

FMEA REF.	REV	NAME, QTY & DRAWING REF. DESIGNATION	FUNCTION	FAILURE MODE & CAUSE	MISSION PHASE	FAILURE EFFECT ON END ITEM	HARDWARE FUNCTION CRITICALITY	RATIONALE FOR ACCEPTANCE
14010	B	GRAPPLE SHAFT, QTY-1 P/N SPAR 315870108-1 DRIVE SHAFT, QTY-1 P/N SPAR 315870154-1 GRAPPLE SHAFT SPRING, QTY-1 P/N SPAR 315870143-1	PROVIDES MECHANICAL INTERFACE BETWEEN EE AND PAYLOAD, SPRING PROVIDES SHAFT RETRACTION FORCE	MODE: GRAPPLE AND DRIVE SHAFT ASSEMBLY BINDING CAUSE(S): BEARING IN GRAPPLE OR DRIVE SHAFT HOUSING ASSEMBLY, OR IN SPRING HOUSING.	CRBT	EE CARTRIDGE MAY NOT REACH FULLY PROXIMIZER POSITION WITH POSSIBLE EE MOTOR BURROUT IF NO HOUS FLGO. ELECTRICAL CONNECTORS MAY NOT MATE OR DENATE UNEVEN OR DELAYED CONNECTOR SEPARATION AT EE BACKOFF CAUSING UNEXPECTED PAYLOAD MOTION AT RELEASE <u>WORST CASE</u> PAYLOAD DOES NOT RELEASE CREW ACTION REQUIRED <u>TIME TO REPAIR</u> HOURS <u>REDUNDANT PARTS REMAINING</u> ONE LEFT/ONE	S19 <u>REDUNDANCY SCHEMES</u> A - PASS B - PASS C - PASS	<u>DESIGN FEATURES</u> THE GRAPPLE SHAFT, PART NUMBER 315870108-1, IS MANUFACTURED FROM TITANIUM ALLOY PER MIL-T-904, COMPOSITION 6, HEAT TREATED CONDITION 87A. THIS PART IS DRY LUBRICATED USING TUNGSTEN DISULFIDE. THE INWARD END OF THIS SHAFT IS THREADED INTO THE DRIVE SHAFT, PART NUMBER 315870154-1. THIS PART IS ALSO FABRICATED FROM TITANIUM ALLOY. THE GRAPPLE AND DRIVE SHAFT ASSEMBLY SLIDES AXIALLY IN ITS HOUSING ASSEMBLY TO EXTEND AND RETRACT THE GRAPPLE FIXTURE DURING EE'S RICHIZATION AND DERICHIZATION. THIS MOVEMENT ALSO ACTS VIA MECHANICAL LINKAGE, TO MATE AND DEMATE THE EEPF AND EE ELECTRICAL CONNECTORS. THE ENDS OF THE HOUSING ASSEMBLY ARE DESIGNED TO PROVIDE A RESTRICTED PATH FOR THE MESHES OF BEARS. THE COMPRESSION SPRING, P/N 315870143-1 IS A BOUGHT OUT ITEM, MANUFACTURED FROM SAE 925 CHROMIUM-VANADIUM ALLOY STEEL, IN ACCORDANCE WITH ASTM A229 SPECIFICATION. THE SPRING IS SUBJECTED TO HEAT TREATMENT PER MIL-H-8815 AND SHOT PEENING PER MIL-F-13285. REFERENCE DISCOM ANALYSIS REPORT SPAR-RMB-R-1100 FOR EEPF MARGINS OF SAFETY. THE SPRING HOUSING P/N SPAR 315870108-1 CREATES A CLOSED CAVITY IN WHICH THE SHAFT RETURN SPRING OPERATES. THE HOUSING HAS A 0.13 IN. DIA. VENTING HOLE. THIS ASSEMBLY RESULTS IN A RESTRICTED PATH FOR THE MESHES OF BEARS. PRIOR TO ITS INSTALLATION TO THE GRAPPLE FIXTURE, EACH SHAFT RETURN SPRING IS SUBMITTED TO A WORK-IN TEST THAT INCLUDES 100 COMPRESSION CYCLES. FOLLOWING INSTALLATION OF THESE PARTS INTO THE EEPF, THE FOLLOWING OPERATIONAL ACCEPTANCE TESTING IS CONDUCTED ON THE GRAPPLE FIXTURE. THE EXTENSION AND RETRACTION OF THE GRAPPLE AND DRIVE SHAFT ASSEMBLY IS EXTENSIVELY EXERCISED DURING THE COURSE OF THIS TESTING. <u>ACCEPTANCE TESTS</u> THE ELECTRICAL FLIGHT GRAPPLE FIXTURE (EFP) IS SUBJECTED TO THE FOLLOWING ACCEPTANCE TESTS (REF. SPAR-RMS-ATR-187): - VISUAL INSPECTION AND CRITICAL DIMENSION VERIFICATION - AMBIENT FUNCTIONAL TESTS: A) MECHANICAL - GRAPPLE SHAFT OPERATION, ELECTRICAL CONNECTOR MATE/DEMATE, AND EVA SHAFT RELEASE/REINSERTION, UNDER LOAD AND NO LOAD. B) ELECTRICAL - CONTINUITY, ISOLATION RESISTANCE, DIELECTRIC STRENGTH UNDER 0 AND 30 DC V, 0 AND 50 AC V AND SEPARATION. - VIBRATION TEST, 0.04 g ² /Hz IN EACH OF X, Y, AND Z AXIS. - VISUAL INSPECTION - STRUCTURAL ADEQUACY TEST - - AXIAL LOAD = 2714 LBF. - BENDING MOMENT = 1200 FT-LBS - TORSIONAL MOMENT = 400 FT-LBS. - VISUAL INSPECTION AND CRITICAL DIMENSIONS VERIFICATION - AMBIENT FUNCTIONAL TESTING - MECHANICAL - THERMAL TEST: - 44 DEG. DI-62 DEG. C, TWO CYCLES - MECHANICAL FUNCTION TESTED AT TEMPERATURE EXTREMES. - FUNCTIONAL TESTING - MECHANICAL AND ELECTRICAL - DIMENSIONAL INSPECTION PERFORMED IN ACCORDANCE WITH SPAR-RMS-ITP-192.

