

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 03-2A-211110-X

SUBSYSTEM NAME: AFT REACTION CONTROL SYSTEM (RCS)

REVISION: 2 12/12/89

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	TANK ASSEMBLY, PROPELLANT PARKER HANNIFIN <i>Martini Magnette</i>	MC282-0061-0603 855C3310000-049
LRU :	TANK ASSEMBLY, PROPELLANT PARKER HANNIFIN <i>Martini Magnette</i>	MC282-0061-0604 855C3310000-050/060
LRU :	TANK ASSEMBLY, PROPELLANT PARKER HANNIFIN <i>Martini Magnette</i>	MC282-0061-0614 855C3310000-050/060

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
TANK ASSY, PROPELLANT INCLUDING ACQUISITION DEVICE. ACQUISITION
DEVICE INCLUDES UPPER AND LOWER COMPARTMENT CHANNELS, SCREENS, FEEDOUT
TUBE, PLENUM BULKHEAD, BARRIER AND COLLECTOR. TK 203/204/303/304

QUANTITY OF LIKE ITEMS: 4
TWO PER MODULE

FUNCTION:
TO STORE/SUPPLY PROPELLANT FOR REACTION CONTROL THRUSTERS. ACQUISITION
DEVICE RETAINS PROPELLANTS FOR ADEQUATE FEED DURING 1"G", 0"G" AND HIGH
"G" CONDITIONS. REGULATED HELIUM IS SUPPLIED TO THE ULLAGE TO FORCE
PROPELLANT TO THE THRUSTERS AS REQ'D. TANK OPERATING PRESSURE IS 243
(+/- 4 PSI). THE TANK VOLUME IS 17.95 CUBIC FEET.

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REVISION: 0 11/21/88 W

SUBSYSTEM: AFT REACTION CONTROL SYSTEM (RCS)

LRU : TANK ASSY, PROPELLANT

CRITICALITY OF THIS

ITEM NAME: TANK ASSY, PROPELLANT

FAILURE MODE: 1 1

FAILURE MODE:

STRUCTURAL FAILURE FAILS TO FEED PROPELLANT DUE TO RETENTION DEVICE
FAILURE, GAS BUBBLES IN PROPELLANT, SCREEN DRY OUT.

MISSION PHASE:

LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
: 103 DISCOVERY
: 104 ATLANTIS

CAUSE:

FATIGUE, CONTAMINATED PROPELLANT, CONTAM, VIB, MECH SHOCK, SCREEN
COLLAPSE OR DRY OUT, FROZEN PROP, PROP SLOSH LOADS, FASTENING HARDWARE
FAILS, HIGH FLOW RESULTING FROM SERVICING OR PROCEDURAL ERRORS,
INSTALLATION/ASSEMBLY DAMAGE.

CRITICALITY 1/1 DURING ANY MISSION PHASE OR ABORT? Y

REUNDANCY SCREEN A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:

A)
B)
C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

SUBSYSTEM DEGRADATION, REDUCED PROPELLANT FLOW, GAS BUBBLES IN
PROPELLANT CAUSING REDUCED THRUST, O/F RATIO SHIFT OR COMBUSTION
INSTABILITY.

(B) INTERFACING SUBSYSTEM(S):

SAME AS (A)

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(C) MISSION:

POSSIBLE EARLY MISSION TERMINATION DUE TO INABILITY TO USE PROPELLANT FROM THAT TANK.

(D) CREW, VEHICLE, AND ELEMENT(S):

POSSIBLE LOSS OF CREW/VEHICLE - FAILURE OF ACQUISITION DEVICE SCREENS COULD CAUSE PREMATURE GAS INGESTION INTO THE THRUSTER MANIFOLDS DURING MATED COAST/ET SEP AND/OR ENTRY MANEUVERING CAUSING LOSS OF VEHICLE CONTROL.

RATIONALE FOR CRITICALITY:

 - DISPOSITION RATIONALE -

(A) DESIGN:

SAFETY FACTORS OF 1.4 (MINIMUM) IN SCREEN WILL MINIMIZE FAILURE POTENTIAL. SAFETY FACTOR OF 1.5 ON THE PRESSURE VESSEL.

THE TANK IS MADE OF ALL STAINLESS STEEL MATERIALS THAT ARE COMPATIBLE WITH PROPELLANT. A SWIRL DIFFUSER HAS BEEN INSTALLED TO PRECLUDE SCREEN DRYOUT. BLEED PORTS ARE INSTALLED TO BLEED ALL GAS PREVENTING SCREEN DRYOUT. THE TANK IS A TOTAL PASSIVE SYSTEM HAVING NO MOVING PARTS.

(B) TEST:

THE QUALIFICATION-TEST PROGRAM INCLUDES EXPULSION CYCLES (188,000 FLOW TRANSIENTS OVER 200 EXPULSION CYCLES), PRESSURE CYCLES (800 CYCLES), BOOST RANDOM VIBRATION (48 MIN/AXIS), ACCELERATION, EXTERNAL PRESSURE, PROPELLANT EXPOSURE, PRESSURE HOLD CREEP, BURST RUPTURE (>525 PSIG), FUNCTIONAL TEST, HANDLING SHOCK, SHIPPING CONTAINER SHOCK, 100 MISSION LIFT-OFF VIBRATION.

THE TANK ALSO QUALIFIED AS PART OF THE POD IN THE VIBRO-ACOUSTIC TEST AT JSC (131 EQUIVALENT MISSIONS) AND THE HOT FIRE TEST AT WSTF (24 EQUIVALENT MISSION DUTY CYCLES AND APPROX 7 YEARS OF PROPELLANT EXPOSURE).

