CHAPTER 3 — CORROSION CONTROL AND PROTECTIVE COVERINGS/COATINGS

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CORROSION CONTROL AND PROTECTIVE COVERINGS/COATINGS

3-1. GENERAL

There are many various forms of corrosion which attack metal and metallic materials causing early part failure. Several types of corrosion most common in aircraft are listed below. Routine and preventive maintenance and inspections are designed to help prevent corrosion caused component failure.

1. Surface Corrosion. The direct surface attack form of corrosion is generally the least serious of the various forms of corrosion. It is the result of direct reaction of metal surfaces with oxygen in air and occurs more readily when metal surfaces are exposed to salt spray or salt-bearing air. Sulphur and chlorine compounds which may be present in smoke stack gases and engine exhaust gases also cause direct surface attack. Etching may be noticed on the surface when corrosion deposits are removed. If the metal is aluminum alloy with a coating of pure aluminum (ALCLAD), the affect on strength of ductility of metal is negligible; however, corrosion of a similar degree on non-clad metals may be considered serious. (Refer to applicable Component Repair and Overhaul Manual). The pits may become sites for crack development in parts which are critical in fatigue.

2. Galvanic Corrosion. This is caused by dissimilar metal contact in the presence of a liquid such as salt spray or condensate, forming a true chemical cell. This causes electrons to flow and the most easily oxidized surface becomes the anode and corrodes. The emitting surface becomes the cathode of the cell.

3. Pitting Attack. This is a special kind of galvanic reaction and is usually localized. It occurs at a point of weakness and is caused by a lack of homogeneity in the alloy surface. Pitting originates from mechanical contact, faulty heat treatment, or localized contamination that breaks down surface protection. These areas become anodic characteristics of the pit area. A deep penetrating attack develops rather than general surface attack.

4. Intergranular Corrosion. This is a selective type of corrosion and attacks along the grain boundaries of metal alloys. Aluminum alloys which contain appreciable amounts of copper and zinc and some stainless steels are vulnerable to intergranular corrosion. Piano hinges are an example of aluminum extrusions which are vulnerable. Lack of uniformity in the alloy structure caused by heat treating procedures or localized overheating such as from fire damage, may result in intergranular corrosion. This corrosion may exist without visible evidence on exterior surfaces and serious structural weakening may occur without detection.

5. Exfoliation. This is a type of corrosion which most often occurs in aluminum parts made from plate, bar, tube and extrusions which have long, thin grains. Exfoliation corrosion is recognizable by the long, thin leafs of material which delaminate from the surface of a part. This type of corrosion often appears as a blister on the surface of a part. This is due to corrosion products between the grains forcing the grains apart, causing a bulge on the surface. Exfoliation corrosion is a form of intergranular corrosion.

6. Stress Corrosion. Stress affects metals that are too highly stressed under corrosive conditions. Shrink fit parts and parts subjected to cold working conditions are susceptible to stress corrosion cracking. Stressed metal tends to become anodic when in contact with stress-free metal. Galvanic corrosion occurs along the lines of stress and rapid failure of the part results.

7. Fatigue Corrosion. This is closely related to stress corrosion and appears in metals under cyclic stress in a corrosive surrounding. A jet engine turbine blade is an example of a part subject to fatigue corrosion. The corrosion causes sharp deep pits which, in turn, become the origin of cracks that may ultimately result in failure of the part. It is difficult to detect this type of attack in advance except as cracking develops.

8. Fretting Corrosion. This type corrosion develops when two heavily loaded surfaces contact each other and are subject to slight vibratory motion. The rubbing contact removes small particles of virgin metal from each surface. These particles will usually oxidize to form abrasive materials. The attack is compounded by the continued motion which prevents formation of any protective oxide film, creating a prime area for further corrosion to occur. Fretting is evident at an early stage by surface discoloration and the presence of corrosion particles in any lubricant present. Continued fretting will ruin bearing surfaces, destroy critical dimensions, and may be serious enough to eventually cause cracking and fatigue failure. Fretting may be controlled by preventing

slippage of the two surfaces or by lubricating the surfaces.

9. Hygroscopic Material Corrosion. This is caused by such materials as sponge rubber, felt, cork, etc., absorbing water and holding it in contact with the part. As a result, surface or galvanic corrosion may develop.

3-2. CORROSION PREVENTION

3-3. CORROSION PREVENTIVE TREATMENT

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-105	Corrosion Preventive
C-304	Solvent

After parts are cleaned, control and precautionary measures shall be exercised at all times to prevent corrosion. Fingerprint residue, reactive with moisture in the air, will cause accelerated corrosion in the affected areas. In order to avoid these difficulties, the following procedures shall be applied to ferrous metal parts after cleaning and inspection.

1. Wash all ferrous parts in a clean rinse of solvent (C-304) then drain the parts.

2. Gently agitate parts in fingerprint remover corrosion preventive (C-105) and allow to drain.

NOTE

Normally, parts treated with the above compounds may be left covered in indoor storage for approximately six days without being affected.

3. Immediately prior to reassembly, clean parts with solvent (C-304) and coat with approved oil. Do not handle or assemble unoiled parts.

3-4. CORROSION PREVENTIVE OIL

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-125	Preservative Oil

Use preservative oil (C-125) as a general light corrosion preventive for bonded, exposed, and painted metals.

