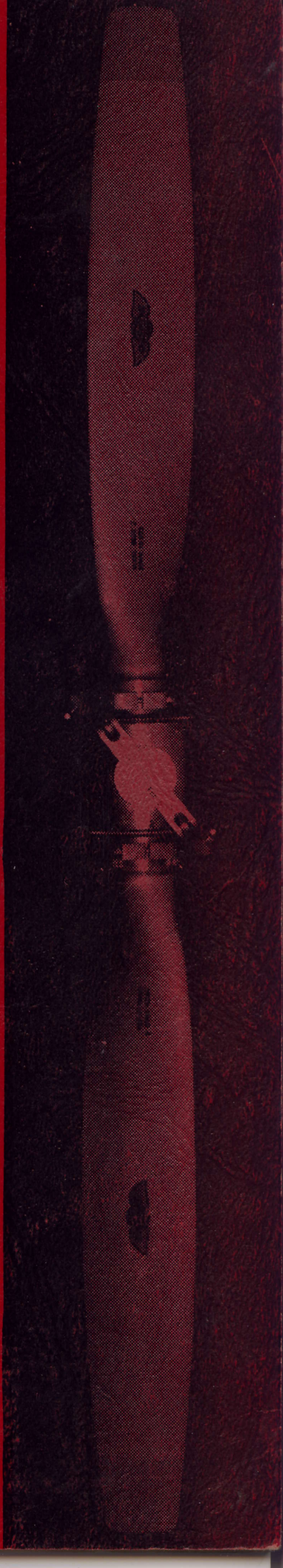
UNIVAIR

SERVICE MANUAL

FLOTTORP MODEL F12
CONSTANT SPEED PROPELLER



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INTRODUCTION

This manual contains routine inspection, maintenance, overhaul, and minor repair procedures which can be accomplished by propeller servicing facilities. These instructions are intended to supplement the criteria set forth in Civil Air Regulations Part 18 and Civil Aeronautics Manual 18. In no case are they to be construed or interpreted as overriding or contradictory to the material in the regulations or manual.

The use of this manual by any propeller servicing facility shall not, under any circumstances, be interpreted or construed as an approval of the facility by Universal Aircraft Industries.

NOTE

This manual has been approved by the Federal Aviation Agency.

Revised July 10, 1962

SECTION I

SPECIFICATIONS AND DESCRIPTION

A. General Specifications

Type	Hydraulically Operated Constant Speed
Number of Blades	Two
Blade Material	Aluminum Alloy
Hub Material	Steel
Engine Shaft	Flanged Shaft 4 inch Diameter Bolt Circle, 1/2-inch Bolts and Dowel Pins
Total Pitch Range	20 Degrees
Low Pitch	Adjustable at Pitch Control Arms
High Pitch	Fixed High Pitch Stop on Piston Rod
Weight	68 lbs.

B. Installations.

Aircraft	Engine	Rating	Propeller Assy.	Blade Assy.	Propeller Diameter Max.	Min.
Beech Debonair 35-33, -A33	Continental IO-470-J	225 HP 2600 RPM	F12A-4, -5	8400-0	84	82
35 -B33	IO-470-K	225 HP 2600 RPM	F12A-4, -5	8400-0	84	82
Beech Bonanza H 35	Continental O-470-G	240 HP 2600 RPM	F12A-5	8400-0	84	83
J35, K35, M35	IO-470-C	250 HP 2600 RPM	F12A-3	8400-2	82	81½
N35, P35	IO-470-N	260 HP 2625 RPM	F12A-3	8400-2	82	82

C. Governors

The Flottorp governor Model 1F-1 is the Garwin Model 34-825, and is used on the Beech Debonair series aircraft. For service instructions, refer to Garwin Handbook of Overhaul Instructions and Parts List No. 825. The Woodward governor 210 series is used on the Beech Bonanza series aircraft. For service instructions, refer to the appropriate Woodward service manuals.

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D. Description

The hub of the Model F12 propeller is machined from welded and furnace-brazed steel tubing, and is attached to the engine crankshaft flange with 6 bolts and 2 dowels. The hub encloses the hydraulic piston and piston rod. Forward of the hub body, the piston rod is attached to a bar that links it with the two blades through ball-joint links which entirely eliminate all binding in the control system. A permanent lubricant is used in the ball joints to eliminate the necessity for periodic lubrication for the life of the propeller.

The blades are retained in the hub by a retention nut. The retention nut and the bearing races are a part of the permanent blade assembly. However, the bearing races are designed so that if it becomes necessary to replace them, they can be broken, and new races which have previously been broken can be installed.

The aluminum alloy spinner streamlines the propeller installation and contributes to engine cooling. The spinner dome is attached firmly to the rear bulkhead. Drain holes in the rear bulkhead flange prevent accumulation of moisture which could cause an out-of-balance condition.

All functional parts of the actuating mechanism are made from materials specifically selected to require no lubrication. The retention assembly is prepacked with grease, not requiring replenishment during the overhaul period. All grease and oil seals are synthetic rubber "O" rings operating at low pressure to assure long life. All parts subject to corrosion are anodized or protected by suitable plating.

E. Principles of Operation

The Model F12 constant speed propeller is a single-acting unit using hydraulic pressure for increasing the blade angle (decreasing RPM), and the natural centrifugal twisting moment of the blades for decreasing the blade angle (increasing RPM).

The hydraulic source for operation is oil from the engine lubricating system boosted in pressure by the governor gear pump, and supplied to the propeller through the propeller shaft flange. A conventional governing system (centrifugal flyweights balanced by a speeder spring operating a pilot valve) meters oil to and from the propeller, increasing or decreasing the blade angle to maintain a pre-selected RPM.

In case of failure of the oil supply to the propeller, the blades will go to low pitch. Under this condition flight may be maintained at reduced throttle to prevent engine overspeeding, where sufficient power is available to climb or cruise at various flight configurations at lower forward airspeeds.

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SECTION II

SERVICE TOOLS & EQUIPMENT

Only one special tool is necessary for maintenance and overhaul of the F12 propeller:

Blade Retention Nut Wrench, Part No. EB19000

Standard tools and equipment necessary for maintenance and overhaul of the F12 propeller:

Propeller Assy. Table

Pliers for Internal Snap Ring
(Waldes Truarc No. 5 or No. 25, 90° tips)

Suspension Type Propeller Balancer

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SECTION III

PERIODIC INSPECTION AND LUBRICATION

A. Periodic Inspection

Component	Nature of Inspection	Inspection Time
Propeller Hub	Security of Mounting and Mounting Bolts Safetied	Postflight
Propeller Blades	Minor Nicks, Scratches, and Cracks	Postflight

CAUTION

Due to the high stresses to which the propeller blades are subjected, their careful maintenance is vitally important, particularly on the leading edge of each blade from the tip inboard for approximately 8 inches. All nicks and scratches must be repaired before the airplane is flown. Nicks and scratches set up concentrations of stress which can exceed the strength of the blade material; the result will be a crack and premature failure of the blade.

Propeller Spinner	Obvious Damage and Security of Mounting	Postflight
Propeller Governor	Leaks and Security of Mounting	Postflight
Propeller Governor Controls	Connections Mechanically Secure and Safetied	Postflight
Propeller Blades	Corrosion, Cracks, Nicks or Dents Beyond Permissible Limits	Postflight nearest 30 hours
Propeller Governor Controls	Travel and Wear	Postflight nearest 30 hours
Propeller Hub and Blades	Blade Retention and Propeller Track	Postflight nearest 120 hours

WARNING

During postflight inspection if the IO-470 fuel injection engine is warm and it is necessary to move the propeller, stand clear of the area of rotation and move the propeller against the normal direction of rotation. Make certain the magneto switch is off. While the engine is warm, residual fuel in the intake ports and injectors may ignite and cause the engine to kick.

Component	Nature of Inspection	Inspection Time
Propeller Hub and Blades	Visual	Overspeed up to 3150 rpm (If the propeller exceeds 3150 rpm, replace it.)
Propeller Assembly	Overhaul	At Engine Overhaul but not to exceed 1000 hrs.
Governor Assembly	Overhaul	At Engine Overhaul

B. Lubrication

No external lubrication of any parts of this propeller is necessary. At overhaul, after cleaning and inspection of the blade bearing races and balls, they should be repacked with clean grease such as Sinclair AF No. 2EP. Prior to assembly, all O-Rings, and the surfaces on which they ride, should be coated with a lubricating oil to facilitate installation, and prevent tearing or shearing the O-Ring.

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SECTION IV

MAINTENANCE

With proper care, the Model F12 propeller can give many hours of efficient operation. Inspect the blades and hub at the recommended intervals, and perform only the maintenance described in the following paragraphs; maintenance and repairs which require more involved procedures or disassembly of the propeller must be performed by a FAA certificated propeller repair station. If an out-of-balance condition is suspected, remove the propeller and send it to a FAA certificated propeller repair station. Line maintenance personnel should not attempt to balance the propeller since balance procedures are intricate and require special tools and equipment.

