL LOADED	LEAK	5			MACHINE ERROR	1	100% FUNCTION TEST CONTINUITY PROBE	1	2								
		IMPROPERLY CUT SEAL	LEAK DIAPHRAGM LIFE FAILURE YIELD LOSS	6			MACHINE ERROR	1	100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS PREVENTIVE MAINT.	1	4								
		MISPLACED SEAL	LEAK REDUCED DIAPHRAGM LIFE	6			MACHINE ERROR OR STATIC	1	100% FUNCTION TEST CONTINUITY PROBE ANTI-STATIC STATION PREVENTIVE MAINT. CYCLING AUDITS	1	6								
		MORE THAN (2) SEALS LOADED	SHIFT IN SET POINTS	5			STATIC BUILD UP	1	ANTI-STATIC STATION	1	3								
7	NONRELEASABLE BLANK AND ASSEMBLE (3RD) SEAL FOR BRAKE APPLICATION	FAILS TO IDENTIFY MISSING OR OUT OF PLACE SEAL(S)	LEAK	6			MACHINE ERROR	1	SET-UP MASTERS	1	5								
7	NONRELEASABLE BLANK AND ASSEMBLE (3RD) SEAL FOR BRAKE APPLICATION	NO SEAL LOADED	LEAK	5			MACHINE ERROR	1	100% FUNCTION TEST CONTINUITY PROBE	1	5								
		IMPROPERLY CUT SEAL	LEAK DIAPHRAGM LIFE FAILS PREVENTS SUBSEQUENT ASSEMBLY YIELD LOSS	6			MACHINE ERROR	1	100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS PREVENTIVE MAINT.	1	6								
		MISPLACED SEAL	LEAK REDUCED DIAPHRAGM LIFE	6			MACHINE ERROR OR STATIC	1	100% FUNCTION TEST CONTINUITY PROBE ANTI-STATIC STATION PREVENTIVE MAINT. CYCLING AUDITS	1	6								
		MORE THAN (1) SEAL LOADED	SHIFT IN SET POINTS	5			STATIC BUILD UP	1	ANTI-STATIC STATION	1	3								

71-NHTSA 019300

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLER/ANN REA

FMEA DATE (ORIG.) 4/29/98
FMEA REVISION: B

MODEL YEAR(S)/VEHICLE(R): 52/53/77/MONRTPS

OSQ/NQUAL/MPG RESPONSIBILITY: KEITH ROBIELLO / JIM WATT / PEGGY ALLEN

ID	Process Function/Responsibility	Potential Failure Mode	Potential Effect(s) of Failure	S	O	D	C	Customer Process Controls	D	K	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
														Y	C	D	R	P.	
8	WHERE APPLICABLE, CONFIRM (WFO) SEAL PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE SEAL	LEAK	8				MACHINE ERROR	1			SET-UP MASTERS	1	8					
9	FEED AND ASSEMBLE CONVERTER TO WASHER	MISSED CONVERTER	INOPERATIVE SWITCH	5				MACHINE MISFEED	3			100% PRESENCE CHECK 100% FUNCTION TEST	1	18					
		MISSED WASHER	INOPERATIVE DEVICE	9				MACHINE MISFEED	3			100% PRESENCE CHECK 100% FUNCTION TEST	1	27					
		UPSIDE DOWN WASHER	LEAK SHIFT IN DEVICE SET POINTS REDUCED KAPTON LIFE	9				MACHINE MISFEED OPERATOR ERROR	1 1			100% PRESENCE CHECK POKE YOKO LIN. TRACK 100% FUNCTION TEST	1 1	9					
10	FEED AND ASSEMBLE WASHER/CONVERTER ASSEMBLY	DISLOPMENT OF CONVERTER	INOPERATIVE DEVICE	5				JAM PICK AND PLACE ERROR	1			OPERATOR SET-UP	1	9					
		NON-COINCIDENTIC PLACEMENT	MISPLACED KAPTON REDUCED KAPTON LIFE MISPLACED DISC INOPERATIVE DEVICE	9				JAM PICK AND PLACE ALIGNMENT ERROR	1			OPERATOR SET-UP	1	6					
		FAILS TO LOAD ASSEMBLY	NO SUBSEQUENT ASSEMBLY PERMISSIBLE YIELD LOSS	5				MACHINE ERROR	1			PREVENTIVE MAINT.	1	6					
		LOADS MULTIPLE ASSEMBLES	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5				MACHINE ERROR	1			PREVENTIVE MAINT. 100% PRESENCE CHECK	1	6					
11	CONFIRM WASHER/CONVERTER ASSEMBLY PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE WASHER/CONVERTER ASSEMBLY	INOPERATIVE DEVICE	6				MACHINE ERROR	1			YIELD MONITORING	1	6					
12	BLANK AND ASSEMBLE SPACER	MISPLACED SPACER	REDUCED DISC LIFE	7				MACHINE ERROR	1			100% FUNCTION TEST	1	7					

TI-NHTSA 018301

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLERS/ANN REA

FMEA DATE (OPSG.) 4/28/09
FMEA REVISION: B

MODEL YEAR(S)/VEHICLE(S): 52/57/77/80/87/PS

DSGN/DUAL/MPG RESPONSIBILITY: KEITH ROSIELLO / JIM WATT / PEGGY ALLEN

ID	Process Function/Requirement	Potential Failure Mode	Potential Effect(s) of Failure	S	O	D	Current Process Controls	D	P	R	Recommended Actions	Responsibility & Target Completion Date	Action Results					
													Actions Taken	B	O	D	S.P.	
			CONTINUITY FAILURE LOSS OF CALIBRATION DRIFT OVER LIFE				CONTINUITY PROBE CYCLING AUDITS TRAPPED DISC PROBE											
		NO SPACER	REDUCED DISC LIFE LOSS OF CALIBRATION DRIFT OVER LIFE	7			MACHINE ERROR TOOL DULL, BROKEN, OR OTHERWISE MALF.	1	7		100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS PREVENTIVE MAINT.							
		IMPROPERLY CUT SPACER; TOO LARGE	REDUCED DISC LIFE LOSS OF CALIBRATION DRIFT OVER LIFE CONTINUITY FAILURE	7			MACHINE ERROR TOOL DULL, BROKEN, OR OTHERWISE MALF.	1	7		100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS PREVENTIVE MAINT.							
		IMPROPERLY CUT SPACER; TOO SMALL	REDUCED DISC LIFE LOSS OF CALIBRATION DRIFT OVER LIFE	7			MACHINE ERROR TOOL DULL, BROKEN, OR OTHERWISE MALF.	1	7									
		2 OR MORE SPACERS LOADED	CONTINUITY FAILURE LOSS OF CALIBRATION DRIFT OVER LIFE	7			STATIC BUILD-UP	1	7		ANTI-STATIC STATION							
13	CONFIRM SPACER PRESENCE.	FAILS TO IDENTIFY MISSING OR OUT OF PLACE SPACER.	REDUCED DISC LIFE	7			MACHINE ERROR	1	7		SET-UP MASTERS							
14	FEED AND ASSEMBLE DISC	MISPLACED DISC (TRAPPED)	CONTINUITY FAILURE	8			MACHINE ERROR	3	15		PRESSURE PROBE TRAPPED DISC PROBE 100% FUNCTION TEST							
		UPSIDE DOWN DISC	CONTINUITY FAILURE	8			MACHINE ERROR	3	14		100% DISC PROBE TRAPPED DISC PROBE 100% FUNCTION TEST							
		MULTIPLE DISC	CONTINUITY FAILURE ACTUATION FAILURE	8			MACHINE ERROR	3	14		100% DISC PROBE TRAPPED DISC PROBE							
		WRONG DISC	LOSS OF CALIBRATION	8			NOISE	1	8		100% FUNCTION TEST DISC SLIPS ROUTE SLIP							
			AUDIBLE SNAP ON QUIET															

TI-NHTSA 019302

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERS/MANN REA

FMEA DATE (ORIG.) 4/29/96
FMEA REVISION: B

MODEL YEAR(S)/VEHICLE(S): 52/57/77/80/87/PS

DSGN/QUAL/MFG RESPONSIBILITY: KEITH ROSIELLO / JIM WATT / PEGGY ALLEN

Item	Process Function/Requirements	Potential Failure Mode	Potential Effects of Failure	C I S S E	P o t e n t i a l C a u s e (M e c h a n i s m s o f F a i l u r e	O c c u r r e n c e	C u r r e n t P r o c e s S e n s i n g C o n t r o l s	D e t e c t i v e n e s s	R e s p o n s i b i l i t y	R e c o m m e n d e d A c t i o n s	R e s p o n s i b i l i t y & T a r g e t C o m p l e t i o n D a t e	Action Results						
												Actions Taken	S e v e r i t y	O c c u r r e n c e	D e t e c t i v e n e s s	R e s p o n s i b i l i t y		
			APPLICATIONS															
16	CONFIRM DISC PRESENCE	MISSING DISC FAILS TO IDENTIFY MISSING OR OUT OF PLACE DISC.	CONTINUITY FAILURE INOPERATIVE DEVICE	6 7	MACHINE ERROR	1	100% DISC PROBE 100% FUNCTION TEST YIELD MONITORING	1	6 7									
16	FEED AND ASSEMBLE CUP	MISSING CUP DISLACEMENT OF INTERNAL COMPONENTS LEAK MULTIPLE CUPS LOADED	NO DEVICE OPERATION INOPERATIVE DEVICE LEAK NO SUBSEQUENT ASSEMBLY PERMISSIBLE	6 8 6	MACHINE INDEX ERROR MISALIGNED AIR PICK AND PLACE MACHINE ERROR	1 1 1	100% PRESENCE CHECK 100% FUNCTION CHECK TRAPPED DISC PROBE 100% FUNCTION TEST CYCLING AUDITS 100% PRESENCE CHECK	1 1 1	6 9 6									
		LOW RATIO CUP LOADED IN PLACE OF HIGH RATIO CUP	SHIFT IN DEVICE SET POINTS EXCESSIVE SPRING PRE-LOAD CREEP CONTINUITY FAILURE	6	MIXING ERROR OPERATOR ERROR	1	100% FUNCTION CHECK KAM BAN LOT CONTROL	1	6									
		HIGH RATIO CUP LOADED IN PLACE OF LOW RATIO CUP	SHIFT IN DEVICE SET POINTS INSUFFICIENT SPRING PRE-LOAD CREEP CONTINUITY FAILURE	6	MIXING ERROR OPERATOR ERROR	1	100% FUNCTION CHECK KAM BAN LOT CONTROL	1	6									
17	CONFIRM CUP PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE CUP.	INOPERATIVE DEVICE	7	MACHINE ERROR	1	YIELD MONITORING	1	7									

TI-NHTSA 018303

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLERSMANN PEA

FMEA DATE (ORIG.) 4/28/99
FMEA REVISION: B

MODEL YEAR(S)/VEHICLE(S): 52/57/77/80/87/95

D89N/QUALMFG RESPONSIBILITY: KEITH ROSIELLO / JIM WATT / PEGGY ALLEN

Item	Process Step/Requirement	Potential Failure Mode	Potential Effects of Failure	S	C	Potential Cause(s) / Mechanism(s) of Failure	O	Current Process Controls	D	P	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Plan				
														Autosave Tables	S	C	O	R
15	PRE-CRIMP SENSOR ASSEMBLY	UNDER CRIMP OVER CRIMP	DISLORMENT OF INTERNAL COMPONENTS DURING TRANSFER TO PICK CONVEYOR DIFFICULT FINAL CRIMP DUE TO SIDE WALL INTERFERING	5	5	BROKEN OR WORN TOOLS PRESSURE TOO LOW EXCESS PRESSURE	5	OPERATOR SET-UP 100% FUNCTION TEST PREVENTIVE MAINT. PREVENTIVE MAINT.	1	15								
19	PROBE FOR TRAPPED DISC	FAILS TO IDENTIFY MISSING OR TRAPPED DISC	INOPERATIVE DEVICE CONTINUITY FAILURE	7		MACHINE ERROR	1	YIELD MONITORING	1	7								
20	TRANSFER PRE-CRIMPED SENSOR ASSEMBLY TO SENSOR CRAMPER	DISLOGGED INTERNAL COMPONENTS FAILS TO TRANSFER TRANSFERS MULTIPLE SENSOR ASSEMBLY FR	LEAK CONTINUITY FAILURE EMPTY PICK, NO EFFECT ON SUBSEQUENT OPERATIONS SENSOR DAMAGE	8	5	INSUFFICIENT PRE-CRIMP MACHINE ERROR INCORRECT OPERATOR INTERVENTION	1	PREVENTIVE MAINT. 100% FUNCTION TEST SET-UP INSPECTION PREVENTIVE MAINT. OPERATOR AWARENESS TRAINING	1	8								
21	UNLOAD BAD PARTS SENSOR ASSEMBLIES	FAILS TO UNLOAD	HEXPORT LOADED ONTO OCCUPIED NEST.	5		UNLOAD FAILURE	1	EMPTY NEST PROBE	1	5								
22	CHECK EMPTY NEST.	FAILS TO IDENTIFY OCCUPIED NEST.	HEXPORT LOADED ONTO OCCUPIED NEST.	5		UNLOAD FAILURE	1	YIELD MONITORING	1	5								
23	WHERE APPLICABLE, PLACE EXTERNAL O-RING ON HEXPORT	FAILS TO PLACE O-RING ON PART	IF UNDETECTED IN SUBSEQUENT OPERATION COULD CAUSE LEAK IN APPLICATION	8		PICK & PLACE MIS-HANDLES O-RING NO O-RING PRESENT AT TRACK DUE TO EMPTY BOWL, FEED, CONTAMINATION IN TRACK, MISALIGNED TRACK	5	100% O-RING CHECK ON CRIMP TABLE O-RING STATION P.M. ROUTE GLIP AND VISUAL AIDS FOR O-RING REQUIREMENTS	5	54	ADD O-RING CHECK TO FINAL FUNCTION TEST AS A REDUNDANT CHK.	MFG. ENGINEERING	COMPLETE 12/83	5	3	1	16	

TI-NHTSA 019304

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLERS/ANN REA

FMEA DATE (ORIG) 4/28/06
FMEA REVISION: B

MODEL YEAR(S)/VEHICLE(S): 525777/0087PS

DESIGN/QUAL/MFG RESPONSIBILITY: KETH PICIELLO / JIM WATT / PEGGY ALLEN

ID	Process Step/Requirement	Potential Failure Mode	Desired Effect of Failure	S	O	D	Current Process Control	D	I	P	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
														W	C	D	R			
							O-RING STATION NOT ACTIVATED PICK & PLACE WORK, MISALIGNED OR NOT DESIGNED PROPERLY PUCK NOT LOCATED PROPERLY DUE TO MISALIGNED STOP OR CONTAMINATION BELT STRIPPER PIN FAILS TO REMOVE O-RING	100% VISUAL INSPECTION AT PRESSURE TEST AND PACKING												
	PLACES TWO O-RINGS ON ONE PART	HIGH ASSEMBLY TORQUE POTENTIAL INABILITY TO FULLY ASSEMBLE IN APPLICATION		4	5	3	PUCK STOP FAILS TO RELEASE PUCK AT END OF CYCLE	100% MULTIPLE O-RING CHECK ON CRIMP TABLE	3	24	3	ADD O-RING CHECK TO FINAL FUNCTION TEST	MFG, ENG.	COMPLETE 12/08	4	2	1	8		
	O-RING DAMAGED BY FEED SYSTEM OR PICK & PLACE	POSSIBLE LEAK IN APPLICATION		5	3	1	PICK & PLACE AND FEED SYSTEM WORK OR NOT DESIGNED PROPERLY	P.M. FOR PICK & PLACE AND FEED SYSTEM DESIGN VERIFICATION THROUGH DEBUG AND PROCESS HISTORY Q.C. PLOT FROM EACH LOT SUBJECT TO FLUID LEAK CHECK	2	12	2									
	THREADS DAMAGED BY PICK & PLACE	MAY RESULT IN HIGH INSTALLATION TORQUE FINISHED DEVICE WILL NOT ASSEMBLE AT CUSTOMER		4	3	2	PICK & PLACE AND FEED SYSTEM WORK, MISALIGNED OR NOT DESIGNED PROPERLY PUCK NOT LOCATED PROPERLY	P.M. FOR PICK & PLACE AND FEED SYSTEM DESIGN VERIFICATION THROUGH DEBUG AND PROCESS HISTORY Q.C. AUDIT FROM EACH LOT SUBJECT TO THREAD QUALITY CHECK	2	12	2									

TI-NHTSA 019305

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERS/ANN REA

MODEL YEAR(S)/VEHICLE(S): 525777/505775

DSGN/QUAL/MFG RESPONSIBILITY: KETH ROSIELLO / JIM WATT / PEGGY ALLEN

FMEA DATE (ORIG.) 4/29/08
FMEA REVISION: 5

Item	Process Parameter Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S. N. Y. S.	O. I. S.	Recommended Cause(s) Mechanism(s) of Failure	S. N. Y. S.	Current Process Controls	D. S. Y. S.	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
													Actions Taken	S. Y. S.	O. C. S.	D. U. S.	R. P. S.
24	TRANSFER SENSOR ASSEMBLY TO ROTARY CRIMP NEST.	O-RING NOT LOCATED PROPERLY ON THE ASBY.	MAY RESULT IN HIGH INSTALLATION TORQUE	4		PICK & PLACE AND FEED SYSTEM WORK, MISALIGNED OR NOT DESIGNED PROPERLY	2	P.M. FOR PICK & PLACE AND FEED SYSTEM	2	15							
			POTENTIAL O-RING DAMAGE DURING ASSEMBLY RESULTING IN I/PAK	5	PICK NOT LOCATED PROPERLY	1	DESIGN VERIFICATION THROUGH DESIGN AND PROCESS HISTORY Q.C. AUDIT FROM EACH LOT SUBJECTED TO THREAD QUALITY CHECK 100% VISUAL CHECK AT PRESSURE TEST AND PACK	3	15								
25	45 DEGREE CRIMP SENSOR ASSEMBLY	FAIL TO TRANSFER	PRE-CRIMPED SENSOR ASSEMBLY LOADED ONTO DOCUFIED NEST.	5		UNLOAD FAILURE	1	YIELD MONITORING	1	5							
26	45 DEGREE CRIMP SENSOR ASSEMBLY	UNDER CRIMP	LOSS OF SPC CONTROL OF DIAMETER OR HEIGHT POTENTIAL DIAPHRAGM LIFE PROBLEM	5		PRESSURE TOO LOW TOOL WEAR/BREAKAGE	1	SPC DIA. AND HEIGHT PROCESS SPEC SET-UP PREVENTIVE MAINT. 100% FUNCTION TEST CYCLING AUDITS	1	0							
		OVER CRIMP	CRIMP DIAMETER TOO LARGE CAUSING DIFFICULT FINAL ASBY. COMPONENT DAMAGE POTENTIAL DIAPHRAGM LIFE PROBLEM	5		PRESSURE TOO HIGH	1	SPC DIA. AND HEIGHT PROCESS SPEC SET-UP PREVENTIVE MAINT. 100% FUNCTION TEST CYCLING AUDITS	1	0							
		IMPROPER CRIMP	COMPONENT DAMAGE CRIMP DIAMETER AND HEIGHT OUT OF SPEC.	5		OPERATOR SET-UP 50 DEG. TOOL IN 45 DEG. STATION WORKING DIE GEOMETRY	2	SPC DIA. AND HEIGHT PROCESS SPEC SET-UP PREVENTIVE MAINT. 100% FUNCTION TEST CYCLING AUDITS	1	15							
		FAIL TO CRIMP	COMPONENT DAMAGE AT 45 DEGREE CRIMP CRIMP DIAMETER AND HEIGHT OUT OF SPEC.	5		MACHINE MALFUNCTION SET-UP ERROR	1	PREVENTIVE MAINT. SET-UP SPECS	1	5							