3-5. CORROSION PROTECTION — CONTROL BOLTS, ROTATING, AND NON-ROTATING

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound
C-104	Corrosion Preventive Compound

Prior to assembly, coat all rotating and non-rotating control bolt shanks with corrosion preventive compound (C-104) unless otherwise specified. After assembly, coat boltheads and exposed threads with corrosion preventive compound (C-101).

3-6. CORROSION CORRECTIVE TREATMENT

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-304	Solvent
C-500	Crocus Cloth

Corrosion corrective treatment can be applied to all metal parts of the assemblies in varying degrees (unless otherwise specified in the text). The following method shall be applied to remove corrosion using the

applicable information as a criteria to determine serviceability of the part.

1. Wash part in solvent (C-304) to remove loose foreign matter.

2. Dry the part.

3. Use crocus cloth (C-500) or hand buffing wheel with jewelers rouge to remove corrosion from affected area by polishing. Do not use any abrasive coarser than specified.

4. Clean parts to remove all traces of corrosion and polishing agents.

NOTE

No polishing is acceptable on bearing surfaces.

3-7. CORROSION REMOVAL — STEEL PARTS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-344	Cleaner

1. Thoroughly mix one volume of cleaner (C-344) and three volumes of water.

2. Prepared surfaces which are to receive cleaner shall be free of oil, grease, shop soil, and paint. Recleaning shall be accomplished, as required, by any acceptable method.

3. Apply cleaner to metal surface by brushing or swabbing. The cleaner shall remain in contact with metal surface for one to three minutes and shall be followed by a thorough rinse.

NOTE

Step 3 may be repeated, as required, to remove light rust. Apply cleaner to corroded area only, then rinse.

4. Surfaces shall be dried using an oven 150°F (65°C) maximum, clean dry rags, or using compressed air which has been filtered to render it oil and moisture free.

5. Treat for corrosion prevention (paragraph 3-2).

3-8. CORROSION REMOVAL — ALUMINUM PARTS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-423	Abrasive Cloth or Paper

1. Remove corrosion using 400 grit abrasive cloth or paper (C-423).

NOTE

Depth of repair shall be twice the depth of corrosion not to exceed repair limits. Refer to applicable maintenance or CR&O manual for limits.

2. Apply two coats of epoxy polyamide primer (C-204) to repaired area.

3-9. CORROSION REMOVAL — MAGNESIUM PARTS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-116	Chromic Acid
C-117	Hydroflouric Acid
C-304	Solvent
C-305	Aliphatic Naphtha
C-309	Methyl-Ethyl-Ketone (MEK)
C-348	Alkaline Steel Cleaner

NOTE

A chromic acid bath is used to remove corrosion from magnesium parts.

1. Wipe parts clean before immersing in acid bath using solvent (C-304), MEK (C-309), or aliphatic naphtha (C-305).

CAUTION

CORROSION REMOVAL PROCESS SHALL BE MONITORED TO ENSURE MACHINED DIMENSIONS ARE MAINTAINED, CORROSION LIMITS SPECIFIED FOR THE INDIVIDUAL PART ARE NOT EXCEEDED, AND CADMIUM PLATING IS NOT REMOVED FROM STUDS.

2. Mix a solution of 20 to 24 ounces of chromic acid (C-116) with one gallon of water.

NOTE

The mixture can be used at room temperature to 200°F (93°C). Preferred temperature range being from 160°F to 180°F (71°C to 82°C).

3. Immerse corroded part in mixture until corrosion has been removed.

4. Thoroughly rinse part in fresh water until all corrosion removing products are removed.

5. Remove remaining contaminants from parts using alkaline cleaner (C-348). Follow manufacturer's instructions for use of cleaner on magnesium parts.

6. Rinse parts in fresh water until all cleaner is removed.

7. Acid pickle parts as follows:

a. Prepare a 15 to 20 percent (by weight) hydrofluoric acid solution (C-117).

b. Allow solution to reach room temperature.

c. Immerse AZ31B alloy parts for 30 seconds to one minute. Immerse all other alloys for four to five minutes.

d. Thoroughly rinse parts in fresh water to remove all traces of fluoride.

8. Immediately after corrosion removal, apply chemical film treatment (paragraph 3-15).

3-10. CORROSION REMOVAL — ELASTOMERIC COMPONENTS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-305	Aliphatic Naphtha
C-355	Detergent

NOTE

Many elastomeric components on helicopter will be severely damaged, if they are allowed to remain in contact with oil. Oil contaminants should be removed on regular basis, using mild detergent (C-355) and warm water.

1. Scrub elastomeric components used in main rotor, swashplate pylon support, and airframe. Use mild detergent (C-355) and water. Rinse with water and dry with clean cloths.

2. Rinse both metal and rubber elastomeric component surfaces with aliphatic naphtha (C-305). Wipe dry with clean cloths.

3-11. CORROSION PROTECTION — FAYING SURFACES

Refer to tables 3-1 and 3-2 for definitions of similar and dissimilar metals and organic protective requirements.

