## SECTION 7. BASIC CORROSION REMOVAL TECHNIQUES

**6-113. GENERAL.** When active corrosion is found, a positive inspection and rework program is necessary to prevent any further deterioration. The following methods of assessing corrosion damage and procedures for rework of corroded areas could be used during cleanup programs. In general, any rework would involve the cleaning and stripping of all finish from the corroded area, removal of corrosion products, and restoration of surface protective film.

**a. Repair of corrosion damage** includes removal of all corrosion and corrosion products. When the corrosion damage is severe and exceeds the damage limits set by the aircraft or parts manufacturer, the part must be replaced.

**b. If manufacturer information** and limits are not available, then a DER must be consulted before the aircraft or part is returned to service.

**6-114. PREPARATIONS FOR REWORK.** All corrosion products should be removed completely when corroded structures are reworked. Before starting rework of corroded areas, carry out the following:

**a. Document** corrosion damage**.**

**b. Position the aircraft** in a wash rack or provide washing apparatus for rapid rinsing of all surfaces.

**c. Connect a static ground line** from the aircraft to a grounding point.

**d. Prepare the aircraft** for safe ground maintenance.

**(1)** Remove battery(s), liquid oxygen generator container (if installed), and external hydraulic and electric power.

**(2)** Install all applicable safety pins, flags, and jury struts.

**e. Protect** the pitot-static ports, louvers, airscoops, engine opening, wheels, tires, magnesium skin panels, and airplane interior from moisture and chemical brightening agents.

**f. Protect** the surfaces adjacent to rework areas from chemical paint strippers, corrosion removal agents, and surface treatment materials.

**6-115. FAIRING OR BLENDING REWORKED AREAS.** All depressions resulting from corrosion rework should be faired or blended with the surrounding surface. Fairing can be accomplished as follows:

**a. Remove rough edges** and all corrosion from the damaged area. All dish-outs should be elliptically shaped with the major axis running spanwise on wings and horizontal stabilizers, longitudinally on fuselages, and vertically on vertical stabilizers. (Select the proper abrasive for fairing operations from table 6-1.)

**b. In critical and highly stressed areas,** all pits remaining after the removal of corrosion products should be blended out to prevent stress risers that may cause stress corrosion cracking. (See figure 6-14.) On a non-critical structure, it is not necessary to blend out pits remaining after removal of corrosion products by abrasive blasting, since this results in unnecessary metal removal.

**TABLE 6-1.** Abrasives for corrosion removal.

| METALS OR MATERIALS TO BE PROCESSED | RESTRICTIONS | OPERATION | ABRASIVE PAPER OR CLOTH | | | ABRASIVE FABRIC OR PAD | ALUMINUM | STAINLESS STEEL | PUMICE 350 MESH OR FINER | ABRASIVE WHEEL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ALUMINUM OXIDE | SILICON CARBIDE | GARNET | | | | | |
| FERROUS ALLOYS | | CORROSION REMOVAL OR FAIRING | 150 GRIT OR FINER | 180 GRIT OR FINER | | FINE TO ULTRA FINE | X | X | X | X |
| | | FINISHING | 400 | | | | X | X | X | |
| ALUMINUM ALLOYS EXCEPT CLAD ALUMINUM | DO NOT USE SILICON CARBIDE ABRASIVE | CORROSION REMOVAL OR FAIRING | 150 GRIT OR FINER | | 7/0 GRIT OR FINER | VERY FINE AND ULTRA FINE | X | | X | X |
| | | FINISHING | 400 | | | | X | | X | |
| CLAD ALUMINUM | SANDING LIMITED TO THE REMOVAL OF MINOR SCRATCHES | CORROSION REMOVAL OR FAIRING | 240 GRIT OR FINER | | 7/0 GRIT OR FINER | VERY FINE AND ULTRA FINE | | | X | X |
| | | FINISHING | 400 | | | | | | X | |
| MAGNESIUM ALLOYS | | CORROSION REMOVAL OR FAIRING | 240 GRIT OR FINER | | | VERY FINE AND ULTRA FINE | X | | X | X |
| | | FINISHING | 400 | | | | X | | X | |
| TITANIUM | | CLEANING AND FINISHING | 150 GRIT OR FINER | 180 GRIT OR FINER | | | | X | X | X |

**c. Rework** depressions by forming smoothly blended dish-outs, using a ratio of 20:1, length to depth. (See figure 6-15.) In areas having closely spaced multiple pits, intervening material should be removed to minimize surface irregularity or waviness. (See figure 6-16.) Steel nut-plates and steel fasteners should be removed before blending corrosion out of aluminum structure. Steel or copper particles embedded in aluminum can become a point of future corrosion. All corrosion products must be removed during blending to prevent reoccurrence of corrosion.

**6-116. CORROSION REMOVAL BY BLASTING.** Abrasive blasting is a process for cleaning or finishing ferrous metals by directing a stream of abrasive particles against the surface of the parts. Abrasive blasting is used for the removal of rust and corrosion and for cleaning prior to painting or plating. The following standard blast-cleaning practices should be adopted.

**a. The part to be blast-cleaned** should be removed from the aircraft, if possible. Otherwise, areas adjacent to the part should be masked or protected from abrasive impingement and system (hydraulic, oil, fuel, etc.) contamination.