TI-NHTSA 019306

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERS/MANN REA

FMEA DATE (ORIG.) 4/29/06
FMEA REVISION: B

MODEL YEAR(S)/VEHICLE(S): 52/57/77/80/87/98

DESIGN/QUAL/MFG RESPONSIBILITY: KEITH ROSIELLO / JIM WATT / PEGGY ALLEN

Item	Desired Function Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S	O	D	C	P	R	N	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
													Y	C	D	P	N		
		IMPROPER TOOL REGISTRATION	MINOR REGISTRATION ERROR: SENSOR DIAMETER OUT OF TROUND SENSOR HEIGHT UNEVEN MAJOR REGISTRATION ERROR: - COMPONENT	2															
26	VERIFY O-RING PRESENT ON SENSOR	FAILS TO DETECT MISSING O-RING	PART WILL BE UNLOADED INTO GOOD BIN AND COULD CAUSE LEAK IN APPLICATION IF UNDETECTED IN SUBSEQUENT OPERATIONS	4							PROBE MISALIGNED, WORN OR IMPROPERLY DESIGNED	MASTER DEVICE REDUNDANT O-RING CHK ON FINAL FUNCTION CK	1	12					
		FAILS TO DETECT O-RING PRESENT	PART WILL BE UNLOADED INTO BAD BIN RESULTING IN YIELD LOSS	3							PROBE MISALIGNED, WORN OR IMPROPERLY DESIGNED	ALIGNMENT TOOL	1	4					
		FAILS TO DETECT TWO O-RINGS PRESENT	PART WILL BE UNLOADED INTO GOOD BIN POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE AT PART TURN	4							PROBE CONTAMINATION PART ALIGNMENT IN NEST	ALIGNMENT TOOL VISUAL INSPECTION PROBE P.A.I.'S	1	4					
		FAILS TO DETECT TWO O-RINGS PRESENT	PART WILL BE UNLOADED INTO GOOD BIN POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE AT PART TURN	4							PROBE MISALIGNED, WORN OR IMPROPERLY DESIGNED	ALIGNMENT TOOL	2	18					
		FAILS TO DETECT TWO O-RINGS PRESENT	PART WILL BE UNLOADED INTO GOOD BIN POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE AT PART TURN	4							PROBE CONTAMINATION PROBE STATION NOT ACTIVATED	PROBE P.A.I.'S ROUTE SLIPS VISUAL INSPECTION	1	4					
		O-RING DAMAGED BY PROBE TIP	LEAK IN APPLICATION	5							PROBE MISALIGNED, WORN OR IMPROPERLY DESIGNED	PROBE DESIGNED TO MINIMIZE THREAD CONTACT	2	10					
		O-RING DAMAGED BY PROBE TIP	LEAK IN APPLICATION	5							PROBE MISALIGNED, WORN OR IMPROPERLY DESIGNED	PROBE P.A.I.'S PROBE DESIGN PROVEN THROUGH RE-DEBUG AND PROCESS HISTORY	2	10					
27	90 DEGREE CRIMP SENSOR ASSEMBLY	UNDER CRIMP	BURST RESISTANCE (DEGRADED)	9							PRESSURE TOO LOW	SPC. DIA. AND HEIGHT	1	9					

TI-NHTSA 019307

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLERMAN/ REA

FMEA DATE (ORIG.) 4/24/99
FMEA REVISION: 6

MODEL YEAR(S)/VEHICLE(S): S25777/80187P6

DESIGN/QUALITY RESPONSIBILITY: KEITH ROSIELLO / JIM WATT / PEGGY ALLEN

ID	Process Function Requirements	Potential Failure Mode	Potential Effects of Failure	S: Severity O: Occurrence D: Detectability	Process Capability/ Effectiveness of Failure	Current Process Controls	D: Drift I: Intermittent R: Random C: Constant N: None	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
										Actions Taken	S Y	O 6	D 1	R P. N.L.	
		OVER CRIMP	LEAK CRIMP HEIGHT OUT OF SPEC DIFFICULT FINAL ASSEMBLY CRIMPS		TOOL WEAR/REWORK ARE DEG. TOOL IN 60 DEG. STATION	PROCESS SPEC SET-UP P.M.J.G.O. AUDITS 100% FUNCTION TEST CYCLING AUDITS									
28	OVER-PRESSURE SENSOR ASSEMBLY	INSUFFICIENT OP	CRIMP DIAMETER TOO LARGE CAUSING DIFFICULT FINAL ASSY	5	PRESSURE TOO HIGH	1	1	5							
29			DRIFT OVER LIFE OR CALIBRATION CHANGE LEADING TO YIELD LOSS	3	UNPROPER DESIGN OF OP HEAD INCORRECT OP SETTINGS INADEQUATE SEAL IN ROTARY PUMP	1	1	3	PROCESS SPEC SET-UP PREVENTIVE MAINT. 100% FUNCTION TEST CYCLING AUDITS						
30	UNLOAD GOOD SENSOR ASSEMBLY	FAILS TO UNLOAD GOOD SENSOR	TABLE WONT INDEX PAST NEXT CYCLE (EMPTY NEST FAILURE)	3	LOOSE/ MISADJUSTED OR IMPROPERLY DESIGNED PICK-UP JAW	2	1	4	EMPTY NEST PROBE NEST/CRAMPER PAIRS						
		THREAD DAMAGE	YIELD/UP TIME LOSS	2		1	1	2	JAW DESIGN PROVEN THROUGH DEBUG & PROCESS HISTORY						
			POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE	4	JAWS WORK, MISALIGNED OR IMPROPERLY DESIGNED	2	2	16	JAW P.M.'S JAWS DESIGNED TO MINIMIZE THREAD CONTACT DESIGN PROVEN THROUGH DEBUG & PROCESS HISTORY						
30	PICK & UNLOAD ASSEMBLY TWO CHANGES	FAILS TO UNLOAD GOOD SENSOR	TABLE WONT INDEX PAST NEXT CYCLE (EMPTY NEST FAILURE)	3	LOOSE/ MISADJUSTED OR IMPROPERLY DESIGNED PICK UP JAW	2	1	4	EMPTY NEST PROBE NEST/CRAMPER PAIRS JAW DESIGN PROVEN THROUGH DEBUG & PROCESS HISTORY						
		THREAD DAMAGE	UP TIME LOSS	2		1	1	2							
			POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE AT CUSTOMER	4	JAWS WORK, MISALIGNED OR IMPROPERLY DESIGNED	2	2	16	JAW P.M.'S JAWS DESIGNED TO MINIMIZE THREAD CONTACT DESIGN PROVEN THROUGH DEBUG & PROCESS HISTORY						

TI-NHTSA 019308

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERS/ANN REA

FMEA DATE (OF#): 4/28/06

MODEL YEAR(S)/VEHICLE(S): 02/07/77/NO/07P6

DESIGN/QUALITY RESPONSIBILITY: KETH ROSIELLO / JIM WATT / PEGGY ALLEN

FMEA REVISION: B

ID	Process Function/Requirement	Potential Failure Mode	Potential Strategic Failure	D 1 S A S A	Potential Cause(s) / Mechanism(s) / Failure	O C E F	Critical Process Controls	D S 1 C O	F P N	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Actions Taken	S y	O c c	D e t	R. F. N.
31	CHECK EMPTY NEST.	FAIL TO IDENTIFY OCCUPIED NEST.	SENSOR ASSEMBLY LOADED ONTO OCCUPIED NEST.		UNLOAD FAILURE		YIELD MONITORING									

TI-NHTSA 019309

**POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)**

PROCESS: AUTOMATED BASE ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLERBIANN REA

PREPARED BY: MATT SELLERS

MODEL YEAR(S)/VEHICLE(S): 77/87PB

DSGN/QUAL/MPG RESPONSIBILITY: KEITH ROSIELLO / JIM WATT / PEGGY ALLEN

FMEA DATE (ORIG.) 4/29/98
FMEA REVISION: A

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	O c c u r r e n c e	Potential Cause(s)/ Mechanism(s) of Failure	O c c u r r e n c e	Current Process Controls	D e t e c t i v e	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
													Actions Taken	S e v e r i t y	O c c u r r e n c e	D e t e c t i v e	R. P. N.
1	FEED AND ASSEMBLE BASE TO NEST	DOES NOT FEED	NO SUBSEQUENT ASSEMBLY PERMISSIBLE YIELD LOSS	5		MACHINE ERROR	1	PREVENTATIVE MAINT.	1	5							
		DOES NOT NEST PROPERLY	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5		DEBRIS IN NEST; MACHINE ERROR	1	PREVENTATIVE MAINT.	1	5							
		LOADS MULTIPLE BASES	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5		MACHINE ERROR	1	100% PRESENCE CHECK PREVENTATIVE MAINT	1	5							
2	CONFIRM BASE PRESENCE	FALLS TO IDENTIFY MISSING BASE	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5		SET-UP ERROR	1	PREVENTATIVE MAINT.	1	5							
		CUT-OFF STATIONARY TERMINAL AND INSERT INTO BASE	CUT NOT CENTERED	WILL NOT SEAT INTO BASE. TERMINAL POSITION OUT OF SPEC.	5		MACHINE RAPID AIR INDEX ERROR.	1	100% PILOT PROBE SENSORS. TERMINAL POSITION SPC.	1	5						
3	CUT-OFF STATIONARY TERMINAL AND INSERT INTO BASE	TERMINAL NOT FULLY INSERTED INTO BASE	TERMINAL HEIGHT OUT OF SPEC. FAILURE OF CALIBRATION.	5		TOOL WEAR ON CUT-OFF. TOOL BREAKAGE ON CUT-OFF. INSERTION PROBE WEAR. INSERTION PROBE BREAKAGE.	3	TERMINAL HEIGHT SPC. 100% PILOT PROBE SENSORS. PREVENTATIVE MAINT. 100% INSERTION DISTANCE SENSOR.	1	15							
		BLANK SPRING	HOLE LOCATIONS INCORRECT	WILL NOT ALLOW SUBSEQUENT OPERATION.	5		TOOL BREAKAGE. SET-UP ERROR.	1	VISUAL INSPECTION DURING SPC. SET-UP INSPECTION.	1	5						
4	BLANK SPRING	HOLE LOCATIONS MISSING	WILL NOT ALLOW SUBSEQUENT OPERATION.	5		TOOL BREAKAGE. SET-UP ERROR.	1	VISUAL INSPECTION DURING SPC. SET-UP INSPECTION.	1	5							
		TRANSFER PIN BUMP MISSING/ INCORRECT	REDUCED SPRING LIFE	5		TOOL BREAKAGE. SET-UP ERROR.	1	SET-UP INSPECTION. BUMP HEIGHT SPC. VISUAL INSPECTION DURING SPC.	1	5							
5	RVLET SPRING TO MOVABLE TERMINAL STRIP	INSUFFICIENT RVLETING	LOOSE SPRING	5		WORN DRIVER. BROKEN DRIVER. INCORRECT SET-UP HEIGHT.	3	SPRING TONGUE SPC. RVLET HEIGHT SPC. SET-UP INSPECTION. PREVENTATIVE MAINT.	1	15							

TI-NHTSA 019310

PROCESS: AUTOMATED BASE ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERS/ANN REA

FMEA DATE (ORIG.) 4/28/95
FMEA REVISION: A

MODEL YEAR(S)/VEHICLE(S): 77/77P8

DSG/QUALMFG RESPONSIBILITY: KEITH ROSIELLO / JIM WATT / PEGGY ALLEN

Rev	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C i r c u i t a r i t y	Potential Cause(s)/ Mechanism(s) of Failure	O c c u r r e n c e	Current Process Controls	D e t e c t a b i l i t y	R e p. a r t s	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
													Actions Taken	S e v e r i t y	C i r c u i t a r i t y	D e t e c t a b i l i t y	R e p. a r t s	
6	INSERT AND RIVET MOVABLE CONTACT TO SPRING	EXCESSIVE RIVETING	LOOSE SPRING DAMAGED SPRING	3	0	INCORRECT SET-UP HEIGHT	3	SPRING TORSION SPEC. PREVENTATIVE MAINT. RIVET HEIGHT SPEC. SET-UP INSPECTION	1	15								
		RIVET MISSING	NO SPRING DEVICE WILL NOT OPERATE	3	0	MISFEED	6	100% PRESENCE SENSOR. 100% PRESENCE CHECK	1	15	RIVETER RE-DESIGN PENDING	MECHANIZATION	RIVETER REDESIGN COMPLETE CAPABILITY ASSESSMENT COMPLETE	3	1	1	3	
		INSUFFICIENT ROLL	LOOSE CONTACT.	5	0	WORN ANVIL BROKEN ANVIL INCORRECT SET-UP HEIGHT.	1	ROLL DIAMETER ON SPEC. SET-UP INSPECTION. PREVENTATIVE MAINT.	1	5								
7	FORM SPRING ANGLE	EXCESSIVE ROLL	DAMAGED CONTACT. LOOSE CONTACT.	8	0	INCORRECT SET-UP HEIGHT.	1	ROLL DIAMETER ON SPEC. PREVENTATIVE MAINT. SET-UP INSPECTION	1	5								
		CONTACT MISSING	CONTACT RESISTANCE INCREASES OVER LIFE.	5	0	MISFEED.	3	100% PRESENCE CHECK.	1	15								
		ANGLE TOO HIGH	REDUCED SPRING LIFE. REDUCED DISC LIFE. SHIFT IN SET-POINT OVER LIFE. DEVICE SH-OP.	7	0	WORN/BROKEN TOOL. INCORRECT SET-UP.	1	ANGLE SPEC. SET-UP INSPECTION. PREVENTATIVE MAINT. 100% POSITION SENSOR.	1	7			CRITICALITY OF FORM TOOL DIMENSIONS RECOGNIZED. ITERATIVE PROCESS COMPLETED AND DOCUMENTED.					
8	CUT-OFF MOVABLE TERMINAL AND INSERT INTO BASE	ANGLE TOO LOW	LOW CONTACT GAP. HYPOP FAILURE. SHORTED DEVICE.	7	0	WORN TOOL. INCORRECT SET-UP.	1	ANGLE SPEC. SET-UP INSPECTION. PREVENTATIVE MAINT. 100% POSITION SENSOR.	1	7			CRITICALITY OF FORM TOOL DIMENSIONS RECOGNIZED. ITERATIVE PROCESS COMPLETED AND DOCUMENTED.					
		CUT NOT CENTERED	WILL NOT BEAT INTO BASE. TERMINAL POSITION OUT OF SPEC.	5	0	MACHINE RAPID AIR INDEX ERROR.	1	100% PILOT PROBE SENSOR. TERMINAL POSITION SPEC.	1	8								
9	STAKE TERMINALS TO BASE	TERMINAL NOT FULLY BEATED INTO BASE	TERMINAL HEIGHT OUT OF SPEC. FAILURE AT CALIBRATION.	5	0	CUT-OFF TOOL WORN/BROKEN. INSERTION PROBE WORN/BROKEN.	3	100% INSERTION DISTANCE SENSOR. PREVENTATIVE MAINT. TERMINAL HEIGHT SPEC.	1	15								
		INSUFFICIENT STAKE	LOOSE TERMINAL	5	0	BROKEN TOOL. INSUFFICIENT HEAD PRESSURE.	1	SET-UP INSPECTION. PUSHOUT STRENGTH SPEC. PREVENTATIVE MAINT.	1	8								
9	STAKE TERMINALS TO BASE	STAKING TOOL CHANNELS IMPROPERLY POSITIONED	TERMINAL POSITION OUT OF SPEC	5	0	INCORRECT SET-UP TOOL. MISFEED/SHAKE	3	TERMINAL POSITION SPEC. SET-UP INSPECTION	1	15								

TI-NHTSA 019311

PROCESS: AUTOMATED BASE ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLERSIANN REA

FMEA DATE (ORNL) 4/22/98

MODEL YEAR(S)/VEHICLE(S): 77/87PB

DESIGN/QUAL/MPG RESPONSIBILITY: KEITH ROMELLO / JIM WATT / PEGGY ALLEN

FMEA REVISION: A

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S	C	Potential Cause(s)/ Mechanism(s) of Failure	O	Current Process Controls	D	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
													Severity	Occurrence	Detection	Prevention	R.P.N.
10	CHECK FOR CONTACT ORIENTATION	FAILS TO DETECT OUT OF POSITION CONTACT	OUT OF RANGE BASE CALIBRATION	1		SET-UP ERROR	1	SET-UP INSPECTION YIELD LOSS MONITORING	1	5							
11	CALIBRATE BASE ASSEMBLY	CALIBRATOR MISSES TARGET RANGE (HIGH)	REDUCED CYCLE LIFE CREEP ACTUATION SHIFT IN CALIBRATION	7		OPERATOR SET-UP EXCESSIVE CALIBRATOR BOMB	1	100% SORT AT CHECK STATION 100% FUNCTION TEST CYCLING AUDITS PILOTING	1	7							
		CALIBRATOR MISSES TARGET RANGE (LOW)	CREEP RELEASE REDUCED CYCLE LIFE SHIFT IN CALIBRATION	7		OPERATOR SET-UP EXCESSIVE CALIBRATOR BOMB	1	100% SORT AT CHECK STATION 100% FUNCTION TEST CYCLING AUDITS PILOTING	1	7							
		DEVICE DOES NOT CALIBRATE	CREEP RELEASE REDUCED CYCLE LIFE SHIFT IN CALIBRATION	7		OPERATOR SET-UP	1	100% SORT AT CHECK STATION 100% FUNCTION TEST CYCLING AUDITS PILOTING	1	7							
12	CHECK BASE ASSEMBLY CALIBRATION	CHECK STATION DRIFT LVDI MALFUNCTION	OUT OF RANGE CALIBRATION FAILURE PASSED AS GOOD	7		STATION WEAR LVDI SOFTWARE ERROR STATION BRG/AGE INCORRECT LVDI SET-UP	1	OFF LINE SPC ORDER 100% FUNCTION TEST CYCLING AUDITS PILOTING PREVENTATIVE MAINT.	1	7							
13	WHERE APPLICABLE: UNLOAD LOW GAGE BASE ASSEMBLY	HIGH GAGE BASE UNLOADED INTO LOW GAGE CHUTE	INSUFFICIENT SPRING PRELOAD LOWER ACTUATION PRESSURE AT ELEVATED TEMPERATURE	6		SOFTWARE ERROR OPERATOR ERROR	3	SET-UP INSPECTION P-CHART SPC ELEVATED TEMPERATURE CONTINUITY CHECKS 100% FUNCTION TEST	1	10							
14	UNLOAD HIGH GAGE -OR- STANDARD GAGE BASE ASSEMBLY	LOW GAGE BASE UNLOADED INTO HIGH GAGE CHUTE	EXCESSIVE SPRING PRELOAD HIGHER ACTUATION PRESSURE AT LOWER TEMPERATURE	5		SOFTWARE ERROR OPERATOR ERROR	3	SET-UP INSPECTION P-CHART SPC ELEVATED TEMPERATURE CONTINUITY CHECKS 100% FUNCTION TEST	1	10							
15	UNLOAD BAD CALIBRATION BASE ASSEMBLY	FAILS TO UNLOAD	YIELD LOSS	5		UNLOAD ERROR	1	YIELD LOSS MONITORING	1	5							
16	UNLOAD BAD PARTS BASE ASSEMBLY	FAILS TO UNLOAD	BASE LOADED ONTO OCCUPIED NEST	5		UNLOAD FAILURE	1	EMPTY NEST PROBE	1	5							
17	CHECK EMPTY NEST	FAILS TO IDENTIFY OCCUPIED NEST	BASE LOADED ONTO OCCUPIED NEST	5		UNLOAD FAILURE	1	YIELD MONITORING	1	5							