Table 3-1. Definitions of Similar and Dissimilar Metals

GROUP I	GROUP II	GROUP III	GROUP IV
1. Magnesium and its alloys.	1. Cadmium and its alloys	1. Iron	1. Copper
2. Aluminum Alloys of 5052, 5056, 5356, 6061, and 6063	2. Zinc and its alloys	2. Lead	2. Chromium
	3. Aluminum and its alloys (Including the Aluminum Alloys in Group I)	3. Tin	3. Nickel
			4. Titanium
			5. Cobalt
			6. Stainless Steel

NOTES:

1. Metals classified in the same group are considered similar.
2. Metals classified in different groups are considered dissimilar.
3. For the purpose of this table, the metal referred to is the metal on the surfaces of the part.

Table 3-2. Organic Protective Requirements for Metals

METAL	INTERIOR	EXTERIOR
Magnesium	0.4 mil (min) - epoxy polyamide primer	0.4 mil (min) epoxy polyamide primer, then applicable finish
Aluminum	0.4 mil (min) - epoxy polyamide primer	One coat of epoxy polyamide primer, then applicable finish
Copper alloys 400 series steel and low alloy steels (see NOTE)		
200 and 300 series stainless steels	No protective finish required	
Titanium		

NOTE

When 400 series steels are used in high heat application, omit the organic finish.

3-12. SIMILAR METALS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer
C-308	Sealant
C-430	Tape

Faying surfaces of similar metals shall be protected by applying epoxy polyamide primer to interior or exterior surfaces as required by table 3-1.

1. Exterior surfaces. In addition to the 0.4 mil minimum thickness of epoxy polyamide primer (C-204) applied to each surface, magnesium faying surfaces on the interior or exterior surfaces of the helicopter shall be protected using sealing compound sealant (C-308). The sealant shall be applied between surfaces and squeezed out at the boundaries. The squeeze-out shall be approximately 1/4 inch in width and shall be smoothed to fair in.

2. Interior surfaces. In addition to the 0.4 mil minimum thickness of epoxy polyamide primer (C-204) applied to each surface, magnesium faying surfaces shall be protected by placing either of the following materials between the surfaces:

a. Adhesive barrier tape (C-430). When adhesive barrier tape is used, it shall cover the entire faying surface area of one of the parts. Also, it shall extend at least 1/4 inch beyond the joint edges.

b. Sealing compound sealant (C-308). When sealing compound sealant (C-308) is used, it shall be applied between the surfaces and squeezed out at all boundaries. The squeeze-out shall form a fillet approximately 1/4 inch in width.

3. Butt joints. In addition to the 0.4 mil minimum thickness of epoxy polyamide primer (C-204) applied to each surface, the separating butt joints consisting of magnesium sheet and a sheet of any other material, including magnesium, shall be filled with sealing compound sealant (C-308).

3-13. DISSIMILAR METALS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-204	Primer

Faying surfaces of dissimilar metals (except magnesium) shall be protected by applying a 0.4 mil minimum thickness of epoxy polyamide primer (C-204) to each surface.

3-14. CORROSION PROTECTION — EXCEPTIONS

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-101	Corrosion Preventive Compound
C-104	Corrosion Preventive Compound
C-204	Primer

1. On parts that are to be welded or adhesive bonded.

2. Slip fits. Use unreduced epoxy polyamide primer (C-204) except when anaerobic sealants are specified.

3. Press fits. Use unreduced epoxy polyamide primer (C-204) except when anaerobic sealant or adhesives are used. Press fitted parts, permanently housed in oil, shall be assembled with the oil to be used in the housing.

4. Thermal fits. Assemble thermal fits without organic coatings.

5. Staked bearings. Using one of the following methods, as applicable.

a. Use unreduced wet epoxy polyamide primer (C-204) on faying surfaces. Do not allow primer to get on seal or shield of bearing.

b. If bearings operate in oil or other fluid, use fluid they operate in on faying surface.

c. If bearings are installed with a sealant, do not use epoxy polyamide primer.

6. Adjusting threads. Coat threads with corrosion preventive compound (C-101) before and after each adjustment.

7. Control bolts, rotating and nonrotating. Coat all rotating and nonrotating control bolt shanks with corrosion preventive compound (C-104) unless otherwise specified.

3-15. CHEMICAL FILM (CHROMIC ACID) TREATMENT — MAGNESIUM

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-103	Chromic Acid
C-113	Calcium Fluoride
C-114	Corrosion Treatment
C-115	Magnesium Fluoride
C-116	Chromic Acid
C-118	Sodium Hydroxide
C-204	Primer
C-309	Methyl-Ethyl-Ketone (MEK)
C-318	Cleaning Compound
C-407	Abrasive Pad
C-426	Tape

1. Immersion Method. The following procedure is a dip tank formula and complies with DOW 7, Type III, and MIL-M-3171 Type III corrosion treatment (C-114).

a. Mix magnesium alloy chemical film treatment as follows:

MAGNESIUM ALLOY CHEMICAL FILM TREATMENT

	MEASUREMENTS
Sodium Dichromate (C-212),	16 to 24 oz. (473.00 to 609.00 liter)
Calcium (C-113) or Magnesium (C-115) Flouride,	1/3 oz. (9.86 liter)
and	
Water to make	1 gal. (3.7854 liter)

(1) The pH factor of the solution shall be maintained between 4.1 to 5.5 while processing castings, and 4.1 to 5.0 while processing other magnesium.