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Working group

8 June 92

DISPOSITION DATE:

1, 2, B

CRITICAL ITEMS LIST

PROB DI - CARGO ELEMENT INTERFACE
ASSEMBLY ELECTRICAL FLIGHT GRAPPLE FIXTURE

SYSTEM
PAYLOAD GRAPPLE FIXTURE
ASSEMBLY NUMBER:
81N7806-1

MSA REF.	REV	NAME, QTY & DRAWING REF. DESIGNATION	FUNCTION	FAILURE MODE & CAUSE	MISSION PHASE	FAILURE EFFECT ON END-ITEM	HARDWARE FUNCTION CRITICALITY	RATIONALE FOR ACCEPTANCE
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QUALIFICATION TESTS

THE EPOF QUALIFICATION CONSISTED OF PERFORMING ESSENTIALLY THE SAME TESTS AS REQUIRED FOR ACCEPTANCE TESTS WITH THEIR ASSOCIATED MECHANICAL AND ELECTRICAL FUNCTIONAL INSPECTIONS (REF. SPAR-RMS-TP-1074):

- STRUCTURAL ADEQUACY TEST:
- ATP REPEATED USING 1.5X DESIGN LOAD AND MOMENT VALUES.

- THERMAL VACUUM TEST:
- -105 DEG C AT 500 C.TEN CYCLES
- MECHANICAL FUNCTION TESTED AT TEMPERATURE EXTREMES

- VIBRATION TEST:
- RESONANCE EVALUATION AT 8.5 g
- 0.001 g²/Hz IN EACH OF X, Y, AND Z AXES

QA INSPECTIONS

THE EPOF IS MANUFACTURED UNDER DOCUMENTED QUALITY CONTROLS BY SPAR AND APPROVED SUBCONTRACTORS. THESE CONTROLS ARE EXERCISED THROUGH DESIGN, PROCUREMENT, PROCESSING, FABRICATION, ASSEMBLY TESTING, SHIPPING AND RECEIVING OF UNITS. SPAR GOVERNMENT REPRESENTATIVE MANDATORY INSPECTION POINTS ARE INVOKED ON THE SUBCONTRACTOR AT VARIOUS LEVELS OF ASSEMBLY AND TESTING.