A. Propeller Removal

The propeller should be in the full low pitch-high rpm position before beginning removal. Normally, the propeller will stop in this position and the piston will be in its extreme aft position, leaving a minimum amount of oil within the cylinder. A rag should be kept handy to catch the oil that is freed during the removal operation. Remove the propeller as follows:

1. **Remove the 12 spinner dome retaining screws, and remove the dome, taking care that the propeller blades are not damaged. Mark the dome and mating bulkhead for identical reinstallation, if the original marking has been obliterated.**

2. **Remove the six propeller retaining bolts and washers at the crankshaft flange and remove the propeller assembly.**

B. Minor Repair, Cleaning, and Inspection

No repairs are authorized on the propeller hub, and the only acceptable methods of repairing cuts, nicks, cracks, etc. in blades are those by which the damaged portion is removed from the blades to leave a smooth well-faired surface. Methods which attempt to relocate metal by cold-working to cover or conceal the defect rather than remove the damage are not permissible; acceptable blade repairs are described in CAM 18. For cleaning, use warm fresh water and soap, unleaded gasoline, or kerosene, and suitable brushes or cloths. After the blades have been cleaned, all cleaning substances must be immediately removed. Soap in any form should be removed by thoroughly rinsing with fresh water, after which all steel surfaces should be dried and coated with clean engine oil. Scrapers, power buffers, steel brushes, and any other tools or substances that will scratch or otherwise mar the surface must not be used on blades. In special cases where a high polish is desired, a good metal aircraft polish may be used; however, upon completion of the polishing, all traces of polish should be immediately removed. In no instance shall the blades be polished with a power buffer.

C. Propeller Installation

To install the propeller, use the following procedure:

1. **Align the two guide pins in the propeller hub with the corresponding holes in the engine crankshaft flange placing the No. 1 blade on the**

side of the TC mark on the engine flange, and install the propeller.

2. Install the 6 retaining bolts and washers. Torque them to 600 to 700 inch-pounds.

3. Secure the bolts with safety wire.

4. Position spinner dome on propeller according to marks made on removal, and install 12 retaining screws.

D. Checking Propeller Track in the Shop

1. With the propeller in low pitch, mount it on a protractor bench mandrel.

2. Place a stationary object at the tip of one of the blades and make a mark on the object where the center of the blade touches it.

3. Rotate the propeller 180 degrees and repeat the above operation with this blade.

4. Measure the distance between the centerlines of the two marks. The allowable difference is 1/8 inch.

5. If the distance is greater than 1/8 inch, the propeller should be sent to a FAA certificated propeller repair station for further inspection and repair.

E. Checking Propeller Track on the Aircraft

The following procedure should not be attempted unless it is known that the engine shaft is not out of line. When checking the track, the airplane must be in a hangar where air currents will not rock it. Use the following procedure:

1. Place a stationary object at the tip of one of the blades and make a mark on the object where the center of the blade touches it.

2. Rotate the propeller 180 degrees and repeat the above operation with this blade.

3. Measure the distance between the centerlines of the two marks. The allowable difference is 1/8 inch.

4. If the distance is greater than 1/8 inch, the propeller should be sent to a FAA certificated propeller repair station for further inspection and repair.

F. Low Pitch Adjustment

Low pitch settings for the F12 propellers are measured at the 33R blade station.

Aircraft	Propeller Assy.	Blade Assy.	Pitch Angle
Beech Debonair 35-33, -A33, -B33	F12A-4, -5	8400-0	11.7°
Beech Bonanza H35	F12A-5	8400-0	13.0°
Beech Bonanza J35, K35, M35, N35, P35	F12A-3	8400-2	13.5°

If the pitch angle is not correct, refer to Figure 1 and use the following procedure:

1. With a hexagon wrench, loosen 2 set screws (1) in each pitch control arm (2) (one in each half). This will require some effort to back them out against the safety staking.

2. Remove cotters and loosen the 2 clamp bolts (3) on each blade.

3. Adjust the blade pitch to the desired angle.

CAUTION

Do not attempt to adjust the propeller blade angle with the pitch control links (4). Although they appear to be turnbuckles, they are not, but are permanently pinned together. Any attempt to rotate the sleeve of this link will damage it so that replacement of the entire link will be necessary.

CAUTION

The pitch change linkage in this propeller has been purposely designed with ball joints to eliminate all binding in the system during operation. The links (4) will always be in tension, thus seeking to remain in a plane passing through the piston rod. This will cause the front cross bar, piston rod, and piston to rotate a small amount during travel between the extremes of pitch. However, if the natural forces are reversed (i.e. pitch is increased manually by twisting the blade, or pitch is decreased manually by pushing back on the front cross bar), the links will then be in compression, and will seek to align themselves perpendicular to a plane passing through the piston rod. This action will cause rotation of the front bar until the ends of the link jam against the bar (23) or against the pitch arm (2), which places an undue strain on the ball joints tending to pry them apart. If no resistance, other than normal friction of the system is encountered, the joints will not be harmed. However, in any case, it is strongly recommended, that when adjusting or changing the pitch, increase the pitch by pulling on the front cross bar

at the center, and decrease the pitch by twisting both blades. This not only will protect the ball joints against damage, but will also eliminate errors in setting the pitch.

4. Tighten the clamp bolts (3) to proper torque. (See Fig. 6).

CAUTION

It is extremely important to apply the correct torque to these nuts. The clamping action of these bolts plus the biting of the set screw into the retainer must resist the centrifugal twisting moment of the blade under vibratory conditions. If either or both blades slip from their set position the propeller will become extremely rough from aerodynamic excitation. A forced landing may result.

5. Re-check the pitch angle. If incorrect repeat steps 2, 3, and 4.

6. Install cotters. If cotter hole does not line up, always advance nut to next slot, as long as torque does not exceed 140 in. lbs.

7. Tighten the set screws (1).

8. Stake the set screws with a center punch.

G. Governor Maintenance

Governor maintenance that can be performed by operating personnel is limited by the availability of special facilities required for extensive repairs. Governor repair and overhaul should be accomplished only by facilities having adequate servicing and test equipment, and either Garwin Manual No. 825 or the appropriate Woodward service publications.

Since governor action is directly related to the propeller pitch changing mechanism, there are very few governor troubles that can be isolated with the governor installed and operating. Failure of the propeller to change pitch correctly might be caused either by the governor or the propeller. Except for locating obvious troubles, it is best to replace the governor with one known to be in good condition when trouble occurs in the propeller pitch-changing system. If the trouble disappears, the governor was at fault; if the trouble persists, the propeller may be at fault.

The governor is mounted on the engine pad with four studs and self-locking nuts. Removal is accomplished as follows:

1. Disconnect the control bracket at the governor control lever.

2. Remove the four mounting nuts and pull the governor from the studs.

3. Install a shipping cover on the governor base to protect it.

4. Cover the engine pad with a dummy base or accessory pad cover.

Installation of the governor is accomplished as follows:

1. Use a clean dry cloth and wipe the engine pad clean.

CAUTION

When installing the governor make certain the male splines on the governor drive mesh with the female splines on the engine drive before placing the governor on the mounting pad and tightening the nuts.

2. Place the mounting gasket over the engine pad studs with the raised surface of the gasket screen facing away from the engine. Do not use sealing compounds of any kind. Place the governor in position on the mounting studs and rotate the propeller sufficiently to mesh the governor and engine drive splines. When the splines are meshed the governor will easily fit into place on the engine pad.

CAUTION

Do not force the governor onto the engine pad. To do so will force apart the beveled gears in the engine.

3. Install four plain washers and self-locking nuts on the studs and tighten evely. Recommended torque is 20 foot-pounds (240 inch-pounds).

4. Attach the control rod to the governor control lever, being sure that the lever can be operated against both high and low speed stops through the linkage from the cockpit propeller control. Check for excessive binding or lost motion in the linkage.

SECTION V

INSPECTION, REPAIR, AND OVERHAUL

In general, all instructions and procedures outlined in CAM 18 for all inspection, repair, and overhaul of parts of this propeller should be adhered to. The following instructions supplement those in CAM 18 with details peculiar to this propeller.

A. Disassembly. Refer to Figures 1, 2, 3, and 4.

1. Remove cotter and nut from the blade end of each pitch link (4), slide end of link from stud (5) in arm (2), and remove washer.

2. Remove snap ring (7).

3. Carefully remove through the front of the hub, the entire pitch control assembly, taking care not to tilt the piston to cause it to bind in the cylinder. Also have rags or container handy to catch oil from in front of piston. This complete assembly is shown in Figure 2.

