THE ENSTROM HELICOPTER CORPORATION
TWIN COUNTY AIRPORT, P.O. BOX 277, MENOMINEE, MICHIGAN 49858

SERVICE INFORMATION LETTER

DATE: December 15, 1987

SUBJECT: Preventive Maintenance of Main and Tail Rotor Blades for Corrosion Control in the Field

MODEL: F-28A, 280, F-28C, 280C, F-28F and 280F Helicopters

EFFECTIVITY: As noted in text

The main and tail rotor blades are highly efficient bonded structural components, fabricated with high strength aluminum alloys which are protected from corrosive action. In order for the owner-operator to achieve the maximum longevity of these bonded components, a mandatory program of continuous preventive maintenance must be maintained. If this preventive maintenance program is not adhered to, corrosion may be initiated at the seams of the bonded joints. Once initiated, continued propagation is inherent in the materials being used. It is extremely important that the integrity of the blade coatings be maintained and protected against oxidation, erosion, and atmospheric residues which are continually attacking these components during their service life. Once this protective coating is breached and corrosive action is allowed to propagate unchecked, premature bond line and spar corrosion will occur, resulting in early retirement of these components, regardless of what action is taken.

From field observations and examination of main and tail rotor blades sent in for repair or refurbishing, it is evident that the majority of these components have seen little or no regular preventive maintenance.

This service information letter details a comprehensive blade care program, inspection criteria, and preventive maintenance procedures which must be adhered to in order to achieve a long and useful life of these components.

REGULARLY SCHEDULED FIELD PREVENTIVE MAINTENANCE PROGRAM:

NOTE: This procedure is intended for the complete helicopter, with special attention to the main and tail rotor blades.

The following procedures must be followed for:

A. Helicopter operations over salt water or coastal regions.

(1) Flush with fresh water thoroughly, daily.

(2) Wash with mild soap and fresh water, flush thoroughly weekly, and wax every second week.

B. Helicopter operations in tropical or subtropical high humidity regions.

(1) Wash with mild soap and fresh water, flush thoroughly weekly, and wax every second week.

C. Helicopter operations in arid, moderate, and cold regions.

(1) Flush with fresh water thoroughly weekly.

(2) Wash with mild soap and fresh water, flush thoroughly monthly, and wax every second month.

NOTE: Use a good quality paste wax.

NOTE: This procedure may be suspended during cold or winter months if item (2) was accomplished prior to the cold season.

NOTE: Aircraft based in or near heavy industrial and/or metropolitan areas with heavy atmospheric pollution should abide by procedure (B).

D. Helicopter operations involving agricultural spraying and dusting must consider the procedures in paragraph (A) as a mandatory minimum requirements, and should increase the frequency per their specific operation. Reference Enstrom Maintenance Manual, page MM-10-18.

E. Helicopters which are to be non-operational and not hangared for a period of one week or more should be washed with mild soap and fresh water, flushed thoroughly and waxed prior to parking.

NOTE: It should be emphasized that after washing, as indicated in parts (A) through (E), the tail rotor drive shaft and teeter bearings should be purged with grease to assure that any ingested water is evacuated.

F. Field Inspections of Main and Tail Rotor Blade Assemblies:
A constant watch for corrosion damage must be maintained in the field. The following procedures will define specific conditions to inspect for.

General Daily Inspection:

(1) Examine the condition of paint coverage for blistering, erosion, cracking, chipping, peeling, or overall oxidation, on:

(a) Exposed areas on the leading edge or spar.

(b) Exposed areas on the blade skins and trailing edge.

Any areas found in (a) or (b) where the paint cover and primer have broken down exposing bare metal, must be protected by methods described in part (G), paragraph (1).

(2) Visually examine the main rotor blade spar, especially on blades not using leading edge tape, and those where the paint cover has eroded away, for the following:

(a) Slight slivering or flaking of the exposed spar surface.

NOTE: When checking for slivering, do not use hands; use glove or shop cloth.

(b) A light grainy surface, resembling a fine wood grain finish.

