PRINT DATE: 02/23/89

SHUTTLE CRITICAL ITEMS LIST - ORBITER **NUMBER: 03-1CA-0513-X**

SUBSYSTEM NAME: MAIN PROPULSION

REVISION : 0 02/23/89 W

		PART NAME **VENDOR NAME**	**PART NUMBER** **VENDOR NUMBER**
SRU	:	DISCONNECT, ET PRESS	MC284-0391-0001
SRU	:	DISCONNECT, ORB PRESS	MC284-0391-0022

QUANTITY OF LIKE ITEMS: 1
ONE GO2

DESCRIPTION/FUNCTION:
PROVIDES THE FLOW PATH BETWEEN THE ET AND THE ORBITER FOR THE GO2 FROM THE MAIN ENGINES TO PRESSURIZE THE ET. ALSO USED FOR He ANTI-ICING FLOW (PRELAUNCH) AND He PREPRESSURIZATION PRIOR TO ENGINE START. THE DISCONNECT POPPETS ARE OPEN UNTIL ORBITER/ET SEPARATION, AT WHICH TIME THE DISCONNECT CLOSES TO PREVENT CONTAMINATION OF THE MPS DURING ENTRY AND LOSS OF REPRESSURIZATION HELIUM.

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SUMMARY

SUBSYSTEM NAME: MAIN PROPULSION

ITEM NAME: DISCONNECT, ORB PRESS

FMEA NUMBER	ABBREVIATED FAILURE MODE DESCRIPTION	CIL FLG	CRIT	HZD FLG
03-1CA-0513-01	EXTERNAL LEAKAGE	X	1/1	
03-1CA-0513-02	FAILS OPEN OR FAILS TO CLOSE (OR RETRACT) COMPLETELY	X	1/1	
03-1CA-0513-03	FAILS CLOSED OR FAILS TO OPEN (OR EXTEND) COMPLETELY	X	1/1	
03-1CA-0513-05	EXTERNAL LEAKAGE	X	1/1	

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SUBSYSTEM: MAIN PROPULSION

ITEM NAME: DISCONNECT, ORB PRESS CRITICALITY OF THIS FAILURE MODE:1/1

FAILURE MODE:
EXTERNAL LEAKAGE OF THE ET/ORB INTERFACE DURING ENGINE OPERATION.

MISSION PHASE:
PL PRELAUNCH
LO LIFT-OFF

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

CAUSE:
DAMAGED INTERFACE SEAL, INSUFFICIENT PRELOAD, CONTAMINATION.

CRITICALITY 1/1 DURING INTACT ABORT ONLY? N/A

REDUNDANCY SCREEN A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
DURING ENGINE OPERATION, RESULTS IN GO2 LEAKAGE INTO THE ORB/ET UMBILICAL CAVITY. OXYGEN ENTERS THE AFT FUSELAGE AND ESCAPES INTO THE ATMOSPHERE. POSSIBLE FIRE/EXPLOSIVE HAZARD BOTH INTERNAL AND EXTERNAL TO THE VEHICLE. POSSIBLE AFT COMPARTMENT OVERPRESSURIZATION.

DURING ANTI-ICING OPS AND ET HELIUM PREPERESS, GHe LEAKAGE INTO THE AFT COMPARTMENT MAY BE DETECTABLE USING HGDS (UP TO T-9 MINUTES).

ON THE GROUND, NO HAZARDOUS GAS DETECTION CAPABILITY CURRENTLY EXISTS AT THE ET/ORBITER INTERFACE. INFRARED CAMERAS, COLOR TV MONITORS, AND PAPER STRIPS MAY DETECT THE PRESENCE OF FIRE.

LOSS OF ET LO2 ULLAGE PRESSURE WILL RESULT IN VIOLATION OF TANK

MINIMUM STRUCTURAL CAPABILITY REQUIREMENTS AND POSSIBLE UNCONTAINED SSME SHUTDOWN LATE IN FLIGHT DUE TO LOW NPSP. THE FLOW CONTROL VALVES WILL OPEN IN AN ATTEMPT TO MAINTAIN ET ULLAGE PRESSURE.