**b. Parts should be dry and clean** of oil, grease, or dirt, prior to blast cleaning.

**c. Close-tolerance surfaces,** such as bushings and bearing shafts, should be masked.

**d. Blast-clean** only enough to remove corrosion coating. Proceed immediately with surface treatments as required.

**6-117. CLEANERS, POLISHES, AND BRIGHTENERS.** It is important that aircraft be kept thoroughly clean of contaminating deposits such as oil, grease, dirt, and other foreign materials.

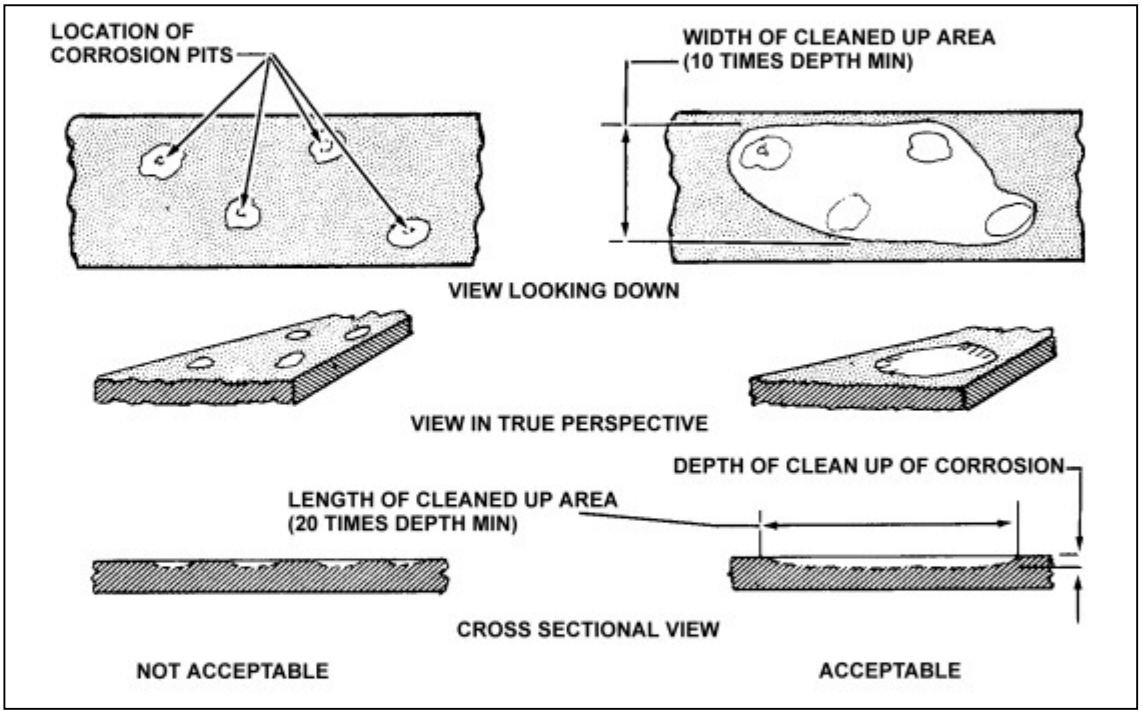


**FIGURE 6-14.** Typical example of acceptable cleanup of corrosion pits.

**a. Materials.** Do not use harmful cleaning, polishing, brightening, or paint-removing materials. Use only those compounds that conform to existing government or established industry specifications or that have been specifically recommended by the aircraft manufacturer. Observe the product manufacturer's recommendations concerning use.

**b. Chemical Cleaners.** Chemicals must be used with great care in cleaning assembled aircraft. The danger of entrapping corrosive materials in faying surfaces and crevices counteracts any advantages in their speed and effectiveness. Use materials that are relatively neutral and easy to remove.

**c. Removal of spilled battery acid.** The battery, battery cover, battery box and adjacent areas will be corroded if battery acid spills onto them. To clean spilled battery acid, brush off any salt residue and sponge the area with fresh water. For lead-acid batteries, sponge the area with a solution of 6 ounces of sodium bicarbonate (baking soda) per gallon of fresh water. Apply generously until bubbling stops and let solution stay on the area for 5 to 6 minutes, but do not allow it to dry. For nickel-cadmium batteries, sponge the area with a solution of 6 ounces of monobasic sodium phosphate per gallon of fresh water. Sponge area again with clean fresh water and dry surface with compressed air or clean wiping cloths.

**6-118. STANDARD METHODS.** Several standard mechanical and chemical methods are available for corrosion removal. Mechanical methods include hand sanding using abrasive mat, abrasive paper, or metal wool; and powered mechanical sanding, grinding, and buffing, using abrasive mat, grinding wheels, sanding discs, and abrasive rubber mats. The method used depends upon the metal and degree of corrosion. The removal method to use on each metal for each particular degree of corrosion is outlined in the following section.

