



## SERVICE DIRECTIVE BULLETIN

SERVICE DIRECTIVE BULLETIN NO. 0036

Supersedes Service Note No. 0031

Page 1 of 3

Date: August 2, 1976

Subject: Main Rotor Shaft

Model: F-28A & 280

Effectivity: Model F-28A - Serial Numbers 003 thru 303; 305 thru 327;  
Model 280 - Serial Numbers 1001 thru 1019; 1021 thru 1022;  
& All Main Rotor Gearboxes Overhauled prior to Jan. 14, 1976.

Compliance: As Noted Below

It has been reported from field service that fatigue cracks were found in the main rotor shaft on the upper shoulder radius below the main rotor hub. We have had four reported occurrences of this condition, one of which resulted in an aircraft accident. Because of the effects of corrosion on aircraft which fly rather infrequently, the inspection procedure previously recommended is modified in Part I below. Additional information regarding shaft modifications is contained in Part II of this bulletin.

### Part I

Unless previously performed within the last 20 hours or one month, all owners and operators shall make a dye penetrant inspection, prior to the next flight, of the main rotor shaft at the upper shoulder radius, just below the main rotor hub. This inspection shall be repeated at 20-hour intervals or one month, whichever occurs first. A three-step dye penetrant technique should be performed by maintenance personnel familiar with this process. A fluorescent penetrant system is preferred for those who are equipped with the facilities and technical expertise to utilize it.

Between the dye penetrant checks, at 10-hour intervals or 15-day intervals, whichever is sooner, a close visual inspection of the upper radius shall be performed with an 8-power, or greater, magnifying glass. If a crack is suspected by visual inspection, a dye penetrant check should be performed for verification and Enstrom Customer Service should be notified for further instructions. Rotor shafts with a verified positive indication should not be flown.

Shafts found with tool marks in the inspection area should be reported immediately to Enstrom Customer Service. The following flight characteristics will be evident in a helicopter that has developed a crack in the shaft in the later stages of fatigue failure. A smooth flying helicopter will progressively develop a moderate to heavy one-per-rev bounce symptomatic of a blade out of track. This condition will be accompanied by one blade flying out of plane and will remain out regardless of attempts to track. This may be a warning of an impending shaft failure. Any aircraft which responds in this manner should be inspected immediately per this Service Directive Bulletin. Continued flight may result in a complete failure of the shaft and separation of the rotor from the airframe.

## Part II

Laboratory analysis has shown that the cracks originate from deep tool marks in the fillet radius and/or residual tensile stresses which could originate from machining with dull tools. The possibility of such conditions can be removed by an inspection and rework of the shaft.

The specified rework involves magnetic particle inspection for damage, polishing of the critical fillet radius to remove tool marks, poor blends, or rough ground surfaces, and shot-peening to remove residual tensile stresses. New shafts have been manufactured with this process since December 1975. All gearboxes which have been factory-overhauled since 14 January 1976 have been reworked with this process, anticipating that the final laboratory analyses would confirm the appropriateness of this process and FAA approval would be obtained.

Enstrom has developed the tooling and facilities to rework all gearboxes on a high-volume basis without disassembly. We estimate reshipment of reworked gearboxes within two weeks after delivery at the factory. Cost of reworking the shaft is \$225. 00. Upon satisfactory rework and shot-peening of the main rotor transmission shafts per this procedure, the inspection requirements set forth in Part I are no longer required.

All Enstrom owners or operators with non-shot-peened shafts are urged to have their main rotor transmission shafts reworked as soon as possible. Transmission can be completely overhauled on the published exchange price basis with no increase in price for the shaft rework. We request you notify Enstrom Customer Service of an anticipated date of shipment.

In the near future, Spooner Aviation Limited in England will be authorized to perform main rotor gearbox overhaul and rework of the shaft in accordance with Enstrom special process specifications.

Care in packing transmissions for freight shipment is recommended to assure transportation damage does not occur. A sketch of a recommended packing method is shown below:

