

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE  
NUMBER: 03-1-0408-X**

**SUBSYSTEM NAME: MAIN PROPULSION**

**REVISION: 1 5/11/94**

	<b>PART NAME VENDOR NAME</b>	<b>PART NUMBER VENDOR NUMBER</b>
LRU	: DISCONNECT, LO2, 17 INCH	MC284-0389-0551 (ORB HALF)
LRU	: DISCONNECT, LO2, 17 INCH	MC284-0389-0552 (ET HALF)

**PART DATA**

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
DISCONNECT, LO2 FEED, 17 INCH, ORBITER & ET HALF. (PD1)

**QUANTITY OF LIKE ITEMS: 1**  
ONE

**FUNCTION:**

ET/ORBITER FEED LINE DISCONNECT PROVIDES LO2 PROPELLANT TO THE MPS AND A MEANS OF LOADING AND DETANKING THE ET. EACH DISCONNECT HALF CONTAINS A PNEUMATICALLY ACTUATED FLAPPER CLOSURE DEVICE WHICH REMAINS IN ITS LAST ACTUATED POSITION (BISTABLE). THE VALVES ARE CLOSED AFTER MECO TO PREVENT PROPULSIVE VENTING LEADING TO ET/ORBITER RECONTACT, TILE/DOOR DAMAGE DUE TO EXPOSURE TO PROPELLANTS, LOSS OF HELIUM SUPPLY DURING MANIFOLD REPRESSURIZATION (RTLSTAL ABORT CRITICAL), AND SYSTEM CONTAMINATION DURING ENTRY. DURING UMBILICAL SEPARATION, THE VALVE SYSTEM IS DESIGNED TO MECHANICALLY CLOSE BOTH THE ORBITER AND ET DISCONNECT FLAPPERS IF UNABLE TO CLOSE THEM PNEUMATICALLY (POST MECO). REDUNDANT OPEN AND CLOSE (TWO EACH) VALVE POSITION SWITCHES ARE LOCATED ON THE ORBITER HALF OF THE DISCONNECT. THE FLAPPER DRIVE MECHANISM IS DESIGNED TO ALLOW RELIEF OF PROPELLANTS TRAPPED BETWEEN THE FLAPPERS AFTER DISCONNECT CLOSURE.

A PNEUMATICALLY ACTUATED LATCH MECHANISM IS PROVIDED TO PREVENT THE VALVE FLAPPERS FROM CLOSING DURING FLOW CONDITIONS. THE LATCH IS BISTABLE AND IS CONTROLLED BY A SEPARATE PNEUMATIC ACTUATOR ASSEMBLY WITH REDUNDANT LOCK AND UNLOCK (TWO EACH) POSITION SWITCHES. LATCH MECHANISM INCORPORATES A TOGGLE PIVOT WHICH ALLOWS FLAPPER CLOSURE DURING BACK UP MECHANICAL SEPARATION WITH LATCH IN LOCKED POSITION. SEE LATCH FMEA/CIL 0454 FOR ADDITIONAL INFORMATION.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : MAIN PROPULSION

FMEA NO: 03-1 -0408 -10 REV: 02/20/1

ASSEMBLY :  
P/N RI : MC284-0389-XXXX  
ORB HALF 0551  
ET HALF 0552

CRIT. FUNC: :  
CRIT. HDW: :

P/N VENDOR:

QUANTITY : 1  
: ONE  
:

VEHICLE	102	103	10
EFFECTIVITY:	X	X	X
PHASE(S):	PL	LO X OO	DO LS

PREPARED BY:  
DES J E OSUND  
REL L H FINEBERG  
QE E M GUTIERREZ

REDUNDANCY SCREEN: A- B- C-  
APPROVED BY:  
DES *[Signature]* APPROVED BY (NASA)  
REL *[Signature]* SSM *[Signature]*  
QE *[Signature]* REL *[Signature]*  
*[Signature]* 2-24-  
*[Signature]* ASDZ

ITEM:  
DISCONNECT, LO2 FEED (WITH LATCH) 17 INCH, ORBITER & ET HALF. (PD1)

FUNCTION

ET/ORBITER FEED LINE DISCONNECT PROVIDES LO2 PROPELLANT TO THE MPS AND MEANS OF LOADING AND DETANKING THE ET. EACH DISCONNECT HALF CONTAINS A PNEUMATICALLY ACTUATED FLAPPER CLOSURE DEVICE WHICH REMAINS IN ITS LAST ACTUATED POSITION (BISTABLE). THE VALVES ARE CLOSED AFTER MECO TO PREVENT PROPULSIVE VENTING LEADING TO ET/ORBITER RECONTACT, TILE/DOCR DAMAGE DUE TO EXPOSURE TO PROPELLANTS, LOSS OF HELIUM SUPPLY DURING MANIFOLD REPRESSURIZATION (RTLS/TAL ABORT CRITICAL), AND SYSTEM CONTAMINATION DURING ENTRY. DURING UMBILICAL SEPARATION, THE VALVE SYSTEM IS DESIGNED TO MECHANICALLY CLOSE BOTH THE ORBITER AND ET DISCONNECT FLAPPERS IF UNABLE TO CLOSE THEM PNEUMATICALLY (POST MECO). REDUNDANT OPEN AND CLOSE (TWO EACH) VALVE POSITION SWITCHES ARE LOCATED ON THE ORBITER HALF OF THE DISCONNECT. THE FLAPPER DRIVE MECHANISM IS DESIGNED TO ALLOW RELIEF OF PROPELLANTS TRAPPED BETWEEN THE FLAPPERS AFTER DISCONNECT CLOSURE.

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FAILURE MODE

ERRONEOUS INDICATION (VALVE OPEN, CLOSED POSITION INDICATOR ON)  
POST MECO, PRE UMBILICAL RETRACT

CAUSE(S)

PIECE PART STRUCTURAL FAILURE OF VALVE, BINDING.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION

FMEA NO:03-1 -0408 -10 REV:02/20/88

EFFECT(S): ON

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

(A,B) RESULTS IN EITHER FLAPPER (ORBITER OR ET) FAILING TO CLOSE BUT BOTH CLOSED POSITION SWITCHES INDICATING ON. VALVE POSITION INDICATION SWITCHES ARE LOCATED ON THE ORBITER HALF OF THE DISCONNECT AND ONLY INDICATE POSITION OF THE INPUT END OF THE ORBITER FLAPPER DRIVE SHAFT.

STRUCTURAL FAILURE OF THE MECHANICAL LINKAGE TO THE FLAPPER WOULD NOT ALLOW EITHER FLAPPER TO CLOSE BY PNEUMATIC ACTUATION OR BY MECHANICAL SEPARATION (UMBILICAL RETRACT). BINDING IN THE DRIVE MECHANISM LINKAGE (AT THE OUTPUT END OF THE ET FLAPPER TORSION BAR) WILL NOT ALLOW ET FLAPPER TO CLOSE.

VEHICLE SOFTWARE WILL PROCEED WITH ET STRUCTURAL SEPARATION IF ONE OF TWO CLOSE SWITCHES INDICATE "ON." RESULTS IN POSSIBLE TILE AND DOOR DAMAGE AT THE UMBILICAL AREA DUE TO CRYO EXPOSURE AND ORBITER/ET RECONTACT DUE TO PROPULSIVE VENTING FOLLOWING ET STRUCTURAL SEPARATION. ALSO MAY RESULT IN ET IMPACT OUTSIDE ALLOWABLE FOOTPRINT.

(C,D) POSSIBLE LOSS OF CREW/VEHICLE/LIFE/PROPERTY

DISPOSITION & RATIONALE:

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

(A) DESIGN

A PNEUMATIC ACTUATOR MOUNTED ON THE ORBITER HALF OF THE DISCONNECT DRIVES THE ET FLAPPER THROUGH A ROLLER/CLEVIS LINKAGE. THIS ACTION IN TURN DRIVES A SECOND ROLLER/CLEVIS LINKAGE WHICH OPERATES THE ORBITER FLAPPER AND THE POSITION INDICATOR ASSEMBLY. THE POSITION INDICATORS ARE MOUNTED ON ONE END OF THE ORBITER FLAPPER DRIVE ARM SHAFT. THE SHAFT IS LINKED TO THE POSITION INDICATOR DRIVE CAM. THE INDICATORS ARE MECHANICALLY ACTIVATED MICROSWITCHES.