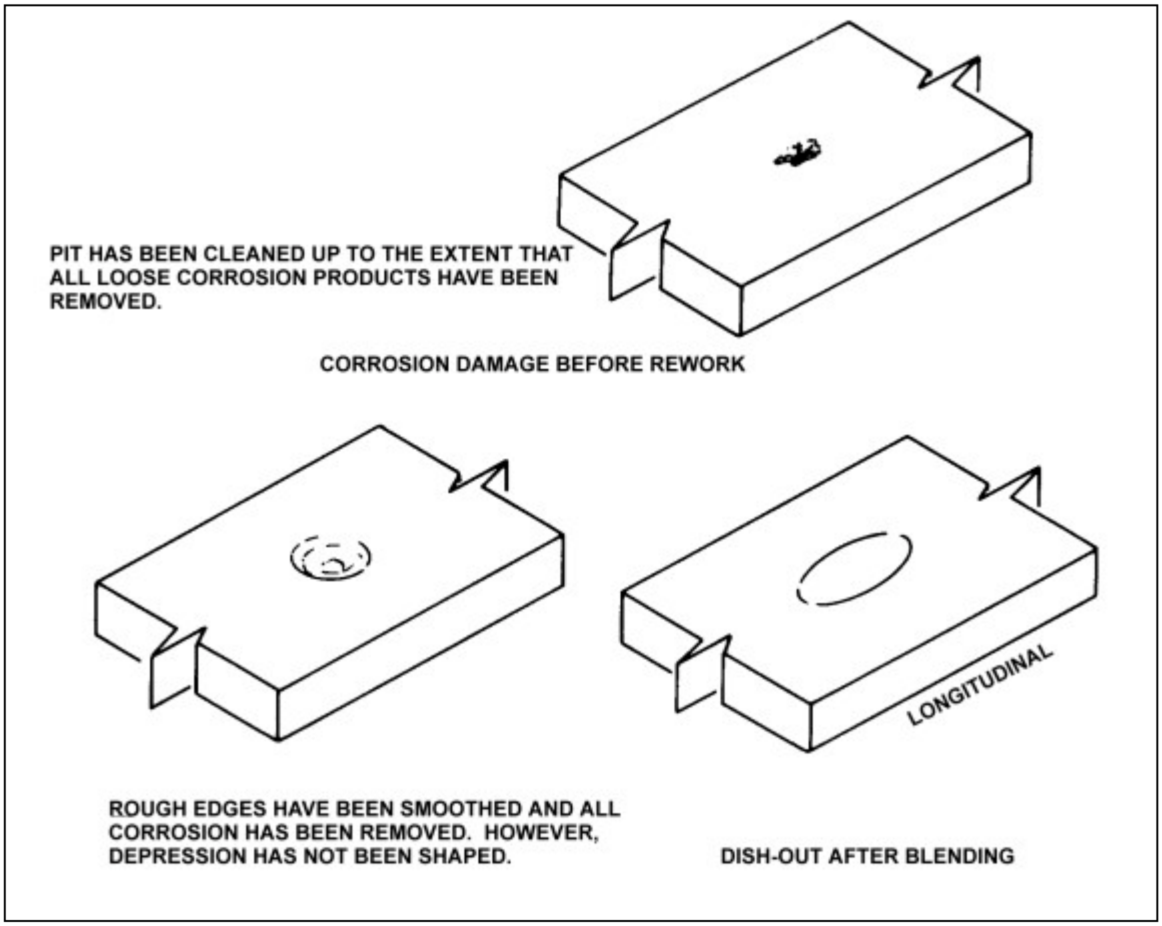


**FIGURE 6-15.** Blendout of corrosion as a single depression.

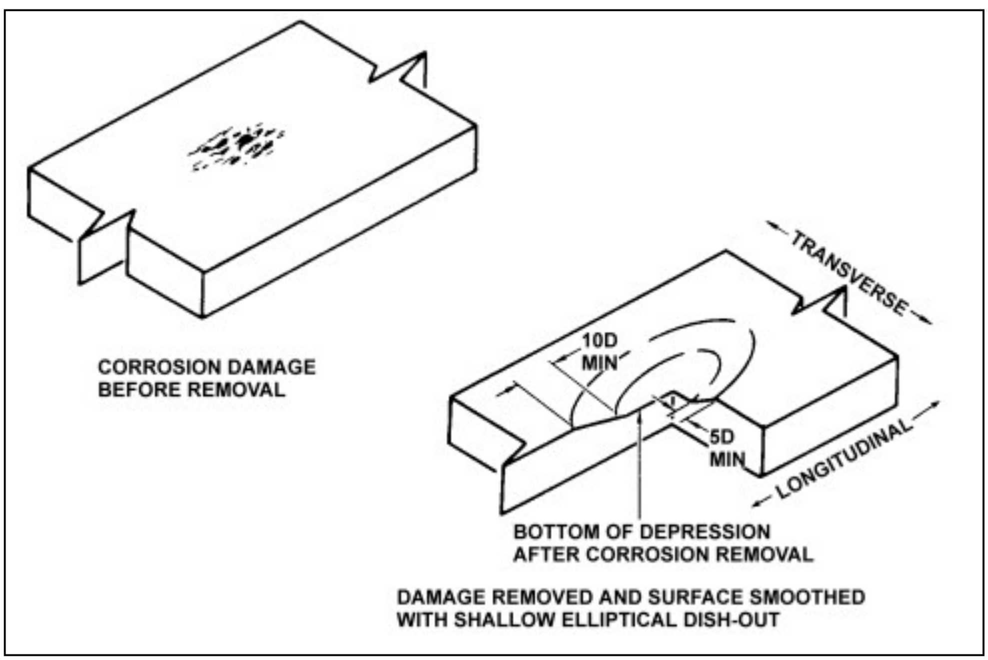


**FIGURE 6-16.** Blendout of multiple pits in a corroded area.

## 6-119.—6-131. [RESERVED.]

## SECTION 8. ALUMINUM AND ALUMINUM ALLOYS

**6-132. GENERAL**. Aluminum and aluminum alloys are the most widely used material for aircraft construction. Aluminum appears high in the electro-chemical series of elements and corrodes very easily. However, the formation of a tightly-adhering oxide film offers increased resistance under most corrosive conditions. Most metals in contact with aluminum form couples that undergo galvanic corrosion attack. The alloys of aluminum are subject to pitting, intergranular corrosion and intergranular stress corrosion cracking. In some cases the corrosion products of metal in contact with aluminum are corrosive to aluminum. Therefore, aluminum and its alloys must be cleaned and protected.