If either condition as described in (a) or (b) is found, these surfaces must be reworked as soon as possible to arrest the corrosive condition by methods described in part (J), paragraph (1).

(c) Deep material slivering, heavy or deeply grained surface, and may be accompanied by a white powdery substance in the bottom of the granular crevices. If this condition is present, the operator should take immediate action to have blades inspected for possible rework as described in part (J), paragraph (2), by competent maintenance personnel.

(3) Visual examination of bond lines at:

(a) The main and tail rotor blade trailing edge, for any voids or openings, dark deposits, bubbly or scaly paint condition.

If any voids or openings are found, procedures as noted in part (H) must be followed for acceptance or rejection. Dark deposits, bubbly or scaly paint conditions must be treated per procedures in part (I).

(b) The leading edge bond lines for raised sections or voids. Dark deposits, bubbly or scaly paint condition along its length.

If any raised sections or voids are detected, procedures as noted in part (H), paragraph (1) must be followed for acceptance or rejection. Dark deposits or scaly paint must be treated per procedures in part (I), paragraph (1).

(c) The faired bond lines on doubler edges for paint cracking, dark deposits, voids in fairing compound, and scaly paint condition, with special attention to tail rotor blades.

Any of the indications as noted must be treated by procedures prescribed in part (H), paragraph (1b) and paragraph (2c) for a more permanent deterrent.

(4) Main Rotor Blade Leading Edge Tape

The leading edge polyurethane tape should be inspected for:

(a) Security; loose ends should be carefully trimmed equally on all blades.

(b) Check for punctures or tears.

(c) Bubbles or lumpy surface.

Any blade tape found with questionable security should be replaced. If punctures, tears, or bubbles are detected, the tape should be replaced with new material. Prior to installation the spar should be carefully inspected per part (F), paragraph (2). New blade tape should never be installed on spars without proper preparation and paint cover.

G. Limited Anti-Corrosion Methods for In-Field Operation

These are considered as temporary corrosion deterrent until permanent maintenance procedures can be accomplished at a proper facility.

(1) Any areas detected by inspections in part (F), paragraphs (1) through (4), should have corrosion inhibitors applied upon detection and semi-weekly as a minimum, until proper maintenance can be accomplished. Application by aerosol of corrosion inhibitors per MIL-C-16173D, MIL-C-23411 or MIL-C-85054 Type I.

(a) To all exposed areas of the main and tail rotor blades.

(b) Application to be made on all suspect bond line corrosion areas, cracks, scaly finish and small voids. This also includes bond lines on the blade doublers, with special attention to the tail rotor blades.

NOTE: For helicopters operating (ref. part A) over salt water or coastal regions, MIL-C-85054 Type I inhibitor is preferred.

(2) For larger exposed areas of the main rotor spar as defined in part (F), paragraph (2) (a)(b), the spar should be worked lightly with aluminum oxide medium grit paper, washed, and degreased with acetone or perchlorethylene. Application of the inhibitor can be made and allowed to dry at least 30 minutes. This can be followed by a coat of epoxy primer DeSoto 593X300 for improved protection. Cover over with flat acrylic aerosol paint.

NOTE: Blades must be worked on in sets equally to assure continuity of weight between them.

List of materials in order of preference:

PRIMERS

DeSoto #593X300
Primer Aerosol Touch-Up Epoxy
Zinc Chromate per MIL-D-6889C Type I, MIL-P-8585A.

CORROSION INHIBITORS

LPS #1 or #2 Metal Protector
MIL-C-1673D & MIL-C-23411
Crown #7540
MIL-C-1673D
WD-40
MIL-C-23411

SALT WATER & CORROSION INHIBITORS

Care #1900
Amguard
MIL-C-85054 (A5) Type I

NOTE: Any product meeting the corrosion inhibitor MIL specification can be used as a deterrent.

