

Ford Motor Company

James P. Vondale, Director
Automotive Safety Office
Environmental & Safety Engineering

October 8, 2003

Ms. Kathleen C. DeMeter, Director
Office of Defects Investigation Safety Assurance
National Highway Traffic Safety Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

Dear Ms. DeMeter:

Subject: EA02-025:NVS-213bby

In the process of preparing a request for confidentiality for our response to Request 14 of your letter dated July 30, 2003 requesting information concerning the speed control deactivation switch on certain 1993-1995 model year Lincoln Town Car, Mercury Grand Marquis, and Ford Crown Victoria vehicles, we determined that a document provided to Ford by Texas Instruments does not qualify for confidential treatment. Accordingly, we are submitting a copy of the document as a supplement to Appendix I of our September 26, 2003 response. Two copies of the document are provided.

The confidential document that comprised Appendix I of Ford's September 26, 2003 response was provided to the Office of the Chief Counsel with our October 6, 2003 letter.

Sincerely,


James P. Vondale

Attachment

OFFICE OF DEFECTS
INVESTIGATION

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NVS-210



I

System
Subsystem
 Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
(DESIGN FMEA)

Design Responsibility Pressure Switch Group

Document Number 503756
Revision Level C
Revision Date 4-Nov-88
Original (Initial) Date 20-Dec-83

Model Year(s)/Vehicle(s) Various

Key Date 1983

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	O c c u r r e n c e	Current Design Controls	D e t e r m i n e d	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results			
												Actions Taken	S a v e	O c c u r	D e l a y
BASE (PS) (48515) Provides a system of slots which guide, locate, and physically support terminals.	Fails to properly locate terminals.	Terminals out of position.	3		Incorrect dimensions and/or tolerances specified between slots and terminals. Inadequate staking design concept.	1	Comparison with dimensions of similar 57PS product.	1	3						
	Fails to properly guide the terminals (difficult insertion).	Device will not assemble properly; yield loss in mfg.	5		Incorrect dimensions and/or tolerances specified between slots and terminals. Insufficient lead-in.	1	Review with assembly equipment designers to determine correct clearances and lead in.	1	5						
	Fails to properly support the terminals.	Terminals move relative to each other or the base (such as under physical or thermal loadings).	5		Incorrect material specified. Excessively large dimensions specified on terminal slots.	1	Comparison with design of similar 57PS product.	1	5						
Provides features to enhance the effectiveness of terminal staking.	Terminal staking is insufficient.	Loose terminals. Shift/fluctuation in switch subpoints	5		Incomplete understanding of design of staking features.	1	Comparison with design of similar 57PS product. Staking evaluations.	1	5						
Provides a dielectric medium for the electrical elements.	Current leakage between terminals or terminal-to-housing.	Improper switching action.	5		Low insulation resistance. Incorrect material specified.	1	Comparison with design of similar 57PS product. Material evaluation.	1	5						

System
Subsystem
 Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
(DETAILED FMEA)

Design Responsibility Pressure Switch Group

Document Number 503788

Revision Level C

Revision Date 4-Nov-86

Original (Initial) Date 20-Dec-83

Model Year(s)/Vehicle(s) Various

Key Date 1983

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 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 Design Controls	D e t e c t i o n	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Plans				
												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 e p a r t u r e
BASE [PS] (48515) Provides physical isolation of the switch components.	Fails to physically isolate; ingress of matter from external environment.	High current leakage. High millivolt drop. Erratic or inoperative switch action.	5		Incorrect material specified. Poor molded part design (i.e. wall sections too thin, etc.	1	Comparison with design of similar 57PS product. Design review with molder. Mold flow analysis.	1	5							
Provides a reference surface which locates the electrical elements relative to the pressure sensor.	Fails to properly locate the switch elements relative to the pressure sensor.	Shift in setpoints. Erratic or inoperative switch.	5		Warpage of the reference surface. Intrusion of other design elements into the plane of the reference surface. Excessive clearance specified between mating features.	1	Specification of flatness on print. Raise this surface to prevent intrusion of other elements. Tolerances stackup analysis.	1	5							
Provides a flange to compress the internal environmental seal	Improper compression of internal environmental seal.	Inadequate compression may lead to ingress of matter. Excessive compression may prevent switch from seating correctly to sensor assembly.	7		Incorrect seal gland design. Warpage.	1	Review of standard gland design practice. Comparison to similar products. Flatness specified on print.	1	7							

System
 Subsystem
 Component Process Switch

FAILURE MODE AND EFFECTS ANALYSIS (D. FMEA)

Design Responsibility Process Switch Group

Document Number 503788
 Revision Level C
 Revision Date 4-Nov-86

Original (Initial) Date 20-Dec-83

Model Year(s)/Vehicle(s)/Version _____

Key Date 1983

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	P o t e n t i a l C a u s e (s) 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 R a t e	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 c t a b i l i t y	R. P. M.	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				
												A c t i o n s T a k e n	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. M.
BASE (PS) (48G15) Provides interference tabs to locate and temporarily hold the base in relation to the crimp ring prior to crimp.	Fails to properly locate/hold prior to crimp.	Too large may cause difficulty in assembly, base cracking, or prevent switch from seating to contact. Too small provides no effect; possibly affecting subsequent assembly operations.	5		Design of interference tabs is insufficient.	1	Calculation and experimentation to determine limits of size. Tolerance stackup analysis.	1	5							
Provides a flange surface for the crimp ring.	Fails to provide adequate geometry for crimp ring.	Base loose or insufficient torque withstand. Base cracked.	7		Incorrect design of flange for crimp ring.	1	Comparison with design of similar 57PS product.	1	7							
Provides lock tabs, toys, and features which mate to electrical connector.	Mating electrical connector doesn't fit properly.	Connector difficult to install. Connector falls off.	6		Connector geometry improperly specified.	1	Review of dimensions relative to mating connector prints.	1	6							
Provides compression to environmental seal in connector.	Mating connector seal is not properly compressed.	Ingress of matter into switch cavity. Connector difficult to install and/or falls off.	7		Connector geometry and/or surface condition/finish is improperly specified. Incorrect material specified.	1	Review of dimensions relative to mating connector prints. Material evaluation.	1	7							

System _____
 Subsystem _____
 X Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
 (Design FMEA)

Document Number 503789
 Revision Level D
 Revision Date 28-May-88

Design Responsibility Pressure Switch Group

Original (Initial) Date 20-Dec-83

Model Year(s)/Vehicle(s) Various

Key Date 1983

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	O	Current Design Controls	D	R.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												e	v	o	c	e
STATIONARY TERMINAL (36688 & 36726) Provides a brass blade for interconnection.	Poor interconnection.	Device appears open-circuit when connector installed.	7		Contamination of brass blade. Material specified too thin.	1	Review design and dimensions of mating connector to ensure proper interference and wiping action.	1	7							
	Blade geometry improper.	Difficult to install mating connector.	5		Lead-in chamfers on terminal are insufficiently specified. Material specified too thick.	1	Review design and dimensions of mating connector. Comparison with design of similar 57PS product.	1	5							
Provides a silver inlay surface for electrical contact	Fails to provide adequate electrical contact.	Device appears open-circuited. Intermittent continuity. High millivolt drop.	7		Incorrect contact material specified. Contamination. Silver layer specified too thin.	1	Review of TI proprietary and general contact design info. Eliminate paths for ingress of contamination.	1	7							
	Excessive loss of contact height dimension (mechanical loads).	Shift in set points over life.	7		Silver layer specified too thick.	1	Review of TI proprietary and general contact design info. Life Testing.	1	7							
	Erosion of contacts due to electrical loads.	Shift in setpoints over life. Intermittent or no continuity.	7		Incorrect material specified for particular electrical loading.	1	Review of TI proprietary and general contact design info. Review and testing with actual electrical loads.	1	7							

ES02-025-A 1984B

System _____
 Subsystem _____
 X Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
 (Derivative FMEA)

Design Responsibility Pressure Switch Group

Document Number 503789
 Revision Level D
 Revision Date 28-May-98
 Original (Initial) Date 20-Dec-83

Model Year(s)/Vehicle(s) Various

Key Date 1983

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	C l a s s	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	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results			
												Actions Taken	S e v	O c c	D e t e c t
STATIONARY TERMINAL (36888 & 36726) Provides feature for device calibration.	Poor calibration	Mfg. yield loss. Shift in setpoints over life.	5		Design is excessively stiff. Design has excessive spring back. Material hardness is incorrectly specified. Initial position requires excess deformation to calibrate. Design has inadequate strength to maintain calibration over life.	1	Mechanical (and/or FEA) analysis Force deflection springback testing Testing with actual production calibration equipment.	1	4						
Provides features to ensure adequate staking into base.	Terminal is inadequately staked into base.	Loose terminals. Shift/fluctuation in switch setpoints.	7		Incomplete understanding of design of staking features.	1	Comparison of design with similar 57PS product. Staking evaluations.	1	7						
Provides features which mate with slots in base for location of terminal.	Fails to properly locate terminal.	Terminals out of position.	3		Incorrect dimensions and/or tolerances specified between slots and terminals. Inadequate staking design concept.	3	Comparison of design with similar 57PS product.	1	8						
Provides electrical path from silver alloy contact to mating connector.	Fails to provide adequate conductivity.	High resistance shown as high millivolt drop.	5		Incorrect material specified. Inadequate cross-section area.	1	Calculations of resistance Testing	1	5						

System
 Subsystem
 X Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
 (D. J. ...)

Document Number 503780
 Revision Level C
 Revision Date 4-Nov-96

Design Responsibility Pressure Switch Group

Original (Initial) Date 20-Dec-83

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 e	C l a s s	Potential Cause(s) Mechanism(s) of Failure	O c c u r r e n c e	Current Design Controls	D e t e r m i n e d	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 r m i n e d	R. P. N.
MOVABLE TERMINAL (30007) Provides a brass blade for interconnection.	Poor interconnection.	Device appears open- circuit w/mating connector installed.	7		Material specified too thin.	1	Review design and dimensions of mating connector to ensure proper interference and wiping action.	1	7							
	Blade geometry improper.	Difficult to install mating connector.	5		Lead-in chamfers on terminal are insufficiently specified. Material specified too thick.	1	Review design and dimensions of mating connector. Comparison with design of similar 57PS product.	1	5							
Provides a mounting point for the spring via rivet.	Fails to allow proper spring rivet installation.	Shift/fluctuation in switch setpoints (loose rivet). Inoperative device (rivet falls out completely) Mfg. yield loss.	7		Rivet hole size is specified incorrectly. Rivet hole position is specified incorrectly. Support surface for spring is incorrectly specified. Choice of fastener style incorrect.	1	Comparison with design of similar products. Check with recommendations of rivet manufacturer. Testing.	1	7							
Provides features to ensure adequate staking into base.	Terminal is inadequately staked into base.	Loose terminals. Shift/fluctuation in switch setpoints.	7		Incomplete understanding of design of staking features.	1	Comparison of design with similar 57PS product. Staking evaluations.	1	7							

ENG-925-R 1995

System
Subsystem
X Component Pressure Switch

FAILURE MODE EFFECTS ANALYSIS
(D... FMEA)

Design Responsibility Pressure Switch Group

Document Number 503780
Revision Level C
Revision Date 4-Nov-96

Original (Initial) Date 20-Dec-89

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

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 l a s s	Potential Cause(s) Mechanism(s) of Failure	O c c u r r e n c e	Current Design Controls	D e t e r m i n e d	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 r m i n e d
MOVABLE TERMINAL (36847) Provides features which mate with slots in base for location of terminal.	Fails to properly locate terminal.	Terminals out of position.	3		Incorrect dimensions and/or tolerances specified between slots and terminals. Inadequate staking design concept.	3	Comparison of design with similar 57PS product.	1	3						
Provides electrical path from movable contact via spring to mating connector.	Fails to provide adequate conductivity.	High resistance shown as high millivolt drop.	5		Incorrect material specified. Inadequate cross-section area.	1	Calculations of resistance Testing	1	5						

System
Subsystem
X Component Pressure Switch

FAILURE MODE EFFECTS ANALYSIS
(D. of FMEA)

Design Responsibility Pressure Switch Group

Document Number 503782
Revision Level C
Revision Date 4-Nov-98

Original (Initial) Date 20-Dec-98

Model Year(s)/Vehicle(s) Various

Key Date 1993

Prepared By C. Wegner

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	P o t e n t i a l C a u s e(s) 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 D e s i g n C o n t r o l s	D e t e r i n i s t i c	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 r i n i s t i c	R. P. N.
SPRING (30008) Provides contact force.	Low contact force.	High millivolt drop across contacts.	5		Incorrect geometry specified. Incorrect material specified.	3	Beam deflection equations. Force/deflection testing.	1	15							
	High contact force.	Shift in setpoints. Disc cracking over life.	7		Incorrect geometry specified. Incorrect material specified.	3	Beam deflection equations. Force/deflection testing.	1	21							
Provides electrical path from movable contact to movable terminal.	Fails to provide adequate conductivity.	High resistance shown as high millivolt drop.	5		Incorrect material specified. Inadequate cross-section area.	1	Calculations of resistance using $R = (\rho \cdot l) / A$ Testing	1	5							
Provides feature to interface with transfer pin.	Fails to interface correctly with transfer pin.	Spring failure over life. Shift in setpoints over life. Sticking transfer pin causes intermittent operation.	7		Inadequate height of feature specified. Inadequate shape of feature specified. Improper position of feature specified.	1	Comparison of design with similar product. Dimension and tolerance stackup analysis. Actual measurement. Testing	1	7							
Provides feature for attachment to movable contact.	Fails to provide adequate mounting for movable contact.	Intermittent or erratic operation. Open circuit.	6		Hole size/position incorrectly specified. Fit/finish inadequate.	1	Rivet mtg. recommendations. Comparison of design with similar product. Testing.	1	6							
Loads movable contact.	Fails to adequately locate movable contact relative to stationary contact.	High millivolt drop over life. Excessive contact erosion over life.	7		Spring geometry incorrectly specified.	1	Dimension and tolerance stackup analysis. Testing	1	7							

System
 Subsystem
 X Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
 (D. J. FMEA)

Document Number 503782
 Revision Level C
 Revision Date 4-Nov-85

Design Responsibility Pressure Switch Group

Original (initial) Date 20-Dec-83

Model Year(s)/Vehicle(s) Variants _____

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 e	C l a s s	Potential Cause(s) Mechanism(s) of Failure	O c c u r r e n c e	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. 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 r m i n e d	R i s k P. N.
SPRING (36009) Provides feature for attachment to movable terminal.	Fails to properly attach to movable terminal.	Erratic or intermittent operation. Shift in setpoints. Open or short circuit.	6		Rivet hole size or position incorrectly specified. Rivets inadequate. Choice of fastener style incorrect.	1	Rivet mfg. recommendations. Comparison of design with similar product. Testing.	1	6							
Allows disc overtravel.	Fails to allow disc overtravel.	Shift in setpoints. Disc cracking. Device inoperative at assembly. Poor calibration.	5		Incorrect geometry specified. Incorrect material specified.	3	Beam deflection equations. Force/deflection testing.	1	18							
Provides force to open contacts.	Inadequate force to open contacts	Inefficient resistance to mechanical vibration. Short circuit.	6		Incorrect geometry specified. Incorrect material specified.	1	Beam deflection equations. Force/deflection testing.	1	6							
	Excessive force to open contacts.	Shift in setpoints. Disc cracking. Device inoperative at assembly. Poor calibration.	7		Incorrect geometry specified. Incorrect material specified.	3	Beam deflection equations. Force/deflection testing.	1	21							