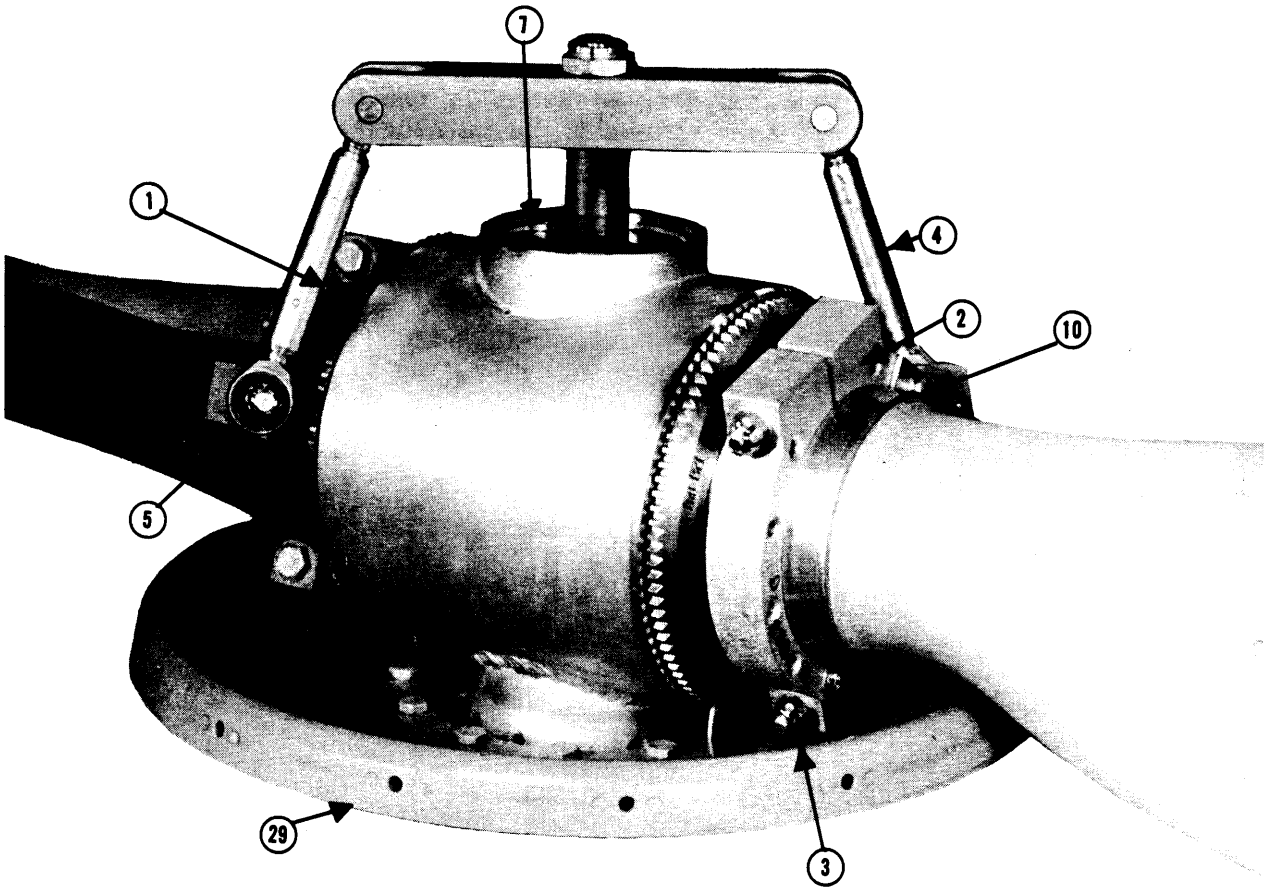

Figure 1.

4. Disassemble the pitch control mechanism as follows (see Fig. 2):

   a. Remove nut (11), piston (12), O-Ring (13), O-Ring (14), and high pitch stop (15) from rear end of piston rod (17).

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CAUTION

When removing and replacing the nuts at each end of the piston rod, use only an adjustable or open end wrench with smooth jaws on the flats (22) at the front end of the piston rod so as not to raise burrs on the rod. Burrs will damage the piston rod bearing material. If this surface does become burred, use a fine file to dress the rod down to its original diameter.

b. Remove nut (24), pitch bar and link assembly (4) (23) (31), piston rod guide (18), O-Ring (19), O-Ring (20) from the front end of the piston rod. Bearing (21) is a press fit into guide (18) and need be removed and replaced only for damage and excessive wear.

CAUTION

Do not disassemble pitch bar and link assembly (4) (23) (31) unless looseness or damage has occurred to link (4) or bar (23). If necessary to disassemble, always push on the ungrooved end of the pin (31). Always replace with a new pin, and insert it so that the grooves will not line up with the grooves in bar (23). Do not attempt to disassemble the pitch links (4). Although they appear to be turnbuckles, they are not, but are permanently pinned together. Any attempt to rotate the sleeve of this link will damage it so that replacement of the entire link will be necessary.

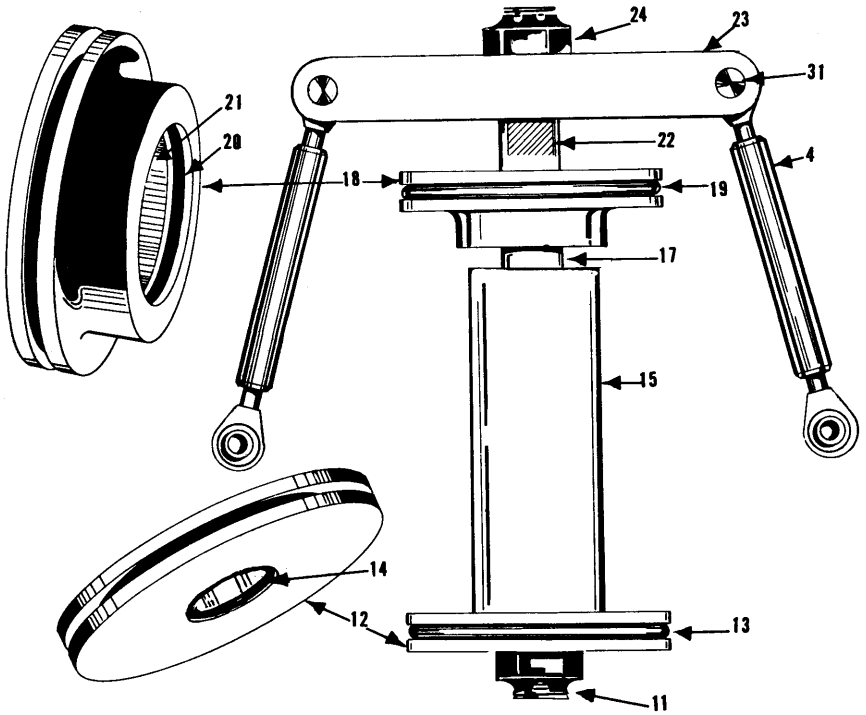

Figure 2. Pitch Control Assembly

5. Remove hub pilot ring (25), O-Ring (26), and O-Ring (27) from rear of hub (See Figure 3).

6. Remove 2 screws, washers, retention nut locks (8).

7. Remove 6 bolts and washers (28) from the periphery of engine mounting flange on the hub, and remove spinner rear bulkhead assy. (29).

CAUTION

While removing and replacing this bulkhead when it is not necessary to remove the propeller blades, take care not to rotate the blades or in any way disturb the retention nut settings. Since the retention nut locks have been removed, the nuts are free to rotate.

8. Using wrench, EB 19000, remove both blade assemblies. Pull them straight out so as not to damage the threads on the retention nut (30) and on the inside of the hub. A rag tied around the blade shank between the retention nut and the pitch control arm (2) will hold the nut in place to prevent the loose bearing balls from falling out of the races.

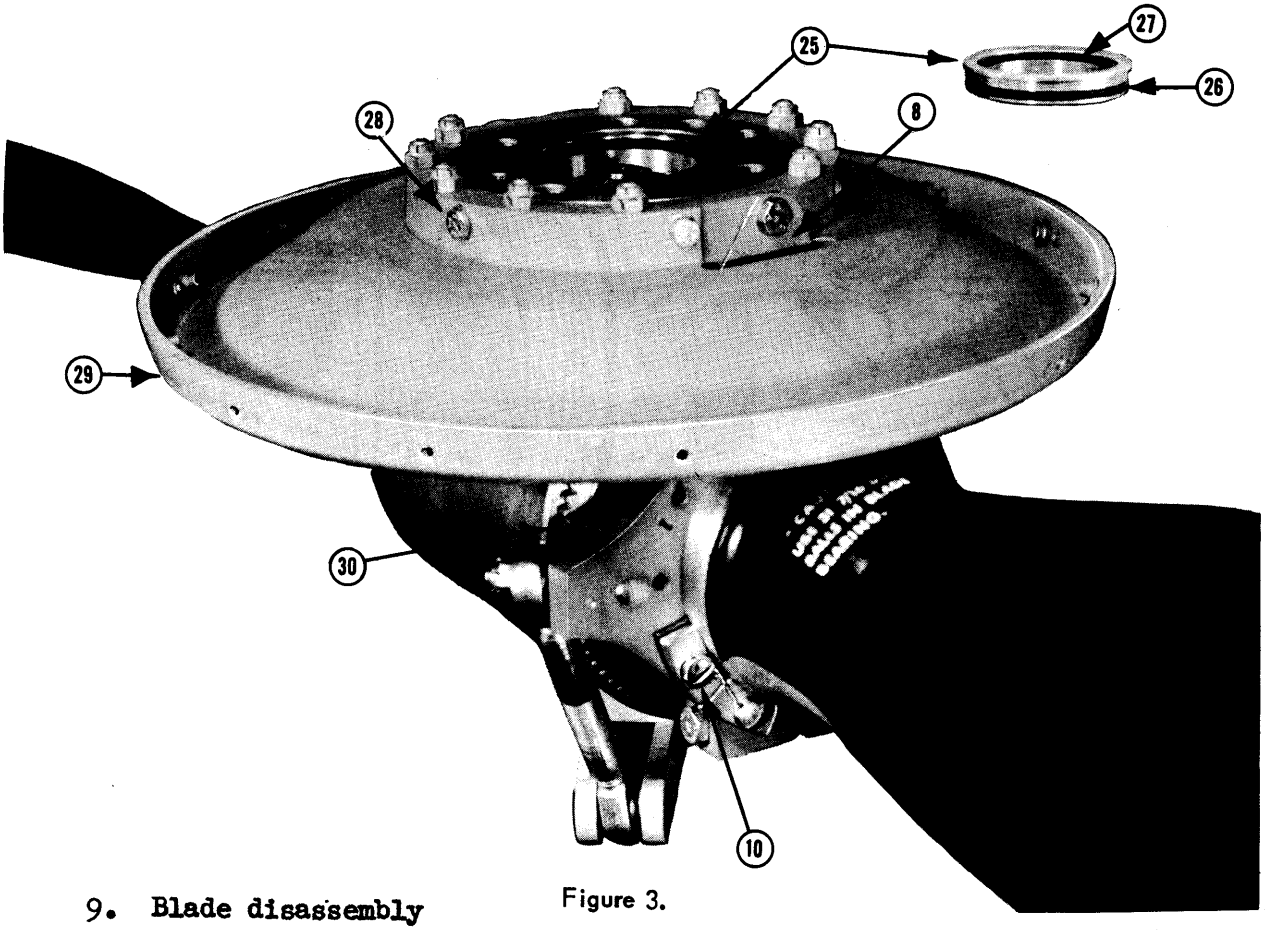

Figure 3.