(B) INTERFACING SUBSYSTEM(S):
SAME AS A.

(C) MISSION:
POSSIBLE LAUNCH SCRUB IF DETECTED.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS
FUNCTIONAL CRITICALITY EFFECTS:

1R/2, 2 SUCCESS PATHS. TIME FRAME - LOADING.
1) EXTERNAL LEAKAGE PAST ET/ORB INTERFACE SEAL.
2) LOSS OF HELIUM ANTI-ICING PURGE.

ALLOWS GO2 FROM THE ET TO LEAK INTO THE ORB/ET UMBILICAL CAVITY CAUSING OXYGEN TO ENTER BOTH THE AFT FUSELAGE AND ESCAPE INTO THE ATMOSPHERE. POSSIBLE FIRE/EXPLOSIVE HAZARD BOTH INTERNAL AND EXTERNAL TO THE VEHICLE.

ON THE GROUND, NO HAZARDOUS GAS DETECTION AT ET/ORBITER INTERFACE, BUT MAY BE DETECTED WITHIN THE AFT COMPARTMENT TO T-38 SECONDS. INFRARED CAMERAS AND COLOR TV MONITORS MAY DETECT THE PRESENCE OF FIRE.

POSSIBLE LAUNCH SCRUB IF DETECTED.

POSSIBLE LOSS OF CREW/VEHICLE.

- DISPOSITION RATIONALE -

(A) DESIGN:
THE DISCONNECT CONSISTS OF A TANK HALF AND AN ORBITER HALF. THE DISCONNECT IS A MECHANICAL DEVICE, EACH HALF CONTAINING A POPPET ASSEMBLY WHICH IS SPRING LOADED TO THE CLOSED POSITION. EACH POPPET IS ACTUATED TO THE OPEN POSITION DURING THE MATING OF THE ET AND ORBITER UMBILICALS. THE ORBITER HALF IS MOUNTED TO A BELLEVILLE WASHER ARRANGEMENT WHICH PROVIDES THE CLAMPING FORCE TO MAINTAIN INTERFACE SEAL REQUIREMENTS TO PREVENT LEAKAGE.

THE CLOSURE SEAL (301 CRES, FULL HARD), POPPET (316 CRES INVESTMENT CAST), POPPET RETURN SPRING (302 CRES CONDITION B), BUSHINGS (ALUMINUM BRONZE), AND BODY (316 CRES INVESTMENT CAST) ARE IDENTICAL FOR EACH HALF. THE TWO HALVES DIFFER ONLY IN THEIR CAP SECTIONS. THE ORBITER CAP SECTION CONTAINS THE WASHER TYPE INTERFACE SEAL (301 CRES, FULL HARD) RETAINED AGAINST THE CAP SECTION BY A RETAINER (304 CRES,

CONDITION A) WHICH SCREWS ON THE CAP SECTION AND IS TORQUED TO 275 FOOT-POUNDS. LEAKAGE PAST THE RETAINER AND SEAL IS PREVENTED BY A SOFT COPPER GASKET. THE ET CAP SECTION INCORPORATES A GUIDE SECTION AT THE INTERFACE, TO PROPERLY ALIGN AND MAINTAIN THE ORBITER SECTION, AND A SEAT SURFACE COATED WITH TEFLON. EACH OF THE CAP SECTIONS IS MATED TO ITS RESPECTIVE BODY USING A SOFT COPPER GASKET AND 18 INCONEL 718 SCREWS TORQUED TO 30 INCH-POUNDS MAXIMUM. THE COPPER GASKET IS UTILIZED TO PREVENT EXTERNAL LEAKAGE AT HIGH TEMPERATURES.

EACH POPPET IS GUIDED BY TWO LINEAR BUSHINGS. THESE BUSHINGS ARE INSTALLED IN AND SUPPORTED BY A PAIR OF RADIAL STRUTS. EACH RADIAL STRUT CONSISTS OF TWO SUPPORTING LEGS WHICH ARE 120° APART. THE STRUTS ARE AN INTEGRAL PART OF THE BODY AND CAP SECTION AND ARE ALIGNED DURING ASSEMBLY OF THE CAP SECTION TO THE BODY TO MINIMIZE THERMAL STRESSES AND PREVENT COCKING BETWEEN THE POPPET SHAFT AND BUSHING. INDEX MARKS ARE LOCATED ON EACH FLANGE TO INSURE PROPER CLOCKING OF THE ET AND ORBITER HALVES.

THE ORBITER HALF CONTAINS THE INTERFACE MATING SEAL MADE OF 301 CRES FULL HARD SHEET STOCK WHICH IS TREATED WITH DRY LUBRICANT AND LAPPED TO OBTAIN FLATNESS (8 MICRO-INCH SURFACE FINISH). THE INTERFACE SEAL IS HELD AGAINST THE ET SEAT (FEP TEFLON COATED CRES) BY THE PRELOAD EXERTED BY THE ORBITER HALF AND ITS INSTALLATION IN THE UMBILICAL PLATE. THE MATING PROCEDURE CAUSES THE COMPRESSION OF ORBITER HALF BELLEVILLE SPRINGS WHICH CREATE THE REQUIRED PRELOAD ON THE INTERFACE MATING SEAL.

LOSS OF PRELOAD IS POSSIBLE DUE TO STRUCTURAL FAILURE OF THE BELLEVILLE SPRINGS (INCONEL 718) USED IN THE ORBITER DISCONNECT INSTALLATION. EXPOSURE OF THE CRES MATERIAL BELLEVILLE SPRINGS TO THE SALT AIR ENVIRONMENT AT KSC LIMITS THEIR MATERIAL LIFE. THE ESTABLISHED BELLEVILLE TIME LIMIT CRITERIA FOR MAXIMUM EXPOSURE IS:

I MATED (WITHOUT PURGE).....4 MONTHS
II MATED (WITH PURGE).....VARIES, REF OMRSD S00GEN.720

ALL VEHICLES FLYING WITH THE CRES MATERIAL SPRINGS (BEGINNING WITH OV103, STS-26) IN THE DISCONNECT ASSEMBLIES HAVE BEEN REWORKED WITH NEW BELLEVILLE SPRINGS USING THE CRES MATERIAL. IN ADDITION, A CONTINUOUS, CONDITIONED, DRY AIR PURGE WILL BE PROVIDED AT THE DISCONNECT TO REDUCE THE BELLEVILLE STRESS CORROSION (BEGINNING WITH OV103, STS-26). SINCE THE ORBITER MATED TIME (AND CORRESPONDING BELLEVILLE EXPOSURE DURATION) FOR STS-27 & 30 (OV104) IS MUCH SHORTER THAN THE RECOMMENDED LIMITS, NO DRY AIR PURGE WAS REQUIRED.

THE BELLEVILLE SPRING MATERIAL HAS BEEN CHANGED TO CORROSION RESISTANT MP35N (NICKEL-COBALT-CHROMIUM ALLOY) MUTLIPHASE MATERIAL. THESE NEW SPRINGS WILL BE INSTALLED ON THE VEHICLE DISCONNECTS AS SOON AS PRODUCTION UNITS ARE MADE AVAILABLE. THE CONTINUOUS POST MATING PURGE IS NOT REQUIRED FOR THIS MATERIAL.

AFTER MATING OF THE ORBITER/EXTERNAL TANK UMBILICALS, THE PRESSURIZATION SYSTEMS ARE LEAK CHECKED. ANY BELLEVILLE SPRING FAILURE OR DAMAGE TO THE INTERFACE SEAL WILL BE DETECTED AT THIS POINT.

EXTERNAL LEAKAGE DUE TO CONTAMINATION IS AVOIDED BY THE FILTRATION OF THE FACILITY SUPPLIED GASSES TO 25 MICRONS ABSOLUTE IN THE GROUND SYSTEM. THAT SAME SYSTEM IS MAINTAINED TO THE 300A CLEANLINESS LEVEL OF KSC SPEC -123. THE CONTAMINATION WOULD HAVE TO BE PRESENT AT THE TIME OF MATING AND WOULD BE DETECTED IN THE LEAK CHECK.

DURING MATING OF THE ET/ORBITER UMBILICALS A VISUAL INSPECTION (USING A BORESCOPE) OF THE INTERFACE IS PERFORMED TO INSURE PROPER POPPET STEM MATING. IMPROPER ALIGNMENT WILL CAUSE BENDING OF THE POPPET STEMS AND PREVENT POPPETS FROM FULLY OPENING, FULLY CLOSING ON SEPARATION, AND MAY CAUSE INTERFACE LEAKAGE.

(B) TEST:
ATP

EXAMINATION OF PRODUCT

PROOF PRESSURE
920 PSIG MATED
500 PSIG ORBITER HALF
56 PSIG ET HALF

INTERNAL LEAKAGE (ACROSS CLOSURE, DEMATED), BOTH HALVES
20 PSIG GHe (18 SCIM MAX)
40 PSIG GHe (100 SCIM MAX)

EXTERNAL LEAKAGE, MATED
600 PSIG GHe (100 SCIM MAX)

OPERATIONAL TEST (3 CYCLES)
PRESSURIZE BOTH HALVES TO 5 PSIG
MATE
RAISE PRESSURE TO 37 PSIG
DEMATE
RECORD ENGAGE (120 LB MAX) AND DISENGAGE (50 LB MAX) FORCES

ROSAN INSERT TORQUE VERIFICATION

CERTIFICATION

COMPONENT

HIGH TEMPERATURE LEAKAGE (500°F)
MATED WITH 600 PSIG GHe (183 SCIM MAX AT INTERFACE)

DEMATED, ACROSS CLOSURE (EACH HALF)
20 PSIG GHe (18 SCIM MAX)
40 PSIG GHe (201 SCIM MAX)

VIBRATION
RANDOM: 48 MINUTES IN EACH OF TWO AXES AT 600 PSIG, 500°F
FOLLOWED BY ATP OPERATIONAL AND LEAKAGE TESTS AT BOTH
500°F AND AMBIENT

THERMAL CYCLE (100 CYCLES)
MATE
REDUCE BODY TEMPERATURE TO -100°F
FLOW 8 LB/SEC GO2 AT 600 PSIG AND 500°F (26 PSID MAX PRESSURE DROP)
THROUGH UNIT UNTIL BODY TEMPERATURE IS STABILIZED (700 SECONDS MAX)
REDUCE PRESSURE TO 37 PSIG
DEMATE
AFTER EACH 25 CYCLES PERFORM HIGH TEMPERATURE LEAKAGE TEST AND
OPERATIONAL, INTERNAL LEAKAGE, AND EXTERNAL LEAKAGE TESTS

LIFE CYCLE
380 OPERATIONAL TESTS AT AMBIENT
100 OPERATIONAL TESTS AT 500°F
AFTER EACH 25 CYCLES PERFORM INTERNAL AND EXTERNAL LEAKAGE TESTS

BURST (MATED): 1,200 PSIG

SYSTEM

UMBILICAL SEPARATION TEST
THE DISCONNECT WAS INSTALLED IN THE UMBILICAL ASSEMELY DURING THE SEPARATION TEST PROGRAM. THE UMBILICAL ASSEMBLY WAS SUBJECTED TO RANDOM VIBRATION TESTS (4.4 HOURS PER AXIS). THE DISCONNECT WAS ALSO SUBJECTED TO UMBILICAL RETRACT TESTS AT BOTH NOMINAL CONDITIONS AND SIMULATED HYDRAULIC RETRACT ACTUATOR FAILURES.