RECEIVING INSPECTION VERIFIES THAT ALL PARTS RECEIVED ARE AS IDENTIFIED IN THE PROCUREMENT DOCUMENTS, THAT NO PHYSICAL DAMAGE TO PARTS HAS OCCURRED DURING SHIPMENT AND THAT APPROPRIATE DATA HAS BEEN RECEIVED WHICH PROVIDES ADEQUATE TRACEABILITY INFORMATION AND IDENTIFIES ACCEPTABLE PARTS.

PARTS ARE INSPECTED THROUGHOUT MANUFACTURE, ASSEMBLY AND TEST AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED.

THESE INSPECTIONS INCLUDE:

LIQUID PENETRANT INSPECTION PER MIL STD-4046, TYPE I, METHOD B, SENSITIVITY LEVEL 2 TO CHECK THAT NO CRACKS ARE PRESENT. VERIFICATION THAT FITTED PARTS ARE CORRECT PRIOR TO ASSEMBLY AND TRACEABILITY INFORMATION RECORDED.

INSPECTION TO DRAWING THROUGHOUT THE ASSEMBLY PROCESS. VISUAL INSPECTION AND CRITICAL DIMENSIONAL VERIFICATION IS PERFORMED TO SPAR INSPECTION TEST PROCEDURE SPAR-RMS-TP-1073 WHICH INCLUDES GROUNDING VERIFICATION, WORKMANSHIP, DIMENSIONAL, WEIGHT, (SPAR GOVERNMENT MANDATORY INSPECTION POINT).

ACCEPTANCE TESTING (ATP) INCLUDES CRITICAL DIMENSIONAL CHECKS, FUNCTIONAL TESTING FOR GRAPPLE SHAFT OPERATION, ELECTRICAL MATÉRIELETE AND ELECTRICAL OPERATION, BREAKOUT AND RUNNING TO HOUSES FOR EVA SHAFT WITHDRAWAL AND INSERTION UNDER LOAD, PROOF LOADING AND GROUNDING TEST. (SPAR GOVERNMENT MANDATORY INSPECTION POINT).

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CRITICAL ITEMS LIST

PROJECT: CARGO ELEMENT INTERFACE
 ASSEMBLY: ELECTRICAL MOUNT GRAPPLE
 PARTS

SYSTEM:
 PAYLOAD GRAPPLE FIXTURE
 ASSEMBLY NUMBER:
 315812100.1

W&A REF.	REV	NAME, CITY & DRAWING REF. DESIGNATION	FUNCTION	FAILURE MODE & CAUSE	MISSION PHASE	FAILING EFFECT ON END ITEM	HARDWARE /FUNCTION CRITICALITY	RATIONALE FOR ACCEPTANCE
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CRITICAL

NONE

FAILURE HISTORY

NONE

OPERATIONAL EFFECTS

NORMAL ELECTRICAL CONNECTOR REMATE NOT POSSIBLE

CREW ACTIONS

EVA REMATE OF CONNECTOR IS POSSIBLE. RMS JETTISON IS AVAILABLE.

CREW TRAINING

THE CREW SHALL BE TRAINED TO EVA RELEASE THE ELECTRICAL CONNECTOR AND JETTISON THE RMS

MISSION CONSTRAINTS

OPERATE UNDER VERMEX GATES WITHIN 10 FT. OF STRUCTURE. THE ARM WILL NOT BE DRIVEN UNLESS THE CREW IS OBSERVING THE EXPECTED MOTION OF THE ARM/PAYLOAD STRUCTURE VIA WINDOW AND/OR OCUP VIEWS

EE BROOKS SWITCH SET TO OFF POSITION IMMEDIATELY AFTER SPECIFIED DRIVE TIME HAS ELAPSED.

WHEN CAPTURING OR RELEASING A FREE FLYING PAYLOAD, THE CREW MUST BE FAR ENOUGH AWAY FROM STRUCTURE TO PROHIBIT CONTACT REGARDLESS OF PAYLOAD ROTATIONS.

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PREPARED BY:

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APPROVED BY:

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Working arm *8. Jan 92*

SUPERSEDING DATE: