

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
 NUMBER: 06-1B-0630 -X

SUBSYSTEM NAME: ARS - COOLING

REVISION: 1

01/08/98

 PART DATA

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
	: AIR DUCTS	
LRU	: COUPLING, SLEEVE, FLEXIBLE	ME276-0024
LRU	: COUPLING, SLEEVE, FLEXIBLE	ME276-0026
LRU	: DUCT, FLEXIBLE	ME276-0028
LRU	: DUCT, FLEXIBLE	ME276-0037
LRU	: DUCT	V070-613492
LRU	: DUCT	V070-613520
LRU	: DUCT	V070-613527
LRU	: DUCT	V070-613658
LRU	: DUCT	V070-613659
LRU	: DUCT	V070-613662
LRU	: DUCT	V070-613663
LRU	: DUCT	V070-613668
LRU	: DUCT	V070-613675
LRU	: DUCT	V070-613676
LRU	: DUCT	V070-613677
LRU	: DUCT	V070-613678
LRU	: DUCT	V070-613688
LRU	: DUCT	V070-613689
LRU	: DUCT	V070-613690

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -CIL HARDWARE
NUMBER: 06-1B-0630 -X**

LRU	: DUCT	V070-613691
LRU	: DUCT	V070-613692
LRU	: DUCT	V070-613693
LRU	: DUCT	V070-613697
LRU	: DUCT	V070-613698
LRU	: DUCT	V070-613699
LRU	: DUCT	V070-613711
LRU	: DUCT	V070-613715
LRU	: DUCT	V070-613717
LRU	: DUCT	V070-613737
LRU	: DUCT	V070-613779
LRU	: DUCT	V070-613783
LRU	: DUCT	V070-613787
LRU	: DUCT	V070-613792
LRU	: DUCT	V070-613799
LRU	: DUCT	V070-613801
LRU	: DUCT	V070-613802
LRU	: DUCT	V070-613823
LRU	: DUCT	V070-613875

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
DUCT SECTIONS, CABIN RETURN AIR AND IMU**

REFERENCE DESIGNATORS:

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -CIL HARDWARE
NUMBER: 06-1B-0630 -X**

**QUANTITY OF LIKE ITEMS: 1
ONE SET PER VEHICLE**

FUNCTION:

PRE-MEDS:

(THIS IS A COLLECTOR FMEA WHICH COMBINES SEPARATE FMEA'S WRITTEN WITH THE INTENT OF SUBDIVIDING ARS DUCTS INTO FUNCTIONAL GROUPS).

1. PROVIDE RETURN AIR FLOW PATH FROM FLIGHT DECK JUNCTION POINT OF RETURN AIR DUCTS DOWN THE STARBOARD WALL OF MIDDECK TO THE CABIN FAN INLET PLENUM. P/N'S: V070-613689, 690, 691, 692, 693, 697, 698, 699, 715, 717.
2. PROVIDE CONNECTIONS BETWEEN 3 MAIN RETURN DUCTS AND CABIN FAN, CO2 ABSORBER AND TEMP CONTROLLER ASSY, AND HUMIDITY CONTROL HEAT EXCHANGER. P/N'S V070-613492, 677, 678, 688, ME276-0024 & 0026.
3. PROVIDE RETURN AIR FLOW PATH FROM THE CABIN HUMIDITY AND PPO2-C SENSOR HOUSING TO THE COMMON RETURN DUCT. P/N'S V070-613799, 875.
4. PROVIDE COMMON RETURN AIR FLOW PATH FOR FLIGHT DECK EQUIPMENT: VSU, AVV12, DDU3, RCU, MSS, DU4, DEU4, AM12, PPO2-A,B,C, HUMIDITY, CABIN TEMP CONTROL SENSORS AND CABIN TEMP MONITOR SENSOR. P/N'S V070-613783, 799.
5. PROVIDE RETURN AIR FLOW PATH FROM THE DISPLAY ELECTRONICS UNITS (DEU'S) TO THE MAIN BRANCH OF THE RETURN AIR DUCT. P/N'S V070-613520, ME276-0024, -0037.
6. PROVIDE RETURN AIR FLOW PATH FROM THE ALPHA MACH INDICATORS (AM1'S) TO THE MAIN BRANCH OF THE RETURN AIR DUCT. P/N ME276-0024.
7. PROVIDE RETURN AIR FLOW PATH FROM THE THREE CABIN TEMPERATURE SENSORS AND THE PPO2-A,B SENSORS. P/N'S V070-613799, 875.
8. PROVIDE RETURN AIR FLOW PATH FROM THE ALTITUDE VERTICAL VELOCITY INDICATORS (AVV1'S) TO THE COLLECTION BRANCH RETURN DUCT. P/N ME276-0037.
9. PROVIDES RETURN AIR FLOW PATH FROM THE REMOTE CONTROL UNIT (RCU) TO THE COLLECTION BRANCH RETURN DUCT. P/N ME276-0028.
10. PROVIDES RETURN AIR FLOW PATH FROM THE MISSION SPECIALIST STATION (MSS) TO THE COLLECTION BRANCH RETURN DUCT. P/N ME276-0037.
11. PROVIDES RETURN AIR FLOW PATH FROM THE VIDEO SWITCHING UNIT (VSU) TO THE COLLECTION BRANCH RETURN AIR DUCT. P/N ME276-0028.
12. PROVIDES RETURN AIR FLOW PATH FROM THE DISPLAY DRIVER UNIT (DDU3) TO THE COLLECTION BRANCH RETURN AIR DUCT. P/N ME276-0028.
13. PROVIDES RETURN AIR FLOW PATH FROM DISPLAY UNIT (DU4) TO THE COLLECTION BRANCH RETURN DUCT. P/N ME276-0037.
14. PROVIDE RETURN AIR FLOW PATH FROM DISPLAY UNITS (DU1, DU2, DU3) TO THE MAIN BRANCH OF THE RETURN AIR DUCT. P/N'S V070-613779, ME276-0024 AND -0037.
15. PROVIDE RETURN AIR FLOW PATH FROM TWO TELEVISION MONITORS (TV) TO THE COMMON RETURN DUCT. P/N V070-613792, ME276-0037.