(2) The pH factor shall be adjusted and maintained with chromic acid (C-116) or caustic soda sodium hydroxide (C-118) as necessary.

(3) The solution shall be kept saturated with fluorides by suspending a cloth or fiberglass bag filled with calcium fluoride (C-113) or magnesium fluoride (C-115) in the solution corrosion treatment (C-114).

(4) The temperature of the solution shall not fall below 200°F (93°C) during treatment.

b. Treat parts for 30 ±5 minutes. Alloy EK60A may be treated for only 15 minutes due to faster coating action.

c. After chemical treatment, the parts shall be thoroughly rinsed in room temperature water followed by a dip in hot water maximum 180°F (82°C), to facilitate drying. If a hot air dryer is used, a double water rinse shall precede the drying.

d. Parts requiring painting as the next operation shall be painted as soon as practicable after drying, preferably within 24 hours. Bare steel inserts shall be oiled immediately after drying to prevent corrosion.

2. A brush-on method of chemical film treatment MIL-M-3171 type VI can be applied to magnesium parts that require touchup. This treatment is generally

used in refinishing procedures and is relatively inexpensive. The treatment may be applied with a brush and is not harmful when trapped in faying surfaces, nor does it present the toxicity hazards of related treatments.

a. Preparation. Mask the area to receive treatment with masking tape (C-426) and wrapping paper to protect adjacent areas from coating.

b. Cleaning.

(1) Remove oil and grease with a clean cloth dampened with solvent MEK (C-309).

(2) Scrub area with abrasive pad (C-407) and cleaning compound (C-318) 10 to 20 percent by volume in clean water. Thoroughly rinse with clean water.

c. Drying. Allow surface to air dry or force dry using clean, filtered, compressed air and clean dry cloths.

d. Mix magnesium touchup treatment solution as follows:

MAGNESIUM TOUCHUP TREATMENT SOLUTION

	MEASUREMENTS
Chromic Acid (C-116),	1-1/3 oz (10 g)
Calcium Sulfate (C-120),	1 oz (7.5 g)
and	
Water to make	1 gal. (1 liter)

e. Treatment. Apply magnesium touchup solution, or premixed solution chromic acid (C-103) liberally to area to be treated. Keep area wet with solution about 1 to 3 minutes, to produce a brown film. Treatment should not be less than 30 seconds nor longer than 3 minutes. Rinse area thoroughly with clean water and dry.

NOTE

Do not rinse area with hot water. Time between coating and water rinsing is not critical. In fact, where running water is not feasible, rinse step can be eliminated without altering coating effectiveness.

f. Appearance. The treatment should provide an appearance that is continuous and uniform. The color should range from brassy iridescence to dark brown depending upon treatment time. Up to 1 minute of treatment produces a brassy film and from 2 to 3 minutes a dark brown coating. For best paint adhesion, dark brown coatings are preferred. Processed coatings require painting or sealing before exposure to overnight or outdoor atmospheric conditions.

g. Primer. Apply one spray coat (0.6 mil minimum thickness) of primer (C-204).

3-16. ALUMINUM ALLOY — CHEMICAL FILM TREATMENT (TOUCHUP)

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-100	Chemical Film Material
C-204	Primer
C-304	Solvent
C-309	Methyl-Ethyl-Ketone (MEK)
C-318	Cleaning Compound
C-407	Abrasive Pad
C-422	Aluminum Wool
C-426	Tape

The chemical film treatment of aluminum alloy is a chromate conversion coating that increases the corrosion resistance and provides a base for organic finishes on all aluminum alloys. The chemical film coating has no significant abrasion resistance.

NOTE

When applying solution near or next to an anodized surface, the solution must not make contact with the anodized surface. Make sure the anodized surface is protected with masking tape (C-426) and plastic sheeting.

1. Preparation. To protect adjacent areas from coating, mask the perimeter of the area to receive treatment with masking tape (C-426) and plastic sheeting.

2. Cleaning.

a. Remove oil and grease with a clean cloth dampened with drycleaning solvent (C-304) or MEK (C-309).

b. Scrub area to be treated to clean bare metal using nylon web abrasive pad (C-407) or fine aluminum wool (C-422).

c. Scrub area with nylon web abrasive pad and cleaning compound (C-318) 10 to 20% by volume in clean water.

d. Thoroughly rinse with clean water.

e. Repeat step c and step d until water break-free surface cleanliness is achieved.

3. Drying. Allow surface to air dry or force dry using clean filtered compressed air and clean dry cloths.

4. Mix aluminum conversion coating solution chemical film material (C-100) as follows:

ALUMINUM CONVERSION COATING SOLUTION RATIO

	RATIO BY VOLUME
Chemical Film Material (C-100)	6 parts
Nitric Acid (C-432)	1 part
and	
Distilled or Demineralized Water	256 parts

NOTE

When applying solution near or next to an anodized surface, the solution must not make contact with the anodized surface. Make sure the anodized surface is protected with masking tape (C-426) and plastic sheeting.

5. Treatment. Apply solution chemical film material (C-100) liberally to area to be treated. Keep area wet with solution 1 to 3 minutes. Rinse area thoroughly with clean water and dry.

6. Appearance. The treatment should provide an appearance that is continuous and uniform. Color should range from golden iridescent to brown. Streaks and mottled areas caused by the surface condition of the metal will be allowed, provided there is chemical film coverage in these areas.

