34-1-21. REASSEMBLY OF WOBBLE PLATE. (See figure 34-1-2.)

a. Install bearings (13) into snap ring side of gimbal (33) and inner ring (30). Retain bearings with snap rings (14), which are installed with chamfer facing outward.

NOTE: A locally fabricated bearing press can be manufactured from a 2-inch piece of tubing with an outside diameter of 1.120 inch.

b. Install the remaining bearings in the gimbal and inner ring but do not press them into location.

c. Select one laminated spacer (7) approximately 0.090-inch thick, and a second laminated spacer approximately 0.080-inch thick.

d. Place gimbal ring (33) into position in the inner ring (30) with spacers located between bearings and gimbal. The 0.080-inch spacer must be located on snap ring bearing side. Install bolts (5) and nuts (15) and tighten to 250/350 pound-inches. The nuts can be interchanged to obtain lockwire hole alignment.

e. Rock gimbal ring from side to side to determine there is no interference between gimbal and inner rings.

f. Install gimbal sleeve (6) into gimbal ring selecting and installing spacers as in steps c and d above. Make certain that the 0.080-inch thick spacer (7) is installed on the snap ring bearing side.

g. Using an aluminum drift, gently tap the bolts securing the movable bearings (not illustrated) to ensure that they are fully in position.

h. Using wobble plate check fixture (item 51A, table 92-1-I or equivalent), check concentricity between gimbal sleeve ID and inner ring OD at diameter surface below ring flange.

i. Vary thickness of spacers located at snap ring locations by removing or adding laminations at desired locations so that diametral concentricity is within 0.015 inch.

CAUTION: WHEN CORRECT SPACER LAMINATION THICKNESS IS DETERMINED, MAKE CERTAIN THAT GIMBAL BOLT ATTACH NUTS ARE TIGHTENED TO 250/350 POUND-INCH TORQUE VALUE.

j. Secure nuts (15) with lockwire (MS20995C32), taking care to wrap the wire between inner race of bearing and attach nut. The wire cut end must be twisted so that it will not chafe on the surrounding surface.

CAUTION: TO PREVENT THE PYLON YOKE ATTACHING BOLTS FROM BOTTOMING AGAINST THE LARGE DIAMETER WOBBLE PLATE BEARING SET, USE ONLY PRESCRIBED LENGTH BOLTS WHEN ATTACHING THE PYLON YOKE TO WOBBLE PLATE RING.

k. Attach pylon yoke (41) to wobble plate ring assembly with internal wrenching head bolt at right-hand side of ring assembly, and hexhead bolt at left-hand side of ring assembly. Secure boltheads to holes provided in wobble plate ring with lockwire (MS20995C32).

CAUTION: MAKE CERTAIN THAT SNAP RING IS FULLY SEATED.

l. Press duplex bearing set (19) into wobble plate outer ring and secure with snap ring (18). Install matched duplex bearing set with each bearing seal facing outward. The nonchamfered side of the snap ring must be placed next to bearings.

m. Press inner ring into position in wobble plate outer ring. Secure inner ring with left-hand threaded lock ring (23). Tighten lock ring with spanner wrench (item 40, table 92-1-I), to 2160/2640 pound-inch torque value. Do not overtighten lock ring. Secure lock ring with lockwire (MS20995C32) in two places.

n. Secure shield (16) to wobble plate outer ring with attaching screws. Obtain 0.032-inch clearance between shield and inner ring by inserting AN960-10 washers (28) between shield and wobble plate. Lock the shield attaching screws by staking each screw in one place.

o. Install lubrication fittings (21).

p. Lubricate wobble plate assembly. (See figure 10-19.)

34-1-22. DISASSEMBLY OF SCISSORS. (See figure 34-1-3.)

a. Remove cotter pin, nut, washers and bolt from the hinge line between each lower and upper scissors arms.

b. Extract retainer rings and shims from lower scissors.

CAUTION: SECURE BEARING AND SPACER SETS TOGETHER ON REMOVAL WITH LOCKWIRE OR CORD TO MAINTAIN THEM AS MATCHED SETS. IDENTIFY THEM FOR PROPER REINSTALLATION.

c. Press bearing set and spacer set from each of end of the lower scissors.

CAUTION: DO NOT PRESS AGAINST THE BEARING BALL.

Table 34-1-II. Table of Allowable Limits for Wobble Plate Assembly

Figure 34-1-2 Index No.	Nomenclature	Limits (Inches) Min	Max
5	Wobble Plate Gimbal Bolt (1/2-20 UHF - 3A thread)		
	Major Diameter of Shank	0.4981	0.4996
3	Flanged Bushing ID (installed, 2 places)		
6	Wobble Plate Gimbal Sleeve		2.554
	ID		0.5630
	Bore Dia, sleeve-to-gimbal attach bolt locations (bushing removed, 2 places)	(On Condition)	
8	Insert		
33	Gimbal Ring		0.5005
	Bore Dia, scissors attach ears (bushing removed, 4 places)		1.1255
	Bearing Bore Dia (2 places)		0.4996
	Bore Dia, gimbal bolt location (2 places)		1.2505
	Bore Dia (bushing removed, 2 places)		1.1280
	Bearing Bore Dia (allowable with Loctite, 2 places)		0.064
	Groove width, snap ring location		0.3775
34	Bushing Bore Dia (installed)		
13	Bearing		
	OD	1.1245	
	ID		0.5000
30	Inner Ring		
	OD	5.9975	
	Bore Dia (bearing removed, 2 places)		1.1255
	Bore Dia (bushing removed, 2 places)		1.2505
	Groove width, snap ring location		0.064
	Lock Ring attach thread (5-7/8 12NS-3 LH)	(On Condition)	
	Bearing Bore Dia (allowable with Loctite)		1.1280
19	Bearing		
	OD	7.1240	
	ID		6.0000

Table 34-1-II. Table of Allowable Limits for Wobble Plate Assembly (cont)

Figure 34-1-2 Index No.	Nomenclature	Limits (Inches) Min	Max
20	Outer Ring		
	ID		7.302
	Bore Dia, yoke attach location (bushing removed)		0.3755
	Bore Dia, control rod attach location (bushing removed)		0.3755
22	Plain Bushing ID (installed)		0.2520
23	Lock Ring	(On Condition)	
24	Flanged Bushing ID (installed)		0.2520
25	Plain Bushing ID (installed, 2 places)		0.2520
28	Plain Bushing ID (installed)		0.2520
31	Plain Bushing ID (installed)		0.3775
32	Bushing ID (installed)		1.1255

Table 34-1-III. Table of Allowable Limits for Scissors Assembly

Figure 34-1-3 Index No.	Nomenclature	Limits (Inches) Min	Max
5	Bearing (Spherical) internal wear between ball and outer race		
	Axial		0.010
	Radial		0.004
6	Upper Scissors Arm		
	Bore dia (allowable with Loctite)		1.0033
	Bore dia (bearing removed)		1.0008
	Diametral clearance, bearing - scissors bore		0.0013
	Axial movement between spherical outer race and upper scissors bore (snap ring installed)		0.016
	Hinge line bore (bushings removed)		0.5005
8	Flanged Bushing ID (bushing installed)		0.3775
14	Lower Scissors Arm		
	Bore dia (bearings removed)		0.8760
	Allowable end play with bearings, spacer and snap rings installed		0.002
15	Plain bushing ID (bushing installed)		0.3775

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d. Extract retainer ring at the spherical bearing in the upper scissors arm and press out bearing.
e. Remove lubrication fittings from scissors units.

34-1-23. REASSEMBLY OF SCISSORS. (See figure 34-1-3.)

a. Install retainer rings in lower scissor on lubrication fitting side.
b. Install matched bearing and matched spacer sets. The bearing seals must face outward.
c. Temporarily install retainer ring into position opposite the lubrication fitting side.
d. Use a thickness gage to measure clearance between retaining ring and bearing. Add or remove laminated shims between retainer ring and bearing to obtain clearance of less than 0.002 inch.
e. Accomplish step d on opposite end of lower scissor.
f. Install upper scissor arm spherical bearing and secure with retainer ring.
g. Assembly lower scissors to upper scissors arm with spacer bushings, bolts, washers and nuts. The upper scissors lubrication fitting and/or spherical bearing retainer must face outboard.

CAUTION: DURING REASSEMBLY OF LOWER SCISSORS, SCISSORS ARM AND WOBBLE PLATE GIMBAL RING HINGE LINE POINTS, MAKE CERTAIN THAT THE TOTAL ASSEMBLY GAP BETWEEN MATING PARTS AT HINGE LINE DOES NOT EXCEED 0.005 INCH WITH THE BOLT INSTALLED, BUT NOT TIGHTENED. AN EXCESSIVE GAP WILL ALLOW ADVERSE BENDING LOADS TO BE IMPOSED UPON WOBBLE PLATE GIMBAL RING AND UPPER SCISSOR ARM EARS. ESTABLISH REQUIRED DISTANCE BETWEEN BUSHINGS, IF NECESSARY, BY REPOSITIONING THE PLAIN (UNFLANGED) BUSHING.

h. Install scissors assembly to wobble plate assembly with spacers, bolt, washers and nut. The lower scissors lubrication fitting holes must face to the left.
i. Tighten nuts securing scissors bolts to 40/70 pound-inch torque value and secure with cotter pin.
j. Install lubrication fittings.

34-1-40. MAINTENANCE OF WOBBLE PLATE AND SCISSORS. All required data for dimensional inspection of the wobble plate and scissors assembly are available in the tables of allowable limits (34-1-II and 34-1-III). The manufacturing minimum and maximum limits are applicable for all items not given a wear tolerance. Parts worn in excess of wear tolerances and for which there is no permissible wear, shall be replaced. In addition to required specific dimensional checks, accomplish serviceability checking of assembly parts as follows.

a. It is permissible to remove minor surface defects from the wobble plate and scissors assembly up to a maximum depth of 0.020 inch after rework. There are no length or width limits for damage of a minor nature if rework is blended smoothly into the surrounding area.

b. Remove, clean and check upper scissors arm spherical bearing (5, figure 34-1-3) for notchiness and excessive wear. Allowable wear (or movement) between ball and outer race is limited to an axial movement of 0.010 inch and a radial movement of 0.004 inch. Replace bearing if defective; repack with grease, if applicable, and reinstall if serviceable.

c. Check for end (axial) play between spherical bearing outer race and upper scissor arm bore with the retaining ring installed. Normal (manufacturing) movement possible may be 0.016-inch maximum. If play is detected, it is permissible to fabricate and install a sufficient thickness of shims (1.00-inch OD by 0.81-inch ID steel) to restrict end play to allowable maximum.

NOTE: Insert shims between inner end of the bearing (end opposite the retaining ring) and bearing bore. Total installed movement is limited to 0.019-inch maximum, of which 0.016 inch is bearing movement, and 0.003 inch is axial bearing play.

d. Check fit of the spherical bearing in the scissors arm bore. Maximum diametral clearance is limited to 0.0013 inch.

e. The allowable bore diameter approved for installation of the spherical bearing in the upper scissors arm may be increased from a maximum diameter of 1.0008 inch to 1.0033 inch, provided that spherical bearing (5) is installed with Loctite, Grade C, (item 24, table 10-VI).

f. Check fit of the matched bearing (12) sets to bore of lower scissors. Maximum clearance between bearings and bore is limited to 0.0010 inch.

g. Reassemble scissors (paragraph 34-1-23).

h. (See figure 34-1-2.) Remove pylon yoke (41) and check the three bearings (35 and 39) for notchiness and excessive wear. Maximum permissible axial play is 0.004 inch. Radial play is limited to 0.002 inch-maximum. Replace unserviceable bearings (paragraph 34-1-45).

i. Check that end (axial) play between gimbal ring (33) and sleeve (6) is no greater than 0.016 inch, and between inner ring (30) and gimbal ring is no greater than 0.016 inch. Disassemble wobble plate and make necessary corrections to eliminate excessive end play.

NOTE: It is permissible to use Loctite, Grade C (table 10-VI, item 24) to secure pivot bearings (13) in the wobble plate inner ring (30) and gimbal ring (33), provided that the bearing bore diameter does not exceed 1.1280 inch.

j. Check radial play (looseness) between gimbal sleeve (6) and setscrew (9).

(1) Radial play is to be measured after sleeve and setscrew are removed.
(2) Position setscrew in sleeve so that setscrew thread end adjacent to screw head is just even with outer surface of sleeve threaded boss.
(3) Position a dial indicator at screw head adjacent to the lockwire hole. Move screw head back and forth in a straight plane against dial indicator pointer, and record reading.
(4) If radial play exceeds 0.011 inch, check for worn screw threads or worn sleeve threads.
(5) Replace worn screws; replace worn inserts in aluminum alloy sleeves; install inserts in steel sleeves (paragraph 34-1-42).

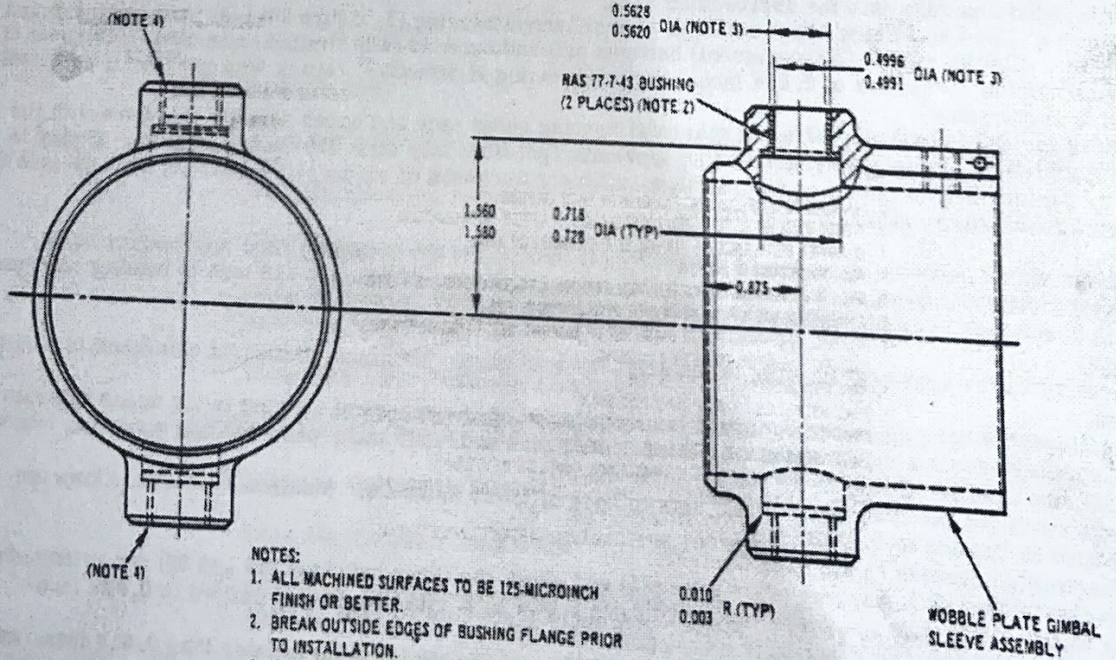
k. Refer to paragraphs 34-1-41 through 34-1-45 for wobble plate component overhaul instructions.

34-1-41. REPAIR OF WOBBLE PLATE GIMBAL SLEEVE. Repair worn or damaged bolt holes in the wobble plate gimbal sleeve (aluminum alloy) as follows.

a. Drill and line-ream bolt holes to 0.5620/0-5628-inch diameter, maintaining original hole center. Counterbore each hole 0.718/0.728-inch diameter, as shown in figure 34-1-4.
b. Coat bushings (NAS77-7-43) with primer (table 10-VI, item 3) and install while primer is still wet. Make certain that bushing is firmly seated against bottom of counterbore. Machine bushing flush with boss face.
c. Drill and line-ream bushings to 0.4991/0.4996-inch diameter.
d. Fluorescent-penetrant inspect sleeve after rework is accomplished.

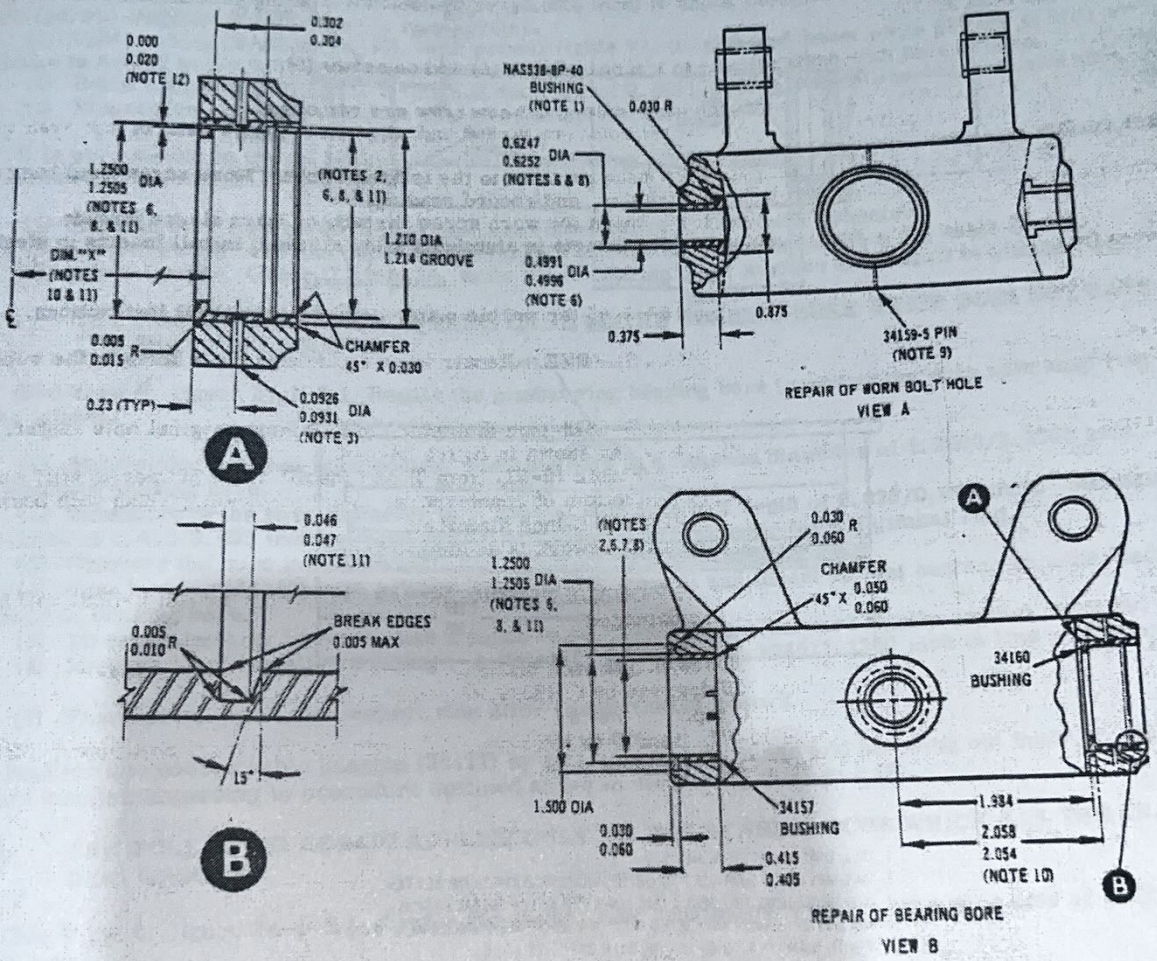
34-1-42. REPAIR OF DAMAGED THREADS IN WOBBLE PLATE GIMBAL SLEEVE. Install helical coil insert in steel sleeve whenever setscrew threads are damaged.

a. Use a Size W drill to drill hole (0.358/0.392-inch diameter) through boss of steel sleeve.
b. Countersink outer face of hole 120 degrees by 0.420/0.460-inch diameter.
c. Tap hole with 3/8 by 24 Heli-coil tap.
d. Apply a coat of primer (table 10-VI, item 3) to interior of hole and insert helical coil insert (MS124658) in hole to depth of 1/16 inch below outer face of sleeve boss.



NOTES:
1. ALL MACHINED SURFACES TO BE 125-MICROINCH FINISH OR BETTER.
2. BREAK OUTSIDE EDGES OF BUSHING FLANGE PRIOR TO INSTALLATION.
3. MAINTAIN CENTERLINES OF HOLES IN LINE
4. BUSHING TO BE MACHINED FLUSH WITH BOSS FACE (2 PLACES).
5. ALL DIMENSIONS IN INCHES.

Figure 34-1-4. Repair of Wobble Plate Gimbal Sleeve



NOTES:

1. MACHINE END OF BUSHING FLUSH WITH FACE OF BOSS.
2. FINISH BUSHING ID TO 1.1245/1.1250 DIAMETER AFTER INSTALLATION.
3. CHAMFER BOTH ENDS OF PIN HOLES 45 DEGREES BY 0.030.
4. ALL DIMENSIONS IN INCHES.
5. UNLESS OTHERWISE INDICATED, ALL DIMENSION TOLERANCES ARE ±0.010.
6. FINISHED DIAMETER TO BE IN LINE WITH OPPOSITE HOLE.
7. BEFORE MACHINING INSIDE DIAMETER OF BUSHING, SET TANGS OUTWARD AGAINST CHAMFER TO RETAIN BUSHING.
8. MAINTAIN ORIGINAL HOLE CENTER.
9. PINS INSTALLED ON SNAP RING SIDE ONLY.
10. DIMENSION "X" DISTANCE FROM CENTER LINE OF ASSEMBLY TO FINISHED FACE (BEARING SIDE) OF BUSHING FLANGE.
11. MACHINE SURFACE TO BE 125-MICROINCH FINISH OR BETTER.
12. INSTALL PINS WITH 0.000/0.020 CLEARANCE BETWEEN END OF PIN AND FINISHED BEARING BORE STAKE OUTER END OF PIN.
13. FLUORESCENT-PENETRANT INSPECT ASSEMBLY AFTER COMPLETION OF REPAIR.

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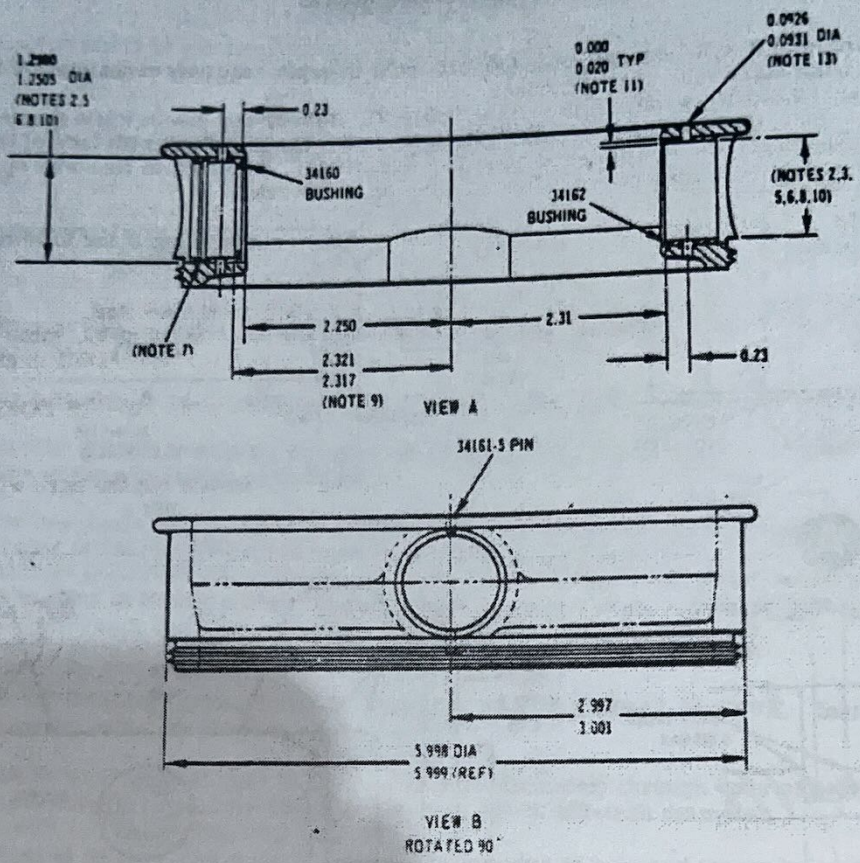
Figure 34-1-5. Repair of Wobble Plate Gimbal Ring (Typical)



NOTES:

1. ALL DIMENSIONS IN INCHES
2. ALL MACHINED SURFACES TO BE 125 MICROINCH FINISH OR BETTER
3. FINISH BUSHING TO 1.1250/1.1245 DIAMETER AFTER INSTALLATION
4. UNLESS OTHERWISE INDICATED, ALL DIMENSION TOLERANCES ARE ±0.010
5. FINISH DIAMETER TO BE IN LINE WITH OPPOSITE HOLE.
6. BEFORE MACHINING INSIDE DIAMETER OF BUSHING, INSTALL PINS TO RETAIN BUSHINGS
7. REFER TO DETAIL "B" FIGURE 34-1-5 FOR DETAIL MACHINING OF BEARING BORE AND SNAP RING GROOVE
8. MAINTAIN ORIGINAL HOLE CENTER
9. DISTANCE FROM CENTER LINE OF ASSEMBLY TO FINISHED FACE (BEARING SIDE) OF BUSHING FLANGE
10. TYPICAL DIAMETER DIMENSION EITHER BUSHING LOCATION.
11. INSTALL PINS WITH 0.000/0.020 CLEARANCE BETWEEN END OF PIN AND FINISHED BEARING BORE.
12. FLUORESCENT-PENETRANT INSPECT ASSEMBLY AFTER REPAIR
13. CHAMFER BOTH ENDS OF PIN HOLES 45 DEGREES BY 0.030.

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Figure 34-1-6. Repair of Wobble Plate Inner Ring (Typical)

e. Magnetic-particle inspect sleeve after rework is accomplished.
f. Replace any worn or damaged helical coil insert (MS124658) in aluminum alloy wobble plate sleeve.

34-1-43. REPAIR OF WOBBLE PLATE GIMBAL RING. Repair worn bolt holes or worn bearing bore, and replace unserviceable bushings in the gimbal ring as follows.

a. (See View A, figure 34-1-5.) Repair a gimbal ring bolt hole as follows:

(1) Drill and ream hole to a finished diameter of 0.6247/0.6252 inch, in line with opposite hole, Maintain original hole center.

(2) Counterbore hole 0.875-inch diameter (±0.010 inch) to depth required to maintain a distance of 0.375 inch (±0.010 inch) from outer face of ring surface.
(3) Coat bushing (NAS538-8P-40), with primer (table VI, item 3) and insert while primer is still wet, so that flange is seated in the 0.875-inch counterbore. Machine end of bushing flush with face of boss.
(4) Ream installed bushings to a finished diameter of 0.4991/0.4996 inch in line with opposite hole.
(5) Fluorescent-penetrant inspect ring after completion of rework.

b. It is permissible to install bearings in oversize bearing bore in gimbal ring if the following dimensions and procedures are observed:

(1) Bearing bore may be worn to a maximum diameter of 1.1280-inch diameter.
(2) Clean bearing bore and outer circumference of bearing with solvent (item 32, table 10-VI).
(3) Apply Loctite, Grade C (item 24, table VI) to bearing outer surface and install in gimbal ring.

CAUTION: THE FOLLOWING REPAIR APPLIES ONLY TO THE BEARING BORE WHICH DOES NOT HAVE THE SNAP RING GROOVE.

c. (See View B, figure 34-1-5.) Repair the gimbal ring bearing bore (opposite the bore with snap ring groove) as follows:

(1) Maintaining original bore center, machine bore to a finished diameter of 1.2500/1.2505 inch, in line with opposite bearing bore.
(2) Counterbore the bore diameter to 1.500 (±0.010) inch to a depth of 0.030/0.060 inch. Maintain indicated depth of 0.415/0.405 inch between bottom of counterbore and inner face of gimbal ring.
(3) Chamfer the bore inside surface to 45 degrees by 0.050/0.060 inch.
(4) Coat bushing (34157) with primer (table 10-VI, item 3) and insert so that bushing shoulder faces outer surface of bearing bore.
(5) To retain bushing in place, use a punch to set bushing tangs outward tightly against chamfer.
(6) Machine ID of installed bushing to a finished diameter of 1.1245/1.1250 inch in line with opposite bore.
(7) Fluorescent-penetrant inspect ring after completion of rework.

d. Replace an unserviceable bushing (34157) by straightening out tangs and pressing out bushing. Install replacement bushing according to procedure outlined above in steps c (4) through c (8).

CAUTION: THE FOLLOWING REPAIR APPLIES ONLY TO THE BEARING BORE WHICH HAS THE SNAP RING GROOVE.

e. (See View B, figure 34-1-5.) Repair the gimbal ring bearing bore on the snap ring side of gimbal ring as follows:

(1) Maintaining original bearing bore center, machine bore to finished diameter of 1.2500/1.2505 inch in line with opposite bearing bore. Maintain a 125-microinch finish.
(2) Chamfer bore inside surface to 45 degrees by 0.030 inch.
(3) Coat bushing (34160) with primer (table 10-VI, item 3) and insert so that inner face of bushing flange is located 1.984 inches from centerline through gimbal bolt bore.
(4) (See View A and Detail A.) Locate 2 bushing retaining pin holes on bushing bore vertical centerline. 0.23 inch from inner face of bushing. Drill and finish-ream holes through ring and bushing to 0.0926/0.0931-inch diameter. Chamfer both ends of holes to 45 degrees by 0.030 inch.
(5) Install pins (34159-5) [0.250-inch long, chamfered 45 degrees by 0.030 inch on both ends] through ring and into bushing, allowing 0.000/0.020-inch clearance between finished bore of bushing and end of pin.
(6) Stake outside end of pins.
(7) (See View B and Detail A.) Machine bushing bore to a finished diameter of 1.1245/1.1250 inches. Machine material from bottom of bore to provide a 2.058/2.054 inch dimension from flange surface (bearing side) to centerline of gimbal bolt bore. Maintain a 125-microinch finish. Maintain original bearing bore centered with bore in line with opposite bore.
(8) (See Detail B.) Machine a snap ring groove to finish diameter of 1.210/1.214 inch, maintaining dimensions shown in Details A and B. Locate the snap ring groove straight face 0.302/0.304 inch from bearing bore flange.
(9) Fluorescent-penetrant inspect ring after completion of rework.

f. Replace an unserviceable gimbal ring bushing (34160) by driving out the two pins and pressing out bushing. Install replacement bushing according to procedures outlined above in steps e (3) through e (9).

34-1-44. REPAIR OF WOBBLE PLATE INNER RING. (See figure 34-1-6.) Repair worn bearing bore or unserviceable bore bushings in the wobble plate inner ring according to the following procedures.

a. It is permissible to install bearings in oversize bearing bores in inner ring if the following dimensions and procedures are observed:

(1) Bearing bore may be worn to a maximum of 1.1280-inch diameter.
(2) Clean bearing bore and bearing outer circumference with solvent (item 32, table 10-VI).
(3) Apply Loctite, Grade C (item 24, table 10-VI) to bearing outer surface and install in bearing bore.

b. Repair worn bearing bore opposite snap ring groove as follows.

(1) Maintaining original hole center, machine-bore to a finished diameter of 1.2500/1.2505 inch, in line with opposite bearing bore. Maintain a 125-microinch finish.
(2) Coat bushing (34162) with primer (item 3, table 10-VI) and insert so that inner face of bushing is located 2.31 inches from centerline of the inner ring.
(3) Locate 2 bushing retaining pin holes on the vertical centerline of the bushing bore and 0.23 inch from bushing inner face. Drill and finish-ream holes through ring and bushing to 0.0926/0.0931-inch diameter. Chamfer both ends of holes 45 degrees by 0.030 inch.
(4) Install pins (34161-5) [0.160-inch long] through ring and into bushing, allowing 0.000/0.020-inch clearance between finished bore of bushing and end of the pin.
(5) Stake outside ends of pins.
(6) Maintaining original bearing bore center in line with opposite bore, machine bushing bore to a finished diameter of 1.1245/1.1250 inches. Maintain a 125-microinch finish. Break sharp edges on bushing bore 0.010/0.030 inch.
(7) Fluorescent-penetrant inspect inner ring after rework has been completed.

c. Replace an unserviceable inner ring bushing (34162) by driving out pins and pressing out bushing. Install replacement bushing as outlined in steps b (2) through b (7).

d. Repair a worn bearing bore on the snap ring side of the inner ring as follows.

(1) Maintaining original bearing bore center, machine inner ring bore to a finished diameter of 1.2500/1.2505 inches in line with opposite bearing bore. Maintain a 125-microinch finish.
(2) Chamfer-bore inside surface 45 degrees by 0.030 inch.
(3) Coat inner ring bushing (34160) with primer (item 3, table 10-VI) and insert so that inner face of bushing flange is located 2.250 inches from centerline of inner ring.
(4) Locate 2 bushing retaining pin holes on the vertical centerline of bushing bore and 0.23 inch from the inner face of the bushing. Drill and finish-ream holes through ring and bushing to 0.0926/0.0931-inch diameter. Chamfer both ends of hole 45 degrees by 0.030 inch.
(5) Install pins (34161-5) [0.160-inch long] through ring and into bushing, allowing 0.000/0.020-inch clearance between finished bore of bushing and end of pin.
(6) Stake outside end of pins.
(7) Maintaining bearing bore original center, machine bushing bore to finished diameter of 1.1245/1.1250 inches. Machine material from bottom of bearing bore to provide a 2.321/2.317-inch dimension from flange surface (bearing side) to centerline of inner ring.
(8) (See figure 34-1-5.) Machine a snap ring groove to finished diameter of 1.210/1.214 inches, maintaining dimensions shown in Details A and B. Locate snap ring straight face 0.302/0.304 inch from bearing bore flange.
(9) Fluorescent-penetrant inspect inner ring after completion of rework.

e. Replace a damaged or worn inner ring bushing (34160) by driving out pins and pressing out bushing. Install replacement bushing in accordance with procedure outlined in steps d (3) through d (9).

34-1-45. REPAIR OF WOBBLE PLATE PYLON YOKE. (See figure 34-1-7.) Replace pylon yoke rod end bearings in the following manner.

a. Remove drive screws and roll pins securing rod end bearings in yoke.

b. Position new rod end bearings in accordance with dimensions illustrated in figure 34-1-7.

c. Drill 0.125/0.129-inch diameter holes through the rod end (four places), using existing holes in yoke end as pilot holes.

NOTE: Drill one side at a time. Do not drill through hollow shaft of rod end bearings.

d. Clean all chips and burrs from assembly.

e. Install roll pins and drive screws.

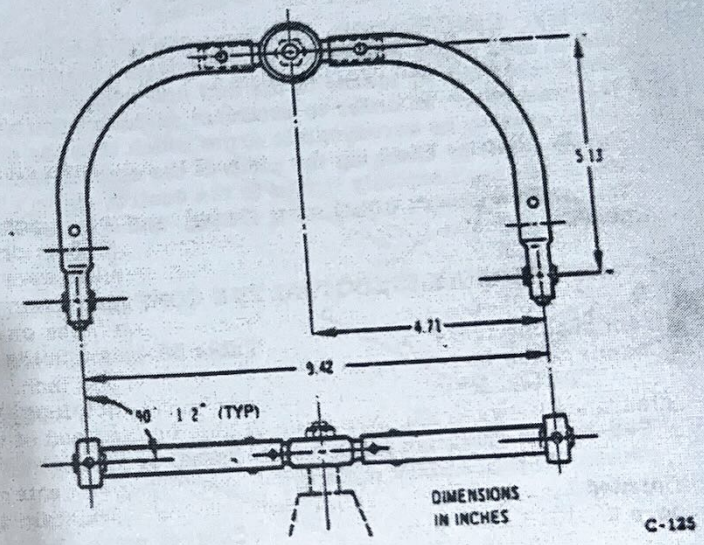


Figure 34-1-7. Repair of Wobble Plate Yoke

CONTROL ROTOR

36-1-1. CONTROL ROTOR ASSEMBLY.

36-1-2. DESCRIPTION. The variable pitch control rotor assembly comprises a pair of blades located at the end of spar tubes extending from the main rotor hub. These symmetrical airfoil blades are mounted on the main rotor hub by means of the cuff and trunnion assembly. The control rotor changes the plane of rotation of the main rotor in order to establish various flight attitudes. Changing the angle of incidence of the control rotor creates an aerodynamic force which tilts the main rotor about its vertical axis. This is accomplished during flight by changing the pitch of the control rotor blades by pilot movement of the cyclic control sticks which are mechanically linked to the control rotor. The assembly includes an incidence adjustment bracket at the cyclic scissors attachment fitting, and a balance weight location at the outboard face of each control rotor blade.

36-1-3. TROUBLESHOOTING THE CONTROL ROTOR ASSEMBLY. Refer to table 36-1-1.

Table 36-1-1. Troubleshooting the Control Rotor

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Two-to-one vibration (may be present in ship and/or control system)	Rough or notchy cuff and trunnion bearings	Replace cuff and trunnion bearings.
	Control rotor blades out of rig	Re-rig control rotor blades.
Feedback in cyclic control system	Control rotor spar tube bent	Straighten spar tube.

36-1-10. REMOVAL OF CONTROL ROTOR ASSEMBLY. (See figure 36-1-1.)

a. Only when necessary, remove the two bolts attaching control rotor blade spar tube to the cuff and withdraw blade from cuff.

CAUTION: TAKE CARE TO RETAIN THE CUFF BRACKET TO UPPER SCISSOR BEARING BOLT AS NO SUBSTITUTION IS PERMISSIBLE. NAS 464 MUST BE STAMPED ON THE BOLTHEAD.

b. Disconnect upper scissor arm from the incidence adjustment fitting by removing bolt which passes through the bracket and upper scissor bearing. Take care not to lose the two tubular spacers located between bracket arms and bearing.

c. Remove cuff and trunnion from hub as follows:

(1) Remove the eight nuts securing the base of each trunnion to the main hub.

(2) Slip cuff and trunnion assembly off the eight studs in hub assembly. Be careful not to damage stud threads.

36-1-11. INSTALLATION OF CONTROL ROTOR ASSEMBLY.

a. Install each cuff and trunnion assembly on the rotor hub. Tighten the eight nuts to 160/190 pound-inches.

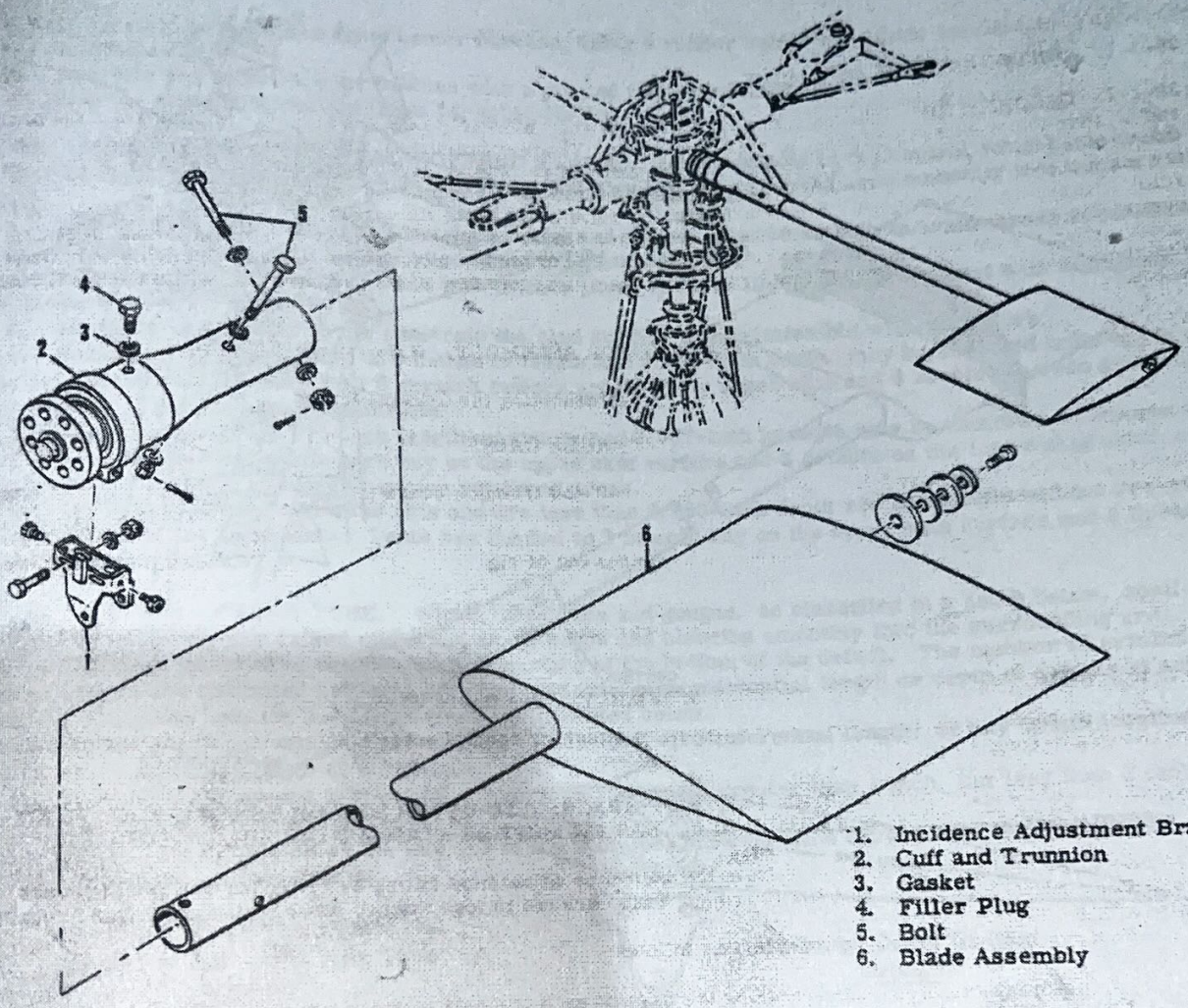
b. Apply a thin coat of Lubriplate 630-AA (item 16, table 10-VI) to the slip fit surface of the control rotor blade spar tube, and install blade in the cuff. Align the blade attaching bolt holes with the holes in the cuff.

c. Coat the blade attaching bolts (5) with Lubriplate 630-AA, and install them through the cuff and spar tube bolt holes. Use one washer under each nut, and one washer under each bolthead. Add an extra washer at either location, if required to provide correct alignment of nut castellation with cotter pin hole.

CAUTION: DO NOT EXCEED MAXIMUM TORQUE SPECIFIED FOR BLADE ATTACHMENT NUTS

d. Tighten nuts to 50/70 pound-inches, secure with cotter pins. PASANTES

CAUTION: MAKE CERTAIN THAT CUFF BRACKET-TO-UPPER SCISSORS BEARING BOLT IS IDENTIFIED WITH NAS464 STAMPED ON BOLTHEAD.



1. Incidence Adjustment Bracket
2. Cuff and Trunnion
3. Gasket
4. Filler Plug
5. Bolt
6. Blade Assembly

Figure 36-1-1. Control Rotor Assembly

e. Connect upper scissor arm to incidence adjustment bracket by installing the bolt through the bracket, tubular spacers and upper scissor bearing. The bolthead must be located at the inboard side of the assembly. Tighten nut to standard torque value.

f. Lubricate cuff as directed in table 10-II.

36-1-30. RIGGING OF CONTROL ROTOR. (See figure 36-1-2.) Rig control rotor and set the correct incidence angle in control rotor blades as follows:

a. Jack up helicopter as necessary to bring main rotor shaft within 0.2 degree of vertical. (Use jacking procedures outlined in Section 10.)

b. Using two main rotor hub and wobble plate leveling blocks (items 28 and 28A, table 92-1-I) lock main rotor assembly and wobble plate in position at right angle to main rotor shaft.

c. Recheck vertical position of main rotor shaft. Readjust jacks if required.

d. Place control rotor rigging template (item 2, table 92-1-I) chordwise between control rotor blade inboard rib and the adjoining rib.

e. Adjust incidence angle of control rotor blade by loosening bolts securing the slotted brackets to cuff. Turn the fore and aft screws in at one end and out at opposite end until rigging template spirit level indicates a setting of plus nine degrees (± 0.2 degree).

f. Tighten the bolts at the bracket slots to 20/30 pound-inch torque value.

g. Tighten the fore and aft screws to 30/40 pound-inch torque value.

h. Secure each bracket attaching nut to adjacent adjustment screw with lockwire.

i. Remove rigging and leveling equipment.

