

**MIL-STD-2110(EC)**

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# **MILITARY STANDARD**

## **RESTORATION, OVERHAUL, AND REPAIR OF ELECTRONIC EQUIPMENT**



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DEPARTMENT OF THE NAVY  
NAVAL ELECTRONIC SYSTEMS COMMAND  
Washington, DC 20360

Restoration, Overhaul, and Repair of Electronic Equipment

MIL-STD-2110 (EC)

1. This Military Standard is approved for use by the Naval Electronic Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Electronic Systems Command (ELEX-5043), Washington, DC 20360 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

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## 1. SCOPE

1.1 Scope. This standard covers the general requirements for the Restoration, Overhaul, and Repair (ROR) of electronic equipment and those aspects of the maintenance processes which are applicable to electronic equipment. It establishes uniform standards and procedures to be used in the ROR process, for example, receipt and evaluation, maintenance procedures, selection and use of parts and material, identification and marking of equipments, and preservation and packing for shipment.

## 2. REFERENCED DOCUMENTS

2.1 Issue of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this standard to the extent specified herein.

## SPECIFICATIONS

## FEDERAL

L-P-387	Plastic Sheet, Laminated, Thermosetting (For Designation Plates)
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## MILITARY

MIL-I-631	Insulation, Electrical, Synthetic-Resin Composition, Nonrigid
MIL-M-3171	Magnesium Alloy, Processes For Pretreatment And Prevention Of Corrosion On
MIL-C-5541	Chemical Conversion Coatings On Aluminum And Aluminum Alloys
MIL-A-8625	Anodic Coatings, For Aluminum And Alloys
MIL-P-15024	Plate, Tags And Bands For Identification Of Equipment
MIL-E-16400	Electronic, Interior Communication And Navigation Equipment, Naval Ship And Shore, General Specification For
MIL-E-17555	Electronic And Electrical Equipment, Accessories, And Repair Parts, Packaging And Packing Of
MIL-C-45662	Calibration System Requirements
MIL-I-46058	Insulating Compound, Electrical (For Coating Printed Circuit Assemblies)

## STANDARDS

## MILITARY

MIL-STD-275	Printed Wiring For Electronic Equipment
MIL-STD-454	Standard General Requirements For Electronic Equipment
MIL-STD-480	Configuration Control - Engineering Changes, Deviations And Waivers
MIL-STD-681	Identification Cooling And Application Of Hookup And Lead Wire
MIL-STD-965	Parts Control Program

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer).

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### 3. DEFINITIONS

3.1 Marginal quality. Deteriorated or damaged parts that will fail before the equipment, module, or assembly is again inducted for Repair, Overhaul, or Restoration.

3.2 Approved engineering/field change. An approved change of a configuration item, after formal approval and establishment of its configuration identification in accordance with MIL-STD-480.

3.3 Procuring activity. The Government activity that negotiates or contracts for the restoration, overhaul, or repair of a repairable equipment or module.

3.4 Requiring activity. The Government activity having technical cognizance of the equipment or module undergoing ROR. It can be an activity delegated by the technical cognizant organization which has the authority, responsibility, and accountability for effective execution of the total program including equipment or modules undergoing ROR. Execution of the total program is the planning, programming, budgeting, development, integrated logistics support, procurement, and configuration management.

3.5 ROR controlling documentation. The specific equipment or module Technical Repair Standards (TRS), technical manuals, or repair specifications and this standard are the ROR controlling documentation.

3.6 Overhaul. The process of reconditioning an item to conform to current technical specifications of the item with a life expectancy equivalent to similarly configured new equipment, by repair or replacement of parts and components that have failed, or are of marginal quality, due to wear, deterioration, or damage so as to preclude a major failure; cosmetic reconditioning; and installation of all approved engineering or field changes.

3.7 Repair. The process of returning an unserviceable item to operational status by repair or replacement of parts or components that have failed or are of marginal quality, due to wear, deterioration, or damage.

3.8 Restoration. The process of upgrading an item to conform to the current technical specifications to assure specified operational capability and the restoration of the equipment's physical appearance to manufacturer's original condition. It includes the repair or replacement of parts and components that have failed, or are of marginal quality, due to wear, deterioration, or damage; full cosmetic reconditioning, and mandatory installation of all approved engineering or field changes.

3.9 Repairable item. An item of durable nature which, when unserviceable, normally can be economically restored to a serviceable condition through repair procedures performed by a Government or commercial overhaul facility.

### 4. GENERAL REQUIREMENTS

4.1 Restoration, overhaul, and repair. The ROR activity shall perform the level of repair (see 4.1.2, 4.1.3, and 4.1.4), as identified by the procuring activity, required to return the repairable equipment or module to a ready for issue (RFI) condition from a non-ready for issue (NRFI) condition.

4.1.1 Marginal quality. The following criteria shall be used in determining if a part should be repaired or replaced because it is of marginal quality:

- a. Wiring. Pinched, broken, charred, missing, or deteriorated wires, and wires with insulation that is broken, cracked, frayed, or burned shall be replaced. Replaced wires shall be routed identically to the original design. All excess or unauthorized wiring shall be removed.
- b. Cables. Cable assemblies and wire harnesses containing wires that are deteriorated, brittle, or broken shall be repaired or replaced. Replaced wires shall not be run external to cable assemblies or wire harnesses. Molded external cables that contain broken or spliced wires, or with insulation that is cracked, shall be replaced in its entirety.