7. Primer. Apply one spray coat (0.6 ml minimum thickness) of epoxy polyamide primer (C-204) to interior and exterior surfaces.

3-17. CADMIUM PLATING

Selective brush cadmium plating shall be in accordance with MIL-STD-865.

CAUTION

BELL HELICOPTER TEXTRON DOES NOT AUTHORIZE CADMIUM PLATING OF STRUCTURAL PARTS IN THE FIELD USING ELECTRO DEPOSITED OR VACUUM DEPOSITED PROCEDURES.

NOTE

Selective brush cadmium plating is intended to be used for the repair and/or touch up of metal surfaces where existing cadmium plating has been damaged or partially removed.

Bell Helicopter Textron approves the use of LHE brush cadmium plating methods, procedures, and equipment established by:

LDC
Liquid Development Company
3748 East 91st Street
Cleveland, Ohio
U.S.A. 44105
Phone: (216) 641-9366
Toll Free: 1-800-321-9194
Fax: (216) 641-6416
http://www.ldcbrushplate.com

OR

SIFCO Metachemical
Div. of SIFCO Industries Inc.
Cleveland, Ohio 44131.
Phone: (216) 881-8600

3-18. CHROMATE CONVERSION COATING

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-112	Chromate Conversion Coating

NOTE

Chromate conversion coating is used over cadmium plated surfaces.

1. Mix chromate conversion coating (C-112) as follows:

CHROMATE CONVERSION COATING

	MEASUREMENTS
Cadmium Chromate Conversion Coating (C-112)	6-1/2 (191.80 ml)
Nitric Acid (C-432)	2-3/4 oz
and	
Water	1 gal

2. Apply chromate conversion coating (C-112) liberally to the area to be treated. Rinse area thoroughly with clean water or by swabbing with clean cloths wetted with water. Dry with clean dry cloths or dry compressed air.

3. The treatment shall provide an appearance that is smooth, fine grained, adherent, free from blisters, pits, nodules, and burned areas. The color should be bronze iridescent to light brown.

3-19. DELETED

3-20. SOLID FILM LUBRICANT

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-005	Solid Film Lubricant
C-021	Solid Film Lubricant
C-305	Aliphatic Naphtha
C-309	MEK
C-316	Acetone
C-407	Abrasive Pad
C-426	Masking Tape
C-486	Cheesecloth
C-516	Low-lint Cleaning Cloth

1. If the solid film lubricant is partially or completely removed from the part, do the steps that follow:

a. If applicable, remove any solid film lubricant that remains with an abrasive pad (C-407) moistened with acetone (C-316) or MEK (C-309).

b. Clean the area to be coated with a clean cheesecloth (C-486) and aliphatic naphtha (C-305). Dry the part with a clean low-lint cleaning cloth (C-516) before aliphatic naphtha (C-305) evaporates.

c. Cover areas that do not require solid film lubricant with masking tape (C-426).

NOTE

Refer to Table 3-3 for the applicability of solid film lubricants.

e. Spray solid film lubricant (C-005) or solid film lubricant (C-021), as applicable, on the area to be coated to a thickness of 0.0002 to 0.0008 inch (0.005 to 0.020 mm), unless otherwise specified.

NOTE

Let the solid film lubricant dry for 15 minutes before you touch it.

f. Air dry the part for a minimum of 30 minutes.

g. Remove masking tape (C-426) from the part.

NOTE

Refer to Table 3-3 for the different cure temperature and time applicable to solid film lubricants.

h. As applicable, heat cure the solid film lubricant (C-005) or solid film lubricant (C-021).

2. If the solid film lubricant on the part requires a touch-up, do the steps that follow:

NOTE

Only touch-up repairs not exceeding 5% of the coat area are permitted.

a. Clean the area to be repaired with aliphatic naphtha (C-305).

b. Lightly abrade the area with an abrasive pad (C-407).

c. Clean the area again with a clean cheesecloth (C-486) and aliphatic naphtha (C-305). Dry with a clean low-lint cleaning cloth (C-516).

d. Cover areas that do not require solid film lubricant with masking tape (C-426).

e. Spray solid film lubricant (C-021) on the area to be repaired to a thickness of 0.0002 to 0.0008 inch (0.005 to 0.020 mm), unless otherwise specified.

NOTE

Let the solid film lubricant dry for 15 minutes before you touch it.

f. Air dry the part for 12 hours before use.

g. Remove the masking tape (C-426) from the part.

Table 3-3. Solid Film Lubricants — Heat Cure Applicability and Characteristics

SOLID FILM LUBRICANT	MATERIAL	CURE TEMPERATURE	CURE TIME (1)
C-005	Steel (2)	370 to 430°F (187 to 221°C)	60 minutes
	Corrosion Resistant Steel (CRES) (3)		
	Titanium		
	Titanium alloys		
	Plated surfaces (4)		
C-021	Aluminum alloy	135 to 165°F (57 to 75°C)	60 minutes
	Magnesium alloy		
	CRES 440		
	Steel (5)		

NOTES:

(1) Cure time begins when the part reaches the specified temperature.

(2) Except carburized parts or parts containing induction hardened areas.

(3) Except CRES 440.

(4) Unless limited by the base material.

(5) Carburized parts or parts containing induction hardened areas.