TI-NHTSA 019312

PROCESS CONTROL PLAN

ITEM: AUTOMATED BASE ASSEMBLY
 MODEL YEAR(S)/VEHICLE(S): 77PS, 87PS
 CORE TEAM: DI HAU LAINE ROSEJOE CARMEN

SUPPLIER/PLANT: TEXAS INSTRUMENTS, INC., ATTLESBORO, MA
 PROCESS RESPONSIBILITY: STEVE FROM, VALENTINA VIDEVA
 PHONE: (978) 238-1380/1233

Document #: 883848
 REVISION LEVEL: C
 REVISION DATE: 10/17/87
 ORIGINAL (INITIAL) DATE: 5/2/88

PREPARED BY: V.VIDEVA

Item	Operation Description	Characteristics		Special Char. Class.	Evaluation Measurement Technique	Methods		Control Method	Reaction Plan
		Product	Process			Sample			
						Size	Frequency		
1	FEED AND ASSEMBLE BASE TO NEST.	PART PRESENCE & ORIENTATION			HEIGHT PROBE	100%	CONTINUOUS	AUTO INSPECTION	SINGLE FAULT - UNLOAD BAD DOUBLE FAULT - UNLOAD BAD & HALT PROCESS FOR OPERATOR INTERVENTION/CORRECTION
3	CUT OFF STATIONARY TERMINAL AND INSERT INTO BASE.	PART PRESENCE & ORIENTATION			HEIGHT PROBE	100%	CONTINUOUS	AUTO INSPECTION	SINGLE FAULT - UNLOAD BAD DOUBLE FAULT - UNLOAD BAD & HALT PROCESS FOR OPERATOR INTERVENTION/CORRECTION
		TERMINAL WIDTH			CALIPERS	5	EVERY 4 HOURS	X-BAR & R CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.
4	BLANK SPRING	"BUMP" HEIGHT			CALIPERS	5	EVERY 4 HOURS	X-BAR & R CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.
5	RIVET SPRING TO MOVABLE TERMINAL STRIP	SPRING TORQUE			FORCE GAGE	5	HOURLY	X-BAR & R CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.
6	INSERT AND RIVET MOVABLE CONTACT TO SPRING.	PART PRESENCE & ORIENTATION			THROUGH BEAM PROBE	100%	CONTINUOUS	AUTO INSPECTION	UNLOAD BAD.
		CONTACT QUARTER			CALIPERS	5	HOURLY	X-BAR & R CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.
7	FORM SPRING ANGLE.	SPRING ANGLE			COMPARATOR	5	EVERY 4 HOURS	X-BAR & R CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.
		SPRING BEND STRENGTH			VISUAL INSPECTION	2	5U REPAIR MAYL CHANGE	P-CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.
9	STAKE TERMINALS TO BASE.	TERMINAL HEIGHT			DIAL INDICATOR	5	HOURLY	X-BAR & R CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.
		TERMINAL PUSH OUT			FORCE GAGE DIAL INDICATOR	5	HOURLY	X-BAR & R CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.
		TERMINAL SEPARATION			PLUG GAGE	5	EVERY 2 HOURS	X-BAR & R CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.

TI-NHTSA 019313

PROCESS CONTROL PLAN

Document #: 19348
 REVISION LEVEL: C
 REVISION DATE: 10/17/97
 ORIGINAL (INITIAL) DATE: 6/2/96

ITEM: AUTOMATED BASE ASSEMBLY
 MODEL YEAR(S)/VEHICLE(S): 77PS, 87PS
 CORE TEAM: DI HAE LAINE ROSENJOE CARMEN

SUPPLIER/PLANT: TEXAS INSTRUMENTS, INC., ATTLEBORO, MA
 PROCESS RESPONSIBILITY: STEVE PROIA, VALENTINA VIDEVA
 PHONE: (508) 238-1383/1283

PREPARED BY: V.VIDEVA

Item	Operation Description	Characteristics		Special Char. Class.	Methods			Reaction Plan	
		Product	Process		Evaluation Measurement Technique	Sample			Control Method
						Size	Frequency		
10	CHECK FOR CONTACT ORIENTATION	TERMINAL ALIGNMENT			PLUG GAGE	5	EVERY 2 HOURS	X-BAR & R CHART	HALT PROCESS. QUARANTINE MATERIAL SINCE LAST CHECK. NOTIFY MAINTENANCE.
		PART PRESENCE			REFLECTIVE PROBE	100%	CONTINUOUS	AUTO INSPECTION	SINGLE FAULT - UNLOAD BAD DOUBLE FAULT - UNLOAD BAD & HALT PROCESS FOR OPERATOR INTERVENTION/CORRECTION
11	CALIBRATE BASE ASSEMBLY.	BASE CALIBRATION			LVDI	100%	CONTINUOUS	AUTO INSPECTION	UNLOAD BAD CALIBRATION.
			PROPER FUNCTION			DIAL INDICATOR	QUANT: 5 HI 5 LO SNP: 5	5/U, HOURLY AFTER 50 PCS. REPAIR	X-BAR & R CHART

TN-NHTSA 019314

POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)

PROCESS: AUTOMATED FINAL ASSEMBLY

PROCESS RESPONSIBILITY: ROBERT GALDEA

PREPARED BY: MATT SELLERS

MODEL YEAR(S)/VEHICLE(S): 5777/RRPS

DSO/QUALMFO RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILDEY

FMEA DATE (ORIG.): 4/28/88
FMEA REVISION: B

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C o n t r o l s	Potential Cause(s)/ Mechanism(s) of Failure	O c c u r r e n c e	Current Process Controls	D e t e c t i o n	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
													Action Taken	S e v e r i t y	O c c u r r e n c e	D e t e c t i o n	R. P. N.	
1	ASSEMBLE CRIMP RING TO NEST AND CHECK	DOES NOT FULLY SEAT	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5		MACHINE ERROR	1	PREVENTIVE MAINT	1	5								
2	ASSEMBLE SENSOR ASSEMBLY TO NEST AND CHECK	DOES NOT FULLY SEAT	DIFFICULT SUBSEQUENT OPERATIONS	5		OUT OF ROUND SENSOR ASSEMBLY MACHINE ERROR	3	PREVENTIVE MAINT DIA. BIT SPC (80% HEIGHT CHECK)	3	48	SEE "CRIMP RING DISTORTED" ON PAGE 4	MECHANIZATION	INCREASE CODE FONT SIZE	3	1	1	3	
3	ASSEMBLE ENVIRONMENTAL SEAL TO NEST AND CHECK	WRONG SEAL	INTERNAL CORROSION DUE CRACKED BASE DURING CRIMPING	7		MACHINE ERROR	5	100% PRESSURE BASE TORQUE SPC	1	35								
		MIS-PLACED SEAL	INTERNAL CORROSION DUE CRACKED BASE DURING CRIMPING DAMAGED TRANSFER PIN ON LIFE	7		MACHINE ERROR	5	100% PRESENCE SENSE BASE TORQUE SPC	1	35								
		MULTIPLE SEALS	LOSS OF CALIBRATION CRACKED BASE DURING CRIMPING	7		LIN-CUT GASKET SECTION	1	POKE YOKO DOWN FEED ESCAPEMENT	1	7								
4	ASSEMBLE TRANSFER PIN AND CHECK	WRONG SIZE PIN SELECTED	CRIMP OPERATION REDUCED CYCLE LIFE SHIFT IN CALIBRATION	7		OPERATOR ERROR MIXING	1	ROUTE CARDS PILOT ROUTE SHEETS 100% FUNCTION TEST CRIMP MONITORING P-CHECK SPC HIGH TEMPERATURE CONTINUITY AUDITS WYPLOT AUDITS AT ELEVATED TEMPERATURE	1	7								
		MISPLACED NO PIN	NO DEVICE OPERATION	8		MACHINE ERROR	1	HEIGHT PROBE 100% FUNCTION TEST	1	5								
5	ASSEMBLE BASE ASSEMBLY AND CHECK	WRONG BASE ASSEMBLY	LOSS OF LOT CONTROL WRONG SPECIFICATION	5		OPERATOR ERROR MIXING	1	ROUTE CARDS 100% FUNCTION TEST CRIMP MONITORING VISUAL INSPECTION O.C. SAMPLE P-CHECK SPC HIGH TEMPERATURE CONTINUITY AUDITS WYPLOT AUDITS AT ELEVATED TEMPERATURE	1	5								
		DEPLOYMENT OF PIN	DEVICE WILL NOT OPERATE	5		PICK AND PLACE ERROR	1	100% FUNCTION TEST PREVENTIVE MAINT	1	5								
		DEPLOYMENT OF SEAL	CRACKED BASE DAMAGED TRANSFER PIN ON LIFE	7		PICK AND PLACE ERROR	1	100% FUNCTION TEST PREVENTIVE MAINT BASE TORQUE SPC	1	7								
6	CRIMP FINAL DEVICE	CRIMP DIAMETER OUT OF SPEC	VIOLATION OF CUSTOMER ENVELOPE INTERNAL CORROSION	7		INCORRECT HEAD PRESSURE WORN CRIMP DIE BROKEN CRIMP DIE	1	PREVENTIVE MAINT BASE TORQUE SPC CRIMP DIAMETER SPC CRIMP TO A STOP	1	7								

TI-NHTSA 019316

PROCESS: AUTOMATED FINAL ASSEMBLY

PROCESS RESPONSIBILITY: ROBERT GILDEA

MODEL YEAR(S)/VEHICLE(S): 577/MZPS

DISMOUNTALING RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILDEY

FMEA DATE (ORIG.) 4/28/95
FMEA REVISION: 8

Item	Process Function/Requirement	Potential Failure Mode	Potential Effect(s) of Failure	C I S V	P S E	Potential Cause(s)/Mechanism(s) of Failure	D C E T	Classified Process Control	D S I E	R. P. M.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
													Action Taken	S U N	O C C U R	D E T R I M I N		
		CRIMP HEIGHT OUT OF SPEC	VIOLATION OF CUSTOMER ENVELOPE INTERNAL CORROSION	7		INCORRECT HEAD PRESSURE WORN CRIMP DIE BROKEN CRIMP DIE	1	PREVENTIVE MAINT HARD TORQUE SPEC CRIMP HEIGHT SPEC CRIMP TO A STOP PCME YORK FUNCTION TESTER	1	7								
		CRACKED BASE	INTERNAL CORROSION	7		WORN CRIMP DIE BROKEN CRIMP DIE HIGH HEAD PRESSURE	3	PREVENTIVE MAINT TORQUE SPEC CRIMP TO A STOP	1	21								
7	VACUUM CLEAN	FAILS TO CLEAN ADEQUATELY	CONTAMINATION CONCERN	7		CLOGGED FILTER	2	PREVENTIVE MAINT MAINTENANCE	1	14								
8	UNLOAD GOOD DEVICES	FAILS TO UNLOAD	HEAVY PORT LOADED ONTO OCCUPIED NEST	6		UNLOAD FAILURE	1	PREVENTIVE MAINT	1	5								
9	UNLOAD BAD PARTS FINAL ASSEMBLER	FAILS TO UNLOAD	HEAVY PORT LOADED ONTO OCCUPIED NEST	6		UNLOAD FAILURE	1	EMPTY NEST PROBE	1	5								
10	CHECK EMPTY NEST	FAILS TO IDENTIFY OCCUPIED NEST	CRIMP PINS LOADED ONTO OCCUPIED NEST	6		UNLOAD FAILURE	1	YIELD MONITORING	1	5								

TI-NHTSA 019316

POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)

PROCESS: AUTOMATED BASE ASSEMBLY
MODEL YEAR(S)/VEHICLE(S): 77/87PS

PROCESS RESPONSIBILITY: ROBERT GILDEA
DSG/QUAL/MFG RESPONSIBILITY: SEAN MULLIGAN / JIM WATT / MARY MILKEY

PREPARED BY: MATT SELLERS
FMEA DATE (ORIG.): 4/29/98
FMEA REVISION: C

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Severity	Cause(s) of Failure	Occurrence	Current Process Controls	D e t e c t i o n	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
												Actions Taken	S e v	O c c	D e t	R. P. N.	
1	FEED AND ASSEMBLE BASE TO NEST	DOES NOT FEED	NO SUBSEQUENT ASSEMBLY PERMISSIBLE YIELD LOSS	5	MACHINE ERROR	1	PREVENTIVE MAINT 100% PRESENCE CHECK VERIFY OPERATION OF CHECK PROBE	1	5								
		DOES NOT NEST PROPERLY	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5	DEBRIS IN NEST, MACHINE ERROR	1	PREVENTATIVE MAINT 100% PRESENCE CHECK	1	5								
		LOADS MULTIPLE BASES	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5	MACHINE ERROR	1	PREVENTATIVE MAINT 100% PRESENCE CHECK	1	5								
2	CONFIRM BASE PRESENCE	FAILS TO IDENTIFY MISSING BASE	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	4	SET-UP ERROR	1	PREVENTATIVE MAINT	1	5								
3	CUT-OFF STATIONARY TERMINAL AND INSERT INTO BASE	CUT NOT CENTERED	WILL NOT SEAT INTO BASE TERMINAL POSITION OUT OF SPEC	5	MACHINE RAPID AIR INDEX ERROR	1	100% PILOT PROBE SENSOR TERMINAL POSITION SPC	1	5								
		TERMINAL NOT FULLY INSERTED INTO BASE	TERMINAL HEIGHT OUT OF SPEC FAILURE OF CALIBRATION	5	TOOL WEAR ON CUT OFF TOOL BREAKAGE ON CUT-OFF INSERTION PROBE WEAR INSERTION PROBE BREAKAGE	3	100% PILOT PROBE SENSE PREVENTIVE MAINT 100% INSERTION DISTANCE SENSOR	1	15								
4	BLANK SPRING	HOLE LOCATIONS INCORRECT	WILL NOT ALLOW SUBSEQUENT OPERATION	5	TOOL BREAKAGE SET-UP ERROR	1	VISUAL INSPECTION DURING SPC	1	5								
		HOLE LOCATIONS MISSING	WILL NOT ALLOW SUBSEQUENT OPERATION	5	TOOL BEVERAGE SET-UP ERROR	1	SET-UP INSPECTION DURING SPC	1	5								
		TRANSFER PIN SLUMP MISSING/ INCORRECT	REDUCED SPRING LIFE	5	TOOL BEVERAGE SET-UP ERROR	1	SET-UP INSPECTION SET-UP INSPECTION SLUMP HEIGHT SPC VISUAL INSPECTION DURING SPC	1	5								
5	RIVET SPRING TO MOVABLE TERMINAL STRIP	INSUFFICIENT RIVETING	LOOSE SPRING	5	WORN DRIVER BROKEN DRIVER INCORRECT SET-UP HEIGHT	0	RIVET TORQUE SPC RIVET HEIGHT SPC SET-UP INSPECTION PREVENTATIVE MAINT	1	15								
		EXCESSIVE RIVETING	LOOSE SPRING DAMAGED SPRING	5	INCORRECT SET-UP HEIGHT	3	SPRING TORQUE SPC PREVENTATIVE MAINT RIVET HEIGHT SPC SET-UP INSPECTION	1	15								

TI-NHTSA 019317

PROCESS: AUTOMATED BASE ASSEMBLY

PROCESS RESPONSIBILITY: ROBERT GILDEA

MODEL YEAR(S)/VEHICLE(S): 77/87PS

DSM/QUALMFG RESPONSIBILITY: SEAN MULLIGAN / JIM WATT / MARY MILKEY

FMEA DATE (ORIG.) 4/28/86
FMEA REVISION: C

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	C I S S U E	Potential Cause(s)/ Mechanism(s) of Failure	D I S C R I M I N A T O R	Current Process Controls	D e t e c t i o n	R. P. M.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Actions Taken	S e v e r i t y	O c c u r r e n c e	D e t e c t i o n	R. P. N.
6	INSERT AND RIVET MOVABLE CONTACT TO SPRING	INSUFFICIENT ROLL EXCESSIVE ROLL CONTACT MISSING	NO SPRING DEVICE WILL NOT OPERATE LOOSE CONTACT DAMAGED CONTACT LOOSE CONTACT CONTACT RESISTANCE INCREASES OVER LIFE	2 4 8 5	MISFEED WORN AIRAL BROKEN AIRAL INCORRECT SET-UP HEIGHT INCORRECT SET-UP HEIGHT MIS-FEED	6 1 1 3	100% PRESENCE SENSOR 100% PRESENCE CHECK ROLL DIAMETER ON SPC SET-UP INSPECTION PREVENTATIVE MAINT ROLL DIAMETER ON SPC PREVENTATIVE MAINT SET-UP INSPECTION 100% PRESENCE CHECK	1 1 1 1	18 8 8 16	RIVETER RE-DESIGN PENDING MECHANIZATION	MECHANIZATION	RIVETER REDESIGN COMPLETE CAPABILITY ASSESSMENT CYMARET	3	1	1	3
7	FORM SPRING ANGLE	ANGLE TOO HIGH ANGLE TOO LOW	REDUCED SPRING LIFE REDUCED OBC LIFE SHIFT IN SET-POINT OVER LIFE DEVICE IN-OP LOW CONTACT GAP PIVOT FAILURE SHORTED DEVICE	7 7	WORN/BROKEN TOOL INCORRECT SET-UP WORN TOOL INCORRECT SET-UP	1 1 1	ANGLE SPC SET-UP INSPECTION PREVENTATIVE MAINT 100% POSITION SENSOR ANGLE SPC SET-UP INSPECTION PREVENTATIVE MAINT 100% POSITION SENSOR	1 1 1	7 7			CRITICALITY OF FORM TOOL DIMENSIONS RECOGNIZED, ITERATIVE PROCESS COMPLETED AND DOCUMENTED CRITICALITY OF FORM TOOL DIMENSIONS RECOGNIZED, ITERATIVE PROCESS COMPLETED AND DOCUMENTED				
8	CUT-OFF MOVABLE TERMINAL AND INSERT INTO BASE	CUT NOT CENTERED TERMINAL NOT FULLY SEATED INTO BASE	WILL NOT SEAT INTO BASE TERMINAL POSITION OUT OF SPEC TERMINAL HEIGHT OUT OF SPC FAILURE AT CALIBRATION	8 8	MACHINE RAPID AIR INDEX ERROR CUT-OFF TOOL WORN/BROKEN INSERTION PROBE MISMATCH	1 3	100% PILOT PROBE SENSOR TERMINAL POSITION SPC 100% INSERTION DISTANCE SENSOR PREVENTATIVE MAINT TERMINAL HEIGHT SPC	1 1	5 16							
9	STAKE TERMINALS TO BASE	INSUFFICIENT STAKE STAKING TOOL CHANNELS IMPROPERLY POSITIONED	LOOSE TERMINAL TERMINAL POSITION OUT OF SPEC	5 8	BROKEN TOOL INSUFFICIENT HEAD PRESSURE INCORRECT SET-UP TOOL WEAR/BREAKAGE	1 3	SET-UP INSPECTION PUSHOUT STRENGTH SPC PREVENTATIVE MAINT TERMINAL POSITION SPC SET-UP INSPECTION	1 1	8 15							
10	CHECK FOR CONTACT ORIENTATION	FAILS TO DETECT OUT OF POSITION CONTACT	OUT OF RANGE BASE CALIBRATION	8	SET-UP ERROR	1	SET-UP INSPECTION YIELD LOSS MONITORING	1	5							