FAILURE MODE EFFECTS ANALYSIS
(Design FMEA)

Document Number 503784
Revision Level C
Revision Date 4-Nov-95

System _____
Subsystem _____
X Component Pressure Switch

Design Responsibility Pressure Switch Group

Original (Initial) Date 20-Dec-83

Model Year(s)/Vehicle(s)/Version _____

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	O c c u r r e n c e	Current Design Controls	D e t e c t e d	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Action Taken	S e v	O c c	D e t	R. P. N.
GASKET (74353) Provides fluid seal between support and diaphragm.	Fails to provide adequate fluid seal.	Brake fluid leakage.	9		Insufficient compression specified. Very excessive compression specified, leading to displacement from gland. Incorrect ID and/or OD leading to displacement from gland. Incorrect cross-section shape specified. Incorrect material specified, fluid incompatibility. Incorrect design of sealing mechanism.	1	Review of general seal design principles. Manufacturer's recommendations. Burst, impulse, and thermal cycle tests. Comparison with design of similar products.	1	9							

System
Subsystem
X Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
(D. A. FMEA)

Document Number 503795
Revision Level G
Revision Date 4-Nov-98

Design Responsibility Pressure Switch Group

Original (Initial) Date 20-Dec-83

Model Year(s)/Vehicle(s) Various

Key Date 1993

Prepared By G. 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 s	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 a b i l i t y	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.
CUP (27713 OR 27290) Provides crimpable area which holds pressure sensor together.	Fails to provide a suitable geometry for crimp.	Leakage Low burst	5		Crimp wall thickness incorrectly specified. Crimp wall height incorrectly specified. Incorrect material specified.	1	Burst and impulse testing. Comparison of design with similar product.	1	8							
Locates hexport, diaphragm, and washer.	Fails to correctly locate hexport, diaphragm, or washer.	Difficult assembly.	5		I.D. specified incorrectly.	1	Tolerance stackup analysis.	1	5							
Provides support and location for disc.	Fails to support and locate the disc/corverter correctly.	Shift in endpoints. Erratic operation. Stuck open at assembly. Reduced disc life.	7		Incorrect disc envelope specified. Bump true-position incorrectly specified. Poor surface condition of bump, no control specified.	1	Tolerance stackup analysis. Impulse testing.	1	7							
Provides guide for transfer pin.	Fails to guide transfer pin correctly.	Erratic operation. Device stuck short-circuit.	7		Pin guide geometry is incorrectly specified.	1	Tolerance stackup analysis.	1	7							
Provides portion of environmental seal gland.	Fails to allow a proper environmental seal.	Ingress of matter. Switch does not seal correctly to cup.	7		Surface condition required for good seal not understood or not correctly specified. Geometry incorrectly specified.	1	Environmental testing. Switch cavity pressurization testing. Review of standard gland design rules.	1	7							

System _____
 Subsystem _____
 X Component Pressure Switch

FAILURE MODE EFFECTS ANALYSIS
 (DESIGN FMEA)

Document Number 503795
 Revision Level C
 Revision Date 4-Nov-88
 Original (Initial) Date 20-Dec-83

Design Responsibility Pressure Switch Group

Model Year(s)/Vehicle(s) Various

Key Date 1983

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	C l a s s	Potential Cause(s) Mechanism(s) of Failure	O c c u r	Current Design Controls	D e t e r m i n e	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Actions Taken	S e v	C l a s s	D e t e r m i n e	R. P. N.
CUP (27713 OR 27288) Provides surface to interface with base/switch assembly.	Fails to properly locate relative to switch.	Shift in setpoints. Erratic or inoperative switch.	5		Incorrect geometry of mating surface specified.	1	Tolerance stackup analysis. Cross-section etched devices for inspection of interface.	1	5							
(Post-sensor-crimp) provides geometry for final assembly with crimp ring.	Fails to allow proper final assembly with crimp ring.	Erratic operation. Ingress of matter. Cracked base.	7		Post-crimp geometry is not controlled per design intent. Cup diameter incorrectly specified.	1	Tolerance stackup analysis. Beam torque testing.	1	7							

NO MENTION
 OF RESINE
 FLUID OUT
 OF BASE

ERR-025-A 18896

System _____
 Subsystem _____
 X Component Pressure Switch

FALLURE MODE EFFECTS ANALYSIS
 (DEVELOPERS/MEA)

Document Number 503767
 Revision Level G
 Revision Date 4-Nov-88

Design Responsibility Pressure Switch Group

Original (initial) Date 20-Dec-83

Model Year(s)/Vehicle(s) Y99/98

Key Date 1993

Prepared By C. Wagner

Case 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 i r c u i t r y	Potential Cause(s) Mechanism(s) of Failure	O c c u r r e n c e	Current Design Controls	D e t e r m i n 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 r m i n e
WASHER (PS) (27838) Provides a portion of the support surface for diaphragm.	Fails to correctly support the diaphragm.	Reduced diaphragm life results in leakage.	8		Contours of diaphragm support surface are specified incorrectly. Condition of edges of support surface specified incorrectly. Clearance between washer I.D. and converter base is specified too wide.	1	Burst, impulse, and Thermal Cycle tests. Comparison of design with similar products.	1	8						
Provides support for compression of gasket	Fails to allow proper gasket compression.	Leakage.	8		Washer firmness is incorrectly specified or unspecified. Washer thickness is specified too small. Washer material and/or heat-treat is incorrectly specified.	1	Burst, impulse, and Thermal Cycle tests. Comparison of design with similar products.	1	8						
Locates and guides converter with respect to cup.	Converter is not properly located relative to cup.	Shift in setpoints. Erratic behavior.	5		Incorrectly specified portion guide I.D. Incorrectly specified washer O.D.	1	Comparison of design with similar products. Tolerance stackup analysis.	1	5						
	Converter travel is restrained by washer.	Disc cannot release; device is stuck open-circuit.	7		Washer firmness is incorrectly specified or unspecified. Washer thickness is specified too small. Washer material and/or heat-treat is incorrectly specified. I.D. of portion guide is too small.	1	Burst, impulse, and Thermal Cycle tests. Comparison of design with similar products. Tolerance stackup analysis.	1	7						

ENG-428-4 18857

FAILURE MODE AND EFFECTS ANALYSIS
(DEVELOPMENT FMEA)

Document Number 503797
Revision Level C
Revision Date 4-Nov-86

System _____
Subsystem _____
K Component Pressure Switch

Design Responsibility Pressure Switch Group

Original (Initial) Date 20-Jan-83

Model Year(s)/Vehicle(s) Various

Key Date 1988

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	C i a s e	Potential Cause(s) Mechanism(s) of Failure	O c c u r r	Current Design Controls	D e t e r m i n e	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Action Taken	S e v	O c c u r	D e t e r m i n e	R. P. N.
WASHER (PG) (27638) Interface with cup feature and provides a portion of component stack for crimp.	Fails to interface correctly with cup.	Difficult assembly (washer O.D. too large). Poor washer/cup/cup location relative to cup (washer O.D. too small).	7		Washer O.D. specified incorrectly.		Comparison of design with similar products. Tolerance stackup analysis.	1	7							
	Fails to allow proper crimp.	Reduced burst capability leads to leakage. Reduced fatigue resistance leads to leakage.	8		Thickness incorrectly specified. O.D. incorrectly specified. Edge condition incorrectly or unspecified.	1	Tolerance stackup analysis. Burst, Impact, and Thermal Cycle tests.	1	8							

System
 Subsystem
 X Component Pressure Switch

FAILURE MODE EFFECTS ANALYSIS
 (DETAILED FMEA)

Document Number 503788
 Revision Level E
 Revision Date 13-May-88

Design Responsibility Pressure Switch Group

Original (Printed) Date 20-Dec-83

Model Year(s)/Vehicle(s)/Variants _____

Key Date 1983

Prepared By D.Ha

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 l a s s	Potential Cause(s) Mechanism(s) of Failure	O c c u r r e n c e	Current Design Controls	D e t e r m i n e	F. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Action Taken	S e v	O c c	D e t	R. P. N.
CONVERTER (PS) (27406) Transfers pressure from fluid (via diaphragm) to a force on pressure-sensing disc.	Fails to correctly transfer fluid pressure to force on disc.	Shift in setpoints	5		Button O.D. incorrectly specified relative to washer I.D. Converter major O.D. incorrectly specified relative to cup I.D. Converter thickness incorrectly specified. Incorrect material specified.	1	Tolerance stackup analysis. Force/deflection analysis to determine strength and resistance to plastic deformation. Burst, impulse, and Thermal cycle tests.	1	5							
Provides alignment and support to disc.	Fails to properly align and support disc.	Loose tolerances allow misalignment which may cause shift in setpoints or erratic operation. Disc-out-of-place relative to converter may cause erratic operation or inoperative device, stuck open-circuit.	5		Button O.D. incorrectly specified relative to washer I.D. Converter major O.D. incorrectly specified relative to cup I.D. Disc support ramp incorrectly specified. Disc retaining wall incorrectly specified.	1	Tolerance stackup analysis. Comparison of design with similar product.	1	5							

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System
Subsystem
X Component Pressure Switch

FAILURE MODE EFFECTS ANALYSIS
(Or FMEA)

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Revision Level E
Revision Date 13-May-88

Design Responsibility Pressure Switch Group

Original (Initial) Date 20-Dec-83

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

Key Date 1988

Prepared By DI Ha

Core Team Design Engineering, Manufacturing Engineering, Manufacturing, Quality

Item Function	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r e	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 e d	F l a t t e r e d	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Action Taken	S e v e r e	O c c u r r e n c e	D e t e c t e d	R. P. N.
CONVERTER (PS) (27406) Provides a portion of the support surface for diaphragm.	Fails to properly support diaphragm.	Reduced diaphragm life results in leakage.	8		Contours of surface in contact with diaphragm are specified incorrectly. Condition of edges in contact with diaphragm are specified incorrectly. Clearance between converter bump and washer I.D. are specified too wide.	1	Bural, Input, and Thermal cycle tests. Comparison of design with similar product.	1	8							
Provides disc support during over pressure (proofburst).	Fails to properly support disc during over pressure.	Disc deformation results in shift in sealpoints. Reduced disc travel if disc reaction is restricted prematurely. Reduced disc life.	6		Features which control disc motion during over pressure are incorrectly specified.	3	Pre-and post-proof characterization Pressure-deflection measurements of disc motion.	1	10							
Vent in converter prevents pressure buildup from affecting sealpoints.	Does not vent properly.	Shift in sealpoints over temp. Reduced disc snap.	5		Vent hole incorrectly specified.	1	Comparison of design with similar product. Temperature characterizations.	1	5							

Systems
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 X Component Pressure Switch

FAILURE MODE EFFECTS ANALYSIS
 (DFMEA/FMEA)

Document Number 503788
 Revision Level C
 Revision Date 4-Nov-88

Design Responsibility Pressure Switch Group

Original (Initial) Date 20-Dec-83

Model Year(s)/Vehicle(s) Various

Key Date 1983

Prepared By G. Wagner

Core Team Design Engineering, Manufacturing Engineering, Manufacturing, Quality

Item Function	Potential Failure Mode	Potential Effect(s) of Failure	S e v e r e	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 Design Controls	D e t e r m i n e d	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Actions Taken	S u c c e s s f u l	O c c u r r e n c e	D i s c o n f i r m a n c y	R. e p. a r t i c l e
SPACER (73858) Reduce friction between disc and converter	Fails to effectively reduce friction.	Shift in setpoints over life. Reduced disc life.	5		Incorrect material specified. Incorrect dimensions specified.	1	Impulse and Thermal Cycle tests. Pre- and Post-life characterizations. Tolerance stackup analysis.	1	5							
Allow venting of chamber formed by disc and converter.	Fails to allow venting.	Shift in setpoints over temp. Reduced disc action.	5		Vent hole incorrectly specified.	1	Comparison of design with similar product. Temperature characterization.	1	5							

System _____
 Subsystem _____
 X Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
 (Design FMEA)

Document Number 503800
 Revision Level C
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 Original (Initial) Date 20-Dec-83

Design Responsibility Pressure Switch Group

Model Year(s)/Vehicle(s) Various

Key Date 1983

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	O c c u r r e n c e	Current Design Controls	D e t e r m i n e d	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 r m i n e d	R. P. N.
DISC (28858) Controls actuation and release set-points of switch relative to applied force.	Fails to actuate and/or release at the proper points of assembly.	Mfg. yield loss.	5		Disc material improperly specified. Dimensions and tolerances improperly specified.	1	Characterization experiments. Comparison of design with similar product.	1	5							
Key component in defining usable service life of device.	Disc actuation and/or release setpoints change excessively over life.	Shift in device setpoints over life.	5		Disc material improperly specified. Disc heat-treat improperly specified. Material thickness improperly specified. Excessive force applied by spring.	1	Impulse testing. Pre- and post-characterizations.	1	5							
	Service life shorter than customer requirements.	Drastic shift in setpoints over life. Device inoperative - open circuit.	7		Disc material improperly specified. Disc heat-treat improperly specified. Material thickness improperly specified. Excessive force applied by spring.	1	Impulse testing. Pre- and post-characterizations.	1	7							

System
 Subsystem
 Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
 (DESIGN FMEA)

Document Number 503801
 Revision Level C
 Revision Date 4-Nov-88

Design Responsibility Pressure Switch Group

Original (trial) Date 20-Dec-83

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

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	P o t e n t i a l C a u s e (s) M e c h a n i s m (s) o f F a i l u r e	D e t e c t i v e n e s s	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 c t i v e n e s s	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Items					
												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. P. N.	
CRIMP RING (74297) Hold together base assembly and sensor assembly.	Fails to hold base to sensor correctly.	Erratic switch operation. Cracked base. Stall in setpoints. Low base torque withstand.	5		Incorrect geometry of crimpable area specified. Incorrect geometry of formed radii. Incorrect material specified.	3		Impulse, thermal cycle, base torque, and base/terminal impact tests.	1	15							
Provide a surface for part identification/trace code.	ID characters flegible.	Improperly identified parts at assembly plant.	2		Geometry/finish not properly specified. Wrong material specified.	1		Coding tests. Environmental tests.	1	2							
Inpart environmental protection and resistance to device.	Inability to withstand environment.	Corrosion causes material consumption, loss of mechanical properties, switch eventually falls off sensor. Flegible coding.	7		Wrong material specified.	1		Environmental tests.	1	7							
Provide lubrication to crimp dies via grex coating.	Inufficient lubrication.	Metal flake/particles on external device surfaces.	5		Incorrect or insufficient was specified.	1		Crimping tests.	1	5							

System _____
 Subsystem _____
 Component Pressure Switch

FAILURE MODE EFFECTS ANALYSIS
 (DETAILED FMEA)

Document Number 503802
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 Revision Date 4-Nov-95
 Original (Initial) Date 20-Dec-93

Design Responsibility Pressure Switch Group

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 e	C l a s s	Potential Cause(s) Mechanism(s) of Failure	O c c u r e n c e	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. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Action Taken	S a v e	O c c u r	D e t e r m i n e	R. P. N.
TRANSFER PIN (74079) Transfers disc motion to movable electrical contact.	Fails to properly transfer disc motion.	Contacts stuck open. Contacts stuck closed. Erratic operation.	7		Diameter incorrectly specified. Chips/fragments cause pin to lodge.	1	Tolerance stackup between pin and pin guide in cup. Check with supplier for material properties regarding chips.	1	7							
Insulates electrical components from switch housing.	Fails to insulate.	Continuity between movable terminal and housing to ground.	5		Wrong material specified.	1	Check with supplier for material properties. Check with customer for electrical logic of movable terminal.	1	5							

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System _____
 Subsystem _____
 X Component Pressure Switch

FAILURE MODE, EFFECTS ANALYSIS
 (DETROIT FMEA)

Design Responsibility Pressure Switch Group

Document Number 503803
 Revision Level C
 Revision Date 4-Nov-85
 Original (Initial) Date 20-Dec-88

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 e	C i r c u l a r	Potential Cause(s) Mechanism(s) of Failure	D e t e c t i v e	Current Design 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 e	C i r c u l a r	D e t e c t i v e
ENVIRONMENTAL SEAL (74247) Prevents ingress of matter to switch cavity. <i>Effects No Corrosion?</i>	Contaminants enter switch cavity.	High current leakage High millivolt drop. Erratic or inoperative switch operation.	7		Gasket thickness is specified too small. Limits on porosity not specified. Incorrect material.	1	Review of standard practice for gland design. Review with gasket manufacturer. Comparison of design with similar product.	1	7						
Provides friction to aid in preventing base rotation.	Base rotates too easily.	Perceived as inadequate by assembly plant and/or service personnel.	5		Gasket thickness improperly specified.	1	Review of standard practice for gland design. Torque-to-rotate testing. Comparison of design with similar product.	1	5						

ENG-020-0 1993

System _____
 Subsystem _____
 X Component Pressure Switch

FAILURE MODE, EFFECTS ANALYSIS
 (DESIGN FMEA)

Design Responsibility Pressure Switch Group

Document Number 503604
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 Revision Date 4-Nov-88

Original (Initial) Date 29-Dec-83

Model Year(s)/Vehicle(s)/Variety _____

Key Date 1983

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	O c c u r r e n c e	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 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
THREAD CAP (74888) Protects hexport threads from damage during shipping and transit. Prevents dust from entering the fluid cavity.	Incorrect length.	Does not protect threads sufficiently.	6		Length incorrectly specified.	1	Dimensional stackup study.	1	6						
	Loose Cap.	Allows dust to enter fluid cavity.	4		Incorrect diameter specified.	1	Dimensional analysis.	1	4						

EMR2-025-A 19856

FAILURE MODE EFFECTS ANALYSIS
(DEFINITION FMEA)

Document Number 503805
Revision Level C
Revision Date 30-Oct-86

Original (Initial) Date 20-Dec-83

System _____
Subsystem _____
X Component Pressure Switch

Design Responsibility Pressure Switch Group

Prepared By C. Wagner

Model Year(s)/Vehicle(s) Various

Key Date 1983

Core Team Design Engineering, Manufacturing Engineering, Manufacturing Quality

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Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	S e v	C l a s s	Potential Cause(s) Mechanism(s) of Failure	O c c u r r e n c e	Current Design Controls	D e t e r m i n e d	R. P. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Actions Taken	S e v	O c c u r r e n c e	D e t e r m i n e d	R. P. N.
REPORT (36800) 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	Cross-check of print dimensions vs. SAE standard. Comprehensive evaluation of design all tolerance limits. Burst testing to customer-specified limits.	1	9							
Provides external thread for installation into mating port.	Fails to properly install in mating port.	Damages threads in mating port during installation. Does not allow installation.	7	FF	Threads specified improperly. Threads not gauged per ANSI spec's. Flaring buildup.	3	Cross-check of applicable SAE and ANSI standards.	3	83							
	Apparently installs, but fails to properly seal and seal.	Brake fluid leakage.	9	FF	Threads specified improperly. Threads not gauge per ANSI spec's. Flaring buildup.	1	Cross-check of applicable SAE and ANSI standards.	3	27							
Provides hex feature for 9/16" wrench.	Incorrect hex size.	Damage to hex flats during wrenching. 9/16" wrench does not fit.	5		Hex features improperly specified per established SAE/ANSI spec's.	1	Cross-check of applicable SAE and ANSI standards.	1	5							
Provides fluid passage to pressure-sensing elements.	Fluid passage is too small.	Electrical signal from switch is delayed vs. pressure signal especially at very low temp. Subject to blockage by foreign matter.	7	FF	Inadequate size of fluid passage specified. Inadequate review of Ford standard practices.	1	Review of Ford standard practices. Review of industry practices.	1	7							
	Fluid passage is too large.	Resulting thin wall section causes breakage during installation during underhood service operations	7	FF	Fluid passage specified excessively large.	1	Torque testing.	1	7							

System _____
 Subsystem _____
 X Component Pressure Switch

FAILURE MODE EFFECTS ANALYSIS
 (DETAILED FMEA)

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 Revision Date 30-Oct-88
 Original (Initial) Date 20-Dec-83