3-21. BLACK OXIDE

CAUTION

BLACK OXIDE TREATMENT OF PARTS IS NOT REQUIRED OR AUTHORIZED.

3-22. DELETED

3-23. COPPER PLATING

MATERIALS REQUIRED

Refer to Chapter 13 for specifications.

NUMBER	NOMENCLATURE
C-413	Stripper
C-415	Corrosion Preventive
C-417	Inhibitor
C-431	Hydrochloric (Muriatic) Acid
C-506	Potassium Cyanide
C-507	Sodium Cyanide

NOTE

Copper plating is used to coat indicated areas. This procedure is to be used to remove copper plating and reapply copper plate to the same area.

1. Remove all oils and grease from component.

2. Strip existing copper plating using Metex copper F stripper (C-413) per manufacturers instructions.

3. Rinse part thoroughly with water.

4. Clean part using corrosion preventive (C-415) following manufacturers instructions.

5. Rinse part thoroughly with water.

6. Mask areas that are not to be plated.

CAUTION

ACID PICKLE (HYDROCHLORIC (MURIATIC) ACID (C-431) SOLUTION) WILL REMOVE ANY BLACK OXIDE COATING THAT IS PRESENT. USE SOLUTION ONLY AT ROOM TEMPERATURE AND KEEP FULLY INHIBITED USING RODINE AID PICKLE INHIBITOR (C-417).

IMMERSE CASE HARDENED PARTS A MAXIMUM OF 10 SECONDS.

7. Immerse part in acid pickle solution (40 to 60% Hydrochloric (muriatic) acid (C-431) by volume in water).

8. Rinse part thoroughly in water.

9. Cyanide dip parts to passivate, if required, to hold parts prior to plating. Cyanide dip solution consists of 2 to 6 ounces of potassium cyanide (C-506) or sodium cyanide (C-507) per gallon of water.

10. If part is not going directly to plating bath, wash part thoroughly in clean water.

11. Copper plate part in solution given in Table 3-4. Plating thickness shall be in accordance with dimensions specified in applicable maintenance chapter. Adjust voltage for current densities of 30 to 45 amps per square foot. Rotate part as necessary to eliminate unplated areas under clamps and to ensure a uniform thickness of plating is achieved.

12. Rinse part thoroughly in clean water.

13. Dry part and remove masking tape.

14. Perform embrittlement relief in accordance with instruction contained in appropriate maintenance text.

15. Apply corrosion preventive to part, if required (paragraph 3-2).

Table 3-4. Copper Plating Bath

INGREDIENT AND/OR CONDITIONS	CONTROL RANGE
Ph	12.5 — 13.5
Free Cyanide	1.4 — 2.5 oz/gal
Copper Metal	4.0 — 6.0 oz/gal
Rocheltex	4.0% — 8.0% by vol
Carbonates	9.0 oz/gal maximum
Temperature	140°F to 160°F
Wetting Agent	0.33% by vl maximum
This bath composition may be obtained by dissolving the following materials in water:	
Copper Cyanide	- 8.6 oz/gal
Potassium Cyanide	- 14.1 oz/gal
Potassium Hydroxide	- 1.0 oz/gal
Rocheltex	6.0% by vol
Copper Brightener	- 2.0% by vol
Wetting Agent	- 0.33% by vol
Copper metal concentration may be maintained by using Potassium Copper Cyanide:	
Double Salts or Copper Cyanide.	

3-24. PLASTIC MEDIA BLASTING

Plastic Media Blasting (PMB) is a mechanical method to remove organic finish, fairing compounds and adhesives from helicopter parts and assemblies. The process is done with the use of compressed air to propel a stream of plastic particles at a part to abrade the paint.

PMB can cause damage to helicopter parts if it is done by untrained personnel. PMB can cause warping of skins, roughing of surface finish, removal of corrosion protective inorganic surface treatments, penetration through of thin tapered metal fittings, and close fatigue cracks.

CAUTION

PMB MEDIA AND DUST CAN BLOCK OIL AND AIR PASSAGEWAYS, OR CONTAMINATE BEARINGS, WHICH CAN LEAD TO PREMATURE FAILURE.

1. There are two ways to do PMB:

a. Method 1: Closed cabinet blasting of detail parts and assemblies.

b. Method 2: Open booth blasting of the helicopter exterior or individual panels (metal or composite) that form the exterior of the helicopter.

2. Even if PMB is done by a trained operator, damage to some materials can occur. It is not recommended to use PMB with all types of components or materials.

CAUTION

USE EXTREME CARE WHEN USING PMB ON A GEARBOX CASE. THE GEARBOX CASE CONTAINS CORED AND/OR DRILLED OIL PASSAGES WHICH CAN BE BLOCKED WITH PMB MEDIA.

3. The example that follows gives a list of materials on which PMB method 1 is not recommended:

a. Composite Surface: The resins and adhesive used in composite parts are easily removed as the organic coating by PMB. Excessive resin removal can damage the structural composition of the parts. Resin removal cannot be controlled.

b. Unsupported Skins: Unsupported (not stiffened or non-core bonded) aluminum skins, less than 0.032 inch (0.813 mm) thick can be distorted by PMB. The pummeling effect and the friction heat build-up of PMB cannot be prevented.

c. Clad Aluminum and Cadmium Plated Surfaces: Ductile clad aluminum and cadmium plated surfaces are easily moved and removed by PMB. The clad on aluminum is not repeatable and cadmium plating is restricted to touch-up.