H. Inspection and Rejection Criteria for Bond Line Corrosive Delamination

(1) Main Rotor Blade

Inspect edge of all bond lines for separations, visually and coin tap. If inspection reveals evidence of delamination, depth may be checked on trailing edge and doublers with plastic shim stock .001" in thickness. Do not use shim stock to check spar to leading edge delamination, COIN TAP ONLY.

CAUTION: Do not use anything other than shim stock to check depth of delamination.

(a) Coin tap detectable bond separations at the skin-spar joint in excess of limits in Figures 1 and 2 are cause for rejection.

(b) Visual or coin tap detectable bond separations at the blade trailing edge of more than 3.00 inches in length or deeper than .25 inch are cause for rejection.

(c) Any bond separations on the doubler closer than 2.00 inches to the tip, or more than 3.00 inches in length, or greater than .125 inch in depth are cause for rejection.

(2) Tail Rotor Blade

Using the same method as in Part (H) (1), inspect all bond lines.

(a) Bond separations on the trailing edge deeper than .050 inch or more than 2.00 inches in length are cause for rejection.

(b) Any bond separation on the stainless steel cap more than 2.00 inches in length or greater in depth than .062 inch is cause for rejection.

(c) Any bond separation on the doublers closer than 2.00 inches to the tip of the doubler under which it appears, or greater than 1.00 inch in length, or deeper than .062 inch in depth is cause for rejection.

NOTE: Delaminations as noted in (1) and (2) which are lesser, are acceptable, if procedures in paragraph I are performed.

I. Preliminary Repair Procedures for Acceptable Blade Bond Delamination to Arrest Corrosive Action Prior to Refinish

(1) Skin to Spar Bond Sealing Procedure (Main Rotor Blade)

Separations smaller than the limits shown in Figures 1 and 2 may be sealed using the following procedure.

(a) Remove paint and or surface corrosion in separated area by aluminum oxide abrasive paper.

(b) Degrease by wiping with acetone or MEK.

(c) Warm to 180-200°F to evacuate residual moisture.

NOTE: Do not heat bond line above 250°F.

(d) Apply corrosion inhibitor and allow to dry 30 minutes.

(e) Seal with epoxy, Hysol Type EA 9309.2 sealant.

NOTE: The skin to spar seam should be faired flush with the blade contour.

(f) Refinish per Part (L).

(g) This repair requires a preflight daily inspection and a close visual and coin tap inspection at 25-hour intervals to monitor for growth of delamination.

(h) Log book entry must be made at the time of repair identifying location and S/N of blade; thereafter at 25-hour intervals for inspections.

(2) Trailing Edge Bond Sealing Procedure (Main and Tail Rotor Blade).

Separations less than the limits in part (H), paragraph (1b) or paragraph (2a) may be sealed by procedures in part (I), paragraphs (1a) through (1h).

(3) Doubler Edge Bond Sealing Procedure (Main and Tail Rotor Blade).

Separations less than the limits in Part (H), paragraph (1b) or paragraph (2c) may be sealed by procedures in part (I), paragraphs (1a) through (1h).

NOTE: With application of sealant item (C) the epoxy should be faired along the exposed edge, completely along its length.

(4) Stainless steel cap bonding sealing procedures (tail rotor blade) separations less than the limits in part (H), paragraph (2b) may be sealed by procedures in part (I), paragraphs (1a) through (1h).

NOTE: The skin to stainless steel cap seam should be faired flush with blade contour, both sides with epoxy sealant, per paragraph (1e), this part.

J. Inspection and Rejection Criteria for Main Rotor Spar

Spar intergranular corrosion illustrates its presence by exfoliation, flaking or metal slivers on the exposed surface. This condition can also create a wood grain effect on the metal surface in early and/or later stages of its progress. This condition, if allowed to progress untreated, will eventually destroy the spar. Therefore the following maintenance action is very important.

(1) For spar conditions as noted in part (F), paragraph (2a) and (2b), the following procedures should be followed.

