

PAGE: 202

PRINT DATE: 08/25/95

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE  
NUMBER: M8-1MR-BM022-X

SUBSYSTEM NAME: MECHANICAL - EDS

REVISION: 1 9/1/95

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	: GUIDE RING ASSEMBLY NPO-ENERGIA	33U.6271.011-05 33U.6271.011-05
SRU	: SENSOR NPO-ENERGIA	33U.5319.027 33U.5319.027

---

**PART DATA**


---

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**  
CAPTURE SENSOR

**REFERENCE DESIGNATORS:**

**QUANTITY OF LIKE ITEMS: 3**  
THREE

**FUNCTION:**

THREE SENSORS, LOCATED ON THE GUIDE RING ASSEMBLY, ARE USED TO MONITOR THE RING MATCHING OF BOTH THE ORBITER AND MIR DOCKING RING ASSEMBLIES. EACH SENSOR CONTAINS TWO REDUNDANT SHORT CONTACTS AND TWO REDUNDANT LONG CONTACTS. THE SHORT CONTACTS OF THE THREE SENSORS ARE CONNECTED IN SERIES AND THE LONG CONTACTS OF THE THREE SENSORS ARE CONNECTED IN PARALLEL. TOGETHER THEY SENSE THE MATING OF THE TWO DOCKING RINGS AND SEND A SIGNAL TO THE DSCU TO ACTIVATE THE HIGH ENERGY DAMPERS AND TO ILLUMINATE THE 'CAPTURE' INDICATOR LIGHT ON THE DOCKING CONTROL PANEL WHEN ALL THREE SENSORS ACTUATE SIMULTANEOUSLY. THE LONG CAPTURE SIGNAL IS DOWNLINKED TO GROUND PERSONNEL. THESE SENSORS SENSE THE SECOND POINT IN THE AUTOMATIC DOCKING SEQUENCE - MATING OF THE TWO DOCKING RINGS.

**SERVICE IN BETWEEN FLIGHT AND MAINTENANCE CONTROL:**  
VISUAL INSPECTION, SERVICEABILITY CONTROL, DOCKING WITH CALIBRATING DOCKING MECHANISM.

**MAINTAINABILITY**  
REPAIR METHOD - REPLACEMENT.

**REFERENCE DOCUMENTS:** 33U.5319.027  
33U.6271.011-05

**Proprietary Data**

M8-1MR - 247

PAGE: 210

PRINT DATE: 08/25/95

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE**

NUMBER: M8-1MR-BM022-02

REVISION# 1 9/1/95

SUBSYSTEM NAME: MECHANICAL: EDS  
 LRU: GUIDE RING ASSEMBLY  
 ITEM NAME: SENSOR, CAPTURE

CRITICALITY OF THIS  
 FAILURE MODE: 2R3

FAILURE MODE:  
 ONE CONTACT SET FAILS CLOSED

MISSION PHASE:  
 OO ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 104 ATLANTIS

CAUSE:  
 CONTAMINATION, PIECE PART STRUCTURAL FAILURE DUE TO MECHANICAL/THERMAL  
 SHOCK, VIBRATION, OR MANUFACTURER/MATERIAL DEFECT

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

CRITICALITY 1R2 DURING INTACT ABORT ONLY (AVIONICS ONLY)? NO

REDUNDANCY SCREEN      A) PASS  
    B) FAIL  
    C) PASS

## PASS/FAIL RATIONALE:

A)

B)  
 SCREEN "B" FAILS BECAUSE ONE CAPTURE SENSOR "SHORT CONTACT" CONTACT SET  
 FAILING CLOSED IS NOT DETECTABLE IN FLIGHT. (HOWEVER, ONE CAPTURE SENSOR  
 "LONG CONTACT" CONTACT SET FAILING CLOSED IS DETECTABLE.)

