

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1C -0230 -3 REV: 01/C7/

ASSEMBLY : PRESSURE CONTROL SYSTEM				CRIT. FUNC: ---
P/N RI : ME284-0556-0001				CRIT. HDW: 3
P/N VENDOR: 2666-0001-3 CARLETON	VEHICLE	102	103	104
QUANTITY : 2	EFFECTIVITY:	X	X	X
: ONE PER N2 SYSTEM	PHASE(S):	PL X LO X	OO X DO X	LS X

PREPARED BY:	DES M. PRICE <i>MP</i>	APPROVED BY:	DES <i>[Signature]</i>	REDUNDANCY SCREEN: A-PASS B-FAIL C-PASS
REL N. L. STEISSLINGER <i>NLS</i>	REL <i>[Signature]</i>	SSM	SSM <i>[Signature]</i>	APPROVED BY (NAEA):
QE M. SAVALA	QE <i>[Signature]</i>	REL <i>[Signature]</i>	REL <i>[Signature]</i>	QE <i>[Signature]</i>

ITEM:  
LATCHING VALVE, MMU SUPPLY

FUNCTION:  
PROVIDES VALVE CONTROL OF NITROGEN TANK PRESSURE TO THE MANNED MANEUVERING UNIT (MMU) LINES FOR MMU TANK RECHARGE.

FAILURE MODE:  
INTERNAL LEAKAGE

CAUSE(S):  
MECHANICAL SHOCK, VIBRATION, CONTAMINATION, CORROSION, PHYSICAL BINDING/JAMMING, SEAL MATERIAL DEGRADATION

EFFECT(S) ON:

- (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
- (A) LOSS OF MMU N2 DISTRIBUTION LINE ISOLATION CAPABILITY.
- (B,C,D) NO EFFECT UPON FIRST FAILURE. DOWNSTREAM MMU LINES SEALED AT DYNATUBE CAP.
- (E) FUNCTIONAL CRITICALITY EFFECT - SUBSEQUENT ASSOCIATED EXTERNAL LEAKAGE OF MMU N2 DISTRIBUTION LINE WOULD RESULT IN LOSS OF N2 FROM ONE N2 STORAGE SYSTEM. A FAILURE IN THE REMAINING N2 SYSTEM WHICH RENDERS IT UNUSABLE REQUIRES ABORT AND RETURN ON CABIN VOLUME OF AIR WITH CABIN PRESSURE FEED OF WATER TO PES. SCREEN B FAILS BECAUSE INTERNAL LEAKAGE OF THE VALVE CANNOT BE DETECTED DOWNSTREAM; THERE IS NO PRESSURE SENSOR IN THE MMU LINES.

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

(A) DESIGN

THE VALVE IS AN INTERMITTENT DUTY, 28 VOLT DC MOTOR OPERATED, LATCHING VALVE WHICH COMPRISES A VALVE PLUNGER, LATCHING MECHANISM, MOTOR ASSEMBLY AND VALVE POSITION INDICATION. VALVE HOUSING MATERIAL IS 6061-T651 ALUMINUM ALLOY AND VALVE BODY IS PH13-8 MO CRES CONDITION A. A NICKEL BELLOWS IS UTILIZED AS A DYNAMIC SEAL WHICH CONSIDERABLY REDUCES FRICTION, STICKING AND WEAR. BAL-SEALS ACT AS BACKUP TO BELLOWS LEAKAGE.

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STATIC SEALS ARE SILASTIC 675 SILICONE RUBBER, WHICH HAS GOOD RESISTANCE TO ENVIRONMENTAL EXPOSURE, FLEXING AND FATIGUE. IT ALSO HAS LOW FLAMMABILITY AND OUTGASSING. THE OZONE RESISTANCE OF SILICONE RUBBER IS EXCELLENT. PLUNGER MOVEMENT IS INITIATED BY A SCREW-DRIVEN ACTUATOR WHICH IS DRIVEN BY THE GEAR MOTOR OUTPUT SHAFT. BELLEVILLE SPRING LATCHING PROVIDES POSITIVE DETENTING. THE VALVE SEAT IS MADE OF VESPEL SP-1, WHICH EXHIBITS HIGH MECHANICAL STRENGTH, LOW WEAR RATE, AND SEALING COMPLIANCE WITHOUT PERMANENT DISTORTION. VALVE INLET/OUTLET PORTS ARE FILTER PROTECTED TO 25 MICRONS.