**6-133. SPECIAL TREATMENT OF ANODIZED SURFACES.** Anodizing is the most common surface treatment of aluminum alloy surfaces. The aluminum sheet or casting is made the positive pole in an electrolyte bath in which chromic acid or other oxidizing agents produce a supplemental protective oxide film on the aluminum surface. The anodized surface coating offers the alloy a great deal of protection as long as it is not damaged. Once the film is damaged, it can only be partially restored by chemical surface treatment. Therefore exercise care to avoid breaking of the protective film, particularly at the edges of the sheet.

**6-134. REPAIR OF ALUMINUM ALLOY SHEET METAL**. After extensive corrosion removal the following procedures should be followed:

**a. If water can be trapped** in blended areas, chemical conversion coat in accordance with MIL-C-81706 and fill the blended area with structural adhesive or sealant to the same level and contour as the original skin. When areas are small enough that structural strength has not been significantly decreased, no other work is required prior to applying the protective finish.

**b. When corrosion removal** exceeds the limits of the structural repair manual, contact a DER or the aircraft manufacturer for repair instructions.

**c. Where exterior doublers** are installed, it is necessary to seal and insulate them adequately to prevent further corrosion.

**d. Doublers** should be made from alclad, when available, and the sheet should be anodized (preferred) or a chemical conversion coat applied after all cutting, drilling, and countersinking has been accomplished.

**e. All rivet holes** should be drilled, countersunk, surface treated, and primed prior to installation of the doubler.

**f. Apply** a suitable sealing compound in the area to be covered by the doubler. Apply sufficient thickness of sealing compound to fill all voids in the area being repaired.

**g. Install** rivets wet with sealant. Sufficient sealant should be squeezed out into holes so that all fasteners, as well as all edges of the repair plate, will be sealed against moisture.

**h. Remove** all excess sealant after fasteners are installed. Apply a fillet sealant bead around the edge of the repair. After the sealant has cured apply the protective paint finish to the reworked area.

**6-135. CORROSION REMOVAL AROUND COUNTERSUNK FASTENERS IN ALUMINUM ALLOY.** Intergranular corrosion in aluminum alloys often originates at countersunk areas where steel fasteners are used.

**a. When corrosion is found** around a fixed fastener head, the fastener must be removed to ensure corrosion removal. All corrosion must be removed to prevent further corrosion and loss of structural strength. To reduce the recurrence of corrosion, the panel should receive a chemical conversion coating, be primed, and have the fasteners installed wet with sealant.

**b. Each time** removable steel fasteners are removed from access panels, they should be inspected for condition of the plating. If mechanical or plating damage is evident, replace the fastener. One of the following fastener installation methods should be used:

**(1)** Brush a corrosion-preventive compound on the substructure around and in the fastener hole, start the fastener, apply a bead of sealant to the fastener countersink, set and torque the fastener within the working time of the sealant (this is the preferred method).

**(2)** Apply the corrosion preventive compound to the substructure and fastener, set and torque the fastener.

**(3)** Apply a coating of primer to the fastener, and while wet with primer, set and torque the fastener.

**6-136. EXAMPLES OF REMOVING CORROSION FROM ALUMINUM AND ALUMINUM ALLOYS.**

**a. Positively** identify the metal as aluminum.

**b. Clean** the area to be reworked. Strip paint if required.

**c. Determine** extent of corrosion damage.

**d. Remove** light to moderate corrosion with one of the following.

**(1)** Non-Powered Corrosion Removal.

**(a)** The removal of corrosion products by hand can be accomplished by use of aluminum grit and silicon carbide abrasive, such as non-woven, non-metallic, abrasive mat (Spec. MIL-A-9962), abrasive cloth, and paper. Aluminum wool, fiber bristle brushes, and pumice powder are also acceptable methods.

**(b)** Stainless steel brush (Spec. H-B-178, type III, class 2) may be used as long as the bristles do not exceed 0.010 inch in diameter. After use of this brush the surface should be polished with 60 grit aluminum oxide abrasive paper, then with 400 grit aluminum oxide paper. Care should be exercised in any cleaning process to avoid breaking the protective film.

**(c)** Steel wool, emery cloth, steel wire brushes (except stainless steel brush) copper alloy brushes, rotary wire brushes, or severe abrasive materials should not be used on any aluminum surface.