THE DISCONNECT VALVE CONSISTS OF COMPONENTS MANUFACTURED FROM 2024-T651 AL ALLOY (FLAPPER ASSEMBLY), INCONEL 718 (ARM FOLLOWER) AND A286 CRES (ARM DRIVE ASSEMBLY). THE VALVE HOUSING IS MANUFACTURED FROM 2219 AL ALLOY.

DESIGN FACTORS OF SAFETY FOR INTERNAL PRESSURE ARE 1.3 PROOF, 1.5 BURST FOR THE DISCONNECT. THE FLAPPERS ARE DESIGNED TO WITHSTAND A PROOF PRESSURE IN THE CLOSED POSITION OF 286 PSIG FOR THE ORBITER SECTION AND 58.5 PSIG FOR THE EXTERNAL TANK SECTION. THE DRIVE MECHANISM HAS A MINIMUM LIFE EQUIVALENT OF 100 ORBITER MISSIONS. THE ORBITER FLAPPERS HAVE A MINIMUM USEFUL LIFE OF 3500 CYCLES WHICH IS EQUIVALENT TO 100 ORBITER MISSIONS. THE ET FLAPPERS HAVE A MINIMUM LIFE OF 150 CYCLES WHICH IS EQUIVALENT TO ONE ORBITER MISSION. STRUCTURAL ANALYSIS INDICATES POSITIVE MARGINS OF SAFETY FOR ALL CONDITIONS OF VALVE OPERATION; FRACTURE/FATIGUE ANALYSIS SHOW THAT ALL CRITICAL PARTS ARE SATISFACTORY FOR FOUR TIMES EXPECTED LIFE (ET - ONE MISSION, ORBITER - 100 MISSIONS).

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION

FMEA NO:03-1 -0408 -10 REV:02/20/8

(B) TEST

ATP (ACTUATOR)

PROOF: AMBIENT, 1275 PSIG

OPERATIONAL (TWO CYCLES): AMBIENT: 400, 740, 780 PSIG

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION

FMEA NO:03-1 -0408 -10 REV:12/17/8

RESPONSE TIME (OPENING/CLOSING): ROOM AMBIENT/-300 DEG F  
RESPONSE TIME AT 400, 700 AND 780 PSIG

LEAKAGE: EXTERNAL AND INTERNAL, AMBIENT AND CRYO

ATP - ET/ORBITER MATED DISCONNECT ASSEMBLY

FLAPPER ANGLE: ET 4.5 +/- 0.25 DEG, ORB 3.0 +/- 0.25 DEG

TIP LOAD: ET 55 LB MINIMUM, ORB 40 LB MINIMUM

POSITION SWITCH VERIFICATION: LATCH IN LOCKED POSITION. ROTATION FROM  
FLAPPER POSITION OF REST ON DOWNSTRIKE SURFACE TO FLAPPER POSITION  
WHERE OPEN INDICATOR LIGHT TURNS ON MUST BE 4 DEG, MINIMUM.

PROOF: AMBIENT, 1275 PSIG, ACTUATOR  
286 PSIG FOR ORBITER CLOSURE DEVICE  
58 PSIG FOR ET CLOSURE DEVICE

OPERATIONAL CYCLE: CRYO, -300 DEG F, ACTUATOR PRESSURE 740 PSIG FOR 8  
CYCLES AND 450 PSIG FOR 5 CYCLES  
AMBIENT, H<sub>2</sub> AT 400 PSIG (1 CYCLE) AND 740 PSIG (5  
CYCLES)

CLEANLINESS VERIFICATION: MOISTURE FREE AND CLEANED TO LEVEL 400A OF  
MA 0110-301

LEAKAGE: EXTERNAL

VALVE: LN<sub>2</sub>/AMBIENT TEMPS: 50 SCIMS OF GHE AT 10 PSIG, 50  
SCIMS OF GHE AT 50 PSIG; LATCH SHAFT SEAL, 80 SCIMS OF  
GHE; 150 SCIMS OF GN<sub>2</sub> AT 185 PSIG; LATCH SHAFT SEAL,  
80 SCIMS OF GN<sub>2</sub>

VALVE ACTUATOR:

CRYO (BODY TEMP AT -300 DEG F, ACTUATOR AT -200 TO  
0 DEG F)/AMBIENT TEMPS: 100 SCIMS OF GHE AT 740 PSIG

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION FMEA NO:03-1 -0408 -10 REV:02/20/88

