SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :FLIGHT CONTROL MECH FMEA NO 02-2B -A01-SV-1? REV:07/07/88

ASSEMBLY :TVC ACTUATOR
P/N RI :MC621-0015
P/N VENDOR:MOOG
QUANTITY :24
:4 PER ACTUATOR
:

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE EFFECTIVITY:	102	103	104
	X	X	X

PHASE(S): PL LO X OO DO LS

REDUNDANCY SCREEN: A-PASS B-FAIL C-PASS

PREPARED BY:		APPROVED BY:		APPROVED BY (NASA):	
DES	N LEVERT	DES		SSM	
REL	C NELSON	REL		REL	
QE	M SAVALA	QE		QE	

ITEM:
SERVOVALVE

FUNCTION:
THE FOUR INDEPENDENT SERVOVALVES METER HYDRAULIC FLUID FLOW/PRESSURE TO THE POWER VALVE, IN PROPORTION TO THE INPUT CURRENT, TO CONTROL THE ACTUATOR OUTPUT.

FAILURE MODE:
FAILS AT NULL OR ERRONEOUS OUTPUT

CAUSE(S):
LOSS OF SIGNAL, DEFECTIVE TORQUE MOTOR, MECHANICAL FAILURE, JAMMED SPOOL CONTAMINATION

EFFECT(S) ON:
(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE

(A) POSSIBLE DEGRADATION IN ACTUATOR PERFORMANCE. REDUCTION IN ACTUATOR REDUNDANCY.

(B,C) NONE

(D) POSSIBLE LOSS OF CREW/VEHICLE AFTER SECOND UNDETECTED SERVOVALVE FAILURE.

(E) FUNCTIONAL CRITICALITY EFFECTS - POSSIBLE LOSS OF CREW/VEHICLE AFTER SECOND UNDETECTED SERVOVALVE FAILURE. LOSS OF FUNCTION CAN RESULT IN LOSS OF VEHICLE CONTROL. "B" SCREEN FAILS SINCE A FAILURE MAY NOT BE DETECTED BY THE ATVC (ONE FAILED SERVOVALVE CHANNEL MAY NOT CREATE A STRONG ENOUGH FORCE FIGHT TO BE DETECTED).

DISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(A) DESIGN
SPOOL AND SLEEVE ARE 440C MATERIAL, HARDENED AND LAPPED FOR A MATCHED SET. SPOOL IS GROOVED TO CLEAR SILTING. SERVOVALVE IS FILTERED WITH 5 MICRON HYDRAULIC SYSTEM FILTER, 15 MICRON SERVOVALVE INLET FILTER, AND A 35 MICRON SERVOVALVE FILTER.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :FLIGHT CONTROL MECH FMEA NO 02-2B -A01-SV-19 REV:07/07/8

(B) TEST

QUALIFICATION:
ENDURANCE CYCLING-400 MISSION DUTY CYCLES UNDER LOAD AT MAXIMUM TEMPERATURE OF 275 DEGREES F. ACTUATOR WAS VIBRATED AT FLIGHT LEVELS AN TESTED AT -65 AND 250 DEGREES F. 100,000 PRESSURE IMULSE CYCLES AT EAC SUPPLY AND RETURN PORT, AT 230 DEGREES F. SUPPLY PORTS WERE CYCLED FRO 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. VERIFIED THAT ALL PARTS WERE WITHIN ACCEPTABLE LIMITS DURING DISASSEMBL AND INSPECTION AT COMPLETION OF QUALIFICATION.

ACCEPTANCE:
PERFORMANCE TESTS VERIFY THAT THE SERVOVALVE MEETS OPERATIONAL REQUIREMENTS. FLUID FROM ACTUATOR IS VERIFIED TO MEET CLEANLINESS LEVE 190 PER MA0110-301.

OMRSD:
MPS ENGINE POSITIONING TEST AND MPS GIMBLE PROFILE, PERFORMED PRIOR TO EACH MISSION. HYDRAULIC FLUID SAMPLES ARE TAKEN AFTER EVERY FLIGHT AN VERIFIED TO BE WITHIN SPECIFIED CLEANLINESS LEVELS.

(C) INSPECTION

RECEIVING INSPECTION
RAW MATERIAL CERTIFICATIONS ARE VERIFIED. SPECIAL MATERIAL REQUIREMENT ARE IDENTIFIED IN CERTIFICATIONS.

NONDESTRUCTIVE EVALUATION
PIECE PARTS EVALUATED BY SELECTED PENETRANT, MAGNETIC PARTICLE, ULTRASONIC, AND RADIOGRAPHIC INSPECTIONS.

SPECIAL PROCESSES
CRITICAL/CLOSE TOLERANCE DIMENSIONS AND FINISHES ARE 100 PERCENT INSPECTED FOLLOWING MACHINING.

CONTAMINATION CONTROL
ASSEMBLY AREA CLEANLINESS IS VERIFIED BY CONTAMINATION CONTROL PLAN. SERVOVALVE IS ASSEMBLED IN A CLASS 10,000 LAMINAR FLOW BENCH. COMPONEN ARE PRECLEANED PRIOR TO ASSEMBLY. PARTS AND TOOLS/AIDS ARE CLEANED PRI TO ASSEMBLY. END ITEM FLUID SAMPLE IS VERIFIED PRIOR TO ACTUATOR DELIVERY.

TESTING
ATP IS VERIFIED BY INSPECTION AND IS PERFORMED AT BOTH THE COMPONENT AN ACTUATOR LEVELS. 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 B CONTROL PLAN. ATP VERIFICATION IS MIP FOR RI QA REPRESENTATIVE.

(D) FAILURE HISTORY
THERE IS NO HISTORY OF FAILURE FOR THIS FAILURE MODE.

(E) OPERATIONAL USE
NONE