(a) Blade spars exhibiting slight flaking, less than .032 inch in depth, slivering or a fine wood grain surface must be reworked. The surface should be mechanically worked by hand, removing this corroded surface condition. This rework must be accomplished uniformly to contour on each blade and in sets, to insure continuity of weight between them. This hand work should only be accomplished by abrasive paper or flap wheel, to insure uniform removal.

NOTE: Care must be taken when working the contaminated or corroded areas. Contamination can be spread by hands, tools, or materials to other blades or areas.

(b) After rework is accomplished, wash thoroughly with mild soap and water, flush thoroughly.

(c) The area then must be etched for 15 minutes with acid paste, Passa Jell #105, or a metal prep, to remove any residual corrosive residue. Flush thoroughly with fresh water and allow to dry.

(d) A chemical conversion coat is then applied per part (L), paragraph (4).

(e) The reworked area is now ready for refinish. Ref. part (L).

NOTE: The skin to spar bond line must be inspected in the repair area to be sure the rework has not damaged the sealing or fairing compound which fills the crevice. Reseal if damaged.

(2) For spar conditions as noted in part (F), paragraph (2c). Indicated severe intergranular corrosion in the advanced stages. No attempt to rework these areas in the field should be made prior to contacting your nearest Enstrom Service Center or Enstrom Customer Service Department for proper action. During this interim the owner should treat the affected area daily with a recommended corrosion inhibitor as defined in part (G), paragraph (1).

K. Disposition of main and tail rotor blades rejected under the criteria as noted in this Service Information Letter may still be within repairable limits. Therefore owners and operators with subject rejected blades should contact their nearest Enstrom Service Center or Enstrom Customer Service for final disposition.

L. Main Rotor and Tail Rotor Refinishing

(1) Strip assembly with Electro Cold # T-416 or alternate. Remove residue with stiff bristled brush, flush thoroughly with water. Do not allow stripper to remain on blade assemblies for more than a 3 hour period. Additional stripper may be used as required, but must be flushed clean every 3 hours.

(2) Inspect blade thoroughly as defined in this Service Instruction Letter.

(a) Any areas requiring rework should be accomplished at this time.

(b) Resealing and fairing of all bond lines on skins and doublers.

(c) Removal of any surface corrosion or residues with fine grit aluminum oxide paper.

(3) The total blade assembly must be washed thoroughly and treated with metal prep. Alum Prep #33 can be brushed on and flushed for this application.

(4) A chemical conversion coating is applied by brush, per MIL-C-5541. Prepare solution Allied-Kelite, Iridite #144 for application. Keep solution wet on blade assembly until a dark gold color is achieved, then rinse with cold water and allow to dry.

(5) Primer application, preferred, MIL-P-23377C, Primer Epoxy Polyamide by DeSoto. Alternate Super Koropon II by DeSoto.

(a) Main rotor, application of three coats. Care must be exercised for thin, even coats. These coats shall be applied as follows to maintain uniformity of weight on the blade. Apply two coats to spar. Feather out past leading edge skin line. Apply two coats to trailing edge straight on, then finish total blade with the third coat.

(b) The application is the same for the tail rotor blade, except for three coats all over.

NOTE: It is extremely important that the trailing edge of both blades have good coverage.

(6) The finish overcoat can be any good quality finish. Urethanes are preferred, as they will remain intact for a longer period of time, resulting in more equitable life for the owner, with better corrosion protection of the blade assemblies.

CAUTION: Refinishing of tail rotor blades requires that the tail rotor assembly be rebalanced dynamically (i.e., Chadwick balancer). Refinishing the main rotor blades will require retracking the rotor system. Dynamic lateral balance is permissible with the Chadwick balancer.

CAUTION: Tip weight changes must be made to keep 75% of the blade tip weight in the forward blade pocket to maintain chordwise balance.

(7) List of materials in order of preference:

PRIMERS

Primer Epoxy Polyamide by DeSoto #(513X307(510X386), MIL-P-23377C
Super Koropon II by DeSoto #(513C329)
Zinc Chromate per MIL-D-6889C, MIL-P-8585A

STRIPPER

Electro Cold Stripper #T-416 by Whittaker Chemical, or any name brand alternate.