TL-NHTSA 019318

PROCESS: AUTOMATED BASE ASSEMBLY

PROCESS RESPONSIBILITY: ROBERT GILDEA

MODEL YEAR(S)/VEHICLE(S): 77/77P8

DSGM/DUAL/MFG RESPONSIBILITY: SEAN MULLIGAN / JIM WATT / MARY MILKEY

FMEA DATE (ORIG.) 4/29/96
FMEA REVISION: C

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	C I R S E V	Potential Cause(s)/ Mechanism(s) of Failure	D C O U F	Current Process Controls	D e t e c t	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Actions Taken	S b v	O c c	D a t	R. P. N.
11	CALIBRATE BASE ASSEMBLY	CALIBRATOR MISSES TARGET RANGE (HIGH) CALIBRATOR MISSES TARGET RANGE (LOW) DEVICE DOES NOT CALIBRATE	REDUCED CYCLE LIFE DREEP ACTUATION SHIFT IN CALIBRATION DREEP RELEASE REDUCED CYCLE LIFE SHIFT IN CALIBRATION DREEP RELEASE REDUCED CYCLE LIFE SHIFT IN CALIBRATION	7 7 7	OPERATOR SET-UP EXCESSIVE CALIBRATOR SMOGA OPERATOR SET-UP EXCESSIVE CALIBRATOR SMOGA OPERATOR SET-UP	1 1 1	100% SORT AT CHECK STATION 100% FUNCTION TEST CYCLING AUDITS 100% SORT AT CHECK STATION 100% FUNCTION TEST CYCLING AUDITS 100% SORT AT CHECK STATION 100% FUNCTION TEST CYCLING AUDITS	1 1 1	7 7 7							
12	CHECK BASE ASSEMBLY CALIBRATION	CHECK STATION DRIFT LVDT MALFUNCTION	OUT OF RANGE CALIBRATION FAILURE PASSED AS GOOD	7	STATION WEAR LVDT/SOFTWARE ERROR STATION BREAKAGE INCORRECT LVDT	1	OFF LINE SPC GAGER 100% FUNCTION TEST CYCLING AUDITS PAGING PREVENTATIVE MAINT	1	7							
13	UNLOAD LOW GAGE BASE ASSEMBLY	HIGH GAGE BASE UNLOADED INTO LOW GAGE CHUTE	INSUFFICIENT SPRING PRELOAD LOWER ACTUATION PRESSURE AT ELEVATED TEMPERATURE	5	SOFTWARE ERROR OPERATOR ERROR	3	SET-UP INSPECTION P-CHART SPC ELEVATED TEMPERATURE CONTINUITY CHECKS 100% FUNCTION TEST	1	15							
14	UNLOAD HIGH GAGE -OR- STANDARD GAGE BASE ASSEMBLY	LOW GAGE BASE UNLOADED INTO HIGH GAGE CHUTE	EXCESSIVE SPRING PRELOAD HIGHER ACTUATION PRESSURE AT LOWER TEMPERATURE	5	SOFTWARE ERROR OPERATOR ERROR	3	SET-UP INSPECTION P-CHART SPC ELEVATED TEMPERATURE CONTINUITY CHECKS 100% FUNCTION TEST	1	15							
15	UNLOAD BAD CALIBRATION BASE ASSEMBLES	FAILS TO UNLOAD	YIELD LOSS	5	UNLOAD ERROR	1	YIELD LOSS MONITORING	1	5							
16	UNLOAD BAD PARTS BASE ASSEMBLY	FAILS TO UNLOAD	BASE LOADED ONTO OCCUPIED NEST	5	UNLOAD FAILURE	1	EMPTY NEST PROBE	1	5							
17	CHECK EMPTY NEST	FAILS TO IDENTIFY OCCUPIED NEST	BASE LOADED ONTO OCCUPIED NEST	5	UNLOAD FAILURE	1	YIELD MONITORING	1	5							

71-NHTSA 010319

POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)

PROCESS: AUTOMATED CRIMP RING CODE

PROCESS RESPONSIBILITY: ROBERT GILDEA

PREPARED BY: MATT SELLERS

MODEL YEAR(S)/VEHICLE(S): ALL HYDRAULIC PS

DESIGN/QUALMFG RESPONSIBILITY: SEAN MULLIGAN / JIM WATT / MARY MILKEY

FMEA DATE (ORIG) 04/29/96
FMEA REVISION B

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S	C	Potential Cause(s)/ Mechanism(s) of Failure	D	O	Current Process Controls	D	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
														Actions Taken	S	O	D	R		
1	LOAD CRIMP RING TO ROTARY TABLE NEST	FAILS TO LOAD CRIMP RING	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	4		MACHINE ERROR	1		PREVENTIVE MAINT	1	5									
2	CODE PART NUMBER, DATE/LOT CODE	WRONG CODE	LOSS OF LOT TRACEABILITY	5		SET-UP ERROR	3		SET-UP CHECK	1	15									
			CUSTOMER MIXING																	
		ILLEGIBLE CODE	LOSS OF LOT TRACEABILITY	5		SET-UP ERROR	3		SET-UP CHECK	1	15									
			CUSTOMER MIXING																	
		CRIMP RING DISTORTED	DIFFICULT INSTALLATION INTO CRIMP NEST	4		EXCESSIVE CODE PRESSURE	8		SET-UP CHECK	3	75	PROPOSE CRIMP SYSTEM SET-UP ENHANCEMENTS	MECHANIZATION							
			DIFFICULT INSERTION OF OF SENSOR ASSEMBLY																	
		MISSING CODE	LOSS OF LOT TRACEABILITY	4		SET-UP ERROR	3		SET-UP CHECK	1	15									
			CUSTOMER MIXING																	
			INSUFFICIENT CODE PRESSURE																	
3	UNLOAD CODED CRIMP RINGS	FAILS TO UNLOAD	RING LOADED ONTO OCCUPIED NEST	5		UNLOAD FAILURE	1		SET-UP	1	4									

TI-NHTSA 019920

POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)

PROCESS: AUTOMATED FINAL FUNCTION TEST
MODEL YEAR(S)/MODEL(S): ALL HYDRAULIC PE

PROCESS RESPONSIBILITY: BOB OLDEY/STEVE PROW
DESIGN/QUALITY RESPONSIBILITY: SEAN MULLIGAN / JIM WATT / MARY MILKE

PREPARED BY: MATT SELLERS
FMEA DATE (DPR): 4/29/98
FMEA REVISION: C

Item	Process Function/Requirement	Potential Failure Mode	Potential Effect(s) of Failure	Criticality	Potential Cause(s) or Mechanism(s) of Failure	Current Process Controls	DPR	SPL	Action(s)	Responsibility & Target Completion Date	Action Results				
											Action Taken	S	C	S	P
1	FUNCTIONALITY - AUTOMATIC RELEASE - CHECK NAME - CHECK ALARMS - ETC	NON-REPRODUCTION OF ALARMS	IMPACT ON THE PRODUCTION LINE - GOOD THROUGHPUT	7	TRANSPACER OFF OF CALIBRATION - IMPROPER TUNE IN VEHICLE - FAILURE TO RECALIBRATE - IMPROPER PRODUCTION OPERATOR SET-UP ERROR	1. CALIBRATION NUMBERS ON PRINT - FROM PREVENTATIVE MAINTENANCE FAILURE MODE ANALYSIS	1	7							
2	MILLAGE TIGHT	EXCESSIVE WEAR OF COMPONENTS - CONSTRUCTION TOLERANCE	IMPACT ON THE PRODUCTION LINE	7	FLUID ON TERMINAL FOLLOWER TO PIV	1. CALIBRATION NUMBERS - FROM PREVENTATIVE MAINTENANCE FAILURE MODE ANALYSIS	1	7							
3	MAXIMUM TORQUE	EXCESSIVE WEAR OF COMPONENTS	IMPACT ON THE PRODUCTION LINE	7	MAINTENANCE ERROR	1. MAINTENANCE CHECK	1	7							
4	MINIMUM TORQUE	EXCESSIVE WEAR OF COMPONENTS	IMPACT ON THE PRODUCTION LINE	7	REWORK FROM MAINTENANCE	1. CHECK REWORK FROM MAINTENANCE	1	7							
5	MAXIMUM TORQUE	EXCESSIVE WEAR OF COMPONENTS	IMPACT ON THE PRODUCTION LINE	7	MAINTENANCE ERROR	1. MAINTENANCE CHECK	1	7							
6	MINIMUM TORQUE	EXCESSIVE WEAR OF COMPONENTS	IMPACT ON THE PRODUCTION LINE	7	MAINTENANCE ERROR	1. MAINTENANCE CHECK	1	7							
7	MAXIMUM TORQUE	EXCESSIVE WEAR OF COMPONENTS	IMPACT ON THE PRODUCTION LINE	7	MAINTENANCE ERROR	1. MAINTENANCE CHECK	1	7							
8	MINIMUM TORQUE	EXCESSIVE WEAR OF COMPONENTS	IMPACT ON THE PRODUCTION LINE	7	MAINTENANCE ERROR	1. MAINTENANCE CHECK	1	7							

TI-NHTSA 010321

POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R.GILDEA

PREPARED BY: MATT SELLERS

MODEL YEAR(S)/VEHICLE(S): 53/57/77/00N2P6

DESIGN/DUAL/IFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

FMEA DATE (ORIG.) 04/29/98

FMEA REVISION: C

Step	Process Function/ Requirement(s)	Potential Failure Mode	Potential Effect(s) of Failure	S	C	Potential Cause(s)/ Mechanism(s) of Failure	O	C	D	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
													v	a	u	P.	N.
1	FEED AND ASSEMBLE HEXPORT TO NEST.	DOES NOT FEED	NO SUBSEQUENT ASSEMBLY PERMISSIBLE YIELD LOSS	5		MACHINE ERROR	1			6	PREVENTIVE MAINT.						
		DOES NOT NEST PROPERLY	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5		DEBRIS IN NEST; MACHINE ERROR	1			4	PREVENTATIVE MAINT. 100% PRESENCE CHECK						
		LOADS MULTIPLE HEXPORT	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5		MACHINE ERROR	1			5	PREVENTATIVE MAINT. 100% PRESENCE CHECK						
2	CONFIRM HEXPORT PRESENCE AND STYLE	FAILS TO IDENTIFY OUT OF RANGE HEXPORT	WRONG HEXPORT	4		SET-UP ERROR	1			5	SET-UP MASTERS						
3	FEED AND ASSEMBLE GASKET TO HEXPORT GLAND. TL-NHTSA 019322	MISPLACED GASKET	LEAK BURST RESISTANCE DEGRADATION	3		MACHINE ERROR OPERATOR INTERVENTION	1			3	100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS						
		NO GASKET	LEAK BURST RESISTANCE DEGRADATION	3		MACHINE ERROR OPERATOR INTERVENTION	1			3	100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS						
		MULTIPLE GASKET	LEAK BURST RESISTANCE DEGRADATIO YIELD LOSS	3		OPERATOR INTERVENTION	1			3	100% FUNCTION TEST						
4	CONFIRM GASKET PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE GASKET	LEAK	3		MACHINE ERROR	1			3	SET-UP MASTERS						
5	BLANK AND ASSEMBLE (7) SEALS	ONLY (1) SEAL LOADED	REDUCED DIAPHRAGM LIFE	3		OPERATOR DOES NOT TURN ON 3RD STATION	1			3	PROCESS SPECS MACHINE SET-UP MATERIAL FITTING						

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R.GILDEA

MODEL YEAR(S)/VEHICLE(B): 52/57/77/80/87P6

DSGN/QUAL/MFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

FMEA DATE (ORIG.): 04/29/96
FMEA REVISION: C

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S	C	I	Potential Cause(s) or Mechanism(s) of Failure	O	C	D	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
														Severity	Occurrence	Detectability	Prevention	Control	Actions Taken
6	CONFIRM (2) SEALS PRESENCE	NO SEAL LOADED	LEAK	9			MACHINE ERROR	1	100% FUNCTION TEST	1	0								
		IMPROPERLY CUT SEAL	LEAK DIAPHRAGM LIFE FAILURE YIELD LOSS	9			MACHINE ERROR	1	100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS PREVENTIVE MAINT.	1	0								
		MISPLACED SEAL	LEAK REDUCED DIAPHRAGM LIFE	9			MACHINE ERROR OR STATIC	1	100% FUNCTION TEST CONTINUITY PROBE ANTI-STATIC STATION PREVENTIVE MAINT. CYCLING AUDITS	1	0								
7	WHERE APPLICABLE - BLANK AND ASSEMBLE (OR) SEAL FOR BRAKE APPLICATIONS	MORE THAN (2) SEALS LOADED	SHIFT IN SET POINTS	3			STATIC BUILD UP	1	ANTI-STATIC STATION	1	0								
		FAILS TO IDENTIFY MISSING OR OUT OF PLACE SEAL(S)	LEAK	9			MACHINE ERROR	1	SET-UP MASTERS	1	0								
		NO SEAL LOADED	LEAK	9			MACHINE ERROR	1	100% FUNCTION TEST	1	0								
		IMPROPERLY CUT SEAL	LEAK DIAPHRAGM LIFE FAILURE PREVENTS SUBSEQUENT ASSEMBLY YIELD LOSS	9			MACHINE ERROR	1	CONTINUITY PROBE 100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS PREVENTIVE MAINT.	1	0								
		MISPLACED SEAL	LEAK REDUCED DIAPHRAGM LIFE	9			MACHINE ERROR OR STATIC	1	100% FUNCTION TEST CONTINUITY PROBE ANTI-STATIC STATION PREVENTIVE MAINT. CYCLING AUDITS	1	0								
		MORE THAN (1) SEAL LOADED	SHIFT IN SET POINTS	3			STATIC BUILD UP	1	ANTI-STATIC STATION	1	0								

TI-NHTSA 019323

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R.GILDEA

FMEA DATE (ORIG.) 04/28/86
FMEA REVISION: C

MODEL YEAR(S)/VEHICLE(S): 53/57/77/80/87PS

DSGNOUAL/MFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S	C	Potential Cause(s)/ Mechanism(s) of Failure	D	Current Process Controls	D	F.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
													et	P.	Actions Taken	S	O
				v	e		c		a	N.			e	c	a	P.	
8	WHERE APPLICABLE... CONFIRM OVEN SEAL PRESENCE.	FAILS TO IDENTIFY MISSING OR OUT OF PLACE SEAL.	LEAK	0		MACHINE ERROR	1	SET-UP MASTERS	1	0							
9	FEED AND ASSEMBLE CONVERTER TO WASHER	MISSED CONVERTER	INOPERATIVE SWITCH	0		MACHINE MISFEED	3	100% PRESENCE CHECK 100% FUNCTION TEST	1	15							
		MISSED WASHER	INOPERATIVE DEVICE	0		MACHINE MISFEED	3	100% PRESENCE CHECK 100% FUNCTION TEST	1	27							
		UPSIDE DOWN WASHER	LEAK SHIFT IN DEVICE SET POINTS REDUCED KAPTON LIFE	0		MACHINE MISFEED OPERATOR ERROR	1	100% PRESENCE CHECK 100% FUNCTION TEST POKE YONE U/A TRACK 100% FUNCTION TEST CYCLING AUDITS	1	0							
10	FEED AND ASSEMBLE WASHER/CONVERTER ASSEMBLY	DISLODMENT OF CONVERTER	INOPERATIVE DEVICE	5		WAS PICK AND PLACE ERROR	1	OPERATOR SET-UP 100% FUNCTION TEST 100% PRESENCE CHECK PREVENTIVE MAINT CYCLING AUDITS	1	0							
		NON-CONCENTRIC PLACEMENT	MISPLACED KAPTON REDUCED KAPTON LIFE MISPLACED DISC INOPERATIVE DEVICE	0		WAS PICK AND PLACE ALIGNMENT ERROR	1	OPERATOR SET-UP 100% FUNCTION TEST 100% PRESENCE CHECK PREVENTIVE MAINT. CYCLING AUDITS	1	0							
		FAILS TO LOAD ASSEMBLY	NO SUBSEQUENT ASSEMBLY PERMISSIBLE YIELD LOSS	0		MACHINE ERROR	1	PREVENTIVE MAINT. 100% PRESENCE CHECK VERIFY OPERATION OF CHECK PROBE	1	0							
		LOADS MULTIPLE ASSEMBLES	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	0		MACHINE ERROR	1	PREVENTIVE MAINT 100% PRESENCE CHECK	1	0							
11	CONFIRM WASHER CONVERTER ASSEMBLY PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE WASHER CONVERTER ASSEMBLY	INOPERATIVE DEVICE	0		MACHINE ERROR	1	YIELD MONITORING	1	0							
12	BLANK AND ASSEMBLE SPACER	MISPLACED SPACER	REDUCED DISC LIFE	7		MACHINE ERROR	1	100% FUNCTION TEST	1	7							

