

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 02-2C-C01-PP-A -X**

SUBSYSTEM NAME: FLIGHT CONTROL MECH

REVISION: 0 12/04/87

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	:ELEVON ACTUATOR	MC621-0014
	MOOG	
SRU	:PISTON POSITION TRANSDUCERS	

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
TRANSDUCER, PISTON POSITION (QUAD)

QUANTITY OF LIKE ITEMS: 16
FOUR PER ACTUATOR

FUNCTION:
PROVIDES PISTON SIGNAL FOR ELECTRICAL CLOSED LOOP OPERATION THROUGH
INTERFACE WITH THE AVIONIC FLIGHT CONTROL SYSTEM.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 02-2C-C01-PP-A-06

REVISION#: 1 08/20/98

SUBSYSTEM NAME: FLIGHT CONTROL - ELEVON ACTUATOR

LRU: ELEVON ACTUATOR

ITEM NAME: PISTON POSITION TRANSDUCERS

CRITICALITY OF THIS FAILURE MODE: 1R2

FAILURE MODE:

LOSS OF OUTPUT, ONE CHANNEL

MISSION PHASE:

LO LIFT-OFF
DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102 COLUMBIA
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

CAUSE:

OPEN OR SHORT CIRCUIT IN TRANSDUCER

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:

A)

B)

"B" SCREEN IS FAILED SINCE THIS FAILURE MODE IS UNDETECTABLE WHEN THE POSITION COMMAND IS NEAR THE POSITION TRANSDUCER NULL.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

NONE

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(B) INTERFACING SUBSYSTEM(S):
NONE

(C) MISSION:
NONE

(D) CREW, VEHICLE, AND ELEMENT(S):
NONE

(E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF CREW/VEHICLE AFTER TWO UNDETECTED FAILURES. LOSS OF
FUNCTION CAN RESULT IN LOSS OF VEHICLE CONTROL.

-DISPOSITION RATIONALE-

(A) DESIGN:

MATCHED SETS OF PARTS MAINTAINED AND VERIFIED DURING MANUFACTURING. ATTACHMENT VERY LIGHTLY LOADED. TRANSDUCERS HAVE LARGE CLEARANCE BETWEEN CORE/CORE ASSEMBLY. THE FOUR DRIVE RODS ARE BRAZED TO A COMMON DRIVE MEMBER AFTER NULL ADJUSTMENT. THE DRIVE MEMBER IS MOUNTED IN A PRELOADED, DOUBLE-ANGULAR CONTACT BALL BEARING PROVIDED TO ALLOW FOR ROTATION OF THE PISTON ROD RELATIVE TO THE BODY. THE DRIVE MEMBER HAS BEEN SIZED, MOUNTED, AND DUAL-RETENTION SECURED IN THE PISTON ROD TO PROVIDE A NONCREDIBLE SINGLE FAILURE POINT.

(B) TEST:

QUALIFICATION: ENDURANCE CYCLING - 400 MISSION DUTY CYCLES UNDER LOAD AT MAXIMUM TEMPERATURE OF 250 DEGREES F. ACTUATOR WAS VIBRATED AT FLIGHT LEVELS AND TESTED AT -85 AND 250 DEGREES F. 100,000 PRESSURE IMPULSE CYCLES AT EACH SUPPLY AND RETURN PORT, AT 225 DEGREES F. SUPPLY PORTS WERE CYCLED FROM 3,000 PSIG TO 4,500 PSIG TO 1,500 PSIG, BACK TO 3,000 PSIG EACH CYCLE; RETURN PORTS, FROM 750 PSIG TO 1,500 PSIG TO 0 PSIG, BACK TO 750 PSIG. PERFORMANCE RECORD TESTS CONDUCTED AT 35 AND 225 DEGREES F FOLLOWING ENDURANCE TESTING. VERIFIED THAT ALL PARTS WERE WITHIN ACCEPTABLE LIMITS DURING DISASSEMBLY AND INSPECTION AT COMPLETION OF QUALIFICATION.

ACCEPTANCE: PERFORMANCE TESTS VERIFY PISTON POSITION TRANSDUCERS ARE OPERATIONAL.

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GROUND TURNAROUND TEST
ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH
OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION
RAW MATERIAL CERTIFICATIONS ARE VERIFIED. SPECIAL MATERIAL REQUIREMENTS
ARE IDENTIFIED IN CERTIFICATIONS. END FITTING IS MANUFACTURED BY MOOG AND
SUPPLIED TO TRANSDUCER VENDOR.

CRITICAL PROCESSES
VENDOR'S SOLDERING AND TIG WELDING PROCESSES ARE CONTROLLED BY MOOG.

SPECIAL PROCESSES
TRANSDUCER VENDOR COIL DESIGN AND MANUFACTURING PLANNERS ARE
CONTROLLED BY MOOG.

ASSEMBLY/INSTALLATION
SAFETY WIRING AND TORQUING OPERATIONS ARE PERFORMED AND VERIFIED BY
MANDATORY INSPECTIONS. SPECIALLY DESIGNED ASSEMBLY TOOLS/FIXTURES ARE
REQUIRED BY ASSEMBLY DOCUMENTATION. CRIMP CONNECTIONS OF TRANSDUCER
LEADS TO ELECTRICAL CONNECTORS ARE PERFORMED BY SPECIALLY TRAINED/
CERTIFIED TECHNICIANS.

TESTING
ATP WITNESSED BY ROCKWELL QUALITY AND DCAS. TRANSDUCER ATP PERFORMED AT
COMPONENT LEVEL AND AT ACTUATOR LEVEL. ROCKWELL DESIGN AND QUALITY
PERSONNEL, WITH NASA PARTICIPATION, CONDUCT A DETAILED ACCEPTANCE REVIEW
OF THE HARDWARE AT THE VENDOR'S FACILITY, PRIOR TO THE SHIPMENT OF EACH END
ITEM COVERED BY CONTROL PLAN.

(D) FAILURE HISTORY:

CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND
OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE
FOUND IN THE PRACA DATA BASE.

(E) OPERATIONAL USE:

NONE

- APPROVALS -

EDITORIALLY APPROVED
TECHNICAL APPROVAL

: BNA
: VIA APPROVAL FORM

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: 95-CIL-009_02-2C