OMRSD
V41BU0.330 MPS DISCONNECT (PD4,5) CAVITY INSPECTION (EVERY FLIGHT)
V41BV0.020 PD4,5 GO2/GH2 PRESS DISCONNECT CLEANING (EVERY FLIGHT)
V41BV0.030 ORB/ET UMBILICAL DISCONNECT AND SEAL INSPECTION (EVERY FLT)
T41QAL.060 INSPECT ET/ORB SEALING SURFACES (EVERY FLIGHT)
T41QAL.100 GO2/GH2 PREPRESS DISCONNECT CLEANING (EVERY FLIGHT)
S00GEN.720 MPS 2"/4" DISCONNECT TRICKLE PURGE (EVERY FLIGHT - ONLY APPLICABLE TO THE CRES MATERIAL BELLEVILLE SPRINGS)
S00HC0.400 VERIFY ET/ORB DISCONNECT MATING AND ALIGNMENT (EVERY FLIGHT)
S00000.081 VERIFY ORB/ET DISC (PD4) INTERFACE SEAL LEAK TESTS (EVERY FLT)

(C) INSPECTION:
COMPONENT

RECEIVING INSPECTION
INCOMING COMPONENTS ARE VERIFIED BY INSPECTION FOR MATERIALS AND PROCESSES CERTIFICATION.

CONTAMINATION CONTROL
THE DISCONNECT INTERNAL SURFACES ARE MAINTAINED TO LEVEL 400A PER REQUIREMENT. CORROSION PROTECTION IS IMPLEMENTED AND VERIFIED. PROTECTIVE CAPS ARE PROVIDED TO PREVENT CONTAMINATION AND PROTECT SEALING SURFACES.

ASSEMBLY/INSTALLATION
CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. MANUFACTURING PROCESSES AND INSTALLATION AND ASSEMBLY OPERATIONS, INCLUDING PARTS PROTECTION, ARE VERIFIED BY INSPECTION. TORQUE FORCES APPLIED TO PARTS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES
HEAT TREATMENT AND PART PASSIVATION ARE VERIFIED BY INSPECTION. APPLICATION OF DRY FILM LUBRICANT IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
THE BODY CASTING IS X-RAYED AND PRESSURE TESTED. THE BODY CASTING IS PENETRANT INSPECTED AFTER PRELIMINARY MACHINING.

TESTING
ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING FOR SHIPMENT IS VERIFIED BY INSPECTION.

UMBILICAL ASSEMBLY

HEAT TREATED AND DRY FILM LUBE COATED BELLEVILLE SPRINGS ARE VISUALLY INSPECTED AND LOAD TESTED PRIOR TO ASSEMBLY. CORRECT INSTALLATION OF THE BELLEVILLE WASHERS IS A MANDATORY INSPECTION POINT. THE SHIMS, WHICH ARE REQUIRED TO SET THE HEIGHT OF THE 2 INCH DISCONNECT MATING SURFACE ABOVE THE 17 INCH DISCONNECT MATING SURFACE AS EXTERNAL FORCE IS APPLIED TO THE 2 INCH DISCONNECT, ARE DIMENSIONALLY INSPECTED. THE SHIMS, WHICH ARE REQUIRED TO SET THE PRELOAD IN THE UNMATED CONDITION, ARE DIMENSIONALLY INSPECTED.

(D) FAILURE HISTORY:
THREE CASES DURING ATP WHERE THE MATED DISCONNECT WAS PRESSURIZED TO 600 PSIG AND HAD AN EXTERNAL LEAKAGE OF 200 SCIM (REFERENCE CAR's A4715, A4716). A BUILDUP OF THE EVERLUBE LUBRICANT BETWEEN THE SEAT AND SEAL INTERFACE CAUSED THE FAILURE. DRAWING IS CHANGED TO REQUIRE THE LAPPING OF ONE SIDE OF THE INTERFACE SEAL AFTER EVERLUBE IS APPLIED.

