

CRITICAL ITEMS LIST

PROJECT: SRMS

ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM

ASS'Y P/N: 51140F1177

SHEET: 1

FMEA REF.	FMEA REV.	NAME, QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2540	1	MOTOR CONTROL LOOP QTY-6 SCHEMATIC 2563721 AND 2563722	<p>MODE: ANALOG OUTPUT FROM T.E. TO MDA. FAILS HIGHER THAN COMMANDED.</p> <p>CAUSE(S): HIGH OUTPUT DUE TO PARTS FAILURE OF -</p> <p>(1) INPUT SHIFT REGISTER AND LATCH.</p> <p>(2) DIGITAL COMPARATOR AND LIMITER</p> <p>(3) D TO A CONVERTER</p> <p>(4) ANALOG SUMMER.</p>	<p>FALSE RATE ERROR SIGNAL PRODUCED. JOINT WILL RUNAWAY. CONSISTENCY CHECK WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- AUTOBRAKES</p>	<p>DESIGN FEATURES -----</p> <p>THE DESIGN UTILIZES PROVEN CIRCUIT TECHNIQUES AND IS IMPLEMENTED USING CMOS LOGIC DEVICES.</p> <p>CMOS DEVICES OPERATE AT LOW POWER AND HENCE DO NOT EXPERIENCE SIGNIFICANT OPERATING STRESSES. THE TECHNOLOGY IS MATURE, AND DEVICE RELIABILITY HISTORY IS WELL DOCUMENTED. ALL STRESSES ARE ADDITIONALLY REDUCED BY DERATING THE APPROPRIATE PARAMETERS IN ACCORDANCE WITH SPAR-RMS-PA.003. SPECIAL HANDLING PRECAUTIONS ARE USED AT ALL STAGES OF MANUFACTURE TO PRECLUDE DAMAGE/STRESS DUE TO ELECTROSTATIC DISCHARGE.</p> <p>ALL RESISTORS AND CAPACITORS USED IN THE DESIGN ARE SELECTED FROM ESTABLISHED RELIABILITY (ER) TYPES. LIFE EXPECTANCY IS INCREASED BY ENSURING THAT ALL ALLOWABLE STRESS LEVELS ARE DERATED IN ACCORDANCE WITH SPAR-RMS-PA.003. ALL CERAMIC AND ELECTROLYTIC CAPACITORS ARE ROUTINELY SUBJECTED TO RADIOGRAPHIC INSPECTION.</p> <p>DISCRETE SEMICONDUCTOR DEVICES SPECIFIED TO AT LEAST THE TX LEVEL OF MIL-S-19500. ALL DEVICES ARE SUBJECTED TO RE-SCREENING BY AN INDEPENDANT TEST HOUSE. SAMPLES OF ALL PROCURED LOTS/DATE CODES ARE SUBJECTED TO DESTRUCTIVE PHYSICAL ANALYSIS (DPA) TO VERIFY THE INTEGRITY OF THE MANUFACTURING PROCESSES. DEVICE STRESS LEVELS ARE, DERATED IN ACCORDANCE WITH SPAR-RMS-PA.003 AND VERIFIED BY DESIGN REVIEW.</p> <p>COMPARATORS AND OPERATIONAL AMPLIFIERS ARE STANDARD LINEAR INTEGRATED CIRCUITS WITH MATURE MANUFACTURING TECHNOLOGY. APPLICATION CONSTRAINTS ARE IN ACCORDANCE WITH SPAR-RMS-PA.003.</p> <p>D TO A CONVERTER IS SCREENED TO THE REQUIREMENTS OF SPAR-RMS-PA.003.</p>

PREPARED BY: MFVG

SUPERCEDING DATE: 11 SEP 86

RMS/ELEC - 228

DATE: 24 JUL 91

CIL REV: 1

CRITICAL ITEMS LIST

PROJECT: SRMS

SYSTEM: ELECTRICAL SUBSYSTEM

ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

ASS'Y P/N: 51T40FT177

SHEET: 2

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	NDWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2540	1	MOTOR CONTROL LOOP QTY-6 SCHEMATIC 2563721 AND 2563722	<p>MODE: ANALOG OUTPUT FROM T.E. TO MDA. FAILS HIGHER THAN COMMANDED.</p> <p>CAUSE(S): HIGH OUTPUT DUE TO PARTS FAILURE OF -</p> <p>(1) INPUT SHIFT REGISTER AND LATCH.</p> <p>(2) DIGITAL COMPARATOR AND LIMITER</p> <p>(3) D TO A CONVERTER</p> <p>(4) ANALOG SUMMER.</p>	<p>FALSE RATE ERROR SIGNAL PRODUCED. JOINT WILL RUNAWAY. CONSISTENCY CHECK WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- AUTOBRAKES</p>		<p>ACCEPTANCE TESTS ----- THE SPA IS SUBJECTED TO THE FOLLOWING ENVIRONMENTAL TESTING AS AN SRU.</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</p> <p>O THERMAL: PLUS 70 DEGREES C TO -25 DEGREES C DURATION - 1 1/2 CYCLES</p> <p>THE SPA IS THEN TESTED AS PART OF THE JOINTS ACCEPTANCE TESTS (VIBRATION AND THERMAL VACUUM TEST).</p> <p>THE SPA'S/JOINTS UNDERGO RMS SYSTEM TESTS (TP518 RMS STRONGBACK AND TP552 FLAT FLOOR TESTS) WHICH VERIFIES THE ABSENCE OF THE FAILURE MODE.</p> <p>QUALIFICATION TESTS ----- THE SPA IS SUBJECTED TO THE FOLLOWING SRU QUALIFICATION TEST ENVIRONMENTS. THE SPA WAS ALSO TESTED AS PART OF THE JOINT QUALIFICATION TESTS.</p> <p>O VIBRATION: LEVEL AND DURATION - REFERENCE TABLE 4</p> <p>O SHOCK: 20G/11 MS/3 AXES (6 DIRECTIONS)</p> <p>O THERMAL VAC: +81 DEGREES C TO -36 DEGREES C (6 CYCLES) 1X10⁻⁶ TORR</p> <p>O HUMIDITY: TESTED WITH THE SHOULDER JOINT</p> <p>O EMC: MIL-STD-461 AS MODIFIED BY SL-E-0002 (TEST CE01, CE03, CS01, CS02, CS06, RE01, RE02 (N/B), RS01)</p> <p>FLIGHT CHECKOUT ----- PDRS OPS CHECKLIST (ALL VEHICLES) JSC 16987</p>

PREPARED BY: MFWG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY:

DATE: 26 JUL 91

CIL REV: 1

CRITICAL ITEMS LIST

PROJECT: SRMS
ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
ASS'Y P/N: 51140F1177

SHEET: 3

FMEA REF.	FMEA REV.	NAME, QTY. & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HWWR / FUNC. 2/1R CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2540	1	MOTOR CONTROL LOOP QTY-6 SCHEMATIC 2563721 AND 2563722	<p>MODE: ANALOG OUTPUT FROM T.E. TO MDA. FAILS HIGHER THAN COMMANDED.</p> <p>CAUSE(S): HIGH OUTPUT DUE TO PARTS FAILURE OF -</p> <p>(1) INPUT SHIFT REGISTER AND LATCH.</p> <p>(2) DIGITAL COMPARATOR AND LIMITER</p> <p>(3) D TO A CONVERTER</p> <p>(4) ANALOG SUMMER.</p>	<p>FALSE RATE ERROR SIGNAL PRODUCED. JOINT WILL RUNAWAY. CONSISTENCY CHECK WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- AUTOBRAKES</p>	QA/INSPECTIONS -----	<p>UNITS ARE MANUFACTURED UNDER DOCUMENTED QUALITY CONTROLS. THESE CONTROLS ARE EXERCISED THROUGHOUT DESIGN PROCUREMENT, PLANNING, RECEIVING, PROCESSING, FABRICATION, ASSEMBLY, TESTING AND SHIPPING OF THE UNITS. MANDATORY INSPECTION POINTS ARE EMPLOYED AT VARIOUS STAGES OF FABRICATION ASSEMBLY AND TEST. GOVERNMENT SOURCE INSPECTION IS INVOKED AT VARIOUS CONTROL LEVELS.</p> <p>EEE PARTS INSPECTION IS PERFORMED AS REQUIRED BY SPAR-RMS-PA.003. EACH EEE PART IS QUALIFIED AT THE PART LEVEL TO THE REQUIREMENTS OF THE APPLICABLE SPECIFICATION. ALL EEE PARTS ARE 100X SCREENED AND BURNED IN, AS A MINIMUM, AS REQUIRED BY SPAR-RMS-PA.003, BY THE SUPPLIER. ADDITIONALLY, EEE PARTS ARE 100X RE-SCREENED IN ACCORDANCE WITH REQUIREMENTS, BY AN INDEPENDENT SPAR APPROVED TESTING FACILITY. DPA IS PERFORMED AS REQUIRED BY PA.003 ON A RANDOMLY SELECTED 5% OF PARTS, MAXIMUM 5 PIECES, MINIMUM 3 PIECES FOR EACH LOT NUMBER/DATE CODE OF PARTS RECEIVED.</p> <p>WIRE IS PROCURED TO SPECIFICATION MIL-W-22759 OR MIL-W-01381 AND INSPECTED AND TESTED TO NASA JSCM8080 STANDARD NUMBER 95A.</p> <p>RECEIVING INSPECTION VERIFIES THAT ALL PARTS RECEIVED ARE AS IDENTIFIED IN THE PROCUREMENT DOCUMENTS, THAT NO PHYSICAL DAMAGE HAS OCCURRED TO PARTS DURING SHIPMENT, THAT THE RECEIVING DOCUMENTS PROVIDE ADEQUATE TRACEABILITY INFORMATION AND SCREENING DATA CLEARLY IDENTIFIES ACCEPTABLE PARTS.</p> <p>PARTS ARE INSPECTED THROUGHOUT MANUFACTURE AND ASSEMBLY AS APPROPRIATE TO THE MANUFACTURING STAGE COMPLETED. THESE INSPECTIONS INCLUDE,</p> <p>PRINTED CIRCUIT BOARD INSPECTION FOR TRACK SEPARATION, DAMAGE AND ADEQUACY OF PLATED THROUGH HOLES,</p> <p>COMPONENT MOUNTING INSPECTION FOR CORRECT SOLDERING, WIRE LOOPING, STRAPPING, ETC. OPERATORS AND INSPECTORS ARE TRAINED AND CERTIFIED TO NASA NHB 5300.4(3A) STANDARD, AS MODIFIED BY JSC 0800A.</p> <p>CONFORMAL COATING INSPECTION FOR ADEQUATE PROCESSING IS PERFORMED USING ULTRAVIOLET LIGHT TECHNIQUES.</p> <p>POST P.C. BD. INSTALLATION INSPECTION, CLEANLINESS AND WORKMANSHIP (SPAR/GOVERNMENT REP. MANDATORY INSPECTION POINT)</p> <p>P.C. BD. INSTALLATION INSPECTION, CHECK FOR CORRECT BOARD INSTALLATION, ALIGNMENT OF BOARDS, PROPER CONNECTOR CONTACT MATING, WIRE ROUTING, STRAPPING OF WIRES ETC.,</p> <p>PRE-CLOSURE INSPECTION, WORKMANSHIP AND CLEANLINESS (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p> <p>PRE-ACCEPTANCE TEST INSPECTION, WHICH INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC., (MANDATORY INSPECTION POINT).</p>

CRITICAL ITEMS LIST

PROJECT: SRMS

SYSTEM: ELECTRICAL SUBSYSTEM

ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

ASS'Y P/N: 51140FT177

SHEET: 4

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDWR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2540	1	MOTOR CONTROL LOOP QTY-6 SCHEMATIC 2563721 AND 2563722	<p>MODE: ANALOG OUTPUT FROM T.E. TO MOA. FAILS HIGHER THAN COMMANDED.</p> <p>CAUSE(S): HIGH OUTPUT DUE TO PARTS FAILURE OF -</p> <p>(1) INPUT SHIFT REGISTER AND LATCH.</p> <p>(2) DIGITAL COMPARATOR AND LIMITER</p> <p>(3) D TO A CONVERTER</p> <p>(4) ANALOG SUMMER.</p>	<p>FALSE RATE ERROR SIGNAL PRODUCED. JOINT WILL RUNAWAY. CONSISTENCY CHECK WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE ----- UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING ----- AUTOBRAKES</p>	<p>A TEST READINESS REVIEW (TRR) WHICH INCLUDES VERIFICATION OF TEST PERSONNEL, TEST DOCUMENTS, TEST EQUIPMENT CALIBRATION/ VALIDATION STATUS AND HARDWARE CONFIGURATION IS CONVENED BY QUALITY ASSURANCE IN CONJUNCTION WITH ENGINEERING, RELIABILITY, CONFIGURATION CONTROL, SUPPLIER AS APPLICABLE, AND THE GOVERNMENT REPRESENTATIVE, PRIOR TO THE START OF ANY FORMAL TESTING (ACCEPTANCE OR QUALIFICATION).</p> <p>ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT PERFORMANCE, THERMAL AND VIBRATION TESTING, (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).</p> <p>INTEGRATION OF UNIT TO JOINT SRU - INSPECTIONS INCLUDE GROUNDING CHECKS, CONNECTORS FOR BENT OR PUSHBACK CONTACTS, VISUAL, CLEANLINESS, INTERCONNECT WIRING AND POWER UP TEST TO THE APPROPRIATE JOINT INSPECTION TEST PROCEDURE (ITP) ETC.</p> <p>JOINT LEVEL PRE-ACCEPTANCE TEST INSPECTION, INCLUDES AN AUDIT OF LOWER TIER INSPECTION COMPLETION, AS BUILT CONFIGURATION VERIFICATION TO AS DESIGN ETC.</p> <p>JOINT LEVEL ACCEPTANCE TESTING (ATP) INCLUDES AMBIENT, VIBRATION AND THERMAL-VAC TESTING. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT).</p> <p>SRMS SYSTEMS INTEGRATION, THE INTEGRATION OF MECHANICAL ARM SUBASSEMBLIES AND THE FLIGHT CABIN EQUIPMENT TO FORM THE SRMS. INSPECTIONS ARE PERFORMED AT EACH PHASE OF INTEGRATION WHICH INCLUDES GROUNDING CHECKS, THRU WIRING CHECKS, WIRING ROUTING, INTERFACE CONNECTORS FOR BENT OR PUSH BACK CONTACTS ETC.</p> <p>SRMS SYSTEMS TESTING - STRONGBACK AND FLAT FLOOR AMBIENT PERFORMANCE TEST. (SPAR/GOVERNMENT REP. - MANDATORY INSPECTION POINT)</p>

PREPARED BY: MFVG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 1

CRITICAL ITEMS LIST

PROJECT: SRMS

SYSTEM: ELECTRICAL SUBSYSTEM

ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

ASS'Y P/N: 51140F1177

SHEET: 5

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HOWR / FUNC. Z/YR CRITICALITY	RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2540	1	MOTOR CONTROL LOOP QTY-6 SCHEMATIC 2563721 AND 2563722	<p>MODE: ANALOG OUTPUT FROM T.E. TO MDA. FAILS HIGHER THAN COMMANDED.</p> <p>CAUSE(S): HIGH OUTPUT DUE TO PARTS FAILURE OF -</p> <p>(1) INPUT SHFT REGISTER AND LATCH.</p> <p>(2) DIGITAL COMPARATOR AND LIMITER</p> <p>(3) D TO A CONVERTER</p> <p>(4) ANALOG SUMMER.</p>	<p>FALSE RATE ERROR SIGNAL PRODUCED. JOINT WILL RUNAWAY. CONSISTENCY CHECK WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE</p> <p>UNEXPECTED MOTION, JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING</p> <p>AUTOBRAKES</p>	<p>FAILURE HISTORY</p> <p>-----</p> <p>THE FOLLOWING FAILURE ANALYSIS REPORT(S) ARE RELEVANT:</p> <p>FAR 3008: S/N 208 NOV 78</p> <p>DESCRIPTION</p> <p>-----</p> <p>HOT: RATE OUT-PUT HIGH, 16.0 VOLTS VICE 14.1 V (SOT RES.R35 INCORRECT). COLD: LOOP ERRORS, 3 BITS VICE 2 (REFER TO FAR-RMS-3011) SERIAL DATA OUT-PUT ERRORS. PINS 1&2 OF CONN. J3 SHORTED, POOR WORKMANSHIP.</p> <p>CORRECTIVE ACTION</p> <p>-----</p> <p>REPL. R35, OPERATOR INSTR. REFER TO FAR-RMS-3011. REPL. CONN J3, R35, R39, R4, PROVIDED COORECT TOOLING.</p> <p>FAR 2118: S/N 202 MAR 80</p> <p>DESCRIPTION</p> <p>-----</p> <p>EXCESSIVE RATE OVERSHOT, CAUSE UNKNOWN, IE. 12.1 R/S-S/B-12.0 R/S.</p> <p>CORRECTIVE ACTION</p> <p>-----</p> <p>NONE REQUIRED RETEST O.K.</p>	

PREPARED BY:

MFVG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY:

DATE: 24 JUL 91

CIL REV: 1

CRITICAL ITEMS LIST

PROJECT: SRMS
 ASS'Y NOMENCLATURE: SERVO POWER AMPLIFIER

SYSTEM: ELECTRICAL SUBSYSTEM
 ASS'Y P/N: 511401177

SHEET: 6

FMEA REF.	FMEA REV.	NAME, QTY, & DRAWING REF. DESIGNATION	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	HDMR / FUNC. 2/1R CRITICALITY RATIONALE FOR ACCEPTANCE SCREENS: A-PASS, B-PASS, C-PASS
2540	1	MOTOR CONTROL LOOP QTY-6 SCHEMATIC 2563721 AND 2563722	<p>MODE: ANALOG OUTPUT FROM I.E. TO MDA. FAILS HIGHER THAN COMMANDED.</p> <p>CAUSE(S): HIGH OUTPUT DUE TO PARTS FAILURE OF -</p> <p>(1) INPUT SHIFT REGISTER AND LATCH.</p> <p>(2) DIGITAL COMPARATOR AND LIMITER</p> <p>(3) D TO A CONVERTER</p> <p>(4) ANALOG SUMMER.</p>	<p>FALSE RATE ERROR SIGNAL PRODUCED. JOINT WILL RUNAWAY. CONSISTENCY CHECK WILL DETECT AND INITIATE AUTO BRAKES. LOSS OF LIMPING DURING END EFFECTOR CAPTURE.</p> <p>WORST CASE UNEXPECTED MOTION. JOINT RUNAWAY. AUTOBRAKES.</p> <p>REDUNDANT PATHS REMAINING AUTOBRAKES</p>	<p>OPERATIONAL EFFECTS</p> <p>-----</p> <p>JOINT RUNAWAY. AUTOBRAKES. CANNOT USE COMPUTER SUPPORTED MODES. DIRECT DRIVE AND BACKUP AVAILABLE. ARM WILL NOT STOP AUTOMATICALLY IF AN UNDETECTED FAILURE OF THE AUTO BRAKES SYSTEM HAS PREVIOUSLY OCCURRED. BRAKES CAN BE APPLIED MANUALLY.</p> <p>CREW ACTION</p> <p>-----</p> <p>APPLY BRAKES. USE DIRECT DRIVE.</p> <p>CREW TRAINING</p> <p>-----</p> <p>THE CREW WILL BE TRAINED TO ALWAYS OBSERVE WHETHER THE ARM IS RESPONDING PROPERLY TO COMMANDS. IF IT ISN'T, APPLY BRAKES.</p> <p>MISSION CONSTRAINT</p> <p>-----</p> <p>OPERATE UNDER VERNIER RATES WITHIN 10 FT OF STRUCTURE. THE OPERATOR MUST BE ABLE TO DETECT THAT THE ARM/PAYLOAD IS RESPONDING PROPERLY TO COMMANDS VIA WINDOW AND/OR CCTV VIEWS DURING ALL ARM OPERATIONS.</p> <p>OHRSD OFFLINE</p> <p>-----</p> <p>DRIVE EACH JOINT IN COMPUTER CONTROLLED MODE. VERIFY MOTOR RATES AND NO MOTION WITH ZERO RATES.</p> <p>OHRSD ONLINE INSTALLATION</p> <p>-----</p> <p>NONE</p> <p>OHRSD ONLINE TURNAROUND</p> <p>-----</p> <p>IN SINGLE, DRIVE EACH JOINT. VERIFY TACHO SIGNATURE WITH COMMANDS AND NO MOTION WITH ZERO RATES.</p>

PREPARED BY:

MFVG

SUPERCEDING DATE: 11 SEP 86

APPROVED BY:

DATE: 26 JUL 91

CIL REV: 1