TI-NHTSA 019324

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S	C	Potential Cause(s)/ Mechanism(s) of Failure	O	Current Process Controls	D	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
													ev	o	o	o	R		
13	CONFIRM SPACER PRESENCE	NO SPACER	CONTINUITY FAILURE LOSS OF CALIBRATION DRIFT OVER LIFE	7		MACHINE ERROR TOOL DULL, BROKEN, OR OTHERWISE MALF.	1	CONTINUITY PROBE CYCLING AUDITS TRAPPED DISC PROBE	1	7									
			REDUCED DISC LIFE LOSS OF CALIBRATION DRIFT OVER LIFE					100% FUNCTION TEST CONTINUITY PROBE											
								CYCLING AUDITS PREVENTIVE MAINT.											
		IMPROPERLY CUT SPACER, TOO LARGE	REDUCED DISC LIFE LOSS OF CALIBRATION DRIFT OVER LIFE CONTINUITY FAILURE	7		MACHINE ERROR TOOL DULL, BROKEN, OR OTHERWISE MALF.	1	100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS PREVENTIVE MAINT.											
		IMPROPERLY CUT SPACER, TOO SMALL	REDUCED DISC LIFE LOSS OF CALIBRATION DRIFT OVER LIFE	7		MACHINE ERROR TOOL DULL, BROKEN, OR OTHERWISE MALF.	1	100% FUNCTION TEST CONTINUITY PROBE CYCLING AUDITS PREVENTIVE MAINT.											
		2 OR MORE SPACERS LOADED	CONTINUITY FAILURE LOSS OF CALIBRATION DRIFT OVER LIFE	7		STATIC BUILD-UP	1	ANTI-STATIC STATION											
14	FEED AND ASSEMBLE DISC	MISPLACED DISC (TRAPPED)	CONTINUITY FAILURE	8		MACHINE ERROR	3	PRESSURE PROBE TRAPPED DISC PROBE 100% FUNCTION TEST	1	15									
		UPSIDE DOWN DISC	CONTINUITY FAILURE	5		MACHINE ERROR	3	100% DISC PROBE TRAPPED DISC PROBE 100% FUNCTION TEST	1	15									
		MULTIPLE DISC	CONTINUITY FAILURE ACTUATION FAILURE	5		MACHINE ERROR	3	100% DISC PROBE TRAPPED DISC PROBE	1	15									
		WRONG DISC	LOSS OF CALIBRATION AUDIBLE SNAP ON OMET	8		MIXING	1	100% FUNCTION TEST DISC SLIPS ROUTE SLIPS	1	15									

TT-NHTSA 019325

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r e	C i t a t e	Potential Cause(s)/ Mechanism(s) of Failure	O c c u r r e n c e	Current Process Controls	D e t e c t a b i l i t y	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
													Actions Taken	S e v e r e	O c c u r r e n c e	D e t e c t a b i l i t y	R. P. N.		
APPLICATIONS																			
15	CONFIRM DISC PRESENCE.	MISSING DISC	CONTINUITY FAILURE	6		MACHINE ERROR	1	100% DISC PROBE 100% FUNCTION TEST	1	5									
		FAILS TO IDENTIFY MISSING OR OUT OF PLACE DISC.	INOPERATIVE DEVICE	7		MACHINE ERROR	1	YIELD MONITORING	1	7									
16	FEED AND ASSEMBLE CUP	MISSING CUP	NO DEVICE OPERATION	8		MACHINE INDEX ERROR	1	100% PRESENCE CHECK 100% FUNCTION CHECK	1	5									
		DISLODGMENT OF INTERNAL COMPONENTS	INOPERATIVE DEVICE	9		MISALIGNED AIR PICK AND PLATE	1	TRAPPED DISC PROBE	1	8									
		LEAK						100% FUNCTION TEST CYCLING ALICITS											
		MULTIPLE CUPS LOADED	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5		MACHINE ERROR INCORRECT OPERATOR INTERVENTION	1	100% PRESENCE CHECK	1	8									
		LOW RATIO CUP LOADED IN PLACE OF HIGH RATIO CUP	SHIFT IN DEVICE SET POINTS	5		MACHINE ERROR	1	100% FUNCTION CHECK	1	5									
		EXCESSIVE SPRING PRE-LOAD CREEP CONTINUITY FAILURE				OPERATOR ERROR		KAN BAN LOT CONTROL											
17	CONFIRM CUP PRESENCE.	HIGH RATIO CUP LOADED IN PLACE OF LOW RATIO CUP	SHIFT IN DEVICE SET POINTS	5		MACHINE ERROR	1	100% FUNCTION CHECK	1	5									
		INSUFFICIENT SPRING PRE-LOAD CREEP CONTINUITY FAILURE				OPERATOR ERROR		KAN BAN LOT CONTROL											
17	CONFIRM CUP PRESENCE.	FAILS TO IDENTIFY MISSING OR OUT OF PLACE CUP.	INOPERATIVE DEVICE	7		MACHINE ERROR	1	YIELD MONITORING	1	7									

TI-NHTSA 019328

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e r i e s	C l a s s	Potential Cause(s)/ Mechanism(s) of Failure	O c c u r	Current Process Controls	D e t e c t	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
													Actions Taken	S a v	O c c	D e t	R. P. N.
18	PRE-CRIMP SENSOR ASSEMBLY	UNDER CRIMP	DISLODMENT OF INTERNAL COMPONENTS DURING TRANSFER TO PICK CRAMPER	5		BROKEN OR WORN TOOLS PRESSURE TOO LOW	3	OPERATOR SET-UP 100% FUNCTION TEST PREVENTIVE MAINT.	1	15							
		OVER CRIMP	DIFFICULT FINAL CRIMP DUE TO SIDE WALL STIFFENING	5		EXCESS PRESSURE SET-UP ERROR	3	PREVENTIVE MAINT. SET-UP INSPECTION	1	15							
19	PROBE FOR TRAPPED DISC	FAILS TO IDENTIFY MISSING OR TRAPPED DISC	INOPERATIVE DEVICE CONTINUITY FAILURE	7		MACHINE ERROR	1	YIELD MONITORING	1	7							
20	TRANSFER PRE-CRIMPED SENSOR ASSEMBLY TO SENSOR CRAMPER	DISLODDED INTERNAL COMPONENTS	LEAK CONTINUITY FAILURE	8		INSUFFICIENT PRE-CRIMP	1	PREVENTIVE MAINT. 100% FUNCTION TEST SET-UP INSPECTION	1	8							
		FAILS TO TRANSFER	EMPTY PICK NO EFFECT ON SUBSEQUENT OPERATIONS	6		MACHINE ERROR	1	PREVENTIVE MAINT.	1	5							
		TRANSFERS MULTIPLE SENSOR ASSEMBLY	SENSOR DAMAGE	5		INCORRECT OPERATOR INTERVENTION	1	OPERATOR AWARENESS TRAINING	1	5							
21	UNLOAD BAD PARTS SENSOR ASSEMBLIES	FAILS TO UNLOAD	HEXPORT LOADED ONTO OCCUPIED NEST.	5		UNLOAD FAILURE	1	EMPTY NEST PROBE	1	8							
22	CHECK EMPTY NEST.	FAILS TO IDENTIFY OCCUPIED NEST.	HEXPORT LOADED ONTO OCCUPIED NEST.	5		UNLOAD FAILURE	1	YIELD MONITORING	1	5							
23	WHERE APPLICABLE, PLACE EXTERNAL O-RING ON HEXPORT	FAILS TO PLACE O-RING ON PART	IF UNDETECTED IN SUBSEQUENT OPERATION COULD CAUSE LEAK IN APPLICATION	8		PICK & PLACE MIS-HANDLES O-RING NO O-RINGS PRESENT AT TRACK DUE TO EMPTY BOWL FEED, CONTAMINATION IN TRACK, MISALIGNED TRACK	3	100% O-RING CHECK ON CRIMP TABLE O-RING STATION P.M. ROUTE SLIP AND VISUAL AIDS FOR O-RING REQUIREMENTS	3	54	ADD O-RING CHECK TO FINAL FUNCTION TEST AS A REDUNDANT CHK	MFG. ENGINEERING	COMPLETE 12/02	9	3	1	18

TI-NHTSA 019327

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R.GILDEA

FMEA DATE (ORIG.) 04/29/99

MODEL YEAR(S)/VEHICLE(S): 52/57/77/80/87PS

DSGNQUAL/MFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

FMEA REVISION: C

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S	C	Potential Cause(s)/ Mechanism(s) of Failure	O	Current Process Controls	D	R.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
													Actions Taken	S	O	D	R.		
						O-RING STATION NOT ACTIVATED		100% VISUAL INSPECTION AT PRESSURE TEST AND PACKING											
						PICK & PLACE WORK, MISALIGNED OR NOT DESIGNED PROPERLY													
						PUCK NOT LOCATED PROPERLY DUE TO MISALIGNED STOP OR CONTAMINATION BELT													
						STRIPPER PIN FAILS TO REMOVE O-RING													
		PLACES TWO O-RINGS ON ONE PART	HIGH ASSEMBLY TORQUE	4		PUCK STOP FAILS TO RELEASE PUCK AT END OF CYCLE	2	100% MULTIPLE O-RING CHECK ON CRIMP TABLE	3	24	ADD O-RING CHECK TO FINAL FUNCTION TEST	MFG ENG.	COMPLETE 1288	4	2	1	6		
			POTENTIAL INABILITY TO FULLY ASSEMBLE IN APPLICATION	5			2	100% VISUAL INSPECTION AT PRESSURE TEST AND PACKING P.M. FOR O-RING STATION	3	30				6	2	1	10		
		O-RING DAMAGED BY FEED SYSTEM OR PICK & PLACE	POSSIBLE LEAK IN APPLICATION	4		PICK & PLACE AND FEED SYSTEM WORN OR NOT DESIGNED PROPERLY	1	P.M. FOR PICK & PLACE AND FEED SYSTEM	2	12									
								DESIGN VERIFICATION THROUGH DEBUG AND PROCESS HISTORY Q.C. AUDIT FROM EACH LOT SUBJECTED TO FLUID LEAK CHECK											
		THREADS DAMAGED BY PICK & PLACE	MAY RESULT IN HIGH INSTALLATION TORQUE	4		PICK & PLACE AND FEED SYSTEM WORN, MISALIGNED OR NOT DESIGNED PROPERLY	2	P.M. FOR PICK & PLACE AND FEED SYSTEM	2	18									
			FINISHED DEVICE WILL NOT ASSEMBLE AT CUSTOMER	5		PUCK NOT LOCATED PROPERLY	1	DESIGN VERIFICATION THROUGH DEBUG AND PROCESS HISTORY Q.C. AUDIT FROM EACH LOT SUBJECTED TO THREAD QUALITY CHECK	2	10									

TI-NHTSA 019328

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S	C	I	Potential Cause(s)/ Mechanism(s) of Failure	O	C	C	D	D	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
																Actions Taken	S	O	D	R. P. N.
		O-RING NOT LOCATED PROPERLY ON THE ASBY.	MAY RESULT IN HIGH INSTALLATION TORQUE	4			PICK & PLACE AND FEED SYSTEM WORK, MISALIGNED OR NOT DESIGNED PROPERLY	2					16							
			POTENTIAL O-RING DAMAGE DURING ASSEMBLY RESULTING IN 1 Fail	5			PICK NOT LOCATED PROPERLY	1					16	DESIGN VERIFICATION THROUGH DEBUG AND PROCESS HISTORY D.C. AUDIT FROM EACH LOT SUBJECTED TO THREAD QUALITY CHECK 100% VISUAL CHECK AT PRESSURE TEST AND PACK						
24	TRANSFER SENSOR ASSEMBLY TO ROTARY CRIMP NEST.	FAILS TO TRANSFER	PRE-CRIMPED SENSOR ASSEMBLY LOADED ONTO OCCUPIED NEST.	5			UNLOAD FAILURE	1					5	YIELD MONITORING						
25	45 DEGREE CRIMP SENSOR ASSEMBLY	UNDER CRIMP	LOSS OF SPC CONTROL OF DIAMETER OR HEIGHT POTENTIAL DIAPHRAGM LIFE PROBLEM	8			PRESSURE TOO LOW TOOL WEAR/BREAKAGE	1					8	SPC DIA. AND HEIGHT PROCESS SPC SET-UP PREVENTIVE MAINT. 100% FUNCTION TEST CYCLING AUDITS						
		OVER CRIMP	CRIMP DIAMETER TOO LARGE CAUSING DIFFICULT FINAL ASBY. COMPONENT DAMAGE POTENTIAL DIAPHRAGM LIFE PROBLEM	9			PRESSURE TOO HIGH	1					9	SPC DIA. AND HEIGHT PROCESS SPC SET-UP PREVENTIVE MAINT. 100% FUNCTION TEST CYCLING AUDITS						
		IMPROPER CRIMP	COMPONENT DAMAGE CRIMP DIAMETER AND HEIGHT OUT OF SPEC.	8			OPERATOR SET-UP 90 DEG TOOL IN 45 DEG. STATION WRONG DIE GEOMETRY	8					15	SPC DIA. AND HEIGHT PROCESS SPC SET-UP PREVENTIVE MAINT. 100% FUNCTION TEST CYCLING AUDITS						
		FAILS TO CRIMP	COMPONENT DAMAGE AT 90 DEGREE CRIMP CRIMP DIAMETER AND HEIGHT OUT OF SPEC	8			MACHINE MALFUNCTION SET-UP ERROR	1					5	PREVENTIVE MAINT. SET-UP SPECS						

T-NHTSA 019329

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R.GILDEA

MODEL YEAR(S)/VEHICLE(S): 58/57/77/80/87 PG

DSGN/QUAL/MFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

FMEA DATE (ORIG.) 04/29/96
FMEA REVISION: C

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S	C	O	D	R.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results							
											o	e	e	P.	Actions Taken	S	O	D
		IMPROPER TOOL REGISTRATION	MINOR REGISTRATION ERROR: SENSOR DIAMETER OUT OF ROUND SENSOR HEIGHT UNEVEN MAJOR REGISTRATION ERROR: - COMPONENT MISMATCH	5					SPEC. DIA. AND HEIGHT PREVENTIVE MAINT.									
26	VERIFY O-RING PRESENT ON SENSOR	FAILS TO DETECT MISSING O-RING	PART WILL BE UNLOADED INTO GOOD BIN AND COULD CAUSE LEAK IN APPLICATION IF UNDETECTED IN SUBSEQUENT PROCESSING	8					PROBE MISALIGNED, WORN OR IMPROPERLY DESIGNED PROBE CONTAMINATION PROBE STATION NOT ACTIVATED	MASTER DEVICES REDUNDANT O-RING CHK ON FINAL FUNCTION OK ALIGNMENT TOOL VISUAL INSPECTION PROBE P.M.'S	1	12						
		FAILS TO DETECT O-RING PRESENT	PART WILL BE UNLOADED INTO BAD BIN RESULTING IN YIELD LOSS	2					PROBE MISALIGNED, WORN OR IMPROPERLY DESIGNED PROBE CONTAMINATION PART ALIGNMENT IN BEST	MASTER DEVICES ALIGNMENT TOOL PROBE DESIGN PROVEN THROUGH DEBUG & PROCESS HISTORY PROBE P.M.'S	1	4						
		FAILS TO DETECT TWO O-RINGS PRESENT	PART WILL BE UNLOADED INTO GOOD BIN POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE AT FINAL USER	4					PROBE MISALIGNED, WORN OR IMPROPERLY DESIGNED PROBE CONTAMINATION PROBE STATION NOT ACTIVATED	MASTER DEVICES ALIGNMENT TOOL PROBE P.M.'S ROUTE SLIPS VISUAL INSPECTION	2	10						
		O-RING DAMAGED BY PROBE TIP	LEAK IN APPLICATION	5					PROBE MISALIGNED, WORN OR IMPROPERLY DESIGNED PROBE P.M.'S PROBE DESIGN PROVEN THROUGH RES-DEBUG AND PROCESS HISTORY	PROBE DESIGNED TO MINIMIZE THREAD CONTACT	2	10						
27	90 DEGREE CRIMP SENSOR ASSEMBLY	UNDER CRIMP	BURST RESISTANCE DEGRADED	8					PRESSURE TOO LOW	SPEC. DIA. AND HEIGHT	1	9						

TI-NHTSA 018330

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r e	C a u s e	Potential Cause(s)/ Mechanism(s) of Failure	C o n s e q u e n c e	Current Process Controls	D e t e c t	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
													Actions Taken	S u c c e s s	O c c u r	D e t e c t	R. P. N.
28	OVER-PRESSURE SENSOR ASSEMBLY	OVER CRIMP	LEAK	5	TOOL WEAR/BREAKAGE AS DEG TOOL IN 90 DEG. STATION	1	PROCESS SPEC SET-UP F.M.I.C. AUDITS 100% FUNCTION TEST CYCLING AUDITS	1	5								
			CRIMP HEIGHT OUT OF SPEC. DIFFICULT FINAL ASSEMBLY CRIMPING	CRIMP DIAMETER TOO LARGE CAUSING DIFFICULT FINAL ASSY	5	PRESSURE TOO HIGH	1	SFC. DIA. AND HEIGHT PROCESS SPEC SET-UP PREVENTIVE MAINT. 100% FUNCTION TEST CYCLING AUDITS	1	5							
29	UNLOAD GOOD SENSOR ASSEMBLY	INSUFFICIENT OP	DRIFT OVER LIFE OR CALIBRATION CHANGE LEADING TO YIELD LOSS	2	IMPROPER DESIGN OF OP HEAD INCORRECT OP SETTING INADEQUATE SEAL	1	100% FUNCTION TEST. MIN. PRESSURE LEVEL GAGE	1	3								
30	UNLOAD GOOD SENSOR ASSEMBLY	FAILS TO UNLOAD GOOD SENSOR	TABLE WONT INDEX PAST NEXT CYCLE (EMPTY NEST FAILURE)	2	LOOSE/ MISADJUSTED OR IMPROPERLY DESIGNED PICK-UP (JAW)	2	EMPTY NEST PROBE NESTCRIMPER PAIRS	1	4								
			YIELD/UPTIME LOSS	2	JAW DESIGN PROVEN THROUGH DEBUG & PROCESS HISTORY	1	2										
30	PICK & UNLOAD ASSEMBLY W/O O-RINGS	THREAD DAMAGE	POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE	4	JAWS WORN, MISALIGNED OR IMPROPERLY DESIGNED	2	JAW P.M.'S JAWS DESIGNED TO MINIMIZE THREAD CONTACT DESIGN PROVEN THROUGH DEBUI & PROCESS HISTORY	2	18								
			TABLE WONT INDEX PAST NEXT CYCLE (EMPTY NEST FAILURE)	2	LOOSE/ MISADJUSTED OR IMPROPERLY DESIGNED PICK UP (JAW)	2	EMPTY NEST PROBE NESTCRIMPER PAIRS JAW DESIGN PROVEN THROUGH DEBUI & PROCESS HISTORY	1	4								
30	PICK & UNLOAD ASSEMBLY W/O O-RINGS	THREAD DAMAGE	UPTIME LOSS	2	JAW DESIGN PROVEN THROUGH DEBUI & PROCESS HISTORY	1	2										
			POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE AT CUSTOMER.	4	JAWS WORN, MISALIGNED OR IMPROPERLY DESIGNED	2	JAW P.M.'S JAWS DESIGNED TO MINIMIZE THREAD CONTACT DESIGN PROVEN THROUGH DEBUI & PROCESS HISTORY	2	18								

