

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1B -0616 -1 REV:06/22/83

ASSEMBLY : AIR DUCTS
P/N RI : V070-613427, 524, 558, 881
P/N RI : ME276-0037
P/N VENDOR:
QUANTITY : 1 SET PER VEHICLE

VEHICLE	102	103	104
EFFECTIVITY:	X	X	X
PHASE(S):	PL	LO X	OO X DO LS

CRIT. FUNC: 2
CRIT. HDW: 2

PREPARED BY: REDUNDANCY SCREEN A- B- C-
DES N. K. DUONG APPROVED BY: APPROVED BY (NASA):
REL N. L. STEISSLINGER 78 REL SSM
QE D. STOICA 42 QE W. J. COVRIEN QE

ITEM:
DUCT SECTIONS, IMU, RETURN AIR TO CABIN

FUNCTION:
ROUTE AIR FROM THE IMU FAN OUTLET TO THE IMU HEAT EXCHANGER, AND FROM THE HEAT EXCHANGER TO THE IMU MUFFLER.

FAILURE MODE:
RESTRICTED FLOW

CAUSE(S):
PHYSICAL DAMAGE, DEBRIS/CONTAMINATION

EFFECT(S) ON:
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
(A) INCREASED FLOW RESISTANCE DOWNSTREAM OF IMU FANS.
(B) REDUCTION OF AIR FLOW THROUGH IMU'S. INCREASED IMU TEMPERATURE.
(C) POSSIBLE EARLY MISSION TERMINATION BASED UPON MAGNITUDE OF RESTRICTION AND ITS EFFECT ON IMU COOLING.
(D) NO EFFECT. EARLY MISSION TERMINATION WILL PRECLUDE LOSS OF CREW/VEHICLE.

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

(A) DESIGN
DUCT SYSTEM IS COMPRISED OF RIGID AND FLEXIBLE DUCT SECTIONS.
RIGID DUCTING IS FABRICATED OUT OF ALUMINUM TUBING WITH 0.015 OR 0.049 INCH THICK WALLS AND EPOXY/ARAMID MATERIAL. SECTIONS ARE FASTENED TOGETHER WITH CLAMPS AROUND END FLANGES AND HARD MOUNTED TO STRUCTURE BY A BRACKET/BAND CLAMP ASSEMBLY. DUCT BRANCHES LEADING TO IMU BOXES ARE WELDED INTO THE MAIN BRANCH DUCT SECTION.

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FLEXIBLE DUCTS OF SILICONE/FIBERGLASS FABRIC OVER STEEL HELICAL SPRING WIRE ARE USED AT THE MUFFLER/IMU INTERFACE, AT THE IMU/ALUMINUM DUCT INTERFACE, AND BETWEEN THE IMU FAN PACKAGE AND THE ALUMINUM DUCTS. ALL AIR ENTERING THE RETURN DUCT SYSTEM IS THROUGH THE IMU MUFFLER FILTERS. DUCTS ARE PROTECTED FROM DAMAGE BY CLOSEOUT PANELS.

(B) TEST

QUALIFICATION TESTING - SIMILAR SILICONE/FIBERGLASS FLEX DUCTS WERE SHOWN BY TEST TO WITHSTAND TEMPERATURES FROM -60 F TO 600 F WITHOUT PROBLEMS. NON-NUTRIENT TO FUNGUS DEMONSTRATED BY TEST... SALINITY TOLERANCE DEMONSTRATED BY TEST OF IDENTICAL MATERIAL EXPOSED TO A 20% SALT SOLUTION AT 95 F AND 85% RELATIVE HUMIDITY FOR 50 HOURS WITH NO EFFECT. BURST PRESSURE DEMONSTRATED BY TEST TO BE GREATER THAN 200 PSIG. TRANSIENT AND RANDOM VIBRATIONS WERE CERTIFIED BY TESTS OF THE SIMILAR DUCTS AND CRASH LOADS BY ANALYSIS. DUCTING IS STRESS AND FATIGUE CERTIFIED BY ANALYSIS.

ACCEPTANCE TESTING - PROOF PRESSURE TESTED AT 1.50 PSIG. LEAK TESTED AT 0.5 PSIG, MAX LEAKAGE 0.04 SCFM.

IN-VEHICLE TESTING - IMU FAN DELTA-P IS MONITORED CONTINUOUSLY WHEN IMU'S ARE POWERED UP.

OMRSD - IMU FAN DELTA-P IS MONITORED CONTINUOUSLY WHEN IMU'S ARE POWERED UP DURING EACH TURNAROUND AND SERVES AS AN INDICATION OF RESTRICTED FLOW.

(C) INSPECTION

RECEIVING INSPECTION

MATERIAL AND PROCESS CERTIFICATION ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CONTAMINATION CONTROL AND CORROSION PROTECTION PER MA0608-301 ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING, INSTALLATION AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. STANDARD DETAIL, DIMENSIONING AND TOLERANCING ARE VERIFIED BY INSPECTION. INSPECTION VERIFIED TUBING FABRICATION PER MA0102-306.

CRITICAL PROCESSES

WELDING PER MA0107-303 IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION IS VERIFIED BY INSPECTION.

TESTING

THE ATP, WHICH INCLUDES LEAK AND PROOF TESTING, EXAMINATION FOR WORKMANSHIP, FINISH AND DIMENSIONAL FEATURES IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PARTS PROTECTION AND HANDLING REQUIREMENTS ARE VERIFIED BY INSPECTION.

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(D) FAILURE HISTORY

NO FAILURE HISTORY IN IMU DUCTS. THE FOLLOWING FAILURES HAVE OCCURRED IN THE CABIN SUPPLY AND RETURN DUCTS:

DR ECL3010337, 9/24/79: IN CHECKING DFI CONTAINER AIR FLOW, THE CABIN AIR SUPPLY FLOW BALANCE INDICATED REDUCED FLOW TO THE PLT DIFFUSER. A PLASTIC BAG WAS FOUND INSIDE THE DUCT. RETEST YIELDED ADEQUATE FLOW. THIS PROBLEM WAS NOT A CAR; CLOSED AS A PR, WITH NO CORRECTIVE ACTION.

CAR AC2915-000, 9/13/83: DURING SUPPLY DUCT FLOW TESTS AT PALMDALE, REDUCED FLOW WAS NOTED AT AFT FLIGHT DECK DIFFUSER "A". A WHITE TAG WAS FOUND LODGED IN THE DIFFUSER. CORRECTIVE ACTION - AN "AWARE" WAS ISSUED TO HELP PROTECT DUCTS FROM DEBRIS. MANUFACTURING AND QUALITY AGREED TO APPLY INSPECTION SEALS ON ALL OPEN DUCT COVERS.

CAR AC8168-000, 5/24/84: WHILE WORKING A TPS AT KSC - REMOVING CAP TO VERIFY SUCTION LINE, A PARTS TAG (FORM 93-H) WAS FOUND TAPED INSIDE THE LINE. ACTION WAS TRANSFERRED TO CAR AD2016-000, ON WHICH SEVERAL OCCURRENCES OF DUCT/LINE CONTAMINATION WERE ACCUMULATED. CORRECTIVE ACTION - DUCT INSTALLATION PLANNING WAS REVISED TO REQUIRE A BUY-OFF OF VISUAL VERIFICATION THAT THERE IS NO DEBRIS IN DUCTS JUST PRIOR TO CLOSEOUT.

(E) OPERATIONAL USE
TBS.