**(2)** Chemical Corrosion Removal.

**(a)** The corrosion removal compound aluminum pretreatment MIL-C-38334, an acid material, may be used to remove corrosion products from aluminum alloy materials or items (e.g., skins, stringer, ribs in wings, tubing, or ducts). MIL-C-38334 is available in two types:

*1* Type I Liquid concentrate materials should be diluted in accordance with the manufacture's instructions before use. Type I has a 1 year shelf life; therefore it shall not be used after 1 year from the date of manufacture.

*2* Type II Powdered concentrate materials should be dissolved in the volume of water specified on the kit. These materials have an indefinite shelf life in the dry state. Once mixed, they should be used within 90 days.

**(b)** Mix MIL-C-38334 in wood, plastic, or plastic-lined containers only. Wear acid-resistant gloves, protective mask and protective clothing when working with this acid compound. If acid contacts the skin or eyes, flush immediately with water.

**(c)** Apply MIL-C-38334 solution by flowing, mopping, sponging, brushing, or wiping. When applying the solution to large areas, begin the application at the lowest area and work upward, applying the solution with a circular motion to disturb the surface film and ensure proper coverage. If pumping is required, pumps, valves, and fittings should be manufactured from 18-8 stainless steel or plastic.

**CAUTION: When working with MIL-C-38334, keep the solution away from magnesium surfaces. The solution must be confined to the area being treated. All parts and assemblies including cadmium-plated items and hinges susceptible to damage from acid should be masked and/or protected. Also mask all openings leading to the primary structure that could trap the solution and doors or other openings that would allow the solution (uncontrolled) to get into the aircraft or equipment interior. It is a good practice to keep a wet rag on hand at all times, for removal of spills or splashes.**

**(d)** Allow the solution to remain on the surface for approximately 12 minutes and then rinse away with clean tap water. For pitted or heavily-corroded areas the compound will be more effective if applied warm (140 °F) followed by vigorous agitation with a non-metallic acid-resisting brush or aluminum oxide abrasive nylon mat. Allow sufficient dwell time, 12 to 15 minutes, before rinsing. After each application examine the pits and/or corroded area to determine if another application is required with a 4 to 10 power magnifying glass. (Select the power depending on the distance available to make the inspection.) Corrosion still on the area will appear as a powdery crust slightly different in color than the uncorroded base metal. Darkening of area due to shadows and reaction from the acid remover should not be considered.

**(e)** Once the corrosion has been removed and the area well-rinsed with clean water, a chromate conversion coating such as MIL-C-81706 or MIL-C-5541 alodine 1200, must be applied immediately thereafter.

**e. Remove** moderate to heavy corrosion with one of the following.

**(1)** Powered Corrosion Removal.

**(a)** Where the problem is severe enough to warrant the use of power tools, a pneumatic drill motor driving either an aluminum-oxide-impregnated nylon abrasive wheel, flap brush or rubber grinding wheel may be used with an abrasive value to approximately 120 grit, as needed. Corrosion-removal accessories, such as flap brushes or rotary files, should be used on one type of metal only. For example, a flap brush used to remove aluminum should not be used to remove magnesium, steel, etc. Pneumatic sanders may be used with disk and paper acceptable for use on aluminum.

**(b)** When mechanically removing corrosion from aluminum, especially aircraft skin thinner than 0.0625 inch, extreme care must be used. Vigorous, heavy, continuous abrasive grinding can generate enough heat to cause metallurgical change. If heat damage is suspected, hardness tests or conductivity tests must be accomplished to verify condition of the metal. The use of powered rotary files should be limited to heavy corrosion and should not be used on skin thinner than 0.0625 inch.

**(2)** Blasting.

**(a)** Abrasive blasting may be used on aluminum alloys using glass beads (Spec. MIL-G-9954) sizes 10 to 13, or grain abrasive (Spec. MIL-G-5634) types I and III may be used as an alternate method of removing corrosion from clad and non-clad aluminum alloys. Abrasive blasting should not be used to remove heavy corrosion products. Direct pressure machines should have the nozzle pressure set at 30 to 40 psi for clad aluminum alloys and 40 to 45 psi for non-clad aluminum alloys. Engineering approval should be obtained prior to abrasive blasting metal thinner than 0.0625 inch.

**(b)** When using abrasive blasting on aluminum alloys, do not allow the blast stream to dwell on the same spot longer than 15 seconds. Longer dwell times will cause excessive metal removal. Intergranular exfoliation corrosion is not to be removed by abrasive blasting; however, blasting may be used with powered corrosion removal to determine whether all exfoliation corrosion has been removed.

**f. Inspect the area** for remaining corrosion. Repeat procedure if any corrosion remains.

**NOTE: If corrosion remains after the second attempt, use a stronger method, e.g., chemical to mechanical.**

**g. Using a blend ratio** of 20:1 (length to depth) blend and finish the corrosion rework area with progressively finer abrasive paper until 400-grit paper is used.

**h. Clean** reworked area using dry cleaning solvent. Do not use kerosene or any other petroleum base fuel as a cleaning solvent.

**i. Determine** depth of faired depressions to ensure that rework limits have not been exceeded.

**j. Apply** chemical conversion coating, MIL-C-81706, immediately after reworking. If 48 hours or more have elapsed since the conversion coating was first applied and the primer or final paint system has not yet been applied, then reapply the conversion coating before continuing.