INTERNAL

VALVE: AMBIENT TEMPS: 1000 TO 2000 SCIMS OF GHE AT 1 TO 15 PSIG; 2500 SCIMS OF GN2 AT 200 PSIG

LN2 TEMPS: 2500 SCIMS OF GHE AT 60 PSIG; 2500 SCIMS OF GN2 AT 200 PSIG

VALVE ACTUATOR:

CRYO (BODY TEMP AT -300 DEG F, ACTUATOR AT -200 TO 0 DEG F)/AMBIENT TEMPS: 100 SCIMS OF GHE AT 740 PSIG

RELIEF OPERATION: -300 DEG F, CRACKING/RESEAT PRESSURE, 0.1-5 PSID (ET ONLY)

ELECTRICAL CHARACTERISTICS (INSULATION RESISTANCE AND VOLTAGE DROP), AND DIELECTRIC STRENGTH

FLOW LINER - ROUNDNESS VERIFICATION (FREE END EIGHT POINTS MEASUREMENT)

CERTIFICATION

COMPONENT QUALIFICATION (INCLUDES TESTING FROM PREVIOUS CONFIGURATION  
----- WITHOUT LATCH)

SALT FOG

VIBRATION - THREE AXES:

SINUSOIDAL: 5 TO 35 HZ AT 0.25 G, ZERO TO PEAK

RANDOM: 20 TO 2,000 HZ 5.7 G RMS FOR X-AXIS, 5.2 G RMS FOR Y AND Z-AXIS, NO FLOW (LN2), FLAPPERS OPEN, LATCH ENGAGED

THE DISCONNECT IS CHILLED WITH LN2 AND STABILIZED AT -300 DEG F. 10 PSIG DISCONNECT, 740 PSIG ACTUATOR. THESE CONDITIONS ARE MAINTAINED THROUGHOUT SINUSOIDAL AND RANDOM VIBRATION. ACTUATOR VENTED DURING LAST TWO MINUTES OF VIBRATION.

THERMAL CYCLE: -400 TO 150 DEG F, 3 CYCLES

OPERATING LIFE: AMBIENT, 740 PSIG HE FOR A TOTAL OF 2,400 CYCLES FOR ORBITER AND 100 CYCLES FOR ET.  
THE RELIEF MECHANISM WAS CYCLED DURING ET VALVE CYCLING.

CRYO, 740 PSIG HE, -400 DEG F FOR A TOTAL OF 1000 CYCLES FOR ORBITER AND 50 CYCLES FOR THE ET.  
THE RELIEF MECHANISM WAS CYCLED DURING ET VALVE CYCLING.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION

FMEA NO:03-1 -0408 -10 REV:02/20/8

ELECTRICAL CHARACTERISTICS (INSULATION RESISTANCE AND VOLTAGE DROP)

LEAKAGE: EXTERNAL AND INTERNAL, AMBIENT AND CRYO

ENGAGE - DISENGAGE: ENGAGE FORCE = 1000 LBS MAX, DISENGAGE  
FORCE = 6000 LBS MAX

BURST TEST: PNEUMATIC ACTUATOR, 1700 PSIG HYDROSTATIC PRESSURE FOR  
2 MINUTES

TYPE I AND TYPE II MATED (OPEN POSITION) 450 PSIG HYDROSTATI  
PRESSURE FOR 2 MINUTES

TYPE I AND TYPE II DEMATED (CLOSED POSITION) 330 PSID TO  
TYPE I, 68 PSID TO TYPE II FOR 2 MINUTES

UMBILICAL SEPARATION TEST: (WITHOUT LATCH)  
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THE DISCONNECT WAS INSTALLED IN THE UMBILICAL ASSEMBLY DURING THE  
SEPARATION TEST PROGRAM. THE UMBILICAL ASSEMBLY WAS SUBJECTED TO  
RANDOM VIBRATION TESTS (4.4 HOURS PER AXIS) WHILE FILLED WITH LN2. THE  
DISCONNECT WAS ALSO SUBJECTED TO UMBILICAL RETRACT TESTS AT BOTH  
NOMINAL CONDITIONS AND SIMULATED HYDRAULIC RETRACT ACTUATOR FAILURES.