9. Blade disassembly

a. With a hexagon wrench, loosen 2 set screws (1) in each pitch control arm (2) (one in each half). This will require some effort to back them out against the safety staking.

b. Remove cotters, nuts, washers, and bolts (3), and arm (2).

CAUTION

When it is necessary to remove the balance screws, plates, and weights (10), carefully note their exact location and identify them by blade. Replacement as they were originally will greatly simplify balancing the propeller.

c. Lift the blade retention nut (30) and remove the 31 balls from the thrust bearing race.

d. Shake the blade retention nut up and down to drop the outboard thrust bearing race from within the blade retention nut. If the outboard race does not fall, wrap tape around the blade shank and lift the retention nut above the steel retainer. Hold the nut in this position, slip a flat curved blunt end tool between the blade and retention nut and tap lightly, rotating the nut while tapping (figure 4).

e. With the race free from the retention nut remove the blade O-Ring.

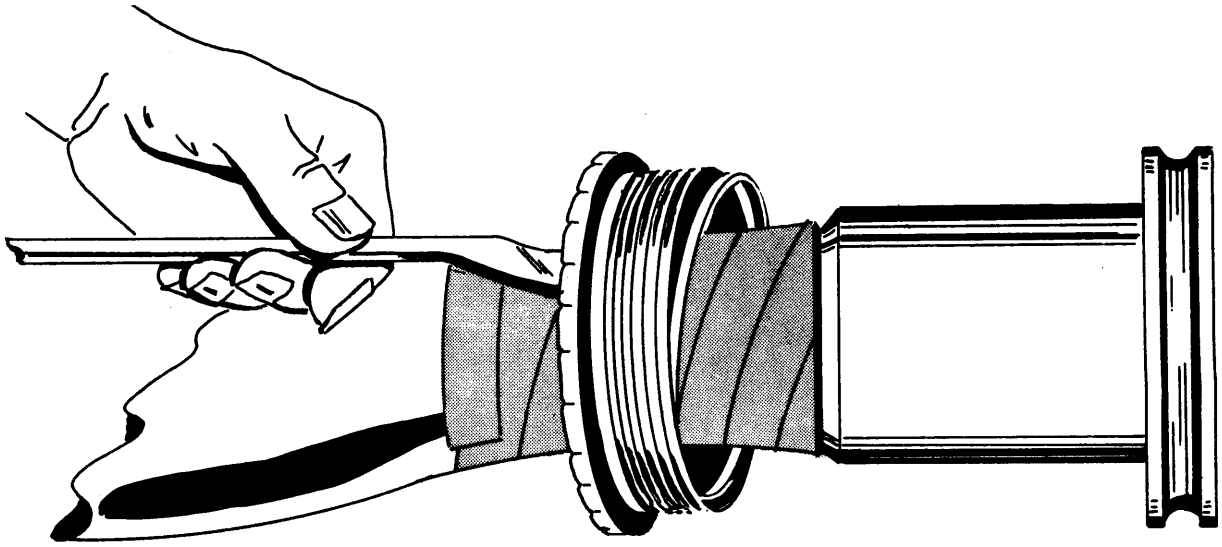

Figure 4. Removing Blade Race

B. Inspection

1. Blades

In addition to the methods discussed in CAM 18, another satisfactory method for detecting cracks in blades is as follows:

a. Clean the blade carefully with carbon tetrachloride and dry the blade thoroughly, using a clean air blast if necessary.

b. Prepare a solution of 50% non-toxic, non-corrosive oil which has fluorescent quality, and 50% kerosene.

c. Completely immerse the blade in the solution, including the blade retaining nut and allow it to remain for a minimum of thirty minutes. After this period, remove the blade from the bath and allow the excess fluid to drain. Spray the blade with carbon tetrachloride to completely remove the remaining solution. Allow the blade to stand for fifteen minutes so that the solution will bleed out of any cracks present.

d. Carefully inspect the entire blade under a near-ultraviolet light source. The inspection must be conducted in a darkened booth or room. Solution bleeding from a surface crack will show up under the light as a bright fluorescent line.

2. Other Aluminum Alloy Parts

The following parts are structural parts of the pitch control system and should be inspected for fatigue cracks by penetrant inspections or anodize:

a. Pitch control arm (2). Inspect adjacent to all tapped holes.

b. Piston rod (17). Inspect each end at the shoulder fillet, and adjacent to the threads.

c. Pitch control bar (23). Inspect adjacent to all holes.

3. Magnetic Inspection

Carefully inspect the hub, pitch links, blade races, retention nut, and all steel bolts and nuts by magnetic inspection (preferably the fluorescent type) in accordance with the best recommended practices. When checking the blade races, place a copper braided cable between the races and the blade. Then placing the bar between the electrode plates, fashion the cable between plate and bar thus inducing magnetic contact. Magnetize the races in five or more equally spaced positions to insure complete coverage. No insulation is necessary between cable and races. De-magnetize all parts prior to returning to service.

4. Visual Inspection

Carefully inspect all parts for wear, galling, metal pickup, cracks, nicks, burrs, and other damage. Examine all O-Rings for damage, deformation and deterioration. Check blade races for chipping at break points. This causes a "brinelling action" to the bearings. Races showing chipping effect at break points will be replaced. Check all threads for rough edges, irregularities, metal pickup, and galling. Thoroughly examine all plated and painted parts for damage exposing bare metal. It should be noted at this point that the blade is anodized giving it a dull gray finish. Plated parts with exposed base metal must be stripped and replated. Painted parts may be touched up, using approved methods.

NOTE

All steel parts that have been re-cadmium plated must be embrittlement relieved.

Inspect moving parts for freedom of movement. Check shrink fits such as the blade retainer for tightness. Examine internal passages for cleanliness and freedom from loose particles of metal or other substances.

C. Repair and Overhaul

1. Hub Minor Repair

Minor galling and scoring of the mounting flange may be removed by polishing with emery paper.

If the threads in the mounting flange are damaged, ream out and install a heli-coil. Minor scoring and scratches to the dowel pins in the mounting flange may be removed with emery paper. More serious damages to the dowel pins will require replacement. Corrosion sometimes develops in the rear portion of the cylinder due to gases from the engine. This corrosion and/or minor scoring may be removed by polishing with crocus cloth. Do not use emery paper and always remove a minimum amount of metal. Scrap the hub if threads in the hub for the blade retention nut are damaged beyond repair.

2. Hub Major Repair

The cylinder may be machine honed to remove roughness or scoring using a very fine stone. Although the piston bore may be honed to a maximum I.D. of 2.881 inches, for use with a standard sized piston, only the minimum amount of material necessary to clean up any scoring should be removed. Care must be exercised to maintain straight cylinder walls throughout the area traveled by the piston.

3. Spinner Repair

Inspect the spinner for cracks, tears and other damage. Small cracks may be stop-drilled. No patches or doublers are recommended because of the critical balance condition to be maintained. Should it become necessary in an emergency to add a patch or a doubler, be sure to add one of equal weight to the opposite side. Polish out minor nicks and scratches with emery paper.

4. Blade minor and major Repair. Repairs only within the limitations of CAM 18 are permissible.

5. Blade Bearing Races. All blades have thrust bearing races with grooves ground 180 degrees apart in the aft side. This groove assists in breaking the race for replacement and was designed for that purpose. Races cannot be repaired; they must be replaced when they become brinelled or chipped. If races in stock are not broken, devise a tool to break the races (see Figure 5). Set race in press, and place tool above the race. Bringing press into action, exert an even pressure over the grooves cut in races.