(B) TEST

ACCEPTANCE TEST - PER ATP 2666-37. PROOF PRESSURE TEST AT 4975 +/- 25 PSIG (1.5 TIMES MAXIMUM OPERATING PRESSURE). INTERNAL LEAK TESTS (FORWARD AND REVERSE) AT 75 +/- 5 PSIG AND 3325 +/- 25 PSIG WERE PERFORMED TO VERIFY SPECIFICATION REQUIREMENT OF 2.5 SCCM MAX LEAKAGE AT 200 TO 300 PSIG, BY INTERPOLATION. FLOW AND PRESSURE DROP TEST; WITH 10 - 350 PSIG INLET PRESSURE AND FLOW RATE 150 LB/HR, DELTA-P LIMITED TO 16 PSID MAX. BONDING AND INSULATION RESISTANCE TESTS PERFORMED.

QUALIFICATION TESTING - PER QTP 2721-3. RANDOM VIBRATION SPECTRUM 20 TO 80 HZ INCREASING AT 6 DB/OCTAVE TO 0.03 G\*\*2/HZ, CONSTANT AT 0.03 G\*\*2/HZ FROM 80 TO 300 HZ, DECREASING AT 6 DB/OCTAVE FROM 300 TO 2000 HZ FOR 48 MINUTES IN EACH OF THREE ORTHOGONAL AXES. SINUSOIDAL VIBRATION SWEEP - FROM 5 TO 35 HZ AT ONE OCTAVE PER MINUTE SWEEP RATE. ELECTRO-MAGNETIC COMPATIBILITY TEST PERFORMED. LIFE CYCLE TEST - PRESSURIZED BETWEEN 150 AND 3300 PSIG; MINIMUM 50 CYCLES. ATP TO VERIFY LEAKAGE IS PERFORMED AFTER SHOCK AND VIBRATION TESTING.

IN-VEHICLE TESTING - INTERNAL LEAK TESTED AT 2800 - 3000 PSIG, 10 SCCM MAX LEAKAGE.

OMRSD - INTERNAL LEAKAGE TEST IS PERFORMED AFTER N2 TANK SERVICING. BUBBLE LEAK TEST IS PERFORMED AT SERVICED TANK PRESSURE, AT MMU INTERFACES WITH DYNATUBE CAP LOOSENEED.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL CERTIFICATIONS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS TO LEVEL 300 OF MA0110-301 VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

BELLEVILLE SPRING FORCES VERIFIED BY INSPECTION. DIMENSIONAL CHECKS PERFORMED BY INSPECTION. MIPS FOR CONCENTRICITY AND PERPENDICULARITY. DIAMETER AND THREADS ON LOWER BELLOWS VERIFIED BY INSPECTION. VISUAL, DIMENSIONAL, BELLOWS RATES AND CHECK FOR BELLOWS DAMAGE PERFORMED BY INSPECTION. 10X INSPECTION ON SEAL RING IS VERIFIED. NICKEL FINISH ON BELLOWS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

PASSIVATED PARTS AND ANODIZING VERIFIED BY INSPECTION. HEAT TREATMENT VERIFIED BY INSPECTION. SOLDER CONNECTIONS VERIFIED BY INSPECTION IN

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ACCORDANCE WITH NHB5300.4(3A). POTTING VISUALLY VERIFIED BY INSPECTION.  
TIG WELD SCHEDULE VERIFIED BY INSPECTION. APPLICATION OF LUBRICANT ON  
SEAL RING VERIFIED BY TECHNICIAN.

NONDESTRUCTIVE EVALUATION  
INSPECTION OF WELDS BY 20X VISUAL EXAM, X-RAY AND PENETRANT.

TESTING  
ATP VERIFIED BY INSPECTION.

HANDLING/PACKAGING  
HANDLING, PACKAGING, STORAGE AND SHIPPING PROCEDURES ARE VERIFIED.

(D) FAILURE HISTORY  
NO FAILURE HISTORY APPLICABLE TO INTERNAL LEAKAGE FAILURE MODE. THE  
LATCHING VALVE HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM FOR  
THIS FAILURE MODE.

(E) OPERATIONAL USE  
NONE.