C)

METHOD OF FAULT DETECTION:  
 NONE FOR FIRST THREE FAILURES. FOURTH FAILURE CAN BE DETECTED THROUGH  
 VISUAL OBSERVATION (PREMATURE CAPTURE INDICATION WHEN NOT REQUIRED) AND  
 INSTRUMENTATION (TELEMETRY DATA WILL INDICATE POWER TO THE HIGH ENERGY  
 DAMPERS WHEN PREMATURELY ENGAGED).

MASTER MEAS. LIST NUMBERS: V53X0757E

**- FAILURE EFFECTS -**

(A) SUBSYSTEM:  
 INADVERTENT "RING SHORT CAPTURE" OR "RING LONG CAPTURE" SIGNAL TO DSCU, NO  
 EFFECT FIRST FAILURE. A FAILS CLOSED CONDITION ON ONE "SHORT" CONTACT SET  
 ON ALL THREE CAPTURE SENSORS ACCOMPANIED WITH A FAILS CLOSED CONDITION  
 ON A "LONG" CONTACT SET ON ONE OF THREE SENSORS WILL RESULT IN PREMATURE

**Proprietary Data**

PAGE: 211

PRINT DATE: 08/25/95

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE  
NUMBER: M8-1MR-BM022- 02**

**HIGH ENERGY DAMPER ACTIVATION AND A FALSE 'CAPTURE' INDICATION ON THE DOCKING CONTROL PANEL AND TO THE GROUND THROUGH TELEMETRY DATA.**

**(B) INTERFACING SUBSYSTEM(S):**

NO EFFECT UNTIL FOURTH FAILURE. AT WHICH TIME EXCESSIVE LOADS INCURRED DURING DOCKING, AS THE RESULT OF THE HIGH ENERGY DAMPERS BEING ACTIVATED PRIOR CAPTURE, COULD PROPAGATE TO EXTERNAL AIRLOCK AND ORBITER STRUCTURE.

**(C) MISSION:**

NO EFFECT FIRST FAILURE. IF SIMILAR FAILURE ON ONE 'SHORT' CONTACT SET ON THE REMAINING TWO CAPTURE SENSORS AND ONE 'LONG' CONTACT SET ON ANY ONE SENSOR OCCURS PRIOR TO CAPTURE, DAMAGE THAT COULD OCCUR AS THE RESULT OF THE DAMPERS BEING ENGAGED COULD IMPEDE THE DOCKING PROCESS.

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

NO EFFECT ON CREW OR VEHICLE. POTENTIAL DAMAGE TO ORBITER AND MIR DOCKING MECHANISMS DUE TO HIGH LOADS INCURRED DURING CAPTURE.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

NO EFFECT FIRST, SECOND, AND THIRD FAILURES (FAILED CLOSED CONDITION ON ONE 'SHORT' CONTACT SET OF ALL THREE CAPTURE SENSORS). FOURTH FAILURE (ONE 'LONG' CONTACT SET OF ANY ONE CAPTURE SENSOR FAILING CLOSED) WOULD RESULT IN THE FOLLOWING: (1) A PREMATURE CAPTURE INDICATION AND (2) PREMATURE ENGAGEMENT OF HIGH ENERGY DAMPERS PRIOR TO CAPTURE RESULTING IN HIGH DOCKING LOADS. THESE HIGH LOADS COULD PREVENT CAPTURE OR CAUSE DAMAGE TO BOTH ORBITER AND MIR DOCKING MECHANISMS. POTENTIAL DAMAGE TO ORBITER DOCKING MECHANISM COULD PRECLUDE RING MOVEMENT RESULTING IN LOSS OF DOCKING. WORST CASE, LOSS OF MISSION OBJECTIVES.

**DESIGN CRITICALITY (PRIOR TO OPERATIONAL DOWNGRADE, DESCRIBED IN F): 2R3**

**(F) RATIONALE FOR CRITICALITY CATEGORY DOWNGRADE:**

N/A (THERE ARE NO WORKAROUNDS TO CIRCUMVENT THIS FAILURE.)