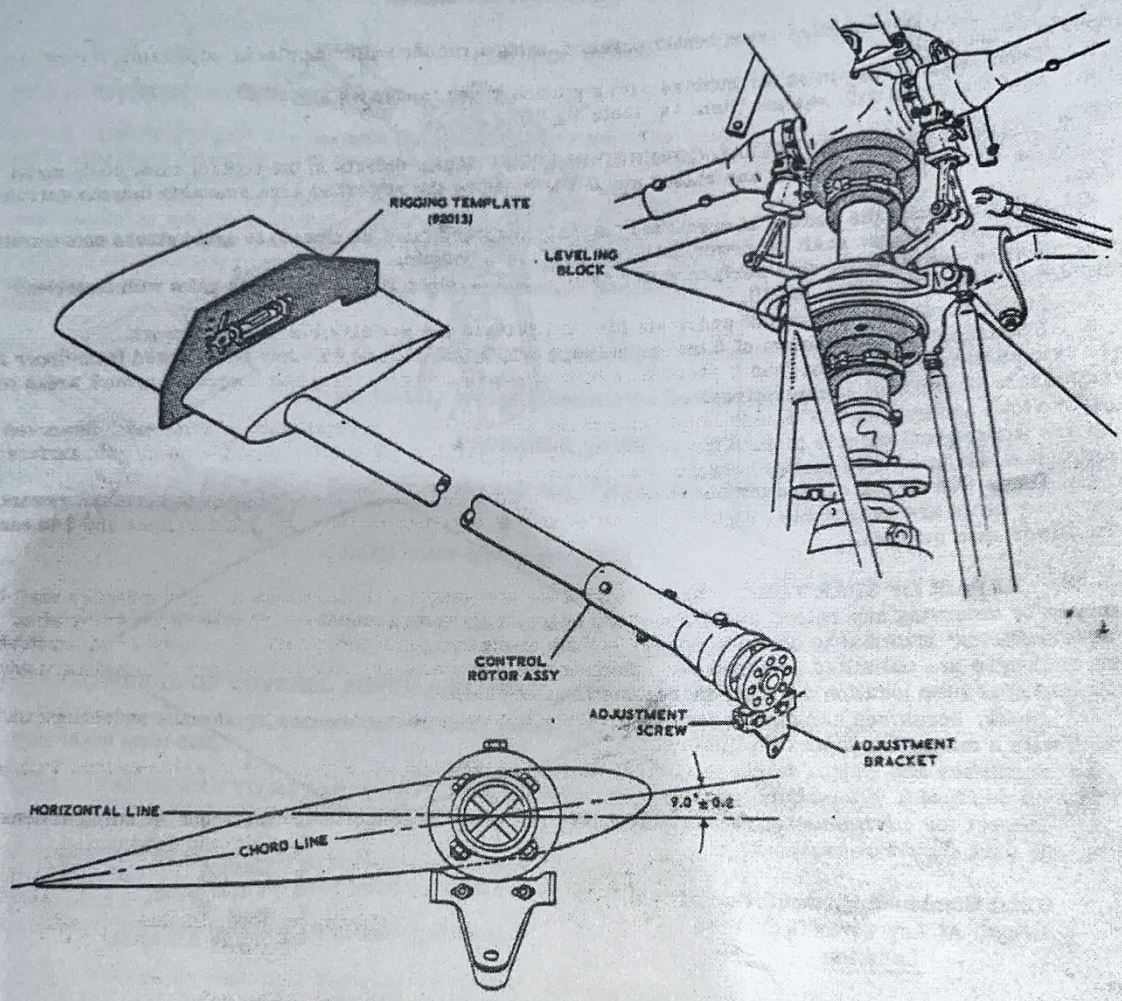


Figure 36-1-2. Setting Incidence Angle of Control Rotor Blade

36-1-40. GENERAL MAINTENANCE OF CONTROL ROTOR ASSEMBLY. General maintenance of the control rotor assembly shall be limited to inspection, servicing and repairing damage outlined in paragraphs 36-1-41 through 36-1-45.

a. For major repairing and overhaul refer to the appropriate following manuals.

(1) Control rotor blade - Structural Repair Manual.
(2) Control rotor cuff and trunnion - Control Rotor Cuff and Trunnion Assembly Overhaul.

b. Due to the highly stressed nature of the cuff and trunnion assembly, nicks, scratches and corrosion spots shall be reworked locally to the limits specified in the appropriate Overhaul Manual.

36-1-41. INSTALLATION OF ABRASIVE STRIP ON FABRIC COVERED CONTROL ROTOR BLADES. When excessive abrasion of the leading edge of the control rotor is observed, install replacement abrasive strip (item 12, table 10-VI) for leading edge protection. Apply strip in the following manner.

a. Thoroughly clean leading edge with naphtha (item 4, table 10-VI) or equivalent.
b. Remove protective liner from the strip and apply to surface, using care to locate for overall position prior to initial contact.

c. Work strip onto surface from center outward, using a rubber roller or plastic applicator to expel any trapped air bubbles.

d. Puncture any remaining air bubbles with a pin and press to remove air.

e. Seal the edges with sealant (item 14, table 10-VI).

36-1-42. MINOR REPAIR OF METAL COVERED BLADES. Minor defects in the control rotor blade metal skin may be repaired by removing any raised metal and blending the reworked area smoothly into the surrounding surface.

a. After rework, the bottom of scratches, nicks and gouges must be smooth to avoid stress concentration.

b. No repaired area shall be reworked again to remove defects.

c. After rework, paint skin surface with primer (item 3, table 10-VI) and finish paint with lusterless black lacquer (item 33, table 10-VI).

d. Minor scratches that do not penetrate the clad surface are permissible without rework.

e. Scratches, to a maximum of 5 inches in length and 0.005-inch depth, may be removed from upper and lower skin surfaces. No more than 6 scratch rework areas on the upper skin and 6 scratch rework areas on the lower surface (2 per bay) are permissible.

f. Nicks and gouges 0.375-inch length maximum and 0.007-inch in depth may be removed. Reworked areas are limited to 3 defects in each bay on the upper skin surface and 3 defects on the lower skin surface with a minimum spacing of 1.50 inches between reworked areas.

g. Dents that do not crease the skin and are less than 0.080-inch depth are acceptable without rework. No. overlapping dents are acceptable. Dents are limited to 3 in each bay on the upper skin surface and 3 in each bay on the lower skin surface.

36-1-43. REPAIR OF SPAR TUBE. Nicks, scratches and gouges, as classified in a and b below, shall be reworked by removing any raised metal and sharp edges and blending smoothly into the surrounding area. Remove sufficient material to obtain a smooth surface at the bottom of the defect. The number of scratches, nicks or gouges are unlimited provided the combined total circumferential length or depth of defects at any particular spar tube location does not exceed limits stated below.

a. Nicks, scratches and gouges less than 1-inch-total circumferential length, or any length longitudinal scratch with a maximum depth of 0.010-inch.

b. Scratches and gouges with a total circumferential length greater than 1 inch, but less than 2 inches with a maximum depth of 0.005-inch or less.

c. Inspect for corrosion on the interior of the spar tube. If corrosion exceeds the following dimensional limits, the part should be replaced:

Total Combined Circumferential Length At Any Given Spar Tube Location	Maximum Depth Of Rust Deposit
0.0 to 1.0 inch	0.010 inch
1.0 to 2.0 inches	0.005 inch
greater than 2.0 inches	0.002 inch

d. Remove rust spots by polishing affected area with a medium or fine emery cloth or paper and then polish with crocus cloth (item 36, table 10-VI) dipped in solvent (item 25, table 10-VI). Finish by lightly coating areas where plating is removed with two coats of zinc chromate primer (item 3, table 10-VI).

e. Dye-penetrant inspect the spar area which fits inside the control rotor cuff, paying particular attention to the four bolt holes, and inspect entire control rotor blade assembly for cracks. If cracks are found, replace assembly.

f. Inspect retention bolt holes for elongation, corrosion, burrs, pitting or fretting. If any discrepancies are found, the outboard holes may be reamed out by removing all damage plus an additional 0.02-inch diameter, but not to exceed a total diameter of 0.312-inch. If elongation of any inboard bolt hole is found, replace the control rotor blade. Corrosion, pitting or fretting of the inboard bolt holes need not be cleaned up.

g. Repeat step e above after reaming holes.

h. After the blade holes have been reamed out, reidentify the spar and blade assembly by etching an "R" after the part number shown on the nameplate located at the inboard end of the paddle.

NOTE: Both outboard bolt holes must be reamed out to the same diameter.

NOTE: If the reaming procedure cannot be followed without exceeding the 0.312-inch diameter limitation, the control rotor blade must be replaced.

NOTE: If the bolt holes have been reamed out as per the instructions above, the control rotor blade must be replaced upon attaining 2500 additional operating hours.

If a retirement life has been imposed on the blade assembly before this rework, the blade assembly must be replaced upon attaining the original retirement life. (Refer to Inspection Guide, Section III.)

i. If burrs are found, deburr bolt holes, paying particular attention to the holes in the interior of the spar tube. Maximum chamfer permitted is 0.010-inch.

j. If the control rotor attach bolts (AN174-26) show signs of wear or rust, they should be replaced. Corrosion resistant steel bolts (AN174-C26) may be used as replacements.

36-1-44. STRAIGHTENING CONTROL ROTOR SPAR TUBE. It is permissible to cold-straighten control rotor spar tubes as follows.

CAUTION: SPAR TUBES SHALL BE STRAIGHTENED IN THE COLD CONDITION ONLY.

a. Spar tubes with less than 0.030-inch TIR (total indicated run-out) are acceptable for service without straightening.

b. Check TIR of spar tube while installed in the cuff and trunnion assembly.

(1) Support the trunnion assembly in a manner that will allow cuff and blade to rotate freely.
(2) Position a dial indicator on spar tube 0.75 (± 0.25)-inch inboard of the blade rib.
(3) Rotate supported blade and cuff assembly, and record TIR reading.

c. Support spar tube outboard of cuff attach area and inboard of blade inboard rib (approximately 28 inches span). Apply pressure midway between supporting blocks to reduce bends to less than 0.030-inch TIR.

d. Remove paint from spar tube and magnetic-particle inspect for metal fractures that might have occurred during bending or attempts to straighten.

e. The spar tube must be rejected if magnetic-particle inspection reveals failure, or if flat spots, out-of-round, kinks or buckling results from bending or attempts to straighten bends.

f. After satisfactory completion of rework, paint stripped spar with two spray coats of primer (item 3, table 10-VI) and finish paint with lusterless black lacquer (item 33, table 10-VI).

36-1-45. CHECKING INSTALLED CONTROL ROTOR ASSEMBLY FOR VERTICAL MOVEMENT. Check an installed control rotor assembly periodically or whenever cyclic control system malfunction is encountered, for vertical movement in the control rotor assembly. Movement of 1/8-inch maximum is allowed between the cuff and trunnion. No play is permissible between the rotor blade spar and cuff.

a. Disconnect control rotor from the upper scissors (paragraph 36-1-10).

b. Using main rotor head leveling block (item 28, table 92-1-I), block main rotor head securely to allow detection of movement in cuff and trunnion.

c. Without deflecting the spar, exert only sufficient pressure at blade tip to detect movement in cuff and trunnion.

d. Measure movement at balance screw located on blade outboard end.

e. If maximum vertical movement is exceeded or cyclic control system malfunction indicates cuff and trunnion assembly is unserviceable, refer to control rotor cuff and trunnion overhaul manual and perform the following checks.

(1) Cuff retaining nut for proper torque.
(2) Cuff rotational drag.
(3) Disassemble and check condition of all parts.

f. Reassemble cuff and trunnion. Install control rotor assembly and recheck vertical movement.

STABILIZER

37-1-1. HORIZONTAL STABILIZER. (See figure 37-1-1.)

37-1-2. DESCRIPTION. The horizontal stabilizer is a single all-metal, stressed-skin airfoil section mounted on the extreme aft end of the tail boom. It extends outboard from the right-hand side of the helicopter. The horizontal stabilizer maintains a relatively constant cyclic control stick margin at high forward speeds.

NOTE: The stabilizer angle setting must be changed when float landing gear is installed. (Refer to Section 44.)

37-1-10. REMOVAL OF HORIZONTAL STABILIZER.

a. Disconnect the tail light wire assembly at the knife disconnect on the horizontal stabilizer spar tube, as applicable.
b. Remove the bolt securing the horizontal stabilizer spar tube to the aft tail boom bulkhead.
c. Remove the horizontal stabilizer from the tail boom.

NOTE: Use the stabilizer spar arbor press (item 32, table 92-1-1) to remove the spar tube from the bulkhead if necessary.

37-1-11. INSTALLATION OF HORIZONTAL STABILIZER.

a. Apply a thin film of general purpose aircraft lubricating grease to the spar tube.
b. Insert the spar tube in the bore of the bulkhead. Rotate the horizontal stabilizer so that the hole in the spar tube is alined with the horizontal (left-hand) hole in the bulkhead.
c. Install the bolt securing the spar tube to the bulkhead. Take care not to enlarge the bolt holes.
d. Tighten attach bolt to 50/70 pound-inch torque value.
e. Connect tail light wire assembly.

37-1-30. ADJUSTMENT OF HORIZONTAL STABILIZER.

a. To change the stabilizer angle, remove the spar bolt from its horizontal (left-hand) location; rotate the stabilizer until the vertical (right-hand) hole in the tail boom bulkhead is in alinement. Insert spar bolt, taking care not to enlarge the bolt holes.
b. Tighten bolt to 50/70 pound-inch torque value.

37-1-40. MINOR REPAIR AND PARTS REPLACEMENT OF HORIZONTAL STABILIZER.

a. Smooth dents and light surface scratches free of cracks are considered negligible damage and are permissible without repair. The spar tube may be worn to a maximum depth of 0.010-inch in the area of the inner rib sleeve provided that the wear goove blends smoothly into the adjacent unworn tube area.
b. Replace a cracked or bent spar tube, or one which is worn beyond specified limits.
c. Maximum permissible service wear (rotational movement) between spar and stabilizer is limited to 3/16-inch measured at the trailing edge of the stabilizer. To measure rotational movement (not spring deflection) use normal hand pressure until a positive stopping action is felt. A slight movement between the rib sleeve and the spar tube, as well as oil-canning, is normal and is not sufficient cause for rejecting the assembly. The inboard rib of the stabilizer assembly is not rigidly attached to the spar tube and a slight amount of relative movement between the two parts may be detected during the check for rotational play.

NOTE: Maximum allowable play between the spar tube and the bulkhead bore is limited to 0.0024-inch movement.

d. Maximum allowable in-service limit of horizontal stabilizer attach bolt hole is 0.255-inch diameter. Repair by bushing in accordance with instructions given in the UH-12E/L Structural Repair Manual.

37-101-1. STABILIZER ASSEMBLY, FOUR-PLACE CONFIGURATION. (See figure 37-101-1.)

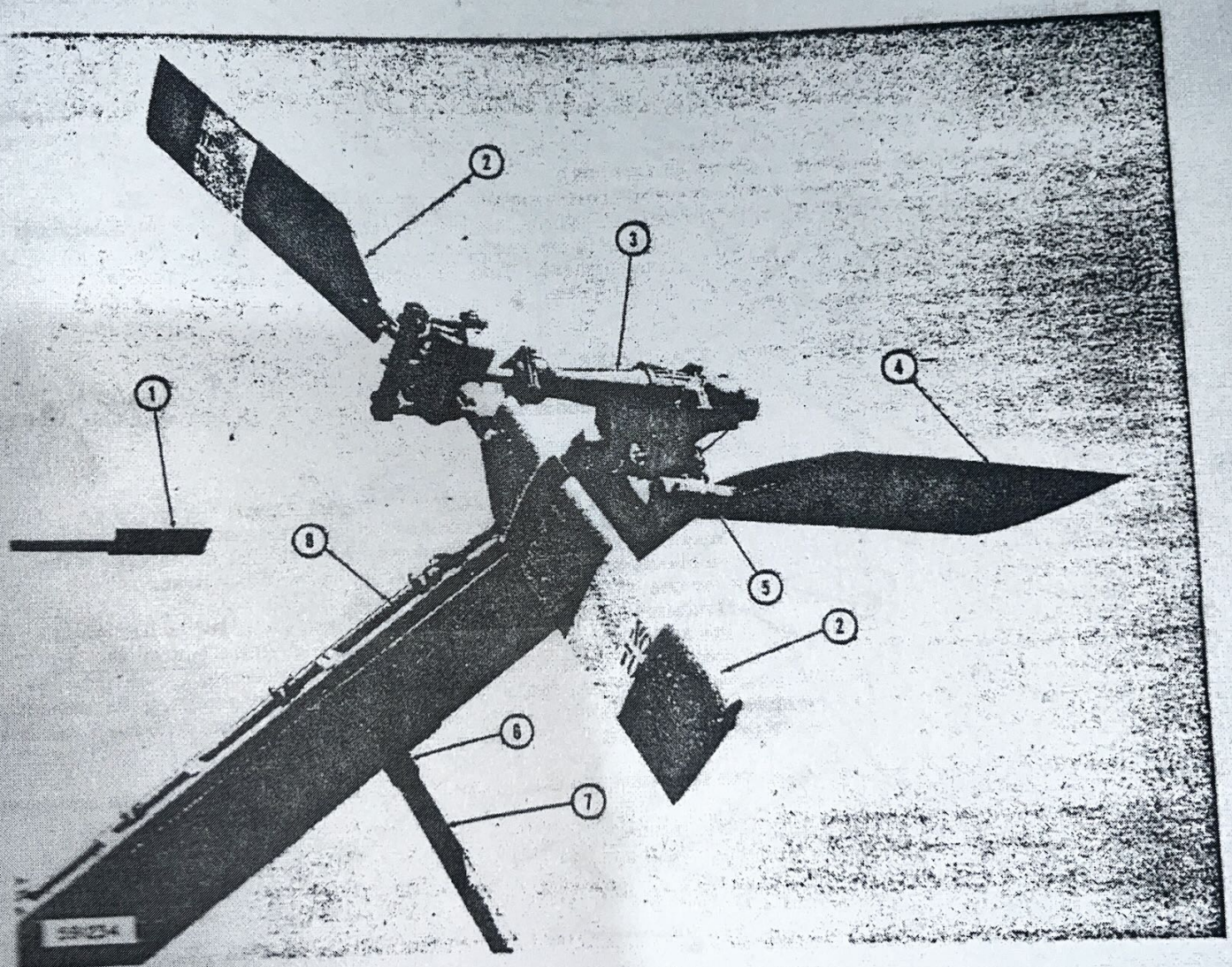
37-101-2. DESCRIPTION. The stabilizer assembly consists of two all-metal stressed-skin semi-cantilevered airfoil sections mounted on the tail boom at station 169.75. Each airfoil section extends outboard from the tail boom and slopes downward at an angle of 25 degrees below the horizontal. The stabilizer assembly offsets pitch-yaw moments and provides a constant cyclic control stick displacement at high forward airspeeds.

37-101-10. REMOVAL OF STABILIZER ASSEMBLY, FOUR-PLACE CONFIGURATION.

a. Remove bolts securing stabilizer spar tubes to support on tail boom.
b. Remove bolts securing rods to the stabilizer eye bolts.
c. Remove stabilizers from support.
d. Remove bolts securing stabilizer rods to angle fitting on lower side of tail boom.

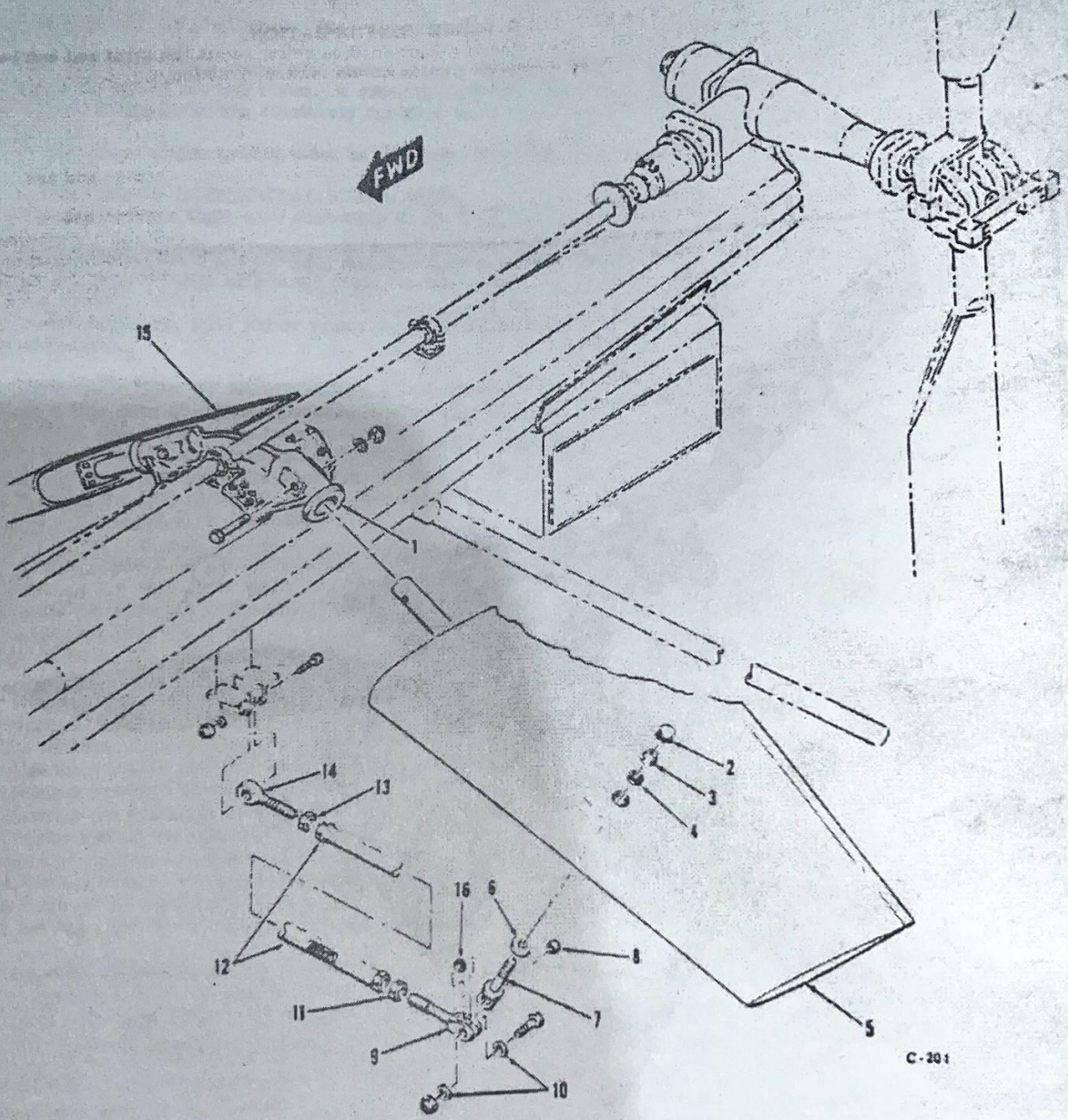
37-101-11. INSTALLATION OF STABILIZER ASSEMBLY, FOUR-PLACE CONFIGURATION.

a. Apply a thin film of general purpose lubricating grease to each stabilizer spar.
b. Insert spar into bore of stabilizer support. Rotate stabilizer to aline holes. Install bolts securing spars to fitting taking care not to enlarge bolt holes.
c. Tighten nuts securing stabilizer spar to 50/70 pound-inch torque value.



1. Control Rotor Blade
2. Tail Rotor Blade
3. Tail Rotor Speed Decreaser
4. Horizontal Stabilizer
5. Bulkhead
6. Support
7. Tail Skid
8. Aft Tail Rotor Drive Shaft

Figure 37-1-1. Tail Skid and Horizontal Stabilizer



1. Support
2. Plug Button
3. Nut
4. Washer
5. Left-Hand Stabilizer
6. Spacer
7. Eye Bolt
8. Bushing
9. Fork
10. Washers
11. Nut
12. Rod
13. Nut
14. Rod End Bearing
15. Right-Hand Stabilizer

Figure 37-101-1. Stabilizer Assembly, Four-Place Configuration

d. Install stabilizer rods making sure rod clevis ends connect to eyebolts of each stabilizer section. Install bolts, washers and nuts.

37-101-38. RIGGING STABILIZER ASSEMBLY, FOUR-PLACE CONFIGURATION.

a. With stabilizer installed and rod attach bolts free of any preload on bolts, rotate the strut rod end bearing one full turn clockwise to provide preload on the stabilizer in a down and inward direction.

b. Tighten rod checknuts.

c. Tighten rod end bearing attach bolts.

37-101-40. MINOR REPAIR AND PARTS REPLACEMENT OF STABILIZER ASSEMBLY.

a. Smooth dents and light surface scratches free of cracks are considered negligible damage and are permissible without repair.

b. Replace a cracked, bent or otherwise damaged stabilizer or support with one that is serviceable.

c. Maximum allowable play between stabilizer spar tube and support is limited to 0.0024-inch movement.

d. Maximum permissible service wear (rotational movement) between spar and stabilizer is limited to 1/4-inch measured at the trailing edge of the stabilizer. To measure rotational movement (not spring deflection), use normal hand pressure until a positive stopping action is felt. A slight movement between the rib sleeve and spar, as well as oil-canning, is normal and is not sufficient cause for rejecting the assembly. The inboard rib of the stabilizer assembly is not rigidly attached to the spar and a slight amount of relative movement between the two parts may be detected during the check for rotational movement.

e. Stabilizer spar may be worn to a maximum of 0.010-inch in the area of the inner rib sleeve provided that the wear groove blends smoothly into the adjacent unworn spar area.

f. Replace eye bolt, support angle bushings, or support rod forks when bolt holes are worn oversize. Replace excessively worn rod end bearings.

g. Check proper seating and condition of the plug button.

CYCLIC TRIM SYSTEM

38-1-1. CYCLIC TRIM CONTROL SYSTEM. (See figure 38-1-1.)

38-1-2. DESCRIPTION. The cyclic control system is trimmed longitudinally and laterally by spring assemblies and remotely controlled trim actuators. Both trim systems are essentially identical in function, construction, and operation. Each system includes a spring-loaded pushrod contained in a cylinder which is attached to the cyclic linkage. The pushrod is connected to an electrically operated actuating unit. The actuating units are remotely controlled from a five-position selector switch mounted on the hand grip of each cyclic control stick. Refer to Section 83 for detailed electrical information.

38-1-3. TROUBLESHOOTING TRIM CONTROL SYSTEM. Refer to Table 38-1-I for trim control system troubleshooting information.

38-1-10. REMOVAL OF CYCLIC TRIM ACTUATORS.

a. Disconnect the electrical connector at the actuator.
b. Detach the rod end clevis of the spring assembly from the actuator crank arm.
c. Remove the actuator from the supporting structure by cutting the lockwire and removing the mounting screws.

38-1-11. INSTALLATION OF CYCLIC TRIM ACTUATORS.

a. Place the actuator on the supporting structure. Install the screws and lockwire in pairs.
b. Secure the spring assembly rod end clevis with the clevis bolt to the actuator crank arm. Safety the nut with a cotter pin.

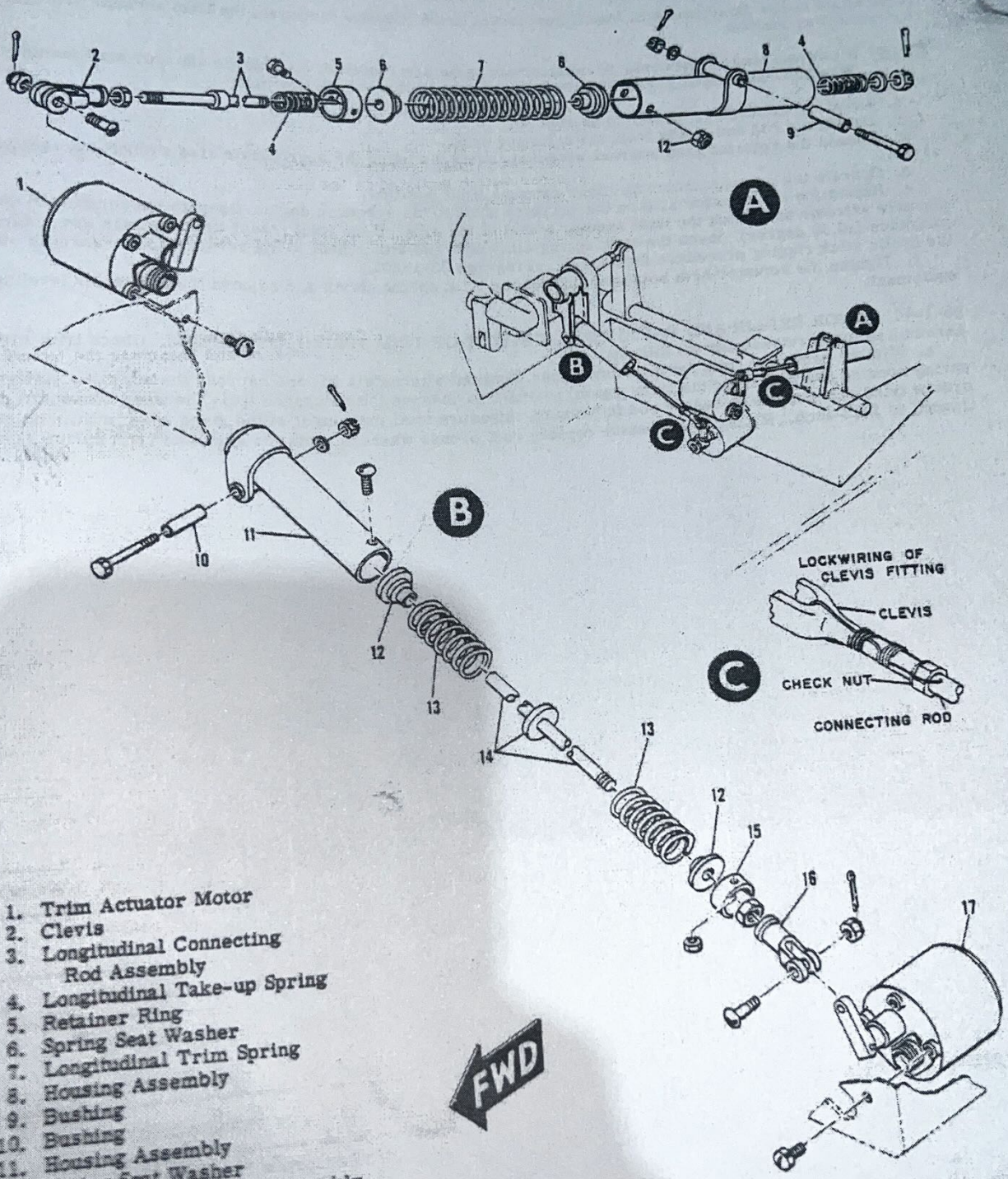
CAUTION: DO NOT OVERTIGHTEN CLEVIS ATTACH BOLT. ALLOW SOME CLEARANCE (PLAY) TO EXIST BETWEEN THE CLEVIS AND THE ACTUATOR CRANK ARM. DO NOT OVERTIGHTEN BOLTS SECURING THE SPRING HOUSING TO THE CRANKS; TO DO SO WILL PERMIT BINDING TO OCCUR IN THE CYCLIC SYSTEM.

c. Connect the electrical connector to the actuator.

38-1-30. ADJUSTMENT OF CYCLIC TRIM LIMIT SWITCHES. Adjustment of the cyclic trim actuators is limited to maintaining the extreme travel positions indicated in Section 33, figure 33-1-2. If excessive

Table 38-1-I. Troubleshooting the Trim Control System

TROUBLE	PROBABLE CAUSE	REMEDY
Inadequate trim (in flight)	Helicopter inproperly loaded	Refer to the loading instructions in the Flight Manual.
	Improperly rigged	Check rigging for proper tolerance.
Excessive trim	Malfunctioning limit switches on trim actuators	Replace with serviceable actuator.
	Broken trim spring assembly	Replace spring assembly.
Erratic or binding trim operation	Weak or broken trim spring, bent shafts, bent or misaligned spring housing	Replace or repair spring assembly.
Inoperative trim actuator	Circuit breaker open	Close or replace breaker.
	Trim actuator motor defective	Replace with serviceable trim actuator.
Simultaneous trim in two directions	Defective trim switch in cyclic stick grip	Replace with serviceable cyclic stick grip assembly.
Trim actuator responds in direction opposite from trim switch movements	Electrical system polarity reversed	Check wiring connections at battery, external power receptacle and trim system.



1. Trim Actuator Motor
2. Clevis
3. Longitudinal Connecting Rod Assembly
4. Longitudinal Take-up Spring
5. Retainer Ring
6. Spring Seat Washer
7. Longitudinal Trim Spring
8. Housing Assembly
9. Bushing
10. Bushing
11. Housing Assembly
12. Spring Seat Washer
13. Lateral Trim Spring Assembly
14. Lateral Connecting Rod
15. Ring
16. Clevis
17. Trim Actuator Motor

Figure 38-1-1. Cyclic Trim Actuator Installation

travel exists in one direction, with insufficient travel in the opposite direction, the trim actuator arm may be repositioned as follows:

NOTE: If internal stop adjustments or replacement parts are required, consult the actuator manufacturer. General Design, Inc., 11910 Valerio Street, North Hollywood, California.

a. Level the helicopter. (Refer to Section 10.)
b. Detach the rod end clevis from the actuating arm.
c. Loosen the actuator arm internal wrenching setscrew using the appropriate size wrench and remove the arm.
d. Operate the actuator motor to either extreme limit position.
e. Reposition the actuator arm on the serrated shaft to the specified angle. Operate the actuator to the opposite extreme and check the total angular travel of the arm. If the total travel limit settings are within tolerance (±0.50 degree), check the trim spring alinement and attachment to the actuator for conformity with the cyclic stick rigging procedure (Section 33, paragraph 33-1-30).
f. Tighten the actuator arm setscrew, install the trim spring clevis and remove the helicopter leveling equipment.

38-1-40. MINOR REPAIR AND PARTS REPLACEMENT OF TRIM SPRING ASSEMBLIES. Check trim spring assemblies for serviceability as follows:

a. Without removing trim spring from either location, alternately lift and depress the edge of a given trim spring housing (edge nearest the trim motor) in order to observe the clearance (play) between connecting rod and bronze trim washers which center rod in housing. Measure total movement at the given edge; maximum play is limited to 3/16-inch. If play is excessive replace rod, bronze washers, both, or complete trim spring assembly.

SKID LANDING GEAR

43-1-1. SKID LANDING GEAR.

43-1-2. DESCRIPTION. (See figure 43-1-1.) The helicopter is equipped with tubular aluminum skid runners bolted to steel support fittings on the basic body. Replaceable stellite reinforced scuff plates attach to each skid runner. A ground handling wheel and axle assembly is fitted into a support mounted toward the rear of each skid gear tube. Each wheel can be locked in either the up or down position by adjustment of the chain-attached support pin and safety pin. An extended height landing gear leg kit is available as an alternate installation.

43-1-4. LANDING GEAR GROUND HANDLING WHEELS. Service wheels and tires as directed in Section 10.

43-1-10. REMOVAL OF SKID LANDING GEAR. (See figure 43-1-1.) To remove skid landing gear, transfer the helicopter weight from the landing gear by hoisting or jacking helicopter [Section 10]. Do not lift landing gear skid runners off the ground.

a. Remove bolts attaching the drag and vertical struts to aft spring tube.

b. Remove bolts and spring tube attachment caps (including rubber bushings) securing forward spring tube to the two support assemblies.

c. Raise helicopter sufficiently to permit disengagement of spring tube assemblies from the forward supports and rear center brace.

d. Remove struts by removing attaching bolts.

43-1-11. INSTALLATION OF SKID LANDING GEAR. (See figure 43-1-1.) Install skid landing gear as follows.

a. Attach the vertical struts to body support fittings with the clevis bolts, washers, and nuts. Safety nuts with cotter pins.

b. Raise helicopter sufficiently to permit placing landing gear in position.

c. Place forward spring assembly under forward support assemblies at each side of basic body. If forward supports have been removed or replaced, shimming is required between the body fittings, forward supports and support brackets as follows:

(1) Install washers (AN960PD416 or AN960PD416L) between forward supports and fittings.

(2) Install washers (AN960PD416 or AN960PD416L) to obtain side support-to-bracket bolt hole alignment. Bolts at this location should have a snug, slip fit.

(3) Maintain a minimum clearance of 0.020-inch between support and fitting (View A).

(4) Check misalignment between support and bracket. Overlapping (opposite) surfaces must be parallel within 0.060-inch maximum (View A).

d. Attach forward spring tube attachment cap and cushion assemblies to forward support assemblies, and tighten nuts to 50/60 pound-inches.

e. Insert bolts attaching aft spring tube assembly to vertical struts at both sides of basic body.

f. Raise helicopter clear of floor. Place a spirit level longitudinally along top surface of skid runners forward of aft legs. The same degree of inclination (if any) should be shown when the spirit level is placed on the longitudinal level marks on the helicopter seat structure. Adjust length of each vertical strut as necessary to make skid runners longitudinally parallel with the helicopter level marks.

g. Adjust vertical strut length equally to obtain a clearance of 0.41/0.57-inch between top of aft spring tube assembly and inside of basic body attachment brace (View B).

h. Attach forward ends of drag struts to basic body fitting with clevis bolts, washers and nuts. Safety nuts with cotter pins.

i. Connect aft ends of drag struts and vertical struts to aft spring tube attachment lugs. Install aluminum washers as shims between the drag and vertical strut rod end bearings and the attach lug ears to obtain rod end bearing alignment.

j. Secure struts with attaching hardware. Tighten locknuts securing rod end bearings in drag struts and vertical struts.

43-1-40. MINOR REPAIR AND PARTS REPLACEMENT FOR SKID LANDING GEAR. (See figure 43-1-1.) Cuts or punctures of tubes or tires can be repaired by conventional repair methods, using commercial tire cut filler or patches. In replacing a wheel and axle support fitting, install the nuts on the outboard side of the support. Tighten nuts to 35/40 pound/inch torque value maximum. Replace landing gear components in accordance with the following instructions.

a. Disassemble landing gear components as required:

(1) Remove bolts securing forward and aft spring tube assemblies and legs to skid runners.

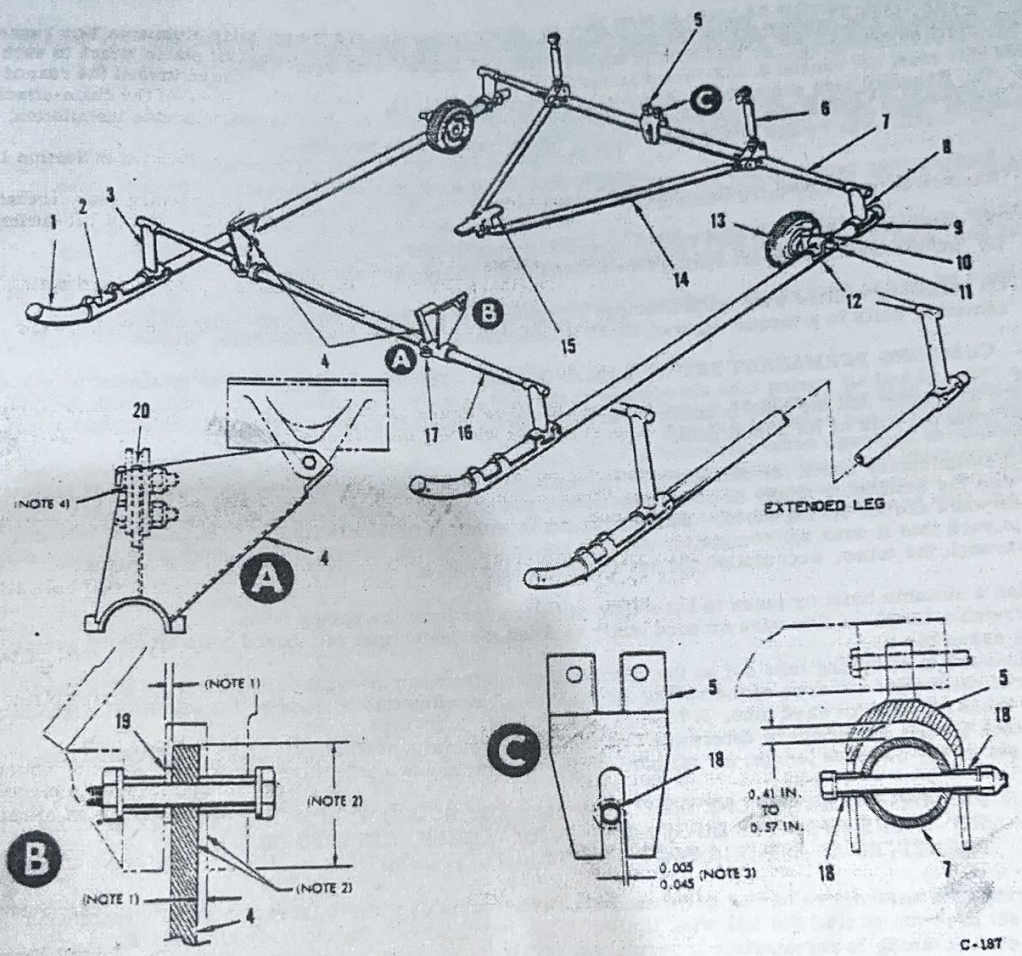
(2) Remove bolts from clamps securing forward scuff plates. Slide scuff plates forward and off.

(3) Remove attaching hardware, noting number and location of washers and spacers used to position rear center brace on aft spring tube.

b. Replace damaged forward supports as follows:

(1) Center replacement support in forward body fitting with the shim washers (AN960PD816 or AN960PD816L). Install bolts and tighten nuts.

(2) Using the bushings in the body side bracket as a guide, center-punch support side brace accurately with a 1/4-inch transfer punch. Remove support from fitting.



NOTES:
1. 0.020-INCH MINIMUM.
2. SURFACE MUST BE PARALLEL WITHIN 0.060-IN MAXIMUM OVER AREAS INDICATED.
3. WEAR TOLERANCE DIMENSION ONLY.
4. CENTER SUPPORT BETWEEN BODY FITTING WITH SHIMS

1. Skid Gear Runner
2. Forward Scuff Plate
3. Forward Leg
4. Forward Support Assy
5. Rear Center Brace
6. Vertical Strut
7. Aft Spring Tube Assy
8. Aft Leg
9. Aft Scuff Plate
10. Lock Pin
11. Axle Assy
12. Wheel Support
13. Ground Handling Wheel
14. Drag Strut
15. Drag Strut Fitting
16. Forward Spring Tube Assy
17. Spring Tube Attachment Cap
18. Bearings (bushings)
19. Shim Washers
20. Shim Washers

Figure 43-1-1. Skid Landing Gear

(3) Hold support securely for drilling. Use a Letter D (0.246-inch) drill to drill hole carefully in support side brace.

(4) Reinstall support as given in step (1).

(5) Use a 1/4-inch hand reamer with appropriate entering taper diameter to line ream the support brace hole drilled in step (3), so that hole in support brace is aligned with bushed holes in body bracket. Finished hole must not exceed 0.252-inch diameter.

(6) Reinstall side supports as directed in paragraph 43-1-11.

c. Reassemble landing gear components as follows.

(1) Install rear center brace on aft spring tube with attaching hardware.

NOTE: Replace rear center brace if brace spacer slot width wear tolerance exceeds 0.045-inch (View B). Replace excessively worn bearings.

(2) Slide scuff plates on skid runner and install clamps and bolts.

(3) Install forward and aft spring tube assemblies and legs on skid runners.

NOTE: On helicopters fitted with nylon bearings (bushings) for aft spring tube centering, tighten nuts on centering bolts to a torque value of 10/15 pound-inches; do not exceed specified torque.

43-1-41. CHECKING PERMANENT SET OF LANDING GEAR. (See figure 43-1-2.) The maximum permanent set in the forward and aft spring tube assemblies of the landing gear is determined by checking both the total spring tube deflection and the locally deflected areas. Spring tube set shall be considered as deformation of tube away from the axis of its actual path.

NOTE: A rudimentary check for deflection of the landing gear spring tubes may be accomplished as follows: with the helicopter empty of pilot, passengers and baggage. Sight through the hollow centers of the forward and aft spring tubes. Tube deflection is within permissible limits if deflection of both tubes is such that it does not completely obscure vision through the tubes. If it is impossible to sight clearly through the tubes, accomplish the set check outlined below.

a. Use a suitable hoist or jacks to lift weight of helicopter from the spring tubes.

b. Stretch a length of fine wire or cord tautly between the centerlines of inboard bolts attaching spring tube to leg assemblies.

c. Measure total spring tube set as the vertical distance between the wire or cord and the horizontal centerline of the lowest set area of the spring tube length. The allowable permanent set without straightening the spring tubes is: for forward tube, 0.75-inch; for aft tube, 1.25-inch.

d. Check locally set areas to determine that the following limits are not exceeded: for forward tube, 0.15-inch set in any one foot length; for aft tube, 0.25-inch set in any one foot length.

CAUTION: PERMANENT SET IN ONE DIRECTION MAY NOT OCCUR WITHIN ONE FOOT OF A PERMANENT SET IN THE OPPOSITE DIRECTION. FOR EXAMPLE, REVERSE OR S-BENDS ARE NOT PERMITTED IN ANY ONE FOOT OF SPRING TUBE LENGTH.

e. Spring tube assemblies having permanent set beyond allowable limits (step c) may be straightened if permanent set does not exceed the following limits: for forward tube, 1.25-inch; for aft tube, 2.00-inch.

f. No straightening is permissible if permanent set limits for locally set areas (specified in step d) are exceeded

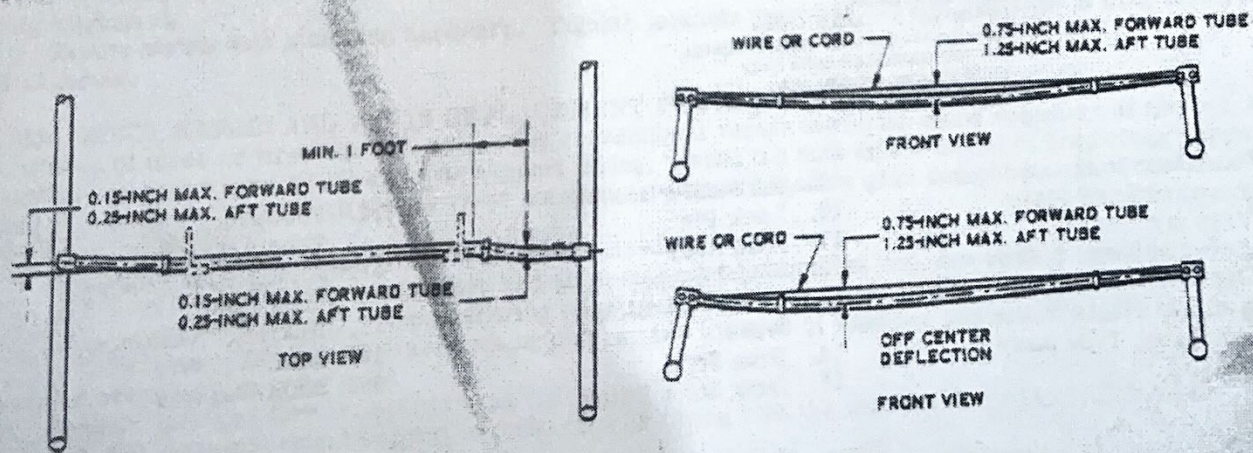


Figure 43-1-2. Checking Landing Gear Permanent Set

43-1-42. STRAIGHTENING SPRING TUBES. Straighten the forward or aft spring tubes in accordance with the following procedure.