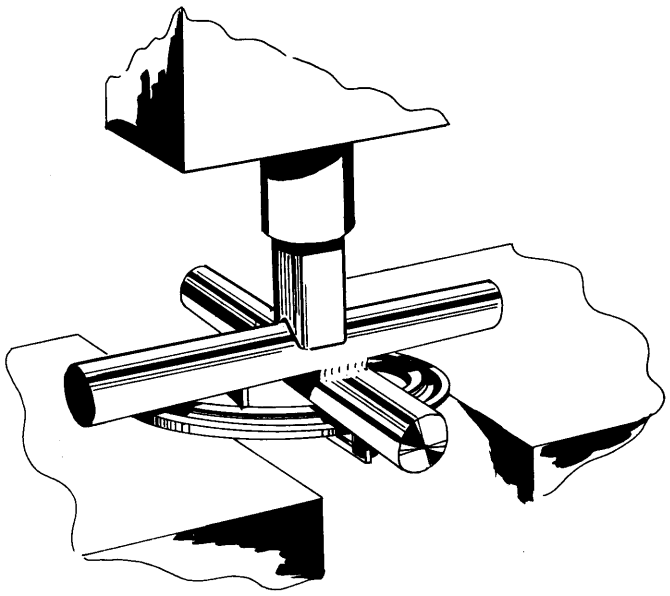

Figure 5. Breaking Blade Races

NOTE

Be sure break is even and clean with no chips in evidence, as this will cause a "Brinelling action" to bearings. Races must also be kept in matched pairs.

When installing, the inboard and outboard races should be positioned so that the breaks are 90 degrees apart. The inboard and outboard races are not alike, they are identified by the -2 and -4 stamp on them. The -4 race fits into blade retention nut having a larger chamfer around inner circumference for seal clearance. If they are placed in blade opposite to this, the blade will bind when tightened.

6. Painting - Blade Repair. Carefully touch up blades having minor paint damage due to repair operations or wear. Blades requiring complete repainting shall first be stripped of their remaining paint and then painted according to the following instructions:

   a. All surfaces to be painted shall be thoroughly cleaned immediately before the application of the primary coat. Use one of the following solvents: benzol, carbon tetrachloride or some other suitable organic solvent. Use same care when applying second topcoat, that preceding topcoat has not become soiled.

   b. The flat face of the blade will receive a three-coat application; one primary coat and two topcoats. Mask-off the camber face of the blade, using any suitable method.

   c. The primer shall be zinc chromate thinned with toluol. Apply it evenly over the surface of blade avoiding a heavy coat. Allow to dry for at least 30 minutes at room temperature in a dust free atmosphere.

d. Apply the first topcoat so that it covers the primary coat completely. The topcoat shall be camouflage flat black lacquer thinned with cellulose nitrate thinner. They shall be throughly mixed before applying.

e. Allow the first topcoat to dry thoroughly (at least 15 minutes) and then apply the second topcoat in a similar manner. Allow the final topcoat to dry for at least two hours at a normal room temperature. The blades shall not be considered ready for service until they have dried for a period of 48 hours.

f. Apply one coat of zinc chromate primer and two coats of camouflage flat yellow lacquer to both sides of the outer four inches of the blade. Also apply a stripe of yellow lacquer at the 33 in. reference station on the flat face of the blade. This stripe shall be 1/8 in. wide by 2 in. in length starting 1 7/8 inches from the leading edge of the blade.

g. Install the bearing ball information decal on the flat face side of the blade shank, 1 1/4 inches from the steel retainer. After it has dried, apply clear lacquer over its surface.

D. Assembly

When assembling the propeller, always remember: before inserting O-Rings, apply a coating of clean engine oil to the O-Rings and to all surfaces onto which they are assembled; apply the proper torque to all screws, bolts, and nuts (see Fig. 6); safety all bolts, nuts, screws, etc. where necessary.

Item	Part Number	Part	Parts per Propeller	Torque (in. lbs.)
(3)	AN310-5	Pitch Control Arm Clamp Nut	4	120 to 140
(5)	AN310-5	Pitch Control Arm Stud Nut	2	100 to 120
	AN4H7A	Retention Nut Lock Screw	2	70 to 90
(11)	AN364-1018C	Piston Rod Nut	2	450 to 500
(28)	AN3H7A	Spinner Rear Bulkhead Screw	6	30 to 40
(28)	AN4H7A	Spinner Rear Bulkhead Screw	6	70 to 90
	AN8H10A	Hub Flange Attaching Bolts	6	600 to 700

Figure 6.

Wrench Torque for Bolts and Nuts

Since it is necessary to pass the spindle of the balancer through the hub cylinder, only the blades and the spinner rear bulkhead assy. should be installed prior to balancing the propeller.

1. Install spinner rear bulkhead assy. (29) and 6 bolts and washers (28) onto the engine mounting flange of the hub. The bulkhead should be parallel to the hub flange within .040 TIR when measured near the outer flange.

CAUTION

Propeller F12A-4 has hub 212 (S/N 1 thru 206) and FS200 spinner assy. (No S/N or S/N thru 213) which uses bulkhead 248. These parts are drilled and tapped for AN3 attaching bolts. Propellers F12A-3 and F12A-5 have hub 212-1 (S/N 207 and after) and FS200-1 spinner assy. (S/N 214 and after) which uses bulkhead 248-1. These parts are drilled and tapped for AN4 attaching bolts. Take care not to interchange parts.

2. **Install the O-Ring in the retention nut on the blade.**

3. **Assure proper seating of the outer bearing race in the retention nut, and of the inner bearing race on the blade retainer.**

4. Install 31 bearing balls 7/16 diam., and pack with grease such as Sinclair AF No. 2EP.

5. Install both blades being especially careful not to allow any of the bearing balls to fall out.

NOTE

At this stage the faces of the blade retainer flanges, and the shelf or seat in the hub on which they rest should not be lubricated.

6. **Install pitch control arm (2), 2 set screws (1), 2 bolts, nuts, and washers (3), and balance screws, plates, and weights (10) on each blade. The stud (5) must be at the leading edge of the blade, and point toward the hub. The arm must enclose the ridge which runs around the blade retainer approximately 3/4 inch outboard of the retention nut, and must be pushed outboard until it rests against it. Set the center line of the arm at 16 1/2° to the 33R blade reference station on each blade (see Figure 7). Snug up the clamp bolts (3), but not the set screws (1).**

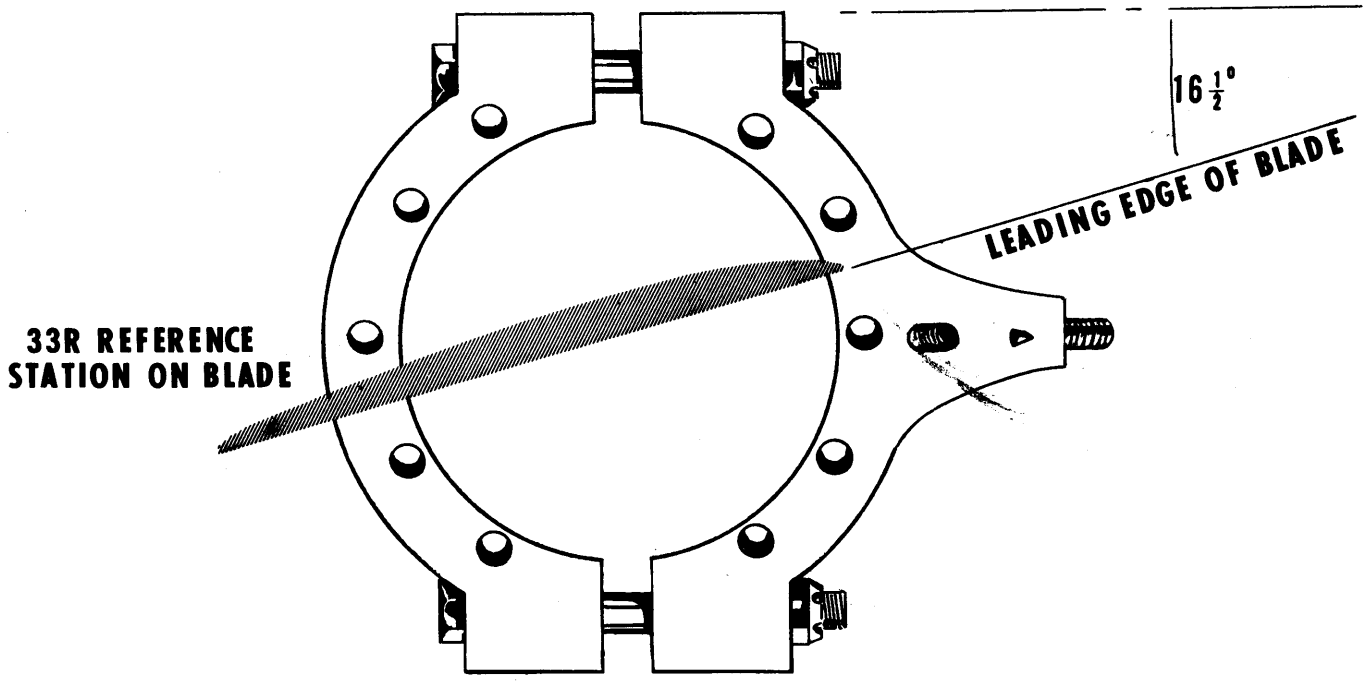

Figure 7. Pitch Control Arm Setting

7. **Balance the propeller as outlined in paragraph E.**

8. Remove both blades, and liberally apply grease such as Sinclair AF No. 2EP to the face of the blade retainer flanges, and to the shelves or seats in the hub on which they rest.

9. Re-install blades. Tighten the retention nut until all play (other than rotation) disappears from the tip. Loosen the nut 1 to 1 1/2 notches until a small amount of play can be felt between the nut and retainer. Over-tightening will damage the blade bearing and impair operation of the propeller.