---

**-DISPOSITION RATIONALE-**

---

**(A) DESIGN:**

DESIGN OF THE SENSOR, SELECTION OF MATERIALS, AND SMALL ELECTRICAL LOADS REDUCE THE FAILURE PROBABILITY OF BOTH CONTACTS. DESIGN OF THE CONTACT PAIR (DUAL CHANNEL) HAS PASSED MAGNITUDES OF GROUND FUNCTIONAL TESTING AND MULTIPLE USES DURING PILOTED VEHICLE OPERATIONS IN SPACE. WIRE REDUNDANCY FOR EACH CONTACT, CHOICE OF MATERIALS AND COATINGS FOR THE CONTACT PAIR, AND MAXIMUM SPACING BETWEEN LEADS OF EACH CONTACT PAIR ASSURES A HIGH LEVEL OF RELIABILITY. SPRING WHICH RETURNS THE INTERNAL ROD TO THE INITIAL POSITION IS DESIGNED TO OPERATE BEYOND LIMITS OF FATIGUE AND THUS, POSSIBILITY OF SPRING FAILURE IS VERY LOW. MISALIGNMENT OF THE ROD IS NOT POSSIBLE BY DESIGN.

ANALYSIS HAS SHOWN THAT THE MAXIMUM AXIAL LOADS INCURRED AS THE RESULT OF THE HIGH ENERGY DAMPERS BEING ACTIVATED PRIOR TO CAPTURE ARE 5097KG (TENSION) AND 2906 KGF (COMPRESSION) IN THE Z-AXIS. ANALYSIS HAS INDICATED THAT THE CAPTURE LATCHES WILL DISENGAGE WHEN THE AXIAL LOAD ON THIS AXIS



RSC  
Energia

*Proprietary Data*

PAGE: 212

PRINT DATE: 08/25/85

## FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

NUMBER: M8-1MR-BM022-02

REACHES 3698 KGF. DAMAGE TO THE CAPTURE LATCH, THAT WOULD PREVENT IT FROM BEING ACTUATED OPEN, WILL NOT OCCUR PRIOR TO THE DISENGAGEMENT AXIAL LOAD OF 3698 KGF. THESE LOADS WILL NOT EXCEED EXTERNAL AIRLOCK/ORBITER STRUCTURAL LIMITS.

**(B) TEST:****DOCKING MECHANISM ACCEPTANCE TESTS:**

1. ELECTRICAL SCHEMATIC CHECKOUT - CONTACT RESISTANCE ON EACH PIN OF THE CONNECTOR WHICH IS ELECTRICALLY TIED TO THE CAPTURE SENSOR IS CHECKED. THIS TEST VERIFIES CONTINUITY THROUGH THE CAPTURE SENSOR WHEN CAPTURE LATCHES ARE IN THEIR CLOSED POSITION.
2. INSULATION ELECTRICAL RESISTANCE TEST - THE INSULATION RESISTANCE AND ELECTRICAL STRENGTH OF INSULATION CHECKOUT OF EACH PIN OF THE CAPTURE SENSOR CONNECTOR TO THE APDA HOUSING WILL VERIFY THAT THE SENSOR CONTACT SETS ARE NOT ELECTRICALLY SHORTED TO GROUND.
3. INSPECTION SERVICEABILITY TEST - DURING SENSOR FUNCTIONAL TEST CAPTURE SENSOR CHECKOUT IS PERFORMED WITH DOCKING RING AT ITS INITIAL POSITION. THE PLUNGER OF EACH CAPTURE SENSOR IS MANUALLY DEPRESSED AND APPROPRIATE LIGHTS ON THE TEST PANEL ARE VERIFIED TO ILLUMINATE.
4. VIBRORESISTENT TEST - APDS SUBJECTED TO THE FOLLOWING VIBRATION LEVELS FOR 2 MINUTES PER AXIS:

FREQUENCY (HZ)	SPECTORAL DENSITY ACCELERATION
FROM 20 TO 80	INCREASING, 3DB OCTAVE TO 0.04G <sup>2</sup> /HZ
FROM 80 TO 350	PERMANENT 0.04G <sup>2</sup> /HZ
FROM 350 TO 2000	DECREASING 3DB OCTAVE WITH 0.04G <sup>2</sup> /HZ