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16. PROVIDES RETURN AIR FLOW PATH FROM THE MANIPULATOR CONTROL INTERFACE UNIT (MCIU) TO THE COMMON RETURN DUCT. P/N'S V070-613823, ME276-0028.
17. PROVIDE RETURN AIR FLOW PATH FROM DISPLAY DRIVER UNITS (DDU1, DDU2) TO THE COLLECTION BRANCH OF THE RETURN AIR DUCT. P/N'S V070-613787, ME276-0024.
18. PROVIDE RETURN AIR FLOW PATH FROM PAYLOAD TO THE COMMON RETURN DUCT. P/N'S V070-613801, 802.
19. PROVIDE RETURN AIR FLOW PATH FROM THE WASTE COLLECTION AREA TO THE CABIN FAN INLET PLENUM. P/N'S V070-613658, 659, 662, 663, 665, 675, 676, 711.
20. ROUTE IMU COOLING AIR FROM THE IMU MUFFLER TO IMU'S, AND IMU'S TO MANIFOLD. P/N'S V070-613527, ME276-0037

MEDS CONFIGURATION:

(THIS IS A COLLECTOR FMEA WHICH COMBINES SEPARATE FMEA'S WRITTEN WITH THE INTENT OF SUBDIVIDING ARS DUCTS INTO FUNCTIONAL GROUPS).