CHEMICAL COATING

Allied Kelite Iridite #144 per MIL-C-5541

SEALING COMPOUND NA

Hysol #EA9309.2 Two-Part Epoxy by Dexter
Fairing Compound Epoxy #RP-1257-3 by REN

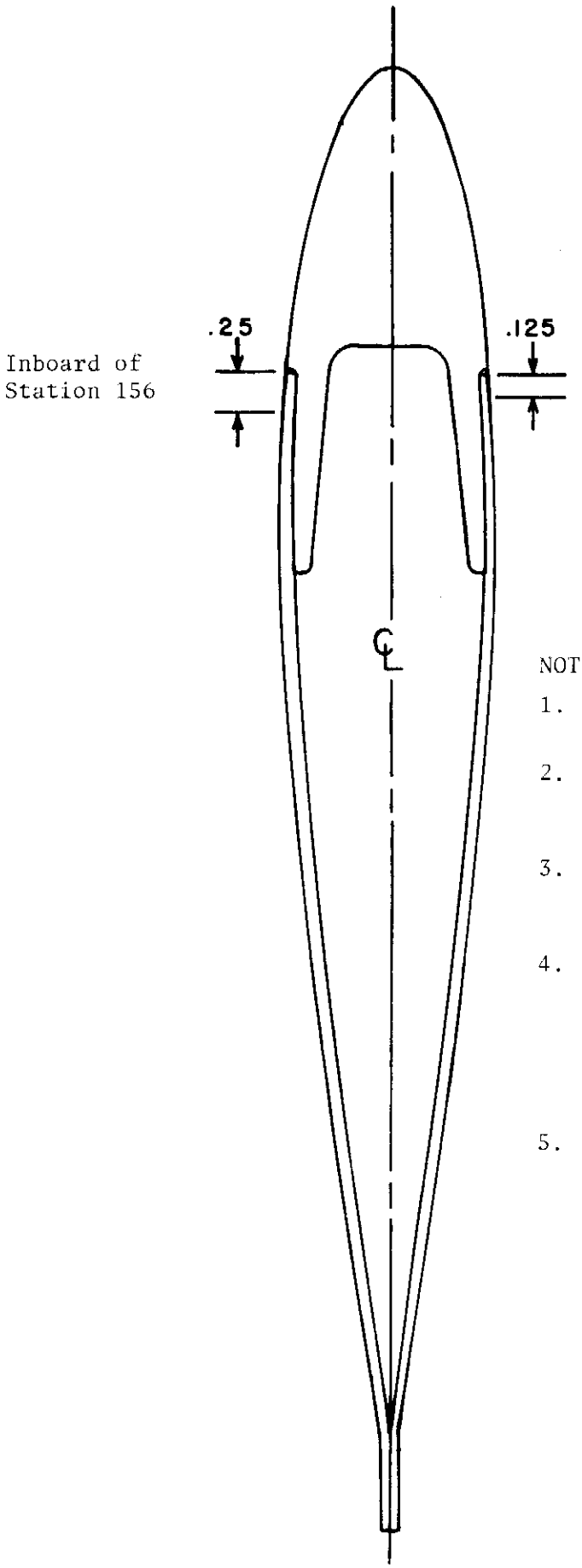
METAL ETCH

Passa Jell #105 by Semco

METAL PREP

Aluma Prep #33 by American Chemical

Figure 1. Bond Separation Criteria - Skin to Spar Bond



NOTES:

1. Determine extent of separation by coin tap.
2. Separations greater than 3.0 inches spanwise dimension are cause for rejection.
3. Separations greater than indicated chordwise depth are cause for rejection.
4. Coin detectable separations less than these limits must be sealed using approved materials and procedures (see paragraph 5.2.1) and inspected daily for growth.
5. Log book entry must be made when each separation is first detected and sealed, and for each daily inspection thereafter.

Figure 2. Skin-Spar Bond Separation Criteria