CAUTION: SPRING TUBES MUST BE STRAIGHTENED IN COLD CONDITION. HEATING OF SPRING TUBES WILL MAKE THEM UNSERVICEABLE. SPRING TUBES CANNOT BE STRAIGHTENED MORE THAN TWICE.

a. Use hardwood blocks grooved to fit tube contour and line the grooves with leather or canvas.
b. Apply restoring force at the bend point; and, to allow for spring-back action of the tube, continue applying force until tube is slightly bent in the opposite direction.
c. Remove the restoring force and check tube for straightness.
d. Upon completion of straightening operations, magnetic-particle inspect tube for cracks or fractures. Replace any defective part with a serviceable unit.
e. After spring tube is straightened, steel-stamp symbol "X" one-eighth-inch high minimum adjacent to part number on the steel collars located 17.50-inches from each end of the forward spring tube, and 18.50-inches from each end of aft spring tube.
f. If two symbols (XX) are found adjacent to spring tube part number, spring tube cannot be further straightened and must be replaced.

43-101-1. SKID LANDING GEAR EXTENDED LEG KIT.

43-101-2. DESCRIPTION. The extended leg kit available for installation as part of the skid landing gear includes four vertical legs that are approximately nine inches longer than the standard configuration legs. Installation of this kit provides additional ground clearance for the helicopter when operated in rocky or otherwise uneven terrain. The kit must be installed to accommodate the amphibious float gear [Section 44]. Removal, installation and parts replacement procedures are essentially the same as given for the standard configuration. (Refer to the UH-12E Parts Catalog for suitable spring tube assemblies used with the landing gear extended leg kit.)

FLOAT LANDING GEAR

44-101-1. FLOAT KIT INSTALLATION, LANDING GEAR. (See figure 44-101-1.)

44-101-2. DESCRIPTION. The float kit installation consists of two 22-pound, nylon fabric (neoprene coated) float bags, suspended on four longitudinal tubes from a truss and support beam secured to the standard basic body fittings. A 13-pound ballast weight is included as part of the float kit and replaces the standard nine pound ballast weight in the helicopter when the float kit is installed. The kit also provides four plastic mounting blocks, extension wiring and associated hardware for mounting position lights to the truss, and support clamps and brackets for a quick-release method of attaching litters and/or cargo racks.

a. Each float bag has a volume of 40.2 cubic feet and a buoyancy of 2600 pounds. The float bag is divided into four individual compartments separated by bulkheads, separate air valves located on top of the bags (to the right of center) are provided for inflating the compartments. The bags are protected against chafing in pressure contact areas by chafing strip doublers. The exterior surface of each bag is protected against weathering by a coating of black Hypalon paint. Four anti-drag nylon-webbing straps with buckle fasteners are attached to the top of each bag to prevent bag slippage on the suspension tubes. Three equally spaced tension (girt) strips maintain proper spacing, position and alinement of the longitudinal suspension tubes. Maximum operating pressure of the float bags is 6.3 psi. Refer to table 44-101-I for allowable altitude change limitations when float landing gear is installed. Refer to the UH-12E Flight Manual for airspeed limitations with float gear installed.

b. The float kit suspension equipment used in addition to the standard landing gear supports (see 4, 5 and 6, figure 43-1-1) is shown in figure 44-101-1. The cantilever-type truss and U-shaped channel support beam are designed to provide simplified attachment of either a litter installation of cargo racks. The longer and larger diameter drag struts used with the float installation provide the proper float bag drag support. A sash chain is attached to the support beam to provide ground contact for static electricity discharge.

44-101-10. REMOVAL OF FLOAT LANDING GEAR. KIT INSTALLATION.

a. On helicopters equipped with position lights, disconnect the position light wiring at both ends of the truss (inboard of the wire supporting clamp) and secure the wiring away from the truss.

b. Jack or hoist the helicopter far enough to transfer the weight off the float bags, following the instructions outlined in section 10.

c. Remove the bolts securing the vertical struts to the lugs on the support beam.

d. Remove the clevis bolts attaching the drag struts to the body fitting and remove the strut end fittings from the body fitting.

e. Remove the bolts attaching the truss to the forward supports.

f. Raise the helicopter far enough to clear the truss and disengage the rear body brace from the support beam centering bolt.

g. Remove the float assembly from beneath the body.

44-101-11. INSTALLATION OF FLOAT LANDING KIT INSTALLATION.

NOTE: The skid type landing gear may be removed as a complete unit in preparation for installation of the float kit. (Refer to steps a through d, and step f of paragraph 43-1-10 for removal instructions.) Removal of all the landing gear installation components shown in figure 43-1-1 is required, with the exception of items 4, 5, 6 and 17, which are retained as a part of the float support equipment. On helicopters equipped with position lights, remove the light and bracket assemblies from the forward legs by disconnecting the wire connectors and loosening and removing the light mounting bracket; secure the wiring away from the spring tube.

a. Hoist or jack the helicopter far enough to allow clearance for positioning the assembled float landing gear unit under the basic body.

b. Lower the helicopter until the front and rear basic body supports can be attached, but with the weight of the helicopter off the float bags.

c. Check that the forward right-and left-hand support rubber bushing inserts are still in place.

d. Attach the forward supports to the truss with the correct length bolt (supplied in kit) and tighten to 50-60 pound-inch torque value. (Refer to step g below.)

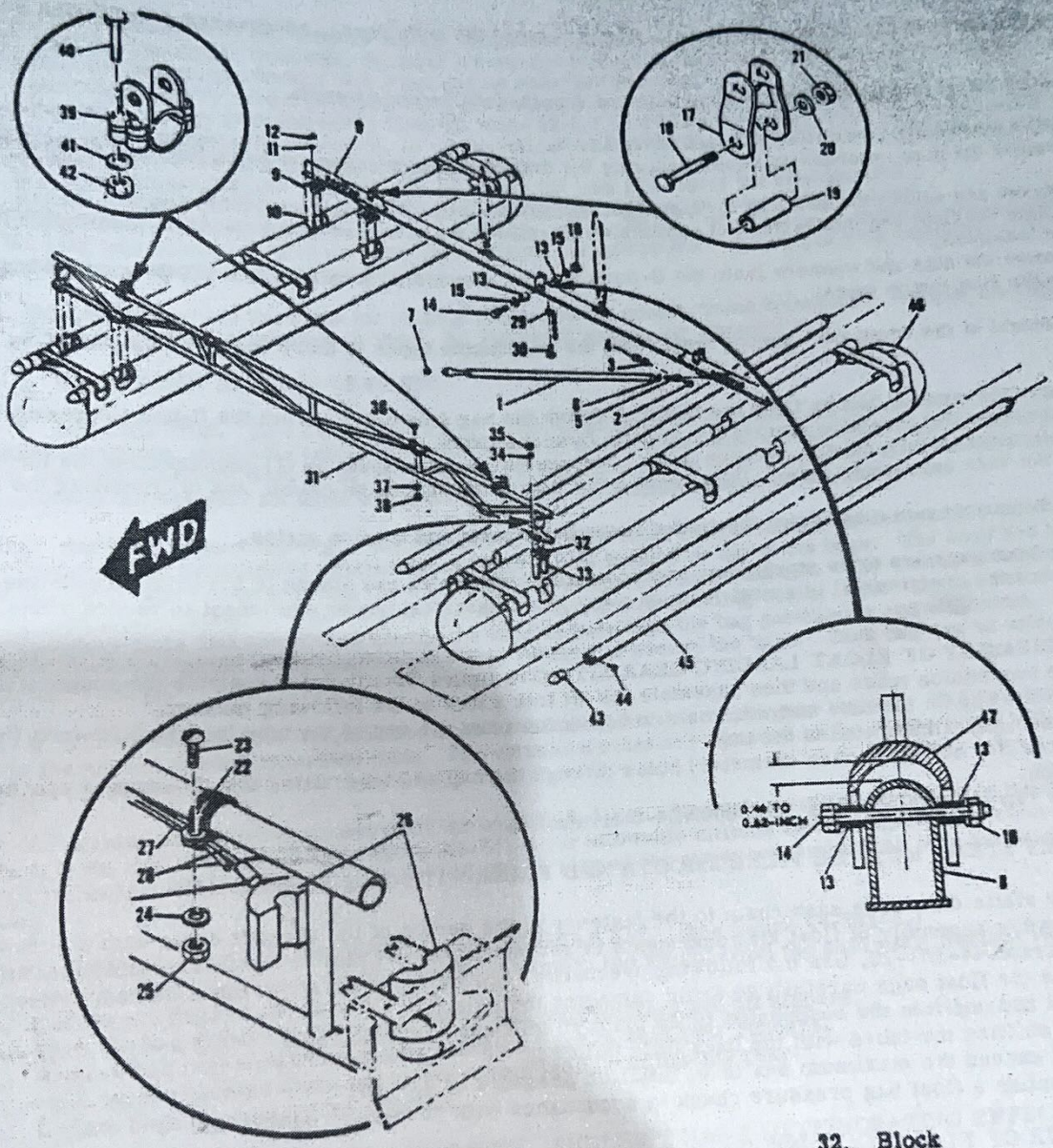
e. Adjust the length of both vertical struts equally to obtain a clearance of 0.46-inch (minimum) to 0.62-inch (maximum) between the top of the support beam and the inside upper surface of the body attachment brace. (See figure 44-101-1.)

f. Install the drag struts as described in paragraph 43-1-11, steps j through o.

g. On helicopters equipped with position lights, install the mounting blocks, light assemblies, extension wiring and associated hardware. Locate the center of the light approximately 3.0 inches below the centerline of the upper tube.

h. Rotate the horizontal stabilizer to reposition the angle to a setting of minus 10 degrees. The stabilizer is at minus 10 degrees when the 1/4-inch hole (located approximately 2-1/2 inches from the end of the spar tube) is in line with the vertical (right-hand) hole in the bulkhead. (If installed, note the stabilizer positioning instruction plate "FLOAT GEAR" arrow.)

Changed October, 1965



1. Drag Strut Assembly
2. Bolt
3. Washer
4. Nut
5. Rod End Bearing
6. Nut
7. Bushing
8. Aft Support Beam Assembly
9. Contour Block
10. U-Bolt
11. Washer
12. Nut
13. Sleeve Spacer
14. Bolt
15. Washer
16. Nut
17. Bracket
18. Bolt
19. Sleeve Spacer
20. Washer
21. Nut
22. Clamp
23. Screw
24. Washer
25. Nut
26. Position Light Mounting Block
27. Wire Assembly
28. Wire Assembly
29. Sash Chain
30. Screw
31. Front Truss Assembly
32. Block
33. U-Bolt
34. Washer
35. Nut
36. Bolt
37. Washer
38. Nut
39. Clamp
40. Bolt
41. Washer
42. Nut
43. Suspension Tube Cap
44. Rivet
45. Float Gear Suspension Tube
46. Float Bag Assembly
47. Body Attachment Brace

Figure 44-101-1. Float Kit Installation Landing Gear

NOTE: If the spar tube lacks the hole for this setting, modify the stabilizer in accordance with Service Bulletin 2007.

i. Install the 13-pound ballast weight in place of the standard 9-pound weight.

44-101-20. DISASSEMBLY OF FLOAT LANDING GEAR.

a. Remove the nuts, washers and bolts securing the drag struts to the support beam lugs and remove the struts.

b. Release and detach the antidrag straps (eight places) from the truss and support beam.

c. Deflate the float bag compartments sufficiently to relieve the pressure at the U-bolt to suspension tube attachment locations.

d. Remove the nuts and washers from the U-bolts at each suspension location; then lift the support beam and truss from the suspension tubes.

NOTE: Removal of the truss and support beam from the suspension tubes is more easily accomplished by two persons.

e. Remove the contour blocks from the U-bolts. Press the bag fabric away from the U-bolt to prevent chafing by the bolt threads, and carefully remove the U-bolts from the tubes.

f. On helicopters equipped with position lights, remove the position lights by (1) disconnecting the light wiring outboard of the wire supporting clamp, (2) loosening the light bracket tension clamp, and (3) removing the mounting blocks.

g. Slide the suspension tubes from the fabric suspension bands and tension strips.

NOTE: If the float bags are to be stored they should be carefully folded and stored in the original container(s) or equivalent. Store the container(s) in a cool location away from electrical power equipment to reduce ozone deterioration.

44-101-21. ASSEMBLY OF FLOAT LANDING GEAR KIT. (See figure 44-101-1.) Assemble the suspension tube end caps to the suspension tubes and then assemble the kit into a unit in the following manner:

a. Position the cap on the tube end with the drain hole down and the end of the tube located 0.50-inch (minimum) to 0.75-inch (maximum) inside the cap.

b. Drill three No. 30 (0.128-inch diameter) holes through the cap and tube, using the 120-degree spaced pilot holes for location.

c. Rivet the cap to the tube using MS20600AD4-3 rivets.

CAUTION: RIVET STEMS MUST BE FILED SMOOTH AND FLUSH WITH THE RIVETHEADS.

d. Attach the static discharge sash chain to the fastener at the center of the support beam with a screw.

e. The remaining assembly of float kit components is essentially a reversal of the disassembly instructions provided in paragraph 44-101-20. Use the following precautions during or as a part of the assembly procedure:

(1) Handle the float bags carefully to avoid damaging the fabric.
(2) Install and position the suspension tubes prior to inflating the float bags.
(3) Avoid shifting the tubes with the bags fully inflated.
(4) Do not exceed the maximum sea level inflation pressure of 6.3 psi.
(5) Accomplish a float bag pressure check in accordance with paragraph 44-101-41.

44-101-40. REPAIR OF FLOAT LANDING GEAR BAGS. Refer to the UH-12E/ UH-12L Series Structural Repair Manual.

Table 44-101-1. Float Pressure Limitations

Float Pressure at Takeoff (psi)	Allowable Altitude Change UP (max ft)	Allowable Altitude Change DOWN (max ft)
1.5	11,500	700
2.5	8,900	2,700
3.5	6,400	4,800
4.5	4,000	7,000
5.5	1,700	9,000
6.3	0	11,900

44-101-41. PRESSURE TESTING FLOAT BAGS. Prior to installation of float landing gear on the helicopter (or whenever float bag leakage is detected), perform a pressure test on the float bags using the following procedure:

a. Inflate the bag compartments to 1.0 psi and let stand for 24 hours.
b. Check the pressure drop with a pressure gage which indicates 0 to 15 psi, graduated in 1/2-psi increments. (A dial indicating pressure gage assembly Item 47, table 92-1-I or an Ashcroft gage, Type 1000, obtainable from the Republic Supply Company of California, or an equivalent type may be used for this test.) Maximum allowable drop in 24 hours is limited to 1/4-psi per compartment.
c. If a pressure drop is noted, locate the source of the leak and repair the affected area.
d. Repeat pressure check of the repaired compartment as outlined in steps a and b above.
e. If a pressure drop still occurs, check the repair for soundness. If no trace of external leakage can be found, the leak may be occurring in the internal compartment bulkhead(s). Allowable drop resulting from a bulkhead leak is limited to 1/4-psi in 3 hours.

NOTE: No instructions are available for making repairs to the compartment bulkheads. Request for repairs in this area should be referred to the U. S. Rubber Company for disposition.

44-201-1. AMPHIBIOUS LANDING GEAR KIT.

44-201-2. DESCRIPTION. (See figure 44-201-1.) The amphibious landing gear kit includes two 35-pound, fuel-and oil-resistant, inflatable fabric bags that attach to the extended skid landing gear legs and skid gear runners; two skid gear extension tubes; two splice tube extensions; two scuff plates; and associated hardware. The amphibious landing gear kit must be installed only on the extended length skid landing gear.

44-201-3. Each amphibious air bag is divided into seven individual compartments separated by bulkheads. Each compartment is individually inflated through air valves located on top of the bags. The bags are protected against chafing by strip doublers, and the top surface is reinforced as a walkway. The under surface is puncture- and scuff-resistant. The exterior surface color is nonreflecting black. Each bag has two covered zippered closure slots that are placed around the landing gear legs for bag positioning and alignment. Bag attachment flaps are bolted to the landing gear skid runners to secure the bags. Each bag can be folded for handling and storage.

44-201-4. The two splice tube extensions attach to the aft end of each skid gear runner. The two scuff plates attach to the aft end of each extension tube. The extension tubes are retained to the splice tubes with the bag attachment hardware.

44-201-5. Maximum operating pressure of the bags is 6.3-psi. Normal operating pressure of the bags at sea level is 1.5-psi to 2.0-psi. Refer to table 44-101-1 for allowable altitude change limitations when amphibious landing gear is installed. Refer to the UH-12E Flight Manual for air speed limitations with amphibious gear installed.

44-201-10. REMOVAL OF AMPHIBIOUS LANDING GEAR KIT. (See figure 44-201-1.)

a. Hoist or jack the helicopter far enough to remove the weight from the skid gear [Section 10].
b. Deflate air bags to approximately 0.1-psig.
c. Open the bag zipper flaps and cut twine securing forward and aft zippers.
d. Remove hardware securing bag attachment flaps to skid gear runners.
e. Open zipper closure slots and remove bags from skid landing gear.
f. Deflate bags completely for storage.

CAUTION: DO NOT STORE BAGS IN SUNLIGHT. SUNLIGHT HAS A DETERIORATING EFFECT ON BAG FABRIC.

g. Remove extension tubes from skid gear runner splice tubes.
h. Remove splice tubes from aft end of skid gear runners.

44-201-11. INSTALLATION OF AMPHIBIOUS LANDING GEAR KIT. (See figure 44-201-1.)

NOTE: Whenever the amphibious landing gear kit is installed, three place helicopters must be equipped with a modified pitot-static system. (Refer to the UH-12E Flight Manual.)

a. Hoist or jack the helicopter far enough to remove weight from skid gear [Section 10].
b. Standard skid landing gear legs must be replaced with extended skid landing gear legs [Section 43] prior to installation of amphibious landing gear.
c. Install splice tubes in aft end of skid landing gear runners.
d. Install extension tubes on aft end of each skid gear runner splice tube. Align the first two holes of extension tube with aft two holes in splice tube.

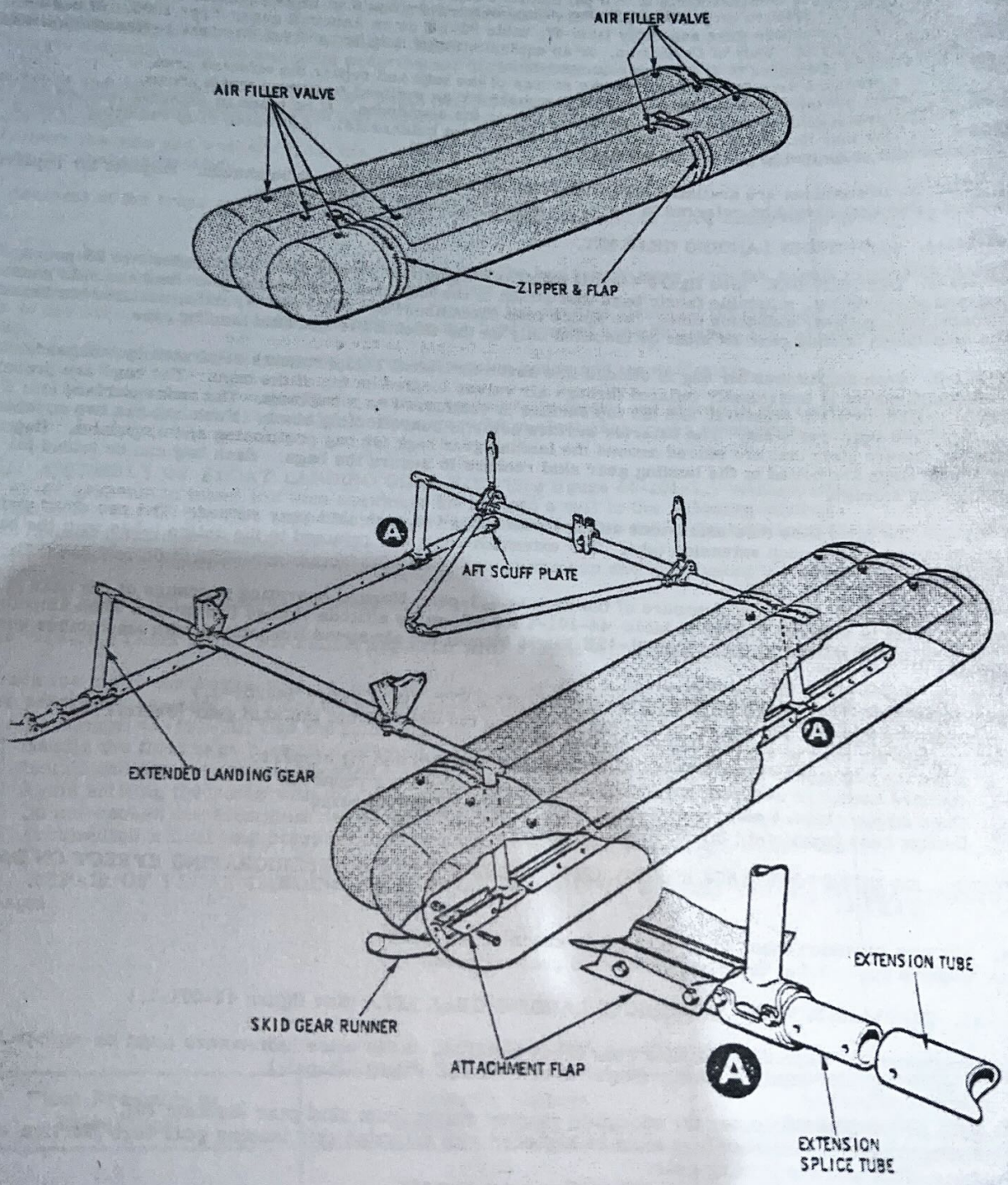


Figure 44-201-1. Amphibious Landing Gear

e. Position right- and left-hand bag next to their respective skid gear runner with the bag zippers facing the skid gear legs.
f. Inflate each bag to 0.1-psig. Check pressure with dial indicating pressure gage (item 47A, table 92-1-1).
g. Open the two zipper closure slots and slide bags into position on skid gear legs.
h. Secure bag attachment flaps to skid gear runners and extension tubes, beginning at front of bag and working aft. (The hardware that secures the bag attachment flaps to the extension tube also secures extension tube to splice tube.)
i. Close zipper closure slots. Use waxed twine (item 21, table 10-VI) to tie the forward zipper slider to forward skid leg with a fixed bight so that twine will slide when bag is deflected. Tie both aft zippers together with waxed twine.
j. Fasten zipper flaps.
k. Inflate the bag air compartments to the pressure and in the sequence listed.

CAUTION: DO NOT EXCEED BAG INFLATION PRESSURE OF 6.3-PSI UNDER ANY CONDITION.

(1) Inflate forward inboard cell to 0.5-psig.
(2) Inflate middle inboard cell to 0.5-psig.
(3) Inflate aft inboard cell to 0.5-psig.
(4) Inflate forward center cell to 0.5-psig.
(5) Inflate aft center cell to 0.5-psig.
(6) Inflate forward outboard cell to 0.5-psig.
(7) Inflate aft outboard cell to 0.5-psig.
(8) Complete inflation of cells to 1.5-psig to 2.0-psig, in the sequence indicated above.

NOTE: Atmospheric air temperature changes have a significant effect on bag pressure. Each 3-degree Fahrenheit change in the ambient air temperature results in a bag pressure change of 0.1-psi.

44-201-40. REPAIR OF AMPHIBIOUS AIR BAGS. A repair kit (including instructions) is available from Hiller Aircraft Company for general repair of amphibious bags.

NOTE: No instructions are available for making repairs to the compartment bulkheads; request for repairs in this area should be directed to the Garrett Corporation, Air Cruisers Division, Belmar, New Jersey.

44-201-41. PRESSURE TESTING AMPHIBIOUS BAGS. Prior to installation of amphibious landing gear on the helicopter (or whenever bag leakage is detected), perform a pressure test on the amphibious bags using the following procedure.
a. Inflate the bag air compartments to 2.0-psi and let stand for 12 hours.
b. Check the pressure drop with dial indicating pressure gage (item 47A, table 92-1-1). Maximum allowable drop in 12 hours is limited to 0.5-psi per compartment.
c. If a pressure drop is noted, locate the source of the leak and repair the affected area.
d. Repeat pressure check of the repaired area as outlined in steps a and b above.
e. If a pressure drop still occurs, check the repair for soundness. If no trace of external leakage can be located, the leak may be occuring in the internal compartment bulkhead(s).
f. Maintain bag inflation pressure at lowest value consistent with satisfactory operation.

MAIN ROTOR ASSEMBLY

50-1-1. MAIN ROTOR ASSEMBLY. (See figure 50-1-1.)

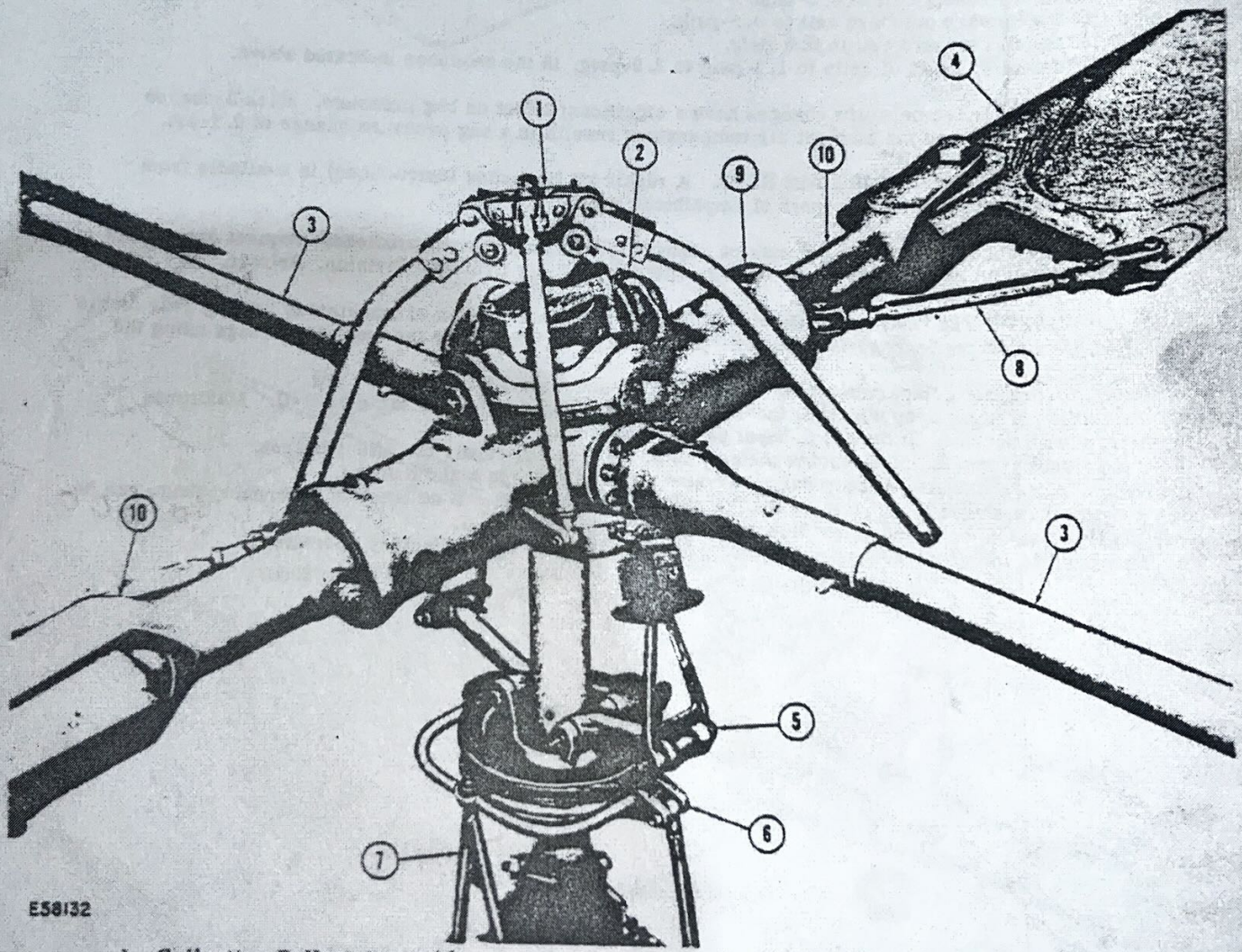
50-1-2. DESCRIPTION. The main rotor assembly is mounted on a teetering head mechanism on top of the main rotor drive shaft. It consists of two main rotor blades, a head assembly and two control rotor blade assemblies. The main rotor drive shaft delivers torque through the head spline fitting to rotate the gimbal ring and main rotor hub. The main rotor blades are restrained spanwise by the grip fork assemblies and chordwise by the drag struts.

50-1-3. TROUBLESHOOTING THE MAIN ROTOR ASSEMBLY. Refer to Table 50-1-I.

50-1-10. REMOVAL OF MAIN ROTOR ASSEMBLY. (See figures 50-1-1, -2 and -3.)

a. Remove the collective pitch ballast assembly (refer to Section 31).

b. Disconnect upper scissors assemblies from the two control rotor incidence adjustment brackets at the control rotor cuffs. Be careful not to lose the two tubular spacers located between incidence adjustment brackets and upper scissors bearings.



1. Collective Ballast Assembly
2. Main Rotor Gimbal Ring Assembly
3. Control Rotor Assembly
4. Main Rotor Blade Assembly
5. Scissors Assembly
6. Wobble Plate Assembly
7. Wobble Plate Pylon Assembly
8. Main Rotor Blade Drag Strut Assembly
9. Main Rotor Hub Assembly
10. Main Rotor Blade Root Fork

Figure 50-1-1. Main Rotor Installation

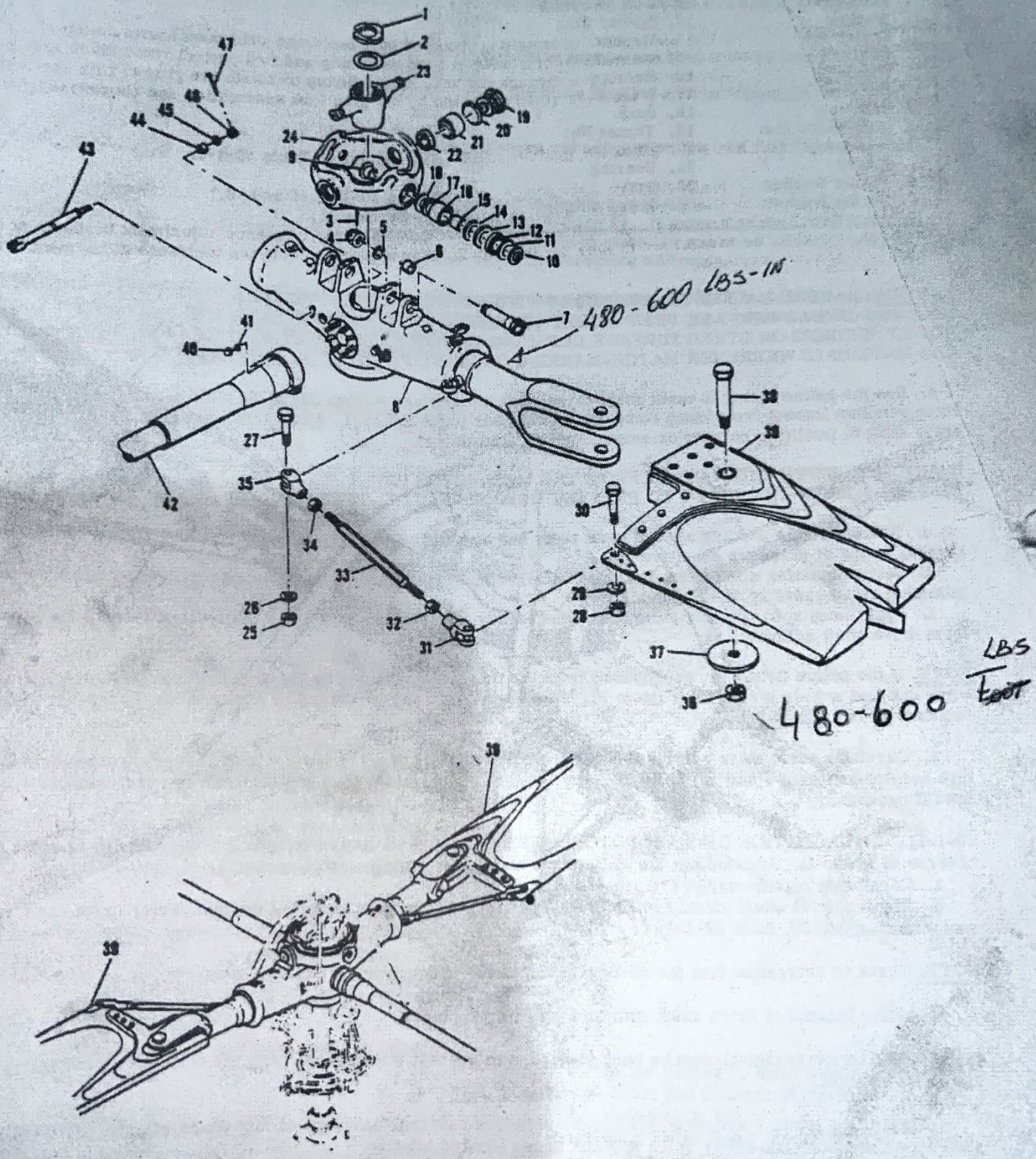


Figure 50-1-2. Main Rotor Assembly

INDEX TO FIGURE 50-1-2

1. Lock Nut
2. Washer
3. Cotter Pin
4. Nut
5. Washer
6. Bushing
7. Bolt
8. Main Rotor Hub Assembly
9. Spacer
10. Thrust Washer
11. Thrust Washer
12. Rubber Spacer
13. Spacer Ring
14. Washer
15. Inner Race
16. Bearing
17. Washer
18. Seal
19. Thrust Nut
20. Shim
21. Bearing
22. Seal
23. Spline Fitting
24. Gimbal Ring
25. Nut
26. Washer
27. Bolt
28. Nut
29. Washer
30. Bolt
31. Terminal Fitting
32. Nut
33. Drag Strut
34. Nut
35. Terminal Fitting
36. Nut
37. Washer (or weight AR)
38. Attachment Pin
39. Blade Assembly
40. Nut
41. Washer
42. Control Rotor
43. Incidence Arm
44. Spacer
45. Washer
46. Nut
47. Cotter Pin

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0 60 250
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CAUTION: HANDLE MAIN ROTOR ASSEMBLY WITH EXTREME CARE. THE HUB, GRIP FORKS, SPLINE FITTING AND GIMBAL RING ARE VERY HIGHLY STRESSED PARTS. DO NOT MARK ANY PARTS OF THE ASSEMBLY BY SCRIBING OR OTHER SURFACE DEFACING METHODS. USE ONLY SOFT CRAYON, CHALK OR SIMILAR MATERIALS WHEREVER MATCH-MARKING OR IDENTIFICATION OF THE PARTS IS REQUIRED.

c. Use the spline fitting to main rotor drive shaft nut spanner wrench (item 22, table 92-1-I) to remove main rotor retainer locknut from main rotor drive shaft (see figure 50-1-3). Mark upper surfaces of spline fitting and drive shaft to facilitate correct orientation during installation.

CAUTION: REMOVE THE WASHER FROM THE MAIN ROTOR DRIVE SHAFT BEFORE HOISTING MAIN ROTOR ASSEMBLY FROM THE SHAFT TO PREVENT DAMAGING SHAFT THREADS.

d. Place suitable padding around main rotor hub assembly and cover main rotor drive shaft threads with several wraps of pressure sensitive tape.

e. Secure hoisting sling (item 1, table 92-1-I) to main rotor hub. Attach sling to an overhead hoist with a minimum rated capacity of 400 pounds.

f. Apply tension to hoisting sling and, if necessary, use a brass drift and a mallet to loosen spline fitting from drive shaft splines.

NOTE: If the spline fitting is not released from the drive shaft splines by the drift and mallet, attach the main rotor hub and wobble plate puller (item 18, table 92-1-I) and engage the puller hooks under the spline fitting arms to remove the spline fitting.

g. Carefully raise main rotor assembly from helicopter and place assembly on the main rotor stand and fixture assembly (items 9 and 12, table 92-1-I). A locally fabricated stand and fixture of similar design may be used if necessary.

50-1-11. INSTALLATION OF MAIN ROTOR ASSEMBLY. Installation of main rotor assembly is essentially the reverse of removal. Accomplish the following additional assembly requirements:

a. Check that match-marks are alined.

b. Tighten drive shaft locknut to 2160/3000 pound-inch torque value using the main rotor drive shaft nut spanner wrench (item 22, table 92-1-I). 180/250 L.BS/FOOT

NOTE: Check to determine that the 50-degree OD bevel of the locknut is facing down.

c. Safety locknut to drive shaft with lockwire in two places.

NOTE: The lockwire pigtail must be bent downward to prevent interference with the collective pitch ballast assembly bracket.

d. Insert the tubular spacers between the scissors bearings and ears of incidence adjustment bracket. Install upper scissors assembly bolts with the heads located inboard.

e. Check the collective pitch system for proper rig (refer to Section 31).

50-1-30. STATIC BALANCING OF MAIN ROTOR ASSEMBLY. Static balancing of complete main rotor assembly shall be accomplished whenever flight vibratory characteristics indicate that an unbalanced condition exists (one-to-one lateral vibration in the plane of rotation), or whenever main rotor assembly components are individually replaced.

NOTE: The following balance procedures are based upon the use of the special tools listed in table 92-1-1; however, the balancing operations may also be accomplished by use of the Marvel Manufacturing Company Suspension-type Propeller and Small Parts Balancing Kits, Part Numbers 7A050 and 7HEL054. Marvel balancing equipment must be used according to instructions provided with the kits and in conjunction with the balance tolerances specified in this handbook.

a. Make certain that the main rotor head and control rotor blade assemblies have been balance checked and are within allowable tolerance. (Refer to Section 51.)

b. Set main rotor blades at zero degrees incidence, using the blade leveling arm assembly (paragraph 50-1-31, step c).

NOTE: Measure blade incidence at upper retention plate, outboard end adjacent to the root fork, and perpendicular to blade leading edge.

c. Aline main rotor blades according to procedures outlined in paragraph 50-1-31.

d. Check the spanwise balance using special tools indicated in Section 51. If more than four AN960-416 tolerance check washers are required at surface of the "light" blade tip to establish spanwise balance, add weight to the "light" blade tip to produce assembly balance within the foregoing tolerance.

NOTE: Main rotor blade tip assemblies must be installed during the static balance check or balancing procedure as they constitute part of a complete balanced assembly. However, tip replacement for damage or excessive erosion is permissible without the requirement for complete assembly rebalancing.

e. Adjust the tip weight of the "light" blade by removing blade tip assembly and adding weight to the tip weight adjustment provision (see figure 50-1-4). Remove the tip weight retention bolt, index plate, balance weights and washers, and retention spring as a unit. Insert additional balance weights or washers, as required, between index plate and retention spring.

f. The maximum number of lead weights which may be installed at the blade tip is eleven. A minimum of one lead weight must remain at the blade tip. Either the basic part number or the alternate part number lead weights may be used as required.

NOTE: There is 0.01-lb weight difference between balance weights, the alternate part number weight being the heavier.

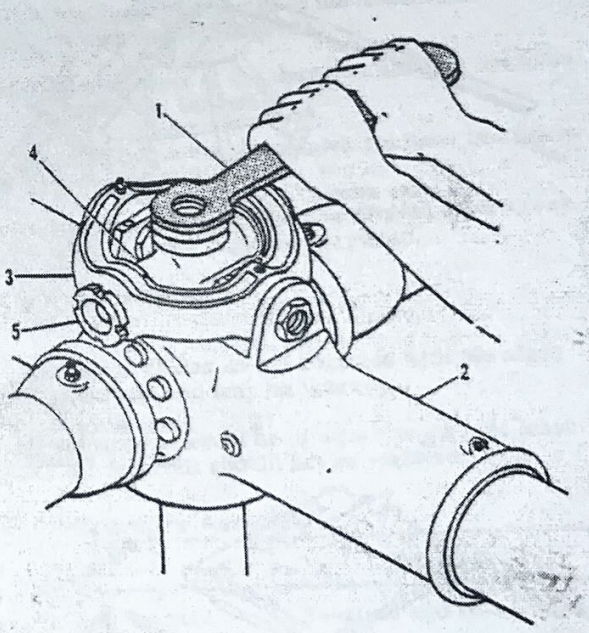
g. Cut the retention spring, if required, to accommodate added weights. Minimum free length of spring shall not be less than 0.5-inch when shortened, and when assembled, the spring must be in compression. If added weights result in a spring length of less than 0.5-inch, remove the spring and replace with a solid stack of AN960-416 (or AN960-416L) washers, as required to retain balance weights firmly against index plate.

NOTE: Segments of the inboard lead weight may be cut away to assist in obtaining spanwise balance. The minimum permissible radius of any portion of an altered (cut) balance weight is 5/16-inch, measured from the bolt hole center.

h. Reinstall the tip weight assembly parts in reverse order of removal.

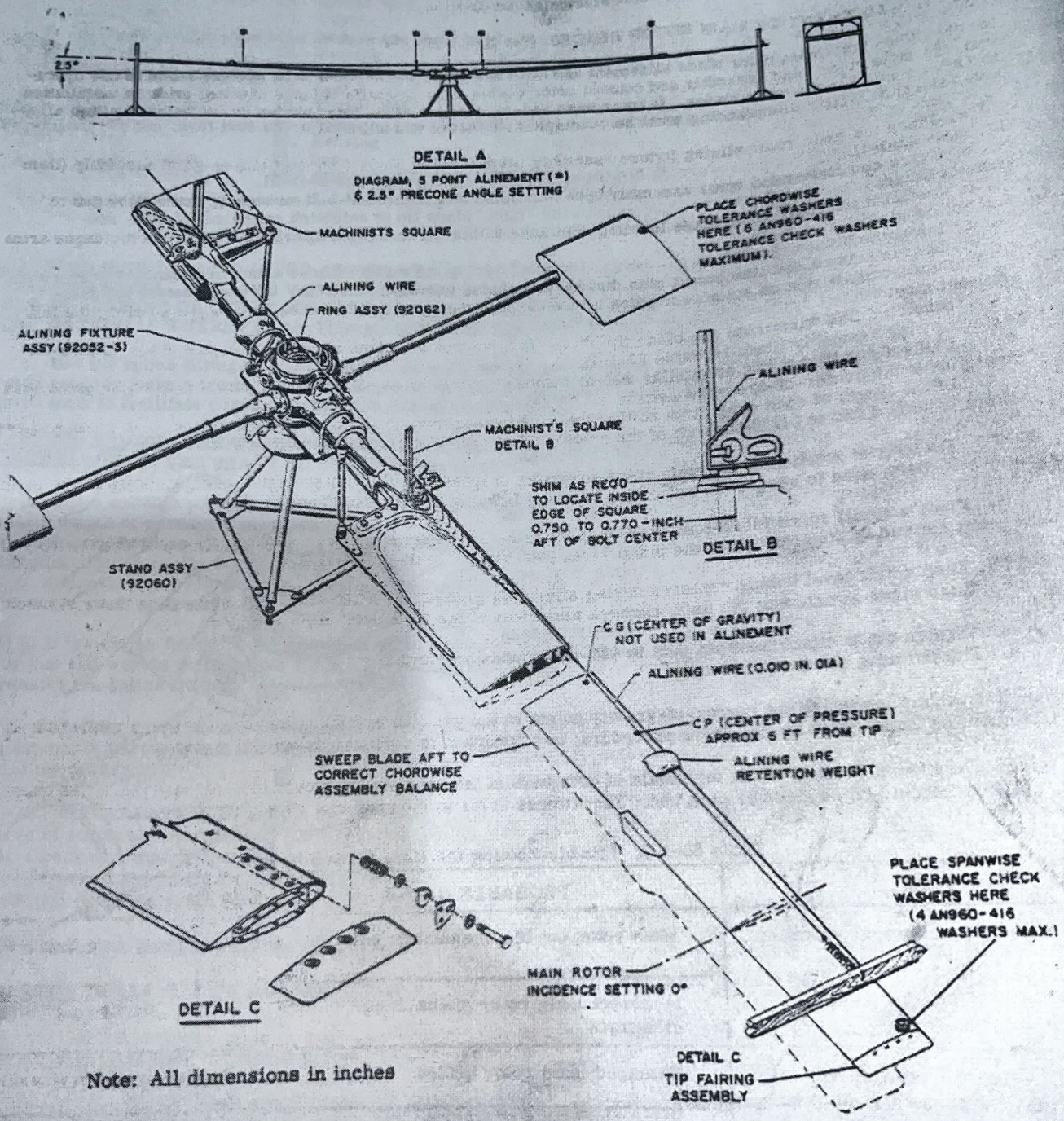
CAUTION: (deleted)

i. Check the chordwise balance. Balance shall be within the weight of six AN960-416 tolerance check washers placed at tip of the "light" control rotor blade. Correct any out-of-balance condition by sweeping one blade aft toward the light side. Limit the amount of sweep so that it



1. Spline Fitting to Main Drive Tube Nut Spanner Wrench
2. Main Rotor Hub
3. Main Rotor Head Gimbal Ring
4. Splined Fitting
5. Gimbal Ring Thrust Nut

Figure 50-1-3. Removing Main Rotor Locknut



Note: All dimensions in inches

Figure 50-1-4. Main Rotor Blade Alinement and Chordwise Balance

does not exceed 1/6-turn of the drag strut, using the applied strut alinement marks as a neutral reference (paragraph 50-1-31).

j. Tighten blade attachment pin nut to 480-600 pound-inch torque value.

k. Using red lacquer, apply a narrow stripe across the outboard end of the drag strut check nut and terminal on the aft-swept blade to indicate the chordwise balanced position.

50-1-31. ALINEMENT OF MAIN ROTOR BLADES. (See figure 50-1-4.)

NOTE: When both main rotor blade alinement and head assembly balance are to be accomplished in one operation, the main rotor head assembly and control rotor blades must be static balance checked prior to installation and alinement of main rotor blades. If rotor head assembly and control rotor blades do not balance within allowable tolerance, static prebalancing must be accomplished (Refer to Section 51.)

a. Place the main rotor alining fixture assembly (item 9, table 92-1-I) on the balance stand assembly (item 12, table 92-1-I).

b. Place complete main rotor assembly upon alining fixture; secure U-bolts attaching main rotor hub to balance stand.

c. Install main rotor stand blade leveling arm assemblies (item 35, table 92-1-I) between the incidence arms and hollow gimbal ring bolts.

d. Level the blades chordwise.

e. Loosen nuts on the attachment pins that secure blades to forks.

f. Support blade tips on suitable cradles high enough to maintain a 2.5-degree precone angle along the full span of blade.

g. Stretch a fine wire from one blade tip to the other so that it passes across centerline of the main rotor balancing ring assembly (item 14, table 92-1-I).

h. Place a small shot bag or similar weight outboard of the center-of-pressure points to hold the piano wire exactly over the center-of-pressure points.

i. Adjust length of each drag strut so that the wire passes over the axis of rotation of the main rotor and over a point located 0.750 to 0.770-inch aft of the centerline of each blade attachment pin head.

NOTE: The axis of rotation of the main rotor assembly is located at the center of the four bolt holes in the main rotor hub (bolts used to secure the collective ballast assembly to main rotor assembly).

j. Place a small spirit level-square on each blade retention plate against the attachment pin head to project the point defined in step i above to the piano wire. (See Figure 50-1-4, Detail B.)

NOTE: Keep spirit level bubble centered during alinement procedure. After each tightening of drag strut check nuts and the blade attachment pin nuts, recheck alinement of the wire over the three check points.

k. Tighten blade attachment pin nuts to 480-600 pound-inch torque value.

l. Tighten drag strut check nuts.

NOTE: In many instances the center-of-gravity points in the main rotor blades do not coincide with the blade alinement as determined by the above procedure; this condition is normal and may be ignored.

m. The hidden threads of the terminals at both ends of the drag struts should be of equal length. At least 1/2-thread should be exposed at each end. The witness holes in the terminal should not be exposed.

Table 50-1-I. Troubleshooting the Main Rotor Assembly

TROUBLE	PROBABLE CAUSE	REMEDY
One-to-one lateral vibration	Main rotor out of alinement or balance	Re-aline and re-balance rotor
	Incorrect main rotor gimbal ring clearance	Adjust gimbal ring shims.
One-to-one vertical vibration (may be present in ship and/or collective control)	Damaged main rotor blades	Replace with serviceable blades.
	Rotor blades out of track	Retrack rotor blades.
Two-to-one vibration (may be present in ship and/or control system).	Main rotor blade tabs bent excessively	Reposition blade tabs.

NOTE: The length of the drag strut assemblies should not be changed after main rotor blade alinement has been completed, except as required to establish complete main rotor assembly chordwise balance (refer to paragraph 50-1-30).

n. Using yellow or white lacquer, apply a narrow alinement stripe across drag strut check nut and terminal outer end of each blade to indicate the neutral alinement point.

50-1-40. GENERAL MAINTENANCE OF MAIN ROTOR ASSEMBLY. General maintenance of main rotor assembly shall be limited to the inspection, cleaning, servicing, and parts removal and installation procedures outlined above.

a. For major repair and overhaul of the following assemblies, refer to the appropriate repair and overhaul manual indicated below:

(1) Main rotor head assembly - Main Rotor Head Assembly Overhaul Manual.
(2) Main rotor blade assembly - Structural Repair Manual.
(3) Control rotor cuff and trunnion assembly - Control Rotor Cuff and Trunnion Assembly Overhaul Manual.

b. Minor exposed surface defects such as scratches, nicks, and dents may be hand reworked and refinished provided that the reworked defect does not exceed 0.010-inch depth and one square inch in surface area prior to the refinishing operation. Rework is to be accomplished according to the following procedure:

CAUTION: NO REWORK OF THE MAIN ROTOR SPLINE FITTING IS PERMISSIBLE, EXCEPT TO REMOVE CORROSION DEPOSITS WITHIN THE LIMITS GIVEN IN THE MAIN ROTOR HEAD ASSEMBLY OVERHAUL MANUAL. REFER TO SECTION 36 FOR PERMISSIBLE REWORK OF THE CONTROL ROTOR CUFFS, AND TO SECTION 53 FOR MAIN ROTOR BLADE DEFECT REMOVAL.

c. Determine that area to be reworked does not exceed specified tolerances.
d. Use abrasive paper (fine grade) to remove sharp edges and blend defect into surrounding area.

NOTE: Defects such as dents which blend smoothly with surrounding area do not require rework if there are no sharp edges present.

e. Polish out sanding marks with progressively finer grades of abrasive paper. Sanding of main rotor blade defects should be accomplished in a spanwise direction if practicable.

CAUTION: DO NOT USE ABRASIVE PAPER CONTAMINATED WITH OTHER METALS. DISSIMILAR METAL IMBEDDED IN SURFACE BEING POLISHED CAN CAUSE CORROSION.

f. Apply three coats of zinc chromate primer, confining application to a slight overlapping of sanded area.

MAIN ROTOR HEAD

51-1-1. MAIN ROTOR HEAD ASSEMBLY. (See figure 51-1-1.)

51-1-2. DESCRIPTION. The main rotor head assembly consists of a forged aluminum drop-center hub, a forged steel gimbal ring and spline fitting and two steel blade root forks. The spline fitting and gimbal ring are mounted to the hub through needle bearings and provide the necessary teetering and feathering axes. A tension-torsion plate assembly, located in each grip fork resists the high centrifugal blade forces and at the same time permits rotation of the grip fork as collective pitch is applied.

51-1-3. TROUBLESHOOTING THE MAIN ROTOR HEAD ASSEMBLY. Refer to Section 50.

51-1-10. REMOVAL AND INSTALLATION OF THE MAIN ROTOR HEAD ASSEMBLY. Refer to Section 50. 50-1-10 and -11.

51-1-20. DISASSEMBLY OF THE MAIN ROTOR HEAD ASSEMBLY. (See figure 50-1-2.) and 51-1-2.) Only removal and installation procedures for the gimbal ring and spline fitting are discussed in this section. Damaged or otherwise defective parts requiring more extensive repairs are fully discussed in the main rotor head assembly overhaul manual. Replacement of gimbal ring and spline fitting are outlined in the following paragraphs.

a. Remove main rotor head gimbal ring from main rotor head assembly as follows:
   (1) Remove main rotor from the helicopter (refer to section 50).
   (2) Remove cotter pins and nuts securing main rotor gimbal ring to main rotor hub ears.
   (3) Remove main rotor hub hinge bolts from gimbal ring.

CAUTION: DO NOT DAMAGE THE RUBBER SPACERS AND THRUST WASHERS.

(4) Lift the flanged spacers out from inner end of bearing bores. Using a small block of wood, tap out the thrust washers, rubber spacers, spacer rings, spacers, inner races of the bearings, washer and spacer.

(5) Press out bearing outer races and remove inner washers. Gimbal rings are provided with holes to facilitate bearing removal by use of wood or plastic drifts.

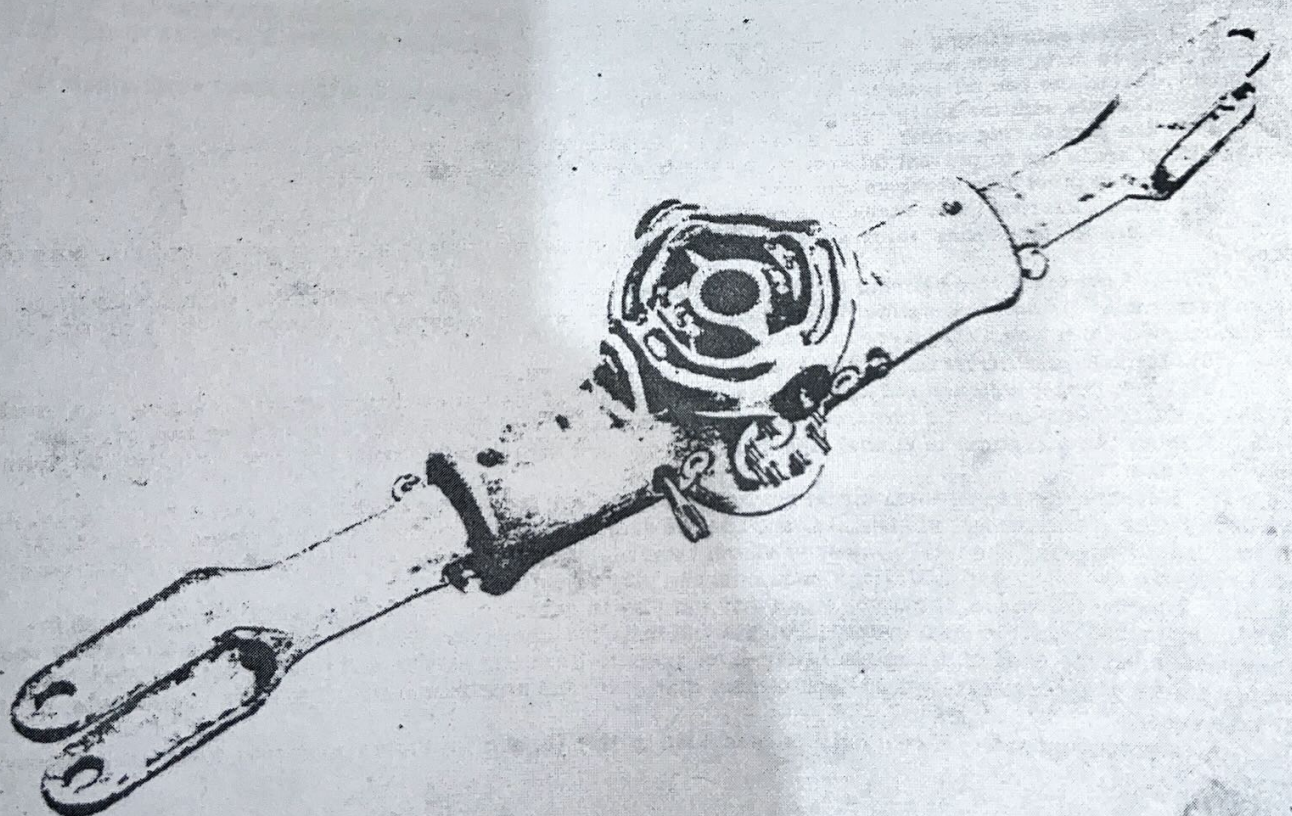


Figure 51-1-1. Main Rotor Head Assembly

b. Remove main rotor head spline fitting from gimbal ring as follows:

(1) Remove main rotor gimbal ring from main rotor head assembly (refer to step a, above.)

(2) Remove the thrust nut from each end of the gimbal ring-spline fitting hinge line with the main rotor gimbal thrust nut spanner wrench (item 20, table 92-1-I).

(3) Remove any shims between inboard shoulder of the thrust nut and outer face of gimbal ring bore. Note the number and thickness of the shims used in each end and match-mark thrust nut and gimbal ring to facilitate re-assembly.

(4) Support gimbal ring in a vise with the pivot arms of the spline fitting in a vertical position. Using a brass drift, tap against spline fitting oil seal in lower bore. Force oil seal and pivot arm bearing and bearing race out of gimbal ring.

CAUTION: VISE JAWS MUST BE PADDED TO PREVENT NICKS AND SCRATCHES IN THE HIGHLY STRESSED GIMBAL RING.

(5) Reverse the gimbal ring position in the vise, and force opposite oil seal and pivot arm bearing out of the opposite bore as described above.

(6) After removal of oil seals and pivot arm bearings, remove splined fitting from gimbal ring by offsetting the fitting to one side until it can be cocked and removed from gimbal ring.

Figure 51-1-2. Deleted.

51-1-21. ASSEMBLY OF MAIN ROTOR HEAD ASSEMBLY.

a. Install spline fitting and gimbal ring into rotor head as follows:

(1) Install spline fitting in the gimbal ring before attaching ring to main rotor hub. When the spline fitting is in place, install the two oil seals through bore outer end. Install the oil seals with the sharp edge of the lip facing inboard toward gimbal ring center. Use a piece of rolled shim stock over the spline fitting ends to prevent damage to oil seals and to prevent oil seal from hanging up on grooved ends of spline fitting.

(2) Press pivot arm bearings into bore.

(3) Install bearing inner races on arms.

(4) Reinstall any shims which were located between thrust nut inboard shoulder and gimbal ring bore outer face.

(5) Use the main rotor gimbal thrust nut spanner wrench, (item 20, table 92-1-I), to install the thrust nut on each end of gimbal ring-spline fitting hinge line. Take care to reinstall thrust nuts in the same side of the gimbal ring from which they were originally removed.

(6) Tighten each thrust nut to 600-650 pound-inch torque value.

(7) When thrust nuts are fully seated, the total end play of the spline fitting within the gimbal ring must be between 0.001 to 0.003-inch. To check or establish correct end play adjustment, first remove any thrust nut shims. Tighten one thrust nut in gimbal ring opposite bore and tighten until thrust nut inner end contacts spline fitting pivot arm.

(8) Measure the gap between thrust nut flange and the end face of the gimbal ring with a feeler gage. Add 0.001-inch to the measurement so obtained, and use the sum as the total thickness of the shims required. At each end, install one-half the total number of shims required, dividing shims equally between the two sides of the gimbal ring to provide proper 0.003-inch maximum end play adjustment.

(9) In some instances, it may be found that end play in excess of 0.003-inch exists with no shims installed under thrust nuts. In such cases, fabricate and install washer type steel shims between innermost ends of the thrust nuts and the ends of the spline fitting pivot arms to limit end play to specified 0.001 to 0.003-inch. Fabricate shims of approximately 0.88-inch outside diameter, and approximately 0.190-inch center hole, to allow for grease access.

(10) Tighten and safety thrust nuts as described in step (6) above. Safety nuts with 0.041-inch diameter lockwire.

NOTE: If the safety wire holes do not line up through the gimbal ring and the thrust nut after adjustment of end play, it is permissible to drill additional holes, with a No. 50 drill (0.070/0.072-inch) (using the existing hole in the gimbal ring as a guide) through the thrust nut. The following restrictions apply when an additional hole is required:

1. The maximum number of holes in any 90-degree arc is four, provided that 30-degree spacing is maintained.

2. A fifth hole within any 90-degree arc is permissible, but shall not be drilled with a spacing of less than 15 degrees from any existing hole.

3. If fewer than the maximum number of holes exist within any 90-degree arc, one hole may be drilled with a minimum of 15 degrees spacing from any existing hole, provided that any subsequent holes drilled are within the 30-degree spacing up to a maximum of five holes. Any thrust nut with an excess number of holes or exceeding the minimum hole spacing shall be removed from further service.

(11) After locating oil seals at the inner end of the bores, stake each oil seal in two places, using a rounded 0.040-inch punch. Place the stakes approximately 180 degrees apart, and approximately 40 to 45 degrees from the vertical centerline.

b. Install gimbal ring in rotor head as follows:

(1) Install the two grease seals in the recesses in the bearing bore inner ends. The seal lips should face toward the bearings.

(2) Install the hinge line parts in the following order:

(a) the 1-19/64-inch inside diameter washer
(b) the bearing
(c) the 1-3/8-inch inside diameter washer
(d) the washer
(e) the spacer, ring, rubber washer and outboard thrust washers.

(3) Insert the special flanged spacers through the gimbal ring bore inboard end, with spacer flanged end facing inboard.

(4) Place gimbal ring assembly in position.

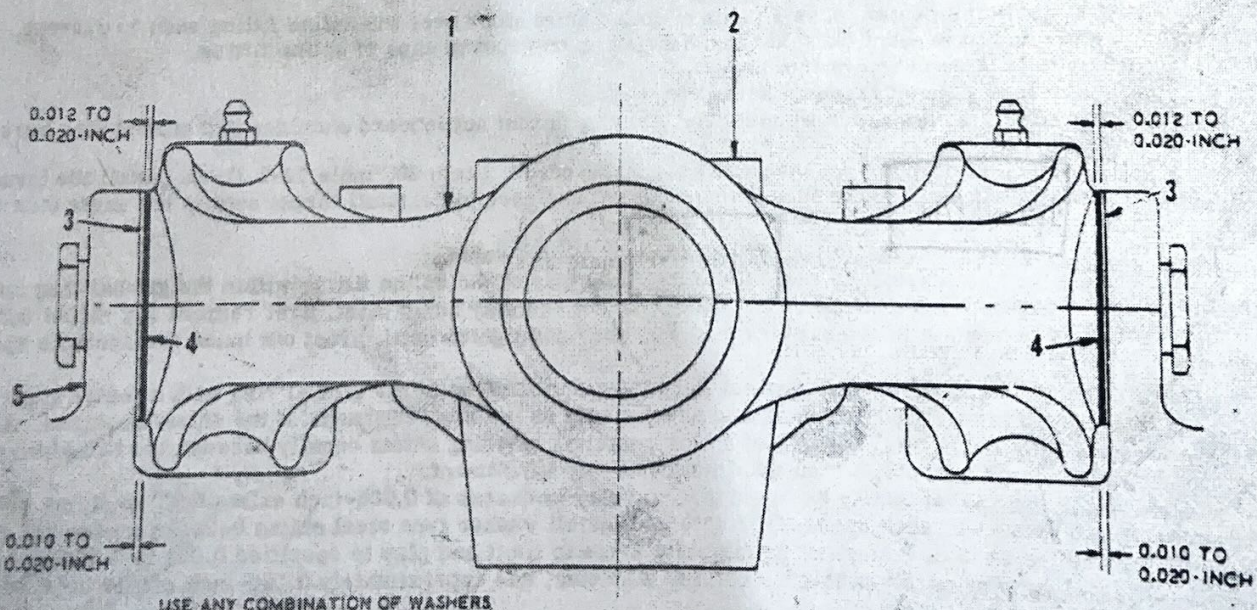
(5) Install the outer thrust washers in thickness combinations to maintain the gimbal ring-to-hub ear clearance specified in figure 51-1-3. Divide the outer thrust washers as nearly equally as possible between the two gimbal ring-to-hub ear locations.

CAUTION: THE CLEARANCES SPECIFIED IN FIGURE 51-1-3 MUST EXIST SIMULTANEOUSLY AT BOTH SIDES OF THE GIMBAL RING AND THE MAIN ROTOR HUB EARS. USE TWO FEELER GAGES TO MEASURE THE CLEARANCE. UNDER NO CIRCUMSTANCES SHALL THE CLEARANCE BE SET TO LESS THAN THE MINIMUM SPECIFIED.

(6) Install hinge line bolts, washers and nuts.

(7) Tighten nuts to 180/200 pound-inch torque value and safety with cotter pins.

(8) Check the installation to determine that there is clearance between the underside of the bolt head and the outer ear of the main rotor hub. This clearance will indicate that no adverse bending load is being imposed on the hub ears.

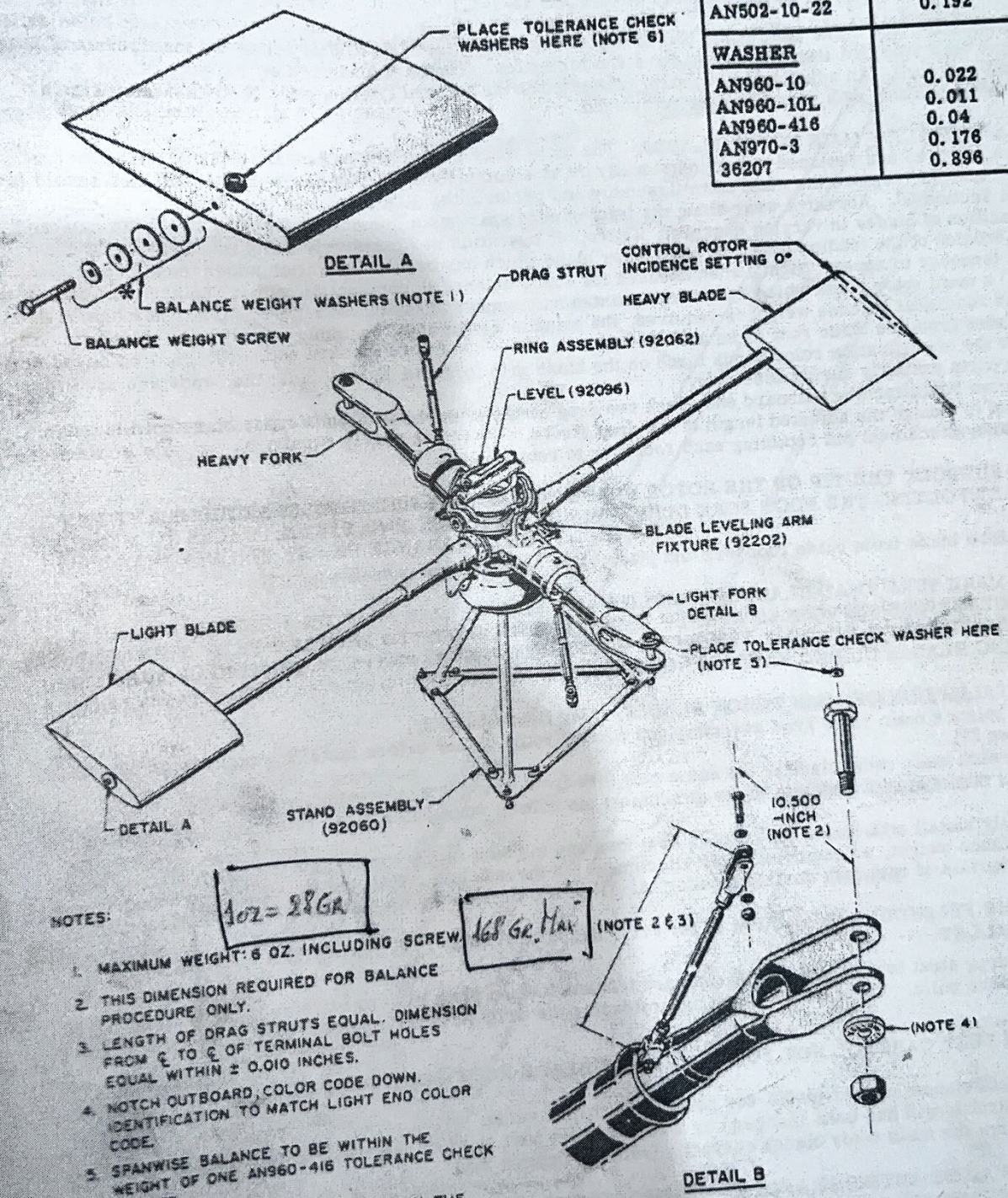


1. Main Rotor Gimbal Ring
2. Main Rotor Spline Fitting
3. Thrust Washer
4. Rubber Spacer
5. Main Rotor Hub Assembly

Figure 51-1-3. Main Rotor Head Gimbal Ring Clearance

*TABLE OF SIZES AND WEIGHTS

PART NO.	WEIGHT (OZ)
SCREW	
AN502-10-22	0.192
WASHER	
AN960-10	0.022
AN960-10L	0.011
AN960-416	0.04
AN970-3	0.176
36207	0.896



NOTES:

1. MAXIMUM WEIGHT: 6 OZ. INCLUDING SCREW. 1oz = 28Gr 168 Gr. Max
2. THIS DIMENSION REQUIRED FOR BALANCE PROCEDURE ONLY. (NOTE 2 & 3)
3. LENGTH OF DRAG STRUTS EQUAL. DIMENSION FROM ℄ TO ℄ OF TERMINAL BOLT HOLES EQUAL WITHIN ± 0.010 INCHES.
4. NOTCH OUTBOARD, COLOR CODE DOWN. IDENTIFICATION TO MATCH LIGHT END COLOR CODE.
5. SPANWISE BALANCE TO BE WITHIN THE WEIGHT OF ONE AN960-416 TOLERANCE CHECK WASHER.
6. CHORDWISE BALANCE TO BE WITHIN THE WEIGHT OF 5 AN960-416 TOLERANCE CHECK WASHERS.

Figure 51-1-4. Main Rotor Head Assembly Balance

MAIN ROTOR BLADES

53-1-1. MAIN ROTOR BLADES. (See figures 50-1-1 and 53-1-1.)

53-1-2. DESCRIPTION. The main rotor blades are all-metal symmetrical airfoil sections, incorporating a steel leading edge spar and aluminum alloy skins and laminates. They are anchored at the inboard end by a forged steel root fork. An adjustable drag strut connected at the inboard trailing edge restrains the blade in a fixed chordwise position with respect to the rotor head.

53-1-10. REMOVAL OF MAIN ROTOR BLADES. The main rotor blades are interchangeable to the extent that they may be removed and replaced either individually or as a complete set. Whenever one or both main rotor blades are replaced, remove the main rotor assembly and perform the alignment and static balance procedures specified in Section 50. Abrasive wear along the leading edge spar has a normal tendency to affect the master balance condition of blades in varying degrees. Helicopter operation in excessively dusty or sandy areas can accelerate erosion of the leading edge. A main rotor blade which has been in operation under these conditions may have a tendency to appear "light" when checked for static balance in conjunction with a replacement blade; conversely, a main rotor blade which has been repainted may appear "heavy". Whenever main rotor blades are replaced and additional balance weight is required, the balance weight shall be added to the "light" blade tip. Remove the blades from the blade root forks as follows:

a. Note the identification color bands found on the blade grip fork and on the blade; the bands are used to match these parts properly during assembly.

b. Remove bolt attaching outboard end of the two drag struts at the base of each rotor blade trailing edge. Be careful not to change the adjusted length of the drag struts.

c. Remove attachment pin retaining each root fork to rotor blade.

CAUTION: SUPPORT THE TIP OF THE ROTOR BLADE TO PREVENT BINDING THE ATTACHMENT PIN OR DISTORTING THE ROOT FORK DURING BLADE REMOVAL OPERATIONS.

d. Withdraw blade from blade root fork and place blade on a suitable padded support.

CAUTION: MAKE SURE THAT BLADE ASSEMBLIES ARE ALWAYS LAID FLAT ON A BENCH, OR ARE OTHERWISE SUPPORTED EVENLY ALONG THEIR LENGTH TO PREVENT THEM FROM BOWING, DROOPING OR BENDING. EXERCISE EXTREME CARE TO PREVENT GOUGING OR SCRATCHING BLADES DURING HANDLING OR STORAGE.

53-1-11. INSTALLATION OF MAIN ROTOR BLADES. (See figure 50-1-2.)

a. Static balance main rotor head assembly and control rotor blades before installing main rotor blades (refer to Section 51).

b. Install each main rotor blade in the same root fork from which it was previously removed.

c. Apply a thin coat of Lubriplate in the attachment pin hole in main rotor blade retention plates and root fork.

d. Carefully install attachment pin through root fork and the hole in the rotor blade retention plates. Place a washer or balance weight, as required, over attachment pin threads and install nut far enough to support fork and prevent distortion of root fork during installation. (Refer to Section 51 for balance weight positioning.)

CAUTION: THE PIN SHOULD BE A FIRM PUSH FIT. DO NOT FORCE THE PIN WITH A HAMMER OR MALLET.

e. Secure drag strut to terminal end of outboard tension-torsion plate pin and to rotor blade trailing edge with close tolerance bolts. To prevent drag strut preloading the drag strut must mate freely with blade attach fitting.

CAUTION: BE VERY CAREFUL NOT TO DAMAGE THE BLADE ROOT BOLT HOLES.

f. Tighten attachment pin nut to 480-600 pound-inch torque value.

g. If drag strut length has been changed, or a replacement part is being installed, adjust drag strut length as required to align the main rotor blades correctly (refer to Section 50).

53-1-20. REMOVAL OF ANTINODE AND TIP WEIGHT ASSEMBLIES. Instructions for the removal of the antinode and tip weight assemblies are beyond the intended scope of this manual and are therefore included in the Structural Repair Manual.

53-1-30. ALIGNMENT OF MAIN ROTOR BLADES. (Refer to Section 50.)

53-1-40. MINOR REPAIR AND PARTS REPLACEMENT OF MAIN ROTOR BLADES. (See figures 53-1-2 and

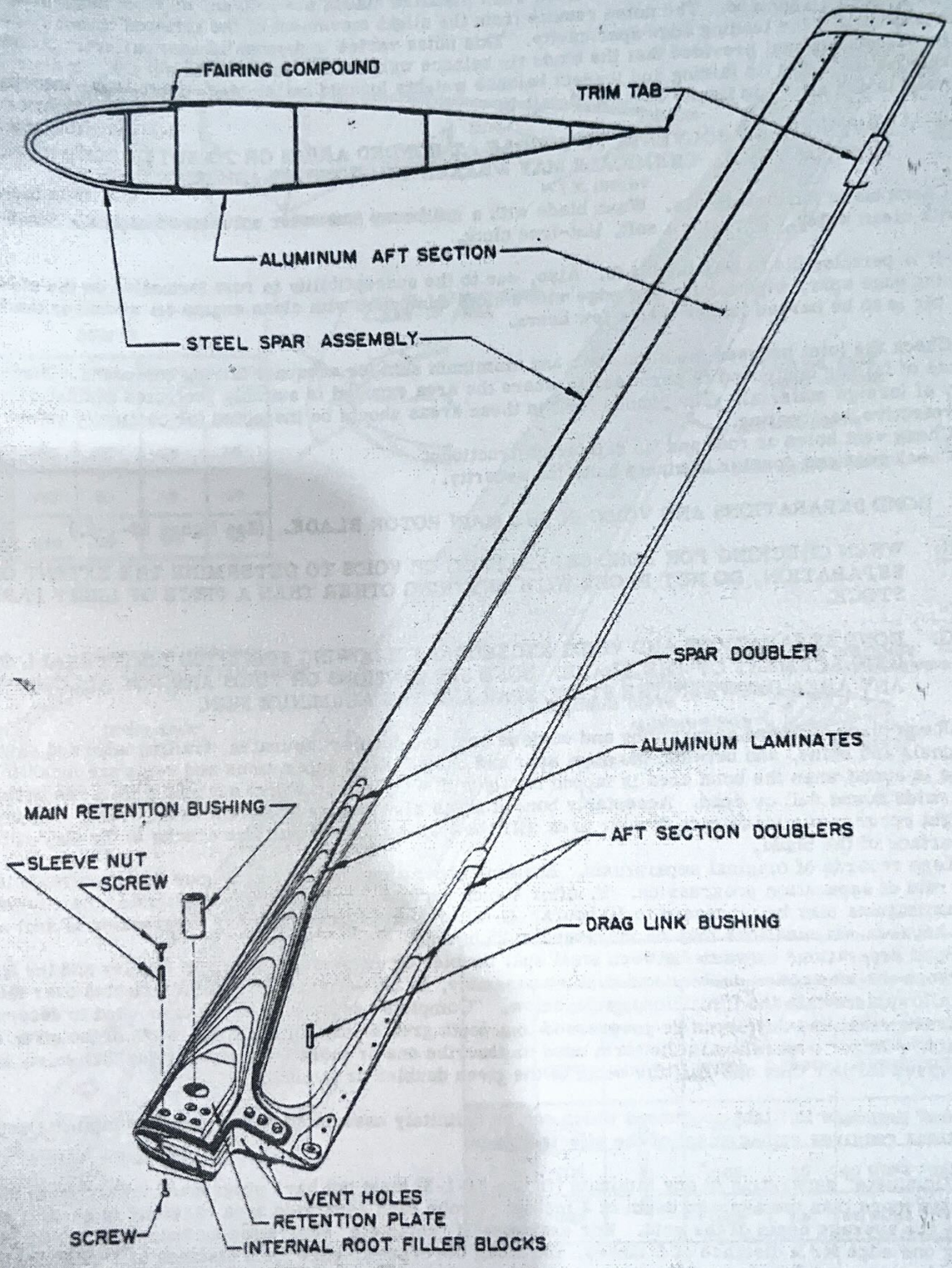


Figure 53-1-1. Main Rotor Blade Assembly

53-1-3). Check main rotor blade condition at regular intervals as outlined below:

NOTE: A rattle-type noise may often be detected when installed blades are shaken, or when unmounted blades are rotated or handled. The noise results from the slight movement of the antinode balance assembly located inside the leading edge spar cavity. This noise varies in degree between different blades, but is considered normal provided that the blade tip balance weights are known to be secure. If doubt exists, remove the blade tip fairing and inspect balance weights located inside blade tip for security. Balance weights are shown in figure 50-1-4, Detail C.

CAUTION: NEVER ALLOW SOLVENTS TO PUDDLE AT BONDED AREAS OR TO ENTER BOND SEPARATIONS OR VOIDS. CHEMICALS MAY WEAKEN THE BONDING ADHESIVE.

a. Check blade for cleanliness. Wash blade with a mild soap and water solution or naptha. Rinse thoroughly with clean water. Dry with a soft, lint-free cloth.

NOTE: It is permissible to wax the blade. Also, due to the susceptibility to rust formation on the steel leading edge spar, wipe the leading edge with a cloth dampened with clean engine oil whenever the helicopter is to be parked longer than a few hours.

b. Check the joint between the steel spar and aluminum skin for adequate fairing compound. Discontinuity or absence of fairing compound is permissible where the area exposed is suitably protected against corrosion and entry of foreign material. The bonded joint in these areas should be inspected for continuity before application of protective wax coating.

c. Check vent holes at root and tip cap for obstructions.

d. Check root end doubler laminate bolts for security.

53-1-41. BOND SEPARATIONS AND VOIDS IN THE MAIN ROTOR BLADE. (See figure 53-1-3.)

CAUTION: WHEN CHECKING FOR BOND SEPARATIONS OR VOIDS TO DETERMINE THE EXTENT OF SEPARATION, DO NOT PROBE WITH ANYTHING OTHER THAN A PIECE OF LIGHT PAPER STOCK.

WARNING: BOND SEPARATIONS AND VOIDS EXCEEDING FOLLOWING SPECIFIED LIMITS SHALL REQUIRE REPLACEMENT OF THE BLADE. BOND SEPARATIONS OR VOIDS ARE NOT ALLOWABLE IN ANY AREA BETWEEN THE STEEL SPAR AND THE ALUMINUM SKIN.

a. Check blade for bond separations and voids at root end doubler laminates, trailing edge and skin, spanwise channels and skins, and between the steel spar and skins. Bond separations and voids are detectible by the difference in sound when the bond area is tapped lightly with a light blunt object such as a coin. Separated areas and bond voids sound dull or dead. Acceptably bonded areas reverberate or have a lively sound. Delaminations which might occur in the blade root doubler area will show up initially as hairline cracks in the bond fillet and painted surface of the blade.

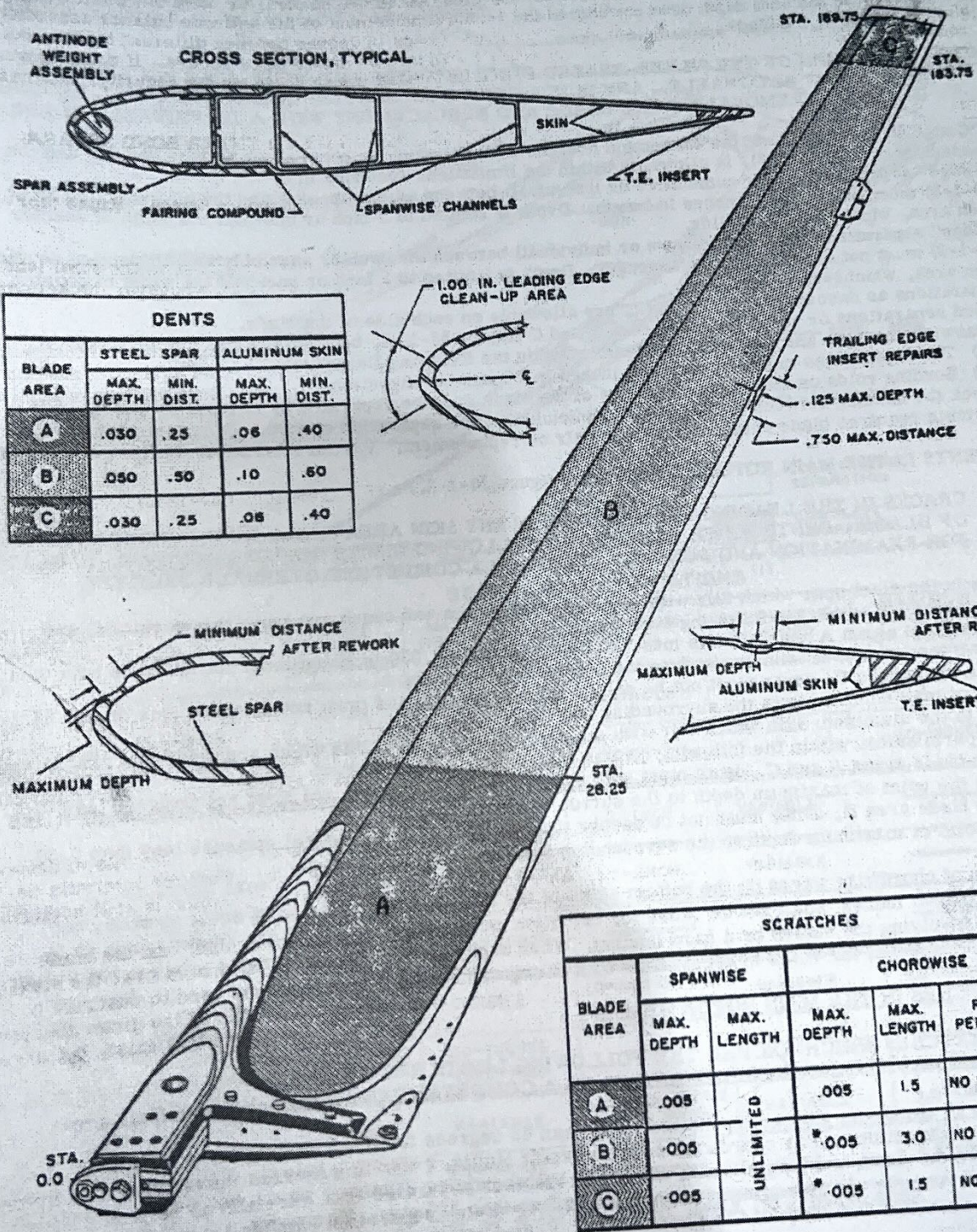
b. Keep records of original separations. Examine separations initially at 5-hour flight intervals to determine the rate of separation progression. If, after 4 such periods, progression is negligible, the intervals between examinations may be increased to 10 hours. If, after four 10-hour periods, progression is still negligible, intervals between examinations may be increased to 25 hours.

c. Bond separations or voids between steel spar doubler or aft section aluminum doubler and the blade skin, between the aft section doubler and doubler assembly, or between the aluminum laminates over the steel spar are allowable within the limitations given below. "Complete" separation is the term used to describe a bond separation that has developed or progressed to a depth greater than one-half the width of the given doubler or laminate. "Edge" separation is the term used to describe one or more bond separations that exist, but have not progressed further than one-half the width of the given doubler or laminate.

NOTE: Any increase in flight roughness which can be definitely associated with doubler or laminate separations requires replacement of the affected blade.

d. "Complete" separation of any laminate (figure 53-1-3) must not have progressed inward from the tip of the laminate more than the average depth of 2 inches. Probe each separated area carefully in several places to determine the average depth of the void. For example: If "complete" separation extends from the tip of a laminate along one edge for a distance of 3 inches, and along the opposite edge for a distance of 1 inch, the average depth would not exceed 2 inches. Separations as described above must not exist under more than three laminates. The three laminates may be adjoining or individual and may exist on each side of the blade.

e. "Edge" separation (either cumulative or individual) of aluminum laminates must not total more than 3-3/4 square inches in area. Probe each separated area carefully in several places to determine the average depth. For example: If the total length of one or several "edge" separations is equal to 7-1/2 inches, then the average depth shall not exceed 1/2 inch. Separations as described above must not exist under more than three laminates (either joining or individual) on each side of the blade.



DENTS				
BLADE AREA	STEEL SPAR		ALUMINUM SKIN	
	MAX. DEPTH	MIN. DIST.	MAX. DEPTH	MIN. DIST.
A	.030	.25	.06	.40
B	.050	.50	.10	.60
C	.030	.25	.06	.40

SCRATCHES					
BLADE AREA	SPANWISE		CHOROWISE		
	MAX. DEPTH	MAX. LENGTH	MAX. DEPTH	MAX. LENGTH	REPAIRS PERMISSIBLE
A	.005	UNLIMITED	.005	1.5	NO MORE THAN 20
B	.005		*.005	3.0	NO MORE THAN 20
C	.005		*.005	1.5	NO MORE THAN 5

ALL MEASUREMENTS SHOWN ARE IN INCHES.

Figure 53-1-2. Reparable Areas of Main Rotor Blades

Changed May 1965

f. "Complete" separation between the aluminum skin and the steel spar doubler (figure 53-1-3) must not exceed 4 inches in length. ("Complete" separation in this area is a void which has progressed to the leading edge spar). Any separation (cumulative or individual) which exceeds the 4-inch length specified above, is limited to a 1-inch depth; however, separation in this area may progress along the entire length of the doubler-to-skin bond line provided the void depth does not exceed the 1-inch limitation. Separations as described above are allowable on each side of the blade.

WARNING: SEPARATION OF THE SILVER-BRAZED JOINT BETWEEN THE STEEL SPAR DOUBLER AND SPAR IS NOT ALLOWABLE. ANY INDICATION OF SEPARATION IN THIS AREA WILL REQUIRE IMMEDIATE REMOVAL OF THE BLADE AND REPLACEMENT WITH A SERVICEABLE BLADE.

g. "Complete" separation of the aft section doubler from the skin, or between aft section doubler and the doubler assembly (figure 53-1-3), is allowable within the limitations specified in d.

h. "Edge" separation (either cumulative or individual) between aluminum skin and the aft section doubler (figure 53-1-3) must not exceed 7 inches in length. Depth is limited to 1 inch or one-half the width of doubler in the given area, whichever is smaller.

i. "Edge" separation (either cumulative or individual) between the doubler assembly and aft section doubler (figure 53-1-3) must not exceed 5 inches in length. Depth is limited to 1 inch or one-half the width of doubler in the given area, whichever is smaller.

j. Separations as described in g, h, and i, are allowable on each side of the blade.

k. Bond separations or voids in blade areas B and C (figure 53-1-2), between the trailing edge skin or between spanwise channels and skin are permissible within the following limitations:

(1) The separations must not exceed 2 inches in a spanwise direction.

(2) Bonding voids on either top or bottom of the blade must be separated by at least 20 inches.

l. Check the bonding between trim tab and aluminum skin for separation cracks. Complete bond separation to the rivets requires blade removal for tab repair or replacement. Partial bond separation is permissible.

53-1-42. DENTS IN THE MAIN ROTOR BLADE. (See figure 53-1-2.)

WARNING: CRACKS IN THE LEADING EDGE SPAR OR IN ANY SKIN AREA SHALL REQUIRE REPLACEMENT OF BLADE. DENTS WHICH EXCEED THE FOLLOWING LIMITS REQUIRE REMOVAL OF BLADE FOR EXAMINATION AND POSSIBLE REPAIR BY A COMPETENT OVERHAUL FACILITY.

a. Dents in the steel spar which fair with the surrounding area and which are free from scratches and cracks are permissible within the following limitations:

(1) In blade areas A and C, dents must not be deeper than 0.030 inch and must not measure less than 0.125 inch from the point of maximum depth to the surrounding surface.

(2) In blade area B, dents must not be deeper than 0.050 inch and must not measure less than 0.25 inch from the point of maximum depth to the surrounding surface.

b. Dents in the aluminum skin which fair with the surrounding surface and which are free from cracks and scratches are permissible within the following limitations:

(1) In blade areas A and C, dents must not be deeper than 0.060 inch and must not measure less than 0.20 inch from the point of maximum depth to the surrounding surface.

(2) In blade area B, dents must not be deeper than 0.100 inch and must not measure less than 0.30 inch from the point of maximum depth to the surrounding surface.

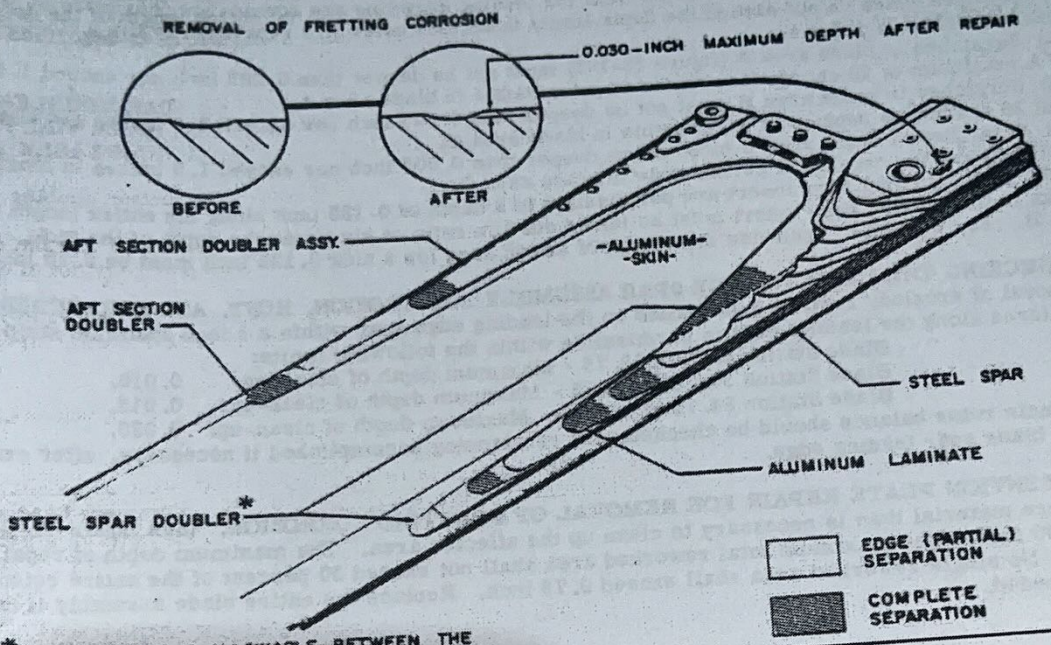
NOTE: A series of chordwise waves on the bottom skins of the blades, with depths from crest to valley not exceeding .040 inches, shall not be cause for rejection unless such waves are the known result of an accident involving the blades or a hard landing. When such waves occur, all bonded joints in the vicinity should be inspected for voids in accordance with paragraph 53-1-41.

53-1-43. SCRATCHES IN THE MAIN ROTOR BLADE.

WARNING: SCRATCHES WHICH EXCEED THE FOLLOWING LIMITS REQUIRE REMOVAL OF BLADE FOR EXAMINATION AND POSSIBLE REPAIR BY A COMPETENT OVERHAUL FACILITY.

a. Scratches in aluminum skin areas inclined less than 45 degrees from the leading edge line are considered spanwise in direction. (For chordwise scratch repair limits, refer to b below). Spanwise scratches which do not exceed the depth and length limits described below require repair by abrasive blending and polishing. Use silicon carbide or aluminum oxide paper not coarser than 320 grit. The width of the blended area should be at least six times the width of the scratch.

NOTE: No additional depth is allowed for scratches which occur in a previously repaired area. The second scratch is reparable only if removal can be accomplished without exceeding the depth limits specified below. Scratch depth must be measured from the original, unrepaired surrounding surfaces. No scratches may be permitted to remain without repair.



*NO SEPARATION IS ALLOWABLE BETWEEN THE STEEL SPAR DOUBLER AND THE STEEL SPAR.

SEPARATION LIMITATIONS (1)

AREA	TYPE OF SEPARATION	MAXIMUM INDIVIDUAL LENGTH	MAXIMUM DEPTH	ALLOWABLE NUMBER	MAXIMUM TOTAL AREA OR LENGTH
BETWEEN ALUMINUM LAMINATES	EDGE	VARIABLE	VARIABLE	VARIABLE (2)	3.75 SQ IN.
	COMPLETE	2.0-INCHES (AVERAGE)	—	3	6.0-INCHES
BETWEEN ALUMINUM SKIN AND STEEL SPAR DOUBLER	EDGE	VARIABLE (NO LIMIT)	1.0-INCH	VARIABLE	—
	ANY IN EXCESS OF 4.0-INCHES	VARIABLE (NO LIMIT)	1.0-INCH	VARIABLE	—
	COMPLETE	4.0-INCHES	—	1	—
BETWEEN ALUMINUM SKIN AND AFT DOUBLER	EDGE	VARIABLE	1.0-INCH OR 1/2 DOUBLER WIDTH (3)	VARIABLE	7.0-INCHES
	COMPLETE	2.0-INCHES (AVERAGE)	—	1	2.0-INCHES
BETWEEN AFT SECTION DOUBLERS	EDGE	VARIABLE	1.0-INCH OR 1/2 DOUBLER WIDTH (3)	VARIABLE	5.0-INCHES
	COMPLETE	2.0-INCHES (AVERAGE)	—	1	2.0-INCHES

(1) LIMITS SHOWN ARE FOR ONE SIDE OF BLADE ONLY BUT APPLY TO EITHER SIDE.
(2) SEPARATED LAMINATES SHALL NOT EXCEED THREE.
(3) SMALLER DIMENSION ESTABLISHES MAXIMUM DEPTH LIMIT.

Figure 53-1-3. Allowable Laminate Separations on Main Rotor Blades

(1) Scratches must not be deeper than 0.005 inch.
(2) The length of scratches in a spanwise direction is not critical. Maximum allowable length is unlimited provided depth limitations are not exceeded.

b. Scratches inclined 45 degrees or more from the leading edge line are considered chordwise in direction. Chordwise scratches which do not exceed the depth limits described below are reparable by the method outlined for spanwise scratches in d above.

(1) Scratches in blade area A (figure 53-1-2) must not be deeper than 0.005 inch nor exceed 1.5 inches in length. A maximum of 20 chordwise repairs is permissible in blade area A.
(2) Scratches in blade area B must not be deeper than 0.005 inch nor exceed 3.0 inches in length. A maximum of 20 chordwise repairs is permissible in blade area B.
(3) Scratches in blade area C must not be deeper than 0.005 inch nor exceed 1.5 inches in length. A maximum of 5 chordwise repairs is permissible in blade area C.

c. Nicks in the trailing edge insert are permissible to a depth of 0.125 inch along the entire length of blade. Nicks in the trailing edge insert must be faired out at a ratio of six times the depth of the nick. (See figure 53-1-2). For example: Spanwise dimension of faired area for a nick 0.125 inch must be 0.75 inch.

53-1-44. CHECKING THE LEADING EDGE SPAR ASSEMBLY FOR EROSION, RUST, AND SCRATCHES.

a. Removal of erosion, rust, and scratches on the leading edge spar within a 1 inch spanwise strip (figure 53-1-2), centered along the leading edge is permissible within the following limits:

Blade Station 0.00 to 32.75 - Maximum depth of clean-up: 0.010.
Blade Station 32.75 to 84.75 - Maximum depth of clean-up: 0.015.
Blade Station 84.75 to 189.75 - Maximum depth of clean-up: 0.020.

b. The main rotor balance should be checked, and rebalancing accomplished if necessary, after extensive rework of the blade spar leading edge.

53-1-45. RETENTION PLATE REPAIR FOR REMOVAL OF FRETTING CORROSION. (See figure 53-1-3.) Remove no more material than is necessary to clean up the affected area. The maximum depth of repair is limited to 0.030 inch. The maximum total reworked area shall not exceed 30 percent of the entire retention plate surface. No single reworked area shall exceed 0.75 inch. Replace the entire blade assembly if these limits are exceeded.

51-1-30. STATIC BALANCE OF THE MAIN ROTOR HEAD ASSEMBLY. (See figure 51-1-4.) A static balance check of the head and control rotor assembly shall be performed whenever main rotor blades are replaced. Replacement of control rotor assemblies or components will not require the complete prebalancing of the head assembly as described in this paragraph, provided that a static balance check of the complete main rotor assembly is accomplished and complete assembly balance is maintained within tolerance.

NOTE: The following balance procedures are based upon use of the special tools listed in table 92-1-I; however, the balancing operations may also be accomplished by use of the Marvel Manufacturing Company Suspension-Type Propeller and Small Parts Balancing Kits, Part Numbers 7A050 and 7HEL054. Marvel balancing equipment must be used according to instructions provided with the Kits and in conjunction with the balance tolerances specified in this handbook.

a. Prepare assembly for balancing by removing main rotor blades from root forks (Section 53).

b. Reinstall blade attachment pins and nuts, washer(s) or balance weight, if previously installed in the root forks.

c. Place main rotor balancing mast support (item 15, table 92-1-I) on balance stand assembly (item 12, table 92-1-I).

d. Install main rotor balancing ring assembly, (item 14, table 92-1-I) on hub and lower it onto the balance stand. Make sure that the pivot fits into the hub spline fitting. When the full weight of the assembly is supported by balance stand, screw down the ring inner cap until it is finger-tight against spline fitting.

NOTE: Take care to prevent damaging the balance point cone and pivot. Any nicks or scratches must be polished out to prevent balance errors.

e. Set control rotor blades and hub forks to an approximate horizontal position.

f. Position the drag strut assemblies approximately 45 degrees from the hub fork. Adjust the length of each drag strut assembly to establish a 10.500-inch radius dimension between the centerlines of the main rotor blade attachment pin and the outboard drag strut terminal bolt hole. Drag strut assembly lengths between terminal bolt centers shall be equal within 0.010-inch after adjustment.

NOTE: The main rotor head assembly shall be lubricated and finish-painted prior to balancing operations. The drag strut, drag strut bolt heads and the head of the blade attachment pins shall be color coded to mate with hub color code band.

g. Place main rotor balancing level assembly (item 23, table 92-1-I) on main rotor balancing ring assembly (item 14, table 92-1-I) and check the chordwise and spanwise balance of control rotors and hub.

h. To establish chordwise balance within the weight of five AN960-416 tolerance washers, add or remove balance washers at control rotor blade tips. (See Detail A, figure 51-1-4.)

NOTE: Do not exceed the specified maximum of six ounces, including weight of attach screw, at rotor blade tips.

i. Adjust spanwise balance by removing the standard washer from the attachment pin at the light fork and replacing it with one main rotor balance weight.

j. Select the closest (heavier) balance weight from the seven available weight sizes.

k. To establish a spanwise balance within the weight of one AN960-416 tolerance check washer placed at the main rotor attachment pin head center, use a 3/16 or 1/4-inch drill to remove material near the V-notched edge of the weight face. Maintain a minimum edge distance of 0.09-inch and drill out a sufficient number of holes to obtain proper balance.

l. Identify the balance weight by steel-stamping the mating color code (yellow or blue) on the part number side of the weight.

NOTE: The balance weight need not be painted.

m. Install the weight with the part number and color code facing down and with the V-notched edge located outboard.

TAIL ROTOR ASSEMBLY

55-1-1. TAIL ROTOR ASSEMBLY. (See figures 55-1-1 and -2.)

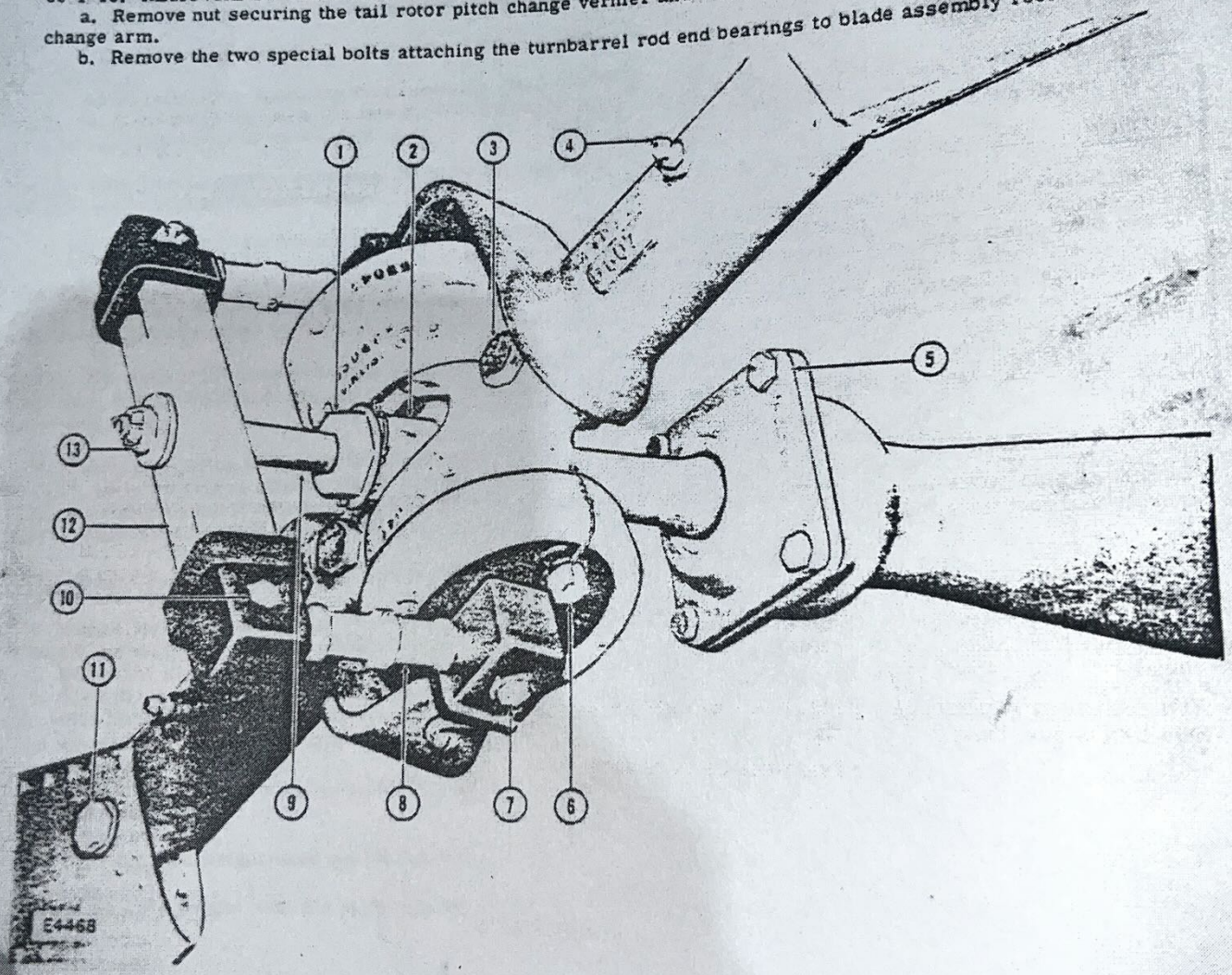
55-1-2. DESCRIPTION. The tail rotor assembly furnishes a lateral thrust which counteracts the torque set up in the helicopter by the main rotor. It is all-metal construction with a variable pitch mechanism actuated by the rudder pedals. The tail rotor blades are symmetrical airfoil shapes hinged on an axis parallel to the plane of rotation. The blades are of all-metal stressed-skin construction. Operation of the tail rotor assembly controls the heading of the helicopter in flight.

55-1-3. TROUBLESHOOTING THE TAIL ROTOR ASSEMBLY. Refer to Table 55-1-I.

55-1-10. REMOVAL OF TAIL ROTOR ASSEMBLY. (See figure 55-1-3.)

a. Remove nut securing the tail rotor pitch change vernier and lock pin located outboard of tail rotor pitch change arm.

b. Remove the two special bolts attaching the turnbarrel rod end bearings to blade assembly root fittings.



1. Drive Shaft Cap
2. Outboard Stop
3. Tension-Torsion Bar Bolt
4. Lubrication Fitting
5. Tail Rotor Gear Box Output End Cover
6. Yoke Cover Plug
7. Inboard Rod End Bolt (Special)
8. Control Turnbarrel
9. Pitch Change Rod Assembly
10. Outboard Rod End Bolt
11. Blade Attachment Tension-Torsion Bar Bolt
12. Pitch Change Arm
13. Pitch Change Arm Nut

Figure 55-1-1. Tail Rotor Installation, Outboard View

CAUTION: BE CAREFUL NOT TO LOSE THE FLANGED BUSHING INSTALLED IN THE BLADE FITTING FORK.

c. Separate rod end bearings and boots from blade root fittings and remove pitch change arm.
d. Remove tail rotor drive shaft cap and lock washer. Use the tail rotor outboard stop socket wrench (item 36, table 92-1-I) to remove the outboard stop.
e. Remove tail rotor assembly from tail rotor gear box drive shaft.
f. Remove inboard tail rotor stop.

55-1-11. INSTALLATION OF TAIL ROTOR ASSEMBLY. (See figure 55-1-3.)
a. Install inboard tail rotor stop on tail rotor gear box drive shaft.
b. Position tail rotor assembly on tail rotor gear box drive shaft splines.
c. Install outboard tail rotor stop. Tighten to 300 pound-inch torque value.
d. Seat the rotor assembly firmly on the shaft spline by tapping against the hub assembly with an aluminum drift and medium weight hammer.
e. Loosen outboard stop and retighten to 250 pound-inch torque value.
f. Place lock washer against the stop and secure with tail rotor drive shaft cap. Tighten cap to 15/25 pound-inch torque value.

NOTE: Secure both outboard tail rotor stop and tail rotor drive shaft cap to the lock washer with lockwire.

g. Install pitch change arm on pitch change shaft. Connect rod end bearings with special attach bolts.

CAUTION: CHECK FOR PROPER INSTALLATION OF FLANGED BUSHING IN BLADE FITTING FORK.

h. Rotate pitch change arm on shaft until arm is in alinement with blade arm fittings.
i. Install vernier lock. Install lock pin through hole of lock and into the mating hole of pitch change arm. Tighten pitch change arm retaining nut to 80/100 pound-inch torque value and safety with cotter pin.
j. Check that tail rotor yoke filler plugs and inboard rod end bearing bolts are identified with SPL stamped on their heads. Substitution is not permissible.
k. Adjust the pitch change angle setting of tail rotor blades (refer to Section 32) and track the tail rotor (refer to Section 30.)

NOTE: After approximately five hours of flight, recheck torque of outboard tail rotor stop.

Table 55-1-I. Troubleshooting the Tail Rotor

TROUBLE	PROBABLE CAUSE	REMEDY
Binding of blade yoke assembly and root fitting	Improper clearance between yoke and root fitting	Disconnect pitch change turnbarrel assemblies. Twist blade within normal pitch range only. Replace the tail rotor blade assembly.
High frequency vibration (frequency too fast to count)	Binding or frozen pitch change links at tail rotor	Replace rod end bearings. Rebalance tail rotor assembly.
High frequency vibration (108 cycles per minute)	Tail rotor damaged or out of track and/or rig	Inspect for damage, retrack rotor.
	Tail rotor out of balance	Remove excess grease from tail rotor blade and fitting. Replace faulty or incorrectly installed O-ring packing or oil seal.
		Replace blade, hub assembly, or complete tail rotor assembly. Rebalance complete tail rotor assembly.
	Loose tail rotor outboard stop nut	Tighten nut to specified torque value.
	Worn tail rotor retaining root bushings	Replace tail rotor blade if bushing diameter exceeds yoke diameter by 0.005-inch or more.
Unwanted change of pitch	Turnbarrel creep or loose check nuts	Tighten check nuts.

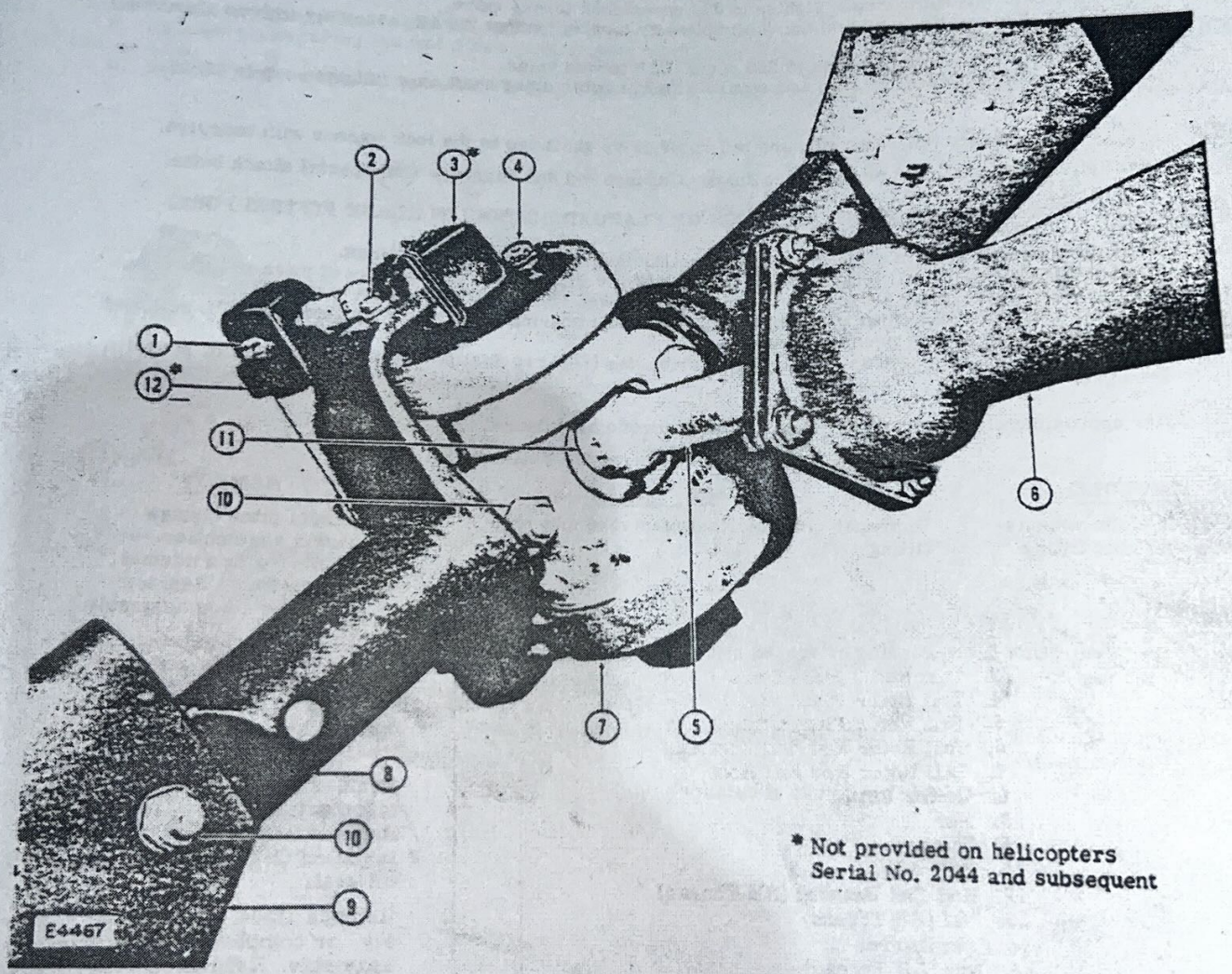
55-1-12. REMOVAL OF TAIL ROTOR BLADE ASSEMBLY.

a. Remove the special bolt retaining the turnbarrel rod end bearing and rubber boot.

NOTE: Rod end rubber boots (index 3 and 12, figure 55-1-2) are not provided on helicopters Serial No. 2044 and subsequent.

b. Remove the outboard bolt, washer and nut securing the tail rotor blade to the tension-torsion bar.
c. Withdraw tail rotor blade from tail rotor hub and yoke assembly.
d. If required, remove the grease seal from the groove at the end of the blade fitting bore (adjacent to the hub), and the O-ring packing from blade fitting bushing.

NOTE: The blade root grease seal and O-ring packing are not included with replacement blade assemblies.



* Not provided on helicopters Serial No. 2044 and subsequent

1. Rod End Nut
2. Tail Rotor Blade Balancing Screw
3. Inboard Rod End Boot
4. Yoke Cover Plug
5. Tail Rotor Gear Box Output Shaft
6. Tail Rotor Gear Box Main Housing
7. Tail Rotor Yoke
8. Blade Fitting Assembly
9. Tail Rotor Blade Assembly
10. Blade Attachment Nut
11. Inboard Stop
12. Outboard Rod End Boot

Figure 55-1-2. Tail Rotor Installation, Inboard View

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55-1-13. INSTALLATION OF TAIL ROTOR BLADE ASSEMBLY. (See figures 55-1-1 through 55-1-3.) Reassemble major components, and install tail rotor blade assembly as follows.

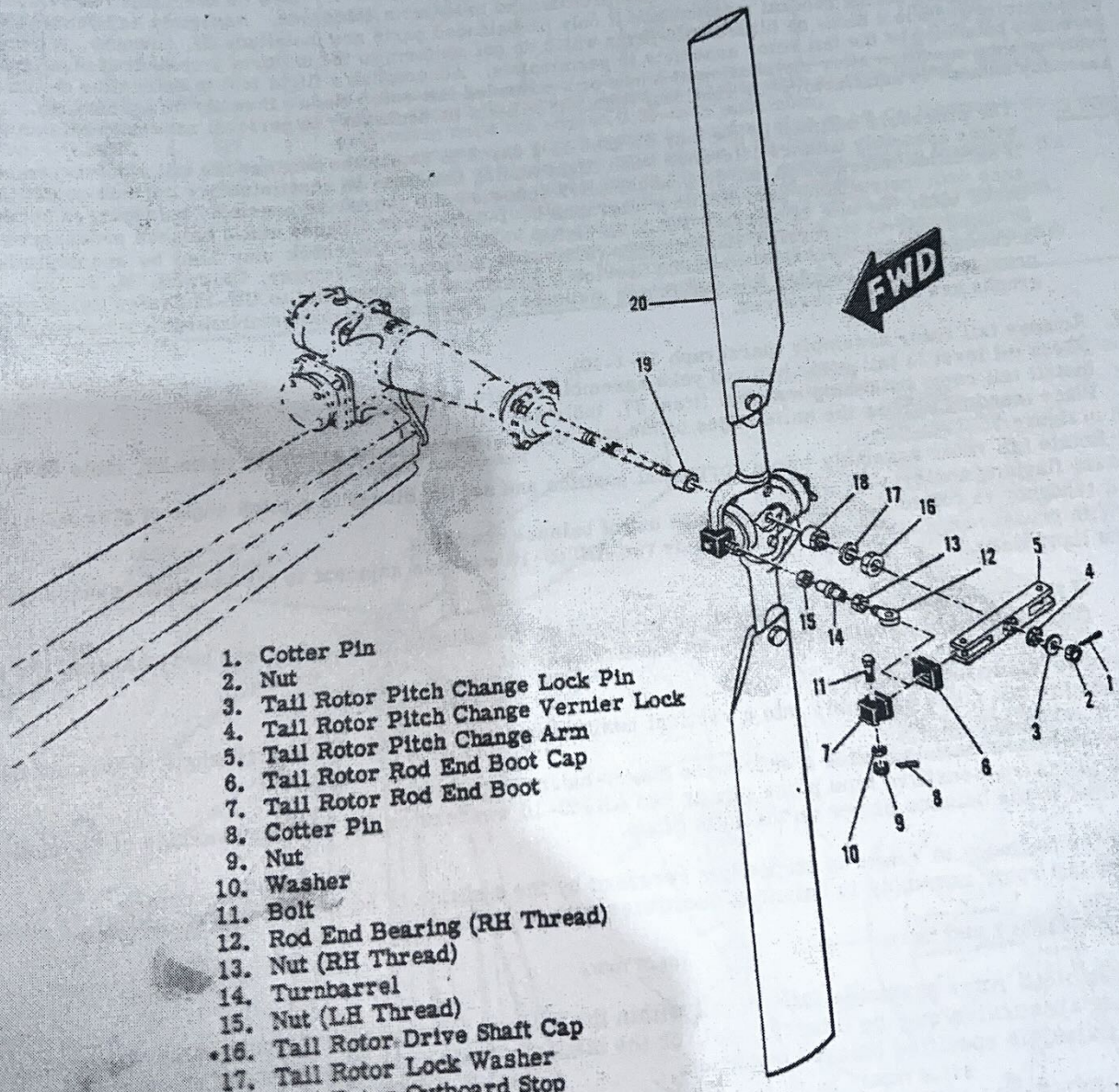
a. Apply a light coating of lubricant to the blade fitting O-ring packing and install it in the groove at the end of the fitting bore bushing (adjacent to the blade end).

b. Install the oil seal in the recess in the fitting bore (adjacent to the hub), placing the seal so that its lip will face toward the hub in the installed position.

c. Insert the tension-torsion bar assembly into the blade fitting bore. Place a washer under the bolthead and install the bolt so that the head is located on the same side of the blade as the lubrication fitting. Secure with the second washer and nut, and tighten to 50/70 pound-inches.

d. Apply a light coating of grease to the yoke shank and slide blade assembly onto the yoke.

CAUTION: TAKE CARE NOT TO DISLODGE THE GREASE SEAL AND O-RING INSIDE BLADE FITTING BORE WHEN INSTALLING BLADE ASSEMBLY ON YOKE.



1. Cotter Pin
2. Nut
3. Tail Rotor Pitch Change Lock Pin
4. Tail Rotor Pitch Change Vernier Lock
5. Tail Rotor Pitch Change Arm
6. Tail Rotor Rod End Boot Cap
7. Tail Rotor Rod End Boot
8. Cotter Pin
9. Nut
10. Washer
11. Bolt
12. Rod End Bearing (RH Thread)
13. Nut (RH Thread)
14. Turnbarrel
15. Nut (LH Thread)
16. Tail Rotor Drive Shaft Cap
17. Tail Rotor Lock Washer
18. Tail Rotor Outboard Stop
19. Tail Rotor Inboard Stop
20. Tail Rotor Assembly

Figure 55-1-3. Tail Rotor Assembly and Pitch Change Mechanism

e. Install the tension-torsion bar retention bolt, nut and washer, with the bolthead located on the same side of blade assembly as the lubrication fitting. Tighten to 50/70 pound-inches.
f. Check that the splined nut and bushings are installed in the blade fitting fork.

NOTE: If splined nut is loose or damaged, replace as outlined in paragraph 55-1-41.

g. Slide rod end bearing into place and secure with the special bolt and washers as required to maintain bolt end flush with blade fitting nut. Safety bolt to balance screw with 0.032-inch diameter wire (table 10-VI, Item 6): or, if screw is not installed, safety bolt to the lockwire hole adjacent to screw hole.
h. Install boot, if applicable, and safety with double wrap of 0.032-inch diameter wire. Check that rod end bearing shank is positioned so that it faces toward lubrication fitting in blade assembly.
i. Assemble opposite blade assembly in accordance with procedure outlined above.
j. Lubricate the tail rotor assembly. (See figure 10-19.)

55-1-30. TAIL ROTOR ASSEMBLY BALANCE CHECK. (See figure 55-1-4.) New or overhauled individual tail rotor blades and the hub and yoke assembly are prebalanced to uniform standards. Assembly balancing is normally not required during general maintenance if only prebalanced parts are installed. If, however, it becomes necessary to replace a blade or blades with parts which do not conform to the uniform prebalanced standard, assembly balancing of the tail rotor assembly is permissible. Accomplish a flight test to determine the tail rotor balance condition after installation of a new or overhauled tail rotor blade assembly or assemblies. If the assembly balance is satisfactory for continual flight, it will not be necessary to perform assembly balancing.

NOTE: The procedure outlined below may be used as a check to determine whether the tail rotor assembly is within assembly balance tolerance when flight testing indicates an unsatisfactory balance condition. If specified tolerance is not met, accomplish spanwise and chordwise assembly balancing in accordance with instructions provided in paragraphs 55-1-31 and -32. These static balance procedures are based upon the use of Special Tools as listed. However, the check may also be accomplished by using Marvel Aircraft Balancing Kits (Marvel Manufacturing Company, Caldwell, N. J.) in accordance with their Operation and Service Instructions as applicable to UH-12 Series Helicopters, provided that the balance tolerances and methods of weight application established in subsequent paragraphs are strictly observed.

a. Remove tail rotor assembly (paragraph 55-1-10).
b. Check oil level in tail rotor hub and yoke assembly (figure 10-19).
c. Install tail rotor balancing mandrel (item 37, table 92-1-I).
d. Place mandrel across the knife edges of the tail rotor balancing stand assembly (item 39, table 92-1-I) as shown in figure 55-1-4.
e. Rotate tail rotor assembly into a horizontal position and set the blades to a pitch angle of plus six degrees and a zero flapping angle.
f. A tendency to rotate indicates a spanwise out of balance condition.
g. With pressure sensitive tape place one or two AN960-10 washers adjacent to the bolt and washers on the tip of the light blade.

NOTE: If the tendency to rotate is stopped or reversed by the addition of no more than two washers, the tail rotor assembly is balanced spanwise within tolerance.

h. Remove the washers and tape.
i. Rotate the tail rotor assembly into a vertical position and set the blades to a pitch angle of plus six degrees and a zero flapping angle.
j. A tendency to rotate indicates a chordwise out-of-balance condition.
k. With pressure-sensitive tape place one or two AN960-10 washers on the outboard surface of the blade root fitting adjacent to the balance screw on the light blade.

NOTE: If the tendency to rotate is stopped or reversed by the addition of no more than two AN960-10 washers the tail rotor assembly is balanced chordwise within tolerance.

l. Remove washers and tape.

NOTE: When a tail rotor assembly fails to fall within the balance tolerance, individual complete hub and/or blade assemblies may be interchanged, or the blades may be assembly balanced as necessary to establish the specified balance condition.

55-1-31. SPANWISE BALANCING OF TAIL ROTOR ASSEMBLY. (See figure 55-1-4.)

NOTE: When a "used" blade is to be balanced to a new (prebalanced) blade the "used" blade will probably be the lighter of the two. Weight adjustment should be made on the "used" blade to maintain the prebalanced (unaltered) condition of the new blade.

ASSEMBLY BALANCING - TABLE OF SIZES AND WEIGHTS

ROOT FITTING (1) AND TIP RIB SCREW (AFT) (2)			TIP RIB SCREW (FWD) (3)			WASHER		ALLOWABLE BALANCE WEIGHT (MAX*)	
Length (Inches)	Size (AN503-10)	Weight (Grams*)	Length (Inches)	Size (AN503-416)	Weight (Grams*)	Size	Weight (Grams*)	Location	Weight (Grams*)
3/8	-6	2.1	5/8	-10	5.9	AN960-10(1)(2)	0.9	Root Fitting	30.0
1/2	-8	2.4	3/4	-12	6.8	AN960-10L(1)(2)	0.5		
5/8	-10	2.8	7/8	-14	7.3	AN960-416(3)	1.1		
3/4	-12	3.2	1	-16	7.7	AN960-416L(3)	0.6	Tip Rib Fwd of ℄	30.0
7/8	-14	3.5	1-1/8(3)	-18(3)	8.2	55080-3(1)	3.5		
1(1)	-16(1)	3.8				55080-5(3)	4.3		
1- 1/8	-18	4.2				AN970-3(1)	4.3	Tip Rib Aft of ℄	15.0
1- 1/4	-20	4.5							
1- 3/8	-22	4.9							
1- 1/2	-24	5.2							
1- 5/8	-26	5.7							
1- 3/4	-28	6.0							
1- 7/8	-30	6.4							
2(2)	-32(2)	6.8							

(1) Do not exceed this screw length or washer size at root fitting. Thread protrusion must not exceed 0.31-inch maximum.
(2) Do not exceed this screw length or washer size at aft tip location - tip rib width aft of blade pitch axis equals 0.38-inch.
(3) Do not exceed this screw length or washer size at fwd tip location - tip rib width fwd of blade pitch axis equals 0.562-inch.
* All weights listed are average values rounded off to the nearest tenth. The total allowable weight must include the weight of the attaching screw. (Screw must be long enough to extend through or be flush with the root fitting or tip rib. See notes 1, 2 and 3.)

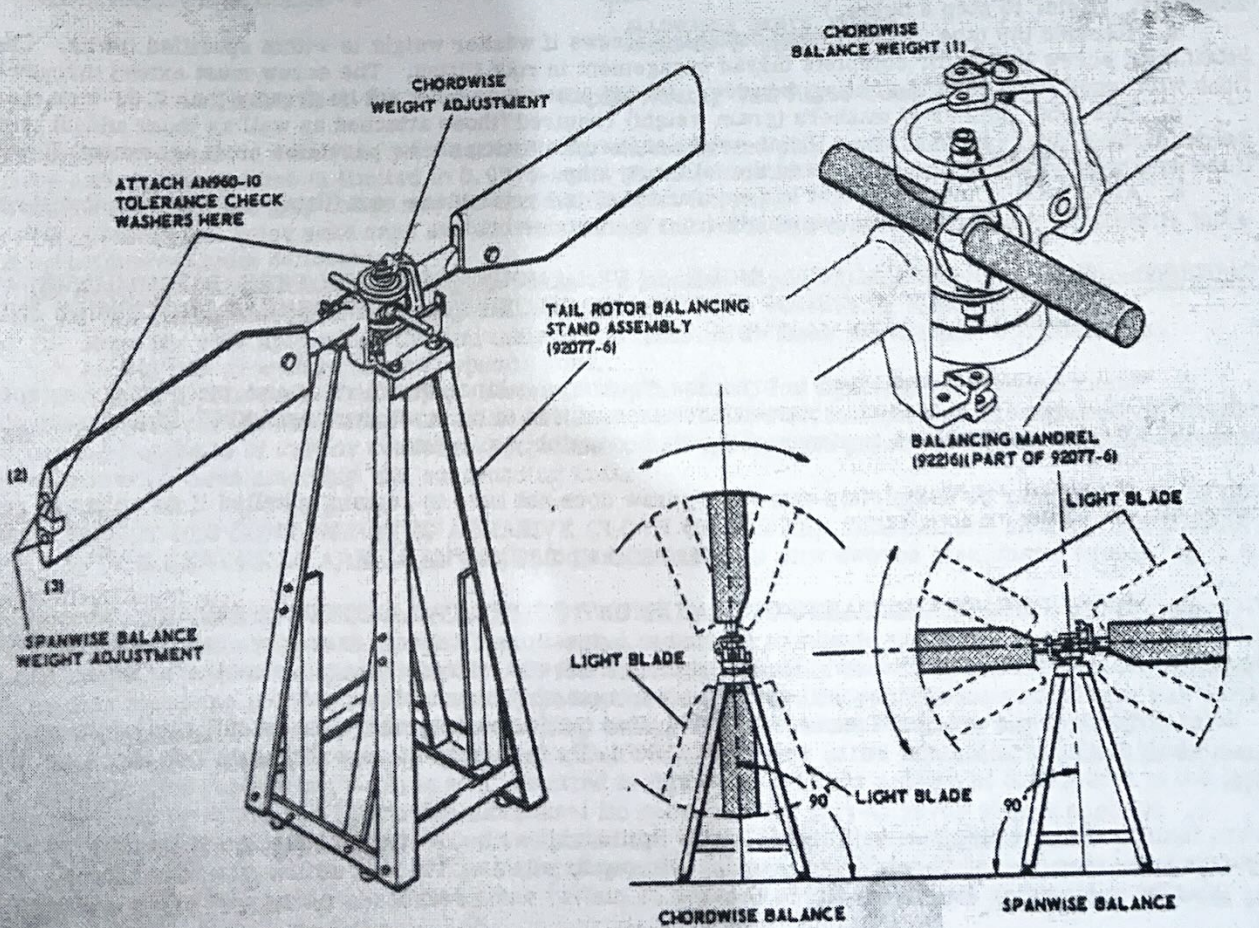


Figure 55-1-4. Balancing the Tail Rotor Assembly

a. Check spanwise balance of the assembly using instructions provided in paragraph 55-1-30, steps a through g.

b. Attach extra washers at forward tip rib screw (AN503-416) of the light blade with pressure sensitive tape as required to stop rotation of assembly. (Refer to step f, below.)

c. Remove tape, washers and attaching screw if the washer weight is within limits. Check length of the attachment screw for necessary thread engagement in the tip rib. The screw must be long enough to extend through, or be flush with inner surface of the tip rib.

d. Add the total number of washers (gram weight) required (those attached as well as those added) to the weight of the proper length screws. Total weight at the tip rib forward screw provision must not exceed 30 grams. If weight is within limits, disregard the following steps.

e. Weight in excess of the maximum limit must be transfered to aft tip rib screw. Repeat steps b, c and d to determine that total weight at the tip rib aft screw provision does not exceed 15 grams.

f. After total allowable weight has been added to the tail rotor blade tip and tendency of the assembly to rotate is not eliminated, proceed to remove weight from the heavier blade.

g. The sequence to follow in removing weight is reverse of that for adding weight; that is, the weight should be removed from tip rib aft screw provision as the first step in removing weight from the heavy blade.

NOTE: Weight washers may not be required at either location, but one screw of minimum length must be installed in either hole at blade tip.

h. The tail rotor assembly is satisfactorily balanced spanwise if addition of no more than two AN960-10 tolerance check washers will stop or reverse a tendency of the blade assembly to rotate.

i. Secure attachment screws with lockwire to the holes provided.

55-1-32. CHORDWISE BALANCING OF TAIL ROTOR ASSEMBLY. (See figure 55-1-4.)

NOTE: When a "used" blade is to be balanced to a new (prebalanced) blade the "used" blade will probably be the lighter of the two. Weight adjustment should be made on the "used" blade to maintain the pre-balanced (unaltered) condition of the new blade.

a. Check assembly chordwise balance according to paragraph 55-1-30, steps a through c, h and i.

b. Attach extra washers at the root fitting with pressure sensitive tape as required to stop rotation of assembly. (Refer to step e below.)

c. Remove the tape, washers and attaching screws if washer weight is within specified limits. Check attachment screw length for complete thread engagement in root fitting. The screw must extend through or be flush with inner surface of the fitting; however, thread protrusion must not be greater than 0.31-inch maximum.

d. Add total number of washers (gram weight) required (those attached as well as those added) to the weight of the proper length screw. Total weight at the root fitting screw provision must not exceed 30 grams. If the weight is within limits, disregard the following step.

e. After total allowable weight has been added to tail rotor blade root fitting and the tendency to rotate is not eliminated, proceed to remove weight from the heavier blade.

CAUTION: WASHER REMOVAL WILL INCREASE THE AMOUNT OF SCREW THREAD PROTRUSION AT THE INNER SIDE OF THE ROOT FITTING. MAKE CERTAIN THAT THREAD PROTRUSION IS LIMITED TO 0.31-INCH MAXIMUM.

f. Remove weight as required to bring the chordwise balance of tail rotor assembly within the specified tolerance. Satisfactory balance is obtained when the addition of no more than two AN960-10 tolerance check washers will stop or reverse a tendency of the blade assembly to rotate.

NOTE: Weight may be completely removed; screw does not have to remain installed if no weight is required.

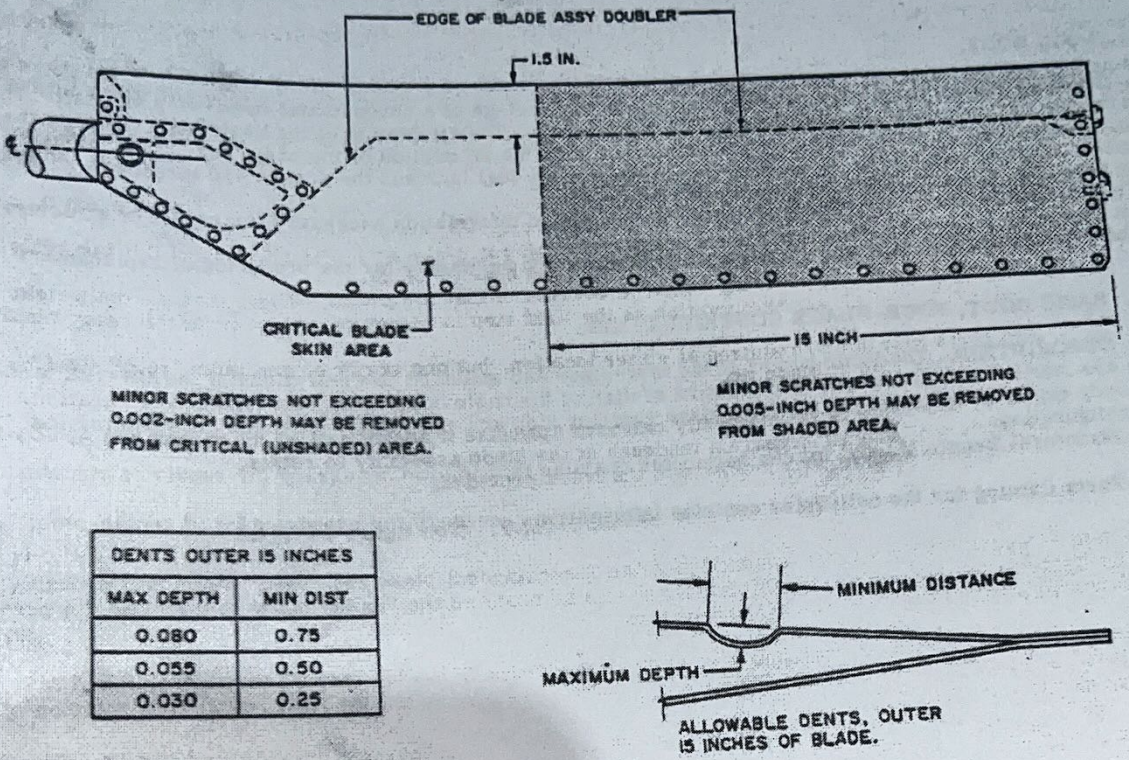
g. Secure attachment screws with lockwire to the holes provided.

55-1-40. MINOR REPAIR AND PARTS REPLACEMENT OF THE TAIL ROTOR ASSEMBLY. General maintenance of the tail rotor assembly should be limited to inspection, cleaning, servicing, parts removal and installation procedures outlined below. Damaged or defective parts requiring more extensive repair shall be removed and repaired in accordance with the tail rotor assembly overhaul manual.

a. Whenever the original lockwire hole is pulled out (through the edge) of the tail rotor yoke cap, it is permissible to drill one additional hole, using a No. 50 drill, in the cap at approximately 1/2 inch from the original hole.

b. Replace a yoke cover O-ring packing when oil leakage is detected.

(1) Using a strap wrench (MS16183 or equivalent) with a 12-inch handle, hook a small spring scale (having a scale reading of four to eight pounds) to strap handle at a 10-inch radius from cap center. Tighten yoke cap to 40/80 pound-inch torque value.



DENTS OUTER 15 INCHES	
MAX DEPTH	MIN DIST
0.080	0.75
0.055	0.50
0.030	0.25

Figure 55-1-5. Permissible Repair Areas, Tail Rotor Blade.

c. Replace or overhaul a hub and yoke assembly for excessive end play in the hub bearings. Maximum end play between either yoke and hub is limited to 0.0015-inch. Total (cumulative) end play between yokes is limited to 0.0030-inch. The end play check may be accomplished as follows:

(1) Remove tail rotor yoke caps and covers. Mount tail rotor hub in a suitable holding fixture if tail rotor has been removed from helicopter.

(2) Clamp a dial indicator on one of the yokes in a position which will allow the indicator contact point to touch the hub end having that yoke bearing (small diameter end of the yoke) being checked.

(3) Move the yoke upon which the dial indicator is mounted to check the end play of the bearing.

(4) Repeat this procedure for the opposite yoke.

(5) Reinstall yoke covers and caps. (Refer to step b. above, for tightening procedure.)

d. Remove minor nicks and scratches which do not exceed 0.005-inch in depth and one square inch in surface area, or light deposits of rust or corrosion by polishing with appropriate grades of oilstone or fine abrasive cloth. Blend reworked area smoothly into surrounding area.

CAUTION: DO NOT USE CONTAMINATED ABRASIVE CLOTH OR PAPER. DISSIMILAR METAL IMBEDDED IN THE REWORKED AREA CAN RESULT IN CORROSION.

55-1-41. MINOR REPAIR AND PARTS REPLACEMENT OF TAIL ROTOR BLADES. General maintenance of tail rotor blade should be limited to the inspection, cleaning, servicing, parts removal and installation procedures outlined below. (Refer to paragraph 55-1-30 for tail rotor assembly balancing requirements.) Damaged or defective parts requiring more extensive repair are beyond the intended scope of this manual.

a. It is permissible to remove minor scratches by using a fine grit stone or emery cloth, or by careful burnishing, provided that the scratches do not exceed a depth of 0.002-inch in the critical area of the blade (defined by the unshaded portion of the blade as illustrated in figure 55-1-5) nor a depth of 0.005-inch in the less critical area (defined by shading in figure 55-1-5).

b. No more than two single line scratches are permitted within one inch of each other in the critical area of the blade (defined by the unshaded area of the blade, figure 55-1-5) nor are V- or X-shaped scratches which intersect or cross each other in the chordwise plane (within 45 degrees of the chordline) of the blade skin permitted.

BASIC BODY SECTION

61-1-1. BASIC BODY.

61-1-2. DESCRIPTION. The basic body corresponds to the fuselage of a conventional fixed-wing aircraft. The forward section of the basic body supports the cabin enclosure. The aft section of the basic body contains the fuel tank. The power plant is located above the engine deck on the aft section of the basic body. The landing gear attaches to the underside of the basic body. Except for the fuel tank and the access and inspection panels the basic body is a single all-metal, stressed-skin structure.

a. The Structural Repair Manual for the helicopter contains information necessary for repair of structural members.

b. The Parts Catalog for the helicopter contains information necessary for the procuring of replacement parts.

61-101-1. BASIC BODY, FOUR-PLACE CONFIGURATION.

61-101-2. DESCRIPTION. The basic bodies of the four-place and standard configurations of the UH-12E Model Helicopter are similar except for extended forward section of the basic body in the four-place configuration. The basic body repair procedures for the four-place configuration are essentially the same as those for the standard configuration.

a. The Structural Repair Manual for the helicopter contains information necessary for repair of structural members.

b. The Parts Catalog for the helicopter contains information necessary for procurement of replacement parts.

c. Smooth dents in the tail rotor blade skin which fair with surrounding area and which are free from cracks, scratches, or displaced metal are permissible without repair, if they are within the following limits:

(1) No dents are permissible in the critical blade skin areas.

(2) In the areas 15 inches from the tip of the blade, dents shall not be deeper than 0.080-inch and shall be limited in the minimum length, as tabulated in figure 55-1-5.

(3) No detectible separation of the bond under the dents is permissible.

NOTE: Bond separations and voids are detected by the difference in sound when the bond area is tapped lightly with a light, blunt object such as a coin. Separated areas and bond voids sound dull or dead. Acceptably bonded areas reverberate or have a lively sound. There is no inspection requirement for trailing edge bond separation.

(4) Blade tip erosion through the leading edge skin, but not into the doubler, is acceptable if the limits specified in figure 55-1-6 are not exceeded and the bond of the skin adjacent to the eroded area is intact. No skin bond separation is permissible adjacent to the eroded area.

d. Check tail rotor blades at regular intervals for the condition of the bonded joint between the skin and leading edge doubler at the tip and the root. Bonding separation which does not exceed 40% of the exposed edge at either the blade tip or blade root is allowable. If separation is in excess of 40% of the bonded edge at either location, the blade must be retired from service.

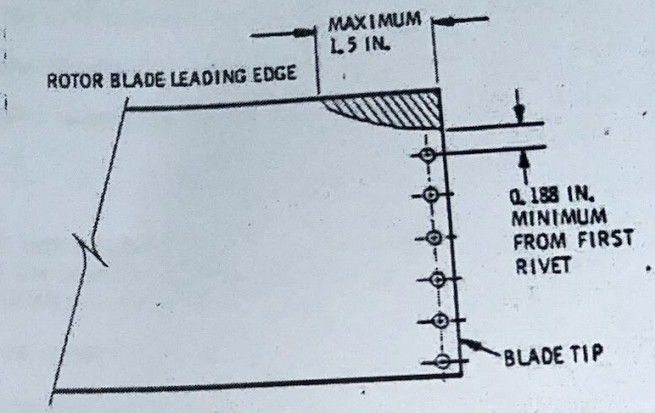


Figure 55-1-6. Erosion Limits, Tail Rotor Blade

TAIL BOOM

62-1-1. TAIL BOOM ASSEMBLY. (See figure 62-1-1.)

62-1-2. DESCRIPTION. The tail boom consists of two permanently joined all-metal, stressed skin sections. The forward tapered portion is identified as the transition section. The aft portion of the tail boom is conical shaped. The transition section is approximately semicircular in cross section at the forward bulkhead and becomes circular at the point of attachment to the aft portion of the tail boom.

a. A 125-pound capacity cargo compartment is installed in the tail boom transition section effective with helicopters Serial Number 2091 and subsequent. Cargo compartment kits are available for installation in the tail boom of helicopters Serial Number 2090 and below.

b. A tubular tail skid (paragraph 62-10-1) and ballast weight (paragraph 62-20-1) are located at the aft end of the tail boom.

62-1-10. REMOVAL OF TAIL BOOM ASSEMBLY.

a. Disconnect the two turnbarrels on the rudder control cables forward of the transition section-basic body junction. (Refer to Section 32.)

b. Disconnect the forward end of the radio antenna assembly, as applicable.

c. Remove the right-hand aft engine deck access panel and disconnect the tail light wire assembly at the knife disconnect at the aft end of the basic body.

d. Remove the forward tail rotor drive shaft.

e. Partially remove the bolts securing the lower center transition section to the basic body. It is not necessary to remove the bolts completely.

f. Provide suitable support under the transition section and aft section of the tail boom.

CAUTION: INSUFFICIENT SUPPORT OF THE TAIL BOOM ASSEMBLY DURING THE REMAINING STEPS OF REMOVAL WILL RESULT IN SERIOUS DAMAGE TO THE STRUCTURE.

g. Remove the bolts securing the transition section to the basic body at both sides of the engine deck.

h. Remove the tail boom assembly from the basic body.

62-1-11. INSTALLATION OF TAIL BOOM ASSEMBLY.

a. Support the tail boom assembly so that the mating surfaces of the three fitting assemblies are correctly alined.

b. Install the four bolts, washers and nuts securing the transition section to the basic body at both sides of the engine deck. Tighten to 100/140 pound-inch torque value.

c. Install the two bolts, washers and nuts at the fitting assembly bottom center of the basic body. Tighten to 160/190 pound-inch torque value.

d. Insert a 0.002-inch feeler gage between the mating surfaces of all attachment points. If the feeler gage cannot be inserted to the depth of the attaching bolts, the fit between the tail boom assembly and the basic body is satisfactory.

NOTE: If the feeler gage can be inserted to touch any of the attaching bolts, the fit between the tail boom and the basic body is not satisfactory. In this case, remove the boom and inspect the mating surfaces to determine cause of trouble. If necessary, carefully file the boom mounting pads to provide a smooth flat surface. When surface is flat, reinstall the boom and recheck the fit as outlined above. Make certain the bushings in the fitting assemblies do not protrude beyond the mating surfaces.

e. Remove the boom and clean the mating surfaces.

f. Apply a thin coat of zinc chromate primer to all of the fitting surfaces prior to the final attachment of the mated tail boom assembly.

NOTE: Do not allow the primer to dry before attachment is made as the attaching bolt torque values will not be accurate.

g. Install the forward tail rotor drive shaft.

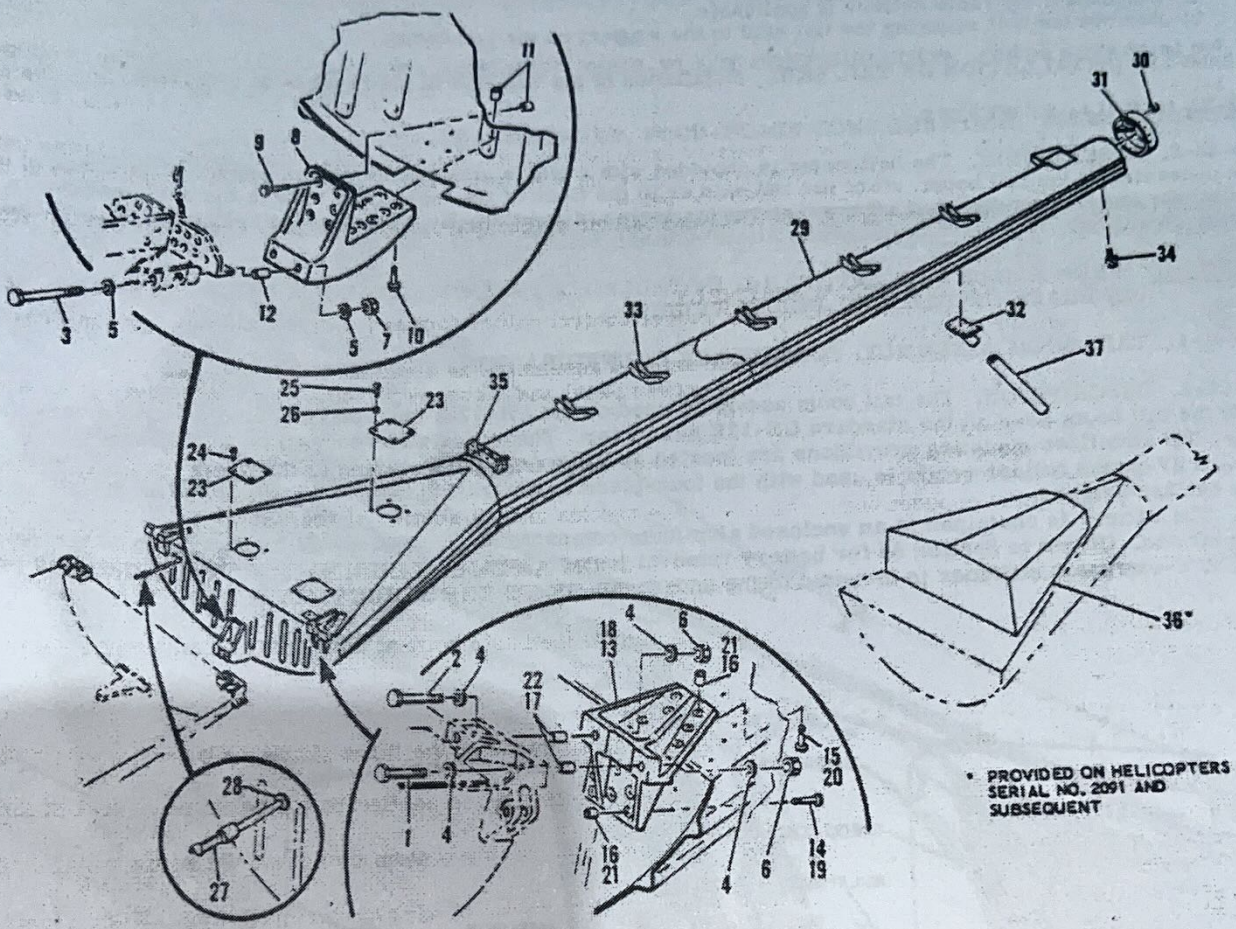
h. Connect the tail light wire assembly at the knife disconnect.

i. Connect the rudder control cables and adjust the tension and rudder pedal neutral position. (Refer to Section 32.)

j. Install the radio antennas as applicable.

62-10-1. TAIL SKID. (See figure 62-1-2.)

62-10-2. DESCRIPTION. The tubular aluminum tail skid is located on the aft portion of the tail boom. In low-level maneuvering of the helicopter, it prevents the tail rotor from striking the ground. It also serves as the



1. Bolt
2. Bolt
3. Bolt
4. Washer
5. Washer
6. Nut
7. Nut
8. Tail Boom Lower Fitting Assembly
9. Lockbolt
10. Lockbolt
11. Collar
12. Bushing
13. Tail Boom Upper LH Fitting Assembly
14. Lockbolt
15. Lockbolt
16. Collar
17. Bushing
18. Tail Boom Upper RH Fitting Assembly
19. Lockbolt
20. Lockbolt
21. Collar
22. Bushing
23. Access Hole Cover
24. Screw
25. Bolt
26. Washer
27. Knife Disconnect
28. Wire Assembly
29. Aft Section Tail Boom Assembly
30. Bushing
31. Bulkhead
32. Support
33. Guide Bracket
34. Eye Bolt
35. Rudder Control Pulley Bracket Assembly
36. Cargo Compartment
37. Tail Skid

Figure 62-1-1. Tail Boom Assembly

aft anchor of the radio antennas. The skid is attached to the tail boom structure with a through bolt at the permanently attached skid support.

62-10-10. REMOVAL OF TAIL SKID.

a. Disconnect the radio antenna if applicable.
b. Remove the bolt securing the tail skid to the support on the tail boom.

62-10-11. INSTALLATION OF TAIL SKID. Installation of the tail skid is the reverse of removal.

62-20-1. BALLAST WEIGHT.

62-20-2. DESCRIPTION. The helicopter is provided with a single nine-pound ballast weight. It is attached to the underside of the tail boom, aft of the tail skid or to the floor of the right-hand side of the cabin enclosure as necessary to establish fore and aft corrections for center of gravity. It attaches to the helicopter with T-handle quick release pins which are permanently attached to the weight.

WARNING: WHEN FLOAT LANDING GEAR IS INSTALLED, A 13-POUND BALLAST WEIGHT IS REQUIRED IN PLACE OF THE NINE-POUND WEIGHT.

62-101-1. TAIL BOOM ASSEMBLY, FOUR-PLACE CONFIGURATION. (See figure 62-101-1.)

62-101-2. DESCRIPTION. The tail boom assembly used on the UH-12E, four-place configuration, is very similar to the tail boom used on the standard UH-12E helicopter. The major differences are as follows:

a. The stabilizer mounting provisions are located at tail boom station 169.75.
b. A 17-pound ballast weight is used with the four-place configuration (figure 62-101-2 shows the aft location of the ballast weight.)
c. The battery is contained in an enclosed aluminum compartment located under the tail boom at the extreme aft end. (Refer to Section 83 for battery removal instructions.)
d. A T-extrusion stiffener is mounted to the underneath side of the tail boom.

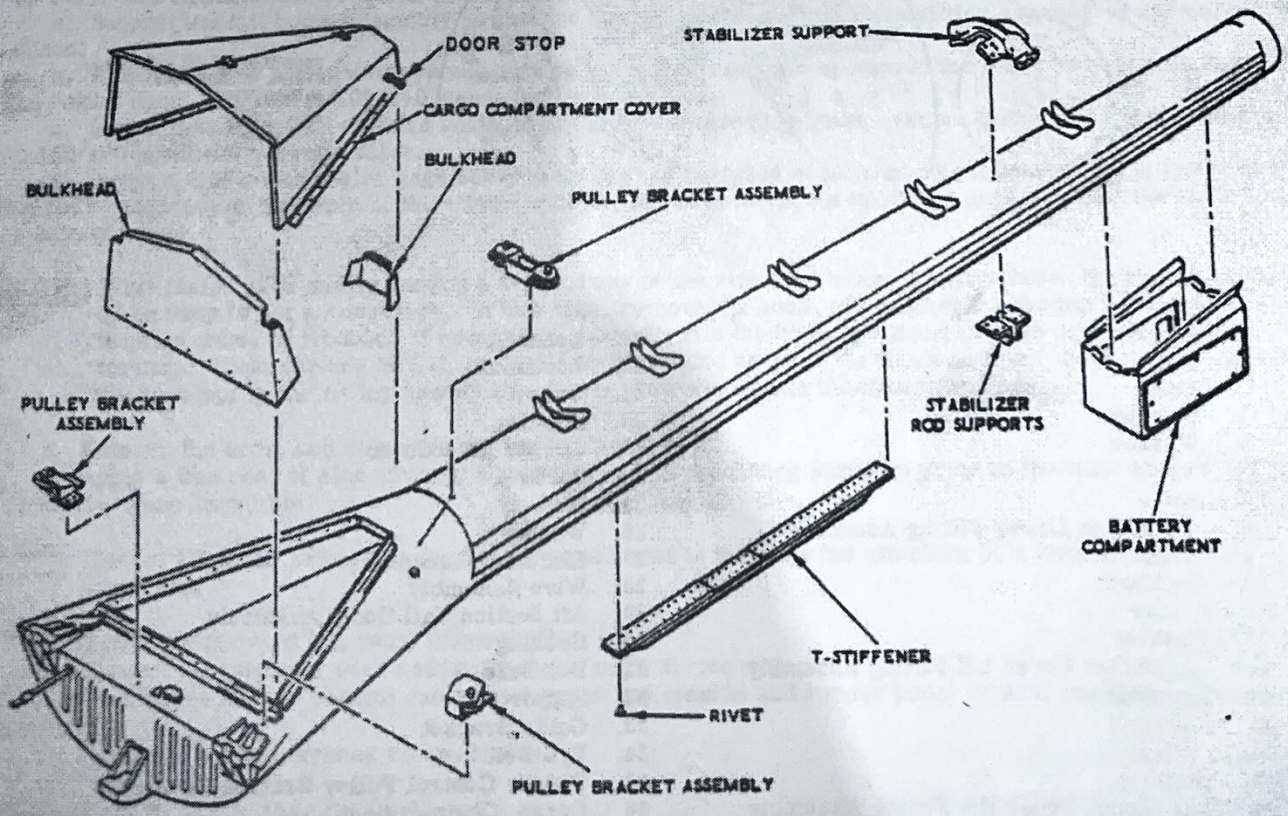


Figure 62-101-1. Tail Boom Assembly, Four-Place Configuration

62-101-10. REMOVAL OF TAIL BOOM ASSEMBLY, FOUR-PLACE CONFIGURATION. Follow procedures outlined in paragraph 62-1-10.

62-101-11. INSTALLATION OF TAIL BOOM ASSEMBLY, FOUR-PLACE CONFIGURATION. Follow procedures outlined in paragraph 62-1-11.

62-101-12. REMOVAL OF STABILIZER ASSEMBLY, FOUR-PLACE CONFIGURATION. Follow procedures outlined in Section 37. paragraph 37-101-10.

62-101-13. INSTALLATION OF STABILIZER ASSEMBLY, FOUR-PLACE CONFIGURATION. Follow procedures outlined in Section 37, paragraph 37-101-11.

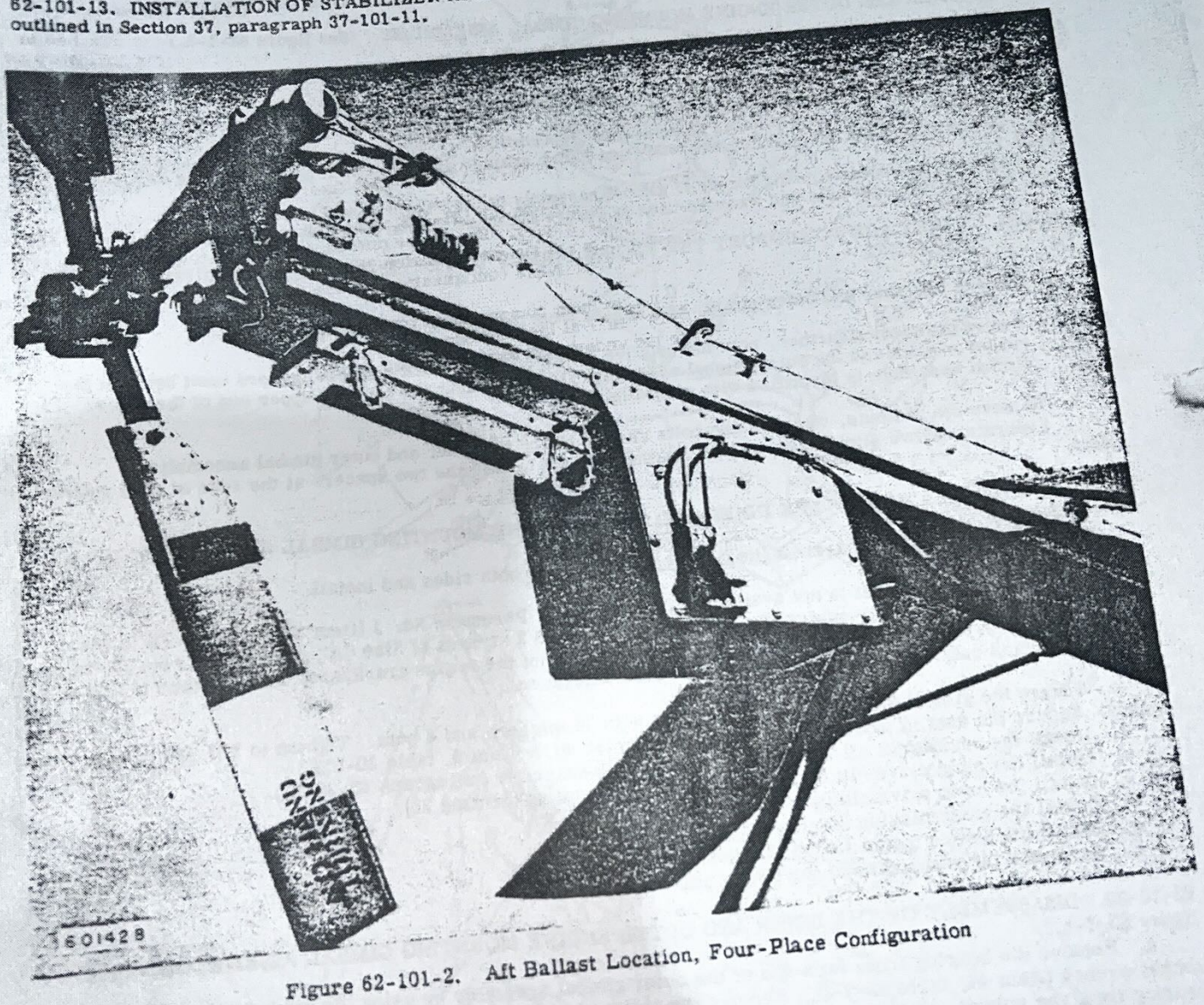


Figure 62-101-2. Aft Ballast Location, Four-Place Configuration

ENGINE MOUNT INSTALLATION

63-1-1. INNER AND OUTER ENGINE MOUNTING GIMBAL ASSEMBLIES, ENGINE MOUNT ASSEMBLIES AND ENGINE SNUBBER ASSEMBLIES.

63-1-2. DESCRIPTION. The engine mount installation includes a removable engine frame assembly, engine mount strut assembly and partial engine mount assembly fabricated from type 4130 steel tubing with welded steel fittings. The frame assemblies are bolted in position. The engine snubber assemblies are bolted to the engine snubber attachment fitting assemblies and to the engine snubber brackets on the engine deck.

63-10-1. INNER AND OUTER ENGINE MOUNTING GIMBAL ASSEMBLIES. (See figure 63-1-1.)

63-10-10. REMOVAL OF THE INNER AND OUTER ENGINE MOUNTING GIMBAL ASSEMBLIES. (See figure 63-1-1.)

a. Remove the main transmission assembly (Section 23).
b. Remove the power plant (Section 70).
c. Support the engine in a suitable engine stand (Section 70).
d. Remove the main drive clutch assembly and clutch adapter assembly or torsion coupling as applicable (Section 21).
e. Remove the bolts securing the outer gimbal assembly to the engine mount frame assembly.
f. Remove the eight nuts and washers used to secure the inner gimbal assembly to the engine.

CAUTION: TAKE CARE TO SUPPORT THE ENGINE FIRMLY TO PREVENT IT FROM DROPPING OR TOPPLING.

g. Remove the inner and outer gimbal assemblies from the engine.

NOTE: Before proceeding further, note the relative positions of the thick and thin spacers used between the rubber mounts and the outer gimbal assembly. Note also that the forward upper end of the outer gimbal assembly is identified with raised letters.

h. Remove the two nuts, washers and bolts used to attach the inner and outer gimbal assemblies.
i. Separate the two gimbal assemblies, taking care not to lose the two spacers at the ends of each rubber mount.

63-10-11. INSTALLATION OF THE INNER AND OUTER ENGINE MOUNTING GIMBAL ASSEMBLIES. (See figure 63-1-1.)

a. Coat gasket (8A) with Sealant (item 35, table 10-VI) on both sides and install.

NOTE: If serviceable gasket is not available, apply a coat of Permatex No. 3 (item 23, table 10-VI) to the inner gimbal ring-to-engine parting surfaces. Imbed 2 strands of Size "A" silk thread (item 28, table 10-VI) in the Permatex sealant around the perimiter of the engine crankcase, with 1 strand inside and 1 strand outside of engine attaching stud circumference.

b. Secure the gimbal assemblies to the engine with 16 washers and 8 nuts. Tighten to 360/480 pound-inches. Secure the nuts in pairs with 0.041 inch diameter wire (item 6, table 10-VI).
c. Install the crankshaft oil seal in the inner gimbal assembly (paragraph 63-20-11).
d. Install the main drive clutch adapter or torsion coupling (Section 21).
e. Install the main drive clutch (Section 21).
f. Install the transmission (Section 23).
g. Install the engine mount frame (Section 70).
h. Assemble the remainder of the power plant (Section 70).

63-10-20. DISASSEMBLY OF THE INNER AND OUTER ENGINE MOUNTING GIMBAL ASSEMBLIES. (See figure 63-1-1.)

a. Remove the bearing from each end of the outer gimbal assembly by using the gimbal bearing lockring socket wrench (item 44, table 92-1-1). Remove the slotted locking ring used to retain the bearing and press the bearing from the gimbal.

b. Remove the rubber mounts from each side of the inner gimbal assembly by removing the retaining ring and pressing the mount from the gimbal.

63-10-21. ASSEMBLY OF THE INNER AND OUTER ENGINE MOUNTING GIMBAL ASSEMBLIES. (See figure 63-1-1.)

a. Remove any dried zinc chromate primer from the rubber mount bores of the inner gimbal.

1. Spacer Assembly
2. Retaining Ring
3. Rubber Mount
4. Spacer Assembly
5. Inner Gimbal
6. Washer
7. Nut
8. Crankshaft Oil Seal
8A. Gasket
9. Bolt
10. Bushing
11. Washer
12. Nut
13. Outer Gimbal
14. Bearing
15. Locking Ring
16. Washer
17. Nut
18. Washer
19. Bolt
20. Lubrication Fitting

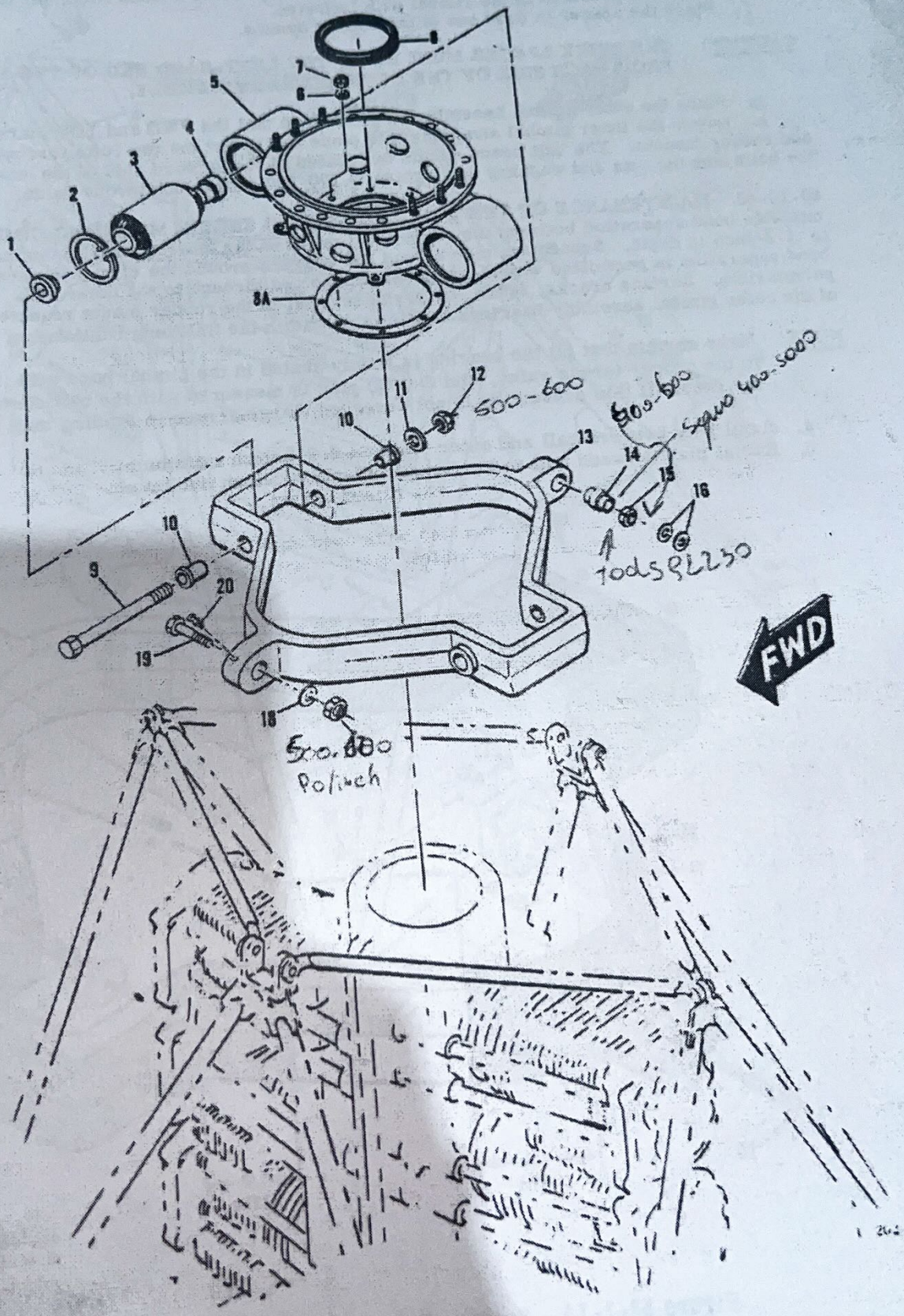


Figure 63-1-1. Engine Mounting Gimbal Assemblies

b. Apply a wet coat of zinc chromate primer to the outer circumference of the rubber mounts and the bores of the inner gimbal and press the mounts into the bores while the primer is still wet. Take care not to allow the primer to run over the rubber ends of the mount.

c. Secure the mount in place with the retainer ring.

d. Apply a wet coat of zinc chromate primer to the outer race of the outer gimbal bearings and press the bearings into the gimbal while the primer is still wet.

e. Secure the outer gimbal bearings in place with the slotted locking rings and tighten to a torque value of 400/500 pound-inches using the gimbal bearing lock ring socket wrench (item 44, table 92-1-1). Secure the rings to the holes provided in the gimbal with lockwire.

f. Place the spacer in each end of the rubber mounts.

CAUTION: THE THICK SPACER MUST BE AT THE LEFT-HAND END OF THE MOUNT WHEN VIEWED FROM EACH SIDE OF THE INNER GIMBAL ASSEMBLY.

g. Place the outer gimbal assembly on a bench so that the FWD and TOP markings are facing upward.

h. Lower the inner gimbal assembly into place and insert the two bolts through the outer gimbal, spacers and rubber mounts. The bolt heads should be located at the forward side of the outer gimbal assembly. Secure the bolts with the nuts and washers and tighten to 500/600 pound-inch torque value.

63-10-40. MAINTENANCE OF THE INNER AND OUTER ENGINE MOUNTING GIMBAL ASSEMBLIES. Permissible bond separation between the rubber and metal of the inner gimbal assembly Lord mounts is limited to 1/4-inch in depth. Separation may extend 360 degrees around the circumference at both ends; however, no bond separation is permitted which extends from one end through to the other end. Minor surface checking is permissible. Surface cracks, tears, or permanent set in the rubber mount require mount repalcement. Wear of the outer gimbal assembly bearings is allowable within the following limitations:

NOTE: Make certain that (1) the bearing is firmly seated in the gimbal bore with locking ring tightened to the proper torque value, and that (2) play is measured with the ball centered (not swiveled) in the race. If this precaution is not observed, large errors in reading may result.

a. Axial play between ball and outer race----0.010-inch maximum.
b. Radial play between ball and outer race----0.005-inch maximum.

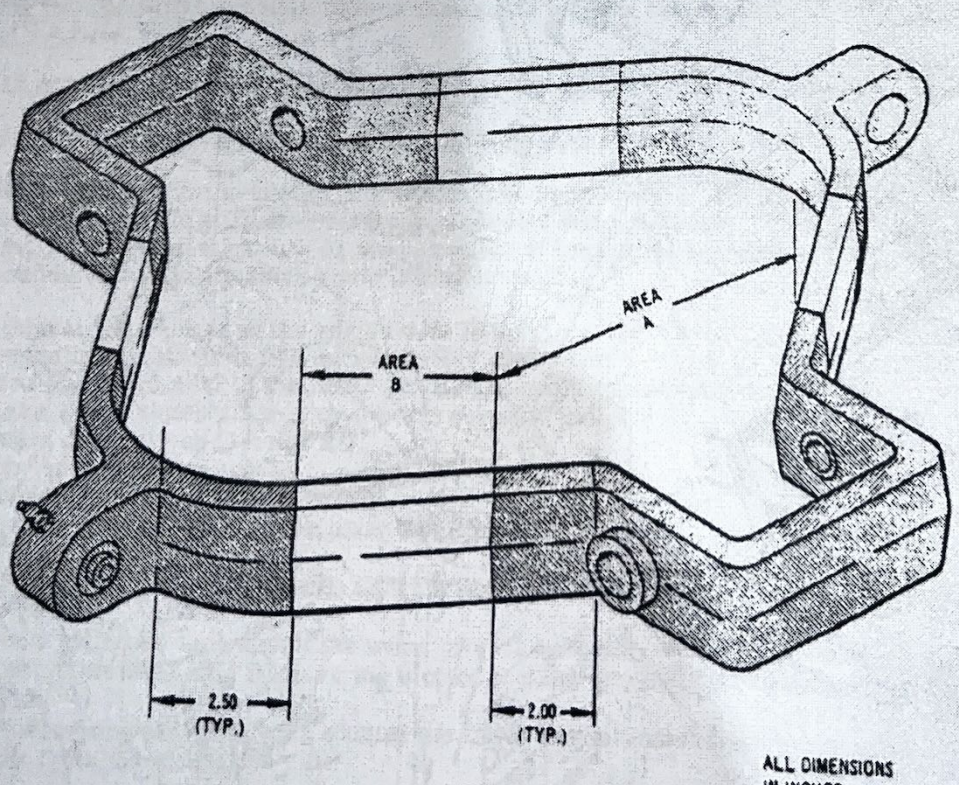


Figure 63-1-1A. Surface Defect Repair Limits, Engine Outer Gimbal

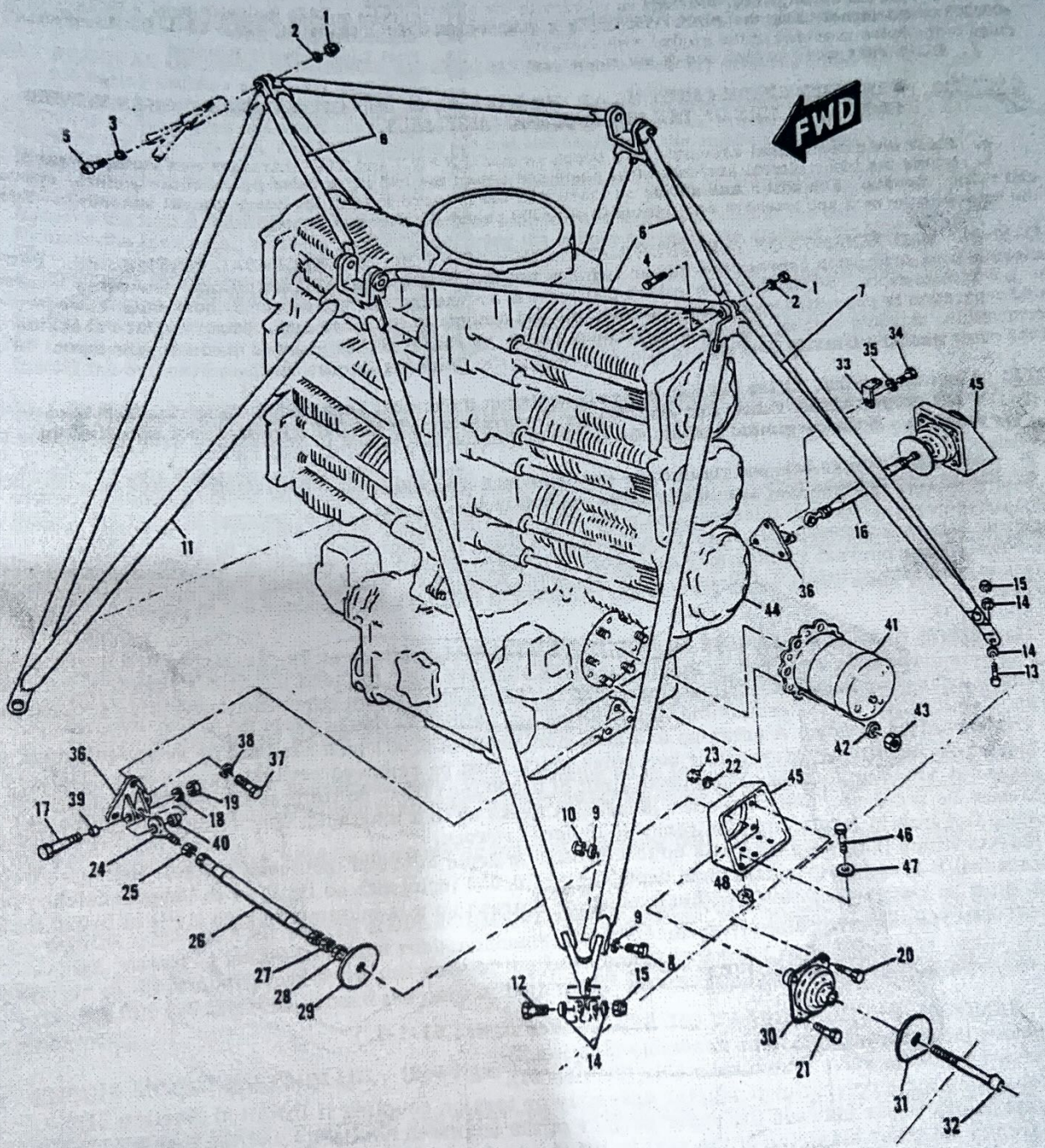


Figure 63-1-2. Engine Mount and Snubber Assemblies

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INDEX FOR FIGURE 63-1-2

1. Nut
2. Washer
3. Washer
4. Bolt
5. Bolt
6. Engine Mount Strut Assembly
7. Removable Engine Frame Assembly
8. Bolt
9. Washer
10. Nut
11. Partial Engine Mount Assembly
12. Bolt
13. Bolt
14. Washer
15. Nut
16. Aft Engine Snubber Assembly
17. Bolt
18. Washer
19. Nut
20. Bolt
21. Bolt
22. Washer
23. Nut
24. Rod End Bearing
25. Nut
26. Rod
27. Nut
28. Nut
29. Engine Snubber Stop
30. Mount
31. Slotted Engine Snubber Stop
32. Engine Snubber Bolt
33. Fuel Line Support Bracket
34. Bolt
35. Washer
36. Engine Snubber Attach Fitting Assembly
37. Bolt
38. Washer
39. Bushing
40. Bushing
41. Generator/*Alternator*
42. Washer
43. Nut
44. Engine
45. Engine Snubber Bracket
46. Bolt
47. Washer
48. Nut

63-10-41. MINOR REPAIR OF ENGINE MOUNT INNER GIMBAL. Minor nicks and scratches may be removed from the engine mount inner gimbal machined surface within the limits and in accordance with procedures outlined below.

a. Blend reworked area smoothly into the surrounding area, and treat the affected surface in accordance with requirements for aluminum alloy as outlined in Section 10.

b. After rework, the web thickness, as measured from the bottom of the counterbore around the bolt holes must not be less than 0.260-inch. A surface finish of at least 125 microinches must be maintained.

c. The gimbal internal surface may be reworked to a finish depth of 0.040-inch, provided that the wall thickness is not reduced below 0.180-inch. A surface finish equal to, or better than the manufactured surface is required.

63-10-42. MINOR REPAIR OF ENGINE MOUNT OUTER GIMBAL. Minor nicks, scratches and surface defects on the outer gimbal may be repaired by stoning or using abrasive cloth to blend the defect smoothly into the surrounding surface and than treating the repaired area in accordance with corrosion preventive processes for aluminum alloy (Section 10). Permissible repair areas are defined in figure 63-1-1A.

a. Defects within (shaded) A areas up to a maximum depth of 0.001 inch need not be removed except such defects located adjacent to or intersecting bolt holes which must be removed regardless of depth. Defects within (shaded) A areas up to a maximum depth limit of 0.020 inch (with no limit as to number, length or direction) must be removed. Defects within (shaded) A areas up to a maximum depth limit of 0.040 inch, and not exceeding 0.4 inch in length, may be removed by local rework.

b. Defects within (unshaded) B areas up to a maximum depth of 0.002 inch need not be removed. Defects within (unshaded) B areas up to a maximum depth limit of 0.030 inch (with no limit as to length, number or direction) must be removed. Defects within (unshaded) B areas up to a maximum depth limit of 0.050 inch. and not to exceed 0.5 inch in length, may be removed.

63-20-1. CRANKSHAFT OIL SEAL. (See figure 63-1-1.)

63-20-10. REMOVAL OF CRANKSHAFT OIL SEAL. (See figure 63-1-1.)

a. Remove the main transmission assembly (Section 23).

b. Remove the main drive clutch assembly (Section 21).

c. Remove the main drive clutch adapter assembly or torsion coupling if installed (Section 21).

d. Insert an offset bar between the upper surface of the engine drive flange and the inside of the seal and gently pry around the inner diameter of the seal to lift the seal out of its seat.

CAUTION: TAKE CARE NOT TO DAMAGE THE INNER GIMBAL ASSEMBLY SHOULDER DIRECTLY BELOW THE LOWER FACE OF THE SEAL.

e. Inspect adapter seal area for grooves or surface defects that might result in oil leakage. (Replace an unserviceable wear sleeve (Section 21).

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63-20-11. INSTALLATION OF CRANKSHAFT OIL SEAL. (See figure 63-1-1.)

a. Remove the dried zinc chromate primer from the seal recess in the inner gimbal assembly.
b. Apply a coat of zinc chromate primer to the seal bore and press the seal into place while the primer is still wet. The lip of the seal must face toward the engine.
c. Install the main drive clutch adapter assembly or torsion coupling if applicable (Section 21).
d. Install the main drive clutch assembly (Section 21).
e. Install the main transmission assembly (Section 23).

63-30-1. ENGINE SNUBBER ASSEMBLIES. (See figure 63-1-2.)

63-30-10. REMOVAL OF ENGINE SNUBBER ASSEMBLY. (See figure 63-1-2.) Remove either the left-hand side or the aft engine snubber assembly as follows:

a. Loosen the two checknuts used to lock the snubber tube. Rotate the tube to unthread it from the rod end bearing attached to the engine and from the bolt assembly extending through the rubber mount.
b. Remove the nut, washer, and bolt securing the rod end bearing to the engine fitting and withdraw the bearing from the engine fitting.
c. Use a wrench to hold the head of the bolt extending through the rubber mount and remove the nut and snubber stop from the threaded end of the bolt.
d. Remove the bolt assembly and outboard snubber stop located under the head of the bolt.
e. Remove the four nuts, washers and bolts securing the rubber mount to the snubber bracket.

63-30-11. INSTALLATION OF ENGINE SNUBBER ASSEMBLY. (See figure 63-1-2.) Install either the left-hand side or aft engine snubber assembly as follows:

a. Install the rubber mount against the inner side (outboard mounting surfaces) of the snubber bracket. Secure the mount with the four bolts, nuts and washers. Tighten the nuts to 40/50 pound-inch torque value.
b. Install the outboard snubber stop on the bolt.

CAUTION: THE STOP MUST BE INSTALLED WITH THE CHAMFERED SIDE OF CENTER HOLE AGAINST THE BOLT HEAD AND THE STRAIGHT EDGE DOWN.

c. Install the bolt and stop in the rubber mount.
d. Place the inner snubber stop on the threaded end of the bolt and secure in place with the lock nut.
e. Install the rod end bearing in the engine fitting and secure in place with the bolt, washer and nut. Locate the bearing in the fitting so that the grease fitting will be accessible.
f. Install the checknuts on the rod end bearing and the inner threaded end of the bolt and thread the snubber tube into place between the two parts. Start the threads evenly at each end of the tube.
g. Adjust the length of the snubbers as required to establish the correct angle of the main rotor drive shaft (Section 33).

CAUTION: AFTER THE SNUBBERS ARE CORRECTLY ADJUSTED AND THE CHECKNUTS HAVE BEEN TIGHTENED, CHECK TO DETERMINE THAT THE ROD END BEARING THREADS AND THE OUTER BOLT THREADS ARE INSERTED FAR ENOUGH INTO THE TUBE TO COVER THE WITNESS HOLES IN EACH END OF THE SNUBBER RODS.

h. Check the snubber attach bracket to basic body mounting bolts for correct torque value as follows:
(1) On helicopters with 1/4-inch diameter bracket attaching bolts correct torque is 115/125 pound-inches.
(2) On helicopters with 3/16-inch diameter bracket attaching bolts correct torque is 40/50 pound-inches.

63-30-40. MINOR REPAIR AND PARTS REPLACEMENT OF ENGINE SNUBBER ASSEMBLY. Replace worn rod end bearings, damaged or deteriorated rubber mounts, or other unserviceable parts as required. Permissible separation of the rubber from the metal core of the Lord mount is limited to 1/16-inch in depth. Separation may extend a full 360 degrees around the core at both ends. Any separation beyond these limits requires mount replacement.

63-40-1. ENGINE MOUNT ASSEMBLIES. (See figure 63-1-2.)

63-40-10. REMOVAL OF ENGINE MOUNT ASSEMBLIES. (See figure 63-1-2.) Refer to Section 70 for instructions for removal of engine mount assemblies.

63-40-11. INSTALLATION OF ENGINE MOUNT ASSEMBLIES. (See figure 63-1-2.) Refer to Section 70 for engine mount assembly installation procedures.

63-40-40. CHECKING RELATIVE MOVEMENT BETWEEN ATTACHING POINTS OF THE LOWER ENGINE MOUNT FRAME AND BASIC BODY FITTINGS.

a. Attach a dial indicator to lower end of frame assembly with the indicator button touching the top of basic body fitting. The dial indicator must be positioned at a right angle to engine deck to ensure full measurement.

NOTE: If desired, four dial indicators may be used and relative movement checks can be performed at all locations simultaneously.

b. Hoist the helicopter, utilizing procedures outlined in Section 10 and figure 10-11, and check the maximum deflection of dial indicator pointer. If movement exceeds 0.010-inch in any of the four attaching points, remove the lower engine mount frome from helicopter and inspect the holes for wear or elongation. Maximum allowable wear or elongation is 0.25555-inch.

c. Inspect the bushings in the basic body fittings for wear or elongation. Maximum allowable wear or elongation is 0.2565-inch.

d. If any holes or bushings are worn or elongated beyond the maximum allowable dimensions specified in steps b and c above, they may be repaired by following procedures outlined in the handbook of structural repair for this helicopter.

e. Inspect all mounting bolts for wear. Replace bolts showing indications of wear.

CABIN ENCLOSURE

64-1-1. CABIN ENCLOSURE. (See figure 64-1-1.)

64-1-2. DESCRIPTION. The cabin enclosure consists of a canopy, a lower windshield and two windshield glasses, left-hand and right-hand doors, a seat back and cabin support tube assembly. The canopy, lower windshield, windshield glasses and doors are transparent plastic panels with impregnated fiberglas reinforced edges. The firewall serves as the seat back and primary structural element. The cabin support tube assembly and door frames are tubular aluminum.

64-1-10. REMOVAL OF CABIN ENCLOSURE.

a. Remove the cabin doors. (Refer to paragraph 64-50-10.)
b. Remove the canopy. (Refer to paragraph 64-10-10.)
c. Remove the lower windshield and windshield glasses. (Refer to paragraphs 64-20-10 and 64-30-10.)
d. Remove the cabin support tube assembly. (Refer to paragraph 64-40-10.)

64-1-11. INSTALLATION OF CABIN ENCLOSURE.

a. Install the cabin support tube assembly. (Refer to paragraph 64-40-11.)
b. Install the lower windshield and windshield glasses. (Refer to paragraphs 64-20-11 and 64-30-11.)
c. Install the canopy. (Refer to paragraph 64-10-11.)
d. Install the cabin doors. (Refer to paragraph 64-50-11.)

64-1-40. MINOR REPAIR AND PARTS REPLACEMENT OF CABIN ENCLOSURE. Instructions for repair and replacement of plastic components of the cabin enclosure are contained in the Structural Repair Manual.

64-10-1. CANOPY. (See figure 64-1-1.)

64-10-2. DESCRIPTION. The canopy is a one-piece free-blown plastic panel. It extends from the top of the firewall to the front of the cabin support tube assembly and is attached to the firewall and cabin support tube assembly with screws and eyebolts.

64-10-10. REMOVAL OF CANOPY.

a. Remove the cabin doors. (Refer to paragraph 64-50-10.)

CAUTION: HANDLE PLASTIC CANOPY AS DESCRIBED IN PARAGRAPH 64-10-41.)

b. Disconnect the cabin heating system. (Refer to Section 88.) Remove the cabin heat diffuser.
c. Remove the free-air temperature indicator. (Refer to Section 81.)
d. Disconnect and remove the map light. (Refer to Section 83.)

CAUTION: PRIOR TO DISCONNECTING OR REMOVING ANY COMPONENT WHICH INVOLVES THE ELECTRICAL SYSTEM, THE MASTER SWITCH AND THE IGNITION SWITCH MUST BE IN THE OFF POSITION. DISCONNECT THE BATTERY FROM THE ELECTRICAL SYSTEM.

e. Remove the screws and eyebolts attaching the canopy to the firewall and the cabin support tube assembly.
f. Lift the canopy off the cabin support tube assembly and carefully place the canopy on suitable pads to prevent damage to the edges of the plastic.

64-10-11. INSTALLATION OF CANOPY. Installation of the canopy is the reverse of removal.

CAUTION: ALL ATTACHING SCREWS AND EYEBOLTS MUST BE STARTED FINGERTIGHT TO INSURE CORRECT SEATING OF THE CANOPY BEFORE ANY OF THE SCREWS ARE TIGHTENED. TIGHTEN SCREWS AND EYEBOLTS UNIFORMLY. USE GREAT CARE WHEN TIGHTENING SCREWS AND EYEBOLTS TO PREVENT CRACKING THE PLASTIC.

64-10-40. MINOR REPAIR AND PARTS REPLACEMENT OF CANOPY. Refer to the UH-12E Structural Repair Manual.

64-10-41. EXTREME WEATHER MAINTENANCE OF CANOPY. The canopy can be handled and worked with minimum danger of cracking at ambient temperatures above 24°C (75°F). Removal and installation of the canopy may be accomplished with extra care at temperatures down to 10°C (50°F). At colder temperatures, only emergency maintenance should be performed on the canopy.

64-20-1. LOWER WINDSHIELD. (See figure 64-1-1.)

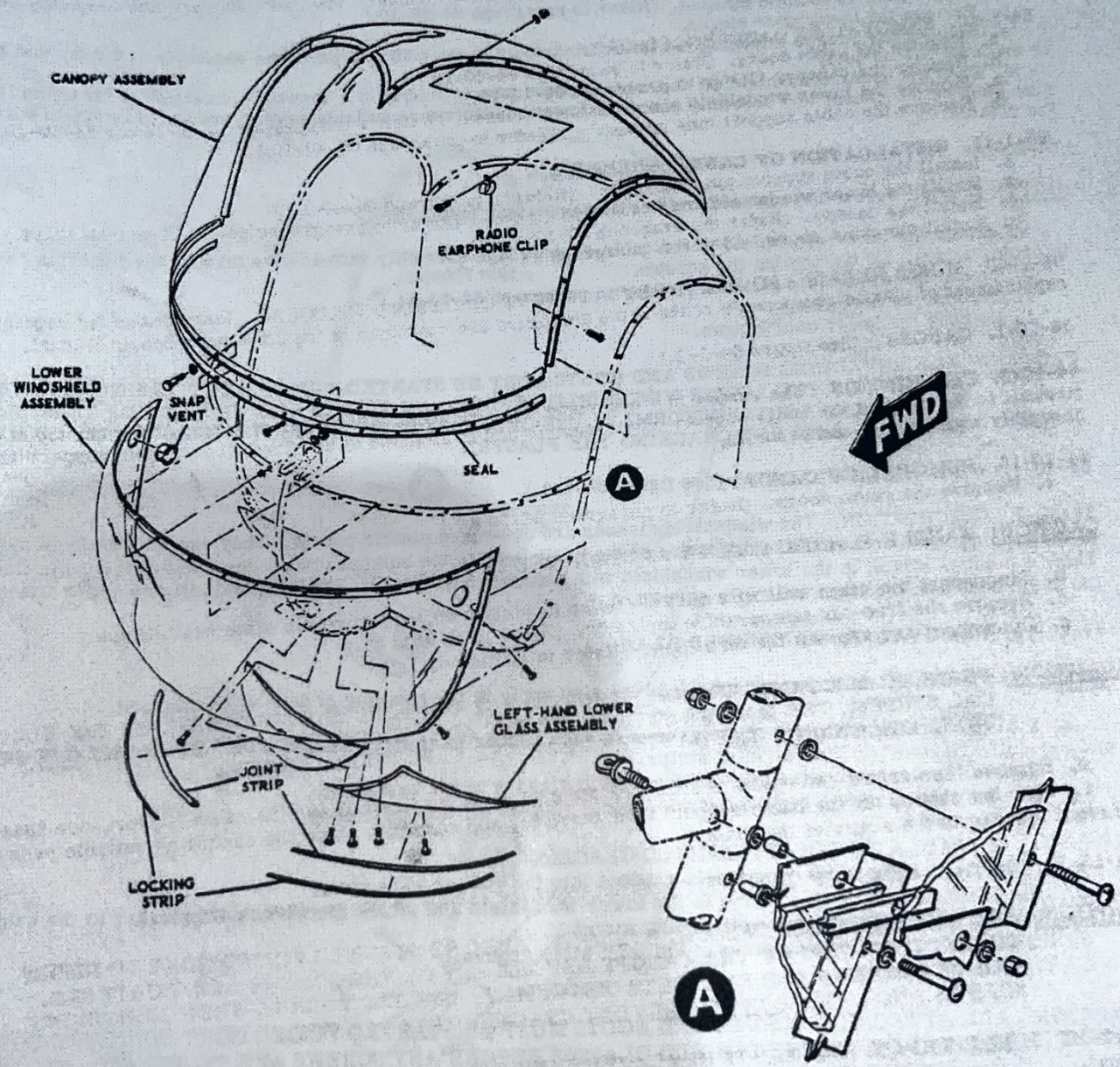

Figure 64-1-1. Canopy, Lower Windshield and Windshield Glasses

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64-20-2. DESCRIPTION. The lower windshield is a one-piece plastic panel. It extends from the left-hand door around to the right-hand door. It attaches to the cabin support tube assembly at both sides, to the canopy at the top and to the two windshield glasses at the bottom. A directional flow snap vent is installed on both sides of the lower windshield.

64-20-10. REMOVAL OF LOWER WINDSHIELD.

NOTE: The instructions in paragraph 64-10-41 also apply to the handling of the lower windshield.

a. Remove the windshield glasses. (Refer to paragraph 64-30-10.)
b. Remove the lower door hinges.
c. Remove the screws attaching the lower windshield to the cabin support tube assembly at the top and sides of the lower windshield.
d. Ease the lower windshield off the cabin support tube assembly in a downward direction to clear the fiberglas strip on the canopy and carefully place the lower windshield on suitable pads to prevent damage to edges of the plastic.

64-20-11. INSTALLATION OF LOWER WINDSHIELD.

NOTE: Coat all screw threads with rubber cement before installation.

a. Attach the lower windshield to the cabin support tube assembly with screws through the fiberglas reinforcing strips. Do not tighten the screws.
b. Install the windshield glasses. (Refer to paragraph 64-30-11.)
c. Tighten the screws.
d. Replace the lower door hinges.

CAUTION: ALL ATTACHING SCREWS AND BOLTS MUST BE STARTED FINGERTIGHT TO INSURE CORRECT SEATING OF THE LOWER WINDSHIELD BEFORE ANY SCREWS ARE TIGHTENED. TIGHTEN SCREWS AND BOLTS UNIFORMLY. USE GREAT CARE WHEN TIGHTENING SCREWS AND EYEBOLTS TO PREVENT CRACKING THE PLASTIC.

64-30-1. WINDSHIELD GLASSES. (See figure 64-1-1.)

64-30-2. DESCRIPTION. The windshield glasses are one-piece plastic panels. They extend from both sides of the landing light well at the forward end of the basic body to the bulkhead below the front of the cabin floor. Their top edges attach to the lower windshield with a rubber joint strip. The back and inboard edges attach to the basic body and the light well with screws.

64-30-10. REMOVAL OF WINDSHIELD GLASSES.

NOTE: The instructions in paragraph 64-10-41 also apply to the handling of windshield glasses.

a. Pull the locking strip out of the groove in each rubber joint strip along the top of the windshield glasses and carefully remove the rubber joint strips.
b. Remove the screws attaching the windshield glasses to the basic body.
c. Lift the left-hand and right-hand windshield glasses off the basic body.

64-30-11. INSTALLATION OF WINDSHIELD GLASSES.

a. Fit the top edges of the windshield glasses into the rubber joint strip.
b. Aline and install the joint strip to the lower windshield and attach the windshield glasses to the basic body with screws through the fiberglas reinforcing strips.
c. Install the rubber locking strip in the joint strip groove.
d. Tighten the screws.

CAUTION: ALL ATTACHING SCREWS AND BOLTS MUST BE STARTED FINGERTIGHT TO INSURE CORRECT SEATING OF THE WINDSHIELD GLASSES BEFORE ANY SCREWS ARE TIGHTENED. TIGHTEN THE SCREWS UNIFORMLY. USE GREAT CARE WHEN TIGHTENING THE SCREWS TO PREVENT CRACKING THE PLASTIC.

64-40-1. CABIN SUPPORT TUBE ASSEMBLY. (See figure 64-1-2.)

64-40-2. DESCRIPTION. The cabin enclosure is supported along the sides and at the front by a tubular aluminum framework. The framework extends forward from the firewall and down to the cabin floor, providing door openings. Another tubular member extends horizontally from one door to the other across the front of the cabin enclosure. The support tubes are attached to the basic body with cast aluminum fittings. The entire assembly is secured along the top of the firewall and to the cabin floor by screws. A compass bracket is attached

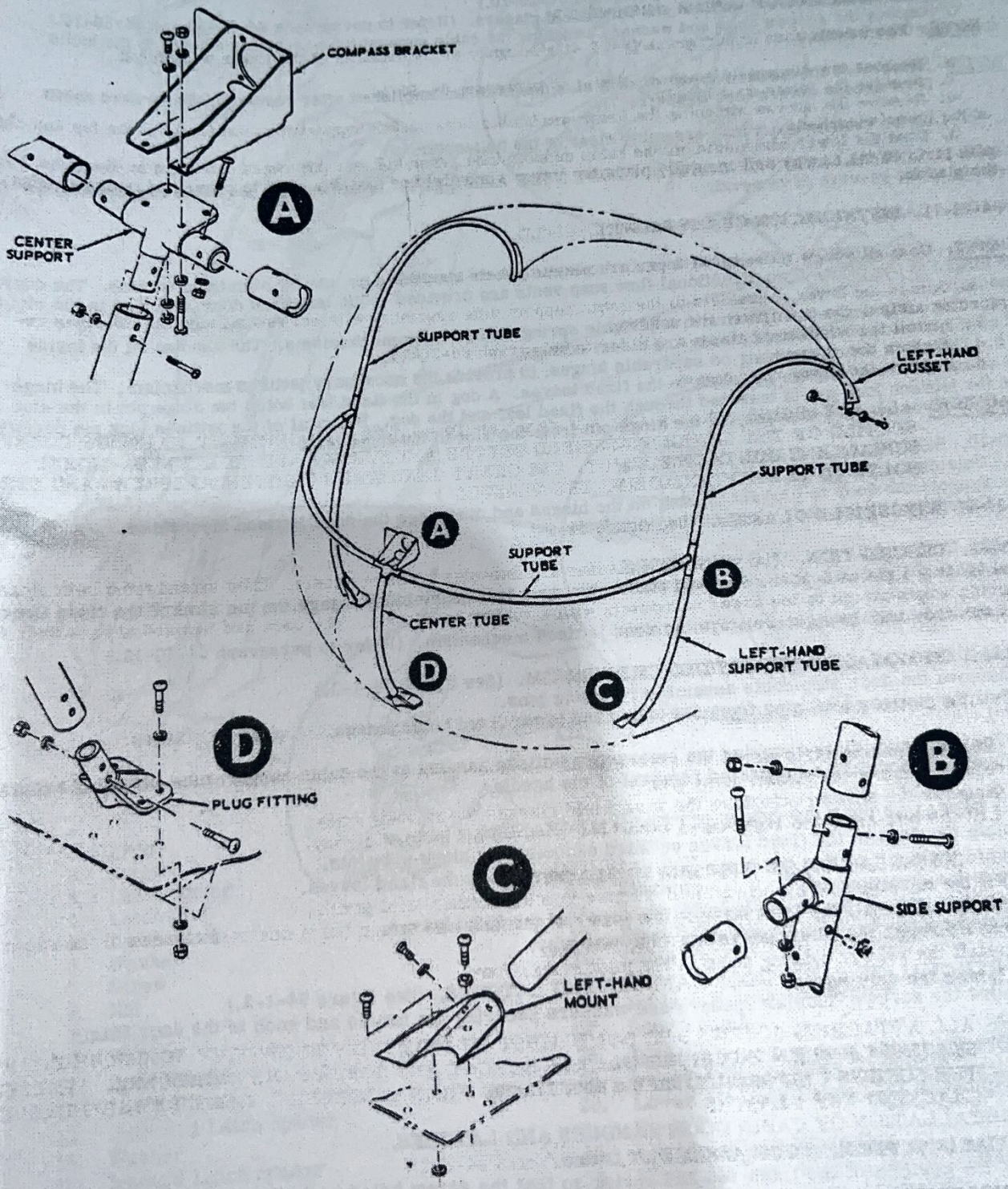

Figure 64-1-2. Cabin Support Tube Assembly

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to the forward center support tube.

64-40-10. REMOVAL OF CABIN SUPPORT TUBE ASSEMBLY.
a. Remove the cabin doors. (Refer to paragraph 64-50-10.)
b. Remove the canopy. (Refer to paragraph 64-10-10.)
c. Remove the lower windshield and windshield glasses. (Refer to paragraphs 64-20-10 and 64-30-10.)
d. Remove the screws, nuts and washers attaching the cabin support tube assembly mounts to the cabin floor and the firewall.

NOTE: Removal of the inboard screw of each side mount is accomplished after removing the forward cabin floor access covers (see figure 10-7).

e. Lift the cabin support tube assembly clear of the helicopter.

64-40-11. INSTALLATION OF CABIN SUPPORT TUBE ASSEMBLY. Installation of the cabin support tube assembly is the reverse of removal.

64-50-1. CABIN DOORS. (See figure 64-1-3.)

64-50-2. DESCRIPTION. The cabin doors are plastic panels supported by tubular aluminum frames. The doors are hinged at the front. Two directional flow snap vents are provided in the left-hand door, and four in the right-hand door.

a. The cabin doors are fitted with adjustable spring-loaded latch mechanisms. The handles on the inside and on the outside of the door frames are direct acting.

b. The cabin doors are hung on separable hinges, to provide the necessary jettison mechanism. The hinge pins on the door leaf engage pin slots in the fixed leaves. A dog in the fixed leaf holds the hinge pin in the slot when the jettison lock pin is inserted through the fixed leaf and the dog. Removal of the jettison lock pin permits the dog to pivot outward disengaging the hinge pin from the slot in the fixed leaf.

64-50-10. REMOVAL OF CABIN DOORS.
a. Unlatch the doors.
b. Support the door to prevent binding on the hinges and disengage the door jettison mechanism.
c. Carefully lift the door clear of the helicopter.

64-50-11. INSTALLATION OF CABIN DOORS.
a. Locate the doors so that the hinge pins in the door leaf assemblies engage the pin slots in the fixed hinge leaves.
b. Lock the hinge pins, and engage the door jettison mechanism. (Refer to paragraph 64-50-13.)

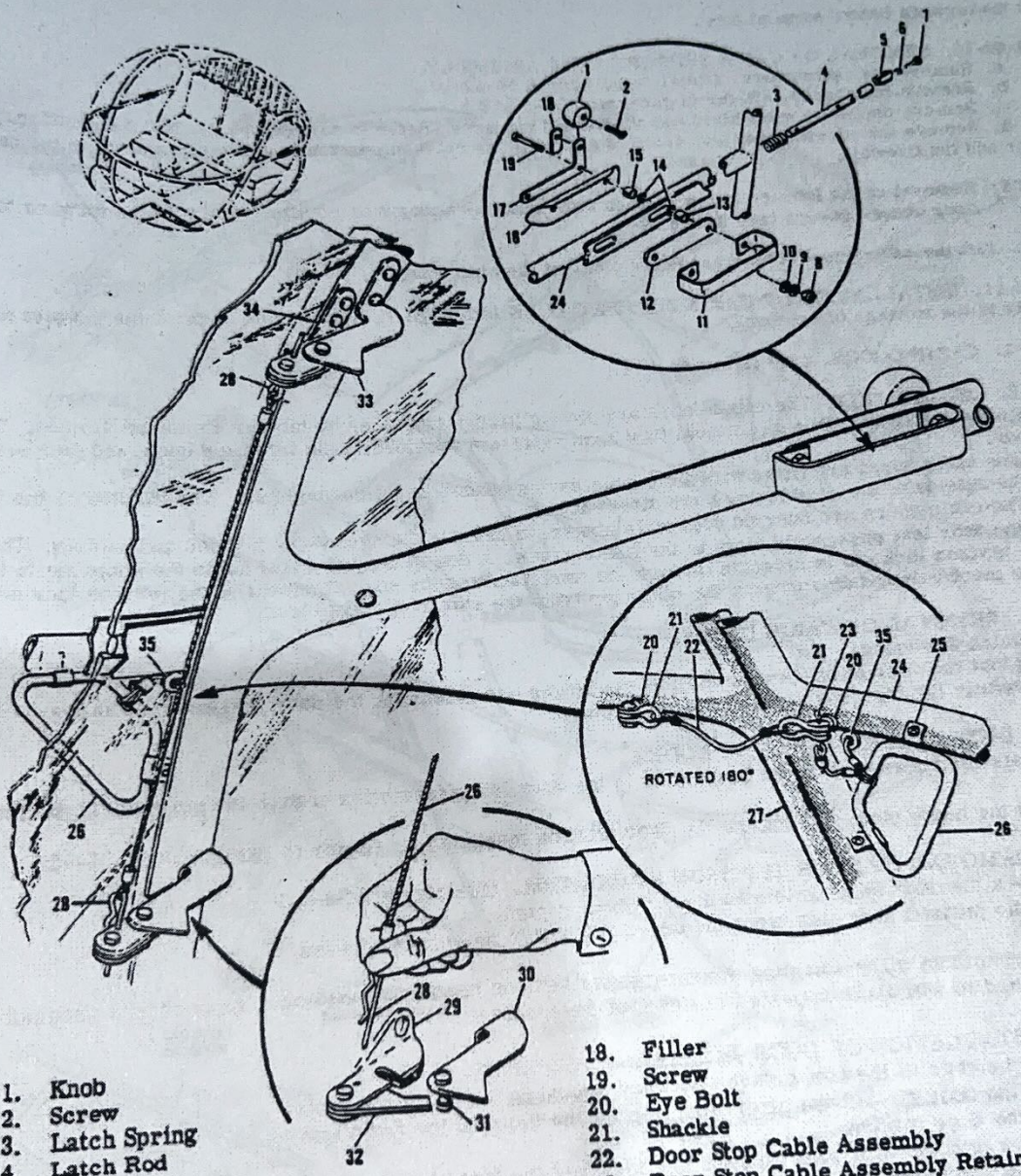
64-50-12. REMOVAL OF DOOR JETTISON MECHANISM. (See figure 64-1-3.)
a. Remove the door stop cable assembly retaining pins.
b. Pull the jettison lock pins from the upper and lower fixed hinge leaves.

NOTE: The aluminum clips securing the emergency jettison handles to the cabin support tube assembly are not designed to withstand repeated removal of the handles.

64-50-13. INSTALLATION OF DOOR JETTISON MECHANISM.
a. Rotate the dogs in the fixed leaves outward exposing the hinge pin slots.
b. Locate the door so that the hinge pins engage the slots in the fixed leaves.
c. Rotate the dogs inward.
d. Insert the jettison lock pins through the dogs and the fixed leaves.
e. Insert the door stop cable assembly retaining pins.

64-50-14. REMOVAL OF CABIN DOOR HANDLES AND LATCHES. (See figure 64-1-3.)
a. Remove the screws, tubular spacers and washers securing the handle and knob to the door frame assembly.
b. Remove the inside knob and outside handle.
c. Withdraw the latch rod and spring from the door frame.

64-50-15. INSTALLATION OF CABIN DOOR HANDLES AND LATCHES.
a. Insert the latch spring and rod in the door frame.
b. Adjust the position of the latch rod and spring so that the screw holes in the latch rod aline with the screw holes in the handles and the slots in the door frame.
c. Install the spacers and washers as required to obtain free movement between the guard plates and the frame assembly. The washers are installed next to the latch rod. The spaces are installed next to the guard plates.
d. Install the screws.



1. Knob
2. Screw
3. Latch Spring
4. Latch Rod
5. Latch Pawl
6. Washer
7. Screw
8. Nut
9. Washer
10. Washer
11. Door Handle
12. Latch Plate
13. Outboard Latch Spacer
14. Washer
15. Inboard Latch Spacer
16. Guard Plate
17. Arm
18. Filler
19. Screw
20. Eye Bolt
21. Shackle
22. Door Stop Cable Assembly
23. Door Stop Cable Assembly Retaining Pin
24. Cabin Support Tube Assembly
25. Clip
26. Jettison Release Assembly
27. Door Frame
28. Lock Pin
29. Lower Jettison Hinge Assembly
30. Lower Aft Door Hinge Leaf Assembly
31. Hinge Pin
32. Lower Jettison Hinge Dog
33. Upper Aft Door Hinge Leaf Assembly
34. Upper Jettison Hinge Assembly
35. Grommet

Figure 64-1-3. Cabin Door Installation

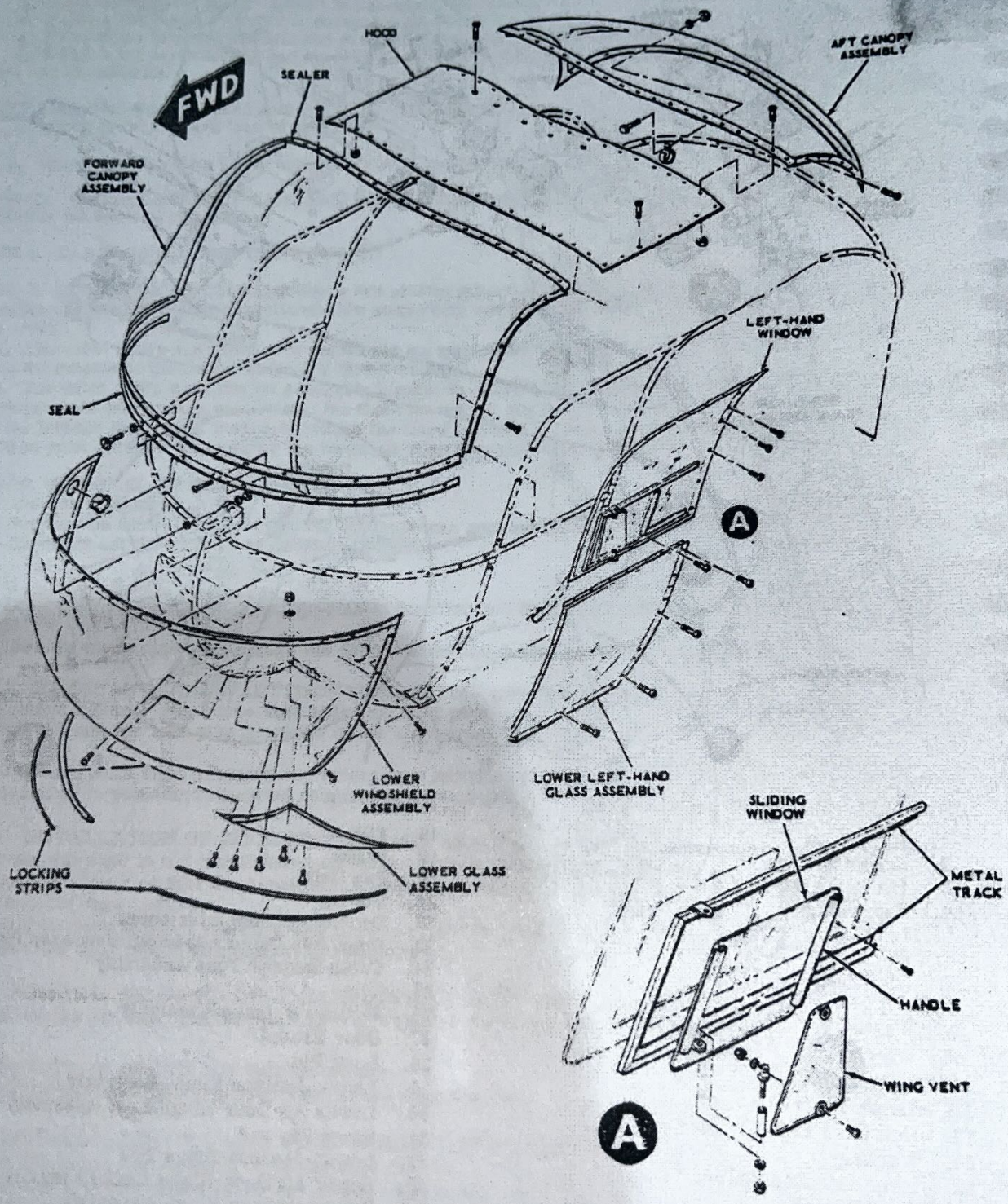


Figure 64-101-1. Canopy, Lower Windshield and Windshield Glasses, Four-Place Configuration

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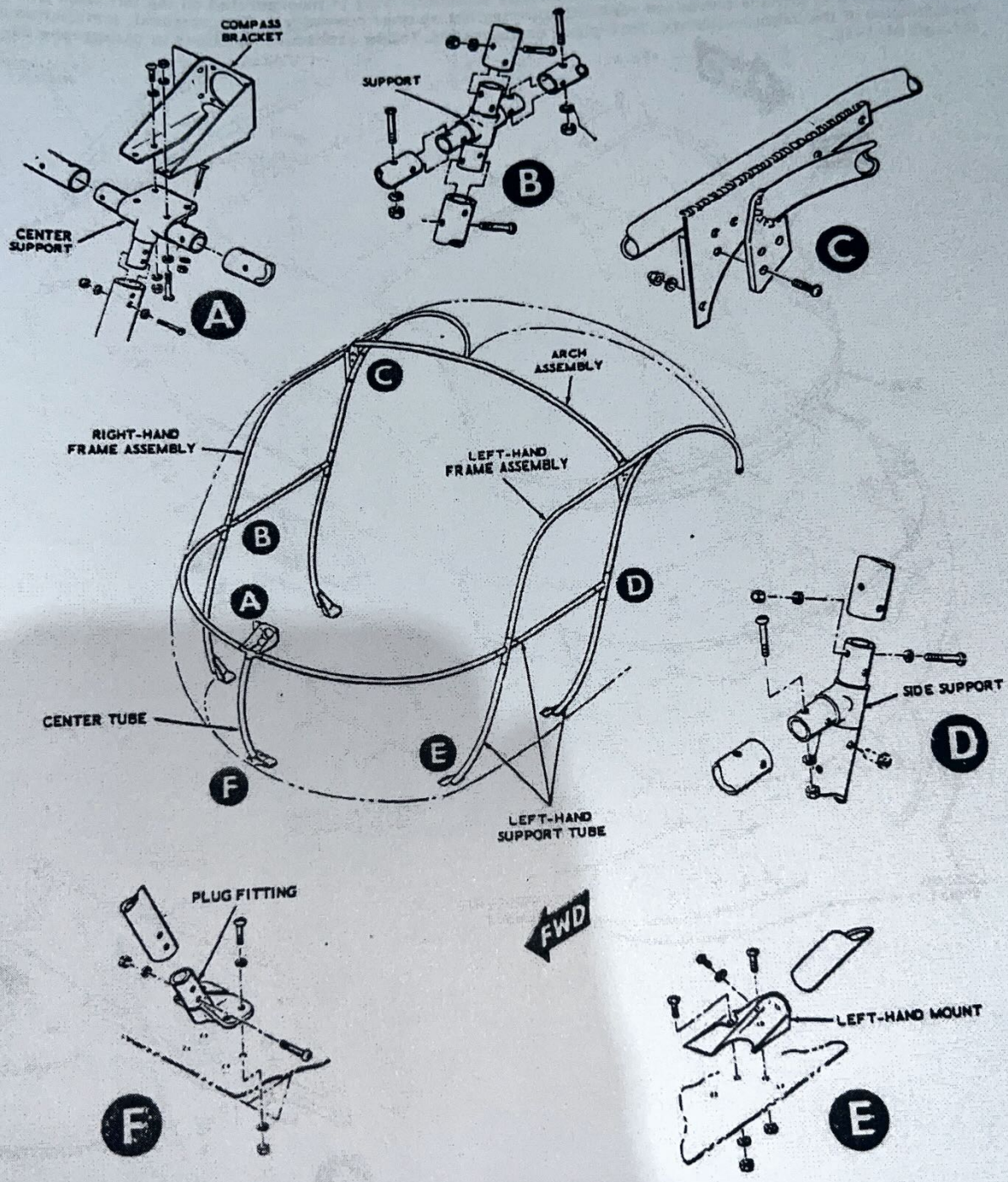

Figure 64-101-2. Cabin Support Tube Assembly, Four-Place Configuration

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64-101-1. CABIN ENCLOSURE, FOUR-PLACE CONFIGURATION. (See figures 64-101-1 and -2.)

64-101-2. DESCRIPTION. The cabin enclosure of the four-place configuration is essentially the same as the three-place configuration except that the former contains the necessary splices and extensions for the increased length of the cabin. A sliding window and a manually adjustable wing is incorporated on the left and right-hand window glasses to provide increased ventilation during hot weather operations. For removal, installation and maintenance of the cabin enclosure, four-place configuration, follow procedures outlined in paragraphs 64-1-1 through 64-1-40.

POWER PLANT AND RELATED SYSTEMS

70-1-1. POWER PLANT AND RELATED SYSTEMS.

70-1-2. DESCRIPTION. The power plant and its related functional systems are located on the basic body, aft of the firewall. The installation includes the following: the engine, engine mount and snubber assemblies; cooling, exhaust, induction and carburetion systems; clutch and transmission assemblies; and fuel, oil and ignition systems.

70-1-10. REMOVAL OF THE POWER PLANT. (See figures 70-1-1 and 70-1-2.)

a. Prior to removal of the power plant from the helicopter, accomplish the following preliminary steps:

(1) If the power plant assembly is in an operating condition, preserve engine and transmission if either or both will remain in storage for any appreciable length of time. (Refer to Section 10.)

CAUTION: DISCONNECT ANY EXTERNAL POWER; TURN MASTER SWITCH AND IGNITION SWITCH OFF.

(2) Disconnect the battery.
(3) Drain engine and transmission lubrication systems. (Refer to Section 10.)
(4) Drain the fuel system above the engine deck. (Refer to Section 10.)
(5) Provide a suitable overhead hoist with a minimum capacity of 1400 pounds for lifting the power plant.

NOTE: If the overhead hoist is not portable, position the helicopter to facilitate maneuvering it away from the hoisted power plant.

(6) Remove the main rotor assembly. (Refer to Section 50.)
(7) Attaching hoisting eye (table 92-1-I, item 19) as shown in figure 10-11.
(8) Remove the forward tail rotor drive shaft. (Refer to Section 24.)

b. Whenever it is convenient, remove the transmission. (Refer to Section 23.)

c. Remove the main drive clutch installation and engine adapter from the crankshaft flange (Section 21). Attach vertical lifting tool, Lycoming Special Tool No. 64753, on the crankshaft flange, using spacers between the crankshaft flange and lifting tool to prevent damage to the inner gimbal assembly seal.

d. Disconnect or remove (as applicable) the related systems components as follows:

(1) Disconnect the electrical plug connectors at the following accessories: rotor tachometer generator, transmission oil temperature bulb, transmission oil pressure warning switch, anticollision light, engine oil temperature bulb, carburetor air temperature bulb, engine tachometer generator and the aft magneto harness at the engine deck.

(2) Remove the electrical terminals at the engine starter and the generator, and the retard and primary magneto switch leads from the right and left-hand magneto breaker cover.

(3) Disconnect the knife disconnects in the wiring for the cylinder head temperature, primer solenoid, and transmission warning switch.

(4) Disconnect the wiring harness from the right-hand and front sides of the engine accessory case.
(5) Remove the engine air intake duct assembly. (Refer to Section 76.)
(6) Disconnect the cyclic control firewall-to-transmission pushrod assemblies.
(7) Disconnect the collective control firewall-to-transmission push rod assemblies.
(8) Disconnect the cabin heating assembly. (Refer to Section 88.)
(9) Remove the exhaust system. (Refer to Section 76.)

(10) Disconnect the following fuel lines: hose between the auxiliary fuel pump and the engine driven fuel pump; drain hose attached to engine driven fuel pump; and the drain hose attached to bottom of engine air induction system and carburetor drain system. Plug all openings.

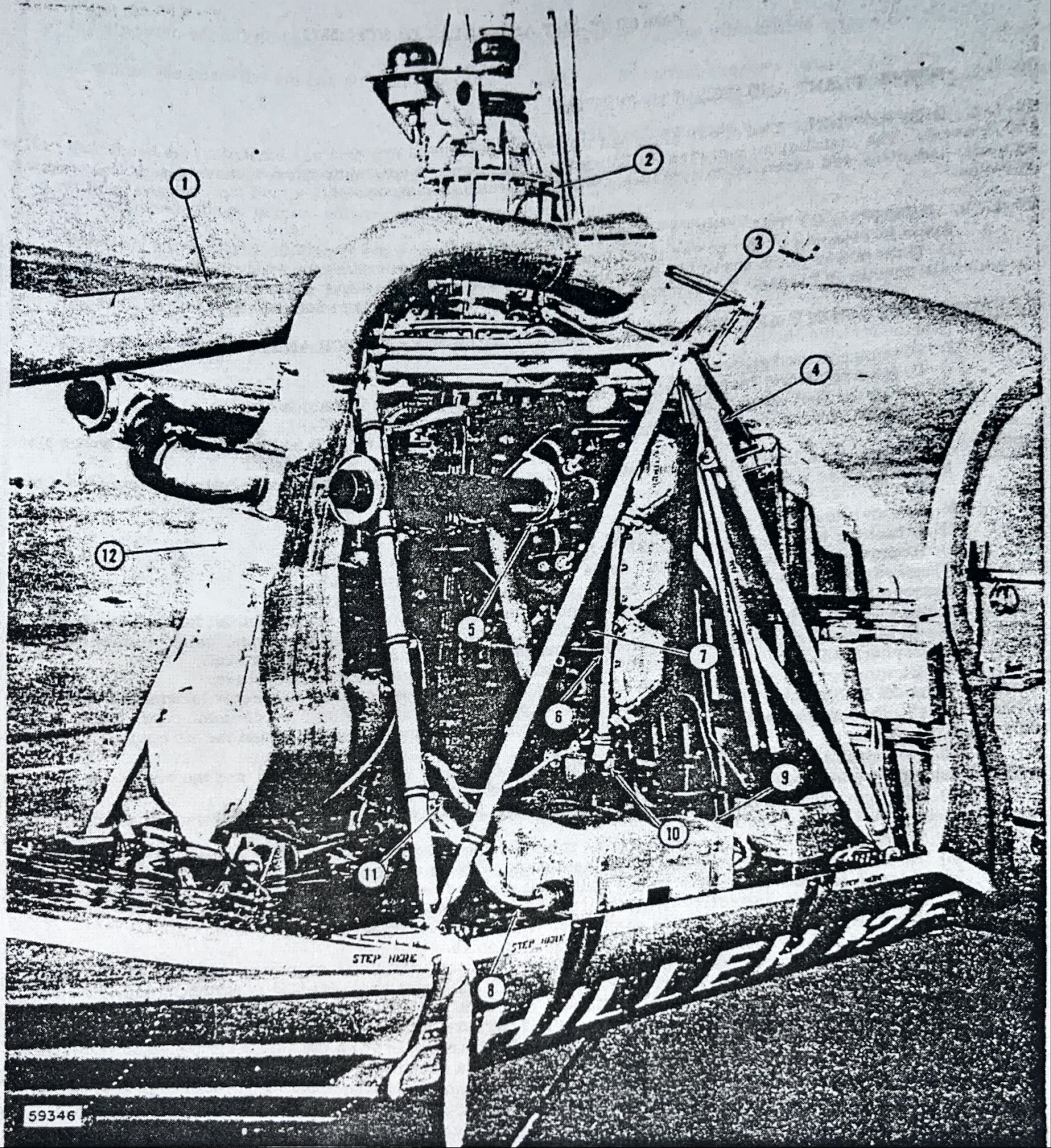
(11) Disconnect the throttle actuating cable and mixture control cable from the carburetor.
(12) Disconnect the carburetor heat control cable from the lever on the engine air induction assembly.
(13) Remove the carburetor(s) and lower air induction assembly. (Refer to Section 72.)

(14) Disconnect the following parts of the oil system(s): the drain, inlet, and return hose assemblies from the engine accessory case; engine oil tank vent hose; transmission oil pump inlet and discharge hose; transmission oil cooler to transmission hose; cooling fan gear box to transmission oil tank hose; transmission case and tail rotor drive unit drain hose to transmission oil pump drain hose and engine case breather hose. Plug all openings.

(15) Remove the oil cooler duct assembly.
(16) Disconnect the oil, fuel and manifold pressure lines at the engine deck.
(17) Disconnect the engine snubber assemblies. (Refer to Section 63.)

e. Whenever it is desired to leave the engine mount assembly installed on the helicopter, the power plant should be removed as follows:

(1) Remove the engine and transmission oil cooler assemblies. (Refer to Section 73.)
(2) Remove engine-to-engine mount ground strap and anticollision ground wire.
(3) Remove the detachable frame assembly from the left-hand side of the engine mount assembly.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(4) Lift the engine sufficiently to take its weight off the fore and aft mounting bolts in the outer gimbal assembly.

(5) Remove the nuts, washers and bolts securing the outer gimbal ring and the left-hand engine mount struts to the engine mount.

NOTE: Take care not to lose the shim washers if installed.

(6) Lift the power plant sufficiently to swing the engine clear of the helicopter.

(7) Place the power plant in a suitable engine stand. (See figure 70-1-3.)

f. Whenever it is necessary to use the engine mount assembly as an engine buildup stand, the engine mount assembly shall be removed with the power plant as follows:

(1) Disconnect the wiring harness assembly from the aft side of the engine junction box; the electrical plug through engine deck aft of junction box, and the power plant-to-basic body ground strap.

(2) Disconnect and remove engine breather tube from the aft right-hand engine mount.

(3) Disconnect the upper end of the lateral and longitudinal cyclic control pushrods from the firewall upper bellcrank assemblies.

(4) Disconnect the lower end of firewall collective rod assembly and bungee assembly from the collective control bellcrank.

(5) Lift the engine sufficiently to take the engine weight off the engine mount assembly attaching bolts.

(6) Remove nuts, washers and bolts securing the engine mount to the engine deck of the basic body.

(7) Lift the power plant together with the engine mount assembly clear of the helicopter.

CAUTION: DO NOT LOWER THE ENGINE WEIGHT ONTO THE ENGINE MOUNT ASSEMBLY UNTIL A SUITABLE FIXTURE HAS BEEN LOCATED UNDER THE ENGINE MOUNT ASSEMBLY LEGS TO PREVENT THEM FROM SPREADING.

70-1-11. INSTALLATION OF POWER PLANT. (See figures 70-1-1 and 70-1-2.) The following steps in the installation of the power plant in the helicopter shall be performed whether or not the engine has been removed independent of the engine mount assembly:

a. Position a suitable overhead hoist with a minimum rated capacity of 1400 pounds.

b. Attach hoisting eye (table 92-1-I, item 19), or if transmission is not installed, attach Lycoming Special Tool No. 64753 to engine crankshaft flange.

c. Lift power plant clear of engine stand.

NOTE: In cases where the overhead hoist is not portable the helicopter should be located to facilitate maneuvering it under the hoisted power plant.

d. When the engine mount frame assembly has been removed with the power plant, the installation procedure is the reverse of removal. (Refer to paragraph 70-1-10, f.)

NOTE: It is permissible to deflect the engine mount frame assembly a maximum of 0.38-inch to provide bolt hole alinement.

e. When the engine mount assembly has been retained on the helicopter, the following procedure shall be followed in completing the installation of the power plant:

(1) Lower the power plant carefully through the opening in the left-hand side of the engine mount assembly.

(2) Locate the power plant in the engine mount assembly so that the holes in the outer gimbal assembly bearings are in line with the holes in the engine mount assembly.

(3) Position the left-hand struts and install bolts, washers and nuts.

NOTE: The forward bolt head must be to the right-hand side of the helicopter. The aft bolt head must be to the left-hand side.

(4) Check that the maximum gap between each gimbal bearing and engine mount frame fitting assembly does not exceed 0.015-inch before tightening the bolt. If necessary, use AN960-1016L or AN960PD1016L washers to reduce the gap. Insert the washers between the gimbal bearing locking ring and the frame fitting assembly.

(5) Install the detachable frame assembly on the left-hand side of the engine mount assembly.

NOTE: It is permissible to deflect the detachable frame assembly a maximum of 0.050-inch to provide bolt hole alinement.

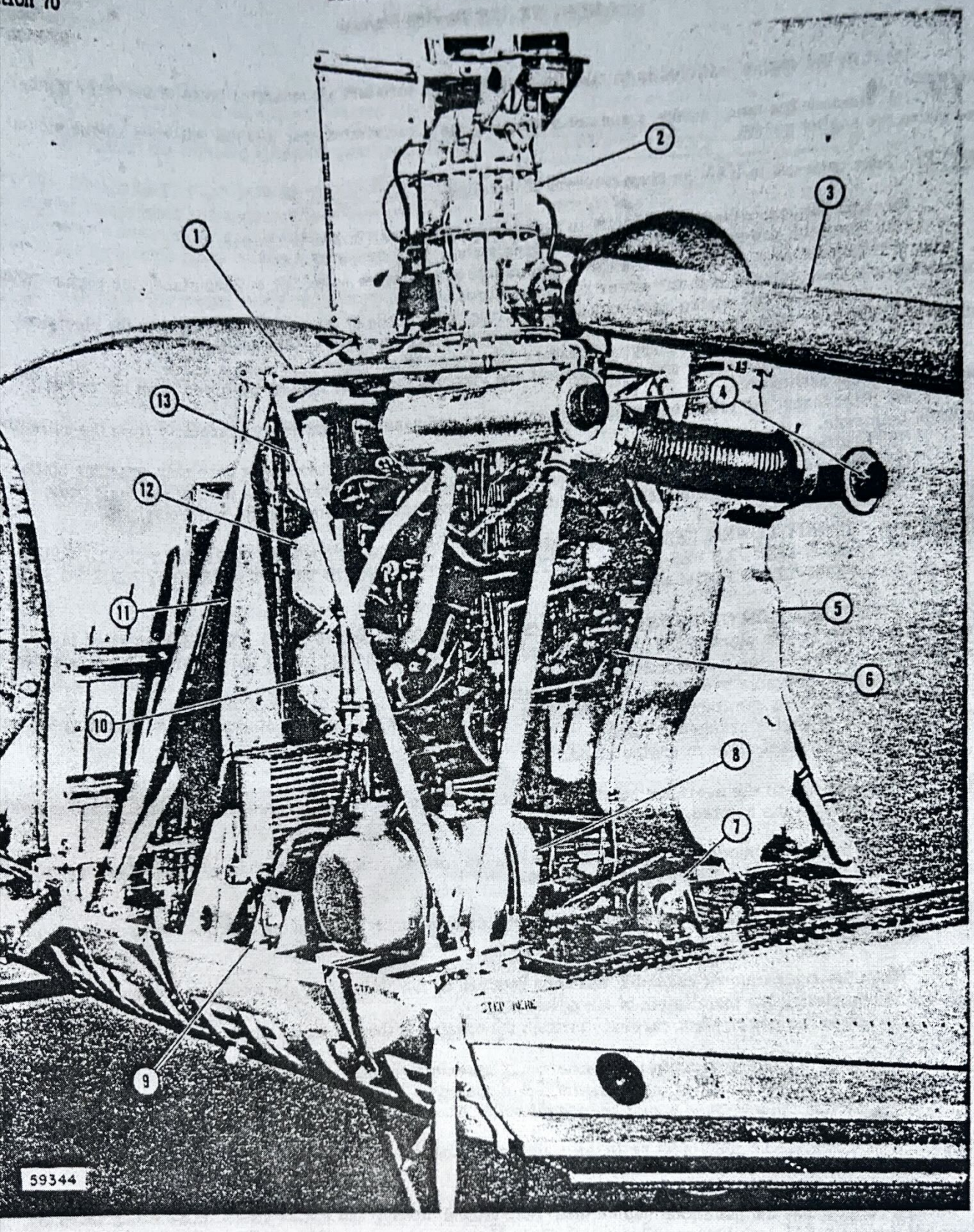
(6) Tighten the bearing bolts to 250/300 pound-inch torque.

(7) Connect the engine snubber assemblies. (Refer to Section 63.) No rigging is necessary at this time.

(8) Install main drive clutch. (Refer to Section 21.)

(9) Install the transmission. (Refer to Section 23.)

(10) Connect engine-to-engine mount electrical ground strap and anticollision ground wire.



1. Engine Strut Assembly
2. Transmission
3. Tail Rotor Forward Drive Shaft
4. Engine Exhaust System
5. Engine Air Induction System
6. Carburetor
7. Aft Snubber Assembly
8. Oil Tank
9. Left-Hand Snubber Assembly
10. Left-Hand Rocker Box Drain Manifold
11. Oil Cooler Duct Assembly
12. Engine
13. Engine Frame Assembly

Figure 70-1-2. Aft Left-Hand View of Power Plant Installation

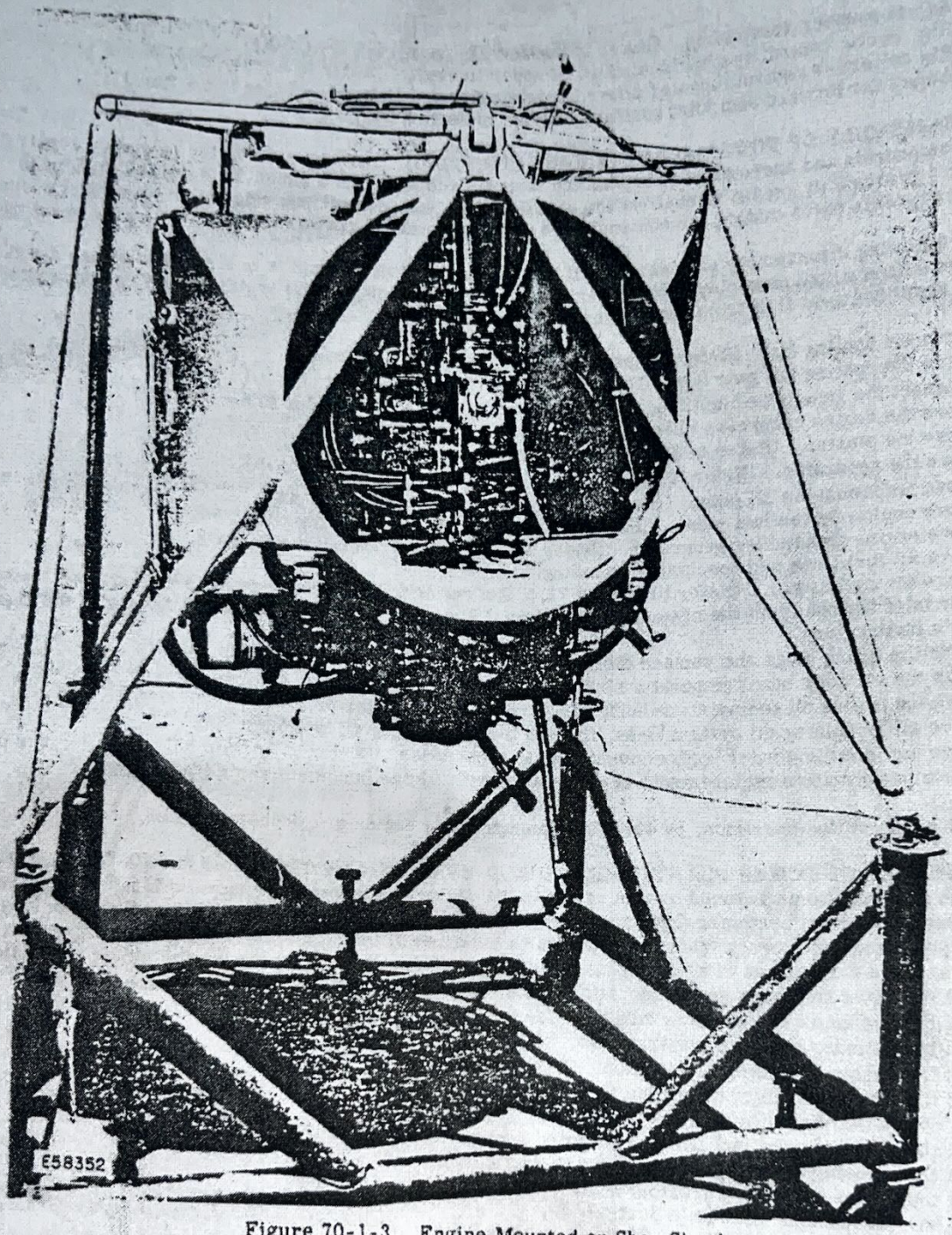


Figure 70-1-3. Engine Mounted on Shop Stand

(11) Install forward tail rotor drive shaft. (Refer to Section 24.)
(12) Install engine and transmission oil cooler(s). (Refer to Section 73.)
(13) Install engine oil tank. (Refer to Section 73.)
(14) Install electrical plugs; assemble knife connectors and secure electrical wiring harness.
(15) Connect fuel, oil and manifold pressure hoses. (Refer to Section 81.)
(16) Connect oil system hoses, lines and fittings. (Refer to Section 73.)
(17) Install exhaust system. (Refer to Section 76.)
(18) Install engine air induction system. (Refer to Section 76.)
(19) Install oil cooler air duct. (Refer to Section 73.)
(20) Connect fuel system hoses, lines and fittings.
(21) Connect engine air flexible duct.
(22) Connect cabin heating system. (Refer to Section 88.)
(23) Install collective control bellcrank-bracket and pushrod assemblies. (Refer to Section 31.)
(24) Install cyclic control bellcrank-bracket and pushrod assemblies. (Refer to Section 33.)
(25) Install main rotor assembly. (Refer to Section 50.)

(26) Adjust snubber assemblies. (Refer to Section 33, paragraph 33-1-30.)
(27) Rig cyclic control system located aft of upper firewall. (Refer to Section 33.)
(28) Rig collective controls located above the upper firewall linkage. (Refer to Section 31.)
(29) Adjust the forward slip joint position. (Refer to Section 24.)

70-1-20. DISASSEMBLY OF POWER PLANT (ENGINE STRIPPING). Instructions for the extensive repair or overhaul of components and assemblies is beyond the intended scope of this manual. Refer to the applicable manufacturer's overhaul or repair manual for the specifications and instructions relative to these operations. Refer to the applicable parts catalog for nomenclature and part numbers required to procure replacement parts.

NOTE: The following disassembly procedure shall be carried out with the engine in a suitable engine stand or in the engine mount assembly. Whenever possible, the stripping of the engine should be accomplished in a sheltered area free from blowing dust or contamination.

a. Remove the cooling fan. (Refer to Section 74.)
b. Remove the cooling fan gear box. (Refer to Section 74.)
c. Disconnect the generator blast tube; remove the cooling shroud. (Refer to Section 74.)
d. Remove the engine crankcase breather tube. Plug hole.
e. Remove the starter. (Refer to Section 83.) Install cover plate.
f. Remove the generator. (Refer to Section 83.) Install cover plate.
g. Remove transmission oil pump. (Refer to Section 73.) Install cover plate.
h. Remove engine driven fuel pump. (Refer to Section 72.) Install cover plate.
i. Remove engine tachometer generator. (Refer to Section 81.) Install cover plate.
j. Remove all fuel lines and associated plumbing.
k. Remove the carburetor. (Refer to Section 72.) If a replacement carburetor is to be installed, remove the carburetor inlet fittings from the removed carburetor. Preserve carburetor in accordance with the engine manufacturer's instructions.
l. Remove the spark plugs and replace them with dehydrator plugs.
m. Remove the cylinder head temperature bulb. (Refer to Section 81.)
n. Remove the engine oil temperature bulb. Replace with dehydrator plug.
o. Remove all remaining oil system lines, fittings and tees. Plug all openings.
p. Remove the inner and outer engine mount gimbal assemblies. (Refer to Section 63.) Install cover plate.
q. Perform preservation requirements in accordance with engine manufacturer's instructions.

NOTE: After preservation operation, be sure all openings in the engine are properly sealed.

70-1-21. ASSEMBLY OF POWER PLANT (ENGINE BUILD-UP.) (See figures 70-1-1 and 70-1-2.) Perform depreservation and conditioning procedures on replacement engines removed from storage in accordance with procedures described in the Lycoming Operators Manual (Model VO-540 series helicopter engine). Remove all dehydrators, plugs and dust covers from the engine to be installed in the helicopter. The following engine build-up procedure shall be carried out with the engine in a suitable engine stand or in the engine mount assembly:

a. Install the inner and outer engine mounting gimbal assemblies. (Refer to Section 63.)
b. Install the engine oil temperature bulb. (Refer to Section 81.)
c. Install the cylinder head temperature bulb. (Refer to Section 81.)
d. Install the engine tachometer generator. (Refer to Section 81.)
e. Install the starter. (Refer to Section 83.)
f. Install the generator. (Refer to Section 83.)
g. Install the engine driven fuel pump. (Refer to Section 72.)
h. Install the transmission oil pump. (Refer to Section 73.)
i. Install the engine crankcase breather tube.
j. Install the carburetor. (Refer to Section 72.)
k. Install the fuel lines and fittings. (Refer to Section 72.)
l. Install the oil system lines and fittings. (Refer to Section 73.)
m. Install the cooling shroud. (Refer to Section 74.)
n. Install the cooling fan gear box. (Refer to Section 74.)
o. Connect the cooling fan drive shaft. (Refer to Section 74.)
p. Install the cooling fan. (Refer to Section 74.)

NOTE: Helicopters Serial No. 2199 and subsequent, and those helicopters on which Service Bulletin 2027A has been accomplished, shall have the crankshaft oil front plug in the engine crankshaft (31, figure 21-1-1) seated with 0.41-inch clearance below the face of the highest point of the crank shaft attaching flange. Apply Loctite, Grade B (item 24, table 10-VI) to plug prior to installation.

70-10-1. ENGINE. (See figures 70-1-1 and 70-1-2.)

70-10-2. DESCRIPTION. The UH-12E helicopter is powered by a VO-540 series helicopter engine. The engine is a six cylinder, horizontally-opposed, dry sump, air cooled model designed for vertical installation in rotor

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driven aircraft. The manufacturer is the Lycoming Division of AVCO Manufacturing Corporation, Williamsport, Pennsylvania.

a. Refer to the current FAA Engine Specification E-304 for the VO-540-series engine specifications.

b. In locating various engine components, the parts are described in their relation to the position of the engine as installed in the airframe. The power take-off section of the engine is considered as the upper section, and the accessory drive end as the lower section. Components such as the carburetor and induction system are at the rear of the engine. Reference to the left side and the right side of the engine are made with the observer standing at the rear of the engine looking forward. The cylinders are numbered from the top to bottom. The left bank cylinders are numbered one, three and five, beginning at the top; the right bank cylinders are numbered two, four and six.

NOTE: It is not within the scope of this manual to reflect special inspection and maintenance requirements imposed by the Engine Manufacturer after an engine overspeed. Refer to the Engine Manufacturer's publications for specific inspection procedures.

70-10-3. TROUBLESHOOTING THE ENGINE. Refer to table 70-1-I for engine troubleshooting.

70-20-1. IGNITION SYSTEM. Refer to Lycoming Operators Manual (Model VO-540 Series Helicopter Engine) for magneto timing information. Whenever using timing tool (table 92-1-I, item 50) for turning the engine, observe the following procedure.

a. Warm up engine (if necessary) to ensure a minimum oil temperature of 16.33°C (65°F).

b. Remove rear spark plugs from each cylinder.

c. Remove hydraulic pump cover located on the right-hand aft portion of the engine accessory drive case.

d. Insert splined end of timing adapter (table 92-1-I, item 50) in hydraulic pump drive shaft.

e. Insert suitable combinations of 3/8-inch drive extensions with a handle in the universal end of timing adapter and turn engine to meet magneto timing requirements.

NOTE: The timing adapter is designed to fail at the universal joint end before the maximum torque of 125 pound-feet is exceeded on the hydraulic pump drive.

f. Reinstall hydraulic pump drive cover and spark plugs upon completion of engine turning operation.

Table 70-1-I. Troubleshooting the Engine

TROUBLE	PROBABLE CAUSE	REMEDY
Starter fails to turn engine	Discharged battery	Recharge battery.
	Defective battery	Replace battery.
	Defective starter switch	Replace switch.
	Defective main power relay	Replace relay.
	Defective starter or starter clutch	Replace with a serviceable starter.
Starter fails to engage or disengage	Damaged or defective starter	Replace with a serviceable starter.
Engine fails to start	Fuel shut off	Open fuel shutoff valve.
	Lack of fuel	Fill fuel tank with aviation gasoline (Table 10-II).
	Overpriming	Open full throttle, ignition switch "OFF". Mixture control in idle cut-off. Crank engine about 10 revolutions. Return to normal starting procedure.
	Underpriming	Continue priming. Crank engine.
	Insufficient fuel flow	Inspect fuel system for clogged strainers and damaged lines. Verify fuel pump discharge rate. Replace defective parts.

Table 70-1-I. Troubleshooting the Engine (cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Engine fails to start (cont)	Insufficient fuel pressure	Inspect fuel system for leaks. Verify fuel pump discharge pressure. Replace defective parts. Adjust fuel pump relief valve.
	Dirt or water in fuel system	Drain and flush system. Clean strainers. Refill fuel tank.
	Fouled spark plugs or defective spark plugs	Clean, inspect and regap spark plugs or replace spark plugs.
	Low-charge battery	Recharge battery.
	Incorrect throttle grip setting	Open throttle to one-tenth of its full range.
	Loose ignition connections	Inspect and tighten all ignition terminals.
	Shorted magneto ground wire	Inspect ground wire for cracks in insulation. Replace defective wire.
	Defective ignition switch	Replace switch.
	Incorrect magneto timing	Synchronize and reset magneto timing.
	Defective condenser	Replace condenser.
	Leaks in induction system	Inspect system for loose connections or defective gaskets. Replace defective parts. Tighten all connections.
	Incorrect manual mixture control setting at ALT COMP position	Check mixture control cable for proper rig; carburetor mixture control arm for proper actuation to R position.
	Defective starting vibrator	Replace with serviceable starting vibrator.
Engine fails to idle properly	Incorrect idle mixture adjustment	Adjust idle mixture screw.
	Incorrect throttle idle rpm adjustment	Adjust carburetor arm idle rpm adjustment screw.
	Insufficient fuel pressure	Inspect fuel system for leaks. Verify fuel pump discharge pressure. Replace defective parts. Adjust fuel pump relief valve.
	Leaks in induction system.	Inspect system for loose connections or defective gaskets. Replace defective parts. Tighten all connections.
	Low cylinder compression	Check engine compression.
	Insufficient fuel flow	Inspect fuel system for clogged strainers and damaged lines. Verify fuel pump discharge rate. Replace defective parts.
	Faulty or loose spark plugs	Inspect spark plugs. Clean and adjust if necessary. Replace.

Table 70-1-I. Troubleshooting the Engine (cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Engine fails to idle properly (cont)	Leaking primer system	Note exhaust for black smoke at idle. Repair primer system as necessary.
	Insufficient fuel pressure	Inspect fuel system for leaks. Verify fuel pump discharge pressure. Replace defective parts. Adjust fuel pump relief valve.
	Excessive fuel pressure	Adjust fuel pump relief valve. Replace defective parts.
	Dirt or water in fuel system	Drain and flush system. Clean strainers. Refill fuel tank.
	Defective ignition system	Clean, inspect and regap spark plugs and magneto breaker points. Inspect and test magneto switch and condenser. Check terminals for tightness. Replace defective parts. Check wiring with electric tester.
	Restricted air flow	Inspect air filter elements. Inspect induction system inlet screen.
Engine backfires	Incorrect spark plug lead connections	Check and reconnect ignition harness.
	Fouled spark plugs	Clean, inspect and regap spark plugs.
	Incorrect automatic mixture (lean)	Adjust fuel pump relief valve. Inspect carburetor. Replace defective parts.
	Incorrect valve clearance	Adjust valve clearances.
	Dirt or water in fuel system	Drain anf flush system. Clean strainers. Refill fuel tank.
	Incorrect grade of fuel	Drain fuel system. Refill fuel tank with aviation gasoline (Table 10-II).
	Insufficient fuel pressure	Inspect fuel system for leaks. Verify fuel pump discharge pressure. Replace defective parts. Adjust fuel pump relief valve.
	Defective ignition system	Clean, inspect and regap spark plugs and magneto breaker points. Inspect and test magneto switch and condenser. Check terminals for tightness. Replace defective parts.
	Incorrect magneto timing	Synchronize and reset magneto timing.
Engine falters or runs roughly	Incorrect automatic mixture (lean)	Adjust fuel pump relief valve. Inspect carburetor. Replace defective parts.
	Incorrect automatic mixture (rich)	Check primer valve for leakage. Adjust fuel pump relief valve. Inspect carburetor. Replace defective parts.

Table 70-1-I. Troubleshooting the Engine (cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Engine fails to idle properly (cont)	Leaking primer system	Note exhaust for black smoke at idle. Repair primer system as necessary.
	Insufficient fuel pressure	Inspect fuel system for leaks. Verify fuel pump discharge pressure. Replace defective parts. Adjust fuel pump relief valve.
	Excessive fuel pressure	Adjust fuel pump relief valve. Replace defective parts.
	Dirt or water in fuel system	Drain and flush system. Clean strainers. Refill fuel tank.
	Defective ignition system	Clean, inspect and regap spark plugs and magneto breaker points. Inspect and test magneto switch and condenser. Check terminals for tightness. Replace defective parts. Check wiring with electric tester.
	Restricted air flow	Inspect air filter elements. Inspect induction system inlet screen.
Engine backfires	Incorrect spark plug lead connections	Check and reconnect ignition harness.
	Fouled spark plugs	Clean, inspect and regap spark plugs.
	Incorrect automatic mixture (lean)	Adjust fuel pump relief valve. Inspect carburetor. Replace defective parts.
	Incorrect valve clearance	Adjust valve clearances.
	Dirt or water in fuel system	Drain anf flush system. Clean strainers. Refill fuel tank.
	Incorrect grade of fuel	Drain fuel system. Refill fuel tank with aviation gasoline (Table 10-II).
	Insufficient fuel pressure	Inspect fuel system for leaks. Verify fuel pump discharge pressure. Replace defective parts. Adjust fuel pump relief valve.
	Defective ignition system	Clean, inspect and regap spark plugs and magneto breaker points. Inspect and test magneto switch and condenser. Check terminals for tightness. Replace defective parts.
	Incorrect magneto timing	Synchronize and reset magneto timing.
Engine falters or runs roughly	Incorrect automatic mixture (lean)	Adjust fuel pump relief valve. Inspect carburetor. Replace defective parts.
	Incorrect automatic mixture (rich)	Check primer valve for leakage. Adjust fuel pump relief valve. Inspect carburetor. Replace defective parts.

Table 70-1-I. Troubleshooting the Engine (cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Engine falters or runs roughly (cont)	Excessive carburetor air temperature	Adjust carburetor air heat control valve linkage and cables. Inspect valve. Check induction system for obstructions. Verify accuracy of carburetor air temperature indicator.
	Defective ignition system	Clean, inspect and regap spark plugs and magneto breaker points. Inspect and test magneto switch and condenser. Check terminals for tightness. Replace defective parts. Check ignition wiring with electric tester. Use high tension "megger" where applicable.
	Dirt or water or incorrect grade of fuel in fuel system	Drain and flush system. Refill fuel tank with aviation gasoline (Table 10-II).
Engine fails to develop full power	Incorrect throttle arm adjustment	Open throttle. Inspect carburetor. Adjust linkage and cables.
	Incorrect grade of fuel	Drain fuel tank and refill with proper fuel (Table 10-II).
	Restricted fuel flow	Inspect fuel system for clogged strainers and damaged lines. Verify fuel pump discharge rate. Replace defective parts.
	Carburetor defective or out of adjustment	Replace with a serviceable carburetor.
	Leak in induction system	Inspect system for loose connections or defective gaskets. Replace defective parts. Tighten all connections.
	Restriction in the carburetor air intake duct	Clean carburetor air intake duct.
	Defective ignition system	Clean, inspect and regap spark plugs and magneto breaker points. Inspect and test magneto switch and condenser. Replace defective parts.
High cylinder head temperature	Excessive carburetor air temperature	Adjust carburetor heat control valve.
	Incorrect automatic mixture (lean)	Adjust fuel pump relief valve. Inspect carburetor. Replace defective parts.
	Incorrect magneto timing	Synchronize and reset magneto timing.
	Defective cylinder head temperature indicator	Test the indicator and resistance bulb. Replace defective parts.
High oil temperature	Insufficient oil supply	Fill oil tank with aircraft reciprocating (piston) engine lubricating oil (table 10-II).
	Excessive blow-by	Check engine compression.
	Failed or failing bearings in engine or transmission.	Inspect oil filter element, drain oil and check for metal particles. Replace engine or transmission if excessive metal is found.

Table 70-1-I. Troubleshooting the Engine (cont)

TROUBLE	PROBABLE CAUSE	REMEDY
High oil temperature (cont)	Defective oil cooler valve	Replace oil cooler.
	Incorrect magneto timing	Synchronize and reset magneto timing.
	Restricted air flow in oil cooler	Inspect cooler core for foreign particles. Clean or replace cooler.
	Defective oil temperature indicator	Replace defective pressure indicator.
High oil pressure	Cold oil	Allow engine to warm up.
	Incorrect grade of oil	Drain and flush oil system. Fill oil tank with aircraft reciprocating (piston) engine lubricating oil (table 10-II).
	Defective or obstructed oil pressure relief valve	Clean and inspect valve. Replace defective parts.
	Defective oil pressure indicator	Replace defective pressure indicator.
Low oil pressure	Incorrect grade or insufficient supply of oil	Drain and flush oil system. Fill oil tank with aircraft reciprocating (piston) engine lubricating oil (table 10-II).
	Dirt in oil filter	Clean filter.
	Restricted oil flow	Inspect oil system for clogged strainers and damaged lines. Verify oil pump discharge pressure. Replace defective parts.
	Defective or obstructed oil pressure relief valve	Clean and inspect valve. Replace defective parts.
	Bearing excessively worn or defective	Inspect oil filter element, drain oil and check for metal particles.
	Defective oil pressure indicator	Replace defective pressure indicator.
Slow oil pressure build up (cold weather operation)	Trapped air in line to pressure indicator	Drain and flush line. Refill line with kerosene, federal specification VV-K-211.
Excessive oil consumption	Incorrect grade of oil	Drain and flush oil system. Fill oil tank with aircraft reciprocating (piston) engine lubricating oil (table 10-II).
	Bearings excessively worn or defective	Inspect oil filter element, drain oil and check for metal particles.
	Worn piston rings	Check engine compression.
	Oil leaks in the engine or external oil system	Replace defective parts.
	Defective scavenger oil pump	Replace with a serviceable oil pump.
Excessive rpm drop during magneto check	Fouled spark plugs	Clean, inspect and regap spark plugs.
	Defective spark plugs	Replace spark plugs.
	Incorrect magneto timing	Synchronize and reset magneto timing.

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Table 70-1-I. Troubleshooting the Engine (cont)

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive rpm drop during magneto check (cont)	Moisture in ignition system	Clean, dry and inspect terminals.
Low fuel pressure (engine-driven pump)	Dirt in fuel strainers	Clean strainers.
	Restricted fuel flow	Inspect fuel system for clogged strainers and damaged lines. Verify engine-driven fuel pump discharge pressure. Replace defective parts.
	Leak in fuel system	Inspect system for loose connections or defective seals. Replace defective parts. Tighten all connections.
	Defective or leaking shutoff valve	Clean and inspect valve. Replace defective parts.
	Defective or dirty pressure relief valve	Clean and inspect valve. Readjust and verify discharge pressure. Replace fuel pump if defective.
Low or no fuel pressure (auxiliary fuel pump)	Open circuit breaker	Reset circuit breaker.
	Discharged battery	Recharge battery.
	Defective or dirty pump pressure relief valve	Clean and inspect valve. Replace defective parts.
	Worn pump motor brushes	Replace auxiliary fuel pump or complete assembly.
	Defective pump	Replace auxiliary fuel pump assembly.
Engine does not stop (with ignition switch)	Faulty magneto ground circuit	Check magneto ground wire and terminals for open circuit. Replace defective parts.
	Defective ignition switch	Inspect switch failure to make contact. Replace defective parts.
Engine does not stop (with mixture control lever)	Incorrect manual mixture control setting at IDLE CUT-OFF position	Check mixture control cable for proper rig; check carburetor mixture control arm for proper actuation to L position.

FUEL SYSTEM

72-1-1. FUEL SYSTEM. (See figures 72-1-1 and 72-1-2.)

72-1-2. DESCRIPTION. The fuel system of the UH-12E helicopter consists of either a standard fuel system or a standard fuel system plus an auxiliary fuel system kit installation. The standard fuel system includes: an engine-driven fuel pump, a strainer, and shutoff valve; an electrically operated auxiliary fuel pump; a 46-gallon capacity bladder type fuel cell; and either a single carburetor or a dual carburetor installation. The fuel system instrumentation consists of a fuel quantity and a fuel pressure indicating system. (Refer to paragraph 72-101-1 for auxiliary fuel system kit installation maintenance instructions).

72-1-40. PRESSURE CHECK OF FUEL SYSTEM.

a. Check the fuel system for its normal pressure of three to four psi when the engine driven pump only is in operation.

b. Check the fuel system for a slight pressure rise when the electrical auxiliary fuel pump is turned on (engine-driven pump operating).

NOTE: A pressure rise should be noticed with the auxiliary fuel pump in operation. If necessary adjust either pump within specified limits to provide pressure rise required.

c. Check all fuel lines and connections for evidence of leakage. Check the carburetor for leakage due to overflow. Replace all defective fittings or lines.

72-10-1. SINGLE CARBURETOR INSTALLATION. (See figures 72-1-3 and 72-1-4.)

72-10-2. DESCRIPTION. The single carburetor is an altitude compensating, natural atomization, float type unit. It is centrally located at the rear of the engine, attached to the inlet distribution chamber on the rear crankcase cover. Bellows for automatic pressure altitude mixture control, an accelerating pump and idle cut-off in the idle system are incorporated in the carburetor.

72-10-10. REMOVAL OF SINGLE CARBURETOR INSTALLATION. (See figures 72-1-3 and 72-1-4.)

a. Disconnect throttle and mixture control cable assemblies.
b. Disconnect fuel inlet, instrument and drain line from the carburetor.
c. Disconnect air intake and fuel pump drain line assemblies.
d. Detach carburetor and the mixture control support bracket from the engine air intake outlet by removing the cap screws and washers from the carburetor lower flange.
e. Remove bolts securing engine air intake to the carburetor support bracket.
f. Remove the attaching clamps and detach the lower air intake duct assembly from both the upper air intake duct assembly and the flexible air intake duct.

NOTE: Detach the lower duct assembly only as necessary for carburetor removal. Provide adequate support for the lower and upper duct assemblies during carburetor removal and installation.

g. Remove nuts and washers securing the carburetor to the carburetor mounting studs on the crankcase cover.
h. Discard the gaskets from the top flanges (two gaskets) and bottom flange (one gasket) of the carburetor.
i. Cover the opening to the distribution chamber with a suitable cover or plate to prevent entry of foreign material.

72-10-11. INSTALLATION OF SINGLE CARBURETOR INSTALLATION. (See figures 72-1-3 and 72-1-4.)

CAUTION: USE CARE IN POSITIONING THE CARBURETOR FLANGE OVER THE MOUNTING STUDS. A SCRATCH ON THE MOUNTING FLANGE CAN RESULT IN AN AIR LEAK.

a. Lower the engine air intake duct far enough to allow the installation of the carburetor and carburetor support bracket on the crankcase cover studs.
b. Install new gaskets on top of the carburetor, and between the carburetor support arm and the distribution chamber.
c. Secure with the four washers and nuts.
d. Install the gasket between the carburetor and engine air intake duct. Secure the bottom flange of the carburetor and the mixture control support bracket to the air intake duct with the four cap screws. Safety the heads together in pairs with lockwire.
e. Connect throttle control to the carburetor and attach the fuel inlet, instrument and drain lines.
f. Attach the mixture cable to the cable support bracket and mixture control arm.
g. Install the clamps attaching the flexible and upper air intake ducts to the lower duct assembly.

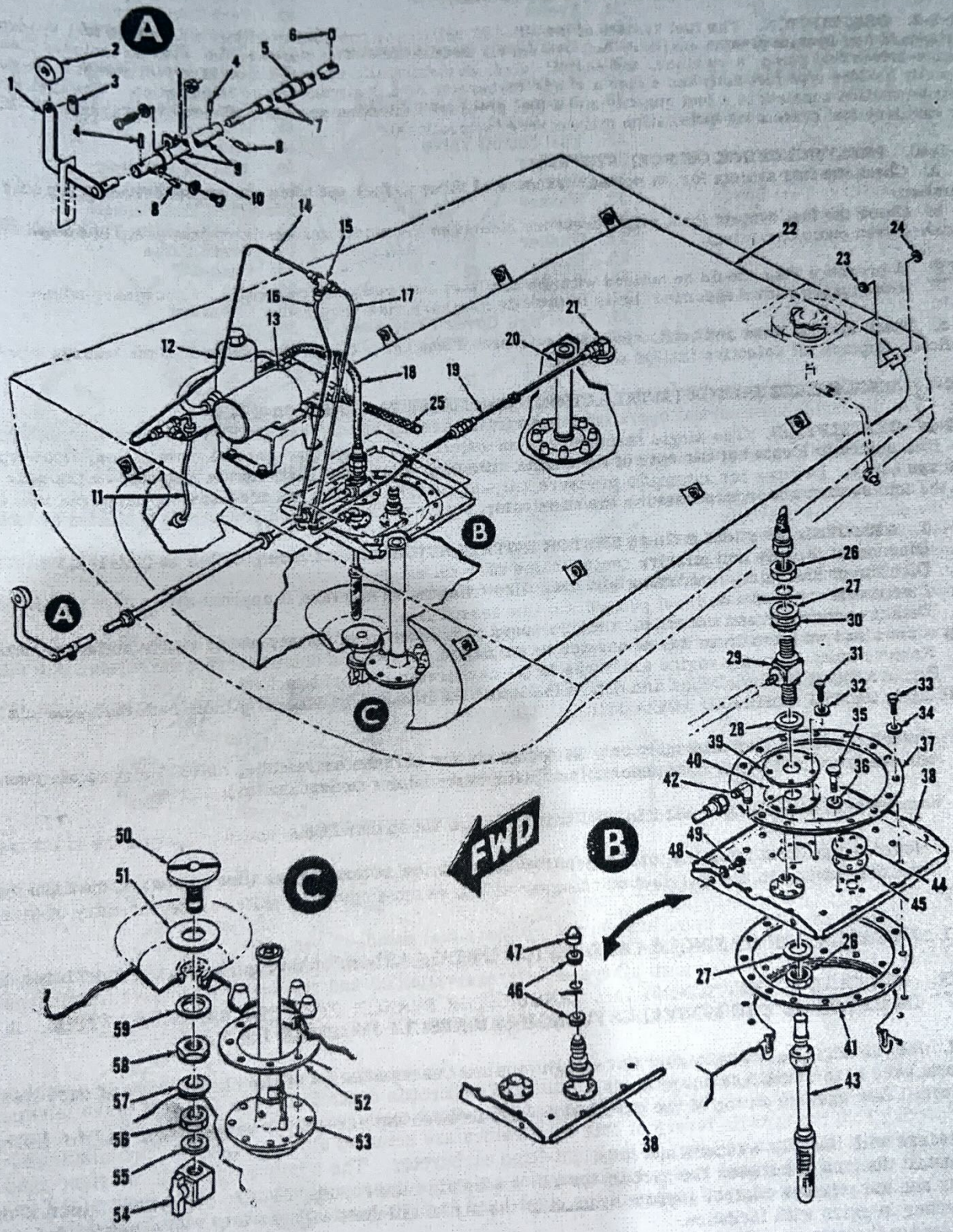

Figure 72-1-1. Forward Fuel System

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INDEX FOR FIGURE 72-1-1

1. Fuel Shutoff Valve Handle
2. Handle Control Knob
3. Knob Filler
4. Roll Pin
5. Tube Guide Bearing
6. Roll Pin
7. Control Tube Assy, Aft
8. Roll Pin
9. Control Tube, Forward
10. Clip
11. Lower Vent and Drain Line
12. Fuel Strainer
13. Auxiliary Fuel Pump
14. Upper Vent Line
15. Tee
16. Aft Vent Fwd Tube
17. Fwd Vent Tube
18. Fuel Supply Hose Assy
19. Aft Vent Aft Tube
20. Fuel Quantity Tank Unit, Aft
21. Aft Fuel Cell Vent Fitting
22. Fuel Cell Assembly
23. Eyelet
24. Washer
25. Fuel Supply Hose Assembly
26. Nut
27. Washer
28. Strainer and Valve Flange Gasket
29. Fuel Shutoff Valve
30. Washer
31. Bolt
32. Washer
33. Bolt
34. Washer
35. Bolt
36. Washer
37. Retainer
38. Fuel Cell Cover Plate Assy
39. Shutoff Valve Plate
40. Shutoff Valve Plate Gasket
41. Fuel Cell Cover Plate Gasket
42. Vent Tube Elbow
43. Strainer Assembly
44. Cover Plate
45. Cover Plate Gasket
46. Washer
47. Cap Assembly
48. Washer
49. Bolt
50. Fuel Cell Fitting
51. Sump Gasket
52. Tank Unit Gasket
53. Fuel Quantity Tank Unit, Fwd
54. Drain Valve
55. Gasket
56. Nut
57. Grommet
58. Nut
59. Washer

72-10-30. ENGINE IDLE ADJUSTMENT - SINGLE CARBURETOR. (See figure 72-1-4.)

a. Run the engine until normal operating temperatures are maintained and stabilized before attempting any adjustment.

b. Screw the idle rpm adjustment screw counter clockwise slowly until the engine idles at 1050 rpm (± 50 rpm).

c. Turn the carburetor idle mixture adjusting screw slowly toward the rich position as indicated by letter R until the engine runs unevenly.

d. Turn the carburetor idle mixture adjusting screw slowly toward the lean position as indicated by letter L until engine lags, or runs irregularly.

e. Turn the carburetor idle mixture adjusting screw slowly back toward R approximately 1/4-turn to provide smooth, even engine operation.

f. When the idle mixture is changed, the idle speed will change accordingly and it may be necessary to readjust the idle rpm adjustment screw and repeat steps b, c, d and e to obtain correct carburetor idle mixture.

CAUTION: NEVER BREAK THE SEAL ON THE CARBURETOR ECONOMIZER SCREW. FIELD ADJUSTMENT OF THE SCREW IS NOT AUTHORIZED.

g. Screw the idle rpm adjustment screw clockwise slowly until the engine idles at 1600 rpm (± 50 rpm).

h. Recheck throttle control cable assembly adjustments. (Refer to Section 75.)

72-10-40. DEPRESERVATION AND FLUSHING OF SINGLE CARBURETOR.

NOTE: Depreservation and flushing of a new carburetor may be accomplished after the carburetor has been installed on the engine.

a. Fill carburetor with fuel by turning on the auxiliary fuel pump.

b. Turn auxiliary fuel pump off, and drain all fuel from the carburetor through the carburetor drain valve.

c. Refill and drain carburetor until all traces of preservation oil and residue are removed from carburetor.

72-11-1. DUAL CARBURETOR INSTALLATION. (See figures 72-1-5 and 72-1-6.)

72-11-2. DESCRIPTION. Each carburetor used in the dual carburetor installation is similar in operation to the carburetor used in the single carburetor installation. The throttle control cable is attached to the left-hand carburetor. The throttle levers of the left-hand and right-hand carburetors are linked together by means of an interconnecting rod; the throttle levers of both carburetors are actuated simultaneously. The mixture control cable is attached to the mixture lever of the right-hand carburetor. The mixture levers of the right-hand and left-hand carburetors are linked together by means of a flexible interconnect cable. Movement of the mixture control cable actuates the mixture levers of the right-hand and left-hand carburetors simultaneously.

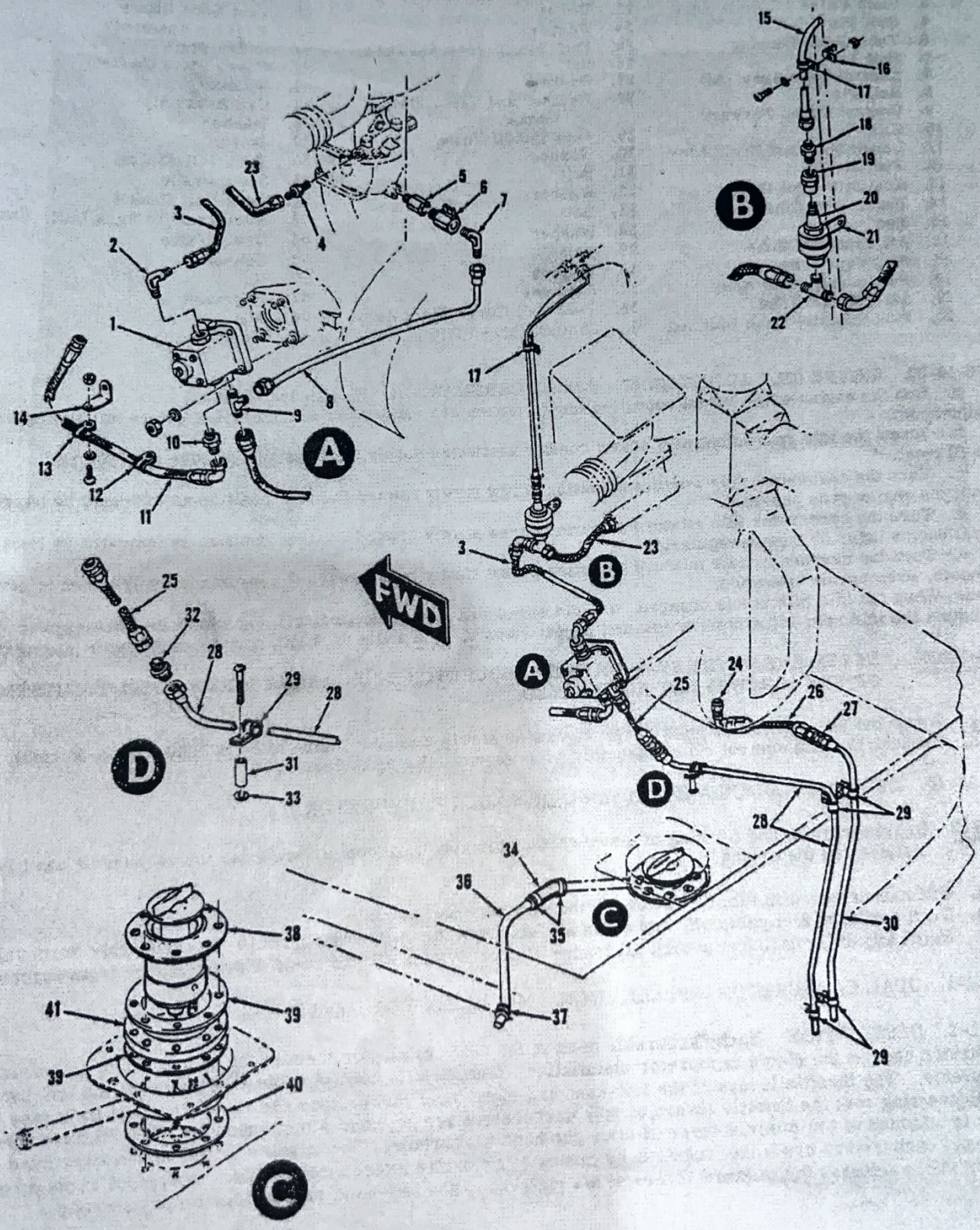

Figure 72-1-2. Aft Fuel System

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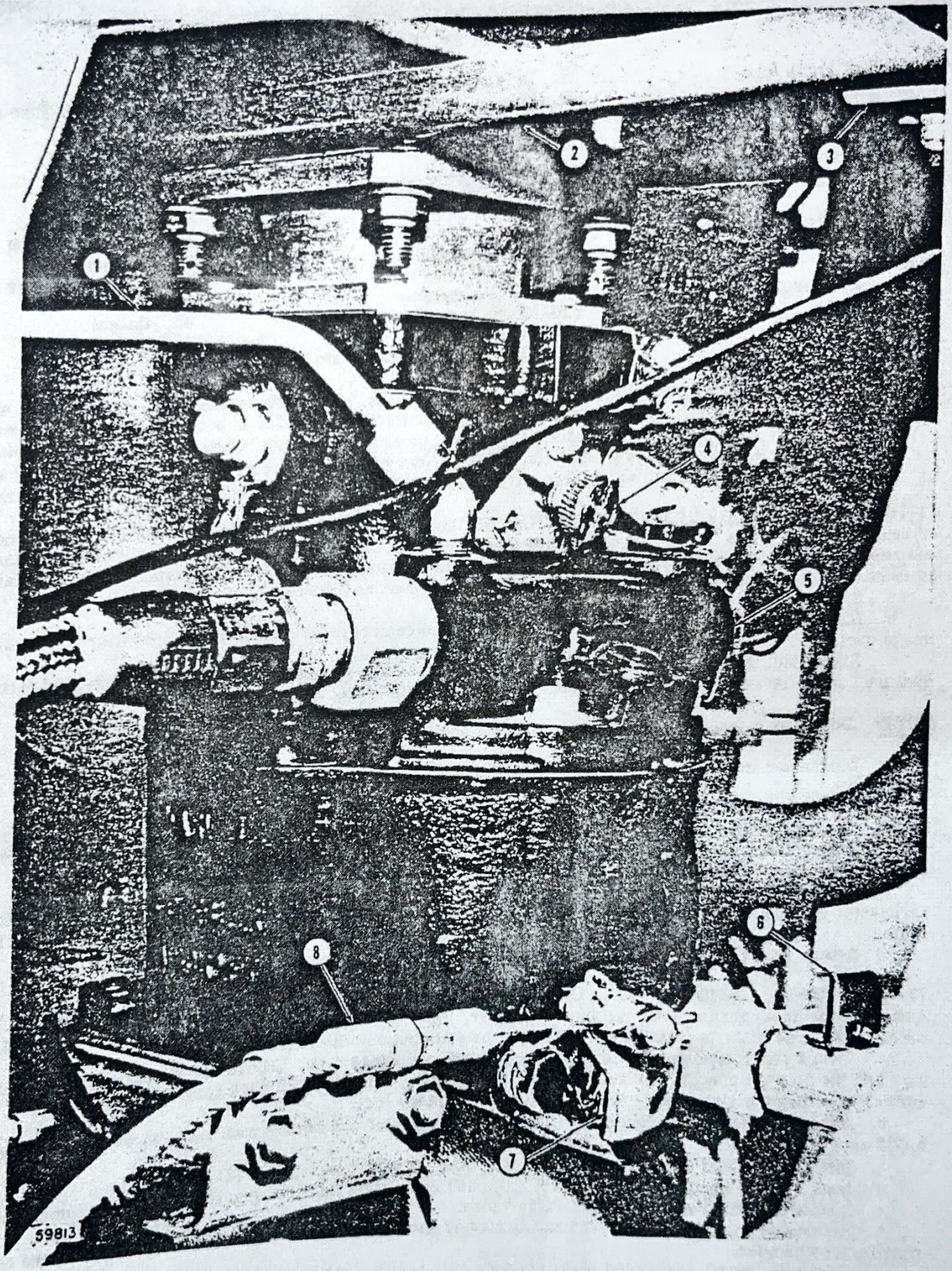

1. Fuel Pressure Instrument Line
2. Engine Air Intake Support Arm
3. Engine Air Intake Support Bracket
4. Idle Mixture Adjusting Screw
5. Carburetor
6. Carburetor Drain Valve
7. Mixture Control Lever
8. Mixture Control Cable

Figure 72-1-3. Left-Hand View of Single Carburetor Installation

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