UMBILICAL SEPARATION TEST: (WITH LATCH)  
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FLAPPER PNEUMATICS/LATCH PNEUMATICS/PYROS/RETRACTOR HYDRAULICS

- (1) PNEUMATIC CLOSURE (NORMAL) - 4 CYCLES
- (2) MECHANICAL CLOSURE (BACKUP) - 5 CYCLES

、 BOTH PERFORMED AT AMBIENT, LN2 AND LH2 CONDITIONS.

FLOW LINER WATER FLOW TESTS:  
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DESIGN FLOW TO 19,600 GPM  
ALLOWABLE DELTA P IS 10 PSID AT THE LINER

TO DETERMINE THE STABILITY OF THE FLOW LINER. THE FLOW TUBE HAD NO  
PERMANENT DAMAGE AFTER BEING SUBJECTED TO WATER FLOWS UP TO 20,000 GPM  
(TEST TIME OF 2 MINUTES / 6 RUNS MINIMUM). AFTER VERIFYING  
PERFORMANCE AT 20,000 GPM, THE UNIT WAS SUBJECTED TO 22,700 GPM TO  
VERIFY DESIGN MARGIN (NO PERMANENT DAMAGE).

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION

FMEA NO:03-1 -0408 -10

REV:02/20/83

FLAPPER ANGLE STABILITY MARGIN WATER FLOW TESTS:  
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FOURTEEN (14) EXPLORATORY TEST SERIES (FLOW 4,000 TO 20,800 GPM)  
E.T. FLAPPER SETTING VARYING FROM 1.6 TO 5.8 DEG.  
ORB. FLAPPER SETTING VARYING FROM 0.9 TO 5.4 DEG.

CERTIFICATION TEST RUN AT WORST CASE PRODUCTION SETTING (FLOW RANGE  
TO 109% POWER LEVEL).

PROOF TEST SERIES - MAXIMUM FLOW 22,700 GPM, AT ANGLES BELOW MINIMUM  
FLIGHT SETTINGS

PRODUCTION ANGLE SETTINGS

E.T. 4.5 +/- 0.25 DEG

ORB. 3.0 +/- 0.25 DEG

FLAPPER TIP LOAD MARGIN WATER FLOW TEST:  
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EIGHT (8) EXPLORATORY TEST SERIES (FLOW RANGE TO 109% POWER LEVEL)

FLOW 4,000 TO 20,600 GPM

ORBITER: 3.0 +/- 0.1 DEG FOR SEVEN SERIES, 4.1 +/- 0.1 FOR ONE SERIES  
TIP LOAD RANGE: 20 TO 62 LBS

ET: 3.95 +/- 0.1 DEG

TIP LOAD RANGE: 23 TO 61 LBS

RECOMMENDED TIP LOAD:

ORBITER: 40 LBS MINIMUM

ET: 55 LBS MINIMUM

LATCH WATER FLOW TESTS:  
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TWENTY-FOUR (24) EXPLORATORY TEST SERIES (FLOW 4,000 TO 22,100 GPM)

CERTIFICATION TEST RUN AT MINIMUM PRODUCTION SETTING (FLOW RANGE  
TO 109% POWER LEVEL).

TWO TEST SERIES IN FILL DIRECTION (FLOW 4,000 TO 6,400 GPM), LATCH  
PNEUMATIC PRESSURE VENTED (BISTABILITY)

PROOF TEST - 23,200 GPM

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION

FMEA NO:03-1 -0408 -10 REV:02/20/8

LATCH CRYO FLOW TESTS:  
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SIXTEEN (16) TESTS WITH LN2/LO2 (FLOWS VARY FROM ONE ENGINE AT 65% TO THREE AT 109%):

DISCONNECT FLAPPER STABILITY/LOADS

CAVITATION

FRICTION PRESSURE LOSS

ENGINE CUTOFF SENSOR RESPONSE

STEADY STATE TEST: LN2 (65% AND 109% OF RATED POWER LEVEL), LATCH ENGAGED. LO2 (100%, 104% AND 109% OF RATED POWER LEVEL), LATCH ENGAGED AND NOT ENGAGED.

TERMINAL DRAIN: (SATURATED LO2) (65% AND 109%) LATCH ENGAGED AND NOT ENGAGED.

OMRSD

V41AYO.010 LO2 EXTERNAL LEAK TEST (15)  
V41AYO.130 LO2 DECAY TEST (EVERY FLT)  
V41AYO.221 HELIUM SIGNATURE TEST (EVERY FLT)  
V41AYO.260 LO2 SHAFT SEAL LEAK CHECK (15)  
V41BBO.080 LO2 SEAT LEAKAGE TEST (EVERY FLT)  
V41BIO.240 ORB/ET DISC RESPONSE TIME (POST FLT DATA ANALYSIS)  
V41BUO.280 DISCONNECT FLAPPER ANGLE VERIFICATION (EVERY FLT)  
V41BUO.320 DISCONNECT INSPECTION AND TIP LOAD VERIF (EVERY FLT)  
V41BUO.330 MPS COMPONENT CAVITY INSPECTION (EVERY FLT)  
V41BUO.370 LO2/LH2 17" DISC ACTUATOR OPERATIONAL VERIF (EVERY FLT)  
T41QAL.090 LO2/LH2 17" DISCONNECT INSPECTION (EVERY FLT)  
T41FUN.040 OPENING TORQUE BEFORE MATING (EVERY FLT)  
T41FUN.061 ET 17" TIP LOAD/FLAPPER ANGLE INSPECTION (EVERY FLT)  
T41FUN.070 ROLLER ARM INSPECTION (EVERY FLT)  
S00000.090 PD1 RESPONSE TIME (MATED) (EVERY FLT)  
S00HCO.400 VERIFY ET/ORB DISC POSITIONS (PRIOR TO MATING) (EVERY FLT)

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIALS ARE VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION. ALL MACHINED ITEMS ARE DIMENSIONALLY INSPECTED AND VERIFIED (MIL-STD-105). CHEMICAL/MECHANICAL PROPERTIES AND RECORDS OF RECEIVED MATERIALS ARE RETAINED FOR VERIFICATION. BODY FORGING IS ULTRASONICALLY AND DYE PENETRANT INSPECTED.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :MAIN PROPULSION

FMEA NO:03-1 -0408 -10 REV:02/20/88

CONTAMINATION CONTROL

CLEANLINESS LEVEL TO 400A VIA FREON FLUSH AND SAMPLE VERIFIED. ALL SEAL GROOVES ARE INSPECTED FOR CLEANLINESS AND EVIDENCE OF DAMAGE.

ASSEMBLY/INSTALLATION

THREADED INSERTS AND CRITICAL DIMENSIONS VERIFIED BY INSPECTION. SEALING SURFACES ARE VISUALLY INSPECTED FOR DEFECTS. REPAIRED AND REWORKED ITEMS ARE DIMENSIONALLY CHECKED. LOG OF CLEAN ROOM VERIFIED. ALL ENGINEERING-DEFINED FEATURES AND SURFACE FINISHES AND TORQUE REQUIREMENTS ARE COMPLETELY INSPECTED AND VERIFIED.

THE PRIMARY INTERFACE SEAL IS CHECKED FOR ID, OD AND ROUNDNESS. ALL DIMENSIONS DEFINED IN DRAWING ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES

HEAT TREATMENT AND PART PASSIVATION ARE VERIFIED BY INSPECTION.

NON-DESTRUCTIVE EVALUATION

PARTS ARE RADIOGRAPHICALLY AND DYE PENETRANT INSPECTED AS IMPOSED BY ENGINEERING IN THE DRAWING REQUIREMENTS.

TESTING

ATP AND TEST MEASUREMENT EQUIPMENT CALIBRATION VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PACKAGING FOR SHIPMENT VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES OF THIS FAILURE MODE ASSOCIATED WITH PIECE PART STRUCTURAL FAILURE.

HIGH CLOSING TORQUE ON THREE OCCASIONS DURING ATP HAS DETERMINED THAT A REDESIGN WAS NECESSARY ON DRIVE SHAFT BEARINGS (REFERENCE CAR'S AB8568, AB8514, AB8726). TOLERANCES ON THE BEARING WERE REVISED AND THE ALLOWABLE TORQUE AT CRYOGENIC TEMPERATURE WAS INCREASED FROM 100 FT-LBS TO 140 FT-LBS.

(E) OPERATIONAL USE

NO CREW ACTION CAN BE TAKEN.