AT THE SUPPLIER, EXTERNAL LEAKAGE WAS 180 SCIM DUE TO A ROUGH COATING

OF TEFLON ON THE CAP SEALING SURFACE (REFERENCE CAR AC8544). THE SURFACE WAS RECOATED; FAILURE IS ATP SCREENABLE.

DURING QUALIFICATION TESTING AFTER THE SAND AND DUST EXPOSURE TEST, THE MATED DISCONNECT EXHIBITED EXTERNAL LEAKAGE OF 270 SCIM (REFERENCE CAR A5202). FAILURE RESULTED FROM A REDUCTION IN COMPRESSIVE FORCE ON THE COPPER GASKET STATIC SEAL AT THE CAP TO BODY INTERFACE. DRAWINGS AND ASSEMBLY PROCEDURES HAVE BEEN CHANGED TO REQUIRE A DIFFERENT MATERIAL FOR THE CAP-TO-BODY INTERFACE SCREWS, A HIGHER SCREW INSTALLATION TORQUE, AND A TORQUE WRENCH THAT ALLOWS PROPER ALIGNMENT.

SIX CASES DURING QUALIFICATION TESTING WHERE THE EXTERNAL LEAKAGE OCCURRED AT THE INTERFACE OR DYNAMIC SEAL BETWEEN THE ORBITER AND TANK SECTIONS (REFERENCE CAR A5378, A6138). A SIMILAR FAILURE OCCURRED DURING THE THERMAL CYCLING (REFERENCE CAR AB6946). BOTH SEALING SURFACES SHOW SIGNS OF WEAR. THE LEAKAGE WAS ATTRIBUTED TO THE TANK DISCONNECT HALF WHICH IS A LIMITED LIFE ITEM. TANK SECTION MATING SEAL WAS REWORKED AND QUALIFICATION TESTING WAS COMPLETED. ADDITIONALLY, THE CLAMPING FORCE ON THE DISCONNECTS WAS INCREASED FOR TESTING PURPOSES. THE COPPER GASKET SEAL DRAWING WAS REVISED TO LAP BOTH SURFACES TO ENSURE PROPER FLATNESS.

DURING QUALIFICATION THERMAL CYCLING TESTING, THE LEAKAGE RATE WAS 280 SCIM AT THE INTERFACE SEAL (REFERENCE CAR AB9144). THE DRY LUBRICANT COATING HAD WORN THROUGH DUE TO REPEATED MATING AND DEMATING OF THE DISCONNECT. A DESIGN CHANGE HAS BEEN INITIATED TO APPLY A TEFLON COATING TO THE SEALING SURFACE OF THE TANK HALF..

TWO CASES AT KSC OCCURRED WHERE THE COMBINED EXTERNAL LEAKAGE OF THE GH2 2 INCH AND THE GH2 VENT WAS 50 SCIM (REFERENCE CAR's AB5395, AB5471). OMRSD WAS REVISED TO ALLOW 100 SCIM LEAKAGE.

AT KSC, LEAKAGE BETWEEN THE LO2 2 INCH LINE AND THE LO2 2 INCH DISCONNECT LEAKED 7.5 SCCM (REFERENCE CAR AB6442). THE SEALING SURFACE OF THE FLANGE WAS SCRATCHED DUE TO HANDLING. THE LEAKAGE WAS DETECTED DURING OMI MAIN PROPULSION SYSTEM LEAK AND FUNCTIONAL CHECK.

AT KSC, THE MATED DISCONNECT LEAKED 32 SCIM AT 6 PSIG (REFERENCE CAR AC9328). MAXIMUM ALLOWED IS 30 SCIM. 300 CRES CONTAMINATION WAS FOUND ON THE MATING SEALING SURFACES. CONTAMINATION WAS REMOVED AND THE LEAKAGE RATE WAS 11.8 SCIM.