**NOTE: These solutions should not be allowed to come in contact with magnesium or high-strength steels (180,000 psi). Do not permit solutions or materials to contact paint thinner, acetone or other combustible material: FIRE MAY RESULT.**

**k. Apply** paint finish to area.

**6-137.—6-147. [RESERVED.]**

# SECTION 9. MAGNESIUM AND MAGNESIUM ALLOYS

**6-148. GENERAL**. Magnesium and magnesium alloys are the most chemically active of the metals used in aircraft construction and are the most difficult to protect. However, corrosion on magnesium surfaces is probably the easiest to detect in its early stages. Since magnesium corrosion products occupy several times the volume of the original magnesium metal destroyed, initial signs show a lifting of the paint films and white spots on the magnesium surface. These rapidly develop into snow-like mounds or even white whiskers. The prompt and complete correction of the coating failure is imperative if serious structural damage is to be avoided.

**6-149. TREATMENT OF WROUGHT MAGNESIUM SHEETS AND FORGINGS**. Corrosive attack on magnesium skins will usually occur around the edges of skin panels, underneath hold-down washers, or in areas physically damaged by shearing, drilling, abrasion, or impact. Entrapment of moisture under and behind skin crevices is frequently a contributing factor. If the skin section can be easily removed, this should be accomplished to ensure complete inhibition and treatment.

**a. Complete mechanical removal** of corrosion products should be practiced when practical. Mechanical cleaning should normally be limited to the use of stiff bristle brushes and similar nonmetallic cleaning tools.

**b. Any entrapment of steel particles** from steel wire brushes, steel tools, or contamination of treated surfaces, or dirty abrasives, can cause more trouble than the initial corrosive attack. The following procedural summary is recommended for treatment of corroded magnesium areas when accomplished under most field conditions.

**c. When aluminum insulating** washers are used and they no longer fasten tightly to magnesium panels, corrosion is likely to occur under the washers if corrective measures are not taken.

**(1)** When machine screw fasteners are used, aluminum insulating washers must be removed from all locations to surface treat the magnesium panel.

**(2)** Where permanent fasteners other than machine screws are used, the insulating washer and fastener must be removed.

**(3)** When located so water can be trapped in the counter-bored area where the washer was located, use sealants to fill the counterbore. If necessary, fill several areas adjacent to each other. It may be advantageous to cover the entire row of fasteners with a strip of sealant.

**6-150. REPAIR OF MAGNESIUM SHEET METAL AFTER EXTENSIVE CORROSION REMOVAL**. The same general instructions apply when making repairs in magnesium as in aluminum alloy skin, except that two coats of epoxy primer may be required on both the doubler and skin being patched instead of one. Where it is difficult to form magnesium alloys in the contour, aluminum alloy may be utilized. When this is done, it is necessary to ensure effective dissimilar metal insulation. Vinyl tape will ensure positive separation of dissimilar metals, but edges will still have to be sealed to prevent entrance of moisture between mating surfaces at all points where repairs are made. It is recommended that only non-corrosive type sealant be used, since it serves a dual purpose of material separation and sealing.

**6-151. IN-PLACE TREATMENT OF MAGNESIUM CASTINGS**. Magnesium castings, in general, are more porous and more prone to penetrating attack than wrought magnesium skin. However, treatment in the field is, for all practical purposes, the same for all magnesium. Bellcranks, fittings, and numerous covers, plates, and handles may also be magnesium castings. When attack occurs on a casting, the earliest practical treatment is required to prevent dangerous corrosive penetration. Engine cases in salt water can develop moth holes and complete penetration overnight.

**a. If at all practical**, faying surfaces involved shall be separated to treat the existing attack effectively and prevent its further progress. The same general treatment sequence as detailed for magnesium skin should be followed. Where engine cases are concerned, baked enamel overcoats are usually involved rather than other top coat finishes. A good air drying enamel can be used to restore protection.

**b. If extensive removal** of corrosion products from a structural casting is involved, a decision from the aircraft manufacturer or a DER may be necessary to evaluate the adequacy of structural strength remaining. Refer to the aircraft manufacturer if any questions of safety are involved.

**6-152. EXAMPLE OF REMOVING CORROSION FROM MAGNESIUM**. If possible, corroded magnesium parts shall be removed from aircraft. When impossible to remove the part, the following procedure will be used.

**a. Positively** identify metal as magnesium.

**b. Clean** area to be reworked.

**c. Strip** paint if required.

**d. Determine** the extent of corrosion damage.

**e. Remove** light to moderate corrosion by one of the following means.

**(1)** Non-Powered Corrosion Removal.

**(a)** Non-powered removal can be accomplished using abrasive mats, cloth, and paper with aluminum oxide grit (do not use silicon carbide abrasive). Metallic wools and hand brushes compatible with magnesium such as stainless steel and aluminum, may be used.

**(b)** When a brush is used the bristles should not exceed 0.010 inch in diameter. After using a brush, the surface should be polished with 400 grit aluminum oxide abrasive paper, then with 600 grit aluminum oxide abrasive paper.

**(c)** Pumice powder may be used to remove stains or to remove corrosion on thin metal surfaces where minimum metal removal is allowed.

**(2)** Chemical Corrosion Removal.

**(a)** Chemical corrosion removal on magnesium alloys is usually done with a chromic acid pickle solution. Chemical corrosion removal methods are not considered adequate for areas that have:

***1*** Deep pitting,

***2*** Heavy corrosion and corrosion by products,

***3*** Previously had corrosion removed by mechanical means, or

***4*** Previously been sand blasted.

**(b)** Do not use this method for parts containing copper and steel-based inserts (unless the inserts are masked off) and where it might come into contact with adhesive bonded skins or parts.