SUBSEQUENT TO THIS TEST AN INSPECTION IS PERFORMED TO IDENTIFY BROKEN OR LOOSE HARDWARE; AND AN ELECTRICAL CIRCUIT TEST, INSULATION RESISTANCE TEST, AND SENSOR FUNCTIONAL TEST ARE PERFORMED AS DEFINED IN ATP TESTS #1, #2, AND #3 ABOVE TO VERIFY PROPER CAPTURE SENSOR PERFORMANCE.

5. DOCKING MECHANISM CHECKOUT (STATIC) TEST - OPENING OF CAPTURE LATCHES IS VERIFIED. CAPTURE LATCHES ARE OPENED PER STEP 11 OF INSTRUCTION 33U.6201.008-05 PM-3. DURING CAPTURE LATCH LATCHING FORCE TEST, THE FORCE TO TRIP ALL THREE CAPTURE LATCHES AND LONG AND SHORT CAPTURE SENSORS IS VERIFIED NOT TO EXCEED 16 KGF.

6. THERMO VACUUM TEST - DOCKING OF THE MECHANISM IS THERMALLY CYCLED, UNDER LOAD CONDITIONS, FROM +20°C TO -50/-55°C TO +50/+55°C TO +20°C IN A VACUUM AT 10<sup>-4</sup> TO 10<sup>-5</sup> TORR. DWELL AT EACH TEMPERATURE AND BETWEEN OPERATIONS AT EACH TEMPERATURE IS A MINIMUM OF 60 MINUTES AFTER STABILIZATION. OPERATIONS INCLUDES PERFORMING DOCKING/CAPTURE. DOCKING IS ACCOMPLISHED AT A SPEED OF 0.15M/SEC BETWEEN THE SIMULATOR AND MOVEABLE PLATFORM (CONTAINING THE DOCKING MECHANISM) AND CAPTURE INDICATION IS VERIFIED DURING CAPTURE. PROPER OPERATION OF CAPTURE SENSORS IS VERIFIED FOR A TEMPERATURE RANGE OF -50°C/-55°C TO 50°C/55°C.

RSC  
Energia

Proprietary Data

M8-1MR - 259

## FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

NUMBER: M8-1MR-BM022-02

7. CONTROLLED DOCKING TEST - CONTROLLED DOCKING IS PERFORMED UNDER LOAD CONDITIONS. VISUAL OBSERVATION OF CAPTURE INDICATION DURING CAPTURE WILL VERIFY PROPER SENSOR OPERATION.

DOCKING MECHANISM QUALIFICATION TESTS:

1. ELECTRICAL CIRCUIT CHECK - CONTACT RESISTANCE ON EACH PIN OF THE CONNECTOR WHICH IS ELECTRICALLY TIED TO THE CAPTURE SENSOR IS CHECKED. THIS TEST VERIFIES CONTINUITY THROUGH THE CAPTURE SENSOR WHEN CAPTURE LATCHES ARE IN THEIR CLOSED POSITION.

2. INSULATION RESISTANCE TEST - THE INSULATION RESISTANCE AND ELECTRICAL STRENGTH OF INSULATION CHECKOUT OF EACH PIN OF THE CAPTURE SENSOR CONNECTOR TO THE APDA HOUSING WILL VERIFY THAT THE SENSOR CONTACT SETS ARE NOT ELECTRICALLY SHORTED TO GROUND.

3. TRANSPORTABILITY STRENGTH TEST - SHIPPING LOADS ARE SIMULATED ON A VIBRATING TABLE TO VERIFY THAT THE DOCKING MECHANISM WILL NOT BE DAMAGED DURING SHIPMENT. THIS TEST IS CONDUCTED UNDER THE CONDITIONS CONTAINED IN THE FOLLOWING TABLE.

VIBRATION ACCELER DIRECTION	VIBRATION ACCELER AMPLITUDE	FREQUENCY SUBBAND, HZ					TOTAL TEST DURATION	
		5-7	7-15	15-30	30-40	40-60	HR	MIN
		TEST DURATION, MIN						
ALONG X-AXIS	1.4	-	4	-	-	-	-	4
	1.2	76	93	32	61	39	5	7
ALONG Y-AXIS	1.1	-	4	-	-	-	-	4
	1.0	13	16	7	10	7	-	53
ALONG Z-AXIS	1.1	-	4	-	-	-	-	4
	1.0	32	40	16	28	16	2	10

SUBSEQUENT TO THIS TEST AN INSPECTION IS PERFORMED TO IDENTIFY BROKEN OR LOOSE HARDWARE; AND AN ELECTRICAL CIRCUIT CHECK TEST AND INSULATION RESISTANCE TEST ARE PERFORMED, AS DEFINED IN QTP TESTS #1 AND #2 ABOVE, TO VERIFY PROPER FUNCTIONING OF THE CAPTURE SENSORS.

4. VIBRATION STRENGTH TEST - APDS SUBJECTED TO THE FOLLOWING VIBRATION LEVELS IN EACH AXIS FOR A 400 SECOND DURATION.

FREQUENCY (HZ)	SPECTRAL DENSITY ACCELERATION
FROM 20 TO 80	INCREASING, 3DB OCTAVE TO 0.067G <sup>2</sup> /HZ
FROM 80 TO 350	CONSTANT 0.067G <sup>2</sup> /HZ
FROM 350 TO 2000	DECREASING 3DB OCTAVE WITH 0.067G <sup>2</sup> /HZ

SUBSEQUENT TO THIS TEST AN INSPECTION IS PERFORMED TO IDENTIFY BROKEN OR LOOSE HARDWARE; AND AN ELECTRICAL CIRCUIT CHECK TEST AND INSULATION RESISTANCE TEST ARE PERFORMED, AS DEFINED IN QTP TESTS #1 AND #2 ABOVE, TO VERIFY PROPER FUNCTIONING OF THE CAPTURE SENSORS.

5. SHOCK AND SAWTOOTH LOADING STRENGTH TEST - DOCKING MECHANISM IS SUBJECTED TO 20G TERMINAL SAWTOOTH SHOCK PULSES IN EACH AXIS, 3 PULSES IN EACH DIRECTION FOR A TOTAL OF 6 PULSES/AXIS. AFTER COMPLETION AN INSPECTION IS PERFORMED TO IDENTIFY BROKEN OR LOOSE HARDWARE; AND AN ELECTRICAL CIRCUIT CHECK TEST AND INSULATION

RSC  
Energia

Proprietary Data

PAGE: 214

PRINT DATE: 08/25/95

## FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE

NUMBER: M8-1MR-8M022-02

RESISTANCE TEST ARE PERFORMED, AS DEFINED IN QTP TESTS #1 AND #2 ABOVE, TO VERIFY PROPER FUNCTIONING OF THE CAPTURE SENSORS.

6. COLD AND HEAT RESISTANCE TEST - DOCKING OF THE MECHANISM IS THERMALLY CYCLED FROM +20°C TO -50/-55°C TO +50/+55°C TO +20°C IN A VACUUM AT  $10^{-4}$  TO  $10^{-5}$  TORR. DWELL AT EACH TEMPERATURE AND BETWEEN OPERATIONS AT EACH TEMPERATURE IS A MINIMUM OF 60 MINUTES AFTER STABILIZATION. AFTER EACH DOCKING/CAPTURE, AS SHOWN IN THE FOLLOWING TABLE, CAPTURE INDICATIONS ARE VERIFIED.

SEQ NO.	DOCKING RATE, M/S	SIMULATOR ROTATIONAL ANGLE		TEMP °C	VOLTAGE VOLTS	PRESS INTEGRITY CHECKOUT
		PITCH	ROLL			
1	0.10	0°	0°	25 +/-10	23	YES
2	0.10	0°	4°	25 +/-10	34	NO
3	0.12	4°	4°	25 +/-10	27	NO
4*	---	---	---	+50 +/-5	---	YES
4	0.10	4°	0°	+50 +/-5	27	YES
5*	---	---	---	-(80 +/-5)	---	YES
5	0.10	4°	0°	-(30 +/-5)	27	YES
6*	---	---	---	+80 +/-5	---	YES
6	0.12	0°	4°	+50 +/-5	23	YES
7*	---	---	---	-(80 +/-5)	---	YES
7	0.10	0°	4°	-(30 +/-5)	23	YES
8*	---	---	---	+80 +/-5	---	YES
8	0.12	4°	4°	50 +/-5	34	YES
9*	---	---	---	-(80 +/-5)	---	YES
9	0.12	4°	4°	-(30 +/-5)	34	YES
10*	---	---	---	+80 +/-5	---	YES
10	0.10	4°	0°	+50 +/-5	27	YES
11*	---	---	---	-(80 +/-5)	---	YES
11	0.10	0°	4°	-(30 +/-5)	27	YES
12*	---	---	---	+80 +/-5	---	YES
12	0.10	0°	4°	+50 +/-5	27	YES
13*	---	---	---	-(80 +/-5)	---	YES
13	0.12	4°	4°	-(30 +/-5)	27	YES
14*	---	---	---	+80 +/-5	---	YES
14	0.12	4°	4°	+50 +/-5	27	YES
15*	---	---	---	+25 +/-10	23	YES

\*MC821-0087-2001, -4001, &amp; -5001 ONLY

AFTER COMPLETION AN INSPECTION IS PERFORMED TO IDENTIFY BROKEN OR LOOSE HARDWARE; AND AN ELECTRICAL CIRCUIT CHECK TEST AND INSULATION RESISTANCE TEST ARE PERFORMED, AS DEFINED IN QTP TESTS #1 AND #2 ABOVE, TO VERIFY PROPER FUNCTIONING OF THE CAPTURE SENSORS.

7. APDS SERVICEABILITY TEST IN A SIX-DEGREE-OF-FREEDOM DYNAMIC TEST - THE SIX-DEGREE-OF-FREEDOM DYNAMIC TEST VERIFIES APDS DOCKING AND UNDOCKING OPERATIONS UNDER CLOSE-TO-FULL-SCALE CONDITIONS. STATIC

RSC  
Energia

Proprietary Data

M8-1MR-261

PAGE: 215

PRINT DATE: 08/25/95

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE****NUMBER: M8-1MR-BM022- 02**

MOTION OF ENTITIES IS SIMULATED UNDER SPECIFIC INERTIAL AND GEOMETRICAL PARAMETERS FOR VARIOUS INITIAL CONDITIONS FOR MIR/SHUTTLE DOCKING. A TOTAL OF 20 DOCKINGS IS PERFORMED, WHICH INCLUDES CAPTURE. SUBSEQUENT TO THIS TEST AN ENGINEERING INSPECTION IS PERFORMED TO IDENTIFY BROKEN OR LOOSE HARDWARE; AND AN ELECTRICAL CIRCUIT CHECK TEST AND INSULATION RESISTANCE TEST ARE PERFORMED, AS DEFINED IN QTP TESTS #1 AND #2 ABOVE, TO VERIFY PROPER FUNCTIONING OF THE CAPTURE SENSORS.

8. TARGET SERVICE LIFE TEST - TESTS ARE PERFORMED TO VERIFY PROPER DOCKING AND UNDOCKING OPERATIONS OVER ITS LIFE OF 100 DOCKINGS. PROPER CAPTURE INDICATION (CAPTURE SENSOR OPERATION) IS VERIFIED DURING 100 DOCKING AND UNMATING CYCLES (FOR M0821-0087-1001/-3001 UNITS ONLY). FOR M0821-0087-2001, -4001, & -5001 UNITS PROPER OPERATION VERIFIED DURING 388 CYCLES (44 VACUUM/LOAD CYCLES, 16 LOAD CYCLES, & 324 NO-LOAD CYCLES). AFTER COMPLETION AN INSPECTION IS PERFORMED TO IDENTIFY BROKEN OR LOOSE HARDWARE; AND AN ELECTRICAL CIRCUIT CHECK TEST AND INSULATION RESISTANCE TEST ARE PERFORMED, AS DEFINED IN QTP TESTS #1 AND #2 ABOVE, TO VERIFY PROPER FUNCTIONING OF THE CAPTURE SENSORS.