Design Responsibility Pressure Switch Group

Model Year(s)/Vehicle(s) Various

Key Date 1983

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	O c c u r r e n c e	Current Design 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 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.
HEXPOR (38900) Provides gland for internal gasket.	Fails to seal internal gasket properly.	Leakage of brake fluid.	9		Gland dimensions improperly specified. Surface finishes improperly specified. Gland geometry improperly designed.	1	Cross-check with recommendations of gasket supplier. Comprehensive testing.	1	9							
Provides flange which interfaces with other components to form pressure-sensor structure.	Flange fails to mate properly with other components of pressure sensor.	Dia. too large results in assembly difficulty. Diameter too small results in bad component alignment. Flange too thick results in poor crimp. Flange too thin results in reduced burst capacity. Improper edge chamfer results in stress concentration which weakens crimp.	9		Improper or incomplete specification of dimensions and tolerances.	1	Experiments and analysis to determine proper thickness for required strength. Tolerance stack-up analysis. Print review.	1	9							
	Material too soft or weak.	Inadequate burst capacity. Damage/breakage during installation or subsequent service. Threads prone to damage, leads to assembly difficulties.	9		Improper material selection.	1	Comprehensive evaluation of physical properties.	1	9							
	Material creeps.	Loosening of crimp leads to leakage.	9		Improper material selection.	1	Review of material properties.	1	9							
	Material degrades in presence of working fluid(s).	Leakage	9		Improper material selection.	1	Cross-check with similar products.	1	9							
	Insufficient environmental protection.	Long-term attack causes weakening of key areas which leads to leakage or breakage.	9		Improper or insufficient plating specification.	1	Comprehensive environmental testing.	3	27							

EP02-025-A 19888

System _____
 Subsystem _____
 X Component Pressure Switch

FAILURE MODE AND EFFECTS ANALYSIS
 (Default FMEA)

Design Responsibility Pressure Switch Group

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 Revision Date 30-Oct-99
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Model Year(s)/Vehicle(s) Various

Key Date 1993

Prepared By C. Warner

Core Team Design Engineering, Manufacturing Engineering, Manufacturing, Quality

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	S e v	C i e n t	Potential Cause(s) Mechanism(s) of Failure	D c e n t	Current Design Controls	D e t e r m	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.	
EXPORT (9900) Provides large which interface with other components to form pressure-sensor module.		Cosmetic problems.	9			1	Review of plating practices.	3	27								

Req. No.	Requirement	Failure Mode	Failure Effect	Severity	Control Method	Control Location	Control Method	Control Location	Control Method	Control Location
1	Provides electrical switching function with arbitrary terminal	Fails to provide adequate electrical contact	Device appears as an open circuit	7	Correct material specified for die	1	Review of TI proprietary and general contact design file	1	7	
2			Intermittent continuity							
3			High resistance drop							
4										
5										
6										
7										
8										
9										
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11										
12										
13										
14	Provides electrical path from terminal to contact arm	Fails to provide adequate conductivity	High resistance shown as high contact drop	7	Correct material specified	1	Review with contact manufacturer	1	7	
15										
16										
17										
18										
19	Provides means of preloaded attachment to contact arm	Inadequate attachment to contact arm	Shift in contacts over life	7	Correct geometry specified	1	Manufacturer recommendation	1	7	
20			Scale operation							
21			Open circuit							
22										
23										
24										
25										
26										
27	Provides rigidity to maintain contact gap and transfer device collection over time	Collection shift	Shift in contacts	6	Correct geometry specified	1	Manufacturer recommendation	1	6	
28										
29										
30										
31	Provides a feature to concentrate contact force in a particular area	Inadequate force concentration	High resistance drop	7	Correct geometry specified	1	Manufacturer recommendation	1	7	
32										
33										
34										
35	Provides feature to allow feeding automation	Fails to allow feeding automation	Manufacturing yield loss	6	Correct geometry specified	7	Manufacturing validation	1	56	
36										
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System _____
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 X Component Pressure Switch

FAILURE A EFFECTS ANALYSIS
 (LACMGN FMEA)

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Design Responsibility Pressure Switch Group

Original (Initial) Date 20-Dec-88

Model Year(s)/Vehicle(s) Various

Key Date 1993

Prepared By D. Ha

Core Team Design Engineering, Manufacturing Engineering, Manufacturing, Quality

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	S e v	C a s 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 r m i n e	R. F. N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
												Action Taken	S e v	O c c u r r e n c e	D e t e r m i n e	R. F. N.
RIVET (74818) Fastens spring to movable terminal.	Fails to adequately fasten spring to movable terminal.	Spring rotates about axis of stud. Spring falls off movable terminal.	6		Improper rivet diameter for given hole sizes. Improper rivet length for given material thickness. Improper head size. Improper tubular feature. Improper material.	1	Rivet manufacturer recommendations. Comparison with similar products. Testing to determine torque to rotate spring.	1	6							
Provides a force between movable terminal and spring which causes intimate contact for current flow.	Inadequate force between spring and movable terminal.	High resistance or no continuity at interface of spring and movable terminal.	6		Improper rivet diameter for given hole sizes. Improper rivet length for given material thickness. Improper head size. Improper tubular feature. Improper material.	1	Rivet manufacturer recommendations. Comparison with similar products. Testing to determine torque to rotate spring.	1	6							

ENG-028-A 10071