1. PROVIDE RETURN AIR FLOW PATH FROM FLIGHT DECK JUNCTION POINT OF RETURN AIR DUCTS DOWN THE STARBOARD WALL OF MIDDECK TO THE CABIN FAN INLET PLENUM. P/N'S: V070-613689, 690, 691, 692, 693, 697, 698, 699, 715, 717.
2. PROVIDE CONNECTIONS BETWEEN 3 MAIN RETURN DUCTS AND CABIN FAN, CO2 ABSORBER AND TEMP CONTROLLER ASSY, AND HUMIDITY CONTROL HEAT EXCHANGER. P/N'S V070-613492, 677, 678, 688, ME276-0024 & 0026.
3. PROVIDE RETURN AIR FLOW PATH FROM THE CABIN HUMIDITY AND PPO2-C SENSOR HOUSING TO THE COMMON RETURN DUCT. P/N'S V070-613799, 875.
4. PROVIDE COMMON RETURN AIR FLOW PATH FOR FLIGHT DECK EQUIPMENT: VSU, DDU3, RCU, MSS, PPO2-A,B,C, HUMIDITY, CABIN TEMP CONTROL SENSORS AND CABIN TEMP MONITOR SENSOR. P/N'S V070-613783, 799.
5. PROVIDE RETURN AIR FLOW PATH FROM THE INTEGRATED DISPLAY PROCESSORS (IDP'S) TO THE MAIN BRANCH OF THE RETURN AIR DUCT. P/N'S V070-613520, ME276-0024, -0037.
6. PROVIDE RETURN AIR FLOW PATH FROM THE THREE CABIN TEMPERATURE SENSORS AND THE PPO2-A,B SENSORS. P/N'S V070-613799, 875.
7. PROVIDES RETURN AIR FLOW PATH FROM THE REMOTE CONTROL UNIT (RCU) TO THE COLLECTION BRANCH RETURN DUCT. P/N ME276-0028.
8. PROVIDES RETURN AIR FLOW PATH FROM THE MISSION SPECIALIST STATION (MSS) TO THE COLLECTION BRANCH RETURN DUCT. P/N ME276-0037.
9. PROVIDES RETURN AIR FLOW PATH FROM THE VIDEO SWITCHING UNIT (VSU) TO THE COLLECTION BRANCH RETURN AIR DUCT. P/N ME276-0028.
10. PROVIDES RETURN AIR FLOW PATH FROM THE DISPLAY DRIVER UNIT (DDU3) TO THE COLLECTION BRANCH RETURN AIR DUCT. P/N ME276-0028.
11. PROVIDE RETURN AIR FLOW PATH FROM TWO TELEVISION MONITORS (TV) TO THE COMMON RETURN DUCT. P/N V070-613792, ME276-0037.
12. PROVIDES RETURN AIR FLOW PATH FROM THE MANIPULATOR CONTROL INTERFACE UNIT (MCIU) TO THE COMMON RETURN DUCT. P/N'S V070-613823, ME276-0028.

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13. PROVIDE RETURN AIR FLOW PATH FROM DISPLAY DRIVER UNITS (DDU1, DDU2) TO THE COLLECTION BRANCH OF THE RETURN AIR DUCT. P/N'S V070-613787, ME276-0024.
14. PROVIDE RETURN AIR FLOW PATH FROM PAYLOAD TO THE COMMON RETURN DUCT. P/N'S V070-613801, 802.
15. PROVIDE RETURN AIR FLOW PATH FROM THE WASTE COLLECTION AREA TO THE CABIN FAN INLET PLENUM. P/N'S V070-613658, 659, 662, 663, 666, 675, 676, 711.
16. ROUTE IMU COOLING AIR FROM THE IMU MUFFLER TO IMU'S, AND IMU'S TO MANIFOLD. P/N'S V070-613527, ME276-0037
17. PROVIDE RETURN AIR FLOW PATH FROM MULTIFUNCTION DISPLAY UNITS (MDU'S) TO THE MAIN BRANCH OF THE RETURN AIR DUCT. P/N'S V070-613737, ME276-0024.

- APPROVALS -

SS&PAE MANAGER	: P. STENGER-NGUYEN	<u><i>P. Stenger-Nguyen</i></u>
SS&PAE	: T. AI	<u><i>T. Ai</i></u>
DESIGN ENGINEERING	: K. DUONG	<u><i>K. Duong</i></u>
MEDS SYSTEM	: M. B. WARNER	<u><i>M. B. Warner</i></u>
MEDS HARDWARE	: R. SITAPARA	<u><i>R. Sitapara</i></u>
JSC MOD	:	<u><i>[Signature]</i></u>

2/23/98

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1B -0630 -1 REV: 08/22/88

ASSEMBLY : AIR DUCTS											
P/N RI : V070-61300K											
P/N RI : ME276-00XX											
P/N VENDOR:											
QUANTITY : 1 SET PER VEHICLE											

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

PREPARED BY:		REDUNDANT	SCREEN	A-PASS	B-PASS	C-PASS
DES N. K. DUONG	APPROVED BY:	<i>[Signature]</i>	<i>[Signature]</i>	APPROVED BY (NASA):	<i>[Signature]</i>	<i>[Signature]</i>
REL N. L. STEISSLINGER	DES	<i>[Signature]</i>	<i>[Signature]</i>	SSM	<i>[Signature]</i>	<i>[Signature]</i>
QE D. STOICA	REL	<i>[Signature]</i>	<i>[Signature]</i>	REL	<i>[Signature]</i>	<i>[Signature]</i>
	QE	<i>[Signature]</i>	<i>[Signature]</i>	QE	<i>[Signature]</i>	<i>[Signature]</i>