**(3)** The following solution may be used to remove surface oxidation and light corrosion products from magnesium surfaces.

**(a)** Solution Composition and Operation:

*1* Chromium Trioxide. 24 oz.

*2* (O-C-303, Type II). Water to Make 1 gal. Reaction Time 1 to 15 min.

*3* Operation Temperature. (Solution can be operated at room temperature for a longer reaction time if desired.) 190 to 202 °F.

*4* Container Construction. Lead-lined steel, stainless steel, or 1100 aluminum.

**(b)** Mask off nearby operating mechanisms, cracks and plated steel to keep the solution from attacking them.

**(c)** Apply chromic acid solution carefully to the corroded area with an acid-resistant brush.

**(d)** Allow the solution to remain on the surface for approximately 15 minutes. Agitation may be required.

**(e)** Thoroughly rinse the solution from the surface with plenty of clean water.

**(f)** Repeat the preceding sequence as necessary until all corrosion products have been removed and the metal is a bright metallic color.

**f. Remove** moderate to heavy corrosion by one of the following means.

**(1)** Powered Corrosion Removal.

**(a)** Powered corrosion removal can be accomplished using pneumatic drill motor with either an aluminum-oxide-impregnated abrasive wheel, flap brush, or rubber grinding wheel with an abrasive value to approximately 120 grain size.

**(b)** Also a rotary file with fine flutes can be used for severe or heavy corrosion product buildup on metals thicker than 0.0625 inch. If a flap brush or rotary file is used, it should only be used on one type of metal. Do not use either a hand or rotary carbon steel brush on magnesium.

**(c)** Pneumatic sanders are acceptable if used with disk or paper of aluminum oxide. When using sanders, use extra care to avoid over heating aircraft skins thinner than 0.0625 inch.

**(d)** Do not use rotary wire brushes on magnesium.

**WARNING: Cuttings and small shavings from magnesium can ignite easily and are an extreme fire hazard. Fires of this metal must be extinguished with absolutely dry talc, calcium carbonate, sand, or graphite by applying the powder to a depth of 1/2 inch over the metal.**

**(2)** Blasting. Abrasive blasting is an approved method of corrosion removal on magnesium alloys of a thickness greater than 0.0625 inch. Remove heavy corrosion products by hand brushing with a stainless steel or fiber brush followed by vacuum abrasive blasting with glass beads, (Spec. MIL-G-9954) sizes 10-13; or grain abrasive (Spec. MIL-G-5634), types I or III at an air pressure of 10 to 35 psi (if suction equipment is used, use a 50 percent higher pressure). Upon completion of blasting, inspect for the presence of corrosion in the blast area. Give particular attention to areas where pitting has progressed into intergranular attack. This is necessary because abrasive blasting has a tendency to close up streaks of intergranular corrosion rather than remove them if the operator uses an improper impingement angle. If the corrosion has not been removed in a total blasting time of 60 seconds on any one specific area, other mechanical methods of removal should be utilized.

**CAUTION: When blasting magnesium alloys, do not allow the blast stream to dwell on the same spot longer than 15 seconds. Longer dwell times will cause excessive metal removal.**

**g. Inspect** the reworked area to ensure that no corrosion products remain. If corrosion products are found, repeat method used and re-inspect.

**h. Fair depressions** resulting from rework using a blend ratio of 20:1. Clean rework area using 240 grit abrasive paper. Smooth with 300 grit and finally polish with 400 grit abrasive paper.

**i. Determine** depth of faired depressions to ensure that rework limits have not been exceeded. Refer to the manufacture's specifications.

**j. Clean** reworked area using a solvent to provide a water-break-free surface. Do not use kerosene or another petroleum base fuel as a cleaning solvent.

**k. Apply** Chromic Acid Brush-on Pretreatment.

**(1)** Chemical pretreatment such as the following chromic acid solution (Conversion coat conforming to Spec. MIL-M-3171, type VI) provides a passive surface layer with an inhibitive characteristic that resists corrosive attack and also provides a bond for subsequent coatings. Properly-applied magnesium pretreatment tend to neutralize corrosion media in contact with the surface.

**(2)** The chromic acid brush-on pretreatment may be applied to all magnesium parts that require touch-up. This treatment is generally used in refinishing procedures or when parts and assemblies are too large to be immersed. This treatment is less critical to apply than the other brush-on treatments. It is relatively inexpensive and not as harmful when trapped in faying surfaces.

**(a)** Solution Composition and Operation:

***1*** Distilled Water 1 gal.

***2*** Chromic Acid ($CrO_3$) 1.3 oz.

***3*** (99.5 pure), Calcium Sulfate 1 oz. ($CaSo_4.2H_2O$)

***4*** Operating Temp. 70-90 °F.

***5*** Container: Stainless Steel, Aluminum, Vinyl, Polyethylene, or Rubber.

**NOTE: Good application requires proper preparation of the chromic acid coating solution and cleaning of the surface where the solution will be applied. A water-break test is recommended if the cleanliness of the surface is in doubt.**

**(b)** Add chemicals to water in the order shown.

**(c)** Stir vigorously for at least 15 minutes, either mechanically or by air agitation, to ensure that the solution is saturated with calcium sulfate. (Let solution stand for 15 minutes before decanting.)