- c. Connectors and receptacles. Connectors and receptacles with damaged shells, bent, broken or missing pins, or with phenolic inserts that are cracked, broken, or carbonized shall be replaced. Coaxial connectors with worn plating, worn or damaged pin inserts, or poor electrical connection, shall be replaced. All pins and pin inserts shall be cleaned.
- d. Capacitors. All capacitors that are chipped, cracked, have damaged shells, broken connectors, or show signs of overheating (bulging, wax or oil leaks) shall be replaced. Porcelain terminals of capacitors with cracks or breaks shall be replaced. Variable capacitors that do not operate freely throughout their tuning range or with damaged rotor/stator plates shall be replaced.
- e. Transformer, chokes, coils, and pulse forming networks. Items with broken connectors or pigtailed or showing signs of physical damage or overheating (bulging, leaking wax, oil, or tar) shall be replaced. Porcelain terminals with breaks or cracks are to be replaced.
- f. Relays. Relays with loose or broken connectors, contact springs, or points, misaligned or improper contact spacing, pitted, bent, burned contact points, loose or missing relay clasps or covers, shall be repaired or replaced. Relay field coils that show signs of overheating may cause replacement of the entire relay. Hermetically sealed relays that do not function properly shall be replaced.
- g. Relay and tube sockets. All sockets that are carbonized, burned, loose or cracked, or contain deteriorated or broken connectors, shall be replaced. Loose or missing shields or clamps shall be repaired or replaced.
- h. Rotary switches. Rotary switches with broken or cracked wafers, loose or broken contact members, improper mating of contact members, burned or pitted contact members, or improper switching action, shall be replaced. All switch contact members (wipers and stationary contacts) shall be cleaned with an appropriate solvent.
- i. Switches and circuit breakers. Sealed toggle switches and circuit breakers broken, burned, or with damaged connections, or which indicate signs of improper switching action, shall be replaced. Open toggle switches (selector switches) with burned, pitted, or damaged contact points shall be repaired by burnishing or replacement of individual element, or replaced in its entirety, as required. All contact points of unsealed toggle switches shall be cleaned with an appropriate solvent. All reset, bypass, and interlock switches that indicate signs of improper operation shall be replaced.
- j. Resistors. Fixed resistors that are cracked, chipped, discolored, bulged or blistered due to the overheating, or with broken connections or pigtailed, shall be replaced. Enclosed or sealed variable resistors (rheostats and potentiometers) operating with rough or binding action of the control shaft, are causes for replacement. All open-case, wire-wound rheostats and potentiometers shall be inspected to ensure that the wiper arm contact presses firmly against the resistance windings throughout the entire range. Damaged wiper arm contact or open/damage winding shall be burnished or cleaned with an appropriate solvent.
- k. Electron tubes. All electron tubes with loose, broken or cracked envelopes, bases or pins, broken plate, grid, or high voltage caps, shall be replaced. Cathode-ray tubes with damaged screens or burned spots 0.4763 centimeters (cm) (0.1875 (3/16) in) or more in diameter, shall be replaced. Bent pins shall be straightened.
- l. Fuse and fuseholders. All improper rated fuses shall be replaced. All cracked or broken fuseholders and broken connectors shall be replaced. Holders with only small surface chips need not be replaced. Broken fuseholder caps shall be replaced as individual items. Missing or deteriorated boots shall be replaced.
- m. Semiconductor devices. All semiconductors that are discolored, cracked, chipped, have loose or broken pigtailed, or show any other sign of mechanical or electrical deterioration, shall be replaced.
- n. Indicator lamps and lamp sockets. All improper lamps shall be replaced. All cracked or broken lamp sockets and broken connectors shall be replaced. All lenses shall be cleaned or replaced if missing. Missing or deteriorated boots shall be replaced.
- o. Meters. All damaged hermetically sealed meters shall be replaced. Cracked, broken, or missing meter glasses, damaged or frozen meter movements or needles, or illegible index or scale markings, shall be replaced as individual items on meters not hermetically sealed whenever practical.

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- p. Terminal board and bus bars. Broken, burned, or cracked terminal boards shall be replaced. Terminal boards that are stained or discolored but conform to all mechanical and electrical tests shall not be replaced merely for appearance's sake. Loose terminal boards and corroded or damaged bus bars shall be repaired or replaced. Marking of boards and bus bars shall be in accordance with terminal strip and board marking specified in 5.3.8.7.
- q. Test point jacks and coaxial test points. Cracked, broken, burned, or deteriorated test points and damaged coaxial test points, shall be replaced.
- r. TR and ATR tube. Inspect the mounting surfaces of transmit/receive (TR) and antitransmit/receive (ATR) tubes for foreign matter and mechanical damage. Check to see that the mounting screws are clean and that the screw threads are undamaged. Tubes shall fit snug against the waveguide mounting places. Check for signs of cloudiness and indications of burning or discoloration. These conditions indicate a defective unit and the tube shall be replaced. Check to see that the keep-alive electrode in the TR box is clean.
- s. Klystron and magnetron tubes. Klystron and magnetron tubes shall be subjected to thorough inspection prior to disposal or turn-in. These tubes shall be inspected to determine their serviceability for reuse.
- t. Motors, blowers, and fans. All motors, blowers, and fans shall be disassembled, cleaned, and inspected for damaged armatures, fields, housings, shafts, bearing races, and thrust washers. All sealed bearings shall be replaced with new bearings regardless of condition, except when the item is being repaired in accordance with 4.1.4; replace bearings only when requested by the procuring activity. All other damaged parts shall be repaired or replaced.
- u. Gearcases and drive assemblies. All gearcases and drive assemblies shall be disassembled, cleaned, and inspected for worn or damaged gears, shafts, keys, and retainer rings. All worn or damaged parts shall be repaired or replaced. New seals, gaskets, lubricants, and bearings shall be used in reassembly.
- v. Universal joints. All universal joints shall be inspected for cracked or deteriorated seals, excessive backlash, and damaged or bent shafts. Parts replacement shall be accomplished based upon acceptable level of wear. Universal joints shall be lubricated.
- w. Actuators. All actuators, motors, and drive mechanisms shall be disassembled to inspect for damaged armatures, fields, housings, shafts, bearing races, and gears. All sealed bearings shall be replaced with new bearings, regardless of condition except when the item is being repaired in accordance with 4.1.4; replace bearings only when requested by the procuring activity. All motor, drive, and linkage parts shall be replaced or repaired. Control circuitry shall be inspected for damage or deterioration. Mechanical stops shall be inspected for damage, corrosion, and freedom of adjustment. All damaged parts shall be replaced or repaired.
- x. Waveguide, rotary joints, cavities (RF plumbing). All waveguide sections shall be visually or electrically inspected for corrosion, evidence of arcing, external damage, or damage to plated surfaces and proper operation of tuning adjustments. All items showing any of the damage specified herein shall be repaired or replaced.
- y. Synchro motors and drive systems. Synchro motors and drive mechanisms shall be disassembled and inspected for damaged rotors, stators, housings, shafts, bearing races, and gears. All sealed bearings shall be replaced with new bearings regardless of condition, except when the item is being repaired in accordance with 4.1.4; replace bearings only when requested by the procuring activity. All motor, drive, and linkage parts shall be thoroughly cleaned and free of any corrosion. Control circuitry shall be inspected for damage or deterioration. All damaged parts shall be repaired or replaced.

4.1.2 Restoration. Electronic equipment shall be processed to conform to the current technical specifications for the item to ensure specified operational capability, and the restoration of the equipment's physical appearance to the manufacturer's original condition (like new). This process shall accomplish:

- a. Disassembly and cleaning required to upgrade the equipment to conform to the technical and cosmetic requirements
- b. Sealing, removing dents, sanding, priming, painting, and silkscreening chassis and cabinet surfaces to present a manufacturer's original appearance

- c. Repair or replacement of parts and components that are of marginal quality (see 4.1.1) due to wear, deterioration, or damage so as to return the item to specification requirements as required by ROR controlling documentation (see 3.5)
- d. Mandatory installation of all approved engineering or field changes (see 3.2)
- e. Reassembly, alignment, and testing

4.1.3 Overhaul. Electronic equipment shall be processed for the reconditioning to conform to current technical specifications for the items with a life cycle expectancy equivalent to similarly configured new equipment. This overhaul process shall accomplish:

- a. Disassembly and cleaning required to facilitate reconditioning of the equipment, to conform to technical requirements
- b. Cosmetic reconditioning in accordance with TABLE I
- c. Repair or replacement of parts and components that are of marginal quality (see 4.1.1) due to wear, deterioration, or damage so as to return the item to specification requirements as required by ROR controlling documentation (see 3.5)
- d. Installation of all approved engineering or field changes (see 3.2) as specified in the contract or order
- e. Reassembly, alignment, and testing

4.1.4 Repair. Electronic equipment shall be processed for the return of unserviceable items to an operational status. This process shall accomplish:

- a. Disassembly and the cleaning required to facilitate the equipment repairs
- b. Repair or replacement of parts and components that are of marginal quality (see 4.1.1) due to wear, deterioration, or damage so as to return the item to specification requirements as required by the ROR documentation (see 3.5)
- c. Reassembly, alignment, and testing

When repair will not produce the specified operational results, refurbishment shall be required in accordance with TABLE I.

## 5. DETAILED REQUIREMENTS

5.1 Equipment. Equipment undergoing ROR shall be refitted complete as identified and described in the applicable equipment technical manual. Common installation hardware, wire, cable, coaxial cable, solid coaxial lines, waveguide, and fittings shall accompany the equipment to the receiving organization only as specified by the procuring activity (see 3.3).

### 5.2 Materials.

5.2.1 Selection of parts and material. ROR activities shall utilize those parts specified in either the applicable TRS, equipment Allowance Parts Lists (APL), latest detail drawings, or equipment design specifications, whichever is the governing rework document. Any part which a) would change the form, fit, or equipment function, b) does not appear in the TRS or equipment APL, or c) is not in conformance with the Selection of Parts paragraph of MIL-E-16400, shall not be utilized. Requests for approval of non-standard parts shall be submitted in accordance with proposed additions to the approved Program Parts Selection Lists (PPSL) paragraph of MIL-STD-965. The requirements of this paragraph shall not apply to equipment procured to a commercial specification.

5.2.2 Modular assemblies. When the equipment undergoing ROR is constructed of Appropriation Purchase Account (APA) modules or sub-assemblies, the ROR activity shall remove NRFI APA modules or sub-assemblies and replace with RFI items from the supply system. The NRFI items shall be returned to the supply system where they will be shipped to the assigned Designated Overhaul Point (DOP) for repair. The activity may repair the NRFI items if a) the ROR activity is the DOP for the repairable items, b) the RFI items are not available in the supply system, or c) the delivery of the APA items from supply will delay accomplishment of the restoration action beyond the required availability dates.

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TABLE 1. Overhaul cosmetics decision matrix.

Defects	No action	Repair	Light sanding	Feather edging	Touch up painting	Overspray	Repaint and silkscreen engrave
Dents affecting operation		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Dents not affecting operation	<input type="checkbox"/>						
Holes in sealed equipment		<input type="checkbox"/>			<input type="checkbox"/>		
Holes in unsealed equipment	<input type="checkbox"/>						
Scratched/Marked				<input type="checkbox"/>	<input type="checkbox"/>		
Chipping				<input type="checkbox"/>	<input type="checkbox"/>		
Flaking			<input type="checkbox"/>			<input type="checkbox"/>	
Rust			<input type="checkbox"/>		<input type="checkbox"/>		
Burns/Blisters			<input type="checkbox"/>			<input type="checkbox"/>	
Corrosion			<input type="checkbox"/>		<input type="checkbox"/>		
Discoloration	<input type="checkbox"/>						
Faded	<input type="checkbox"/>						
Lettering illegible							<input type="checkbox"/>

NOTES:

1. The above matrix provides general guidelines for corrective action appropriate to overhaul of equipments.
2. Thoroughly clean exterior surface. Touchup to blend with existing finish. Strip and repaint only if more than 20 percent of the surface will be affected by touchup. A thin film overspray may be employed if touchup cannot be blended into existing finish.

5.3 ROR process. FIGURE 1 is a general outline of the processes which shall be performed during each ROR to the extent specified by the procuring activity in the contract or order. Technical Repair Standards (TRS), maintenance manuals, and work specifications will contain specific instructions for accomplishment of the ROR processes and will be referenced in the contract or order.

5.3.1 Inspection. In the course of ROR, three levels of inspection shall be performed, as follows:

- a. Incoming inspection. This inspection shall be performed at the point of receipt of the ROR equipment to detect damage incurred in transit. Prior to induction, the equipment shall be compared to the work request to verify the level of work required. The equipment shall be inspected for completeness, for model type per contract or order, and for obvious flaws or defects. If the equipment or module is received incomplete or damaged in transit, the procuring activity shall be immediately notified of the discrepancy. The ROR activity shall identify and record the deficient or damaged property by its nomenclature, National Stock Number (NSN), Manufacturer's Part Number, or Federal Manufacturer's Code (as applicable or available), date of receipt, quantity, number inspected, number defective, contract number, the nature of the defect, the circumstances of discovery, and estimated repair cost. The procuring activity or its representative shall verify the condition of the received equipment. The ROR receiving inspection report and estimated cost of repair will be forwarded to the procuring activity for evaluation and disposition of equipment.
- b. In-process inspections. These inspections shall be performed during ROR after specified amounts of ROR activity take place. The points during ROR where these inspections shall take place will be specified in the TRS, allied control documents, or in the contract or order. During in-process inspections, the ROR equipment shall be checked for parameters specified in the ROR controlling documentation (see 3.5). Examples of such inspections are 1) adherence to fault isolation and test procedures, 2) proper application of coatings and treatments, and 3) proper mounting and connection of piece-parts. The results of all in-process inspections shall be recorded.
- c. Final inspection. This inspection shall be performed after ROR has been completed. Final inspection shall consist of 1) a visual examination of workmanship, assembly and fit, mechanical and electrical safety and marking, materials, parts, and finish, treatment for prevention of corrosion, and treatment of tropicalization, and 2) verification of all operations specified in the ROR controlling documentation (see 3.5). All final inspection observations and measurements shall be recorded and certified.

5.3.2 Disassembly. The degree of disassembly on any equipment or module processed by a ROR facility shall depend on the level of work to be performed (see 4.1).

5.3.3 Testing. In the course of ROR, two types of testing shall be performed, as follows:

- a. Operational tests. These tests shall be for the purpose of verifying operation and to identify areas requiring fault isolation.
- b. Final performance and acceptance testing. This test shall confirm acceptability of alignment and function. The ROR equipment shall be energized and subjected to an operational test to ensure the physical readiness of the equipment and conformance with safety requirements. The qualifying performance standard for the equipment shall be the test criteria contained in the ROR controlling documentation (see 3.5) or supplied by the procuring activity. The designated Government representative shall verify that the equipment will conform to the qualifying performance standards.

5.3.4 Fault isolation. Troubleshooting of electronic equipment shall recognize the fault symptom, identify the circuit responsible, and isolate the defective component or sub-assembly. After a fault has been localized, but prior to corrective action, ascertain that the specific fault is actually the cause of the malfunction, rather than a symptom of some other malfunction. The ROR activity shall be responsive to the troubleshooting procedures as indicated in the applicable TRS or established test procedures.

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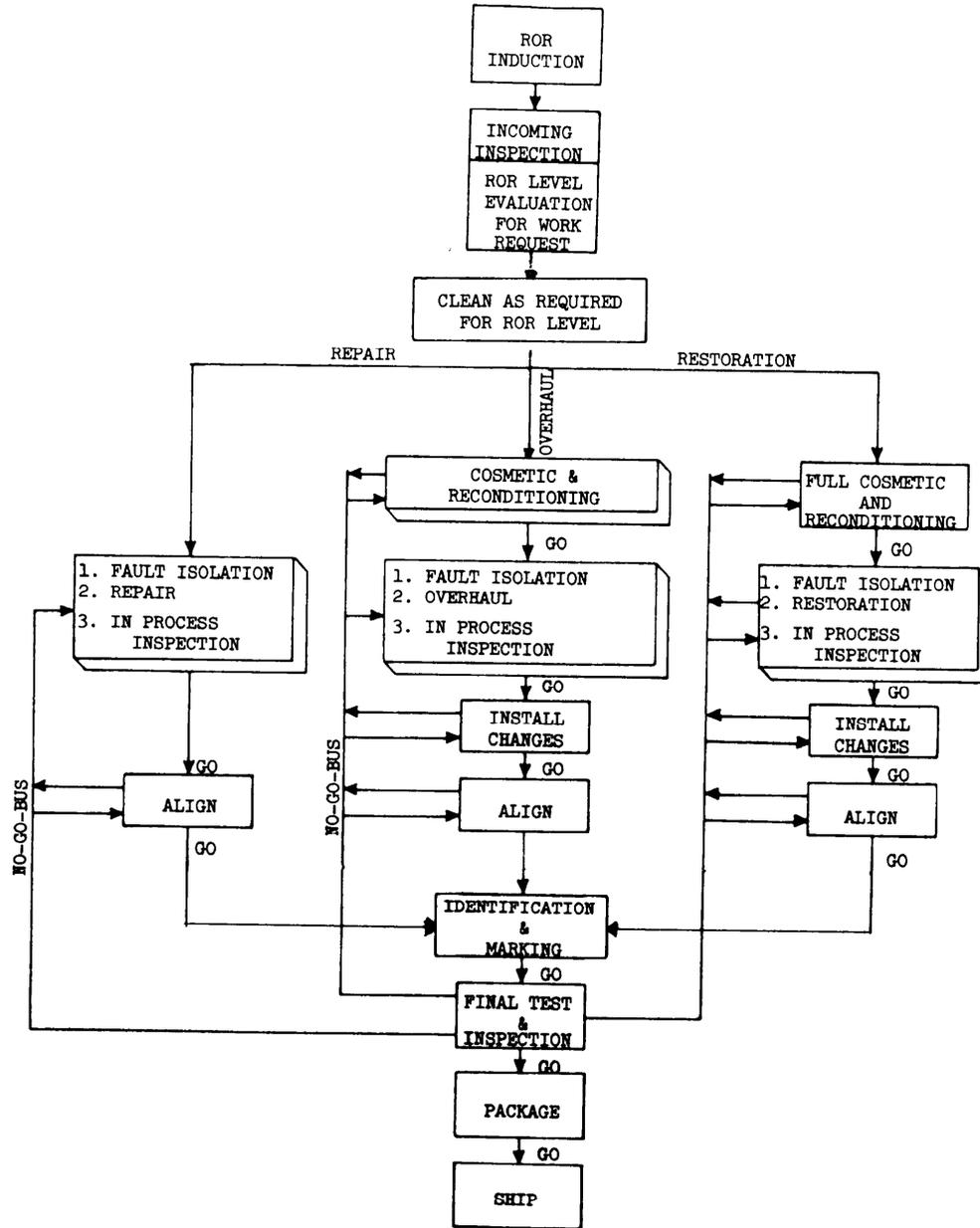


FIGURE 1. ROR flow chart.

5.3.5 Parts replacement. Selection of parts for replacement during ROR shall be as specified in 5.3. The criteria for parts replacement determination shall be in accordance with 4.1.1, unless otherwise specified in the contract or order.

5.3.6 Cleaning, bonding, and finishes.

5.3.6.1 Cleaning. Equipment requiring cleaning during ROR shall be cleaned prior to or during pre-induction inspection and disassembly, whichever is deemed more practical by the ROR activity. Cleaning shall be performed in accordance with 4.1.

5.3.6.2 Electrical bonding. Those points that require electrical bonding shall be free of protective finishes, for example, shielding or connections. Provision shall be made to ensure permanence of electrical contact between the surfaces of all parts in contact over long periods of time or in the presence of humid saline atmosphere.

5.3.6.3 Coatings and treatments. All machine and assembly operations, for example, drilling, tapping, component assembly, and soldering, shall be completed before the corrosion-resistant treatment is applied.

5.3.6.3.1 Plating. All hardware, for example, nuts, flat washers, lock washers, and screws, used to reassemble any item that is exposed to salt water spray and stack gasses shall be austenitic corrosion resisting steel 300 series (preferably 304 or 316) cadmium plated, and chemically treated to provide a conversion coating conforming to MIL-C-5541. The original equipment manufacturer's criteria shall be followed for plated hardware replacement during restoration. The plating thickness in all cases shall assure conductivity and shall be corrosion resistant. Electrodeposited metallic coatings shall be in accordance with 5.3.6.3.2 through 5.3.6.3.6.

5.3.6.3.2 Plating types. Zinc, nickel, chromium, silver, gold, and cadmium plating applied during ROR shall be as specified in the Metals and Alloys paragraph of MIL-E-16400.

5.3.6.3.3 Protection of aluminum and aluminum alloys. Unpainted aluminum and aluminum alloy parts shall be anodized in accordance with MIL-A-8625. Where anodizing interferes with electrical properties, chemical treatment conforming to MIL-C-5541 shall be used. Prior to painting, aluminum and aluminum alloys shall be anodized in accordance with MIL-A-8625 or chemically treated in accordance with MIL-C-5541.

5.3.6.3.4 Protection of magnesium and magnesium alloys. Magnesium and magnesium alloys shall be finished in accordance with MIL-M-3171.

5.3.6.3.5 Protection of printed wiring. Printed wiring assemblies shall be coated with a material that conforms to MIL-I-46058. The coating shall be applied in accordance with the Conformal Coating paragraph of MIL-STD-275.

5.3.6.3.6 Tropicalization. Equipment shall not receive tropicalization treatment unless authorized by the contract or order.

5.3.6.4 Painting. Equipment requiring painting shall be painted prior to reassembly and in accordance with procedures established in the Painting paragraph of MIL-E-16400 or as specified in the controlling documents.

5.3.7 Reassembly. The equipment shall be reassembled using new or repaired parts so that the equipment shall be operationally equal to that of new equipment. Servo systems shall be set to zero and shall conform to the equipment manufacturer's technical specifications for minimum backlash and torque. All moving parts shall operate smoothly and quietly and shall not introduce objectionable noise into the electronic components of the equipments. Reassembly and testing of each equipment shall be in accordance with the instruction, illustrations, and requirements specified in the TRS or other applicable documentation for that equipment.

5.3.8 Identification and marking.

5.3.8.1 Equipment identification plates. Electronic equipment shall carry identification plates in accordance with MIL-P-15024. Equipment identification plates shall be attached to each item to which an equipment identification plate was previously attached. When new equipment

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identification plates are fabricated, the size, shape, lettering, coloring, and format of the original plate shall be duplicated, except as otherwise specified in the contract or order.

5.3.8.1.1 Serial numbers. Serial numbers are required for each item, system, set, group, unit, and accessory to which an identification plate is applied. If the original serial number cannot be ascertained, a serial number shall be obtained from the procuring activity.

5.3.8.2 Restoration and overhaul identification plates. Restored or overhauled electronic equipment shall carry an identification plate fabricated in accordance with MIL-P-15024. Identification plates shall contain the following information:

- a. Name of ROR activity
- b. Date of restoration or overhaul
- c. Applicable job order or contract number

5.3.8.2.1 Location. Restoration and overhaul identification plates may be fabricated as an integral part of the equipment identification plate. In the event this option is exercised, the restoration and overhaul identification plate shall be located at the bottom of the equipment identification plate and shall be of the same lettering type and format.

5.3.8.3 Electronic assembly identification labels. ROR electronic assemblies shall carry an identification label fabricated from pressure sensitivity material such as Scotch-cal, or equivalent. Electronic assembly identification labels shall indicate the following:

- a. NSN
- b. Name of ROR activity
- c. Date of ROR

5.3.8.4 Field change identification plates. Field change (FC) identification plates shall be in accordance with MIL-P-15024 and shall be installed whenever field changes are incorporated in complete systems, sets, or equipments. Applicable field changes installed during restoration or overhaul, or previously installed field changes, shall be certified and indicated as accomplished by the ROR activity. Field change identification plates shall be columnar in format and shall contain the following information:

- a. FC number
- b. Installed by
- c. Date

5.3.8.4.1 Future field changes. Field change identification plates, when attached by the ROR activity, shall contain a minimum of five blank spaces for future field changes.

5.3.8.5 Instruction plates. When attached to an individual equipment, instruction plates showing wiring and schematic diagrams, calibration charts, operating instructions, safety notices, lists of tools, lists of contents, or similar information, shall conform to the requirements of 5.3.8.5.1 through 5.3.8.5.6.

5.3.8.5.1 Lettering. Gothic type lettering shall be used.

5.3.8.5.2 Border. A border of 0.635 cm (0.25 (1/4) inch) or more shall be provided on each edge of the instruction plate.

5.3.8.5.3 Legibility. Instruction plates shall be legible and shall be fabricated to last for the service life of the equipment on which they are mounted.

5.3.8.5.4 Materials and processes. One of the following materials and processes shall be used for instruction plates:

- a. Reverse etched lithographed, printed, or silk-screened on aluminum, nickel-copper alloy, or corrosion-resistant steel plate.
- b. Printed on a good grade of white paper and laminated between two sheets of:
  1. Clear plastic
  2. Vinylchloride or suitable copolymers thereof

3. Polyethylene terephthalate with lightfast copolymer
4. Polyethylene adhesive systems bonded together to seal against moisture
- c. Laminated thermosetting plastic conforming to L-P-387
- d. Etched on aluminum, nickel-copper alloy, or austenitic corrosion-resistant steel plate and filled with contrasting permanent color
- e. Photographed in accordance with Type H of MIL-P-15024

5.3.8.5.5 Rubber stamping and decalcomanias. Rubber stamping and decalcomanias shall not be used.

5.3.8.5.6 Instruction plate mounting. In general, instruction plates shall not be mounted by means of rivets, self-tapping screws, or welding. They shall be attached by removable type screws (threaded or drive) made of the same material as the plate.

5.3.8.6 Parts identification by reference designations (symbol designations). In order to facilitate maintenance, each part assembled in a unit or set shall be identified by the reference designation originally used in the equipment.

5.3.8.6.1 Location of reference designations. The reference designations shall be located adjacent to each part and shall be marked on the chassis, back of the front panel, partitions, or insulator strips. Reference designations shall be marked to physically identify the parts and be readily visible for purposes of maintenance without removal of other parts. The removal of a part shall not result in loss of the identification of the physical location of that part. On printed wiring boards where space does not permit, the reference designations shall be printed on the board. The designations shall be located on a surface adjacent to the boards, or the information shall be contained in chart form in the technical manual or TRS.

5.3.8.6.2 Enclosed parts. Reference designations for parts enclosed in separate and removable shields or compartments may be marked on the shields or the supporting structures that are not interchangeable with other shields or supporting structures within the unit. Reference designations shall not appear on electron tube shields.

5.3.8.6.3 Electron tube and socket identification. The type designation of each tube and the appropriate reference designation shall be marked adjacent to the tube socket on the tube side of the chassis or supporting structure. The reference designation used to identify the tube socket and the type designation of the tube shall be marked on the reverse side of the chassis adjacent to the socket. If space does not permit the marking of tube type designations and reference designation for tubes and tube sockets, a diagram showing the location of the tubes and sockets shall be placed where it is visible when viewing either the tubes or the bottom of the tube sockets.

5.3.8.7 Terminal strips and boards marking. All terminal strips and boards shall be marked in a permanent manner to identify individual terminals and facilitate replacement of connections to terminal boards. When space limitations prohibit marking on the terminal strip or boards, the marking shall be on the chassis adjacent to the terminal strip or boards.

#### 5.3.8.8 Switch marking.

5.3.8.8.1 Open-frame construction. Each switch section shall be marked with a dot of contrasting color on or near the periphery of the section between terminals number one and two, on the plane facing the viewer, when viewed from the rear end of the switch. The front plate shall be similarly marked on the same plane and in the same relative position. Each switch whose sequence is arranged in a counter-clockwise direction when viewed from the rear end of the switch, shall be marked with numbers designating the terminals. When a terminal marking plate is used, it shall also be marked with a dot of the same color, on the same plane, and in the same relative position as the individual switch sections.

5.3.8.8.2 Closed construction. Switches whose sequence is arranged in a counter-clockwise direction, shall be marked with numbers designating the rows of identically numbered terminals. The marking shall be visible when viewed from the rear end of the switch.

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#### 5.3.8.9 Wire and cable identification.

5.3.8.9.1 Identification (color) coding. Identification color coding shall be used for all chassis wiring. The coding shall duplicate the identification color coding used in the existing wiring or shall conform to MIL-STD-681. The exception to this requirement is in digital equipments where signal carrying miscellaneous wires shall be solid colors. The use of white wire stenciled to indicate color coding is acceptable.

5.3.8.9.2 Identification of conductors. All non-insulated wire leads in excess of 10.16 cm (4 inches) shall be color coded by means of colored lacquer spotted near terminals, except when leads terminate at marked terminals or when the terminal destinations and the placement of the leads provide easy lead identification.

5.3.8.9.3 Terminal ends. The terminal ends of each conductor of a jacketed cable or hook-up wire harness, if not otherwise identified, shall be marked for identification purposes by the use of sleeving markers in accordance with Type F, Grade A, Form U, Class I, Category 1, of MIL-I-631. All wire markings shall be clearly visible in the assembled equipment.

5.3.8.10 Function identification. The function of each control, indicator, connector, and test point shall be identified by symbols and abbreviations. The identification shall be adjacent to the control, indicator, connector, and test point. All terminals for connection to transmission lines shall be marked with the nominal impedance characteristics of the line.

5.3.9 Packaging. ROR electronic equipment shall be preserved, packaged, packed, and marked in accordance with the provisions of MIL-E-17555. Levels of protection shall comply with the instructions stated in the contract or order.

5.4 Workmanship. The equipment, including all parts and accessories, shall be restored, overhauled, or repaired in compliance with this standard and Requirement 9 of MIL-STD-454. Particular attention shall be given to the quality of soldering, marking of parts and assemblies, wiring, welding, plating, finishing, and freedom of parts from burrs and sharp edges. Any damages or defect that could make the part or equipment unsatisfactory for the operation, intended function, or present any safety hazard to personnel or associated equipment, shall be corrected.

5.5 Documentation. All rework performed and parts replaced on each item shall be documented. The record sheet shall contain all operations, that is, repair, cleaning, testing, and inspection, that have been performed.

5.5.1 Test data record sheet. A record of data obtained during test performed (see 5.3.3) shall be made on the test data record sheet which appears in the ROR controlling documentation. When the test data record sheet is not provided in the ROR controlling documentation or by the procuring activity, the ROR activity shall prepare a document (see FIGURE 2).

5.5.2 Repair documentation file. The ROR activity shall maintain a current file of complete test data record sheets and all other records of work performed during ROR. These records shall be maintained in an active file for one year, an inactive file for an additional year, and shall be available for an audit by the procuring activity during this period. All records two years or older shall be purged.

5.6 Calibration. Test equipment utilized during ROR shall be calibrated in accordance with MIL-C-45662, using certified standards traceable to the National Bureau of Standards.

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TRS TEST DATA RECORD

DOP ACTIVITY: NAME: \_\_\_\_\_  
 LOCATION: \_\_\_\_\_  
 \_\_\_\_\_

TRS TITLE: RF and Power Amplifier \_\_\_\_\_  
 TRS NO: SRC-20/21-1A1A2-001 \_\_\_\_\_ REV.: \_\_\_\_\_

<u>4G ITEM - NOMENCLATURE</u>	<u>4G ITEM - PART NO.</u>	<u>4G ITEM - SER. NO</u>
RF and Power Amplifier	549-3380-003	

TEST VERIFICATION CHECK LIST

Proc'r. Step	EQUIPMENT		Test- Insp'n. Date	TEST	
	Performance Requirement	Actual Performance (Record Test Results)		Conductor (Initial)	Insp'n (Initial)
4.3.3a(1)	Power output at				
(3) & (4)	frequencies listed				
	NLT 16 watts				
	399.9 MHz	W			
	389.9 MHz	W			
	379.9 MHz	W			
	369.9 MHz	W			
	359.9 MHz	W			
	349.9 MHz	W			
	339.9 MHz	W			
	329.9 MHz	W			
	319.9 MHz	W			
	309.9 MHz	W			
	299.9 MHz	W			
	289.9 MHz	W			
	279.9 MHz	W			
	269.9 MHz	W			
	259.9 MHz	W			
	249.9 MHz	W			
	239.9 MHz	W			
	229.9 MHz	W			
	225.0 MHz	W			

FIGURE 2. Sample test data record sheet.