ITEM:
DUCT SECTIONS, CABIN RETURN AIR AND IMC

FUNCTION:

- (THIS IS A COLLECTOR FMEA WHICH COMBINES SEPARATE FMEAS WRITTEN WITH THE INTENT OF SUBDIVIDING AIR DUCTS INTO FUNCTIONAL GROUPS).
1. PROVIDE RETURN AIR FLOW PATH FROM FLIGHT DECK JUNCTION POINT OF RETURN AIR DUCTS DOWN THE STARBOARD WALL OF MIDDECK TO THE CABIN FAN INLET PLENUM. P/N'S: V070-613689, 690, 691, 692, 693, 697, 698, 699, 715, 717.
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 3. PROVIDE RETURN AIR FLOW PATH FROM THE CABIN HUMIDITY AND PPO2-C SENSOR HOUSING TO THE COMMON RETURN DUCT. P/N'S V070-613799, 875.
 4. PROVIDE COMMON RETURN AIR FLOW PATH FOR FLIGHT DECK EQUIPMENT: VSU, AVVI2, DDU3, RCU, MSS, DU4, DEU4, AMI2, PPO2-A, B, C, HUMIDITY, CABIN TEMP CONTROL SENSORS AND CABIN TEMP MONITOR SENSOR. P/N'S V070-613783, 799.
 5. PROVIDE RETURN AIR FLOW PATH FROM THE DISPLAY ELECTRONICS UNITS (DEU'S) TO THE MAIN BRANCH OF THE RETURN AIR DUCT. P/N'S V070-613520, ME276-0024, -0037.
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 7. PROVIDE RETURN AIR FLOW PATH FROM THE THREE CABIN TEMPERATURE SENSORS AND THE PPO2-A, B SENSORS. P/N'S V070-613799, 875.
 8. PROVIDE RETURN AIR FLOW PATH FROM THE ALTITUDE VERTICAL VELOCITY INDICATORS (AVVI'S) TO THE COLLECTION BRANCH RETURN DUCT. P/N ME276-0037.
 9. PROVIDES RETURN AIR FLOW PATH FROM THE REMOTE CONTROL UNIT (RCU) TO THE COLLECTION BRANCH RETURN DUCT. P/N ME276-0028.
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 12. PROVIDES RETURN AIR FLOW PATH FROM THE DISPLAY DRIVER UNIT (DDU3) TO THE COLLECTION BRANCH RETURN AIR DUCT. P/N ME276-0028.
 13. PROVIDES RETURN AIR FLOW PATH FROM DISPLAY UNIT (DU4) TO THE COLLECTION BRANCH RETURN DUCT. P/N ME276-0037.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1B -0630 -1 REV:08/22/88

14. PROVIDE RETURN AIR FLOW PATH FROM DISPLAY UNITS (DU1, DU2, DU3) TO THE MAIN BRANCH OF THE RETURN AIR DUCT. P/N'S V070-613779, ME276-0024 AND -0037.
15. PROVIDE RETURN AIR FLOW PATH FROM TWO TELEVISION MONITORS (TV) TO THE COMMON RETURN DUCT. P/N V070-613792, ME276-0037.
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18. PROVIDE RETURN AIR FLOW PATH FROM PAYLOAD TO THE COMMON RETURN DUCT. P/N'S V070-613801, 802.
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20. ROUTE IMU COOLING AIR FROM THE IMU MUFFLER TO IMU'S, AND IMU'S TO MANIFOLD. P/N'S V070-613527, ME276-0037.

FAILURE MODE:

EXTERNAL LEAKAGE (DISLODGED DUCT AS WORST CASE)

CAUSE(S):

PUNCTURE, ABRASION, MATERIAL DEFECT, BROKEN CLAMPS

EFFECT(S) ON:

(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) "SHORT-CIRCUITED" COOLING AIR FLOW THROUGH FLIGHT DECK AVIONICS LRU'S OR IMU'S.

(B) REDUCED COOLING AIR FLOW THROUGH FLIGHT DECK AVIONICS LRU'S OR IMU'S.

(C) POSSIBLE EARLY MISSION TERMINATION BASED UPON MAGNITUDE OF LEAK.

(D) POSSIBLE LOSS OF CREW/VEHICLE DUE TO FAILURE OF THE AFFECTED AVIONICS AS THE RESULT OF LRU OVERHEATING.