BROKEN BELLEVILLE WASHERS WERE FOUND ON THE GO2 2" PRESSURIZATION DISCONNECT (PD4) UMBILICAL ASSEMBLY ON MPTA AND OV102 (REFERENCE CAR AD3602 AND AD3464). INVESTIGATION HAS DETERMINED THAT THE FAILURES WERE DUE TO STRESS CORROSION OF THE WASHERS. CORRECTIVE ACTION IS TO CHANGE THE BELLEVILLE WASHER MATERIAL TO CORROSION RESISTANT MP35N (NICKEL-COBALT-CHROMIUM ALLOY) MULTIPHASE MATERIAL. THESE NEW WASHERS WILL BE INSTALLED ON THE VEHICLE DISCONNECTS AS SOON AS PRODUCTION UNITS ARE MADE AVAILABLE. OV103 (STS-26 & 29) AND OV104 (STS-27) UMBILICAL ASSEMBLIES HAVE ALREADY BEEN REWORKED WITH NEW BELLEVILLE

WASHERS USING THE CURRENT MATERIAL (CRES). THIS PROCEDURE WILL CONTINUE UNTIL THE MP35N WASHERS ARE AVAILABLE. IN ADDITION, A CONTINUOUS, CONDITIONED, DRY AIR PURGE WILL BE PROVIDED AT THE DISCONNECT TO REDUCE THE BELLEVILLE STRESS CORROSION ON ALL VEHICLES THAT ARE TO FLY WITH THE CRES MATERIAL. APPROVED EXPOSURE DURATION OF THE MATED UNPURGED CRES BELLEVILLE WASHERS IS DETERMINED TO BE 4 MONTHS. SINCE THE ORBITER MATED TIME (AND CORRESPONDING BELLEVILLE EXPOSURE DURATION) FOR STS-27 (OV104) IS MUCH SHORTER THAN THE RECOMMENDED LIMITS, NO DRY AIR PURGE WAS REQUIRED.

GENERAL SYSTEM CONTAMINATION

THIS FAILURE MODE HAS NOT OCCURRED ON THIS COMPONENT DUE TO CONTAMINATION. HOWEVER, GENERAL MPS SYSTEM CONTAMINATION HAS OCCURRED WHICH MAY LODGE ANYWHERE IN THE SYSTEM CAUSING THIS FAILURE MODE (REFERENCE THE FOLLOWING PARAGRAPHS).

CONTAMINATION FAILURES HAVE OCCURRED AT ALL PHASES OF MANUFACTURING AND PARTS REPLACEMENT. IN ALL CASES, STRICT ADHERENCE TO CLEANLINESS CONTROL PROCEDURES IS THE PRIMARY METHOD OF CONTAMINATION PREVENTION.

NUMEROUS LARGE PARTICLES OF BLACK RUBBER MATERIAL WERE FOUND DURING A POST FLIGHT EXAMINATION OF THE LH2 17 INCH DISCONNECT OF OV099 (FLIGHT 7, REFERENCE CAR AC9800). THE LO2 AND LH2 SYSTEMS OF ALL VEHICLES WERE EXAMINED. NO RUBBER WAS FOUND IN ANY OTHER VEHICLES. AFTER EXTENSIVE INVESTIGATION THE ORIGIN WAS NOT DETERMINED.

METAL SHAVINGS HAVE BEEN DISCOVERED IN LINES AND COMPONENTS, WHICH WAS MOST LIKELY GENERATED WHEN THEY WERE CUT OUT AND/OR REPLACED (REFERENCE CARs AC9868, A9654, AC2210, AB1706: DR AD2226). METHODS ARE BEING REVISED TO MINIMIZE PARTICLE GENERATION WHEN INSTALLING/REPLACING COMPONENTS, LINES, AND FITTINGS REQUIRING WELDED OR BRAZED JOINTS (PRODUCT QUALITY IMPROVEMENT COUNCIL). PERSONNEL HAVE BEEN CAUTIONED. ROCKWELL PROBLEM ACTION CENTER WILL CONTINUE TO MONITOR BRAZING/WELDING REWORK CONTAMINATION. PROCEDURES ARE BEING REVISED TO IMPROVE CLEANLINESS MAINTENANCE DURING COMPONENT BUILD UP AND REWORK (REFERENCE MCR 12512). SUPPLIER DOCUMENTS/PROCEDURES HAVE BEEN REVIEWED AND CLEANLINESS MAINTENANCE PROCEDURES HAVE BEEN IMPROVED.

A PIECE OF A BRAZING PREFORM LODGED IN A 2-WAY SOLENOID VALVE ON OV-099 AT PALMDALE CAUSING A LEAKAGE FAILURE (REFERENCE CARs AC2111, AB2538). STEEL AND ALUMINUM PARTICLES CAUSED EXCESSIVE LEAKAGE ON THE 850 PSIG HELIUM RELIEF VALVE (REF CAR AC2229). FOR BOTH FAILURES CORRECTIVE ACTION WAS TO ADD SPECIAL PURGE PORTS TO THE MPS HELIUM PANEL ASSEMBLIES TO IMPROVE THE QUALITY OF FINAL CLOSEOUT BRAZES.

SEVERAL FOREIGN MATERIALS WERE INTRODUCED INTO THE MPS SYSTEM DURING MANUFACTURE AND PARTS REPLACEMENT. EXAMPLES ARE: GLASS CLOTH IN LINE TO PREVENT TRAVEL OF CHIPS DOWN LINE; POLYSTYRENE OBJECT TO HOLD VALVE

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POPPET OPEN WHILE PURGING; COTTON SWAB MATERIAL AND GLASS BEADS FROM CLEANING OPERATION; MISCELLANEOUS PLASTIC; FOAM; AND TAPE (REFERENCE CARS AB4751, AC2217, AC6768, AC9868, MPS3A0005, AC7912, AB0530). MATERIALS WERE REMOVED AND PERSONNEL WERE CAUTIONED. A HIGH FLOW DELTA P TEST AT PALMDALE WAS ADDED TO VERIFY THAT LINES WERE NOT PLUGGED. GRIT BLASTING (GLASS BEADS AND SAND USED TO CLEAN A LINE) IS NO LONGER PERFORMED. PROCEDURES ARE BEING REVISED TO IMPROVE CLEANLINESS MAINTENANCE DURING COMPONENT BUILD UP AND REWORK (REFERENCE MCR 12512). SUPPLIER DOCUMENTS/PROCEDURES HAVE BEEN REVIEWED AND CLEANLINESS MAINTENANCE PROCEDURES HAVE BEEN IMPROVED.

ONE PIECE OF WIRE WAS FOUND IN THE INTERNAL RELIEF VALVE OF THE LO2 PREVALVE ON OV103 (REFERENCE CAR AC9101). THE SOURCE OF THE CONTAMINATION WAS NEVER FOUND, BUT IT WAS BELIEVED TO BE FROM THE ET. OTHER CONTAMINATION HAS BEEN FOUND ON THE FEEDLINE SCREENS, SUCH AS AN UNIDENTIFIED ROUND OBJECT AND VARIOUS METALLIC PARTICLES (REFERENCE CARS AB0529 AND AB0530). SOURCE OF CONTAMINATION WAS UNDETERMINED. BORESCOPE EXAMINATIONS ARE CONDUCTED ON ALL FEEDLINE SCREENS EVERY FIFTH FLIGHT TO VERIFY CLEANLINESS. CONTAMINATION WAS REMOVED WHEN POSSIBLE.

(E) OPERATIONAL USE:
NO CREW ACTION CAN BE TAKEN.

- APPROVALS -

RELIABILITY ENGINEERING	L. H. FINEBERG	
DESIGN ENGINEERING	J. E. OSLUND	3-1-89
QUALITY ENGINEERING	R. WILLIAMS	3-3-89
NASA RELIABILITY		
NASA SUBSYSTEM MANAGER		3-21-89
NASA QUALITY ASSURANCE		