TI-NHTSA 019331

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R.GILDEA

FMEA DATE (ORIG.) 04/29/96

MODEL YEAR(S)/VEHICLE(S): 52/57/77/80/87PS

DSGN/QUAL/MFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

FMEA REVISION: C

ID	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C i r c u m s t a n c e s	Potential Cause(s)/ Mechanism(s) of Failure	O c c u r r e n c e	Current Process Controls	D e t e c t a b i l i t y	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
													Actions Taken	S e v e r i t y	O c c u r r e n c e	D e t e c t a b i l i t y	R. P. N.
31	CHECK EMPTY NEST.	FAIL TO IDENTIFY OCCUPIED NEST	SENSOR ASSEMBLY LOADED ONTO OCCUPIED NEST.	5		UNLOAD FAILURE	1	YIELD MONITORING	1	5							

TI-NHTSA 019332

Docuport #: 503251

POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERMAN REA

PREPARED BY: MATT SELLERS

MODEL YEAR(S)/VEHICLE(S): 58/57/77/88/95/PS

DESIGN/QUALITY RESPONSIBILITY: KEITH ROSELLO / JIM WATT / PEGGY ALLEN

FMEA DATE (OFB): 4/28/98
FMEA REVISION: B

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C o n t r o l s	Potential Cause(s) / Mechanism(s) of Failure	O c c u r r e n c e R a t e	C u r r e n t P r o c e s C o n t r o l s	D e t e c t i o n R a t e	R e s p o n s i b i l i t y	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
													Action Taken	S e v e r i t y	O c c u r r e n c e R a t e	D e t e c t i o n R a t e	R e s p o n s i b i l i t y	
1	FEED AND ASSEMBLE HEADPORT TO M8T	DOES NOT FEED	NO SUBSEQUENT ASSEMBLY FEASIBLE FIELD LOSS	9		MACHINE ERROR	1	PREVENTIVE MAINT.	1	0								
		DOES NOT FEED PROPERLY	NO SUBSEQUENT ASSEMBLY FEASIBLE	9		DEBRIS IN FEED; MACHINE ERROR	1	PREVENTIVE MAINT.	1	0								
		LOADS MULTIPLE HEADPORT	NO SUBSEQUENT ASSEMBLY FEASIBLE	9		MACHINE ERROR	1	PREVENTIVE MAINT.	1	0								
2	CONFIRM HEADPORT PRESENCE AND STYLE	FAILS TO IDENTIFY CLUT OF FRAME AS M8T	WRONG HEADPORT	5		SET-UP ERROR	1	SET-UP MASTERS	1	0								
		REPLACED GASKET TO HEADPORT ISLAND	LEAK	9		MACHINE ERROR	1	MISS FUNCTION TEST	1	0								
3	FEED AND ASSEMBLE GASKET TO HEADPORT ISLAND	NO GASKET	LEAK	9		MACHINE ERROR	1	MISS FUNCTION TEST	1	0								
		NO GASKET	LEAK	9		OPERATOR MISDIAGNOSIS	1	CONSISTENCY FROM CYCLING AUDITS	1	0								
		NO GASKET	LEAK	9		OPERATOR MISDIAGNOSIS	1	CONSISTENCY FROM CYCLING AUDITS	1	0								
4	CONFIRM GASKET PRESENCE	FAILS TO IDENTIFY MISSING OR CLUT OF PLACE GASKET	LEAK	9		MACHINE ERROR	1	SET-UP MASTERS	1	0								
		ONLY (1) SEAL LOADED	REDUCED COMPRESSOR LIFE	9		OPERATOR DOES NOT TURN ON 2ND STATION	1	PROCESSING OFFICER	1	0								
5	BLANK AND ASSEMBLE (1) SEALS	ONLY (1) SEAL LOADED	REDUCED COMPRESSOR LIFE	9		OPERATOR DOES NOT TURN ON 2ND STATION	1	PROCESSING OFFICER	1	0								

TI-NHTSA 019333

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERS/ANN RGA

FMEA DATE (OFBQ) 4/28/08

MODEL YEAR(S)/VEHICLE(S): 08/07/77/80/07/08

DISCIPLINARY RESPONSIBILITY: KEITH ROSELLO / JIM WATT / PEGGY ALLEN

FMEA REVISION: 5

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S.O.C.V.	Critical Component(s) or Mechanism(s) of Failure	Current Process Controls	D.S.I.P.N.	R.P.N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results			
											Actions Taken	S	O	C
6	CONFIRM (2) SEALS PRESENCE.	NO SEAL LOADED	LEAK	0	MACHINE ERROR	SEALS FUNCTION TEST	1	0						
		IMPROPERLY CUT SEAL	LEAK DIAPHRAGM LIFE FAILURE YIELD LOSS	0	MACHINE ERROR	SEALS FUNCTION TEST	1	0						
		REPLACED SEAL	LEAK REDUCED Diaphragm LIFE	0	MACHINE ERROR OR STATIC	SEALS FUNCTION TEST	1	0						
		MORE THAN (2) SEALS LOADED	SHIFT IN SET POINTS	0	STATIC BUILD UP	ANTI-STATIC SENSOR	1	0						
7	WHERE APPLICABLE, BLANK AND ASSEMBLE (2ND) SEAL FOR BRACE APPLICATION	FAILS TO IDENTIFY SENSORS OR SIZE OF PLUCK SEAL(S)	LEAK	0	MACHINE ERROR	SET-UP SENSORS	1	0						
		NO SEAL LOADED	LEAK	0	MACHINE ERROR	SEALS FUNCTION TEST	1	0						
		IMPROPERLY CUT SEAL	LEAK DIAPHRAGM LIFE FAILURE PREVENTS SUBSEQUENT ASSEMBLY YIELD LOSS	0	MACHINE ERROR	SEALS FUNCTION TEST	1	0						
		REPLACED SEAL	LEAK REDUCED Diaphragm LIFE	0	MACHINE ERROR OR STATIC	SEALS FUNCTION TEST	1	0						
TI-NHTSA 019334		MORE THAN (2) SEALS LOADED	SHIFT IN SET POINTS	0	STATIC BUILD UP	ANTI-STATIC STATION	1	0						

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELERSOHN/FEA

MODEL YEAR(S)/VEHICLE(S): 2002/770007P2

DSO/OLM/AFG RESPONSIBILITY: KETH ROSSILLO / JIM WATT / PEGGY ALLEN

FMEA DATE (OFB): 4/2000
FMEA REVISION: B

Step	Process Function/ Requirements	Potential Failure Mode	Potential Severity of Failure	C I S S I V E	Potential Cause(s) of Failure	O C C U R E N C E	Current Process Controls	S E V E R E T Y	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
												Action Taken	E V A L U E	O C C U R E N C E	S E V E R E T Y	R. P. N.		
9	WASHER ADJUSTABLE. CONFIRM PROX. SEAL PRESENCE.	FAILS TO IDENTIFY MISSING OR OUT OF PLACE SEAL	LEAK	9	MACHINE ERROR	1	SET-UP MATHS	1	9									
8	FEED AND ASSEMBLE CONVERTER TO WASHER	MISSING CONVERTER	INOPERATIVE SWITCH	6	MACHINE MISFEED	3	WPS PRESENCE CHECK	1	16									
		MISSING WASHER	INOPERATIVE DEVICE	6	MACHINE MISFEED	3	WPS PRESENCE CHECK	1	27									
		UPSIDE DOWN WASHER	LEAK SHIFT IN SERVICE SET POINTS REDUCED WIPON LIFE	6	MACHINE MISFEED	1	WPS FUNCTION TEST POSSIBLE VIB. IN TRACK	1	6									
					OPERATOR ERROR	1	WPS FUNCTION TEST	1	6									
10	FEED AND ASSEMBLE WASHER/CONVERTER ASSEMBLY	IMPROPERMENT OF CONVERTER	INOPERATIVE DEVICE	6	WASHER PICK AND PLACE ERROR	1	OPERATOR SET-UP	1	6									
		NON-CONCENTRIC PLACEMENT	MISPLACED WIPON REDUCED WIPON LIFE MISPLACED DISC INOPERATIVE DEVICE	6	WASHER PICK AND PLACE ALIGNMENT ERROR	1	OPERATOR SET-UP WPS FUNCTION TEST WPS PRESENCE CHECK PREVENTIVE MAINT. CYCLING ALARMS	1	6									
		FAILS TO LOAD PROPERLY	NO SUBSEQUENT ASSEMBLY PERMISSIBLE YIELD LOSS	6	MACHINE ERROR	1	PREVENTIVE MAINT. WPS PRESENCE CHECK VERIFY OPERATION OF CHECK POINTS	1	6									
		LOADS MULTIPLE ASSEMBLES	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	6	MACHINE ERROR	1	PREVENTIVE MAINT. WPS PRESENCE CHECK	1	6									
11	CONFIRM WASHER/CONVERTER ASSEMBLY PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE WASHER/CONVERTER ASSEMBLY		6	MACHINE ERROR	1	YIELD MONITORING	1	6									
12	BLANK AND ASSEMBLE SPACER	MISPLACED SPACER	REDUCED DISC LIFE	7	MACHINE ERROR	1	WPS FUNCTION TEST	1	7									

TI-NHTSA 019336

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLERS/AMN REA

MODEL YEAR(S)/VEHICLE(S): 55/57/77/88/93/95

ORGANIZATION RESPONSIBILITY: KETH ROSELLO / JIM WATT / PEGGY ALLEN

FMEA DATE (ORIG): 4/29/98

FMEA REVISION: B

Item	Process Function/Requirement	Potential Failure Mode	Potential Effect(s) of Failure	C I E V	S E S	Potential Cause(s)/ Mechanism(s) of Failure	D E S R	Current Process Controls	D E S R	R P E L	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
													Action Taken	S E S	O E S	D E S	R P E L		
		NO SPACER	CONTINUITY FAILURE LOSS OF CALIBRATION DRIFT OVER LIFE			MACHINE ERROR	1	100% FUNCTION TEST CONTINUITY PROBE	1	7									
		IMPROPERLY CUT SPACER, TOO LARGE	REDUCED DISC LIFE LOSS OF CALIBRATION DRIFT OVER LIFE CONTINUITY FAILURE	7		MACHINE ERROR TOOL DULL, BROKEN, OR OTHERWISE MALF	1	100% FUNCTION TEST CONTINUITY PROBE	1	7									
		IMPROPERLY CUT SPACER, TOO SMALL	REDUCED DISC LIFE LOSS OF CALIBRATION DRIFT OVER LIFE	7		MACHINE ERROR TOOL DULL, BROKEN, OR OTHERWISE MALF	1	100% FUNCTION TEST CONTINUITY PROBE	1	7									
		2 OR MORE SPACERS LOADED	CONTINUITY FAILURE LOSS OF CALIBRATION DRIFT OVER LIFE	7		STATIC BUILD-UP	1	UNIT-STATIC STATION	1	7									
13	CONFIRM SPACER PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE SPACER	REDUCED DISC LIFE	7		MACHINE ERROR	1	SET-UP MASTERS	1	7									
14	FEED AND ASSEMBLE DISC	REPLACED DISC (JAMMED)	CONTINUITY FAILURE	5		MACHINE ERROR	3	PRESSURE PROBE	1	15									
		UPSIDE DOWN DISC	CONTINUITY FAILURE	5		MACHINE ERROR	3	100% DISC PROBE	1	10									
		MULTIPLE DISC	CONTINUITY FAILURE ACTIVATION FAILURE	5		MACHINE ERROR	3	100% DISC PROBE TRAPPED DISC PROBE	1	11									
		WRONG DISC	LOSS OF CALIBRATION MOBILE SWAP ON CLUT	5		SWAP	1	100% FUNCTION TEST DISC SLIPS PICTURE SLIPS	1	8									

TI-NHTSA 01933B

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT SELLERMAN REA

MODEL YEAR/VEHICLE ID: 2017/78647PS

DEIGN/QUALMFG RESPONSIBILITY: KEITH ROBELLO / JIM WATT / PEGGY ALLEN

FMEA DATE (FORM): 4/22/10
FMEA REVISION: B

ID	Process Function/ Requirements	Potential Failure Mode	Potential (Cause(s) of Failure)	S	O	D	C	E	P	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Family						
													Active Taken	M	O	D	R		
			APPLICATION																
15	CONFIRM DISC PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE DISC	CONTINUITY FAILURE INSUFFICIENT DEVICE	6 7							MISS DISC PROBE MISS. FUNCTION TEST YIELD MONITORING								
16	FEED AND ASSEMBLE CUP	MISSING CUP DISLOCMENT OF INTERNAL COMPONENTS LEAK MULTIPLE CUPS LOADED	NO DEVICE OPERATION INSUFFICIENT DEVICE LEAK NO SUBSEQUENT ASSEMBLY FEASIBLE	8 9 8 8							MISSING FEED ERROR MISSING PRESENCE CHECK MISSING FUNCTION CHECK TRAPPED DISC PROBE MISSING FUNCTION TEST CYCLING PROBLEMS MISSING PRESENCE CHECK								
		LOW RATIO CUP LOADED IN PLACE OF HIGH RATIO CUP	SHIFT IN DEVICE NET POINTS EXCESSIVE SPRING PRE-LOAD CRISP CONTINUITY FAILURE	6							MISSING ERROR MISSING FUNCTION CHECK HUSH BELL LOT CONTROL								
		HIGH RATIO CUP LOADED IN PLACE OF LOW RATIO CUP	SHIFT IN DEVICE NET POINTS INSUFFICIENT SPRING PRE-LOAD CRISP CONTINUITY FAILURE	6							MISSING ERROR MISSING FUNCTION CHECK HUSH BELL LOT CONTROL								
17	CONFIRM CUP PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE CUP	INSUFFICIENT DEVICE	7							MISSING ERROR YIELD MONITORING								

TI-NHTSA 019337

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLENBACH REA

MODEL YEAR(S)/VEHICLE(S): 68577780WPS

DESIGN/PLANT RESPONSIBILITY: KEITH ROBELLO / JM WATT / PEGGY ALLEN

FMEA DATE (ORIG.): 4/28/00
FMEA REVISION: 8

ID#	Process Function/ Requirement	Potential Failure Mode	Potential Effect(s) of Failure	C I R K S V	D I A G N O S I S I C A B L E	Potential Cause(s)/ Mechanism(s) of Failure	O C C U R R E N C E	Control Process Controls	D E T E C T I O N	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
													Action Taken	S W	O C C U R R E N C E	D I A G N O S I C A B L E	R. P. N.
16	PRE GRASP SENSOR ASSEMBLY	UNDER GRASP	DEFORMATION OF INTERNAL COMPONENTS DURING TRANSFER TO PICKUP COMPACT	3	3	ROUGH OR WORN TOOL	1	OPERATOR SET-UP	1	31							
						PRESSURE TOO LOW	1	FINAL FUNCTION TEST									
						PRESSURE TOO HIGH	1	PREVENTIVE MAINT.									
		OVER GRASP	DIFFICULT FINAL GRASP DUE TO SIDE WALL STIFFNESS	5	5	EXCESSIVE PRESSURE	3	PREVENTIVE MAINT.	1	31							
						SET-UP ERROR	1	SET-UP INSPECTION									
18	PROBE FOR TRAPPED DISC	FAILS TO IDENTIFY MISSING OR TRAPPED DISC	REPERATIVE DISK/ CONTAMINANT FAILURE	7	7	MACHINE ERROR	1	YIELD MONITORING	1	7							
20	TRANSFER PRE-CRIMPED SENSOR ASSEMBLY TO SENSOR CRAMPER	UNLOADED INTERNAL COMPONENTS	LEAK CONTAMINANT FAILURE	5	5	INSUFFICIENT PRE-CRIMP	1	PREVENTIVE MAINT.	1	30							
		FAILS TO TRANSFER	EMPTY PICK, NO EFFORT OR SUBSEQUENT OPERATIONS SENSOR DAMAGE	5	5	MACHINE ERROR	1	PREVENTIVE MAINT.	1	31							
		TRANSFERS MULTIPLE SENSOR ASSEMBLY PA		5	5	INCORRECT OPERATOR PREVENTION	1	OPERATOR AMBIDEXTERITY	1	31							
						TRAPPED	1										
21	UNLOAD BAD PARTS SENSOR ASSEMBLY	FAILS TO UNLOAD	HEMPORT LOADED ONTO OCCUPIED NEST.	5	5	UNLOAD FAILURE	1	EMPTY NEST PROC	1	31							
22	CHECK EMPTY NEST	FAILS TO IDENTIFY OCCUPIED NEST	HEMPORT LOADED ONTO OCCUPIED NEST.	5	5	UNLOAD FAILURE	1	YIELD MONITORING	1	31							
23	REMOVE ATTACHEMIL, PLACE EXTERNAL O-RING ON HEMPOT	FAILS TO PLACE O-RING ON PART	IF UNDETECTED IN SUBSEQUENT OPERATION COULD CAUSE LEAK IN APPLICATION	8	8	PICK & PLACE AND HANDLE O-RING	3	SET'S O-RING CHECK ON CRIMP TABLE	3	34	YIELD MON CHECK TO FINAL FUNCTION TEST AS A REDUNDANT CH	MPR ENGINEERING	COMPLETE 12/03	5	3	1	14
						NO O-RING PRESENT AT TRACK DUE TO EMPTY BOWL, FEED, O-CREAMING ON IN TRACK, MISLADDED TRACK	3	O-RING STATION PM ROUTINE SUP AND VISUAL AND FOR O-RING REQUIREMENTS									