**(d)** Prior to use, decant solution (avoid transfer of undissolved calcium sulfate) into suitable containers (polyethylene or glass).

**(e)** Apply solution by brush, swab, or flow on using low-pressure spray (non-atomizing) until the metal surface becomes a dull color (the color can vary from green-brown, brassy, yellow-brown to dark-brown). For good paint adhesion, a dark-brown color free of powder is considered best. The color may vary in using different vendors' materials.

**NOTE: Too long an exposure to the brush-on solution produces coatings that will powder and impair adhesion of applied paint finish/films.**

**(f)** Observe the coating closely during the treatment for color changes, rinsed with cold running water when the desired condition/color is reached and air dried. Preparation and use of test panels made of the same material and under the same conditions, before starting the actual treating operation may be used as to determine the application time required to produce the required coating. A good coating is uniform in color/density, adheres well and is free of loose powder.

**l. Apply** primer and top coat finish

**m. Remove** masking and protective coverings.

**6-153.—6-163. [RESERVED.]**

## SECTION 10. FERROUS METALS

**6-164. GENERAL**. One of the most familiar kinds of corrosion is red iron rust. Red iron rust results from atmospheric oxidation of steel surfaces. Some metal oxides protect the underlying base metal, but red rust is not a protective coating. Its presence actually promotes additional attack by attracting moisture from the air and acts as a catalyst to promote additional corrosion.

**a. Red rust** first shows on bolt heads, hold down nuts, and other unprotected aircraft hardware. Red rust will often occur under nameplates that are secured to steel parts. Its presence in these areas is generally not dangerous. It has no immediate effect on the structural strength of any major components. However, it shows a general lack of maintenance and may indicate attack in more critical areas.

**b. When paint failures occur** or mechanical damage exposes highly-stressed steel surfaces to the atmosphere, even the smallest amount of rusting is potentially dangerous and should be removed immediately.

**6-165. SPECIAL TREATMENT OF HIGH-STRENGTH STEEL**. (High-strength steels heat treated above Rockwell C40, 180,000 psi tensile strength). Any corrosion on the surface of a highly-stressed steel part is potentially dangerous, and the careful removal of corrosion products is mandatory. Surface scratches or change in surface structure from overheating can cause sudden failure of these parts. The removal of corrosion products is required and will be performed carefully and completely.

**a. Acceptable methods** include careful use of mild abrasive mats, cloths, and papers, such as fine grit aluminum oxide, metallic wool, or fine buffing compounds.

**b. Undesirable methods** include the use of any power tool because the danger of local overheating and the formation of notches that could lead to failure. The use of chemical corrosion removers is prohibited, without engineering authorization, because high-strength steel parts are subject to hydrogen embrittlement.

**6-166. SPECIAL TREATMENT OF STAINLESS STEEL**. Stainless steels are of two general types: magnetic and nonmagnetic.

**a. Magnetic steels** are of the ferritic or martensitic types and are identified by numbers in the 400-series. Corrosion often occurs on 400-series stainless steels and treatment is the same as specified in high-strength steels. (See paragraph 6-165.)

**b. Non-magnetic stainless steels** are of the austenitic type and are identified by numbers in the 300-series. They are much more corrosion resistant than the 400-series steels, particularly in a marine environment.

**(1)** Austenitic steels develop corrosion resistance by an oxide film, which should not be removed even though the surface is discolored. The original oxide film is normally formed at time of fabrication by passivation. If this film is broken accidentally or by abrasion, it may not restore itself without repassivation.

**(2)** If any deterioration or corrosion does occur on austenitic steels, and the structural integrity or serviceability of the part is affected, it will be necessary to remove the part.

**6-167. EXAMPLE OF REMOVING CORROSION FROM FERROUS METALS**. If possible, corroded steel parts should be removed from the aircraft. When impractical to remove the part, follow the procedure below.

**a. Prepare** the area for rework.

**b. Positively identify** the metal as steel and establish its heat-treated value.

**c. Clean** the area and strip paint if required.

**NOTE: Use of acid-based strippers, chemical removers, or chemical conversion coatings are not permitted on steel parts without engineering authorization.**

**d. Determine** extent of corrosion damage.

**e. Remove** residual corrosion by hand sanding with mild abrasive mats, cloths, and papers, such as fine aluminum oxide grit.

**f. Remove** heavy deposits of corrosion products by approved mechanical methods for that particular form of steel and/or stainless steel.

**g. Inspect** the area for remaining corrosion. Repeat procedure if any corrosion remains and the structural integrity of the part is not in danger, and the part meets the rework limits established by the manufacturer or FAA authorized DER.

**h. Fair depressions** using a blend ratio of 20:1. Clean area using 240-grit paper. Smooth area with 300-grit paper and give final polish with 400-grit paper.

**i. Determine** depth of faired depression to ensure that rework limits have not been exceeded.

**j. Clean** reworked area with dry cleaning solvent. Do not use kerosene.

**k. Apply** protective finish or specific organic finish as required.

**NOTE: Steel surfaces are highly-reactive immediately following corrosion removal; consequently, primer coats should be applied within 1 hour after sanding.**

**l. Remove** masking and protective coverings.

**6-168.—6-178. [RESERVED.]**