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Sheet 2 of 2

TRS TEST DATA RECORD

TRS TITLE: RF and Power Amplifier  
 TRS NO: SRC-20/21-1A1A2-001 REV.: \_\_\_\_\_

TEST VERIFICATION CHECK LIST

Proc'r. Step	EQUIPMENT		Test- Insp'n. Date	TEST	
	Performance Requirement	Actual Performance (Record Test Results)		Conductor (Initial)	Insp'n (Initial)
4.3.3b(6)	RMS voltmeter indic (signal + noise) at 399.9 MHz	dB (ref)			
4.3.3b(7)	RMS voltmeter indic (noise) at 399.9 MHz NLT 10 dB diff	dB			
4.3.3b(8)	S/A 4.3.3b(6) at 299.9 MHz	dB (ref)			
	S/A 4.3.3b(7) at 299.9 MHz	dB			
4.3.3b(9)	S/A 4.3.3b(6) at 225.0 MHz	dB (ref)			
	S/A 4.3.3b(7) at 225.0 MHz	dB			

FMO INJECTION LEVEL DURING TEST \_\_\_\_\_  
 AC LINE VOLTAGE DURING TEST \_\_\_\_\_  
 1st IF INJECTION LEVEL DURING TEST \_\_\_\_\_

DOP: \_\_\_\_\_ TEST RESULTS ACCEPTED BY: \_\_\_\_\_  
 Test Supervisor \_\_\_\_\_ DOP: \_\_\_\_\_ Customer: (optional)  
 Quality Assurance Office: \_\_\_\_\_ Agency: \_\_\_\_\_  
 Approved: \_\_\_\_\_ Approved: \_\_\_\_\_ Witnessed/Concurred by: \_\_\_\_\_  
 Date: \_\_\_\_\_ Date: \_\_\_\_\_ Date: \_\_\_\_\_

FIGURE 2. Sample test data record sheet. (Continued)

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## 6. NOTES

6.1 Intended use. The process covered by this standard is intended for Restoration, Overhaul, and Repair of repairable equipment, both modules and end items. The provisions and requirements of this standard are applicable to all organic and contractor facilities involved in ROR of repairable items. Requirements not specified in this document will be covered in the contract or order by the procuring activity.

6.2 Data requirements. The following data may be ordered and specified on the Contract Data Requirements List, DD Form 1423, as a result of having invoked pertinent work tasks established within this standard:

<u>Paragraph Number</u>	<u>DID title</u>	<u>DID number</u>
5.3.1(a)	Restoration, Overhaul and Repair Receiving Inspection Report	DI-L-22342

Preparing activity:  
NAVY-EC  
(Project MISC-N007)

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## OVERHAUL COSMETICS DECISION MATRIX

DEFECTS	NO ACTION	REPAIR	LIGHT SANDING	FEATHER EDGING	TOUCH-UP PAINTING	OVERSPRAY	REPAINT AND SILKSCREEN ENGRAVE
DENTS AFFECTING OPERATION		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
DENTS NOT AFFECTING OPERATION	<input type="checkbox"/>						
HOLES IN SEALED EQUIPMENT		<input type="checkbox"/>			<input type="checkbox"/>		
HOLES IN UNSEALED EQUIPMENT	<input type="checkbox"/>						
SCRATCHED-MARKED				<input type="checkbox"/>	<input type="checkbox"/>		
CHIPPING				<input type="checkbox"/>	<input type="checkbox"/>		
FLAKING			<input type="checkbox"/>			<input type="checkbox"/>	
RUST			<input type="checkbox"/>		<input type="checkbox"/>		
BURNS-BLISTERS			<input type="checkbox"/>			<input type="checkbox"/>	
CORROSION			<input type="checkbox"/>		<input type="checkbox"/>		
DISCOLORATION	<input type="checkbox"/>						
FADED	<input type="checkbox"/>						
LETTERING ILLEGIBLE							<input type="checkbox"/>

THE ABOVE MATRIX PROVIDES GUIDELINES FOR CORRECTIVE ACTION APPROPRIATE TO OVERHAUL OF EQUIPMENTS

THOROUGHLY CLEAN EXTERIOR SURFACE, TOUCH UP TO BLEND WITH EXISTING FINISH. STRIP, AND REPAINT ONLY IF MORE THAN 20% OF THE SURFACE WILL BE AFFECTED BY TOUCH-UP. A THIN FILM OVERSPRAY MAY BE EMPLOYED IF TOUCH-UP CANNOT BE BLENDED INTO EXISTING FINISH.

FOLD

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL	
<p><b>INSTRUCTIONS:</b> This form is provided to solicit beneficial comments which may improve this document and enhance its use. DoD contractors, government activities, manufacturers, vendors, or other prospective users of the document are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity. A response will be provided to the submitter, when name and address is provided, within 30 days indicating that the 1426 was received and when any appropriate action on it will be completed.</p> <p><b>NOTE:</b> This form shall not be used to submit requests for waivers, deviations or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.</p>	
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DD FORM 1426  
1 OCT 76

Replaces edition of 1 Jan 72 which may be used.

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