TI-NHTSA 01933B

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLEMINI / PEA

MODEL YEAR(S)/VEHICLE(S): 2015/77MM/7P8

DESIGN/ALMFG RESPONSIBILITY: KEITH ROSELLO / JIM WATT / PEGGY ALLEN

FMEA DATE (OFBG) 4/22/06
FMEA REVISION: 6

Item	Process Function/ Requirements	Potential Failure Mode	Potential Severity of Failure	C I S E V	Potential Cause(s)/ Mechanism(s) of Failure	D S E V E R I T Y	Current Process Controls	D I S C O V E R A B I L I T Y	P. P. M.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
												Action Taken	S	O	C	P.		
					O-RING POSITION NOT ACTIVATED	1	100% VISUAL INSPECTION AT PRESSURE TEST AND PACKING											
					PICK & PLACE WORK, IMBALANCED OR NOT DEIGNED PROPERLY	1												
					PICK NOT LOCATED PROPERLY DUE TO IMBALANCED STOP OR COMBINATION ONLY	1												
					STRIPPER FEEDS TO RELEASE O-RING	1												
		PLACES TWO O-RINGS ON ONE PART	NON ASSEMBLY TORQUE	4	PICK STOP FAILS TO RELEASE PICK AT END OF CYCLE	2	100% MULTIPLE O-RING CHECK ON CRIMP TABLE	2	84	ADD O-RING CHECK TO FINAL FUNCTION TEST TEST	MMF End	COMPLETE 1/24/02	4	2	1	8		
			POTENTIAL INABILITY TO FULLY ASSEMBLE IN APPLICATION	3		2	100% VISUAL INSPECTION AT PRESSURE TEST AND PACKING P.M. FOR O-RING SEARCH	3	30				5	2	1	10		
		O-RING DAMAGED BY FEED SYSTEM OR PICK & PLACE	POSSIBLE LEAK IN APPLICATION	3	PICK & PLACE AND FEED SYSTEM WORK OR NOT DEIGNED PROPERLY	1	P.M. FOR PICK & PLACE AND FEED SYSTEM	3	12									
							DESIGN VERIFICATION THROUGH DDBS AND PROCESS HISTORY I.D.C. AND FROM EACH LOT - SUBJECT TO RING LEAK CHECK.											
		THREADS DAMAGED BY PICK & PLACE	MAY RESULT IN HIGH INSTALLED TORQUE	4	PICK & PLACE AND FEED SYSTEM WORK, IMBALANCED OR NOT DEIGNED PROPERLY	2	P.M. FOR PICK & PLACE AND FEED SYSTEM	1	16									
			FINISHED DEVICE WILL NOT ASSEMBLE AT CUSTOMER	3	PICK NOT LOCATED PROPERLY	1	DESIGN VERIFICATION THROUGH DDBS AND PROCESS HISTORY I.D.C. AND FROM EACH LOT - SUBJECT TO THREAD QUALITY CHECK.	2	30									

TI-NHTSA 019339

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLERMAN REA

MODEL YEAR(S)/VEHICLE(S): 2015/77/2017PS

DSU/PLANT/MPG RESPONSIBILITY: KETH ROSS/ILLO / JIM WATT / PEGGY ALLEN

FMEA DATE (ORIG) 4/28/06

FMEA REVISION: B

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	C I R K S C R	P O T E N T I A L C O N S E Q U E N C E S O F F A I L U R E	O C C U R R E N C E	Current Process Controls	D O S E	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
												Action Taken	E A S Y	O C C U R R E N T	D I F F I C U L T	R. P. N.		
24	TRANSFER SENSOR ASSEMBLY TO CRIMP OR CRIMP HERE.	CLAMP NOT LOCATED PROPERLY ON THE ARBY	ARM BRASSY IN HIGH INSTALLATION TORQUE	1	POK & PLACE AND FEED SYSTEMS STOP, UNBALANCED OR NOT DEFORMED PROPERLY	1	P.A. FOR POK & PLACE AND FEED SYSTEM	1	70									
			POTENTIAL O-RING DAMAGE DURING ASSEMBLY RESULTING IN LEAK	1	FLUID NOT LOCKED/ PROPERLY	1	DEBRIN VERIFICATION THROUGH DEBRIN AND PROCESS HISTORY	1	10									
		FAILS TO TRANSFER	PRE-CRIMPED SENSOR ASSEMBLY LOADED ONTO OCCUPIED HUB.	1	UNLOAD FAILURE	1	FIELD MONITORING	1	1									
			45 DEGREE CRIMP SENSOR ASSEMBLY	LOSS OF SPC CONTROL OF DIAMETER OR HEIGHT POTENTIAL DIAPHRAGM LIFE PROBLEM	1	PRESSURE TOO LOW TOOL WEAR/REPLACEMENT	1	SFO DIA AND HEIGHT PROCESS SPC SET-UP PREVENTIVE MAINT. TENS FUNCTION TEST CYCLING ALERTS	1	5								
				OVER CRIMP	CRIMP DIAMETER TOO LARGE CAUSING DIFFICULT FEEL ANY COMPONENT DAMAGE POTENTIAL DIAPHRAGM LIFE PROBLEM	1	PRESSURE TOO HIGH	1	SPC DIA AND HEIGHT PROCESS SPC SET-UP PREVENTIVE MAINT. TENS FUNCTION TEST CYCLING ALERTS	1	5							
25	45 DEGREE CRIMP SENSOR ASSEMBLY	IMPROPER CRIMP	COMPONENT DAMAGE	1	OPERATOR SET-UP	3	SPC DIA AND HEIGHT PROCESS SPC SET-UP PREVENTIVE MAINT. TENS FUNCTION TEST CYCLING ALERTS	1	10									
			CRIMP DIAMETER AND HEIGHT OUT OF SPEC.	1	ANDED TOOL IN AN USER STATION BRINGING DIE DIMETRY	1	PROCESS SPC SET-UP PREVENTIVE MAINT. TENS FUNCTION TEST CYCLING ALERTS	1	5									
26	45 DEGREE CRIMP SENSOR ASSEMBLY	FAILS TO CRIMP	COMPONENT DAMAGE AT 45 DEGREE CRIMP CRIMP DIAMETER AND HEIGHT OUT OF SPEC	1	MACHINE MALFUNCTION SET-UP ERROR	1	PREVENTIVE MAINT. SET-UP SPC'S	1	5									

TI-NHTSA 019340

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLEFRANN REA

MODEL YEAR(S)/VEHICLE(S): 2015/770000770

ORGANIZATIONAL RESPONSIBILITY: KEITH FIORELLA / JIM WATT / PEGGY ALLEN

FMEA DATE (KPN): 4/20/08

FMEA REVISION: 6

ID	Process Function/ Requirements	Potential Failure Mode	Potential Impact of Failure	C I S S A S	Potential Cause(s) / Mechanism(s) of Failure	O C C U R R E N C E	Current Preventive Controls	D I S C R I M I N A T O R Y	S E V E R I T Y	R P N	Recommended Actions	Responsibility & Target Completion Date	Action Priority						
													Actions Taken	S O L U T I O N	O C C U R R E N C E	D I S C R I M I N A T O R Y	R P N		
26	VERIFY O-RING PRESENT ON SENSOR	<p>IMPROPER TOOL CONFIGURATION</p> <p>FAILS TO DETECT MISSING O-RING</p> <p>FAILS TO DETECT O-RING PRESENT</p> <p>FAILS TO DETECT TWO O-RINGS PRESENT</p> <p>O-RING DAMAGED BY PROBE TIP</p>	<p>SENSOR RESISTANCE ERROR: SENSOR DAMAGED OUT OF RANGE</p> <p>IMPROPERLY MOUNTED O-RING RESULTING IN HIGH RESISTANCE ERROR - SENSOR FAILURE</p> <p>PART WILL BE UNLOADED INTO GOOD BIN AND COULD CAUSE LINK IN APPLICATION IF UNREMOVED IN SUBSEQUENT PARTITION</p> <p>PART WILL BE UNLOADED INTO BAD BIN RESULTING IN YIELD LOSS</p> <p>PART WILL BE UNLOADED INTO GOOD BIN POSSIBLY RESULTING IN HIGH RESISTANCE TORQUE AT PART PART</p> <p>LEAK IN APPLICATION</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>1</p> <p>2</p>	<p>SENSOR O-RING MAINTENANCE SET-UP ERROR</p> <p>PROBE MISMATCH, WORK OR IMPROPERLY MOUNTED</p> <p>PROBE CONTAMINATION PROBE BRUSH NOT ACTIVATED</p> <p>PROBE MISMATCH, WORK OR IMPROPERLY MOUNTED</p> <p>PROBE CONTAMINATION PART ALIGNMENT IN NEST</p> <p>PROBE MISMATCH, WORK OR IMPROPERLY MOUNTED</p> <p>PROBE CONTAMINATION PROBE BRUSH NOT ACTIVATED</p> <p>PROBE UNLOADED TO WORK OR IMPROPERLY MOUNTED</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>1</p> <p>2</p>	<p>SPEC. IN, AND HEIGHT PREVENTIVE 4000</p> <p>SENSOR DEVICE PRELOADING O-RING ON FINAL FUNCTION OR ALIGNMENT TOOL</p> <p>VISUAL INSPECTION PROBE PALS</p> <p>SENSOR DEVICE ALIGNMENT TOOL</p> <p>PROBE DESIGN PROVEN THROUGH DESIGN & PROCESS HISTORY PROBE PALS</p> <p>SENSOR DEVICE ALIGNMENT TOOL</p> <p>PROBE PALS</p> <p>ROULETTE VISUAL INSPECTION</p> <p>PROBE DESIGNED TO AVOID THREAD CONTACT</p> <p>PROBE PALS</p> <p>PROBE DESIGN PROVEN THROUGH DESIGN AND PROCESS HISTORY</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>1</p> <p>2</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>1</p> <p>2</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>1</p> <p>2</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>1</p> <p>2</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>1</p> <p>2</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>1</p> <p>2</p>	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>1</p> <p>2</p>					
27	90 DEGREE CRIMP SENSOR ASSEMBLY	UNDER CRIMP	ELIMINATE RESISTANCE DEGRADED	1	PRESSURE TOOL LOW	1	SPEC. IN, AND HEIGHT	1	1										

TI-NHTSA 019341

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT GELLERSWAIN REA

MODEL YEAR(S)/VEHICLE(S): 2017/77/88/87/8

DGDP/PLM/AMFG RESPONSIBILITY: KETH ROSS/OLD / JIM WATT / PERRY ALLEN

FMEA DATE (KRMG) 4/20/16
FMEA REVISION: 5

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	C I S Y	Potential Cause(s) or Mechanism(s) of Failure	O C C R	Current Process Controls	D E F E C T	R P N	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
												Action Taken	S	O	C	R		
24	OVER-PRESSURE SENSOR ASSEMBLY	OVER CRIMP	LEAK		TOOL PERFORMANCE AS DES. TOOL IN BR. DES. SECTION		PROCESS SPEC SET-UP P.M.A.C. AUDITS											
			CRIMP DIMENSION OUT OF SPEC. DIFFICULT PART. ASSEMBLY CRIMPED					100% FUNCTION TEST										
			CRIMP DIMENSION TOO LARGE CAUSING DIFFICULT FULCRUM	4	PRESSURE TOO HIGH				100% DIA. AND HEIGHT	1	5							
25	UNLOAD GOOD SENSOR ASSEMBLY	INEFFICIENT OP	DRIFT OVER LIFE OR CORRECTION CHANGE LEADING TO YIELD LOSS	4	IMPROPER DESIGN OF OP HEAD INCORRECT OP VECTORS IMPRECISE SEAL IN SHIRT TUB	1	100% FUNCTION TEST 100% PRESSURE LEVEL BASE	1	3									
			TABLE WONT INDEX PART NEXT CYCLE (EMPTY NEST FAILURE)	4	LOOSE/ MISALIGNED OR IMPROPERLY DESIGNED PICK-UP APPR	2			EMPTY NEST FROM INJECTION/PER PART	1	4							
			YIELD/TIME LOSS	4					JAN DESIGN FROM THROUGH DEBUB & PROCESS HISTORY	1	2							
26	PICK & UNLOAD ASSEMBLY NO CHANGE	THREAD DAMAGE	POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE	4	JAW WORK UNBALANCED OR IMPROPERLY DESIGNED	2	JAW FAIL JAWS DESIGNED TO RESIST THROUGH CONTACT DESIGN FROM THROUGH DEBUB & PROCESS HISTORY	2	15									
			TABLE WONT INDEX PART NEXT CYCLE (EMPTY NEST FAILURE)	2	LOOSE/ MISALIGNED OR IMPROPERLY DESIGNED PICK UP APPR	2			EMPTY NEST FROM INJECTION/PER PART JAN DESIGN FROM THROUGH DEBUB & PROCESS HISTORY	1	4							
			UPTIME LOSS	2					JAN FAIL JAW DESIGN TO RESIST THROUGH CONTACT DESIGN FROM THROUGH DEBUB & PROCESS HISTORY	1	2							
27	PICK & UNLOAD ASSEMBLY NO CHANGE	THREAD DAMAGE	POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE AT CUSTOMER.	4	JAW WORK UNBALANCED OR IMPROPERLY DESIGNED	2	JAW FAIL JAWS DESIGNED TO RESIST THROUGH CONTACT DESIGN FROM THROUGH DEBUB & PROCESS HISTORY	2	15									
			TABLE WONT INDEX PART NEXT CYCLE (EMPTY NEST FAILURE)	2	LOOSE/ MISALIGNED OR IMPROPERLY DESIGNED PICK UP APPR	2			EMPTY NEST FROM INJECTION/PER PART JAN DESIGN FROM THROUGH DEBUB & PROCESS HISTORY	1	4							
			UPTIME LOSS	2					JAN FAIL JAW DESIGN TO RESIST THROUGH CONTACT DESIGN FROM THROUGH DEBUB & PROCESS HISTORY	1	2							

TI-NHTSA 019342

PROCESS: AUTOMATED SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: MATT BELLERS/ANN REA

MODEL YEAR(S)/VEHICLE(S): 2005/77/80/87PS

DESIGN/QUAL/MFG RESPONSIBILITY: KEITH ROSHELLO / JIM WATT / PEGGY ALLEN

FMEA DATE (OF R3): 4/23/04
FMEA REVISION: 8

Item	Process Function/ Requirement	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C i r c u l a r i t y	Potential Cause(s)/ Mechanism(s) of Failure	D e t e c t i v e n e s	C u r r e n t P r o c e s C o n t r o l s	D e t e c t i v e n e s	E. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
													Action Taken	A v a i l a b l e	O c c u r r e n c e s	D e t e c t e d	R. F. N.	
31	CHECK EMPTY NEST	FAIL TO IDENTIFY OCCUPIED NEST	SENSOR ASSEMBLY LOADS INTO OCCUPIED NEST.	6		UNLOAD FAILURE		WELD MONITORS	1	3								

TI-NHTSA 019343

POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)

PROCESS: MANUAL SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R. GILDEA

PREPARED BY: MATT SFLEHNS

MODEL YEAR(S)/VEHICLE(S): ALL HYDRAULIC PS

DSG/MOULDA/IFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

FMEA DATE (ORIG): 4/29/98
FMEA REVISION: C

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C o n t r o l s	Potential Cause(s)/ Mechanism(s) of Failure	O c c u r r e n c e	Critical Process Controls	D e t e c t i v e	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
													Actions Taken	E v a l u e d	O c c u r r e n c e	D e t e c t e d	R. e p. a r t	
1	ASSEMBLE NEOPORT TO NEST	DOES NOT FEED	NO SUBSEQUENT ASSEMBLY PERMISSIBLE YIELD LOSS	5		OPERATOR ERROR	1	PREVENTIVE MAINT	1	5								
		DOES NOT NEST PROPERLY	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	5		OPERATOR ERROR	1	100% PRESENCE CHECK PREVENTATIVE MAINT	1	5								
2	VISUALLY CONFIRM NEOPORT STYLE	FAILS TO IDENTIFY WRONG NEOPORT	MIXED NEOPORT	5		SET-UP ERROR	1	100% PRESENCE CHECK OPERATOR TRAINING VISUAL AIDS	1	5								
		MISPLACED GASKET	LEAK	8		OPERATOR ERROR	1	100% FUNCTION TEST	1	8								
3	ASSEMBLE GASKET TO NEOPORT GLAND	NO GASKET	LEAK	8		OPERATOR ERROR	1	CYCLING AUDITS 100% FUNCTION TEST	1	9								
		MULTIPLE GASKET	LEAK	8		INCORRECT OPERATOR INTERVENTION	1	CYCLING AUDITS 100% FUNCTION TEST	1	9								
		FAILS TO IDENTIFY MISSING OR OUT OF PLACE GASKET	LEAK	8		OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS	1	9								
4	ASSEMBLE (2) SEALS	ONLY (1) SEAL LOADED	REDUCED DIAPHRAGM LIFE	8		OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS MACHINE SET-UP	1	8								
		NO SEAL LOADED	LEAK	8		OPERATOR ERROR	1	100% FUNCTION TEST	1	8								
		IMPROPERLY CUT SEAL	LEAK	8		OPERATOR ERROR	1	100% FUNCTION TEST	1	8								
		DIAPHRAGM LIFE FAILURE PREVENTS SUBSEQUENT ASSEMBLY YIELD LOSS	LEAK	8		OPERATOR ERROR	1	CYCLING AUDITS PREVENTIVE MAINT 100% FUNCTION TEST	1	9								
		MISPLACED SEAL	REDUCED DIAPHRAGM LIFE	8		OPERATOR ERROR	1	CYCLING AUDITS	1	9								
5		MORE THAN (2) SEALS LOADED	SHIFT IN SET POINTS	7		OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS	7	3								

TI-NHTSA 019344

PROCESS: MANUAL SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R. GILDEA

MODEL YEAR(S)/VEHICLE(S): ALL HYDRAULIC PS

DSGN/DUAL/MFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

(MEA DATE (ORIG.): 4/28/95
FMEA REVISION: C

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	C I S e v e	Potential Cause(s)/ Mechanism(s) of Failure	D o c u m e n t	Current Process Controls	D e t e c t i v e	B. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
												Actions Taken	E v e n t	O c c u r r e n c e	D e t e c t i v e	R. P. N.	
6	VISUALLY CONFIRM (2) SEALS PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE SEAL(S)	LEAK	6	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS	7	0								
7	WHERE APPLICABLE, ASSEMBLE (RND) SEAL FOR BRAKE APPLICATIONS	NO SEAL LOADED	LEAK	6	OPERATOR ERROR	1	100% FUNCTION TEST	1	0								
		IMPROPERLY CUT SEAL	LEAK DIAPHRAGM LIFE FAILURE PREVENTS SUBSEQUENT ASSEMBLY YIELD LOSS	6	OPERATOR ERROR	1	CONTINUITY PROBE 100% FUNCTION TEST CYCLING AUDITS	1	0								
		MISPLACED SEAL	LEAK REDUCED DIAPHRAGM LIFE	6	OPERATOR ERROR	1	PREVENTIVE MAINT 100% FUNCTION TEST CYCLING AUDITS	1	0								
		MORE THAN (1) SEAL LOADED	SHIFT IN SET POINTS	6	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS	1	0								
6	WHERE APPLICABLE, VISUALLY CONFIRM (2RD) SEAL PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE SEAL	LEAK	6	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS	1	0								
8	ASSEMBLE CONVERTER TO WASHER	MISSED CONVERTER	INOPERATIVE SWITCH	6	OPERATOR ERROR	3	OPERATOR TRAINING VISUAL AIDS 100% FUNCTION TEST	1	15								
		MISSED WASHER	INOPERATIVE DEVICE	6	OPERATOR ERROR	3	OPERATOR TRAINING VISUAL AIDS 100% FUNCTION TEST	1	27								
		UPSIDE DOWN WASHER	LEAK SHIFT IN DEVICE SET POINTS REDUCED NAPTON LIFE	6	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS 100% FUNCTION TEST	1	9								
					6	OPERATOR ERROR	1	CYCLING AUDITS	1	0							
10	ASSEMBLE WASHER/CONVERTER ASSEMBLY	DISLODMENT OF CONVERTER	INOPERATIVE DEVICE	6	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS 100% FUNCTION TEST CYCLING AUDITS	7	5								
		NON-CONCENTRIC PLACEMENT	MISPLACED NAPTON REDUCED NAPTON LIFE MISPLACED DISC INOPERATIVE DEVICE	6	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS 100% FUNCTION TEST 100% PRESENCE CHECK PREVENTIVE MAINT	1	0								

TI-NHTSA 019346

PROCESS: MANUAL SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R. GILDEA

FMEA DATE (ORIG): 4/29/98
FMEA REVISION: C

MODEL YEAR(S)/VEHICLE(S): ALL HYDRAULIC PS

DSO/QUAL/MFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

Item	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	C I E S	Potential Cause(s)/ Mechanism(s) of Failure	O C U R	Control Process Controls	D S I C	R. P. K.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results			
												Actions Taken	S v	O c	D i
11	VISUALLY CONFIRM WASHER CONVERTER ASSEMBLY PRESENCE	FAILS TO LOAD ASSEMBLY	NO SUBSEQUENT ASSEMBLY PERMISSIBLE YIELD LOSS	6	OPERATOR ERROR	1	CYCLING AUDITS OPERATOR TRAINING VISUAL AIDS	5	5						
		LOADS MULTIPLE ASSEMBLIES	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	6	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS	1	6						
		FAILS TO IDENTIFY MISSED OR OUT OF PLACE WASHER CONVERTER ASSEMBLY	INOPERATIVE DEVICE	9	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS	1	8						
12	ASSEMBLE SPACER	IMPLACED SPACER	REDUCED DISC LIFE	7	OPERATOR ERROR	1	YIELD MONITORING OPERATOR TRAINING VISUAL AIDS CYCLING AUDITS	1	7						
		NO SPACER	CONTINUITY FAILURE LOSS OF CALIBRATION DRIFT OVER LIFE REDUCED DISC LIFE	7	OPERATOR ERROR	1	TOOL DULL, BROKEN, OR OTHERWISE MALF	1	7						
		IMPROPERLY CUT SPACER TOO LARGE	REDUCED DISC LIFE LOSS OF CALIBRATION	7	OPERATOR ERROR	1	100% FUNCTION TEST CONTINUITY PROBE	1	7						
		IMPROPERLY CUT SPACER TOO SMALL	DRIFT OVER LIFE CONTINUITY FAILURE REDUCED DISC LIFE	7	OPERATOR ERROR	1	CYCLING AUDITS PREVENTIVE MAINT OPERATOR TRAINING VISUAL AIDS	1	7						
		2 OR MORE SPACERS LOADED	LOSS OF CALIBRATION DRIFT OVER LIFE CONTINUITY FAILURE	7	OPERATOR ERROR	1	TOOL DULL, BROKEN, OR OTHERWISE MALF	1	7						
		FAILS TO IDENTIFY MISSED OR OUT OF PLACE SPACER	REDUCED DISC LIFE	7	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS	1	7						
		13	VISUALLY CONFIRM SPACER PRESENCE	FAILS TO IDENTIFY MISSED OR OUT OF PLACE SPACER	REDUCED DISC LIFE	7	OPERATOR ERROR	1	OPERATOR TRAINING VISUAL AIDS	1	7				

TI-NHTSA 019346

PROCESS: MANUAL SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R. GALDEA

MODEL YEAR(S)/VEHICLE(S): ALL HYDRAULIC PS

DSGN/DUAL MFG RESPONSIBILITY: SEAN MULLIGAN, JM WATT, MARY MILKEY

FMEA DATE (ORIG.) 4/28/98
FMEA REVISION: C

Item	Process Function/Requirement	Potential Failure Mode	Potential Effect(s) of Failure	S	C	I	Potential Cause(s)/Mechanism(s) of Failure	D	C	Critical Process Controls	D	R	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
															Severity	Occurrence	Detectability	R.P.N.	Actions Taken
14	ASSEMBLE DISC	MISPLACED DISC (TRAPPED)	CONTINUITY FAILURE	5			OPERATOR ERROR	3		100% FUNCTION TEST	1	15							
		UPSIDE DOWN DISC	CONTINUITY FAILURE	5			OPERATOR ERROR	3		OPERATOR TRAINING VISUAL AIDS 100% FUNCTION TEST	1	15							
		MULTIPLE DISC	CONTINUITY FAILURE ACTUATION FAILURE	8			OPERATOR ERROR	3		OPERATOR TRAINING VISUAL AIDS 100% FUNCTION TEST	1	15							
		WRONG DISC	LOSS OF CALIBRATION	5			MISSING	1		OPERATOR TRAINING VISUAL AIDS 100% FUNCTION TEST DISC SUPS OPERATOR TRAINING VISUAL AIDS	1	5							
		MISSING DISC	CONTINUITY FAILURE	5			OPERATOR ERROR	1		OPERATOR TRAINING VISUAL AIDS 100% FUNCTION TEST	1	5							
15	VISUALLY CONFIRM DISC PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE DISC	INOPERATIVE DEVICE	7			OPERATOR ERROR	1		OPERATOR TRAINING VISUAL AIDS	1	7							
16	ASSEMBLE CUP	MISSING CUP	NO DEVICE OPERATION	5			OPERATOR ERROR	1		100% FUNCTION CHECK	1	5							
		OBSCUREMENT OF INTERNAL COMPONENTS	INOPERATIVE DEVICE LEAK	9			OPERATOR ERROR	1		OPERATOR TRAINING VISUAL AIDS 100% FUNCTION CHECK	1	9							
		MULTIPLE CUPS LOADED	NO SUBSEQUENT ASSEMBLY PERMISSIBLE	8			OPERATOR ERROR	1		OPERATOR TRAINING VISUAL AIDS	1	5							
17	VISUALLY CONFIRM CUP PRESENCE	FAILS TO IDENTIFY MISSING OR OUT OF PLACE CUP	INOPERATIVE DEVICE	7			OPERATOR ERROR	1		OPERATOR TRAINING VISUAL AIDS	1	7							
18	LOAD SENSOR ASSEMBLY TO SENSOR CRAMPER	OBSCURED INTERNAL COMPONENTS	LEAK CONTINUITY FAILURE	9			OPERATOR ERROR	1		100% FUNCTION CHECK OPERATOR TRAINING VISUAL AIDS	1	9							

TI-NHTSA 019347

PROCESS: MANUAL SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R. GALDEA

MODEL YEAR(S)/VEHICLE(S): ALL HYDRAULIC PS

DSGN/QUAL/MFG RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

FMEA DATE (ORIG.) 4/29/95
FMEA REVISION: C

ID#	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C l a s s i f i c a t i o n	Potential Cause(s)/ Mechanism(s) of Failure	O c c u r r e n c e	Current Process Controls	D e t e c t i o n	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
													Actions Taken	S e c u r e	O c c u r e n c e	D e t e c t i o n	R. P. N.	
19	UNLOAD BAD PARTS SENSOR ASSEMBLIES	FAILS TO UNLOAD	HEXPORT LOADED ONTO OCCUPIED NEST	5	1	UNLOAD FAILURE	1	EMPTY NEST PROBE	1	5								
20	CHECK EMPTY NEST	FAILS TO IDENTIFY OCCUPIED NEST	HEXPORT LOADED ONTO OCCUPIED NEST	5	1	UNLOAD FAILURE	1	YIELD MONITORING	1	5								
21	WHERE APPLICABLE PLACE EXTERNAL O-RING ON HEXPORT	FAILS TO PLACE O-RING ON PART	IF UNDETECTED IN SUBSEQUENT OPERATION COULD CAUSE LEAK IN APPLICATION	5	3	OPERATOR ERROR	3	100% O-RING CHECK ON FUNCTION TESTER UNLOAD	1	10	ADD O-RING CHECK TO FINAL FUNCTION TEST AS A REDUNDANT CHK	MFG ENGINEERING	COMPLETE 12/93	5	3	1	10	
		PLACES TWO O-RINGS ON ONE PART	HIGH ASSEMBLY TORQUE	4	2	OPERATOR ERROR	2	OPERATOR TRAINING VISUAL AIDS	3	24								
		POTENTIAL INABILITY TO FULLY ASSEMBLE IN APPLICATION	5	2	100% VISUAL INSPECTION AT PRESSURE TEST AND PACKING OPERATOR TRAINING VISUAL AIDS	3	30											
		O-RING NOT LOCATED PROPERLY ON THE ASBY	MAY RESULT IN HIGH INSTALLATION TORQUE	4	2	OPERATOR ERROR	2	OPERATOR TRAINING VISUAL AIDS	2	10								
22	45 DEGREE CRIMP SENSOR ASSEMBLY	UNDER CRIMP	LOSS OF SPC CONTROL OF DIAMETER OR HEIGHT POTENTIAL DIAPHRAGM LIFE PROBLEM	5	1	PRESSURE TOO LOW TOOL WEAR/BREAKAGE	1	SPC DIA AND HEIGHT PROCESS SPEC SET-UP PREVENTIVE MAINT 100% FUNCTION TEST CYCLING AUDITS	1	5								
		OVER CRIMP	CRIMP DIAMETER TOO LARGE CAUSING DIFFICULT FINAL ASBY COMPONENT DAMAGE POTENTIAL DIAPHRAGM LIFE PROBLEM	5	1	PRESSURE TOO HIGH	1	SPC DIA AND HEIGHT PROCESS SPEC SET-UP PREVENTIVE MAINT	1	5								
		IMPROPER CRIMP	COMPONENT DAMAGE CRIMP DIAMETER AND HEIGHT OUT OF SPEC	5	3	OPERATOR SET-UP 90 DEG TOOL IN 45 DEG STATION W/CRIMP DIE GEOMETRY	3	100% FUNCTION TEST CYCLING AUDITS SPC DIA AND HEIGHT PROCESS SPEC SET-UP PREVENTIVE MAINT	1	10								
		FAILS TO CRIMP	COMPONENT DAMAGE AT 90 DEGREE CRIMP CRIMP DIAMETER AND HEIGHT OUT OF SPEC	5	1	MACHINE MALFUNCTION SET-UP ERROR	1	100% FUNCTION TEST CYCLING AUDITS PREVENTIVE MAINT SET-UP SPEC	1	5								

TI-NHTSA 019348

PROCESS: MANUAL SENSOR ASSEMBLY

PROCESS RESPONSIBILITY: R. GK DEA

FMEA DATE (ORIG.) 4/29/98
FMEA REVISION: C

MODEL YEAR(S)/VEHICLE(S): ALL HYDRAULIC PS

DESIGN/QUALITY RESPONSIBILITY: SEAN MULLIGAN, JIM WATT, MARY MILKEY

REQ	Process Function/ Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C l a s s i f i c a t i o n	Potential Cause(s) Mechanism(s) of Failure	O c c u r r e n c e	Current Process Controls	D e t e c t i v e	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
													Actions Taken	E v e n t	C o u n t	D e l e t e	R. P. M.	
23	90 DEGREE CRIMP SENSOR ASSEMBLY	IMPROPER TOOL REGISTRATION UNDER CRIMP OVER CRIMP	MAJOR REGISTRATION ERROR - SENSOR DIAMETER OUT OF ROUND - SENSOR HEIGHT UNEVEN MAJOR REGISTRATION ERROR - COMPONENT BURST RESISTANCE DEGRADED LEAK CRIMP HEIGHT OUT OF SPEC DIFFICULT FINAL CRIMPING CRIMP DIAMETER TOO LARGE CAUSING DIFFICULT FINAL ASSEMBLY	5 5 5	1 1 1	INDEXER ERROR MAINTENANCE SET-UP ERROR PRESSURE TOO LOW WEAR/BREAKAGE 45 DEG TOOL IN 90 DEG STATION PRESSURE TOO HIGH	1 1 1	SPC DIA AND HEIGHT PREVENTIVE MAINT SPC DIA AND HEIGHT PROCESS SPEC SET-UP P M Q C AUDITS HIGH FUNCTION TEST CYCLING AUDITS SPC DIA AND HEIGHT PROCESS SPEC SET-UP PREVENTIVE MAINT 100% FUNCTION TEST CYCLING AUDITS	1 1 1	5 5 5								
24	OVER-PRESSURE SENSOR ASSEMBLY	INSUFFICIENT OP	DRIFT OVER LIFE OR CALIBRATION CHANGE LEADING TO YIELD LOSS	3	1	IMPROPER DESIGN OF OP HEAD INCORRECT OP SETTINGS INADEQUATE SEAL	1	100% FUNCTION TEST MIN PRESSURE LEVEL GAGE	1	3								
25	UNLOAD GOOD SENSOR ASSEMBLY	FAIL TO UNLOAD GOOD SENSOR THREAD DAMAGE	TABLE WONT INDEX PAST NEXT CYCLE (EMPTY NEST FAILURE) YIELD/UPTIME LOSS POSSIBLY RESULTING IN HIGH INSTALLATION TORQUE	3 2 4	2 1 2	LOOSE/ MISADJUSTED OR IMPROPERLY DESIGNED PICKUP LAMP JAWS WORN, MISALIGNED OR IMPROPERLY DESIGNED	2 1 2	EMPTY NEST PROBE NEST/CRIMPER PARTS JAW DESIGN PROVEN THROUGH DE-BUG & PROCESS HISTORY JAW P M'S JAWS DESIGNED TO MINIMIZE THREAD CONTACT DESIGN PROVEN THROUGH DE-BUG & PROCESS HISTORY	1 1 2	4 3 18								
26	CHECK EMPTY NEST	FAIL TO IDENTIFY OCCUPIED NEST	SENSOR ASSEMBLY LOADED ONTO OCCUPIED NEST	5	1	UNLOAD FAILURE	1	YIELD MONITORING	1	5								

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POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(DESIGN FMEA)

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System _____
Subsystem _____
X Component Pressure Switch

Design Responsibility Program Switch Group

Model Year (of Vehicle(s)) 1993

Key Date 1993

Prepared By C. Wagner

Core Team: Design Engineers, Manufacturing Engineers, Manufacturing, Quality

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C o n s e q u e n c e	Potential Cause(s) / Mechanism(s) of Failure	O c c u r r e n c e	Current Design Controls	D e t e c t i o n	R e p a r a b l e	Recommended Action(s)	Responsibility & Target Completion Date	Action Results						
												S e v e r i t y	O c c u r r e n c e	D e t e c t i o n	R e p a r a b l e	S e v e r i t y		
REPORT (2880)																		
Provides a hydraulic sealing surface per SAE J512	Fails to seal	Leakage of brake fluid	9	FF	Incorrect surface finish specification. Incorrect material specification. Incorrectly specified geometry. Excessive pressure	1	Case-check of part dimensions vs. SAE standard. Compressive operation of design at tolerance limits. Burst testing to customer specified limits.	1	R									
Provides initial thread for installation into mating part	Fails to properly install in mating part.	Foreign threads in mating part during installation. Does not allow installation.	7	FF	Threads specified improperly. Threads not gauged per ANSI spec's. Flaring failure.	3	Case-check of applicable SAE and ANSI standards.	3	43									
	Approximately installs, but fails to properly seat and seal.	Blocks fluid leakage.	8	FF	Threads specified improperly. Threads not gauge per ANSI spec's. Flaring failure.	1	Case-check of applicable SAE and ANSI standards.	3	71									
Provides low leakage for O/NF switch	Increased low side.	Damage to low side wiring resulting. O/NF switch does not fit.	6		How fixtures improperly specified for established SAE/ANSI spec's	1	Case-check of applicable SAE and ANSI standards.	1	6									
Provides fluid passage in pressure-sensing elements	Fluid passage is too small.	Electrical signal from switch is delayed or, pressure signal inoperable at very low temp. Subject to blockage by foreign matter.	7	FF	Inadequate size of fluid passage specified.	1	Review of Ford standard practices.	1	7									
	Fluid passage is too large.	Flexing thin wall section causes leakage during installation during undrained service operation.	7	FF	Fluid passage specified excessively large.	1	Target testing	1	7									

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POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(DESIGN FMEA)

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System
Subsystem
Component Pressure Switch

Design Responsibility Pressure Switch Group

Model Year(s)/Vehicle(s) Year(s)

Key Date 1993

Prepared By C. Wagner

Core Team Design Engineering, Manufacturing Engineering, Manufacturing, Quality

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	S	C	Potential Cause(s) Mechanism(s) of Failure	D	Current Design Controls	O	P	Recommended Action(s)	Responsibility & Target Completion Date	Action Required					
												Severity	Occurrence	Detection	Retention	Prevention	
HERSPORT (38900) Provides relief for column jacket	Flange to not extend jacket properly.	Leakage of brake fluid.	9	1	Clear dimensions improperly specified Surface finish improperly specified Clear geometry improperly designed	1	Cross-check with recommendations of jacket supplier. Compressive testing.	1	9								
Provides flange which interfaces with other components in lower pressure section structure	Flange fails to mate properly with other components of pressure cover	Oil, too large results in assembly difficulty. Distorted too great results in bad component alignment. Flange too thick results in poor clamp. Flange too thin results in reduced heat capacity. Improper edge chamfer results in stress concentration which reduces clamp.	9	1	Improper or incomplete specification of dimensions and tolerances	1	Engineer's draft analyst to determine proper thickness for required strength. Tolimex stack-up analysis. Print review.	1	9								
	Material too soft at neck.	Insufficient burst capacity. Distortion during installation or subsequent service. Threads prone to damage, leads to assembly difficulties.	9	1	Improper material selection	1	Compressive evaluation of physical properties	1	9								
	Material creeps	Lossing of clamp leads to leakage.	9	1	Improper material selection	1	Review of material properties.	1	9								
	Material degrades in presence of working fluid	Leakage	9	1	Improper material selection	1	Cross-check with similar products.	1	9								
	Inadequate environmental protection	Long-term attack causes weakening of key parts which leads to leakage or cracking	9	1	Improper or insufficient plating specification	1	Comprehensive environmental testing.	3	27								

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POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
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System _____
Subsystem _____
X Component Pressure Switch

Design Responsibility Pressure Switch Group

Original (total) Date 20 Dec 93

Model Year(s)/Vehicle(s) Various

Key Date 1993

Prepared By C. Wagner

Core Team Design Engineering, Manufacturing Engineering, Manufacturing Quality

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r i t y	C o n s e q u e n c e	Potential Cause(s) / Mechanism(s) of Failure	D e t e r m i n e d	C u r r e n t D e s i g n C o n t r o l s	D e t e r m i n e d	R i s k P o t e n t i a l	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
												Actions Taken	S e v e r i t y	O c c u r r e n c e	D e t e r m i n e d	R i s k P o t e n t i a l	
REPORT (36900) Provides range which interfaces with other components in area pressure-sender circuitry		Cosmetic problems.	5			1	Position of plating position.	3	27								

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