9. CONTROL DISASSEMBLY - UPON COMPLETION OF ALL QUAL TESTING THE DOCKING MECHANISM IS DISMANTLED AND CAPTURE SENSORS ARE CHECKED FOR EVIDENCE OF WEAR OR FAILURE.

OMRSD - TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

**(C) INSPECTION:**

RECEIVING INSPECTION

ALL INCOMING PARTS ARE SUBJECTED TO EXTERIOR INSPECTION.

**CONTAMINATION CONTROL**

CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL VERIFIED BY INSPECTION. CHECK OF ROOM CLEANLINESS; PARTS WASHING AND OTHER OPERATIONS OF THE TECHNOLOGICAL PROCESS WHICH PROVIDES CLEANLINESS ARE VERIFIED BY INSPECTION.

**CRITICAL PROCESSES:**

HEAT TREATING, SOLDERING, CHEMICAL PLATING, AND CURING VERIFIED BY INSPECTION.

**ASSEMBLY/INSTALLATION**

ASSEMBLY/INSTALLATION VERIFIED BY INSPECTION.

**TESTING**

ATP/QTP/OMRSD TESTING VERIFIED BY INSPECTION.

**HANDLING/PACKAGING**

PROPER PACKAGING, STORAGE, AND TRANSPORTATION VERIFIED BY INSPECTION.

**(D) FAILURE HISTORY:**

ONE FAILURE OCCURRED ON MIR DOCKING MECHANISM RELATING TO A STUCK ROD. THE FAILURE RESULTED FROM MOISTURE INGRESS BETWEEN THE ROD AND THE

RSC  
Energia**Proprietary Data**

M8-1MR - 262

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL FAILURE MODE  
NUMBER: M8-1MR-SM022-02

GUIDE AT -50 DEGREES C. TO PREVENT FAILURES OF THIS NATURE, A LUBRICANT WAS INTRODUCED INTO THE GAP AND THE QUALITY OF THE ROD SURFACE WAS IMPROVED. CURRENT DATA ON TEST FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING OF ODS DOCKING MECHANISMS CAN BE FOUND IN PRACA DATA BASE.

(E) OPERATIONAL USE:

GIVEN SUFFICIENT TIME CREW COULD CONTROL CLOSING PARAMETERS TO AVOID HIGH LOADS DURING CAPTURE. CREW MUST NOT RELY 100% ON THE CAPTURE INDICATION. VISUAL OBSERVATION THROUGH ORBITER CREW HATCH AND REMOTE TV VIEWING THROUGH EXTERNAL AIRLOCK UPPER HATCH WINDOW COULD PROVIDE INDICATION AS TO THE PROXIMITY BETWEEN BOTH DOCKING MECHANISMS DURING THE CAPTURE PROCESS. UNDER NORMAL CONDITIONS AN INITIAL CONTACT INDICATION WILL PRECEED THE CAPTURE INDICATION AND ONLY UNDER IDEAL CLOSING CONDITIONS WILL IT NOT APPEAR FIRST. THERE IS NO WORKAROUND FOR A PREMATURE ACTIVATION OF HIGH ENERGY DAMPERS IF NOT DETECTED PRIOR TO CONTACT.

- APPROVALS -

DESIGN ENGINEER  
DESIGN MANAGER  
NASA SS/MA  
NASA SUBSYSTEM MANAGER

M. NIKOLAYEVA  
A. SOUBCHEV

*[Handwritten signatures and initials over approval lines]*



RSC  
Energia

Proprietary Data