10. Install 2 screws, washers, retention nut locks (8),

11. Into the rear of the hub, insert hub pilot (25) and O-Rings (26) and (27).

12. Stand the hub with the engine mounting flange down on a smooth surface that will prevent the hub pilot (25) from slipping out.

13. Assemble the piston rod (17), high pitch stop (15), piston (12), O-Rings (13) and (14), and nut (11).

14. Insert this assy. through the front of the cylinder, taking care to prevent shearing the O-Rings, and to prevent the piston from binding.

15. Pour 1 1/2 to 3 oz. of clean engine oil on top of the piston.

NOTE

The purpose of this oil is to prevent corrosion of the exposed surface of the cylinder between overhaul periods.

16. Insert piston rod guide (18), O-Rings (19) and (20), and snap ring (7).

NOTE

This assy. may not stay in its position until installation of the snap ring because the air trapped between it and the piston will be compressed, and will tend to force the guide assy. out of the hub. However, this compressed air will be useful later to help keep the piston to the rear of the cylinder while setting the low pitch.

17. Install pitch bar and link assy. (4) (23) (31) and nut (24).

NOTE

It will be necessary to use a little effort to pull the piston rod out of the cylinder against the compressed air far enough to use a smooth wrench on the flats on the front end.

18. Inspect for and remove burrs on piston rod at the flats.

19. Place a AN960-616 washer on stud (5) in arm (2) and slide end of link (4) onto stud on top of washer; install nut. Repeat for other blade.

20. Loosen the clamp bolts (3) in each pitch arm. Set the blade low pitch angle of 11.7° at the 33R blade reference station. Tighten the clamp bolts. Recheck pitch and reset if necessary. Torque the nuts and install cotters.

CAUTION

When adjusting the blade pitch, or when changing pitch manually, observe the cautions noted in Section IV F3 of this manual.

21. Tighten the set screws (1) and stake with a center punch.

E. Balance

Following any appreciable blade repair, propeller overhaul, or major part replacement, the propeller assy. must be balanced. The suspension type balancer is recommended because of the direct indication of the direction in which the propeller is out of balance, no delicately adjusted balance ways are necessary, and because of its ease of interpretation.

Vertical balance of each blade, and final balance of the propeller assy. is accomplished by attaching lead segments topped by steel plates with cap screws to the outboard face of the pitch control arm (2). The lead segments can be cut and trimmed to any size as long as at least one full screw hole remains in each segment. The lead segments should always be topped by a steel plate. Do not alter the steel plates in any way.

1. For the primary balance operation, set each blade angle at the value specified in Section IV F, and tighten each blade retaining nut sufficiently to prevent blade angle change during the balancing operation.

2. Check the track of each blade as prescribed in Section IV D.

3. Mount the propeller in the balancer using the proper adapter cones.

4. Add or remove lead as indicated until balance in all directions is obtained.

5. Remove the propeller from the balancer, and for the secondary balance operation, reset the blade angle 90° above low pitch position.

6. Mount the propeller in the balancer.

7. Because longitudinal balance was obtained during the primary operation, any unbalance that occurs in the secondary position should be to either side only. If longitudinal unbalance is indicated, recheck the primary balance, the accuracy of the balancer, or both.

8. To correct sideways unbalance in the secondary position in a manner that will not affect the primary balance, add an equal amount of lead in 4 places on the same side of the hub, 2 on each blade as shown in Figure 8. Where only a small correction is required, 4 screws without any lead or plates may be used. It would also be permissible to use several AN960-416 washers on each screw (the same quantity on each).

9. Re-check the primary balance. If it indicates a considerable change, secondary balancing was incorrectly accomplished. If only a slight change has occured, correct it. It will then not be necessary to re-check secondary balance.

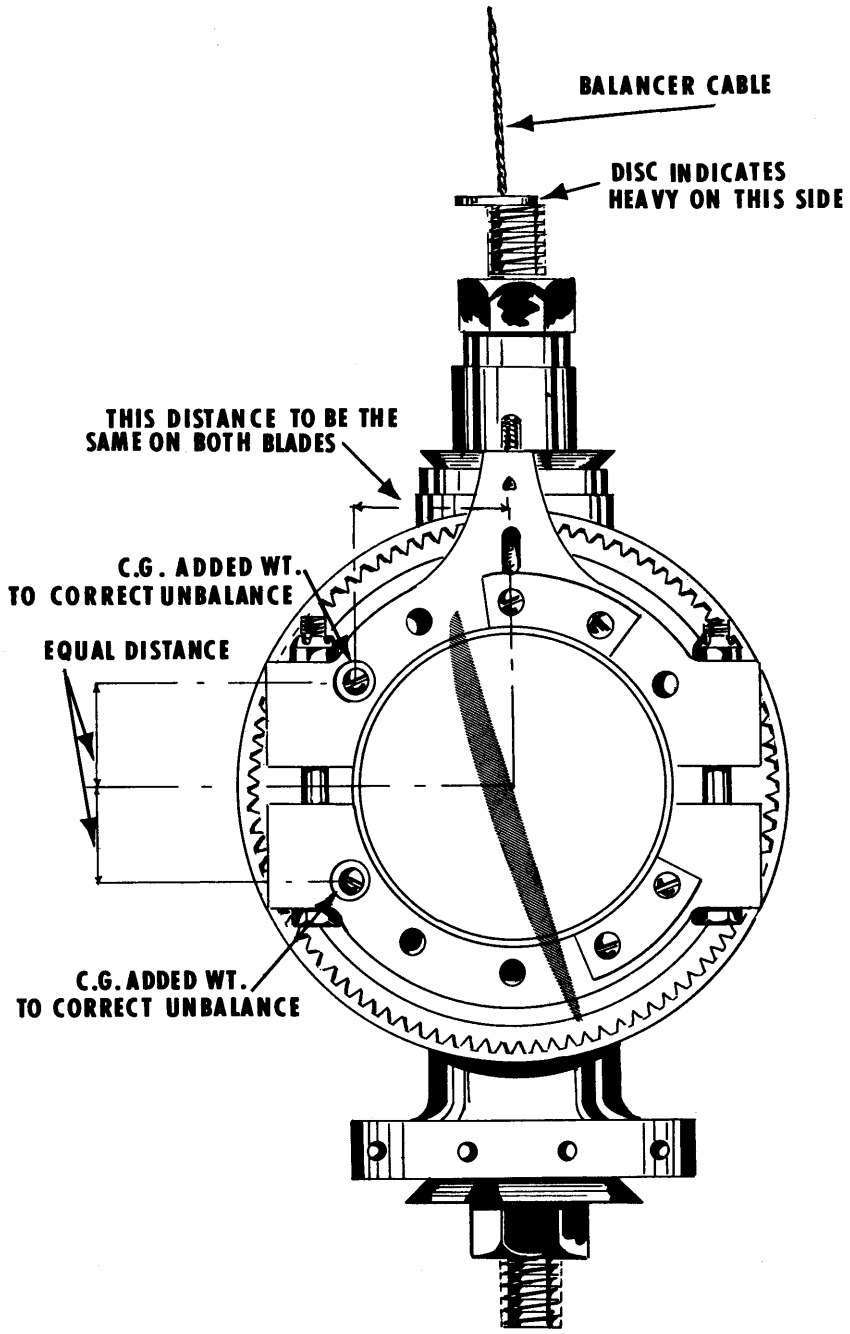

Figure 8. Secondary Balance Correction

For those who have conventional balancing arbors, adapter cones, and parallel knife edges, the procedure is identical to the preceeding instructions. However, instead of unbalance being indicated by a disc indicator, it is indicated by a tendency of the propeller to rotate toward the heavy side. It should be noted that the knife edges, arbors, and adapters must be free from all foreign matter, and must be smooth and true. The ways should be checked for parallelism prior to balancing the propeller.

SECTION VI

PARTS LISTS

TABLE A

F12 Manufactured Parts and Sub-assys.

Item No.	Part No.	Nomenclature	No. Req. Per Propeller
32	8400-0	Blade Assy. (F12A-4, -5 Propellers)	2
32	8400-2	Blade Assy. (F12A-3 propeller)	2
	FS200	Spinner Assy. (F12A-4 Propeller)	1
	FS200-1	Spinner Assy. (F12A-3, -5 Propellers)	1
24	106	Hub Pilot (Obsolete. Replace with part 171)	1
17	112	Piston Rod	1
21	113	Piston	1
19	128	High Pitch Stop (Obsolete. Replace with part 231)	1
18	129	High Pitch Stop Washer (Used only with part 128)	1
3	136	Pitch Control Bar & Link Assy.	1
50	156	Balance Plate	as req.
48	157	Balance Plate	as req.
51	158	Balance Weight	as req.
24	171	Hub Pilot	1
11	212	Hub (F12A-4 Propeller)	1
11	212-1	Hub (F12A-3, -5 Propellers)	1
19	231	High Pitch Stop	1
13	237	Retention Nut Lock	2
48	238	Balance Plate	as req.
7	241	Piston Rod Guide Assy.	1

TABLE B

Manufactured Parts Which Are Included in F12 Sub-Assys., But Which May Be Ordered Separately.