4. The method that follows gives material on which a PMB method 2 is not recommended:

a. Cadmium Plated Surfaces: The cadmium plated surface is easily moved or removed by the PMB.

b. Replacement of the cadmium plating is restricted to touch-up.

3-25. PLASTIC MEDIA BLASTING EQUIPMENT — DESCRIPTION

1. The siphon feed abrasive blasting equipment is not to be used for PMB. Only direct pressure feed abrasive blasting equipment is to be used for PMB. The blasting equipment must have indication and regulation devices to measure and control the blasting pressure.

2. The PMB equipment must have a separation system which is made up of a cyclone separator, a vibrator screen system, and dust bag to remove paint chips, dust, sand, metallic particles etc., produced by the blasting operation.

3. Manufacturers of cabinet and open booth for PMB include, but are not limited to, Paul & Griffin, Clemo, Zeroblast, and Turco.

4. Open booth (Method 2) operator must have the equipment that follows:

a. Breathing Air: A compressor is used to provide breathing air for the operators along with the safety equipment that follows:

b. Breathing Air Filter: A breathing air filter to remove particles, moisture, and vapor. Clemco Industries, Model CPF-80 or equivalent.

c. Carbon Monoxide Monitor: A carbon monoxide monitor, Dynamation Inc., Model ABL-50 or equivalent.

d. Voice Communications: Two radio headsets to permit communication between the blaster and the blast helper.

e. Hearing Protection: All PMB personnel must wear hearing protection.

f. Blast Suit: An "Apollo" helmet with a protection cover suit and gloves.

5. Open booth equipment:

a. Safety Warning Light: A safety light is installed outside the personnel entrance doors and flashes during PMB operation.

b. Booth Door: The booth door opens outward.

c. Ground Cords: The ground cords are used to ground the helicopter or parts that are to be blasted.

d. Emergency Lighting: An integrated emergency lighting system is used in the event of a power failure.

e. Illuminated Exit Sign(s): An illuminated exit sign is used to show the exit(s) location.

f. Ventilation: A minimum cross-draft ventilation rate of 75 cubic feet per minute per square foot (2,12 cubic meters per minute per 926 square centimeters) of open face area.

3-26. PLASTIC MEDIA BLASTING OPERATOR TRAINING

Only PMB operators with a thorough knowledge of helicopter components and the potential for direct and indirect damage are to be considered as PMB operators. The operator must have a working understanding of the PMB operation parameters and have the aptitude for PMB operation. The PMB operator has to be able to remove organic finishes layer by layer.

3-27. MEDIA PARTICLES METHOD 1

1. The media particles that are used in method 1 have to meet the specification MIL-P-85891, Type II. The particles are made of thermoset Urea Formaldehyde that have to be free of moisture.

2. Particle Sizes: 16/20, 20/30, 30/40, and 40/60 may be used. However, a particle size of 20/30 is recommended.

a. Color: Yellow or unspecified color.

b. Hardness: Barcol hardness 54 to 62 (approximately MOH hardness 3.5).

c. Manufacturers: Blast Off Inc., U.S. Technology Corp., Tri-Mech Co.

d. P/N When Ordering Yellow Color Particles: M85891-21-1620, M85891-21-2030, M85891-21-3040, M85891-21-4060.

e. P/N When Ordering Unspecified Color Particles: M85891-26-1620, M85891-26-2030, M85891-26-3040, M85891-26-4060.

3-28. MEDIA PARTICLES METHOD 2

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-318	Cleaning Compound

1. The media particles that are used in method 2 have the specification of MIL-P-85891, Type V. The particles are made from thermoplastic "Acrylic Plastic". The particles must be free of moisture and are not to exceed 200 parts per million of high density particle contamination.

2. Particle Sizes: Only particle size of 20/30 is recommended.

a. Color: White to light grey or unspecified color.

b. Hardness: Barcol hardness 46 to 54 (approximately MOH hardness 3.5).

c. Manufacturers: Blast Off Inc., U.S. Technology Corp., Tri-Mech Co.

d. P/N When Ordering White Color Particles: M85891-55-2030.

e. P/N When Ordering Unspecified Color Particles: M85891-56-2030.

3-29. PMB Procedure — Requirement

1. Observe all of the operation limits given by the equipment manufacturers for cabinet blasting and open booth blasting modes.

2. PMB Method 1 (close cabinet) parameters — Description.

a. Blasting Pressure: Never exceed 40 PSI (276 kPa) of blasting pressure. The normal operating blasting pressure is 20 to 30 PSI (138 and 207 kPa) for most applications. The pressure is to be measured at the nozzle and not from the regulating gauge. To check the nozzle pressure, use a hypodermic needle gauge positioned at a 45 degree angle to the main flow and away from the main flow.

b. Impingement angle: The impingement angle is measured from the horizontal and is between 45 and 60 degrees.

c. Nozzle Distance: The distance between the tip of the nozzle and the part to be blasted should never be closer than 4 inches (10.2 cm).

d. Dwell Time: Never let the nozzle stay in a localized area for more than one second. It is recommended to make several passes over the area to be stripped rather than to let the nozzle stay in a localized area.

e. Flow Rate: The flow rate is between 140 and 170 Pounds per hour (63.6 and 77.2 kilograms per hour).

