ORGANIZATIONAL, INTERMEDIATE AND DEPOT MAINTENANCE

PRESERVATION OF NAVAL AIRCRAFT

Includes IRAC 8, 9, and 10.

This publication supersedes NAVAIR 15-01-500, dated 1 August 2007.

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Total number of pages in this manual is 310, consisting of the following:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<td>0</td>
<td>8-1 - 8-9</td>
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<tr>
<td>2-11 - 2-15</td>
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<td>8-11 - 8-15</td>
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<td>2-17 - 2-18</td>
<td>0</td>
<td>4-3 - 4-23</td>
<td>0</td>
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<td>8-17 - 8-24</td>
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<td>4-25 - 4-37</td>
<td>0</td>
<td>A-1 - A-2</td>
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</tr>
<tr>
<td>3-5 - 3-15 ...</td>
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<td>4-38 Blank</td>
<td>0</td>
<td>B-1 - B-2</td>
<td>0</td>
</tr>
<tr>
<td>3-16 Blank</td>
<td>0</td>
<td>4-39 - 4-42</td>
<td>0</td>
<td>Glossary-1 - Glossary-9</td>
<td>0</td>
</tr>
<tr>
<td>3-17 - 3-31</td>
<td>0</td>
<td>5-1 - 5-5</td>
<td>0</td>
<td>Glossary-10 Blank</td>
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</tr>
<tr>
<td>3-32 Blank</td>
<td>0</td>
<td>5-6 Blank</td>
<td>0</td>
<td>Index-1 - Index-7</td>
<td>0</td>
</tr>
<tr>
<td>3-33 - 3-39 ...</td>
<td>0</td>
<td>5-7 - 5-9</td>
<td>0</td>
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REF B IS THE NAVAL AIR SYSTEMS COMMAND TECHNICAL MANUAL PROGRAM
REF C IS THE TECHNICAL PUBLICATION DEFICIENCY REPORT/
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1. IRAC 011 TO 15-01-500 DTD 01-SEP-2013
2. RESPONSIBLE CODES:
   A. IN-SERVICE ENGINEERING: LOUISE NICOLOFF,NAVAIR,4.3.4.6,619-545-9759, 735-
      9759,LOUISE.NICOLOFF@NAVY.MIL
   B. LOGISTICS: N/A
3. PURPOSE OF CHANGE: TO ENHANCE MISSION CAPABILITY AND FLEET READINESS BY
   CORRECTING WATER CONTENT LIMITS FOR PRESERVATION OIL AND SPECIFYING MATERIAL
   FOR AIRCRAFT TOP COVERS.
4. DETAILED INFORMATION: PEN AND INK CHANGES TO THE TECHNICAL CONTENT OF A MANUAL
   ARE NOT AUTHORIZED. THE FOLLOWING TECHNICAL CONTENT CHANGE INFORMATION
   APPLIES TO THE FOLLOWING REFERENCED PAGES AND PARAGRAPHS OF THE SUBJECT
   MANUAL UNTIL THE FORMAL CHANGE IS RELEASED.
   PAGE 3-35, TABLE 3-7: CHANGE WATER CONTENT LIMIT FOR NEW OIL FROM 120 PPM TO 100
   PPM, USED OIL FROM 200 PPM TO 120 PPM.
   PAGE 5-11, PARAGRAPH 5-8.(B): IN FIRST SENTENCE, DELETE THE WORDS "AND MATERIAL" ON
   THE SECOND LINE. ADD A NEW SENTENCE AFTER THE FIRST SENTENCE TO READ AS
   FOLLOWS: TOP COVERS ARE MADE OF A WATERPROOF FLEXIBLE PLASTIC MATERIAL, MIL-
   P-58102 TYPE III.
5. VALIDATED BY: LOUISE NICOLOFF, FLTREADCEN SOUTHWEST, 4.3.4.6, 619-545-9759, 735-9759,
   LOUISE.NICOLOFF@NAVY.MIL
6. RELATED INSTRUCTIONS:
   A. FOR IRACS AFFECTING MANUALS IN PAPER COPY - MAINTAIN THIS IRAC WITH THE
      APPLICABLE MANUAL BY PLACING OR ATTACHING IT DIRECTLY BEHIND THE TITLE PAGE.
      MARK THE SPECIFIC AREA AFFECTED AND ANNOTATE THE CHANGED PAGE OR CARD
      LISTED ON THE A PAGE WITH A VERTICAL LINE IN THE MARGIN NEXT TO THE CHANGED
      DATA, OPPOSITE THE BINDING. FOR DOUBLE COLUMN MATERIAL, MARK THE CENTER
      MARGIN WHEN THE INNER PARAGRAPH IS AFFECTED. NOTE THE IRAC NUMBER IN THE
      MARGIN. THIS IRAC SHALL NOT BE REMOVED UNTIL RECEIPT OF FORMAL CHANGE PAGES.
   B. FOR IRACS AFFECTING MANUALS THAT ARE ON DIGITAL MEDIA - AFFIX AN ADHESIVE LABEL
      TO THE DIGITAL MEDIA CASE ANNOTATED WITH THE APPLICABLE PUBLICATION NUMBER
      AND IRAC NUMBER. THE LABEL SHOULD BE POSITIONED TO ALLOW FOR ADDITIONAL IRACS
      AS THEY OCCUR AND SHOULD NOT COVER THE DATE OR DIGITAL MEDIA TITLE. MAINTAIN
      THE IRAC ON FILE UNTIL RECEIPT OF THE SUPERSEDING DIGITAL MEDIA.
   C. SUBJECT IRAC SHALL BE INCORPORATED INTO APPLICABLE MANUAL NLT 12 MONTHS
      FROM THE DATE OF IRAC ISSUE.
   D.//
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF ILLUSTRATIONS</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TECHNICAL PUBLICATIONS DEFICIENCY REPORTS INCORPORATED TPDR-1</td>
<td></td>
</tr>
<tr>
<td>WARNINGS APPLICABLE TO HAZARDOUS MATERIALS HMWS-1</td>
<td></td>
</tr>
<tr>
<td>1 INTRODUCTION</td>
<td>1-1</td>
</tr>
<tr>
<td>2 GENERAL PROCEDURES</td>
<td>2-1</td>
</tr>
<tr>
<td>SECTIONS</td>
<td></td>
</tr>
<tr>
<td>2-1. Introduction</td>
<td>2-1</td>
</tr>
<tr>
<td>2-2. Level I</td>
<td>2-1</td>
</tr>
<tr>
<td>2-3. Level II</td>
<td>2-1</td>
</tr>
<tr>
<td>2-4. Level III</td>
<td>2-1</td>
</tr>
<tr>
<td>2-5. Level IV</td>
<td>2-1</td>
</tr>
<tr>
<td>2-6. Shipment</td>
<td>2-1</td>
</tr>
<tr>
<td>2-7. Description</td>
<td>2-3</td>
</tr>
<tr>
<td>2-8. Prepreservation</td>
<td>2-3</td>
</tr>
<tr>
<td>2-9. Cleaning</td>
<td>2-3</td>
</tr>
<tr>
<td>2-10. Inspection</td>
<td>2-3</td>
</tr>
<tr>
<td>2-11. Corrosion Control</td>
<td>2-3</td>
</tr>
<tr>
<td>2-12. Protection</td>
<td>2-3</td>
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<tr>
<td>2-13. Maintenance</td>
<td>2-3</td>
</tr>
<tr>
<td>2-14. Depreservation</td>
<td>2-5</td>
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<tr>
<td>2-15. Represervation</td>
<td>2-5</td>
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<tr>
<td>2-16. Description</td>
<td>2-7</td>
</tr>
<tr>
<td>2-17. Prepreservation</td>
<td>2-7</td>
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<tr>
<td>2-18. Cleaning</td>
<td>2-7</td>
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<tr>
<td>2-19. Inspection</td>
<td>2-7</td>
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<td>2-20. Corrosion Control</td>
<td>2-7</td>
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<td>2-22. Maintenance</td>
<td>2-7</td>
</tr>
<tr>
<td>2-23. Depreservation</td>
<td>2-9</td>
</tr>
<tr>
<td>2-24. Represervation</td>
<td>2-9</td>
</tr>
<tr>
<td>2-25. Description</td>
<td>2-11</td>
</tr>
<tr>
<td>2-26. Prepreservation</td>
<td>2-11</td>
</tr>
<tr>
<td>2-27. Cleaning</td>
<td>2-11</td>
</tr>
<tr>
<td>2-28. Inspection</td>
<td>2-11</td>
</tr>
<tr>
<td>2-29. Corrosion Control</td>
<td>2-11</td>
</tr>
<tr>
<td>2-30. Protection</td>
<td>2-11</td>
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<td>2-31. Maintenance</td>
<td>2-11</td>
</tr>
<tr>
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<td>2-12</td>
</tr>
<tr>
<td>2-33. Represervation</td>
<td>2-12</td>
</tr>
</tbody>
</table>

# SECTIONS

## 1 INTRODUCTION

- **1-1. General**
- **1-2. Purpose**
- **1-3. Compliance**
- **1-4. Scope**
- **1-5. Procedural Duplication**
- **1-6. References**
- **1-7. Records/Logbooks/Work Directives**
- **1-8. Preservation Check Lists**
- **1-9. Depreservation Check Lists**
- **1-10. Engine Preservation**
- **1-11. Use**
- **1-12. Requisitioning and Automatic Distribution**
- **1-13. Warnings and Cautions Applicable to Hazardous Material**

## 2 GENERAL PROCEDURES

- **2-1. Introduction**
- **2-2. Level I**
- **2-3. Level II**
- **2-4. Level III**
- **2-5. Level IV**
- **2-6. Shipment**
- **2-7. Description**
- **2-8. Prepreservation**
- **2-9. Cleaning**
- **2-10. Inspection**
- **2-11. Corrosion Control**
- **2-12. Protection**
- **2-13. Maintenance**
- **2-14. Depreservation**
- **2-15. Represervation**
- **2-16. Description**
- **2-17. Prepreservation**
- **2-18. Cleaning**
- **2-19. Inspection**
- **2-20. Corrosion Control**
- **2-21. Protection**
- **2-22. Maintenance**
- **2-23. Depreservation**
- **2-24. Represervation**

## 3 LEVEL II PRESERVATION GUIDELINES

### SECTION III

- **3-1. General**
- **3-2. Deterioration**
- **3-3. Prevention of Damage**
- **3-4. Environmental Deterioration**
- **3-5. Standard Procedures**

### SECTION IV

- **4-1. General**
- **4-2. Preserved Aircraft/Components**
- **4-3. Level I Preservation**
- **4-4. Level II Preservation**
- **4-5. Level III Preservation**
- **4-6. Level IV Preservation**
- **4-7. Desert Storage**
- **4-8. Selecting a Preservation Level**
- **4-9. Economics**

## 4 LEVEL III PRESERVATION GUIDELINES

### SECTION V

- **5-1. General**
- **5-2. Preservation Check Lists**
- **5-3. Represervation**
- **5-4. Depreservation**
- **5-5. Maintenance**
- **5-6. Protection**
- **5-7. Cleaning**
- **5-8. Inspection**
- **5-9. Use**
- **5-10. Requisitioning and Automatic Distribution**
- **5-11. Warnings and Cautions Applicable to Hazardous Material**

### SECTION VI

- **6-1. General**
- **6-2. Preservation Check Lists**
- **6-3. Represervation**
- **6-4. Depreservation**
- **6-5. Maintenance**
- **6-6. Protection**
- **6-7. Cleaning**
- **6-8. Inspection**
- **6-9. Use**
- **6-10. Requisitioning and Automatic Distribution**
- **6-11. Warnings and Cautions Applicable to Hazardous Material**

## 5 LEVEL IV PRESERVATION GUIDELINES

### SECTION VII

- **7-1. General**
- **7-2. Preservation Check Lists**
- **7-3. Represervation**
- **7-4. Depreservation**
- **7-5. Maintenance**
- **7-6. Protection**
- **7-7. Cleaning**
- **7-8. Inspection**
- **7-9. Use**
- **7-10. Requisitioning and Automatic Distribution**
- **7-11. Warnings and Cautions Applicable to Hazardous Material**

## 6 SHIPMENT

- **6-1. General**
- **6-2. Preservation Check Lists**
- **6-3. Represervation**
- **6-4. Depreservation**
- **6-5. Maintenance**
- **6-6. Protection**
- **6-7. Cleaning**
- **6-8. Inspection**
- **6-9. Use**
- **6-10. Requisitioning and Automatic Distribution**
- **6-11. Warnings and Cautions Applicable to Hazardous Material**

## 7 DISTRIBUTION TO HAZARDOUS MATERIALS

### SECTION VIII

- **8-1. General**
- **8-2. Preservation Check Lists**
- **8-3. Represervation**
- **8-4. Depreservation**
- **8-5. Maintenance**
- **8-6. Protection**
- **8-7. Cleaning**
- **8-8. Inspection**
- **8-9. Use**
- **8-10. Requisitioning and Automatic Distribution**
- **8-11. Warnings and Cautions Applicable to Hazardous Material**

## 8 RECORDS/LOGBOOKS/WORK DIRECTIVES

### SECTION IX

- **9-1. General**
- **9-2. Preservation Check Lists**
- **9-3. Represervation**
- **9-4. Depreservation**
- **9-5. Maintenance**
- **9-6. Protection**
- **9-7. Cleaning**
- **9-8. Inspection**
- **9-9. Use**
- **9-10. Requisitioning and Automatic Distribution**
- **9-11. Warnings and Cautions Applicable to Hazardous Material**

## 9 CORROSION CONTROL

### SECTION X

- **10-1. General**
- **10-2. Preservation Check Lists**
- **10-3. Represervation**
- **10-4. Depreservation**
- **10-5. Maintenance**
- **10-6. Protection**
- **10-7. Cleaning**
- **10-8. Inspection**
- **10-9. Use**
- **10-10. Requisitioning and Automatic Distribution**
- **10-11. Warnings and Cautions Applicable to Hazardous Material**

## 10 ENGINE SHELTER

### SECTION XI

- **11-1. General**
- **11-2. Preservation Check Lists**
- **11-3. Represervation**
- **11-4. Depreservation**
- **11-5. Maintenance**
- **11-6. Protection**
- **11-7. Cleaning**
- **11-8. Inspection**
- **11-9. Use**
- **11-10. Requisitioning and Automatic Distribution**
- **11-11. Warnings and Cautions Applicable to Hazardous Material**

## 11 ORGANIZATION AND CONTROL

### SECTION XII

- **12-1. General**
- **12-2. Preservation Check Lists**
- **12-3. Represervation**
- **12-4. Depreservation**
- **12-5. Maintenance**
- **12-6. Protection**
- **12-7. Cleaning**
- **12-8. Inspection**
- **12-9. Use**
- **12-10. Requisitioning and Automatic Distribution**
- **12-11. Warnings and Cautions Applicable to Hazardous Material**
### TABLE OF CONTENTS (Cont.)

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION V LEVEL IV PRESERVATION GUIDELINES</td>
<td>2-13</td>
<td>SECTION III ARMAMENTS</td>
<td>3-17</td>
</tr>
<tr>
<td>2-34. Description</td>
<td>2-13</td>
<td>3-17. Ammunition and Pyrotechnics</td>
<td>3-17</td>
</tr>
<tr>
<td>2-35. Delayed Induction</td>
<td>2-13</td>
<td>3-18. Armament Equipment</td>
<td>3-18</td>
</tr>
<tr>
<td>2-36. Prepreservation</td>
<td>2-13</td>
<td>(Bomb Racks, Pylons, Missile Launchers and Bomb Release Units)</td>
<td>3-17</td>
</tr>
<tr>
<td>2-40. Corrosion Control</td>
<td>2-13</td>
<td>3-22. Drive and Gearbox (External Portions)</td>
<td>3-21</td>
</tr>
<tr>
<td>2-41. Protection</td>
<td>2-13</td>
<td>3-23. Drive and Gearbox (Internal Portions)</td>
<td>3-21</td>
</tr>
<tr>
<td>2-42. Maintenance</td>
<td>2-14</td>
<td>SECTION IV DRIVE AND GEAR BOX</td>
<td>3-21</td>
</tr>
<tr>
<td>2-43. Depreservation</td>
<td>2-14</td>
<td>3-24. Electrical</td>
<td>3-23</td>
</tr>
<tr>
<td>2-44. Represervation</td>
<td>2-14</td>
<td>3-25. Batteries, Dry Cell</td>
<td>3-24</td>
</tr>
<tr>
<td>2-46. Description</td>
<td>2-17</td>
<td>3-27. Battery Vent System Units</td>
<td>3-25</td>
</tr>
<tr>
<td>2-47. Maintenance</td>
<td>2-17</td>
<td>3-28. Connectors</td>
<td>3-25</td>
</tr>
<tr>
<td>2-48. Depreservation</td>
<td>2-17</td>
<td>3-29. Consoles and Control Panels</td>
<td>3-26</td>
</tr>
<tr>
<td>SECTION VI SHIPMENT GUIDELINES</td>
<td>2-17</td>
<td>3-30. Junction Boxes</td>
<td>3-27</td>
</tr>
<tr>
<td>3 AIRCRAFT SYSTEMS</td>
<td>3-1</td>
<td>3-31. Lights</td>
<td>3-28</td>
</tr>
<tr>
<td>3-1. Use of This Chapter</td>
<td>3-1</td>
<td>3-32. Motors and Inverters</td>
<td>3-28</td>
</tr>
<tr>
<td>3-2. General Requirements</td>
<td>3-1</td>
<td>SECTION V ELECTRICAL</td>
<td>3-23</td>
</tr>
<tr>
<td>SECTION II AIRFRAMES</td>
<td>3-5</td>
<td>3-33. Electronics</td>
<td>3-29</td>
</tr>
<tr>
<td>3-3. Airframe System</td>
<td>3-5</td>
<td>3-34. Antennas</td>
<td>3-29</td>
</tr>
<tr>
<td>3-4. Access and Escape Chute Doors</td>
<td>3-5</td>
<td>3-35. Desiccant Units</td>
<td>3-29</td>
</tr>
<tr>
<td>3-5. Battery Compartments</td>
<td>3-6</td>
<td>3-36. Headsets and Microphones</td>
<td>3-30</td>
</tr>
<tr>
<td>3-7. Bilges, Floats and Sponsons</td>
<td>3-8</td>
<td>3-38. Radomes</td>
<td>3-30</td>
</tr>
<tr>
<td>3-8. Control Cables</td>
<td>3-9</td>
<td>3-39. Vapor Cycle Units</td>
<td>3-30</td>
</tr>
<tr>
<td>3-9. Canopy Frames and Seals</td>
<td>3-10</td>
<td>3-40. Waveguides</td>
<td>3-31</td>
</tr>
<tr>
<td>3-10. Cargo Hoists, Rescue Slings, and Drums</td>
<td>3-11</td>
<td>SECTION VII FUEL SYSTEM</td>
<td>3-33</td>
</tr>
<tr>
<td>3-11. Cockpits</td>
<td>3-11</td>
<td>3-41. Fuel</td>
<td>3-33</td>
</tr>
<tr>
<td>3-12. Control Surfaces</td>
<td>3-12</td>
<td>3-42. Exterior</td>
<td>3-33</td>
</tr>
<tr>
<td>3-14. Seats (Except Ejection)</td>
<td>3-13</td>
<td>3-44. Interior</td>
<td>3-35</td>
</tr>
<tr>
<td>3-15. Skin Surfaces (Exterior)</td>
<td>3-14</td>
<td>3-45. Lines and Fittings</td>
<td>3-39</td>
</tr>
<tr>
<td>3-16. Transparancies</td>
<td>3-15</td>
<td>3-46. Reticulated Foam</td>
<td>3-39</td>
</tr>
<tr>
<td>(Canopies, Windows)</td>
<td>3-15</td>
<td>3-47. Auxiliary Tanks</td>
<td>3-39</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS (Cont.)

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION VIII HYDRAULICS</td>
<td>3-41</td>
<td>3-80. Gas Turbine Engine and APU Inspection</td>
<td>3-60</td>
</tr>
<tr>
<td>3-49. Lines and Fittings</td>
<td>3-44</td>
<td>3-82. Gas Turbine Engine and APU Protection</td>
<td>3-61</td>
</tr>
<tr>
<td>3-50. Pressure Accumulators</td>
<td>3-45</td>
<td>3-83. Gas Turbine Engine and APU Maintenance</td>
<td>3-64</td>
</tr>
<tr>
<td>3-51. System Filters</td>
<td>3-45</td>
<td>3-84. Gas Turbine Engine and APU Depreservation</td>
<td>3-64</td>
</tr>
<tr>
<td>SECTION IX INSTRUMENTS</td>
<td>3-47</td>
<td>3-85. Reciprocating Engine Cleaning</td>
<td>3-66</td>
</tr>
<tr>
<td>3-52. Instruments</td>
<td>3-47</td>
<td>3-86. Reciprocating Engine Inspection</td>
<td>3-67</td>
</tr>
<tr>
<td>3-53. Air Filters</td>
<td>3-47</td>
<td>3-87. Reciprocating Engine Corrosion Control</td>
<td>3-67</td>
</tr>
<tr>
<td>3-54. Gyros</td>
<td>3-47</td>
<td>3-88. Reciprocating Engine Protection</td>
<td>3-67</td>
</tr>
<tr>
<td>3-55. Instrument Panels</td>
<td>3-47</td>
<td>3-89. Reciprocating Engine Maintenance</td>
<td>3-71</td>
</tr>
<tr>
<td>3-57. Automatic Pilot and Stabilization Units</td>
<td>3-48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SECTION X LANDING AND ARRESTING GEAR</td>
<td>3-49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-58. Landing and Arresting Gear</td>
<td>3-49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-59. Arresting Gear Hooks</td>
<td>3-50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-60. Bearings, Wheel</td>
<td>3-50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-61. Brakes</td>
<td>3-51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-62. Brake Hydraulic System</td>
<td>3-51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-63. Catapult Hooks/Launch Bar</td>
<td>3-51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-64. Deceleration Chutes</td>
<td>3-52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-65. Doors, Landing Gear</td>
<td>3-52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-66. Shock Struts</td>
<td>3-52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-67. Skis</td>
<td>3-53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-68. Tires</td>
<td>3-53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-69. Wheels</td>
<td>3-54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SECTION XI PHOTOGRAPHIC</td>
<td>3-55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-70. Cameras</td>
<td>3-55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-71. Camera Mounts</td>
<td>3-55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-72. Controls</td>
<td>3-56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-73. Desiccant Units</td>
<td>3-56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-74. Viewfinders</td>
<td>3-56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SECTION XII PNEUMATICS</td>
<td>3-57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-75. Pneumatics</td>
<td>3-57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-76. Chemical Air Driers</td>
<td>3-57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SECTION XIII POWER PLANTS</td>
<td>3-59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-77. Power Plant</td>
<td>3-59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-78. Gas Turbine and APU Engine Oil System Protection</td>
<td>3-59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-79. Gas Turbine Engine and APU Cleaning</td>
<td>3-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-80. Gas Turbine Engine and APU Inspection</td>
<td>3-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-81. Gas Turbine Engine and APU Corrosion Control</td>
<td>3-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-82. Gas Turbine Engine and APU Protection</td>
<td>3-61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-83. Gas Turbine Engine and APU Maintenance</td>
<td>3-64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-84. Gas Turbine Engine and APU Depreservation</td>
<td>3-64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-85. Reciprocating Engine Cleaning</td>
<td>3-66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-86. Reciprocating Engine Inspection</td>
<td>3-67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-87. Reciprocating Engine Corrosion Control</td>
<td>3-67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-88. Reciprocating Engine Protection</td>
<td>3-67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-89. Reciprocating Engine Maintenance</td>
<td>3-71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-90. Reciprocating Engine Depreservation</td>
<td>3-72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SECTION XIV PROPELLERS</td>
<td>3-75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-91. Propellers and Propeller Components</td>
<td>3-75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-92. Constant Speed Propellers</td>
<td>3-75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-93. Dicers</td>
<td>3-75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-94. Variable Pitch Propellers</td>
<td>3-76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SECTION XV ROTOR HEAD AND HUB</td>
<td>3-79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-95. Rotor Head and Hub System</td>
<td>3-79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-96. Blades, Main and Tail</td>
<td>3-79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-97. Controls, Linkages, Dampers and Swashplates</td>
<td>3-80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-98. Rotor Heads and Hubs</td>
<td>3-81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SECTION XVI SAFETY AND SURVIVAL</td>
<td>3-83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-99. Safety and Survival</td>
<td>3-83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-100. Aircrew Escape Propulsion System (AEPs) Devices</td>
<td>3-83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-101. Cartridge Actuated Devices (CADs)</td>
<td>3-84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-102. Floatation Gear</td>
<td>3-84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-103. Liquid Oxygen Converters</td>
<td>3-84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-104. Oxygen Cylinders and Regulators</td>
<td>3-85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-105. Oxygen Rebreathers</td>
<td>3-85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-106. Parachutes and Harness</td>
<td>3-86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-107. Perishables and Pilferables</td>
<td>3-86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-108. Seat Belts, Shoulder Harnesses, and Inertia Reels</td>
<td>3-87</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE OF CONTENTS (Cont.)

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION XVII UTILITY</td>
<td>3-89</td>
</tr>
<tr>
<td>3-109. Utility</td>
<td>3-89</td>
</tr>
<tr>
<td>3-110. Air Conditioning</td>
<td>3-89</td>
</tr>
<tr>
<td>3-111. Cabin Filters, Ducts and Regulators</td>
<td>3-90</td>
</tr>
<tr>
<td>3-112. Deicer Components (Air Type)</td>
<td>3-90</td>
</tr>
<tr>
<td>3-113. Galley Facilities</td>
<td>3-90</td>
</tr>
<tr>
<td>3-114. Lavatory Facilities</td>
<td>3-91</td>
</tr>
<tr>
<td>3-115. Relief Tubes</td>
<td>3-91</td>
</tr>
<tr>
<td>3-116. Smoke Abatement Units/Engine Fire Extinguisher Components</td>
<td>3-91</td>
</tr>
<tr>
<td>3-117. Toilet Facilities</td>
<td>3-92</td>
</tr>
<tr>
<td>3-118. Water Injection</td>
<td>3-93</td>
</tr>
<tr>
<td>3-119. Water Tanks</td>
<td>3-93</td>
</tr>
<tr>
<td>3-120. Windshield Defrosters/Cabin Heaters (Fluid Type)</td>
<td>3-93</td>
</tr>
<tr>
<td>3-121. Windshield Wiper Blades and Arms</td>
<td>3-94</td>
</tr>
</tbody>
</table>

### 4 REMOVED COMPONENTS | 4-1 |

#### SECTION I INTRODUCTION | 4-1 |
- Purpose | 4-1 |
- Technical Instructions | 4-2 |

#### SECTION II REMOVED COMPONENT PRESERVATION | 4-3 |
- Purpose | 4-3 |
- Component Removal | 4-3 |
- Sources | 4-3 |
- Received Components | 4-3 |
- General | 4-3 |
- Cleaning | 4-4 |
- Lubrication | 4-4 |
- Protection | 4-4 |
- Packaging | 4-4 |

#### SECTION III PRESERVATION OF SPECIFIC COMPONENTS | 4-7 |
- Purpose | 4-7 |
- Aircraft Gun Systems and Airborne Crew Served Weapons and Associated Mounts | 4-7 |
- Armament Equipment (Bomb Racks, Pylons, Bomb Release Units, Missile Launchers) | 4-9 |
- Bearings | 4-11 |
- Composite Components | 4-11 |

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION III</td>
<td>4-16</td>
</tr>
<tr>
<td>4-17. Drive and Gearbox System Components</td>
<td>4-11</td>
</tr>
<tr>
<td>4-18. Electrical/Electronic System Components</td>
<td>4-11</td>
</tr>
<tr>
<td>4-19. Engines</td>
<td>4-12</td>
</tr>
<tr>
<td>4-20. Flight Control Surfaces (Ailerons, Stabilizers, Flaps, Wings)</td>
<td>4-14</td>
</tr>
<tr>
<td>4-21. Fragile or Delicate Components</td>
<td>4-14</td>
</tr>
<tr>
<td>4-22. Fuel System Components, General</td>
<td>4-15</td>
</tr>
<tr>
<td>4-23. Fuel Cells</td>
<td>4-15</td>
</tr>
<tr>
<td>4-24. Fuel Tanks, External</td>
<td>4-16</td>
</tr>
<tr>
<td>4-25. Hydraulic System Components</td>
<td>4-16</td>
</tr>
<tr>
<td>4-26. Instrument System Components</td>
<td>4-16</td>
</tr>
<tr>
<td>4-27. Landing and Arresting Gear System Components</td>
<td>4-17</td>
</tr>
<tr>
<td>4-28. Photographic System Components</td>
<td>4-17</td>
</tr>
<tr>
<td>4-29. Pneumatic System Components</td>
<td>4-17</td>
</tr>
<tr>
<td>4-30. Propellers (Variable Pitch)</td>
<td>4-17</td>
</tr>
<tr>
<td>4-31. Rotor and Hub System Components</td>
<td>4-21</td>
</tr>
<tr>
<td>4-32. Safety and Survival System Components</td>
<td>4-23</td>
</tr>
<tr>
<td>4-33. Miscellaneous Equipment</td>
<td>4-23</td>
</tr>
</tbody>
</table>

#### SECTION IV PACKAGING OF REMOVED COMPONENTS | 4-25 |
- Purpose | 4-25 |
- General Guidelines | 4-25 |
- Materials | 4-25 |
- Packaging | 4-26 |
- Basic Packaging Methods | 4-26 |
- Unit Container | 4-26 |
- Marking and Closure | 4-27 |

#### SECTION V HANDLING REMOVED COMPONENTS | 4-29 |
- Purpose | 4-29 |
- General Guidelines | 4-29 |
- Handling Guidelines | 4-29 |

#### SECTION VI REUSABLE CONTAINERS | 4-31 |
- Purpose | 4-31 |
- Component Preparation | 4-31 |
- Container Preparation | 4-31 |
- Component Installation Guidelines | 4-32 |
TABLE OF CONTENTS (Cont.)

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-48. Final Testing of Nonpressurized Containers</td>
<td>4-33</td>
<td>4-14. Introduction...</td>
<td>5-19</td>
</tr>
<tr>
<td>4-49. Final Testing of Pressurized Containers</td>
<td>4-35</td>
<td>5-15. Preparation of Aircraft</td>
<td>5-20</td>
</tr>
<tr>
<td>4-50. Markings on Containers</td>
<td>4-36</td>
<td>5-16. Use of Spray Equipment</td>
<td>5-24</td>
</tr>
<tr>
<td>4-51. Shipment And Storage</td>
<td>4-36</td>
<td>5-17. Preparation of Strippable Coating Compounds</td>
<td>5-25</td>
</tr>
<tr>
<td>4-52. Maintenance of Containerized Components</td>
<td>4-37</td>
<td>5-18. Application of Compounds</td>
<td>5-25</td>
</tr>
<tr>
<td>4-53. Component Removal Guidelines</td>
<td>4-37</td>
<td>5-19. Aircraft Markings and Placards</td>
<td>5-26</td>
</tr>
<tr>
<td>5  BARRIER SYSTEMS</td>
<td>5-1</td>
<td>5-20. Inspection/Maintenance/Repair of Coatings</td>
<td>5-26</td>
</tr>
<tr>
<td>5-1. Introduction</td>
<td>5-1</td>
<td>5-21. Removal of Strippable Coatings</td>
<td>5-27</td>
</tr>
<tr>
<td>5-2. Aircraft Markings and Placards</td>
<td>5-2</td>
<td>5-22. Depreservation</td>
<td>5-27</td>
</tr>
<tr>
<td>5-3. Rigid Shelter</td>
<td>5-3</td>
<td>5-23. Represervation</td>
<td>5-27</td>
</tr>
<tr>
<td>5-4. Tension Fabric Shelters</td>
<td>5-3</td>
<td>SECTION VI TAPE AND BARRIER</td>
<td>5-29</td>
</tr>
<tr>
<td>5-5. Pre-Engineered Building</td>
<td>5-4</td>
<td>5-24. Introduction</td>
<td>5-29</td>
</tr>
<tr>
<td>5-6. Drop Shrouds</td>
<td>5-7</td>
<td>5-25. Surface Preparation</td>
<td>5-29</td>
</tr>
<tr>
<td>5-7. Application and Procedures</td>
<td>5-7</td>
<td>5-26. Tape</td>
<td>5-29</td>
</tr>
<tr>
<td>5-9. Aircraft Preparation</td>
<td>5-11</td>
<td>SECTION VII SHRINKWRAP</td>
<td>5-31</td>
</tr>
<tr>
<td>5-10. Cover Installation Guidelines</td>
<td>5-13</td>
<td>5-28. Introduction</td>
<td>5-31</td>
</tr>
<tr>
<td>5-11. Maintenance</td>
<td>5-16</td>
<td>5-29. Aircraft Preparation</td>
<td>5-31</td>
</tr>
<tr>
<td>5-12. Cover Removal Guidelines</td>
<td>5-17</td>
<td>5-30. Installation Guidelines</td>
<td>5-33</td>
</tr>
<tr>
<td>5-13. Depreservation</td>
<td>5-18</td>
<td>5-31. Maintenance</td>
<td>5-34</td>
</tr>
<tr>
<td>6  ENVIRONMENTAL CONTROL</td>
<td>6-1</td>
<td>5-32. Removal</td>
<td>5-34</td>
</tr>
<tr>
<td>6-1. Introduction</td>
<td>6-1</td>
<td>5-33. Depreservation</td>
<td>5-34</td>
</tr>
<tr>
<td>6-2. Dehumidification</td>
<td>6-1</td>
<td>5-34. Represervation</td>
<td>5-34</td>
</tr>
<tr>
<td>6-3. Psychrometric Chart</td>
<td>6-2</td>
<td>SECTION VIII STORAGE AND MAINTENANCE</td>
<td>6-5</td>
</tr>
<tr>
<td>6-4. Psychrometers</td>
<td>6-2</td>
<td>6-5. Static Dehumidification</td>
<td>6-5</td>
</tr>
<tr>
<td>6-5. Dehumidifiers</td>
<td>6-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-6. Applications</td>
<td>6-9</td>
<td>SECTION IX SHIPMENT OF STORAGE AND MAINTENANCE</td>
<td>6-9</td>
</tr>
<tr>
<td>6-7. Application and Procedures</td>
<td>6-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-8. Applications</td>
<td>6-10</td>
<td>6-9. Maintenance</td>
<td>6-9</td>
</tr>
</tbody>
</table>
## TABLE OF CONTENTS (Cont.)

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION IV DEHUMIDIFICATION</td>
<td></td>
</tr>
<tr>
<td>EQUIPMENT AND INSTALLATION</td>
<td>6-15</td>
</tr>
<tr>
<td>6-9.  Dehumidification Equipment</td>
<td>6-15</td>
</tr>
<tr>
<td>6-10. DH Material and Equipment</td>
<td>6-17</td>
</tr>
<tr>
<td>6-11. Installation Procedures</td>
<td>6-17</td>
</tr>
<tr>
<td>6-12. Troubleshooting RH Variance</td>
<td>6-20</td>
</tr>
<tr>
<td>6-13. Maintenance</td>
<td>6-20</td>
</tr>
<tr>
<td>SECTION V DEHUMIDIFICATION</td>
<td></td>
</tr>
<tr>
<td>EQUIPMENT MAINTENANCE</td>
<td>6-21</td>
</tr>
<tr>
<td>6-14. DH Equipment Maintenance</td>
<td>6-21</td>
</tr>
<tr>
<td>6-15. Daily General Maintenance</td>
<td>6-22</td>
</tr>
<tr>
<td>7 AIRCRAFT SECURING AND SHIPMENT</td>
<td>7-1</td>
</tr>
<tr>
<td>SECTION I SECURING AIRCRAFT</td>
<td>7-1</td>
</tr>
<tr>
<td>7-1.  Introduction</td>
<td>7-1</td>
</tr>
<tr>
<td>7-2.  Spotting and Securing of Aircraft</td>
<td>7-1</td>
</tr>
<tr>
<td>7-3.  Tiedown Procedure</td>
<td>7-1</td>
</tr>
<tr>
<td>7-4.  Grounding Procedures</td>
<td>7-5</td>
</tr>
<tr>
<td>7-5.  Storage Site</td>
<td>7-7</td>
</tr>
<tr>
<td>7-6.  Wheel Chocks</td>
<td>7-7</td>
</tr>
<tr>
<td>SECTION II AIRCRAFT SHIPMENT</td>
<td>7-9</td>
</tr>
<tr>
<td>7-7.  General Information</td>
<td>7-9</td>
</tr>
<tr>
<td>7-8.  Land Shipment</td>
<td>7-11</td>
</tr>
<tr>
<td>7-9.  Ocean Shipment</td>
<td>7-11</td>
</tr>
<tr>
<td>7-10. Air Shipment</td>
<td>7-12</td>
</tr>
<tr>
<td>7-11. Air Lift</td>
<td>7-12</td>
</tr>
<tr>
<td>8 GUIDELINES</td>
<td>8-1</td>
</tr>
<tr>
<td>SECTION I CLEANING GUIDELINES</td>
<td>8-1</td>
</tr>
<tr>
<td>8-1.  General</td>
<td>8-1</td>
</tr>
<tr>
<td>8-2.  Aircraft Cleaning With Soap and Water</td>
<td>8-1</td>
</tr>
<tr>
<td>8-3.  Waterless Spot Cleaning</td>
<td>8-4</td>
</tr>
<tr>
<td>8-4.  Hand Cleaning Oxygen Systems</td>
<td>8-4</td>
</tr>
<tr>
<td>SECTION II INSPECTION GUIDELINES</td>
<td>8-11</td>
</tr>
<tr>
<td>8-5.  Inspection</td>
<td>8-11</td>
</tr>
<tr>
<td>SECTION III CORROSION CONTROL</td>
<td>8-15</td>
</tr>
<tr>
<td>8-6.  Corrosion Control</td>
<td>8-15</td>
</tr>
<tr>
<td>SECTION IV PRESERVATION MATERIALS</td>
<td>8-17</td>
</tr>
<tr>
<td>8-7.  Preservation Materials</td>
<td>8-17</td>
</tr>
<tr>
<td>APPENDIX A RELATED PUBLICATIONS,</td>
<td></td>
</tr>
<tr>
<td>SPECIFICATIONS, STANDARDS, AND INSTRUCTIONS</td>
<td>A-1</td>
</tr>
<tr>
<td>APPENDIX B ACRONYMS</td>
<td>B-1</td>
</tr>
<tr>
<td>GLOSSARY</td>
<td>Glossary-1</td>
</tr>
<tr>
<td>INDEX</td>
<td>INDEX-1</td>
</tr>
</tbody>
</table>

## LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1.</td>
<td>Preservation/Depreservation Record (CNAF 4790/136A)</td>
<td>1-4</td>
</tr>
<tr>
<td>1-2.</td>
<td>Preservation Checklist Example</td>
<td>1-6</td>
</tr>
<tr>
<td>1-3.</td>
<td>Galvanic Series</td>
<td>1-9</td>
</tr>
<tr>
<td>1-4.</td>
<td>Storage Costs</td>
<td>1-17</td>
</tr>
<tr>
<td>1-5.</td>
<td>Dehumidified Storage Line of Aircraft in Flexible Bags</td>
<td>1-17</td>
</tr>
<tr>
<td>3-1.</td>
<td>Examples of Movable Surface Battens</td>
<td>3-13</td>
</tr>
<tr>
<td>3-2.</td>
<td>Stencilled Explosive Warnings</td>
<td>3-19</td>
</tr>
<tr>
<td>3-3.</td>
<td>Warning Tag for Dry Cell Battery</td>
<td>3-24</td>
</tr>
<tr>
<td>3-4.</td>
<td>Fuel Vent Extension Tube Installation</td>
<td>3-34</td>
</tr>
<tr>
<td>3-5.</td>
<td>Warning Tag for Fuel Connections</td>
<td>3-36</td>
</tr>
<tr>
<td>3-6.</td>
<td>Preservation Tag for Fuel System</td>
<td>3-37</td>
</tr>
<tr>
<td>3-7.</td>
<td>Contamination Tag for Hydraulic System</td>
<td>3-44</td>
</tr>
<tr>
<td>3-8.</td>
<td>Pitot Tube Preservation</td>
<td>3-48</td>
</tr>
<tr>
<td>3-9.</td>
<td>Protective Cover for Aircraft Tire</td>
<td>3-54</td>
</tr>
<tr>
<td>3-10.</td>
<td>Preservation Tag for Engine</td>
<td>3-60</td>
</tr>
<tr>
<td>3-11.</td>
<td>Desiccant Warning Tag</td>
<td>3-62</td>
</tr>
<tr>
<td>3-12.</td>
<td>Warning Tag for Oil System</td>
<td>3-63</td>
</tr>
<tr>
<td>3-13.</td>
<td>Warning Tag for Fluid System Connection</td>
<td>3-64</td>
</tr>
<tr>
<td>3-14.</td>
<td>Reciprocating Engine Aircraft</td>
<td>3-68</td>
</tr>
<tr>
<td>3-15.</td>
<td>Caution Tag for Reciprocating Engine</td>
<td>3-69</td>
</tr>
</tbody>
</table>
LIST OF ILLUSTRATIONS (Cont.)

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-1.</td>
<td>Engine in Dehumidified Flexible Bag</td>
<td>4-13</td>
</tr>
<tr>
<td>4-2.</td>
<td>Engines Stored Indoors, Covered with Tape and Barrier</td>
<td>4-41</td>
</tr>
<tr>
<td>5-1.</td>
<td>Proper Stencil Format</td>
<td>5-2</td>
</tr>
<tr>
<td>5-2.</td>
<td>Tension Membrane Shelter</td>
<td>5-3</td>
</tr>
<tr>
<td>5-3.</td>
<td>Pre-Engineered Building</td>
<td>5-4</td>
</tr>
<tr>
<td>5-4.</td>
<td>Shroud Draped Over a Metal Frame</td>
<td>5-7</td>
</tr>
<tr>
<td>5-5.</td>
<td>Aircraft Inside a Shroud</td>
<td>5-7</td>
</tr>
<tr>
<td>5-6.</td>
<td>Aircraft In a Flexible Bag</td>
<td>5-11</td>
</tr>
<tr>
<td>5-7.</td>
<td>Aircraft In a Top Cover</td>
<td>5-11</td>
</tr>
<tr>
<td>5-8.</td>
<td>Cushioning Material</td>
<td>5-12</td>
</tr>
<tr>
<td>5-10.</td>
<td>Properly Placed Cushioning Material On Landing Gear Door and Antenna</td>
<td>5-13</td>
</tr>
<tr>
<td>5-11.</td>
<td>F/A-18 Cushion Points</td>
<td>5-14</td>
</tr>
<tr>
<td>5-12.</td>
<td>Aircraft With Strippable Coating</td>
<td>5-19</td>
</tr>
<tr>
<td>5-13.</td>
<td>Strippable Coating Applied to Selected Areas</td>
<td>5-19</td>
</tr>
<tr>
<td>5-14.</td>
<td>Methods of Closing Small Openings</td>
<td>5-22</td>
</tr>
<tr>
<td>5-15.</td>
<td>Methods of Closing Large Openings</td>
<td>5-23</td>
</tr>
<tr>
<td>5-16.</td>
<td>Methods of Covering Sharp Edges</td>
<td>5-23</td>
</tr>
<tr>
<td>5-17.</td>
<td>Masking by Applying a Bead of Coating Compound</td>
<td>5-24</td>
</tr>
<tr>
<td>5-18.</td>
<td>Installing Ripcord Inserts</td>
<td>5-24</td>
</tr>
<tr>
<td>5-19.</td>
<td>Tape and Barrier (T&amp;B) Applied to Aircraft Openings</td>
<td>5-29</td>
</tr>
<tr>
<td>5-20.</td>
<td>Shingled Tape</td>
<td>5-30</td>
</tr>
<tr>
<td>5-21.</td>
<td>Aircraft in Shrinkwrap</td>
<td>5-31</td>
</tr>
<tr>
<td>6-1.</td>
<td>Psychrometric Chart</td>
<td>6-3</td>
</tr>
<tr>
<td>6-2.</td>
<td>Desiccant Stacked in an Intake Duct</td>
<td>6-6</td>
</tr>
<tr>
<td>6-3.</td>
<td>Installed Humidity Indicator Card</td>
<td>6-7</td>
</tr>
<tr>
<td>6-4.</td>
<td>Desiccant Wheel Dehumidifier Schematic</td>
<td>6-9</td>
</tr>
<tr>
<td>6-5.</td>
<td>Cooling Based Dehumidification System Schematic</td>
<td>6-9</td>
</tr>
<tr>
<td>6-6.</td>
<td>Operational Dehumidification Hook-Up to Environmental Control System for Avionics Protection</td>
<td>6-11</td>
</tr>
<tr>
<td>6-7.</td>
<td>Operational Dehumidification Hook-Up for Engine Protection</td>
<td>6-11</td>
</tr>
<tr>
<td>6-8.</td>
<td>Dehumidification of Bagged Aircraft</td>
<td>6-13</td>
</tr>
<tr>
<td>6-9.</td>
<td>Storage Schematic for a Removed Components Storage Warehouse (Dehumidified and Air-Conditioned)</td>
<td>6-13</td>
</tr>
<tr>
<td>6-10.</td>
<td>Dehumidifier Label</td>
<td>6-16</td>
</tr>
<tr>
<td>7-1.</td>
<td>Tiedown Anchors</td>
<td>7-2</td>
</tr>
<tr>
<td>7-2.</td>
<td>TD-1A or TD-1B Tiedown Assembly</td>
<td>7-3</td>
</tr>
<tr>
<td>7-3.</td>
<td>TD-1A or TD-1B Tiedown Assembly Design Hazard</td>
<td>7-4</td>
</tr>
<tr>
<td>7-4.</td>
<td>Screw Pin Shackle</td>
<td>7-6</td>
</tr>
<tr>
<td>7-5.</td>
<td>Identification of a Certified Ground Point</td>
<td>7-6</td>
</tr>
<tr>
<td>7-6.</td>
<td>Vehicle Dimensional Limitations</td>
<td>7-11</td>
</tr>
<tr>
<td>7-7.</td>
<td>Ramp and Cargo Space</td>
<td>7-13</td>
</tr>
<tr>
<td>8-1.</td>
<td>Aircraft Cleaning Procedure</td>
<td>8-2</td>
</tr>
<tr>
<td>8-2.</td>
<td>Automatic Water Spray Nozzle</td>
<td>8-3</td>
</tr>
</tbody>
</table>

LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1.</td>
<td>Outline of Manual</td>
<td>1-2</td>
</tr>
<tr>
<td>1-2.</td>
<td>Description of CNAF 4790/136A Entries</td>
<td>1-5</td>
</tr>
<tr>
<td>1-3.</td>
<td>Deterioration of Aircraft Materials</td>
<td>1-8</td>
</tr>
<tr>
<td>1-4.</td>
<td>Preservation Level Designations</td>
<td>1-12</td>
</tr>
<tr>
<td>1-5.</td>
<td>AMARG Preservation Type Designation</td>
<td>1-13</td>
</tr>
<tr>
<td>1-6.</td>
<td>Recommended Preservation Level</td>
<td>1-15</td>
</tr>
<tr>
<td>1-7.</td>
<td>Barrier System Comparison Chart</td>
<td>1-16</td>
</tr>
<tr>
<td>2-1.</td>
<td>Summary of Aircraft System Preservation for Each Level</td>
<td>2-2</td>
</tr>
<tr>
<td>2-2.</td>
<td>Inspection Elements and Corrective Actions</td>
<td>2-4</td>
</tr>
<tr>
<td>2-3.</td>
<td>Ocean Shipping Inspections and Corrective Actions</td>
<td>2-18</td>
</tr>
<tr>
<td>3-1.</td>
<td>Airframe System Summary</td>
<td>3-5</td>
</tr>
<tr>
<td>3-2.</td>
<td>Armament System Summary</td>
<td>3-17</td>
</tr>
<tr>
<td>3-3.</td>
<td>Drive and Gearbox System Summary</td>
<td>3-21</td>
</tr>
<tr>
<td>3-4.</td>
<td>Electrical Systems Summary</td>
<td>3-23</td>
</tr>
<tr>
<td>3-5.</td>
<td>Electronics Systems Summary</td>
<td>3-29</td>
</tr>
<tr>
<td>3-6.</td>
<td>Fuel System Summary</td>
<td>3-33</td>
</tr>
<tr>
<td>3-7.</td>
<td>Contamination Limits for Preservation Oil</td>
<td>3-35</td>
</tr>
<tr>
<td>3-8.</td>
<td>Hydraulic System Summary</td>
<td>3-41</td>
</tr>
<tr>
<td>3-9.</td>
<td>Navy Standard for Particulate Contamination of Hydraulic Fluid (Particle Count Test)</td>
<td>3-43</td>
</tr>
<tr>
<td>3-10.</td>
<td>Contamination Limits for Aircraft Hydraulic Fluids</td>
<td>3-43</td>
</tr>
<tr>
<td>3-11.</td>
<td>Instruments Systems Summary</td>
<td>3-47</td>
</tr>
<tr>
<td>Table</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>3-12.</td>
<td>Landing and Arresting Gear System Summary</td>
<td>3-49</td>
</tr>
<tr>
<td>3-13.</td>
<td>Photographic System Summary</td>
<td>3-55</td>
</tr>
<tr>
<td>3-14.</td>
<td>Pneumatic System Summary</td>
<td>3-57</td>
</tr>
<tr>
<td>3-15.</td>
<td>Power Plant Systems Summary</td>
<td>3-59</td>
</tr>
<tr>
<td>3-16.</td>
<td>Contamination Limits for Engine Oil</td>
<td>3-61</td>
</tr>
<tr>
<td>3-17.</td>
<td>Propellers and Propeller Components System Summary</td>
<td>3-75</td>
</tr>
<tr>
<td>3-18.</td>
<td>Rotor Head and Hub System Summary</td>
<td>3-79</td>
</tr>
<tr>
<td>3-19.</td>
<td>Safety and Survival System Summary</td>
<td>3-83</td>
</tr>
<tr>
<td>3-20.</td>
<td>Utility Systems Summary</td>
<td>3-89</td>
</tr>
<tr>
<td>4-1.</td>
<td>Components Typically Stored in Reusable Containers</td>
<td>4-31</td>
</tr>
<tr>
<td>4-2.</td>
<td>Recommended Torque Values (inch-pounds)</td>
<td>4-34</td>
</tr>
<tr>
<td>4-3.</td>
<td>Initial Pressure Readings for Container Leak Check Test</td>
<td>4-34</td>
</tr>
<tr>
<td>4-4.</td>
<td>Container Relief Valve and Operational Pressure</td>
<td>4-35</td>
</tr>
<tr>
<td>5-1.</td>
<td>Materials and Equipment for Application of Strippable Coating</td>
<td>5-21</td>
</tr>
<tr>
<td>5-2.</td>
<td>Strippable Coating Drying Times</td>
<td>5-25</td>
</tr>
<tr>
<td>5-3.</td>
<td>Materials and Equipment for Shrinkwrapping</td>
<td>5-32</td>
</tr>
<tr>
<td>6-1.</td>
<td>Maximum Allowable Contamination (Cumulative)</td>
<td>6-6</td>
</tr>
<tr>
<td>6-2.</td>
<td>Requirements for Desiccant Wheel Dehumidifiers</td>
<td>6-10</td>
</tr>
<tr>
<td>6-3.</td>
<td>Material and Equipment for Dynamic Dehumidification</td>
<td>6-18</td>
</tr>
<tr>
<td>6-4.</td>
<td>Dehumidification Equipment Maintenance Guidelines</td>
<td>6-21</td>
</tr>
<tr>
<td>7-1.</td>
<td>Tiedown Information for the Parking of Aircraft</td>
<td>7-2</td>
</tr>
<tr>
<td>7-2.</td>
<td>Tiedown Chain Data</td>
<td>7-3</td>
</tr>
<tr>
<td>7-3.</td>
<td>Wire Rope Safe Working Loads</td>
<td>7-5</td>
</tr>
<tr>
<td>7-4.</td>
<td>Shackle Safe Working Load and NSN</td>
<td>7-6</td>
</tr>
<tr>
<td>7-5.</td>
<td>Main Aircraft Hoisting Slings</td>
<td>7-10</td>
</tr>
<tr>
<td>7-6.</td>
<td>Transport Aircraft Dimensions</td>
<td>7-12</td>
</tr>
<tr>
<td>8-1.</td>
<td>Cleaner Compatibility</td>
<td>8-5</td>
</tr>
<tr>
<td>8-2.</td>
<td>Cleaner Removal Effectiveness</td>
<td>8-5</td>
</tr>
<tr>
<td>8-3.</td>
<td>Cleaning Materials and Equipment</td>
<td>8-6</td>
</tr>
<tr>
<td>8-4.</td>
<td>Common Aircraft Greases</td>
<td>8-9</td>
</tr>
<tr>
<td>8-5.</td>
<td>Material Defect Indications</td>
<td>8-12</td>
</tr>
<tr>
<td>8-6.</td>
<td>General Inspection Guidelines</td>
<td>8-13</td>
</tr>
<tr>
<td>8-7.</td>
<td>Equipment Used to Aid Inspection</td>
<td>8-14</td>
</tr>
<tr>
<td>8-8.</td>
<td>Water Displacing Corrosion Preventive Compounds</td>
<td>8-18</td>
</tr>
<tr>
<td>8-9.</td>
<td>Time Limitations for CPCs</td>
<td>8-19</td>
</tr>
<tr>
<td>8-10.</td>
<td>Non-Water Displacing Corrosion Preventive Compounds</td>
<td>8-19</td>
</tr>
<tr>
<td>8-11.</td>
<td>Volatile Corrosion Inhibitors (VCI)</td>
<td>8-20</td>
</tr>
<tr>
<td>8-12.</td>
<td>Materials for Preservation</td>
<td>8-21</td>
</tr>
<tr>
<td>8-13.</td>
<td>Materials and Equipment for Packaging</td>
<td>8-24</td>
</tr>
</tbody>
</table>
## LIST OF TECHNICAL PUBLICATIONS DEFICIENCY REPORTS INCORPORATED

<table>
<thead>
<tr>
<th>Report Control Number (RCN)</th>
<th>Location</th>
<th>Report Control Number (RCN)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>N09112-2012-0044</td>
<td>Pg 6-20</td>
<td>N65888-2011-1093</td>
<td>Pg 4-7</td>
</tr>
<tr>
<td>MALS-12</td>
<td></td>
<td>N65923-2009-P488</td>
<td></td>
</tr>
<tr>
<td>N39783-2007-0096</td>
<td>Pg A</td>
<td>R09364-2009-0045</td>
<td>Pg 3-94</td>
</tr>
<tr>
<td>VX-23</td>
<td></td>
<td>VAQ-131</td>
<td></td>
</tr>
<tr>
<td>N39783-2007-0101</td>
<td>Pg A</td>
<td>R09970-2009-0043</td>
<td>Pg 3-37</td>
</tr>
<tr>
<td>VX-23</td>
<td></td>
<td>VAQ-134</td>
<td></td>
</tr>
<tr>
<td>N44323-2007-0038</td>
<td>Pg 4-18</td>
<td>R21847-2010-0002</td>
<td>Pg 4-10 , 8-22</td>
</tr>
<tr>
<td>AIMD Atsugi</td>
<td></td>
<td>USS John C Stennis</td>
<td></td>
</tr>
<tr>
<td>N44493-2010-0016</td>
<td>Pg 4-32, 4-36, 8-21, 8-22</td>
<td>V09131-2009-0040</td>
<td>Pg 2-1</td>
</tr>
<tr>
<td>FRC East Willow Grove</td>
<td></td>
<td>MALS-31</td>
<td></td>
</tr>
<tr>
<td>N44493-2010-0052</td>
<td>Pg 8-22</td>
<td>V09167-2012-0041</td>
<td>Pg 4-21</td>
</tr>
<tr>
<td>FRC East Willow Grove</td>
<td></td>
<td>MALS-26</td>
<td></td>
</tr>
<tr>
<td>N62617-2011-0001</td>
<td>Pg A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAWCAD P-3 FMS LEM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N65888-2011-1092</td>
<td>Pg 2-13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRCSW</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WARNINGS APPLICABLE TO HAZARDOUS MATERIALS

1. Warnings and cautions for hazardous materials listed are designed to apprise personnel of hazards associated with such items when they come in contact with them by actual use. Additional information related to hazardous materials is provided in the Navy Hazardous Material Control Program, NAVSUPPINST 5100.27, Navy Occupational Safety and Health (NAVOSH) Program Manuals, OPNAVINST 5100.23 (Ashore), OPNAVINST 5100.19 (Afloat), and the DOD 6050.5 Hazardous Materials Information System (HMIS) series publications. For each hazardous material used within the Navy, a Material Safety Data Sheet (MSDS) must be provided and available for review by users. Consult your local safety and health staff concerning any questions regarding hazardous materials, MSDS, personal protective equipment requirements, appropriate handling and emergency procedures and disposal guidance.

2. Under the heading HAZARDOUS MATERIALS WARNINGS, complete warnings, including related icon(s) and a numeric identifier, are provided for hazardous materials used in this manual. The numeric identifiers have been assigned to the hazardous material in alphabetical order by material nomenclature. Each hazardous material is assigned only one numerical identifier. Repeat use of a specific hazardous material references the numeric identifier assigned at its initial appearance. The approved icons and their application are shown below.

3. In the text of the manual, the caption WARNING is not used for hazardous material warnings. Hazards are cited with appropriate icon(s), the nomenclature of the hazardous material and the numeric identifier that relates to the complete warning. Users of hazardous materials shall refer to the complete warnings, as necessary.

4. EXPLANATION OF HAZARDOUS MATERIALS ICONS.

- **Chemical**
  The symbol of a liquid dripping onto a hand shows that the material will cause burns or irritation to human skin or tissue.

- **Cryogenic**
  The symbol of a hand in a block of ice shows that the material is extremely cold and can injure human skin or tissue.

- **Explosion**
  This rapidly expanding symbol shows that the material may explode if subjected to high temperature, sources of ignition or high pressure.

- **Eye Protection**
  The symbol of a person wearing goggles shows that the material will injure the eyes.

- **Fire**
  The symbol of a fire shows that the material may ignite or overheat and cause burns.

- **Poison**
  The symbol of a skull and crossbones shows that the material is poisonous or is a danger to life.

- **Vapor**
  The symbol of a human figure in a cloud shows that material vapors present a danger to life or health.
<table>
<thead>
<tr>
<th>INDEX</th>
<th>MATERIAL</th>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acid, Boric A-A-59282</td>
<td>Boric Acid, A-A-59282, is an eye, skin, and respiratory tract irritant. If mixed with potassium, the mixture may explode on impact. Acid is readily absorbed through cut or burned skin. Avoid contact with potassium, alkalis, carbonates, and hydroxides. Use in a well ventilated area. Do not get on skin, in eyes, or on clothing. Do not breathe dust or mist. Wash hands and face after use. Keep container closed when not in use. Store in a cool, dry area. Protection: Wear chemical goggles and gloves. A half-face dust/mist respirator may be worn in areas with poor ventilation. If eye contact occurs, flush immediately with large amounts of water for 15 minutes, lifting upper/lower eyelids occasionally, and seek medical attention. If skin contact occurs, remove contaminated clothing and shoes, wash with soap and water for 15 minutes, and seek medical attention if irritation persists. If ingested, induce vomiting immediately, and seek medical attention. If inhalation occurs, remove from area to fresh air. If breathing is difficult, give oxygen.</td>
</tr>
<tr>
<td>2</td>
<td>Acid, Phosphoric A-A-55820</td>
<td>Phosphoric acid, A-A-55820, is a severe skin, eye, and respiratory tract irritant. Contact with liquid is corrosive. The acid liberates explosive hydrogen gas when reacting with chlorides or stainless steel. Do not add water to acid. Use only in a well ventilated area. Do not ingest or inhale. Wash hands and face thoroughly after use. Keep container closed when not in use. Keep away from metals. Store in a separate safety storage area for corrosive materials. Protection: Wear faceshield or chemical splash goggles and rubber gloves; half-mask respirator may be required in poorly ventilated areas, especially when misting occurs. If eye contact occurs, flush immediately with large amounts of water for 15 minutes, lifting upper/lower eyelids occasionally, and seek medical attention. If skin contact occurs, remove contaminated clothing and shoes, wash with soap and water for 15 minutes, seek medical attention. Discard contaminated clothes. If ingested, do not induce vomiting, give 2-4 cups of milk or water, and seek medical attention. If inhalation occurs, remove from area to fresh air. If breathing is difficult, give oxygen. If not breathing, give CPR. Seek medical attention immediately.</td>
</tr>
<tr>
<td>INDEX</td>
<td>MATERIAL</td>
<td>WARNING</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>3</td>
<td>Alcohol, Isopropyl TT-I-735</td>
<td>Isopropyl alcohol, TT-I-735, is toxic, flammable, and a skin and respiratory tract irritant. It may be fatal if swallowed. <strong>DO NOT</strong> use near open flame, sparks or heat. <strong>DO NOT</strong> use synthetic cloths for wiping with this solvent. <strong>DO NOT</strong> smoke, eat or drink when using solvent. Avoid breathing vapor. Use only in well ventilated areas. Metal containers containing solvent shall be grounded to prevent sparking and fires. Avoid prolonged breathing of vapor and skin contact, which can cause dermatitis, irritated nose and throat, and dizziness. Protection: Wear butyl gloves and chemical goggles; faceshield and protective clothing required when splashing is possible or expected; half-mask respirator with organic vapor cartridge required in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If ingested, give water to drink and seek medical attention. Do not induce vomiting. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>4</td>
<td>Cleaning Compound, Aircraft, Exterior MIL-PRF-85570 Type II</td>
<td>Cleaning compound, MIL-PRF-85570 Type II, is an eye, skin, and respiratory tract irritant. Avoid contact with eyes, skin and clothing. Prolonged contact may cause dermatitis. Avoid breathing vapors. Avoid contact with strong acids or oxidizing agents. Use only in well ventilated areas. Wash hands thoroughly after use. Launder contaminated clothing before re-use. Keep containers closed when not in use. Store in a cool, dry, well ventilated area. Protection: Wear chemical goggles, rubber gloves, faceshield, and protective clothing; half-mask respirator with organic vapor cartridge required in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>5</td>
<td>Cleaning Compound, Turbine Engine Gas Path MIL-PRF-85704 Type II/II RTU</td>
<td>Cleaning compound, MIL-PRF-85704 Type II/II RTU, is toxic, and an eye, skin and respiratory tract irritant. Avoid contact with eyes, skin and clothing. Prolonged contact may cause dermatitis. Avoid breathing vapors. Use only in well ventilated areas. Wash hands thoroughly after use. Launder contaminated clothing before re-use. Keep containers closed when not in use. Store in a cool, dry, well ventilated area. Protection: Wear chemical goggles, rubber gloves, faceshield, and protective clothing; half-mask respirator with organic vapor cartridge required in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If ingested, give water to drink and seek medical attention. Do not induce vomiting. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>INDEX</td>
<td>MATERIAL</td>
<td>WARNING</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>6</td>
<td>Coatings, Sprayable, Strippable, Protective MIL-PRF-6799 Type II Class 1</td>
<td>Strippable coating, MIL-PRF-6799 Class 1 (black), is a minor skin, eye, and respiratory irritant. It may be harmful if absorbed through the skin or swallowed. Use only in well ventilated areas. Store in a cool dry place. Keep container closed when not in use. Protection: Wear safety glasses, chemical resistant gloves and apron; respiratory protection is required in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 20 minutes, lifting upper/lower eyelids occasionally, and seek medical attention. If skin contact occurs, remove contaminated clothing and shoes, wash with soap and water for 15 minutes, and seek medical attention if irritation persists. If ingested, do not induce vomiting unless directed by medical personnel; seek medical attention immediately. If inhalation occurs, remove from area to fresh air. If breathing is difficult, give oxygen.</td>
</tr>
<tr>
<td>7</td>
<td>Coatings, Sprayable, Strippable, Protective MIL-PRF-6799 Type II Class 5, 6, and 7</td>
<td>Strippable coating, MIL-PRF-6799 Class 5, 6, and 7 (white), is a moderate skin, eye, and respiratory irritant. It may be harmful if absorbed through the skin or toxic if swallowed. Vapors may be ignited and cause a fire. Vapors may be ignited by heat, sparks, or flames. Vapors are heavier than air and may travel to an ignition source and flash back. Use only in well ventilated areas. Store in a cool dry place. Keep container closed when not in use. Protection: Wear safety glasses, chemical resistant gloves and apron; respiratory protection is required in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 20 minutes, lifting upper/lower eyelids occasionally, and seek medical attention. If skin contact occurs, remove contaminated clothing and shoes, wash with soap and water for 15 minutes, and seek medical attention if irritation persists. If ingested, do not induce vomiting unless directed by medical personnel; seek medical attention immediately. If inhalation occurs, remove from area to fresh air. If breathing is difficult, give oxygen.</td>
</tr>
<tr>
<td>8</td>
<td>Compound, Corrosion Preventive MIL-PRF-81309 Type II and Type III</td>
<td>Corrosion preventive compound, MIL-PRF-81309 Type II and Type III, is toxic, flammable, and a respiratory tract irritant. Avoid contact with skin and eyes. DO NOT use near open flame, sparks, or heat. Vapor accumulations may explode if ignited. Avoid contact with oxidizing agents. Use only in well ventilated areas. Wash hands thoroughly with soap and water after use. Keep container tightly closed when not in use. Protection: Wear chemical goggles and rubber gloves; faceshield and laboratory apron required when working with large quantities; half-mask respirator with acid/organic vapor cartridge and mist prefilter required during spraying operations or in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If ingested, do not induce vomiting, seek medical attention. If inhalation occurs, remove from area to fresh air.</td>
</tr>
</tbody>
</table>
## HAZARDOUS MATERIALS WARNINGS (Cont.)

<table>
<thead>
<tr>
<th>INDEX</th>
<th>MATERIAL</th>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Compound, Corrosion Preventive&lt;br&gt;MIL-DTL-85054</td>
<td>Corrosion preventative compound, MIL-DTL-85054, is toxic, flammable, and a respiratory tract irritant. Avoid contact with eyes and skin. <strong>DO NOT</strong> use near open flame, sparks, or heat. Use only in well ventilated areas. Wash hands thoroughly with soap and water after use. Keep container tightly closed when not in use. Protection: Wear chemical goggles and rubber gloves. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If ingested, do not induce vomiting, seek medical attention. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>10</td>
<td>Compound, Corrosion Preventive&lt;br&gt;MIL-PRF-16173 Grade 1, 2, and 4</td>
<td>Corrosion preventative compound, MIL-PRF-16173, is toxic, flammable, and a respiratory tract irritant. Avoid contact with eyes and skin. <strong>DO NOT</strong> use near open flame, sparks, or heat. Use only in well ventilated areas. Wash hands thoroughly with soap and water after use. Keep container tightly closed when not in use. Avoid contact with oxidizing agents. Protection: Wear chemical goggles, laboratory apron, and rubber gloves; faceshield and laboratory apron required when working with large quantities; half-mask respirator with acid/organic vapor cartridge and mist prefilter required during spraying operations or in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If ingested, do not induce vomiting, seek medical attention. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>11</td>
<td>Corrosion Preventive,&lt;br&gt;Aircraft Engine&lt;br&gt;MIL-C-6529 Type I and Type II</td>
<td>Aircraft engine corrosion preventive, MIL-C-6529, is a skin and eye irritant. Oil mist is a respiratory hazard. Avoid contact with skin and eyes. Avoid breathing vapors/mists. Store in a cool dry place away from strong oxidizing agents. Protection: butyl gloves and chemical goggles or faceshield; half-mask respirator with organic vapor cartridge required to control oil mist inhalation when exposure to mists or vapor is likely.</td>
</tr>
<tr>
<td>12</td>
<td>Desiccant, Activated&lt;br&gt;MIL-D-3464 Type I</td>
<td>Activated desiccant, MIL-D-3464 Type I, is a respiratory tract irritant. Dust may contain crystalline quartz, a suspected carcinogen. If unit pack integrity is broken, handle with care and avoid breathing dust. Protection: None normally required. Use of dust mask is recommended when excessive dusting may occur.</td>
</tr>
<tr>
<td>INDEX</td>
<td>MATERIAL</td>
<td>WARNING</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>13</td>
<td>Detergent, General Purpose (Liquid, Nonionic) MIL-D-16791 Type I</td>
<td>Cleaning compound, MIL-D-16791, is an eye and skin irritant. Avoid contact with eyes, skin and clothing. Avoid contact with strong oxidizing or reducing agents. Store away from heat sources. Material is corrosive to copper and brass over long storage periods. Protection: Wear chemical goggles and rubber gloves. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water.</td>
</tr>
<tr>
<td>14</td>
<td>Fluid, Hydraulic MIL-PRF-83282</td>
<td>Hydraulic fluid, MIL-PRF-83282, is a skin, eye, and respiratory tract irritant. May contain small quantities of tricresyl-phosphate, a toxic substance. There is a slight fire/explosive hazard when fluid is exposed to heat and flames. Use in well ventilated area. Keep container tightly closed when not in use. Keep away from heat sparks, open flames, and oxidizing agents. Avoid contact with clothing, eyes and skin. Wash hands thoroughly with soap and water after use. Protection: Wear chemical goggles, butyl gloves, and faceshield; half-mask respirator with organic vapor cartridge may be required in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>15</td>
<td>Grease, Aircraft, General Purpose, Wide Temperature Range MIL-PRF-81322 Grade A</td>
<td>Wide temperature range, general purpose aircraft grease, MIL-PRF-81322 Grade A, is an eye irritant, and upon prolonged exposure, a skin irritant. When heated, grease can emit harmful fumes. Product may contain chromium compounds, which are suspected carcinogens. Avoid contact with eyes, skin, and clothing. <strong>DO NOT</strong> use near open flame, sparks, heat or oxidizing agents. Wash hands with soap and water after use. Launder contaminated clothing before re-use. Keep container closed when not in use. Store in a cool, dry, well ventilated area. Protection: Wear chemical goggles and rubber gloves. If eye contact occurs, flush immediately with large amounts of water. If skin contact occurs, wash with soap and water. If inhalation occurs, remove from area to fresh air and seek medical attention.</td>
</tr>
<tr>
<td>INDEX</td>
<td>MATERIAL</td>
<td>WARNING</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>16</td>
<td>Grease, Instrument MIL-PRF-23827</td>
<td>Instrument grease, MIL-PRF-23827, is an eye irritant, and upon prolonged exposure, a skin irritant. When heated, grease can emit harmful fumes. Avoid contact with skin, eyes and clothing. <strong>DO NOT</strong> use near open flame, sparks, heat or oxidizing agents. Wash hands with soap and water after use. Launder contaminated clothing before re-use. Keep container closed when not in use. Store in a cool, dry, well ventilated area. Protection: Wear chemical goggles and rubber gloves. If eye contact occurs, flush immediately with large amounts of water. If skin contact occurs, wash with soap and water. If inhalation occurs, remove from area to fresh air and seek medical attention.</td>
</tr>
<tr>
<td>17</td>
<td>Ink, Stencil A-A-208 Type III</td>
<td>Stencil Ink, A-A-208 Type III, is toxic and flammable. Avoid breathing vapors. Do not use near heat, sparks, and flame. Do not spray in eyes. Do not take internally. Do not puncture or incinerate cans. Do not store above 120°F. Use only in well ventilated areas. Protection: Wear butyl gloves and chemical goggles; protective clothing and half-mask respirator with organic vapor cartridge and paint mist pre-filter are required during spray operations in poorly ventilated areas.</td>
</tr>
<tr>
<td>18</td>
<td>Lubricant, Cleaner and Preservative MIL-PRF-63460</td>
<td>Cleaner and Preservative Lubricant, MIL-PRF-63460, is a skin, eye, and respiratory tract irritant. It is harmful if swallowed. Use in a well ventilated area, especially when exposure to mist is possible. Avoid contact with skin and eyes. Wash hands thoroughly after each use. Launder contaminated clothing before reuse. Keep away from open flame, sparks, or heat. Keep away from strong oxidizers. Store in a cool, dry, well ventilated area. Protection: Wear chemical goggles and rubber gloves; half-mask respirator with organic vapor cartridge may be required in poorly ventilated areas, especially when misting occurs. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If ingested, do not induce vomiting, seek medical attention. If inhalation occurs, remove from area to fresh air.</td>
</tr>
</tbody>
</table>
### HAZARDOUS MATERIALS WARNINGS (Cont.)

<table>
<thead>
<tr>
<th>INDEX</th>
<th>MATERIAL</th>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Naphtha, Aliphatic TT-N-95 Type II</td>
<td>Aliphatic Naphtha, TT-N-95 Type II, is toxic, flammable, explosive, and a skin, eye and respiratory tract irritant. <strong>DO NOT</strong> use near open flame, sparks or heat. Vapor accumulation can flash or explode if ignited. <strong>DO NOT</strong> use synthetic cloths for wiping with this solvent. Avoid contact with strong oxidizing agents. Use only in well ventilated areas. Metal containers containing solvent shall be grounded to prevent sparking and fires. Avoid prolonged breathing of vapor and skin contact, which can cause dermatitis, irritated nose and throat and dizziness. Ingestion will cause gastro-intestinal irritation. Protection: Wear butyl gloves and chemical goggles; faceshield and protective clothing required when splashing is possible or expected; half-mask respirator with organic vapor cartridge required in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If ingested, give water to drink and seek medical attention. Do not induce vomiting. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>20</td>
<td>Nitrogen, Gas A-A-59503 Type I</td>
<td>Nitrogen gas, A-A-59503 Type I, is a nontoxic gas that may cause asphyxiation if inhaled in large concentrations. Nitrogen cylinders may rupture explosively if mishandled. Use only in well ventilated areas. Close valve after each use and when empty. Store cylinders in a cool, dry, ventilated area. Protect cylinders from physical damage. Protection: Wear chemical goggles. Wear safety shoes and leather gloves when handling cylinders. Prompt medical attention is mandatory in cases of overexposure. If inhaled, remove to fresh air, provide oxygen/CPR if needed.</td>
</tr>
<tr>
<td>21</td>
<td>Oil, Lubricating, Aircraft MIL-PRF-23699</td>
<td>Aircraft lubricating oil, MIL-PRF-23699, is toxic, and a skin, eye, and respiratory tract irritant. If lubricating oil is decomposed by heat, toxic gases are released. Keep away from open flame, sparks, or heat. Use in a well ventilated area, especially when exposure to hot oil or mist is possible. Wash hands thoroughly after use. Launder contaminated clothing before re-use; discard contaminated boots or shoes if oil soaked. Keep containers closed when not in use. Avoid strong oxidizing agents. Protection: Wear chemical goggles, rubber gloves, and protective clothing; full-face piece continuous supplied air respirator required in poorly ventilated areas, especially when misting occurs. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water; remove contaminated clothing and shoes. If ingested, do not induce vomiting, seek medical attention. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>INDEX</td>
<td>MATERIAL</td>
<td>WARNING</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>22</td>
<td>Oil, Lubricating, Jet Engine MIL-PRF-6081 Grade 1010N</td>
<td>Lubricating oil, MIL-PRF-6081 Grade 1010N, is a skin, eye, and respiratory tract irritant. Use in a well ventilated area, especially when exposure to hot oil or mist is possible. Avoid contact with skin and eyes. Wash hands thoroughly after each use. Launder contaminated clothing before reuse. Store in a cool, dry place, away from heat, flames, and oxidizing agents. Protection: Wear chemical goggles and rubber gloves; half-mask respirator with organic vapor cartridge may be required in poorly ventilated areas, especially when misting occurs. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>23</td>
<td>Oil, Lubricating, Preservative MIL-PRF-32033</td>
<td>Lubricating oil, MIL-PRF-32033, is a skin, eye, and respiratory tract irritant. Use in a well ventilated area, especially when exposure to mist is possible. Avoid contact with skin and eyes. Wash hands thoroughly after each use. Launder contaminated clothing before reuse. Keep away from open flame, sparks, or heat. Protection: Wear chemical goggles and rubber gloves; half-mask respirator with organic vapor cartridge may be required in poorly ventilated areas, especially when misting occurs. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>24</td>
<td>Potassium Dichromate, Crystals A-A-59508</td>
<td>Potassium Dichromate Crystals, A-A-59508, are extremely destructive to the skin, eyes, and respiratory tract. Reaction with combustible or reducing agents may cause fire; smoke emits toxic fumes. Crystals are a known carcinogen. May be fatal if inhaled/ingested/absorbed through the skin. \textbf{DO NOT} use if skin is cut. \textbf{DO NOT} generate dust. Use in well ventilated area. Launder contaminated clothing before re-use. Keep container tightly closed. Store in a cool, dry place away from reducing agents; avoid storage on wood floors. Protection: Wear chemical goggles and full faceshield, and rubber gloves; appropriate protective clothing to prevent skin contact; half-mask respirator with dust cartridge required during use in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 15 minutes, lifting upper/lower eyelids occasionally, and seek medical attention. If skin contact occurs, remove contaminated clothing and shoes, wash with soap and water for 15 minutes, seek medical attention. If ingested, do not induce vomiting, give large amounts of water, and seek medical attention. If inhalation occurs, remove from area to fresh air. If breathing is difficult, give oxygen. If not breathing, give CPR. Seek medical attention immediately.</td>
</tr>
<tr>
<td>INDEX</td>
<td>MATERIAL</td>
<td>WARNING</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>25</td>
<td>Sodium Bicarbonate, Technical A-A-374</td>
<td>Sodium bicarbonate, A-A-374, is a mild eye and skin irritant. It is generally recognized as a safe food ingredient. Avoid contact with eyes and skin. Store in a dry, cool area away from acids. Protection: None normally required. If eye contact occurs, flush immediately with large amounts of water for 15 minutes. If irritation persists, seek medical attention. If skin contact occurs, wash with soap and water. If irritation persists, seek medical attention.</td>
</tr>
<tr>
<td>26</td>
<td>Solvent, Cleaning SAE AMS-3167</td>
<td>Cleaning solvent, SAE AMS-3167, is combustible, and a skin, eye, and respiratory tract irritant. Avoid contact with skin and eyes. Avoid breathing vapors. Avoid contact with strong acids, bases, or oxidizing agents. Wash hands thoroughly after each use. Launder contaminated clothing before re-use. Store in a cool, dry, well ventilated area, away from heat and other ignition sources. Keep container tightly sealed when not in use. Protection: Wear chemical goggles and rubber gloves; half-mask respirator with organic vapor cartridge required in poorly ventilated areas.</td>
</tr>
<tr>
<td>27</td>
<td>Solvent, Degreasing MIL-PRF-680 Type II and Type III</td>
<td>Degreasing solvent, MIL-PRF-680 Type II and III, is flammable, and a skin and respiratory tract irritant. Type II has a lower flashpoint (140°F) than Type III (200°F). DO NOT use near open flame, sparks or heat. DO NOT use synthetic cloths for wiping with this solvent. DO NOT smoke, eat or drink when using solvent. Avoid contact with strong oxidizing agents. Use only in well ventilated areas. Metal containers containing solvent shall be grounded to prevent sparking and fires. Avoid prolonged breathing of vapor and skin contact, which can cause dermatitis, irritated nose and throat and dizziness. Ingestion will cause gastro-intestinal irritation. Protection: Wear butyl gloves and chemical goggles; faceshield and protective clothing required when splashing is possible or expected; half-mask respirator with organic vapor cartridge required in poorly ventilated areas. If eye contact occurs, flush immediately with large amounts of water for 15 minutes and seek medical attention. If skin contact occurs, wash with soap and water, remove contaminated clothing and shoes. If ingested, give water to drink and seek medical attention. Do not induce vomiting. If inhalation occurs, remove from area to fresh air.</td>
</tr>
<tr>
<td>28</td>
<td>Talc, Technical A-A-59303 Type T1</td>
<td>Talc, Technical, A-A-59303 Type T1, is an respiratory tract irritant. Protection: None normally required. Use of dust mask is recommended when excessive dusting may occur.</td>
</tr>
</tbody>
</table>
CHAPTER 1
INTRODUCTION

SECTION I. PROCEDURES AND DOCUMENTATION

1-1. GENERAL. Prevention of aircraft deterioration is the central theme of COMNAVAIRFORINST 4790.2 (Naval Aviation Maintenance Program (NAMP)). Operational readiness and reserve stocks of sophisticated fixed and rotary wing aircraft can be seriously degraded by moisture intrusion, corrosion and physical damage.

a. Risk. The possibility of significant deterioration is increased when aircraft are inactive, during surface transport, or when poorly protected and maintained. As a general rule, tactical aircraft spend less than 40% of their time in flight. As such, their availability and sustained performance are a direct result of protective and preventative maintenance measures taken on the flight line/deck or in the hangar. If a sound preservation program is not in place, the work of repairing deterioration damage is added to the normal workload and maintenance.

b. Preservation. Protecting aircraft from ozone, ultraviolet (UV) light, wind, salt, pollution, corrosion, oxidation, mold, mildew and animals is the principal focus of this manual. This list of potential environmental dangers to naval aircraft is not all inclusive. It is influenced and continually altered by advances in technology, strategic/tactical threat and geographic location. This manual provides hands-on guidance for aircraft and component protection during non-flying periods.

c. Safety. In addition to safety concerns addressed by the NAVOSH program, OPNAVINST 5100.23, maintenance personnel need to be aware of possible incompatibilities of maintenance chemicals during use or storage. DoDINST 6050.05 and individual Material Safety Data Sheets (MSDS) provide specific important instructions concerning hazardous material. Maintenance personnel, if packaging or packing a hazardous material for shipment, shall be familiar with the pertinent safety specifications.

1-2. PURPOSE. It is the purpose of this manual to present factors which must be considered for the protection of aircraft during periods of inactivity or shipment and to provide preservation procedures that will afford this protection. Preservation instructions included herein have been tried and proven practical, necessary and adequate for protecting aircraft against deterioration. This manual is a guide to the fleet user. It shall be used as the technical base for maintenance instruction manuals (MIMs) and local instructions. This manual also offers procedural blueprints for a wide range of preservation actions. Refer to Table 1-1 for an outline of this manual.

1-3. COMPLIANCE. Just as environmental dangers to aircraft are varied and changing, preservation instructions must be responsive. Direct input from field users is solicited to ensure policy revisions stay in step with new technology, fleet requirements and user innovations. In concert with this approach, all commands, activities and organizations are encouraged to supplement this manual with local instructions within the following guidelines:

a. Local instructions shall not waive any personnel safety or safety of flight precautions.

b. Local instructions shall adhere to the basic procedures established but may amplify, clarify or tailor to local needs or circumstances. Compliance with requirements and procedures of this manual is mandatory at all times, or as mandated by applicable In Service Support Center (ISSC), for activities having reporting custody of aircraft.

c. While preservation instructions included in this manual have been proven effective in reducing or eliminating aircraft deterioration, new preservation techniques and products are continually emerging. Identification of new and better means to preserve aircraft is encouraged. However, such approaches shall not be incorporated into local instructions without prior review and approval by the manual ISSC. The standard Technical Publication Deficiency Report (TPDR) form may be used to request review and approval.

d. All approved local instructions shall be formally distributed by the cognizant Commanding Officer.
### Table 1-1. Outline of Manual

<table>
<thead>
<tr>
<th>SECTION</th>
<th>TITLE</th>
<th>BRIEF DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 1</td>
<td>Introduction</td>
<td>Introduction to preservation elements, concepts and levels. Instructions for choosing a preservation level.</td>
</tr>
<tr>
<td>Chapter 2</td>
<td>General Procedures</td>
<td>Procedures for each preservation level.</td>
</tr>
<tr>
<td>Chapter 3</td>
<td>Aircraft Systems</td>
<td>Guide for cleaning, inspecting, protecting, maintaining and depreserving on-wing aircraft systems and components.</td>
</tr>
<tr>
<td>Chapter 4</td>
<td>Removed Components</td>
<td>Protection, storage and shipment of removed components and parts in repair, including engine canning.</td>
</tr>
<tr>
<td>Chapter 5</td>
<td>Barrier Systems</td>
<td>Application, repair and maintenance of barrier systems, including rigid shelter, drop shroud, flexible bag, top cover, strippable coating, tape and barrier (T&amp;B), and shrinkwrap.</td>
</tr>
<tr>
<td>Chapter 6</td>
<td>Environmental Control</td>
<td>Application, repair and maintenance of environmental systems; static dehumidification and dynamic dehumidification.</td>
</tr>
<tr>
<td>Chapter 7</td>
<td>Aircraft Securing and Shipment</td>
<td>Securing, and land, ocean, and air shipment of aircraft.</td>
</tr>
<tr>
<td>Chapter 8</td>
<td>Guidelines</td>
<td>Cleaning, inspection, corrosion control, and protection guidelines for aircraft. Includes ordering information for commonly used preservation materials.</td>
</tr>
<tr>
<td>Appendix A</td>
<td>Related Publications,</td>
<td>Listing of related technical data for preservation operations.</td>
</tr>
<tr>
<td></td>
<td>Specifications, Standards, and Instructions</td>
<td></td>
</tr>
<tr>
<td>Appendix B</td>
<td>Acronyms</td>
<td>List of acronyms used in this publication.</td>
</tr>
<tr>
<td>Glossary</td>
<td>Glossary</td>
<td>Definition of terms used in this publication.</td>
</tr>
</tbody>
</table>

### 1-4. SCOPE. **This manual establishes the minimum acceptable standards for fixed and rotary wing aircraft preservation, storage and depreservation to ensure satisfactory protection from deterioration. It establishes related procedures for aircraft cleaning, inspection, corrosion control, protection and depreservation. It is applicable to all active and reserve Navy and Marine Corps organizations and to all Navy/Marine aircraft preserved by other military departments, government agencies or contracted activities. Any request for a waiver to procedures herein shall be granted, in writing, by the preservation ISSC and the aircraft ISSC. Procedures are applicable to all levels of maintenance (Organizational, Intermediate and Depot) as well as to special maintenance activities, contracted operations, joint service and multinational operations.**

### 1-5. PROCEDURAL DUPLICATION. **It is not intended that the requirements of this manual cause duplication or repetition of work. However, when any preservation or preservation maintenance procedure of this manual has been directed by an aircraft MIM, it shall be performed in accordance with the aircraft MIM and be appropriately documented in the preservation work records. In case of conflict, contact the aircraft ISSC or preservation ISSC for clarification.**

### 1-6. REFERENCES. References are supporting technical publications which have a direct bearing on the preservation procedures. Whenever appropriate, details from these supporting technical instructions have been included in the text, but no attempt has been made to duplicate all related information. Local conditions may prevent complete compliance with all the details of procedures specified in supporting publications. In no case, however, shall the intent of such instructions be ignored or omitted without approval from the ISSC for the aircraft or component. See Appendix A for a listing of related technical instructions.**
1-7. RECORDS/LOGBOOKS/WORK DIRECTIVES. Complete entries in aircraft processing records or logbooks shall include, at the very least, the aircraft model and serial number, type of preservation, date and activity. The log is a primary record, and information contained in it should be considered the most reliable in case of conflict between records. Proper log entries provide a valuable source of information for use in the technical evaluation of various preservation procedures. Appropriate aircraft and engine log entries shall be made upon completion of preservation or depreservation. Preservation, represervation and depreservation entries shall be made in the Preservation/Depreservation Record, form CNAF 4790/136A (see Figure 1-1 and Table 1-2), in the aircraft and engine logbooks, for aircraft with hardcopy logbooks, or in the NALCOMIS OMA Logs and Records Subsystem of the NALCOMIS database. COMNAVAIRFORINST 4790.2 shall be complied with when making entries in aircraft and engine logs. If any system or component is not depreserved or is partially depreserved and affected aircraft are transferred to another activity, an appropriate log entry shall be made.

a. Immediately upon receipt, all aircraft shall be inspected for preservation discrepancies and log entries shall be reviewed. Action shall be taken to schedule the initial preservation work and to arrange for a periodic inspection and preservation maintenance requirement. Activities which receive improperly preserved or damaged aircraft, incorrectly or incompletely executed logbooks, or faulty inventory records shall report discrepancies in accordance with COMNAVAIRFORINST 4790.2.

b. An organized method of recording preservation inspections and maintenance actions shall be established by each activity. This record may take the form of placards, work directives, check sheets, tags, or other local records. Inspection and preservation maintenance records shall be kept legible and retained for reference until the aircraft is represerved for another storage cycle or transferred to another activity.

c. Preservation work directives shall be issued promptly, and shall specify the type of preservation required for both the airframe and engine. The initial preservation or correction of preservation discrepancies shall be accomplished as soon as practical. In all cases, the work shall be initiated within five days after receipt of the aircraft. Application of the preservation methods of this manual shall be a continuous process up to and including final external sealing or covering and tying down. In no case shall in-process time for Levels II or III preservation exceed 30 calendar days.

1-8. PRESERVATION CHECK LISTS. Locally developed check lists shall be prepared and used by all activities when preserving aircraft. Check lists shall be complete enough to ensure quality conformance to the procedures of this manual, and an individual list shall be made a part of the local processing records for each preserved aircraft. A sample check list is shown in Figure 1-2.

1-9. DEPRESERVATION CHECK LISTS. Since detailed preservation procedures will vary somewhat with type and configuration of aircraft, it is important that receiving activities be apprised of any items requiring special attention during depreservation. Each preserving activity shall develop a depreservation check list for each aircraft model and include a copy of this list with each aircraft preserved for shipment. This depreservation check list shall be inserted in a suitable waterproof package and placed in the cockpit in a conspicuous location. Refer to Chapters 2 and 3 for depreservation requirements.

1-10. ENGINE PRESERVATION. Instructions for preservation of power plants are contained in Chapter 3 (on-wing) and Chapter 4 (removed).

1-11. USE. The principal users of this manual are Fleet Maintenance Personnel, Preservation Engineers, Contractors, Aircraft Program Managers and appropriate Navy Schools. This manual shall be used as a reference in the development of MIMs, local supplements, directives, standard operating procedures (SOPS), Local Engineering Directives (LEDs), and instructions. This manual shall be the primary reference for technical or procedural matters addressing the preservation of naval aircraft, aircraft engines and components.

a. Supporting Publications. Appendix A lists publications that supplement this manual and which shall be fully complied with unless otherwise specified herein.

b. Refer to COMNAVAIRFORINST 4790.2 TPDR instructions and procedures. TPDRs are filed electronically via the Joint Deficiency Reporting System (JDRS) website (https://jdrs.mil).
1-12. REQUISITIONING AND AUTOMATIC DISTRIBUTION.

a. Procedures to be used by Naval activities and other Department of Defense activities requiring NAVAIR technical manuals are defined in NAVAIR 00-25-100.

b. Electronic copies of this manual, including IRACs and validated TPDRs, are available on the NATEC website (https://mynatec.navair.navy.mil/).

c. To automatically receive future changes and revisions to NAVAIR technical manuals, an activity must be established on the Automatic Distribution Requirements List (ADRL) maintained by the Naval Air Technical Data and Engineering Service Command (NATEC). To become established on the ADRL, notify your activity central technical publications librarian. If your activity does not have a library, you may establish your automatic distribution requirements by contacting the Commanding Officer, NATEC, Naval Air Station North Island, P.O. Box 357031, Bldg. 90 Distribution, San Diego, CA 92135-7031. Annual reconfirmation of these requirements is necessary to remain on automatic distribution. Use your NATEC assigned account number whenever referring to automatic distribution requirements.
The CNAF 4790/136A (Figure 1-1) is used to record information on the preservation status of aircraft, engines or related equipment. These forms are compiled in the aircraft logbook and the Aeronautical Equipment Service Record (AESR). An entry is required anytime preservation, depreservation, or represervation occurs. For additional information, refer to COMNAVAIRFORINST 4790.2.

<table>
<thead>
<tr>
<th>BLOCK</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aircraft Model or Equipment Name Enter the aircraft T/M/S or the equipment nomenclature; e.g. &quot;F/A-18D ACFT&quot; or &quot;ACFT Engine&quot;.</td>
</tr>
<tr>
<td>2</td>
<td>Type/Model/Series If aircraft leave blank, or if equipment enter Part Number; e.g. &quot;F404-GE-400&quot;.</td>
</tr>
<tr>
<td>3</td>
<td>BUN0 or Serial Number Enter the aircraft BUN0 or the equipment serial number; e.g. &quot;164725&quot; or &quot;310334&quot;.</td>
</tr>
<tr>
<td>4</td>
<td>Preservation</td>
</tr>
<tr>
<td>4a</td>
<td>Date Enter the day/month/year the preservation was accomplished; e.g. &quot;5 JUN 13&quot;.</td>
</tr>
<tr>
<td>4b</td>
<td>By (Activity) Enter short title of the activity accomplishing the preservation; e.g. &quot;VFA-25&quot;.</td>
</tr>
<tr>
<td>4c</td>
<td>Type Preservation Enter the level of preservation; e.g. &quot;Level I&quot;.</td>
</tr>
<tr>
<td>4d</td>
<td>Reference Identify the NAVAIR manual or the major command document directing the preservation; e.g. &quot;NAVAIR 15-01-500&quot;.</td>
</tr>
<tr>
<td>5</td>
<td>Represerve</td>
</tr>
<tr>
<td>5a</td>
<td>Date Due Indicate the day/month/year the represervation is due; e.g. &quot;25 AUG 13&quot;. When represervation is not required (dehumidified storage), leave blank.</td>
</tr>
<tr>
<td>6</td>
<td>Depreservation</td>
</tr>
<tr>
<td>6a</td>
<td>Date Enter the day/month/year the depreservation was accomplished; e.g. &quot;24 AUG 13&quot;.</td>
</tr>
<tr>
<td>6b</td>
<td>By (Activity) Enter the short title of the activity accomplishing the depreservation; e.g. &quot;VFA-25&quot;.</td>
</tr>
</tbody>
</table>

d. If additional or replacement paper copies of this manual are required with no attendant changes in the ADRL, they may be ordered by submitting requisitions to the Commanding Officer, Naval Supply Systems Command, Naval Logistics Library, 5801 Tabor Avenue, Philadelphia, PA 19120-5099, or via the website (https://nll.ahf.nmci.navy.mil/).

1-13. WARNINGS AND CAUTIONS APPLICABLE TO HAZARDOUS MATERIAL. Warnings and cautions for hazardous materials listed in this manual are designed to apprise personnel of hazards associated with such items when they come in contact with them by actual use. Consult your local health and safety office and the appropriate MSDS concerning specific personal protective equipment requirements. Additional information related to hazardous materials is provided in OPNAVINST 5100.23, Navy Occupational Safety and Health (NAVOSH) Program Manual, and DoDINST 6050.05, DoD Hazard Communication (HAZCOM) Program.
PRESERVATION CHECKSHEET
ROTODOME STORAGE

Part Number: _____________________  Location: _____________________
Serial Number: ___________________

Condition:  
☐ Assembled Rotodome  
☐ Disassembled Rotodome, 14 days or less  
☐ Disassembled Rotodome, more than 14 days

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>CERTIFY</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Initial preservation</td>
</tr>
</tbody>
</table>

INspections/Actions REQUIRED
Inspect the stored rotodome and record the Date, Time, and Certify the entry. In the Remarks column enter type of inspections (7 day, 28 day, etc.) and rotodome condition, abnormalities or corrective actions (such as "Preservation intact", "Corrosion found", "Barrier material repaired").

- **Every 7 days:** Inspect for corrosion, integrity of barrier material and coating. Repair as necessary.
- **Every 28 days:** Remove and replace desiccant, MIL-D-3464 Type I.
- **Every 84 days:** Remove and replace shaft preservative, MIL-PRF-16173 Grade 2.
- **High wind or rain conditions:** Check integrity of barrier material. Repair as necessary.

Figure 1-2. Preservation Checklist Example
SECTION II. PRESERVATION THEORY

1-14. GENERAL. The increasing complexity of aircraft structural design and materials has resulted in an increased potential for significant deterioration when aircraft are idle or inactive. The amount and degree of deterioration depends on the aircraft design, the climatic and operational conditions, the choice of materials, the surface protection provided, and the type of preventive maintenance. In addition, physical damage during handling, shipping, maintenance, and storage operations should be recognized and addressed. Appropriate action needs to be taken to properly protect nonoperational aircraft.

1-15. DEGRADATION. In order to establish effective preventative measures against aircraft deterioration, a general knowledge of likely problem areas is essential. Table 1-3 highlights some common causes for the deterioration of materials used in modern aircraft.

1-16. PREVENTION OF DAMAGE. Effective protection from physical damage is primarily achieved through command education and training programs which reinforce the common sense use of reasonable care when handling aircraft. This effort is a direct chain of command function. Fleet, civilian and contractor personnel shall be knowledgeable in the following areas to avoid preventable physical damage:

a. Job Responsibilities. All operations concerning the aircraft or systems shall be accomplished with clear delineation of responsibilities in accordance with established standard operating procedures (SOPs) and checklists. Maintenance and ground handling personnel shall be aware of their duties and how they interface with the duties of others. Supervisory personnel shall be experienced and skilled in the tasks of their subordinates.

b. Use of Required Equipment. Detailed instructions on the use of aircraft support equipment coupled with hands-on experience in slinging, tiedown, covering, jury strut placement, use of jack pads, and placement of dunnage will enable support personnel to safely service and handle the aircraft and aircraft systems. Lack of this information and training can directly result in physical damage to aircraft or system components, and injury to personnel.

c. Aircraft Care. Surface movement of aircraft, observance of no-step precautions, proper use and care of tools, and the peculiar sensitivities of composite structures are specific areas where particular care shall be exercised to preserve structural integrity of aircraft. In addition, care shall be taken during line movement of aircraft with tugs and operations during inclement weather (snow, ice, rain, high winds, electrical storms), the storage of alloy/composite panels, doors and covers, the maintenance handling of aircraft, and the use of tapes, pads, and barrier materials. Routine operations, as well as precautions to be observed during emergencies, are but a few of the situations which shall be regularly addressed.

d. Sources of Technical Assistance. Maintenance, operational and ground handling personnel shall be trained to know where additional information can be found. MRCs, technical libraries, SOPs, MIMs, directives, local bulletins, past inspection, safety announcements, chain of command, and ISSC engineering are some sources of information and assistance.

e. Procedural Rationale. The cost of repair, personnel injuries, and the operational impact of lost flight capability due to physical damage are strong incentives for personnel to follow established procedures. Aircraft integrity is the product of a sound understanding of the cause and effect of specific maintenance actions.

f. Skill Improvement. Training need not be complex or elaborate. Training shall be relevant and specific to the task. The use of hands-on instruction is preferred. Training videos may also be used. The ISSC (aircraft or preservation) and TYCOMS are available to assist local supervisors and commanders with information and points of contact in support of command information and training programs. Training shall be continuous and interactive among peers, subordinates and superiors to reinforce performance.

1-17. ENVIRONMENTAL DETERIORATION. Environmental deterioration may be found in many forms (refer to Table 1-3). Materials exposed to moisture, dirt and sunlight tend to degrade. For a more complete discussion of environmental effects on aerospace materials, refer to NAVAIR 01-1A-509-1, Cleaning and Corrosion Control - Corrosion Theory.

a. Corrosion. Corrosion is the most common form of environmental deterioration and often is the most damaging. All aerospace metals will corrode (oxidize), whether the aircraft is idle or operating, when exposed to a corrosive environment. Corrosion is the result of
a chemical and/or an electrochemical reaction of an exposed metal surface. The red rust on steel, the blue-green tarnish on copper and the white-to-gray oxide on aluminum or magnesium are all products of corrosion. The corrosive action may progress uniformly across the surface or it may follow the grain boundaries into the material cross-section, creating pits or internal cracking. The rate of attack can vary from metal to metal. Corrosion may proceed slowly, virtually unnoticed, or it may initiate and grow quickly.

(1) Chemical Attack. The metal can be chemically broken down and oxidized by a corrosive liquid or gas. Contaminants on the metal surface (dirt, salt, exhaust gases, urine) pick up moisture from the air and can activate and feed the degradation process.

(2) Galvanic Attack. The metal can corrode from the coupling of dissimilar metals, an anodic metal and a cathodic metal, such as magnesium and steel. Refer to Figure 1-3 for the rankings of some metals based on their relative corrosion potential. The couple must be linked by a liquid or vapor medium, usually water or humidity, for corrosion to occur. Galvanic corrosion is differentiated from a chemical attack by the presence of corrosion buildup at a metal/metal joint.

1-18. STANDARD PROCEDURES. Environmental deterioration of aircraft and aircraft systems is a never ending problem for maintenance personnel. Preservation coupled with corrosion control is the method used to slow, defer or even stop this deterioration. When attempting to define a preservation program, it is necessary to identify all of the basic procedures that must be performed on aircraft and their systems. The level of preservation is a decision that a planner, maintenance officer or Commanding Officer makes based on the criteria described in Section III of this chapter. No matter what level is chosen, the stages are the same. A summary of those stages are as follows:

a. Cleaning. In order to properly evaluate, repair and protect an aircraft or aircraft system, it must be thoroughly cleaned. The cleaning operation chosen for an aircraft or system must remove soils, oils, and corrosive deposits without causing further deterioration. The surfaces must be adequately clean for all visual and physical examinations, and for the subsequent application of the preservation system.

b. Inspection. After a thorough cleaning has been accomplished, all areas of the aircraft must be inspected for evidence of corrosion or other deterioration. Detailed inspections are to be made and all discrepancies are to be recorded regardless of the intent to repair. This will allow for an accurate assessment of the preservation process at the end of the preservation cycle.

c. Corrosion Control. After cleaning and inspection, it may be necessary to remove corrosion damage. Refer to the corrosion control manual, NAVAIR 01-1A-509-2 and aircraft or component MIMs for instructions.

d. Protection. After cleaning, inspecting and controlling corrosion, the aircraft and aircraft systems must be chemically and physically protected.

(1) Chemical protection involves the use of corrosion preventative compounds (CPCs), lubricants

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>TYPE OF DETERIORATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals</td>
<td>Corrosion from stack gases, exhaust from engines, guns, rockets</td>
</tr>
<tr>
<td></td>
<td>Corrosion from moisture</td>
</tr>
<tr>
<td></td>
<td>Physical deterioration from age-hardening, cyclic, sustained or extreme stress, and/or temperature</td>
</tr>
<tr>
<td>Composites</td>
<td>Disbonding, cracking, crazing or corrosion caused by water or contaminate intrusion</td>
</tr>
<tr>
<td></td>
<td>Physical deterioration by ultraviolet light and heat</td>
</tr>
<tr>
<td>Plastics</td>
<td>Physical deterioration due to ultraviolet light, heat, exposure to solvent vapors, microorganisms, and stress</td>
</tr>
<tr>
<td>Rubber and other Elastomers</td>
<td>Oxidation, drying and vulcanization (hardening) from exposure to micro-organisms, temperature extremes, sustained stress, ultraviolet light and ozone</td>
</tr>
<tr>
<td>Fabrics</td>
<td>Rot and decay from microorganisms</td>
</tr>
<tr>
<td></td>
<td>Excessive moisture, heat and/or drying</td>
</tr>
</tbody>
</table>

Table 1-3. Deterioration of Aircraft Materials
and vapor corrosion inhibitors (VCIs). These materials are applied directly to surfaces, pivots, unprotected bare metal, gas paths, fuel systems and so forth. CPCs or preservatives are used to protect metal aircraft parts and components from corrosion on a temporary basis. Refer to Chapter 8 for additional information.

(2) Physical protection involves the use of a variety of materials and techniques as dictated by the level of preservation chosen. The levels are described in detail in Section III of this chapter. Chapter 5 describes the different types of barrier methods, and Chapter 6 provides information on dehumidification. Chapter 7 contains special requirements for protection during aircraft shipment.

e. Maintenance. The level of preservation chosen for a particular aircraft or component will be suitable only if the protection system is properly maintained. A check list shall be developed for periodic maintenance integrity inspections. Maintenance personnel shall look for torn or missing barriers, depleted CPCs, discolored humidity indicators, evidence of new corrosion damage, fluid contamination, water intrusion and so on. If discrepancies are noted, corrective action shall be taken immediately.

f. Placement. The preserved aircraft shall be placed in an area where it is afforded the maximum amount of protection but is still accessible for maintenance inspections. If possible, the aircraft should be stored inside of a hangar or rigid shelter. If the aircraft must be stored outside, it should be placed in a wind protected area. Storing aircraft adjacent to seawalls is not recommended. Accessible electrical power, grounding points and tiedowns are required for outside storage.

g. Logs and Records. Records shall be maintained in accordance with COMNAVAIRFORINST 4790.2 to document the history of the preserved aircraft or aircraft systems. Records shall contain the pre-preservation inspection data, the periodic maintenance inspections, all corrective actions taken, unusual weather activity and any other event that violated the preservation integrity (either accidentally or intentionally). This data is vital in evaluating the effectiveness of a preservation cycle. Refer to Section I of this chapter for more information on record keeping.

h. Depreservation. Depreservation is required upon the completion of a preservation cycle. Depreservation includes the complete removal of the protective system followed by cleaning, inspection and corrosion control operations. All aircraft systems shall be serviced, checked and made operational in accordance with applicable MIMs and MRCs before returning to service.

i. Represervation. When an aircraft has reached its storage time limitation and still requires protection, it shall be represerved. Represervation involves depreservation of the aircraft and the application of a new protective system. Represervation is a complete renewal of the preservation system and begins a new preservation cycle.
SECTION III. CHOOSING A PRESERVATION LEVEL

1-19. GENERAL. Because of the complexity of Naval Aviation assets, a variety of methods have been developed to preserve aircraft. Levels I, II and III designate the different types of preservation. Each level of preservation relates directly to the type of barrier system used and the degree of protection it affords the aircraft and system or component. Certain minimum operations are required for each level of preservation. Refer to Table 1-4 for preservation level designation and time limitations.

1-20. PRESERVED AIRCRAFT/COMPONENTS. An aircraft, aircraft system or component shall be preserved in accordance with this manual if, due to repair, system failure, or parts removal its nonuse is anticipated for an extended period of time. In accordance with COMNAVAIRFORINST 4790.2, an aircraft may be preserved at any time, regardless of material condition reporting status, when it is determined to be in the best interest of the aircraft or activity. In general, it is recommended that an aircraft, aircraft engine, or aircraft component be preserved when nonuse is anticipated to be longer than 14 days. All scheduled special inspections shall be performed on aircraft not in preservation. For aircraft placed in preservation, all scheduled special inspections may be deferred. For aircraft placed in Level III preservation, all corrosion related special inspections, as identified by the aircraft ISSC, may be waived. Because aircraft protection is an ongoing process, regardless of the aircraft status, aircraft not requiring preservation shall be maintained at all times in a manner which will prevent deterioration, and ensure correction of minor discrepancies before they become major problems. This includes normal line maintenance of the aircraft, appropriate cleaning and corrosion control in accordance with NAVAIR 01-1A-509-2, and protecting/maintaining the aircraft in accordance with the appropriate MRCs. MRCs include all calendar sensitive maintenance actions required to prevent deterioration of all systems and equipment during all periods of inactivity.

1-21. LEVEL I PRESERVATION. This preservation level is recommended for short term protection (90 days or less) and is the baseline for all subsequent preservation levels. This level is used for maintenance work in process, work awaiting parts, and any other short term condition for aircraft remaining idle. Refer to Chapter 3 for specific preservation instructions. The following are examples of the procedures required for Level I preservation.

a. Systems Preservation.
   (1) Airframe. Maintain operational.
   (2) Armament. Maintain operational.
   (3) Electrical. Maintain operational.
   (4) Fuel. Maintain fully fueled in accordance with aircraft MIMs.
   (5) Hydraulic. Inspect for water and contamination intrusion.
   (6) Instruments. Maintain operational.
   (7) Lubrication. Inspect for water and contamination intrusion. Replace accordingly.
   (8) Mechanical. Apply lubrication and CPCs.
   (9) Photographic. Maintain operational.
   (10) Pneumatic. Inspect for water intrusion and replace nitrogen.
   (11) Oxygen. Remove bottles or converters if pressure drops below 10 psig.
   (12) Safety. Make safe.

b. Barrier System. Barrier material held in place with tape for protection of selected surfaces and cover openings. Refer to Chapter 5.

c. Record Keeping. Maintain required records in accordance with Chapter 3 in addition to recording periodic maintenance inspections.

1-22. LEVEL II PRESERVATION. This level removes selected systems from operational condition and preserves them for a storage period up to 1 year. This level is also used for aircraft shipment. Level II preservation requires the static dehumidification of selected systems. Refer to Chapter 3 for specific aircraft system preservation instructions. Refer to Chapter 4 for removed components requirements. The following are examples of the procedures, in addition to those of Level I, required for Level II preservation.
a. **Systems Preservation.**

1. Armament. Remove ordnance in accordance with MIMs.


b. **Barrier System.** Refer to Chapter 5.

1. Top Cover. Aircraft/component specific polymer fabric cover used to protect against rain and direct ultraviolet light (UV) down to the drip line.

2. Tape and Barrier. Barrier material held in place with tape for protection of selected surfaces.

3. Strippable Coating. Spray-on strippable coatings, seal entire aircraft or selected surfaces down to the drip line (for shipment only).

4. Shrinkwrap. Low density polyethylene film is used to loosely enclose the entire aircraft and then shrunk to a tight fit with a propane heat gun (for shipment only).

c. **Record Keeping.** Maintain required records in accordance with Chapter 3 or 4 in addition to recording periodic maintenance inspections.

---

### Table 1-4. Preservation Level Designations

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>TIME LIMIT</th>
<th>BARRIER SYSTEM</th>
<th>DESIGNATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>I</td>
<td>Tape and Barrier</td>
<td>I - T &amp; B</td>
</tr>
<tr>
<td>Level II</td>
<td>II</td>
<td>Tape and Barrier</td>
<td>II - T &amp; B</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>Top Cover</td>
<td>II - TOP</td>
</tr>
<tr>
<td>Level II (Shipment)</td>
<td>II</td>
<td>Shrinkwrap</td>
<td>II - SHRK</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>Strippable Coating</td>
<td>II - STRP</td>
</tr>
<tr>
<td>Level III</td>
<td>III</td>
<td>Rigid Shelter</td>
<td>III - RIG</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>Flexible Bag</td>
<td>III - BAG</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>Drop Shroud</td>
<td>III - SHRD</td>
</tr>
</tbody>
</table>

**NOTES:**

Time limits for Level I and II are ± 3 days.
Time limits for Level III are dependent on barrier material life limit.

---

1-23. **LEVEL III PRESERVATION.** This is the highest level of aircraft and aircraft system preservation. It affords the best protection for an indefinite period of time. Although the initial cost is high, the long term cost savings are enormous. Once established, this level allows for short, intermediate and long term storage as well as in-work or depot level storage. Level III preservation requires the dehumidification of the entire aircraft or removed component.

a. **Systems Preservation.** Dynamically or statically maintain the environment surrounding a preserved aircraft or removed aircraft system/component at a relative humidity between 30-40% (refer to Chapter 6).

b. **Barrier System.** Refer to Chapter 5.


2. Drop Shroud. Polymer enclosure freestanding or suspended inside a hangar or rigid shelter.

3. Flexible Bag. Tough, polymer sheeting fashioned into a conformable, resealable bag customized for each aircraft or aircraft system/component.

c. **Record Keeping.** Maintain required records in accordance with Chapter 3 or 4 in addition to recording periodic maintenance inspections, and barrier atmosphere relative humidity, as specified in Chapter 6.

1-24. **LEVEL IV PRESERVATION.** Level IV is an umbrella preservation status for aircraft undergoing depot-level repair. Instead of preserving the entire aircraft in one level of preservation, systems and components may be in various levels of preservation dependent on the requirements of the repair cycle. Refer to Chapter 2 for additional information.

1-25. **DESERT STORAGE.** When the decision is made to remove an aircraft from active service, it may be placed in desert storage with the Aerospace Maintenance and Regeneration Group (AMARG) located at Davis Monthan Air Force Base, Arizona. Table 1-5 lists the AMARG preservation type designations. This type of storage is not recommended for aircraft intended to be reintroduced back into the fleet.
Table 1-5. AMARG Preservation Type Designation

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>Selected areas preserved with strippable coating (4 year represervation).</td>
</tr>
<tr>
<td>1500</td>
<td>Type 1000 with 4 year represervation waived.</td>
</tr>
<tr>
<td>2000</td>
<td>Selected system/parts preserved, airframe unprotected.</td>
</tr>
<tr>
<td>3000</td>
<td>45 day hold in active flying status during which preservation process is accomplished.</td>
</tr>
<tr>
<td>4000</td>
<td>Designated to have selected parts/systems removed before disposal or reclamation.</td>
</tr>
</tbody>
</table>

1-26. SELECTING A PRESERVATION LEVEL.

a. Preservation Level Comparison. The cost of preservation can be deceiving. The higher costs during storage are those from corrosion (deterioration) and maintenance. With this in mind, Levels I and II require relatively low initial costs but offer the least protection for the aircraft systems. The result is high corrosion and maintenance costs. In contrast, these costs are significantly lower for Level III. It is the most cost effective preservation method in spite of its high initial cost. The other two levels, however, do offer certain advantages when budget and time restrictions are considerations.

b. When selecting a preservation level, the following factors should be considered:

(1) Length of time the aircraft is to be inactive.

(2) The environment in which the aircraft is to be held or stored.

(3) The ultimate disposition of the aircraft.

c. Table 1-6 correlates aircraft status with the recommended preservation level. This table assists the planner in making a sound decision based on economics and the required protection.

d. Table 1-7 provides a comparison of the advantages and disadvantages of the various barrier systems.

1-27. ECONOMICS. Each preservation method is limited in the degree of protection it can provide a weapon system. Therefore, the total cost of preservation must include the cost of aircraft or aircraft component deterioration as well as the initial setup costs. In addition, high recurring maintenance costs can eliminate a preservation method from consideration even though initial costs are low. For example, the cost to preserve a fighter aircraft in Level II preservation is initially low, as seen in Figure 1-4. However, as a long term means of preservation the cost can be much higher (due to maintenance) than that of Level III preservation. Also, this does not reflect the deterioration cost, which is relatively high for Level II preservation. The efficiency of a good preservation program for a specific airframe and aircraft system is time dependent. The longer an aircraft is in preservation, the more advantageous Level III preservation becomes. Based on deterioration and maintenance costs, the cost savings from a preservation program’s reliability and effectiveness can usually justify high initial costs.

a. Preservation Costs. Elements of the total cost to preserve, maintain and depreserve aircraft systems are listed below:

(1) Equipment. Includes environmental barriers, environmental control equipment, tiedown cables, grounding cables, chocks.

(2) Site Preparation. Includes surface preparation, and the installation of an electrical supply, pad eyes, security fences.

(3) Preservation. Includes all phases of preservation, making aircraft safe, inspection, component removal, environmental control system installation, placement of aircraft.

(4) Maintenance. Includes the upkeep of the barrier system, environmental systems, aircraft system individually preserved, security.

(5) Corrosion Control. Includes removal of all corrosion products initiated or intensified during the preservation cycle, replacement of corroded components, the application of temporary protection.
(6) Depreservation. Includes the removal of the environmental barrier and preparation of all systems for flight or represervation.

(7) Represervation. Includes removal and renewal of all preservation material in place.

b. Deterioration Costs.

(1) Levels I and II. Level I protects the least. Level II provides additional protection. Neither should be chosen as a preservation method for aircraft to be stored or parked in a tropical or marine environment; water can easily be trapped between the barrier material and the aircraft skin. These levels require disciplined maintenance, inspection, and represervation programs.

(2) Level III. This level offers the best protection against corrosion and physical damage. Level III preservation requires the dehumidification of the entire aircraft or removed component, reducing the maintenance and represervation actions necessary to sustain preservation. According to COMNAVAIRFORINST 4790.2, Level III is the preferred method of preservation. Figure 1-5 shows dehumidified storage of line aircraft.

(3) Desert Storage. This method, over time, is the most costly. Aircraft are exposed to the elements and to the potential for cannibalization of aircraft parts. Although the initial cost for storing aircraft in the desert is low, the storage deterioration and the cost of post-storage reactivation of the aircraft and aircraft systems are both undesirable. This option is only recommended for stricken aircraft or aircraft that are not to be reintroduced into the fleet.
<table>
<thead>
<tr>
<th>AIRCRAFT CATEGORY</th>
<th>PRESERVATION LEVELS</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T &amp; B</td>
<td>TOP/T &amp; B</td>
<td>SHRK/STRP</td>
<td>RIG</td>
</tr>
<tr>
<td>OPERATIONAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awaiting Disposition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backup Aircraft/Stand-down</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannibalized</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipment, Ocean/Land/Air</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repair/Hangar Queen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIPELINE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conversion in Lieu of Procurement (CILOP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depot Level</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>INACTIVE PROGRAM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Delivery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grounded Admin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Life Not Complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NONPROGRAM AIRCRAFT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bailment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Life Complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target Drone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobilization Reserve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STRICKEN AIRCRAFT (AMARG may be considered)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future Part Removal</td>
<td></td>
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<tr>
<td>Foreign Military Sales (FMS)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Immediate Disposal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1-6. Recommended Preservation Level
### Table 1-7. Barrier System Comparison Chart

<table>
<thead>
<tr>
<th>CONSIDERATIONS</th>
<th>Rigid Shelter</th>
<th>Drop Shrouds</th>
<th>Flexible Bags</th>
<th>Top Cover</th>
<th>Shrinkwrap</th>
<th>Strippable Coating</th>
<th>Tape &amp; Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessible for Part Removal</td>
<td>Yes</td>
<td>Yes</td>
<td>Limited</td>
<td>Yes</td>
<td>Yes</td>
<td>Limited</td>
<td>Yes</td>
</tr>
<tr>
<td>Application Sensitive</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Circulation Around Aircraft</td>
<td>Yes</td>
<td>Yes</td>
<td>Limited</td>
<td>Majority</td>
<td>No</td>
<td>No</td>
<td>Majority</td>
</tr>
<tr>
<td>Chaffs Aircraft</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, when removed</td>
<td>Yes, when removed</td>
</tr>
<tr>
<td>Dehumidified</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Possible</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Deterioration During Storage</td>
<td>Light</td>
<td>Light</td>
<td>Light</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Heavy</td>
</tr>
<tr>
<td>Extra Space for Component Storage</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Footprint (1 = aircraft)</td>
<td>&gt;1/1</td>
<td>&gt;1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
</tr>
<tr>
<td>Maintenance Reduction (from Level I)</td>
<td>90%</td>
<td>90%</td>
<td>80%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Material Life</td>
<td>10-20 years</td>
<td>15 years</td>
<td>5-8 years</td>
<td>5-8 years</td>
<td>1 year</td>
<td>3 years</td>
<td>90 days</td>
</tr>
<tr>
<td>Portability</td>
<td>Limited</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Preservation Procedure Reduction (from Level I)</td>
<td>30%</td>
<td>30%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Reusable</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Secure</td>
<td>Yes</td>
<td>No</td>
<td>Moderate</td>
<td>No</td>
<td>No</td>
<td>Moderate</td>
<td>No</td>
</tr>
<tr>
<td>Shipping Protection</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>Limited</td>
<td>Limited</td>
<td>Limited</td>
<td>N/A</td>
</tr>
<tr>
<td>Time Required to Remove Aircraft from Preservation</td>
<td>0.3 hour</td>
<td>0.3 hour</td>
<td>12 hours</td>
<td>2 hours</td>
<td>2 hours</td>
<td>16 hours</td>
<td>12 hours</td>
</tr>
<tr>
<td>Traps Water</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Type/Model/Series Sensitive</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Figure 1-4. Storage Costs

Storage Costs* - 20 Aircraft for 5 Years

*Does not include costs for repairs due to deterioration

Dollars (in Millions)

Preservation/Depreservation
Periodic Maintenance/Utilities
Equipment/Materials
Site Preparation

Dehumidified Shelter (Level III) Dehumidified Bags (Level III) Top Cover (Level II) AMARG (Level II)

Figure 1-5. Dehumidified Storage Line of Aircraft in Flexible Bags
CHAPTER 2
GENERAL PROCEDURES

SECTION I. INTRODUCTION

2-1. INTRODUCTION. This chapter contains step-by-step procedures for the levels of preservation, and discusses the special preservation issues of depot level maintenance and aircraft shipment. Select the level of preservation from Chapter 1, then follow the guidelines outlined in the following sections of this chapter. This chapter emphasizes maintenance of the preservation levels. Aircraft cleaning and preservation procedures can be found in the level maintenance procedures sections of Chapter 3. Component preservation procedures are found in Chapter 4. A summary of how each aircraft system is preserved at each level can be found in Table 2-1.

2-2. LEVEL I. Level I is the most basic preservation. Systems are kept clean and free of water, and fluids are maintained full. The barrier system used is tape and barrier (T&B). Short term preservation procedures are usually found in the MRCs for each model aircraft. The instructions in this section do not replace those in the MRCs. Aircraft may be maintained in Level I preservation for a maximum of 90 days.

2-3. LEVEL II. Level II is similar to Level I. Aircraft systems are kept clean, and operational fluid levels are maintained full. In addition, selected systems are drained of operational fluid, protected with a coating of preservation fluid, and statically dehumidified. Of all the selected systems, preservation of the fuel system and power plant system are the most significant. Level II barrier systems include T&B, top covers, shrinkwrap, and strippable coatings. Level II preservation provides minimum protection for up to one year.

2-4. LEVEL III. Level III preservation adds static or dynamic dehumidification, of the entire aircraft or component, to Level II requirements. Level III barrier systems include portable shelters, drop shrouds, flexible bags, and permanent environmentally controlled facilities/rigid shelters. Level III preservation provides optimum protection for an indefinite period of time.

2-5. LEVEL IV. Level IV preservation is used as an umbrella term to designate the partial preservation of aircraft undergoing depot level maintenance actions. The aircraft systems and components are preserved to the maximum extent possible; however, systems and components may be in various levels (Level I, II or III) of preservation.

2-6. SHIPMENT. Aircraft and removed aircraft components to be shipped must be protected in accordance with the requirements for Level II or Level III preservation. When aircraft or components require shipment, follow the instructions in Chapters 4 and 7. Shipment barrier systems include T&B, top covers, strippable coatings, shrinkwrap, and flexible bags.
Table 2-1. Summary of Aircraft System Preservation for Each Level

<table>
<thead>
<tr>
<th>Systems</th>
<th>Preservation Level I</th>
<th>Preservation Level II</th>
<th>Preservation Level III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airframe/Metal</td>
<td>Cover bare metal and bare composites</td>
<td>Cover bare metal and bare composites</td>
<td>Cover bare metal and bare composites</td>
</tr>
<tr>
<td>CADS</td>
<td>Safety pin</td>
<td>Remove/Safety pin</td>
<td>Remove/Safety pin</td>
</tr>
<tr>
<td>Composite</td>
<td>Maintain operational</td>
<td>Cover with MIL-PRF-131 DO NOT use Strippable Coating</td>
<td>Maintain operational</td>
</tr>
<tr>
<td>Electrical</td>
<td>Maintain operational</td>
<td>CPC for connectors</td>
<td>CPC for connectors</td>
</tr>
<tr>
<td>Electronic</td>
<td>Maintain operational</td>
<td>Maintain dry</td>
<td>Maintain dry</td>
</tr>
<tr>
<td>Flight control surface</td>
<td>Maintain operational</td>
<td>Batten down &amp; apply CPC</td>
<td>Batten down &amp; apply CPC</td>
</tr>
<tr>
<td>Fuel</td>
<td>Maintain operational</td>
<td>Replace fuel with MIL-PRF-6081 Grade 1010N</td>
<td>Replace fuel with MIL-PRF-6081 Grade 1010N</td>
</tr>
<tr>
<td>Hydraulic</td>
<td>Maintain clean &amp; full</td>
<td>Maintain clean &amp; full</td>
<td>Maintain clean &amp; full</td>
</tr>
<tr>
<td>Lubrication</td>
<td>Maintain clean &amp; full</td>
<td>Maintain clean &amp; full</td>
<td>Maintain clean &amp; full</td>
</tr>
<tr>
<td>Pneumatic</td>
<td>Maintain clean</td>
<td>Maintain clean</td>
<td>Maintain clean</td>
</tr>
<tr>
<td>Power Plant</td>
<td>Maintain operational</td>
<td>Replace fuel with MIL-PRF-6081 Grade 1010N</td>
<td>Replace fuel with MIL-PRF-6081 Grade 1010N</td>
</tr>
<tr>
<td>Water</td>
<td>Maintain clean &amp; full</td>
<td>Maintain dry &amp; ventilated</td>
<td>Maintain dry &amp; ventilated</td>
</tr>
</tbody>
</table>
SECTION II. LEVEL I PRESERVATION GUIDELINES

2-7. DESCRIPTION. Level I preservation protects idle/inactive aircraft for a maximum of 90 days. The basic foundation of Level I protection is to ensure all systems are kept free of water and fluids are topped off. Spray or brush-on thin corrosion preventive compounds are applied to bare surfaces to provide a chemical barrier separating metal from moisture. Water and foreign object intrusion areas are sealed with tape and barrier (T&B) material and protective covers.

2-8. PREPRESERVATION.

a. Make the aircraft safe. Install all ground safety devices in accordance with NATOPS and aircraft Maintenance Instruction Manuals (MIMs).

b. Perform a preinduction inspection noting missing panels, leaks and streaks that may indicate problem areas.

c. If the aircraft is being transferred, received, or placed in temporary custody, inventory aircraft in accordance with Aircraft Inventory Record (AIRS).

2-9. CLEANING. Thoroughly wash aircraft exterior. Refer to MIMs and to Chapter 8, Section I, for cleaning guidelines.

2-10. INSPECTION. Perform special inspection requirements. If an aircraft is not on a special inspection schedule, refer to Chapter 8, Section II, for inspection guidelines. Assess the state of degradation and identify corrosion that needs attention. All degradation shall be recorded (regardless of intent to correct) on local preservation forms.

2-11. CORROSION CONTROL. Before an aircraft is preserved, corrosion must be corrected to prevent its continuation. If an aircraft is not on a special inspection schedule, refer to Chapter 8, Section III, for corrosion control guidelines. Areas identified for repair during inspection shall have corrosion control performed in accordance with NAVAIR 01-1A-509-2.

2-12. PROTECTION. Apply protection according to the following instructions:

a. Systems. Follow Level I instruction for each applicable system and component listed in Chapter 3.

b. Removed Components. For components that will be removed according to the AIRS or local instruction, refer to Chapter 4. For storage instructions for removed components, refer to Chapter 4.

c. Barrier Systems. Apply barrier (T&B) in accordance with Chapter 5, Section VI.

d. Aircraft Placement. Park aircraft for storage in accordance with requirements in Chapter 7, Section I.

e. Records. Appropriate aircraft and engine log entries shall be made upon completion of preservation.

2-13. MAINTENANCE. Inspect and treat the following systems and components at the appropriate interval in accordance with Chapter 3.

a. Everyday Inspection. The main purpose of the daily inspection is to quickly look at the aircraft and protection systems.

   (1) Inspect the barrier system for breaks, rips, tears, or lifted tape. Repair as necessary.

   (2) Inspect for corrosion. Refer to MIMs and NAVAIR 01-1A-509-2.

   (3) Inspect for visible deteriorated corrosion preventive compound (CPC) applications. Refer to Chapter 8.

   (4) Reapply CPC as necessary. Refer to Chapter 3.

   (5) Inspect the condition of the following external components and systems. No corrective action required.

      (a) Bomb release units.
      (b) Canopy seals.
      (c) Drain holes open.
      (d) Fitting covers.
      (e) Leaks, hydraulic fluids and oils.
      (f) Pitot tubes and static vents.
      (g) Rotor blades.
      (h) Skin.
      (i) Turrets.
(6) Inspect the condition of the fuel system in accordance with Chapter 3, Section VII.

(7) Inspect the security of the aircraft as follows:

(a) Aircraft tiedowns.

(b) Ground wires.

(c) Safety devices, jury struts and locks.

(d) Access panels/doors.

b. 7 Day Inspection. Combine 7 day inspection requirements with those of the everyday inspection.

(1) Inspect the following additional external components and systems in accordance with Table 2-2:

(a) Arresting Hooks.

(b) Bearings.

(c) Cables, exposed.

(d) Canopy frames and seals.

(e) Hydraulic rods, shock and struts. Reapply a thin film of hydraulic fluid, MIL-PRF-83282, to arresting gear, landing gear, wing fold tailskid, and all exposed portions of reciprocating rods.

(f) Landing Gear. Inspect tires for proper inflation.

(g) Lights.

(h) Oxygen bottles and regulators.

(i) Propellers.

(j) Skis.

(k) Transparencies.

(2) Inspect the following internal components and systems in accordance with Table 2-2:

(a) Cabin filters, ducts and regulators.

(b) Camera mounts.

(c) Cartridge activated devices.

(d) Cockpits.

(e) Consoles and control panels.

(f) Fuel. Maintain system at a minimum of 95% full.

(g) Motors and inverter.

(h) Oxygen. If liquid oxygen converters drop below 10 psi, see applicable MIM for corrective action.

(i) Power supplies.

(i) Seats.

(3) Inspect the condition of desiccant within electrical/avionics units. Maintain fully charged. Refer to MIMs.

(4) Batteries. Maintain fully charged.

(5) Correct any moisture intrusion in accordance with Table 2-2.

Table 2-2. Inspection Elements and Corrective Actions

<table>
<thead>
<tr>
<th>Look for:</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion</td>
<td>Remove</td>
</tr>
<tr>
<td>Deteriorated CPCs</td>
<td>Renew</td>
</tr>
<tr>
<td>Moisture</td>
<td>Dry</td>
</tr>
<tr>
<td>Loose barrier material</td>
<td>Repair and reseal</td>
</tr>
<tr>
<td>Missing caps or plugs</td>
<td>Replace</td>
</tr>
<tr>
<td>Humidity Indicator above 40% RH</td>
<td>Check seal, replace desiccant, and reseal</td>
</tr>
<tr>
<td>Animal &amp; insect intrusion</td>
<td>Remove, clean &amp; reseal</td>
</tr>
</tbody>
</table>
c. **28 Day Inspection.** Combine everyday inspection requirements and 7 day inspection requirements with those of the 28 day inspection.

(1) Correct all discrepancies identified during everyday and 7 day inspections. Inspect and correct the condition of the following additional external components and systems in accordance with Table 2-2:

- (a) Access doors.
- (b) Antennas.
- (c) Catapult hooks.
- (d) Connectors.
- (e) Control linkages, dampers.
- (f) Deicer components.
- (g) Guns.
- (h) Gearbox.
- (i) Lines, tubing and fittings.
- (j) Lubrication. Lubricate aircraft in accordance with MIMs and MRCs.
- (k) Swashplates.
- (l) Transparencies.
- (m) Wheels.

(2) Inspect and correct the condition of the following additional internal components and systems in accordance with Table 2-2:

- (a) AEPS.
- (b) Battery compartment.
- (c) Hydraulics. Check hydraulic fluid levels.
- (d) Junction boxes.
- (e) Lavatories.
- (f) Power plants. Run engines and cycle afterburner 2 times.
- (g) Relief tubes.
- (h) Toilets.
- (i) Water tanks.

(3) Inspect exposed airframe flight surfaces for dirt, bird droppings, oil, or salt deposits, and clean in accordance with aircraft MIMs or Chapter 8 instructions.

d. **Heavy Rain Inspection.** Following a heavy rain condition, perform the following:

(1) Check for water intrusion and entrapment.

(2) Check desiccant unit to ensure charged condition.

(3) Ensure that the drain holes are open and clear.

e. **Storm Inspection.** Perform the following prior to and the day after the arrival of a storm. Storm conditions are winds over 35 knots.

(1) Check tiedowns and ground safety locks.

(2) Spread wings and fins as applicable.

(3) Fold, secure or remove rotor blades.

(4) Check control surface locks.

(5) Check straps to secure wing slats in a retracted position.

(6) Take any further precautions directed by the MIMs. Refer to NAVAIR 17-1-537 for additional information.

2-14. **DEPRESERVATION.** Upon the completion of the preservation cycle (90 days) the aircraft shall be depreserved. Remove T&B material and comply with requirements in Chapter 3 and MRC. Appropriate aircraft and engine log entries shall be made upon completion of depreservation.

2-15. **REPRESERVATION.** If required, the aircraft may be represerved at the same level or placed into a higher level of preservation.
2-16. DESCRIPTION. Level II preservation provides the minimum protection for idle/inactive aircraft and components stored for a maximum of 1 year. Level II protection is based on Level I, with the application of longer lasting protection to selected systems and components. The barrier system for Level II preservation ranges from a broader use of T&B material to the application of a top cover, with the option of shrinkwrap or strippable coating for shipment of aircraft only.

   a. When initiating a Level II preservation cycle, begin with paragraph 2-17.

   b. When transitioning from Level I to Level II, depreserve and begin with paragraph 2-18.

   c. When transitioning from Level I to Level II within 30 days of initial preservation, begin with paragraph 2-21 and preserve according to Level II instructions.

   d. When preserving an aircraft for shipment, follow paragraphs 2-17 through 2-21.

2-17. PREPRESERVATION.

   a. Make the aircraft safe. Install all ground safety devices in accordance with NATOPS and aircraft MIMs.

   b. Perform a preinduction inspection noting missing panels, leaks and streaks that may indicate problem areas.

2-18. CLEANING. Thoroughly wash aircraft exterior. Refer to MIMs and to Chapter 8, Section I.

2-19. INSPECTION. After surface dirt has been removed, conduct a thorough examination and evaluation of the aircraft. Refer to Chapter 8, Section II, for inspection guidelines. Assess the state of degradation and identify corrosion that needs attention. All degradation shall be recorded on local preservation forms regardless of intent to correct.

2-20. CORROSION CONTROL. Before an aircraft is preserved corrosion must be removed in accordance with Chapter 8, Section III. Areas identified for repair during inspection shall have corrosion control performed in accordance with NAVAIR 01-1A-509-2.

2-21. PROTECTION. Apply protection according to the following instructions:

   a. Systems. Follow Level II instructions for each applicable system and component listed in Chapter 3. If Level II instructions are not listed, follow Level I instructions.

   b. Removed Components. For components that will be removed according to the AIRS or local instruction refer to Chapter 4. For storage instructions for removed components, refer to Chapter 4.

   c. Barrier System. Apply barrier selected in Chapter 1 in accordance with Chapter 5.

   d. Shipment. Follow Level II guidelines in Chapter 3 as well as special shipping instructions in Chapter 4 (components) and Chapter 7, Section II (aircraft).

   e. Aircraft Placement. Park aircraft for storage in accordance with the instructions of Chapter 7, Section I.

   f. Records. Appropriate aircraft and engine log entries shall be made upon completion of preservation.

2-22. MAINTENANCE. Inspect and treat the following systems and components at the appropriate interval in accordance with Chapters 3 and 5. The performance of those maintenance actions requiring the removal of the strippable coating or top cover to gain access may be postponed until the 56 day inspection interval. However, if at any time it is suspected that the barrier system has been compromised, immediate action is required.

   a. Everyday Inspection. The main purpose of the daily inspection is to quickly look at the aircraft and protection systems.

      (1) Inspect the barrier system for breaks, rips, tears, or lifted tape. Repair as necessary.

      (2) Inspect for corrosion. Refer to MIMs and NAVAIR 01-1A-509-2.

      (3) Inspect for visible deteriorated CPC applications. Refer to Chapter 8.
(4) Reapply CPC as necessary. Refer to Chapter 3.

(5) Check humidity indicators. Initiate corrective action if humidity exceeds 40% RH.

(6) Inspect the following external components and systems. No corrective action required:
   
   (a) Bomb release units.
   (b) Canopy seals. (T&B only).
   (c) Drain holes open. (T&B only).
   (d) Fitting covers.
   (e) Leaks, hydraulic fluid and oil.
   (f) Pitot tubes and static vents.
   (g) Rotor blades.
   (h) Skin.
   (i) Turrets.

(7) Inspect the security of the aircraft as follows:
   
   (a) Aircraft tiedowns.
   (b) Ground wires.
   (c) Safety devices, jury struts and locks.
   (d) Access panels/doors.

b. 7 Day Inspection. Combine 7 day inspection requirements with those of the everyday inspection.

(1) Inspect the following additional external components and systems, in accordance with Table 2-2:
   
   (a) Arresting hooks.
   (b) Bearings (T&B only).
   (c) Cables, exposed.
   (d) Canopy frames and seals (T&B only).
   (e) Drain holes open (excluding T&B)
   (f) Hydraulic rods, shocks and struts. Apply a thin film of hydraulic fluid, MIL-PRF-83282, to arresting gear, landing gear, wing fold, tailskid and all exposed portions of reciprocating rods.
   (g) Landing Gear. Inspect tires for proper inflation.
   (h) Lights.
   (i) Oxygen bottles and regulators.
   (j) Propellers.
   (k) Skis.
   (l) Transparencies (T&B only).

(2) Inspect the following internal components and systems in accordance with Table 2-2:
   
   (a) Cabin filters, ducts and regulators.
   (b) Camera mounts.
   (c) Cartridge activated devices.
   (d) Cockpits (T&B only).
   (e) Consoles and control panels.
   (f) Motors and inverter.
   (g) Oxygen. If liquid converters drop below 10 psi, see applicable MIM for corrective action.
   (h) Power supplies.
   (i) Seats (T&B only).

(3) Inspect the condition of desiccant within electric/avionic units. Maintain desiccant units fully charged. Refer to MIMs.

(4) Correct any moisture intrusion in accordance with Table 2-2.
c. **28 Day Inspection.** Combine the everyday and 7 day inspection requirements with the following 28 day inspection requirements.

(1) Correct all discrepancies identified during every day and 7 day inspections. Inspect and correct the following additional external components and systems in accordance with Table 2-2:

(a) Access doors.
(b) Antennas. (T&B only)
(c) Catapult hooks.
(d) Connectors.
(e) Control linkages, dampers.
(f) Deicer components.
(g) Guns.
(h) Lines, tubing and fittings.
(i) Lubrication. Lubricate aircraft in accordance with MIMs and MRCs.
(j) Swashplates.
(k) Transparencies.
(l) Wheels.

(2) Inspect and correct the following additional internal components and systems in accordance with Table 2-2:

(a) Aircrew Escape Propulsion System (AEPS).
(b) Battery compartment. (T&B only)
(c) Hydraulics. Check hydraulic fluid levels.
(d) Junction boxes.
(e) Lavatories.
(f) Relief tubes.
(g) Toilets.
(h) Water tanks.

(3) Inspect exposed airframe flight surfaces for dirt, bird droppings, oil or salt deposits, and clean in accordance with aircraft MIMs or Chapter 8 instructions.

d. **56 Day Inspection.** Combine the everyday, 7 day and 28 day inspection requirements with power plant rotation operations in accordance with Chapter 3. Exposed surfaces shall be cleaned in accordance with aircraft MIMs or Chapter 8.

(e. **Heavy Rain Inspection.** Following a heavy rain condition, perform the following:

(1) Check for water intrusion and entrapment.
(2) Check desiccant unit to ensure charged condition.
(3) Ensure that all drain holes are open and clear.

f. **Storm Inspection.** Perform the following prior to and the day after the arrival of a storm. Storm conditions are winds over 35 knots.

(1) Check tiedowns and ground safety locks.
(2) Spread wings and fins, as applicable.
(3) Check control surface locks.
(4) Check straps to secure wing slats in a retracted position.
(5) Take any further precautions directed by the MIMs. Refer to NAVAIR 17-1-537 for additional information.

2-23. **DEPRESERVATION.** Upon the completion of the preservation cycle (1 year) the aircraft shall be depreserved. Remove barrier system in accordance with Chapter 5 and comply with requirements in Chapter 3 and MRC. Appropriate aircraft and engine log entries shall be made upon completion of depreservation.

2-24. **REPRESERVATION.** If required, the aircraft may be represerved at the same level or placed into another level of preservation.
SECTION IV. LEVEL III PRESERVATION GUIDELINES

2-25. DESCRIPTION. Level III preservation provides the optimum protection for idle/inactive aircraft and components. Level III protection requires modified Level II procedures with the addition of dehumidification. The barrier system for Level III preservation includes the flexible bag, the drop shroud and the rigid shelter. The time limitation of the preservation cycle is dependent on the barrier system renewal requirement.

  a. When initiating a Level III preservation cycle begin with paragraph 2-26.

  b. When transitioning from Level I or II to Level III, depreserve in accordance with Chapter 3 and begin with paragraph 2-27.

  c. When transitioning from Level I or II to Level III within 30 days of initial preservation, begin with paragraph 2-30.

  d. For aircraft shipment, follow paragraphs 2-26 through 2-30.

2-26. PREPRESERVATION.

  a. Make the aircraft safe. Install all ground safety devices in accordance with NATOPS and aircraft MIMs.

  b. Perform preliminary inspection noting missing panels, leaks and streaks that may indicate problem areas.

2-27. CLEANING. Thoroughly wash aircraft exterior according to MIMs or Chapter 8, Section I.

2-28. INSPECTION. After surface dirt has been removed, conduct a thorough examination and evaluation of the aircraft. Refer to Chapter 8, Section II, for inspection guidelines. Assess the state of degradation and identify corrosion that needs attention. All degradation shall be recorded on local preservation forms regardless of intent to correct.

2-29. CORROSION CONTROL. Before an aircraft is preserved any corrosion found must be removed in accordance with Chapter 8, Section III. Areas identified for repair during inspection shall have corrosion control performed in accordance with NAVAIR 01-1A-509-2.

2-30. PROTECTION. Apply protection in accordance with the following:

  a. Systems. Follow Level III instructions for each system and component listed in Chapter 3, if applicable to aircraft type. The application of T&B is not required.

  b. Removed Components. Follow the instructions in Chapter 4.

  c. Barrier System. Apply barrier system selected in Chapter 1 in accordance with Chapter 5. Setup instructions for the barrier systems are found in Chapter 5 as shown below.

    (1) Rigid Shelter. Refer to Section II.

    (2) Drop Shroud. Refer to Section III.

    (3) Flexible Cover. Refer to Section IV.

  d. Environmental Control. Refer to Chapter 6 for dehumidified equipment installation and maintenance instructions.

  e. Shipment. Follow Level III guidelines in Chapter 3 and shipping instructions in Chapter 7, Section II.

  f. Aircraft Placement. Park aircraft for storage in accordance with the instructions of Chapter 7, Section I.

  g. Records. Appropriate aircraft and engine log entries shall be made upon completion of preservation.

2-31. MAINTENANCE. Inspect and treat the following items at the appropriate interval in accordance with Chapter 3.

  a. Everyday Inspection. The main purpose of the daily inspection is to quickly look at the systems.

    (1) Inspect the barrier system for breaks, rips, or tears. Repair as necessary.

    (2) Check environmental measurements for exceeded limits. Refer to Chapter 6 for dehumidification equipment maintenance checklists. Initiate corrective action if humidity exceeds 40% RH.

    (3) Check aircraft tiedowns, grounding wires, electrical wires and equipment.
b. **7 Day Inspection.** Perform the everyday inspection requirements as well as check oxygen system cylinders and regulators.

c. **28 Day Inspection.** Combine the everyday and 7 day inspection requirements with the following 28 day inspection requirements.

   1. Check struts for proper extension and tires for proper inflation.
   2. Check thoroughly for any compromises in the barrier.

d. **Storm/Heavy Rain Inspection.** Perform the following prior to and the day after the arrival of a storm or heavy rain. Storm conditions are winds over 35 knots.

   1. Check for water intrusion and entrapment.
   2. Check tiedowns and ground safety locks.
   3. Take any precautions directed by the MIMs. Refer to NAVAIR 17-1-537 for additional information.

2-32. **DEPRESERVATION.** Remove barrier system, and remove any preservation material in accordance with Chapter 3. Execute actions described in MRCs. Appropriate aircraft and engine log entries shall be made upon completion of depreservation.

2-33. **REPRESERVATION.** Level III preservation is considered indefinite; however, the barrier system shall be refurbished periodically in accordance with manufacturer's guidelines.
SECTION V. LEVEL IV PRESERVATION GUIDELINES

2-34. DESCRIPTION. Due to the extensive disassembly required during depot level maintenance, the entire aircraft cannot be maintained in a single preservation status. However, systems and components shall be protected and preserved during the repair cycle to the maximum extent possible.

a. Though the following is the recommended order of operations, some facilities may need to change the sequence of the processes. Local engineering specifications based on the following requirements may be developed to provide detailed preservation instructions. Local instructions may amplify, clarify, or tailor the requirements to local needs or circumstances; however, the instructions shall adhere to the basic procedures established.

b. Aircraft shall have a log entry for induction preservation, represervation, and final depreservation, but do not require log entries while undergoing depot level maintenance. System and component preservation shall be locally documented using checklists, tags, work orders, routers, or other approved documented processes (see Chapter 1, Section I).

c. Scheduled inspections and MRC requirements may be deferred during depot level maintenance.

2-35. DELAYED INDUCTION. If the aircraft cannot be inducted within 14 days due to space or budget considerations, the aircraft shall be preserved in accordance with the Level II or Level III instructions (Level III is preferred) in Chapter 3.

2-36. PREPRESERVATION.

a. Make the aircraft safe. Install all ground safety devices in accordance with NATOPS and aircraft MIMs.

b. Perform preliminary inspection noting missing panels, leaks and streaks that may indicate problem areas.

c. Remove and preserve components (e.g. avionics, gun systems) as required.

d. Ensure that the aircraft is statically grounded in accordance with Chapter 7.

2-37. FUEL SYSTEM PRESERVATION. Internally preserve the fuel system in accordance with Chapter 3, Section VII (hot preservation method is preferred). The hot preservation method adequately purges the system to comply with Gas Free requirements for aircraft inside maintenance hangars/buildings.

2-38. CLEANING. Thoroughly wash the aircraft exterior according to the MIMs or Chapter 8, Section I. Aircraft do not require exterior cleaning if the paint will be stripped as part of the repair process.

2-39. INSPECTION. After cleaning or paint removal, conduct a thorough examination and evaluation of the aircraft. Refer to Chapter 8, Section II, for inspection guidelines. Assess the state of degradation and identify corrosion that needs attention. All degradation shall be recorded, regardless of intent to correct.

2-40. CORROSION CONTROL. Corrosion control actions are dictated by the aircraft repair specification(s). Corrosion control shall be performed at any time in the repair cycle prior to final paint.

2-41. PROTECTION.

a. Systems.

(1) Systems shall be preserved in accordance with Chapter 3 requirements. Local engineering specifications that provide enhanced preservation procedures may also be used.

(2) Hydraulic and oil systems may be drained to facilitate repair and maintenance. Disconnected lines and tubes shall be capped/plugged with appropriate metal closures.

(3) Disconnected pneumatic lines shall be protected with the appropriate caps/plugs/dust covers.

(4) Electrical connectors separated for maintenance shall be capped with metal or plastic caps. If caps are not available, see Chapter 3, Section V, for alternate methods of protection.

(5) Cover exposed bearings in accordance with Chapter 3, Section II.
(6) Transparencies (canopies/windows) shall be protected in accordance with Level I instructions of Chapter 3, Section II.

(7) Installed engines and APUs shall be protected in accordance with Level II instructions of Chapter 3, Section XIII.

(8) Aircraft doors and covers may be opened and/or removed. Removed doors shall be protected from physical damage.

(9) Ensure that bare composite surfaces are covered (see Chapter 3, Section II).

b. Removed Components.

(1) Removed components shall be preserved in accordance with Chapter 4 requirements. Local engineering specifications that provide enhanced preservation procedures may also be used.

(2) Oil, hydraulic, and pneumatic lines removed for access shall be capped and stored in a manner to prevent physical damage.

(3) Protect removed components from physical damage by using appropriate containers, fixtures, separators, cushioning, or a combination of these methods. Components shall not be in direct contact with each other.

(4) Removed engines and APUs shall be protected in accordance with Level II or Level III instructions of Chapter 4, Section III.

2-42. MAINTENANCE. Maintain system preservation in accordance with Chapter 3, and component preservation in accordance with Chapter 4 requirements. The following are minimum maintenance requirements for in-process aircraft.

a. Everyday Inspection. The main purpose of the daily inspection is to quickly look at the aircraft and protection systems.

   (1) Inspect the barrier system for breaks, rips, tears, or lifted tape. Repair as necessary.

   (2) Ensure that disconnected lines are capped or covered.

   (3) Ensure that the aircraft is grounded.

   (4) Check humidity indicators. Initiate corrective action if humidity exceeds 40% RH.

b. 7 Day Inspection.

   (1) Wipe down exposed hydraulic rods, shocks, and struts with a lint free cloth wet with hydraulic fluid, MIL-PRF-83282.

   (2) Reapply CPCs as necessary.

   (3) Inspect tires for proper inflation.

c. 56 Day Inspection. Rotate powerplants in accordance with Chapter 3 (installed) or Chapter 4 (removed) requirements.

2-43. DEPRESERVATION.

a. Depreserve components prior to installation on aircraft.

b. Some components, such as engines, APUs, and canopies, require continued protection upon aircraft installation. These components shall be depreserved prior to final testing of aircraft.

c. Depreservation is not required when the aircraft is changed from a Delayed Induction status (Level II or Level III) to an In-Process status (Level IV).

2-44. REPRESERVATION.

a. Represerve systems as needed in accordance with Chapter 3.

b. Represerve components as needed in accordance with Chapter 4 requirements.

c. Represerve systems prior to beginning repairs when changing from a Delayed Induction status to an In-Process status if the estimated in-process time exceeds the remaining time in the preservation cycle. For example, if the fuel system was preserved with MIL-PRF-6081 Grade 1010N oil nine months ago and there are three months remaining in the preservation cycle, and the estimated in-process time is eight months, the fuel system should be represerved prior to induction.
2-45. RECORDS.

a. For Delayed Induction aircraft, enter the appropriate preservation level and date in the Aircraft Preservation/Depreservation Record, CNAF 4790/136A.

b. Upon induction into the repair cycle, Level IV shall be entered as the Type Preservation in the Aircraft Preservation/Depreservation Record, CNAF 4790/136A.

c. Represervation and final depreservation shall be entered in the Aircraft Preservation/Depreservation Record, CNAF 4790/136A.

d. Enter the appropriate preservation level and date in the Engine Preservation Log, CNAF 4790/25A.

e. For aircraft or engines without hardcopy logbooks, enter preservation, represervation, and final depreservation information into the NALCOMIS OMA Logs and Records Subsystem.
SECTION VI. SHIPMENT GUIDELINES

2-46. DESCRIPTION. After choosing the mode of shipment and level of preservation for the aircraft, follow the guidelines below.

a. General. Aircraft to be shipped shall be protected in accordance with Level II or Level III preservation requirements outlined in Sections III and IV of this chapter. Additional requirements are found in Chapter 7, Section II. Component shipment guidelines are found in Chapter 4.

b. Paperwork. Include the following, in a clear waterproof pouch, with the paperwork affixed to the aircraft.

(1) Location of the tiedown points on the aircraft and tiedown arrangement.

(2) Instructions on the installation of the aircraft sling.

(3) Gas Free Engineering (GFE) certificate.

(4) All applicable Material Safety Data Sheets (MSDS) for material applied to the aircraft.

c. Certification. Aircraft inside flexible covers shall be certified as being safe by GFE before shipping aircraft, connecting DH equipment, or welding tiedown attach points to the deck around the aircraft.

d. Placement. Refer to Chapter 7, Section II, for placement instructions.

2-47. MAINTENANCE. Before and after shipment, follow maintenance guidelines for the chosen level of preservation as described in Chapter 3.

a. After aircraft are tied down, secure barrier system to prevent water intrusion. Aircraft being shipped by ocean shall meet the heavy weather tiedown requirements of the aircraft MIMs and NAVAIR 17-1-537.

b. Inspection Requirements for Truck, Rail, or Air Shipment. Check the security of the barrier system, the tiedowns, and the bucks every day.

c. Inspection Requirements for Ocean Shipment. Ship riders usually accompany aircraft that are shipped by ocean. Inspection of the aircraft is dependent on the location of the aircraft on the ship or barge. A log of the inspections, noting the date, time, items inspected, and any corrective actions taken, shall be kept. Personnel safety is the main concern when performing any inspection.

(1) Ship. Inspections shall be performed every day, and before and after a storm or high winds. Inspect and correct discrepancies in accordance with Table 2-3.

(2) Barge. Inspections shall be performed prior to departure, upon arrival into a port, and every day in port. Inspect and correct discrepancies in accordance with Table 2-3.

NOTE

Strippable coating or shrinkwrap shall be removed within 60 days of application (including time during shipment) or within 5 days of receipt of aircraft, whichever is sooner.

2-48. DEPRESERVATION. Remove barrier system in accordance with Chapter 5 and manufacturer’s instructions. In addition, comply with requirements in Chapter 3 and MRCs.
<table>
<thead>
<tr>
<th>Inspect for:</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security of the Aircraft</td>
<td></td>
</tr>
<tr>
<td>Tiedowns, loose or missing</td>
<td>Notify the ship's Captain or a crewmember</td>
</tr>
<tr>
<td>Wheel chocks, loose or missing</td>
<td>Notify the ship's Captain or a crewmember</td>
</tr>
<tr>
<td>Any movement of the aircraft</td>
<td>Notify the ship's Captain or a crewmember</td>
</tr>
<tr>
<td>Key/combination lock missing</td>
<td>Notify the ship's Captain</td>
</tr>
<tr>
<td>Security seals on compartment</td>
<td>Notify the ship's Captain</td>
</tr>
<tr>
<td>doors/hatch cover openings missing</td>
<td></td>
</tr>
<tr>
<td>Compromise of the Strippable Coating</td>
<td></td>
</tr>
<tr>
<td>Small areas missing (holes, cuts,</td>
<td>Wipe area with a clean rag, and seal with preservation tape, SAE AMS-T-22085.</td>
</tr>
<tr>
<td>separations)</td>
<td></td>
</tr>
<tr>
<td>Large areas missing</td>
<td>Seal or cut away loose coating, exercising care not to damage underlying surface. Wipe area with a clean rag. Cover with barrier material MIL-PRF-131 Class 1, and seal with preservation tape, SAE AMS-T-22085. Overcoat repaired area with brushable topcoat, MIL-PRF-6799 Type II Class 7.</td>
</tr>
<tr>
<td>Compromise of the Flexible Bag</td>
<td></td>
</tr>
<tr>
<td>Small areas missing (holes, cuts,</td>
<td>Wipe area with a clean rag, and seal with preservation tape, SAE AMS-T-22085.</td>
</tr>
<tr>
<td>separations)</td>
<td></td>
</tr>
<tr>
<td>Large areas missing</td>
<td>Wipe area with a clean rag. Cut away any ragged edges. Repair using material and adhesive provided by the bag manufacturer. If material is not available, cover area with barrier material, MIL-PRF-131 Class 1, and seal with preservation tape, SAE AMS-T-22085.</td>
</tr>
<tr>
<td>Compromise of the Shrinkwrap</td>
<td></td>
</tr>
<tr>
<td>Small areas missing (holes, cuts,</td>
<td>Wipe area with a clean rag, and seal with heat shrinkable tape.</td>
</tr>
<tr>
<td>separations)</td>
<td></td>
</tr>
<tr>
<td>Large areas missing</td>
<td>Wipe area with a clean rag. Cut away any ragged edges. Repair using heat shrinkable film and tape. If heat gun is available, apply heat to shrink film. If material is not available, cover area with barrier material, MIL-PRF-131 Class 1, and seal with preservation tape, SAE AMS-T-22085.</td>
</tr>
</tbody>
</table>
CHAPTER 3
AIRCRAFT SYSTEMS

SECTION I. INTRODUCTION

3-1. USE OF THIS CHAPTER. This chapter shall be used as a guide to the cleaning, inspection, corrosion control, protection, maintenance and depreservation of each preservation level (Level I, II, or III).

a. In addition to this section, this chapter is divided into sixteen sections, arranged alphabetically, each covering a different aircraft system. Each system covered is broken down into components, also arranged alphabetically. The components covered in each section are listed in a table at the beginning of each section. The tables follow the basic outline of cleaning, inspection, corrosion control, protection, maintenance and depreservation.

b. All systems shall be cleaned and inspected regardless of the level of preservation. General aircraft cleaning, inspection, and corrosion control guidelines are located in Chapter 8.

c. Additional aircraft preparation procedures required for Level II and III preservation are located in Chapter 5 and Chapter 6.

d. Procedures for securing aircraft and aircraft shipment are located in Chapter 7.

3-2. GENERAL REQUIREMENTS.

a. Composite Structures. Composite material (Graphite/Epoxy and Boron/Epoxy) surfaces are extremely susceptible to both surface and subsurface structural damage. Refer to applicable Structural Repair Manual (SRM) for location of composite surfaces.

(1) At all times during preservation, precautions shall be taken to observe NO STEP areas and to prevent collecting or dropping objects on composite surfaces. During maintenance and repair which requires work near or over horizontal composite surfaces, protective pads and rigid walkway surfaces shall be used to prevent damage to these surfaces.

(2) Removed composite construction doors and panels are easily damaged during handling and storage, especially at edges and corners. Refer to Chapter 4 for information on handling and storage.

b. Loose Attaching Parts and Hardware. When partial disassembly of an aircraft is required during preservation, refer to Chapter 4 for information on preservation of components. As a general maintenance practice, when inspecting aircraft or upon depreservation, check packaged items for integrity of packaging and water damage. Repair as necessary.

c. Shipment. Unless otherwise specified, systems shall be preserved as required for Level II or Level III protection. Refer to Chapters 2 and 7 for aircraft shipment, and Chapter 4 for component shipment.

d. Cleaning. Aircraft and systems shall be thoroughly cleaned before preservation and after depreservation. Whenever possible, hand cleaning methods shall be used, including vacuum cleaners, to remove accumulated dust and dirt, and hand wipe-down methods to remove oils, greases, and corrosion preventive compounds (CPCs). Cleaning shall be complete enough to do the job and yet use the mildest materials and procedures that will effectively remove the contaminants. Refer to Chapter 8, Section I, and this chapter for general cleaning procedures. For details on cleaning of aircraft surfaces, refer to NAVAIR 01-1A-509-2 and the applicable MIM.

e. Lubrication. Lubrication is an essential part of preservation and depreservation, since application of lubricants to clean metal surfaces shields moving joints against dirt, water, and other harmful agents. Properly maintained lubrication will, in some cases, provide adequate protection and eliminate the need for more permanent protective compounds, except as noted in this manual. When it can definitely be established that an aircraft or system has been completely lubricated during upkeep or repair within the last 30 days or as required by the applicable MRCs, additional lubrication is not required.
CAUTION

To avoid contaminating lubricated areas with abrasive dirt and corrosive agents, always wipe lubricator fittings clean and dry before attaching grease guns.

(1) The application of grease-type lubricants through pressure lubricator fittings and use of water displacing/corrosion inhibiting oil type lubricants on squirt can lubricated surfaces tend to force out or displace water and other harmful agents from crevices and moveable joints.

(2) In addition to the specific recommendations within this chapter for individual aircraft systems, the following general lubrication procedures apply when developing requirements for preservation:

(a) Items exposed to the weather when aircraft are parked should always be lubricated upon initial preservation cycle and periodically during storage. Squirt can (oil) lubricated items should be re-lubricated at least once every 7 days while aboard ship, and at least once every 28 days for other environments. Grease lubricated items shall be lubricated upon the initial preservation cycle and re-lubricated at 28 day intervals.

(b) Initial lubrication and periodic re-lubrication of internal or protected items that are not defined within this chapter shall be based on corrosion control history of each item.

(c) Pressure (grease) lubricated items shall always be lubricated both before and immediately following exposure to any cleaning and stripping compounds or procedures.

(d) During or immediately following installation of replacement assemblies and components, all pressure or squirt can lubricated points shall be re-lubricated.

(f) Piano wire type hinge points shall be lubricated during and immediately after assembly. After washing aircraft, hinges shall be sprayed with water displacing CPC, MIL-PRF-81309 Type II, followed by application of oil, MIL-PRF-32033.

(f) Hydraulic actuator piston rods shall always be cleaned before actuating, using a clean wiping cloth, A-A-50129, dampened with the applicable operating hydraulic fluid.

t. Corrosion Control. Before preservation and following cleaning, thoroughly inspect the aircraft for corrosion in accordance with Chapter 8, and arrest corrosion in accordance with NAVAIR 01-1A-509-2.

(g) Maintenance. A given level of preservation will be effective for the life limitations specified in Chapter 1. Variables such as deficiencies in preservation materials and unusual weather conditions make it necessary to establish regular maintenance intervals to ensure that aircraft remain in the "as-preserved" condition throughout the storage cycle. Maintenance inspections at regular intervals may also provide information for improvement of the preservation procedures and techniques through continuous observation of the material performance. Material and procedure deficiencies shall be reported to the cognizant preservation authority.

(1) Servicing of systems as necessary in accordance with the applicable MIM or MRCs shall be incorporated in periodic inspections. MIMs or MRCs with shorter interval requirements shall take precedence over the general inspection intervals.

(2) Aircraft with failed corrosion preventive or paint coatings shall be scheduled for corrective treatment within 24 hours after condition is discovered. Maintenance of preservation procedures shall always include a check for corrosion damage and prompt action to inhibit further corrosive attack.
(3) Level I. Aircraft in short term preservation status shall be maintained in accordance with the guidelines in Chapter 2, Section II.

NOTE

The performance of the maintenance actions for Level II preservation requiring the removal of strippable coating or a top cover to gain access may be postponed until the 56 day inspection interval. However, if at any time it is suspected that the barrier system has been compromised, an immediate inspection of all affected systems is required.

(4) Level II. Aircraft in Level II preservation shall be maintained in accordance with the guidelines in Chapter 2, Section III.

(a) Climatic conditions may make it prudent to use longer or shorter intervals. The assignment of longer or shorter inspection and maintenance intervals shall be under strict engineering control and shall be at the discretion of the cognizant preservation authority.

(b) Aircraft completely covered with shrinkwrap or strippable coatings for shipment shall have doors or access openings selected and reused for periodic inspections. While the aircraft is undergoing shipment, inspection and maintenance intervals shall be in accordance with Chapters 2, 4, and 7. Upon receipt of shipped aircraft protected with a complete strippable plastic coating or shrinkwrap, punch holes at low points and in bulges or sags in the coating immediately to relieve any accumulation of water. If seawater is found, immediate action shall be taken to remove coatings and wash the aircraft. For instructions on removal or maintenance of the strippable coating or shrinkwrap, refer to Chapter 5.

(5) Level III. Aircraft in dehumidified storage shall be maintained in accordance with the guidelines in Chapter 2, Section IV.

h. Depreservation. Aircraft that have reached the protection time limit for their level of preservation and are depreserved shall be immediately inducted for repair, represerved, or returned to service and maintained in accordance with the applicable aircraft MIMs. Regardless of the status of the aircraft/component, depreservation shall always include the removal of deteriorated lubricants, CPCs, barrier material, plastic coatings and tapes.

(1) Each preserving activity shall develop a depreservation checklist for each aircraft model and include a copy of this list with each aircraft preserved for shipment. This depreservation checklist shall be inserted in a suitable waterproof package and placed in the cockpit in a conspicuous location.

(2) If aircraft are being depreserved for return-to-flight status, comply with technical directives, aircraft MIMs and inspection requirements of COMNAVAIRFORINST 4790.2.

(3) Aircraft being depreserved after ocean shipment shall be given special attention to ensure the removal of entrapped sea water and salt deposits as soon as possible.

(4) Service all systems in accordance with the applicable MIM. Ensure that all corrosion preventive compounds, barrier material, locking devices, and plugs installed during the preservation phase are removed before operating affected systems or placing aircraft into service. If any system or component is depreserved, not depreserved or is partially depreserved, make an appropriate log entry. Partial depreservation may be authorized by the ISSC, and shall be considered when the aircraft is to be represerved for another preservation level without a test flight or the operation of selected systems.

i. Represervation. When an aircraft has reached its storage time limitation and still requires protection, it shall be represerved. Represervation involves the depreservation of the aircraft and the initiation of a new preservation cycle. Represervation is a complete renewal of the aircraft protection to another or the same level of preservation.
SECTION II. AIRFRAMES

Table 3-1. Airframe System Summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Doors &amp; Escape Chutes</td>
<td>3-4a</td>
<td>3-4b</td>
<td>3-4c</td>
<td>3-4d</td>
<td>3-4e</td>
<td>3-4f</td>
<td>-----</td>
</tr>
<tr>
<td>Battery Compartments</td>
<td>3-5a</td>
<td>3-5b</td>
<td>3-5c</td>
<td>3-5d</td>
<td>3-5e</td>
<td>3-5f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Bearings, Rollers &amp; Sprockets</td>
<td>3-6a</td>
<td>3-6a</td>
<td>3-6a</td>
<td>3-6b</td>
<td>3-6c</td>
<td>3-6d</td>
<td>NAVAIR 01-1A-503</td>
</tr>
<tr>
<td>Bilges, Floats &amp; Sponsons</td>
<td>3-7a</td>
<td>3-7b</td>
<td>3-7c</td>
<td>3-7d</td>
<td>3-7e</td>
<td>3-7f</td>
<td>-----</td>
</tr>
<tr>
<td>Cables, Control</td>
<td>3-8a</td>
<td>3-8b</td>
<td>3-8c</td>
<td>3-8d</td>
<td>3-8e</td>
<td>3-8f</td>
<td>-----</td>
</tr>
<tr>
<td>Canopy Frames &amp; Seals</td>
<td>3-9a</td>
<td>3-9b</td>
<td>-----</td>
<td>3-9c</td>
<td>3-9d</td>
<td>3-9e</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Cargo Hoists, Rescue Slings &amp; Drums</td>
<td>3-10a</td>
<td>3-10b</td>
<td>3-10b</td>
<td>3-10c</td>
<td>3-10d</td>
<td>3-10e</td>
<td>-----</td>
</tr>
<tr>
<td>Cockpits</td>
<td>3-11a</td>
<td>3-11b</td>
<td>3-11c</td>
<td>3-11d</td>
<td>3-11e</td>
<td>3-11f</td>
<td>-----</td>
</tr>
<tr>
<td>Control Surfaces</td>
<td>3-12a</td>
<td>3-12b</td>
<td>3-12c</td>
<td>3-12d</td>
<td>3-12e</td>
<td>3-12f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Drain Holes</td>
<td>3-13a</td>
<td>3-13b</td>
<td>3-13c</td>
<td>3-13d</td>
<td>3-13e</td>
<td>3-13f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Seats (except ejection)</td>
<td>3-14a</td>
<td>3-14b</td>
<td>-----</td>
<td>3-14c</td>
<td>3-14d</td>
<td>3-14e</td>
<td>-----</td>
</tr>
<tr>
<td>Skin Surfaces (exterior)</td>
<td>3-15a</td>
<td>3-15b</td>
<td>3-15c</td>
<td>3-15d</td>
<td>3-15e</td>
<td>3-15f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Transparencies</td>
<td>3-16a</td>
<td>3-16b</td>
<td>-----</td>
<td>3-16c</td>
<td>3-16d</td>
<td>3-16e</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
</tbody>
</table>

3-3. AIRFRAME SYSTEM. Airframe system is the general term for the airframe structure, along with a few components that do not belong to any other system. Refer to Table 3-1 for items covered in this section.

3-4. ACCESS AND ESCAPE CHUTE DOORS.

a. Cleaning. Clean mating surfaces to remove oils, greases and corrosion preventive compounds (CPCs) by using a cloth moistened with degreasing solvent, MIL-PRF-680 Type II by. Clean rubber seals and mating surfaces to remove greases, oils and CPCs using a cloth moistened with cleaning solution (1 oz. MIL-D-16791 in 1 gal. water) and rinse with a cloth wet with fresh water. Dry with a clean cloth. Carefully clean elastomeric portions and embedded or attached conductors of EMI seals with isopropyl alcohol, TT-I-735.

b. Inspection. Inspect mating surfaces for corrosion. Pay particular attention to avionics doors and panels with EMI seals with an embedded or attached conductor. Since the conductors and mating surfaces are often of dissimilar metals, this is a prime location for corrosion.

c. Corrosion Control. Disassemble the affected areas and remove the corrosion using the mildest method available in accordance with NAVAIR 01-1A-509-2. As required, install replacement seals in accordance with aircraft MIMs or bulletins.
d. Protection. Level I, II, and III.

(1) Lubricate hinges, latches and operation mechanisms of access doors (including bomb bay and cargo compartment doors) in accordance with the applicable MIM. Apply MIL-PRF-81309 Type II to release pins, then thoroughly coat with grease, MIL-PRF-23827.

(2) Level II. Maintain in accordance with Level I requirements. Maintain barrier system in accordance with Chapter 5. Check doors for water and dirt accumulation. Check drain holes to ensure that they are open.

(3) Level III. No maintenance required.

f. Depreservation. Remove tape and barrier materials, and/or strippable coatings around the doors. Open the doors, and clean the seals and mating surfaces. Refer to Chapter 5 for strippable coating removal procedures.

3-5. BATTERY COMPARTMENTS. The battery, battery cover, battery box and adjacent areas (especially areas below the battery compartment where battery electrolyte may have seeped) are subject to corrosion by battery electrolyte. Two different types of batteries are found on aviation equipment. Lead-acid batteries have a sulfuric acid electrolyte. Nickel-cadmium batteries have a potassium hydroxide electrolyte. Each type of battery requires a different neutralization procedure when cleaning electrolyte spills. Consult the applicable maintenance manuals to determine which type of battery is installed.

**WARNING**

Nickel-cadmium batteries shall not be exposed to acid or acid vapors. Use personal protective clothing, gloves, apron and eye shields. Battery electrolytes are extremely corrosive. Spilled electrolyte shall be removed immediately.

**CAUTION**

Fumes from overheated electrolyte will spread to adjacent areas, causing rapid corrosion on unprotected surfaces.

a. Cleaning. Thoroughly clean and dry battery compartments in accordance with NAVAIR 01-1A-509-2. If spilled electrolyte is suspected, clean the battery compartment according to steps (1)-(6) below. If no spill is suspected, clean according to step (5) below.

(1) Remove any standing liquid or puddles with a squeeze bulb type syringe, absorbent cloth, or sponges. Place these items in a labeled, leakproof container for removal to prevent the contamination of other areas.
Identification of Contaminated Area. The use of indicating solutions can be avoided by using test strips of litmus paper. When trying to detect electrolyte spills from acid batteries (such as lead acid), apply a strip of blue litmus paper to the wet surface. A color change to red indicates an acid is present. When trying to detect spills from alkaline batteries (such as nickel-cadmium), apply red litmus paper to the wet surface. A color change to blue indicates an alkaline solution is present.

Neutralizing. Apply the correct neutralizing solution (sodium bicarbonate for lead-acid batteries and boric acid for nickel-cadmium batteries) to the areas where the indicating solution has changed color. Ensure that the area is well saturated and that the stream is directed into all seams and crevices where electrolyte could collect.

Neutralizing Solution. Pour one pint of fresh water into a 500 ml polyethylene wash bottle. Add two ounces of sodium bicarbonate, A-A-374, and mix thoroughly.

Boric Acid Neutralizing Solution. Pour one pint of fresh water into a 500 ml polyethylene wash bottle. Add one half ounce of boric acid powder, A-A-59282, and mix thoroughly.

Use care to prevent liquids from spreading to adjacent areas, and ensure that bilge area drains are open to allow fluids to flow overboard. Allow the neutralizing solution to remain on the surface for five minutes or until all bubbling action ceases, whichever is longer.

Rinse the area thoroughly with a liberal amount of clean water and remove any standing liquid or puddles with a squeeze bulb type syringe, absorbent cloth, or sponges. Place these items in a labeled, leakproof container for removal to prevent the contamination of other areas.

Reapply the litmus paper, as in step (2) above. If the litmus paper does not change color, rinse the area, as in step (5) above, and dry the areas with clean cloths or rags. If the litmus paper changes color, repeat steps (3), (4) and (5) above.

Inspection. Inspect for spills and surface corrosion of adjacent areas.

Corrosion Control. Remove and treat corrosion in accordance with NAVAIR 01-1A-509-2.

Compound, Corrosion Preventive 9 MIL-DTL-85054

CAUTION

Apply preservative compound MIL-DTL-85054 only to nonmoving items requiring no lubrication. Mask off adjacent areas to prevent over spray.

d. Protection. Special acid or alkali resistant paint coatings are usually required for battery compartments, boxes and areas. Refer to the applicable aircraft manuals. When paint coatings are unavailable, battery compartments may be touched up with clear water displacing CPC, MIL-DTL-85054.

e. Maintenance.

(1) Level I. Every 28 days, inspect for corrosion damage and treat in accordance with NAVAIR 01-1A-509-2. Check CPC or paint coating; reapply or touch-up if necessary.

(2) Level II. Maintain in accordance with Level I requirements if protected with T&B system.

(3) Level III. No maintenance required.

f. Depreservation. Clean, inspect and control corrosion as specified above.
3-6. BEARINGS, ROLLERS AND SPROCKETS. The protection and maintenance of bearings installed in aeronautical applications is extremely important if the expected service life of the assembly is to be achieved. Protection begins at installation and continues during the operational life of the bearing assembly. Bearing assemblies shall be protected against harsh handling as well as dirt and other contaminants.

   a. Cleaning/Inspection/Corrosion Control. Clean, inspect and re-lubricate bearings, rollers and sprockets in strict accordance with NAVAIR 01-1A-503 and applicable MIM.

   CAUTION

   Do not mix greases of different specifications.

   Steam guns and pressure sprays or streams shall never be applied directly to bearings or sheaves.

   NOTE

   During maintenance cleaning of aircraft, exposed surfaces shall be covered or masked. When activities are unable to provide effective masking and bearings are capable of being lubricated by external means, bearings shall be lubricated both before and after aircraft cleaning.

   b. Protection. Level I, II, and III. Cover or mask exposed bearing, roller, and sprocket assemblies barrier material, MIL-PRF-131 Class 1, secured with tape, SAE AMS-T-22085 Type II.

   c. Maintenance.

      (1) Level I. Every 7 days, inspect for wear, corrosion and water intrusion. If found, correct in accordance with NAVAIR 01-1A-503.

      (2) Level II. Maintain in accordance with Level I requirements if protected with a tape and barrier system.

      (3) Level III. No maintenance required.

   d. Depreservation. Remove T&B and refer to NAVAIR 01-1A-503.

3-7. BILGES, FLOATS AND SPONSONS. Bilges, floats and sponsons, being natural repositories for water and debris, are particularly susceptible to corrosive attack. Every effort shall be made to rectify any damage detected and to prevent further damage from occurring during the storage period.

   a. Cleaning. Bilges, floats and sponsons may contain water, salt water, dirt, loose fasteners, drill shavings, hydraulic fluid and other debris. Drain using available drains, vacuum cleaners or pumps as appropriate. Clean with soap and water in accordance with NAVAIR 01-1A-509-2 and Chapter 8 and wipe dry.

   CAUTION

   Do not mix greases of different specifications.

   Steam guns and pressure sprays or streams shall never be applied directly to bearings or sheaves.

   WARNING

   During inspection and treatment of bilges and lower fuselage areas, particularly those that are poorly ventilated, maintain forced air ventilation and use respirators and other safety equipment as required.

   b. Inspection. Examine area for corrosion damage by removing access plates and floor boards as necessary. Pay particular attention to areas beneath galleys, battery compartments and personnel relief facilities, as these are particularly susceptible to corrosive attack. Refer to Chapter 8.

   c. Corrosion Control. Treat corroded areas in accordance with NAVAIR 01-1A-509-2.

   Compound, Corrosion Preventive 9

   MIL-DTL-85054

   Potassium Dichromate, Crystals 24

   A-A-59508

   d. Protection. Level I, II and III. Apply CPC, MIL-DTL-85054, to corrosion prone areas around fastener heads, seams and areas with paint damage. Service or replace potassium dichromate receptacles with potassium dichromate crystals, A-A-59508, and close off access openings.
e. **Maintenance.**

(1) Level I. Every 7 days, when inspecting aircraft interior, check bilges for accumulations of water and other fluids. Remove fluids and service potassium dichromate inhibitor receptacles.

(2) Level II. Maintain in accordance with Level I requirements if protected with a tape and barrier system.

(3) Level III. No maintenance required.

f. **Depreservation.** Clean, inspect and control corrosion as specified above as necessary. Service potassium dichromate inhibitor receptacles in accordance with applicable MIMs.

3-8. **CONTROL CABLES.**

Solvent, Degreasing MIL-PRF-680 Type II or III

**CAUTION**

Do not use excessive amounts of solvent to clean installed cables since internal corrosion preventatives/lubricants may be removed or destroyed.

a. **Cleaning.** Clean accessible sections of cable with a cloth moistened with degreasing solvent, MIL-PRF-680 Type II. Pay particular attention to sections passing through bulkheads, fairleads and around pulleys and grooved bellcrank arms.

b. **Inspection.** Inspect all accessible portions of cables for broken strands and other damage by passing a cloth over the area to snag on broken wires. A very careful visual inspection shall be made since a broken wire will not always protrude or stick out of the cable.

(1) Inspect cable for wire kinking. Even though the kink may be straightened so that the damage appears to be slight, the relative adjustment between the strands may have been disturbed and the cable shall be replaced. Replace any cable that has a popped core or loose strands regardless of wear or broken wires.

(2) Inspect clean surfaces for evidence of corrosion. If corrosion is found, release tension on the cable, carefully untwist cable and inspect for corrosion on internal strands. Check remainder of cable for adequacy of corrosion preventive/grease coatings. If the interior strands are corroded, the cable shall be replaced.

(3) Inspect nylon jacketed cables. Any cracks or necking down in diameter in the jacket shall be cause for cable replacement. Usable cable life is over when these conditions begin to appear in the nylon jacket.

**CAUTION**

Do not use wire brushes or metal wool in an attempt to remove corrosion from cables.

c. **Corrosion Control.** Light external corrosion may be removed with a clean dry cloth or fiber bristle brush, H-B-178/1. Cables with any internal or external corrosion which cannot be removed with a dry cloth or fiber bristle brush and cables with broken strands caused by corrosion shall be replaced before flight of the aircraft.

**Compound, Corrosion Preventive** MIL-PRF-81309 Type II

d. **Protection.** Level I, II and III. Apply water displacing CPC, MIL-PRF-81309 Type II. Touch up serviceable cables with grease or CPC as follows:

**Compound, Corrosion Preventive** MIL-PRF-16173 Grade 1 or 4

(1) Low temperature (less than 248°F (120°C)) cables require CPC, MIL-PRF-16173. For interior cables, use Grade 4, and for exterior cables, use Grade 1.

(2) Cables passing through high temperature areas (248°F-356°F (120°C-180°C)) shall be coated with grease, MIL-PRF-81322.

(3) Do not apply compounds so thick that they will interfere with the operation of cables, fairleads, pulleys, or bellcrank arms. Remove excess CPC by wiping with a clean dry cloth.

(4) Removable cables shall be immersed in CPC, MIL-PRF-81309 Type II.
e. **Maintenance.**

(1) Level I and II. Every 7 days, inspect exposed cables.

(2) Level III. No maintenance required.

def. **Depreservation.** Clean, inspect and control corrosion as specified above. Reapply CPCs as necessary in accordance with MIMs.

3-9. **CANOPY FRAMES AND SEALS.**

**WARNING**

Disarm ejection seat mechanism before cleaning. Ensure that only authorized personnel disarm seats and perform cleaning operation.

Ensure that all electrical power is disconnected from the aircraft and all electrical systems in the aircraft are deactivated. Injury or death may otherwise result.

Do not use synthetic wiping cloths (e.g. A-A-59323) with flammable solvents, such as aliphatic naptha, TT-N-95.

a. **Cleaning.**

Naphtha, Aliphatic TT-N-95 Type II

(1) Clean mating metal surfaces of oils, greases and CPCs using a cloth dampened with aliphatic naphtha, TT-N-95 Type II.

Alcohol, Isopropyl TT-I-735

(2) If fungus is noted on rubber parts, clean with cotton cheesecloth, CCC-C-440, moistened with isopropyl alcohol, TT-I-735, or NAVCLEAN.

(3) When drains are provided, drain moisture from pneumatic type canopy seals.

(4) Refer to NAVAIR 01-1A-509-2 and MIMS for specific cleaning instructions.

b. **Inspection.**

(1) Check canopy weather and pressure seals for deterioration and cuts.

(2) Check rubber seals for fungus growth which can cause deterioration of the rubber and corrosion on surrounding metal surfaces.

(3) Inspect canopy frame for cracks, loose or missing fasteners, and corrosion around fasteners.

c. **Protection.** Level I, II and III.

Talc, Technical 28
A-A-59303 Type T1

(1) Dust rubber seals with talc, A-A-59303, Type T1.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

Compound, Corrosion Preventive 9
MIL-DTL-85054

**CAUTION**

Apply MIL-DTL-85054 only to nonmoving items requiring no lubrication.

(2) Touch up bare spots on canopy frame with the applicable paint finish. Mask off adjacent areas to prevent overspray on canopy transparencies. If applicable paint finish is not available, spray bare spots with CPC, MIL-PRF-81309 Type II or MIL-DTL-85054. Remove excess CPC with a clean cloth.

d. **Maintenance.**

(1) Level I. Every 7 days, open canopies and check rubber seals and mating surfaces to ensure they are free of oils, greases and preservatives. Clean seals as necessary and dust with talc, A-A-59303 Type T1, before closing.

(2) Level II. Maintain in accordance with Level I requirements if protected with T&B system.
(3) Level III. No maintenance required.

e. **Depreservation.** Clean, inspect, and control corrosion as specified above.

### 3-10. CARGO HOISTS, RESCUE SLINGS, AND DRUMS.

a. **Cleaning.** Clean in accordance with MIMs and NAVAIR 01-1A-509-2.

![Compound, Corrosion Preventive](image) 9 MIL-DTL-85054

b. **Inspection/Corrosion Control.** Inspect for corrosion and treat in accordance with NAVAIR 01-1A-509-2, paying particular attention to hoist cables and hoist mechanisms located in engine exhaust trail areas. Ensure that painted surfaces of drums are kept touched up with applicable paint finish. If paint is unavailable, use CPC, MIL-DTL-85054.

c. **Protection.**

![Compound, Corrosion Preventive](image) 8 MIL-PRF-81309 Type II

(1) **Level I.** Unwind and preserve cables with CPC, MIL-PRF-81309 Type II. Rewind cables on hoist drum and service hoist mechanism in accordance with applicable MIMs. Cover mechanism with barrier material, MIL-PRF-131 Class 1, secured by tape, SAE AMS-T-22085 Type II.

(2) **Level II.** Apply CPC and rewind cables as required for Level I preservation. Completely cover hoist cable drum mechanism using VCI packaging material, MIL-PRF-3420 Class 1, held in place by tape, SAE AMS-T-22085 Type II. VCI covering shall be sealed as much as possible in order to retain the corrosion inhibiting vapors. To weatherproof the VCI wrapped unit, cover with barrier material, MIL-PRF-131 Class 1, secured by tape, SAE AMS-T-22085 Type II.

![Compound, Corrosion Preventive](image) 8 MIL-PRF-81309 Type II

d. **Maintenance.**

(1) **Level I.** Every 28 days, remove barrier material and unwind and represerve cables with hoist mechanism.

(2) **Level II.** Every 28 days, inspect barrier material for rips or tears. Repair or replace as necessary.

(3) **Level III.** No maintenance required.

e. **Depreservation.** Remove barrier material. Clean, inspect and control corrosion as specified above.

### 3-11. COCKPITS.

**WARNING**

Disarm ejection seat mechanism before cleaning. Ensure that only authorized personnel disarm seats and perform cleaning operation.

![Cleaning Compound, Aircraft](image) 4 MIL-PRF-85570 Type II

![Detergent, General Purpose](image) 13 MIL-D-16791 Type I

da. **Cleaning.** Remove salt deposits, soils, debris and oils from the cockpit area. Wipe with a cloth wet with cleaning solution of 1 part MIL-PRF-85570 Type II, in 9 parts fresh water, or 1 oz. of detergent, MIL-D-16791, in one gallon of fresh water. Wipe and rinse with fresh water. Dry excess water with clean cloth.

b. **Inspection.** Inspect for corrosion, paying particular attention to areas under ejection seats, under soundproofing materials, behind fairings and similar hidden spaces.

c. **Corrosion Control.** Treat corrosion in accordance with NAVAIR 01-1A-509-2.

d. **Protection.** Level I, II and III. Whenever possible, use existing openings in the aircraft structure for ventilation, such as cockpit flood openings and pressure...
relief valves. For Level II shipment preservation, place desiccant bags into cockpit area. Refer to Chapter 6, Section II, for specific information on desiccant amount and application requirements.

e. **Maintenance.**

(1) Level I. Every 7 days, when inspecting aircraft interior, check cockpit area for accumulations of dirt, water and foreign objects. Open unvented cockpits on calm, clear days to allow for ventilation. Close cockpits during rainy or windy weather.

(2) Level II. Maintain in accordance with Level I requirements if protected with a tape and barrier system.

(3) Level III. No maintenance required.

f. **Depreservation.** Clean, inspect and control corrosion as specified above. Remove desiccant from shipped aircraft. Remove spare gear and caution/warning tags.

3-12. **CONTROL SURFACES.** Control surfaces are preserved in the same manner as painted skin surfaces with the addition of installed battens, gust locks, or jury struts, to prevent buffeting.

a. **Cleaning.** Clean in accordance with NAVAIR 01-1A-509-2 and Chapter 8. Check to make sure drains are open.

b. **Inspection.** Inspect in accordance with NAVAIR 01-1A-509-2 and Chapter 8.

c. **Corrosion Control.** Treat corrosion in accordance with NAVAIR 01-1A-509-2.

| Compound, Corrosion Preventive | 8 |
| MIL-PRF-81309 Type II |

| Oil, Lubricating, Preservative | 23 |
| MIL-PRF-32033 |

d. **Protection.** Level I, II and III.

(1) Control surface attaching points and control mechanisms shall be lubricated according to the applicable MIMs. Apply CPC, MIL-PRF-81309 Type II, to all hinged areas and lubricate with corrosion preventive lubricating oil, MIL-PRF-32033. For Level I and II preservation using the T&B barrier system, cover all openings where water might enter and accumulate using barrier material, MIL-PRF-131 Class 1, and preservation tape, SAE AMS-T-22085 Type II.

(2) Gust locks or battens of padded construction shall be installed on control surfaces of aircraft stored outdoors. For examples of movable surface battens see Figure 3-1. Before manufacturing battens, consideration should be given to the control surface size, material construction, and wind load. Wider battens may be necessary to disperse the load on honeycomb materials. Double battens shall be installed on the larger surfaces. Install jury struts as required in accordance with MIMs. When a strippable coating is to be applied, consideration should be given to the desirability of installing battens after strippable coatings are applied, especially where larger surfaces are involved.

**CAUTION**

Large (60-72 inch long) battens of aluminum construction have proved to be unsatisfactory under heavy buffeting and shall not be used for Level II preservation.

(3) Battens shall be constructed of aluminum alloy or of hardwood and designed with sufficient strength to withstand heavy buffeting. Battens shall be padded on the inside with approximately 1/4 inch thick cushioning material. Battens shall be secured using two bolts to keep the battens from rotating. Consult the applicable MIMs for information concerning construction details when local manufacture of battens is required.

e. **Maintenance.**

(1) Level I. Everyday, inspect and repair any compromises to the barrier system. Every 28 days, re-lubricate in accordance with MRCs or renew as necessary on critical areas: hinges, actuating mechanisms, speed brakes and access doors.

(2) Level II. Maintain in accordance with Level I requirements if protected with a T&B barrier system.

(3) Level III. No maintenance required.

f. **Depreservation.** Remove barrier system and battens. Clean, inspect and control corrosion as specified above.
3-13. DRAIN HOLES.

a. **Cleaning.** Make sure that all drain holes are clear by inserting a probe, such as a pipe cleaner. Refer to aircraft maintenance manuals for the locations of drain holes and additional cleaning instructions. If spot cleaning is required, refer to Chapter 8.

b. **Inspection.** Ensure all drain holes are open, and check for proper function.

c. **Corrosion Control.** Remove excessive corrosion in and around drain holes in accordance with NAVAIR 01-1A-509-2.

d. **Protection.** Level I, II and III. Ensure that all drain holes in the aircraft are open and effectively draining the area.

e. **Maintenance.**

   (1) Level I. Everyday inspect exterior drain holes to ensure that they are open and effectively draining the area.

   (2) Level II. Maintain as required for Level I preservation for T&B system only. Check drain holes every 7 days for all other barrier systems.

   (3) Level III. No maintenance required.

f. **Depreservation.** Remove barrier system. Remove auxiliary drain provisions. Inspect to ensure all drain holes are open. Clean, inspect and control corrosion as specified above.

3-14. SEATS (Except Ejection).

![Figure 3-1. Examples of Movable Surface Battens](image)

**Cleaning Compound, Aircraft**

MIL-PRF-85570 Type II

**Detergent, General Purpose**

MIL-D-16791 Type I

a. **Cleaning.** Remove loose dirt with a vacuum cleaner. Remove greases and oils by scrubbing briskly with a sponge wet with cleaning solution (1 part detergent, MIL-D-16791, in 16 parts water or 1 part cleaner, MIL-PRF-85570 Type II, in 4 parts water). Rinse with clean rag or sponge dampened with clean, fresh water. Dry area with clean cloth. Remove mold or mildew using NAVCLEAN in accordance with manufacturer’s instructions.

b. **Inspection.** Refer to aircraft MIMs or Chapter 8.

c. **Protection.** Level I, II and III. Adjusting mechanisms shall be lubricated according to the applicable MIMs. Seats that may be exposed to direct sunlight or fluids such as rain water shall be covered with barrier material, MIL-PRF-131 Class 1, or plastic, ASTM D4801 Type III.

d. **Maintenance.**

   (1) Level I. Every 7 days, when inspecting aircraft interior, check seats for dampness. Ventilate aircraft until seats are dry.
(2) Level II. Maintain as required for Level I preservation for T&B system only.

(3) Level III. No maintenance required.

e. **Depreservation**. Remove barrier system. Clean and inspect as specified above.

### 3-15. SKIN SURFACES (Exterior).

a. **Cleaning**. Remove dirt, salts, loose paint and other debris according to instructions for cleaning surfaces in NAVAIR 01-1A-509-2. Pay particular attention to all corrosion prone areas such as wheel wells, speed brake recesses and wing fold areas. Ensure that all drain holes are open and functioning properly. Clean hidden surfaces by removing all screw-attached or quick disconnect fastener attached fairings located in exhaust trail areas. Refer to Chapter 8.

b. **Inspection**. Inspect surfaces for corrosion and missing paint. Painted aircraft showing extensive paint failure on skin surfaces shall be protected in the same manner as unpainted aircraft. Refer to aircraft MIMs and Chapter 8.

c. **Corrosion Control**. Treat corrosion in accordance with NAVAIR 01-1A-509-2.

d. **Protection**. Level I, II and III.

![Compound, Corrosion Preventive](MIL-DTL-85054)

(1) For bare metal surfaces apply a complete spray or brush coating of CPC, MIL-DTL-85054, after corrosion is removed.

### CAUTION

Repair the paint on bare composite surfaces or cover with tape and barrier material, as sunlight or fluorescent light will deteriorate the composite matrix.

(2) To minimize degradation, bare areas on composite surfaces (where the paint film is broken) shall be refinished in accordance with the applicable MIM prior to preservation. At a minimum, an opaque primer layer is required. Cover with barrier material, MIL-PRF-131, secured with preservation tape, SAE AMS-T-22085 Type II or IV, during periods of storage and before cleaning or preserving aircraft if aircraft cannot be refinished.

e. **Maintenance**.

1. Level I and II.

   a. Every day, inspect and repair barrier material as necessary on composite surfaces.

   b. Every 28 days, inspect skin surfaces. If bare areas are found, preserve metal or composite surface as described above. Renew CPC applications if required.

2. Level III. No maintenance required.

f. **Depreservation**. Remove barrier system and CPCs if applicable. Open all drain holes. Touch up paint or repaint in accordance with MIMs. Clean, inspect and control corrosion as specified above.
3-16. TRANSPARENCIES (CANOPIES, WINDOWS).
A transparency is any portion of the airframe that is optically transparent, including the canopy, windscreen, window, and molded nose. The following instructions apply to both jettisonable and non-jettisonable canopies, windscreens and other plastic surfaces.

**WARNING**

Do not use synthetic wiping cloths (e.g. A-A-59323) with flammable solvents, such as aliphatic naptha, TT-N-95.

Make sure armament switches are in the off/safe/normal position and install canopy jettison safety pins in accordance with aircraft MIMs.

**CAUTION**

Do not apply cleaning compounds, solvents, or polishes to acrylic type plastic unless the plastic is cool and is protected from the heating effects of sunlight.

Do not use any chemical compounds unless specifically authorized for cleaning plastics.

Do not rub dry plastic panels with a dry cloth. This might scratch surface or create an electrostatic charge that will attract dust.

a. **Cleaning.**

   (1) Remove rings, watches and other hard objects from hands and wrists before washing transparent plastics and glass. Personnel shall also take precautions to prevent buttons, badges or other hard objects from scratching surfaces. Do not use hard, dirty or gritty cloths in cleaning and polishing transparent plastics. Wiping with such cloths can mar and scratch plastics.

   Naphtha, Aliphatic TT-N-95 Type II

   (2) Clean transparencies by flushing with fresh water to remove dirt. Rub gently with bare hands or with a clean cloth while applying fresh water. Remove greases and oils by blotting gently with a soft, clean cloth soaked in aliphatic naphtha, TT-N-95 Type II. Aliphatic naphtha solvent will evaporate and not leave a film.

b. **Inspection.** Inspect transparency for cracks, scratches, distortion, crazing and chips. Refer to MIMs for inspection criteria.

**CAUTION**

Never apply sealing tapes directly on transparent plastic surfaces. Apply to adjacent frame or painted surface.

Do not apply polishing compound, P-P-560, to glass windshields or windows.

Do not apply polishing compound, P-P-560, to interior of canopy. Polish may damage interior surface coatings.

c. **Protection.** Level I, II and III. Apply polishing compound, P-P-560, to exterior of plastic transparencies using flannel, A-A-50129, by rubbing with a circular motion until clean. Avoid rubbing too long or too hard on any one spot. Allow polish to dry and wipe clean with a lint-free cloth. Cover transparencies with cotton flannel, A-A-50129, and cover the flannel with barrier material, MIL-PRF-131 Class 1. Secure the barrier material with tape, SAE AMS-T-22085 Type II, to the canopy frame. The canopy shall open and close without disturbing the barrier material.

d. **Maintenance.**

   (1) Level I. Every 7 days, check condition of applicable T&B on transparencies and repair as necessary.

   (2) Level II. Maintain in accordance with Level I requirements for T&B barrier system only.

   (3) Level III. No maintenance required.

e. **Depreservation.** Clean, inspect and polish as specified above.
### 3-17. AMMUNITION AND PYROTECHNICS.

Ammunition consists of projectiles and propellants for guns. Pyrotechnics today include not only visual “firework” devices but also precision igniters for large solid motors, single-shot actuators, hot-gas generators and IR flares giving accurately controlled decoy wavelength.

a. **Cleaning/Inspection/Corrosion Control.** Refer to MIMs and NAVAIR 11-100-1.1-CD for instructions.

b. **Protection.** Level I, II and III. For aircraft subject to periodic flights, pyrotechnics shall be maintained in place in accordance with the applicable MIMs or NATOPS manuals.

c. **Maintenance.** Level I, II and III. When inspecting aircraft interior maintain flare pyrotechnics required for flight, if applicable.

d. **Depreservation.** Clean, inspect, and control corrosion as specified above.

### 3-18. ARMAMENT EQUIPMENT (BOMB RACKS, PYLONS, MISSILE LAUNCHERS, AND BOMB RELEASE UNITS).

Racks and pylons are external attachments to which bombs are secured. They contain mechanical or EM release, fusing and arming circuits, and other services.

a. **Cleaning/Inspection/Corrosion Control.** Clean, inspect and control corrosion in accordance with the specific armament manual and NAVAIR 01-1A-75.

b. **Protection.**

   - Compound, Corrosion Preventive MIL-PRF-81309 Type III
   - Compound, Corrosion Preventive MIL-PRF-16173 Grade 2

   **CAUTION**

   MIL-DTL-85054 and MIL-PRF-16173 Grade 2 CPCs shall not be permitted to contact the interior of racks, fittings or any electrical connections. Use MIL-PRF-81309 Type III CPC on electrical connectors.

   (1) Level I and II. Coat unpainted or paint damaged nonmoving surfaces with clear CPC, MIL-DTL-85054. Use soft film CPC, MIL-PRF-16173 Grade 2, on unpainted or paint damaged moving parts, and MIL-PRF-81309 Type III on electrical connectors. Cover all cavities that might entrap water with barrier material, MIL-PRF-131 Class 1, and secure with tape, SAE AMS-T-22085 Type II.
(2) Level III. Protect in accordance with Level I requirement, however no barrier material cover is required.

c. Maintenance.

   (1) Level I and II. Every 7 days, inspect preservative CPCs on exposed surfaces for integrity. Check water entrapment areas. Ensure that barrier system is intact. Check to ensure that adequate drainage is provided.

   (2) Level III. No maintenance required.

d. Depreservation. Remove barrier system. Clean, inspect and control corrosion in accordance with above instructions. Service in accordance with aircraft MIMs and NAVAIR 01-1A-75.

   **WARNING**

   Observe the following precautions when handling cartridge actuated devices (CADS). Keep away from live circuits. Do not service or adjust alone. Follow smoking regulations and know supervisory responsibilities. Only qualified/certified personnel may de-arm CADS. Failure to consult authorized personnel may lead to serious injury or death.

3-19. CARTRIDGE ACTUATED DEVICES (CADS).
Safety pins with streamers shall be installed in ejection seat CADS and related emergency equipment in accordance with the applicable MIM and NAVAIR 11-100-1.1-CD.

   **WARNING**

   Only qualified/certified personnel shall arm/disarm all seat and related emergency equipment CADS in accordance with the applicable MIM and NAVAIR 11-100-1.1-CD.

   a. Cleaning/Inspection/Corrosion Control. Refer to NAVAIR 11-100-1.1-CD.

   **CAUTION**

   Sealed-type CADS are not to be opened for any reason. Refer to specific instructions in the descriptive text of the individual device.

   b. Protection. Level I, II and III. Protect CAD systems in accordance with NAVAIR 11-100-1.1-CD. If CADS are to remain installed in aircraft, the Level II or III barrier system shall be appropriately marked in accordance with NAVAIR 11-100-1.1-CD using the applicable wording specified in the warning in Figure 3-2.

   (1) Cartridges and CADS removed from ejection seats, parachutes and survival equipment shall be stored in containers with adequate separation, support and cushioning to prevent damage during handling and storage. Store CADS in a cool, dry place protected from the direct rays of the sun and from temperature extremes.

   (2) If removed, plastic protective caps and plugs, NAS 847, shall be installed to prevent contamination by moisture or foreign matter. If caps are not available, cover with MIL-PRF-131 Class 1 barrier material and SAE AMS-T-22085 Type II preservation tape.

   c. Maintenance. Level I, II and III. Every 28 days, check protective covers for corrosion and water intrusion. Clean in accordance with above instructions.

   d. Depreservation. Refer to NAVAIR 11-100-1.1-CD.
Aircraft Contains Cartridge Activated Personnel Escape Devices Containing Class "C" Explosives.

DOT SP 6250

A. Class C Warning

WARNING

Guns and airborne crew served weapons may be stored on aircraft; however, if possible, remove and preserve in accordance with Chapter 4, Section III, requirements.

Cleaning, lubrication and preservation of guns shall be under the supervision of a qualified ordnanceman.

CAUTION

The applicable NATOPS manual contains safety precautions to be observed when maintaining installed guns and airborne crew served weapons.

a. Cleaning/Inspection/Corrosion Control. If guns and airborne crew served weapons are left in place, clean, inspect, and control corrosion in accordance with applicable MIM and NAVAIR 01-1A-75.

b. Protection. Level I, II and III.

(1) Apply TW-25B grease to exposed metal and inside and outside of gun barrels, or as directed in the MIM/MRC.

(2) If applicable, comply with security requirements of OPNAVINST 5530.13.

c. Maintenance.

(1) Level I and II. Every 28 days, inspect guns in accordance with applicable MIM. Reapply TW-25B grease as necessary.

(2) Level III. No maintenance required.

d. Depreservation. Reinstall (if applicable), service and lubricate system in accordance with applicable MIM and NAVAIR 01-1A-75.

NOTE

Markings shall be stencilled and applied to each side of the aircraft in the area of the cockpit. Stencils shall be red letters a minimum of 2 inches high.

Figure 3-2. Stencilled Explosive Warnings
3-21. **TURRETS.** The hydraulic drive portion shall be preserved with the main hydraulic system according to Section VIII. Accomplish the following after preservation of the hydraulic system.

   a. **Cleaning/Inspection/Corrosion Control.** Refer to applicable MIMs and NAVAIR 01-1A-509-2.

   b. **Protection.**

   Compound, Corrosion Preventive 10
MIL-PRF-16173 Grade 2

(1) Level I, II and III. Lock turret in position. Cover electric motors of electrically driven turrets using plastic sheeting, ASTM D4801, held in place with tape, SAE AMS-T-22085 Type II. Apply soft film CPC, MIL-PRF-16173 Grade 2, to azimuth and elevation gears. Seal all openings that would allow entry of water into aircraft using barrier material, MIL-PRF-131 Class 1, and tape, SAE AMS-T-22085 Type II.

(2) Level III. Lock turret in position. Apply soft film CPC, MIL-PRF-16173 Grade 2, to azimuth and elevation gears.

   c. **Maintenance.**

   (1) Level I and II. Every 7 days, check exterior seals, barrier materials and preservative coatings on exposed, unpainted surfaces for integrity. Inspect and treat exposed portions of azimuth and elevation gears for corrosion damage in accordance with the applicable MIM.

   (2) Level III. No maintenance required.

   d. **Depreservation.** Remove barrier material and CPCs. Service hydraulic system accumulators in accordance with applicable MIM. Clean, inspect and control corrosion in accordance with above instructions.
3-22. DRIVE AND GEARBOX (External Portions).
External surfaces of transmissions or gearboxes are particularly vulnerable to corrosion due to salt spray exposure during operation. Magnesium housings are especially prone to corrosion.

a. Cleaning/Inspection/Corrosion Control. Clean and inspect exterior of transmission systems or gearboxes in accordance with NAVAIR 01-1A-509-2 and MIMs.

b. Protection.

Compound, Corrosion Preventive 9 MIL-DTL-85054

(1) Level I and II. Coat exposed magnesium housings and nonmoving unpainted metal surfaces with CPC, MIL-DTL-85054. Seal transmissions and gearboxes and cover all associated openings into the aircraft interior where water and salt spray might enter using barrier material, MIL-PRF-131 Class 1 and tape, SAE AMS-T-22085 Type II.

(2) Level III. Apply CPC in accordance with Level I and II requirements. Aircraft stored in dehumidified enclosures do not require the application of tape and barrier.

c. Maintenance.

(1) Level I and II. Every 28 days, check external seals and barrier materials for integrity. If condition of barrier materials and seals is such that water leakage could have occurred, check gearboxes for water accumulation.

(2) Level III. No maintenance required.

d. Depreservation. Remove barrier system and CPC. Clean, inspect and control corrosion in accordance with the above instructions.

3-23. DRIVE AND GEARBOX (Internal Portions).

a. Cleaning. No cleaning required.

b. Inspection. Inspect for contamination (water, cleaning compounds, particles) by draining a small amount of lubricant from low-point drains and visually inspecting it.

c. Corrosion Control. If contamination is found in lubricant, refer to MIMs for corrective action.

d. Protection - Operable. Level I, II and III. When servicing gearboxes and transmissions prior to runup, comply with periodic lubricant change requirements of the applicable MIM. Rotate the gearbox/transmission for 3-5 minutes, until lubricant is thoroughly distributed throughout the lubrication system. Leave lubricant in system in accordance with applicable MIM. Do not drain.

NOTE

Lubricating fluid, DOD-PRF-85734, has a tendency to attract water. Installation of a desiccant breather in gearboxes using this fluid is highly recommended.

e. Protection - Non-Operable. Level I, II and III. Installed inoperable units or operable units that are incapable of being rotated for at least 3-5 minutes shall be preserved in accordance with aircraft MIMs. If other instructions are not available, preserve as follows:

(1) Fill lubricant reservoir to normal operating level with operating lubricant. When possible, use auxiliary equipment to force the lubricant through the pressure oil system of the unit. Leave the lubricant in the unit. Do not drain.

(2) Replace and secure all access covers and plugs and seal all external openings using tape, SAE AMS-T-22085 Type II, and barrier material, MIL-PRF-131 Class 1.
f. **Maintenance.**

(1) Level I and II.

   (a) Every 7 days, if desiccant breather is installed, check desiccant condition and replace if necessary.

   (b) Every 28 days, check integrity of barrier material.

(2) Level III. No maintenance required.

g. **Depreservation.** Remove barrier system and all covers and plugs. Service with operating lubricant, and conduct ground run in accordance with applicable MIM. Inspect in accordance with above instructions.
### SECTION V. ELECTRICAL

Table 3-4. Electrical Systems Summary

<table>
<thead>
<tr>
<th>ELECTRICAL SYSTEM</th>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>3-24a</td>
<td>3-24a</td>
<td>3-24a</td>
<td>3-24a</td>
<td>3-24b</td>
<td>3-24c</td>
<td>3-24d</td>
<td>NAVAIR 01-1A-509-3</td>
</tr>
<tr>
<td>Batteries, Dry Cell</td>
<td>3-25a</td>
<td>3-25a</td>
<td>3-25a</td>
<td>3-25b</td>
<td>3-25c</td>
<td>3-25d</td>
<td>NAVAIR 17-15BAD-1</td>
<td></td>
</tr>
<tr>
<td>Batteries, Wet Cell</td>
<td>3-26a</td>
<td>3-26b</td>
<td>-----</td>
<td>3-26c</td>
<td>3-26d</td>
<td>3-26e</td>
<td>NAVAIR 17-15BAD-1</td>
<td></td>
</tr>
<tr>
<td>Battery Vent System Unit</td>
<td>3-27a</td>
<td>3-27b</td>
<td>3-27c</td>
<td>3-27d</td>
<td>3-27e</td>
<td>3-27f</td>
<td>NAVAIR 01-1A-509-3</td>
<td></td>
</tr>
<tr>
<td>Connectors</td>
<td>3-28a</td>
<td>3-28b</td>
<td>3-28c</td>
<td>3-28d</td>
<td>3-28e</td>
<td>3-28f</td>
<td>NAVAIR 01-1A-509-3</td>
<td></td>
</tr>
<tr>
<td>Consoles and Control Panels</td>
<td>3-29a</td>
<td>3-29b</td>
<td>-----</td>
<td>3-29c</td>
<td>3-29d</td>
<td>3-29e</td>
<td>NAVAIR 01-1A-509-3</td>
<td></td>
</tr>
<tr>
<td>Junction Boxes</td>
<td>3-30a</td>
<td>3-30b</td>
<td>3-30c</td>
<td>3-30d</td>
<td>3-30e</td>
<td>3-30f</td>
<td>NAVAIR 01-1A-509-3</td>
<td></td>
</tr>
<tr>
<td>Lights</td>
<td>3-31a</td>
<td>3-31b</td>
<td>3-31c</td>
<td>3-31d</td>
<td>3-31e</td>
<td>3-31f</td>
<td>NAVAIR 01-1A-509-3</td>
<td></td>
</tr>
<tr>
<td>Motors and Inverters</td>
<td>3-32a</td>
<td>3-32a</td>
<td>-----</td>
<td>3-32b</td>
<td>3-32c</td>
<td>3-32d</td>
<td>-----</td>
<td></td>
</tr>
</tbody>
</table>

**3-24. ELECTRICAL.** Almost all corrosion that occurs on avionic equipment is similar to that which occurs on the basic airframe structure. The difference between avionic and airframe corrosion is that minute amounts of corrosion in electrical equipment can cause serious degradation or complete failure, while it may be insignificant on larger structures. Except for a few special items, preservation of electrical gear consists primarily of cleaning and removing corrosion, in accordance with NAVAIR 01-1A-509-3, and covering to prevent entrance of dirt and water during storage.

**WARNING**

Before cleaning electrical and avionic equipment, make sure electrical power is disconnected. Injury or death may otherwise result. Open all circuit breakers associated with battery power (refer to applicable aircraft manuals) prior to application of flammable solvent cleaners.

**CAUTION**

Aircraft electrical systems usually cannot tolerate the application of grease or oil-type preservatives or CPCs. Exceptions are for ultra thin materials that have been developed specifically for avionics equipment. Also, many electrical systems have moisture and fungus resistant coatings applied during manufacture or overhaul.

- a. **Cleaning/Inspection/Corrosion.** Refer to NAVAIR 01-1A-509-3. During inspection and treatment for corrosion damage, pay particular attention to areas which are cooled with outside source air during normal operation. Such areas may become covered with salt deposits during operation in a marine atmosphere.

- b. **Protection.**
  
  Compound, Corrosion Preventive 8 MIL-PRF-81309 Type III

  (1) Level I and II. Apply MIL-PRF-81309 Type III to all corrosion prone areas, avoiding relay and circuit breaker contacts. To prevent damage from water and accumulated dirt, keep exposed units covered with barrier material, MIL-PRF-131 Class 1 or ASTM D4801 Type III, held in place with tape, SAE AMS-T-22085 Type II.

  (2) Level III. Apply CPC in accordance with Level I requirements.

- c. **Maintenance.**

  (1) Level I and II. Every 28 days, check integrity of barrier material. Renew CPC and repair/replace barrier material as required.

  (2) Level III. No maintenance required.

- d. **Depreservation.** Remove barrier system. Clean and inspect in accordance with above instructions.
3-25.  **BATTERIES, DRY CELL.** The dry cell contains an aqueous electrolyte either as a paste or gel that is immobilized so that it does not spill when the cell is inverted. Dry cell batteries may be either primary or secondary type and there are several kinds of dry cell construction. The dry type is manufactured in the active condition ready for immediate use. These cells may be used for radios, tape recorders, precision measuring instruments, radiation-detection devices or voltage recorders.

a. **Cleaning/Inspection/Corrosion Control.** Refer to NAVAIR 01-1A-509-3.

b. **Protection.**

   (1) Level I. Leave dry cells installed.

   **NOTE**

   When battery removal involves emergency radio beacons and similar equipment required for flight, install a warning tag on all units involved (see Figure 3-3). If warning tags cannot be readily seen when installed directly on units, install a second tag on engine throttle quadrant or other conspicuous location in the cockpit.

   (2) Level II and III. Remove dry cell batteries and tag location. Use them in other applications or turn in to supply for disposition. Store in accordance with NAVAIR 17-15BAD-1.

c. **Maintenance.** Level I, II and III. Maintain in accordance with NAVAIR 17-15BAD-1 and aircraft MIMs.

d. **Depreservation.** Reinstall batteries if required for flight. Remove warning tags from units when reinstalled. Clean and inspect in accordance with above instructions.

3-26.  **BATTERIES, WET CELL.** Wet cell batteries may be either primary or secondary type. The electrolyte used by a cell may be acidic or alkaline, depending on its construction. Color coding for acid batteries is pink, and for alkaline batteries is blue. Maintain separate tools and materials, such as screwdrivers, wrenches, syringes, hydrometers and gloves for each type of battery.

   **WARNING**

   To avoid electric shock, never use a wire brush to clean a battery. Wear rubber gloves, a rubber apron and protective goggles when handling batteries.

   Nickel-cadmium batteries shall not be exposed to acid or acid vapors. Battery electrolytes are extremely corrosive. Spilled electrolyte shall be removed immediately. Refer to the applicable aircraft manuals for battery type.

   Both sulfuric acid and potassium hydroxide battery electrolytes will cause severe corrosion of metallic structure. Avoid dripping electrolyte on, or allowing contaminated gloves, rags, or sponges to come in contact with aircraft structure. Place all items contaminated with electrolyte in a leakproof plastic container prior to removing them from the aircraft. Remove any battery box which contains spilled electrolyte from the aircraft prior to cleaning it. Electrolyte spilled on aircraft surfaces shall be cleaned up as soon as possible. During the initial flushing procedure, water may pick up enough battery electrolyte residue to become a strong acid or alkali depending on the type of battery used. Flushing water shall be vented away from aircraft structure. Personnel shall avoid bodily contact with cleaning residue.

a. **Cleaning.** If spillage and water are detected, clean the battery and battery area to remove them. Clean the terminals with a fiber brush and flush the area with fresh water. Dry with clean wiping cloths. Keep the cell vents open. Refer to paragraph 3-5 for neutralization procedures.

b. **Inspection.** Inspect for the presence of electrolyte and water in accordance with NAVAIR 17-15BAD-1.
c. Protection.

(1) Level I. Wet cell batteries shall remain installed; fully charged.

Compound, Corrosion Preventive  8
MIL-PRF-81309 Type III

NOTE

Wet cell batteries shall always be maintained in a charged condition in accordance with NAVAIR 17-15BAD-1. This is accomplished by removing batteries and maintaining them in the local battery shop until required for aircraft turn up or flight.

(2) Level II and III. Remove wet cell batteries. Coat cleaned and dried terminals with water-displacing CPC, MIL-PRF-81309 Type III.

**WARNING**

Do not attempt to recharge primary batteries.

(3) Shipment. Charge serviceable wet cell batteries to fully normal operating capacity. Disconnect battery terminals and quick disconnects. Secure cables away from battery.

d. Maintenance.

(1) Level I. Every 7 days, check battery to ensure fully charged condition.

(2) Level II and III. No maintenance required.

(3) Shipment. When inspecting aircraft interior, check to ensure that terminal and quick disconnect coverings are secure and that cables are secured away from battery. Check battery for evidence of electrolyte spillage. Clean and neutralize electrolyte deposits as necessary.

e. Depreservation. If required for ground runups or flight, connect and/or install fully charged battery. Clean and inspect in accordance with above instructions.

3-27. **BATTERY VENT SYSTEM UNITS.** In spite of protective paint systems, CPCs, and venting provisions, the battery vent openings on aircraft skin are corrosion prone areas.


b. Inspection. Visually inspect in accordance with Chapter 8 and NAVAIR 01-1A-509-3.

c. Corrosion Control. Correct any corrosion found in accordance with NAVAIR 01-1A-509-3.

d. Protection.

(1) Level I. When battery is installed, the vent holes shall be kept unobstructed.

(2) Level II. Cover holes with preservation tape, SAE AMS-T-22085 Type II.

(3) Level III. No preservation required.

e. Maintenance.

(1) Level I. Everyday, inspect battery vent to ensure it is unobstructed.

(2) Level II. Every 7 days, inspect tape and replace if lifted.

(3) Level III. No maintenance required.

f. Depreservation. Remove barrier material. Clean and inspect in accordance with above instructions.

3-28. **CONNECTORS.**

a. Cleaning. For detailed treatment of cleaning for each type of connector, refer to NAVAIR 01-1A-509-3.

b. Inspection. Visually inspect in accordance with NAVAIR 01-1A-509-3.

c. Corrosion Control. Multipin electrical connectors, coaxial connectors, edge connectors (printed circuit boards) and mating plugs pose particular corrosion problems. For detailed treatment of corrosion for each type, refer to NAVAIR 01-1A-509-3.
d. Protection.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type III

**CAUTION**

The use of unauthorized sealants or potting materials can cause severe damage to affected connectors or components. Refer to NAVAIR 01-1A-509-3 for authorized avionic materials and procedures.

Only pressure sensitive tape, A-A-59163, is authorized for use directly on electrical connectors.

(1) Disconnected Multipin Electrical Connectors. Level I, II and III. Spray interior of disconnected multipin electrical connectors with CPC, MIL-PRF-81309 Type III. Cap connector with a metal or plastic cap. If caps are not available, cover connectors using one of the following methods. If possible, secure connector cables to adjacent bulkhead with the open connector end facing upward to prevent fluid entrapment.

   (a) Cover connector with barrier material, MIL-PRF-81705 Type I or III (preferred) or MIL-PRF-131 Class 1. Secure barrier material with tape, SAE AMS-T-22085 Type II. Do not attach tape directly to connector shell. Wrap tape tightly around connector cable to seal edges of barrier material against water/fluid intrusion.

   (b) Cover and seal connector using pressure sensitive tape, A-A-59163 Class 1. See NAVAIR 01-1A-505-1 for additional application information.

(2) Interior Deck Mounted Electrical Connectors. Level I, II and III. Disconnect all interior deck-mounted electrical connectors that are vulnerable to water entrapment. Spray disconnected electrical connectors with CPC, MIL-PRF-81309 Type III. Apply a continuous thin wet coat. Cap connector with a metal or plastic cap. Threaded metal or plastic covers are mandatory for deck-mounted receptacles. Secure connectors as near to the point of removal as possible.

f. Depreservation. Remove caps or barrier material. Clean, inspect and remove any corrosion as specified above. Reinstall and secure connectors after coating the interior of connectors with CPC, MIL-PRF-81309 Type III.

3-29. CONSOLES AND CONTROL PANELS.

Detergent, General Purpose 13
MIL-D-16791 Type I

Naphtha, Aliphatic 19
TT-N-95 Type II

**WARNING**

Do not use synthetic wiping cloths (e.g. A-A-59323) with flammable solvents, such as aliphatic naptha, TT-N-95.
CAUTION

Remove rings, watches, or other hard objects from hands and wrists before washing transparent plastics. Personnel shall also take precautions to prevent buttons, badges, or other hard objects from scratching surfaces. Do not use hard, dirty, or gritty cloths in cleaning and polishing transparent plastics. Wiping with such cloths can mar and scratch plastic surfaces. Do not use chemical compounds unless specifically authorized for cleaning plastic surfaces.

Do not use tape on transparent acrylic surfaces.

a. Cleaning. Vacuum consoles using a hand held vacuum cleaner. Remove dust, soils and salt deposits by wiping with cloth, A-A-50129, wet with cleaning solution (1 oz. MIL-D-16791 Type I in 1 gal. water). Remove cleaning solution with a cloth wet with fresh water and dry with a clean cloth, or wipe with a clean cloth wet with aliphatic naphtha TT-N-95, and allow surface to air dry.

b. Inspection. Inspect in accordance with Chapter 8. Pay particular attention to switches, dials, knobs and electrical connectors for corrosion and contaminants.

c. Protection.

NOTE

When tape must be applied to soundproofing and upholstery materials on interior surfaces, use preservation tape SAE AMS-T-22085 Type II. Apply tape to seat frames or adjoining metal surfaces.

(1) Level I and II. Cover consoles that are subject to water damage with barrier material, MIL-PRF-131 Class 1, or plastic, ASTM D4801 Type III, held in place with tape, SAE AMS-T-22085 Type II.

(2) Level III. No protection required.

d. Maintenance.

(1) Level I and II. Every 7 days, when inspecting aircraft interior, check barrier materials for security. Check consoles for water entrapment and corrosion damage. Treat areas in accordance with NAVAIR 01-1A-509-3.

(2) Level III. No maintenance required.

e. Depreservation. Remove barrier materials. Clean and inspect in accordance with the above instructions.

3-30. JUNCTION BOXES.

WARNING

Ensure that all electrical power is disconnected from the aircraft and all electrical systems in the aircraft are deactivated. Disconnect all batteries.

a. Cleaning. Junction boxes shall be cleaned in accordance with NAVAIR 01-1A-509-3. For junction boxes which are exposed to the weather or cleaning compounds, check to ensure that the drain holes are open.

b. Inspection. If drain holes are plugged and upon unplugging water is found, open junction boxes to inspect for corrosion damage.

c. Corrosion Control. Arrest any corrosion found in accordance with NAVAIR 01-1A-509-3.


e. Maintenance.

(1) Level I. Every 28 days, check exposed junction boxes for water intrusion and corrosion damage.

(2) Level II. Maintain in accordance with Level I requirements for T&B protective system only.

(3) Level III. No maintenance required.

f. Depreservation. Clean, inspect and remove any corrosion in accordance with above instructions. Service system in accordance with NAVAIR 01-1A-509-3.
3-31. LIGHTS. External formation lights, wing tip lights, rotating beacons and lower fuselage anticollision lights are highly susceptible to corrosion due to poor seals, exposure to the elements in flight, and water intrusion (especially lower fuselage lights) during aircraft wash.

Naphtha, Aliphatic TT-N-95 Type II

**WARNING**

Do not use synthetic wiping cloths (e.g. A-A-59323) with flammable solvents, such as aliphatic naphtha, TT-N-95.

**CAUTION**

Remove rings, watches or other hard objects from hands and wrists before washing transparent plastics. Personnel shall also take precautions to prevent buttons, badges or other hard objects from scratching surfaces. Do not use hard, dirty or gritty cloths in cleaning and polishing transparent plastics. Wiping with such cloths can mar and scratch plastic surfaces. Do not use chemical compounds unless specifically authorized for cleaning plastics. Do not use tape on transparent acrylic surface.

a. **Cleaning.** Clean plastic lenses of grease and oil by applying aliphatic naphtha, TT-N-95 Type II, with a soft, clean, flannel cloth, A-A-50129. Blot gently or solvent will evaporate and leave a film. Apply polishing compound, P-P-560. Rub using a circular motion until clean, and polish with another soft, clean cloth.

b. **Inspection.** Check lights and light cavities for entrapped moisture, especially those located on the undersurface of aircraft. Disassemble lights as necessary to drain and dry.

c. **Corrosion Control.** Arrest any corrosion found in accordance with NAVAIR 01-1A-509-3.

d. **Protection.**

   (1) Level I and II. Cover plastic light lenses with barrier material, MIL-PRF-131 Class 1, held in place with tape, SAE AMS-T-22085 Type II. Glass-type light lenses do not require covering.

   (2) Level III. No protection required.

e. **Maintenance.**

   (1) Level I. Every 7 days, maintain plastic light lenses free of oils, greases by applying aliphatic naphtha, TT-N-95 Type II, with a soft, clean, flannel cloth, A-A-50129. Blot gently or solvent will evaporate and leave a film. Apply polishing compound, P-P-560. Reapply barrier material. Check lights for water accumulation and drain if necessary.

   (2) Level II. Maintain in accordance with Level I requirements for T&B protective system only.

   (3) Level III. No maintenance required.

f. **Depreservation.** Remove barrier material. Clean and inspect in accordance with above instructions.

3-32. MOTORS AND INVERTERS. Activate motors and inverters on all operable systems during preservation runups to eliminate moisture.

a. **Cleaning/Inspection.** Refer to NAVAIR 01-1A-509-3.

b. **Protection.**

   (1) Level I and II. If these items will be exposed to water during storage or shipment, cover using barrier material, MIL-PRF-131 Class 1, and tape, SAE AMS-T-22085 Type II.

   (2) Level III. No protection required.

c. **Maintenance.**

   (1) Level I. Every 7 days, when inspecting aircraft interior, check exposed units for security of barrier materials.

   (2) Level II. Maintain in accordance with Level I requirements for T&B protective system only.

   (3) Level III. No maintenance required.

d. **Depreservation.** Remove barrier material. Clean and inspect in accordance with NAVAIR 01-1A-509-3. Activate and service system in accordance with applicable MIM.
3-33. **ELECTRONICS.** Instruments, displays, navigational, electronic counter measures and communications are included in electronic systems. Preservation of electronic systems primarily involves desiccating unit installation and maintenance. Refer to Table 3-5 for items covered in this section.

3-34. **ANTENNAS.** Antenna systems normally are exposed to a fairly severe environment. Without a good corrosion preventive procedure, corrosion can render the antenna system useless. Deterioration of the antennas and associated hardware results in shorts, open circuits, loss of dielectrics, signal attenuation, or electromagnetic interference. The antennas mounted on the lower fuselage are particularly corrosion prone. The bilge is a natural collection point for the oils, water and dirt.

   a. **Cleaning.** Refer to NAVAIR 01-1A-509-3.

   b. **Inspection.** Visually check the antenna mounting base metal surface for corrosion attack, the most obvious of which is a corrosion deposit. Visible corrosion generally can be identified as a white or grayish white powder.

   c. **Corrosion Control.** When corrosion is visually apparent, correct in accordance with NAVAIR 01-1A-509-3.

   d. **Protection.**

      (1) Level I. Protect in accordance with NAVAIR 01-1A-509-3.

      (2) Level II and III. Protect as required for Level I preservation. External wire-type antennas that are subject to damage shall be removed and stored in the aircraft. Also, antenna removal may be required when aircraft are preserved with reusable covers or bags. Protect mounting receptacles by covering with shingled preservation tape, SAE AMS-T-22085 Type II (see Chapter 5, Section VI).

   e. **Maintenance.**

      (1) Level I. Every 28 days, check coiled and externally fastened antennas for security.

      (2) Level II. Maintain in accordance with Level I requirements and replace tape covering on mounting receptacles when necessary.

      (3) Level III. No maintenance required.

   f. **Depreservation.** If antenna was removed, install and secure. Clean, inspect and treat corrosion in accordance with above instructions.

3-35. **DESICCANT UNITS.** These are small units that fit inside individual components to provide a relatively dry atmosphere for moisture sensitive parts. They come in various sizes, shapes and colors. Some reactivate when the equipment is operational. Others require replacement or reactivation when the color indicator changes. Refer to the applicable MIMs for servicing and maintenance procedures.
3-36. HEADSETS AND MICROPHONES.

Alcohol, Isopropyl TT-I-735


b. Protection.

(1) Level I, II and III. Coil headset and microphone cords and secure coil with tape, SAE AMS-T-22085 Type II.

(2) Shipment. Secure cords and units to adjacent structure to prevent movement and damage during shipment using preservation tape, SAE AMS-T-22085 Type II, or nylon cord, MIL-C-5040 Type I.

c. Maintenance.

(1) Level I, II and III. No maintenance required.

(2) Shipment. When inspecting aircraft interior, check units to ensure they are securely fastened to prevent movement.

d. Depreservation. Remove tape, uncoil and clean in accordance with above instructions. Service in accordance with applicable MIMs.

3-37. POWER SUPPLIES. Warm up or activate power supplies during engine preservation runups and flights. Ensure that the warm-up period is of sufficient length to dry out all residual moisture.

a. Protection.

(1) Level I and II. Cover power supplies exposed to water leakage in storage or during shipment, using barrier material, MIL-PRF-131 Class 1, or plastic, ASTM D4801 Type III, held in place with tape, SAE AMS-T-22085 Type II.

(2) Level III. No protection required.

b. Maintenance.

(1) Level I and II. Every 7 days, when inspecting aircraft interior, check barrier material for security.

(2) Level III. No maintenance required.

c. Depreservation. Remove barrier material. Clean and service in accordance with applicable MIM.

3-38. RADOMES. A radome is a protective covering over radar or other aerial equipment, especially those with mechanical scanning. They are made of dielectric material selected for operating wavelength and other factors.

Solvent, Degreasing 27 MIL-PRF-680 Type II or III

**WARNING**

Open all circuit breakers associated with battery power (refer to applicable MIM) prior to application of degreasing solvent MIL-PRF-680 Type II or III.

a. Cleaning. Ensure that radome surfaces are kept free of oil, greases and CPCs by wiping fiberglass with cotton cheesecloth wet with cleaning solvent, MIL-PRF-680 Type II or III. Wipe excess solvent with clean cloth. Refer to Chapter 8.

b. Inspection. Check for missing paint and repair in accordance with applicable aircraft MIMs.

c. Protection. Level I, II and III. Service and pressurize statically pressurized radomes in accordance with the applicable MIM. Apply T&B or form fitted cover for Level II protection.

(2) Level III. No protection required.

d. Maintenance. Level I, II and III. Every 28 days, service statically pressurized radomes as necessary to maintain positive internal pressure. Check drains of unpressurized radomes to ensure they are open. Maintain radome surfaces free of oils, greases and preservatives. Check barrier material and repair or replace when necessary to maintain protection.

(1) Level I and II. Every 7 days, when inspecting aircraft interior, check barrier material for security.

(2) Level III. No maintenance required.

de. Depreservation. Remove barrier material. Clean and inspect in accordance with above instructions. Service system in accordance with applicable MIM.

3-39. VAPOR CYCLE UNITS. A vapor cycle unit is so named because it uses vapor in a closed loop system. An example is closed-circuit refrigeration unit for air-conditioning.

a. Cleaning/Inspection/Corrosion Control. Refer to applicable MIM.
b. **Protection.** Level I, II, and III. For systems equipped with vapor cycle units, perform reheat cycle operation to dry out all moisture. If the setup allows the units to be isolated from their loads and kept free from moisture during storage, follow specific instruction manuals to do so.

c. **Maintenance.**

   (1) Level I, and II. Refer to applicable MIM.

   (2) Level III. No maintenance required.

d. **Depreservation.** Service system in accordance with applicable MIM.

3-40. **WAVEGUIDES.** Waveguides are only effective if the internal surfaces are completely clean and dry, undented and not pitted by corrosion. The method of protecting the internal finish on a waveguide is to prevent moisture entry. It is essential that the waveguide seals be maintained.

a. **Cleaning.** Clean in accordance with NAVAIR 01-1A-509-3.

b. **Inspection.** Inspect for corrosion in accordance with NAVAIR 01-1A-509-3.

c. **Corrosion Control.** Correct corrosion in accordance with NAVAIR 01-1A-509-3.

d. **Protection.**

   (1) Level I, II and III. After draining and drying, retighten waveguides in accordance with the applicable MIM.

   (2) Level I and III. If waveguides are partially disassembled, cover waveguide opening with pressure sensitive tape, A-A-59163 Class 1. Shingle tape to ensure complete coverage. See NAVAIR 01-1A-505-1 for additional information.

   (3) Level II. If waveguides are partially disassembled, install desiccant bags, MIL-D-3464 Type I. If waveguide openings are too small to insert the desiccant bags, create a bag using ESD barrier material, MIL-PRF-81705, install desiccant and humidity card and secure bag over the end of the waveguide using tape, SAE AMS-T-22085 Type II. Seal edges of bag with tape to prevent moisture intrusion.

e. **Maintenance.**

   (1) Level I. Every 7 days, check tape for lifting. Replace as necessary.

   (2) Level II. Maintain the desiccant in accordance with Chapter 6.

   (3) Level III. No maintenance required.

f. **Depreservation.** Clean, inspect and treat corrosion in accordance with above instructions. Service system in accordance with applicable MIM.
3-41. **FUEL.** Typical fuel systems include integral fuel cells, auxiliary tanks, lines, fittings, and fuel metering devices; in essence anything that has to do with storage, allocation or transport of fuel for engine use. Included are fuel systems for main power plants as well as auxiliary power units (APUs). Preservation of fuel systems with preservation oil, MIL-PRF-6081 Grade 1010N, is a basic requirement for preservation of aircraft fuel systems. MIL-PRF-6081 Grade 1010N oil does not absorb water as readily as synthetic oils, and is, therefore, used to remove service fuel and coat areas that have been in contact with fuel. Preservation of the fuel system should be done simultaneously with preservation of the power plant system whenever possible (refer to Section XIII). If any fuel system components containing elastomeric parts are not preserved during flushing of complete systems, they shall be drained of fuel and flushed with MIL-PRF-6081 Grade 1010N oil. Fuel metering devices, fuel controls, carburetors, and other components shall be left full of preservation oil and not drained. During defueling and preserving of fuel systems, proper attention shall be given to contamination control in accordance with NAVAIR 00-80T-109. Refer to Table 3-6 for items covered in this section.

**WARNING**

When work such as cleaning, repairing leaks and corrosion repair is to be accomplished on aircraft fuel tanks, adequate safety precautions shall be taken, including inerting or purging in accordance with NAVAIR 01-1A-35.

3-42. **EXTERIOR.**

**CAUTION**

When preserving fuel system accessories separately, never apply oil at pressures higher than normal operating pressures. A pressure range of 5-15 psig is sufficient for most fuel system accessories.

**Cleaning Compound, Aircraft** MIL-PRF-85570 Type II

a. **Cleaning.** Wipe area with a sponge dampened with cleaning solution (1 part MIL-PRF-85570 Type II in 9 parts fresh water). Rinse with fresh water and wipe dry with a clean cloth. Refer to Chapter 8.

b. **Inspection.** Inspect all fuel system vents to ensure they are open. For pressurized fuel systems, check pressure gages for evidence of excessive internal pressure buildup and correct venting system as necessary.

c. **Corrosion Control.** Treat corroded areas in accordance with NAVAIR 01-1A-509-2 and aircraft MIMs.
3-43. PRESERVATION OIL, FUEL SYSTEM. The preservative used for all types of fuel systems shall be MIL-PRF-6081 Grade 1010N oil. This is a petroleum base oil, free of all additives except oxidation inhibitors and pour point depressants. It is used to minimize the danger of gum formation in critical passages. It shall be kept clean and free of water. Contaminated oil shall never be used to preserve aircraft fuel systems. Small quantities of AVGAS or JP-4 fuel in this oil will cause a preserved tank to produce explosive vapors under a wide range of conditions. Work on the systems generally cannot be done until purging or inerting is accomplished (refer to NAVAIR 01-1A-35 for instructions). JP-5 fuels are safer to handle than other fuels; therefore, it is best to maintain two oil tanks or bulk storage facilities, one for systems that have been operating with JP-5 fuel, and one for systems that have been operating with AVGAS, JP-4, JP-8 or other low flash point fuels.

   a. Cleaning.

   (1) Tankers and servicing units used for preserving fuel systems shall be equipped with a 5 micron nominal filter on both suction and discharge systems. Tanker trucks shall be kept full and be equipped with low point drains. Drains shall be actuated on a daily basis to drain water and other contaminants.

   (2) Grade 1010N oil used for preserving engine fuel systems and accessories shall be filtered through "absolute" type filters with a filtration capacity at least equivalent to the smallest particle size filter in the affected system.

   b. Inspection. Preservation oil shall be inspected before use and monitored during service.

   (1) New, unused preservation oil (MIL-PRF-6081 Grade 1010) shall be tested from the drum/container before filling servicing carts or tankers. Oil shall comply with the limits for New Oil shown in Table 3-7.

   NOTE

   The requirement for testing new, unused oil may be waived if MIL-PRF-6081 Grade 1010N is procured under the NSNs provided in Table 8-12.

   e. Maintenance.

   (1) Level I and II. Every 28 days, inspect the condition of CPC and barrier material, if applicable, and reapply or replace. Inspect helicopter fuel cells under floor boards for water accumulation in accordance with applicable MIMs.

   (2) Level III. No maintenance required.

   f. Depreservation. Clean, inspect and treat corrosion as specified above.
Table 3-7. Contamination Limits for Preservation Oil

<table>
<thead>
<tr>
<th>TEST1</th>
<th>NEW OIL LIMITS</th>
<th>USED OIL LIMITS</th>
<th>TEST METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Inspection</td>
<td>No cloudiness, haziness, visible</td>
<td>No cloudiness, haziness, visible</td>
<td>Visual</td>
</tr>
<tr>
<td></td>
<td>droplets, particles or sludge</td>
<td>droplets, particles or sludge</td>
<td></td>
</tr>
<tr>
<td>Flash Point</td>
<td>270°F (min.)</td>
<td>206°F (min.)</td>
<td>ASTM D92</td>
</tr>
<tr>
<td>Water Content</td>
<td>120 ppm</td>
<td>200 ppm</td>
<td>ASTM D6304</td>
</tr>
<tr>
<td>Particulates (Solids)2</td>
<td>2.0 mg/l</td>
<td>2.0 mg/l</td>
<td>FED-STD-791, Method 3010</td>
</tr>
</tbody>
</table>

1 Approximately 1200 ml sample is required to perform all testing.
2 If filtration is not complete within 30 minutes, stop the test and measure the amount of oil filtered.
Report "Filter time greater than 30 minutes" and the amount of oil filtered. Sample fails if filtration cannot be completed.

(a) Number of Oil Samples Required.

1 The following guidelines apply when the oil has the same batch number and manufacturer.
   a If 1-5 drums are received, 1 sample is required.
   b If 6-15 drums are received, 2 samples are required.
   c If 16-30 drums are received, 3 samples are required.

2 If the drums are from different batch numbers or manufacturers, each batch shall be considered separately. For example, if a shipment of 25 drums is received, and there are 20 drums from one batch and 5 drums from a different batch, a total of 4 samples (3 from the 20 drum batch plus 1 from the 5 drum batch) is required.

(b) Records of new oil test results shall be maintained for six months.

(2) Preservation oil shall be visually inspected for water and other contaminants before the first use of the day. Visual inspection shall consist of discharging at least one quart of the preservation oil from the filter nozzle into a clear glass or clear plastic container and comparing it to a similar sample of new, unused oil in the same type and size container. If the sample is hazy, cloudy, or contains any visible water droplets, particulate contamination or sludge, the oil shall not be used. The suspect oil shall then be analyzed and certified for use by an authorized Materials Engineering Laboratory.

3-44. INTERIOR. Fuel systems are in their ideal preservation state when they are used and constantly bathed with fresh, clean fuel. Dry fuel systems deteriorate rapidly. Fuel tank liners crack or become porous, and tank sealants, system O-rings, and gaskets dry and shrink. Metal surfaces formerly in contact with fuel may corrode. Microbiological attack may occur at the fuel line.

(3) Preservation oil may be used until it exceeds the limits for Used Oil shown in Table 3-7. Samples shall be taken from the discharge nozzle, or from a sampling port that is downstream from the filter. Equipment shall not be used until the sample has been analyzed and certified for use by an authorized Materials Engineering Laboratory.

(a) Oil shall be sampled after filling or refilling servicing units, tankers, or test stands.

(b) Oil in tankers or servicing units shall be sampled after servicing four aircraft.

(c) Oil in test stands shall be sampled every 30 days.

(d) Oil in seldom used equipment shall be sampled prior to use.

(e) Records of used oil test results shall be maintained for 12 months.
CAUTION

When any fuel metering device is to be dry (totally drained of fuel) for longer than 72 hours, or any fuel tank is to be dry for more than 14 days, all parts normally in contact with fuel shall be preserved with MIL-PRF-6081 Grade 1010N oil.

NOTE

When fuel cells are drained and opened for examination or repair, the elastomeric materials shall only be exposed to ambient air for a maximum of 72 hours. After 72 hours, fuel cells shall be preserved with MIL-PRF-6081 Grade 1010N oil.

a. Cleaning. Do not preserve a contaminated system. For instructions on cleaning fuel systems that have become contaminated with sea water or microbiological growth, refer to NAVAIR 01-1A-35.

b. Inspection.

(1) Take fuel sample from low point drain as directed by applicable MRC. Check for water, particulates, presence of sea water, and microbiological growth. Test and correct in accordance with NAVAIR 00-80T-109 and NAVAIR 01-1A-35.

(2) Check strainers and filters for contamination and take appropriate corrective action as required by the applicable MRCs.

c. Corrosion Control. Treat corroded areas in accordance with NAVAIR 01-1A-509-2 and applicable MIMs.

d. Protection.

CAUTION

Fuels deteriorate in storage, collect water and cause corrosion of metals. Therefore, it is necessary to limit the time that an inactive fuel system may be preserved with service fuel. The entire fuel system, including engine system, may be maintained up to 90 days by keeping metering devices, pumps and lines full of service fuel and fuel tanks serviced to at least 95% of capacity (95% full).

(1) Level I. Maintain fuel systems at a minimum of 95% full of operating fuel. Avoid breaking lines or dismantling fuel systems whenever possible. Always use normal servicing points for filling and draining of fuel systems. If it becomes necessary to break connections, install warning tags (Figure 3-5) to call attention to the need for checking leaks during depreservation and fuel system integrity checks.

(2) Level II and III. The best method of preserving fuel systems consists of thoroughly draining the fuel system followed by filling with preservation oil, MIL-PRF-6081 Grade 1010N, to the maximum permissible level and operating fuel transfer systems, boost pumps, valves, in such a manner that all systems are thoroughly coated with oil. Flushing is followed by complete drainage of tanks with fuel metering devices, engine driven pumps and lines left full of oil. However, fuel tanks may be preserved separately by spray coating if all interior surfaces of the tank can be made accessible either by opening access covers or by using specially designed extensions and spray nozzles. Place a tag on the throttle quadrant stating that the fuel system has been preserved with MIL-PRF-6081 Grade 1010N oil (see Figure 3-6). Internally mounted units, such as boost and transfer pumps, fuel level control valves, that cannot be effectively blanked off with protective closures shall be removed. Oil flushing of aircraft engine fuel systems may be accomplished in two ways as follows:

(a) "Hot Pres" consists of running the engine, using MIL-PRF-6081 Grade 1010N oil as a service fuel, for a short period of time. Hot preserving protects the fuel system completely and is the preferred method. Hot preserve the fuel system in accordance with the following procedure.
CAUTION
UNIT PRESERVED WITH
MIL-PRF-6081, GRADE 1010N OIL
DATE
DEPRESSURIZE IN ACCORDANCE WITH NAVAIR 15-01-500 BEFORE USE

Figure 3-6. Preservation Tag for Fuel System

WARNING

The ambient air temperature should be above 40°F. Any activity using the hot preservation procedure for the first time shall use extreme caution until firm procedures have been established. Start-up fires may be more persistent when MIL-PRF-6081 Grade 1010N oil is used for fuel. It is, therefore, important that no oil be allowed to collect in the engine exhaust system or aircraft fuselage, and that no attempt be made to start the engines without having sufficient normal service fuel in the engine system to attain ignition and ground idle speed before the MIL-PRF-6081 Grade 1010N oil reaches the fuel nozzles.

1. Defuel aircraft and remove residual fuel from all tanks, including auxiliary tanks, using low point drains where necessary. Leave the engine fuel system full of service fuel to provide for safe and easy starting.

2. Preserve fuel tanks by the fill-and-drain procedures; fill fuel tank with oil, MIL-PRF-6081 Grade 1010N, and drain leaving one tank with a sufficient amount of Grade 1010N oil to displace all fuel from engine and fuel transfer systems. An alternate procedure is to fill one tank as described above and coat the remaining fuel tanks using a 1010N oil spray.

WARNING

Engine runup shall be in accordance with the applicable NATOPS procedures and safety precautions. Fire fighting equipment and personnel shall be available.

Bonding and grounding wires shall be attached to clean, unpainted, conductive surfaces to be effective.

Connect all grounding and bonding wires (cables) prior to removing fuel tank filler cap. Do not disconnect any grounding or bonding wire until fuel tank filler cap is reinstalled.

NOTE

Oil used for preserving fuel systems shall be controlled and filtered in accordance with paragraph 3-43b.

3. After ensuring that all prestart checks have been made, open fuel valve and run engine for 2-5 minutes according to the applicable MIM. To coat all areas of the engine fuel system with 1010N oil, run at least two (2) afterburner cycles.

4. As soon as engine and afterburner runs are completed, observe cooling cycle requirements specified in applicable MIM, shut down engine, and shut off oil supply.

5. Place engine throttle in fully closed position. Leave fuel metering devices (e.g. fuel controls) full of preservation oil. Do not drain.

6. Perform compressor spray operation in accordance with engine MIM if applicable.

7. Drain excess oil from all fuel tanks.

8. Tag aircraft cockpit with tag, Figure 3-6, to indicate that fuel system has been oil preserved.

9. Leave fuel system vents open to allow breathing and install extension tubes as required (refer to Figure 3-4).
(b) "Cold Pres" consists of preserving by pumping preservation oil through the aircraft fuel system with an external pressurizing device (PON-6 or equivalent). Cold preservation is performed only when hot preservation cannot be performed. Cold preserve the fuel system in accordance with the following procedure.

1 Defuel aircraft and open all system drains, including low point water drains. Remove as much fuel as possible from system. Close drains.

Oil, Lubricating, Jet Engine

MIL-PRF-6081 Grade 1010N

2 Preserve fuel tanks by a modified fill-and-drain procedure. Fill fuel tanks with MIL-PRF-6081 Grade 1010N preservation oil, and drain leaving one tank with a sufficient amount of 1010N oil to displace all fuel from engine and fuel transfer systems. An alternate procedure is to fill one tank as described above and coat the remaining fuel tanks using a Grade 1010N oil spray.

3 Ensure overboard drains are open and functioning properly and that the attitude of the aircraft is such that displaced fuel and oil will not collect in engine exhaust system or aircraft fuselage. Operate fuel transfer systems in such a manner that entire aircraft fuel system, including lines, are coated with preservation oil.

4 Drain excess oil from fuel tanks.

5 Tag aircraft cockpit with tag, Figure 3-6, to indicate that fuel system has been oil preserved.

6 Leave fuel system vents open to allow breathing and install extension tubes as required (see Figure 3-4).

e. Maintenance.

**WARNING**

When aircraft are to be worked as fueled aircraft, all personnel concerned shall be thoroughly indoctrinated in the hazards and safety precautions associated with fuel. In addition, aircraft shall be identified with a large placard with the words "FUELED AIRCRAFT" in at least 6 inch high letters with either red letters on a white background or white letters on a red background.

1 Level I. Inactive fuel systems can be effectively maintained for short periods of time if systems are kept full of fuel and sampled through low point drains daily to remove water and detect other contaminants.

   (a) Fuel samples shall be taken from low point drains and inspected for water and other contaminants in accordance with NAVAIR 00-80T-109 prior to each engine operational turn-up and each day until satisfactory samples are obtained on three consecutive days. Once satisfactory samples are obtained the periodic sampling interval may be extended to 7 calendar days.

   (b) If microbiological growth is noted at any sampling interval, immediate action shall be taken to defuel the aircraft and decontaminate the fuel system in accordance with NAVAIR 01-1A-35.

   (c) For aircraft such as helicopters where self-sealing, bladder-type and piocell fuel cells are located under floorboards and aircraft have been subject to internal water leakage, remove floorboards as necessary to check cavities for water accumulation.

2 Level II and III. No maintenance required.
f. **Depreservation.**

   (1) Fuel system components shall be filled with service fuel no earlier than 8 hours before the depreservation run of the engines. An 8 hour soaking period is necessary to restore flexibility to the diaphragms in the fuel metering devices. Refer to Section XIII and applicable MIMs for engine runup procedures.

   (2) Remove caution tags, and the extensions from vents. Drain residual oil and fill system to the maximum permissible level. Perform a fuel integrity check. Service system in accordance with applicable MIM.

3-45. **LINES AND FITTINGS.** Refer to Section VIII.

3-46. **RETICULATED FOAM.** If reticulated foam is found in the fuel cells, refer to applicable MIMs and NAVAIR 01-1A-35.

3-47. **AUXILIARY TANKS.** Auxiliary tanks include the wing, fuselage and external tanks.

   a. **Cleaning.** Clean the exterior, when applicable, in accordance with Chapter 8.

   b. **Inspection.** Take fuel sample from low point drain as directed by applicable MRC. Check for water, particulates, presence of sea water, and microbiological growth. Test and correct in accordance with NAVAIR 00-80T-109 and NAVAIR 01-1A-35.

   c. **Corrosion Control.** Arrest corrosion in accordance with NAVAIR 01-1A-509-2.

   d. **Protection.**

      (1) Level I. Maintain fuel level at least 95% full of operating fuel.

      Oil, Lubricating, Jet Engine 22
      MIL-PRF-6081 Grade 1010N

      (2) Level II and III.

         (a) If possible, preserve internally concurrently with aircraft fuel system preservation procedures.

         (b) If concurrent preservation cannot be performed, preserve tank separately by fill-and-drain procedures or remove tank and spray coat with generous quantities of MIL-PRF-6081 Grade 1010N oil. At a minimum, spray valves internally with MIL-PRF-6081 Grade 1010N oil to protect elastomeric components. See Chapter 4, Section III, for additional requirements for removed tanks.

   e. **Maintenance/Depreservation.** Refer to instructions of paragraph 3-44.
3-48. **HYDRAULIC SYSTEM.** A complete aircraft hydraulic system consists of a power system and a number of actuating systems. Refer to Table 3-8 for items covered in this section. The power system includes the fluid supply (reservoir), power supply (pump) and all other components leading up to but not including the selector (directional control) valves. The selector valve is considered part of its related actuating system. For general information on the testing, usage and handling of hydraulic fluids, refer to NAVAIR 01-1A-17 and COMNAVAIRFORINST 4790.2.

a. **Definitions.**

(1) **Recirculation Cleaning.** Recirculation cleaning is accomplished by circulating the contaminated fluid through the hydraulic filters in the aircraft system or portable hydraulic test stand to remove particulates.

(2) **Purification.** Purification is the process of removing air, water, or solid particles from hydraulic fluid using a purifier.

(3) **Flushing.** Flushing is a means to effectively decontaminate a system found to contain water, large amounts of gelatinous type materials, or severe particulate contamination. The fluid is removed to the maximum extent practical and replaced.

(4) **Purging.** A decontamination process in which the aircraft system is drained to the maximum extent practical and the removed fluid discarded. A suitable cleaning agent is then introduced into the system and circulated as effectively as possible so as to remove gross contaminants. The operation is completed by removing the circulated cleaning agent and replacing it with new operating fluid. Purging is usually followed by a period of recirculation cleaning to ensure adequate decontamination. System purging is limited to use by depot level maintenance activities, under the direct supervision of the cognizant engineering authority.

b. **Cleaning.** Evaluate the condition of the operating fluid in accordance with Tables 3-9 and 3-10 and take appropriate action in accordance with NAVAIR 01-1A-17. If decontamination is required, repeat fluid testing after decontamination. Annotate preservation records with results.

### Table 3-8. Hydraulic System Summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic System</td>
<td>3-48b</td>
<td>3-48c</td>
<td>3-48d</td>
<td>3-48e</td>
<td>3-48f</td>
<td>3-48g</td>
<td>NAVAIR 01-1A-17</td>
</tr>
<tr>
<td>Lines and Fittings</td>
<td>3-49a</td>
<td>3-49b</td>
<td>3-49c</td>
<td>3-49d</td>
<td>3-49e</td>
<td>3-49f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Pressure Accumulator</td>
<td>3-50a</td>
<td>3-50b</td>
<td>3-50c</td>
<td>3-50d</td>
<td>3-50e</td>
<td></td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>System Filters</td>
<td>-----</td>
<td>3-51</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) **Piston rods.** Clean sand, dirt, salt deposits and other foreign particles from exposed surfaces with a clean cloth dampened in hydraulic fluid, MIL-PRF-83282. Take care not to scratch the surface. Wipe away from seals to preclude collection of soil at seal junction areas. Make sure piston surface is clean and completely lubricated but not dripping.

(2) **Filter Elements.** Cleanable filter elements removed from hydraulic systems shall be placed in individual polyethylene bags for forwarding to the intermediate or depot level maintenance activity for cleaning. Do not attempt to clean cleanable filter elements by washing them in a container and blowing them out with shop air. Cleanable filter elements shall be cleaned and tested in accordance with the applicable MIMs.
CAUTION

Ensure that aircraft hydraulic test fluid conforms to Class 5 or above of Table 3-9.

Before connecting a portable hydraulic test stand to an aircraft, clean all connections, interconnect the pressure and return lines of the stand, and circulate the hydraulic fluid through the test stand filters.

Use only authorized hydraulic fluid, O-rings, lubricants, and filter elements.

Use an authorized fluid service unit to dispense hydraulic fluid. Ensure the hydraulic fluid can is clean prior to installation. Keep hydraulic fluid in a closed container at all times.

Replace filters immediately after removal.

If possible, fill filter bowl with proper hydraulic fluid before installing. This minimizes induction of air into the system. Do not use plastic plugs or caps. Plastic plugs and caps are a possible source of contamination.

All fluids drained from hydraulic systems shall be discarded as waste material. Do not reuse in aircraft hydraulic systems.

Do not use chlorinated solvents to clean connectors. Use degreasing solvent, MIL-PRF-680 Type II or III, or filtered hydraulic fluid.

c. Inspection. Using the sampling procedures of NAVAIR 01-1A-17 and the applicable MIM, take fluid samples from each separate hydraulic system, including a sample from each fluid reservoir. Test for particulate and water contamination in accordance with steps listed in Table 3-10. The acceptable hydraulic fluid particulate level is Navy Standard Class 5 or cleaner for naval aircraft and Navy Standard Class 3 for related support equipment. Analysis shall be accomplished by the use of the particle counter (preferred method) or the Contamination Analysis Kit 57L414 at all levels of maintenance. Additionally, depot and intermediate levels of maintenance, including commercial rework activities, shall analyze samples for water contamination. If capability exists, decontaminate the system in accordance with NAVAIR 01-1A-17 if contamination (including water) is suspected. Ensure that all reservoir filler caps are tightly closed and that vents and filler scupper drains are open.

WARNING

Exercise extreme caution when working on hydraulic equipment in the vicinity of grinding, blasting, machining or other contaminant generating operation. Much of the grit which is harmful cannot be seen with the naked eye. Protect exposed portions of actuating cylinders.

CAUTION

CPCs shall be removed before actuating cylinders.

d. Corrosion Control. Refer to NAVAIR 01-1A-17 and NAVAIR 01-1A-509-2.

e. Protection.

CAUTION

Hydraulic systems contaminated with chlorides or water shall be cleaned before preservation.

(1) If hydraulic systems are contaminated by particulates in excess of NAVY Class 5 (refer to Table 3-9) and cannot be decontaminated, tag each system involved (see Figure 3-7) and make the following entry in the aircraft processing records and/or logs: "Hydraulic system (list each system) contamination exceeding NAVY Class 5. Decontaminate according to NAVAIR 01-1A-17 before system operation."

Fluid, Hydraulic
MIL-PRF-83282

(2) Level I, II and III.

(a) Hydraulic System. Keep hydraulic systems filled to normal operating level with operating fluid, MIL-PRF-83282. If condition of aircraft is such that system cannot be maintained full, it shall be flushed with hydraulic fluid, MIL-PRF-83282. Ensure that all reservoir filler caps are tightly closed and that vents and filler scupper drains are open.
### Table 3-9. Navy Standard for Particulate Contamination of Hydraulic Fluid (Particle Count Test)

<table>
<thead>
<tr>
<th>MICRON SIZE RANGE</th>
<th>ACCEPTABLE</th>
<th>UNACCEPTABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class 0</td>
<td>Class 1</td>
</tr>
<tr>
<td>5-10</td>
<td>2,700</td>
<td>4,600</td>
</tr>
<tr>
<td>10-25</td>
<td>670</td>
<td>1,340</td>
</tr>
<tr>
<td>25-50</td>
<td>93</td>
<td>210</td>
</tr>
<tr>
<td>50-100</td>
<td>16</td>
<td>28</td>
</tr>
<tr>
<td>Over 100</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3,480</td>
<td>6,181</td>
</tr>
</tbody>
</table>

**NOTE**

1. The class of contamination is based upon the total number of particles in any size range per 100 ml. of hydraulic fluid. Exceeding the allowable particle count in any of one or more size ranges requires that the next higher class level be assigned.
2. Class 5 is the maximum acceptable contamination level for hydraulic systems in naval aircraft.
   Fluid delivered by SE to equipment under test or being serviced shall be Class 3 or better.
3. The Class 5 level of acceptability shall be met at the inspection interval specified for the equipment under test.

---

### Table 3-10. Contamination Limits for Aircraft Hydraulic Fluids

<table>
<thead>
<tr>
<th>Test</th>
<th>Reference Specification</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MIL-PRF-83282</td>
</tr>
<tr>
<td>Visual</td>
<td>N/A</td>
<td>No detectable water, fluid cannot be cloudy or milky, no microbiological growth or dirt particles.</td>
</tr>
<tr>
<td>Particulates*</td>
<td>NAVAIR 01-1A-17</td>
<td>NAVY Class 5 (see Table 3-9)</td>
</tr>
<tr>
<td>Water</td>
<td>Karl-Fischer Aquatest (ASTM D1744)</td>
<td>250 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3000 ppm</td>
</tr>
<tr>
<td>Chlorinated Solvents</td>
<td>NAVAIR 01-1A-17</td>
<td>200 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>Total Acid Number</td>
<td>Fed Std 791 Method 5105 or ASTM D974</td>
<td>0.8 mg KOH/g max</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.2 mg KOH/g max</td>
</tr>
<tr>
<td>Flash Point</td>
<td>ASTM D92</td>
<td>180° F min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>320° F min</td>
</tr>
</tbody>
</table>

* When testing Skydrol, special o-rings are required on particle counter and special procedures shall be followed (see NAVAIR 01-1A-17).
(b) Piston Rods. Lubricate exposed portions of piston rods using a clean low-lint wiping cloth, A-A-59323, saturated with the operating hydraulic fluid, wiping away from seals. Take care not to scratch surfaces.

**NOTE**

If it is necessary to replace one type of fluid with another, refer to the procedures of the applicable MIM and NAVAIR 01-1A-17.

f. Maintenance.

(1) Level I and II.

(a) Everyday check for hydraulic system leaks. If major leaks are evident, check hydraulic reservoir and refill with the applicable fluid. Repair the leak. If the leak cannot be readily repaired, or if the condition of the aircraft is such that the system cannot be maintained full, disconnect the leaking item and blank off all openings. Appropriately tag when items are disconnected and blanked off, and make an entry in aircraft processing records to ensure corrective treatment prior to flight.

(b) Every 7 days, reapply a thin film of hydraulic fluid, MIL-PRF-83282, on exposed areas of reciprocating rods. Check condition of tags and replace if illegible or missing.

(c) Every 28 days, ensure hydraulic systems are kept at normal operating level with operating fluid.

(2) Level III. Every 28 days, check fluid operating level and inspect for hydraulic system leaks. Repair leaks in accordance with step (1)(a) above.

g. Depreservation. Check aircraft processing records to determine system status.

(1) If preserved as a contaminated system and if the aircraft is being represerved for another storage period without flight, decontamination is not required. Using the fluid installed in the system, service in accordance with the applicable MIM.

(2) If aircraft is being returned to service, service with operating fluid. Cycle all systems, including landing gear, at least 10 times. Perform contamination check and decontaminate as necessary in accordance with NAVAIR 01-1A-17 and the applicable MIM. Remove tagged material. Clean and inspect as specified above. Service system in accordance with applicable MIM.

### 3-49. LINES AND FITTINGS

Lines and fittings include plumbing lines installed in exposed locations such as wheel wells, wing fold areas and speed brake recesses, which are not completely painted and sealed with a sealant at tubing and fitting junctions.

![Image](image.png)

**Figure 3-7. Contamination Tag for Hydraulic System**

**WARNING**

HYDRAULIC SYSTEM CONTAMINATED IN EXCESS OF CLASS 5

**DATE**

DECONTAMINATE IAW NAVAIR 01-1A-17 BEFORE FLIGHT

---

a. **Cleaning.** Externally clean coupling nuts, fittings, and tubing immediately adjacent to the nuts using solvent, MIL-PRF-680 Type II or III, to provide an oil-free surface. Wipe surface using a sponge dampened with cleaning solution (1 part MIL-PRF-85570 Type II in 9 parts fresh water). Lines and fittings exposed to exterior environment can also be cleaned externally using a sponge dampened with cleaning solution (1 part MIL-PRF-85570, Type II in 9 parts fresh water). Rinse with fresh water and wipe dry with a clean cloth.

b. **Inspection.** Inspect for corrosion damage. Pay particular attention to aluminum end fittings of fuel hoses constructed with external wire braid. The aluminum end fittings are subject to stress corrosion cracking.

c. **Corrosion Control.** Arrest corrosion in accordance with NAVAIR 01-1A-509-2.
d. Protection.

(1) Level I and II. For exposed fittings that are not completely painted or sealed, apply clear water displacing CPC, MIL-DTL-85054, to entire coupling nut and fitting surfaces, extending compound at least 1/4 inch on adjacent tubing. Apply compound in such a manner that all spaces between parts are sealed from the atmosphere. Apply a second coat of CPC, MIL-DTL-85054, after approximately 30 minutes or after the first coat has thoroughly dried.

(2) Level III. No protection is required.

e. Maintenance.

(1) Level I and II. Every 28 days, check line and tube fittings for corrosion. If found, remove corrosion and protect in accordance with NAVAIR 01-1A-509-2.

(2) Level III. No maintenance is required.

f. Depreservation. Clean, inspect and remove corrosion in accordance with above requirements and applicable MIMs.

3-50. PRESSURE ACCUMULATORS.

a. Cleaning/Inspection. Clean and inspect in accordance with applicable aircraft MIMs.

b. Corrosion. Arrest corrosion in accordance with NAVAIR 01-1A-509-2.

CAUTION

It is important that only dry nitrogen, A-A-59503 Type I, be used to service accumulators.

c. Protection.

(1) Level I. Accumulators shall be serviced to normal operating pressure.

(2) Level II and III. Adjust pressure in accumulators to approximately 10% of normal operating pressure.

d. Maintenance.

(1) Level I. Every 28 days, check pressure accumulators and service as necessary using nitrogen, A-A-59503 Type I, to maintain required preservation pressure.

(2) Level II and III. Every 28 days, check accumulators and service as necessary using nitrogen, A-A-59503 Type I, to maintain approximately 10% normal operating pressure.

(3) Shipment. At least once and within five days of shipping date, service accumulators in accordance with the applicable MIM. Before shipment, ensure that any access provisions used to service accumulators are properly sealed.

e. Depreservation. Clean, inspect and treat corrosion as specified above and in accordance with applicable MIMs. Service system to normal operating pressure if applicable.

3-51. SYSTEM FILTERS. Hydraulic filter elements shall be replaced prior to or after preservation on either a periodic or conditional basis as specified in the applicable MIM or MRC. Periodic replacement intervals, when specified, shall be consistent with the established service life. Conditional replacement of elements shall be authorized only when it has been determined that the filter assembly has been provided with a known reliable differential pressure indicator.
SECTION IX. INSTRUMENTS

Table 3-11. Instruments Systems Summary

<table>
<thead>
<tr>
<th>INSTRUMENTS SYSTEMS</th>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Filters</td>
<td>3-53a</td>
<td>3-53b</td>
<td>-----</td>
<td>3-53c</td>
<td>3-53d</td>
<td>3-53e</td>
<td>Applicable MIM</td>
<td></td>
</tr>
<tr>
<td>Gyros</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>3-54b</td>
<td>3-54c</td>
<td></td>
<td>Applicable MIM</td>
<td></td>
</tr>
<tr>
<td>Instrument Panels</td>
<td>3-55</td>
<td>3-55</td>
<td>3-55</td>
<td>3-55</td>
<td>3-55</td>
<td></td>
<td>Section V, Electrical, Control Panels</td>
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</tr>
<tr>
<td>Pitot Tubes &amp; Static Vents</td>
<td>3-56a</td>
<td>3-56b</td>
<td>3-56c</td>
<td>3-56d</td>
<td>3-56e</td>
<td></td>
<td>NAVAIR 01-1A-509-2</td>
<td></td>
</tr>
<tr>
<td>Automatic Pilot &amp; Stabilization Unit</td>
<td>3-57</td>
<td>3-57</td>
<td>3-57</td>
<td>3-57</td>
<td>3-57</td>
<td></td>
<td>Section V, Electrical</td>
<td></td>
</tr>
</tbody>
</table>

3-52. INSTRUMENTS. Initially, instruments and instrument systems shall be cleaned to remove salt deposits, soils, or grease using the methods of NAVAIR 01-1A-509-3. During maintenance, cleaning, preservation and depreservation, make sure that instrument lenses are kept free of CPCs, greases, oils and solvents. Refer to Table 3-11 for items covered in this section.

3-53. AIR FILTERS.

a. Cleaning. Clean in accordance with applicable MIM and NAVAIR 01-1A-509-3.

b. Inspection. Check desiccant units for humidity indication.

c. Protection.

(1) Level I and II. Vent instrument system inlets and outlets with an installation similar to Figure 3-4. Desiccant units shall be fully charged. Refer to applicable MIMs.

(2) Level III. No protection required.

d. Maintenance.

(1) Level I and II. Every 7 days, check to ensure desiccant units are fully charged. Check vents to ensure that they are open.

(2) Level III. No maintenance required.

e. Depreservation. Remove vents. Clean, inspect and service system in accordance with applicable MIM. Fully charge desiccant units.

3-54. GYROS.

a. Protection. Level I, II and III. Cage gyros in accordance with the applicable MIM. Gyros shall be kept caged at all times while inactive. If gyros are removed, handle and package in accordance with NAVSUP P700.

b. Depreservation. Uncage and/or install prior to flight.

3-55. INSTRUMENT PANELS. Refer to Section V, Electrical, Consoles and Control Panels.

3-56. PITOT TUBES, ANGLE OF ATTACK (AOA) PROBES, AND STATIC VENTS. (See Figure 3-8, View A).

a. Cleaning/Inspection. Ensure that all water is drained from static vent systems and that any exterior drain holes are fully open. Refer to the applicable MIM for information on the location of system drains. If the applicable maintenance manual does not contain specific instructions for the care of these items, the following procedures apply.

(1) Remove bleeder vents. Clean and inspect openings as necessary to remove dirt, grease, insects, and metal polish.

   Naphtha, Aliphatic TT-N-95 Type II

(2) Clean openings by using a cloth dampened with aliphatic naphtha, TT-N-95.
(3) If additional cleaning is required, refer to NAVAIR 01-1A-509-2.

b. **Corrosion Control.** Refer to NAVAIR 01-1A-509-2.

c. **Protection.** Level I, II and III. Protect against foreign material and damage from temperature/pressure changes with special support equipment covers and guard fixtures. If covers are not available, wrap with barrier material, MIL-PRF-131 Class 1, and secure to painted aircraft surface with tape, SAE AMS-T-22085 Type II (see Figure 3-8, View B).

d. **Maintenance.** Level I, II and III. Everyday inspect external drain holes and vents to ensure they are open.

e. **Depreservation.** Remove covers/barrier material. Check for foreign material. Clean, inspect, and treat corrosion as specified above.

3-57. **AUTOMATIC PILOT AND STABILIZATION UNITS.** Clean, inspect, preserve and maintain in accordance with instructions in Section V.

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![Figure 3-8. Pitot Tube Preservation](image-url)
3-49

SECTION X. LANDING AND ARRESTING GEAR

Table 3-12. Landing and Arresting Gear System Summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landing &amp; Arresting Gear</td>
<td>3-58a</td>
<td>3-58b</td>
<td>3-58c</td>
<td>3-58d</td>
<td>3-58e</td>
<td>3-58f</td>
<td>NAVAIR 01-1A-509-2</td>
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<tr>
<td>Arresting Gear Hooks</td>
<td>3-59a</td>
<td>3-59b</td>
<td>3-59c</td>
<td>3-59d</td>
<td>3-59e</td>
<td>3-59f</td>
<td>NAVAIR 01-1A-503</td>
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<tr>
<td>Bearings, Wheel</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>3-60a</td>
<td>3-60b</td>
<td>3-60c</td>
<td>NAVAIR 04-10-1</td>
</tr>
<tr>
<td>Brakes</td>
<td>3-61a</td>
<td>3-61b</td>
<td>3-61c</td>
<td>3-61d</td>
<td>3-61e</td>
<td>3-61f</td>
<td>NAVAIR 01-1A-503</td>
</tr>
<tr>
<td>Brake Hydraulic System</td>
<td>3-62</td>
<td>3-62</td>
<td>3-62</td>
<td>3-62</td>
<td>3-62</td>
<td>3-62</td>
<td>Section VIII, Hydraulics</td>
</tr>
<tr>
<td>Catapult Hooks</td>
<td>3-63a</td>
<td>3-63b</td>
<td>3-63c</td>
<td>3-63d</td>
<td>3-63e</td>
<td>3-63f</td>
<td>NAVAIR 13-1-6.2</td>
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<td>Deceleration Chutes</td>
<td>3-64</td>
<td>3-64</td>
<td>3-64</td>
<td>3-64</td>
<td>3-64</td>
<td>3-64</td>
<td>NAVAIR 01-1A-509-2</td>
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<td>Doors, Landing Gear</td>
<td>3-65</td>
<td>3-65</td>
<td>3-65</td>
<td>3-65</td>
<td>3-65</td>
<td>3-65</td>
<td>Section II, Airframes, Access Doors</td>
</tr>
<tr>
<td>Shock Struts</td>
<td>3-66a</td>
<td>3-66b</td>
<td>3-66c</td>
<td>3-66d</td>
<td>3-66e</td>
<td>3-66f</td>
<td>NAVAIR 01-1A-17</td>
</tr>
<tr>
<td>Skis</td>
<td>3-67a</td>
<td>3-67b</td>
<td>3-67c</td>
<td>3-67d</td>
<td>3-67e</td>
<td>3-67f</td>
<td>NAVAIR 01-1A-509-2</td>
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<tr>
<td>Tires</td>
<td>3-68a</td>
<td>3-68b</td>
<td>-----</td>
<td>3-68c</td>
<td>3-68d</td>
<td>3-68e</td>
<td>NAVAIR 04-10-506</td>
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<tr>
<td>Wheels</td>
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<td>3-69c</td>
<td>3-69d</td>
<td>3-69e</td>
<td>3-69f</td>
<td>NAVAIR 04-10-1</td>
</tr>
</tbody>
</table>

3-58. LANDING AND ARRESTING GEAR. Wheel well areas probably receive more abuse than any other area on the aircraft. They are exposed to mud, salt, gravel and other flying debris from runways during taxiing, takeoff and landing, and they are exposed to salt water and spray when aircraft are parked aboard ship. Because of the many complicated shapes, assemblies and fittings in the area, complete coverage with protective coatings is difficult to maintain. Refer to applicable MIM for lubrication information. Before preservation procedures begin, safety wire or lock gear control and ensure gear is in DOWN position and emergency release is in unreleased position. Refer to Table 3-12 for items covered in this section.

a. Cleaning. Clean in strict accordance with NAVAIR 01-1A-509-2.

b. Inspection. Inspect in accordance with NAVAIR 01-1A-509-2 and Chapter 8.

c. Corrosion Control. Treat corroded areas in accordance with NAVAIR 01-1A-509-2. Restore protective finishes as required. Corrosion treatment shall include accessible hollow portions of the axis.

d. Protection.

![Compound, Corrosion Preventive](MIL-PRF-81309 Type II)

(1) Level I. Coat all unpainted metal surfaces of landing gear with CPC, MIL-PRF-81309 Type II. Give particular attention to moveable joints and internal recesses of linkage. Protect exposed reciprocating portions of the hydraulic actuating cylinders in accordance with Section VIII.

(2) Level II and III. Protect in accordance with Level I requirements plus safety wire or lock retracting mechanism controls in normal ground position (landing gear DOWN and arresting gear UP).
3-50

NAVAIR 15-01-500
01 September 2013

e. Maintenance.

(1) Level I and II. Every 7 days, inspect high strength steel parts for CPC deterioration and reapply when necessary. Maintain hydraulic cylinders in accordance with Section VIII. Check system for corrosion. If found, remove corrosion in accordance with NAVAIR 01-1A-509-2 and represerve.

(2) Level III. No maintenance required.

f. Depreservation. Clean (removing CPC), inspect and lubricate as specified above and in the applicable MIM. Remove safety wire or pin from landing gear controls. If aircraft is being returned to service, perform the following:

(1) Hydrostatically test emergency system air bottles as required by the Department of Transportation (CFR Title 49, Parts 71-90) regulations.

(2) Service emergency system in accordance with the applicable MIM.

(3) Functionally check landing and arresting gear systems including emergency extension systems, in accordance with the applicable MIM.

3-59. ARRESTING GEAR HOOKS.

CAUTION

Protect adjacent surfaces and, in particular, tires and braking surfaces, from overspray of CPCs.

a. Cleaning. Clean and lubricate arresting gear. Clean arresting gear in accordance with NAVAIR 01-1A-509-2. Refer to applicable MIM for lubrication information.

CAUTION

Do not lubricate arresting gear tracks except as specified in the applicable MIM.

b. Inspection/Corrosion Control. Refer to NAVAIR 01-1A-509-2 and Chapter 8.

NOTE

Arresting gear hooks on crash damaged aircraft shall be secured in fixed position using steel cable or several turns of heavy duty safety wire.

c. Protection. Level I, II and III. Ensure drains are open and functioning. Arresting gear hooks not incorporating drains shall have potential water entrapment cavities either filled with soft film CPC, MIL-PRF-16173 Grade 2, or have the area thoroughly coated with clear CPC, MIL-DTL-85054.

d. Maintenance.

(1) Level I and II. Every 7 days, check potential water entrapment cavities to ensure they are adequately filled with CPC. Inspect hooks and exposed high strength steel parts for corrosion damage and correct in accordance with NAVAIR 01-1A-509-2.

(2) Level III. No maintenance required.

e. Depreservation. Clean, inspect, and treat any corrosion as specified above. Open all drain holes.

3-60. BEARINGS, WHEEL. Policies for wheel bearing lubrication and associated maintenance are contained in NAVAIR 04-10-1, NAVAIR 01-1A-503 or applicable aircraft MIM.

NOTE

Depot level maintenance activities shall forward removed bearings to an approved bearing shop for cleaning, inspecting, and relubricating in accordance with NAVAIR 01-1A-503.

a. Protection. Level I, II and III. Ensure that bearings are lubricated in accordance with the applicable MIM.
b. **Maintenance.**

   (1) Level I and II. Every 7 days, inspect for and maintain bearing lubrication.

   (2) Level III. No maintenance required.

c. **Depreservation.** Lubricate bearings as required in accordance with the applicable MIM.

### 3-61. BRAKES.

**WARNING**

Dust, corrosion products and other fine particles generated by beryllium brake assemblies are toxic when inhaled or contacted by the skin. Beryllium brake assemblies shall be cleaned in accordance with the applicable aircraft MIM.

**CAUTION**

Do not apply oily type preservative compounds to any braking surface.

a. **Cleaning.** Remove accumulated dirt from exterior housings in accordance with NAVAIR 01-1A-509-2. Remove brake piston and clean cavities and pistons. Refer to applicable MIM.

b. **Inspection.** Refer to NAVAIR 01-1A-509-2.

c. **Corrosion Control.** Arrest corrosion in accordance with NAVAIR 01-1A-509-2.

d. **Protection.**

   **CAUTION**

   Always refer to the applicable MIM before adding fluids to hydraulic systems. Ensure that only clean fluids of the proper type are used for replenishment or filling.

   (1) Level I. Pistons shall be coated with operating hydraulic fluid. Reassemble and refill with the applicable service fluid to normal operating level in accordance with applicable MIMs.

### NOTE

If brake hydraulic systems are to be drained or partially drained during storage period, flush all components with the applicable hydraulic fluid. Cap off all openings with the applicable sealing type closures.

   (2) Level II. Remove brakes during extended period of storage.

   (3) Level III. No protection required.

e. **Maintenance.** No maintenance required.

f. **Depreservation.** If applicable, remove all sealing closures from openings. Drain components, reinstall brakes, flush system and refill with operating fluid in accordance with applicable MIM before flight. Service brake system in accordance with applicable MIM.

### 3-62. BRAKE HYDRAULIC SYSTEM.

Refer to the applicable MIM and Section VIII.

### 3-63. CATAPULT HOOKS/LAUNCH BAR.

Solvent, Degreasing 27 MIL-PRF-680 Type II or III

a. **Cleaning.** Clean using degreasing solvent, MIL-PRF-680 Type II. Lubricate in accordance with the applicable MIM.

b. **Inspection.** Inspect in accordance with NAVAIR 01-1A-509-2 and Chapter 8.

c. **Corrosion Control.** Remove and treat corrosion in accordance with NAVAIR 01-1A-509-2.

d. **Protection.** Level I, II and III. Lubricate and preserve catapult mechanism in the same manner as landing gear. Refer to this section and the applicable MIM.
e. Maintenance.

(1) Level I and II. Every 7 days, inspect exposed high strength steel parts for CPC deterioration and/or corrosion damage. Reapply CPC or remove corrosion when necessary in accordance with NAVAIR 01-1A-509-2.

(2) Level III. No maintenance required.

f. Depreservation. Clean, inspect and remove corrosion as specified above.

3-64. DECELERATION CHUTES. Remove deceleration chutes and turn in to parachute shop for inspection, drying and maintenance in accordance with NAVAIR 13-1-6.2. Reinstall upon depreservation of system if aircraft is returning to service.

3-65. DOORS, LANDING GEAR. Refer to the instructions in Section II Airframes, Access Doors, for guidelines.

3-66. SHOCK STRUTS. Exposed reciprocating portions of hydraulic shock struts are prone to pick up dirt and salt spray.

**CAUTION**

Actuation of struts in a contaminated condition can cause pickup of abrasive material in backup rings and seals. Scoring and galling of the piston rods and glands and eventual leakage will result. It is essential that these parts be kept clean, especially when actuated.

Fluid, Hydraulic MIL-PRF-83282

a. Cleaning. Saturate a clean lint-free cloth, A-A-59323, with operating hydraulic fluid and wipe away from seal areas to preclude collection of soil at seal junction areas. Make sure piston surface is clean and completely lubricated but not dripping. If piston is dry, the telescoping action of strut will force gritty particles into cylinder causing eventual failure. Do not use aerosol dispensed fluid on hydraulic systems.

b. Inspection. Using oil syringe equipped with the necessary extension tubes, draw a sample of hydraulic fluid from each strut. The sample shall be taken from as near to the bottom of the strut as possible. Examine the fluid sample for contamination in accordance with Section VIII and decontaminate as required in accordance with the applicable MIM and NAVAIR 01-1A-17.

**NOTE**

Hydraulic fluids shall not be applied to struts of aircraft stored in dry, dusty climates until aircraft are being prepared for towing or flight.

c. Corrosion Control. Remove corrosion in accordance with NAVAIR 01-1A-509-2.

d. Protection.

(1) Level I. Service landing gear shock struts to operating level with the applicable operating hydraulic fluid. When servicing struts, refer to NAVAIR 01-1A-17 and the applicable MIMs to ensure that the correct fluids are used.

Fluid, Hydraulic MIL-PRF-83282

(2) Level II and III. After aircraft is parked in the storage area, deflate struts to approximately 1 inch above minimum height for Level II protection. For both Level II and III protection, coat exposed portions of strut piston with operating hydraulic fluid. Give particular attention to movable joints, internal recesses of linkage and exposed reciprocating portions of hydraulic actuating cylinders.

(3) Shipment. After aircraft are loaded aboard the transportation vehicle, deflate the struts of fixed wing aircraft to 25% of normal height. Do not deflate landing gear shock struts of rotary wing aircraft.

e. Maintenance.

(1) Level I and II. Every 7 days, check the preservative coatings on exposed surfaces of struts for integrity. If struts are being maintained in a clean, lubricated condition, wipe clean and lubricate with a lint-free cloth saturated with the operating hydraulic fluid. Inspect struts for proper inflation. If found flat, air up once. If found flat again on subsequent inspection, mark strut casing with red letter “D” and leave deflated. Repair during depreservation.
(2) Level III. Every 28 days, inspect struts for proper inflation. If found flat, air up once. If found flat again upon subsequent inspection, mark strut casing with red letter "D" and leave deflated. Repair during depreservation.

f. **Depreservation.** Before towing aircraft or actuating gear, clean reciprocating portions as specified above. Repair struts marked with a red letter "D". Inflate and service struts in accordance with applicable MIM. Clean, inspect, and treat corrosion, as specified above.

3-67. **SKIS.**

**WARNING**

Wire or lock ski control handle in UP or RETRACTED position.

a. **Cleaning.** Clean skis and internal (bilge) areas in accordance with Chapter 8.

b. **Inspection.** Inspect skis and associated mechanisms for corrosion in accordance with Chapter 8.

c. **Corrosion Control.** Arrest corrosion in accordance with NAVAIR 01-1A-509-2.

d. **Protection.**

![Compound, Corrosion Preventive](MIL-DTL-85054)

Compound, Corrosion Preventive 9

![Compound, Corrosion Preventive](MIL-PRF-16173 Grade 2)

Compound, Corrosion Preventive 10 MIL-PRF-16173 Grade 2

(2) **Level II.** Protect in accordance with Level I requirements. Remove skis, associated cables, and bungee cord. Preserve unpainted portions of skis with soft film CPC, MIL-PRF-16173 Grade 2, and store in aircraft. Due to their relatively short storage life, removed bungee cords should be diverted to other use.

(3) **Level III.** No protection required.

e. **Maintenance.**

(1) Level I and II. Every 7 days, inspect preservative coatings on unpainted surfaces for integrity. Treat exposed portions of hydraulic actuating cylinders by wiping exposed surfaces. Clean and lubricate using a cleaning cloth saturated with the operating hydraulic fluid. If rods are coated with preservatives, repair or replace coatings as necessary.

(2) **Level III.** No maintenance required.

f. **Depreservation.** Clean, inspect, and treat corrosion as specified above. Service skis and operating mechanisms in accordance with applicable MIM. Install new bungee cord. Remove safety wire from control handle.

3-68. **TIRES.** Inflate tires to normal operating pressure based on minimum aircraft weight. Refer to aircraft MIMs or NAVAIR 04-10-506 for instructions on maintenance of aircraft tires and technical guidance when checking tires for condition.

a. **Cleaning.** Clean tires to remove oil, grease and CPCs in accordance with Chapter 8.

b. **Inspection.** Inspect tire condition for cracks in accordance with NAVAIR 04-10-506.
3-69. **WHEELS.**

a. **Cleaning.** Clean wheels in accordance with Chapter 8 and NAVAIR 04-10-1.

   **NOTE**

   If wheels are removed for any reason, ensure that bearings are properly lubricated with grease and free of contaminants before reinstalling wheels. Refer to paragraph 3-60.

b. **Inspection.** Refer to Chapter 8 and NAVAIR 04-10-1.

   **CAUTION**

   Tires shall be maintained free of oils, greases, and CPCs during preservation of wheels.

c. **Corrosion Control.** Treat corroded areas in accordance with NAVAIR 01-1A-509-2.

d. **Protection.**

   (1) Level I, II and III. Coat bare metal with CPC, MIL-DTL-85054.

   (2) Shipment. After aircraft is loaded and spotted aboard transport vessel, install wheel covers, SAE AS5778, in such a way that free drainage is provided. If wheel covers are not provided in special support equipment, fabricate cover using barrier material, MIL-PRF-131 Class 1.

e. **Maintenance.**

   (1) Level I and II. Every 28 days, inspect wheels for corrosion damage and correct. Pay particular attention to brake cavity areas and dissimilar metal contacts. If brakes have been left installed under emergency conditions, inspect wheel covers for security and proper drainage.

   (2) Level III. No maintenance required.

def. **Depreservation.** Remove covers or barrier material if applicable. Check for foreign material. Clean, inspect, treat corrosion, and service as specified above and in accordance with applicable MIM.
SECTION XI. PHOTOGRAPHIC

Table 3-13. Photographic System Summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameras</td>
<td>3-70a</td>
<td>3-70b</td>
<td>-----</td>
<td>3-70c</td>
<td>3-70d</td>
<td>3-70e</td>
<td>-----</td>
</tr>
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<td>3-71a</td>
<td>3-71b</td>
<td>-----</td>
<td>3-71c</td>
<td>3-71d</td>
<td>3-71e</td>
<td>-----</td>
</tr>
<tr>
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<td>3-72</td>
<td>3-72</td>
<td>3-72</td>
<td>3-72</td>
<td>3-72</td>
<td>3-72</td>
<td>Section V, Electrical</td>
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<td>Dessicant Units</td>
<td>3-73</td>
<td>3-73</td>
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<td>3-73</td>
<td>3-73</td>
<td>3-73</td>
<td>Chapter 6, Section II</td>
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<td>View Finders</td>
<td>3-74a</td>
<td>3-74b</td>
<td>-----</td>
<td>3-74c</td>
<td>3-74d</td>
<td>3-74e</td>
<td>-----</td>
</tr>
</tbody>
</table>

3-70. CAMERAS.

CAUTION

Camera lenses and camera compartment windows are delicate optical elements. They are covered with vacuum deposited coatings which are easily scratched. These elements should be cleaned only as specified in the applicable MIM.

a. Cleaning. Clean in accordance with applicable MIMs.

b. Inspection. Inspect in accordance with Chapter 8. If cameras are left installed, check for water damage. When inspecting aircraft interior, check indicating-type dessicant units and service in accordance with the applicable MIM. Check barrier materials for security.

c. Protection.

(1) Level I. The camera shall be removed or covered with a special support equipment cover or with barrier material, MIL-PRF-131 Class 1. Refer to applicable MIMs.

NOTE

Camera removal is at the option of the local custodian in cases of aircraft shipment.

(2) Level II and III. Remove, preserve and package camera units in accordance with NAVSUP P700. If instructions are not available in the NAVSUP publications, package in accordance with the guidelines of MIL-STD-2073-1 using Level A criteria. Turn packaged cameras into supply storage or handle in accordance with local instructions.

d. Maintenance.

(1) Level I. Every 7 days, check camera window covers for security. When inspecting aircraft interior, check system dehydrator units to ensure fully activated condition and check camera for water damage.

(2) Level II and III. No maintenance required.

e. Depreservation. If aircraft is being returned to service and being made mission ready, remove cover or barrier material, or reinstall camera. Service systems in accordance with applicable MIM. Vacuum clean to remove accumulated dust and debris. If necessary, clean and inspect as specified above.

3-71. CAMERA MOUNTS. Preserve camera mounts only if cameras are removed.

Solvent, Degreasing 27
MIL-PRF-680 Type II or III

a. Cleaning. Remove corrosion preventive coatings using degreasing solvent MIL-PRF-680 Type II or III. Clear camera mounts of dust or dirt.

b. Inspection. Inspect for corrosion in accordance with Chapter 8.

Compound, Corrosion Preventive 10
MIL-PRF-16173 Grade 2

c. Protection. Level I, II and III. Coat unpainted portions of mounts with soft film CPC, MIL-PRF-16173 Grade 2.
d. **Maintenance.**

   (1) Level I and II. Every 28 days, check preservative coatings on unpainted portions of mounts for integrity. Reapply CPC as required.

   (2) Level III. No maintenance required.

e. **Depreservation.** Remove CPC, clean and inspect as specified above.

3-72. **CONTROLS.** Refer to Section V, Electrical.

3-73. **DESSICANT UNITS.** These are small units that fit inside individual components to provide a relatively dry atmosphere for moisture sensitive parts. They come in various sizes, shapes and colors. Some reactivate when the equipment is operational. Others require replacement or reactivation when the color indicator changes. Refer to the applicable MIMs for servicing and maintenance procedures.

3-74. **VIEWFINDERS.**

   a. **Cleaning.** Use a vacuum cleaner to clear view finder of dust and debris.

   b. **Inspection.** Check view finders for moisture as indicated by fogging of optical elements or high humidity indicator readings. If moisture is found, treatment usually consists of servicing desiccant cartridge, operating the system and repeating charging and operating procedures until system is completely dry (refer to applicable MIM). The desiccant cartridge shall be serviced and a new humidity indicator installed after completion of the drying operation.

c. **Protection.** Level I, II and III. View finders shall be covered with special support equipment covers or with barrier material, MIL-PRF-131 Class 1. Desiccant units shall be in an activated condition.

d. **Maintenance.**

   (1) Level I and II. Every 7 days, remove special support equipment covers or barrier materials. Inspect for moisture and service in accordance with the applicable MIM. Treatment usually consists of servicing desiccant cartridge, operating system and repeating charging and operating procedures until system is completely dry.

   (2) Level III. No maintenance required.

e. **Depreservation.** Remove special support equipment covers or barrier material. Service in accordance with applicable MIM. Clean and inspect as specified above.
SECTION XII. PNEUMATICS

Table 3-14. Pneumatic System Summary

<table>
<thead>
<tr>
<th>PNEUMATIC SYSTEM</th>
<th>Clean</th>
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<td>3-75a</td>
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<td>-----</td>
<td>3-75b</td>
<td>3-75c</td>
<td>3-75d</td>
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<tr>
<td>Chemical Air Driers</td>
<td>3-76a</td>
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<td>-----</td>
<td>3-76b</td>
<td>3-76c</td>
<td>3-76d</td>
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</tr>
</tbody>
</table>

**WARNING**

All air bottles more than 5 years past the last test date shall be removed and hydrostatically tested before use.

3-75. **PNEUMATICS.** Every 30 days, and within 5 days of shipment, service pneumatic systems to normal operating pressure in accordance with the applicable MIM. Ensure that any access ports used for servicing are properly sealed.

a. **Cleaning/Inspection.** Check for water in the system by bleeding a small amount of air from bleed air ports and observing the condition of color indicators or desiccant units. If no water is found on inspection, the system shall be considered dry and suitable for storage. If water is found, completely bleed the system of all air, service chemical air driers, fill system with dry nitrogen, A-A-59503 Type I, and recheck for water. Repeat draining and refilling as necessary to ensure a dry system. After drying operations are complete, reservice chemical air driers.

b. **Protection.** Level I, II and III. Service all pneumatic systems, including landing gear and other emergency operation systems, to normal operating pressure. When pneumatic systems are partially disassembled during maintenance or storage, blank off all openings, including chemical air driers using non-shedding threaded type caps and plugs, NAS 847, or barrier material, MIL-PRF-131 Class 1, and tape, SAE AMS-T-22085 Type II. Adjust system pressure to normal operating pressure.

c. **Maintenance.**

(1) Level I and II. Every 28 days, check to ensure pressurization is maintained.

(2) Level III. No maintenance required.

d. **Depreservation.** Remove barrier material or closures. Clean and inspect as specified above. Service system to normal operating pressure in accordance with applicable MIM.

3-76. **CHEMICAL AIR DRIERS.**

a. **Cleaning/Inspection.** Refer to Chapter 8.

b. **Protection.** Level I, II and III. Service chemical air driers in accordance with the applicable MIM. When pneumatic systems are partially disassembled during storage, blank off all openings using non-shedding threaded type caps and plugs, NAS 847, or barrier material, MIL-PRF-131 Class 1, and tape, SAE AMS-T-22085 Type II. Adjust system pressure to normal operating pressure.

c. **Maintenance.** Level I, II and III. Every 28 days, check to ensure pressurization is maintained. Check chemical air driers to ensure they are charged.

d. **Depreservation.** Remove barrier material or plugs as applicable. Service system to normal operating pressure in accordance with applicable MIM. Clean and inspect as specified above.
**3-77. POWER PLANT.** This section addresses the cleaning, inspection, protection, maintenance and depreservation of operational or nonoperational auxiliary power units (APUs), gas turbine engines and reciprocating engines installed on the aircraft. Refer to Table 3-15 for items covered in this section. See Chapter 4 for information on procedures applicable to removed engines. Level I preservation of engines requires the fuel system to be kept 95% full of fuel for no longer than 90 days. Engine fuel systems which are to be drained of fuel for longer than 3 days or remain inactive for longer than 90 days shall be preserved with oil, MIL-PRF-6081 Grade 1010N, and statically or dynamically dehumidified. Engine control cables shall be preserved in accordance with Section II.

a. Log Entries. Only Level II and III engine preservation requires a log book entry. Incomplete or missing log entries cause unnecessary expenditures of man-hours and materials. This is especially true with preservation entries since discrepancies resulting from the lack of proper preservation will usually not be evident until after failure has occurred or disassembly of the engine has been accomplished. The verification of the preservation cannot be adequately done by external examination of the engine. Therefore, it is important that preservation entries in engine logs be complete and accurate. All activities shall ensure that engine logs and records under their cognizance are processed and maintained in accordance with COMNAVAIRFORINST 4790.2. All preservation, represervation, and depreservation actions shall be entered in Preservation Depreservation Section, CNAF Form 4790/136(AESR) for engines (refer to Chapter 1, Section I) or in NALCOMIS OMA Logs and Records Subsystem. Special log entries are not required for routine preservation maintenance on engines, such as treatment of minor corrosion or replacement of desiccant. Log entries are mandatory when maintenance is accomplished as follows:

1. When engine is being represerved after having reached the end of its authorized storage time limitations.
2. When an engine is converted from one level of preservation to another.

b. Installation of Preservation Tags. After completion of all preservation operations, a preservation tag, form NAVAIR 4835/8 (see Figure 3-10), shall be filled out. The tag shall be placed near the main fuel control where it can be easily seen through engine access doors. The tag shall indicate the level of preservation, the internal preservatives used, the name of the preserving activity, and the date of preservation. Whenever a change is made in the level of preservation, the preservation tag shall be updated to reflect that change. Additional tags are required to indicate the use of preservation oil and placement of desiccant packs.

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**Table 3-15. Power Plant Systems Summary**

<table>
<thead>
<tr>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil System</td>
<td>3-78a</td>
<td>3-78b</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>NAVAIRINST 10350.4</td>
</tr>
<tr>
<td>Gas Turbine Engines &amp; APUs</td>
<td>3-79</td>
<td>3-80</td>
<td>3-81</td>
<td>3-82</td>
<td>3-83</td>
<td>3-84</td>
<td>-----</td>
</tr>
<tr>
<td>Reciprocating Engines</td>
<td>3-85</td>
<td>3-86</td>
<td>3-87</td>
<td>3-88</td>
<td>3-89</td>
<td>3-90</td>
<td>-----</td>
</tr>
</tbody>
</table>

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**3-78. GAS TURBINE AND APU ENGINE OIL SYSTEM PROTECTION.** Before conducting preservation runs, check lubricating oil supply from the engine, APU, VEN, and AMAD for contamination. Drain and refill the oil reservoir with MIL-PRF-23699 C/I engine oil prior to the preservation or exercising run.

**NOTE**

If an engine is rejected due to oil system contamination and is sent to another activity for analysis, do not clean or otherwise remove contaminants from filters, as this evidence is useful in isolating the cause of the possible system failures. If particle contamination of the lubrication system is involved, comply with the requirements of the applicable MIMs.
a. Cleaning. When a change of the oil is required due to contamination or accumulated operating time, the oil reservoir shall be drained and refilled to normal operating level with operating lubricant which has been filtered through a 3 micron filter (refer to NAVAIRINST 10350.4). The oil shall be filtered before being added to the engine oil reservoirs to prevent contamination from sealants, rust particles, and metal slivers resulting from the opening of the metal containers.

b. Inspection. Test engine oil in accordance with Table 3-16. If oil fails any test, correct in accordance with applicable MIM. Check oil filters for evidence of clogging or microbiological growth. If found, replace or clean in accordance with applicable MIM. When inspecting and servicing oil tanks, make sure that tank filler scupper drains are open and that tiller caps are reinstalled and secured.

3-79. GAS TURBINE ENGINE AND APU CLEANING. Cleaning is necessary prior to protection at any level of preservation.

   a. External.

   (1) Before cleaning, all engine openings shall be sealed, and exposed wiring and bearings shall be masked to prevent exposure to cleaning solutions. Keep unused openings blanked off with non-shedding metal closures or with tape, SAE AMS-T-22085 Type II, and plastic sheet, ASTM D4801 Type III.

   (2) Before engine runups, ducts such as inlets and outlets, and cooling air ducts shall be cleaned as necessary to remove dirt, salt deposits, and foreign objects.

   (a) Clean engine inlets and gas path in accordance with NAVAIR 01-1A-509-2. Care shall be taken to prevent the entrapment of water in recesses or in the engine interior.

   NOTE

   Engine runup shall be in accordance with applicable NATOPS procedures and safety precautions. If aircraft will undergo an initial preservation runup to preserve the fuel systems within 4 hours of wash, this can be used to dry the aircraft engines.

   (b) If water is accidentally introduced into the engine from rain or while cleaning, or if a compressor liquid cleaning procedure is used, perform a 5 minute engine runup to dry out any entrapped water or cleaning solution.

   (3) Collect runoff and dispose of according to local regulations. Except where water displacing compounds are to be used, all surfaces should be clean and dry before application of any preservative coating.

   b. Internal. Clean engines in accordance with applicable aircraft MIMs.

3-80. GAS TURBINE ENGINE AND APU INSPECTION. Ensure that fuel has been inspected in accordance with paragraph 3-44b and engine oil has been inspected in accordance with paragraph 3-78b prior to preservation procedures.

3-81. GAS TURBINE ENGINE AND APU CORROSION CONTROL. Treat and remove corrosion in accordance with NAVAIR 01-1A-509-2 and applicable MIMs.
3-82. GAS TURBINE ENGINE AND APU PROTECTION. The following instructions are for the protection of gas turbine engines, APUs, and related components. Before performing preservation procedures, ensure that the engine oil reservoir has been serviced and that it is filled to the normal operating level with the applicable operating lubricant.

a. Operational Engine/APU. For installed engines, the entire aircraft fuel system, including tanks, pumps, and lines are preserved concurrently with the power plant system.

(1) Initial Preservation Runup. All operational engines preserved at any of the three levels of preservation shall be given a preservation runup at the beginning of the preservation cycle using the following procedure.

(a) Start and operate the engine for a minimum of 5 minutes at 75% normal rated speed (ground idle speed for turboprop engines) using the normal service fuel in the fuel system. Starting and operating procedures shall be in accordance with the applicable NATOPS or MIM for each engine model.

(b) If the engine is equipped with an afterburner or emergency fuel system, perform at least two (2) cycles of each of these systems during the initial preservation runup.

(c) Shut down the engine in accordance with procedures contained in the applicable MIM or NATOPS manual.

(d) Oil filters shall be removed, inspected, and cleaned following the initial preservation runup. If contamination is found during oil filter check, refer to paragraph 3-78 and applicable MIM for corrective action.

(2) Level I. Keep fuel systems at least 95% full of fuel. Seal seams and openings of engine, except compressor inlet and exhaust outlet, using barrier material, MIL-PRF-131 Class 1, held in place with tape, SAE AMS-T-22085 Type II. Seal seams and small openings with tape, SAE AMS-T-22085 Type II. Seal engine inlet, outlet and other large openings either with a fitted cover, with barrier material, MIL-PRF-131 Class 1, or with rigid fillers, secured in place with safety wire (see Figure 5-16).

CAUTION

Serious damage can occur to elastomeric parts and engine in-flight failures may result if fuel systems are left drained of fuel and unprotected for longer than 72 hours.

(3) Level II Internal. For engines inactive for a period greater than 90 days or those to be drained of fuel (dry) for longer than 72 hours, the engine and the entire fuel system shall be preserved with Grade 1010N lubricating oil using the "hot pres" method described in Section VII. This method consists of starting and operating the engine while allowing the Grade 1010N preservation oil to pass through the engine and fuel system and burn as fuel. The main power plant and auxiliary power plant fuel system are preserved concurrently with the aircraft fuel system. It is important that fuel controls be thoroughly purged of all service fuel during the preservation procedure.

(4) Level II External.

(a) After completion of the hot preservation run, completely seal all engine openings to the interior and nacelle/fuselage as called out in Level I.

Table 3-16. Contamination Limits for Engine Oil

<table>
<thead>
<tr>
<th>Test</th>
<th>Reference Specification</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>NAVAIRINST 10350.4</td>
<td>No detectable water; fluid cannot be cloudy or hazy; no microbiological growth; no particulate matter that can be seen without magnification. Color may vary and shall not be used as a basis for rejecting oil.</td>
</tr>
<tr>
<td>Metal Particles</td>
<td>NAVAIR 17-15-50.2</td>
<td>Varies for each engine type</td>
</tr>
<tr>
<td>Water</td>
<td>Karl-Fischer Aquatest (ASTM D1744)</td>
<td>1000 ppm</td>
</tr>
<tr>
<td>Total Acid Number</td>
<td>SAE ARP-5088</td>
<td>2.0 maximum</td>
</tr>
</tbody>
</table>
(b) Statically dehumidify the engine cavities using desiccant, MIL-D-3464 Type I. Install desiccant in all engine inlet and outlet openings (see Figure 6-2). Place barrier material, MIL-PRF-131 Class 1, under each batch of desiccant. Install humidity cards, MIL-I-8835, in inlet and outlet covers. Install warning tags, Figure 3-11, to indicate number of desiccant bags installed in each cavity (see Figure 6-3). Refer to Chapter 6, Section II, for detailed instructions on desiccant installation.

(c) Cover and seal compressor inlet, exhaust nozzle, compressor bleed valves, and other similar openings, using prefabricated manufacturer’s closures or waterproof barrier material, MIL-PRF-131 Class 1, held in place with preservation tape, SAE AMS-T-22085 Type II. Close all engine overboard drains (except combustion chamber drains) and vents with plastic caps.

(d) Ensure that engine compartments (exterior of engine) are equipped with adequate drainage to remove accumulated liquids in low point areas. Ensure that the combustion chamber drains are functioning and are not obstructed in any way. When strippable coatings or shrinkwrap are applied, add exterior drain provisions as specified in Chapter 5.

(5) Level III. Protect engine internally as specified for Level II preservation. No external protection is required.

(6) Install engine preservation tag (Figure 3-10) and make log entries in accordance with paragraph 3-77.

b. Nonoperational Engine/APU. Nonoperational engines or APUs shall be protected with MIL-PRF-6081 Grade 1010N preservation oil in accordance with Level II requirements.

**CAUTION**

To prevent damage due to operating an engine in the "dry" condition, ensure that all installed accessories are supplied with fluids/lubricants during rotation. If fluid/lubricants cannot be supplied, disconnect or deactivate accessories as necessary to prevent actuation or rotation.

(1) Level II General. For nonoperational installed engines, the entire aircraft fuel system, including tanks, pumps, and lines shall be preserved concurrently with the engine system. If a powered runup cannot be performed due to missing or incomplete aircraft components or lack of aircraft tiedown provisions, the engine shall be protected by the "cold pres" method. It is important that fuel controls be thoroughly purged of all service fuel during the preservation procedure. The entire fuel system shall be preserved with MIL-PRF-6081 Grade 1010N preservation oil. Preservation oil shall be controlled and filtered in accordance with Section VII. For additional information, refer to applicable MIM.

**NOTE**

The "cold pres" method affords protection to only selected areas of the fuel and power plant systems. It is not recommended if "hot pres" can be performed.

(2) Level II Internal. Perform the following procedures to internally protect nonoperational installed engines by the "cold pres" method.

**NOTE**

The engine fuel system shall be preserved concurrently with the rotation.

(a) If shaft can be rotated:

1. Cold preserve fuel system in accordance with Section VII.
2. Connect an external source of oil, MIL-PRF-6081 Grade 1010N, to the main fuel inlet, and pump at 2-5 psi.

3. Using a suitable turning device, rotate the compressor and turbine rotor for a minimum of 3 minutes. If the engine starter can be used, the engine shall be rotated through two 30 second starter cycles. Existing starter limitations shall be strictly observed. If maximum cranking speed cannot be obtained due to engine or starter deficiency, fuel controls (main and afterburner) shall be removed and preserved separately.

4. Preservation oil shall not be drained from the engine.

5. To prevent accidental draining of fuel systems during maintenance starter turnover operations, safety wire throttle levers in the "CLOSED" position after preservation. If fuel system design is such that drainage cannot occur when throttle or power lever is in "OPEN" position during engine rotation (up to maximum starter speed), safety wiring of control in "CLOSED" position is not required.

6. If required, spray the compressor section in accordance with applicable engine MIM.

WARNING

OIL RESERVOIR DRAINED

Figure 3-12. Warning Tag for Oil System

NOTE

Prohibitions against getting oil into fuel nozzles may be ignored if care is taken to ensure combustion chamber drains are functioning properly and upon depreservation, the fuel nozzles are to be flushed with fuel prior to starting.

(c) Leave fuel metering devices full of MIL-PRF-6081 Grade 1010N preservation oil. Engine fuel systems shall not be drained but shall also be left full of preservation oil after fuel has been purged. Make sure that combustion chamber drains are functioning and are not obstructed.

WARNING

To prevent loss of preservation oil and potential fire hazard, pressure seal type closures shall be used on all fuel system openings. Use appropriate metal fittings on threaded openings and gasketed metal plates on flanged fittings.

(d) Fuel controls shall be rotated at approximately 1/4 maximum bench test speed and have throttle lever and solenoids cycled during rotation for adequate flushing and coating of all components.

(e) Drain excess oil from fuel tanks if applicable. Lubricating oil reservoir shall be drained and appropriately tagged (see Figure 3-12).
When internal surfaces of the engine fuel system have been thoroughly purged of fuel and coated with preservation oil, reinstall and secure all lines, fittings and plugs. Each fuel system connection plug or fitting disturbed during preservation shall be identified with a warning tag, Figure 3-13.

**WARNING**

Failure to tag may result in fuel loss, fire, damage or injury to personnel.

Tag aircraft cockpit to indicate that fuel systems have been oil preserved (see Figure 3-6).

(3) **Level II External.** Preserve the engine exterior as specified for operational engines. Leave fuel system vents open to allow breathing. When vents are located in a position to collect water and airborne dirt, install extension tubes as shown in Figure 3-4.

(4) **Level III.** Internally, preserve the engine in accordance with the above requirements for Level II. No external protection is required for engines installed in an aircraft being stored in a dynamically dehumidified environment.

(5) Install engine preservation tag (Figure 3-10) and make log entries in accordance with paragraph 3-77.

### 3-83. GAS TURBINE ENGINE AND APU MAINTENANCE.

a. **Level I.**

(1) 7 day. Check fuel level, maintain 95% full. Check barrier material and replace when necessary.

(2) 28 day. Hot run the engine, and cycle systems, including afterburner, twice. Inspect and renew the external coating of CPC as required.

b. **Level II.**

(1) 7 Day. Maintain all closures in place and keep desiccant in engine cavities in a fully activated condition. Replace desiccant if an indication is found that the humidity exceeded 40 percent. In addition, reinspect barrier material or closures for compromises. Check combustion chamber drains to ensure they are open. Check extensions of vents and other engine openings for integrity, and repair or replace as necessary.

(2) 28 Day. Renew external CPC protection, if required by the applicable MIMs.

(3) 56 Day. Rotate the engine using the starter or an external turning device (such as a pneumatic wrench, speed handle, or ratchet). Shaft rotation will tend to wipe incipient corrosion from parts having relative movement and redistribute the lubricating oil to the bearings which are vulnerable to corrosive attack when left in the dry state. Engine shall be given a starter turnover for a minute duration. If starter cannot be used for the rotation, manually turn the engine through the starter pad using an external device. Ensure lubrication is redistributed throughout the engine during rotation. If a compressor oil spray is specified and if the compressor is dry, it shall be resprayed while the engine is being rotated.

c. **Level III.** For engines installed in dehumidified aircraft or in a dehumidified enclosure, no maintenance is required, other than to maintain the dehumidifier and monitor the equipment (refer to Chapter 6).

### 3-84. GAS TURBINE ENGINE AND APU DEPRESERVATION. The following are procedures to depreserve a gas turbine engine for use.

**Solvent, Degreasing** 27
MIL-PRF-680 Type II or III

3-64
engine filters in accordance with applicable MIMs. Check hoses, lines and fittings to ensure that items disconnected during depreservation are reconnected and secured. Service all systems and check lubricating oil for contamination in accordance with applicable MIM. Service the engine with a short depreservation runup. Depreservation runup shall be performed as follows:

(a) After preoiling and performing all prestarting inspections in accordance with the applicable MIM or NATOPS manual, start and operate engine for 3-5 minutes at 75% normal rated speed and cycle through all engine systems, including afterburner.

(b) Shut down the engine using procedures outlined in the applicable MIM or NATOPS manual and inspect for fuel and oil leaks.

(c) Remove, inspect, clean or replace fuel and oil filters in accordance with paragraph 3-78 and Section VII. Inspect fuel and oil screens for O-ring and seal deterioration.

(d) Remove all warning or caution tags after fuel and oil integrity has been established.

(e) Enter required depreservation/represervation information into the engine logs (refer to paragraph 3-77).

b. Level II. Gas turbine engines shall be depreserved in accordance with the applicable MIM. When no special instructions are contained in the engine MIM, perform the procedures outlined below.

(1) For installed engines where the lubricant has not been drained, check for accumulated water and debris in oil reservoirs or sumps by temporarily opening available drain valves or drain plugs. If water or other contamination is found on this check or if engine has been in storage for 1 year or more, completely drain lube oil system and service in accordance with paragraph 3-78. Otherwise, service oil reservoir with normal operating lubricant. Check compressor and turbine housings for accumulation of oil and drain as necessary.

(2) Remove safety wire from throttle or power lever.

(3) Ensure that combustion chamber drains are functioning normally.

(4) For turboprop engines, clean propeller shaft, and install propeller.

(5) Drain excess preservation oil from fuel tanks, flush, and service with operating fuel. Depreserve fuel systems using the guidelines of Section VII, and supply fuel to the fuel inlet. Flush fuel nozzle with fuel. Supply fuel at normal boost or fuel inlet pressure.

CAUTION

Do not initiate steps (6) through (10) until immediately prior to engine runup. Observe preoiling requirements.

(6) Remove closures from air intakes, tailpipes, blow-in doors, and check openings for foreign material.

NOTE

All openings of the engines shall be kept covered until it becomes necessary to install accessories or other equipment over these openings, or until the engine is ready to be placed in service.

(7) Ensure that all engine and accessory vent openings are free of tape and foreign material.

(8) Remove bagged desiccant from all ducts, vents and other engine openings.

(9) Where fire and safety regulations permit, fittings and lines to fuel nozzle may be left connected and the following purging procedures used:

(a) Remove compressor inlet and turbine outlet seals. Place receptacles under combustion chamber drains to catch purged oil and fuel.

(b) After depreserving the fuel controls and with ignition deactivated, rotate the engine with the starter.

(c) While the engine is being rotated, actuate main and afterburner fuel shutoff valves in accordance with applicable MIM and supply fuel to the fuel system. Actuate the throttle or power lever through its full travel range several times so that the fuel system, including nozzles, is purged of oil.

(d) Repeat step (c) as many times as required (observing starter limitations) until oil free fuel flows from combustion chamber drains.

(e) Visually inspect the engine for fuel and oil leaks, paying particular attention to fittings marked with warning tags. Do not remove tags at this time.
(f) Allow engine combustion chambers to drain and dry thoroughly before attempting any starts.

(10) Perform the preoil procedures in accordance with the applicable MIM or as follows:

(a) If engine is equipped with drains in oil lines, open the drains briefly to bleed off any entrapped air. Engines with air and oil lubricated bearings shall be preoiled immediately prior to starting using an external pressure pump until all bearing lines are filled with oil and bled of all entrapped air.

(b) After all bearing lines are full of lubricating oil, perform a non-ignition start cycle. If oil pressure is not observed on the oil pressure gauge, perform a second non-ignition start. If the oil pressure is not observed on the second attempt, perform the necessary inspections and repairs to correct the trouble, using the applicable MIM.

**CAUTION**

Leave all cockpit utility systems, operating from compressor bleed air, shut off during initial starts in order to prevent contamination of the cabin air systems with accumulated oil.

(11) After preoiling and performing all prestarting inspections in accordance with the applicable MIM or NATOPS manual, start and operate engine for 3-5 minutes at 75% normal rated speed and cycle through all engine systems, including afterburner.

(12) Shut down the engine using procedures outlined in the applicable MIM or NATOPS manual and inspect for fuel and oil leaks.

(13) Remove, inspect, clean or replace fuel and oil filters in accordance with paragraph 3-78 and Section VII.

(14) Refill oil tank to normal operating level with specified operating lubricant if applicable.

(15) Remove all warning or caution tags after fuel and oil integrity has been established.

(16) Start the engine and perform a standard ground runup in accordance with applicable MIM or the NATOPS manual. During the ground run perform operational checks of all engine systems.

(17) After shutdown, clean engine sufficiently to remove excess oil and preservative compounds.

(18) If the engine is equipped with an operating time meter, record the operating time.

(19) Make a depreservation log entry on CNAF Form 4790/25A (AESR) or in NALCOMIS OMA in accordance with paragraph 3-77.

  c. **Level III.** Depreserve internally in accordance with Level II depreservation instructions. Engines being removed from Level III preservation shall remain in the dehumidified package as long as practicable.

3-85. **RECIPROCATING ENGINE CLEANING.**

a. **External.** Refer to cleaning instructions of paragraph 3-79 and NAVAIR 01-1A-509-2.

b. **Internal.**

(1) Condensation shall be drained from all sumps and oil coolers by using available drains. When accumulations of sludge, metal particles, carbon, and dirt are noted during tank sump and drain checks, oil tanks shall be drained and cleaned in accordance with the applicable MIM. Any cleaning of internal engine cavities on engines destined for reinstallation or reuse shall be limited to flushing with operating oil.

(2) Clean spark plug lead terminals using a clean lint-free cloth moistened with degreasing solvent, MIL-PRF-680. Do not permit the solvent to run down inside the sleeves or on the spark plug leads. After cleaning and drying the terminals, install clean protective caps over the sleeves. If the spark plugs are left installed during Level II preservation for later use during the depreservation run, spark plug leads should be reinstalled following cleaning and drying.

(3) Perform any other cleaning required by the applicable MIM.

  c. **Oil System.** Refer to paragraph 3-78.
3-86. RECIPROCATING ENGINE INSPECTION. Refer to paragraph 3-80.

3-87. RECIPROCATING ENGINE CORROSION CONTROL. Treat and remove corrosion in accordance with NAVAIR 01-1A-509-2 and applicable MIM.

3-88. RECIPROCATING ENGINE PROTECTION. For reciprocating engines inactive for a period greater than 7 days or those to be drained of fuel (dry) for longer than 72 hours, the entire fuel system shall be preserved in accordance with the Level II or III preservation instructions.

   a. Operational Engines.

      WARNING

      Engine runup shall be in accordance with NATOPS procedures and safety precautions. Fire fighting equipment shall be available.

      (1) Initial Preservation Runup. All operational reciprocating engines preserved at any of the three levels of preservation shall be given a preservation runup at the beginning of the preservation cycle using the following procedure.

         (a) Preoil the engine by rotating with the starter without ignition until oil pressure is indicated on the oil pressure gauge (refer to the applicable MIM).

         (b) Start and operate the engine at no-load, governed speed for 10-15 minutes using normal service fuel in the fuel system. The engine shall be operated so that an oil inlet temperature of 205-215°F is maintained for the entire preservation run. This auxiliary heating eliminates moisture from the oil. The oil coolers may be blanked off or bypassed to maintain the desired oil inlet temperatures.

      CAUTION

      To prevent damage to the engine and ignition system components, the specified engine cylinder temperature shall not be exceeded at any time during the preservation runup.

         (c) During the preservation runup, operate supercharger clutches as applicable through two complete cycles. To avoid overheating and burning of the clutches allow approximately 5 minutes between the clutch cycles. Operate engine oil operated controllable pitch propellers through their entire range a minimum of three (3) times.

         (d) For Level II and III preservation, proceed directly to step (3).

         (e) For Level I preservation, secure the power, turn off the fuel pump, close the throttle, and place the master control in "IDLE CUTOFF" position.

      (2) Level I. Fuel system shall be kept full (95% minimum) of service fuel during Level I preservation cycle. As soon as engine is cool enough to work on, after preservation run, cover all exhaust openings, carburetor intakes, and alternate air intakes, as applicable, using barrier material, MIL-PRF-131 Class 1, secured in place with safety wire (when possible) and seal edges with tape, SAE AMS-T-22085 Type II. Install a solid cover over the carburetor air intake opening.

      (3) Level II and III Internal. If only the engine is being preserved, proceed to step (4). If the engine and fuel system are being preserved concurrently, proceed to step (5).

      (4) Level II and III Engine Preservation Only. At the completion of the preservation run, inject preservative into the induction system (see Figure 3-14).

         (a) Equipment. The recommended corrosion preventive injection device consists of an injection nozzle, sufficient medium pressure hydraulic hoses to reach from the engine rear section to the pilot's compartment, a throttle-type shutoff valve, and assorted hose fittings and plumbing to attach the lines and valve. Attach one suitable length of the hose to the pressure side of the engine oil pump, using any available port at the pump, or teeing into the oil pressure gage line if such a port is not available. This line should run to the pilot's compartment and back to the injection nozzle located at the engine carburetor throat section with a throttle-type valve installed in the line at a point that is accessible to the operator. The recommended nozzle operating pressure is 50 psi. Nozzle temperature of the compound shall be maintained at no less than 205°F during the injection.

         NOTE

         The MA-2A preservation unit (Preservation and Preoiling Machine) may be used to provide the heated compound for the injection operation. Refer to NAVAIR 19-1-67 for operation and service instructions.
(b) Procedure.

1. Adjust the engine so that it is operating steadily at about 1200-1600 rpm.

2. Begin injecting MIL-C-6529 Type II, heated to approximately 215°F, at a rate of approximately 40-50 gallons per hour. Injection shall be made in such a manner as to achieve full coverage of the intake system and each cylinder bore.

3. As soon as steady smoking is observed from all engine exhausts, move the automatic mixture or master control to "IDLE CUTOFF". On small engines not equipped with an automatic mixture or master control, shut off fuel flow to the carburetor. Do not close the throttle at this time.

4. When the engine comes to a stop turn off the ignition.

5. Cut off the supply to the injected preservative compound.

6. For engines not equipped with direct injection type fuel systems, ensure that the engine has come to a complete stop, open the throttle, turn on the fuel emergency or booster pump, and place the mixture control in the "AUTO-RICH" position. When fuel-free oil is observed running from the supercharger drain valve, close the throttle and mixture control, and shut off the auxiliary fuel pump.

NOTE

The propeller should not be moved following this operation.

7. Immediately after step 6 and while the engine is still hot, place the propeller with the rear cone slot in the 6 o'clock position or in the proper position for handling sling attachment.

8. Install preservation tag, Figure 3-15.
(5) Level II and III Engine and Fuel System Preservation. Preserve the engine and the fuel system simultaneously as follows:

Oil, Lubricating, Jet Engine 22
MIL-PRF-6081 Grade 1010N

**NOTE**

The entire operation shall be carried out in sufficient time to observe the time limitations between the completion of engine run and cylinder spray operations.

(a) Put sufficient clean and filtered MIL-PRF-6081 Grade 1010N preservation oil into a drained fuel tank to displace all residual fuel in the engine system (refer to Figure 3-14).

(b) Remove one spark plug from each lower cylinder of the engine to make the engine easier to rotate and prevent hydraulic lock. Remove a spark plug from all cylinders in direct injection systems.

(c) Remove plugs from carburetors and injection pumps, and drain excess fuel. Reinstall plugs and secure.

(d) Open the throttle wide and place the mixture control, if applicable, in the "FULL RICH" position.

(e) To prevent flooding of the cylinders in direct injection systems and washing away of the preservative, disconnect pressure fuel lines between injection pumps and fuel injection nozzles in direct injection systems. Provide drain lines and receptacles to catch fuel and oil.

(f) Operate the boost or emergency fuel pump from an external power source and pump MIL-PRF-6081 Grade 1010N preservation oil through the fuel system until fuel-free oil is observed running out of the engine blower drain or from the fuel injection nozzle lines.

(g) With spinner injection type carburetors, operate the throttle through its full travel several times during the flushing operation in order to assure complete purging and oil filling of the carburetor "C" chamber and/or the accelerating pump.

(h) With direct injection type fuel systems, the engine shall be rotated with the starter during the flushing operation in order to coat all portion of the injection pumps.

(i) When all internal surfaces of the engine fuel system have been coated with oil, secure the power, turn off the fuel pump, close the throttle and place the master control in "IDLE CUTOFF".

(j) Reinstall and secure all plugs and lines. Spark plugs shall be retained for use or disposed of as required by the applicable MIM.

Oil, Lubricating, Jet Engine 22
MIL-PRF-6081 Grade 1010N

**CAUTION**

Take every precaution against liquid locking of the engine. Keep the flushing time to a minimum and permit the lower cylinders to drain before replacing the spark plugs.

(k) Using MIL-PRF-6081 Grade 1010N preservation oil, spray coat tanks which have not been preserved by fill-and-drain procedures.

(l) Blank off all openings with positive sealing closures to prevent loss of preservation oil.
WARNING

Failure to tag may result in fuel loss, fire, damage or injury to personnel.

(m) Tag aircraft cockpit (see Figure 3-6), to indicate that fuel systems have been oil flushed.

(6) Level II and Level III Cylinder Spray. The cylinders shall be sprayed with undiluted MIL-C-6529 Type I. The purpose of the spray is to apply an even coating of the hot preservation compound over the cylinder bore surfaces above the piston. The engine crankshaft shall not be turned after cylinder wall spraying.

CAUTION

Do not apply excessive amounts of preservative to cylinder interiors. Excessive material does not contribute to the effectiveness of the preservation and increases the chances of hydraulic lock at the time of depreservation.

If the crankshaft is accidentally turned while the engine is still hot (above 205°F), repeat the cylinder wall spraying operation. If the crankshaft is turned after the engine has cooled, the entire preservation run and cylinder wall spraying operation shall be repeated.

(a) Treatment of the cylinders may be delayed until after the engine has cooled some from preservation run but shall be accomplished before the engine interior has cooled below 205°F. Under ambient temperature conditions (60-75°F), reciprocating engines are too cold for the spraying operation. Spraying shall be done within 4 hours after engine shutdown.

(b) The cylinder spray operation shall be done in accordance with the following procedures.

1. Remove ignition leads from those engines equipped with low tension ignition systems, and cap the openings at the coil. As an alternate procedure, cap the spark plug lead insulators and reclean the leads following preservation of the cylinders. For other type ignition systems, check the ignition lead gland nuts for tightness.

2. Heat preservative, MIL-C-6529 Type I, to 205-215°F.

NOTE

The nozzle of the spray gun should be cleared each time just before starting any operation to ensure that a slug of cold material is not injected into the cylinder cavity.

3. When using the SP-162 or Janke gun, Aeroil Product Inc., the nozzle of the gun shall be inserted in the cylinder through an open spark plug hole at a sufficient depth to ensure the spherical nozzle is clear of the spark plug hole and fully inside the cylinder bore area. The spray shall be activated for about 5 seconds or for the length of time determined best for complete coverage. Do not rotate crankshaft.

4. The thickness of the coating shall be held to a minimum.

5. Upon completion of the spraying operation, install spark plugs or solid plugs in all spark plug openings.

6. Reinstall ignition leads removed in step 1.

(7) As soon as possible after the preservation run and while the engine is still hot, drain excess corrosion preventive compound from the engine, sumps, crankcase and oil screen and filter chambers. Remove screens and filters, and check for contamination with metal particles. If contamination is found, correct in accordance with applicable MIM. Otherwise, clean the oil screens and filters as required and flush with MIL-C-6529 Type II. Reinstall and secure in place.

(b) The cylinder spray operation shall be done in accordance with the following procedures.

8. Level II External.

(a) Completely seal all engine openings to the interior and nacelle/ fuselage as called out for Level I preservation.
Desiccant, Activated 12
MIL-D-3464 Type I

(b) Install desiccant, MIL-D-3464 Type I, in all engine inlet and outlet openings (see Figure 6-2) prior to applying barrier material or cover. Place barrier material, MIL-PRF-131 Class 1, under each batch of desiccant. Install humidity cards, MIL-I-8835, in inlet and outlet covers (refer to Chapter 6, Section II, for further instructions). Install warning tag, Figure 3-11, to indicate number of desiccant bags installed in each cavity. Dehydrator plugs shall be installed in oil sump openings.

(c) Close all engine overboard drains (except combustion chamber drains) and vents with plastic caps. Close all breather openings using preservation tape, SAE AMS-T-22085 Type II. Ensure that engine compartments (exterior of engine) are equipped with adequate drainage to remove accumulated liquids in low point areas. Ensure that the combustion chamber drains are functioning and are not obstructed in any way.

(d) For engines preserved internally with MIL-C-6529, tag the aircraft cockpit (see Figure 3-15), and stencil on the lowermost propeller blade, using a contrasting color, the preservation level and the date preserved.

(9) Level III External. No external protection is required.

(10) Install engine preservation tag (Figure 3-10) and make log entries in accordance with paragraph 3-77.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

(11) Shipping. For unprotected surfaces exposed to the exterior environment, apply a coat of CPC, MIL-PRF-81309 Type II. Stow a new or spare set of spark plugs, packaged in a sealed water vapor-proof barrier with desiccant, in the aircraft.

b. Nonoperational Engines. The following procedures are to be used for the protection of engines inoperable for any reason, such as internal failure or missing major parts.

(1) Level I. Level I preservation of nonoperational engines is not recommended.

(2) Level II.

(a) Internally preserve the engine as follows:

Corrosion Preventive, Aircraft Engine 11
MIL-C-6529 Type II

1 Using a preservation machine, preoiler, or other pressure equipment, force preservation oil, MIL-C-6529 Type II, heated to 205°F to 215°F, through the pressure oil system of the engine so that all passages are thoroughly coated with preservative.

2 Drain excess preservative.

(b) Externally preserve the same as operational reciprocating engines.

(3) Level III. Internally preserve the engine in accordance with the above requirements for Level II preservation. No external protection is required.

3-89. RECIPROCATING ENGINE MAINTENANCE.

a. Level I.

(1) 7 day. Check fuel level, maintain 95% full. Check barrier material and replace when necessary.

(2) 28 day. Hot run the engine and cycle systems, operating at no-load, governed speed for 10-15 minutes, or rotate the propeller at least 4 revolutions using the starter. Inspect and renew the external coating of CPC as required.

b. Level II. Every 7 days, inspect barrier material, CPC applications, desiccant indicators and dehydrator plugs and renew as required.

c. Level III. For engines installed in dehumidified aircraft or in a dehumidified enclosure, no maintenance is required, other than to maintain the dehumidifier and monitor the equipment (refer to Chapter 6).
3-90. RECIPROCATING ENGINE DEPRESERVATION.

a. Level I. Remove barrier material and perform runup operation in accordance with NATOPS instructions.

b. Level II and III. Depressure in accordance with the following procedures:

1. Remove closures, covers, plug, and seals from all engine openings, cooler intakes, and exhaust ports. Remove all desiccant bags.

2. Clean the propeller shaft in accordance with the applicable MIM, and install propeller, if applicable.

3. Drain CPC from fuel and oil sumps and tanks, including carburetors, as applicable, and remove spark plugs from cylinders.

NOTE

Drainage of fuel and oil systems and clearing of cylinders will be improved if engine is rotated for a few revolutions by hand or with the starter while plugs and drains are open.

4. After drainage of excess CPC, reinstall plugs and close drains in fuel and oil systems. Service engine to normal operating level with normal service fuel and lubricating oil in accordance with applicable MIMs.

5. Depressure carburetor as follows:

   a. Injection Type.

      1. Supply fuel to the carburetor fuel inlet by using the aircraft fuel boost pump or an external fuel supply.

      2. Check the supercharger drain valve to make sure that it is functioning properly.

      3. Remove one spark plug from each cylinder located below the horizontal centerline of the engine.

      4. Open the carburetor mixture control to the "FULL RICH" position and open the throttle to the "FULL OPEN" position. During the flushing operation, operate the throttle through its full cycle several times to displace all oil and air from the carburetor metered fuel chambers.

      5. Continue the flushing operation until oil-free fuel runs out of the supercharger drain valve.

   b. Float Type.

      1. Remove drain plugs from the carburetor float chamber and fuel pump sediment bowl, and drain excess preservative oil.

      2. Introduce fuel into the carburetor and fuel pump until all oil has been flushed out.

      3. Discontinue the flushing operation and reinstall all plugs and other components.

6. Depressure direct injection type controls and pumps as follows.

   a. Remove plugs from the master control and injection pump fuel chambers and drain excess oil. Replace plugs and lockwire.

   b. Remove one spark plug from each cylinder. Supply fuel to the master control inlet at the normal fuel booster pressure. Ensure that supercharger drain valve is functioning properly. Open throttle or master control lever to the "FULL OPEN" position.

      NOTE

Old (serviceable) spark plugs should be used for depreservation runs.

7. Install and torque spark plugs in accordance with the applicable MIM.

   a. Solvent, Degreasing

   b. MIL-PRF-680 Type II or III

(8) Clean excess CPC from the engine exterior with MIL-PRF-680 Type II, degreasing solvent.
(9) Preoil the engine in accordance with the applicable MIM. If such instructions are not available, the engine may be preoiled by motoring with the starter (without ignition) until oil pressure is observed on the oil pressure gauge. Do not exceed starter limitations.

(10) Perform the following depreservation run procedures.

NOTE

Refer to applicable engine MIMs prior to starting a radial engine for the first time if not already accomplished during preoiling operations.

(a) Start the engine in accordance with NATOPS instruction or applicable MIM.

(b) Perform ground runs with cowl flaps fully open and whenever practical, with the aircraft headed into the wind.

(c) After the engine has been started and is functioning normally, run at approximately 1000 rpm for 5 minutes, after which time the engine shall be stopped.

(d) Inspect the engine for leaks and general condition.

(e) After making the necessary checks and repairs, start the engine and run at approximately 1000 rpm for 25 minutes, followed by a 5 minutes run at 50% normal rated speed.

NOTE

Operation of these units is necessary to thoroughly flush all passages with lubricating oil.

(f) During the depreservation run, functionally test supercharger clutches, propeller pitch change mechanisms, and other engine components which utilize engine lubricating oil for hydraulic pressure.

(g) Stop the engine and check for leaks and general condition.

(11) Shut down engine and drain the oil reservoir while engine is still warm.

(12) Check fuel and oil filters/strainers for contamination; clean and replace as necessary. Reinstall and secure all drain plugs.

(13) Install a set of new or reconditioned spark plugs, and install leads.

(14) If applicable, inspect supercharger drain valve and clean as necessary.

(15) Service oil reservoir to the normal operation level with new service lubricant.

(16) Remove all preservation tags and make a log entry on CNAF Form 4790/25A (AESR) or in NALCOMIS OMA in accordance with paragraph 3-77.
3-91. PROPELLERS AND PROPELLER COMPONENTS. Internal working parts of variable pitch propellers are preserved during engine preservation by cycling the propeller through its operational range (refer to the applicable MIMs). Each type of propeller requires supplementary treatment as specified in the following paragraphs. Refer to Table 3-17 for items covered in this section. Refer to Section XIII for engine preservation procedures.

a. See Chapter 4, Section III, for procedures applicable to removed or disassembled propellers.

b. Logs. Appropriate propeller log entries shall be made upon completion of preservation and depreservation.

3-92. CONSTANT SPEED PROPELLERS.

Solvent, Degreasing 27
MIL-PRF-680 Type II or III

a. Cleaning. During initial treatment and at each engine runup, clean and lubricate constant speed propellers in accordance with the applicable MIM. Clean CPCs from pitch change mechanism with degreasing solvent, MIL-PRF-680 Type II or III, and a clean cloth.

b. Inspection. Refer to Chapter 8.

c. Corrosion Control. Refer to NAVAIR 01-1A-509-2.

d. Protection. Level I, II and III. Exercise constant speed mechanism during preservation and represervation runs. Cover pitch change mechanism with soft film preservative, MIL-PRF-16173 Grade 2.

e. Maintenance.

(1) Level I and II. Every 28 days, inspect preservative and reapply when necessary for full coverage.

(2) Level III. No maintenance required.

f. Depreservation. Clean and inspect as specified above, ensuring the removal of CPC from the pitch change mechanism.

3-93. DEICERS.

CAUTION

Exercise care to prevent contaminating deicer portions of blades with CPCs.

a. Cleaning. Clean deicers to remove greases, CPCs and oils using procedures in Chapter 8. Cleaning of deicers should be repeated after each engine runup.

b. Inspection. Refer to applicable MIMs or NAVAIR 01-1A-509-2.

c. Protection. Level I, II and III. Drain fluid tanks and flush with CPC (soluble oil), MIL-C-4339.

d. Maintenance.

(1) Level I and II. Every 28 days, inspect the condition of CPC application and renew as necessary. The deicers shall be cleaned after each engine runup.

(2) Level III. No maintenance required.

e. Depreservation. Flush tank to remove CPCs, and service with operating fluid. Inspect as specified above.

<table>
<thead>
<tr>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant Speed Propellers</td>
<td>3-92a</td>
<td>3-92b</td>
<td>3-92c</td>
<td>3-92d</td>
<td>3-92e</td>
<td>3-92f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Deicers</td>
<td>3-93a</td>
<td>3-93b</td>
<td>-----</td>
<td>3-93c</td>
<td>3-93d</td>
<td>3-93e</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Variable Pitch Propellers</td>
<td>3-94a</td>
<td>3-94b</td>
<td>3-94c</td>
<td>3-94d</td>
<td>3-94e</td>
<td>3-94f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
</tbody>
</table>
3-94. VARIABLE PITCH PROPELLERS.

Cleaning Compound, Aircraft MIL-PRF-85570 Type II

a. Cleaning. Depending on the extent of disassembly, clean all accessible areas of the propeller blades (including blade taper bores as applicable), hubs, and dome to remove grease, grime and oil using cleaning solution (1 part cleaning compound MIL-PRF-85570 Type II, in 9 parts water), refer to chapter 8. Apply cleaning solution, agitate, and rinse with fresh water. Wipe propeller blades, hub and dome dry using a clean, dry, lint free cloth. Ensure that all water is completely removed. Particular attention shall be given to areas that may trap water.

b. Inspection. Refer to applicable MIMs for inspection criteria. Check hydraulic system for contamination in accordance with Section VIII. Service aeroprop reservoir with operating hydraulic fluid.

NOTE

Propeller blades have critical balance requirements. Refer to the appropriate propeller manual for evaluation and repair limits of corrosion and abrasion damage.

c. Corrosion Control. Treat corroded areas in accordance with NAVAIR 01-1A-509-2. Refer to the applicable propeller MIM for evaluation and repair limits for corrosion and abrasion damage.

d. Protection.

(1) Level I.

(a) Service propeller control in accordance with applicable MIMs.

CAUTION

Exercise care to prevent contaminating deicer portions of blades with CPCs. If necessary, cover deicer boots with barrier material, MIL-PRF-131 Class 1, prior to application of CPCs.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

(b) Apply a coating of CPC, MIL-PRF-81309 Type II, to all metal areas of the blade, hub, and dome. Remove excess using a clean, lint-free cloth.

(c) Wrap propeller assembly with barrier material, MIL-PRF-131 Class 1, and secure with tape, SAE AMS-T-22085 Type II.

(2) Level II.

(a) Whenever possible, preserve variable pitch propellers in conjunction with engine preservation (see Section XIII). Operate feathering pumps and cycle propeller through its full range of operation during the preservation run.

(b) Service propeller control in accordance with applicable MIMs.

CAUTION

Exercise care to prevent contaminating deicer portions of blades with CPCs. If necessary, cover deicer boots with barrier material, MIL-PRF-131 Class 1, prior to application of CPCs.

Compound, Corrosion Preventive 10
MIL-PRF-16173 Grade 2

(c) Apply a coating of CPC, MIL-PRF-81309 Type II, to all metal areas of the blade, hub, and dome. Remove excess using a clean, lint-free cloth. Follow with a coating of CPC, MIL-PRF-16173 Grade 2.

(d) Wrap propeller assembly with barrier material, MIL-PRF-131 Class 1, and secure with tape, SAE AMS-T-22085 Type II.
(3) Level III.

(a) Whenever possible, preserve variable pitch propellers in conjunction with engine preservation (see Section XIII). Operate feathering pumps and cycle propeller through its full range of operation during the preservation run.

(b) Service propeller control in accordance with applicable MIMs.

e. Maintenance.

(1) Level I.

(a) 7 Day. Inspect the barrier material for tears, water intrusion, or damage. If barrier material is damaged, inspect for corrosion and visibly deteriorated corrosion preventive compound. Treat corroded areas as necessary in accordance with paragraph 3-94c. Reapply CPCs as necessary. Replace barrier material as necessary.

(b) 28 Day.

Fluid, Hydraulic MIL-PRF-83282

1 Check hydraulic fluid reservoir. Ensure hydraulic fluid is maintained at proper level in accordance with the applicable MIM.

2 Note number of blade located at the 12 o’clock position. Rotate propeller concurrently with the 28 day engine run (see Section XIII). Position propeller to ensure most recent blade number is not returned to the 12 o’clock position.

(2) Level II.

(a) 7 Day. Inspect the barrier material for tears, water intrusion, or damage. If barrier material is damaged, inspect for corrosion and visibly deteriorated corrosion preventive compound. Treat corroded areas as necessary in accordance with paragraph 3-94c. Reapply CPCs as necessary. Replace barrier material as necessary.

(b) 56 Day.

Fluid, Hydraulic MIL-PRF-83282

1 Check hydraulic fluid reservoir. Ensure hydraulic fluid is maintained at proper level in accordance with the applicable MIM.

CAUTION

Ensure engine desiccant bags are removed prior to performing propeller rotation.

2 If engine is operational, note number of blade located at the 12 o’clock position. Rotate propeller concurrently with the 56 day engine rotation (see Section XIII). Position propeller to ensure most recent blade number is not returned to the 12 o’clock position.

3 If engine is non-operational, note number of blade located at the 12 o’clock position. Manually rotate propeller through at least three revolutions. Position propeller to ensure most recent blade number is not returned to the 12 o’clock position.

(3) Level III. No maintenance required.

(4) Shipment. When blades are preserved in place, check covers and blocking and bracing devices for security.

f. Depreservation. Remove barrier material and CPCs. Inspect system and treat corrosion as specified above. Operate propeller pitch change mechanisms and governors through their full range during engine depreservation runs.
### SECTION XV. ROTOR HEAD AND HUB

Table 3-18. Rotor Head and Hub System Summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blades, Main &amp; Tail</td>
<td>3-96a</td>
<td>3-96b</td>
<td>3-96c</td>
<td>3-96d</td>
<td>3-96e</td>
<td>3-96f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Controls, Dampers, Linkages &amp; Swashplates</td>
<td>3-97a</td>
<td>3-97b</td>
<td>3-97c</td>
<td>3-97d</td>
<td>3-97e</td>
<td>3-97f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Rotor Heads &amp; Hubs</td>
<td>3-98a</td>
<td>3-98b</td>
<td>3-98c</td>
<td>3-98d</td>
<td>3-98e</td>
<td>3-98f</td>
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</table>

3-95. **ROTOR HEAD AND HUB SYSTEM.** Helicopter rotors, hubs and associated components shall be preserved in accordance with the detailed requirements of the following paragraphs. Refer to Table 3-18 for items covered in this section.

3-96. **BLADES, MAIN AND TAIL.** Rotor blades are critical items which can be easily damaged during preservation, storage, loading and shipping.

![Cleaning Compound, Aircraft MIL-PRF-85570 Type II](image)

3-96a. **Cleaning.** Remove grime, oils, greases and exhaust stains from helicopter rotor blades using a cloth wet with cleaning solution (1 part MIL-PRF-85570 Type II in 9 parts fresh water). Rinse with fresh water.

3-96b. **Inspection.** Examine rotor blades for fretting and surface corrosion. Inspect corrosion prone areas such as erosion strips, tip caps, aft spar areas and attach points.

3-96c. **Corrosion Control.** Arrest and remove corrosion in accordance with NAVAIR 01-1A-509-2.

3-96d. **Protection.**

**CAUTION**

Folding and stowing provisions for main rotor blades are sometimes not suitable for high velocity winds. Most tail rotor designs are such that blades "cone" (move freely in their mountings when the aircraft is on the ground). If this movement is not prevented, wind damage may result.

1. **Level I.** Secure blades in accordance with applicable MIM.

![Compound, Corrosion Preventive MIL-PRF-16173 Grade 2](image)

**CAUTION**

Synthetic type oils, such as MIL-PRF-23699, and some solvents may attack nonmetallic materials used in rotor blades. Maintain blades free of synthetic type lubricants and use only the cleaning materials specified by this manual, NAVAIR 01-1A-509-2, or the applicable MIM.

Rotor blades are critical items which shall be handled with care at all times. Use only the equipment and procedures specified by the applicable MIM when removing and handling blades.

2. **Level II.** Remove rotor blades. Protect blade attaching points and unpainted metallic portions of the blades with soft film CPC, MIL-PRF-16173 Grade 2. Wrap and package blades in reusable containers, MIL-PRF-5806, and store (inside aircraft if manageable) in accordance with the NAVSUP P700 and the applicable MIM. Refer to Chapter 4, Section III, for additional information on removed components.

3. **Level III.** Protect blade in accordance with Level I requirements.
e. Maintenance.

(1) Level I. Everyday check for security in accordance with the applicable MIM.

(2) Level II. When blades are stored outdoors in reusable containers, open container at 6 month intervals and check the integrity of desiccant packs (where applicable) and inspect for corrosion damage. Repair or replace as necessary. Treat corroded areas in accordance with NAVAIR 01-1A-509-2. Remove blades from containers for engine/gearbox turnovers.

(3) Level III. No maintenance is required.

f. Depreservation. Remove blades from containers if applicable. Clean, inspect and treat corrosion as specified above. Install, check, and secure blades in accordance with applicable MIM.

3-97. CONTROLS, LINKAGES, DAMPERS AND SWASHPLATES.

Solvent, Degreasing 27
MIL-PRF-680 Type II or III

Cleaning Compound, Aircraft 4
MIL-PRF-85570 Type II

Fluid, Hydraulic 14
MIL-PRF-83282

a. Cleaning. Controls and linkages shall be cleaned of grime, oil and grease using a cloth wet with cleaning solution (1 part MIL-PRF-85570 Type II in 9 parts fresh water), refer to Chapter 8. Rinse with fresh water. For persistent greases and oils, wipe with a cloth wet with degreasing solvent, MIL-PRF-680 Type II or III, refer to Chapter 8. Clean grime, oils and greases from exposed surfaces on hydraulic pistons with a lint-free cloth soaked in hydraulic fluid, MIL-PRF-83282. Take care not to scratch the piston surface and always wipe away from the seals.

b. Inspection. Inspect any bare metal along linkage for corrosion. Check hydraulic system for contamination using the sampling procedures of NAVAIR 01-1A-17 and the applicable MIM (refer to Section VIII). Take fluid samples from each separate hydraulic system, including a sample from each fluid reservoir. Determine chemical and particulate contamination amounts and record results in aircraft preservation records.

c. Corrosion Control. Treat corroded areas in accordance with NAVAIR 01-1A-509-2.

d. Protection. Level I, II and III. Controls and linkages shall be lubricated in accordance with the applicable MIM. Cover controls with barrier material, MIL-PRF-131 Class 1.

e. Maintenance.

(1) Level I and II. Every 28 days, check fluid system. Check for deterioration of lubrication and protective barrier material. Repair or replace as necessary.

(2) Level III. No maintenance required.

f. Depreservation. Remove barrier material. Clean, inspect and treat corrosion as specified above.
3-98. **ROTOR HEADS AND HUBS.** A complete hub of a helicopter rotor includes the flight control linkage and all auxiliary components (nitrogen pressure signal, anti-icing connection, lights). In practice, hubs also include all central portions, including pitch and other mechanisms, deicing and instrumentation, but not the spinner or other fairing.

Solvent, Degreasing 27
MIL-PRF-680 Type II or III

Cleaning Compound, Aircraft 4
MIL-PRF-85570 Type II

**CAUTION**

Some rotor heads have teflon-lined bearings in the control system linkage. To prevent possible damage to teflon inserts from accumulations of abrasive materials and cleaning solvents, avoid applying CPCs, lubricants and solvents to these items.

a. **Cleaning.** Remove grime, oils, greases and exhaust stains from rotor heads and rotor hubs using a cloth wet with cleaning solution (1 part MIL-PRF-85570 Type II in 9 parts fresh water). Rinse with fresh water. For persistent grime or CPCs, follow with a cloth wet with degreasing solvent, MIL-PRF-680 Type II or III. Clean deicer components in accordance with instructions in paragraph 3-93.

b. **Inspection.** Make sure that drain holes in water entrapment areas are open and functioning properly.

c. **Corrosion Control.** Arrest and remove corrosion in accordance with NAVAIR 01-1A-509-2.

d. **Protection.**

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<thead>
<tr>
<th>Compound, Corrosion Preventive</th>
<th>10</th>
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<tbody>
<tr>
<td>MIL-PRF-16173 Grade 2</td>
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</table>

(1) Level I, II and III. Lubricate in accordance with the applicable MIM. Coat exposed metal surfaces with soft film CPC, MIL-PRF-16173 Grade 2. Cover heads with barrier material, MIL-PRF-131 Class 1, held in place with tape, SAE AMS-T-22085 Type II. Preserve deicing components in accordance with instruction in paragraph 3-93.

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<thead>
<tr>
<th>Compound, Corrosion Preventive</th>
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<tbody>
<tr>
<td>MIL-PRF-16173 Grade 2</td>
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</table>

(2) Shipment. Coat exposed metal surfaces with soft film CPC, MIL-PRF-16173 Grade 2. Cover heads with special support equipment covers, SAE AS5778, or cover with barrier material, MIL-PRF-131 Class 1, held in place with tape, SAE AMS-T-22085 Type II.

e. **Maintenance.**

(1) Level I and II. Every 28 days, check for deterioration of covering system; repair and replace as necessary check for deterioration in CPC and protective material. If barrier system is compromised, inspect rotor heads for water entrapment and corrosion, and correct in accordance with NAVAIR 01-1A-509-2.

(2) Level III. No maintenance required.

f. **Depreservation.** Remove cover or barrier material. Clean, inspect and treat corrosion as specified above. Service and lubricate rotor heads and hubs in accordance with applicable MIM.
3-99. SAFETY AND SURVIVAL. In this manual, safety and survival systems include all those components listed under "Aviators Equipment" in COMNAVAIRFORINST 4790.2. Special care and maintenance instructions for survival equipment may generally be found in applicable NAVAIR 13-1-6 series technical manuals. Refer to Table 3-19 for items covered in this section.

**WARNING**

If rocket motor is dropped, shows evidence of rough handling or has visible defects (except minor surface corrosion), dispose of unit. Removal and disposal of AEPS devices found in hazardous condition is the responsibility of Explosive Ordnance Disposal (EOD) personnel. Failure to comply could result in death or serious injury to aircrew during ejection.

**CAUTION**

All expended (fired) AEPS material which functioned normally may have residual unburned propellant and shall be considered hazardous.

3-100. AIRCREW ESCAPE PROPULSION SYSTEM (AEPS) DEVICES. Some ejection seats use rocket motors to separate from the aircraft. Prior to any preservation activities, all cartridge actuated devices (CAD) in ejection seat mechanisms shall be made safe by authorized personnel in accordance with NAVAIR 11-100-1.1-CD. All AEPS devices shall be made safe by authorized personnel by using NAVAIR 11-85M-2 instructions.

a. Cleaning. Clean and service ejection seats in accordance with the specific ejection seat MIMs.

b. Inspection. Inspect seat and seat mechanisms for corrosion. Address corrosion prone areas such as rod assemblies, link assemblies, pistons, locking nuts and rings.

**WARNING**

Application of CPCs or paints to certain areas could prevent or restrict ejection seat operation. Specific ejection seat instructions shall be followed carefully.

Removal of minor surface corrosion shall be accomplished in a spark free environment without the use of power tools. No smoking is permitted. Gas inlet port shall be capped at all times.

c. Corrosion Control. Treat corrosion on ejection seats in accordance with the applicable MIM and MRCs. Corrosion on AEPSs shall be treated in accordance with NAVAIR 11-85M-2.

<table>
<thead>
<tr>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircrew Escape Propulsion</td>
<td>3-100a</td>
<td>3-100b</td>
<td>3-100c</td>
<td>3-100d</td>
<td>3-100e</td>
<td>3-100f</td>
<td>NAVAIR11-100-1.1-CD</td>
</tr>
<tr>
<td>Floatation Gear</td>
<td>3-102a</td>
<td>3-102b</td>
<td>-----</td>
<td>3-102c</td>
<td>3-102d</td>
<td>3-102e</td>
<td>NAVAIR 11-100-1.1-CD</td>
</tr>
<tr>
<td>Liquid Oxygen Converters</td>
<td>3-103a</td>
<td>3-103b</td>
<td>3-103c</td>
<td>3-103d</td>
<td>3-103e</td>
<td>3-103f</td>
<td>NAVAIR 13-1-6.4-4</td>
</tr>
<tr>
<td>Oxygen Cylinders &amp; Regulators</td>
<td>3-104a</td>
<td>3-104b</td>
<td>-----</td>
<td>3-104c</td>
<td>3-104d</td>
<td>3-104e</td>
<td>NAVAIR 13-1-6.4-2</td>
</tr>
<tr>
<td>Oxygen Rebreathers (OBOGS)</td>
<td>3-105a, 3-105b</td>
<td>3-105c</td>
<td>-----</td>
<td>3-105d</td>
<td>3-105d</td>
<td>3-105e</td>
<td>NAVAIR 13-1-6.4-3</td>
</tr>
<tr>
<td>Parachute and Harness</td>
<td>3-106a</td>
<td>3-106a</td>
<td>-----</td>
<td>3-106b</td>
<td>3-106c</td>
<td>3-106d</td>
<td>NAVAIR 13-1-6.2</td>
</tr>
<tr>
<td>Perishables &amp; Pilferables</td>
<td>3-107a</td>
<td>3-107a</td>
<td>-----</td>
<td>3-107b</td>
<td>3-107c</td>
<td>3-107d</td>
<td>NAVAIR 13-1-6.5</td>
</tr>
<tr>
<td>Seat Belts, Shoulder Harnesses &amp; Inertia Reels</td>
<td>3-108a</td>
<td>3-108b</td>
<td>3-108c</td>
<td>3-108d</td>
<td>3-108e</td>
<td>3-108f</td>
<td>NAVAIR 13-1-6.5</td>
</tr>
</tbody>
</table>
d. Protection.

(1) Level I. Egress system parts shall be lubricated and preserved at each inspection in accordance with the applicable MIM.

**WARNING**

Air or gas pressure shall not be applied to inlet ports of some unit types, because gas pressure initiates propulsive force. Such rocket motors not installed in the aircraft shall have inlet ports closed with protective caps. Failure to comply could result in death or serious injury to personnel.

(2) Level II and III. Disarm seats in accordance with MIM.

e. Maintenance.

(1) Level I. Every 28 days, check for corrosion and reapply lubrication when necessary according to MIM. Maintain CADS in accordance with applicable MIM.

(2) Level II and III. No maintenance required.

f. Depreservation. Clean, inspect and remove corrosion as specified above. Service and lubricate jettison mechanisms and cockpit flooding devices in accordance with applicable MIM. Install cartridge-actuated devices and AEPS devices in accordance with applicable MIMs before flight.

3-101. CARTRIDGE ACTUATED DEVICES (CADS). Refer to Section III, paragraph 3-19.

3-102. FLOTATION GEAR. Prior to any preservation activities, all CADS in flotation gear shall be made safe by authorized personnel in accordance NAVAIR 11-100-1.1-CD.

**WARNING**

Failure to follow authorized procedures when handling CADS may lead to serious injury or death.

a. Cleaning. Clean flotation bags as necessary in accordance with applicable aircraft MIMs.

b. Inspection. Inspect in accordance with applicable aircraft MIMs.

c. Protection.

(1) Level I. Protect in accordance with applicable aircraft MIMs.

(2) Level II and III. Remove floatation bags and CAD inflation device and store in accordance with NAVAIR 11-100-1.1-CD. Dry and dust with talc, A-A-59303. Package in a loose fitting fiberboard carton and forward to Supply.

(3) Shipment. Protect in accordance with Level II instructions. Store flotation gear in parent aircraft.

d. Maintenance.

(1) Level I. Maintain in accordance with applicable aircraft MIMs.

(2) Level II and III. No maintenance required.

e. Depreservation. If required, remove packaged gear from storage and install in aircraft. Install cartridge actuated devices in accordance with MIM and NAVAIR 11-100-1.1-CD. Clean and inspect as specified above.

3-103. LIQUID OXYGEN CONVERTERS. Personnel assigned to preservation of oxygen equipment shall be familiar with hazard and safety precautions associated with oxygen and shall be thoroughly trained in servicing techniques. NAVAIR 13-1-6.4-4 contains safety precautions applicable to using/servicing oxygen equipment and contains instructions on clothing for oxygen handlers.

**NOTE**

Some liquid oxygen converters are peculiar to a particular aircraft. Such converters cannot be installed in another aircraft without extensive modification of the system. These non-interchangeable converters shall not be separated from parent aircraft.

a. Cleaning. Liquid oxygen converters shall be cleaned of fuels, oils, greases and CPCs in accordance with the applicable aircraft MIMs. If converters are removed, openings shall be capped with rigid plastic closures, NAS 847. Refer to NAVAIR 13-1-6.4-4.

b. Inspection. Inspect for corrosion in accordance with Chapter 8. Address corrosion prone areas for specific converters as described in NAVAIR 13-1-6.4-4.
c. Corrosion Control. Correct corrosion in accordance with NAVAIR 13-1-6.4-4.

d. Protection.

(1) Level I, II and III. Remove, purge, and replace converter as required in accordance with applicable aircraft MIMs.

(2) Shipment. Due to the normal venting characteristics of liquid oxygen converters, it is not practical to keep units filled during shipment. Remove, purge, and replace as required in accordance with applicable aircraft MIMs.

e. Maintenance. Level I, II and III. No maintenance required.

f. Depreservation. Clean and inspect as specified above. Service in accordance with applicable MIM and NAVAIR 13-1-6.4-4.

### 3-104. OXYGEN CYLINDERS AND REGULATORS

Personnel assigned to preservation of oxygen equipment shall be familiar with hazard and safety precautions associated with oxygen and shall be thoroughly trained in servicing techniques. NAVAIR 13-1-6.4-2 contains safety precautions applicable to using/servicing oxygen equipment and instructions on clothing for oxygen handlers.

**WARNING**

Cylinders which have been open to atmosphere or voided of oxygen (to less than 15 psig) shall be removed from service and subjected to heat vacuum treatment before recharging.

a. Cleaning. Clean oxygen equipment and maintain free of fuels, oils, greases and CPCs. Refer to NAVAIR 13-1-6.4-2.

b. Inspection. Refer to Chapter 8.

c. Protection.

(1) Level I and III.

(a) Bleed portable oxygen cylinders to 25 psi (for low pressure type) or 50 psi (for high pressure type) and leave on aircraft.

(b) Bleed low and high fixed-type oxygen cylinders to approximately 100 psi.

(c) Shut off all cylinders at manual shut off or disconnect lines at self-opening valves located on or near cylinders. Cap all openings with pressure type caps or plugs as applicable.

(2) Level II. Protect in accordance with Level I requirements plus preserve oxygen system regulators by covering regulator openings and connections with barrier material, MIL-PRF-131 Class 1, held in place with tape, SAE AMS-T-22085 Type II.

d. Maintenance. Level I, II and III. Every 7 days, check packaged oxygen bottles for water damage. Remove oxygen bottles for rework if pressure has dropped below 10 psi. Make sure oxygen equipment is kept free of oil, greases and CPCs and that closures and seals remain intact. Maintain in accordance with applicable MIM.

e. Depreservation. Remove barrier material, caps or plugs. Clean and inspect as specified above. Install charged cylinders or maintain existing cylinders in accordance with applicable MIM. Remove cylinders for overhaul if pressure has dropped below 15 psi. If required for flight, install fully charged cylinders. For flight, reinstall liquid oxygen converters and bottles. Purge as necessary and service in accordance with applicable MIM. Remove foreign material from regulator openings.

### 3-105. OXYGEN REBREATHERS

On board oxygen generating system (OBOGS) uses aircraft engine bleed air to provide a moisture reduced, low contamination, oxygen enriched breathing gas. This system is used to replace liquid oxygen systems and gaseous oxygen systems on aircraft. OBOGS is comprised of two major subsystems: the oxygen enriched air system (OEAS) and the airframe installed components for the bleed air and oxygen delivery system. The oxygen enriched air system is comprised of the oxygen concentrator, oxygen monitor and the aircrew oxygen regulator and connects with the aircrew's personal oxygen mask and hose assembly. The bleed air oxygen delivery system airframe installed components are comprised of bleed air shutoff valves, heat exchangers, over temperature sensors, check valves, test connections, plenums, and emergency oxygen assemblies.

a. Cleaning. Refer to applicable aircraft MIMs.
Nitrogen, Gas
A-A-59503 Type I

b. **Purging.** If the system was disconnected during maintenance or storage, purge with hot dry nitrogen, A-A-59503 Type I, between the concentrator and the survival kit manifold. The temperature at the inlet to the system should not exceed 250°F during purging. The purging procedures shall continue until the distribution terminals in the cockpit are warm to the touch (150°F), then continue to purge for an additional ten minutes.

c. **Inspection.** Refer to NAVAIR 13-1-6.4-3 or applicable MIMs.

d. **Protection/Maintenance.** Level I, II and III. Protect and maintain in accordance with applicable aircraft MIMs.

e. **Depreservation.** Clean and inspect as specified above. Service in accordance with applicable MIM.

3-106. **PARACHUTE AND HARNESS.** This system includes pararaft, main and drogue parachutes. Ordinarily, parachutes and harnesses will be forwarded to parachute shop for inspection and drying. Do not attempt to repair or repack parachutes. Maintain removed chutes in a parachute storage area as specified by NAVAIR 13-1-6.2 until they are repackaged and reinstalled for use or turned into supply.

**WARNING**

When a parachute assembly must be packed under unfavorable conditions, provisions shall be made to protect it from possible damage and excessive humidity. In no case shall the parachute assembly be interrupted after the packing operation has started. If the packing operation is interrupted due to unforeseen circumstances, the parachute assembly shall be completely repacked. Parachutes shall only be packed by qualified personnel.

a. **Cleaning/Inspection.** Turn parachutes and harness in to parachute shop for cleaning. When a parachute shop is unavailable, clean in accordance with NAVAIR 13-1-6.2.

b. **Protection.**

(1) Level I, II and III. Remove parachutes and harnesses from aircraft. As determined by local requirements, parachutes and harnesses shall be either repacked and reissued or turned in to supply.

(2) **Shipment.** Package and mark parachutes and harnesses in accordance with MIL-STD-129. Stow packaged parachutes in parent aircraft or turn in to supply for separate shipment.

c. **Maintenance.** Level I, II and III. Maintain parachutes and harnesses in storage in accordance with NAVAIR 13-1-6.2.

d. **Depreservation.** As required for flight, install serviceable parachutes and harnesses in accordance with applicable MIM.

3-107. **PERISHABLES AND PILFERABLES.**

Perishables and pilferables include the following items: Emergency Rations, Exposure Suits and Pressure Suits, First Aid Kits, Life Jackets, Life Rafts, Litters, and Portable Fire Extinguishers.

**CAUTION**

When packaging full pressure suits, make sure that suits are folded only at the specified locations and are padded to prevent sharp folds or creases. Refer to the applicable technical manuals for instructions.

**NOTE**

Remove dry cell batteries from emergency radio beacons and marker light equipment.

a. **Cleaning/Inspection.** Refer to Chapter 8 and applicable MIMs.

b. **Protection.**

(1) Level I, II and III. Perishable or pilferable items shall be removed from aircraft. Preserve, package and mark these items in accordance with NAVSUP P700. If NAVSUP sections do not contain packaging data, package items in accordance with MIL-STD-2073-1 using Level A criteria. Refer to Table 8-13 for a listing.
of multi-application containers. Packaged items shall be stored in a controlled location. As a minimum, items shall be stored indoors under normal supply warehouse conditions. If required by local instructions, turn packaged items in to supply.

(2) Shipment. Either secure packaged items in aircraft or remove and ship separately as specified by the reporting custodian. When portable fire extinguishers are left in aircraft, bottles shall be maintained in a fully charged, ready to use condition. Observe the 5 year test requirements of DOT regulations for compressed gas cylinders.

c. Maintenance. Level I, II and III. No maintenance required.

d. Depreservation. As required for flight, install emergency rations, exposure suits, pressure suits, first aid kits, life jackets, life rafts, and litters. Comply with inspection and maintenance requirements of NAVAIR 13-1-6.5.

3-108. SEAT BELTS, SHOULDER HARNESSSES, AND INERTIA REELS.

Cleaning Compound, Aircraft 4 MIL-PRF-85570 Type II

Detergent, General Purpose 13 MIL-D-16791 Type I

WARNING

Prior to any preservation activities, all CADS shall be made safe by authorized personnel in accordance with NAVAIR 11-100-1.1-CD.

a. Cleaning. Fabric portions of seat belts, shoulder harnesses and inertia reels shall be cleaned to remove light soil and oil spots. Sponge clean using cleaning solution (1 part MIL-D-16791 Type I in 16 parts water or 1 part MIL-PRF-85570 Type II in 4 parts water). Rinse with a clean, damp rag or sponge. Webbing exposed to salt water shall be washed in fresh water.

b. Inspection. Inspect in accordance with NAVAIR 13-1-6.5. Check for signs of wear, cuts, cracks, deterioration, broken stitches, loose bolts, corrosion and fading markings. Verify ease of operation and proper installation.

c. Corrosion Control. Treat corrosion in accordance with NAVAIR 13-1-6.5. Repair or remove webbing from service as required by condition of the gear. Any webbing or fabric that shows signs of deterioration or damage from oils, acids, liquid oxygen, caustic soaps or other compounds shall be removed from service.

Compound, Corrosion Preventive 8 MIL-PRF-81309 Type II

d. Protection. Level I, II and III. Stow webbing and fabric components neatly in place by rolling and taping with SAE AMS-T-22085 Type II. Apply CPC, MIL-PRF-81309 Type II, to all bare metal surfaces. Lubricate inertia reel latch mechanism in accordance with applicable MIM.

e. Maintenance. Level I, II and III. No maintenance required.

f. Depreservation. Unroll webbing and fabric components into place. Clean, inspect and control corrosion as specified above. Inspect and service inertia reel latch mechanism in accordance with applicable MIM.
3-109. **UTILITY.** The systems in this section do not fit into any other category, and are grouped together for convenience. Refer to Table 3-20 for items covered in this section.

3-110. **AIR CONDITIONING.** This system consists of a turbine/compressor assembly, water extractor (evaporator/condenser) and a series of heat exchangers that condition bleed air from the compressor stage of turbine engines. During operation, the air conditioning system can ingest significant quantities of salt spray, grime and other corrosive contaminants. Removal of these corrosive agents before storage will greatly reduce degradation of the system.

Cleaning Compound, Aircraft MIL-PRF-85570 Type II

- **Cleaning.** Remove dirt and salt deposits from external air vents, passages, ducting, and heat exchangers by wiping with a clean cloth wet with cleaning solution (1 part MIL-PRF-85570 Type II in 9 parts water), followed by wiping with a clean cloth wet with fresh water (refer to Chapter 8). Finish by drying with a clean dry cloth. Drain refrigerant from evaporation and condenser units using the procedures in applicable MIM. Place controls of the Air Distribution Control in the OFF or CLOSED position.

- **Inspection.** Check vent areas and any other portions of the system that might be exposed to corrosive elements and areas where water may collect for corrosion.

- **Corrosion Control.** Remove corrosion in accordance with NAVAIR 01-1A-509-2.

- **Protection.**
  1. Level I. Service turbines, compressors and condenser units in accordance with the applicable MIM.

  ![Nitrogen, Gas A-A-59503 Type I](image)

  2. Level II and III. Protect in accordance with the Level I requirements plus drain refrigerant and fill refrigerant system with dry nitrogen, A-A-59503 Type I, and cap off.

- **Maintenance.** Level I, II and III. No maintenance required.

- **Depreservation.** If aircraft is being returned to flight status, purge dry nitrogen from system, and service with refrigerant in accordance with applicable MIM. Clean and inspect as specified above.

### Table 3-20. Utility Systems Summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Clean</th>
<th>Inspect</th>
<th>Corrosion Control</th>
<th>Protection</th>
<th>Maintenance</th>
<th>Depreservation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioning</td>
<td>3-110a</td>
<td>3-110b</td>
<td>3-110c</td>
<td>3-110d</td>
<td>3-110e</td>
<td>3-110f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Cabin Filters, Ducts &amp; Regulators</td>
<td>3-111a</td>
<td>3-111b</td>
<td>3-111c</td>
<td>3-111d</td>
<td>3-111e</td>
<td>3-111f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Deicer Components</td>
<td>3-112a</td>
<td>3-112b</td>
<td>3-112c</td>
<td>3-112d</td>
<td>3-112e</td>
<td>3-112f</td>
<td>----</td>
</tr>
<tr>
<td>Galley Facilities</td>
<td>3-113a</td>
<td>3-113b</td>
<td>3-113c</td>
<td>3-113d</td>
<td>3-113e</td>
<td>3-113f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Lavatory Facilities</td>
<td>3-114a</td>
<td>3-114b</td>
<td>3-114c</td>
<td>3-114d</td>
<td>3-114e</td>
<td>3-114f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Relief Tubes</td>
<td>3-115a</td>
<td>3-115b</td>
<td>3-115c</td>
<td>3-115d</td>
<td>3-115e</td>
<td>3-115f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Smoke Abatement</td>
<td>3-116a</td>
<td>3-116b</td>
<td>3-116c</td>
<td>3-116d</td>
<td>3-116e</td>
<td>3-116f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Toilet Facilities</td>
<td>3-117a</td>
<td>3-117b</td>
<td>3-117c</td>
<td>3-117d</td>
<td>3-117e</td>
<td>3-117f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Water Injection</td>
<td>3-118a</td>
<td>3-118b</td>
<td>3-118c</td>
<td>3-118d</td>
<td>3-118e</td>
<td>3-118f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Water Tanks</td>
<td>3-119a</td>
<td>3-119b</td>
<td>3-119c</td>
<td>3-119d</td>
<td>3-119e</td>
<td>3-119f</td>
<td>NAVAIR 01-1A-509-2</td>
</tr>
<tr>
<td>Windshield Defrosters</td>
<td>3-120a</td>
<td>3-120b</td>
<td>3-120c</td>
<td>3-120d</td>
<td>3-120e</td>
<td>3-120f</td>
<td>----</td>
</tr>
<tr>
<td>Windshield Wiper Blades &amp; Arms</td>
<td>3-121a</td>
<td>3-121b</td>
<td>3-121c</td>
<td>3-121d</td>
<td>3-121e</td>
<td>3-121f</td>
<td>----</td>
</tr>
</tbody>
</table>
3-111. CABIN FILTERS, DUCTS AND REGULATORS.

a. **Cleaning.** Vacuum to remove dirt and other foreign matter.

b. **Inspection.** Refer to Chapter 8.

c. **Corrosion Control.** Treat in accordance with NAVAIR 01-1A-509-2.

d. **Protection.**
   1. Level I and II. Protect exposed openings, regulators, and quick disconnects against contamination by covering with barrier material, MIL-PRF-131 Class 1, and tape, SAE AMS-T-22085 Type II.
   2. Level III. No protection required.

e. **Maintenance.**
   1. Level I and II. Every 7 days, inspect exposed openings and quick disconnects for security of barrier material.
   2. Level III. No maintenance required.

f. **Depreservation.** Remove barrier materials as required. Clean and inspect as specified above.

3-112. DEICER COMPONENTS (Air Type). Deicer components include air lines and fittings as well as deicer boots found on leading edges of wings and stabilizers. Fluid pressure is alternately applied to different sets of tubes in each boot to crack ice as it forms. Rubber boots, a flat array of flexible tubes bonded to the leading edge of wings, can crack and deteriorate if left unprotected for extended periods of time.

Detergent, General Purpose 13
MIL-D-16791 Type I

a. **Cleaning.** Remove dust, dirt, oil and grime from rubber boots by wiping with a cloth, CCC-C-440, wet with cleaning solution (1 oz. MIL-D-16791 in 1 gal. of fresh water). Rinse with fresh water and dry with clean cloth. Refer to NAVAIR 01-1A-509-2.

b. **Inspection.** Refer to Chapter 8.

c. **Corrosion Control.** Treat in accordance with NAVAIR 01-1A-509-2.

d. **Protection.**
   1. Level I. Protect in accordance with applicable aircraft MIM.
   2. Level II. Drain fluid tanks and flush system with corrosion preventive oil, MIL-C-4339. Coat deicer boots with wax, P-W-155. Tag preserved system with a CAUTION tag (see Figure 3-12).
   3. Level III. Drain fluid tanks and flush system with corrosion preventive oil, MIL-C-4339. Tag preserved system with a CAUTION tag (see Figure 3-12).

e. **Maintenance.**
   1. Level I. Maintain in accordance with aircraft MIMs.
   2. Level II and III. No maintenance required.

f. **Depreservation.** Remove wax coating if applicable, from deicer boots. If aircraft is being returned to flight status, drain residual preservative from deicers and remove tag. Flush and fill with anti-icing fluid in accordance with applicable MIM. Clean and inspect as specified above.

3-113. GALLEY FACILITIES. Areas dedicated to food preparation and disposal are subject to degradation due to the presence of water and food debris. Included are sinks, garbage disposal areas, and potable water tanks.

a. **Cleaning.** Clean galley thoroughly to remove all food spillage, especially spillage of items such as salt, sugar, and baking soda. Remove all food from galley areas and store separately in a controlled location. At a minimum, these items shall be stored indoors under normal supply warehouse conditions. Drain water tanks, pumps and lines and air dry.

b. **Inspection.** Check deck, sink areas and waste disposal areas for evidence of corrosion in accordance with Chapter 8.

c. **Corrosion Control.** Correct any detected corrosion in accordance with NAVAIR 01-1A-509-2. Remove corrosion by mechanical methods and ensure that all debris is removed.

d. **Protection.** No additional protection required.

e. **Maintenance.** No maintenance required.
f. **Depreservation.** As required for flight, service galleys, and install supplies. Clean, inspect and control corrosion as specified above.

### 3-114. LAVATORY FACILITIES.

Lavatory facilities include sinks, water tanks and deck areas. For treatment of toilets and urinals see paragraph 3-117.

Cleaning Compound, Aircraft MIL-PRF-85570 Type II

a. **Cleaning.** Remove loose dirt from sinks and deck areas using a vacuum cleaner. Wipe areas with a cloth wet with cleaning solution (1 part MIL-PRF-85570 Type II in 9 parts fresh water). Rinse with a cloth wet with fresh water. Drain water tanks, pumps and lines and air dry.

b. **Inspection.** Inspect sink areas for corrosion in accordance with Chapter 8.

c. **Corrosion Control.** Treat corroded areas in accordance with NAVAIR 01-1A-509-2. Remove corrosion by mechanical methods and ensure that all debris is removed.

d. **Protection.** No additional protection required.

e. **Maintenance.** Every 28 days, check for corrosion and correct in accordance with NAVAIR 01-1A-509-2.

f. **Depreservation.** As required for flight, service in accordance with applicable MIM. Clean, inspect and control corrosion as specified above.

### 3-115. RELIEF TUBES.

Relief tube vent areas are particularly susceptible to corrosion due to the caustic nature of urine.

Cleaning Compound, Aircraft MIL-PRF-85570 Type II

a. **Cleaning.** Wash interior and exterior areas thoroughly with cleaning solution (one part MIL-PRF-85570 Type II in 9 parts fresh water), and a soft bristle brush, MIL-B-23958. Rinse thoroughly with fresh water. Treat the area with disinfectant, O-D-1435.

b. **Inspection.** Inspect for corrosion in accordance with Chapter 8, paying particular attention to vent area and tube fittings.

c. **Corrosion Control.** Treat corrosion in accordance with NAVAIR 01-1A-509-2.

d. **Protection.**

   ![Image](https://example.com/compound.jpg)

   Compound, Corrosion Preventive MIL-PRF-16173 Grade 2

   1. **Level I and II.** Treat bare metal that is normally a coated or painted surface with a light coat of MIL-PRF-16173 Grade 2.
   2. **Level III.** No additional protection required.

   ![Image](https://example.com/alcohol.jpg)

   Alcohol, Isopropyl TT-I-735

   a. **Cleaning.** Drain all smoke abatement additive (CI-2) from the system into a polyethylene or metal pail. Flush the additive storage tank and all connecting tubing with isopropyl alcohol, TT-I-735 Grade A. A CI-2 servicing cart with a CI-2 drum that has been flushed and filled with alcohol may be used for purging the system.

3-91
b. Inspection. Check interior and exterior of storage tank as well as all tubing fittings for corrosion in accordance with NAVAIR 01-1A-509-2.

c. Corrosion Control. Remove corrosion products and apply conversion compound in accordance with NAVAIR 01-1A-509-2.

d. Protection.

(1) Level I. Seal all openings with barrier material, ASTM D4801 Type III, and tape, MIL-PRF-131 Class 1, to prevent intrusion of water.

(2) Level II and III. Protect in accordance with Level I requirements plus deactivate engine fire extinguisher by disconnecting mechanical actuator at the bottle or by removing squib or explosive charge from cartridge actuated cylinders. Retain or dispose of charges in accordance with NAVAIR 11-100-1.1-CD.

e. Maintenance.

(1) Level I and II. Every 56 days, inspect barrier material and replace when necessary. Maintain system in accordance with applicable MIM.

(2) Level III. Maintain system in accordance with the applicable MIM.

f. Depreservation. Remove barrier materials, if applicable, and service in accordance with applicable MIM. For Level II and III depreservation and before engine runup, install fully charged cylinders. Install squib or explosive charge in cartridge-actuated cylinders in accordance with NAVAIR 11-100-1.1-CD and the applicable MIM. Clean, inspect and control corrosion as specified above.

3-117. TOILET FACILITIES. Toilet facilities include toilets, urinals and surrounding areas. Urine is a highly corrosive agent which shall be neutralized and removed from toilet area metal surfaces to minimize degradation during storage.

Cleaning Compound, Aircraft

MIL-PRF-85570 Type II

Sodium Bicarbonate, Technical

A-A-374

a. Cleaning. Remove loose dirt and debris with vacuum cleaner. Flush with fresh water, or wet surface with sodium bicarbonate solution (6 oz. A-A-374 in 1 gallon of fresh water), rinse with fresh water and dry. Clean entire floor by wiping with cleaning solution (one part MIL-PRF-85570 Type II in 9 parts water) and rinse with fresh water. Finish by drying with a clean cloth.

b. Inspection. Refer to Chapter 8.

c. Corrosion Control. Treat corroded areas in accordance with NAVAIR 01-1A-509-2. Pay particular attention to areas where urine has come in contact with metal surfaces (floor around urinal and toilet) and where there may have been standing water.

Compound, Corrosion Preventive

MIL-PRF-16173 Grade 2

d. Protection. Level I, II and III. Treat bare metal with MIL-PRF-16173 Grade 2.

e. Maintenance.

(1) Level I and II. Every 28 days, check for corrosion and treat according to NAVAIR 01-1A-509-2.

(2) Level III. No maintenance required.

f. Depreservation. As required for flight, service in accordance with applicable MIM. Clean, inspect and control corrosion as specified above.
3-118.  **WATER INJECTION.** Water injection is used for thrust augmentation or anti-detonation in certain aircraft engines.

Alcohol, Isopropyl TT-I-735

a.  **Cleaning.** Drain system and flush with isopropyl alcohol, TT-I-735.

b.  **Inspection.** Check for evidence of leakage and corrosion on the systems components in accordance with NAVAIR 01-1A-509-2.

c.  **Corrosion Control.** Treat corroded areas in accordance with NAVAIR 01-1A-509-2.

d.  **Protection.** Level I, II and III. If system is to remain idle during storage or operation period it shall be flushed with corrosion preventive soluble oil, MIL-C-4339. Flushing shall be accomplished in such a manner as to coat the internal walls of all tanks, passages, valves, pumps, tubes and fittings with a protective oil film. Tag preserved water injection system with a CAUTION tag (see Figure 3-12).

e.  **Maintenance.** Level I, II and III. No maintenance required.

f.  **Depreservation.** As required for flight, service in accordance with applicable MIM. Remove CAUTION tag. Clean, inspect and control corrosion as specified above.

3-119.  **WATER TANKS.**

a.  **Cleaning.** Drain water tanks, pumps and lines. Air dry and leave drains open.

b.  **Inspection.** Inspect external portions of tanks and pumps as well as inside of tanks and line fittings for corrosion in accordance with Chapter 8.

c.  **Corrosion Control.** Correct any detected corrosion in accordance with NAVAIR 01-1A-509-2. The interior surfaces of aluminum alloy and all other portable water tanks shall not be painted or conversion coated. Remove corrosion by mechanical methods and ensure that all debris is removed.

d.  **Protection.**

(1)  Level I and II. If tank filler openings are located where airborne dirt contamination is not a problem, leave filler caps open to permit free circulation of air. If airborne dirt contamination is a problem, install vents similar to the one shown for fuel systems in Figure 3-4.

(2)  Level III. No additional protection required.

e.  **Maintenance.**

(1)  Level I and II. Every 28 days, check the aircraft interior. Check area around filler cap for dust and dirt accumulation. If dust or dirt accumulation is noted, check interior of tank, clean and represerve as necessary.

(2)  Level III. No maintenance required.

f.  **Depreservation.** Remove filler opening vents if installed. Flush and service tanks and associated plumbing in accordance with applicable MIM. Clean, inspect and control corrosion as specified above.

3-120.  **WINDSHIELD DEFROSTERS/CABIN HEATERS (Fluid Type).**

a.  **Cleaning.** Drain all fluid and blow dry with low pressure (approximately 10 psi) compressed air.

b.  **Inspection.** Refer to Chapter 8.
c. **Corrosion Control.** Treat in accordance with NAVAIR 01-1A-509-2.

d. **Protection.**

(1) Level I. Flushing of system is not necessary. Service in accordance with the applicable MIM.

(2) Level II and III.

Alcohol, Isopropyl TT-I-735

(a) Flush windshield defroster system with corrosion preventive oil, MIL-C-4339. If defroster nozzle openings are too small to pass the oil as it comes from the container, dilute the oil with isopropyl alcohol, TT-I-735, in a ratio of 3 parts alcohol to 1 part oil. Drain system thoroughly following flush.

(b) Fill heater system with MIL-PRF-6081 Grade 1010N oil and install a CAUTION tag, Figure 3-6.

Oil, Lubricating, Jet Engine MIL-PRF-6081 Grade 1010N

(3) If fungal growth is detected on rubber wiper blades, wipe blades with clean cheesecloth, CCC-C-440, saturated with isopropyl alcohol, TT-I-735, or NAVCLEAN.

f. **Depreservation.** Drain excess preservative. Flush and service with defrosting fluid in accordance with applicable MIM. If aircraft is being returned to flight status, drain excess oil from fuel system, and flush with operating fuel. Remove CAUTION tag, and service heater in accordance with applicable MIM. Clean and inspect as specified above.

3-121. **WINDSHIELD WIPER BLADES AND ARMS.**

a. **Cleaning.** Clean windshield wiper blade rubber components to remove grease, oil and CPCs.

b. **Inspection.** Inspect wiper arms for corrosion, paying particular attention to areas where water may be trapped and where fungal growth on blades may have come in contact with arm.

c. **Corrosion Control.** Treat in accordance with NAVAIR 01-1A-509-2.

d. **Protection.**

(1) Level I. Leave blades and arms in place and wrap with barrier material, MIL-PRF-131 Class 1, and tape, SAE AMS-T-22085 Type II.

(2) Level II and III. Remove blades and arms, wrap with barrier material, MIL-PRF-131 Class 1, and tape, SAE AMS-T-22085 Type II, identify, and store inside aircraft.

e. **Maintenance.**

(1) Level I. Every 7 days, inspect barrier material and replace as necessary for full coverage.

(2) Level II and III. No maintenance required.

f. **Depreservation.** For Level I depreservation, remove barrier materials. For Level II or III depreservation, unpack blades. Check condition of rubber parts to ensure serviceability. Reinstall, if applicable, and service wipers in accordance with applicable MIM. Clean and inspect as specified above.
CHAPTER 4
REMOVED COMPONENTS

SECTION I. INTRODUCTION

4-1. PURPOSE. The purpose of this chapter is to provide practical procedures to fleet maintenance personnel for the cleaning, inspection, protection, maintenance, and packaging of removed components. The procedures are designed to protect removed components from contamination, corrosion, environmental and mechanical damage. Protection can be achieved with a minimal amount of material and equipment. Ordering information for the basic materials and equipment required is provided in Chapter 8.

4-2. TECHNICAL INSTRUCTIONS. Throughout this chapter, reference is made to supporting technical publications which have a direct bearing on preservation procedures. Where appropriate, details from these supporting technical instructions have been included in the text, but no attempt has been made to duplicate all related information. Local conditions may prevent complete compliance with all the details of procedures specified in supporting publications. However, in no case shall the intent of such instructions be ignored or omitted during preservation.
SECTION II. REMOVED COMPONENT PRESERVATION

4-3. PURPOSE. This section provides general guidance for the cleaning, protection, and packaging of removed components in the absence of specific component instructions.

4-4. COMPONENT REMOVAL.
   a. Aircraft components are removed for a variety of reasons:
      (1) Malfunction or failure.
      (2) Aircraft modification.
      (3) Fatigue life achieved.
      (4) Aircraft storage, parts removed automatically.
      (5) To gain access to a malfunctioning part.
      (6) Routine maintenance.
      (7) Cannibalization.
   b. Components that are removed for access shall be immediately protected while the malfunctioning part is being repaired or replaced. A malfunctioning part shall also be further protected and prepared for shipping.
   c. Repairable assemblies not scheduled for immediate induction for local repair shall receive at least Level B protection, in accordance with paragraph 4-42, for return to supply. Cleaning, preservation and unit packaging shall be of sufficient scope and depth to ensure that existing deterioration does not progress while items are awaiting repair.

4-5. SOURCES. Removed components come from a variety of sources:
   a. Supply warehouses (planned component workload).
   b. Inducted aircraft (planned aircraft workload).
   c. Local squadrons through customer service.
   d. Emergency, fleet-wide shortfalls.

4-6. RECEIVED COMPONENTS.
   a. Inspection. Components received from supply or operating squadrons shall be inspected immediately for adequate protection.
      (1) Check the condition of the packing container, crate or box for signs of shipment damage (water intrusion, broken containers, component pieces).
      (2) Check the condition of the cushioning material that surrounds or supports the component for adequacy.
      (3) Check the intimate wrap on the part itself for condition (present, intact, ripped).
      (4) Unwrap the component and inspect it for condition of the CPC (if required). Check the overall appearance of the component (missing parts, caps and plugs; broken pieces, water intrusion or corrosion damage).
      (5) Document any discrepancies found and report them to the customer via email or telecon.
   b. Original Containers. Many components are received from supply packaged in reusable containers. The containers may be made out of metal, thermoplastic, wood, or double or triple walled fiberboard. These containers shall be saved and reused. Reusing containers ensures that the removed component will be properly protected during subsequent shipping and handling.
   c. Inadequate Packaging. When RFI components are received in a damaged condition and the damage can be attributed to improper or inadequate packaging, file a Supply Discrepancy Report via the NAVSEA PDREP website in accordance with NAVSUP P723.
   d. Storage. Keep the RFI components in their original container, overpack, and intimate wrap until they are to be installed. Do not remove them from their containers unless there are adequate storage bins or shelves available to protect them.
      
      CAUTION
      If stored on the aircraft, loose, special, and mission equipment and components shall be secured in such a manner that they will not be overlooked during depreservation of the aircraft or set adrift during aircraft relocation.

4-7. GENERAL. Loose equipment not included as inventory items shall be removed from the aircraft and returned to the reporting custodian or turned in to
Supply. Loose, special, and mission equipment (such as slings, jack pads, ladder, covers, armaments, special instruments, life rafts, and removed components) shall be inventoried, preserved, packaged and identified as necessary in accordance with NAVSUP P700. When packaging loose, special, and mission equipment, items shall be packaged individually. Individual and consolidation packs of items shall be marked on the outside with a list of contents including nomenclature, part number (when available) and aircraft serial number. Packaged items shall be stored inside the aircraft or in separate covered (warehouse) storage.

4-8. CLEANING. As the first step in preservation, clean the interior and exterior of the component. Pay particular attention to all areas of the component where soil or moisture could collect and to those areas that are hidden by subsystems. The extent of cleaning shall be only as necessary to remove corrosive soils, salt, and stack-gas deposits or to obtain a water-break-free surface in preparation for applying tapes, strippable coatings, or CPCs. The extent of cleaning shall be based on examination and evaluation, using the guidelines in NAVAIR 01-1A-509-2.

Solvent, Degreasing 27
MIL-PRF-680 Type II or III

a. The exterior of most components can be cleaned thoroughly by using wiping cloths and bristle brushes saturated with MIL-PRF-680 Type II or III. After solvent cleaning, the surfaces shall be wiped dry. Refer to Chapter 8.

b. Internal surfaces are cleaned and preserved by purging with the operating fluid or specified preservation oil.

c. At repair facilities, the external surfaces of a part or component shall be clean enough to facilitate activities such as disassembly, check and test, and NDI. Refer to local engineering directives for additional component cleaning requirements.

4-9. LUBRICATION. Lubrication is an essential part of preservation and depreservation, since the application of lubricants to clean metal surfaces shields moving joints against dirt, water, and other harmful agents. Properly maintained lubrication will, in some cases, provide adequate protection and eliminate the need for more permanent protective compounds. Areas of the component which cannot be properly masked and may be exposed to cleaning or stripping compounds shall be lubricated before and immediately after cleaning operations. Unless it can definitely be established that an aircraft or system has been completely lubricated during “Upkeep” or “Repair” within the last 30 days, preservation lubrication shall be applied to the following:

a. Items requiring daily lubrication in accordance with MRCs.

b. Items exposed to cleaning and stripping compounds.

c. Items obviously requiring lubrication because of visual or mechanical condition.

4-10. PROTECTION. After cleaning, many parts are sensitive to corrosive attack. Chemical and/or mechanical protection shall be administered to prevent damage. Components, parts, pieces and surfaces shall be inspected and preserved or represerved as often as necessary to ensure adequate protection against corrosion.

Oil, Lubricating, Jet Engine 22
MIL-PRF-6081 Grade 1010N

Oil, Lubricating, Aircraft 21
MIL-PRF-23699

a. Internal Protection. Whenever possible, apply internal preservative coatings during assembly using the test stand operating fluid or the appropriate internal CPC. Except when viscosity, flow, or other calibration/correlation requirements cannot be met, corrosion preventive type oils shall also be used when making functional or bench tests of assembled units.

(1) Use MIL-PRF-6081 Grade 1010N oil in fuel system components.

(2) Use MIL-PRF-23699 in MIL-PRF-23699 oil systems.

(3) Use operating fluid in hydraulic systems.
b. VCI Bag Protection. Dried components, parts and pieces may be preserved by enclosing in sealed VCI treated bags conforming to MIL-DTL-22020. Except for items requiring clean room controls, components preserved by this method will not ordinarily require cleaning before assembly or use. VCI protection is the preferred method for components made of high strength steels.

CAUTION

Do not use CPCs on painted, plastic, elastomeric (rubber) or composite surfaces. For these surfaces, protect with barrier material, MIL-PRF-131 Class 1, held in place with preservation tape, SAE AMS-T-22085 Type II.

c. CPCs. Corrosion-prone metal component surfaces (except oxygen system parts) may be protected with a coating of preservative compound. Surfaces are to be considered corrosion prone if the nature of the metal, shop or storage environment, or length of process cycle are such that corrosive attack may occur. Care shall be taken to avoid applying contact-type preservative compounds to installed antifriction bearings (including teflon-lined self-aligning types), electrical and rubber components, oxygen system components, and any other materials which might be damaged by the CPCs or solvents used to remove coatings.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

(1) If only short term protection is desired, use MIL-PRF-81309 Type II material and reapply at least every 28 days.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type III

(2) Protect electrical connector shells with MIL-PRF-81309 Type III and reapply every 28 days.

Compound, Corrosion Preventive 10
MIL-PRF-16173 Grade 2

(3) If components or assemblies that will be in accumulation areas for longer than 30 days, apply soft film CPC, MIL-PRF-16173 Grade 2. This coating will give adequate protection for up to one year in covered storage.

(4) For additional information concerning the use of the corrosion preventative compounds (CPCs) recommended in this manual, refer to Chapter 8.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

d. Unplated or Unpainted Steel. Bare steel shall be protected with MIL-PRF-81309 Type II or VCI bags/film, MIL-DTL-22020/MIL-PRF-22019. This requirement includes parco-lubrized, black oxide treated and blued surfaces. Do not apply CPC to electrical/electronics gear, oxygen equipment and similar items.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

e. Aluminum Alloys. Aluminum and aluminum alloys are normally protected by anodization, chromate conversion coatings, cladling and paint or primers. Aluminum surfaces that are not protected, or have compromised protective coatings, shall be preserved with MIL-PRF-81309 Type II. Aluminum panels shall be mechanically protected in specialized handling racks or wrapped in bubble wrap, PPP-C-795, to prevent scuffing and crushing.

f. Titanium Alloys. Titanium alloys on aircraft are chemically inert below 600°F. Protecting this metal with CPCs is unnecessary. However, mechanically protect titanium parts with bubble wrap, PPP-C-795, or equivalent.

Compound, Corrosion Preventive 10
MIL-PRF-16173 Grade 2

g. Magnesium Alloy. Unpainted or paint-damaged magnesium alloy components, parts, and pieces of such items as engine and helicopter gearboxes, shall be protected with a coating of MIL-PRF-16173 Grade 2 applied by brush, dip, or spray as appropriate. Surfaces protected with the minimum exterior finish specified by the MIMs need not be preserved.
h. **Rubber Products.** As a minimum requirement, rubber and other elastomeric materials shall be stored in a cool dry place away from operating electrical equipment (ozone).

(1) Items subject to mechanical deformation such as o-rings, gaskets and diaphragms shall be packaged individually in accordance with Method 40 (see paragraph 4-38) and stored in such a manner that static stresses are minimized.

(2) Tires shall be sorted upright or in normal operating position. Refer to NAVAIR 04-10-506 for further information.

(3) Hoses shall be stored straight or uncoiled whenever practicable. Hoses and related items shall be packaged in accordance with MIL-H-775. Preformed hoses shall be packaged and stored in their normal preformed position.

i. **Plastics.** Except for those parts specifically designed for use in oil or grease lubricated systems, plastics shall be maintained free of greases, oil preservatives, and solvents at all times. Transparent plastics not covered by the suppliers special protective paper or packaged in closed containers shall be covered to protect against abrasion as described in paragraph 3-16.

j. **Raw Stock Material.** All aeronautical materials, including raw stock, shall be protected against mechanical and physical damage at all times during handling, transporting and storing. Appropriate containers, fixtures, separators and cushioning shall be used as necessary to prevent damage.

k. **Change Kits.** Change kits shall be unit packaged. Kits may be intermediate packaged for supply when the package size increase and weight factor is cost-effective. Free-flow cushioning materials shall not be used for intermediate packaging. Special care shall be taken to identify the correct quantity of unit packages within the intermediate container. Change kits shall be adequately identified in accordance with MIL-STD-129 and stamped RFI (ready for issue) before routing to the packaging area.

l. **Lines and Fittings.** Cap or plug all fuel, oil, hydraulic, pneumatic lines and electrical connectors with authorized covers. If necessary, when appropriate covers are not available, use strips of barrier material, MIL-PRF-131 Class 1, secured with tape, SAE AMS-T-22085 Type II, to cover or protect the fitting or connector.

4-11. **PACKAGING.**

a. Install desiccant, MIL-D-3464 Type I, in accordance with Chapter 6, Section II. Wrap part with barrier material, MIL-PRF-131 Class 1, and heat seal. Insert a humidity indicator card, MIL-I-8835, inside the wrap in a location opposite that of the desiccant.

b. Place component into a fiberboard box, ASTM D5118, or fast pack, PPP-B-1672, of suitable size.

c. Larger, bulkier components shall be placed in their shipping container, properly secured, and identified with the aircraft (BUNO) from which it was removed.

d. For parts that are too large to be handled by one person, special metal shipping containers, wooden crates or specially designed wood frame reinforced fiberboard boxes shall be used. These large components shall first be wrapped in barrier material that is taped or sealed in place.
SECTION III. PRESERVATION OF SPECIFIC COMPONENTS

4-12. PURPOSE. This section contains procedures for the preservation of specific components. For components not listed here, follow the general instructions of Section II, or contact the Materials Engineering Division, NAVAIR ISSC North Island, for further guidance.

4-13. AIRCRAFT GUN SYSTEMS AND AIRBORNE CREW SERVED WEAPONS AND ASSOCIATED MOUNTS.

WARNING

Aircraft gun systems and airborne crew served weapons may contain explosive ammunition.

a. Prior to any preservation actions, ammunition shall be removed by qualified explosives handling personnel.

b. Aircraft gun systems and airborne crew served weapons may be stored intact or disassembled into subcomponents as required.

c. Procedures for the packaging and shipment of gun systems and airborne crew served weapons shall be in accordance with NAVSUP packaging data, NAVSUP P700.

d. Cleaning/Inspection/Corrosion Control. Clean, inspect, control corrosion, and lubricate in accordance with the MIMs/MRC and NAVAIR 01-1A-75.

e. Security. Airborne crew served weapons shall be stored in secure facilities as required by OPNAVINST 5530.13.

f. Protection.

(1) Level I.

Compound, Corrosion Preventive 8 MIL-PRF-81309 Type III

(a) Apply CPC, MIL-PRF-81309 Type III, to outer and inner surfaces of electrical connectors. Cap open connectors with plastic caps. If caps are not available, cover connectors with ESD barrier paper, MIL-PRF-81705 Type I, and secure with tape, SAE AMS-T-22085 Type II.

(b) Protect open hydraulic lines/fittings with appropriate metal caps/plugs.

(c) Protect open pneumatic lines/fittings with appropriate caps/plugs/dust covers.

(d) Apply a light coat of grease, TW25B, to interior and exterior surfaces of gun bores. The white grease should be slightly visible on the surface.

(e) Loosely cover component with barrier material, MIL-PRF-131 Class 1, and secure with tape, SAE AMS-T-22085 Type II. If possible, store in containers and/or on racks to prevent mechanical damage. If stored in closed containers, the barrier material covering is not required.

(2) Level II. Some aircraft gun systems may not be able to be completely enclosed due to configuration and/or weight. If the component cannot be completely wrapped and sealed, Level I or Level III Dynamic preservation procedures shall be used.

(a) Protect in accordance with Level I procedures (paragraphs 4-13.f.(1) (a)-(d) above).

(b) Cushion projections, sharp edges, or other areas that may damage wrapping material, with foam, A-A-59135 Grade A, or bubble wrap, PPP-C-795. Cushioning shall be clean and dry to minimize possibility of corrosion.

(c) Create bag for component using MIL-PRF-131 Class 1 or 3 barrier material. Ensure that the sealed edge of the bag that would normally be opened for inspection is sufficiently large to permit two subsequent resealings after component inspection.

(d) Install humidity plug, SAE AS26860 Type II, in barrier material, or create a window in the barrier material for a humidity indicator card, MS20003, and install card. See Chapter 6, Section II, for installation procedures.

(e) Install desiccant in package (use one 16-unit bag per 2 cubic feet of interior space). Desiccant shall not be placed behind or near humidity indicator. Desiccant shall not contact metal surfaces of component; if necessary, place desiccant on a piece of barrier material, MIL-PRF-131 Class 1.
Minimize trapped air inside bag by compressing bag to the extent practical prior to final seal.

Heat seal bag.

Store components in suitable containers or on racks to prevent mechanical damage.

Level III Static.

Protect surfaces in accordance with Level I procedures (paragraphs 4-13.f.(1)(a)-(d) above).

Cushion projections, sharp edges, or other areas that may damage wrapping material, with foam, A-A-59135 Grade A, or bubble wrap, PPP-C-795. Cushioning shall be clean and dry to minimize possibility of corrosion.

Create bag for component using MIL-PRF-131 Class 3 barrier material. Ensure that the sealed edge of the bag that would normally be opened for inspection is sufficiently large to permit two subsequent resealings after component inspection.

Install humidity plug, SAE AS26860 Type II (see Chapter 6, Section II). Humidity indicator card, MS20003, is not authorized for Level III Static preservation. Use humidity plug only.

Install desiccant in package (use one 16-unit bag per 2 cubic feet of interior space). Additional desiccant may be required for storage areas that are not environmentally controlled (no heating or air conditioning) or subject to high humidity. Desiccant shall not be placed behind or near humidity indicator. Desiccant shall not contact metal surfaces of component; if necessary, place desiccant on a piece of barrier material, MIL-PRF-131 Class 1.

Minimize trapped air inside bag by compressing bag to the maximum extent practical. Follow with vacuum seal technique to remove all trapped air inside bag prior to final seal.

Heat seal bag.

Store components on racks or in suitable containers to prevent mechanical damage.

Level III Dynamic. Protect in accordance with Level I procedures above. Store in a dehumidified area/building.

Maintenance.

Level I.

Components can remain in Level I preservation for a maximum of 90 days. During Level I, the time counts toward any Daily Special Inspection DSI (aging).

Every 7 days, visually check CPC, grease, and caps/plugs/barrier paper to ensure integrity. Reapply CPC and grease if necessary. Replace missing or damaged caps/plugs. Replace barrier material covering if ripped or torn.

Level II.

Components can remain in Level II preservation for a maximum of 365 days. During Level II, the time does not count towards any DSI (non-aging).

Every 28 days, inspect outer wrapping for integrity and humidity indicator card or plug. If outer wrapping is damaged or humidity exceeds 40%, open bag and inspect component for corrosion damage. Repair any damage found. Remove and replace desiccant, and reseal bag.

Level III Static.

Components can remain in Level III Static indefinitely. During Level II Static, the time does not count towards any DSI (non-aging).

Every 28 days, inspect outer wrapping for integrity and humidity indicator plug. If outer wrapping is damaged or humidity exceeds 40%, open bag and inspect component for corrosion damage. Repair any damage found. Remove and replace desiccant, and reseal bag.

Level III Dynamic

Components can remain in Level III Dynamic indefinitely. During Level III Dynamic, the time does not count towards any DSI (non-aging).

Every 90 days, visually inspect CPC, grease, and caps/plugs/barrier material to ensure integrity. Reapply CPC and grease if necessary. Replace missing or damaged caps/plugs. Replace barrier material covering if ripped or torn. If visual inspection indicates damage to component may have occurred, depreserve, inspect in accordance with the maintenance manual, and represerve as applicable.
(c) Dehumidified area/building shall be maintained in accordance with Chapter 6.

h. Depreservation. Remove barrier system. Clean, inspect, control corrosion, and lubricate in accordance with the MIMs/MRC and NAVAIR 01-1A-75.

i. Records. Document preservation/depreservation in Section V of the Scheduled Removal Component (SRC) card (CNAF 4790/28A) or on the Equipment History Record (EHR) (CNAF 4790/113), as applicable.

4-14. ARMAMENT EQUIPMENT (BOMB RACKS, PYLONS, BOMB RELEASE UNITS, MISSILE LAUNCHERS).

a. Procedures for the packaging and shipment of armament system items shall be in accordance with NAVSUP packaging data, NAVSUP P700.

b. Cleaning/Inspection/Corrosion Control. Clean, inspect, and control corrosion in accordance with the specific armament manual and NAVAIR 01-1A-75.

c. Protection.

(1) Level I.

Compound, Corrosion Preventive 10
MIL-PRF-16173 Grade 2

Compound, Corrosion Preventive 9
MIL-DTL-85054

CAUTION

Do not allow MIL-DTL-85054 or MIL-PRF-16173 to contact the interior of racks, fittings, or any electrical connections.

(a) Coat paint-damaged or unpainted nonmoving surfaces with clear CPC, MIL-DTL-85054. Apply soft film CPC, MIL-PRF-16173 Grade 2, to paint-damaged or unpainted moving parts.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type III

(b) Apply CPC, MIL-PRF-81309 Type III, to outer and inner surfaces of electrical connectors. Cap open connectors with plastic caps. If caps are not available, cover connectors with ESD barrier paper, MIL-PRF-81705 Type I, and secure with tape, SAE AMS-T-22085 Type II.

(c) Loosely wrap component with barrier paper, MIL-PRF-131 Class 1 or MIL-PRF-121 Type I, and secure with tape, SAE AMS-T-22085 Type II, or cover component with clean tarpaulin. Store on racks or in containers to prevent mechanical damage.

(2) Level II.

(a) Protect surfaces in accordance with Level I procedures (paragraphs 4-13c(1)(a) and (b) above).

(b) Cushion projections, sharp edges, or other areas that may damage wrapping material, with foam, A-A-59135 Grade A, or bubble wrap, PPP-C-795. Cushioning shall be clean and dry to minimize possibility of corrosion.

(c) Create bag for component using MIL-PRF-131 Class 1 barrier material. Ensure that the sealed edge of the bag that would normally be opened for inspection is sufficiently large to permit two subsequent resealings after component inspection.

(d) Install humidity plug, SAE AS26860 Type II, or create window in package (see Chapter 6, Section II) for humidity indicator card, MS20003, and install card.

(e) Install desiccant in package (use one 16-unit bag per 2 cubic feet of interior space). Additional desiccant may be required for storage areas that are not environmentally controlled (no heating or air conditioning) or subject to high humidity. Desiccant shall not be placed behind or near humidity indicator. Desiccant shall not contact metal surfaces of component; if necessary, place desiccant on a piece of barrier material, MIL-PRF-131 Class 1.

(f) Minimize trapped air inside bag by compressing bag to the extent practical prior to final seal.

(g) Heat seal bag.

(h) Store components on racks or in suitable containers to prevent mechanical damage.
Level III Static preservation is not authorized for equipment configured with PAGS. See MIMs for functional requirements.

(a) Protect surfaces in accordance with Level I procedures (paragraphs 4-14c(1)(a) and (b) above).

(b) Cushion projections, sharp edges, or other areas that may damage wrapping material, with foam, A-A-59135 Grade A, or bubble wrap, PPP-C-795. Cushioning shall be clean and dry to minimize possibility of corrosion.

(c) Create bag for component using MIL-PRF-131 Class 3 barrier material. Ensure that the sealed edge of the bag that would normally be opened for inspection is sufficiently large to permit two subsequent resealings after component inspection.

(d) Install humidity plug, SAE AS26860 Type II. Humidity indicator card, MS20003, is not authorized for Level III Static preservation. Use humidity plug only.

(e) Install desiccant in package (use one 16-unit bag per 2 cubic feet of interior space). Additional desiccant may be required for storage areas that are not environmentally controlled (no heating or air conditioning) or subject to high humidity. Desiccant shall not be placed behind or near humidity indicator. Desiccant shall not contact metal surfaces of component; if necessary, place desiccant on a piece of barrier material, MIL-PRF-131 Class 1.

(f) Minimize trapped air inside bag by compressing bag to the maximum extent practical. Follow with vacuum seal technique to remove all trapped air inside bag prior to final seal.

(g) Heat seal bag.

(h) Store components on racks or in suitable containers to prevent mechanical damage.

(4) Level III Dynamic. Protect in accordance with Level I procedures above. Store on racks in a dehumidified area/building (see Chapter 6).
4-11. NAVAIR 15-01-500
01 September 2013

e. **Depreservation.**

(1) Level I. Remove barrier system. Clean, inspect, control corrosion, and service in accordance with the specific armament manual and NAVAIR 01-1A-75.

(2) Level II and III. Remove barrier system. Clean, inspect, control corrosion, and conduct mechanical/electrical functional check in accordance with the specific armament manual and NAVAIR 01-1A-75.

4-15. **BEARINGS.** Bearings shall be protected in accordance with NAVAIR 01-1A-503.

4-16. **COMPOSITE COMPONENTS.** Refer to the applicable structural repair manual for location of composite surfaces. Refer to paragraph 4-20 for additional information on storage of flight control surfaces.

a. **Protection.**

(1) To minimize degradation from water intrusion, damaged areas of composite surfaces (where the paint film is broken) shall either be refinished in accordance with the applicable maintenance instruction manual or covered with barrier material, MIL-PRF-131 Class 1, and secured with preservation tape, SAE AMS-T-22085 Type II.

(2) Open fluid lines shall be sealed with the appropriate caps or plugs.

(3) Disconnected electrical connectors shall be protected in accordance with paragraph 3-28.

(4) Airframe panels made of composites shall be wrapped in bubble wrap or barrier material, MIL-PRF-131 Class 1, and secured with tape (SAE AMS-T-22085 Type II). Identify component with a label in red lettering against a yellow background that reads: "CAUTION COMPOSITE PANEL".

b. **Handling.** Removed composite doors and panels (Graphite/Epoxy and Boron/Epox) are easily damaged during handling and storage, especially at edges and corners. Store the wrapped components indoors where they are protected from sharp corners or crushing loads. Components shall be stored on clean padded racks or fixtures, or in other clean handling/transportation equipment. Do not stack or pile wrapped components.

4-17. **DRIVE AND GEARBOX SYSTEM COMPONENTS.**

a. Service units scheduled for supply storage and shipment in accordance with the internal preservation instructions of Chapter 3, Section IV, Level II or III. Units scheduled for local storage and installation shall be preserved for the anticipated length of storage in accordance with the procedures of Chapter 3. Drain unit and blank off openings prior to packaging or storage.

b. All units prepared for supply storage and shipment shall be packaged (Method 50 in accordance with paragraph 4-38) using specially designed dehydrated metal containers. Method 50 protection with locally designed wooden containers may be used on an emergency basis where specially designed metal containers cannot be made available in time to meet production schedules or shipping dates.

4-18. **ELECTRICAL/ELECTRONIC SYSTEM COMPONENTS.**

a. Treat fungus in accordance with NAVAIR 01-1A-509-3.

b. Electron tubes shall be packaged in accordance with the appropriate sections of MIL-DTL-75.

c. Electrostatic Discharge Sensitive Devices shall be handled, marked and packaged in accordance with the requirements of COMNAVAIRFORINST 4790.2, NAVSUP P485 and MIL-HDBK-263.

**CAUTION**

Grease or oil CPCs shall not be applied to electrical/electronic gear unless specifically directed by a detailed specification.

d. Waterproofing compound, SAE AS8660, is sometimes specified for use in connectors at time of assembly but shall not be used as a contact-type preservative. If preservation of external surfaces is required, substitute a light coating of MIL-PRF-81309 Type III.
e. Rechargeable batteries shall be packaged in accordance with MIL-P-6063. Nonrechargeable batteries shall be packaged in accordance with ASTM D3951.

f. When not otherwise protected, cannon plugs and other pin-type connectors shall be protected against contamination at all times with metal or plastic caps, or covered in accordance with paragraph 3-28.

4-19. ENGINES. Engines shall be preserved within 14 days of the last engine run. Removed engines shall be stored indoors. Level I preservation is not recommended for removed engines unless they will be reinstalled within 28 days.

a. Engines shall be cleaned, inspected, and have corrosion control performed in accordance with Chapter 3, Section XIII.

b. Operational Engine Protection.

(1) Level I. Keep fuel systems at least 95% of fuel. Seal seams and openings of engine, except compressor inlet and exhaust outlet, using barrier material, MIL-PRF-131 Class 1, held in place with tape, SAE AMS-T-22085 Type II. Tape shall only be used for sealing seams and small openings. Seal engine inlet, exhaust, and other large openings with a fitted engine cover. If covers are not available, large openings may be sealed with barrier material, MIL-PRF-131 Class 1, held in place with tape, SAE AMS-T-22085 Type II, or with rigid fillers secured in place with safety wire (refer to paragraph 5-14). Reinstall all lines and fittings, caps, and covers on exposed fittings or openings. Cap fluid system openings with fluid tight closures. Attach preservation tag (see Figure 3-10) to the engine data plate.

(2) Levels II and III Internal. Protect the engine fuel system internally with MIL-PRF-6081 Grade 1010N oil using the “cold pres” method described in Chapter 3, Section VII.

(3) Level II External. Protect externally as specified for Level I. Statically dehumidify engine using desiccant, MIL-D-3464 Type I, in accordance with instructions for Level II External Preservation of Operational Engines (see Chapter 3, Section XIII). In addition, cover engine with waterproof cover or shroud made from plastic sheet, ASTM D4801 Type III, or barrier material, MIL-PRF-131 Class 1. Attach preservation tag (see Figure 3-10) to the engine data plate or in other visible location.

(4) Level III External. Reinstall all lines and fittings, caps, and covers on exposed fittings or openings. Cap fluid system openings with fluid tight closures. Place engine in a dehumidified bag (see Figure 4-1) or Shipping and Storage Container (see Section VI). For engines in a dehumidified enclosure (see Chapter 6), cover inlet and exhaust openings with barrier material, MIL-PRF-131 Class 1, secured with tape, SAE AMS-T-22085 Type II. Attach preservation tag (see Figure 3-10) to the outside of the container in an accessible location (bag or container) or to the engine data plate (dehumidified enclosure).

c. Nonoperational Engine Protection. Nonoperative engines cannot be placed in Level I preservation because of the inability to comply with the 28 day maintenance requirement.

(1) Levels II and III Internal. Protect internally with MIL-PRF-6081 Grade 1010N oil using the “cold pres” method described in Chapter 3, Section VII.

(2) Levels II and III External. Protect the same as for operational removed engines.

d. Maintenance.

(1) Level I.

(a) 7 day. Check fuel level, maintain 95% full. Check barrier material and repair or replace if torn or damaged.

(b) 28 day. Install engine on test stand or aircraft. Hot run the engine and cycle systems, including afterburner, twice. Inspect and renew CPC coatings if required.
(2) Level II.

(a) 7 day. Check humidity card. If humidity exceeds 40%, replace desiccant. Inspect barrier material and closures for tears or damage. Repair or replace barrier material and closures as required.

(b) 28 day. Inspect and renew CPC coatings if required.

(c) 56 day (operational engines). Service the engine oil reservoir with the applicable lubricant. If starter can be used, the engine shall be rotated through a one minute starter cycle. If starter cannot be used, manually turn the engine through the starter pad using an external device such as a pneumatic wrench, speed handle, or ratchet. Ensure lubrication is redistributed throughout the engine during rotation. If a compressor oil spray is required, the compressor shall be resprayed while the engine is being rotated.

(d) 56 day (nonoperational engines).

1. If shaft(s) can be rotated, service the engine oil reservoir with the applicable lubricant and connect an external source of MIL-PRF-6081 Grade 1010N oil to the main fuel inlet. Manually turn the engine through the starter pad using an external device. Ensure lubrication is redistributed throughout the engine during rotation.

2. If shaft(s) cannot be rotated, disconnect the necessary oil lines, remove pressure oil system plugs, and inject generous quantities of lubricating oil into the bearings. If thorough coating of the bearings cannot be accomplished by pressure flushing or fill and drain procedures, remove external covers and accessories as necessary to permit spray covering of these areas. Remove engine driven fuel system accessories and rotate by hand while pumping MIL-PRF-6081 Grade 1010N oil through the fuel passages, or place accessories on test benches for preservation.

(3) Level III.

NOTE

If humidity indicator is observed to exceed 40% at any time between 28 day inspections, take corrective action immediately as described below.

(a) For engines stored in Shipping and Storage Containers or statically dehumidified bags, check humidity indicator every 28 days. If humidity exceeds 40%, replace desiccant. Recheck humidity indicator within 72 hours. Repeat desiccant replacement and 72 hour inspection until an acceptable humidity level is achieved. Inspect container or bag for tears or damage. Repair or replace container or bag as required.

(b) For engines stored in dynamically dehumidified bags or dehumidified enclosure, no maintenance of the engine is required. The dehumidification system shall be maintained in accordance with Chapter 6.

e. Depreservation. Engines shall be depreserved in accordance with Chapter 3, Section XIII.

f. Engine Components. Engine components may be removed or installed during the engine preservation cycle. If it is suspected that partial drainage of the preservation oil occurred during removal or installation of engine components, the preservation oil shall be replaced as necessary, even if complete represervation of the system is required.
NAVAIR 15-01-500
01 September 2013

4-20. FLIGHT CONTROL SURFACES (AILERONS, STABILIZERS, FLAPS, WINGS). Refer to paragraph 4-16 for additional requirements for composite components.

   a. Clean surfaces in accordance with NAVAIR 01-1A-509-2.

   b. Protection.

      (1) Protect bare metal areas of non-moving surfaces with CPC, MIL-DTL-85054. Protect bare metal areas of moving surfaces with CPC, MIL-PRF-81309 Type II. Lubricate hinges in accordance with MIMs.

      (2) Cover hinges and attach points with barrier material, MIL-PRF-131 Class 1, secured with tape, SAE AMS-T-22085 Type II.

      (3) Cap or plug open lines and electrical connectors.

      (4) Cover coiled cables or wiring harnesses with a plastic bag, MIL-DTL-117, or barrier material, MIL-PRF-131 Class 1, and secure with tape, SAE AMS-T-22085 Type II.

   c. Store components indoors in racks or fixtures, or on shelves. Do not stack.

   d. If components must be temporarily stored outdoors, cover with plastic sheet, ASTM D4801 Type III, or barrier material, MIL-PRF-131 Class 1, and secure with tape, SAE AMS-T-22085 Type II.

   e. Maintenance.

      (1) Level II. Every 28 days, inspect component for damaged or missing barrier material, caps and covers. Repair or replace as necessary. Renew lubricants in accordance with the MIMs.

      (2) Level III. If components are stored in a dehumidified area, no maintenance is required.

4-21. FRAGILE OR DELICATE COMPONENTS.

   a. Fragile or delicate components are defined as the following:

      (1) Items which may be damaged by shock and/or vibration forces encountered in ordinary handling and movement.

      (2) Items which may be shattered or fractured by light impact forces.

      (3) Items having fragile coatings and/or precision machined surfaces, for example light bulbs, electron tubes, exposed electronic circuitry, optical elements, IVD aluminum coated parts.

      (4) Items which may be damaged by forces in the range of 13G to 80G, (for example, gyros). Items capable of withstanding 80G and above are in the rugged category.

   b. Fragility factors for shock protection are established for aeronautical items and included in NAVSUP Packaging Data Codes. As a general rule, instruments, airborne electronic equipment, electrical recording devices, gages, photographic and optical devices and equipment which must be kept in one position are considered delicate or fragile. Intershop handling devices or equipment shall be at least equivalent to the specified shipping containers in impact, shock and vibration protection.

   c. Fragile or delicate components removed from an aircraft undergoing processing, on scheduled rework or check and test, being issued from rework shops for installation, or being forwarded for preservation and packaging shall be given sufficient protection and handled in such a manner that no handling and/or transportation damage will occur.

   d. Fragile or delicate components, parts or pieces shall be conspicuously tagged or labeled before being moved from the receiving area, aircraft disassembly area or the rework shop. Arrows and the word "UP", in accordance with MIL-STD-129, shall be used for items requiring special positioning during handling. To ensure proper handling, unit and/or outer containers shall be marked as applicable.
e. All electrical connectors, receptacles and cannon plugs shall be protected from physical and chemical damage at all times by installation of metal or plastic caps, plugs and/or covers. When closures are not available, minimum protection shall be provided by covering each connector, receptacle or cannon plug with barrier material conforming to MIL-PRF-81705, or MIL-PRF-131 Class 1 secured in place with pressure sensitive tape, SAE AMS-T-22085 Type II.

f. Miniature connectors with protruding pins shall be covered with specially designed protective covers. If covers are unavailable, pins shall be covered with rigid polyurethane foam, MIL-P-26514 Type III Class 1, secured in place with pressure sensitive tape, SAE AMS-T-22085 Type II.

g. Always protect fragile or delicate components from contamination. After the protective covers have been secured in place, those having exposed chassis or operating parts shall be wrapped in barrier material conforming to MIL-PRF-121, MIL-PRF-131, or bubblewrap, PPP-C-795.

h. After wrapping, items shall be placed in their specified shipping container, or a special handling/transportation container which shall provide protection equivalent to its specified container.

i. Units containing magnetrons or magnets, being prepared for shipment via military aircraft or surface transportation and having a field strength in excess of 0.002 gauss at a distance of seven feet from any point on the surface, shall be checked utilizing a sensitive compass or a gauss meter.

j. Electrostatic Discharge Sensitive (ESDS) Devices inducted into the packaging shops for storage and/or shipment, shall be handled, marked and packaged in accordance with the requirements of COMNAVAIRFORINST 4790.2, NAVSUP P485 and MIL-HDBK-263.

k. In the event a fragile or delicate component is dropped or displays evidence of damage or rough handling, the shop supervisor in the area in which the discrepant part is located shall be notified by the person or persons having knowledge of the discrepancies. A discrepancy form shall be prepared and the component shall be returned to the repair shop, checked, tested and repaired, as necessary, after which it will be recertified.

4-22. FUEL SYSTEM COMPONENTS, GENERAL.

Oil, Lubricating, Jet Engine 22
MIL-PRF-6081 Grade 1010N

a. All fuel system components shall be drained of fuel and flushed with clean, water-free, filtered MIL-PRF-6081 Grade 1010N oil. Oil used to flush or coat fuel cells, lines, hoses, booster pumps and other items shall be filtered through 5 micron filters and meet all requirements of Table 3-7.

b. After flushing, fuel systems and all metering devices such as fuel controls and carburetors shall be left filled with MIL-PRF-6081 Grade 1010N oil and sealed with fluid-tight closures to retain the oil. All other components such as fuel cells, lines, hoses, and booster pumps shall be drained of excess oil and blanked-off or wrapped to prevent contamination.

4-23. FUEL CELLS. Self-sealing and bladder-type fuel cells shall be treated as delicate items and given special handling in accordance with NAVSUP 01-1A-35. Cleaning, purging, and preservation shall be in accordance with NAVSUP 01-1A-35. Self-sealing fuel cells shall be packaged in accordance with NAVSUP 01-1A-35 and the following instructions.

a. Specially designed cleated plywood (CP) boxes shall be utilized in accordance with NAVSUP P700.

b. Five sides of the CP box shall be lined with barrier material PPP-B-1055 or A-A-1051.

c. Fuel cells shall be tied to eyelets by the suspension loops with nylon cord, MIL-C-5040 Type 3. Suspension of the cell shall be arranged so that the cell touches, but is not completely resting on, the bottom of the crate and is secured in a manner that shall prevent collapsing of corner, edges, or flat surfaces.

Compound, Corrosion Preventive 9
MIL-DTL-85054

d. Metal fittings shall be preserved with CPC, MIL-DTL-85054. Fittings and all openings shall be covered with barrier material, MIL-PRF-131 Class 1 and secured with tape, SAE AMS-T-22085 Type II.
4-24. **FUEL TANKS, EXTERNAL.** External fuel tanks shall be preserved as follows:

a. Inspect at time of receipt for presence of residual fuel, entrapped water, microbiological agents and other contaminants.

b. Tanks with microbiological contamination shall be treated in accordance with NAVAIR 01-1A-35.

c. Tanks with entrapped water shall be drained and air dried.

d. Tanks with residual fuel shall be drained until no pools of fuel remain.

e. Tanks scheduled for outdoor storage in a local fire department approved area need not be purged or inerted if stored for less than 14 days. Unpurged tanks shall be treated as hazardous and flammable materials, and shall be handled in accordance with station fire and safety regulations. If stored for 14 days or longer, tanks shall be preserved by the fill-and-drain method or by spray coating the interior with MIL-PRF-6081 Grade 1010N oil (refer to Chapter 3, Section VII).

f. Tanks scheduled for repair or storage in any building shall be preserved, tagged, and certified by a certified Gas Free Engineer.

i. Store external tanks indoors or outdoors under cover, or package for shipment.

j. **External Tanks in Long Term Storage.**

(1) Every 28 days, check barrier material and caps and covers for integrity. Repair or replace as necessary.

(2) Every 365 days, represerve tank internally with MIL-PRF-6081 Grade 1010N oil.

4-25. **HYDRAULIC SYSTEM COMPONENTS.**

Fluid, Hydraulic

MIL-PRF-83282

a. All hydraulic system parts shall be flushed with operating fluid and sealed with fluid-tight closures to prevent loss of fluids. If leakage during storage is a problem, flush units and drip drain, followed by sealing of openings with fluid tight closures (refer to paragraph 4-36 for material requirements). Tag all flushed and filled units with the notation "Flushed with MIL-PRF-83282".

b. Corrosion prone parts of hydraulic units shall be protected at all times with a coating of CPC, MIL-PRF-81309 Type II or MIL-PRF-16173 Grade 2. Care shall be taken to avoid contaminating hydraulic systems with accumulated dirt or any other fluid.

4-26. **INSTRUMENT SYSTEM COMPONENTS.**

a. All instruments equipped with caging or locking devices shall be caged or locked before packaging.

b. Instruments and related accessories shall always be packaged individually.

c. Except for units awaiting scheduled induction for local rework, instruments awaiting repair shall be given the same level of protection as ready-for-issue units. Instruments awaiting local rework shall also be afforded mechanical protection from damage.
4-27. LANDING AND ARRESTING GEAR SYSTEM COMPONENTS.

Compound, Corrosion Preventive 10
MIL-PRF-16173 Grade 2

Compound, Corrosion Preventive 9
MIL-DTL-85054

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

a. Because landing and arresting gear system components, parts, and pieces contain ultrahigh-strength steels and aluminum alloys, care shall be taken to prevent nicking or scratching surfaces during preservation, handling and packaging. Voids in painted surfaces or other bare metal surfaces shall be protected at all times with a coating of MIL-PRF-16173 Grade 2 or MIL-DTL-85054. Adequate protection may be obtained for up to 30 days by applying MIL-PRF-81309 Type II, and wrapping the component with barrier material, MIL-PRF-121 or MIL-PRF-131. Alternately, parts may be wrapped in VCI film, MIL-PRF-22019, sealed with tape, SAE AMS-T-22085 Type II, or heat sealed, for storage up to 24 months. No CPC is required when using VCI film. Refer to Chapter 8 for additional CPC information.

b. Photo flash bulbs can be exploded by high energy electromagnetic radiation (radar beams). To minimize hazards, keep flash bulbs in sealed fiberboard cartons until just prior to use and store at maximum distance from operating radar equipment.

4-29. PNEUMATIC SYSTEM COMPONENTS.

Pneumatic systems and components require no internal preservation. However, all items shall be kept dry internally and protected against contamination by the use of approved nonshedding closures.

4-30. PROPELLERS (VARIABLE PITCH). Propellers removed from aircraft shall be stored indoors. This paragraph covers both assembled and disassembled propellers.

a. Assembled Propellers Installed on a Propeller Maintenance Stand or Installed on an Engine on a Maintenance Stand.

(1) Propellers shall be cleaned, inspected, and have corrosion control performed in accordance with Chapter 3, Section XIV.

(2) Protection. Removed propellers shall be protected in Level II or Level III preservation only.

(a) Level II.

1 Service propeller control in accordance with applicable MIMs.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

2 Apply a coating of CPC, MIL-PRF-81309 Type II, to all metal areas of the blade, hub, and dome. Remove excess using a clean, lint-free cloth.

3 Wrap propeller assembly with barrier material, MIL-PRF-131 Class 3, and secure with tape, SAE AMS-T-22085 Type II.

(b) Level III.

1 Service propeller control in accordance with applicable MIMs.

2 Place propeller in a dehumidified enclosure (see Chapter 6).
(3) Maintenance.

(a) Level II.

1 7 Day. Inspect the barrier material for tears, water intrusion, or damage. If barrier material is damaged, inspect for corrosion and visibly deteriorated corrosion preventive compound. Treat corroded areas as necessary in accordance with paragraph 3-94c. Reapply CPCs as necessary. Replace barrier material as necessary.

Fluid, Hydraulic

MIL-PRF-83282 14

2 56 Day. All Propellers. Check hydraulic fluid reservoir. Ensure hydraulic fluid is maintained at proper level in accordance with the applicable MIMs.

3 56 Day. Propellers Installed on a Maintenance Stand which Allows the Propeller to be Rotated.

a The propeller shall be rotated after ensuring that there is adequate hydraulic fluid in the barrel to wet the taper bores of all the blades. Additional fluid may be added to the barrel if necessary.

b Note numbers of the upright blades. Slowly rotate the propeller through at least three revolutions.

c Upon completion of rotation, position propeller, ensuring that the most recent upright blades noted in step b above are not returned to the same upright positions.

d Represerve as necessary.

4 56 Day. Propellers Installed on a Maintenance Stand which Does Not Allow the Propeller to be Rotated.

a Propeller shall be returned to the Intermediate Level for the propeller to be flow checked on a hydraulic test bench. Operation shall consist of at least three cycles from feather to reverse.

b Represerve propeller as necessary and reinstall on maintenance stand.

5 56 Day. Propellers Installed on Uninstalled Engines Stored on a Maintenance Stand or Transportation Dolly.

a If the propeller cannot be rotated due to stand clearance, refer to step 4 above.

CAUTION

Ensure engine desiccant bags are removed prior to performing propeller rotation.

b Propeller shall be rotated concurrently with the 56 day engine rotation.

c Note numbers of the upright blades. Slowly rotate the propeller through at least three revolutions.

d Upon completion of rotation, position propeller, ensuring that the most recent upright blades noted in step c above are not returned to the same upright positions.

e Install desiccant and represerve as necessary.

6 56 Day. Propellers That Cannot Be Rotated. If a propeller cannot be rotated and is idle for more than 56 days, it shall be disassembled prior to use and the taper bore shall be eddy current inspected in accordance with appropriate maintenance manuals.

(b) Level III. No maintenance is required.

(4) Depreservation. Levels II and III.

(a) Remove barrier material (Level II only).

(b) Clean in accordance with paragraph 3-94a.

(c) Inspect in accordance with paragraph 3-94b.

(d) Treat corrosion in accordance with paragraph 3-94c.

(5) Shipment. When assembled propellers are shipped, a transport stand with soft mounts and an air ride truck shall be specified (see Section VII and Chapter 7).
b. Disassembled Propellers.

(1) Propeller components shall be cleaned, inspected, and have corrosion control performed in accordance with Chapter 3, Section XIV. Drain the component of excess fluid. Apply fingerprint remover, MIL-PRF-15074, to all bare metal surfaces and wipe off excess with a clean, lint free cloth.

(2) Protection.

(a) Level I.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

1 Apply a coating of CPC, MIL-PRF-81309 Type II, to all metal areas of the disassembled components. Remove excess using a clean, lint-free cloth.

2 Individually wrap propeller components with barrier material, MIL-PRF-131 Class 1, and secure with tape, SAE AMS-T-22085 Type II. Mark outside of each package with nomenclature, part number, serial number, and date of preservation.

(b) Level II.

NOTE

Propeller components may be protected using CPCs (step 1) or with VCI barrier material (step 2). Do not use both methods together.

Compound, Corrosion Preventive 8
MIL-PRF-81309 Type II

Compound, Corrosion Preventive 10
MIL-PRF-16173 Grade 2

1 Apply CPC, MIL-PRF-81309 Type II, to metal areas of the propeller dome, hub, blades, lowpitch stop, pitchlock regulator assemblies. Lightly remove excess using a clean, lint free cloth. Follow with a coating of CPC, MIL-PRF-16173 Grade 2. Apply CPC, MIL-PRF-81309 Type III, to the electrical contact ring assembly. Wrap propeller components with barrier material, MIL-PRF-121 Type I, secured with tape, SAE AMS-T-22085 Type II. Mark outside of each package with nomenclature, part number, serial number, and date of preservation. Proceed to step 3.

CAUTION

Corrosion inhibitor in VCI bags and film can cause skin irritation. Wash hands thoroughly with soap and water prior to eating, drinking, or smoking. Wear disposable gloves if prolonged contact is anticipated.

2 Individually wrap propeller dome, hub, lowpitch stop, pitchlock regulator assemblies and propeller blade shank (extend material up the blade shank at least 6 inches) with VCI barrier material, MIL-PRF-3420 Class 1 Style C, and secure with tape, SAE AMS-T-22085 Type II. Alternately, components may be wrapped with VCI film, MIL-PRF-22019, and secured with tape, SAE AMS-T-22085 Type II, or heat sealed. Mark outside of each package with nomenclature, part number, serial number, and date of preservation.

3 Overwrap the propeller blade shank and hub with barrier material, MIL-PRF-131 Class 1, and heat seal or secure with tape, SAE AMS-T-22085 Type II.

Fluid, Hydraulic 14
MIL-PRF-83282

4 Coat preformed packings with assembly fluid or hydraulic fluid, MIL-PRF-83282, and package them in barrier material, MIL-PRF-131 Class 1, and heat seal. Mark outside of package with nomenclature, part number, serial number, and date of preservation.

5 Individually vacuum bag propeller components and hardware with barrier material, MIL-PRF-131 Class 1, and heat seal. Mark outside of each package with nomenclature, part number, serial number, and date of preservation.

6 Place all propeller components in a suitable container that provides sufficient protection from handling damage (specially designed propeller containers are preferred). Container shall have provisions made for securing the blades in a fixed position.
(c) **Level III Static.**

1. Apply CPCs or VCI material as described in paragraph 4-30b(2)(b) steps 1 and 2 above for Level II preservation.

2. Create bag for component using MIL-PRF-131 Class 3 barrier material.

3. Install humidity plug, SAE AS26860 Type II, in bag (see Chapter 6, Section II).

**NOTE**

MIL-D-3464 desiccant unit packs come in single and multiple unit packaging. A single unit of bentonite clay desiccant is approximately 33 grams. Adjust the amount of unit packs enclosed within the heatsealed bag to match the stated unit requirements. Refer to MIL-STD-2073-1 or paragraph 6-5a to determine the appropriate amount of desiccant.

4. Enclose the component in the bag, along with the correct amount of MIL-D-3464 desiccant unit packs. Desiccant shall not be placed behind or near the humidity plug. Desiccant shall not contact metal surfaces of the component; if necessary, place desiccant on a piece of barrier material, MIL-PRF-131 Class 1.

5. Minimize trapped air inside bag by compressing bag to the extent practical prior to final seal. Heat seal bag.

6. Place the component in an appropriate container (see Table 8-12) with the humidity plug facing outward. Ensure adequate and equal amounts of cushioning material (bubble wrap, foam or bound fiber (see Table 8-12)) are placed on all sides of component to immobilize it in the container. If INSTAPAK QUICK RT packaging bags are used, perform the following:

   a. Place bag in container and activate in accordance with manufacturer instructions.

   b. Hold bagged component just above QUICK RT packaging bags and allow to fill and conform to the bagged component.

   c. Repeat the process for the sides and top of the bagged component in the container.

7. If applicable, ensure the associated component Equipment History Record card or Scheduled Removal Component card has been annotated with the correct removal and time data, and reason for removal. Any pertinent removal and maintenance data shall be packaged with the component before closing the container.

8. Mark outside of container with nomenclature, part number, serial number, date, and level of preservation.

(d) **Level III Dynamic.**

1. Individually wrap propeller components with barrier material, MIL-PRF-131 Class 1, and secure with tape, SAE AMS-T-22085 Type II.

2. Place all propeller components in a suitable container that provides sufficient protection from handling damage (specially designed propeller containers are preferred). Container shall have provisions made for securing the blades in a fixed position.

3. Place propeller container in a dehumidified enclosure (see Chapter 6).

(3) **Maintenance.**

(a) **Level I.** Every 7 days, inspect the barrier material for tears, water intrusion, or damage. If barrier material is damaged, inspect for corrosion and visibly deteriorated corrosion preventive compound. Treat corroded areas as necessary in accordance with paragraph 3-94c. Reapply CPCs as necessary. Replace barrier material as necessary.

(b) **Level II.** Every 56 days, inspect outer wrapping for integrity. If outer wrapping is damaged, open bag and inspect component for corrosion. Repair any damage found and repackage.

(c) **Level III Static.** Every 28 days, inspect humidity plug and barrier material. If humidity exceeds 40%, open bag and inspect component for corrosion. Repair any damage found. Replace desiccant and repackage.

(d) **Level III Dynamic.** No maintenance is required.
(4) Depreservation.
(a) Remove barrier material.
(b) Clean in accordance with paragraph 3-94a.
(c) Inspect in accordance with paragraph 3-94b.
(d) Treat corrosion in accordance with paragraph 3-94c.
(e) Aluminum bladed propellers only. Perform NDI inspection of blade taper bores in accordance with applicable MIMs.

(5) Represervation. Propellers in storage shall be depreserved and represerved in accordance with this paragraph every 36 months.

4-31. ROTOR AND HUB SYSTEM COMPONENTS.

a. Rotor Blades.

Cleaning Compound, Aircraft MIL-PRF-85570 Type II

(1) Cleaning. Remove grime, oils, greases and exhaust stains from helicopter rotor blades using a cloth wet with cleaning solution (1 part MIL-PRF-85570 Type II in 9 parts fresh water). Rinse with fresh water.

(2) Inspection. Examine rotor blades for fretting and surface corrosion. Inspect corrosion prone areas such as erosion strips, tip caps, aft spar areas and attach points.

(3) Corrosion Control. Arrest and remove corrosion in accordance with NAVAIR 01-1A-509-2.

(4) Protection.

CAUTION
Synthetic type oils, such as MIL-PRF-23699, and some solvents may attack nonmetallic materials used in rotor blades. Maintain blades free of synthetic type lubricants and use only the cleaning materials specified by this manual, NAVAIR 01-1A-509-2, or the applicable MIM.

Rotor blades are critical items which shall be handled with care at all times. Use only the equipment and procedures specified by the applicable MIM when handling blades:

Compound, Corrosion Preventive MIL-PRF-16173 Grade 2

(a) Level II. Protect blade attaching points and unpainted metallic portions of the blades with soft film CPC, MIL-PRF-16173 Grade 2. Wrap and package blades in reusable containers, MIL-PRF-5806, and store in accordance with NAVSUP P700 and the applicable MIM.

(b) Level III Static.

1. Protect blade attaching points and unpainted metallic portions of the blades with soft film CPC, MIL-PRF-16173 Grade 2. Wrap areas with applied CPC with barrier material, MIL-PRF-121.

2. Cushion sharp edges with cushioning material, A-A-59135 Grade A, or bubble wrap, PPP-C-795. Secure cushioning material to blade with tape, SAE AMS-T-22085 Type II. Cushioning shall be clean and dry to minimize possibility of corrosion.

2. Create bag for component using MIL-PRF-131 Class 3 barrier material. Ensure that the sealed edge of the bag that would normally be opened for inspection is sufficiently large to permit two subsequent resealings after component inspection. If there is a fold over side of the bag it shall wrap the spar edge.
4 Install humidity plug, SAE AS26860 Type II (see Chapter 6, Section II). Humidity indicator card, MS20003, is not authorized for Level III Static preservation. Use humidity plug only.

Desiccant, Activated
MIL-D-3464 Type I

5 Position the blade on the bottom piece of the MIL-PRF-131 barrier paper. Lay a sheet of barrier material, MIL-PRF-121 or MIL-PRF-131 Class 1, on the blade surface and secure with tape, SAE AMS-T-22085 Type II. Place ten sixteen unit bags of desiccant, MIL-D-3464 Type I, on top of the barrier material. Additional desiccant may be required for storage areas that are not environmentally controlled (no heating or air conditioning) or subject to high humidity. Desiccant shall not be placed behind or near humidity indicator.

6 Minimize trapped air inside bag by compressing bag to the maximum extent practical. Using a vacuum line, remove all trapped air inside bag prior to final seal.

7 Heat seal bag.

8 Store blades on racks or in suitable containers to prevent mechanical damage.

(c) Level III Dynamic. Individually wrap blade with barrier material, MIL-PRF-131 Class 1, secured with tape, SAE AMS-T-22085 Type II. Place wrapped blade in a suitable container that provides sufficient protection from handling damage. Place container in a dehumidified enclosure (see Chapter 6).

(5) Maintenance.

(a) Level II and Level III Static. Every 28 days, inspect outer wrapping for integrity and humidity indicator card or plug. If outer wrapping is damaged or humidity exceeds 40%, open bag and inspect component for corrosion damage. Repair any damage found. Remove and replace desiccant, and reseal bag.

(b) Level III Dynamic. No maintenance is required.

6 Depreservation. Remove blades from containers, if applicable, and remove barrier material. Clean, inspect and treat corrosion as specified above. Install, check, and secure blades in accordance with applicable MIM.

b. Rotor Heads and Hubs.

CAUTION

Some rotor heads have teflon-lined bearings in the control system linkage. To prevent possible damage to teflon inserts from accumulations of abrasive materials and cleaning solvents, avoid applying CPCs, lubricants and solvents to these items.

Cleaning Compound, Aircraft
MIL-PRF-85570 Type II

Solvent, Degreasing
MIL-PRF-680 Type II or III

(1) Cleaning. Remove grime, oils, greases and exhaust stains from rotor heads and rotor hubs using a cloth wet with cleaning solution (1 part MIL-PRF-85570 Type II in 9 parts fresh water). Rinse with fresh water. For persistent grime or CPCs, follow with a cloth wet with degreasing solvent, MIL-PRF-680 Type II or III.

(2) Inspection. Make sure that drain holes in water entrapment areas are open and functioning properly.

(3) Corrosion Control. Arrest and remove corrosion in accordance with NAVAIR 01-1A-509-2.

Compound, Corrosion Preventive
MIL-PRF-16173 Grade 2
4-23/(4-24 Blank)

(4) Protection.

(a) Level I. Lubricate in accordance with the applicable MIM. Coat exposed metal surfaces with soft film CPC, MIL-PRF-16173 Grade 2. Cover heads with barrier material, MIL-PRF-131 Class 1, held in place with tape, SAE AMS-T-22085 Type II.

(b) Level II.

1 Lubricate in accordance with the applicable MIM. Coat exposed metal surfaces with soft film CPC, MIL-PRF-16173 Grade 2.

2 Cushion projections, sharp edges, or other areas that may damage wrapping material, with foam, A-A-59135 Grade A, or bubble wrap, PEP-C-795. Cushioning shall be clean and dry to minimize possibility of corrosion.

3 Create bag for component using MIL-PRF-131 Class 1 or 3 barrier material. Ensure that the sealed edge of the bag that would normally be opened for inspection is sufficiently large to permit two subsequent resealings after component inspection.

4 Install humidity plug, SAE AS26860 Type II, in barrier material, or create a window in the barrier material for a humidity indicator card, MS20003, and install card. See Chapter 6, Section II, for installation procedures.

5 Install desiccant in package (use one 16-unit bag per 2 cubic feet of interior space). Desiccant shall not be placed behind or near humidity indicator. Desiccant shall not contact metal surfaces of component; if necessary, place desiccant on a piece of barrier material, MIL-PRF-131 Class 1.

6 Minimize trapped air inside bag by compressing bag to the extent practical prior to final seal.

7 Heat seal bag.

8 Store components in suitable containers or on racks to prevent mechanical damage.

(c) Level III. Lubricate in accordance with the applicable MIM. Store in a dehumidified enclosure (see Chapter 6).

(5) Maintenance.

(a) Level I. Every 28 days, check for deterioration of covering system; repair and replace as necessary. If barrier system is compromised, inspect rotor heads for water entrapment and corrosion, and correct in accordance with NAVAIR 01-1A-509-2.

(b) Level II. Every 28 days, check for deterioration of covering system; repair and replace as necessary. Check humidity indicator; if humidity exceeds 40%, open bag and inspect component. If barrier system is compromised, inspect rotor head for water entrapment and corrosion, and correct in accordance with NAVAIR 01-1A-509-2. Remove and replace desiccant, and reseal bag.

(c) Level III. No maintenance required.

(6) Depreservation. Remove cover or barrier material. Clean, inspect and treat corrosion as specified above. Service and lubricate rotor heads and hubs in accordance with applicable MIM.

4-32. SAFETY AND SURVIVAL SYSTEM COMPONENTS.

a. Oxygen system components shall not be exposed to hydrocarbons (oils, greases, fuels and preservatives) or to any other materials not specifically designated for use on oxygen systems. To prevent particulate matter contamination, all openings shall be kept sealed with authorized closures.

b. Parachutes shall be stored and handled at all times in accordance with the requirements of NAVAIR 13-1-6.2. Whenever possible, parachutes packaged for indefinite storage shall be packed and stored in a loosely folded or "fluffed" condition.

c. Flight clothing, perishables, and pilferables shall be packaged in accordance with MIL-STD-2073-1. Detailed packaging instructions for full pressure suits may be found in applicable NAVSUP preservation and packaging instruction.

4-33. MISCELLANEOUS EQUIPMENT. Most special devices have preservation and packaging instructions issued for each piece of equipment. See NAVSUP P700 for additional information.
SECTION IV. PACKAGING OF REMOVED COMPONENTS

4-34. PURPOSE. This section provides information on instructions and specifications, materials, basic packaging methods, and marking and closure requirements for packaging components. The following publications are available through Naval Logistics Library (https://nll.ahf.nmci.navy.mil/) and the MIL-SPEC data system (http://assist.daps.dla.mil/quicksearch).

4-35. GENERAL GUIDELINES. Packaging and handling instructions are provided by various entities. The publications and standards listed below are the primary references for the proper handling, preservation and packaging of repairable/removed components.

a. NAVSUP Weapon System Support (WSS).
   (1) A0-PHS&T-MIM-000, Packaging, Handling, Storage and Transportation for Retrograde Shipment of Aviation Depot Repairables.
   (2) NAVSUP P485 (Volumes 1 3), Naval Supply Procedures.
   (3) NAVSUP P505, Preparation of Hazardous Material for Military Air Shipment.
   (4) NAVSUP P700, Common Naval Packaging. This publication is available on-line at https://tarp.navsisa.navy.mil/.

b. Military Standards.
   (1) MIL-STD-129, Military Marking for Shipment and Storage. This standard provides the requirements for the uniform marking of military supplies and equipment for shipment and storage.
   (2) MIL-STD-648, Design Criteria for Specialized Shipping Containers. This standard establishes general design criteria and associated tests for specialized shipping containers used by the Department of Defense. Definitive requirements for specific containers are defined by the individual acquisition or task order. This standard also describes performance requirements for shipping containers.

c. Department of Defense.
   (1) DTR 4500.9-R, Defense Transportation Regulation - Part II, Cargo Movement.
   (2) Forms.
      (a) DD 1574, Material, Serviceable Tag (0102-LF-014-5600).
      (b) DD 1577-2, Material, Unserviceable Repairable Tag (0102-LF-016-0000).
   (3) OPNAVINST 5442.2, Aircraft Inventory Reporting System. This instruction provides reporting instructions concerning the inventory and logistics flow of Navy and Marine aircraft, and specifies policies and procedures relating to accounting for such aircraft.

4-36. MATERIALS.

a. Tapes.
   (1) Pressure Sensitive Tape. Noncorrosive tapes conforming to SAE AMS-T-22085 shall be used for all preservation operations such as closing of openings to exclude foreign matter, attaching barrier material and tags and securing cushioning material. When using approved tapes for preservation and packaging, do not apply tape directly to machine finished bare metal surfaces or transparent acrylics. Select an adjacent noncritical painted surface for attachment.
   (2) Masking Tape. Paper masking tapes shall not be used for preservation or packaging except for temporary holding of setup box segments during assembly, or when specifically authorized by an engineering directive for a special situation. Because paper masking tapes are corrosive under certain conditions, they shall be removed from all metallic surfaces before items are packaged and before adhesion has built up to the point where tape removal is difficult or adhesive transfer results. Maximum time for removal can vary from a few hours to several days depending on ambient conditions and type/amount of paint saturation. Ordinarily, masking tapes shall be removed no later than the next consecutive work shift after painting is complete or within 24 hours, whichever is sooner.
(3) Water Proof/Resistant Tape. A-A-1671 tape shall be used for domestic carton closures. ASTM D5486 tape shall be used for weather resistant carton closures.

b. Seals Caps and Plugs Used for Fluid System Openings. Seals, caps and plugs used in fuel, lubricating oil, and hydraulic systems shall be designed to positively seal against loss or leakage of fluids under an internal pressure of 2-5 psig. Plastic closures shall be compatible with the operational/testing/preservation fluid used in the component. Refer to NAVAIR 01-1A-20 and NAVAIR 01-1A-17 for authorized closures.

c. Closures, General. For used assemblies and components received for packaging from other activities including those items received through screening, closures shall be installed as necessary to prevent immediately obvious leakage of liquids into the package and to prevent internal contamination by freeflowing cushioning materials. When items are received without necessary closures installed, each individual assembly or unit involved shall be tagged with the following notation: "Unit received for packaging without proper closures installed. Internal particulate contamination suspected." These provisions do not apply to assemblies and components generated by the depot.

4-37. PACKAGING. Well designed packaging protects components from damage from a variety of hazards.

a. Climate. During the shipping, handling and storage cycle, removed components may be subjected to a wide range of weather conditions including extremely low and high temperatures, rain, snow, salt spray, dust and humidity. These conditions can cause drying, cracking, abrasion, soaking, corrosion, mildewing and rotting damage.

b. Mechanical Hazards. While being shipped, handled and stored, removed components may be subjected to mechanical damage such as vibration, impacts, stacking (crushing), and abrasion.

c. Radioactive Materials. The local control of radiological safety hazards is assigned to the Occupational Safety and Health Manager and/or the Station Medical Officer. General regulations for the handling of radioactive materials may be found in NAVMED P5055, Radiation Health Protection Manual. Specifications for the marking of commodities and containers to indicate radioactive material are contained in MIL-STD-129. For purposes of this specification, radioactive items shall be packaged in accordance with the packaging data supplied by NAVSUP P700.

d. Hazardous Materials. Regulations governing the packaging, marking, labeling and shipping of hazardous materials by land, sea or commercial air are contained in NAVSUPINST 4030.55 and NAVSUP P505 shall be complied with when shipping hazardous materials by military aircraft.

4-38. BASIC PACKAGING METHODS. The following packaging methods have been established to provide uniform nomenclature in accordance with MIL-STD-2073-1. For this manual, only Methods 40, 30 and 50 are permitted for aircraft components.

a. Method 40 (formerly Method IA). Preservation coating, wrap and cushioning within a heat sealed, water vaporproof barrier bag. This method provides water vapor protection.

b. Method 30 (formerly Method IC). Preservative coating, wrap and cushioning within a heat sealed greaseproof and waterproof barrier bag. This method provides protection from both oil and water intrusion.

c. Method 50 (formerly Method II). Same as Method 40 except for the addition of desiccant inside of the heat sealed bag. This method provides the highest degree of water vapor protection for delicate or corrosion sensitive items.

4-39. UNIT CONTAINER. After the component has been properly protected as described in Section II or III, it shall be placed in a unit container. If a unit or reusable container does not exist or was thrown away or destroyed, then a suitable container can be assembled from the supply of shipping type fiberboard or fast pack boxes. Place enough cushioning material on the bottom, sides and top of the container to adequately protect the wrapped component. For large items, it will be necessary to request a new container or crate or have one built.

a. Shipping Container.

(1) For fiberboard boxes, check the certificate label marked on the side for maximum size and weight allowable. Normally, these boxes are not used for items over 70 pounds gross weight. Seal fiberboard boxes with ASTM D5486 Type V tape, making sure that none of the labeling is covered. Reinforce with strapping tape.
(2) Specialized containers or crates can be locally manufactured if a carpenter shop is available. Wood and plywood boxes shall be reinforced with steel or plastic strapping. The two specifications that are commonly used as construction guidelines are ASTM D6251 and ASTM D6256.

(3) Items packed in a Reusable Shipping and Storage Container shall comply with the installation instructions and NAVSUP P700.

(4) Any box over 200 pounds shall be skid mounted or shipped on a pallet.

b. Consolidation. After repairables are packed and identified, they may be consolidated into larger handling units. This can be done by strapping packages onto a pallet, or packing into larger boxes. If triple-wall boxes are used, they shall be strapped or nailed to a pallet. If pallets are not used, the triple wall-box is limited to 275 lb. gross weight and 48” x 40” x 32” (120 united inches) by motor freight rules. These limits do not apply when the triple-wall box is used on a pallet for consolidation. A practical maximum pallet load weight is 3,000 lbs.

4-40. MARKING AND CLOSURE.

a. Unit Container Marking.

(1) Mark each unit container with a label or hand writing on the box with the following information:

(a) Stock Number (NSN or NIIN).

(b) Part Number.

(c) Nomenclature.

(d) Quantity and Unit of Issue.

(2) If applicable, it is also appropriate to label the container identifying the condition of the component being shipped; for example, "Unserviceable Item, Return to an Authorized Repair Activity, Do Not Use."

b. Shipment Container Marking. When only one item is packed in a shipping container, mark as a unit container. Otherwise, mark the shipping container MULTIPACK and use a shipping label or tag, forms DD 1387 (label) and DD 1387-1 (tag).

c. Shipment Address Label. Military shipment label/tags shall be utilized when shipping unserviceable repairables through the Defense Transportation System as follows:

(1) Transportation Priority (TP)-1 (red border) shipping label/tag shall be used with movement priority designator (MPD 03 (red stripe)) items.

(2) TP-2 (blue border) shipping label/tag shall be used with MPD 06 (blue border) items.

(3) TP-3 (black border) shipping label/tag shall be used with MPD 13 items.

(4) Alternatively, a plain form may be used provided the TP number is printed in the appropriate block and the applicable color border is applied with a felt tip marker.

(5) The following data shall be included in the overseas or domestic address marking as applicable:

(a) Transportation Control Number (TCN). The TCN shall be shown with a space between each of the data elements, e.g., V03362 6070 0167 RXX.

(b) RDD or expedited handling code.

(c) Project code, when specified. (Clear project names are not required but may be shown at the option of the service/agency concerned.) When shown, the project name shall be separate and distinct from the address marking, but shall appear on the same side as the address marking.
(d) Consignor (shipping activity).
(e) Transportation priority.
(f) POE/APOE (overseas shipments only).
(g) POD/APOD (overseas shipments only).
(h) Consignee (receiving activity).
(i) Piece Number (not required for shipments of a single commodity in standard pack containers/packaging).
(j) Total pieces.
(k) Weight (each piece).
(l) Cube (each piece).

**d. Parcel Post Packages.** Parcel Post (U.S. Mail fourth class) is suitable for sending small items from 1-70 pounds and a total length and girth of less than 100 inches (longest side of package plus total measurement around the thickest part of the package). The container shall be of metal or wood or of a good quality fiberboard. Padded mailing envelopes are acceptable for appropriately sized smaller items. The container shall be secured closed by stapling or taping. Boxes shall be reinforced with strapping tape. The shipping label is the prefranked type with the postage and fees paid by the Navy (DOD 316). The only restrictions are that there shall be no projecting nails, staples or anything sharp; and that nothing appears on the address block below the City, State and Zip Code.
SECTION V. HANDLING REMOVED COMPONENTS

4-41. PURPOSE. This section provides guidelines for handling removed components to prevent physical damage.

4-42. GENERAL. Removed components require special handling in order to prevent physical damage. Components shall be protected by the appropriate CPC, intimate wrapped with a suitable barrier material and then overwrapped with cushioning (i.e. bubble wrap) or placed into a shipping container, crate or transportation fixture that provides adequate protection from mechanical damage. If removed components are not protected, they may be subjected to damage from crushing, abrasion, puncture, falling, vibration, fretting, water intrusion, sunlight and a variety of industrial accidents. Levels of protection have been established by MIL-STD-2073-1 to cover a variety of circumstances:

a. Level A. Protection required to meet the most severe worldwide shipment, handling, and storage conditions. A Level A pack shall, together with the applied preservation, be capable of protecting material from the effects of direct exposure to extremes of climate, terrain, and operational and transportation environments. Examples of situations which indicate a need for use of a Level A pack are: War Reserve Material, mobilization, strategic and theater deployment and employment, open storage, and deck loading. Examples of containers used for Level A packing requirements include overseas type wood boxes, and plastic and metal reusable containers.

b. Level B. Protection required to meet moderate worldwide shipment, handling, and storage conditions. A Level B pack shall, together with the applied preservation, be capable of protecting material not directly exposed to extremes of climate, terrain, and operational and transportation environments. Examples of situations which indicate a need for use of a Level B pack are: security assistance (for example, Foreign Military Sales (FMS)) and containerized overseas shipments. Examples of containers used for Level B packing requirements include weather-resistant fiber drums, and weather-resistant paper and multi-wall shipping sacks.

d. Large, cumbersome items (such as wing panels) require special crates or rolling cradles. These crates or rolling cradles shall be designed with padded supports or bucks to provide the proper support across the entire component surface.

e. Composite panels require special carrying cradles that provide edge support as well as side protection. If special cradles are unavailable, then the panels shall be wrapped in barrier material, MIL-PRF-131 Class 1, taped in place with SAE AMS-T-22085 Type II tape, and then overwrapped with bubble wrap (refer to Section III). The package shall be marked with a label with red lettering on a yellow background reading: "CAUTION, COMPOSITE PANEL". These panels shall not be piled or stacked.

f. Delicate instruments shall always be handled in their specific shock and vibration damped containers (refer to Section III). Hard wheel forklifts rattling over uneven roads or hangar decks can destroy a sensitive instrument during transportation.

g. Electrostatic discharge sensitive (ESDS) devices shall be specially handled as described in the specific MIM or work package. ESDS packaging and labeling procedures shall be followed in order to prevent high voltage discharge damage to microcircuits. ESDS devices shall be handled, marked and packaged in accordance with the requirements of COMNAVAIRFORINST 4790.2, NAVSUP P485, and MIL-HDBK-263.

4-43. HANDLING GUIDELINES. The following is a list of common sense guidelines for the proper handling of removed components. The list is by no means complete but it does touch on the more important aspects of component handling.

a. Fixturing cradles or special handling devices shall be in good condition and maintained periodically.

b. Small components shall be overpacked in a strong, conspicuous container that cannot be crushed or misplaced. As many similar small items as possible shall be packed in a single container.

c. Heavy items shall be placed in a container that is strong enough to support them and still allow a forklift or other mechanical handling device to move it around.

d. Large, cumbersome items (such as wing panels) require special crates or rolling cradles. These crates or rolling cradles shall be designed with padded supports or bucks to provide the proper support across the entire component surface.

NAVAIR 15-01-500
01 September 2013
h. Transportation dollies that carry engines, transmissions or rotating electrical components shall have pneumatic tires and damped suspensions in order to prevent fretting or false brinnelling damage to rolling element bearings.

i. Pallets that carry properly protected and packaged components shall be in good condition and the components shall be strapped down to prevent load shifting. Fiberboard boxes shall be tied down with fiber or nylon rope. Wooden or metal crates and compressed gas cylinders shall be strapped down with metal straps.

j. Pallet containers/bins (or pigpens) shall be in good condition and strong enough to capture several items at a time. It is recommended that the bin be padded with horsehair cushioning covered with canvas in order to protect the more delicate or fragile items. To allow for pallet bin stacking, the components shall not be placed in the bin higher than the top board.

k. Specialized containers or crates can be locally manufactured. The two specifications that are commonly used as construction guidelines for wood cleated boxes are ASTM D6251 and ASTM D6256.
SECTION VI. REUSABLE CONTAINERS

4-44. PURPOSE. This section provides procedures for component/engine preparation, installation (canning) and removal from reusable containers. Table 4-1 lists some items that are typically stored in reusable containers.

4-45. COMPONENT PREPARATION. Components require a basic preservation treatment to ensure they remain protected before, during and after storage. Protect systems and subsystems of removed components in accordance with the instructions in Section II or III of this chapter.

4-46. CONTAINER PREPARATION. Although it is desirable that new or newly reconditioned containers be used for new or newly overhauled components, serviceable containers may be used any number of times without reconditioning as long as minimum standards are met. Rigid containers for both ready-for-issue and repairable components shall be structurally sound, clean and capable of being sealed and/or pressurized.

NOTE

Reusable rigid containers for engines shall not be used for purposes other than storage and shipment of engines unless specifically directed by the appropriate APML.

a. Serviceable Containers. Prior to the installation of a component in a serviceable container the following steps shall be observed.

(1) Clean the container of extraneous material such as liquids, used desiccants, and packaging material.

(2) Inspect the mating surface flanges for distortion, gouges, or other conditions which might affect sealing properties.

(3) Ensure that the rubber seal is not broken or cracked and is resilient enough to adequately seal the clamped joint.

(4) Check the mounting rails and suspension system for integrity and security.

Table 4-1. Components Typically Stored in Reusable Containers

<table>
<thead>
<tr>
<th>COMPONENTS</th>
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<tbody>
<tr>
<td>Antennas</td>
<td>Gear Boxes</td>
</tr>
<tr>
<td>APUs</td>
<td>Propellers</td>
</tr>
<tr>
<td>Blades</td>
<td>Rotor Heads</td>
</tr>
<tr>
<td>Engines</td>
<td>Radio Receivers</td>
</tr>
</tbody>
</table>

NOTE

Repeat mount inspection after the component is installed in the container.

(5) Check rubber shock mounts for cracks, tears, bond separation, splits and other defects that would affect serviceability. Shock mounts with cure dates over 12 years old shall be replaced.

(a) Shear type mounts shall be load tested in accordance with applicable NAVSUP manual at rework or every 30 months. Testing requires an inspection of the shock mounts for cracks, splits, tears, bond separation or other defects while under a 1G load. If a test fixture is not available, loading may be simulated by installing the item in the container.

(b) Compression type mounts do not require a load test and shall be replaced only if deterioration is detected by visual inspection.

(6) Check the breather or relief valve for proper operation and perform a leak check after installation of component.

b. Unserviceable Containers. If a container is not serviceable but is economically repairable, schedule it for reconditioning in accordance with the procedures of the following NAVSUP manuals:

(1) AG-830AC-MEB-000, Reusable Shipping and Storage Containers - Aluminum.
c. Container Markings. If a previously used container is utilized, remove or cover all old shipping data, dated preservation markings and any data not applicable to the unit to be stored or shipped. Refer to paragraph 4-50 for marking instructions.

4-47. COMPONENT INSTALLATION GUIDELINES. The following are special container mounting requirements which may be characteristic of a specific component or group of components.

NOTE

The applicable maintenance instruction manual for each component model shall always be referred to for specific requirements before installing components in containers.

a. Barrier Material. Remove tape from ventilation holes and exhaust ports. If barrier material, MIL-PRF-131, has been used to seal the openings, ventilation may be provided by puncturing the foil with a pencil or other sharp object in approximately twelve places. Ensure that all fluid system openings are positively blanked off.

CAUTION

Avoid coiling hoses and leads too tightly, particularly thermocouple leads and teflon hoses or bellows type flexible tubing, as small radius bends may cause serious damage to these components.

b. Electrical Leads and Hoses. Secure free ends of electrical leads or flexible hoses to any convenient rigid surface to prevent vibration damage during handling and shipping.

c. Hardware. In order to minimize misalignment distortion, most components require the use of special tolerance bolts, bushings or spacers to attach container hardware directly to the component housings. Always check the appropriate service instruction manual to assure the use of correct mounting hardware.

WARNING

Ensure engine/fuel operated components have been properly preserved with MIL-PRF-6081 Grade 1010N preservation oil, and lines have been properly capped or blanked off in accordance with paragraph 4-19. Every effort shall be made to hot preserve engines in accordance with paragraphs 3-44 and 3-82 prior to containerization.

d. Component Installation. After the component has been prepared for installation in the container and the proper lifting eye or sling attached (refer to the applicable service instruction manual), the following general installation procedures shall be followed:

1. Installing Brackets. Remove the flight or stand brackets from the component brackets or mounts as required. Torque bolts to required value and safety wire or use lock nuts when required. Refer to the applicable service instruction manual for torque limits.

2. Installing Rails. Install the side rails, plates or special mounting brackets and torque bolts to required values, safety wire or lock when required.

CAUTION

Damage can occur when external engine accessories or components are used as hand holds during the lowering process.

3. Placing Component in Container. Position the bottom section of the container under the component and carefully lower the component into the container, aligning the holes in the side rails or shipping brackets with the mounting studs or holes in the shipping container. Secure the rails with the proper bolts and nuts. Torque
the nuts or bolts to the required value. Remove the sling or lifting eye from the component. For instructions on installing components in containers designed with a waterproof bag inside a rigid container, refer to the applicable component maintenance instructions.

Desiccant, Activated
MIL-D-3464 Type I

CAUTION

To ensure fully activated desiccant at all times, keep desiccant sealed in the storage container until time of use and avoid delays in closing and sealing the component container. Desiccant and humidity indicators shall not contact liquid water at any time.

(4) Installing Desiccant. Place appropriate amount of desiccant, MIL-D-3464 Type I, in the basket provided in the shipping container. If no amount is indicated for a particular container, use the formula in Chapter 6, Section II, to calculate the amount of desiccant required or use one 16 unit bag per cubic foot. Refer to Chapter 6 for additional requirements for the use of desiccant.

NOTE

If a bag of desiccant is placed too near the indicator it may give a false reading by indicating a local condition rather than a general condition within the enclosed space.

(5) Installing Humidity Indicator. Install the humidity indicator, SAE AS26860, in the container. If a humidity indicator plug, MIL-P-6131, is used, install with a gasket in its respective receptacle in the container and torque to 25 inch-pounds. If an indicator card, MIL-I-8835, is used, fasten it securely in a position to permit its easy viewing through the container window. Refer to Chapter 6, Section II, for additional information on the use of humidity indicators.

e. Container Lid Installation.

(1) If required, attach a suitable sling to the lifting eye in the top section of the container marked “LIFT HERE” and lower the top section in place on the lower section with the aid of two long drift pins, one at each end of the cover.

NOTE

When tightening the flange bolts, alternate from one side to the other, and apply less than full torque when working around the flange the first time.

(2) Install the closures using either the captivated quick release latches or the supplied flange bolts, nuts and washers, and draw down evenly according to the applicable MIM. The final torque is determined by torque values established for the bolts used. The torque loads listed in Table 4-2 may be used for all cadmium plated steel nuts of the fine or coarse thread series which have approximately equal number of threads and equal face bearing areas.

(3) Latches do not require torquing of their drawbolts. Latches shall only be tightened enough to prevent leakage during leak testing.

CAUTION

The use of grease or oil as an aid to sealing shall be avoided as permanent damage to the rubber flange seal may result.

Compound, Corrosion Preventive
MIL-PRF-16173 Grade 1

(4) Touch up flange bolts with preservative compound, MIL-PRF-16173 Grade 1, after final torquing.

f. Installation Recordkeeping. For engine installation, ensure that the appropriate entries are made in the Corrective Action section of the CNAF 4790/60. Refer to paragraph 4-51 of this manual.

4-48. FINAL TESTING OF NONPRESSURIZED CONTAINERS. Most containers in service today are of the controlled breathing type. Controlled breathing containers have two-way breather valves capable of equalizing both pressure and vacuum conditions, as opposed to relief valves which are only designed to relieve pressure buildup. Perform final container leak check testing of nonpressurized container as follows:

a. Seal all breathing devices and insert suitable pressure fittings and gages.

b. Close container and seal in normal manner.
### Table 4-2. Recommended Torque Values (inch-pounds)

<table>
<thead>
<tr>
<th>Fine Thread Series</th>
<th>Coarse Thread Series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tap Size</strong></td>
<td><strong>Tap Size</strong></td>
</tr>
<tr>
<td><strong>Tension Type Nuts</strong></td>
<td><strong>Tension Type Nuts</strong></td>
</tr>
<tr>
<td><strong>MS20365 &amp; NASM310</strong></td>
<td><strong>MS20365 &amp; NASM310</strong></td>
</tr>
<tr>
<td>Aluminum</td>
<td>1.0 - 1.1</td>
</tr>
<tr>
<td>Fiberglass</td>
<td>1.0 - 1.1</td>
</tr>
<tr>
<td>Thermoformed Plastic</td>
<td>0.5 - 0.6</td>
</tr>
<tr>
<td>Steel</td>
<td>1.0 - 1.1</td>
</tr>
</tbody>
</table>

#### WARNING

Container may explode or fasteners may fail during testing. Use protective barriers to avoid injury to personnel.

#### NOTE

Clean dry air is air that is free of particulates and contains no more than 0.06 ml of water per liter of air.

c. Pressurize the container with air from a compressed air supply. If clean dry air is not available, compressed nitrogen may be used. Gradually pressurize container until the initial pressure is achieved (see Table 4-3), or leakage becomes apparent.

d. Allow pressure to stabilize for 30 minutes.

e. Monitor pressure for an additional 30 minutes, then read the gage pressure. A loss in pressure in excess of 0.05 psig (corrected for changes in temperature and barometric pressure) shall be considered unsatisfactory.

f. If pressure loss is unsatisfactory, check for leaks using a Leak-Tek solution. Apply solution to all welds, container gasket area, around windows, humidity indicator, valve area, and any other suspected leak area.

g. Tighten bolts around access panels or gasket area if leaks are detected in these areas.

h. If leak cannot be corrected by tightening, remove the component from the container and repair container in accordance with the applicable container manual (see paragraph 4-46b).

i. Engine or fuel component containers shall be certified as Gas Free as required for shipment or storage.
4-49. FINAL TESTING OF PRESSURIZED CONTAINERS. Some older pressurized containers still exist in the supply system. Most of these are steel containers for engines. These containers have relief valves instead of breather valves. Perform final testing of pressurized containers as follows:

a. Ground container to common ground.

b. Relief Valve Test. Test relief valves for proper performance in accordance with the following procedures:

   **WARNING**

   Excessive pressures may rupture the container and endanger personnel. The oil and fuel seals utilized in certain components will become deformed or rupture when subjected to excessive static pressure. To ensure accuracy and safety, use pressure gages which are graduated in 0.25 psi increments with a maximum range of 0-15 psig.

   **NOTE**

   Clean dry air is air that is free of particulates and contains no more than 0.06 ml of water per liter of air.

   1. Pressurize container with clean dry air or compressed nitrogen to 0.5 psig higher than the positive pressure (psig) valve requirement listed in the "Relief Valve" column of Table 4-4. Set the source regulator to 2-5 psig above relief valve pressure rating. Use a hose attachment equipped with an on-and-off valve and appropriate adapter to the container’s filler valve. Remove the cap from the air valve and install a suitable adapter if required.

   2. Check that the relief valve has actuated and that air is flowing through valve.

   3. **Leak Check.** Leak check container as follows:

      1. After the pressure has dropped sufficiently to allow the relief valve to close, check entire container for leaks using soap solution around all closures, closure flanges, humidity indicators and threaded openings such as relief and filler valve receptacles.

       **CAUTION**

       DO NOT attempt to stop leakage at the closure area by over-torquing closure hardware or by application of gasket adhesives.

       2. Repair leaks, if necessary, and repressurize.

       3. If no leakage is noted with the soap solution, allow the container to stand for 12 hours and recheck pressure. If pressure has dropped less than 0.5 psig, then no further leak testing is necessary and the container is considered suitable for storage and shipment. If necessary, repair leaks, repressurize, and repeat testing.

   c. Container Lead Seal Installation. If required, after securing the container lid on RFI components, install two tamper-proof lead seals on the lid attaching bolts, over center latches, spaced 180 degrees apart. Installation of the seals may be accomplished by substituting two drilled bolts for the regular lid attaching bolts, or, if applicable, by using predrilled holes in the container flange. The drilled bolts may be used with plain hex nuts if the bolts are of sufficient length to allow installation of the seals outboard of the nuts when they are properly torqued.

   d. Engine or fuel component containers shall be certified as Gas Free as required for shipment or storage.

   e. Lead Seal Installation. If required, after securing the container lid on RFI components, install two tamper-proof lead seals on the lid attaching bolts, over center latches, spaced 180 degrees apart. Installation of the seals may be accomplished by substituting two drilled bolts for the regular lid attaching bolts, or, if applicable, by using predrilled holes in the container flange. The drilled bolts may be used with plain hex nuts if the bolts are of sufficient length to allow installation of the seals outboard of the nuts when they are properly torqued.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Relief Valve/Breather Valve Release Pressure</th>
<th>Container Operational Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL-C-5584B (Steel)</td>
<td>+10, +7 psig</td>
<td>+5 psig</td>
</tr>
<tr>
<td>MIL-C-5584C (Steel)</td>
<td>+2.5, -1.0 psid</td>
<td>+2.5, -1.0 psid</td>
</tr>
<tr>
<td>MIL-C-14200/A-A-52462Type I</td>
<td>+5 psig</td>
<td>+5 psig</td>
</tr>
</tbody>
</table>

Table 4-4. Container Relief Valve and Operational Pressure
4-50. MARKINGS ON CONTAINERS. The markings on component shipping containers are very important, not only to ensure proper handling, but also to provide preservation information on the component contained. Remove any old shipping labels or markings. Paint over old markings as required using acrylic paint, MIL-PRF-81352 Type I (see Table 8-12) or equivalent. Affix a new label in area indicated on container. Refer to the applicable MIMs or NAVSUP manual for container specific marking instructions.

a. Markings shall be of a color which provides the best available contrast with the background. Materials used for markings shall be either decals (preferred) or marking ink, A-A-208 (see Table 8-12). Refer to MIL-STD-129 for general information on acceptable labels and marking pens.

b. When adding markings to containers, ensure that only the authorized markings and marking materials are used and that they are placed in the specified locations in accordance with applicable MIMs or NAVSUP manual. Do not apply "special" or temporary markings over handling and precautionary markings. Careless and haphazard application of markings adds to the cost of rework and causes confusion.

c. To assure proper preservation maintenance of the component, all containers housing serviceable or repairable components shall contain the following minimum markings:

1. Preservation level.
2. Date of preservation.
3. Name of preserving activity.
4. Status of component (serviceable or repairable).
5. Component type.
6. Component serial number.
7. Provide a minimum of six spaces for periodic inspection dates.

d. Special Markings. The following special markings shall be added to each container when applicable:

1. Components for which a priority engineering investigation report is desired as a result of accident or failure, shall be marked "EI" in six inch letters, using a contrasting paint or stencil ink.

2. Components containing radioactive materials shall have the container marked with a radioactive material label as required by MIL-STD-129.

3. Marked "LIFT HERE".

NOTE

For additional protection, forms/records shall be placed inside resealable, clear plastic bags prior to being placed in the receptacle on the container.

e. Records. Place Accessory and Component Service Records and other applicable forms in the logbook binder and place in the forms receptacle provided on the container.

4-51. SHIPMENT AND STORAGE. Prior to shipment or storage of a canned engine or fuel component, the following shall be performed.

a. Pressurized Containers Only. Check the internal pressure of the container. Pressure shall meet the container operational pressure requirements of Table 4-4 or the applicable container specification.

b. All Containers. An entry shall be made in the Corrective Action section of the CNAF 4790/60 to identify the following as applicable:

1. The engine has been hot preserved in accordance with NAVAIR 15-01-500.

2. The engine has been cold preserved in accordance with NAVAIR 15-01-500.

3. The date the engine was preserved.

NOTE

Generally, if an engine has been drained and hot preserved, in accordance with paragraphs 3-44 and 3-82, it will contain only trace amounts of fuel. If an engine has been drained and cold preserved, in accordance with paragraphs 3-44 and 3-82, or not preserved at all, it may contain concentrations of residual fuel. Every effort shall be made to hot preserve aircraft engines. Only trained and designated personnel may certify pressurized containers for transportation. Refer to applicable mode of shipment or transport regulation.

b. All Containers. An entry shall be made in the Corrective Action section of the CNAF 4790/60 to identify the following as applicable:

1. The engine has been hot preserved in accordance with NAVAIR 15-01-500.

2. The engine has been cold preserved in accordance with NAVAIR 15-01-500.

3. The date the engine was preserved.
(4) The type of fuel last used to operate the engine (e.g. JP-5, JP-8).

(5) All lines have been capped/blanked off in accordance with NAVAIR 15-01-500.

(6) The container has been pressurized in accordance with NAVAIR 15-01-500 (pressurized containers only).

(7) The date the container was pressurized (pressurized containers only).

c. A copy of the completed CNAF 4790/60 shall be placed in the record receptacle located on the outside of the container.

4-52. MAINTENANCE OF CONTAINERIZED COMPONENTS.

a. Storage Inspections. Every 28 days perform the following:

(1) Check humidity indicator. If an out of limit condition is observed, replace container desiccant and indicator in accordance with the container MIM. Perform a leak check in accordance with paragraph 4-48 (Nonpressurized Containers) or 4-49 (Pressurized Containers). Reinspect within 24 hours.

(2) If the humidity within the container fails to come within the specified limits:

(a) Inspect the container using procedures in paragraph 4-46.

(b) Remove component and inspect for visible signs of corrosion (see paragraph 4-53). Correct if necessary.

NOTE
If the 28 day inspection and the prior to shipment inspection overlap, no 28 day inspection is required.

b. Prior to and after Shipment. Within 24 hours before and after shipment, perform a 28 day inspection.

c. Response to Corrosion/Damage. If corrosion or damage is observed upon the inspection of a container recently received in a shipment or in storage, the component inside shall be subsequently inspected (see paragraph 4-53). If no damage or corrosion is found on the component, it shall be reinstalled in a serviceable container using fresh desiccant.

4-53. COMPONENT REMOVAL GUIDELINES.
Components ready for depreservation, components in containers showing unsafe humidity indicator readings at time of inspection, or components with questionable preservation status shall be removed from their containers and inspected for corrosion and if necessary, repaired, represerved and reinstalled in a container using fresh desiccant. Any of these actions require a log entry.

a. Components shall be removed from their containers in reverse sequence of the procedures used during installation or in accordance with the following general requirements.

NOTE
Use these instructions in conjunction with the applicable maintenance instructions.

(1) Relieve any pressure in nonpressurized containers using the breather valve.

(2) Relieve the pressure in pressurized containers using the filler valve.

(3) Release cover latches or remove lid bolts. Lift the lid from the container with a suitable sling.

(4) Remove desiccant and handle in accordance with the requirements of Chapter 6.

(5) Remove any packaged accessories from the container.

(6) If necessary for adequate inspection, remove the component from the container (lower half) and place on an approved work stand.

NOTE
Replace or apply ventilated covers, plugs, closures, barrier material and CPC as applicable and in accordance with Sections II and III of this chapter.

b. Document all component removal dates, from rigid reusable containers, in the appropriate space of the container markings provided for this purpose.
4-54. PURPOSE. This section provides guidelines for shipping preserved, packaged components by land, ocean, or air.

4-55. INTRODUCTION.

a. General. If more than one mode of transportation is used during shipment of a component, packaging shall be compatible with all conditions to be encountered. If a portion of the shipment involves surface shipment by truck of more than 10 miles or shipment by rail or water vessel, the component shall be packaged in a rigid container or provisions shall be made to repack the component at the point where a different method of shipment is to begin. All components transported within the continental U.S. shall have at least two-thirds of the effective preservation time limitation remaining prior to shipment.

b. Components Received for Transshipment. Components packaged in metal containers shall be inspected within 24 hours before shipment, in accordance with Section VI of this chapter and represerved as necessary before transshipment. Components received in air shipment stands for transshipment shall be inspected for damage or unsafe conditions and corrected as necessary to assure safe delivery. If received components are scheduled for subsequent travel by air or truck for distances in excess of 10 miles, they shall be transferred to sealed metal containers in accordance with MIL-STD-2073-1. Dynamic components being truck shipped in air shipment stands without shock mounts shall be given special bearing brinnel protection by securing the loaded stand on scrap tires or similar resilient material.

c. Log Entries. All activities shall ensure that component logs and records under their cognizance are processed and maintained in accordance with COMNAVAIRFORINST 4790.2. All preservation/depreservation records shall be entered in Preservation/Depreservation Section, Form CNAF 4790/136A (AESR) for components. All entries shall cite this manual as authority. Ensure a copy of the CNAF 4790/60, including preservation/purging information in accordance with paragraph 4-51, is placed in the record receptacle located on the outside of the container.

4-56. LAND SHIPMENT.

a. Component Preparations. The component shall first be properly preserved in accordance with Sections II and III, and properly packaged in accordance with Section IV and VI, as applicable.

b. Shipment Protection.

(1) Rigid Containers. A rigid container, in accordance with the requirements in Section VI, is the preferred form of mechanical protection for aircraft components when transported by truck or train for a distance in excess of 10 miles.

(a) Rigid component containers are equipped with mounts or vibration isolators which will prevent vibration damage to the components under ordinary shipping conditions. Proper blocking and bracing of containers in cars, trucks or vessels is extremely important to ensure proper functioning of the container suspension systems.

(b) Loading and stowing instructions issued by the Department of Transportation and/or DoD instructions shall be consulted when loading components for shipment.

(c) Components received or delivered shall have the relative humidity checked within 24 hours prior to and after shipment (see paragraph 4-52). If either are out of limits, correct in accordance with paragraph 4-53.

CAUTION

Stacking of this type container in two or more layers during shipment and storage is prohibited.

NOTE

Reusable rigid containers for engines shall not be used for purposes other than storage and shipment of engines unless specifically directed by the appropriate APML.

(2) Shipping Stand or Container Lower Half. The use of appropriate shipping stands, dollies, cradles or container lower half for transporting aircraft components by truck or train, 10 miles or less, is acceptable.
CAUTION

Air shipment stands are designed to save weight and space and give mechanical protection to aircraft components subject to shipment by airlift. They shall not be used for shipment of components by truck except for transshipment of 10 miles or less over paved roads such as between local airports, from landing fields to local destinations, or for emergency movement of awaiting overhaul components when no containers are available.

(a) The use of locally manufactured stands and cradles may be necessary if rigid reusable containers are not available. These stands or cradles shall be approved by NAVSUP Weapons System Support (WSS) before use. Minimum standards shall be observed when manufacturing local stands, including consideration of the maximum dimensions permissible for specific cargo plane openings (see Chapter 7).

(b) If the shipment stand, dolly, or cradle is not shock mounted, secure the loaded stand on scrap tires or similar resilient material to minimize the possibility of brinell damage to the component bearings.

(c) The use of component specific stands or cradles is encouraged.

CAUTION

Avoid any material extending beyond the outer edges of the half-can flange as this contributes to shroud material damage when handling the component in confined areas.

To avoid corrosion damage, do not use polyvinyl chloride plastic sheeting to shroud components.

(d) Components mounted on stands, dollies, cradles, or component air shipping stands shall be protected from weather and foreign matter by installing suitable prefabricated covers or shrouds. When sealed, water-shedding, fitted and reusable component covers are not available, shroud type covers can be manufactured locally using MIL-PRF-131 Class 1 barrier material.

(e) If movement is necessary during inclement weather, the shrouded component shall be further protected by a tarpaulin or other waterproof cover. If shipment components are held under cover for longer than a few hours while awaiting or following transportation, the shroud or cover shall be loosened to allow free circulation of air around the component to prevent condensation of moisture.

4-57. OCEAN SHIPMENT. Refer to the requirements of paragraph 4-56 for mechanical protection of aircraft components during ocean shipment.

4-58. AIR SHIPMENT. Refer to paragraph 4-56 for mechanical protection requirements for aircraft components during air shipment.

a. Auxiliary power units shall be air shipped in completely dehumidified containers or packages.

CAUTION

Other cargo shall not be stowed on or against components during storage and shipment. Stacking of this type container in two or more layers during shipment is prohibited.

b. Components on air shipment stands or in container lower halves shall be loaded and secured with the component rotor shaft parallel to the direction of movement. Ensure components are shrouded. If the air shipment stand is equipped with stock mounts, no tiedown shall be attached to the component. Forward and aft tiedowns shall be arranged in such a manner that the smallest possible angle is obtained between the floor and tiedown cables.

c. Components in pressurized containers prepared for military airlift shall comply with NAVSUP P505.

CAUTION

To ensure the safety of flight personnel and to minimize equipment damage, it is important that all shipping stands used be structurally sound and capable of withstanding rough weather flight conditions. Neither the safety of flight personnel nor mechanical protection of the component shall be sacrificed in order to save weight.

d. Air shipping stands shall be tied down in accordance with the applicable aircraft loading instructions.
SECTION VIII. STORAGE AND MAINTENANCE

4-59. PURPOSE. This section provides information on storage location and guidelines for inspection and maintenance of components in storage.

4-60. STORAGE LOCATION.

CAUTION

Do not store containers in areas where water can pool, as the container's breather valve may cycle and ingest water.

a. Components in Rigid Containers.

   (1) Store containerized aircraft components inside a sheltered area, where the interior temperature will remain stable.

   (2) Containers may be stored outdoors on a covered, paved surface (e.g. a lean-to type structure over a concrete or asphalt surface) provided that the area is secure and has good drainage. The frequency of the container inspections shall be changed to 14 days, as cycling of outside temperatures decreases the life of the container desiccant.

b. Components in Flexible Containers (Bags). Components in flexible containers (bags) shall be stored inside a warehouse or shed (see Figure 4-1). Arrangement of components in the storage area shall be such that humidity indicators are readily accessible for inspection and maintenance purposes. Information on the equipment and setup for this type of storage can be found in Chapters 5 and 6.

c. Other Covers. Components stored on air shipping stands shall be stored indoors under cover and shall be protected at all times from the elements (see Figure 4-2). Storage in a humidity controlled (dehumidified) area or building is preferred.

4-61. MAINTENANCE OF STORED COMPONENTS.

a. General. When containers are used for long periods of time, particularly when stored outside, corrosion, material deterioration, or mechanical damage may occur. It may be necessary to repair or replace the container. Always remove the component from the container before starting repair on the container. The component shall be inspected and represerved in a reconditioned container for storage or issued for service. Refer to the applicable container MIM for repair procedures.

   b. Dehumidified Containers. A periodic inspection of the humidity indicator every 28 days (14 days for covered outdoor storage) is required for all components in dehumidified containers. If the internal relative humidity indicator is in excess of 40%, take corrective action as follows:

      (1) If the facility has component repair capability, the container cover shall be removed and the envelope opened to inspect for indications of corrosion. If no corrosion is evident, the desiccant shall be replaced with new material, the envelope evacuated and resealed and the cover reinstalled. If any corrosion is evident, affected areas shall be treated in accordance with NAVAIR 01-1A-509-2 and the component represerved as necessary and reinstalled in the container or issued for service.

      (2) If the facility does not have component repair capability, replace desiccant and reseal container. Note in log that humidity was out of range but no corrosion inspection could be performed. Component shall be inspected and treated for corrosion, if necessary, by the receiving activity prior to use.

   c. Nondehumidified Containers. Periodic inspection for components authorized to be packaged in this type of container is beyond the scope of this manual. Refer to applicable NAVSUP field instructions.
4-62. **LOG ENTRIES.** Log entries are mandatory when the following maintenance actions are accomplished:

a. Initial preservation.

b. When a container is opened for inspection of the component due to unsafe relative humidity indicator readings.

c. When the maintenance accomplished affects the storage time limitation of the component involved, i.e., when converting to another type of preservation.

d. When the component is represerved after having reached the end of its authorized storage time limitation.

e. Depreservation.
CHAPTER 5
BARRIER SYSTEMS

SECTION I. INTRODUCTION

5-1. INTRODUCTION. The physical barriers that are available to protect aircraft and aircraft components or systems are fairly basic. The level of preservation required for the aircraft or component is determined in accordance with Chapter 1. The chosen level then determines the required barrier. In general, Level I provides only temporary or short term protection. Level II provides additional protection but is still environment dependent. It is the usual choice for shipping and it is used extensively in desert storage. Level III dehumidified storage provides maximum protection and it is the most cost effective method of the three levels. The barriers that are called out in each level are summarized below.

   a. Level III. Dehumidified (DH) Storage. Dehumidified storage can be used for individual aircraft or for an entire shelter where many aircraft and components can be protected. Refer to Chapter 6 for information on the setup of a dehumidified storage system.

          (1) Rigid Shelters. Tension membrane shelters are freestanding structures that are constructed of a metal framework and covered with a urethane or vinyl coated polyester material. Pre-engineered structures are freestanding buildings consisting of a metal framework with metal sides and roof panels. These shelters come in a variety of sizes and can be erected in a few hours by a crew of four. The shelters have electrically powered vents at the top that provide four to five air changes per hour. However, by attaching a recirculating dynamic dehumidifier to the shelter, the inside atmosphere can be stabilized to 35±5% relative humidity (RH). The low and relatively constant RH provides the ultimate protection for aviation equipment with minimal maintenance. The shelters are manufactured in many sizes. The smaller units are used for single aircraft, as a DH warehouse (or workshop), or for storage of components. The largest shelters can accommodate several aircraft and a variety of components and support equipment for indefinite storage. Refer to Section II for details.

          (2) Shrouds. These are specialized covering systems that can be erected inside a hangar in order to provide localized DH protection for a variety of items. Shrouds can be manufactured by the tension membrane shelter manufacturers, custom made for individual application or locally assembled with off the shelf plastic sheet. Shrouds can be a rigid frame suspended horizontally from cables and attaching rings to an overhead hoist, or unsupported and used like a blanket. The space created by this shroud is then dehumidified. The shroud concept is intended to provide temporary DH protection to aircraft in-work or provide a quick setup for DH protection of delicate or corrosion sensitive components. Mechanics can work on the aircraft inside of the shroud or, using the hoist, lift the shroud completely away from the aircraft and then return it after the work shift. The shroud can be used as DH storage for removed components or aircraft peculiar support equipment, as well as an environmentally controlled workshop. Refer to Section III for additional information on shrouds.

          (3) Bag. The bag is a flexible cover that is custom fit to a specific aircraft. This cover seals the aircraft completely in a watervaporproof material which is then dynamically or statically dehumidified. Refer to Section IV for details.

   b. Levels I and II. Nondehumidified Storage. Nondehumidified storage, with the top cover, shippable coating, and tape and barrier methods, provides limited protection for the aircraft and components, and requires periodic represervation and maintenance of CPCs to sustain the protection.

          (1) Top Cover. The top cover is a cheaper version of the flexible cover that covers only the top surface of the aircraft and extends to the drip line. Straps hold the cover in place. Refer to Section IV for additional information on top covers.

          (2) Strippable Coating. Strippable coating is a two part covering method which is sprayed on the external surfaces of the aircraft or component. Tape and barrier is used to mask off or span only selected areas. Only during shipment is the aircraft/component completely covered by the strippable coating. Refer to Section V for details.

          (3) Tape & Barrier (T&B). Tape and barrier is used to cover selected areas of the aircraft or component to prevent water intrusion and damage by ultraviolet radiation. The tape and barrier method primarily uses pressure sensitive adhesive tape, SAE AMS-T-22085, and aluminized waterproof packaging material, MIL-PRF-131. Procedures for this type of protection can be found in Section VI.
(4) Shrinkwrap. Shrinkwrap is a low density polyethylene film that conforms to the aircraft when heated. Shrinkwrap is typically used for shipment. Refer to Section VII for details.

5-2. **AIRCRAFT MARKINGS AND PLACARDS.**

a. If aircraft identification markings are covered due to the preservation process, stenciled markings (using 1 inch minimum height lettering) shall be placed on top of the barrier material, strippable coating, shrinkwrap, top cover or T&B. The location shall be at ground level on the forward left hand side of the fuselage. The following preservation information (see Figure 5-1) shall be stenciled with weather resistant black ink (A-A-208):

   (1) Aircraft Model.
   (2) BUNO.
   (3) Level and Type of Preservation.
   (4) Date of Preservation.
   (5) Preserving Activity.

b. To aid loading and maintenance crews, apply appropriate stencils with arrows to indicate access provisions, lifting points, and drain openings. Whenever a symbol has been designed and approved, utilize the precautionary symbols of MIL-STD-2161 in lieu of wording indicating "LIFT", "TIE-DOWN", "NO STEP".

c. If cartridge activated devices and/or rocket motor escape devices are not removed before preservation, one of the Warnings in Figure 3-2 shall be applied to each side of the cockpit area. Lettering shall be red and a minimum of 1 inch in height.

---

**Figure 5-1. Proper Stencil Format**

F/A - 18E  
BUNO - 165111  
PRES TYPE - LEVEL II - SHRK  
4-1-13  
FRCSW
SECTION II. RIGID SHELTER

5-3. INTRODUCTION. In general, any freestanding rigid shelter is an effective barrier system when protecting aircraft and aircraft components in Level III preservation. Using rigid shelters as a barrier system allows accessibility to aircraft or components in preservation without disturbing the protection.

a. Types. Hangers, metal sheds, buildings, pre-engineered metal buildings, and tension fabric shelters have been successfully dehumidified to Level III standards provided the walls, ceiling, doors and floor are adequately sealed. The tension fabric shelter and pre-engineered metal building have been proven to be the most versatile and convenient of the rigid shelters. These structures are reusable, portable and come in a variety of sizes to accommodate any T/M/S aircraft and associated components/support equipment.

b. Material. Standard wood frame and wallboard structures should be sealed with oil primer and enamel topcoat. Metal sheds should be caulked on the overlapped seams and around fasteners. Doors shall be weather proofed with foam rubber seal strips or barrier material. Water vaporproof liners may be used inside buildings for sealing.

c. DH Unit Requirement. Refer to Chapter 6 for dehumidifier (DH) requirements to support Level III preservation in a rigid shelter.

5-4. TENSION FABRIC SHELTERS. A typical structure is shown in Figure 5-2.

a. Structure. The shelter is an aluminum extrusion frame supported tensioned structure built to a standard production size. The arch frame supports provide a clear span with no internal beams or posts. The shelter is designed to be easily transported and quickly erected and disassembled. Typical life of a tension fabric shelter is 8-10 years.

b. Environment.

(1) Weather Protection. The shelter, when properly erected and anchored with all doors closed and storm kits in place (when required) is designed to conform to the U.S. Uniform Building Code, with the recommended Aluminum Safety Factor of 1.95; fully exposed site to 70 m.p.h. (with storm kit to 90 m.p.h.), partially exposed site to 90 m.p.h. winds (with storm kit to 110 m.p.h., winds), and temperature exposure ranging from -20°F to 160°F.

(2) Shelter Site. The site(s) shall slope no more than 3% and shall provide a means for rain water runoff to preclude accumulation from around the structure perimeter. There should be no rock outcroppings (large rocks that cannot be easily picked up and removed), tree stumps or other obstruction within the building area(s).

c. Construction.

(1) Arches. The basic frame is composed of several identical arches, each made by connecting standard beam extrusions together using quick-connect joints. All components of each type shall be fully interchangeable. All extrusions in the frame shall be made from anodized 6061-T6 aluminum alloy. All castings shall be made from A356 aluminum alloy, heat treated to a T6 condition, and powder coated dry bronze. All extrusions and castings shall have a minimum five year warranty.

(2) Outer Shell Membrane Specifications.

(a) The shelter shall provide two double personnel doors giving an entrance/exit approximately 7' high and 3' wide. These doors shall be equipped with crash-bar style exits and glass windows. The doors shall be fitted in a frame and bolted into an assembly. The doors may be located in any bay depending upon customer requirements.

(b) Ventilation shall be provided in the form of electrically powered roof vents in the bays. The air movement shall circulate to allow hot air to exit through vents in roof. The ventilation shall provide approximately four to five changes per hour.
(c) The shelter shall have an interior lighting system. The lighting shall illuminate the floor area to 20 foot candles. General purpose 3 phase/240 VAC/60 Hz receptacles shall be provided. Distribution box, prewired harnesses, attachments and covers shall be provided with the electrical system.

(d) The shelter shall be designed to use storm kits in the event of severe winds, rain, and/or snow conditions as follows:

1. For partially sheltered site in winds above 70 m.p.h.
2. For fully exposed site in winds above 55 m.p.h.
3. The storm kits consist of wall cables and anchors and shall be installed when such storms are anticipated.

**NOTE**

The insulation material increases the "R" value up to "R-10" which greatly reduces heating and cooling loads if the shelter is to be used as a workshop or if maintenance personnel will be spending time in it during weather extremes.

(e) Composite fabric insulation that can be pulled along the inside of the shelter to form an air gap of approximately 4 inches wide may be provided with the shelter.

d. **Installation.** The shelter manufacturer may provide on-site equipment and assistance for erecting the shelter. A complete manual should also be provided. A complete shelter package shall include the following items:

1. The complete tension membrane structure.
2. Storm kit.
3. Personnel doors.
4. Interior lighting system.
5. General purpose 220 VAC/60 Hz receptacle service.
7. Patching kit containing adhesive and membrane material.

e. **Maintenance.** Periodically inspect the entire structure for signs of deterioration. The fabric material is especially vulnerable to mechanical damage. Wash the exterior surfaces of the structure with a mild soap (1 oz. detergent per gallon of water) solution about every 4 months. Rinse with fresh water and inspect for holes, rips and tears. Patch the holes with pieces of the membrane material with either the single component or the two part adhesive provided by the shelter manufacturer. If the fabric is too deteriorated for economical spot repairs, then the entire membrane should be replaced.

f. **Transport, Relocation and Shipping Information.** The shelters consist of lightweight components which nest or fold to allow easy storage and shipment. The shelter is capable of being dismantled and transported to a new location by road, rail or sea in a standard International Standards Organization (ISO) container or by air in crates. Refer to manufacturer's manual for specific instructions on the disassembly and shipment of the shelter.

5-5. **PRE-ENGINEERED BUILDINGS.** A typical structure is shown in Figure 5-3.

a. **Structure.** A pre-engineered building is a steel rigid frame, clear span structure, usually built to a standard production size. The rigid frame supports provide a clear span with no internal beams or posts. For very large structures, a rigid frame interior column design is used. Typical life of a pre-engineered building is 20 years.

b. **Environment.**

1. The building shall be designed to conform to all local requirements with regard to wind, snow, and seismic loads. In the absence of other requirements, the building shall be designed to withstand minimum 70 m.p.h. winds, and temperature exposures of -20°F to 160°F.
(2) Shelter Site. The site shall slope no more than 3%, and shall provide a means for rain water runoff to preclude accumulation around the structure perimeter. There should be no rock outcroppings (large rocks that cannot be easily picked up and removed), tree stumps, or other obstructions within the building area.

c. Construction.

(1) Framing. Typical steels used for framing are ASTM A36 (hot-rolled structural sections), ASTM A572 Grade 55 (built up sections), and ASTM A1011 Grade 55 (endwall sections). All framing members shall be shop fabricated for field bolted assembly. All structural steel and light gauge steel members shall be either painted or primer coated.

(2) Roof. The roof shall be made of standard 24 gauge galvalume steel.

(3) Doors. At least two personnel doors, 7’ high x 3’ wide, shall be provided. The doors shall be equipped with crash-bar style exits and glass windows. Sectional and roll-up doors to accommodate large components or aircraft may be provided in accordance with customer requirements.

(4) Ventilation. Rotary or continuous roof ventilators shall be provided. The air shall circulate to allow hot air to exit through vents in the roof. The ventilation shall provide approximately four to five air changes per hour.

(5) The building shall have an interior lighting system. The lighting shall illuminate the floor area to 20 foot candles. General purpose 3 phase/240 VAC/60 Hz receptacles shall be provided. Distribution box, prewired harnesses, attachments and covers shall be provided with the electrical system.

d. Installation. The building manufacturer shall provide complete erection drawings for proper identification and assembly. The manufacturer may also provide on-site equipment and assistance for erecting the structure. Field modifications of primary structural members shall be authorized by the manufacturer. A complete pre-engineered building package shall include the following:

(1) The pre-engineered building

(2) Personnel and/or hangar doors

(3) Interior lighting system

(4) General purpose 220 VAC/60 Hz service

(5) Ventilation system

e. Maintenance. The building shall be inspected at least annually. Check steel panels/framing for corrosion. Check seals around doors and windows for integrity. Correct corrosion and replace seals as required.

f. Transport, Relocation, and Shipping Information. Pre-engineered buildings are considered temporary structures and are movable. Refer to the manufacturer’s instructions for disassembly and shipment of the structure.
SECTION III. DROP SHROUDS

5-6. INTRODUCTION. The shroud concept was developed to fill a niche in DH protection technology. The shrouds are simply customized, nonconforming covers that can be used for a variety of applications. The material can be supported, draped over a floor mounted framework, hung from a suspended rigid frame, or unsupported (draped over preserved item like a blanket). The supported shroud can be set up in a corner of a hangar as a mini-warehouse for removed components. A hoist suspended drop shroud can be lowered and raised over an in-process aircraft or component. The blanket shroud is simply material draped over the preserved item (aircraft, engine or component); no framework is required. The sides of the material can be sealed to a floorpiece or simply weighted down onto the existing floor with absorbent pigs or sand bags. The DH unit capacity required for a shroud is much smaller than for rigid shelters. Figures 5-4 and 5-5 show typical shroud setups.

a. Framework. The frame can be constructed of rigid steel or aluminum extrusions or box tubing welded or bolted together. The edges and corners shall be radiused enough to protect the material. The frame may have eyebolts affixed to it from which the shroud can be suspended and act as the attaching hardware for the ceiling or hoist mounted cables.

b. Material. The material is a water vaporproof, vinyl coated polyester. It can be heat welded into any desired shape and size. Windows, personnel doors and DH ducting/vents can be installed as required. Grommets shall be fixed along the top seam so the entire shroud can be tied to the framework with nylon rip cord. The material shall be sealed to a floorpiece by snap lock zippers or the side panels can be weighted to the concrete floor with shot-filled pigs. No matter how the material is fixtured, it must be sealed against leaks.

c. DH Unit Requirement. For simple storage areas, a small desiccant wheel DH unit hooked up in a passive mode will usually be adequate. The unit may be placed inside or outside the storeroom/hangar, and the dried process air shall be circulated via flexible ducting and plenums. For suspended drop shrouds that cover in-process components, this setup may be modified by placing the DH unit outside of the shroud and then plumbing the dried and return air from the shroud to the DH unit. Refer to Chapter 6 for DH unit requirements to support a drop shroud system.

5-7. APPLICATION AND PROCEDURES. The following are guidelines for the setup of each type of supported shroud.

a. Component DH Storage. Locate an area in the hangar where storage shelves and bins can be installed (against a wall or in a corner is recommended). Check for adequate electrical power for the DH unit chosen for the job and the lighting system. Erect the framework and tie the drop shroud to it and secure. Seal the drop shroud until there are no leaks. Place the DH unit inside or outside. Duct the dried air throughout the drop shroud enclosure. Ensure return air is ducted to the outside environment. Refer to Chapter 6 for configuration of dry air distribution system. Install the shelves and bins and switch on the DH unit and set the desired relative humidity range on the humidistat.
b. **In Process DH Storage.**

(1) **Stationary Shroud.**

**CAUTION**

Consult the local facilities engineering department for a structural engineering evaluation of the shroud assembly and suspension hardware before attempting installation.

(a) Lay out the shroud on the hangar floor and align it so that the top seams and attaching grommets approximate the geometry of the framework.

(b) Set the framework on top of the shroud and tie them together using nylon rip cord.

(c) Attach the suspension cables to the framework eyebolts and to the ceiling frame or rafters.

**NOTE**

Raising the shroud may be easier if the side material is folded.

(d) Lift the entire assembly to the proper height and level the drop shroud frame.

(e) Tighten the cable clamps and recheck the level.

(f) Attach the angled side bracing cables as required to stabilize the framework.

(g) Attach the shroud sides to the floorpiece panel with the snap lock zippers or if the shroud does not have a floor panel, drape the side panels onto the floor and weigh it down with long, shot filled pigs.

(h) Install the interior lights and seal the window panels and access door.

**NOTE**

For this assembly, it is recommended that the DH unit be set up outside of the shroud.

(i) Direct the dried air into the shroud on one end and pick up the return air on the opposite end. Refer to Chapter 6 for configuration of a dry air distribution system.

**WARNING**

Refer to the local safety office and gas free engineers for guidelines for working in this environment, especially if solvents or other volatile organic compounds are to be used.

**NOTE**

Make sure that the shroud is sufficiently sealed around the ducting. The DH unit itself may remain inside the hangar but the warm, moist return air may be ducted outside the hangar, if desired. Because the drop shroud will be used as a working area, it is recommended that some makeup air be added to the process air return duct for better ventilation.

(j) Open the access door and wheel in the components or aircraft.

**NOTE**

During the work shift, personnel should keep the door closed at all times and keep the number of entries and exits to a minimum.

(k) Reseal the door and switch on the DH unit. After the internal atmosphere stabilizes, the work crew can enter and work can begin.

(l) At the end of the work shift, ensure that the shroud is sealed up, the DH unit is running and the humidistat is properly set.

(2) **Mobile Shroud.** The mobile shroud has an advantage over the stationary shroud in that it can be moved away from the working area to allow the work crew complete access to an in-process aircraft, or to relocate it for use on an immobile aircraft. The movable shroud can be suspended via one or more hoists from the hangar overhead superstructure, or affixed to a freestanding frame.
CAUTION

Suspending a framework from one or two hoists will make the structure unstable, therefore guide wires/cables, attached to the hangar floor or walls, are required.

Consult the local facilities engineering department for a structural engineering evaluation of the drop shroud assembly and suspension hardware and design before attempting installation.

(a) Lay out the shroud and framework assembly and tie it together as described for the stationary shroud. Attach the hoist and cable yoke assembly to the suspension framework and lift the entire shroud high enough to allow the component or aircraft to be moved under it. Lower the drop shroud over the object and attach the side panels to the floor panel (if available) or to the hangar floor as described for the stationary shroud. Hook up the DH unit as recommended for the stationary shroud.

(b) Relocation. Remove DH unit and ducting. Detach the shroud from the frame. Relocate the freestanding framework over the area to be dehumidified, and tie the shroud to it and secure. The framework can either be erected in each location or moved via wheels to a new location. Seal the shroud and install the DH unit as described for the stationary system.
SECTION IV. FLEXIBLE COVERS

5-8. INTRODUCTION. The two basic types of flexible covers are bags and top covers. Both covers are custom made for each model aircraft or large component.

a. Bags. Bags are made of a weather resistant, watervaporproof flexible plastic, MIL-P-58102 Type I, and are fitted with zippers and sealable panels to facilitate their installation onto an aircraft/component (see Figures 4-1 and 5-6). The internal environment is then either statically or dynamically dehumidified. The bags are less expensive than the shelter DH option, and one bag may be the only DH protection required for a particular activity.

(1) Dynamic DH. Once the cover is in place, a dynamic DH unit is hooked up to the bag and dry, processed air is recirculated within the bag. The flexible bag has certain advantages over the use of shelters. The supporting DH unit is much smaller and cheaper to run. Several bagged aircraft can be hooked up in parallel to one DH unit. Refer to Chapter 6, Section III, for dynamic DH setup information.

(2) Static DH. As an alternate method, the environment inside the cover can also be statically dehumidified with a large number of desiccant bags (about one 16 unit bag per cubic foot of space) placed inside of the aircraft just before cover installation. Refer to Chapter 6, Section III, for static dehumidification.

b. Top Covers. Top covers are similar to bags in design and material except that the cover extends just below the drip line and is fastened to the aircraft or component with straps; the underside is open and ventilated (see Figure 5-7). The cover itself cannot be dehumidified but selected internal sections of the aircraft, such as cockpit, avionic bays, and engines may be sealed and statically dehumidified. Top covers can facilitate maintenance as they are easily removed and replaced; the entire cover need not be removed, only the affected area.

5-9. AIRCRAFT PREPARATION. The following are guidelines for the preparation of the aircraft prior to flexible cover installation.

a. Cleaning. Clean all surfaces of aircraft in accordance with NAVAIR 01-1A-509-2. Dry all surfaces using wiping cloths and compressed air as necessary.

b. Inspection.

(1) Ensure that all surfaces to be covered are free from corrosion.

(2) For aircraft with engines and/or components removed, ensure that all fluid system lines are suitably capped with metal closures. Refer to Chapter 3.

c. Corrosion Control. Treat any corrosion found in accordance with NAVAIR 01-1A-509-2.

d. Protection. Preserve aircraft in accordance with Chapter 3 instructions for Level III (bags) or Level II (top covers).

e. Aircraft Preparation Instructions.

(1) Material Required. The following materials are required for preparation of the aircraft.

(a) Cushioning material, polyethylene foam plank, A-A-59136, Class 1, GradeA (2" x 4' x 8').

(b) Packaging material, polyethylene sheet, A-A-59135, Class 1, GradeA (1/2" x 4' x 8').

(c) Tape, SAE AMS-T-22085 Type II, 3M #481 (1 inch and 2 inch width).

(d) Barrier material, MIL-PRF-131, Class 1 (36 inch wide roll).
(2) Control Surface Locks. To prevent control surface movement due to gravity, wind, or cover weight pressure, install peculiar support equipment (PSE) control surface locks or battens manufactured in accordance with Chapter 3, Section II. When battens are used on composite surfaces, battens shall be at least 8 by 16 inches to prevent possible structural damage to composite material.

NOTE

Use only the amount of tape necessary to secure the cushioning materials in place. Do not attempt to cover all of the cushioning material or seal the edges of the cushioning material with tape.

(3) Cushioning. Install mechanical protection type PSE covers or equivalent cushioning on external devices such as angle of attack probes and blade antennas. Adequate cushioning for these items can usually be provided by using appropriate thickness of cushioning material with cutout cavities provided where needed. Apply cushioning material, 2 inches thick, held in place with tape, to sharp edged areas that are high pressure contact points for the installed cover such as sharp horizontal wing/tail leading edges and extensions, rudder trailing edges, engine afterburner fire doors (lower edges), vertical fin tips, wing tips and protruding portions of weapons launchers. The foam sections should be creased or slit as necessary to facilitate applying to sharp edges. Refer to Figure 5-8. See Figures 5-9 and 5-10 for examples of properly placed cushioning.

NOTE

It is not necessary to open fastener attached access doors or panels. Do not fully open doors, as this may cause problems with the flexible cover.

(4) Removable Items. Remove all fragile and protruding items that may be damaged during cover installation or storage, such as rigid static wicks, antennas, windshield wiper blades and arms, or external temperature indicator probes. Store packaged and labeled items in the aircraft pilot/crew compartments. These items may remain installed if mechanically protected.

(5) Ventilation. For bags that will be dynamically dehumidified, close the canopy on a foam block leaving an opening of approximately two inches for ventilation. Partially open any sliding or inward-opening doors or hatches about one inch and secure in this position. This will provide a free exchange of air between aircraft compartments or cavities and the dehumidified air within the flexible cover.

(6) If aircraft is to be statically dehumidified, install desiccant bags in accordance with Chapter 6, Section II.
b. **Cushioning Instruction.** Refer to Figure 5-11 for specific cushioned areas for the F/A-18 and structurally similar aircraft.

   (1) A-A-59136, Class 1, Grade A is used for all foam strip applications.

   (2) A-A-59135, Class 1, Grade A is used for all sheet stock applications.

   **CAUTION**

   **DO NOT** apply tape to transparent surfaces.

   (3) Secure foam in place using preservation tape SAE AMS-T-22085 Type II.

5-10. **COVER INSTALLATION GUIDELINES.** The flexible cover assembly should be prepared and installed in a closed hangar or other shelter where both aircraft and cover can be kept clean, and where wind or other weather elements will not disrupt installation operations. Once the cover is securely in place on top and sides of the aircraft, the cover lower sections may be tied up and installation completed outdoors. Elapsed time between the bag installation and final sealing, with dehumidifier hooked up and turned on, is approximately 72 hours. The following are instructions for the installation of a flexible cover to be used in conjunction with the manufacturer's instructions.

   a. **Equipment Required.**

      (1) An overhead hoist or similar equipment capable of lifting 2000 lbs.

   b. **Installation.**

      **NOTE**

      The preferred method of installing the flexible cover is to use an overhead hoist. However, if a hoist is not available, the container may be installed by hand by placing the cover specially folded on top of the aircraft using a forklift.

      If the folded cover is not initially placed in the exact position and orientation specified by the manufacturer, installation and closure may be difficult or impossible. At that point the cover must be removed, refolded and repositioned.

      (1) Remove the cover from the crate and from the cover storage bag. Attach the lifting sling and use the power lifting equipment to raise cover over the aircraft. Position cover in the location designated in the manufacturer's instructions.

      (2) Fold the cover's protective storage bag as compactly as possible and secure in aircraft right hand gear wheel well using nylon cord.
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<thead>
<tr>
<th>Item</th>
<th>Area</th>
<th>Guideline</th>
<th>Item</th>
<th>Area</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wing leading edge extension</td>
<td>Foam strips, 2&quot;</td>
<td>12</td>
<td>Canopy</td>
<td>Polish, cotton flannel &amp; barrier material</td>
</tr>
<tr>
<td>2</td>
<td>Canopy aft edge</td>
<td>Foam strips, 1/2&quot;</td>
<td>13</td>
<td>Blade antenna</td>
<td>Foam strips, 2&quot;</td>
</tr>
<tr>
<td>3</td>
<td>Wing tip antennas</td>
<td>Foam strips, 1&quot;</td>
<td>14</td>
<td>Vertical stabilizer, leading edge</td>
<td>Foam strips, 1&quot;</td>
</tr>
<tr>
<td>4</td>
<td>Wing tip launchers</td>
<td>Foam strips, 1/2&quot;</td>
<td>15</td>
<td>Vertical stabilizer, top corners</td>
<td>Foam strips, 2&quot;</td>
</tr>
<tr>
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<td>Aileron and flap trailing edge</td>
<td>Foam strips, 1&quot;</td>
<td>16</td>
<td>Rudder trailing edge</td>
<td>Foam strips, 1&quot;</td>
</tr>
<tr>
<td>6</td>
<td>Horizontal stabilizer, leading &amp; trailing edge</td>
<td>Foam strips, 1&quot;</td>
<td>17</td>
<td>Weapons launcher ejector feet (if installed)</td>
<td>Foam strips, 1/2&quot;</td>
</tr>
<tr>
<td>7</td>
<td>Afterburner iris</td>
<td>Foam strips, 1/2&quot;</td>
<td>18</td>
<td>Landing gear doors, lower and aft edge</td>
<td>Foam strips, 1&quot;</td>
</tr>
<tr>
<td>8</td>
<td>Tail hook point</td>
<td>Foam strips, 1/2&quot;</td>
<td>19</td>
<td>Drag brace fairing</td>
<td>Foam strips, 1&quot;</td>
</tr>
<tr>
<td>9</td>
<td>Flap trailing edge</td>
<td>Foam strips, 2&quot;</td>
<td>20</td>
<td>Landing gear doors, lower &amp; forward edges</td>
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<td>21</td>
<td>Pitot probe</td>
<td>Foam strips, 1/2&quot;</td>
</tr>
<tr>
<td>11</td>
<td>Aileron hinge (with wing folded)</td>
<td>Foam strips, 1/2&quot;</td>
<td>22</td>
<td>Blade antenna</td>
<td>Foam strips, 2&quot;</td>
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<td></td>
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<td></td>
<td>Angle of attack probe</td>
<td>Foam strips, 1/2&quot;</td>
</tr>
</tbody>
</table>

**NOTES**

1. A-A-59136, Class 1, Grade A is used for all foam strips.
2. A-A-59135, Class 1, Grade A is used for all foam sheet.
3. Two inch foam strips are 3 inches wide and split 2 inches deep.
4. One inch foam strips are 2 inches wide and split 1 1/2 inches deep.
5. Secure foam in place using preservation tape SAE AMS-T-22085, Type II. DO NOT apply tape to transparent surfaces.
6. Install battens between aileron and flap.

*Figure 5-11. F/A-18 Cushion Points*
CAUTION

Ensure only the walkway areas on the aircraft are used and no-step areas are observed in accordance with the applicable MIMs. The outside of the aircraft cover shall have walkway and no-step areas marked.

(3) Using the procedure specified by the manufacturer, unfold the cover out on top of the aircraft and install cover sections, pockets or sleeves over antennas and vertical fins. At this point, the cover shall be examined for overall correct positioning on the aircraft and shall be adjusted (shifted) as necessary to facilitate further installation and closure.

NOTE

During installation of flexible covers, ensure that aircraft access panels that cover tiedown points are opened. It may be difficult to unfasten these panels after the cover is fully installed.

(4) Bags Only. Using support loops, D-rings or bungee cord provided on cover inner surface, secure cover lower sections to the underside of the aircraft as specified by cover manufacturer’s instructions.

(5) Using the sequence and any special tooling furnished with the cover, close zippers (if applicable) throughout the cover except for landing gear sections which should be left open. Excess material shall be tied up well clear of the deck to facilitate towing. Top covers have straps to secure the cover around the fuselage and wings.

(6) Tow aircraft to storage area in accordance with the applicable MIM.

(7) Bags Only. Position aircraft with landing gear tires approximately 18 inches forward of parking spots. Ground the aircraft in accordance with Chapter 7 and applicable MIMs.

(8) Bags Only. As required, place two 3/4 inch thick by 24 inch by 24 inch plywood sections on the deck (cross-laid on top of each other) aft of main and nose landing gear wheels. Center the plywood sections.

(9) Bags Only. Extend cover landing gear box sections and place the tongue section (longest portion of material) flat on the deck. The cover tongue sections have tire position marks inside the cover which shall be centered on the plywood platforms. To facilitate the box section closure, the tongue tire position markings must be placed at an equal distance aft of the centerline of each wheel hub.

(10) Bags Only. Move the aircraft aft onto the cover’s tongue section until all wheels are on the marked areas.

(11) Install wheel chocks and static grounds to certified common ground in accordance with Chapter 7 and the applicable MIMs.

(12) Seal bag. Tie down aircraft in accordance with the applicable MIM and NAVAIR 17-1-537, using the heavy weather tiedown procedure. Tiedown hardware shall be securely padded at any point where it is likely to cause chafing against the bag material. Close landing gear box sections.

(13) Identify aircraft in accordance with paragraph 5-2.

(14) Bags Only. A Gas Free Engineer check of the Lower Explosive Limit (LEL) vapors in the cover is mandatory before the dehumidification equipment is activated. The LEL shall be less than 10%.

(15) Make entries into the aircraft and engine logbooks.

(16) Complete ground support equipment logbooks. The objective is to maintain a record of the condition and use for each serial number cover assembly. This record form shall be stowed in the record receptacle pouch located on the exterior of the cover assembly.

(17) Bags Only. If applicable, install the dynamic dehumidifier in accordance with Chapter 6, Section III and the manufacturer’s equipment manual.
5-11. **MAINTENANCE.** Inspect the flexible cover for accumulation of dirt and industrial type fallout in accordance with the following maintenance and repair instructions.

![Detergent, General Purpose](image)

**NOTE**

Cleaning the cover will add approximately 20% to the life of the cover. If the cover cannot be cleaned in place, the cost of cleaning may outweigh the savings.

a. **Cleaning.** Clean with a mild detergent solution, MIL-D-16791 Type I. Rinse with fresh water. Cleaning, if cost effective, shall take place every 4 months.

b. **Inspection.** Every 7 days, inspect for the following:

1. Slippage of the padding material and the resulting chafing of the flexible cover material; adjust and repair if found.
2. Accumulation of water on the cover surface; adjust cover for drainage when possible.
3. Water and oil accumulation inside the cover; remove if found.
4. Areas of airflow restrictions; adjust cover or ducting if found.
5. Bungees/straps that have come loose or unfastened; secure if found.
6. Flaking cover material; apply manufacturer's top coat if found.

c. **Repair.**

**NOTE**

When patching is being performed by a mechanic for the first time, practice patching on film stock from the repair kit before attempting repair.

1. **Cover.** The cover material can be repaired in the field by a mechanic using hot air welding techniques with cover material sheet stock, a wooden block (2"x4"), and a heat gun and roller, and by following the instructions below:

   a. If the cover is damaged to the extent that more that 2 inches of cover material has been tom, punched or cut out in any direction, the guidelines above shall apply except that a patch shall be cut, applied and heat welded to the inside as well as the outside of the damaged area.

   **NOTE**

   Petrochemical based materials, such as MIL-PRF-680, gas or kerosene, shall not be used as a cleaner since they leave a film residue that retards adhesion.

   ![Solvent, Cleaning](image)

   **Solvent, Cleaning**

   SAE AMS-3167

   (b) The damaged material shall be made as flat as possible and cleaned using a clean white cloth and cleaning solvent, SAE AMS-3167. The perimeter of the cleaned area shall be at least 2 inches greater than the damaged area. The damaged cover material does not have to be cut out unless the material in and around the tom/cut area will not contour naturally to adjacent material.

   (c) After the damaged area has been cleaned, cut a piece of material from the repair kit supply. The perimeter of the patch shall be 2 inches greater that the area to be repaired.

   **NOTE**

   Minimize handling to prevent fingerprint oil contamination.

   ![Solvent, Cleaning](image)

   **Solvent, Cleaning**

   SAE AMS-3167

   (d) Clean the patch surface with cleaning solvent, SAE AMS-3167, using a clean white cloth.
(2) Zipper. Zippers can be repaired using the same cover repair techniques. Minor damage to the zipper, such as pin holes, cuts or punctures, except for those in the closure track area, may be repaired by cleaning the affected area with a clean white cloth and cleaning solvent, SAE AMS-3167, cutting a patch from the repair kit and hot welding in place.

d. Hot Air Welding Guidelines. The cover may be repaired with a hand welding tool such as the Leister-Triac No. 1a, equipped with #30B2 (40mm wide) or #31A (20mm wide) nozzle. Also recommended is the use of a #22 wide silicon band feed roller (40mm wide).

(1) When using the hot air method, a piece of wood or \(\frac{3}{8}\) inch thick polypropylene shall be used behind the area to be patched to insulate the aircraft from heat and to afford a solid, flat work surface.

(2) The area to be patched shall be prepared in accordance with paragraph 5-11c(1)(b) above.

(3) Mark the patch position on the cover.

(4) Use a lap weld, similar to the cover construction, when attaching the patch.

NOTE

Temperature settings have to be determined each time patching operations are attempted. Hot air welders are sensitive to ambient weather conditions.

(5) Use just enough heat to produce a sound weld. Too much heat will result in degradation of the material.

(6) Adequate pressure must be applied during the welding procedure to afford a sound, durable weld.

(7) Lay the patch on the cleaned, marked area. Place the roller several inches from a corner of the patch. Pull the patch edge up and over the roller and hold with thumb or finger.

CAUTION

DO NOT direct the air flow at hands, face or any body parts.

DO NOT direct the air flow towards flammable of combustible materials.

DO NOT lay the welder on flammable or combustible materials.

DO NOT touch metal surfaces of the welder.

TURN OFF the hot air welder when not in use.

(8) Direct the hot air flow from the welder at the V-point created by the rolled patch and the corner. Heat this area for 3-5 seconds.

(9) Move the nozzle back. Roll the roller forward and back over the area that was heated until both surfaces are welded together.

(10) If bubbles and/or creases appear, heat the patch surface and roll the bumps down.

(11) Continue this procedure, welding sections approximately 2 inches by 4 inches in size, until patch is secured.

5-12. COVER REMOVAL GUIDELINES. The following are guidelines for the removal of a flexible cover from an aircraft. Use these guidelines in conjunction with the manufacturer's instructions.

Detergent, General Purpose 13
MIL-D-16791 Type I

a. Clean the cover with a mild detergent solution, MIL-D-16791 Type I. Rinse with fresh water and allow to dry.

b. Remove, unhook and open all buckles, straps and zippers (if applicable).

c. Uncover the vertical stabilizer(s) and place that portion of the cover on aircraft aft section.
d. Pull cover to the ground. Do not walk on, or lay sharp or heavy objects on, the cover.

e. Spread out the cover to the approximate shape of the aircraft (top side up) on a clean dry surface free of small rocks or pebbles.

f. Pull lower wing and lower horizontal stabilizer sections of the cover forward and fold back on the top section.

 NOTE

During folding, frequently check size of folded cover and stowage bag and make the necessary adjustments. When a cover is removed it shall be packed and stowed.

g. Position four personnel on centerline of cover fuselage section facing outboard. Reach forward approximately 24 inches and pull cover inboard and up slightly for an “S” fold. Repeat until all material on one side is folded. Repeat with opposite side. The folded width of the cover should be approximately the width of the stowage bag.

h. Starting at the AFT end of the cover, roll the material toward the center. Stop when the “UNFOLD AFT” arrow is up. Keep the roll tight.

i. Roll the nose section AFT in a similar manner.

j. Secure the rolled cover with two of the 2 inch straps provided.

k. Place the folded cover in the stowage bag and secure using the MAXI-GRIP and two additional straps.

5-13. DEPRESERVATION. Depreserve the aircraft in accordance with Level II or Level III instructions, as applicable.
SECTION V. STRIPPABLE COATING

5-14. INTRODUCTION. Strippable coating is used to protect aircraft during Level II preservation. It is most familiar as the white cocoon covering on aircraft being shipped (see Figure 5-12). This coating shall be used only for shipment of aircraft/components and is not recommended for storage.

a. Description. The MIL-PRF-6799 Type II Multicoat System, consists of a black base coat, Type II Class 1, and a white topcoat, Type II Class 5 or 6. The black base coat, sprayed on first, ensures strippability. The white topcoating provides water resistance and solar heat reflectance. The two coatings (base and topcoat) blend at their respective mating surfaces to provide a single strippable coating which protects surfaces against the elements. MIL-C-23760 is the controlling specification for the application of strippable coatings. This specification gives detailed procedures for surface preparation, blank-offs, masking, tear strips, spray application, sharp edge coverage and film inspection. Pinhole intrusion of water between the coating and the aircraft skin causes rapid deterioration of the metal surfaces. The coating is adequate for shipment protection, but should be stripped off as soon as practicable when the aircraft reaches its destination. At that time, the aircraft should be washed, inspected and reprotected to the appropriate level of preservation for the length of time the aircraft is to remain in a preservation status. Strippable coatings are also used at AMARG, Davis Monthan AFB, for long term desert storage. The coatings provide minimal protection in a dry, hot climate.

CAUTION

The application of strippable coating directly on composite aircraft structures is prohibited.

b. Use. The Type II sprayable, strippable coating system conforming to MIL-PRF-6799 can be applied to metallic, plastic and painted surfaces without harmful effect. When properly applied and maintained, the coating can be stripped without difficulty. The coating system is generally applied to selected areas of aircraft for Level II preservation. See Figure 5-13. The system is also useful for protecting transparent acrylic surfaces against abrasion during maintenance of aircraft. The coating may be applied to composite sections if the surface is first covered with barrier material, MIL-PRF-131 Class 1, sealed with preservation tape, SAE AMS-T-22085 Type II.

c. Facilities. The sprayable, strippable compounds described herein may normally be applied in any standard paint area. In limited quantities, they may also be applied outdoors in an area protected from dust, wind and rain provided temperatures are between 45-125°F. When spraying these materials in outdoor areas, careful control of spraying techniques is necessary to prevent dry, nonstrippable, porous coatings and excessive loss of material through overspray.

d. Training. Strippable coatings can only be applied by Depot level maintenance activities. Careful control of spraying techniques is necessary to prevent waste of materials and to obtain good quality strippable coatings.

Figure 5-12. Aircraft With Strippable Coating

Figure 5-13. Strippable Coating Applied to Selected Areas
Personnel assigned to the application of these materials shall be thoroughly indoctrinated in the purpose and function of strippable coatings and shall be carefully trained in spraying techniques using the requirements of this section and MIL-C-23760.

e. Safety. Personnel safety precautions, including the wearing of personnel protective devices, shall be as directed by the local safety and industrial health authorities. According to the Material Safety Data Sheet (MSDS), there should be good general ventilation and the artisans should wear rubberized gloves, chemical goggles, boots, overshoes and rubber aprons.

f. Equipment. Equipment required for the application of sprayable, strippable coating compounds consists of spray (airless or atomizing) equipment and caulking guns as follows:

**NOTE**

Local environmental regulations may require the use of high efficiency guns or spray equipment other than the ones described below. Check before applying coatings.

1. **Airless Spray Guns.** The most common airless spray gun used is the Grayco Bulldog Model #205-591 with a regulated compressed air supply of 90 psi. It is recommended that the airless spray gun be equipped with a Reverse-A-Clean tip with orifice size of 0.017-0.021 inch and a spray angle of 40-80 degrees. The airless spray gun is the preferred equipment for applying sprayable strippable coatings.

2. **Atomizing Type Spray Equipment.** The atomizing spray equipment consists of a spray gun (De Vilbiss MBC model with FF fluid tip and No. 765 air cap or equivalent), a mechanically agitated paint pot with the output capacity of 30-40 fluid ounces per minute (suitable for applying all types and classes of MIL-PRF-6799 compounds). Lower capacity units (15-25 fluid ounces per minute) are suitable only for applying Type II Class 1 compounds. A constant compressed air supply (60-70 psi), hoses and fittings, pressure regulators, and air line liquid traps are also required.

3. **Caulking/Flow Gun.** The commonly used caulking gun is the Binks Model No. 31 with a No. D-1935 adapter fitted with a plastic spreader.

4. **Wet and Dry Film Gages.**

g. Consumable Materials. Storage of sprayable water base compounds is recommended at a temperature of 70°F; not to fall below 40°F or exceed 115°F. A list of consumable materials is given in Table 5-1.

**WARNING**

Do not freeze. Do not store in closed drums or vessels near high temperature sources. The brushable consistency topcoating compound described below contains flammable solvents and requires standard fire protection precautions for they are viscous flammable materials with flash points of 20-80°F (6.7-26.7°C).

1. **Base Coating Compound,** MIL-PRF-6799 Type II Class 1. Black, water-based compound provides strippability to two coat system.

2. **Top Coating Compound (Airless Application),** MIL-PRF-6799 Type II Class 5. White top coating applied with airless spray equipment to provide solar radiation protection.

3. **Top Coating Compound (Atomizer Application),** MIL-PRF-6799 Type II Class 6. White water-based top coat compound designed for use with atomizing spray equipment to provide solar radiation protection.

4. **Caulking Compound.** Spraylat Corporation Part No. SC-1076-1. For filling seams and fairing in irregular surfaces under strippable plastic coatings.

5. **Brushable Compound,** MIL-PRF-6799 Type II Class 7. Brushable compound for touch up of white top coatings to repair or patch holes, flaws, or tears in the coating system.

5-15. **PREPARATION OF AIRCRAFT.** Before applying the strippable coating, prepare aircraft as detailed below.

**CAUTION**

At all times during preservation, precautions shall be taken to observe NO STEP areas and to prevent collecting or dropping of objects on composite surfaces.

a. Cleaning.

1. If required, remove any previously applied coatings.
Table 5-1. Materials and Equipment for Application of Strippable Coating

<table>
<thead>
<tr>
<th>Nomenclature</th>
<th>Specification/Part Number</th>
<th>Intended Use</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumable Materials</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caulking Compound</td>
<td>P/N SC-1076-1/2</td>
<td>Filling seams and fairing in irregular surfaces before applying strippable coating</td>
<td>8030-00-721-9832 GL</td>
</tr>
<tr>
<td>Cord, Fibrous, Nylon</td>
<td>MIL-C-5040 Type I</td>
<td>Rip cords under strippable coating</td>
<td>4020-00-240-2154 SL (500 YD)</td>
</tr>
<tr>
<td>Coating, Sprayable, Strippable, Protective, Water Emulsion</td>
<td>MIL-PRF-6799 Type II Class 1 Type II Class 1A</td>
<td>Black base coat for strippable coating system. Class 1A does not contain chromates.</td>
<td>Class 1 8030-00-823-8023 DR (55 GL) 8030-00-721-9380 CN (5 GL) Class 1A 8030-01-620-9387 CN (5 GL)</td>
</tr>
<tr>
<td>Coating, Sprayable, Strippable, Protective, Water Emulsion</td>
<td>MIL-PRF-6799 Type II Class 5</td>
<td>White topcoat for strippable coating system for use with airless spray equipment</td>
<td>8030-00-297-0189 CN (5 GL)</td>
</tr>
<tr>
<td>Coating, Sprayable, Strippable, Protective, Water Emulsion</td>
<td>MIL-PRF-6799 Type II Class 6 Type II Class 6A</td>
<td>White topcoat for strippable coating system for use with atomizing spray equipment. Class 6A does not contain methanol.</td>
<td>Class 6 8030-01-181-6269 CN (5 GL) Class 6A 8030-01-620-9384 CN (5 GL)</td>
</tr>
<tr>
<td>Strippable Coating Repair, Solvent Type, Brushable</td>
<td>MIL-PRF-6799 Type II Class 7</td>
<td>Brushable coating for touch up of white topcoating</td>
<td>8030-00-060-4566 GL</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gage, Wet Film</td>
<td>WF-CCD</td>
<td>Wet film thickness measurement</td>
<td>5210-01-467-1908</td>
</tr>
<tr>
<td>Gage, Dry Film</td>
<td>Starrett P/N 1010 or equivalent</td>
<td>Dry film thickness measurement</td>
<td></td>
</tr>
<tr>
<td>Gun, Caulking</td>
<td>Binks Model 31 or equivalent</td>
<td>Application of caulking compound</td>
<td></td>
</tr>
<tr>
<td>Spray Unit, Airless</td>
<td>Grayco Bulldog Model #205-591 or equivalent</td>
<td>Application of strippable coating</td>
<td></td>
</tr>
<tr>
<td>Spray Unit, Atomizing</td>
<td>DeVilbiss MBC or equivalent</td>
<td>Application of strippable coatings</td>
<td></td>
</tr>
</tbody>
</table>

(2) Clean all surfaces of aircraft to receive a strippable coating to a water-break-free state using the procedures of NAVAIR 01-1A-509-2. Dry all surfaces using wiping cloths and compressed air as necessary.

**WARNING**

Do not mix degreasing solvent with isopropyl alcohol in an attempt to improve the cleaning process.

(3) A cloth wipe-down with degreasing solvent MIL-PRF-680 Type II or III, followed by a final wipe-down with isopropyl alcohol, TT-I-735, will usually produce a clean surface suitable for applying tapes.

b. **Inspection.**

(1) Ensure that all surfaces to be covered are free from corrosion.

(2) Ensure that all permanently installed drain holes are open and free of obstruction after strippable coating application.

(3) For aircraft with engines and/or components removed, ensure that all fluid system lines are suitably capped with metal closures. Refer to Chapter 3.
c. **Corrosion Control.** Treat any corrosion found in accordance with NAVAIR 01-1A-509-2.

d. **Protection.** Preserve aircraft in accordance with Level II requirements. In addition to the requirements outlined in Chapter 3, the following shall be accomplished:

1. **Ventilation.** Prior to sealing aircraft, open all internal passageway doors and access doors or plates located on the underside of the aircraft. If aircraft is compartmentalized without interconnecting openings to allow free breathing, install ventilator tubes, (see Figure 3-5) in such a manner that each compartment can breathe either to the outside or to an adjacent ventilated compartment. Provide controlled ventilation for cockpits. When coating is applied to selected areas only, use existing openings in the aircraft structure, such as cockpit flooding openings or pressure relief valves, for ventilation when possible.

2. **Sensitive Surfaces.** Apply special protective coatings to sensitive material surfaces such as transparencies (see Chapter 3, Section II).

3. **Openings.** Fill or cover all gaps, seams, fastener heads and openings. MIL-PRF-6799 strippable coatings will not bridge openings and will crack when uneven drying occurs. To prevent cracks, close and fair in irregular surfaces according to the following procedures:

   a. Openings less than $\frac{3}{8}$ inch. Close or fair-in seams, gaps, openings in fasteners, skin lap joints and similar irregularities by covering with tape, SAE AMS-T-22085 Type II.

   b. Openings from $\frac{3}{8}$-1 inch. Close openings by covering with tape, SAE AMS-T-22085 Type II (see Figure 5-14, View A).

   c. Openings from 1-6 inches. Close openings using barrier material, MIL-PRF-131 Class 1 and tape, SAE AMS-T-22085 Type II (see Figure 5-14, View B).

   d. Openings from 6-12 inches. Close openings by covering with fiberboard ASTM D4727 Type SF Grade V3s, held in place with tape SAE AMS-T-22085 Type II. Shingle the tape and barrier in accordance with Section VI of this chapter.

   e. Openings greater than 12 inches. Close openings greater than 12 inches, such as air intakes, wheel wells and wing break areas (Figure 5-15, View A) by fitting with rigid fillers such as tempered Masonite, plywood or fiberboard, ASTM D4727 Type SF Grade V3s, as follows:

   1. Cut rigid fillers $\frac{3}{8}$ inch undersize and fit with $\frac{1}{4}$ inch thick strips of cushioning material, PPP-C-1797, which should overlap the outside edges.
Secure the rigid fillers in place with tape, SAE AMS-T-22085 Type II. Use a minimum overlap of $\frac{1}{2}$ inch of the surface wherever possible. Cheesecloth (6 inch wide) and caulking compound may also be used to secure and seal rigid fillers.

(f) Complex shaped openings. To cover complex shapes, projections and openings where rigid fillers are not appropriate, use barrier material, MIL-PRF-131 Class 1, reinforced and held in place by tape, SAE AMS-T-22085 Type II (see Figure 5-15, View B).

(4) Edges. Cover all sharp edges. To prevent breaks in the coating at sharp edges, such as trailing edges of airfoils, apply preservation tape, SAE AMS-T-22085 Type II (see Figure 5-16, View A) or embed strips of cheesecloth, CCC-C-440, into the first coating of the material and allow coating to dry to a tack-free surface before applying the succeeding covering coats (see Figure 5-16, View B).

(5) Masking. Mask areas not intended to receive the coating. When application of the coating is not intended to cover the entire surface of an item, it is often difficult to establish a line of demarcation; and in sprayed coatings, the feather edge zone is difficult or impossible to strip. Where application to a large area is to be avoided, mask using one of the following methods:

(a) Apply masking tape, SAE AMS-T-21595, and masking paper around the area to be sprayed. To prevent lifting edges of the sprayed film, remove masking immediately after the final application of the coating compound, before the coating has dried.
(b) As an alternate procedure, masking may be accomplished by reducing pressure on the spray gun and applying a 2-3 inch wide bead of coating material completely around the area to be coated. When spraying this bead of coating material, the spray gun should be held approximately 3 inches from the surface (see Figure 5-17). Minor overspray shall be removed immediately using a cloth dampened with water.

(6) Ripcords. To aid in removal of masking material and coating compounds, install nylon ripcord inserts, MIL-C-5040 Type I, as illustrated in Figure 5-18. Tie finger-size loops in exposed ends of the ripcords. Be sure to install ripcords at the cockpit and follow the outline of the canopy parting surface in such a manner that the cockpit can be open during storage or transit and resealed without seriously affecting the integrity of the remaining coating.

5-16. USE OF SPRAY EQUIPMENT.

a. Cleaning. Ensure that reservoirs are clean and free of foreign material. Make sure all water and oil have been removed from the air supply system.

b. Inspection. Check the equipment to make sure it is operable and safe for use.

c. Maintenance.

(1) During Operations. Between application of coats, keep the spray guns immersed in a pail of water to prevent clogging of the spray head during any period of nonuse.

(2) Continuous Operations. No cleaning is required. Check the level of compound in the reservoir. If the reservoir is not at least \( \frac{3}{4} \) full, fill to the maximum permissible level with compound and replace the cover. Turn off air supply to the spray gun and trigger gun to fill gun and lines with compound. Do not permit air to contact the compound or it will solidify and clog the gun and lines. To prevent clogging of the spray head during periods of nonuse, keep the spray guns immersed in a pail of water.

(3) Intermittent Operations. When use of spray equipment is intermittent or indeterminate, perform the following:

(a) Blow the gun clear of compound. Flush reservoirs, accessories and guns with clean water. Small quantities of compound left behind will solidify and cause clogging of lines and spray guns.

(b) After use, return compounds to their original containers or other equivalent airtight containers. Ensure containers are stored and marked with Stock Number (NSN), Part Number, Nomenclature, and Date.
5-17. PREPARATION OF STRIPPABLE COATING COMPOUNDS.

a. **Mixing.** Prepare compound for application under clean conditions using clean equipment. Do not open container until ready for use. Clean container cover first and open carefully to prevent dirt from falling into compound. Before mixing compound, carefully remove surface skin, if present. Mix compound thoroughly before adding to spray equipment either by stirring with a paddle or by using a power mixer or agitator until settled pigment is completely mixed. Compound should be smooth, homogeneous and of a consistency resembling heavy cream. Additional agitation may sometimes be required to restore compound to usable condition if it has been stored under adverse conditions.

b. **Diluting.** To improve sprayability, compound may be diluted in accordance with manufacturer's instructions. Additional dilution will adversely affect the physical properties of the compound.

c. **Adding to the Reservoir.** Thoroughly mix the compound just before adding to the reservoir. Strain the compound through cheesecloth, CCC-C-440, or equivalent mesh size wire screen as it is put into the reservoir. Make sure all lids and other equipment are secure. Connect the air and fluid lines.

5-18. APPLICATION OF COMPOUNDS. Apply compounds in a standard box coat fashion (one horizontal pass followed by one vertical pass) depositing a wet film on each. Follow the contour of the surface carefully; otherwise an uneven film and waste of material will result. When spraying curved surfaces, continue to follow the contour of the surface and feather-in any edges by overtraveling. Do not arc the gun at any time during the pass. Wet film thickness can be determined with a wet film gage. Dry film thickness can be determined by cutting out 1 inch square section and measuring with a dry film gage. Allow for a sufficient period of time to obtain a tack-free surface on the first coat before applying the second coat. The change from a glossy to a dull finish will usually indicate that the surface is tack-free. See Table 5-2 for approximate drying times.

**Table 5-2. Strippable Coating Drying Times**

<table>
<thead>
<tr>
<th>MIL-PRF-6799 Type II</th>
<th>Drying Time* (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>3</td>
</tr>
<tr>
<td>Class 5</td>
<td>2</td>
</tr>
<tr>
<td>Class 6</td>
<td>2</td>
</tr>
<tr>
<td>Class 7</td>
<td>2</td>
</tr>
</tbody>
</table>

* Time given is for air dry at 75°F and 50% RH. Drying time will vary for other temperature and humidity conditions.

Coatings, Strippable MIL-PRF-6799 Type II Class 1

**CAUTION**

Complete coating of aircraft in outdoor areas is not recommended due to problems with coating quality.

**NOTE**

When ambient temperatures are above 100°F and relative humidity is below 30%, strippable coatings will usually be of poor quality (dry, porous and nonstrippable).

a. **Black Base Coating.** Apply MIL-PRF-6799 Type II Class 1, black compound with the nozzle of the gun 8-12 inches from surface at all times.

(1) **First Base Coat.** Apply the first coat as a wet film of approximately 0.012-0.014 inch thick to obtain a film of 0.006-0.007 inch when dry.

(2) **Second Base Coat.** Apply additional coatings as necessary to obtain a total dry film thickness of 0.012-0.014 inch.
NOTE

If lack of equipment makes it necessary to walk on previously coated surfaces while applying successive coats it will be necessary for each coating to be thoroughly dry before additional spraying is started.

Coatings, Strippable 7
MIL-PRF-6799 Type II Class 5 or 6

b. White Top Coating. After base coating is dry to a tack-free surface, apply the white top coating, MIL-PRF-6799 Type II Class 5 or Class 6, in two or more coats.

1) First Top Coat. Apply the first coat using a wide fan spray pattern and holding the gun about 18 inches from the surface to produce a dry film. When properly applied, this first topcoat should barely cover the black base coating.

2) Second Top Coat. Apply the second coat holding the gun 8-10 inches from the surface to deposit a wet film. Apply additional coats as necessary to obtain a minimum dry film thickness of 0.004-0.006 inch.

NOTE

Be careful not to scratch the surface during cleaning operations.

3) Cleaning. If overspray onto an unmasked surface occurs, coating shall be removed immediately by wiping with a soft cloth moistened with water which will not scratch the surface. The surface shall then be wiped with a dry cloth.

4) Inspection. Thoroughly inspect the topcoat for areas where the white topcoat is porous or the black base coating is visible and apply brushable topcoat compound, MIL-PRF-6799 Type II Class 7, as necessary.

c. Accelerated Drying of Coatings. Accelerated drying of coatings may be accomplished by using compressed air, infrared lamps or temperature controlled, ventilated ovens. Whenever heat is applied to accelerate drying, allow the surface to cool to room temperature before applying succeeding coats.

1) Compressed Air. To dry with compressed air, allow the coating to air dry for 10-15 minutes, then subject the coated surface to a gentle blast of clean dry compressed air. To prevent sagging of the coatings, keep the initial pass of air at a low pressure.

2) Infrared Lamps. Infrared lamps may be used to dry coatings if coating surface temperatures can be held below a maximum of 150°F and if good air circulation can be provided.

3) Oven. The most satisfactory method of drying coatings is by the use of temperature controlled, properly ventilated ovens. Oven temperatures shall not exceed 150°F. With good air circulation, 8-10 mm of water-based sprayable strippable coating can usually be dried in 30 minutes at 115°F or in 15 minutes at 150°F.

5-19. AIRCRAFT MARKINGS AND PLACARDS.
After the aircraft has been coated and the final topcoat has dried, mark in accordance with paragraph 5-2.

5-20. INSPECTION/MAINTENANCE/REPAIR OF COATINGS.

a. Inspection. After the applied coating has thoroughly dried, inspect surface for pinholes, discontinuities or breaks in the film. Give special attention to areas covered by tapes and areas around sharp edges, seams or other discontinuities in surfaces. Periodic inspection and repair of any defects in the coating are essential to the proper performance of the protective system. The integrity of the strippable coating shall be inspected every 28 days.

b. Maintenance. Maintenance of the strippable coating on an aircraft or components shall include a 56 day inspection of the coating, as well as any other Level II inspection requirements in accordance with Chapter 3 instructions, and the immediate repair of any coating damage found.
c. **Repair.** Repair shall be effected by removing the loose coating, cleaning the surface and reapplying the coating system. If erosion or cracking of the topcoat has begun after prolonged storage, reapply a 0.002-0.003 inch coating of white topcoat. The following are alternate methods of repair for large and small damaged areas.

(1) **Large Areas.**

(a) Cut away the loose coating, exercising care not to damage the underlying surface. Clean surrounding coating surfaces.

(b) Apply barrier material, MIL-PRF-131 Class 1, and tape, SAE AMS-T-22085 Type II. Since most strippable coatings will be somewhat rough in texture, it may be necessary to apply two or three overlapping strips of tape around the edges of the repair to ensure resistance to water penetration. If available, overcoat barrier material and tape using brushable topcoat compound, MIL-PRF-6799 Type II Class 7. Otherwise, overcoat using clear CPC, MIL-DTL-85054.

(2) **Small Areas.**

**CAUTION**

Because of the danger of crazing by the solvents in the brushable compound, this method shall not be used for repairing coatings on transparent acrylic surfaces.

(a) Except for transparent acrylic surfaces, repair small areas by first removing any loose coating material. Clean the surrounding coated surfaces.

(b) Apply a heavy brush coating of caulking compound, Spraylat Part No. SC-1076-1, followed by one brush coat of brushable topcoat MIL-PRF-6799 Type II Class 7.

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**5-21. REMOVAL OF STRIPPABLE COATINGS.**

Remove the coatings by working an edge loose, holding the loose material and trimming with shears or a knife held in such a manner that the underlying surface is not scratched.

**5-22. DEPRESERVATION.** Regardless of status of aircraft, depreservation shall always include the removal of deteriorated lubricants, corrosion preventive coatings, barrier materials, strippable plastic coatings and tapes.

**5-23. REPRESERVATION.**

a. If aircraft is to be represerved for another storage period, the decision to remove or replace strippable coatings shall be based on the general condition of base coatings and cost comparison between touching up and completely stripping and recoating. If representative test areas of coating strip readily and base (black) coating is in good condition, the coating may be left in place and topcoated or touched up with white topcoat material.

b. Coatings shall be removed as necessary to gain access to aircraft interior and to permit engine and other system represervation.

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5-27/(5-28 Blank)
5-24. **INTRODUCTION.** Tape and Barrier Material (T&B) provides protection against the entrance of dust, dirt, FOD, moisture, animals and insects. T&B protects aircraft surfaces from the effects of blowing sand, debris, sunlight (UV) and environmental fallout. Examples of areas protected with T&B (see Figure 5-19):

a. Intakes and exhaust (equipment, engines, APU).

b. Canopies and other transparencies.

c. Water entrapment areas on upper surface of the aircraft.

d. Exposed unprotected surfaces (bare metal, composites).

e. Open hoses, tubes and fittings.

![Figure 5-19. Tape and Barrier (T&B) Applied to Aircraft Openings](image)

**NOTE**

When SAE AMS-T-22085 Type II tape is used, care shall be taken to avoid contaminating tape backings or edges with solvent cut back CPCs, oils and greases. These materials will attack the tape adhesive and cause the tape to lift during storage.

a. **Application.** Do not apply tape directly to machined finished bare metal surfaces or transparent acrylics. Whenever possible, select an adjacent area, such as a noncritical painted surface, for attachment.

b. **Minimum Amount of Tape.** Since preservation tape tends to lift paint on a poorly painted surface during depreservation, the amount of tape used should be kept to a minimum.

c. **Flat and Smooth.** Apply tape as flat as possible, free from voids (air bubbles), wrinkles and creases. Use firm finger pressure for initial applications, and follow by a rubdown with plastic or wooden spatulas as necessary. Tape shall be applied so that a minimum of 1/2 of tape width is applied to the attaching surfaces.

5-25. **SURFACE PREPARATION.** A cloth wipe down with degreasing solvent, MIL-PRF-680 Type II or III, followed by a final wipe down with isopropyl alcohol, TT-I-735, will usually produce a clean surface suitable for applying tape. A solvent approved for prepaint wiping is also acceptable.

5-26. **TAPE.** Only noncorrosive preservation tape, SAE AMS-T-22085 Type II or IV, shall be used for all preservation operations such as closing of openings to exclude foreign matter, attaching barrier material or tags, and securing cushioning material. Type II is for indoor or short term outdoor storage. Type IV is for outdoor or long term storage.
d. **Relax Momentarily.** The Type II tape tends to stretch when applied. Make sure the tape is allowed to relax momentarily after unrolling and before application. If tape must be stretched to prevent edge creasing during applications such as taping convex surfaces, tape shall be applied so that at least 6 inches of unstretched material is left on both ends of each length of tape. Do not stretch tape over concave surfaces. To prevent ragged edges, do not attempt to tear tape but cut with shears or sharp knife.

e. **Prevent Damage.** To prevent damage to the surface DO NOT cut tape with a knife after it has been pressed down against the surface.

f. **Shingle the Tape.** When applying layers of tape to the barrier material or aircraft, shingle the tape from bottom to top (see Figure 5-20).

g. **Removal.** Remove tape adhesive from transparencies using aliphatic naphtha, TT-N-95 Type II.

5-27. **BARRIER MATERIAL.**

a. **Barrier Material.** MIL-PRF-131 is a water-vaporproof, heat sealable, grease-proof flexible barrier material.

   (1) Class 1 is a good general purpose medium duty plastic backed material.

   (2) Class 3 is a heavy duty scrim backed material used mainly for long term component storage.

   (3) When applying barrier material, the side with the red identification lettering shall face outward.

b. **Seal Openings.** For openings from 1-12 inches, seal using tape and barrier material.

c. **Cover Openings.** For openings greater than 12 inches, cover with solid fiberboard, ASTM D4727 Type SF Class Weather-Resistant Grade V3s, plywood or tempered masonite. Whenever possible, secure rigid fillers using safety wire. Seal gaps around closures using tape. When rigid filler is not available, use barrier material MIL-PRF-131, and preservation tape, SAE AMS-T-22085.

d. **Creases and Folds in Barrier Material.** Creases and folds tend to trap or collect moisture. These areas should be sealed using preservation tape, SAE AMS-T-22085 Type II.

e. **Overlap.** Successive layers of barrier material and preservation tape should be applied from bottom to the top of a vertical or curved surface (see Figure 5-20). This shingling effect will prevent water intrusion.
SECTION VII. SHRINKWRAP

5-28. INTRODUCTION. Shrinkwrap is used to protect aircraft or components during Level II preservation (see Figure 5-21). It shall be used only for shipment and is not recommended for storage.

   a. Description. Shrinkwrap is a low density polyethylene (LDPE) film made from low melt resin. The film may contain different additives to resist ultraviolet light, reduce static, balance shrinking, and reduce the tendency of the film to stick to itself. Though the film is available in white, blue, and clear, only the white film shall be used on aircraft in order to reduce heat absorption. The standard film is 7 mils thick, but can be obtained in other thicknesses depending on the application. Shrinkwrap normally comes on rolls, and the film is taped together to encapsulate the aircraft. For some aircraft, pattern kits are available to ensure a better fit and less scrap material at the application site. Shrinkwrap film does not adhere to the aircraft being protected; it will only fuse to itself. Though the film is loose when the aircraft is initially covered, it shrinks to a tight fit when heat is applied using a propane heat gun.

   b. Static DH. The environment inside the shrinkwrap shall be statically dehumidified using a large number of desiccant bags (about one 16 unit bag per cubic foot of space) placed inside the aircraft just before shrinkwrap installation.

   c. A list of consumable materials and equipment required for the shrinkwrap process is given in Table 5-3.

5-29. AIRCRAFT PREPARATION.

   a. Cleaning. Clean all surfaces of aircraft in accordance with NAVAIR 01-1A-509-2. Dry all surfaces using wiping cloths and compressed air as necessary.

   b. Inspection.

      (1) Ensure that all surfaces to be covered are free from corrosion.

      (2) For aircraft with engines and/or components removed, ensure that all fluid system lines are suitably capped with metal closures. Refer to Chapter 3.

   c. Corrosion Control. Treat any corrosion found in accordance with NAVAIR 01-1A-509-2.

   d. Protection. Preserve aircraft in accordance with Level II requirements. In addition to the requirements outlined in Chapter 3, the following shall be accomplished:

      (1) Cushioning. Install mechanical protection type PSE covers or equivalent cushioning on external devices such as angle of attack probes and blade antennas. Apply cushioning material, A-A-59135/ A-A-59136, held in place with preservation tape, SAE AMS-T-22085 Type II, to sharp edged areas that are contact points for the installed shrinkwrap, such as horizontal wing/tail leading edges and extensions, rudder trailing edges, engine afterburner fire doors, vertical fin tips, wing tips, protruding portions of weapons launchers, and edges of propeller/helicopter blades. Poly foam padding is used because it creates an attach point for the shrinkwrap film when heat is applied.

      (2) Removable Items. Remove all fragile and protruding items that may be damaged during shrinkwrap installation or shipment, such as antennas, windshield wiper blades and arms, or external temperature indicator probes. Helicopter blades may be removed if desired. Package and label removed items and store in the aircraft pilot/crew compartments.

      (3) Ventilation. Prior to sealing aircraft, partially open any sliding or inward-opening doors or hatches about one inch and secure in this position. If aircraft is compartmentalized without interconnecting openings to allow free breathing, install breathing tubes (see Figure 3-5) in such a manner that each compartment can breathe to an adjacent ventilated compartment.
### Table 5-3. Materials and Equipment for Shrinkwrapping

<table>
<thead>
<tr>
<th>Nomenclature</th>
<th>Unit of Issue</th>
<th>Part Number</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumable Materials</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic, Heat Shrinkable Film, White, UV resistant, 7 mil, 14' x 200'</td>
<td>Roll</td>
<td>8135SDP000-1</td>
<td>8135-01-250-4931</td>
</tr>
<tr>
<td>Plastic, Heat Shrinkable Film, White, UV resistant, 7 mil, 20' x 200'</td>
<td>Roll</td>
<td>8135SEP000-2</td>
<td>8135-01-250-2301</td>
</tr>
<tr>
<td>Tape, Heat Shrinkable, 2&quot; width</td>
<td>Roll</td>
<td>7510SDP000-1</td>
<td>8135-01-250-2299</td>
</tr>
<tr>
<td>Tape, Heat Shrinkable, 4&quot; width</td>
<td>Roll</td>
<td>FAN-704W</td>
<td>8135-01-335-8884</td>
</tr>
<tr>
<td>Tape, Preservation, 2&quot; width</td>
<td>Roll</td>
<td>SAE AMS-T-22085 Type II</td>
<td>7510-00-852-8180</td>
</tr>
<tr>
<td>Tape, Preservation, 4&quot; width</td>
<td>Roll</td>
<td>SAE AMS-T-22085 Type II</td>
<td>7510-00-916-9659</td>
</tr>
<tr>
<td>Barrier Material, 3' x 200 yds</td>
<td>Roll</td>
<td>MIL-PRF-131 Class I</td>
<td>8135-00-282-0565</td>
</tr>
<tr>
<td>Dessicant, Bagged</td>
<td>Drum (500 bags)</td>
<td>MIL-D-3464 Type I</td>
<td>6850-00-264-6574</td>
</tr>
<tr>
<td>Dessicant, Bagged</td>
<td>Can (1200 bags)</td>
<td>MIL-D-3464 Type I</td>
<td>6850-00-264-6564</td>
</tr>
<tr>
<td>Cushioning Material, Polyethylene Foam</td>
<td></td>
<td>A-A-59136</td>
<td></td>
</tr>
<tr>
<td>Cushioning Material, Polyethylene Sheet</td>
<td></td>
<td>A-A-59135</td>
<td></td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder, Propane, Empty, 20 lb.</td>
<td>Each</td>
<td>RR-C-910/2</td>
<td>8120-00-530-5225</td>
</tr>
<tr>
<td>Heat Gun, Propane, 125,000 BTU/hr output minimum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate Ladders or Aircraft Stands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knife, Safety</td>
<td>Each</td>
<td>HKN1F2</td>
<td>7330-01-255-3444</td>
</tr>
</tbody>
</table>
(4) Insure that fuel tank levels are properly adjusted for shipping in accordance with applicable MIM. Seal fuel filler ports, vents, drains, and battery vents prior to covering the aircraft. Fuel filler ports, vents, and drains should be padded with cushioning material to further protect them from heat during the shrinkwrap process.

Desiccant, Activated 12
MIL-D-3464 Type I

CAUTION

Do not allow desiccant bags to contact metal surfaces. Place a sheet of barrier material, MIL-PRF-131 Class 1, underneath bags if desiccant holders are not available.

(5) Dehumidification. Install desiccant bags, MIL-D-3464 Type I, in accordance with Chapter 6, Section II, immediately prior to installation of shrinkwrap.

5-30. INSTALLATION GUIDELINES. Shrinkwrap may be installed indoors in a hangar or other shelter or outdoors on a clear day with light winds.

a. Safety Precautions.

(1) Inspect aircraft for fuel leaks prior to beginning the shrinkwrap operation. No attempt shall be made to cover an aircraft with known or suspected fuel leaks.

WARNING

Heat from the propane gun may ignite fuel vapors and cause an explosion. Ensure that a Gas Free Inspection is performed prior to work.

(2) A check of the fuel vapors in the aircraft is mandatory before applying the shrinkwrap. The aircraft must be certified as gas-free before work is performed.

(3) Propane gas is flammable, pressurized, and can freeze. Operators shall be properly trained in the use of the heat gun and aware of the dangers involved in using propane fuel.

(4) The work area shall be examined for flammable materials. Flammable materials shall be removed from the immediate area before beginning work.

(5) Use locally mandated personal protective equipment required for use with propane torches. Gloves capable of heat resistance to 200°F are recommended.

b. Installation. For one-time or single aircraft wrapping, it is often faster and more economical to have a contractor apply the shrinkwrap cover. When installation by Navy personnel is desired, proper training is required. The following are general guidelines only and are not a substitute for practical training.

(1) Film will shrink approximately 20% in length and 40% in width. Place the pieces so that large sections are centered on fuel filler ports, vents, and drains, so that no joining seams are formed near potential fuel fume sources. Where two pieces come together to form a horizontal seam, the top piece shall overlap the bottom piece to prevent water entrapment. A minimum overlap of 6 inches is required for all seams.

(a) Pull film from roll and drape over aircraft. Mounting the roll on a rack is recommended. Film should follow aircraft shape but be loosely wrapped.

(b) If using a precut pattern, drape sections over aircraft, starting at the top and working downward.

(2) Cut off film with safety knife or scissors. Attach sheets/sections of film together using shrinkwrap tape.

(3) After the aircraft has been covered, all seams and pieces must be fused together before the film is shrunk. Heat the area to be fused by first shooting the flame between the top and bottom layers to be fused. Then, hold the heat gun 8-12 inches from the seam and move the heat along the seam. As the film becomes soft, pat the seam gently with a safety gloved hand (film is HOT).

(4) After all seams have been fused, allow film to cool. Test seams for proper bonding by trying to pull seams apart with fingernails. If seam loosens, it must be resealed.
NOTE

To allow strut extension during loading, do not shrink film on landing gear.

(5) Shrinking the Film. Hold heat gun 12" away from film. Slightly tilt the nozzle in the direction of movement. Do not wave back and forth like a paint sprayer, but hold heat gun steady and move the hot air slowly slightly ahead of the wrinkled section of the film. Push the hot air ahead to the section to be heated, not behind at the areas already heated, or film may burn. After the heat is removed, the film should shrink to a glove tight fit.

(6) Access Doors. If required, install zipper access door(s) after cover is completely shrunk. Attach access doors to cover using shrinkwrap tape.

(7) Fuel Vents. Cut film and remove tape seals applied to fuel vents. Use heat shrink tape to reseal the film. Do not apply heat to shrink tape.

(8) Inspection. Allow shrinkwrap to cool and set for 30 minutes. Inspect shrinkwrap for holes, tears, or burns. To repair small areas, cover with a piece of shrinkwrap tape. To repair larger areas (greater than 2" diameter), use shrinkwrap tape to attach a piece of shrinkwrap film approximately 1" diameter larger than the area. Use the heat gun to lightly shrink the repaired area.

(9) Identify aircraft in accordance with paragraph 5-2.

(10) Record number and location of desiccant bags in the preservation section of the aircraft logbook.

(11) Hoist Points. For access to hoist points, use safety knife to cut film. Reseal with heat shrink tape after hoisting is complete.

(12) Tiedown Points. For access to tiedown points, use safety knife to cut film. Use heat shrink tape to seal around tiedown attachments.

5-31. MAINTENANCE. Inspect integrity of the shrinkwrap every 28 days for holes or tears.

a. To repair small holes or tears, cover with a piece of shrinkwrap tape.

b. To repair larger holes or tears (greater than 2" diameter), use shrinkwrap tape to attach a piece of shrinkwrap film approximately 1" diameter larger than the area. If possible, use heat gun to lightly shrink repaired area.

5-32. REMOVAL. Shrinkwrap shall be removed within 60 days of wrapping or within 5 days after receipt of aircraft, whichever is sooner. Shrinkwrap is easily removed, as it does not adhere to the aircraft surface. Slit low points using a safety knife and allow water to drain. Use a safety knife or scissors to cut away the film, taking care not to damage the underlying surface.

5-33. DEPRESERVATION. The aircraft may be depreserved for operation, continue in Level II preservation using another barrier method, or be depreserved and inducted for maintenance. Depreserve in accordance with Level II requirements of Chapter 3.

5-34. REPRESERVATION. If the aircraft is to continue in a preservation status, conduct inspections in accordance with Level II requirements and apply chosen barrier method.
CHAPTER 6
ENVIRONMENTAL CONTROL

SECTION I. INTRODUCTION

6-1. INTRODUCTION. Events such as rain, salt spray, corrosive chemical spills, direct sunlight and high temperatures will cause fairly rapid deterioration of unprotected, stored aircraft. All of these forces can be mitigated by the use of simple covers or by storing the aircraft in a sheltered area. The major cause of deterioration is the inability to control specific humidity, relative humidity (RH) and changes in temperature. These factors allow water intrusion into the aircraft structure and areas hidden from casual inspection. These factors cause condensation, resulting in corrosion and bacterial growth.

a. Aircraft have complex geometries where there are zones of heat gradients (large areas where surface temperatures can vary 10-30°F within the structure at any given time of the day). Thin sections experience rapid heat transfer whereas more massive structures act as heat sinks and transfer heat more slowly.

b. In a given storage area, day time and night time air temperatures can vary as much as 40°F. This change in temperature affects the ability of the surrounding air to hold water. For example, at a day time temperature of 70°F, the air can hold over 100 grains of water per pound of air; however, at a lower night time temperature of 40°F the air can only hold about 30 grains of water per pound of air. During the cooling transition between 70-40°F, the excess moisture will condense onto nearby cool surfaces such as aircraft skins and structures.

c. This process of heating and cooling takes place every day. Depending on the specific humidity, some days the condensation and heavy dew will be obvious. On other days the condensation may be microscopic but no less destructive. It is very difficult to control temperature variations, but something can be done about controlling humidity. Dehumidification (DH) is an ancient technique that, coupled with modern technology, can protect stored aircraft. In order to understand the advantages of dehumidification it is necessary to review a few facts about the phenomena of humidity, temperature, dew point and moisture saturation.

6-2. DEHUMIDIFIED STORAGE.

a. Dehumidification is a process by which excess moisture is removed from the air of a storage space. By extracting moisture from the air, the specific humidity and the relative humidity (RH) is reduced to a level whereby the dew point temperature cannot be attained during the normal day-to-night thermal cycle. Dehumidified air that is constantly circulated throughout the covered aircraft or component will eventually extract moisture from inaccessible areas. When system equilibrium is achieved, the static or dynamic DH process will stabilize in the desired RH range.

b. Some materials can exist in a wide range of RH without incurring damage, whereas other materials require a much narrower range. For instance, rubber and plastics can be safely stored in a RH environment of up to 80%, but metallic materials are best protected in a range of 35-45% RH. Some polymeric materials will deteriorate under constant exposure to very low RH levels (less than 25%), but other materials are very sensitive to electrostatic discharge at low RH levels. Because aircraft and components are made of a variety of materials, a compromise RH range for storage was chosen. The compromise range for dehumidified storage of aircraft and aircraft components is 30-40% RH at all temperatures. Clean metal surfaces may be preserved in dehumidified storage indefinitely. Preparation procedures for Level III (dehumidified) preservation are found in Chapter 3 (aircraft) and Chapter 4 (components).

c. There are many ways to dehumidify a storage area. The two discussed in Sections II and III are static and dynamic. Static dehumidification utilizes bags of desiccant scattered throughout the storage area and relies on absorption of moisture from the static air within the storage area until equilibrium is achieved. Dynamic dehumidification utilizes a machine that extracts moisture from the air and provides a means to recirculate the processed dry air throughout the storage area.
6-3. **PSYCHROMETRIC CHART.** Early in the twentieth century, Richard Mollier invented a graphical method to display the properties of various mixtures of air and water vapor. This chart is commonly known as a Mollier diagram or psychrometric chart (see Figure 6-1). The chart relates values of specific humidity, relative humidity, dry and wet bulb temperatures and dew point. Definitions of terms and use of the psychrometric chart are described in the following paragraphs.

a. **Dry Bulb Temperature.** Commonly referred to as the air temperature, the dry bulb temperature is read from a standard thermometer that has no water on its surface. On the psychrometric chart, the dry bulb temperature is displayed on the horizontal (bottom) axis, increasing from left to right.

b. **Wet Bulb Temperature.** The wet bulb temperature is taken by surrounding the thermometer sensor with a wet wick and measuring the reading as the water evaporates. On the psychrometric chart, the wet bulb temperature lines run at an angle to the axis, and the temperature increases from bottom to top.

c. **Specific Humidity.** Specific humidity (GPP) is the weight of water (in grains) per pound of dry air. For a specific humidity of 75 GPP, there are 75 grains of water plus 6925 grains of dry air for a total of 7000 grains (one pound). On the psychometric chart, specific humidity is shown on the right vertical axis, increasing from bottom to top.

d. **Relative Humidity (RH).** The relative humidity of the air is the moisture content of the air as a percent of what the air can hold when the air is fully saturated. RH measures the moisture content in the air relative to the maximum value at the dry bulb temperature of the air. Since the maximum value increases with temperature, it is important to specify the dry bulb temperature when discussing relative humidity. On the psychrometric chart, relative humidity is shown by curved lines, increasing from right to left.

e. **Dew Point.** When moist air is cooled it cannot contain the same amount of moisture. At some point, the moist air will condense water onto nearby surfaces. This point depends on the amount of moisture in the air. This temperature is known as the dew point. On the psychrometric chart, the dew point occurs at 100% RH, and is read off the dry bulb temperature axis.

f. **Examples.**

1. Finding Relative Humidity. At a dry bulb (air) temperature of 75°F and a wet bulb temperature of 65°F, the relative humidity is approximately 60% (see Figure 6-1, point A).

2. Finding the Dew Point. If the dry bulb (air) temperature falls to 65°F, the humidity rises to 100%, and the air is completely saturated (see Figure 6-1, point B). If the air temperature falls below 65°F, water will begin to condense out of the air onto nearby surfaces.

6-4. **PSYCHROMETERS.** RH is measured with a simple instrument called a psychrometer. Psychrometers are very accurate and are used to calibrate other types of humidity sensors. The psychrometer has a dry bulb and a wet bulb thermometer mounted side-by-side. Sample air is passed over both thermometer bulbs and the temperature of both is recorded. Water evaporating from the wet bulb wick draws heat from the bulb, cooling the thermometer in proportion to the amount of evaporation. If both thermometers read the same, then the sample air has a RH of 100%. Normally, however, the wet bulb thermometer will have a lower reading than the dry bulb.
Figure 6-1. Psychrometric Chart
SECTION II. STATIC DEHUMIDIFICATION

6-5. STATIC DEHUMIDIFICATION. This technique is used in conjunction with sealed containers, completely sealed (bagged or coated) aircraft, or partially sealed sections of aircraft or components. Typical applications of static dehumidification are shipping containers (e.g. engine cans), single aircraft that are sealed in a conformable bag, or aircraft with strippable coating (for shipment). Refer to Chapters 3 and 4 for desiccant placement information.

a. Desiccant. Desiccants (drying agents) used in storage applications are substances which are chemically inert but have the ability to pick up and hold water vapor. At elevated temperatures, the reverse process takes place and the moisture is released. Desiccant materials are honeycombed with microscopic pores providing a large exposed surface area which absorbs water.

(1) Function. The air next to the desiccant bed is reduced to a low water vapor content with a resulting change in air density. Convection currents replace the dry air with moist air until eventually the entire space within the moisture barrier has an atmosphere of uniform low relative humidity. If the moisture content of the surrounding air is maintained below 40%, little or no corrosion will take place.

(2) Types. Static desiccants used in Navy packaging are procured under MIL-D-3464. Procurement and use is based on units of desiccant instead of weight. This specification covers a variety of materials classified as follows:

(a) Type I (General Purpose). Type I desiccant is for general use for static dehumidification of packages and closed spaces. Type I is used for engine container storage.

(b) Type II (Nondusting). This desiccant is used in critical packaging applications where dust cannot be tolerated.

(c) Type III (Special Application). Type III desiccant is packaged in special 8 and 16 unit bags. It is intended for use in areas where accidental flooding by water may occur.

(3) Application. Static dehumidification with desiccant bags extracts and holds moisture proportional to its capacity to absorb. Therefore, more bags than would normally be required are used to compensate for system leaks and severe storage conditions. The amount of desiccant prescribed for a given container was originally based on 18 months protection under relatively severe exposure conditions. With the improvement of barrier materials, the increasing use of sealed containers, and the wide variety of internal cushioning and cradling materials currently used, formulas with a series of variables are now necessary for calculating desiccant requirements.

(a) When the amount of desiccant is not specified for use in a particular container, estimate the amount of space to be dehumidified in cubic feet. Use one 16 unit bag of desiccant per 2 cubic feet of volume to be dehumidified. Additional desiccant may be required for storage areas that are not environmentally controlled (no heating or air conditioning) or subject to high humidity.

CAUTION

Place the desiccant bags in screened receptacles throughout the volume to avoid contact with aircraft surfaces. Saturated desiccant bags can cause corrosion when in contact with aluminum or steel surfaces. Barrier material, MIL-PRF-131 Class 1, may be used if receptacles are not available.

NOTE

The calculated amount of desiccant should be doubled when canning water, crash, or fire damaged engines.

(b) To reduce the drying time necessary to reach safe equilibrium conditions, the desiccant shall be distributed throughout the container or bagged aircraft. Figure 6-2 shows desiccant stacked in an air intake duct. Most large containers are equipped with screened receptacles for holding the desiccant. These receptacles shall be used whenever they are installed.
(4) Handling. Since the effectiveness of desiccants is measured in terms of their ability to absorb water vapor, special handling precautions must be observed to assure maximum dryness at time of use. The effectiveness of the desiccant as a drying agent is reduced as its moisture content is increased and this reduction can occur very rapidly.

(a) Desiccants are received in sealed containers. Containers shall be opened only during the brief period when desiccant is being removed. They shall be kept tightly sealed at all other times. Desiccant shall not be placed within any container/bag to be dehumidified until just before the container is closed and sealed. It is extremely important that the desiccant have no direct contact with liquid water.

(b) Humidity indicators shall always be kept in receptacles storing desiccant to verify the condition of the desiccant. If the indicator is pink, or the indicator is missing, the desiccant shall not be used until reactivated.

(5) Disposition. The drying action of most desiccants can be restored and the contained moisture can be driven off with heat. Reactivation procedures vary with the type of desiccant, the heat resistant characteristics of the bags, and the cleanliness of the desiccant. All clean desiccants used in Navy packaging can be economically reclaimed and may be accumulated for forwarding to the nearest reactivating activity.

(a) Maintain a supply of clean shipping containers complete with lids and locking rings that can be used for accumulation of spent desiccant.

(b) Segregate desiccant as it accumulates according to cleanliness of the desiccant bags. Discard all grease contaminated bags. Discard oil contaminated bags which exceed the limits in Table 6-1.

(c) Further segregate clean bags, both by bag size and desiccant material type. Recovery procedures vary both with materials being reactivated and with bag volume.

(d) Label the accumulation containers as “Spent Desiccant” with the type of desiccant and bag size, as applicable.

**CAUTION**

Do not increase the temperature to shorten the reactivation cycle as cloth bags will either scorch or burn at higher temperatures.

(6) Reactivation. Reactivation of desiccant material requires controls to assure that reclaimed materials will be within specification limits. Equipment to be used for reactivation shall be calibrated by a certified calibration laboratory. Equipment to be used for reactivation of subject materials is required to provide uniform temperatures of 250-300°F ±5°F and have an adequate exhaust system for the removal of water from the desiccant. Desiccants shall be reclaimed in accordance with the requirements and limits of MIL-D-3464.

(a) Calibration and maintenance records shall be maintained in all oven locations to assure a quality product. Logs identifying desiccant batches processed shall be maintained for authenticating the usability of reclaimed materials.

(b) Provisions shall be available for immediate canning and sealing of reactivated desiccant when it is removed from the hot oven. All containers shall be clean and should be in such condition as to assure a positive seal when lids and rings are in place. All reclaimed desiccant shall be clearly marked as "Reclaimed Material", with the reactivating activity and date of reactivation clearly indicated.

Table 6-1. Maximum Allowable Contamination (Cumulative)

<table>
<thead>
<tr>
<th>Bag Size</th>
<th>Oil Stained Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 unit</td>
<td>2 in²</td>
</tr>
<tr>
<td>8 unit</td>
<td>4 in²</td>
</tr>
<tr>
<td>16 unit</td>
<td>6 in²</td>
</tr>
</tbody>
</table>

Figure 6-2. Desiccant Stacked in an Intake Duct
b. **Humidity Indicators.**

(1) Types. All desiccant protection requires some manner of indicating the level of relative humidity within the chosen enclosure.

(a) Blue to Pink Indicators. The most common method of relative humidity indication is the use of blue to pink indicators. The color change occurs from a reaction between cobalt chloride and moisture in the air. The color changes from blue to pink at increasing relative humidities. By varying the concentrations, a series of color changes can be obtained at different relative humidities.

(b) Spot-Type Indicator Cards, MIL-I-8835. These cards consist of spots treated with cobalt chloride in a series of concentrations which change color at different relative humidities. The MS20003 three-spot card has color indications at 30, 40, and 50% relative humidities.

(c) Plug Type Indicators. Many engine containers are equipped with indicator plug receptacles. These utilize plug type indicators that are about the same size as an aircraft spark plug.

1. MIL-P-6131 indicators are filled with indicating silica gel that changes color from blue to pink at 30% relative humidity.

2. Indicator plugs, SAE AS26860, are single or three spot indicators which change color from blue to pink at various relative humidities. Type I is used with containers. Type II is for use with MIL-PRF-131 barrier material.

(2) Location.

(a) To protect aeronautical equipment, containers are equipped either with an inspection port through which the condition of the humidity indicator can be inspected, or a plug type indicator which can be read from the outside. When installing any type of humidity indicator, it must be located so that its condition can be inspected without opening the container.

(b) The indicator shall not be attached to or in contact with a bag of desiccant which would give a false indication of humidity control.

Figure 6-3. Installed Humidity Indicator Card

(3) Installation.

(a) Installation of Humidity Indicator Card, MS20003 (see Figure 6-3).

1. Prior to final sealing, cut a rectangular window into the middle of the barrier material, MIL-PRF-131 Class 1. The window shall be large enough so that the indicator card can be clearly seen.

2. Cut a piece of clear plastic sheeting, A-A-3174 Type 1 Class 1, at least 0.5 inches larger than the barrier material hole in all directions.

3. Seal the plastic to the inside of the barrier material using preservation tape, SAE AMS-T-22085 Type II, to form a window. Seal the outside edges of the window to the barrier material to prevent moisture from entering.

4. Secure the indicator card, MS20003, to the inside of the window, using tape, SAE AMS-T-22085 Type II, along the top edge of the indicator card only. Do not tape over the indicator spots.

(b) Installation of SAE AS26860 Type II Indicator Plug into MIL-PRF-131 Barrier Material. When installed correctly, plugs allow for a more airtight seal than cards. Plugs are required for Level III Static dehumidified storage of components.

**NOTE**

Practice the installation procedure on a scrap piece of barrier material prior to plug installation on the actual preservation package.
1. Draw a one inch diameter circle in the plug location.
2. Cut an “X” inside the circle with a knife or shears.
3. Unscrew the lock nut from the plug and push the plug through the barrier material. The plug shall be on the outside of the package.
4. Tighten the nut on the inside of the barrier material. The barrier material should lay as flat as possible. Avoid puckering the barrier material when tightening.
5. Torque the locking nut to 50 ± 5 in lb.

(4) Equilibrium within freshly sealed containers requires a considerable amount of time. Relative humidity readings shall not be accepted as an indication of internal condition until sufficient time has elapsed since closing the container (8-12 hours) to be certain that equilibrium within the container has been established.

(5) Reuse/Replacement.

**NOTE**

Keep indicator container lids closed at all times when not in use.

(a) All types of indicators may be reused unless damaged or contaminated with oil or water.

(b) Plug indicators with colored silica gel (MIL-P-6131) may be reclaimed in the same manner as desiccant bags using the procedures contained in paragraph 6-5a(6). Some low melting plastic materials, from which certain dehydrator plugs are made, require special reclamation procedures to prevent melting or distortion of the shell.

(c) Plug type indicators with paper elements (SAE AS26860) may be reused if the paper element turns blue when momentarily heated with a heat gun or heat lamp. Ensure that rings, plastic windows and sealing surfaces of plug indicators are clean and in good condition. If the plug indicator is otherwise serviceable, the paper element in the plug may be replaced as follows:

1. Insert a 1/2” Allen wrench into the lock nut and turn counterclockwise to loosen.
2. Remove lock nut.
3. Remove Teflon washer.
4. Remove old humidity card.
5. Install new humidity card.
6. Install Teflon washer.
7. Follow Installation Instructions for Humidity Plug in paragraph 6-5b(3) above, or reattach lock nut and store plug until required.

**CAUTION**

If spot-type indicators have been exposed to high humidity conditions and the spots have spread, they cannot be reused. Discard and do not use.

(d) Spot-type indicator cards (MS20003) and indicator buttons do not require special processing before use. Storage in sealed containers with desiccating agent will restore blue color. If blue color is not restored, dispose of indicator card.
SECTION III. DYNAMIC DEHUMIDIFICATION

6-6. INTRODUCTION. Dynamic dehumidification is a term used to describe the process of actively extracting moisture from the air and then pumping or recirculating it throughout the space to be protected. When using a dehumidifier, the dried air can be either recirculated in a closed loop system or exhausted in an open loop. In a dynamic system, the dehumidifier continually extracts water to maintain the proper relative humidity (RH).

6-7. DEHUMIDIFIERS. A dehumidifier is a machine that extracts moisture from the air. These machines are hooked up to aircraft, shelters or containers using plastic ducting. Humidistats and Lower Explosive Limit (LEL) detectors are incorporated to measure and control relative humidity and monitor explosive vapors. There are many different dehumidifiers on the market. The types commonly used in aircraft and component dehumidification are rotating desiccant wheel and cooling-based dehumidifiers.

a. Desiccant Wheel Dehumidifiers. The basic design of the desiccant wheel is shown in the schematic of Figure 6-4.

(1) This unit contains a honeycomb wheel that is impregnated with a desiccant material (e.g. lithium carbonate or silica). The wheel slowly rotates and an air stream passes through the desiccant impregnated honeycomb cells. The moisture in the air is removed and the processed (dried) air is then pumped into the storage area. The moisture laden return air is passed through the desiccant wheel in a continuous cycle until the humidistat detects the proper RH in the storage area and the unit is shut down.

(2) The moisture saturated desiccant cells rotate into an isolated section of the machine where heated reactivation air passes through the cells and moisture is removed. The moisture laden reactivation air is ducted out and dumped into the atmosphere, preferably well removed from the dried space.

(3) After reactivation, the desiccant rotates back into the process air stream where moisture continues to be removed. This recycling can occur indefinitely as long as the air prefilters are changed periodically.

(4) These units are manufactured in several air flow capacities. The most common sizes for aircraft use are 70, 300 and 600 standard cubic feet per minute (scfm). For example, one 300 scfm unit can provide dry air for up to four bagged aircraft in a mild climate. In severe climates (rainy or tropical), the 600 scfm unit may be required.

---

Figure 6-4. Desiccant Wheel Dehumidifier Schematic
The unit capacity, or the combined capacity of several units, used in a closed system, must be able to support a minimum of 3 air volume exchanges per day. Table 6-2 describes air flow rate in SCFM, maximum DH volume capacity for closed and open loop applications, and power requirements. The term "closed loop" refers to a recirculating process air system, whereas the term "open loop" refers to a single pass system when the process air is allowed to vent to the outside atmosphere.

b. Cooling-Based Dehumidifiers. These dehumidifiers are based on the principle of condensation. The incoming air is chilled below its dewpoint. The moisture is then deposited (condensed) on the condenser coils. The dried air is supplied to the storage area, while the condenser rejects the heat to the outside (see Figure 6-5). The process is similar to an air conditioning system. The actual hardware for cooling-based dehumidification is exceptionally diverse. The system is usually custom-designed for the application. Cooling-based dehumidifiers are mainly used in desert regions where high temperatures make them the more efficient choice.

c. Choosing a Dehumidifier. The choice of dehumidifier depends on several factors, including the RH desired, the temperature and humidity of the surrounding air, the cost of installation of the system, and the projected operating cost. In general, cooling-based dehumidifiers are more economical when operating at high air temperatures, and more efficient when drying air to saturated air conditions. Desiccant wheel dehumidifiers are especially efficient when used to create low relative humidities.

6-8. APPLICATIONS. Typical applications for dynamic dehumidification are as follows:

WARNING

Fueled aircraft or components shall be dehumidified using an open system, or a closed system with an explosion proof dehumidifier.

a. Operational Aircraft. Aircraft systems, such as avionics or engines, may be dehumidified when the aircraft is parked. This technique entails the use of a desiccant wheel DH unit that is linked to opening port covers in the aircraft by plastic ducting. The covers seal intakes, exhausts, vent ports, and other openings, and can be made from a variety of materials. The ducting is fitted to one or more of the covers and dehumidified air is circulated throughout internal compartments of the aircraft via internal environmental control ducts to airframe cavities, avionics, radar, fire control and life support systems. This setup is normally an open system where the dehumidified air is allowed to spill overboard through natural vents or leaks in the aircraft. However, a more sophisticated hook up can capture the spent process air through an aft cover and duct it back to the DH unit (a closed system). Either technique is a quick way to provide DH protection to avionics and other internal components during periods of aircraft inactivity. Figures 6-6 and 6-7 are examples of operational aircraft dehumidification.

<table>
<thead>
<tr>
<th>SCFM (Standard Cubic Feet per Minute)</th>
<th>Max D/H Volume (Ft³)</th>
<th>Power (Recommended)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Closed Loop</td>
<td>Open Loop</td>
</tr>
<tr>
<td>70</td>
<td>30,000</td>
<td>4,000</td>
</tr>
<tr>
<td>150</td>
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<td>300</td>
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<tr>
<td>600</td>
<td>280,000</td>
<td>36,000</td>
</tr>
<tr>
<td>1125</td>
<td>540,000</td>
<td>67,000</td>
</tr>
</tbody>
</table>

Table 6-2. Requirements for Desiccant Wheel Dehumidifiers
Compressor raises the pressure and temperature of the refrigerant gas.

Refrigerant is condensed back to a liquid, releasing its heat to the air passing through the condenser coil.

Refrigerant expands inside the coil, removing heat from the air passing through the fins.

Figure 6-5. Cooling Based Dehumidification System Schematic

Figure 6-6. Operational Dehumidification Hook-Up to Environmental Control System for Avionics Protection

Figure 6-7. Operational Dehumidification Hook-Up for Engine Protection
b. Aircraft/Component Storage.

**WARNING**

Aircraft or components stored in Level III preservation shall be purged of fuel in accordance with Chapter 3 requirements.

1. Shelters. Portable shelters are convenient structures that can be erected almost anywhere to provide overall protection. They completely contain the aircraft or component. A description of typical rigid shelters is contained in Chapter 5, Section II.

   a. Once the aircraft is sealed inside the shelter, a DH unit is switched on and process air is recirculated. The humidistat measures and controls the relative humidity to a preset level. Everything inside of the shelter is bathed in dehumidified process air that will eventually extract moisture from all areas and surfaces. Even rain soaked or hygroscopic items such as packaging materials, clothing and upholstery, which adds to the moisture load in the air, will eventually be dried by the dehumidifier.

   b. See Section IV of this chapter for information on equipment and installation requirements.

2. Shroud. A shroud is a specialized device used inside of shelters or repair hangars, to either cover in-work aircraft/components or to provide a sheltered storage space for removed components. A detailed description of the shroud can be found in Chapter 5, Section III.

   a. The DH unit and ducting must be arranged to promote good circulation. The dry air ducting may either lie on the floor or be fitted along the top portion of the shroud. The return lines must be positioned opposite the processed air ducting: if the processed air ducting is located low on the floor, the return line must be positioned high along the ceiling framework. Refer to Section IV of this chapter for ducting requirements and installation instructions.

   b. The edges of the shroud drape to the ground and are then either weighted down with shot filled pigs (in an open system), or zipper fastened to a ground cloth (in a closed system). The dehumidifier in a closed system is set up to recirculate the process air. For an open system, the dried process air is pumped in and allowed to escape at the base of the shroud.

3. Flexible Bag. The flexible bag is a completely encasing cover custom made for a specific type of aircraft or component. The bag is made of tough, vapor barrier material and provides excellent protection from direct weathering damage. The bag is sealed with interlocking zippers to provide an almost airtight environment. Refer to Chapter 5, Section IV, for a complete description of the flexible bag, and to Figures 1-5, 4-1, and 5-7 for examples.

   a. If a DH unit is hooked up to an installed cover, the aircraft is given maximum protection from the effects of humidity. The setup in Figure 6-8 can be used for bagged aircraft serviced by a closed loop DH system. The tubing and DH unit are large compared to the aircraft in order to show hookup details. The DH unit and all aircraft are ground wired together and to an earth ground. Refer to Section IV of this chapter for ducting requirements and installation instructions.

   b. In practice, the DH unit, the delivery ducts and the return ducts are all arranged so the aircraft can be removed or installed without disassembling and moving the ducting network.

4. Storage Areas for Removed Components. Storage areas for removed components may be created in buildings, portable shelters, or drop shrouds. These areas can be set up in a corner of a hangar or they can encompass the entire structure. The construction of the storage area can be of almost any material so long as the walls, ceilings, and doors are sealed against vapor transmission.

   a. Floors can be sealed. Standard wood frame and wallboard structures have been used successfully when the wallboard has been sealed with a good oil based primer and enamel topcoat. Metal sheds are effective when caulked on the overlapped seams and around fasteners. Doors must be weather proofed with foam rubber seal strips. Drop shrouds can be used for temporary component DH storage by setting them up in a convenient spot in the hangar and erecting appropriate shelving inside.

   b. The schematic in Figure 6-9 shows an air-conditioned and dehumidified storage set up. This type of storage is intended for certain types of avionics, fabrics and perishable materials. The DH unit is wall mounted and a simple window air conditioner unit is mounted above it. Combined dehumidifier/air conditioner units are also available and may be more economical to operate. The humidistat and thermostat modules are shown, as well as the hygrothermograph and two auxiliary circulation fans.
Figure 6-8. Dehumidification of Bagged Aircraft

Figure 6-9. Storage Schematic for a Removed Components Storage Warehouse (Dehumidified and Air-Conditioned)
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6-9. **DEHUMIDIFICATION EQUIPMENT.** Additional information on equipment specifications can be obtained from NAVAIR ISSC North Island, Code 43460, San Diego, California.

a. **Hygrothermograph.** A recording hygrothermograph is required to monitor the temperature and RH inside of the DH area. The data is used to check the effectiveness of the DH system and to determine whether corrective action is warranted. Hand held meters only measure the conditions of the moment, whereas this recording unit will report the conditions over time. The hygrothermograph should be spring wound to preclude the problems associated with batteries and power cords. The unit shall be capable of recording and storing data for a minimum of seven days. The data shall be recorded continuously or in increments of not more than one hour.

b. **Data Logger.** Data loggers are instruments that record temperature and RH from analog or digital signals over time. A data logger may be used in place of a hygrothermograph to monitor temperature and RH.

   (1) **Principles of Operation.** Typically, data loggers are compact, wired or battery-powered devices with a built-in microprocessor, data storage, and sensors. A built-in digital display can be used for viewing certain parameters and real time measurements. Data loggers utilize software on a personal computer to initiate the logger and view the collected data. They can be connected to modems for remote monitoring.

   (2) **Requirements.** Data loggers shall have a minimum temperature accuracy of +/-0.8°F and a minimum RH accuracy of +/-2%. The data shall be recorded continuously or at least every 30 minutes. The data logger shall be capable of storing at least one week of data. Data may be stored internally or on an SD card. If data is stored internally, the data logger shall be equipped with a USB port for data download. Software shall be compatible with Excel or with the current computer operating system.

c. **Explosive Gas Sensor.** This unit senses, measures and reacts to explosive gasses present in the DH air loop. The unit is calibrated to shut off the dehumidifier when explosive gases approach the Lower Explosion Limit (LEL) in air or 10% LEL.

   (1) **Principles of Operation.** The sensor is a catalytic device consisting of two elements which are heated by a power supply derived from the electronic control equipment. One of the elements is sensitive to flammable gases and responds to catalytic oxidation. The resultant temperature rise of the sensitive element increases its operational resistivity, which is proportional to the gas concentration. The other element is far less sensitive to flammable gasses and is utilized as the comparison element that compensates for changes in ambient temperature and humidity. A bridge circuit measures the change in resistivity as a function of flammable gas concentration. The response to various flammable gasses can vary from as low as 10 ppm to a high of 5%. The unit is calibrated to fuel and oil hydrocarbon vapors that would be expected to emit from preserved aircraft. The sensor is mounted in the return air line to the dehumidifier.

   (2) **Availability.** The explosive gas sensor is a special unit that is part of the dehumidifier. It shall be specified in the DH procurement document to ensure its inclusion.

d. **Humidistat.** The humidistat is a device that measures and controls RH by switching the DH unit on or off. The humidistat can operate on either mechanical or electronic principles.

   (1) **Mechanical Humidistat.** The sensor in a mechanical humidistat utilizes fiber bundles (human hair) stretched between two attaching points and hooked to a strain gage. As the fiber bundle expands or contracts during changes in RH, the strain gage circuitry measures those changes. The unit is calibrated against psychrometric data.

   (2) **Electronic Humidistat.** The sensors in an electronic humidistat are either capacitive or resistive.

      (a) The capacitive sensor consists of two metal plates separated by an insulator which is exposed to the atmosphere. The dielectric constant of the insulator changes as the RH changes and the resistance in the capacitor circuit changes accordingly. This resistance change is then calibrated against psychrometric data.

      (b) The resistive sensor measures the change in resistance of a polymer as a function of the rate in which the polymer absorbs water vapor from the surrounding air. The rate of water vapor absorption is proportional to the RH in the air. As is the case with all humidistats, this sensor must be calibrated against psychrometric data.
(3) Placement. The humidistat shall be placed in an area of the DH storage volume where it will measure and react to the effectiveness of the dehumidifier. The humidistat shall be placed in the return air duct adjacent to the DH unit or mounted in the center of the storage space where there is good air circulation.

(4) Availability. Normally, humidistats are integral to the DH unit. They can be mounted internally but they must have the capability to be remote mounted. The manufacturer of the DH unit provides a humidistat that matches their electronic control circuitry. Ensure that the humidistat that comes with the DH unit can be mounted in a remote location.

d. Dehumidifier. The dehumidifier shall be capable of continuous operation in ambient temperatures ranging from -40°F to 120°F. The dehumidifier shall also be capable of removing moisture from the air at various ambient conditions. The unit shall be procured complete with reactivation heaters, filters, motors, fans, and electrical controls. The unit shall also have built-in on/off/automatic operation switches, humidistat/control plug and explosive gas sensor. The dehumidifier systems shall be adequately protected from physical damage and the environment if located outside of protected area. The casing should be constructed of welded aluminum for maximum strength, durability and corrosion resistance. A Warning Label (as shown in Figure 6-10) shall be placed on each portable, nonexplosion-proof dehumidifier unit. Desiccant wheels shall be designed as a bacteriostatic inert structure impregnated with a desiccant that will not channel, breakdown or emit a measurable carry over. The design of the dehumidifier shall allow routine maintenance operations to be accomplished easily and quickly, and it shall be simple to operate and maintain. Refer to Section III of this chapter for more information on dehumidifiers.

(1) DH Capacity. Estimate the total volume of the space to be dehumidified, determine whether the system will be open or closed loop, and consult the DH unit capacities of Table 6-2. This will ensure that the chosen unit will perform properly in extreme weather conditions. The following examples demonstrate how to estimate the volume to be protected. Refer to Section III of this chapter for illustrations of the setup described in each example.

(a) Aircraft/Component in Flexible Bag.

1 Estimate the volume of each aircraft by multiplying the overall length by its cross-sectional area. Assume the aircraft is a rough cylinder. All measurements are in feet (ft).

\[ V_1 = \pi \left( \frac{1}{2}D_1 \right)^2 L_1 \]

where:
- \( V_1 \) = volume of space to be protected (ft\(^3\))
- \( D_1 \) = largest diameter of fuselage (ft)
- \( L_1 \) = overall length of the aircraft (ft)
- \( \pi = 3.1416 \)

2 Add 20% to the above answer to compensate for wings, rudders, rotary wings, rotor heads, landing gear and stabilizers. The volume of the flexible bag (if known) may be used instead.

\[ V_2 = 1.2 V_1 \]

where:
- \( V_2 \) = flight surface adjusted volume (ft\(^3\))

3 Multiply the answer from the previous step by the number of aircraft to be supported by the unit.

\[ V_3 = N V_2 \]

where:
- \( V_3 \) = total volume of space to be protected (ft\(^3\))
- \( N \) = total number of aircraft to be protected by the DH unit
4. Measure the length of the ducting that will be used to hook up all of the aircraft to the DH unit; include all supply and return manifolds.

\[ V_4 = \pi \left( \frac{1}{2} D_4 \right)^2 L_4 \]

where:  
- \( V_4 \) = volume of DH ducting (ft\(^3\))  
- \( D_4 \) = diameter of ducting (ft)  
- \( L_4 \) = cumulative length of ducting used (ft)  
- \( \pi = 3.1416 \)

5. Add the volumes of steps 3 and 4 to estimate the total volume to be dehumidified.

\[ V_t = V_3 + V_4 \]

where:  
- \( V_t \) = total volume to be dehumidified (ft\(^3\))

6. Refer to Table 6-2 and choose the appropriate size DH unit.

(b) Storage Areas for Removed Components or In Process Storage (refer to Figure 6-9).

1. Multiply length of the storage or shrouded area times the width and the height. All measurements are in feet (ft). If the dehumidifier is mounted inside the storage area or the amount of ducting used is small (less than 12 ft), the effect of the ducting volume is considered negligible and therefore not included in the total volume calculation.

\[ V_s = W \times L \times H \]

where:  
- \( V_s \) = total volume of space to be protected (ft\(^3\))  
- \( W \) = width of storage or shrouded area (ft)  
- \( L \) = length of storage or shrouded area (ft)  
- \( H \) = height of storage or shrouded area (ft)

2. If the amount of ducting exceeds 12 feet, measure the length of ducting used, including supply and return manifolds.

\[ V_D = \pi \left( \frac{1}{2} D_1 \right)^2 L_1 \]

where:  
- \( V_D \) = volume of DH ducting (ft\(^3\))  
- \( D_1 \) = diameter of ducting (ft)  
- \( L_1 \) = length of ducting (ft)  
- \( \pi = 3.1416 \)

3. Add the volumes of steps 1 and 2 to estimate the total volume to be dehumidified.

\[ V_t = V_s + V_D \]

where:  
- \( V_t \) = total volume to be dehumidified (ft\(^3\))

4. Refer to Table 6-2 and choose the appropriate size DH unit.

(c) Shelters.

1. Check the manufacturer’s specification sheet to determine the volume of the shelter. If unavailable, use the formulas in step (b) above for the calculation.

2. Refer to Table 6-2 and choose the appropriate size DH unit.

6-10. DH MATERIAL AND EQUIPMENT. Table 6-3 is a list of materials and equipment required for installing a dehumidification system.

6-11. INSTALLATION PROCEDURES.

**WARNING**

**DO NOT** operate a nonexplosion-proof dehumidifier within a Class 1 environment.

**CAUTION**

Aircraft and equipment must be grounded prior to starting the DH unit.

a. Dehumidifier Installation. Install the dynamic dehumidifier in accordance with the designated manual for the equipment. Ensure that the dehumidifier is connected to a certified common ground and also is statically grounded to each connected aircraft (if applicable) in accordance with Chapter 7 and the applicable MIM.

1. Flexible Bag/Drop or Freestanding Shroud/Portable Shelter. Install the DH unit(s) outside the space to be protected. Erecting a small shed roof over the DH unit to protect it from the weather is recommended.

2. Removed Component Storage. Dehumidifiers may be installed either inside or outside the protected area. Dehumidifiers installed inside shall be explosion proof if the area contains fueled components. For safety reasons, mount the DH unit at least 18 inches off the floor.
### Table 6-3. Material and Equipment for Dynamic Dehumidification

<table>
<thead>
<tr>
<th>Nomenclature</th>
<th>Specification</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapter, Rigid to Flex, 6 in. dia., 18 in. L &amp; 36 in. L</td>
<td>ASTM D 3034, SDR-35</td>
<td>Connecting rigid to flex ducting at dehumidifier</td>
</tr>
<tr>
<td>Cable Assembly</td>
<td>MIL-HDBK-274</td>
<td>Earth grounding</td>
</tr>
<tr>
<td>Cable Assembly</td>
<td>MIL-HDBK-274</td>
<td>Static grounding</td>
</tr>
<tr>
<td>Cement, PVC plastic piping systems</td>
<td>Standard Plumbers, ASTM D2564</td>
<td>Permanent connection of fittings to ducts</td>
</tr>
<tr>
<td>Chart Paper</td>
<td>Cole Parmer EW-08368-20 or equivalent</td>
<td>7 day recording of temperature and RH</td>
</tr>
<tr>
<td>Connector, Static Ground, Alligator</td>
<td>MIL-DTL-83413/7</td>
<td>Ground connection</td>
</tr>
<tr>
<td>Cushioning Foam</td>
<td>PPP-C-1797 or PPP-C-795</td>
<td>Tiedown &amp; ground strap sealing</td>
</tr>
<tr>
<td>Data Logger</td>
<td>Commercial</td>
<td>Recording of temperature and RH</td>
</tr>
<tr>
<td>Dehumidifier</td>
<td>Desiccant wheel or cooling based</td>
<td>Continuous source of dehumidified air</td>
</tr>
<tr>
<td>Ducting, Flexible, 4 in. or 6 in. dia., PVC or vinyl</td>
<td>P/N Duravent U-10 Dayco Corp. Dynaflex Co. West First St. Dayton, OH 45402</td>
<td>A/C to manifold and DH to manifold connector</td>
</tr>
<tr>
<td>Ducting, Rigid, 4 in. or 6 in. diameter</td>
<td>Standard Plumbers DWV, UV resistant, PVC, Schedule 40</td>
<td>Manifolds and main lines</td>
</tr>
<tr>
<td>Ducting, Rigid, 4 in. or 6 in. diameter</td>
<td>ASTM D 3034</td>
<td>Manifolds and main lines</td>
</tr>
<tr>
<td>Explosive Gas Sensor</td>
<td>Supplied as part of dehumidifier unit</td>
<td>Explosive vapor sensor/unit shutdown</td>
</tr>
<tr>
<td>Fittings, 45° and 90°, 4 in. diameter</td>
<td>Standard Plumbers DWV, UV resistant, PVC, Schedule 40</td>
<td>Tees, elbows and sleeves</td>
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<tr>
<td>Fitting, 45° Bell and Spigot Elbow, 4 in. diameter</td>
<td>ASTM D 3034, SDR-35</td>
<td>Connecting rigid ducting</td>
</tr>
<tr>
<td>Fitting, 90° &quot;ELL&quot;, Bell and Spigot, 4 in. diameter</td>
<td>ASTM D 3034, SDR-35</td>
<td>Connecting rigid ducting</td>
</tr>
<tr>
<td>Fitting, Increaser, Bell and Bell, 4 in. to 6 in. dia.</td>
<td>ASTM D 3034, SDR-35</td>
<td>Connecting rigid ducting</td>
</tr>
<tr>
<td>Fitting, Double Bellstop Coupling, 4 in. diameter</td>
<td>ASTM D 3034, SDR-35</td>
<td>Connecting rigid ducting</td>
</tr>
<tr>
<td>Fitting, Plug, 4 in. diameter</td>
<td>ASTM D 3034, SDR-35</td>
<td>Blank off ends of rigid ducting</td>
</tr>
<tr>
<td>Fitting, 90° Elbow, Bell and Bell, 6 in. diameter</td>
<td>ASTM D 3034, SDR-35</td>
<td>Connecting rigid ducting</td>
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<td>Connecting rigid ducting</td>
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<td>Fitting, Cap, 4 in. diameter</td>
<td>ASTM D 3034, SDR-35</td>
<td>Blank off ends of rigid ducting</td>
</tr>
<tr>
<td>Fitting, &quot;Tee&quot;, Bell and Bell, 4 in. or 6 in. diameter</td>
<td>ASTM D 3034, SDR-35</td>
<td>Connecting rigid ducting</td>
</tr>
<tr>
<td>Hose Clamps, 4 in. and 6 in.</td>
<td>Commercial</td>
<td>Optional connector</td>
</tr>
<tr>
<td>Hub Centers, 4 in./6 in., rubber sleeve with CRES sheath and clamps</td>
<td>Standard Plumbers</td>
<td>Duct-to-duct connector, able to disassemble</td>
</tr>
<tr>
<td>Humidistat</td>
<td>Supplied as part of dehumidifier unit</td>
<td>Controls DH unit to maintain selected range of RH</td>
</tr>
<tr>
<td>Hygrothermograph</td>
<td>Cole Parmer Model #EW-37250-10 or equivalent</td>
<td>7 day recording of temperature and RH</td>
</tr>
<tr>
<td>Preservation Tape</td>
<td>SAE AMS-T-22085 Type II</td>
<td>Balancing DH airflow</td>
</tr>
<tr>
<td>Sealant, Silicone, RTV, non-corrosive</td>
<td>MIL-A-46146 Group 1 Type 1</td>
<td>Sealing flex ducts to aircraft covers and general repairs</td>
</tr>
<tr>
<td>Tie Wraps, plastic</td>
<td>SAE AS23190 Type I</td>
<td>Connect flex to rigid ducts and secure tiedown sleeves</td>
</tr>
</tbody>
</table>
b. **Ducting Installation.** Ensure that the process, return and reactivation air ducts are free from obstructions.

   (1) **Flexible Bag.** Install the rigid ducting and flexible ducting in accordance with the setup shown in Figure 6-8. Use hub connectors to attach the flexible ducts so they may be removed and reattached as aircraft are moved in and out of the area. Attach the flexible ducts to the rigid ducts by using plastic tie wraps. Support the ducting with "V" blocks every 5-7 feet. The support blocks can be made of short lengths of ducting with a "V" notch cut out.

   (2) **Drop or Freestanding Shroud.** Route a process air supply duct across the floor or along the ceiling of the shroud. Positioning the process air ducting along the floor may prove easier to setup. Route the ducting so it does not interfere with components or personnel in the work area. Support the ducting with "V" blocks every 5-7 feet. The support blocks can be made of notched short lengths of spare ducting with a "V" notch cut out. Drill holes into the duct to adequately distribute the air and reduce back pressure to the DH unit. If an open system loop is used, no return ducting is required. If a closed system loop is used, the return ducting should be positioned opposite the process air ducting. For example, if the process air duct is positioned along the floor, the return line must be positioned along the ceiling.

   (3) **Shelter.** Install process air ducting through the shelter wall and into a tee splitter. From the splitter, route rigid ducting to the two nearest corners of the shelter and attach elbows. Attach supply ducts, drilled with holes, to the elbows and run them lengthwise along the edge of the shelter on both sides, positioned high on the walls. The drilled holes must be aligned to point out into the room. Smaller holes shall be drilled near the elbows and larger holes near the capped ends. Ensure that there is very little back pressure on the DH unit. Install return ducting, as it is more efficient to recirculate the air inside the shelter instead of using outside air. If two DH units are used, then set them up on opposite sides of the shelter, with the supply and return ducts fed directly along both sides.

   (4) **Removed Component Storage.** The process air ducting should be suspended from the ceiling. Drill holes into the duct to adequately distribute the air and reduce back pressure to the DH unit. Enlarge the holes furthest from the unit. Lay a return line along the floor positioned towards the center of the storage space. In smaller storage spaces return ducting may not be needed; the return air will enter the DH unit directly. Route the dehumidifier reactivation air ducting outside of the room. Ensure that there is at least a five foot separation between the intake and exhaust ports.

c. **Enclosure Installation.** Ensure that the enclosure to be dehumidified meets the requirements of Chapter 5 and Section III of this chapter.

   (1) **Flexible Bag.** Using the polymer foam cushioning material and tie wraps, ensure that all tie-down cables and other items that protrude through the flexible cover are tightly sealed.

   (2) **Drop or Freestanding Shroud.** Lower the drop shroud over the in-process aircraft/component and the process air ducting.

   (3) **Removed Component Storage Shelter.** Inspect the shelter for proper sealing, especially around the access doors. Caulk cracks or gaps or seal with barrier material.

d. **Airflow Balancing.**

   (1) **Flexible Bag.** The aircraft furthest from the DH unit will receive the least airflow. Correct this by balancing airflow using preservation tape to partially block the airflow to the nearer aircraft. Place strips of tape across the end of the return air rigid duct where the flexible duct attaches. All of the flexible covers should balloon slightly. Covers that are drawn tight against the aircraft skin will not allow proper airflow around all surfaces. Ordinarily, airflow balance can be achieved by applying a single width of two inch wide tape across an air duct. Apply the tape at the edge of duct and work toward the center. If it requires more than 50% coverage, there is something wrong in the system and troubleshooting is in order.

   (2) **Removed Component Storage/Shroud/Shelter.** Check for sufficient air flow at the farthest holes by using strips of tissue paper. The drilled holes in the process air ducting can be further enlarged or blocked off with preservation tape as necessary to balance airflow. There should be very little back pressure on the DH unit.
e. **Hygrothermograph or Data Logger.** Maintain a hard copy file of the hygrothermograph charts, or an electronic file of the data logger readings.

   (1) Flexible Bag. Place a hygrothermograph or data logger in the starboard engine intake in an upright position.

   (a) The hygrothermograph has seven day charts and shall be checked daily and changed weekly. Mark each chart with the beginning and the ending dates, along with the aircraft BUNO.

   (b) Check the data logger daily to verify that the humidity is within limits. Download the data logger weekly.

(2) Removed Component Storage/Shroud/Shelter. Place a spring-wound hygrothermograph or data logger on one of the storage racks, away from the DH unit. Monitor the temperature and humidity once a day. Change the hygrothermograph chart or download the data logger weekly.

   (3) If the RH is out of limits (less than 30% or greater than 40%), troubleshoot the DH system in accordance with paragraph 6-12.

f. **Humidistat.** Mount the remote humidistat in the space to be dehumidified where there is good airflow. Set the RH range to 35%±5%.

g. **Start-Up Procedures.** Hook up the DH unit and make all of the connections as air tight as possible. Obtain a clearance from the local Gas Free Engineer (if required) and switch the unit on. The unit may run continuously for several days before equilibrium is reached. Check the system for airflow leaks and correct if found. Monitor the RH with the hygrothermograph. Check the efficiency of the setup for several days. Limit access into the dehumidified space until the RH stabilizes. Discontinue daily checks when the system is functioning properly.

h. **Recordkeeping.** Maintain a file of the hygrothermograph charts or data logger data for at least 3 years. A log book of maintenance actions shall be kept and a functional preventative maintenance schedule shall be established for the DH equipment (see Section V).

6-12. **TROUBLESHOOTING RH VARIANCE.** If the RH falls out of the specified range (30-40%), begin troubleshooting within 24 hours of discovering the discrepancy.

   a. Inspect the DH system as follows:

   (1) Compare the hygrothermograph or data logger data with a known functioning hygrothermograph or data logger. If faulty, replace hygrothermograph/data logger.

   (2) Check humidistat controls. Repair or replace if faulty or malfunctioning.

   (3) Check the dehumidifier controls for correct settings. If controls are properly set, inspect the DH unit in accordance with the manufacturer’s troubleshooting guide.

   (4) Check for disconnected or damaged ducting. Repair as necessary.

   (5) For DH buildings, check for open doors, windows, or access panels. Close or seal as necessary.

   (6) For items enclosed in a bag or shroud, check for rips or tears in the material. Repair as necessary.

   b. Closely monitor the system for 48 hours to ensure effectiveness of corrective actions. If the specified RH is not re-established, resume troubleshooting.

   c. If it is anticipated that repairs will take longer than 14 days, the items in preservation shall be inspected for corrosion, repaired if necessary, and placed in an alternate DH facility or an alternate level of preservation (Level II or Level III Static is recommended). Items may be depreserved and returned to Level III Dynamic preservation when the facility is repaired and is capable of maintaining the required RH (30-40%).

6-13. **MAINTENANCE.** Maintain the aircraft systems or components in accordance with the Level III preservation requirements found in Chapters 2, 3 and 4. Refer to Section V of this chapter for site maintenance instructions.
SECTION V. DEHUMIDIFICATION EQUIPMENT MAINTENANCE

Table 6-4. Dehumidification Equipment Maintenance Guidelines

<table>
<thead>
<tr>
<th>Item</th>
<th>Inspection Interval</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehumidifier</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filters</td>
<td>2 months</td>
<td>Inspect; replace or clean if airflow is restricted due to dirt and grime.</td>
</tr>
<tr>
<td>Desiccant Wheel</td>
<td>6 months</td>
<td>Inspect for contamination and deterioration due to plugged channels. The wheel should last many years if the prefilters are kept clean and contaminants are not allowed to reach the desiccant channels. The desiccating material may be a hazardous material. Check with the local safety and environmental office for handling procedures.</td>
</tr>
<tr>
<td>Drive Motor and Blowers</td>
<td>6 months</td>
<td>Lubricate bearings and clean seals.</td>
</tr>
<tr>
<td>Drive Belt</td>
<td>6 months</td>
<td>Inspect for cracks and deterioration; replace if faulty.</td>
</tr>
<tr>
<td>Explosive Gas Sensor</td>
<td>6 months</td>
<td>Calibrate</td>
</tr>
<tr>
<td>Humidistat</td>
<td>2 months</td>
<td>Compare reading with psychrometer or hand held humidity sensor. Calibrate or replace if readings are greater than 5% apart.</td>
</tr>
<tr>
<td>Reactivation Air Heater</td>
<td>6 months</td>
<td>Inspect elements for breaks; replace or repair.</td>
</tr>
<tr>
<td>Ducting</td>
<td>30 days</td>
<td>Inspect for cracks, chalking, splits, or damage; replace if found</td>
</tr>
<tr>
<td>Hygrothermograph / Data Logger</td>
<td>2 months</td>
<td>Compare reading with psychrometer or hand held humidity sensor. Calibrate or replace if readings are greater than 5% apart.</td>
</tr>
</tbody>
</table>

6-14. DH EQUIPMENT MAINTENANCE.

a. Maintenance Guidelines. Table 6-4 contains maintenance guidelines for equipment used in dehumidification. The following paragraphs contain additional information.

b. Dehumidifier. The dehumidifier consists of electrical and mechanical parts that require periodic maintenance.

c. Humidistat. The remote humidistat should be inspected and compared against a psychrometer or hand held humidity sensor every 2 months.

(1) The sensor unit accumulates dust and grime from the thousands of cubic feet of process air passing around it. Clean the sensor (in place) with a soft bristle brush and wiping cloths every 6 months.

**CAUTION**

Do not use water to clean the sensor. Water will interfere with the calibrating sequence.

(2) The sensor may be removed for a more thorough cleaning; refer to the manufacturer’s manual. After cleaning and drying, reinstall the sensor and proceed with the calibration procedure.

d. Explosive Gas Sensor. Calibrate the explosive gas sensor every 6 months, or as recommended by the manufacturer. This calibration can only be performed by qualified calibration or maintenance personnel. Do not attempt to calibrate this device without the proper training and certification.

e. Ducting. The ducting is fairly maintenance free, but it will deteriorate during long exposure to sunlight and ozone (air pollution). Visually inspect the ducts for obvious cracks, chalking, splits and mechanical damage every 30 days. Apply light foot pressure against the wall of several representative rigid ducts and check for good resiliency and flexure. Ensure that the ducts are still supported by blocks. Replace any duct that has deteriorated and is not fit for use.

f. Hygrothermograph. Check the hygrothermograph daily to ensure that data is being properly gathered, and change the chart paper weekly. Ensure that the spring is wound properly and that the horizontal time scale matches the day and time of the inspection. Ensure that the recording pens are working and the traces are legible. Every 2 months, compare against a psychrometer or a hand held humidity/temperature sensor. Hygrothermographs must be calibrated by a certified calibration laboratory every 3 years, or as required by the manufacturer.
6-15. DAILY GENERAL MAINTENANCE. Perform daily inspections on the overall setup and record in a logbook. This visual inspection should be quick; as fast as a person can walk around the area. Any discrepancies should be corrected immediately (see paragraph 6-12). Check to ensure the following:

   a. All doors, windows and access panels are closed.

   b. There are no rips in the shrouds, shelters and/or bags.

   c. There are no damaged ducts.

   d. There are no disconnected ducts.

   e. Control for the DH unit is on the “Auto” setting.

   f. The humidistat is properly set.

   g. A proper temperature and RH reading is displayed.

   h. There is no general clutter or obvious safety hazards.
7-1. **INTRODUCTION.** This section contains instructions for arranging and securing aircraft for storage and shipment. Consideration is given to the storage site surroundings and to storage surface/aircraft interface. Refer to Chapter 5 and Chapter 6 for information on types of storage systems for each level of preservation. For storage information on removed aircraft components, refer to Chapter 4, Section III. Refer to the aircraft MIMs and NAVAIR 17-1-537 for aircraft handling and securing requirements.

7-2. **SPOTTING AND SECURING OF AIRCRAFT.** The general requirements for spotting and securing aircraft for storage are as follows:

a. Aircraft shall be spotted with the nose pointed in the direction of the prevailing wind, if applicable, and positioned where the parking apron tiedown anchors can be used.

b. There shall be sufficient spacing between each aircraft to allow for maintenance and emergency equipment.

c. Wheel chocks shall be installed on all aircraft wheels in accordance with NAVAIR 17-1-537 and the applicable MIM.

d. Statically ground the aircraft to a certified ground, and properly tie down the aircraft in accordance with the instructions within this section and the applicable MIM.

e. Install all ground safety devices (for example, landing gear and tailhook external stores). If wings or tail are folded, install jury struts and/or engage internal lock mechanisms.

**NOTE**

During heavy weather or if winds or gusts are above 35 knots, certain aircraft types require the wings to be spread. Refer to the aircraft MIM.

f. Fold and secure rotor blades on helicopters in accordance with the aircraft maintenance instruction manual (MIM).

g. Retract wing flaps to the full up position and install control surface locks.

h. Install protective covers on intakes, exhausts, air conditioning ducts and instrument probes when required by the MIMs.

7-3. **TIEDOWN PROCEDURE.**

a. **General Guidelines.**

   (1) Tiedowns shall run from a designated tiedown fitting on the aircraft to a tiedown anchor point on the ground, without pressing against the preservation barrier material or cover, landing gear struts, hydraulic lines, tires or any other portion of the aircraft. It may be necessary to open the flexible bag zipper when connecting tiedowns through a cover tiedown sleeve.

   (2) Tiedowns shall be positioned according to the aircraft MIM to prevent movement of the aircraft in any direction. Generally, tiedowns should be arranged to oppose each other and should be equally distributed around the aircraft.

   (3) The tiedown procedures will differ with each type of aircraft due to the aircraft configuration. The MIM for each aircraft type includes procedures for normal and heavy weather tiedown, and other securing precautions.

   (4) For the minimum number of tiedowns required for some aircraft types, refer to Table 7-1 or NAVAIR 17-1-537.

   (5) Each air station has a weather bill which defines heavy weather. When heavy weather conditions are set, precautions shall be taken according to the MIMs. In the absence of a heavy weather bill, heavy weather can usually be defined as existing or forecast winds of 35 knots or greater. For additional information refer to NAVAIR 17-1-537.

   (6) Normal weather tiedown procedure should only be used if the aircraft will be unattended for a relatively short period (one or two days) and the weather forecast is good. Heavy weather tiedown procedure shall be used when the aircraft is unattended for an extended period of time or when existing or forecast winds are 35 knots or greater.
b. **Tiedown Anchors (Padeyes).** Aircraft tiedown anchors are generally made of steel bars embedded in the concrete parking apron and spaced in a grid pattern of 12.5 feet by 15 feet. There are depressions in the anchor to allow for the attachment of two tiedown hooks to the steel bar at one time. Refer to Figure 7-1. The capacity of each tiedown anchor is designed for a maximum working load of 20,000 pounds.

c. **Tiedown Lock and Chain Assembly.**

**WARNING**

A design hazard exists with the TD-1A tiedown. Incorrect installation of the chain into the locking mechanism reduces the breaking strength from 16,000 pounds to 6,000 pounds. There is no safe working load. The latest version has arrows on the side plates of the locking assembly to show proper installation. Refer to Figures 7-2 and 7-3.

1. The TD-1B tiedown is the preferred assembly. The TD-1A/TD-1B tiedown is composed of a lock and tightening mechanism, and a hook and chain assembly. The tiedown chain assembly is available in two different lengths: 9 foot and 14 foot (see Table 7-2). The TD-1A/TD-1B assembly, when properly joined, forms an integral unit with a work load capacity of 10,000 pounds. The TD-1A/TD-1B tiedown is the only one authorized for shipboard use.

<table>
<thead>
<tr>
<th>Type</th>
<th>Tiedowns Required</th>
<th>Normal</th>
<th>Permanent</th>
<th>Heavy Weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA-6</td>
<td>9</td>
<td>12</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>AV-8/TAV-8</td>
<td>9</td>
<td>12</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>C-2</td>
<td>9</td>
<td>12</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>E-2</td>
<td>9</td>
<td>12</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>F/A-18</td>
<td>9</td>
<td>12</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>H-1/AH-1</td>
<td>4</td>
<td>8</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>H-2</td>
<td>6</td>
<td>12</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>H-3</td>
<td>6</td>
<td>12</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>H-46</td>
<td>6</td>
<td>12</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>H-53/H-53E</td>
<td>6</td>
<td>12</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>HH-60H/SH-60F</td>
<td>--</td>
<td>--</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>SH-60B</td>
<td>6</td>
<td>12</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>V-22</td>
<td>12</td>
<td>18</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>

---

**Table 7-1. Tiedown Information for the Parking of Aircraft**

**Figure 7-1. Tiedown Anchors**

**Figure 7-2. Bar Sizes for Types A & B**

- H: <10" Bar Ø: 3/4"
- 10" to 12" Bar Ø: 1"
- 13" to 18" Bar Ø: 1-1/4"
Figure 7-2. TD-1A or TD-1B Tiedown Assembly

Table 7-2. Tiedown Chain Data

<table>
<thead>
<tr>
<th>Component</th>
<th>Length</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>TD-1A</td>
<td>9 foot</td>
<td>61A101D</td>
</tr>
<tr>
<td></td>
<td>14 foot</td>
<td>61A101D-2</td>
</tr>
<tr>
<td>TD-1B</td>
<td>9 foot</td>
<td>1540AS100-1</td>
</tr>
<tr>
<td></td>
<td>14 foot</td>
<td>1540AS100-2</td>
</tr>
</tbody>
</table>
NOTE

In many cases the spacing of tiedown anchors on the parking apron will require longer tiedown assemblies. If a longer tiedown is needed, the chain may be lengthened with chains from other tiedown assemblies used in series.

(2) Visually inspect the tiedown assembly prior to use. Inspect the tiedown latch/release mechanism for cracks, missing or broken springs, fractures, binding and other signs of damage. Ensure that the preload tensioning grip and threaded shaft are free of burrs and operate freely. Inspect the chain and hook for cracks, elongation and wear. For detailed maintenance and inspection requirements refer to NAVAIR 17-1-537.

d. Wire Rope.

(1) Wire rope tiedowns can be fabricated in a variety of lengths and sizes. When selecting the size wire rope to be used, careful attention must be given to its intended use and safe working load.

(2) If wire rope is used to extend a tiedown, a wire rope with equal or greater work load capacity must be used. Refer to the aircraft MIM for the required tiedown strength. If the manufacturer’s data for wire rope is not available, refer to Table 7-3 to estimate the safe working load.

(3) Refer to NAVAIR 17-1-537 for the fabrication, inspection, and maintenance of wire rope tiedowns.
(4) Inspect the wire rope before and after severe weather for worn spots, kinks, broken wires (fishhooks), corrosion and loose clips. For additional inspection information refer to NAVAIR 17-1-537.

**WARNING**

There have been repeated cases of the failure of screw pin shackles with the pin welded to the shackle ball. Shackles are forged steel and welding to forged steel can reduce the strength by 30%.

e. **Shackles.** Shackles are used to attach wire rope cables that have fixed eyes to the tiedown point. Each shackle body is embossed with raised or stamped letters on the side of the shackle bow identifying the shackle manufacturer, the trade name, the shackle size and the recommended safe working load (see Figure 7-4). Use RR-C-271 Grade B high strength shackle pins and bolts, which are identified by the raised or stamped letters "HS" on the head. Refer to Table 7-4 for size, safe working loads and NSNs.

7-4. **GROUNDING PROCEDURES.** All aircraft and equipment shall be statically grounded during all maintenance, servicing, preservation and storage operations to prevent injury and damage to personnel, aircraft and equipment. Refer to MIL-HDBK-274 for additional information on the electrical grounding of aircraft.

**WARNING**

Tiedown chains cannot be used to ground aircraft. A separate grounding cable must be used.

a. **Static Ground Point.**

(1) It is important to verify that the impedance of the ground point is less than 10,000 ohms (referenced to earth) for a static ground point and less than 10 ohms (referenced to power system neutral) for a power ground point. This will minimize the possibility of injury or damage. Testing of ground points is described in MIL-HDBK-274.

(2) The recommended time interval between resistance testing is every 15 months. This ensures that over a 5 year period, the ground points will be tested through all seasons, thereby providing a profile of seasonal resistance variations.

(3) Padeyes may be used as static grounds, provided that they have been measured and identified. At some facilities, a stainless steel bead has been welded to the upper exposed area of the padeye. This prevents corrosion buildup and provides a better ground.
Table 7-4. Shackle Safe Working Load and NSN

<table>
<thead>
<tr>
<th>Size * (inches)</th>
<th>Maximum Working Load (pounds)</th>
<th>Minimum Breaking Load (pounds)</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>6,600</td>
<td>33,000</td>
<td>4030-00-369-3894</td>
</tr>
<tr>
<td>5/8</td>
<td>10,000</td>
<td>50,000</td>
<td>4030-00-369-3905</td>
</tr>
<tr>
<td>3/4</td>
<td>14,000</td>
<td>70,000</td>
<td>4030-00-373-0997</td>
</tr>
<tr>
<td>7/8</td>
<td>19,000</td>
<td>95,000</td>
<td>4030-00-369-3909</td>
</tr>
<tr>
<td>1</td>
<td>25,000</td>
<td>125,000</td>
<td>4030-00-373-0998</td>
</tr>
<tr>
<td>1 1/8</td>
<td>30,000</td>
<td>150,000</td>
<td>4030-00-373-1015</td>
</tr>
<tr>
<td>1 1/4</td>
<td>36,000</td>
<td>180,000</td>
<td>4030-00-369-3911</td>
</tr>
<tr>
<td>1 3/8</td>
<td>42,000</td>
<td>210,000</td>
<td>4030-00-369-3913</td>
</tr>
</tbody>
</table>

* Other sizes are available. Refer to RR-C-271.

CAUTION

Certified ground point and aircraft ground point shall be free of paint and corrosion.

(4) Certified ground points are identified by a 22 inch yellow circle outlined and labeled in black. The label indicates the date tested and the resistance measured. Refer to Figure 7-5.

CAUTION

Care must be taken that the rod is not driven into a place where it will damage underground services.

(5) In areas where no approved static or power grounds exist, temporary grounding can be accomplished by metal rods driven into the ground at suitable points adjacent to the proposed aircraft parking position. These rods shall be 8 feet long and 0.875 inch in diameter. If the minimum measured resistance cannot be met, it will be necessary to drive additional or longer rods into the ground.

(6) The use of proper grounding procedures ensures that any arcing or electrical discharge takes place at the certified common ground point and not at the aircraft ground point.
b. **Aircraft Ground Point.**

(1) Many aircraft have grounding receptacles in designated places on the airframe other than the ground refueling areas. Refer to the aircraft MIM for ground point locations.

(2) For those aircraft that do not have additional grounding receptacles, use a grounding cable that has grounding clamp connector (alligator type) conforming to MIL-C-83413/7 attached to each end. Attach one end to an approved static ground point, the other end to a clean metal area on the aircraft.

(3) Grounding cables shall be constructed in accordance with MIL-HDBK-274. Cable length will be determined by user requirements.

(4) For additional information on aircraft grounding and grounding procedures refer to MIL-HDBK-274.

7-5. **STORAGE SITE.** Environmental conditions are a major concern at a storage site. These conditions include weather, industrial fallout, and location. When aircraft are to be stored outside of a hangar or rigid shelter, they should be placed in a wind protected area.

a. **Surface.** The storage area should be paved and of adequate strength to support the load of the aircraft and have ample drainage so as not to allow still water to build up under the aircraft or equipment.

b. **Utilities.** Active electrical and telephone lines may be required to operate dehumidifiers, data acquisition systems and other equipment at the storage site. Examples of the electrical power required for dehumidifiers may be found in Table 6-2.

c. **Security.** The storage site should have controlled access. The use of motion detectors may be used to enhance the security of sensitive equipment. In addition, the area surrounding the storage site shall be clean and verified safe for work by the local safety office.

7-6. **WHEEL CHOCS.** The preferred wheel chocks for land based aircraft are those made from polyurethane, P/N 1509AS300. The wheel chocks are available in three different sizes according to the dash number after the P/N: -1 for wheels up to a 33 inch diameter, -2 over 33 inches in diameter, and -3 for dual or tandem main landing gear. Refer to NAVAIR 17-1-537 for additional information.
SECTION II. AIRCRAFT SHIPMENT

7-7. GENERAL INFORMATION. This section contains general instructions for the shipment of aircraft by surface vessel (ship), truck, rail or aircraft.

   a. Cleaning/Corrosion Control. The aircraft must be thoroughly cleaned and inspected for corrosion in accordance with the instructions in Chapters 2 and 3.

   b. Protection. The aircraft and systems shall be protected in accordance with the requirements of Chapter 3 for Level II or Level III preservation. Aircraft to be shipped by vessel (ocean shipment) are limited to the protection afforded by statically or dynamically dehumidified shrinkwrap, strippable coating, or aircraft bags; partial coverage with barrier material or aircraft covers is prohibited. Prior to the shipment of the aircraft, the protection applied must have at least 45 days of the effective preservation time limitation (60 days) remaining. In addition to the requirements of Chapters 2 and 3, perform the following on aircraft to be shipped.

   (1) Defuel the fuel system; pencil drain and purge, and preserve in accordance with Chapter 3.

   (2) Spray fuel cells with oil, MIL-PRF-6081 Grade 1010N, and pencil drain to remove excess.

   (3) Remove and preserve components in accordance with the requirements of Chapter 4, as required.

   (4) For some model aircraft, shipment may require the wing sections to be folded or removed. Refer to applicable aircraft MIM.

   (5) Protect plastic sections of canopies with a coating of polish, P-P-560 Type I. Cover entire canopy with flannel cloth, A-A-50129, and overlay barrier material, MIL-PRF-131 Class 1, held in place with preservation tape, SAE AMS-T-22085 Type II.

   (6) Apply corrosion preventive compound to all bare metal surfaces.

   c. Shipping Instructions. The following shall be provided by the aircraft ISSC.

   (1) Specific instructions on anchoring, blocking, and tiedown of the aircraft, including the exact station on the aircraft where the padded bucks will be located.

   CAUTION

DO NOT strap aircraft or place a buck over the extension portion of the platform. When underway the platform could flex and cause damage to the aircraft.

Hoisting of the aircraft may require ballast added to the airframe to compensate for removed components.

Aircraft shall not be hoisted when wind speed exceeds 15 knots.

   (2) Loading instructions for the aircraft onto a vessel, truck, or train platform, including bracing requirements or peculiar hoisting instructions.

   (3) A list of support equipment required, including part numbers and national stock numbers.

   (4) A list of equipment and tooling required to prepare the aircraft for shipping.

   (5) A complete list of shipping containers and/ or crates required.

   (6) MSDSs for all hazardous material (this includes oil, hydraulic and cooling fluids).

   d. Security During Shipment. Refer to NAVAIR17-1-537 and NAVAIR17-1-114 for additional information on aircraft securing and handling, and on aircraft securing and handling equipment, respectively.

   (1) Tiedowns. Refer to NAVAIR17-1-537 and Section I of this chapter for tiedown information during land, ocean or air shipments. Aircraft being shipped by ocean shall adhere to heavy weather tiedown requirements in accordance with applicable aircraft MIM.

   (2) Aircraft Ground. Aircraft shall be grounded during shipment in accordance with the requirements in MIL-HDBK-274 and Section I of this chapter.

   CAUTION

Aircraft shall not be hoisted when wind speed exceeds 15 knots.

   (3) Hoisting Slings. Refer to aircraft MIM, NAVAIR17-1-114 and Table 7-5 for specific information on hoisting slings.
Table 7-5. Main Aircraft Hoisting Slings

<table>
<thead>
<tr>
<th>Type Aircraft</th>
<th>Manufacturer</th>
<th>Part Number</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV-8B</td>
<td>McDonnell-Douglas Corp.</td>
<td>75D110000-1005</td>
<td>1730-01-374-1319</td>
</tr>
<tr>
<td>C-2</td>
<td>Grumman Corp.</td>
<td>123GT40027</td>
<td>1730-00-966-6033</td>
</tr>
<tr>
<td>E-2C/C-2</td>
<td>Grumman Corp.</td>
<td>123GT10199</td>
<td>1730-00-913-2086</td>
</tr>
<tr>
<td></td>
<td></td>
<td>123SME50642-1</td>
<td>1730-01-215-5763</td>
</tr>
<tr>
<td>EA-6B</td>
<td>Grumman Corp.</td>
<td>1128SME40001-3</td>
<td>1730-01-004-1836</td>
</tr>
<tr>
<td>F/A-18</td>
<td>McDonnell-Douglas Corp.</td>
<td>74D110003-1001</td>
<td>1730-01-062-4048</td>
</tr>
<tr>
<td>V-22</td>
<td>Bell-Boeing</td>
<td>901-220-933-101</td>
<td>1730-01-266-2246</td>
</tr>
<tr>
<td>AH-1T/W</td>
<td>Bell Helicopter Textron</td>
<td>T101987</td>
<td>1680-00-543-7292</td>
</tr>
<tr>
<td>UH-1/UH-1N</td>
<td>Bell Helicopter Textron</td>
<td>204-011-178-1</td>
<td>1680-00-408-2964</td>
</tr>
<tr>
<td>H-2</td>
<td>Kaman Aerospace Corp.</td>
<td>K604010-5</td>
<td>1730-00-824-6014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K604010-7</td>
<td>1730-01-327-0298</td>
</tr>
<tr>
<td>H-3</td>
<td>Sikorsky Aircraft Corp.</td>
<td>S6170-70004-8</td>
<td>1730-00-824-6014</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S6170-70004-041</td>
<td>1730-01-363-6931</td>
</tr>
<tr>
<td>H-46</td>
<td>Boeing Helicopter Co.</td>
<td>A02G1384-1</td>
<td>1730-01-011-8637</td>
</tr>
<tr>
<td></td>
<td>Aeroquip Corp.</td>
<td>FE300059-01</td>
<td></td>
</tr>
<tr>
<td>CH-53D/RH-53D</td>
<td>Sikorsky Aircraft Corp.</td>
<td>65700-70092-041</td>
<td>1730-00-050-9512</td>
</tr>
<tr>
<td></td>
<td></td>
<td>65700-70092-042</td>
<td>1730-00-129-8637</td>
</tr>
<tr>
<td>CH-53E/MH-53E</td>
<td>Sikorsky Aircraft Corp.</td>
<td>65720-70018-041</td>
<td>1730-01-140-3481</td>
</tr>
<tr>
<td>H-60</td>
<td>Sikorsky Aircraft Corp.</td>
<td>70073-85000-011</td>
<td>1730-01-251-6535</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70073-85000-013</td>
<td>1730-01-367-5166</td>
</tr>
</tbody>
</table>
e. **Maintenance During Shipment.** Maintain the aircraft in the chosen preservation level using maintenance procedures in Chapters 2 and 3. While the aircraft is in transit, check the security of the preservation system and the tiedowns daily.

f. **Depreservation.** The aircraft shall be depreserved (the aircraft bag, shrinkwrap or strippable coating removed), cleaned, and represerved, if applicable, by the receiving activity within 60 days from the preservation activation date, or within 5 days of receiving the aircraft, whichever is earliest.

g. **Crash Damaged Aircraft.** For information on the emergency reclamation of crash damaged aircraft and components refer to NAVAIR 01-1A-509-2. For information on moving and securing crash damaged aircraft, refer to NAVAIR 00-80R-19.

7-8. **LAND SHIPMENT.** Consideration shall be given to dimensional and weight limitations for the land shipment of aircraft. This may require the removal of certain sections of the aircraft. Fixed wing aircraft usually require the removal of a wing section or the entire wing. The removed sections shall be listed and identified separately on the shipping request document.

a. **Transportation Requirements.**

   (1) Restrictions. Vehicle/cargo combinations that do not exceed 660 inches long, 96 inches wide, and 162 inches high do not require special permits in all but a few states and most foreign countries (see Figure 7-6). MIL-STD-1366 establishes dimensional and weight limitations for the movement of items prepared for shipment. These limitations are based on the physical characteristics of the individual modes of transportation, and any legal and administrative regulations.

   (2) Routing. All shipments are controlled and routed by the Military Traffic Management Command (MTMC) located at Fort Eustis, VA.

   (3) Requests. Shipping requests are made through the Naval Supply Center (NSC) or nearest DOD supply activity using DD Form 1149. When using this form, "Requisition and Invoice/Shipping Document", include the following information:

   (a) The number of pieces in the shipment.

   (b) A description of the shipment and the physical support (i.e., pallet, container).

(b) **Accurate dimensions, stated as "length" by "width" by "height" and recorded in inches. Include the pallet dimensions in the measurement if the item is on one. Items of the aircraft that extend outward over the support must also be included in the measurement.

(d) An accurate weight of the aircraft being shipped.

(e) Any special services or equipment needed in support of the shipment, such as dual drivers, a lowboy, an air-ride. For example, the transportation of a small fixed wing fighter aircraft will require a 48 foot single drop lowboy trailer capable of expanding to a required length. The trailer must be a minimum of 8 feet wide with a maximum height of 2 feet from the ground to the top of the bed.

(f) Material Safety Data Sheets (MSDS) for all hazardous material accompanying the shipment.

7-9. **OCEAN SHIPMENT.** An ocean shipment subjects the aircraft to the most severe corrosive condition, exposure to salt water. A good protective system is required on all portions of the aircraft to prevent serious damage. Level III dehumidified preservation provides the most complete protection and is recommended. However, dehumidification generally requires electrical power which normally is not provided on a barge. Therefore, if it is impractical to protect the aircraft in Level III preservation, then protect in accordance with the Level II preservation requirements (statically dehumidified and completely encased in a form fitted bag, shrinkwrap or strippable coating).

a. **Ocean Shipment Environment.** It is imperative that the stowed aircraft be adequately protected during an ocean shipment. Depending on the location of the aircraft on the vessel, harmful conditions may be encountered.

   (1) When aircraft are stowed on a barge or on a ship deck the possible adverse conditions encountered
are pitching movements, rain, salt water spray, waves washing on the deck and severe winds.

(2) When aircraft are stowed below deck on a ship the possible adverse conditions encountered are condensation, high humidity when humidity is not controlled, and pitching movements.

b. **Barge Requirements.** When contracting for barge transportation the following recommendations will ensure the safety of the shipped aircraft.

(1) The barge has a break water.

(2) The barge has a double rail for docking.

(3) The barge is singly towed (no double tows).

(4) The barge has a minimum of 15 feet of free board.

(5) The tug uses a weather fax for navigation.

c. **Maintenance During Shipping.**

(1) Maintenance Crew. Maintenance personnel, or ship riders, monitor the preservation system and make any necessary repairs to ensure that the aircraft remains protected during the ocean crossing. See Chapter 2, Section VI, for additional information.

(2) The following are minimum quantities of materials, for five aircraft, that must accompany the crew.

(a) Sixty square feet of barrier material, MIL-PRF-131 Class 1, and six rolls of tape, SAE AMS-T-22085 Type II.

(b) For strippable coated aircraft, one gallon of brushable consistency top coating compound, MIL-PRF-6799 Type II Class 7, for touch up of white top coating.

(c) For bagged aircraft, necessary patching material and replacement bungee cords.

(d) One gallon each of CPCs, MIL-PRF-16173 Grade 2, MIL-DTL-85054 Type II, and MIL-PRF-81309 Type II.

(e) One gallon of degreasing solvent, MIL-PRF-680 Type II or Type III.

(f) One gallon lubricating oil; MIL-PRF-32033.

(g) Two one gallon metal or plastic containers for handling hazardous waste.

(h) Two 2 inch paint brushes.

7-10. **AIR SHIPMENT.** Air shipment is limited by the size of both the aircraft being transported and the transporting aircraft. Aircraft shipped by air transport shall, at a minimum, be preserved according to Level II preservation procedures; Level III preservation is encouraged when possible. Table 7-6 lists and Figure 7-7 illustrates the basic dimensions for a number of transport aircraft. Refer to MIL-STD-1366 and aircraft MIMs for specific air shipment loading information.

![Table 7-6. Transport Aircraft Dimensions](image)

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Length (inches)</th>
<th>Width (inches)</th>
<th>Height (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-2</td>
<td>345</td>
<td>90</td>
<td>78</td>
</tr>
<tr>
<td>C-5 *</td>
<td>1453</td>
<td>228</td>
<td>161</td>
</tr>
<tr>
<td>C-9 **</td>
<td>136</td>
<td>105</td>
<td>74</td>
</tr>
<tr>
<td>C-17</td>
<td>784</td>
<td>216</td>
<td>147</td>
</tr>
<tr>
<td>C-130</td>
<td>492</td>
<td>122</td>
<td>109</td>
</tr>
<tr>
<td>C-141</td>
<td>840</td>
<td>122</td>
<td>109</td>
</tr>
</tbody>
</table>

* Loading through forward door. Fuselage tapers to a height of 114 inches.
** Loading through large cargo door on port side.

7-11. **AIR LIFT.** Helicopter External Air Transport (EAT) is a mode of transportation by which an aircraft is suspended beneath a rotary wing aircraft for the purpose of transport. The primary application of EAT by helicopter is short range. Aircraft that are to be lifted shall meet the requirements of MIL-STD-913. This standard covers design, test and performance requirements of military equipment for EAT by rotary wing Army, Air Force, Navy, Marine Corps and Coast Guard aircraft. Air lifted aircraft require a minimum of Level II preservation. Refer to Chapters 2 and 3 for specific preservation requirements.
Figure 7-7. Ramp and Cargo Space
CHAPTER 8
GUIDELINES

SECTION I. CLEANING GUIDELINES

8-1. GENERAL.

a. Cleaning. The first step in preservation is thoroughly cleaning the interior and exterior of the aircraft. During cleaning operations, pay particular attention to all areas of the aircraft where soil or moisture can collect, and to those areas that are hidden by fairings or installed equipment. The extent of the cleaning shall be as necessary to remove corrosive soils, salt, bird droppings, and stack gas deposits to prepare aircraft surfaces for the application of preservation materials. The extent of cleaning shall be based on an examination and evaluation of the individual aircraft. Detailed cleaning instructions can be found in the aircraft MIMs and NAVAIR 01-1A-509-2. Consult Table 8-1 and Table 8-2 before cleaning to ensure compatibility and effectiveness of the cleaning agent to be used. For a listing of cleaning materials, refer to Table 8-3.

b. Lubrication. Greased or lubricated items exposed to cleaning or stripping compounds shall always be lubricated both before and immediately following cleaning operations. Refer to the aircraft MIMs for location of lubrication points. Refer to Chapter 3 for additional information on the lubrication of aircraft systems in preparation for preservation. Table 8-4 lists the most commonly used aircraft lubricants.

c. Masking. Cleaning aircraft may be potentially harmful if care is not taken to properly mask against the collection of cleaning residues in the aircraft system joints and openings. Consult the applicable maintenance instruction manual for each aircraft for precautions and proper masking procedures to be used during cleaning.

8-2. AIRCRAFT CLEANING WITH SOAP AND WATER.

a. Precleaning Guidelines.

(1) Lubricate aircraft prior to wash in accordance with aircraft MIMs and MRCs.

(2) Clear drain holes with a soft probe and check low point drains in accordance with aircraft MIMs and MRCs.

(3) Ensure water intrusion areas are covered with barrier material (MIL-PRF-131 Class 1), plastic sheet (A-A-3174 Type I Class 1) and preservation tape (SAE AMS-T-22085 Type II).

(4) Cover vents, openings and ports with barrier material (MIL-PRF-131 Class 1) and preservation tape (SAE AMS-T-22085 Type II).

(5) Cover the aircraft wheels to prevent water contamination of wheel bearings. Use locally manufactured cover or barrier material (MIL-PRF-131 Class 1) and preservation tape (SAE AMS-T-22085 Type II).

(6) Mask off canopy frames with plastic sheet (A-A-3174 Type I Class 1) and preservation tape (SAE AMS-T-22085 Type II).

b. Cleaning Guidelines.

CAUTION
Do not use unauthorized cleaners/solvents on electrical wiring or plastic aircraft canopies as it may cause damage to insulation or crazing of transparent surfaces. Refer to Table 8-1.

Do not wash aircraft when the ambient temperature is 80°F or above. If the aircraft is warmer than 80°F, cool the aircraft down using cold water.

Cleaning Compound, Aircraft MIL-PRF-85570 Type II

(1) Apply diluted cleaning compound (MIL-PRF-85570 Type II) from a bucket, spray, or foaming equipment. Scrub surfaces with a clean pad or sponge (3M No. 33 Aircraft Cleaning Pad and 3M No. 261 Conformable Pan Holder). To prevent streaking start at the lower surfaces and work out and up (see Figure 8-1).
**WARNING**
See applicable aircraft MIMs for no-step and water intrusion areas.

**CAUTION**
Canopies, windscreens and transparencies must be covered during washing to prevent scratching or crazing from aircraft cleaning detergents.

**NOTE**
Open doors and flaps to flapwells, intercoolers, oil coolers, speed brakes, spoilers, and controllable leading edges to permit cleaning of hidden areas.

**STEP 1**
Clean the underside of the fuselage and tail section. Wash (allow detergent to dwell) and rinse, starting from the main landing gear and moving toward the forward and aft ends of the aircraft.

**STEP 2**
Clean the underside of the wings. Wash (allow detergent to dwell) and rinse, starting from the mid-section and moving outward to the wing tips.

**STEP 3**
Clean the center section of fuselage and topside of the wings. Wash (allow detergent to dwell) and rinse, starting from the center section of the fuselage and moving outward to the wing tips.

**STEP 4**
Clean the remaining topside area of the fuselage (except canopy). Wash (allow detergent to dwell) and rinse, starting from the mid-section and moving toward the forward and aft ends of the aircraft fuselage. Wash and rinse the tail section, starting at the bottom and moving up toward the top.

---

**Figure 8-1. Aircraft Cleaning Procedure**
(2) Wheel wells, flap wells and other heavily soiled areas which can tolerate water rinsing can be cleaned with gel cleaner (MIL-PRF-85570 Type V). This cleaner may be sprayed on using a hand pump, and rinsed thoroughly after 5 minutes using a coarse spray (see Figure 8-2).

(3) Low gloss tactical paint schemes with stubborn soils can be cleaned by applying undiluted cleaner (MIL-PRF-85570 Type IV) with a circular motion and allowing 1-3 minutes dwell time. Do not allow cleaner to dry on surfaces or rinsing may be difficult. Rinse thoroughly and dry with a clean cloth.

(4) Gloss paint schemes with ground-in soils can be cleaned by applying undiluted cleaner (MIL-PRF-85570 Type III) with a damp cloth. Rub the area with a circular motion. Do not allow cleaner to dry on surfaces or rinsing may be difficult. Rinse thoroughly and dry with a clean cloth.

(5) Rinse away loosened soil and cleaner with fresh water. Use a rubber padded spray nozzle adjusted in a fan spray directed at an angle between 15-30 degrees (see Figure 8-2). Continue rinsing until all evidence of cleaners and soils have been removed.

c. Post Cleaning Guidelines.

Solvent, Degreasing 27
MIL-PRF-680 Type II or III

(1) Remove covers and masking from all static vents, pitot tubes, air ducts, heater ducts, etc. Remove all tape adhesive residues with dry cleaning solvent (MIL-PRF-680 Type II or III).

(2) Clean all drain holes and use pipe cleaners to ensure all areas accumulating water have been drained.

(3) Lubricate aircraft immediately following wash in accordance with aircraft MIMs and MRCs.
8-3. WATERLESS SPOT CLEANING. Waterless or low water wipe down guidelines shall be used for spot cleaning when called out in this manual, when water is unavailable, or when weather is extremely cold.

a. Cleaning Guidelines. The preferred waterless wipe down method for removing soils and corrosive salt residues is as follows:

Cleaning Compound, Aircraft MIL-PRF-85570 Type II

(1) In a plastic spray bottle or bucket, mix one part cleaner (MIL-PRF-85570 Type II) to nine parts water (9:1 water to cleaner mixture). Using either a spray bottle, cloth wipe (CCC-C-46 Type I Class 7) or brush (MIL-B-23958), apply cleaner onto the exterior surfaces of the aircraft several square feet at a time.

(2) Let the cleaner stand for 30 seconds, then scrub. Wipe the cleaner solution and soil from the surface with a clean cloth.

(3) Rinse using a cloth wetted with fresh water.

(4) Rinse the cleaned surfaces with fresh water when it becomes available.

b. CPC Spot Cleaning Guideline. Use the following guideline only when water is not available for rinsing or when cold weather prevents the use of water:

Compound, Corrosion Preventive MIL-PRF-81309 Type II or III

(1) Apply a film of water displacing CPC (MIL-PRF-81309 Type II).

(2) Wipe with a cloth (CCC-C-46 Type I Class 7) to remove the loosened soil.

(3) Apply a second coat of CPC (MIL-PRF-81309 Type II).

(4) Wipe the surface with a clean cloth (CCC-C-46 Type I Class 7).

c. Hand Spot Cleaning Guidelines. Perform the following solvent cleaning steps on smaller surfaces or on areas where water is prohibited:

Solvent, Degreasing MIL-PRF-680 Type II or III

CAUTION

MIL-PRF-680 Type II or Type III solvent may be used as a general purpose cleaner except on transparencies.

(1) Pour out just enough solvent (MIL-PRF-680 Type II or Type III) for the job. Saturate a wiping cloth (CCC-C-46 Type I Class 7) or dip the brush (MIL-B-23958) in the solvent and wipe or brush away all apparent soluble contamination.

(2) Repeat step (1) using a clean cloth, or clean brush.

(3) Wipe away excess solvent with a clean cloth and ensure that there is no solvent entrapment.

8-4. HAND CLEANING OF OXYGEN SYSTEMS. Cleaning of oxygen systems shall be accomplished in accordance with applicable aircraft MIM.
Table 8-1. Cleaner Compatibility

<table>
<thead>
<tr>
<th>Material</th>
<th>TT-N-95 Type II</th>
<th>MIL-PRF-680 Type II or Type III</th>
<th>TT-I-735</th>
<th>MIL-PRF-81309 Type II</th>
<th>MIL-PRF-85570Type II 1:4 water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composites</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Elastomers</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Metals</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Paints</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Plastics</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Transparencies</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**CAUTION**

Use cleaners on specified component materials only. Misuse of cleaners may cause damage.

Table 8-2. Cleaner Removal Effectiveness

<table>
<thead>
<tr>
<th>Material</th>
<th>TT-N-95 Type II</th>
<th>MIL-PRF-680 Type II*</th>
<th>TT-I-735</th>
<th>MIL-PRF-81309 Type II</th>
<th>MIL-PRF-85570Type II 1:9 water</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL-PRF-32033</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>N/A</td>
<td>Good</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 1</td>
<td>Fair</td>
<td>Fair</td>
<td>Poor</td>
<td>Fair</td>
<td>N/A</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 2</td>
<td>Good</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td>N/A</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 3</td>
<td>Fair</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td>N/A</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 4</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
<td>Good</td>
<td>N/A</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 5</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
<td>N/A</td>
</tr>
<tr>
<td>MIL-PRF-81309 Type II</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
<td>Good</td>
<td>N/A</td>
</tr>
<tr>
<td>MIL-PRF-81309 Type III</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>MIL-DTL-85054</td>
<td>Fair</td>
<td>Fair</td>
<td>Poor</td>
<td>Poor</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Use MIL-PRF-680 Type II for CPC removal first. If unsuccessful, use TT-N-95 (on unpainted surfaces only).
Table 8-3. Cleaning Materials and Equipment

<table>
<thead>
<tr>
<th>SPECIFICATION/NOMENCLATURE</th>
<th>INTENDED USE</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-A-1464 Handle, Aluminum</td>
<td>For use with cleaning pad holder, 3M No. 261</td>
<td>7920-00-926-5146 EA</td>
</tr>
<tr>
<td>A-A-2074 Brush, Aircraft Cleaning, Tampico Fiber</td>
<td>Application of cleaner and scrubbing aircraft surfaces.</td>
<td>7920-00-282-2470 EA</td>
</tr>
<tr>
<td>A-A-2806 Bottle, Spray Applicator</td>
<td>For use with cleaning compounds.</td>
<td>8125-00-488-7952 EA</td>
</tr>
<tr>
<td>A-A-3100 Pad, Cleaning &amp; Polishing (Non-Metallic)</td>
<td>Cleaning and polishing pads for detergent and solvent cleaning aircraft surfaces.</td>
<td>7920-00-151-6120 PG (10 EA)</td>
</tr>
<tr>
<td>A-A-374 Sodium Bicarbonate, Technical</td>
<td>Acid neutralizer for battery compartments.</td>
<td>6810-00-297-0092 BG (50 LB)</td>
</tr>
<tr>
<td>A-A-50129 Cloth, Flannel, Lightweight</td>
<td>Wiping of critically machined surfaces such as hydraulic strut pistons. Cleaning and polishing plastic surfaces such as canopies.</td>
<td>8305-00-913-5817 BO (50 YD)</td>
</tr>
<tr>
<td>A-A-50461 Nozzle, Water, Adjustable</td>
<td>Use for cleaning and rinsing aircraft.</td>
<td>4730-00-223-6731 EA (garden hose)</td>
</tr>
<tr>
<td>A-A-54943 Cleaner, Vacuum, Electric Portable</td>
<td>Removal of dirt and debris.</td>
<td>7910-00-807-3704 EA</td>
</tr>
<tr>
<td>A-A-59253 Pails, Utility, Plastic</td>
<td>Surface preparation and hand cleaning.</td>
<td>7240-00-246-1097 EA (3 GL)</td>
</tr>
<tr>
<td>A-A-59270 Hose Assemblies, Non-Metallic</td>
<td>Washing and rinsing aircraft.</td>
<td>4720-00-203-3920 EA (5/8&quot; x 50 FT)</td>
</tr>
<tr>
<td>A-A-59282 Boric Acid, ACS</td>
<td>A potassium hydroxide neutralizer for acid battery compartments/adjacent areas. A neutralizer for Nicad battery spillage.</td>
<td>6810-00-264-6535 BT (500 g)</td>
</tr>
<tr>
<td>A-A-59318, Type I Polish, Metal, Aluminum (Liquid)</td>
<td>Cleaning skin surfaces around pitot-static openings.</td>
<td>7930-00-267-1224 GL</td>
</tr>
<tr>
<td>A-A-59318, Type II Polish, Metal, Aluminum (Paste)</td>
<td>Cleaning skin surfaces around pitot-static openings.</td>
<td>7930-00-734-4010 QT</td>
</tr>
<tr>
<td>A-A-59323 Cloths, Cleaning, Low-Lint (General Use)</td>
<td>Cleaning, polishing, wiping operations requiring low lint. CAUTION: Do not use on plastics with flammable solvents.</td>
<td>7920-00-044-9281 BX (10 LB)</td>
</tr>
<tr>
<td>CCC-C-46 Type I Class 7 Cloth, Cleaning</td>
<td>Cleaning critical areas where an exceptionally clean cloth is required.</td>
<td>7920-01-180-0556 BX (2700 EA)</td>
</tr>
<tr>
<td>CCC-C-440 Type II Cheesecloth</td>
<td>Polishing and cleaning operations.</td>
<td>8305-00-205-3495 BO (36&quot; x 10 YD)</td>
</tr>
<tr>
<td>MIL-B-23958 Type I Scrub Brush, Nylon Bristle</td>
<td>Application of cleaner and scrubbing of aircraft exterior surface for hard to remove soil.</td>
<td>7920-00-054-7788 EA (Style 1, round block)</td>
</tr>
<tr>
<td>MIL-D-16791 Type I Detergent, General Purpose (Liquid, Nonionic)</td>
<td>Cleaning flexible covers or bags.</td>
<td>7930-00-282-9699 GL</td>
</tr>
<tr>
<td>SPECIFICATION/ NOMENCLATURE</td>
<td>INTENDED USE</td>
<td>NSN</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>MIL-PRF-680 Type II</td>
<td>For general purpose cleaning to remove grease, oil, and corrosion preventive</td>
<td>6850-01-474-2319 GL</td>
</tr>
<tr>
<td>Solvent, Degreasing</td>
<td>compounds from insulated cables and the like. Also, for wiping down aircraft</td>
<td>6850-01-474-2317 CO (5 GL)</td>
</tr>
<tr>
<td></td>
<td>surface to remove grease and oil prior to applying pressure sensitive tapes.</td>
<td>6850-01-474-2316 DR (55 GL)</td>
</tr>
<tr>
<td>MIL-PRF-680 Type III</td>
<td>For general purpose cleaning to remove grease, oil, and corrosion preventive</td>
<td>6850-01-474-2318 GL</td>
</tr>
<tr>
<td>Solvent, Degreasing</td>
<td>compounds from insulated cables and the like. Also, for wiping down aircraft</td>
<td>6850-01-474-2320 CO (5 GL)</td>
</tr>
<tr>
<td>MIL-PRF-85570 Type I</td>
<td>Cleaning of painted or unpainted aircraft surfaces. Cleaning of removable</td>
<td>6850-01-237-8004 DR (55 GL)</td>
</tr>
<tr>
<td>Cleaning Compound, Aircraft</td>
<td>fuel tanks to a vapor-free condition. Type 1A: Prediluted (1:4) saturated</td>
<td>6850-01-237-7482 CN (5 GL)</td>
</tr>
<tr>
<td>Exterior (Solvent Base)</td>
<td>wipes.</td>
<td>6850-01-578-4978 BX (12 EA)</td>
</tr>
<tr>
<td>MIL-PRF-85570 Type II</td>
<td>Cleaning painted and unpainted aircraft surfaces (gloss or tactical paint</td>
<td>6850-01-235-0872 CN (5 GL)</td>
</tr>
<tr>
<td>Cleaning Compound, Aircraft</td>
<td>systems). Can be used in areas of reduced ventilation. Cleaning of</td>
<td>6850-01-236-0128 DR (55 GL)</td>
</tr>
<tr>
<td>Exterior (General Use - Non-</td>
<td>removable fuel tanks to a vapor-free condition. Type II RTU: Prediluted (1:4)</td>
<td>6850-01-239-0571 GL</td>
</tr>
<tr>
<td>Solvent Base)</td>
<td>solution in a 32 OZ trigger spray bottle.</td>
<td></td>
</tr>
<tr>
<td>MIL-PRF-85570 Type III</td>
<td>Abrasive spot cleaning of high gloss paint systems, where Types I and II</td>
<td>6850-01-232-9164 CN (5 GL)</td>
</tr>
<tr>
<td>Cleaning Compound, Aircraft</td>
<td>are ineffective.</td>
<td></td>
</tr>
<tr>
<td>Exterior (Abrasive Spot Cleaner)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-For High Gloss Paint</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surfaces)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIL-PRF-85570 Type IV</td>
<td>Spot cleaning embedded soils for low gloss Tactical Paint Schemes (TPS)</td>
<td>6850-01-235-0873 CN (5 GL)</td>
</tr>
<tr>
<td>Cleaning Compound, Aircraft</td>
<td>systems without changing the paint gloss.</td>
<td>6850-01-248-9830 DR (55 GL)</td>
</tr>
<tr>
<td>Exterior (Rubberized Spot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaner)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIL-PRF-85570 Type V</td>
<td>Cleaning vertical oily or greasy surfaces where water rinsing can be</td>
<td>6850-01-234-0219 CN (5 GL)</td>
</tr>
<tr>
<td>Cleaning Compound, Aircraft</td>
<td>tolerated.</td>
<td>6850-01-235-7458 DR (55 GL)</td>
</tr>
<tr>
<td>Exterior (Gel Type Degreaser)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIL-PRF-85704 Type II</td>
<td>Cleaning turbine engine gas path (engine internal wash) with engine</td>
<td>6850-01-372-8303 CN (5 GL)</td>
</tr>
<tr>
<td>Cleaning Compound, Turbine</td>
<td>off-line.</td>
<td>6850-01-372-8304 DR (55 GL)</td>
</tr>
<tr>
<td>Engine Gas Path (Aqueous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentrate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIL-PRF-85704 Type II RTU</td>
<td>Cleaning turbine engine gas path (engine internal wash) with engine</td>
<td>6850-01-370-5245 CN (5 GL)</td>
</tr>
<tr>
<td>Cleaning Compound, Turbine</td>
<td>off-line.</td>
<td>6850-01-370-5244 DR (55 GL)</td>
</tr>
<tr>
<td>Engine Gas Path (Ready to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use Aqueous Cleaner)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIL-PRF-85704 Type III</td>
<td>Cleaning turbine engine gas path (engine internal wash) with engine</td>
<td>6850-01-343-6436 CN (5 GL)</td>
</tr>
<tr>
<td>Cleaning Compound, Turbine</td>
<td>off-line.</td>
<td>6850-01-343-6438 DR (55 GL)</td>
</tr>
<tr>
<td>Engine Gas Path (Aqueous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentrate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O-M-232 Grade A Methanol,</td>
<td>Flushing of water injection systems.</td>
<td>6810-00-292-9676 CN (1 QT)</td>
</tr>
<tr>
<td>Technical</td>
<td></td>
<td>6810-00-174-5190 CN (5 GL)</td>
</tr>
<tr>
<td>P-P-560 Type I Polish,</td>
<td>Cleaning and polishing transparent acrylic plastic surfaces.</td>
<td>7930-00-935-3794 BX (24 EA)</td>
</tr>
<tr>
<td>Plastic (Liquid)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solvent for Aircraft</td>
<td></td>
<td>7930-01-367-0995 BX (4 GL BT)</td>
</tr>
<tr>
<td>Surfaces, General Purpose</td>
<td></td>
<td>7930-01-367-0996 CO (5 GL)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7930-01-367-0997 DR (55 GL)</td>
</tr>
</tbody>
</table>
Table 8-3. Cleaning Materials and Equipment (Cont.)

<table>
<thead>
<tr>
<th>SPECIFICATION/ NOMENCLATURE</th>
<th>INTENDED USE</th>
<th>NSN</th>
</tr>
</thead>
</table>
| TT-I-735 Grade A Isopropyl Alcohol (Technical) | Used for cleaning fungi (molds) from transparent materials and for final wipe down of surfaces prior to tape application. | 6810-00-753-4993 CN (8 OZ)  
6810-00-983-8551 QT  
6810-00-286-5435 GL  
6810-00-543-7915 DR (55 GL) |
| TT-N-95 Type II Naphtha, Aliphatic | For removal of pressure sensitive tape adhesive residue.                        | 6810-00-238-8119 GL  
6810-00-265-0664 CN (5 GL) |
| 3M No. 33 Aircraft Cleaning Pad, Exterior | Exterior washing of aircraft; use with 3M No. 261 Pad Holder | 7920-01-519-4736 BX (50 EA) |
| 3M No. 261 Aircraft Cleaning Pad, Holder, Conformable | Exterior washing of aircraft; use with 3M No. 33 Pad and A-A-1464 Aluminum Handle | EA7920-01-519-4735 EA |
| 3M Jet Pad Melamine Wash Pad | High efficiency cleaning pad for removal of stubborn stains. May be used with 3M No. 261 Pad Holder. | 7920-01-548-7887 BX (50 EA) |
| 84057 (Part Number) Pipe Cleaner | Cleaning small orifices, crevices (drain holes).                             | 9920-00-292-9946 BX (1344 EA) |
| NAVCLEAN Mildew Remover | Cleaning mold/mildew/fungus from painted aircraft surfaces, rubber, and fabric. Supplied as a four component kit – each kit makes five gallons of usable solution. | 6850-01-581-2150 EA  
6850-01-581-2172 CO (5 EA) |
### Table 8-4. Common Aircraft Greases

<table>
<thead>
<tr>
<th>SPECIFICATION / NOMENCLATURE</th>
<th>INTENDED USE</th>
<th>TEMP. RANGE</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAE AMS-G-4343</td>
<td>Grease, Pneumatic System (NATO Code G-392)</td>
<td>-65 to 200°F (-54 to 93°C)</td>
<td>9150-00-119-9291 TU (2 OZ) 9150-00-269-8255 CN (1.75 LB)</td>
</tr>
<tr>
<td>SAE AMS-G-6032</td>
<td>Grease, Plug Valve, Gasoline &amp; Oil Resistant (NATO Code G-363)</td>
<td>32 to 200°F (0 to 93°C)</td>
<td>Type I</td>
</tr>
<tr>
<td>MIL-G-21164</td>
<td>Grease, Molybdenum Disulfide, for Low &amp; High Temperatures (NATO Code G-353)</td>
<td>-100 to 250°F (-73 to 121°C)</td>
<td>9150-00-935-4018 CA (14 OZ) 9150-00-954-017 CA (6.5 LB) 9150-00-985-7244 CN (1.75 LB)</td>
</tr>
<tr>
<td>MIL-PRF-23827</td>
<td>Grease, Aircraft &amp; Instrument, Gear &amp; Actuator Screw (NATO Code G-354)</td>
<td>-100 to 250°F (-73 to 121°C)</td>
<td>9150-00-985-7244 TU (4 OZ) 9150-00-985-7245 TU (8 OZ) 9150-00-985-7246 CN (14 OZ) 9150-00-985-7247 CN (6.5 LB)</td>
</tr>
<tr>
<td>MIL-G-25013</td>
<td>Grease, Aircraft, Ball &amp; Roller Bearing (NATO Code G-372)</td>
<td>-100 to 450°F (-73 to 232°C)</td>
<td>9150-00-823-8048 TU (8 OZ) 9150-00-935-4019 CA (14 OZ) 9150-00-141-6770 CN (1.75 LB)</td>
</tr>
<tr>
<td>MIL-G-25537</td>
<td>Grease, Aircraft, Helicopter, Oscillating Bearing (NATO Code G-366)</td>
<td>-65 to 160°F (-54 to 71°C)</td>
<td>9150-00-478-0055 CA (14 OZ) 9150-00-616-9020 CN (1.75 LB) 9150-00-721-8570 CN (6.5 LB) 9150-00-721-8581 CN (35 LB)</td>
</tr>
<tr>
<td>MIL-PRF-27617</td>
<td>Grease, Aircraft Fuel &amp; Oil Resistant</td>
<td>-30 to 400°F (-34 to 204°C)</td>
<td>Type I 9150-01-007-4384 TU (8 OZ) 9150-01-311-9771 CN (1.75 LB) Type III (LOX compatible) 9150-00-961-8990 TU (8 OZ) 9150-01-358-5154 CN (1 LB)</td>
</tr>
<tr>
<td>MIL-PRF-32014</td>
<td>Grease, Aircraft and Instrument</td>
<td>-65 to 350°F (-54 to 177°C)</td>
<td>9150-01-499-6648 TU (4 OZ) 9150-01-530-6380 CA (14 OZ) 9150-01-499-6647 JR (1.75 LB) 9150-01-499-6642 CN (6.5 LB)</td>
</tr>
<tr>
<td>MIL-PRF-81322</td>
<td>Grease, Aircraft, General Purpose, Wide Temperature Range (NATO Code G-395)</td>
<td>-65 to 350°F (-54 to 177°C)</td>
<td>9150-00-181-7724 TU (8 OZ) 9150-01-262-3358 CA (14 OZ) 9150-00-944-8953 CN (1.75 LB)</td>
</tr>
</tbody>
</table>

Lubrication between rubber to metal parts of pneumatic systems; pressurized cabin bulkhead grommets and other mechanisms requiring rubber to metal lubrication.

Tapered plug valves; gasket lubricant or seal; general plug valve and fitting use where gasoline, oil, alcohol, or water resistance is required.

Heavily loaded steel sliding surfaces, accessory splines, or anti-friction bearings carrying high loads and operating in wide temperature ranges where grease will prevent or delay seizure in the event of inadequate lubrication.

Sliding and rolling surfaces of such equipment as instruments, cameras, electronic gear and aircraft control systems that are subject to extreme marine and low temperature conditions; ball, roller and needle bearings; gears; low torque equipment; general use on aircraft gears and actuator screws.

Lubrication of ball and roller bearings that operate at extreme high or low temperatures, especially in applications where soap-type greases and oils cannot be used; aircraft actuators; gearboxes.

Lubrication of aircraft bearings having oscillating motion of small amplitude.

Lubrication of taper plug valves, gaskets, and bearings in fuel systems; lubrication of valves, threads, and bearings in liquid oxygen systems. Do not use on aluminum or magnesium dynamic bearings due to possible ignition hazard.

General purpose aircraft lubricant that provides water resistance and corrosion protection over an extended period of time.

Aircraft wheel bearings and internal brake wheel assemblies, antifriction bearings, gearboxes, and plain bearings.
SECTION II. INSPECTION GUIDELINES

8-5. INSPECTION. The thorough removal of surface grease and grime during initial cleaning allows for a complete inspection. After a thorough cleaning has been accomplished, inspect all areas of the aircraft for evidence of corrosion or other deterioration. Refer to Table 8-5 for identification guidelines for some typical material defects.

a. Inspection Guidelines. To adequately inspect an aircraft subsequent to a cleaning operation, perform the following steps in addition to those specified in Chapter 3 and the aircraft MIMs.

(1) Ensure that the aircraft has been made safe. Ensure all ground safety devices are installed.

(2) Perform a walk-around inspection checking for obvious discrepancies such as leaks and streaks that may indicate problem areas, missing panels, or damaged external components.

(3) Take a fluid sample from each of the aircraft operating systems and check for contamination. Refer to the aircraft MIMs.

(4) Inspect the aircraft systems in accordance with the guidelines in Table 8-6, NAVAIR 01-1A-509-2, and the aircraft MIMs, using the recommended equipment specified in Table 8-7.

(5) Make a notation in the preservation records as to the general condition of the aircraft prior to starting the preservation procedures.

b. Documentation. All discrepancies shall be recorded regardless of intent to repair. This will permit accurate assessment of the preservation process at the end of the preservation period. For additional information refer to Chapter 3.
Table 8-5. Material Defect Indications

<table>
<thead>
<tr>
<th>Defect</th>
<th>Look for the Following</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contamination</td>
<td>Dirt, chemicals, debris.</td>
</tr>
<tr>
<td>Crevice Corrosion</td>
<td>Intense and localized corrosion within crevices or other shielded areas on metal surfaces, such as holes, gasket surfaces, lap joints, surface deposits, bolt and rivet heads. This type of attack is usually associated with trapped moisture.</td>
</tr>
<tr>
<td>Exfoliation Corrosion</td>
<td>Usually found in and around metal fasteners. It appears as metal &quot;flaking&quot; or lifting up from the parent material. Occurs in high strength aluminum and magnesium parts.</td>
</tr>
<tr>
<td>Filiform Corrosion</td>
<td>Wormlike traces of corrosion products beneath the paint. Can occur on steels, aluminum and magnesium.</td>
</tr>
<tr>
<td>Galvanic Corrosion</td>
<td>Attachment of two different metals with corrosion product buildup at the joint between the metals.</td>
</tr>
<tr>
<td>General Corrosion</td>
<td>Corrosion of iron or iron-base alloys result in the formation of corrosion products (oxide) on the surface that appear reddish-brown in color. Corrosion of aluminum and its alloys results in white oxides.</td>
</tr>
<tr>
<td>Intergranular Corrosion</td>
<td>Corrosion within the grain structure of the material. Hard to identify by visual inspection, but may look like sand grains in the crack surface.</td>
</tr>
<tr>
<td>Pitting Corrosion</td>
<td>First noticeable as a white or grey powdery deposit similar to dust. When deposits are cleaned away, tiny pits or holes are seen on the metal surface. Most common corrosion in aluminum or magnesium.</td>
</tr>
<tr>
<td>Uniform Surface Corrosion</td>
<td>Mild: General dulling or etching of the metal surface. Advanced: Rough and possibly frosted appearance of the metal surface.</td>
</tr>
<tr>
<td>Cracking</td>
<td>Break in a paint film or coating with the underlying material exposed. Separation of metal surface along a narrow path.</td>
</tr>
<tr>
<td>Erosion</td>
<td>Loss of plating, paint, or parent metal.</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Fine cracks in paint, or distortion of part.</td>
</tr>
<tr>
<td>Fraying</td>
<td>Broken or worn wires in cables, loss of CPC or oil coating.</td>
</tr>
<tr>
<td>Fretting</td>
<td>Loaded surfaces in contact with each other subjected to vibration and slip. It appears as pits, grooves or black streaks at the contact areas of the materials. A red or black powder is often present.</td>
</tr>
<tr>
<td>Mildew</td>
<td>Biological growth and possible musty, rancid odor.</td>
</tr>
<tr>
<td>Moisture</td>
<td>Actual wetness or water marks (deposits).</td>
</tr>
<tr>
<td>Scaling</td>
<td>Partially adherent layers of corrosion products on metal surfaces. Usually found on engines or other high temperature parts.</td>
</tr>
</tbody>
</table>

**NOTE:** Refer to NAVAIR 01-1A-509-1 for additional information and examples.
<table>
<thead>
<tr>
<th>Component</th>
<th>Inspect for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air inlet ducts</td>
<td>Erosion, nicks, pitting.</td>
</tr>
<tr>
<td>Battery compartments and battery vent openings</td>
<td>Spills, leakage, surface corrosion. Include areas adjacent to battery compartment and external vent areas on aircraft skin.</td>
</tr>
<tr>
<td>Bilge areas</td>
<td>Debris, fluids, and resulting corrosion underneath.</td>
</tr>
<tr>
<td>Canopy frame</td>
<td>Cracked seals, blistered surfaces on frame, bare metal.</td>
</tr>
<tr>
<td>Cockpit</td>
<td>Corrosion or surface defects, moisture entrapment, contamination.</td>
</tr>
<tr>
<td>Control cables</td>
<td>Bare spots in CPC coating, contamination, fraying.</td>
</tr>
<tr>
<td>Crevices</td>
<td>Contamination, evidence of moisture, corrosion products, bulging paint.</td>
</tr>
<tr>
<td>Drain holes</td>
<td>Plugged holes, check all low point drains for contamination.</td>
</tr>
<tr>
<td>Ejection seats</td>
<td>Corrosion, deterioration, fraying, cuts and for proper security.</td>
</tr>
<tr>
<td>Electrical connectors</td>
<td>Moisture, oxidation, loose connections.</td>
</tr>
<tr>
<td>EMI seals and gaskets</td>
<td>Galvanic corrosion from dissimilar metals, oxidation, contamination.</td>
</tr>
<tr>
<td>Engine frontal areas</td>
<td>Erosion, nicks, blistering, corrosion.</td>
</tr>
<tr>
<td>Exhaust gas impingement areas</td>
<td>Exhaust deposits (ash or residual solids) and damage to the surface finish (blistered, abrasion)</td>
</tr>
<tr>
<td>Fasteners</td>
<td>Cracks, blisters, corrosion products and entrapped moisture around fastener heads.</td>
</tr>
<tr>
<td>Flap and slat recesses</td>
<td>Surface corrosion and defects, moisture entrapment, and contamination.</td>
</tr>
<tr>
<td>Leading edges</td>
<td>Erosion, nicks and pitting.</td>
</tr>
<tr>
<td>Hinges</td>
<td>Dissimilar metal corrosion, contamination, wear of plated or coated surfaces, areas without protective coating (CPCs).</td>
</tr>
<tr>
<td>Magnesium parts</td>
<td>Corrosion, areas without protective coating (paint).</td>
</tr>
<tr>
<td>Relief tube system</td>
<td>Damage to paint and protective coatings.</td>
</tr>
<tr>
<td>Spot-welded assemblies</td>
<td>Sight or feel along spot weld seams for signs of bulging or buckling.</td>
</tr>
<tr>
<td>Transparencies</td>
<td>Scratches, contamination, and distortion.</td>
</tr>
<tr>
<td>Water entrapment areas</td>
<td>Evidence of standing water, corrosion, and plugged drains.</td>
</tr>
<tr>
<td>Wheel wells and landing gear</td>
<td>Surface defects, corrosion, moisture entrapment, areas without protective coatings (paint, CPCs).</td>
</tr>
<tr>
<td>Wing-fold joints</td>
<td>Surface defects, corrosion, moisture entrapment, contamination, areas without protective coatings (paint, CPCs).</td>
</tr>
</tbody>
</table>
### Table 8-7. Equipment Used to Aid Inspection

<table>
<thead>
<tr>
<th>SPECIFICATION/ NOMENCLATURE</th>
<th>INTENDED USE</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth Gage, Dial Indicator P/N 6527281</td>
<td>Precision measurement of corrosion damage.</td>
<td>5210-00-710-4359 EA</td>
</tr>
<tr>
<td>Flashlight, Metal A-A-1382</td>
<td>Corrosion inspection.</td>
<td>6230-01-247-7549 EA</td>
</tr>
<tr>
<td>Magnifying Glass, 5x</td>
<td>Detailed inspection of corrosion cracks.</td>
<td>6650-00-252-6271 EA</td>
</tr>
<tr>
<td>Magnifying Glass, 5x/20x5x/7x/10x</td>
<td>Detailed inspection of corrosion cracks.</td>
<td>6650-00-530-1880 EA 6650-00-098-6128 EA</td>
</tr>
<tr>
<td>Optical Micrometer Kit</td>
<td>Corrosion inspection.</td>
<td>6650-00-831-5532 EA (Vernier Gage) 6650-01-220-8942 EA (Digital Gage)</td>
</tr>
</tbody>
</table>
SECTION III. CORROSION CONTROL

8-6. CORROSION CONTROL. Corrosion shall be corrected in order to prevent further deterioration of the area during shipment or storage. Each type of corrosion has its own peculiarities and requires special treatment. Complete treatment involves thorough inspection of all corroded areas and evaluation of the corrosion damage, paint and corrosion removal, application of chemical surface treatments, sealing, and the application of paint. For more information on the corrosion control of specific aircraft systems consult Chapter 3 and NAVAIR 01-1A-509-2. Information on corrosion preventive compounds may be found in Section IV of this chapter.
8.7. PRESERVATION MATERIALS. Preservation materials are used to protect aircraft and systems during periods of inactivity.

a. Corrosion Preventive Compounds (CPCs). The function of CPCs is to prevent corrosive materials from contacting and corroding bare metal surfaces. CPCs can be applied by brushing, dipping, or spraying. The area of application, viscosity of the CPC material, and the conditions under which they need to be applied are factors which determine which method to use. Low viscosity materials are best applied by spraying, whereas high viscosity materials are more suited for brushing or dipping. Dipping can be used for all types of CPC material, but the thickness of the coating obtained with low viscosity materials may be too thin to provide adequate corrosion protection. Prior to the application of a CPC, remove any residue of the old preservative. To ensure effective protection, CPCs must only be applied to aircraft surfaces that have been thoroughly cleaned and dried. It is also necessary that an unbroken film of the compound be applied in an atmosphere that is as free of moisture as practicable. Most CPCs can be removed with degreasing solvent, MIL-PRF-680 Type II.

(1) Water Displacing CPCs. Table 8-8 lists the water displacing CPCs used to remove sea water or other electrolytes from metal surfaces to stop the corrosion process. These CPCs are able to penetrate into cracks, crevices, voids in fraying edges, around fastener heads, and into hinges. They provide a very thin coating, 0.001 inch, and are usually clear or translucent. Most water displacing compounds are soft, oily compounds which cannot provide long term protection outdoors or in areas which are frequently handled. Refer to Table 8-9 for time limitations of some commonly used CPCs.

(2) Non-Water Displacing CPCs. Table 8-10 lists non-water displacing CPCs for use on dried surfaces or on surfaces which have been first treated with a water displacing CPC. They are heavier bodied oils which provide long term corrosion protection. These CPCs provide thicker coatings and are light brown to very dark brown in color, with a waxy or greasy appearance. They provide good corrosion protection in areas where large amounts of water collect on or run off of structures. Refer to Table 8-9 for time limitations for some commonly used CPCs.

(3) Volatile Corrosion Inhibitors (VCI). VCIs protect metal surfaces by vaporizing into a cavity and continually depositing a protective layer on exposed unprotected metal surfaces. VCI material must be applied within approximately 12 inches of the area to be protected, and preferably should be dispersed throughout the cavity to assure maximum exposure of the surface areas. For the protection of internal surfaces, sufficient barrier must be provided to prevent the escape of the volatile inhibitor. These barriers do not need to be water vaporproof, but should be sufficiently vaportight to prevent free air circulation. The life of the protection will vary with the effectiveness of the barrier used; however, most VCIs are not intended for use for more than 24 months. VCIs are also available in liquid form. Refer to Table 8-11 for more information on VCI material.

b. Materials. Refer to Table 8-12 for a general listing of common preservation materials. Refer to Table 8-13 for common packaging materials. If additional information is required for the procurement of preservation material or equipment, contact the Materials Engineering Division, Code 4.3.4.6., NAVAIR ISSC North Island.
### Table 8-8. Water Displacing Corrosion Preventive Compounds

<table>
<thead>
<tr>
<th>SPECIFICATION/ NOMENCLATURE</th>
<th>INTENDED USE</th>
<th>TYPE OF COATING</th>
<th>REMOVAL</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL-PRF-32033 Lubricating Oil, General Purpose, Preservative, (Water Displacing, Low Temperature)</td>
<td>Lubrication of hinge areas &amp; wherever a low temperature, water displacing lubricant is required. Requires frequent reapplications. Cannot be used with fuel systems or in engine combustion chambers.</td>
<td>Soft, oily coating</td>
<td>MIL-PRF-680 Type II or Type III</td>
<td>9150-00-273-2389 CN (4 OZ) 9150-00-458-0075 CN (16 OZ) 9150-00-231-6689 QT 9150-00-231-9045 GL 9150-00-231-9062 CN (5 GL) 9150-00-281-2060 DR (55 GL)</td>
</tr>
<tr>
<td>MIL-PRF-63460 Lubricant, Cleaner, &amp; Preservative for Weapons &amp; Weapons Systems</td>
<td>Lubrication &amp; short term preservation of aircraft hinges &amp; small and large caliber weapons. Facilitates the effective removal of firing residues, gums, and other contaminants from weapons components. Do not use on rubber or other elastomeric materials.</td>
<td>Thin, corrosion preventive lubricant</td>
<td>MIL-PRF-680 Type II or Type III</td>
<td>9150-01-079-6124 BT (4 OZ) 9150-01-054-6453 PT (sprayer) 9150-01-327-9631 QT (sprayer) 9150-01-053-6688 GL</td>
</tr>
<tr>
<td>MIL-PRF-81309 Type II Corrosion Preventive Compounds, Water Displacing, Ultra-thin Film</td>
<td>Displacement of water; short term corrosion protection of metal surfaces during shipment, storage, and in-service use. Corrosion protection of moving parts where some lubrication is required, such as hinge areas, bomb racks, and sliding parts. Also used as a waterless cleaner.</td>
<td>Soft, very thin film (0.0005&quot;), translucent, light amber color</td>
<td>MIL-PRF-680 Type II or Type III</td>
<td>Class 1 8030-00-213-3279 GL 8030-00-262-7358 CN (5 GL) 8030-00-542-9487 DR (55 GL) Class 2 8030-00-938-1947 CN (16 OZ) NAVGUARD 8030-01-600-1264 BX (12 16 OZ cans)</td>
</tr>
<tr>
<td>MIL-PRF-81309 Type III Corrosion Preventive Compounds, Water Displacing, Ultra-thin Film</td>
<td>Displacement of water; corrosion protection of avionic equipment, electrical connector plugs and contact pins.</td>
<td>Soft, ultra thin film (0.0002&quot;), translucent, light amber color</td>
<td>MIL-PRF-680 Type II or Type III</td>
<td>Class 1 8030-01-347-0978 GL Class 2 8030-00-546-8637 CN (16 OZ) NAVGUARD 8030-01-600-1265 BX (12 16 OZ cans)</td>
</tr>
<tr>
<td>MIL-DTL-85054 Corrosion Preventive Compound, Water Displacing, Transparent, for Low and High Temperatures</td>
<td>Corrosion protection &amp; water displacement for nonmoving parts, such as skin seams, installed fastener heads where paint has cracked, access panel edges, &amp; areas with damaged paint.</td>
<td>Dry, thin (0.001&quot;), clear, colorless</td>
<td>MIL-PRF-680 Type II or Type III or Spray on fresh MIL-DTL-85054 &amp; rub when wet</td>
<td>Type I 8030-01-347-0980 CN (14 OZ) Type II 8030-01-347-0983 BT (32 OZ sprayer) 8030-01-347-0981 QT 8030-01-347-0982 CN (5 GL)</td>
</tr>
</tbody>
</table>
### Table 8-9. Time Limitations for CPCs

<table>
<thead>
<tr>
<th>CPC</th>
<th>Outdoor⁴</th>
<th>Indoor²</th>
<th>Indoor Covered³</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soft Thin Films</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIL-PRF-81309 Type II</td>
<td>14 days</td>
<td>30 days</td>
<td>180 days</td>
</tr>
<tr>
<td>MIL-PRF-81309 Type III</td>
<td>5 days</td>
<td>14 days</td>
<td>90 days</td>
</tr>
<tr>
<td><strong>Lubrication and Protection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIL-PRF-32033</td>
<td>5 days</td>
<td>30 days</td>
<td>180 days</td>
</tr>
<tr>
<td>MIL-PRF-63460</td>
<td>5 days</td>
<td>30 days</td>
<td>180 days</td>
</tr>
<tr>
<td><strong>Hard Thick Films</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIL-DTL-85054</td>
<td>90 days</td>
<td>210 days</td>
<td>365 days</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 4</td>
<td>60 days</td>
<td>180 days</td>
<td>365 days</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 2</td>
<td>90 days</td>
<td>210 days</td>
<td>365 days</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 1</td>
<td>210 days</td>
<td>365 days</td>
<td>365 days</td>
</tr>
</tbody>
</table>

¹Outdoor: Without cover; exposed to elements in a mild climate; absence of rain and other washing forces; free from air and water borne pollutants.

²Indoor: Hangars, shop areas, storage or parts accumulation areas, warehouses.

³Indoor Covered: Items are wrapped or sealed in a water-resistant material, and stored indoors in a hangar, warehouse, or shop area. Soft thin film CPCs were designed for indoor use and ease of removal.

### Table 8-10. Non-Water Displacing Corrosion Preventive Compounds

<table>
<thead>
<tr>
<th>SPECIFICATION/ NOMENCLATURE</th>
<th>INTENDED USE</th>
<th>TYPE OF COATING</th>
<th>REMOVAL</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL-PRF-16173 Grade 1 Corrosion Preventive Compound, Solvent Cutback, Cold Application</td>
<td>Protect metal surfaces from corrosion when exposed with or without covering indoors or outdoors.</td>
<td>Hard, tack-free, thick (0.004&quot;), dark brown or black color</td>
<td>MIL-PRF-680 Type II or Type III or MIL-T-81772</td>
<td>8030-01-396-5731 PT 8030-01-396-5732 GL 8030-01-347-0970 CN (5 GL) 8030-01-396-5237 DR (55 GL)</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 2 Corrosion Preventive Compound, Solvent Cutback, Cold Application</td>
<td>Protect metal surfaces from corrosion during rework or storage.</td>
<td>Soft, tacky, non-drying, thick (0.002&quot;), light brown color</td>
<td>MIL-PRF-680 Type II or Type III or MIL-T-81772</td>
<td>8030-00-118-0666 CN (11 OZ) 8030-01-149-1731 QT 8030-00-244-1297 GL 8030-00-244-1298 CN (5 GL) 8030-00-244-1295 DR (55 GL)</td>
</tr>
<tr>
<td>MIL-PRF-16173 Grade 4 Corrosion Preventive Compound, Solvent Cutback, Cold Application</td>
<td>Protect metal surfaces from corrosion during indoor storage when a transparent coating is required; coating of interior cables.</td>
<td>Soft, tack-free, thick (0.002&quot;), light brown color</td>
<td>MIL-PRF-680 Type II or Type III</td>
<td>8030-01-396-5738 PT 8030-01-396-5743 GL 8030-01-347-0972 CN (5 GL)</td>
</tr>
</tbody>
</table>
Table 8-11. Volatile Corrosion Inhibitors (VCI)

<table>
<thead>
<tr>
<th>SPECIFICATION/ NOMENCLATURE</th>
<th>USE</th>
<th>DO NOT USE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL-PRF-3420</td>
<td>Preservation or packaging of items requiring corrosion protection of metal surfaces.</td>
<td>Do not use when paper may contact high explosives or propellants associated with ammunition.</td>
<td>Wrap around item or insert into interiors. See MIL-STD-2073-1 and MIL-I-8574 for additional information.</td>
</tr>
<tr>
<td>MIL-PRF-3420</td>
<td>Styles A, B, C, G and H (Kraft paper base) are used for wrapping. Styles J and K (paperboard) are used for wrapping and cushioning.</td>
<td>Do not use for preservation of nonmetallic components. Do not use in high humidity environments. Use MIL-PRF-22019 as a substitute.</td>
<td></td>
</tr>
<tr>
<td>MIL-PRF-22019 Barrier Materials, Transparent, Flexible, Sealable, Volatile Corrosion Inhibitor Treated</td>
<td>Preservation or packaging of items requiring corrosion protection of metal surfaces. Transparency facilitates inspection of item without unpacking. Properly sealed film is also waterproof.</td>
<td>Do not use when plastic may contact high explosives or propellants associated with ammunition. Do not use for preservation of nonmetallic components.</td>
<td>Wrap around item and heat seal or seal with preservation tape, SAE AMS-T-22085 Type II. Apply IAW methods in MIL-STD-2073-1 and MIL-I-8574.</td>
</tr>
<tr>
<td>MIL-DTL-22020 Bags, Transparent, Flexible, Sealable, Volatile Corrosion Inhibitor Treated</td>
<td>Preservation or packaging of items requiring corrosion protection of metal surfaces. Bags are manufactured from MIL-B-22019 material.</td>
<td>Do not use when plastic may contact high explosives or propellants associated with ammunition. Do not use for preservation of nonmetallic components.</td>
<td>Insert item into bag and seal with zip-lock closure, heat seal, or seal with preservation tape, SAE AMS-T-22085 Type II. Apply IAW methods in MIL-STD-2073-1 and MIL-I-8574.</td>
</tr>
<tr>
<td>MIL-I-22110 Inhibitors, Corrosion, Volatile, Crystalline Powder</td>
<td>Designed for use with ferrous, aluminum, aluminum-based alloys and components containing zinc plate, cadmium, zinc-based alloys, lead-based alloys, and alloys of other metals (including solders and brazing alloys).</td>
<td>Direct contact with nonferrous metals (except aluminum) shall be avoided. Direct contact with nonmetals shall be avoided unless the compatibility test in MIL-I-8574 has been met.</td>
<td>Unit packs shall be sealed to prevent escape of VCI vapor. Use 1 g of crystals per cubic foot of enclosed volume. Apply IAW MIL-I-8574.</td>
</tr>
<tr>
<td>MIL-PRF-46002 Preservative Oil, Contact and Volatile Corrosion Inhibited</td>
<td>Use in closed systems where the VCI component of this oil provides protection above the oil level due to the vapors it forms. Can be used as a contact preservative.</td>
<td>This oil shall not be used in fuel systems or fuel storage tanks. Do not use in systems with elastomeric components. Not intended for use as an operational preservative.</td>
<td>This oil is not effective unless an adequate reservoir of oil can be maintained. Requires a minimum of 5 fluid ounces of Grade 1, or 8 fluid ounces of Grade 2, for each cubic foot of area to be protected.</td>
</tr>
</tbody>
</table>
### Table 8-12. Materials for Preservation

<table>
<thead>
<tr>
<th>SPECIFICATION/NOMENCLATURE</th>
<th>INTENDED USE</th>
<th>NSN</th>
</tr>
</thead>
</table>
| A-A-208 Ink, Marking, Stencil, Opaque | Marking of containers and packages and stenciling of preservation data on aircraft. | Black (37078)  
Type I 7510-00-224-6743 PT  
Type III 7510-00-469-7910 PT (spray can)  
Red  
Type II 7510-00-848-9286 PT  
White (37875)  
Type III 7510-00-419-9564 PT (spray can) |
| A-A-3174 Type I Class 1 Polyolefin, Plastic Sheet | General purpose shroud material. | 8135-00-068-9466 RO (36"x 100 FT) |
| A-A-50129 Cloth, Flannel, Lightweight | Wiping of critical machined surfaces such as hydraulic struts; lining protective covers to prevent scratching of transparencies; cleaning and polishing of canopies. | 8305-00-913-5817 BO (50 YD) |
| A-A-59163 Class 1 Type I Insulation Tape, Electrical, Self-Adhering | Protection of disconnected electrical connectors. Tape leaves no adhesive residue. | 5970-00-955-9976 RO (1" width) |
| A-A-59282 Bromothymol Blue | Premade indicator solution for nickel-cadmium batteries. Solution contains methanol. | 6810-00-281-4271 BT (4 OZ) |
| A-A-59503 Type I Nitrogen, Technical, Gas | Purging of liquid oxygen systems and servicing of aircraft pneumatic systems/components. | 6830-00-656-1596 CY |
| ASTM D4727 Type SF, Class Weather-resistant Grade V3s Fiberboard, Solid, Sheetstock | Fabrication of closures for large openings (such as wingfold areas). |  |
| ASTM D4801 Type I Plastic Sheet, Polyethylene | General purpose covering for protection against dirt and water (natural color). | 9330-01-496-0989 SH (0.060” thickness) |
| ASTM D4801 Type III Plastic Sheet, Polyethylene | General purpose covering for protection against dirt and water (black). |  |
| CCC-C-46 Type I Cloth, Cleaning, Nonwoven | General cleaning operations. | Class 4 (heavy duty)  
7920-00-401-8034 HD  
Class 6 (light duty)  
7920-00-292-9204 MX (1000 EA) |
| CCC-C-440 Cloth, Cheesecloth, Cotton | Polishing and cleaning; straining of strippable compounds; reinforcing coatings on sharp edges or irregular surfaces. | 8305-00-205-3496 PG (36” x 10 YD)  
8305-00-205-3495 BO (36” x 100 YD) |
| H-B-176/1-2 Platers Hand Brush | Removal of corrosion products and paint film. Application of cleaning solutions. | 7920-00-244-7431 EA |
### Table 8-12. Materials for Preservation (Cont.)

<table>
<thead>
<tr>
<th>SPECIFICATION/ NOMENCLATURE</th>
<th>INTENDED USE</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIL-A-46146 Group I Type I Adhesive, Sealant, Silicone, RTV, Noncorrosive</td>
<td>Temporary sealing of small irregular openings in flexible covers. CAUTION Compound is not resistant to fuel or hydraulic fluid.</td>
<td>8040-01-331-7133 TU (3 OZ) 8040-01-331-8046 CA (12 OZ)</td>
</tr>
<tr>
<td>MIL-C-15074 Fingerprint Remover</td>
<td>Removal of fingerprint residues from critical machined and highly polished surfaces.</td>
<td>8030-00-558-7649 PT 8030-00-664-4017 QT 8030-00-281-2338 GL</td>
</tr>
<tr>
<td>MIL-C-4339 Corrosion Preventive Soluble Oil for Water Injection Systems</td>
<td>Protection of water injection and windshield defroster systems.</td>
<td>6850-00-224-9582 CN (5 GL)</td>
</tr>
<tr>
<td>MIL-D-3464 Type I Desiccant, Activated, Bagged</td>
<td>Absorb moisture within sealed wateraporproof barriers.</td>
<td>6850-00-264-6572 DR (150 EA) - 16 unit 6850-00-264-6574 DR (500 EA) - 4 unit 6850-00-264-6564 CN (1200 EA) - 1/6 unit</td>
</tr>
<tr>
<td>MIL-D-3464 Type III Desiccant, Activated, Bagged</td>
<td>For use if wet/flooded conditions are expected.</td>
<td>6850-00-194-3291 DR (150 EA) - 16 unit</td>
</tr>
<tr>
<td>MIL-I-8835 (MS 20003) Indicator, Humidity Card</td>
<td>Indicates humidity in enclosed areas, 3 spot card.</td>
<td>6685-00-752-8240 CN (125 EA)</td>
</tr>
<tr>
<td>MIL-PRF-121 Type I Barrier Material, Greaseproof, Waterproof, Flexible</td>
<td>Noncorrosive barrier for preserved machined and polished surfaces such as propeller shafts and unpainted metal parts.</td>
<td>8135-00-224-8885 RO (36&quot; x 200 YD) 8135-00-543-8573 RO (12&quot; x 200 YD)</td>
</tr>
<tr>
<td>MIL-PRF-131 Class 1 Barrier Material, Watervaporproof, Greaseproof, Flexible, Heat Sealable</td>
<td>Method 50 packaging, packaging of retrograde parts, protection under films, exterior protection.</td>
<td>8135-00-282-0565 RO (36&quot; x 200 YD) 8135-00-499-5302 RO (72&quot; x 200 YD)</td>
</tr>
<tr>
<td>MIL-PRF-131 Class 3 Barrier Material, Watervaporproof, Greaseproof, Flexible, Heat Sealable</td>
<td>Heavy duty scrim backed barrier material for long term component storage.</td>
<td>8135-01-015-2810 RO (36&quot; x 200 YD)</td>
</tr>
<tr>
<td>MIL-PRF-3420 Class 1 Style A Packaging Material, VCI Treated, Opaque (Paper)</td>
<td>Wrapping of removed components to prevent corrosion.</td>
<td>8135-00-664-4012 RO (200 YD)</td>
</tr>
<tr>
<td>MIL-PRF-6081 Grade 1010N Lubricating Oil, Engine</td>
<td>Preservation of fuel systems and components.</td>
<td>9150-01-573-8945 QT 9150-01-573-9003 GL 9150-01-570-1493 DR (55 GL)</td>
</tr>
<tr>
<td>MIL-PRF-81352 Type I Coatings, Aircraft Touch-up, Acrylic Base (VOC &lt; 340 g/l)</td>
<td>For covering/obliterating old markings on shipping containers.</td>
<td>8010-00-935-7085 CN (16 OZ aerosol) Color 36440 (light gray)</td>
</tr>
</tbody>
</table>
### Table 8-12. Materials for Preservation (Cont.)

<table>
<thead>
<tr>
<th>SPECIFICATION/NOMENCLATURE</th>
<th>INTENDED USE</th>
<th>NSN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MIL-PRF-81705 Type I</strong></td>
<td>To provide ESD/EMI packaging protection for hardware and components.</td>
<td>8135-00-092-3220 RO (36&quot; x 600') 8135-01-185-6816 RO (36&quot; x 150') 8135-01-158-7786 EA (48&quot; x 48&quot; sheet) 8135-01-163-3486 EA (24&quot; x 36&quot; sheet)</td>
</tr>
<tr>
<td>Barrier Material, Flexible, Electrostatic Protective, Heat Sealable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MIL-PRF-83282</strong> Fluid, Hydraulic</td>
<td>Wiping down struts.</td>
<td>9150-00-149-7431 QT 9150-00-149-7432 GL 9150-00-180-6290 DR (55 GL) 9150-01-009-7709 DR (10 GL)</td>
</tr>
<tr>
<td><strong>NN-P-530 Group B Type Exterior Grade D Plywood, Flat Panel</strong></td>
<td>Solid platform under landing gear wheels, between apron surface and flexible cover.</td>
<td></td>
</tr>
<tr>
<td><strong>P-P-560</strong> Polish, Plastic</td>
<td>Polishing transparencies.</td>
<td>7930-00-935-3794 BX (24 EA) 7930-01-133-5375 DZ</td>
</tr>
<tr>
<td><strong>P-W-155</strong> Wax Floor Water Emulsion</td>
<td>Waxing of deicer boots and neoprene coated surfaces prior to application of strippable plastic coatings.</td>
<td>7930-00-141-5888 CN (5 GL) 7930-00-250-2870 CN (1 GL)</td>
</tr>
<tr>
<td><strong>SAE AS26860 Type II Indicator, Humidity Plug</strong></td>
<td>Used with desiccant packs and installed in barrier material for static DH.</td>
<td>6685-01-038-8686 EA 6685-00-618-1822 PG (5 EA)</td>
</tr>
<tr>
<td><strong>SAE AMS-T-22085 Type II Tape, Pressure Sensitive, Adhesive, Preservation and Sealing (3M No. 481)</strong></td>
<td>Holding barrier material in place, sealing small areas. CAUTION: Do not use on transparent acrylic surfaces.</td>
<td>7510-00-852-8179 RO (1&quot; x 60 YD) 7510-00-852-8180 RO (2&quot; x 36 YD) 7510-00-916-9659 RO (4&quot; x 36 YD)</td>
</tr>
<tr>
<td><strong>SAE AMS-T-22085 Type IV Tape, Pressure Sensitive, Adhesive, Preservation and Sealing (3M No. 838)</strong></td>
<td>Use with MIL-PRF-131 barrier material for long term or outdoor storage.</td>
<td>7510-00-040-5895 RO (1.5&quot; x 72 YD) 7510-00-927-1514 RO (2&quot; x 72 YD)</td>
</tr>
<tr>
<td><strong>SAE AS5778 Type I or II Covers, Aircraft Components</strong></td>
<td>Protection of aircraft openings and components such as engines, rotor heads.</td>
<td></td>
</tr>
<tr>
<td><strong>TA356-HC-2345 Humidity Color Change Disc</strong></td>
<td>Replacement indicator disc for SAE AS26860 Type II humidity plug.</td>
<td>6685-00-523-0700 EA 6685-00-052-1865 HD</td>
</tr>
<tr>
<td><strong>TW25B Light Grease</strong></td>
<td>Lubricant/protectant for aircraft guns and airborne crew served weapons.</td>
<td>9150-01-448-2298 CN (16 OZ aerosol) 9150-01-535-8338 JR (16 OZ) 9150-01-535-8687 JR (32 OZ)</td>
</tr>
<tr>
<td><strong>Blue Litmus Paper</strong></td>
<td>Color change to red indicates acid present (lead-acid batteries).</td>
<td>6640-00-290-0146 HD (100 EA)</td>
</tr>
<tr>
<td><strong>Red Litmus Paper</strong></td>
<td>Color change to blue indicates alkali present (nickel-cadmium batteries).</td>
<td>6640-00-290-0147 HD (100 EA)</td>
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<tr>
<td><strong>Neutral Litmus Paper</strong></td>
<td>Can be used to indicate battery leakage.</td>
<td>6640-00-551-8470 HD (100 EA)</td>
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<tr>
<td>SPECIFICATION/ NOMENCLATURE</td>
<td>INTENDED USE</td>
<td>NSN</td>
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<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
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<tr>
<td>A-A-2953</td>
<td>Heat sealing of barrier material or plastic sheet.</td>
<td>3540-00-293-0377 EA (6&quot; width)</td>
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<td></td>
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<td>3540-00-299-9811 EA (14&quot; width)</td>
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<tr>
<td>ASOINST 80132-13414</td>
<td>Multiapplication reusable (repairable) container for delicate/fragile repairable avionic components</td>
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<tr>
<td>Container, Shipping and Storage, Plastic, Reusable</td>
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<tr>
<td>ASOINST 80132-13623</td>
<td>Multiapplication reusable container for printed circuit cards, flat pack modules</td>
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<tr>
<td>Container, Shipping and Storage, Plastic, Reusable</td>
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<tr>
<td>ASOINST 80132-15024</td>
<td>Multiapplication reusable (repairable) container for extremely delicate/fragile (15G) gyroscopic equipment</td>
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<tr>
<td>Container, Shipping, Storage, and Handling, Plastic, Reusable</td>
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<tr>
<td>ASTM D3950 Type 2</td>
<td>Securing fuselage dive/speed, flaps to prevent movement during storage</td>
<td>8135-00-900-6699 CL (0.5&quot; x 3000 FT)</td>
</tr>
<tr>
<td>Strapping, Plastic</td>
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<tr>
<td>ASTM D5118</td>
<td>Packing of parachutes and other loose items for storage and shipment with aircraft.</td>
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<tr>
<td>Fiberboard Shipping Boxes</td>
<td></td>
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<tr>
<td>MIL-D-6054</td>
<td>Multiapplication reusable metal container for rugged nonfragile cylindrically shaped repairable items when watervaporproof packaging is required</td>
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<tr>
<td>Drum, Metal, Shipping and Storage</td>
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<tr>
<td>MIL-DTL-117 Type I</td>
<td>Use with inner and outer fiberboard container to prevent puncture of watervaporproof bags</td>
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<tr>
<td>Bags, Heat Sealable</td>
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<tr>
<td>MIL-DTL-81997 Type I</td>
<td>To provide ESD packaging protection for small components/connectors.</td>
<td>8105-01-205-0207 HD (8&quot; x 12&quot;)</td>
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<td>Pouches, Cushioned, Flexible, Electrostatic Protective, Transparent</td>
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<td>8105-01-197-2965 EA (12&quot; x 12&quot;)</td>
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<tr>
<td>MIL-PRF-5806</td>
<td>Packaging and storage of removed helicopter rotor blades</td>
<td>8105-01-197-2966 EA (10&quot; x 10&quot;)</td>
</tr>
<tr>
<td>Box, Shipping and Storage, Helicopter Blade</td>
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<td>8105-01-197-7846 EA (10&quot; x 12&quot;)</td>
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<tr>
<td>PPP-C-1120 Type IV Class A</td>
<td>Cushioning of packaged components and padding of sharp edges and noncorrosive fragile surfaces</td>
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<tr>
<td>Cushioning Material, Uncompressed Bound Fiber for Packaging</td>
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<td>8135-00-132-9568 SH (24&quot; x 6’ x 1”)</td>
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<tr>
<td>PPP-C-1797 Type I</td>
<td>Cushioning of packaged components and padding of sharp edges and machined surfaces</td>
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<tr>
<td>Cushioning Material, Resilient, Low Density, Unicellular, Polypropylene Foam</td>
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<td>8135-00-129-9523 BD (24’ x 450’ x 0.125”)</td>
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<tr>
<td>PPP-C-795 Class I</td>
<td>Cushioning of packaged components and padding of sharp edges and machined surfaces</td>
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<tr>
<td>Cushioning Material, Packaging (Bubblewrap)</td>
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<td>8135-00-300-4905 BD (30’ x 225’ x 0.25”)</td>
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<tr>
<td>Dura Label Pro 300 Thermal Transfer Printer</td>
<td>For creating package labels. Complies with MIL-STD-129 requirements.</td>
<td>Open Purchase Graphic Products</td>
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# APPENDIX A
## RELATED PUBLICATIONS, SPECIFICATIONS, STANDARDS, AND INSTRUCTIONS

<table>
<thead>
<tr>
<th>NUMBER</th>
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<tr>
<td>A0-PHS&amp;T-MIM-000</td>
<td>Packaging, Handling, Storage &amp; Transportation for Retrograde Shipment of Aviation Depot Repairables</td>
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<tr>
<td>AG-830AC-MEB-000</td>
<td>Reusable Shipping and Storage Containers – Aluminum</td>
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<tr>
<td>AG-830FC-MEB-000</td>
<td>Reusable Shipping and Storage Containers – Fiberglass</td>
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<tr>
<td>AG-830PC-MEB-000</td>
<td>Reusable Shipping and Storage Containers – Thermoformed Plastic</td>
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<tr>
<td>AG-830SC-MEB-000</td>
<td>Reusable Shipping and Storage Containers – Steel</td>
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<tr>
<td>COMNAVAIRFORINST 4790.2</td>
<td>Naval Aviation Maintenance Program</td>
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<tr>
<td>DODINST 6050.05</td>
<td>DOD Hazard Communication (HAZCOM) Program</td>
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<tr>
<td>DTR 4500.9-R</td>
<td>Defense Transportation Regulation – Part II, Cargo Movement</td>
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<td>MIL-DTL-75</td>
<td>Electron Tubes, Packaging of</td>
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<tr>
<td>MIL-H-775</td>
<td>Hose, Hose Assemblies; Rubber, Plastic, Fabric, or Metal (including Tubing) and Associated Hardware; Packaging of</td>
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<tr>
<td>MIL-HDBK-263</td>
<td>Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies, and Equipment</td>
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<tr>
<td>MIL-HDBK-274</td>
<td>Electrical Grounding for Aircraft Safety</td>
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<tr>
<td>MIL-I-8574</td>
<td>Inhibitors, Corrosion, Volatile, Utilization of</td>
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<tr>
<td>MIL-P-6063</td>
<td>Packaging of Batteries, Storage, Charged and Dry Uncharged and Moist, General Specification for</td>
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<tr>
<td>MIL-STD-129</td>
<td>Military Marking for Shipment and Storage</td>
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<tr>
<td>MIL-STD-130</td>
<td>Identification Marking of U. S. Military Property</td>
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<tr>
<td>MIL-STD-1366</td>
<td>Interface Standard for Transportability Criteria</td>
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<tr>
<td>MIL-STD-2073-1</td>
<td>Standard Practice for Military Packaging</td>
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<tr>
<td>MIL-STD-2161</td>
<td>Paint Schemes and Exterior Markings for US Navy and Marine Corps Aircraft</td>
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<tr>
<td>MIL-STD-648</td>
<td>Design Criteria for Specialized Shipping Containers</td>
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<tr>
<td>MIL-STD-913</td>
<td>Requirements for the Certification of Sling Loaded Military Equipment for External Transportation by Department of Defense Helicopters</td>
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<tr>
<td>NAVAIR 00-25-100</td>
<td>Naval Air Systems Command Technical Manual Program</td>
</tr>
<tr>
<td>NAVAIR 00-80R-19</td>
<td>NATOPS Aircraft Crash and Salvage Operations Manual (Afloat)</td>
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<tr>
<td>NAVAIR 00-80T-109</td>
<td>NATOPS Aircraft Refueling Manual</td>
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<tr>
<td>NAVAIR 01-1A-17</td>
<td>Aviation Hydraulics Manual</td>
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<td>NAVAIR 01-1A-20</td>
<td>Aviation Hose and Tube Manual</td>
</tr>
<tr>
<td>NAVAIR 01-1A-35</td>
<td>Aircraft Fuel Cells and Tanks</td>
</tr>
<tr>
<td>NAVAIR 01-1A-503</td>
<td>Maintenance of Aeronautical Antifriction Bearings</td>
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<tr>
<td>NAVAIR 01-1A-505-1</td>
<td>Installation and Repair Practices - Aircraft Electric and Electronic Wiring</td>
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<tr>
<td>NAVAIR 01-1A-509 (series)</td>
<td>Cleaning and Corrosion Control (Volumes 1-4)</td>
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<tr>
<td>NAVAIR 01-1A-75</td>
<td>Airborne Weapons and Associated Equipment</td>
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<tr>
<td>NAVAIR 04-10-1</td>
<td>Aircraft Wheels</td>
</tr>
<tr>
<td>NAVAIR 04-10-506</td>
<td>Aircraft Tires and Tubes</td>
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<tr>
<td>NAVAIR 11-100-1.1-CD</td>
<td>Cartridge Actuated Devices (CADs) and Propellant Actuated Devices (PADs) (IETM)</td>
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<tr>
<td>NAVAIR 11-85M-2</td>
<td>Rocket Motors (JATO/RATO)</td>
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<tr>
<td>NAVAIR 13-1-6.2</td>
<td>Emergency Personnel and Drogue Parachute Systems</td>
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<tr>
<td>NAVAIR 13-1-6.4-1</td>
<td>Aviation Crew Systems – Oxygen Systems (Aircraft Equipment Masks and Other Systems)</td>
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<tr>
<td>NAVAIR 13-1-6.4-2</td>
<td>Aviation Crew Systems – Oxygen Equipment (Regulators)</td>
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<td>NAVAIR 13-1-6.4-3</td>
<td>Aviation Crew Systems – Oxygen Equipment (Concentrators)</td>
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<td>NAVAIR 13-1-6.4-4</td>
<td>Aviation Crew Systems – Oxygen Equipment (Converters)</td>
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<tr>
<td>NAVAIR 13-1-6.5</td>
<td>Aviation Crew Systems Rescue and Survival Equipment</td>
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<tr>
<td>NAVAIR 15-01-4</td>
<td>Desert Storage Preservation and Process Manual for Aircraft, Aircraft Engines, and Aircraft Auxiliary Power Unit Engines</td>
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<tr>
<td>NAVAIR 17-1-114 (series)</td>
<td>Inspection and Proofload Testing of Lifting Slings for Aircraft and Related Components (Volumes 1-12)</td>
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<tr>
<td>NAVAIR 17-1-125</td>
<td>Support Equipment Cleaning, Preservation and Corrosion Control</td>
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<tr>
<td>NAVAIR 17-1-537</td>
<td>Aircraft Securing and Handling Procedures for Restraining Devices and Related Components</td>
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<tr>
<td>NAVAIR 17-15-50 (series)</td>
<td>Joint Oil Analysis Program (Volumes 1-4)</td>
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<tr>
<td>NAVAIR 17-15BAD-1 (series)</td>
<td>Navy and Air Force Aircraft and Aircraft Support Equipment Storage Batteries (Volumes 1A-1B)</td>
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<tr>
<td>NAVAIR 19-1-67</td>
<td>Spray Outfit - Preservation Machine, Type MA-2 and MA-2A</td>
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<tr>
<td>NAVAIRINST 10350.4</td>
<td>Utilization of Aircraft Engine and Helicopter Transmission Lubricating Oils</td>
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<tr>
<td>NAVSUP P485</td>
<td>Naval Supply Procedures (Volumes 1-3)</td>
</tr>
<tr>
<td>NAVSUP P505</td>
<td>Preparation of Hazardous Material for Military Air Shipment</td>
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<tr>
<td>NAVSUP P700</td>
<td>Common Naval Packaging (website only: <a href="https://tarp.navsisa.navy.mil/">https://tarp.navsisa.navy.mil/</a>)</td>
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<tr>
<td>NAVSUP P723</td>
<td>Navy Inventory Integrity Procedures</td>
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<tr>
<td>NAVSUPINST 4030.55</td>
<td>Packaging of Hazardous Material</td>
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<td>OPNAVINST 5100.23</td>
<td>Navy Occupational Safety and Health (NAVOSH) Program Manual</td>
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<td>OPNAVINST 5442.2</td>
<td>Aircraft Inventory Reporting System (AIRS)</td>
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<td>OPNAVINST 5530.13</td>
<td>Department of the Navy Physical Security Instruction for Conventional Arms, Ammunition, and Explosives (AA&amp;E)</td>
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<tr>
<td>OPNAVINST 8000.16</td>
<td>The Naval Ordnance Management Policy</td>
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# APPENDIX B
## ACRONYMS

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<tr>
<th>Acronym</th>
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<tbody>
<tr>
<td>ABO</td>
<td>Aviator's Breathing Oxygen</td>
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<td>ACC</td>
<td>Aircraft Controlling Custodian</td>
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<td>AEPS</td>
<td>Aircrew Escape Propulsion System</td>
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<td>AFB</td>
<td>Airframe Bulletin</td>
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<tr>
<td>AFC</td>
<td>Airframe Change</td>
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<td>AIMD</td>
<td>Aircraft Intermediate Maintenance Department</td>
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<td>AIRS</td>
<td>Aircraft Inventory Record System</td>
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<td>AMARG</td>
<td>Aircraft Maintenance and Regeneration Group</td>
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<td>AMSDL</td>
<td>Acquisition Management Systems Data Requirements List</td>
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<td>APML</td>
<td>Assistant Program Manager – Logistics</td>
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<td>APU</td>
<td>Auxiliary Power Unit</td>
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<td>ASPA</td>
<td>Aircraft Service Period Adjustment</td>
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<td>BUNO</td>
<td>Bureau Number</td>
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<tr>
<td>CAD</td>
<td>Cartridge Actuated Device</td>
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<td>CFM</td>
<td>Cubic Feet per Minute</td>
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<td>CNO</td>
<td>Chief of Naval Operations</td>
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<td>CP</td>
<td>Cleated Plywood</td>
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<td>CPC</td>
<td>Corrosion Preventive Compound</td>
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<td>DH</td>
<td>Dehumidified</td>
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<td>DID</td>
<td>Data Item Description</td>
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<td>Department of Defense Index of Specifications and Standards</td>
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<td>EAT</td>
<td>External Air Transport</td>
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<td>ECM</td>
<td>Electronic Counter Measures</td>
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<td>Electrostatic Discharge Sensitive</td>
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<td>Foreign Military Sales</td>
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<td>Fleet Readiness Center</td>
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<td>GFE</td>
<td>Gas Free Engineer</td>
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<td>GSE</td>
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<td>HMIS</td>
<td>Hazardous Materials Information System</td>
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<td>I Level</td>
<td>Intermediate Level (see AIMD)</td>
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<td>ISO</td>
<td>International Organization for Standardization</td>
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<td>ISSC</td>
<td>In-Service Support Center</td>
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<td>LEL</td>
<td>Lower Explosive Limit</td>
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<td>Abbreviation</td>
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<td>MAF</td>
<td>Maintenance Action Form</td>
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<td>Master Aircraft Inventory Record</td>
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<td>Maintenance Data Collection System</td>
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<td>NAMP</td>
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<td>Naval Sea Systems Command</td>
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<td>Phased Depot Maintenance</td>
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<td>Program Manager – Air</td>
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<td>PSE</td>
<td>Peculiar Support Equipment</td>
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<tr>
<td>psi</td>
<td>pounds per square inch</td>
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<td>PVC</td>
<td>Polyvinylchloride</td>
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<tr>
<td>RF</td>
<td>Radio Frequency</td>
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<tr>
<td>RFI</td>
<td>Ready For Issue</td>
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<td>RH</td>
<td>Relative Humidity</td>
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<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
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<tr>
<td>SRM</td>
<td>Structural Repair Manual</td>
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<td>TD</td>
<td>Technical Directive</td>
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<td>UV</td>
<td>Ultraviolet</td>
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<tr>
<td>VCI</td>
<td>Vapor Corrosion Inhibitor</td>
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GLOSSARY

A

ACCESS DOORS - A hinged door openable to provide access to interior space or equipment.

ACCUMULATOR - A device or apparatus that accumulates or stores fluid under pressure (usually part of the hydraulic system).

ACTIVE AIRCRAFT - Aircraft currently engaged in flying missions, either through direct assignment to aircraft units or reassignment through any of the logistic processes.

ACTIVE METAL - A metal that readily gives up electrons when in an electrolytic cell and, therefore, is prone to corrode.

AEROBIC - Able to live or grow where oxygen is present.

AIRCRAFT CONTROLLING CUSTODIAN (ACC) - A term applied to air commands and Naval Air Systems Command (NAVAIR) for exercising administrative control of assignment, employment and logistic support of aircraft and aircraft engines as specified by the Chief of Naval Operations (CNO). The following ACCs have been designated by the CNO:
- Commander, Naval Air Force, U.S. Atlantic (AIRLANT);
- Commander, Naval Air Force, U.S. Pacific (AIRPAC);
- Chief, Naval Air Training (CNATRA);
- Commander, Naval Air Reserve Forces (CNAVRES);
- NAVAIR.

AIRCRAFT INTERMEDIATE MAINTENANCE DEPARTMENT (AIMD) - The department of an aviation ship or Naval Air Station responsible for the check, test, repair or manufacture of aeronautical components and support equipment for the supported aircraft.

AIRFRAME - The structural components of the aircraft, including the framework and skin of such parts as the fuselage, empennage, and wings.

AIRFRAME ACCESSORIES - The items of equipment required for operation of the aircraft that cannot be considered an integral part of the airframe or engine, such as wheels, brakes, hydraulic equipment, fuel systems, deicing equipment, anti-icing equipment.

ALCLAD - A trade name (Alcoa) of high-strength light alloys (usually sheet) coated with corrosion-resistant high-purity aluminum.

ANAEROBIC - Able to live or grow where there is no air or oxygen.

ANION - An ion in an electrolyte that carries a negative charge and moves toward the anode under the influence of a potential gradient. The chloride ion in sea water is an anion.

ANODE - The electrode of a cell at which oxidation (loss of electrons) occurs. In corrosion, it is the electrode where metal atoms change into ions and go into solution to migrate to the cathode, thus causing slow disintegration of the anode.

ANODIC - A term indicating one metal is more active than a second metal to which it is electrically coupled. In the presence of an electrolyte the more active (anodic metal) will corrode.

ANODIZE - Application of a protective oxide film on a metal (such as aluminum) through an electrolytic process. This layer provides protection from corrosion and is a good base for paint.

ANTI-ICING - The prevention of ice formation upon an aircraft’s surfaces, either by heat or by use of substances such as oil or alcohol.

ANTICONING DEVICE - In most helicopters and some other rotorcraft, an anticoning device is fitted to prevent main rotor blades from being blown upwards.

AQUATEST - A test to detect water in aircraft fluids.

ARRESTING GEAR - Any gear or apparatus designed to arrest something in its motion; specifically any such apparatus used to arrest airplanes in the landing roll on the carrier deck. Airplane arresting gear in its most common form consists of an arresting hook on the airplane, an arresting cable or arresting wire stretched across the deck or runway in the path of the airplane which engages the arresting hook, and shock-absorbing devices.

ARRESTING GEAR HOOKS - A strong hook hinged to some land-based and most carrier-based combat aircraft for engagement of arresting gear.
**AUTOMATIC PILOT** - The part of an automatic flight control system which provides attitude stabilization with respect to internal references.

**AUXILIARY POWER UNIT (APU)** - Airborne power-generation system other than propulsion or lift engines, used to generate power for airborne systems (electrical, hydraulics, air-conditioning, avionics, pressurization, main-engine starting).

**AVGAS** - Aviation gasoline.

**AVIONICS** - The application of electronics to aviation. For purposes of the Naval Aviation Maintenance Program, avionics includes electronic, instrument, flight control, fire control and bombing equipment and their subsystems.

**BASE** - A general term for compounds which give hydroxyl ions (OH-) in aqueous solution.

**BATTENS** - A strip or bar temporarily secured to a wing or tail to prevent movement of the control surface.

**BIODEGRADABLE** - Capable of being decomposed or oxidized into innocuous products by the action of microorganisms.

**BOMB RACKS** - Individual attachments (in the bomb bay or external) to which bombs are secured; provided with mechanical or EM release, fuzing and arming circuits and sometimes other services. Replaced by universal store carriers tailored to spectrum of weapons.

**BUREAU NUMBER** - A serial number, consisting of six digits, used to identify individual airframes within the naval aircraft inventory. Each number is unique to a particular airframe. Assignment is controlled by the Chief of Naval Operations.

**CANNIBALIZE** - Removal of serviceable parts from one aircraft for installation on another.

**CAPILLARY ACTION** - The action by which the surface of a liquid, where it is in contact with a solid, is raised or lowered. The "wicking" of a fluid up a cloth is an example of capillary action.

**CARBIDE** - A compound of metal with carbon.

**CARBONIZE** - To convert into a carbon residue, usually by high heat.

**CATHODE** - The electrode of a cell at which a reduction reaction (gain of electrons or plating) occurs. In corrosion, it is the electrode which acquires metal ions.

**CAUSTIC** - A strong base which has a corrosive and disintegrating action on the skin, and causes the destruction of living tissue and a burning sensation.

**CHEMICAL CONVERSION COATING** - A chemical treatment of a metal surface, such as aluminum or magnesium, which results in a protective (corrosion resistant) film on the metal’s surface. The coating also greatly enhances paint adhesion.

**CHLORIDE** - Certain compounds of chlorine. Many varieties of these are present in sea water and contribute to making sea water an electrolyte (electrically conductive).

**CLADDING** - Overlaying on one or both sides with a metal coating of a different composition to promote electrical conductivity or corrosion resistance, or to impart other special properties.

**COCKPITS** - A cutout or space in the top of an airplane fuselage for the pilot, other aircrew members or passengers. It may or may not be protected by a canopy.

**COMBUSTION CHAMBER** - A chamber within an engine for the burning of fuel.

**CONFORMAL COATING** - A closely adhering moisture and gas barrier applied to circuit boards to prevent corrosion and breakdown of electrical insulation.

**CONNECTOR** - Standard mating end-fitting for fluid lines, multi-core cables, coax cables and similar transmission hardware, providing automatic coupling.

**CONSTANT SPEED DRIVE** - Infinitely-variable-ratio gear between two rotating systems, especially variable speed aircraft engine and constant frequency alternator.

**CONSTANT SPEED PROPELLER** - A propeller designed to maintain engine speed at a constant rpm, automatically increasing or decreasing pitch as engine speeds increase or decrease.

**CONTROLLING CUSTODIAN** - See Aircraft Controlling Custodian.

**CONTROL LOCK** - A physical lock preventing movement of a control surface.

**CONTROL PANEL** - A panel or board fitted out with switches, instruments, relays, and circuit breakers for
controlling and supervising the operation of equipment or systems.

**CONTROL SURFACE** - A movable airfoil or surface, such as an aileron, elevator, stabilator, flap or trim tab used to control the attitude or motion of an aircraft and to guide it through the air.

**CONTROLS** - A system of levers and pedals in an aircraft cockpit used to deflect the control surfaces and direct the motion of the aircraft.

**CORROSION** - The deterioration of a material, usually a metal, through reaction with its environment.

**CORROSION FATIGUE** - A reduction in the ability of a metal to withstand cyclic stress caused by exposure to a corrosive environment.

**COWL FLAP** - One of several shutters in an aircraft engine cowling, used to regulate the flow of cooling air around the engine.

**CREVICE CORROSION** - An intense localized corrosion that frequently occurs within crevices and other shielded areas on surfaces exposed to corrosives. This type of attack is usually associated with small volumes of stagnant solution within holes, gasket surfaces, lap joints, surface deposits and crevices under bolt and rivet heads.

**D**

**DAMPER** - A device installed to act about the drag hinge of a rotor blade to reduce horizontal oscillation.

**DECELERATION CHUTES** - A parachute attached to an aircraft and deployed to slow the aircraft, during landing. Also called a "brake parachute" or "parabrake."

**DEFECT** - Any nonconformance of the unit or product with specified requirements.

**DEHUMIDIFY** - To remove moisture from the air.

**DEICING** - The breaking off or melting of ice formed on aircraft surfaces.

**DEIONIZED WATER** - Water which has had various minerals and inorganic materials removed by means of an ion exchange process.

**DEVIATION** - To depart from established policy or procedures. In some cases, specific written authorization must be granted for a deviation.

**DIRECTIVE** - A military communication in which a policy is established, a specific action is ordered or a plan is put in effect.

**DOWNTIME** - That period of time during which the item is not in condition to perform its intended function.

**DEPTH GAUGE** - A gauge for measuring the depth of holes.

**DESICCANT** - A drying agent which acts by absorbing moisture.

**DUCT**

(1) Passage or tube that confines and conducts fluid.

(2) Channel or passage in airframe through which electric cables are run.

**E**

**EDDY CURRENT** - An electrical current that is induced by a alternating magnetic field. Eddy current devices are used for nondestructive inspection of aircraft.

**EGRESS SYSTEM** - An egress system is an ejection seat, interconnect and sequence system, installed parachute and seat survival kit and the explosive devices and rocket motors used in their propulsion. It also includes hatches or canopies which are shattered or jettisoned from the aircraft by use of explosive devices.

**ENGINE ACCESSORIES** - Those items of equipment required for engine operation that are not an integral part of the engine. In most cases they are attached to the engine, but in special situations they may be airframe mounted. Accessories include oil pumps, fuel controls, engine fuel pumps, temperature amplifiers, and afterburner controls.

**EJECTION SEAT** - An airplane seat designed to be catapulted with its occupant from the airplane, usually by explosive force.

**ELASTOMER** - A synthetic material with elastic properties.

**ELECTROLYTE** - An aqueous solution of a substance that is capable of conducting electric current. Salt water is known as a strong electrolyte.

**ELEVON** - A control surface that functions both as an elevator and as an aileron. Also called an "ailevator."

**EMULSION** - One liquid dispersed throughout another liquid to form a homogeneous solution. The two liquids do not mix.
ENCAPSULANT - The general term describing materials used to envelop or fill a void to prevent the entrance of moisture or fungus. Conformal coatings, fungus-proof coatings and potting compounds are all forms of encapsulants.

EROSION CORROSION - Increase in rate of attack on a metal because of relative movement between a corrosive fluid and the metal surface.

ESCAPE CHUTES - Rapid-inflation pneumatic chute extended (usually from a door) from transport aircraft to enable passengers and crew to evacuate quickly in emergency.

ESCAPE DOORS (HATCHES) - Hatch in aircraft, usually jettisonable, intended for use by personnel abandoning aircraft.

ESTER/DIESTER OILS - Examples include jet engine oil (MIL-PRF-23699) and hydraulic oil (MIL-PRF-83282). These synthetic oils can attack certain plastics and paints.

F

FAIRING - A piece, part or structure having a smooth, streamlined outline, used to cover a non-streamlined object or to smooth a junction.

FATIGUE - Tendency of a material to fracture under repeated cyclic stresses.

FILIFORM CORROSION - Corrosion that develops under coatings on metals as fine or ragged hairlines, usually wavy and randomly distributed.

FITTINGS - Any small structural part, usually of metal, for joining large structural members.

FLOATATION GEAR - Gear or apparatus, commonly inflatable bags, vests and the like, carried aboard an aircraft to support the aircraft or persons downed in water.

FLOAT - A buoyant structure, usually boat-shaped and decked over, fitted to an aircraft to support or stabilize it on water and to allow it to take off and alight on water. Sometimes called a "pontoon".

FLUOROCARBON - A class of chemically inert compounds that are composed of carbon and fluorine.

FLYABLE - An aircraft in such material condition as to be safe and capable of normal flight operations.

FRETTLING - Wear occurring at the interface of two tightly connecting surfaces, usually under pressure and subject to vibration. In iron alloys, the wear products are rust colored; in aluminum alloys they are black.

FUNGUS - A group of parasitic lower plants that feed on dead or decaying organic matter. Includes molds, mildews, smuts, mushrooms and some bacteria.

G

GALVANIC CORROSION - When two dissimilar are metals placed in contact with one another and joined by an electrolyte, corrosion of the more anodic metal will occur.

GALVANIC COUPLE - A closed electric circuit of two connected dissimilar metals joined by an electrolyte.

GAS TURBINE ENGINE - All turbine engines, whether used to power flight or for auxiliary power or starting purposes. Airborne or ground units are included in the meaning of this term.

GAUSS METER - An instrument that indicates the strength of a magnetic field at any point.

GUN CAMERAS - An aerial camera connected to and operated by the fire control mechanism of an aircraft.

GUST LOCKS - Control locks preventing movement of flight controls of parked aircraft.

GYROS - Short for gyroscope. A device consisting of a wheel having much of its mass concentrated around the rim, mounted on a spinning axis which is free to rotate about one or both of two axes perpendicular to each other and to the spinning axis. The gyroscope is utilized in many different instruments and systems because of the tendency of its spinning axis to remain fixed in space.

H

HEADSETS - A clamp or helmet holding an earphone or pair of earphones.

HUBS - The central part or portion of a wheel, propeller, or similar rotary object; the drum or disk of a compressor or turbine rotor.

HYDRATE - A compound formed by the bonding of water molecules with the molecules of some other substance.

HYDROPHILIC - Relating to or having a strong affinity for water.
HYGROSCOPIC - The property of readily absorbing and retaining moisture.

ILLUSTRATED PARTS BREAKDOWN (IPB) - A manual containing illustrations and part numbers for all parts of the aircraft or equipment for which it is issued. The IPB contains information required for ordering parts and for identifying parts and arrangements of parts in assemblies.

INACTIVE AIRCRAFT - Non-program and reserve stock aircraft.

INHIBITOR - A chemical substance which when present in the proper form and concentration will reduce the rate of corrosion of a metal.

INORGANIC COATING - A coating composed of matter other than of plant or mineral origin, i.e., electroplate, chemical conversion, anodize, phosphate or oxide.

INSPECT - To compare the characteristics of an item with established standards.

INSPECTION - The examination and testing of supplies and services, including raw materials, components and intermediate assemblies, to determine whether they conform to specified requirements.

INSTRUMENT PANEL - A panel or board containing instruments, or instrument dials, typically mounted ahead of and easily visible to the pilot.

INTERGRANULAR CORROSION - Corrosive attack along grain boundaries of some alloys due to presence of compounds formed at grain boundaries during heat treatment cooling. The electrochemical differences of the compounds and the adjacent material results in galvanic cells and attack on the more anodic area.

INVERTERS - A device for converting direct current into alternating current, often used in aircraft electrical systems.

ION - An electrically charged atom or group of atoms. The charge may be positive (cation) or negative (anion).

JUNCTION BOX - A metal box for enclosing the junction of electric wires and cables.

LANDING GEAR - The apparatus comprising those components of an aircraft that support and provide mobility for the aircraft on land, water or other surface. The landing gear consists of wheels, floats, skis, bogies and treads, or other devices, together with all associated struts, bracing, and shock absorbers.

LEADTIME - A composite of production, administrative (both contractor and government), spares positioning and shipping time.

LINE - A single pipe in a fluid system.

LOGBOOK - A master history of the aircraft or engine in which are recorded dates, events and occurrences, incorporation of changes and repairs.

LOGISTICS - The science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, those aspects of military operations that deal with: design and development, acquisition, storage, movement, distribution, maintenance, evaluation and disposition of material.

LOGISTICS SUPPORT - The materials and services required to enable the operating forces to operate, maintain and repair the end item within the maintenance concept defined for that end item. Logistics support encompasses the identification, selection, procurement, scheduling, stocking, and distribution of spares, repair parts, facilities, support equipment, trainers, technical publications, contractor engineering and technical services, and personnel training as necessary to provide the operating forces with the capability needed to keep the end item in a functioning status.

LOOSE EQUIPMENT - Items of equipment to be shipped separate from the aircraft.

MAINTENANCE - All actions taken to retain material in a serviceable condition or to restore it to serviceability. It includes inspection, testing, servicing, classification as to serviceability, repair, reconditioning and reclamation.

MAINTENANCE ACTIVITY - Any organization of the naval establishment assigned the mission, task or functional responsibility of performing aircraft upkeep or repair. Aircraft maintenance activities are classified by the level of maintenance performed. The highest level a particular activity is responsible for performing is established as that activity’s classification.
does not necessarily mean that the activity involved is responsible for all lower levels of maintenance.

MAINTENANCE INSTRUCTION MANUAL (MIM) - A manual containing instructions for the maintenance and servicing of a specific aircraft or component. It identifies each maintenance task to the responsible maintenance level.

MAINTENANCE REQUIREMENT CARDS (MRC) - Sets of cards issued by the Naval Air Systems Command containing scheduled maintenance requirements applicable to intermediate and organizational level activities for the specific aircraft/support equipment for which they are issued.

MANUFACTURER - An individual, company, firm, corporation or government activity engaged in the fabrication of finished or semi-finished products.

MASONITE - Commercial formulation of compressed fiber-board, molded to shape with a glassy finish on at least one surface.

MATTE SURFACE - A lusterless, low reflectivity surface, such as may be produced by etching or sandblasting.

METABOLIC PRODUCTS - Those materials which are generated by the chemical changes that take place in the evolution of living cells.

METROLOGY - The science of measurement or determination of conformance to technical requirements.

MICROBES - Microscopic living plants or organisms such as germs, molds, bacteria and fungus.

MICROBIOLOGICAL CORROSION - Material degradation caused by microorganisms living at fuel/air interfaces and on the surface of virtually all aeronautical materials.

MISSION ESSENTIAL - Those functions and equipment authorized and assigned to combat forces which would be immediately employed to wage war and provide combat support. The equipment is listed in the Mission Essential Subsystem Matrices (MESM).

MULTICOAT - Having more than one coat.

NITRATES - Compounds including certain combinations of nitrogen and oxygen. Present in many industrial pollutants.

NOBLE METALS - Metals such as gold, silver and platinum which essentially do not oxidize in air and are not readily attacked by corrosive agents.

NONDESTRUCTIVE INSPECTION - The methods that may be applied to a structure or component to determine its integrity, composition, physical, electrical or thermal properties, or dimensions without causing a change in any of these characteristics.

ORGANIC COATING - A coating composed of matter derived from living organisms or carbon containing compounds, e.g., paint, lacquer, plastic, grease, preservative.

OUTGASSING - Emission of a gas during the cure or decomposition of organic material, usually increased in rate by higher temperatures.

OVERHAUL - The process of disassembly sufficient to inspect all the operating components and the basic end article. It includes repair, replacement or servicing as necessary, followed by reassembly and bench check/flight test. Upon completion of the overhaul process, the component/end article will be capable of performing its intended service life/service tour.

OXIDIZER - A substance that readily enters into chemical reactions in which it yields oxygen to other substances.

PACKAGING - An all inclusive term covering cleaning, preserving, packing and marking required to protect items during every phase of shipment, handling and storage.

PARABRAKE - A deceleration parachute.

PARARAFT - A raft, especially an inflatable raft, designed to be dropped by parachute, or to be carried by a parachutist.

PASSIVATION - The process or processes by means of which a metal becomes inert to a given corrosive environment.

pH - A numerical measure of the hydrogen ion concentration, indicating degree of acidity or alkalinity of a solution. At the neutral point, pH = 7. At a pH lower than 7, a solution is acidic. At a pH higher than 7, a solution is basic.

PICKLING - Soaking in dilute acid solutions to remove oxides or other surface films or inter-crystalline carbides and surface scale.
PITTING - A form of corrosion which is an extremely localized attack that results in holes in the metal. A pit is a cavity or hole with the same surface diameter and depth.

PITOT TUBES - An open-ended tube or tube arrangement which, when immersed in a moving fluid with its mouth pointed upstream, may be used to measure the stagnating pressure of the fluid.

PLACARDING - A posted notice on or in an aircraft setting forth a requirement or limiting condition in operation.

PNEUMATIC - A device or system operated by air flow/air pressure.

POLYETHYLENE - A thermal plastic (softens with heat) characterized by high impact strength, high electrical resistivity, nontoxic, but combustible. One of several plastics used for wire coating.

POTTING COMPOUND - A poured material which cures to a hard rubber-like consistency and provides moisture resistance and vibration resistance to the item.

POWER SUPPLY - A device providing power to electronic equipment.

POWER PLANT - The complete assemblage or installation of engine or engines, accessories, and support systems that generates the motive power for an aircraft.

PREVENTIVE MAINTENANCE - The care and servicing needed to maintain aircraft equipment, support equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection and correction of incipient failures either before they occur or before they develop into major defects.

PRIMER COAT - The first coat of a protective paint system. Originally applied to improve adherence of the succeeding coat, it now usually contains a corrosion inhibitor.

PROCUREMENT - The process of obtaining personnel, services, supplies and equipment.

PRODUCTION AIRCRAFT - New aircraft accepted from the contractor by the Navy. They include all Navy aircraft that were procured for operational/training purposes. Aircraft procured solely for experimental purposes are not included.

PRODUCTION CONTROL - The functional organization within a maintenance activity responsible for workload control.

PROPELLER GOVERNORS - A simple centrifugal governor which holds propeller speed constant regardless of aircraft forward speed.

PSYCHROMETER - Instrument for measuring atmospheric humidity, usually consisting of dry and wet-bulb thermometers.

PYROTECHNIC - A mixture of chemicals which when ignited is capable of reacting exothermically to produce light, heat, smoke, sound or gas. It may also be used to introduce a delay into an explosive train because of its known burning time. The term excludes propellants and explosives.

R

RADIOGRAPHY - Photography using X-rays, gamma rays or other ionizing radiation; important NDI method, often using radiation source inside test object and film outside.

RADOMES - A dome housing for a radar antenna and its associated equipment on an aircraft, the dome material being transparent to radio waves.

READY FOR ISSUE (RFI) - Material, equipment, aircraft and support equipment which does not require rework of any type, other than routine installation and post installation condition verification prior to use. RFI items are not necessarily new or like new, but are functionally reliable and meet applicable performance specifications.

REBREATHERS - Closed-circuit oxygen system from which CO₂ and water are continuously removed. Pressure is maintained by adding fresh oxygen.

REDUCING AGENT - A substance which causes a decrease in the oxidation state of another substance.

REDUCTION GEAR - A set of gears by means of which the rotational speed of a driven shaft is reduced from that of the drive shaft, as between an engine shaft and a propeller shaft.

RELATIVE HUMIDITY - The ratio, expressed in percentage, of the amount of water vapor in the air compared to the amount of water vapor required for the air to be saturated at the same temperature.

RELIEF TUBES - Personal urinal pipe normally discharging overboard.
REPAIR - Necessary preparation, fault correction, disassembly, inspection, replacement of parts, adjustment, reassembly, calibration or tests accomplished in restoring items to serviceable status.

REPAIRABLE ITEM - Adurable item which, when unserviceable, can be economically restored to a serviceable condition through regular repair procedures.

REPORTING CUSTODIANS - An organizational unit of the lowest echelon of command accepting responsibility for aircraft or engines, as designated either by CNO or by the aircraft controlling custodian.

RESERVOIR - A storage tank in a fluid system.

RETICULATED FOAM - Low-density fire-resistant foam which can be foamed in place inside or outside fuel tanks and other items to prevent buildup of fuel vapors and, even in the presence of severe combat damage or post-crash rupture, prohibit explosion or swift spread of fire.

ROLLER - Support device for moveable wing surfaces.

ROTOR - A part or assembly that rotates or spins, specifically:
(1) An assembly of airfoils, together with a hub and hinges that rotate about a substantially vertical axis to provide lift and thrust for a helicopter.
(2) A turbine wheel or the rotating component of a compressor.

RUNUP - The act of accelerating an engine from idle to full power.

SIGHTS - Optical device for measuring (drift sight) or aiming (gun-sight), often incorporating magnification or combined with Heads Up Display (HUD-Sight).

SOLVENT - A liquid substance capable of dissolving or dispersing other substances, especially oils.

SPONSION - A structural projection, from the side of an aircraft's hull or from the side of an airplane's fuselage, such as a broad lateral strut helping to support the fixed landing gear on a certain type of aircraft.

SPROCKETS - Chain interface component in aircraft mechanical systems.

STATIC VENT - Carefully designed opening in plate aligned with skin of aircraft which under most flight conditions senses true static pressure.

STORAGE - Removal of an aircraft from the active inventory and placement into an inactive status for an indefinite period. Aircraft, in the custody of the Naval Air Systems Command Fleet Support activities, that are not expected to commence a rework process for 60 days or more, shall be reported in the appropriate storage status. An aircraft will remain in storage status from the beginning of the preservation process until removal of preservation upon withdrawal from storage.

STRESS CORROSION CRACKING - Corrosion attack on a metal under sustained tensile stress. The resultant cracks may follow grain boundaries (intergranular) or may go across the grains (transgranular). Interference fits are a typical cause of stress corrosion.

STRIKE - The official action that removes an aircraft from the list of active Navy aircraft.

SULFATE - A particular combination of sulfur and oxygen which can combine with certain elements or compounds. Example: Whitish scale of lead sulfate on plates of a storage battery.

SWASHPLATES - On certain rotary-wing aircraft, an assembly, part of which rotates with, and is linked to, the blades, used to control the pitch of the blades. Also called a "wobble plate".
T

TAIL HOOK - An arresting hook at the tail of an airplane.

TAILSKID - On certain airplanes, a skid attached to the rear part of the airplane on the underside and supporting the tail.

TECHNICAL DIRECTIVE - A document authorized and issued by Naval Air Systems Command to provide technical information necessary to properly and systematically inspect or alter the configuration of aircraft, engines, systems or equipment, subsequent to establishment of each respective baseline configuration. TDs include all types of changes and bulletins and consist of information that cannot be disseminated satisfactorily by revisions to technical manuals.

TECHNICAL MANUAL - A publication containing a description of equipment, weapons or weapon system(s) with instructions for effective use.

THRUST REVERSERS - A device or apparatus for reversing thrust, especially of a jet engine.

TORQUE TUBE - Hollow drive shaft between powerplant accessory gearbox and airframe gearbox or between APU gearbox and airframe gearbox. Torque tubes may be used as drive shafts in other applications.

TOXIC - Poisonous, either through ingestion, inhalation or absorption.

TRANSFER - The act of conveying reporting/controlling custody of aircraft/support equipment to another custodian.

TRANSPARENCY - Any portion of the airframe that is optically transparent including the canopy, windscreen, window, moulded nose, etc. Transparencies may be acrylics or polycarbonate glass.

TURBINE ENGINES - An engine incorporating a turbine as a principal component.

TURRETS - A domelike, rotatable structure, usually transparent, on an aircraft, within which guns are mounted.

U

ULTRASONIC - Mechanical vibrations, e.g. sound waves, of frequency too high to be audible to humans. Generally frequencies above 15 kHz, usually generated by electroacoustic transducer and propagated through solids, liquids and gases, are used for nondestructive inspection.

ULTRAVIOLET LIGHT - Light in a wavelength band ranging from that shorter than visible light to that longer than X-ray. Shorter wavelength unfiltered UF from a UV lamp can cause damage to unprotected eyes.

UNIFORM CORROSION - Corrosion characterized by a chemical or electrochemical reaction which proceeds uniformly over the entire exposed surface over a large area.

UPLOCK - A locking device to hold a retracted landing gear in place.

W

WATER INJECTION - An introduction of water to an internal combustion engine to enhance combustion power for quick takeoff or bursts in speed.
### INDEX

<table>
<thead>
<tr>
<th>Subject</th>
<th>Paragraph, Figure, or Table Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td></td>
</tr>
<tr>
<td>Access and Escape Chute Doors</td>
<td>3-4</td>
</tr>
<tr>
<td>Air Conditioning</td>
<td>3-110</td>
</tr>
<tr>
<td>Air Filters</td>
<td>3-53</td>
</tr>
<tr>
<td>Air Lift, Aircraft</td>
<td>7-11</td>
</tr>
<tr>
<td>Air Shipment, Aircraft</td>
<td>7-10</td>
</tr>
<tr>
<td>Air Shipment, Components</td>
<td>4-58</td>
</tr>
<tr>
<td>Airborne Crew Served Weapons</td>
<td>3-20, 4-13</td>
</tr>
<tr>
<td>Aircraft in a Top Cover</td>
<td></td>
</tr>
<tr>
<td>Aircraft in a Flexible Bag</td>
<td>F5-6</td>
</tr>
<tr>
<td>Aircraft in Shrinkwrap</td>
<td></td>
</tr>
<tr>
<td>Aircraft inside a Shroud</td>
<td>F5-5</td>
</tr>
<tr>
<td>Aircraft with Strippable Coating</td>
<td>F5-12</td>
</tr>
<tr>
<td>Aircrew Escape Propulsion System (AEPS)</td>
<td></td>
</tr>
<tr>
<td>Devices</td>
<td>3-100</td>
</tr>
<tr>
<td>Airframe System</td>
<td>3-3</td>
</tr>
<tr>
<td>Ammunition and Pyrotechnics</td>
<td>3-17</td>
</tr>
<tr>
<td>Antennas</td>
<td>3-34</td>
</tr>
<tr>
<td>Armament Equipment (AAE)</td>
<td>3-18, 4-14</td>
</tr>
<tr>
<td>Arresting Gear Hooks</td>
<td>3-59</td>
</tr>
<tr>
<td>Automatic Pilot</td>
<td>3-57</td>
</tr>
<tr>
<td>Auxiliary Power Unit (APU)</td>
<td>3-77</td>
</tr>
<tr>
<td>Auxiliary Fuel Tanks</td>
<td>3-47</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td></td>
</tr>
<tr>
<td>Battery Compartments</td>
<td>3-5</td>
</tr>
<tr>
<td>Battery Vent System Units</td>
<td>3-27</td>
</tr>
<tr>
<td>Bearings, Removed</td>
<td>4-15</td>
</tr>
<tr>
<td>Bearings, Rollers and Sprockets</td>
<td>3-6</td>
</tr>
<tr>
<td>Bearings, Wheel</td>
<td>3-60</td>
</tr>
<tr>
<td>Bilges</td>
<td>3-7</td>
</tr>
<tr>
<td>Blades, Main and Tail</td>
<td>3-96</td>
</tr>
<tr>
<td>Bomb Racks</td>
<td>3-18, 4-14</td>
</tr>
<tr>
<td>Bomb Release Units</td>
<td>3-18, 4-14</td>
</tr>
<tr>
<td>Brake Hydraulic System</td>
<td>3-62</td>
</tr>
<tr>
<td>Brakes</td>
<td>3-61</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td></td>
</tr>
<tr>
<td>Cabin Ducts, Filters, and Regulators</td>
<td>3-111</td>
</tr>
<tr>
<td>Cabin Heaters (Fluid Type)</td>
<td>3-120</td>
</tr>
<tr>
<td>Camera Mounts</td>
<td>3-71</td>
</tr>
<tr>
<td>Cameras</td>
<td>3-70</td>
</tr>
<tr>
<td>Canning (see Containers, Reusable)</td>
<td></td>
</tr>
<tr>
<td>Canopy Frames and Seals</td>
<td>3-9</td>
</tr>
<tr>
<td>Cargo Hoists</td>
<td>3-10</td>
</tr>
<tr>
<td>Cartridge Actuated Devices (CADS)</td>
<td>3-19</td>
</tr>
<tr>
<td>Catapult Hooks</td>
<td>3-63</td>
</tr>
<tr>
<td>Caution Tag for Reciprocating Engine</td>
<td>F3-15</td>
</tr>
<tr>
<td>Check Lists</td>
<td></td>
</tr>
<tr>
<td>-Depreservation</td>
<td>1-9</td>
</tr>
<tr>
<td>-Preservation</td>
<td>1-8</td>
</tr>
<tr>
<td>Chemical Air Driers</td>
<td>3-76</td>
</tr>
<tr>
<td>Cleaners</td>
<td></td>
</tr>
<tr>
<td>-Compatibility</td>
<td>T8-1</td>
</tr>
<tr>
<td>-Removal Effectiveness</td>
<td>T8-2</td>
</tr>
<tr>
<td>Cleaning</td>
<td>8-1</td>
</tr>
<tr>
<td>-Hand Cleaning Oxygen Systems</td>
<td>8-4</td>
</tr>
<tr>
<td>-Materials and Equipment</td>
<td>T8-3</td>
</tr>
<tr>
<td>-Soap and Water</td>
<td>8-2, F8-1, F8-2</td>
</tr>
<tr>
<td>-Waterless Spot</td>
<td>8-3</td>
</tr>
<tr>
<td>Subject</td>
<td>Paragraph, Figure, or Table Number</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>C (Cont.)</td>
<td></td>
</tr>
<tr>
<td>CNAF 4790/136A</td>
<td>F1-1, T1-2</td>
</tr>
<tr>
<td>Cockpits</td>
<td>3-11</td>
</tr>
<tr>
<td>Component Preservation, General</td>
<td>4-7</td>
</tr>
<tr>
<td>Component Storage and Maintenance</td>
<td>4-59</td>
</tr>
<tr>
<td>Components, Removed</td>
<td></td>
</tr>
<tr>
<td>- Airborne Crew Served Weapons</td>
<td>4-13</td>
</tr>
<tr>
<td>- Armament Equipment</td>
<td>4-14</td>
</tr>
<tr>
<td>- Bearings</td>
<td>4-15</td>
</tr>
<tr>
<td>- Composite Components</td>
<td>4-16</td>
</tr>
<tr>
<td>- Drive and Gearbox System</td>
<td>4-17</td>
</tr>
<tr>
<td>- Electrical/Electronic System</td>
<td>4-18</td>
</tr>
<tr>
<td>- Engines</td>
<td>4-19</td>
</tr>
<tr>
<td>- Flight Control Surfaces</td>
<td>4-20</td>
</tr>
<tr>
<td>- Fragile or Delicate</td>
<td>4-21</td>
</tr>
<tr>
<td>- Fuel System, General</td>
<td>4-22</td>
</tr>
<tr>
<td>- Fuel Cells</td>
<td>4-23</td>
</tr>
<tr>
<td>- Fuel Tanks, External</td>
<td>4-24</td>
</tr>
<tr>
<td>- Guns, Aircraft</td>
<td>4-13</td>
</tr>
<tr>
<td>- Hydraulic System</td>
<td>4-25</td>
</tr>
<tr>
<td>- Instrument System</td>
<td>4-26</td>
</tr>
<tr>
<td>- Landing and Arresting Gear System</td>
<td>4-27</td>
</tr>
<tr>
<td>- Miscellaneous Equipment</td>
<td>4-33</td>
</tr>
<tr>
<td>- Photographic System</td>
<td>4-28</td>
</tr>
<tr>
<td>- Pneumatic System</td>
<td>4-29</td>
</tr>
<tr>
<td>- Propellers (Variable Pitch)</td>
<td>4-30</td>
</tr>
<tr>
<td>- Rotor and Hub System</td>
<td>4-31</td>
</tr>
<tr>
<td>- Safety and Survival System</td>
<td>4-32</td>
</tr>
<tr>
<td>Composite Components</td>
<td>4-16</td>
</tr>
<tr>
<td>Connectors</td>
<td>3-28</td>
</tr>
<tr>
<td>Consoles and Control Panels</td>
<td>3-29</td>
</tr>
<tr>
<td>Constant Speed Propellers</td>
<td>3-92</td>
</tr>
<tr>
<td>Containers, Reusable</td>
<td>4-44</td>
</tr>
<tr>
<td>- Component Installation</td>
<td>4-47</td>
</tr>
<tr>
<td>- Component Preparation</td>
<td>4-45</td>
</tr>
<tr>
<td>- Component Removal</td>
<td>4-53</td>
</tr>
<tr>
<td>- Container Preparation</td>
<td>4-46</td>
</tr>
<tr>
<td>- Final Testing – Nonpressurized</td>
<td>4-48</td>
</tr>
<tr>
<td>C (Cont.)</td>
<td></td>
</tr>
<tr>
<td>Containers, Reusable (Cont.)</td>
<td></td>
</tr>
<tr>
<td>- Final Testing – Pressurized</td>
<td>4-49</td>
</tr>
<tr>
<td>- Maintenance</td>
<td>4-52</td>
</tr>
<tr>
<td>- Markings</td>
<td>4-50</td>
</tr>
<tr>
<td>- Shipment and Storage</td>
<td>4-51</td>
</tr>
<tr>
<td>Contamination Limits</td>
<td></td>
</tr>
<tr>
<td>- Engine Oil</td>
<td>T3-16</td>
</tr>
<tr>
<td>- Hydraulic Fluid</td>
<td>T3-9, T3-10</td>
</tr>
<tr>
<td>- Preservation Oil</td>
<td>T3-7</td>
</tr>
<tr>
<td>Contamination Tag for Hydraulic System</td>
<td>F3-7</td>
</tr>
<tr>
<td>Control Cables</td>
<td>3-8</td>
</tr>
<tr>
<td>Control Surfaces</td>
<td>3-12</td>
</tr>
<tr>
<td>Controls, Photographic</td>
<td>3-72</td>
</tr>
<tr>
<td>Corrosion Control</td>
<td>8-6</td>
</tr>
<tr>
<td>Corrosion Preventive Compounds</td>
<td></td>
</tr>
<tr>
<td>- Non-Water Displacing</td>
<td>T8-10</td>
</tr>
<tr>
<td>- Time Limitations</td>
<td>T8-9</td>
</tr>
<tr>
<td>- Volatile Corrosion Inhibitors</td>
<td>T8-11</td>
</tr>
<tr>
<td>- Water Displacing</td>
<td>T8-8</td>
</tr>
<tr>
<td>Cushioning Material</td>
<td>F5-8</td>
</tr>
<tr>
<td>- On Landing Gear Door and Antenna</td>
<td>F5-10</td>
</tr>
<tr>
<td>- On Propeller Blades</td>
<td>F5-9</td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Deceleration Chutes</td>
<td>3-64</td>
</tr>
<tr>
<td>Dehumidification</td>
<td>6-2</td>
</tr>
<tr>
<td>- Bagged Aircraft</td>
<td>F1-5, F6-8</td>
</tr>
<tr>
<td>- Cooling Based System Schematic</td>
<td>F6-5</td>
</tr>
<tr>
<td>- Dynamic</td>
<td>6-6</td>
</tr>
<tr>
<td>- Equipment</td>
<td>6-9, T6-3</td>
</tr>
<tr>
<td>- Equipment Installation</td>
<td>6-11</td>
</tr>
<tr>
<td>- Equipment Maintenance</td>
<td>6-14, T6-4</td>
</tr>
<tr>
<td>- Removed Components Storage Schematic</td>
<td>F6-9</td>
</tr>
<tr>
<td>- Operational Hook-up for Avionics Protection</td>
<td>F6-6</td>
</tr>
<tr>
<td>- Operational Hook-up for Engine Protection</td>
<td>F6-7</td>
</tr>
<tr>
<td>- Static</td>
<td>6-5</td>
</tr>
</tbody>
</table>
D (Cont.)

Dehumidified Storage ........................................ 6-2, F1-5
Dehumidifiers ..................................................... 6-7
Deicer Components (Air Type) ............................... 3-112
Deicers ............................................................... 3-93
Desiccant Storage ................................................ 1-25
Desiccant .............................................................. 6-5
Desiccant in an Intake Duct ...................................... F6-2
Desiccant Units .................................................... 3-35, 3-73
Desiccant Warning Tag .......................................... F3-11
Desiccant Wheel Dehumidifier Schematic ................. F6-4
Desiccant Wheel Dehumidifier, Requirements .......... T6-2
Deterioration of Aircraft Materials ......................... 1-15, T1-3
Doors, Landing Gear ............................................. 3-65
Drain Holes .......................................................... 3-13
Drive and Gearbox (External Portions) ..................... 3-22
Drive and Gearbox (Internal Portions) ....................... 3-23
Drive and Gearbox, Removed Components ................. 4-17
Drop Shrouds ....................................................... 5-6
Drums ................................................................. 3-10
Ducts ................................................................. 3-111
Dynamic Dehumidification .................................... 6-6

E

Electrical System .................................................. 3-24
Electrical/Electronic Components ......................... 4-18
Electronics .......................................................... 3-33
Engine Fire Extinguisher Components ..................... 3-116
Engine Oil, Contamination Limits for .................... T3-16
Engine in Dehumidified Flexible Bag ....................... F4-1
Engine Preservation Tag ....................................... F3-10
Engine, Gas Turbine ............................................. 3-78
Engine, Reciprocating ........................................... 3-85, F3-14
- Caution Tag ...................................................... F3-15
Engines, Installed (see Power Plants) ....................... 3-77
Engines, Removed ............................................... 4-19
Engines Stored Indoors .......................................... F4-2

E (Cont.)

Environmental Deterioration ............................... 1-17
Equipment
- Cleaning .......................................................... T8-3
- Dehumidification ............................................. 6-9, T6-3
- Inspection ......................................................... T8-7
- Shrinkwrapping ............................................... T5-3
- Strippable Coating ........................................... T5-1
Explosive Warnings, Stencilled ............................. F3-2

F

F/A-18 Cushion Points .......................................... F5-11
Flexible Covers .................................................... 5-8
Flight Control Surfaces, Removed ......................... 4-20
Floatation Gear .................................................... 3-102
Floats and Sponsons ............................................. 3-7
Fragile or Delicate Components ............................. 4-21
Fuel Cells ............................................................ 4-23
Fuel Connection Warning Tag ............................... F3-5
Fuel System ........................................................ 3-41
Fuel System Components ......................................... 4-22
Fuel System Preservation Oil .................................. 3-43
Fuel System Preservation Tag ................................ F3-6
Fuel Tanks, External ............................................ 4-24
Fuel Vent Extension Tube Installation ...................... F3-4

G

Galley Facilities .................................................... 3-113
Galvanic Series .................................................... F1-3
Gas Turbine Engine .............................................. 3-78
Greases, Common Aircraft .................................... T8-7
Grounding Point, Identification of ......................... F7-4
Grounding Procedures, Aircraft .............................. 7-4
Gun Systems on Aircraft ....................................... 3-20
Gun Systems, Removed ......................................... 4-13
Gyros ................................................................. 3-54
<table>
<thead>
<tr>
<th>Subject</th>
<th>Paragraph, Figure, or Table Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H</strong></td>
<td></td>
</tr>
<tr>
<td>Handling Guidelines</td>
<td>4-43</td>
</tr>
<tr>
<td>Headsets and Microphones</td>
<td>3-36</td>
</tr>
<tr>
<td>Humidity Indicator Card, Installation</td>
<td>6-5, F6-3</td>
</tr>
<tr>
<td>Humidity Indicator Plug, Installation</td>
<td>6-5</td>
</tr>
<tr>
<td>Hydraulic Fluid (Particle Count Test), Navy Standard for Particulate Contamination of</td>
<td>T3-9</td>
</tr>
<tr>
<td>Hydraulic System</td>
<td>3-48</td>
</tr>
<tr>
<td>Hydraulic System Components</td>
<td>4-25</td>
</tr>
<tr>
<td>Hydraulic System Contamination Tag</td>
<td>F3-7</td>
</tr>
<tr>
<td><strong>I</strong></td>
<td></td>
</tr>
<tr>
<td>Inertia Reels</td>
<td>3-108</td>
</tr>
<tr>
<td>Inspection Elements and Corrective Actions</td>
<td>T2-2</td>
</tr>
<tr>
<td>Inspection Guidelines</td>
<td>8-5, T8-6</td>
</tr>
<tr>
<td>-Equipment Used to Aid Inspection</td>
<td>T8-7</td>
</tr>
<tr>
<td>-Material Defect Indications</td>
<td>T8-5</td>
</tr>
<tr>
<td>Instrument Panels</td>
<td>3-55</td>
</tr>
<tr>
<td>Instrument System Components</td>
<td>4-26</td>
</tr>
<tr>
<td>Instruments</td>
<td>3-52</td>
</tr>
<tr>
<td>Interior, Fuel System</td>
<td>3-44</td>
</tr>
<tr>
<td><strong>J</strong></td>
<td></td>
</tr>
<tr>
<td>Junction Boxes</td>
<td>3-30</td>
</tr>
<tr>
<td><strong>L</strong></td>
<td></td>
</tr>
<tr>
<td>Land Shipment, Aircraft</td>
<td>7-8</td>
</tr>
<tr>
<td>Land Shipment, Components</td>
<td>4-56</td>
</tr>
<tr>
<td>Landing and Arresting Gear</td>
<td>3-58</td>
</tr>
<tr>
<td>Landing and Arresting Gear Components</td>
<td>4-27</td>
</tr>
<tr>
<td>Launch Bar</td>
<td>3-63</td>
</tr>
<tr>
<td>Lavatory Facilities</td>
<td>3-114</td>
</tr>
<tr>
<td>Level I Preservation</td>
<td>1-21, 2-2, 2-7</td>
</tr>
<tr>
<td>Level II Preservation</td>
<td>1-22, 2-3, 2-16</td>
</tr>
<tr>
<td>Level III Preservation</td>
<td>1-23, 2-4, 2-25</td>
</tr>
<tr>
<td>Level IV Preservation</td>
<td>1-24, 2-5, 2-34</td>
</tr>
<tr>
<td>Lights</td>
<td>3-31</td>
</tr>
<tr>
<td>Lines and Fittings, Hydraulic</td>
<td>3-49</td>
</tr>
<tr>
<td>Liquid Oxygen Converters</td>
<td>3-103</td>
</tr>
<tr>
<td>Maintenance, Dehumidification Equipment</td>
<td>6-14</td>
</tr>
<tr>
<td>Markings and Placards</td>
<td>5-2</td>
</tr>
<tr>
<td>Materials</td>
<td></td>
</tr>
<tr>
<td>-Cleaning</td>
<td>T8-3</td>
</tr>
<tr>
<td>-Dynamic Dehumidification</td>
<td>T6-3</td>
</tr>
<tr>
<td>-Packaging</td>
<td>T8-13</td>
</tr>
<tr>
<td>-Preservation</td>
<td>T8-12</td>
</tr>
<tr>
<td>-Shrinkwrapping</td>
<td>T5-3</td>
</tr>
<tr>
<td>-Strippable Coating</td>
<td>T5-1</td>
</tr>
<tr>
<td>Missile Launchers</td>
<td>3-18, 4-14</td>
</tr>
<tr>
<td>Motors and Inverters</td>
<td>3-32</td>
</tr>
<tr>
<td>Movable Surface Battens, Examples of</td>
<td>F3-1</td>
</tr>
<tr>
<td><strong>O</strong></td>
<td></td>
</tr>
<tr>
<td>Ocean Shipment, Aircraft</td>
<td>7-9</td>
</tr>
<tr>
<td>Ocean Shipment, Components</td>
<td>4-57</td>
</tr>
<tr>
<td>Ocean Shipping Inspections</td>
<td>T2-3</td>
</tr>
<tr>
<td>Oil System Warning Tag</td>
<td>F3-12</td>
</tr>
<tr>
<td>Oxygen Cylinders and Regulators</td>
<td>3-104</td>
</tr>
<tr>
<td>Oxygen Rebreathers</td>
<td>3-105</td>
</tr>
<tr>
<td>Oxygen System Hand Cleaning</td>
<td>8-4</td>
</tr>
<tr>
<td>Packaging</td>
<td>4-37</td>
</tr>
<tr>
<td>-Basic Packaging Methods</td>
<td>4-38</td>
</tr>
<tr>
<td>-Marking and Closure</td>
<td>4-40</td>
</tr>
<tr>
<td>-Materials</td>
<td>4-36, T8-13</td>
</tr>
<tr>
<td>-Standards</td>
<td>4-35</td>
</tr>
<tr>
<td>-Unit Container</td>
<td>4-39</td>
</tr>
<tr>
<td>Parachutes and Harness</td>
<td>3-106</td>
</tr>
<tr>
<td>Subject</td>
<td>Paragraph, Figure, or Table Number</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Perishables and Pilferables</td>
<td>3-107</td>
</tr>
<tr>
<td>Photographic System Components</td>
<td>4-28</td>
</tr>
<tr>
<td>Pitot Tube</td>
<td>F3-8</td>
</tr>
<tr>
<td>Pitot Tubes and Static Vents</td>
<td>3-56</td>
</tr>
<tr>
<td>Pneumatics</td>
<td>3-75</td>
</tr>
<tr>
<td>Pneumatic System Components</td>
<td>4-29</td>
</tr>
<tr>
<td>Power Plants</td>
<td>3-77</td>
</tr>
<tr>
<td>Power Supplies</td>
<td>3-37</td>
</tr>
<tr>
<td>Pre-Engineered Building</td>
<td>F5-3</td>
</tr>
<tr>
<td>Prevention of Damage</td>
<td>1-16</td>
</tr>
<tr>
<td>Preservation Checklist Example</td>
<td>F1-2</td>
</tr>
<tr>
<td>Preservation Guidelines</td>
<td>2-1</td>
</tr>
<tr>
<td>-Level I</td>
<td>2-2, 2-7</td>
</tr>
<tr>
<td>-Level II</td>
<td>2-3, 2-16</td>
</tr>
<tr>
<td>-Level III</td>
<td>2-4, 2-25</td>
</tr>
<tr>
<td>-Level IV</td>
<td>2-5, 2-34</td>
</tr>
<tr>
<td>Preservation Level Designation</td>
<td>T1-4, T1-6</td>
</tr>
<tr>
<td>Preservation Materials</td>
<td>8-7, T8-12</td>
</tr>
<tr>
<td>Preservation Oil</td>
<td>3-43</td>
</tr>
<tr>
<td>Preservation Oil, Contamination Limits for</td>
<td>T3-7</td>
</tr>
<tr>
<td>Preservation Tag</td>
<td>F3-10</td>
</tr>
<tr>
<td>-Engine</td>
<td>F3-6</td>
</tr>
<tr>
<td>Preservation Theory</td>
<td>1-14</td>
</tr>
<tr>
<td>Preservation Type Designation, AMARG</td>
<td>T1-5</td>
</tr>
<tr>
<td>Preservation/Depreservation Record</td>
<td>F1-1, T1-2</td>
</tr>
<tr>
<td>Pressure Accumulators, Hydraulic</td>
<td>3-50</td>
</tr>
<tr>
<td>Propellers</td>
<td>3-92</td>
</tr>
<tr>
<td>-Constant Speed</td>
<td></td>
</tr>
<tr>
<td>-Propellers (Variable Pitch)</td>
<td>3-94</td>
</tr>
<tr>
<td>-Propellers and Propeller Components</td>
<td>3-91</td>
</tr>
<tr>
<td>-Removed Components</td>
<td>4-30</td>
</tr>
<tr>
<td>Protective Cover for Aircraft Tire</td>
<td>F3-9</td>
</tr>
<tr>
<td>Psychrometers</td>
<td>6-4</td>
</tr>
<tr>
<td>Psychrometric Chart</td>
<td>6-3, F6-1</td>
</tr>
<tr>
<td>Pylons</td>
<td>3-18, 4-14</td>
</tr>
<tr>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Radomes</td>
<td>3-38</td>
</tr>
<tr>
<td>Records/Logs/Work Directives</td>
<td>1-7</td>
</tr>
<tr>
<td>Relief Tubes</td>
<td>3-115</td>
</tr>
<tr>
<td>Rescue Slings</td>
<td>3-10</td>
</tr>
<tr>
<td>Reticulated Foam, Fuel Cell</td>
<td>3-46</td>
</tr>
<tr>
<td>Rigid Shelter</td>
<td>5-3</td>
</tr>
<tr>
<td>Rotor and Hub</td>
<td>3-95</td>
</tr>
<tr>
<td>Rotor and Hub Components</td>
<td>4-31</td>
</tr>
<tr>
<td>Rotor Blades, Main and Tail</td>
<td>3-96</td>
</tr>
<tr>
<td>Rotor Controls, Linkages, Dampers and Swashplates</td>
<td>3-97</td>
</tr>
<tr>
<td>Rotor Heads and Hubs</td>
<td>3-98</td>
</tr>
<tr>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Safety and Survival</td>
<td>3-99</td>
</tr>
<tr>
<td>Safety and Survival System Components</td>
<td>4-32</td>
</tr>
<tr>
<td>Seat Belts</td>
<td>3-108</td>
</tr>
<tr>
<td>Seats (Except Ejection)</td>
<td>3-14</td>
</tr>
<tr>
<td>Selecting a Preservation Level</td>
<td>1-26</td>
</tr>
<tr>
<td>-Desert Storage</td>
<td>1-25</td>
</tr>
<tr>
<td>-Economics</td>
<td>1-27</td>
</tr>
<tr>
<td>-Level I</td>
<td>1-21</td>
</tr>
<tr>
<td>-Level II</td>
<td>1-22</td>
</tr>
<tr>
<td>-Level III</td>
<td>1-23</td>
</tr>
<tr>
<td>-Level IV</td>
<td>1-24</td>
</tr>
<tr>
<td>Shipment, Aircraft</td>
<td>7-7</td>
</tr>
<tr>
<td>-Air</td>
<td>7-10</td>
</tr>
<tr>
<td>-Air Lift</td>
<td>7-11</td>
</tr>
<tr>
<td>-Land</td>
<td>7-8</td>
</tr>
<tr>
<td>-Ocean</td>
<td>7-9</td>
</tr>
<tr>
<td>Shipment, Components</td>
<td>4-55</td>
</tr>
<tr>
<td>-Air</td>
<td>4-58</td>
</tr>
<tr>
<td>-Land</td>
<td>4-56</td>
</tr>
<tr>
<td>-Ocean</td>
<td>4-57</td>
</tr>
<tr>
<td>Shipment Guidelines</td>
<td>4-54</td>
</tr>
<tr>
<td>-Components</td>
<td></td>
</tr>
<tr>
<td>-Depreservation</td>
<td>2-48</td>
</tr>
</tbody>
</table>

Index-5
## S (Cont.)

**Shipment Guidelines (Cont.)**

- Maintenance ................................................. 2-47  
- Ramp and Cargo Space ..................................... F7-7  
- Transport Aircraft Dimensions ............................ T7-6  
- Vehicle Dimensional Limitations .......................... F7-6  

**Shock Struts** .............................................. 3-66  

**Shoulder Harnesses** ..................................... 3-108  

**Shrinkwrap** .............................................. 5-28, F5-21  
  - Installation .............................................. 5-30  
  - Materials and Equipment ................................. T5-3  

**Shroud, Aircraft Inside** .................................. F5-5  

**Shroud Draped Over a Metal Frame** .................... F5-4  

**Skin Surfaces (Exterior)** ................................ 3-15  

**Skis** .......................................................... 3-67  

**Slings, Main Aircraft Hoisting** ......................... T7-5  

**Smoke Abatement Units** ................................ 3-116  

**Spotting and Securing of Aircraft** ..................... 7-2  

**Stabilization Units** ................................... 3-57  

**Standard Procedures** .................................. 1-18  

**Static Dehumidification** ................................. 6-5  

**Stencil Format, Aircraft Marking** ...................... F5-1  

**Stencilled Explosive Warnings** ......................... F3-2  

**Storage and Maintenance, Components** .............. 4-59  

**Storage Costs** ........................................... F1-4  

**Storage Sites, Aircraft** ................................ 7-5  

**Strippable Coating** ................................….. 5-14  
  - Aircraft .................................................. F5-12  
  - Application ............................................ 5-18  
  - Installing Ripcord Inserts ................................ F5-18  
  - Materials and Equipment ................................. T5-1  
  - Selected Areas ........................................ F5-13  

**Surface Preparation** .................................... 5-19  
  - Closing Large Openings ................................ F5-15  
  - Closing Small Openings ................................ F5-14  
  - Covering Sharp Edges .................................. F5-16  
  - Masking using Coating Compound ....................... F5-7  
  - Tape and Barrier ...................................... F5-19  

## T

**Tape, Preservation** ..................................... 5-26  

**Tape, Shingled** .......................................... F5-20  

**Tape and Barrier** ........................................ 5-24, F5-19  

**Tension Membrane Shelter** .............................. F5-2  

**Tiedown Anchors** ........................................ F7-1  

**Tiedown Assembly** ...................................... F7-2, F7-3  

**Tiedown Chain Data** .................................... T7-2  

**Tiedown Information for Parking of Aircraft** .......... T7-1  

**Tiedown Procedures, Aircraft** ........................... 7-3  

**Tires** ....................................................... 3-68, F3-9  

**Toilet Facilities** ....................................... 3-117  

**Transparencies (Canopies, Windows)** .................. 3-16  

**Turrets** ................................................... 3-21  

## U

**Utility Systems** ......................................... 3-109
<table>
<thead>
<tr>
<th>Subject</th>
<th>Paragraph, Figure, or Table Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>V</strong></td>
<td></td>
</tr>
<tr>
<td>Vapor Cycle Units</td>
<td>3-39</td>
</tr>
<tr>
<td>Variable Pitch Propellers, on Aircraft</td>
<td>3-94</td>
</tr>
<tr>
<td>Variable Pitch Propellers, Removed</td>
<td>4-30</td>
</tr>
<tr>
<td>Viewfinders</td>
<td>3-74</td>
</tr>
<tr>
<td><strong>W</strong></td>
<td></td>
</tr>
<tr>
<td>Warning Tag</td>
<td></td>
</tr>
<tr>
<td>-Desiccant</td>
<td>F3-11</td>
</tr>
<tr>
<td>-Dry Cell Battery</td>
<td>F3-3</td>
</tr>
<tr>
<td>-Fluid System Connection</td>
<td>F3-13</td>
</tr>
<tr>
<td>-Fuel Connections</td>
<td>F3-5</td>
</tr>
<tr>
<td>-Oil System</td>
<td>F3-12</td>
</tr>
<tr>
<td>Warnings and Cautions for Hazardous Material</td>
<td>1-13</td>
</tr>
<tr>
<td>Water Injection</td>
<td>3-118</td>
</tr>
<tr>
<td>Water Tanks</td>
<td>3-119</td>
</tr>
<tr>
<td>Waterless Spot Cleaning</td>
<td>8-3</td>
</tr>
<tr>
<td>Waveguides</td>
<td>3-40</td>
</tr>
<tr>
<td>Wheel Chocks</td>
<td>7-6</td>
</tr>
<tr>
<td>Wheels</td>
<td>3-69</td>
</tr>
<tr>
<td>Windshield Defrosters</td>
<td>3-120</td>
</tr>
<tr>
<td>Windshield Wiper Blades and Arms</td>
<td>3-121</td>
</tr>
</tbody>
</table>