DISPOSITION & RATIONALE:

(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE

(A) DESIGN

THE CABIN AIR COLLECTION RETURN AND DISTRIBUTION SUPPLY DUCTS ARE RIGID EPOXY/ARAMID SECTIONS NOMINALLY ABOUT 15 INCHES LONG AND PREFORMED TO FIT THE CONTOUR OF THE VEHICLE AT THE INSTALLATION SITE. SECTIONS ARE HARD MOUNTED TO STRUCTURE BY A BRACKET/BAND CLAMP ASSEMBLY. A 0.50 INCH STRESS RELIEF GAP IS PROVIDED BETWEEN DUCT SECTIONS. THIS GAP IS BRIDGED BY FLEXIBLE SILICONE/FIBERGLASS SLEEVES HELD IN PLACE BY BAND CLAMPS AND GROOVES THAT ARE PREFORMED INTO EACH DUCT SEGMENT. DUCT BRANCHES LEADING TO AVIONICS BOXES ARE PREFORMED INTO THE MAIN DUCT SECTIONS OR MOUNTED TO THE MAIN DUCTS VIA PREFORMED INTERFACE FITTINGS. DUCTS ARE PROTECTED FROM DAMAGE BY CLOSEOUT PANELS.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1B -0630 -1 REV:08/22/82

FLEXIBLE DUCTS OF SILICONE/FIBERGLASS FABRIC OVER STEEL HELICAL SPRING WIRE ARE USED AS REQUIRED AT THE DUCT/AVIONICS BOX INTERFACE. BAND CLAMPS ARE USED TO HOLD FLEXIBLE DUCTS TO LRU AND RIGID DUCT INTERFACES. FLEXIBLE DUCTS ARE PROTECTED FROM DAMAGE BY CLOSEOUT PANELS.

IMU DUCT SYSTEM IS COMPRISED OF RIGID AND FLEXIBLE DUCT SECTIONS:

RIGID DUCTING IS FABRICATED OUT OF ALUMINUM TUBING WITH 0.035 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.

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

CABIN AIR RIGID DUCTS:

QUALIFICATION TEST - TESTS OF SIMILAR MATERIAL SHOW THAT RIGID EPOXY/ARAMID DUCTS ARE UNAFFECTED BY HUMIDITY AND TEMPERATURE WITHIN THE LIMITS IMPOSED BY THE CABIN ATMOSPHERE. TENSILE STRENGTH (500 KSI) REMAINED UNCHANGED AFTER EXPOSURE TO 100 PPM OZONE AT 70 F FOR 1000 HOURS. TOLERANCE TO SALINITY WAS DEMONSTRATED BY ANALYSIS BASED ON TESTS OF SIMILAR MATERIAL IN SALT WATER FOR 125 DAYS. TRANSIENT VIBRATIONS, RANDOM VIBRATIONS, AND CRASH LOADS WERE CERTIFIED BY ANALYSIS.

FLEXIBLE DUCTS:

ACCEPTANCE TEST - EXTERNAL LEAK TEST AT 0.5 PSIG FOR 5 MINUTES. MAX LEAKAGE 0.005 CFM/INCH DIAMETER/FT LENGTH. PROOF TEST AT 1.0 PSIG FOR 5 MINUTES.

QUALIFICATION TEST - THE SILICONE/FIBERGLASS FLEX DUCTS WERE CERTIFIED BY SIMILARITY AND WERE SHOWN 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 TEST OF THE SIMILAR DUCTS AND CRASH LOADS BY ANALYSIS.

IN-VEHICLE TESTING - CABIN: SUPPLY AIR FLOW DISTRIBUTION IS MEASURED USING A HOT WIRE ANEMOMETER AT COMPLETION OF ASSEMBLY OF EACH VEHICLE. CABIN FAN DELTA-P IS MONITORED DURING THIS TEST AND THE DELTA-P CAN BE USED AS A REFERENCE POINT TO DETECT MAJOR FLOW RESISTANCE CHANGES IN THE DUCT SYSTEM. DUCT INSTALLATION IS INSPECTED FOR DAMAGE PRIOR TO INSTALLATION OF CLOSEOUT PANELS.

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

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1B -0630 -1 REV:08/22/88

OMRSD - CABIN FAN DELTA-P IS MONITORED DURING EVERY TURNAROUND AND SERVES AS AN INDICATION OF SYSTEM PERFORMANCE/EXTERNAL LEAKAGE. FLEXIBLE AND HARD DUCTS ARE BEING COMPLETELY INSPECTED PRIOR TO FIRST REFLIGHT OF EACH ORBITER AND ARE ALSO INSPECTED AS AVAILABLE IN CONJUNCTION WITH REMOVAL OF PANELS/LRU'S. DUCTS ARE ALSO INSPECTED DURING PERIODIC ZONAL INSPECTIONS.

OMRSD - IMU FAN DELTA-P IS MONITORED CONTINUOUSLY WHEN IMU'S ARE POWERED UP; VERIFIED EVERY TURNAROUND. A DECREASE IN FAN DELTA-P WOULD BE AN INDICATION OF EXTERNAL LEAKAGE.

(C) INSPECTION

CABIN DUCTS:

RECEIVING INSPECTION

CERTIFICATION OF MATERIALS AND PROCESSES IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

INSPECTION VERIFIES THE FOLLOWING: PROCESS REQUIREMENTS RELATIVE TO MATERIALS PREPARATION, FABRICATION OF DUCT SECTIONS (INCLUDING DUCT LENGTH AND WALL THICKNESS) AND CURE CYCLES IN ACCORDANCE WITH REQUIREMENTS, INSTALLATION OF CURED SECTIONS INTO THE DUCT SYSTEM (BONDING, SPLICING, SEAL COATING, INSTALLATION OF CLAMPS, FASTENERS, TAPE AND INSULATION) IN ACCORDANCE WITH DRAWING AND SPECIFICATION REQUIREMENTS.

TESTING

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

PACKAGING AND HANDLING

PARTS PROTECTION AND HANDLING REQUIREMENTS ARE VERIFIED BY INSPECTION.

IMU DUCTS:

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.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

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SUBSYSTEM : ATMOSPHERIC REVIT.

FMEA NO 06-1B -0630 -1

REV: 08/22/88

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.

(D) FAILURE HISTORY

THERE IS NO FAILURE HISTORY OF THE RIGID DUCT. THE FLEXIBLE DUCTS HAVE DEVELOPED MINOR LEAKS THAT HAVE BEEN CAUSED BY ABRASION AND PUNCTURE DUE TO INTERFERING WITH THE SURROUNDING STRUCTURE. NONE OF THE LEAKAGE TO DATE HAS RESULTED IN SIGNIFICANT AIR FLOW REDUCTION TO CAUSE OVERHEATING AND SUBSEQUENT FAILURE OF AVIONICS EQUIPMENT. A REDESIGN IS IN PROGRESS WHICH WILL REPLACE THE STEEL SPRING IN THE DUCT WITH A NYLON SPRING AND THE FIBERGLASS SILICON SHEATH WITH ARAMID/SILICON FABRIC. CAR AD3187-010, DATED 7/15/87, WAS OPENED AGAINST DUCTS REMOVED DURING COMPLETE INSPECTION OF OV-102 DUCTS. IT REMAINS OPEN PENDING REDESIGN.

(E) OPERATIONAL USE

CABIN DUCTS:

1. CREW ACTION

- A. CABIN FAN PERFORMANCE TROUBLESHOOTING.
- B. AVIONICS LRU FAILURE TROUBLESHOOTING.

2. TRAINING

CURRENT ECLSS TRAINING COVERS THE EFFECT OF CABIN FAN PERFORMANCE DEGRADATION.

3. OPERATIONAL CONSIDERATIONS

- A. LRU PERFORMANCE DEGRADATION FROM SPEC PERFORMANCE IS NOT WELL KNOWN.
- B. REAL TIME DATA SYSTEM ALLOWS FOR GROUND MONITORING.
- C. IFM REPAIR WOULD BE CONSIDERED DEPENDING ON LOCATION OF LEAKAGE.

IMU DUCTS:

1. CREW ACTION

FAN PERFORMANCE DEGRADATION TROUBLESHOOTING.

2. TRAINING

CURRENT ECLSS TRAINING COVERS THE FAN PERFORMANCE DEGRADATION EFFECT OF THIS FAILURE.

3. OPERATIONAL CONSIDERATIONS

- A. REAL TIME DATA SYSTEM ALLOWS FOR GROUND MONITORING.
- B. ALTERNATE POWER CYCLING OF EACH OF THE THREE IMU'S IS POSSIBLE.
- C. IFM REPAIR WOULD BE CONSIDERED DEPENDING ON ACCESSIBILITY OF DUCT LEAK.