Item No.	Part No.	Nomenclature	Assy.	No. Req. Per Assy.
56	131	Pitch Control Bar	136	1
54	133	Pitch Link Assy.	136	2
42	135	Pitch Control Arm Assy.	8400-0, -2	1
28	191	Bearing Races (Pair)	8400-0, -2	1
30	194	Bearing Placard	8400-0, -2	1
1	217	Spinner Dome	FS200 & FS200-1	1
31	220	Blade Placard	8400-0, -2	1
9	239	Piston Rod Bearing	241	1
16	248	Spinner Aft. Bulkhead Assy.	FS200	1
16	248-1	Spinner Aft. Bulkhead Assy.	FS200-1	1
	277	Spinner Placard	FS200	1
	277	Spinner Placard	FS200-1	1

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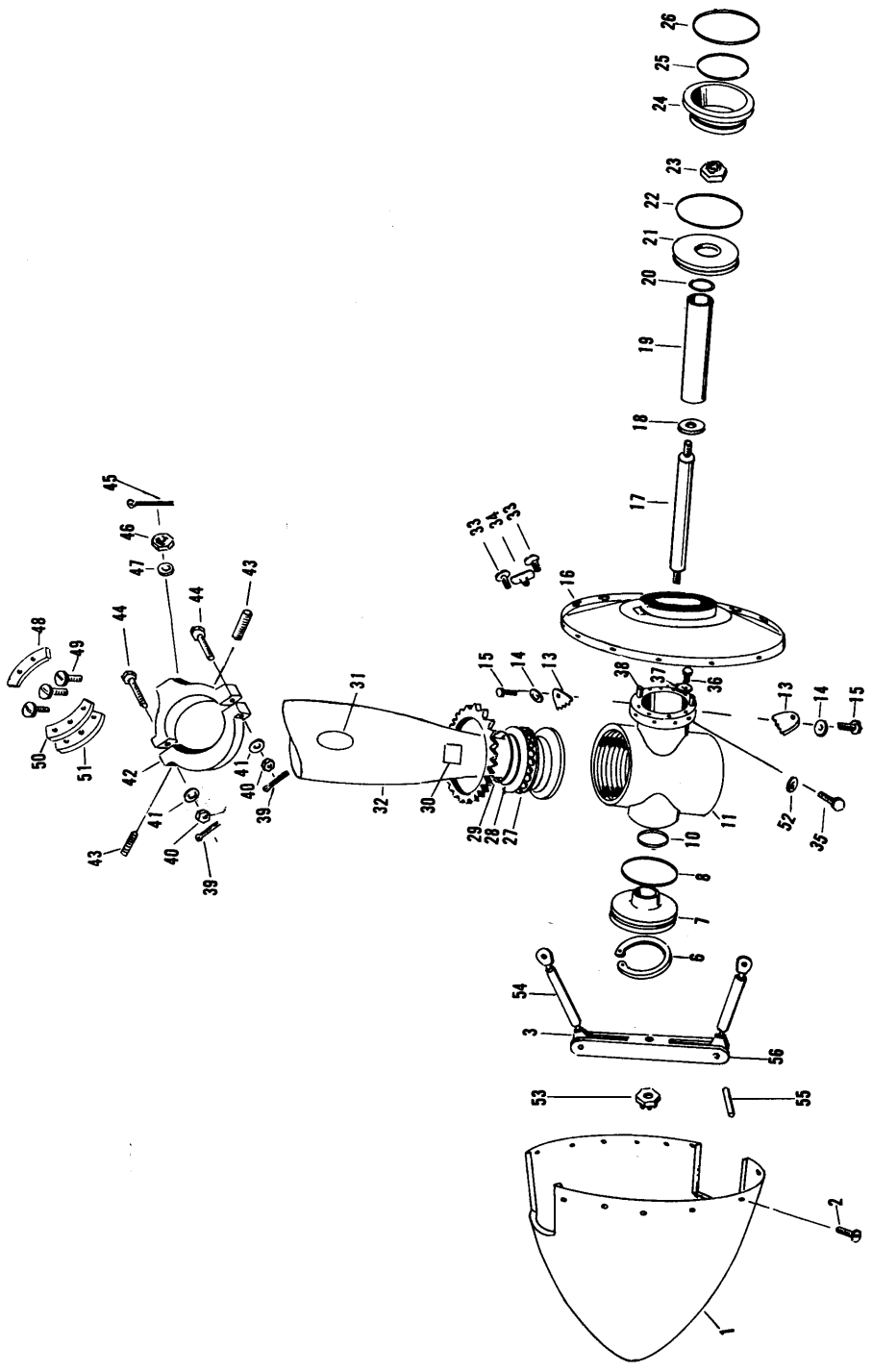


Figure 9. Exploded Parts Identification

TABLE C

F12 Purchased Parts

Item No.	Part No.	Nomenclature	No. Req Per Propeller
20	AN123867	O-Ring	1
10	AN123874	O-Ring	1
22		O-Ring (Precision Rubber Products Corp. 333-8187 (AMS7274)) PRP702-36 (Plastic & Rubber Products Co. PRP568-333-2597 (AMS 7274)) (Parker Appliance Co. 2-333 (N180-7))	
25	AN123888	O-Ring	1
8 and 26	AN123891	O-Ring	2
35	AN3H7A	Bolt (F12A-4 Propeller)	6
35	AN4H7A	Bolt (F12A-3, -5 Propellers)	6
15	AN4H7A	Bolt	2
36	AN8H10A	Bolt	6
46	AN310-5	Nut	2
23 and 53	AN364-1018C	Nut	2
49	AN501A-416-12	Screw	as req.
52	AN960-10L	Washer (F12A-4 Propeller)	6
52	AN960-416L	Washer (F12A-3, -5 Propellers)	6
14	AN960-416L	Washer	2
47	AN960-616	Washer	2
37	AN960-816	Washer	6
45	AN381-2-12	Cotter	2
6		Snap Ring (Waldes Kohinoor Inc. N5000-287)	1
	MS20995-C32	Lock Wire	as req.
38	.5002 Dia X 1.00 long	Hardened Steel Dowel	2

Revised July 10, 1962

TABLE D

Purchased Parts Which Are Included In F12 Sub-Assemblies, But Which May Be Ordered Separately.

Item No.	Part No.	Nomenclature	Assy.	No. Req. Per Assy.
27	7/16 diam.	Bearing Balls (Chrome Steel, Grade 1)	8400-0,-2	31
29		O-Ring (Plastic & Rubber Products Co. PRP6227-47-7163 Silastic Compound)	8400-0,-2	1
		O-Ring (Precision Rubber Products Corp. 344-11306. Compound equivalent to Dow-Corning 7-163 Silastic) PRP 568-344		
44	AN5-31	Bolt	135	2
40	AN310-5	Nut	135	2
41	AN960-D516	Washer	135	2
39	AN381-2-12	Cotter	135	2
43	$\frac{1}{4}$-28UNF x 7/16	Hex Socket Cup Point Set Screw	135	2
2	AN525-10R10	Screw	FS200 & FS200-1	12
34	AN362F1032	Plate Nut	248 & 248-1	12
33	MS20426AD3-8	Rivet (100° c'sk head)	248 & 248-1	24
55	3/8 diam. x $1\frac{1}{4}$	long Grooved Pin (Groov-Pin Corp. Type 1)	136	2

Revised July 10, 1962

UNIVAIR

UNIVERSAL AIRCRAFT INDUSTRIES

PROPELLER DIVISION

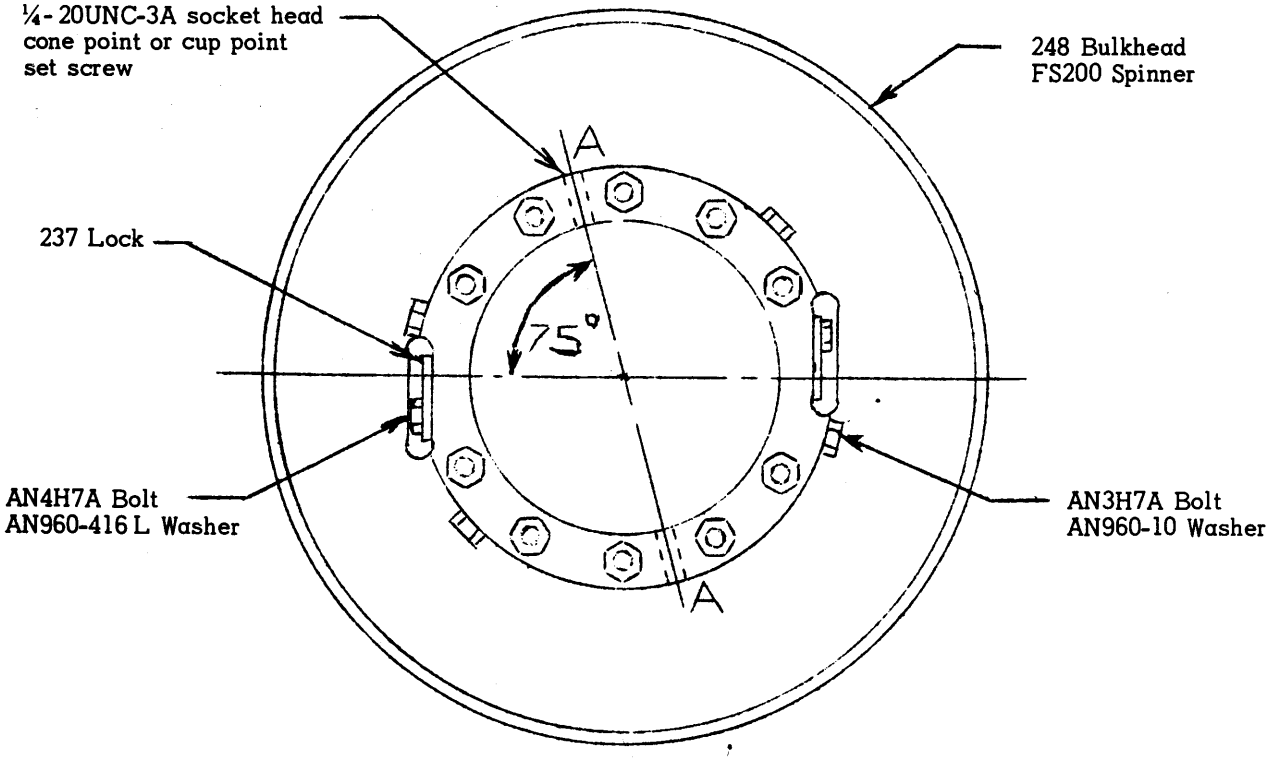
Sky Ranch Airport Post Office Box 5306, Denver, Colorado–80217

November 1, 1962

SERVICE BULLETIN NO. 1
Approved by FAA
Applies to F12A-4 Propellers

In some instances where excessibe clearance exists between the bore of the spinner bulkhead and the hub flange some of the AN3 bolts which attach the bulkhead to the flange have failed. Where broken bolts have been found, the following rework is recommended immediately. Where no broken bolts have been found, the following rework is recommended at the next overhaul. The sequence of installation is important. In all cases, use new bolts which have been magnetically inspected.

1. Tap the 2 holes marked A with ¼-20UNC-3B threads using an H3 tap.
2. Slide the bulkhead onto the hub.
3. Re-install both blade retention nut locks 237, AN4H7A bolts and AN960-416L washers.
4. Re-install 4 AN3H7A bolts and AN960-10 washers.
   Note: If -10 washers are not available use 2 -10L washers under each bolt head.
5. Torque the AN4H7A bolts to 70 to 90 in. lbs.
6. Install 2 ¼-20UNC-3A socket head cone point or cup point set screws ½ inch long into the two tapped holes. Tighten securely by hand with a hex key.
7. Torque the AN3H7A bolts to 30 to 35 in. lbs.
8. Re-check the torque on the AN4H7A bolts.
9. Re-check tightness of set screws. Safety stake each with a center punch in 2 places.
10. Safety all the bolt heads with one continuous piece of MS20995-C32 wire.



Rear View

UNIVAIR

UNIVERSAL AIRCRAFT INDUSTRIES

PROPELLER DIVISION

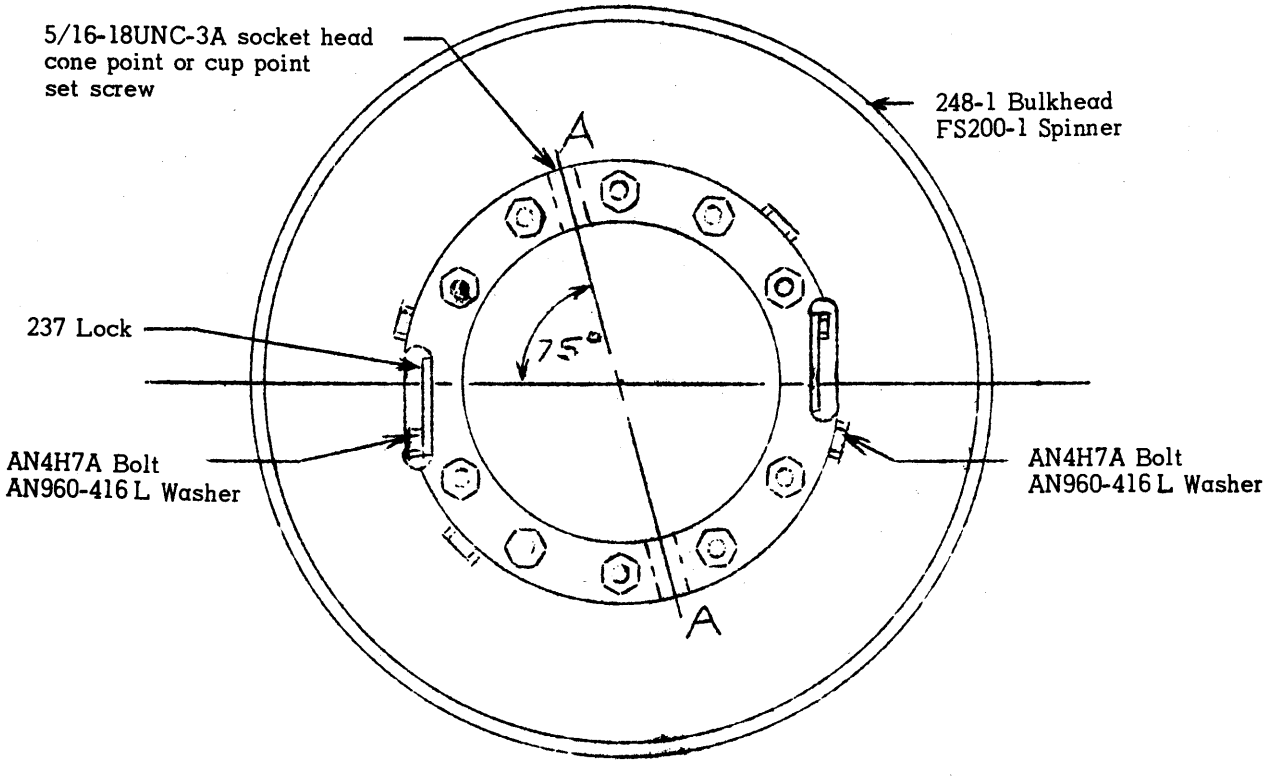
Sky Ranch Airport — Post Office Box 5306, Denver, Colorado–80217

July 15, 1963

SERVICE BULLETIN NO. 2
Approved by FAA
Applies to F12A-3 and F12A-5 Propellers

In some cases where excessive clearance exists between the bore of the spinner bulkhead and the hub flange some of the bolts which attach the bulkhead to the flange have failed. Where broken bolts have been found, the following rework is recommended immediately. Where no broken bolts have been found, the following rework is recommended at the next overhaul. The sequence of installation is important. In all cases, use new bolts which have been magnetically inspected.

1. Tap the 2 holes marked A with 5/16-18UNC-3B threads using an H3 tap.
2. Slide the bulkhead onto the hub.
3. Re-install both blade retention nut locks 237, and their AN4H7A attaching bolts, and AN960-416 L washers.
4. Torque these two bolts to 70 to 90 in. lbs.
5. Install two 5/16-18UNC-3A socket head cone point or cup point set screws ½ inch long into the two tapped holes. Tighten securely by hand with a hex key.
6. Re-install the remaining four AN4H7A bolts and AN960-416 L washers.
7. Torque these four bolts to 70 to 90 in. lbs.
8. Re-check the torque on the first two AN4H7A bolts.
9. Re-check tightness of set screws. Safety stake each with a center punch in 2 places.
10. Safety all the bolt heads with one continuous piece of MS20995-C32 wire.



Rear View

UNIVAIR

UNIVERSAL AIRCRAFT INDUSTRIES
PROPELLER DIVISION
Sky Ranch Airport
Post Office Box 5306, Denver, Colorado–80217

July 18, 1963

SERVICE BULLETIN NO. 3
Approved by FAA
Applies to F12A-3, F12A-4 and F12A-5 Propellers installed on various Beech Model 33 Debonair and Model 35 Bonanza Aircraft

A small crack has been found in the welded joint where the aft side of the hub barrel is joined to the hydraulic cylinder. Such cracks could lead to serious oil loss.

(a) Within the next 25 hours of time in service after the effective date of this bulletin, and thereafter within each 100 hours' time in service, remove the propeller spinner and visually inspect for cracks and oil leaks in the weld area where the aft side of the hub barrel is joined to the hydraulic cylinder.

(b) At each propeller overhaul, inspect the hub by magnetic particle inspection or FAA approved equivalent method. Give particular attention to the weld where the aft side of the barrel is joined to the hydraulic cylinder.

(c) Replace cracked parts with new parts prior to further flight.

Note: Repairs are not permissible.

(d) This bulletin applies only to hubs with serial numbers lower than 400.

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UNIVERSAL AIRCRAFT INDUSTRIES

PROPELLER DIVISION

Sky Ranch Airport Post Office Box 5306, Denver, Colorado–80217

July 18, 1963

SERVICE BULLETIN NO. 4
Approved by FAA
Applies to F12A-3, F12A-4 and F12A-5 Propellers installed on various
Beech Model 33 Debonair and Model 35 Bonanza Aircraft

It has been found in many cases impossible to align the slot in the AN310-5 nut with the cotter pin hole in the pitch control arm stud (item 5 in Figure 1 of Flottorp Model F12 Service Manual) within the specified torque range (Figure 6 in the Manual). Advancing the nut results in shearing the locking pin in the arm. Backing the nut off may eliminate the torque entirely.

We recommend that, at next overhaul, the AN310-5 nuts and AN381-2-12 cotters on these two studs be discarded. Replace with MS20365-524C (all-metal) nuts. Torque to 70 to 80 inch-pounds.

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