THE ACCEPTANCE TEST PROGRAM INCLUDES SUBASSEMBLY BUBBLE POINT VERIFICATION, PAD SUBASSEMBLY VISUAL INSPECTION, PROOF PRESSURE (470 PSIG), BUBBLE POINT RETENTION, OUTFLOW DELTA PRESSURE PERFORMANCE, INTERNAL CLEANLINESS, HOT N2 PURGE WITH SAMPLES FOR IPA.

OMRSD PERFORMS THE FOLLOWING: PROP TANK ACQUISITION VERIFICATION ON A CONTINGENCY BASIS. PROPELLANT LOADING EVERY FLIGHT. PROPELLANT SAMPLING ON FLIGHT #2 AND ON A CONTINGENCY BASIS. V42 7.1.1 CONTROLS FLOW LIMITS. PROPELLANT OFFLOADING HORIZONTAL ON A CONTINGENCY. A PROPELLANT TANK ACQUISITION EVALUATION BY X-RAY THE FIRST, FIFTH AND EVERY 5 FLIGHTS THEREAFTER AND AS A CONTINGENCY WHEN THE POD IS REMOVED AND THE PROPELLANT IS NOT DRAINED FROM THE TANKS. PROPELLANT

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OFFLOADING IN THE VERTICAL POSITION. ALSO, CONTINGENCY EXISTS WHEN OFFLOAD TO GAS BREAK IS REQUIRED WITH VEHICLE ON THE PAD. LOADED PROPELLANTS MEET REQUIREMENTS OF SE-S-0073.

(C) INSPECTION:

RECEIVING INSPECTION

CHEMICAL AND PHYSICAL PROPERTIES TESTS REPORTS ARE VERIFIED BY INSPECTION. CERTIFICATION FOR ALL TANK RAW MATERIALS AND DETAIL PARTS IS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS TO LEVEL 200 FOR MMH AND 200A FOR N2O IS VERIFIED BY INSPECTION. CORROSION PROTECTION IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

TANK HEMISPHERES ARE DIMENSIONALLY AND VISUALLY INSPECTED. VISUAL INSPECTION OF TANK BARRIER WELDS IS VERIFIED BY INSPECTION. BUBBLE POINT TESTING OF PROPELLANT ACQUISITION AND RETENTION DEVICE SCREEN IS VERIFIED BY INSPECTION. CLEARANCE BETWEEN TANK AND POD IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

FORGINGS ARE ULTRASONICALLY INSPECTED. AFT TANK GIRTH WELDS ARE ULTRASONICALLY INSPECTED IN THE COLLECTOR DOME AREA. WELD START AND STOP POINTS ARE INSPECTED WITH FIBER OPTICS. GIRTH WELDS PENETRANT AND RADIOGRAPHICALLY INSPECTED PRIOR TO AND AFTER PROOF PRESSURE TESTING.

TESTING

ATP IS WITNESSED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING, PACKAGING, AND STORAGE ENVIRONMENTS FOR SHIPMENT IS VERIFIED BY INSPECTION. SHOCK PROTECTION PACKAGING IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

CAR'S AB3554 AND AB5965:

TWO AFT TANKS (TA7 & TA10) FAILED BUBBLE POINT TEST AFTER BOOST VIBRATION TESTING WITH OFF LOADED PROPELLANT LOADS. A COLLECTOR SCREEN DEFICIENCY WAS IDENTIFIED AS THE CAUSE. CORRECTIVE ACTION WAS TO USE AS-RECEIVED (COLD WORKED) WIRE CLOTH INSTEAD OF ANNEALED CLOTH. ALSO, ALL MISSIONS ARE FLOWN WITH FULLY LOADED TANKS WHICH ELIMINATES THE SOURCE OF THIS FAILURE.

CAR AB8528:

CORRODED SOLDER REPAIR OF SCREENS WERE REPORTED. THE CORROSION WAS CAUSED BY EXPOSURE TO MMH WHICH WAS CONTAMINATED WITH FREON. CORRECTIVE ACTION WAS TO TEST ALL MMH PRIOR TO USE TO ASSURE NO CORROSIVE AGENTS ARE PRESENT.

CAR AB4002:

ONE TANK FAILED BUBBLE POINT TEST AFTER PRESSURE CYCLING. THIS WAS

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CAUSED BY RAPID COLLAPSE OF VAPOR BUBBLE IN THE LOWER COMPARTMENT WHICH ALLOWED THE TANK PRESSURE TO FALL BELOW THE PROPELLANT'S VAPOR PRESSURE. DURING OPERATION, THE TANK PRESSURE IS ALWAYS MAINTAINED ABOVE VAPOR PRESSURE WHICH PRECLUDES THIS FAILURE.

CAR A8639:
ONE TANK FAILED BUBBLE POINT DUE TO AN OILY FILM ON THE SCREEN. CORRECTIVE ACTION IS TO INSPECT FOR OILY SURFACE AND CLEAN IF PRESENT. TANKS ARE DELIVERED CLEAN AND THE SYSTEM IS KEPT CLEAN.

(E) OPERATIONAL USE:
IF PROPELLANT EXPULSION CAPABILITY IS LOST PRIOR TO ENTRY, USE CROSSFEED FROM THE GOOD SYSTEM. PROPELLANT MAY NOT BE SUFFICIENT TO PERFORM ENTRY.

- APPROVALS -

RELIABILITY ENGINEERING:	R. P. DIEHL	:	<u>[Signature]</u>
DESIGN ENGINEERING	: R. PIEDRA	:	<u>[Signature]</u>
QUALITY ENGINEERING	: W. J. SMITH	:	<u>[Signature]</u>
NASA RELIABILITY	:	:	<u>[Signature]</u>
NASA SUBSYSTEM MANAGER	:	:	<u>[Signature]</u>
NASA QUALITY ASSURANCE	:	:	<u>[Signature]</u>