3-30. PMB Method 1 Procedures

1. Clean the component surface with (C-318).

2. Remove the organic finish from the necessary areas with a regular rate of stroke.

3. Do not blast directly into the bond lines because the adhesive will be removed.

4. The best method to remove organic finishes is to use a combination of low blast pressure, a low impingement angle, and the longest nozzle distance.

5. Do not increase the rate of production with an increase of the blast pressure and an increase of the impingement angle.

6. If the production rate must be increased, it is safer to increase the blast pressure and increase the zozzle distance.

3-31. PMB METHOD 2 (OPEN BOOTH) PROCEDURES

For the method 2 procedures refer to table 3-5.

Table 3-5. PMB Method 2 Parameters — Description

MATERIAL THICKNESS (INCH)	SUPPORTED/ UNSUPPORTED NOTE (1)	AIR PRESSURE (PSI) NOTE (2)	MEDIA FLOW RATE (LBS/HR) NOTE (3)	STANDOFF DISTANCE (INCHES)	IMPINGEMENT ANGLE (DEGREES)	CLAD/ NONCLAD	DWELL TIME (SECONDS)
			METAL				
0.16 - 0.31	Supported/ Unsupported	30 ±2 30 ±2	450 - 480 450 - 480	18 - 24 18 - 24	15 - 30 <16	either	<1
0.32 - 0.63	Supported/ Unsupported Note (1)	30 ±2 30 ±2	450 - 480 450 - 480	18 - 24 18 - 24	15 - 30 15 - 30	either	<1
0.64 - and more	Supported/ Unsupported	30 ±2 30 ±2	450 - 480 450 - 480	18 - 24 18 - 24	60 - 80 45 - 60	either	<1
			COMPOSITES				
All	either	18 - 20	450 - 480	24 - 30	16	N/A	<1

NOTES:

1. Unsupported - no backing structure to the surface being treated.
2. Air pressure reading taken at a 45 degree angle from the linear flow of the media.
3. All parameters based on a nozzle diameter of 0.050 inch.

3-32. PREPARATION OF THE HELICOPTER FOR PMB

MATERIALS REQUIRED

Refer to chapter 13 for specification and source.

NUMBER	NOMENCLATURE
C-318	Cleaning Compound

1. Clean the helicopter exterior or individual panel with cleaning compound (C-318) and a high pressure cleaning machine.

2. Remove, open or protect all the cowlings, doors, avionic equipment, fuel or oil lines, and the fuel cells.

3. Install tape on the doors, the cowlings, and template closures where required.

CAUTION

TO AVOID SEVERE BURNS, WEAR PROTECTIVE GLOVES WHEN YOU USE A HOT GLUE (MOLTEN PLASTIC) GUN.

4. Seal all seam covers and access panel gaps of 3/16 inch (187 mm) or less with a bead of hot glue.

CAUTION

MAKE SURE YOU COVER ALL TRANSPARENT PLASTIC SURFACES BEFORE YOU BEGIN PMB.

5. Install form fitting cover on all glass and transparent plastic surfaces. Mask the transparent edges with tape.

6. Mask or plug all open ports of the helicopter.

7. Mask all areas like driveshafts, bearings, and actuator linkages that will not be stripped.

6. To measure the flow rate, blast the media into a container for one minute and weigh the media. Refer

8. Mask all cadmium plated or conversion coated hardware that will not be replaced after the PMB operation.

3-33. PMB MAPPING PROCEDURE

1. The mapping technique gives the PMB operator information that lets him know what pressure, nozzle distance, and impingement angle to use when removing paint from different skin thicknesses on the helicopter. This technique reduces the possible damage to the different skins during the PMB operation.

a. Make a chart that shows the different skin thicknesses and material compositions of the exterior of the helicopter.

b. Give a specific color for each skin thickness category. Refer to table 3-5.

c. Give a specific color for the composite material.

NOTE

You can use chalk instead of paint to outline the areas. Write on the skin the type of material and the thickness.

2. Spray the outline of each skin thickness and material with the corresponding color on the chart.

3-34. ORGANIC COAT REMOVAL PROCEDURE

1. Put clean and masked part in PMB booth.

2. Ensure the PMB equipment and helicopter are grounded.

3. Ensure the PMB operator wears the proper safety equipment.

4. Measure the media flow pressure at the nozzle with a hypodermic needle gauge and make sure the reading is in the parameters of table 3-5.

5. Measure the flow rate if new media is added or media type has been changed.

to table 3-5 for the media flow rate parameters.

7. Remove the organic coat from the part and use the parameters in table 3-5 in the sequence that follows:

a. Supported aluminum honeycomb.

b. Unsupported skin panels - strip by thickness categories of table 3-5. Strip the panels in thin to thick order.

c. Composite panels.

3-35. PMB CLEAN-UP OPERATION

1. Remove all plastic media and media that remains (with heavy duty wet/dry vacuum cleaner) on the helicopter/individual panel.

2. Remove all the masking material from the masked parts.

3. Examine all the masked areas for media that remains in gaps. Remove the media with an heavy duty wet/dry vacuum cleaner.