

10.140 Tail Rotor Rigging (cont'd)

- 3) To decrease the total travel, shorten the C121-9 push-pull tube for right pedal travel and increase the length of C343-3 or C343-9 push-pull tube for left pedal travel.
- 4) Recheck the tail rotor blade angles per steps e) through h) above.
- j) Ensure all rod ends are installed properly by checking the push-pull tube witness holes. Tighten all rod end palnuts and jam nuts. Torque stripe all nuts.
- k) Balance tail rotor per Section 10.240.

10.150 Throttle Correlation Rigging (see Figure 10-8)

For in-service check and adjustment:

1. Verify idle rpm is correct with engine warm, clutch fully engaged, and throttle closed. Adjust O-540 idle to 53-57% and IO-540 idle to 58-62%.
2. Shut down helicopter.
3. Rotate twist-grip throttle fully closed through overtravel spring pressure to positive stop. Holding throttle tight against stop, raise collective full up while observing throttle arm on carburetor or fuel control, as applicable. Throttle arm should move 0.010-0.030 inch off of idle stop screw when collective up-stop is reached.
4. If necessary, adjust length of throttle push-pull tube at carburetor or fuel control, as applicable.
5. Standard torque jam nut(s) per Section 1.320, check witness holes, and torque stripe per Figure 2-1.

10.160 Actuator Rigging

No field adjustment of actuator-engaged belt tension is permitted. Adjust actuator's down-limit stop screw so there is a delay of less than 5 seconds before rotor starts turning when actuator is engaged at start up.

10.200 TRACK AND BALANCE

The Chadwick-Helmuth Vibrex system, the TEC ACES system, the Dynamic Solutions Systems' MicroVib system, or equivalent equipment is required to perform dynamic rotor balancing and in-flight tracking checks.

10.210 Equipment Requirements

The following list of equipment may be used on the R44 for track and balance:

- a) Balancers
 Chadwick-Helmuth 177M05
 Model Number 177M-6
 177M-6A
 177M-7
 177M-7A
 8350 series
 M192 series
 or equivalent equipment

- b) Strobex
 Chadwick-Helmuth 135M-10*
 Model Number 135M-10A*, B* and C*
 135M-11
 or equivalent equipment

* When tracking the main rotor using the 135M-10 series Strobex a double interrupter must be used.

- c) Cables, accelerometers/velocimeters, pickups, and targets**
 Chadwick-Helmuth 3140 D.C. Adapter Cable
 Model Number 3030 Magnetic pickup
 3319-1 or 10808-25 Magnetic pickup cable
 4177 Accelerometer
 4296-1 and -2 Accelerometer Cable
 3300 Target Patches
 4270 Target Patches
 7310 Velocimeter
 11210-20/-50 Velocimeter Cable

- d) Brackets**
 Robinson MT121-1 Magnetic Pickup Bracket

- e) Charts**
 Robinson Main Rotor Chart
 Tail Rotor Chart

** As required by the balancing equipment being used.

10.220 Equipment Installation10.221 Main Rotor Equipment Installation (see Figure 10-9A)

Refer to specific manufacturer's installation instructions when using balancing equipment other than Chadwick-Helmuth. Install Chadwick-Helmuth equipment as follows:

- a) Install the accelerometer/velocimeter under the upper console left-side attachment screw with cable connector pointing outboard.

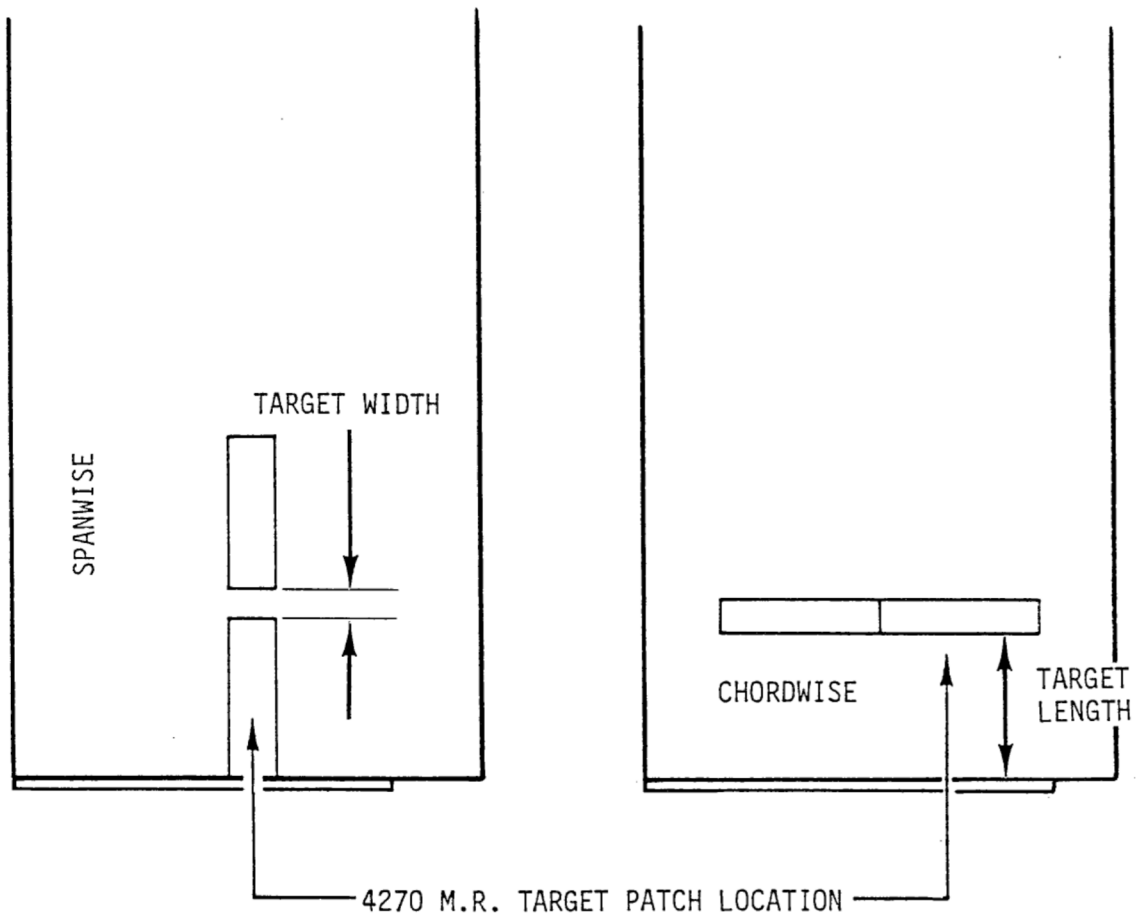


FIGURE 10-9 MAIN ROTOR TARGET PATCH LOCATION

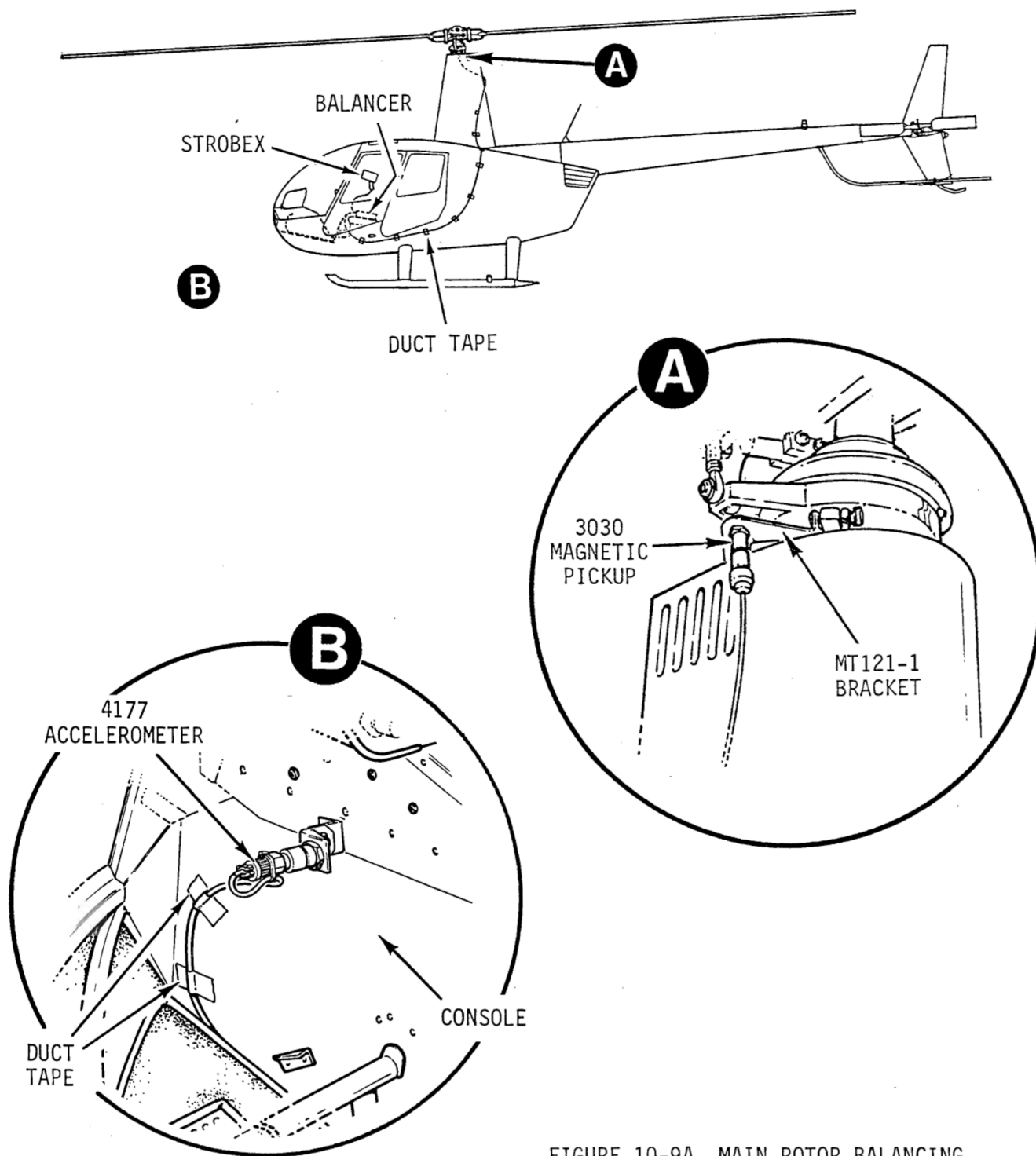


FIGURE 10-9A MAIN ROTOR BALANCING EQUIPMENT INSTALLATION

10.221 Main Rotor Equipment Installation (cont'd)

- b) Install MT121-1 Bracket onto the lower right-hand side of the swashplate.

WARNING

Ensure attachment bolts are torqued to 200 in.-lb plus nut drag. The MT121-1 Bracket will remain installed for in-flight track and balance.

- c) Install the 3030 magnetic pickup onto the MT121-1 Bracket. Set the interrupter pickup gap to 0.030" \pm 0.010".
- d) Attach the cable to the magnetic pickup. Pull collective stick full up and cyclic stick full left. Secure the cable to the mast fairing with duct tape. Route the cable to the lower front of the left door frame. Secure the cable every 12 inches with duct tape.

CAUTION

Security of the cable is essential as the helicopter will be flown at Vne.

- e) Attach the cable to the accelerometer/velocimeter mounted on the left forward hold down screw of the console. Secure with duct tape.

CAUTION

Ensure the cable cannot become entangled with tail rotor pedals.

- f) Attach the cables to the balancer and secure excess cable to the bracket in front of the left seat.
- g) Apply the 4270 target tapes to the main rotor blades per Figure 10-9.

10.222 Tail Rotor Equipment Installation (see Figures 10-9C and 10-9D)

NOTE

Prior to installing balancing equipment, verify blades are clean and smooth, no debris under tip covers (square tip blades), rod end and spherical bearing play are within limits, and elastomeric bearings (if applicable) are satisfactory.

1. Install accelerometer/velocimeter bracket under upper forward tail rotor gearbox output seal housing attachment bolt. Connector end of accelerometer/velocimeter must point up.
2. If using a Vibrex 2000-series balancer with photocell, install photocell bracket between velocimeter and velocimeter bracket as shown in Figure 10-9C.
3. If using Strobex to obtain clock angle, install a target tape spanwise facing outboard on one arm of tail rotor hub. If using photocell to obtain clock angle, install a target tape spanwise facing inboard on one arm of tail rotor hub.
4. Connect cable(s) to accelerometer/velocimeter and photocell (if used). Route cable(s) forward and wrap around tailcone several times. Secure with duct tape.

WARNING

Ensure cable(s) cannot entangle tail rotor.

5. If using Strobex to obtain clock angle, route cable to a position located approximately 20 feet to left of tail rotor. Place sandbags (or similar) on cable to prevent cable movement. If using photocell to obtain clock angle, cables may be routed into cabin and secured with duct tape to prevent cable movement.
6. Connect cable(s) to balancer.

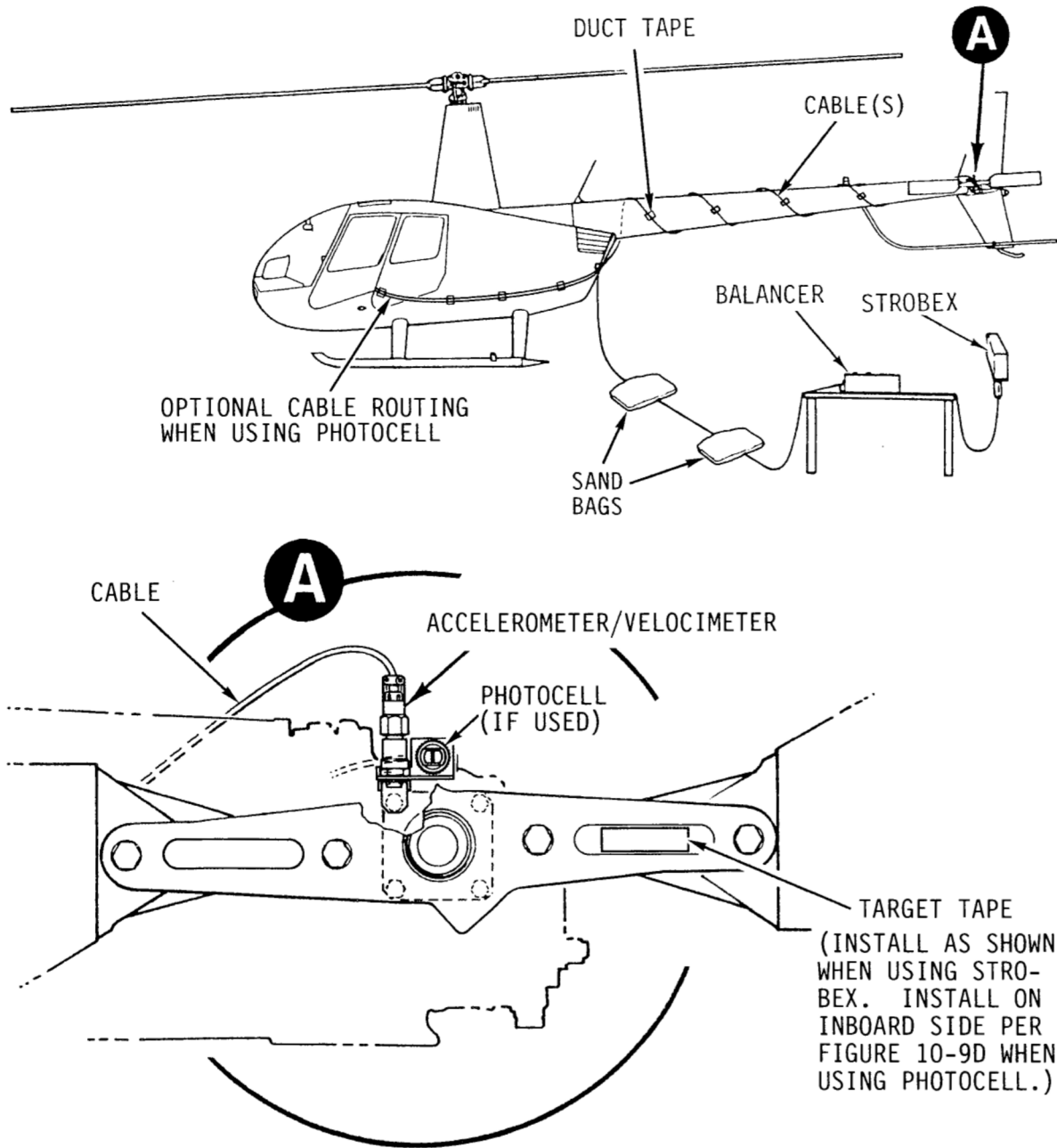
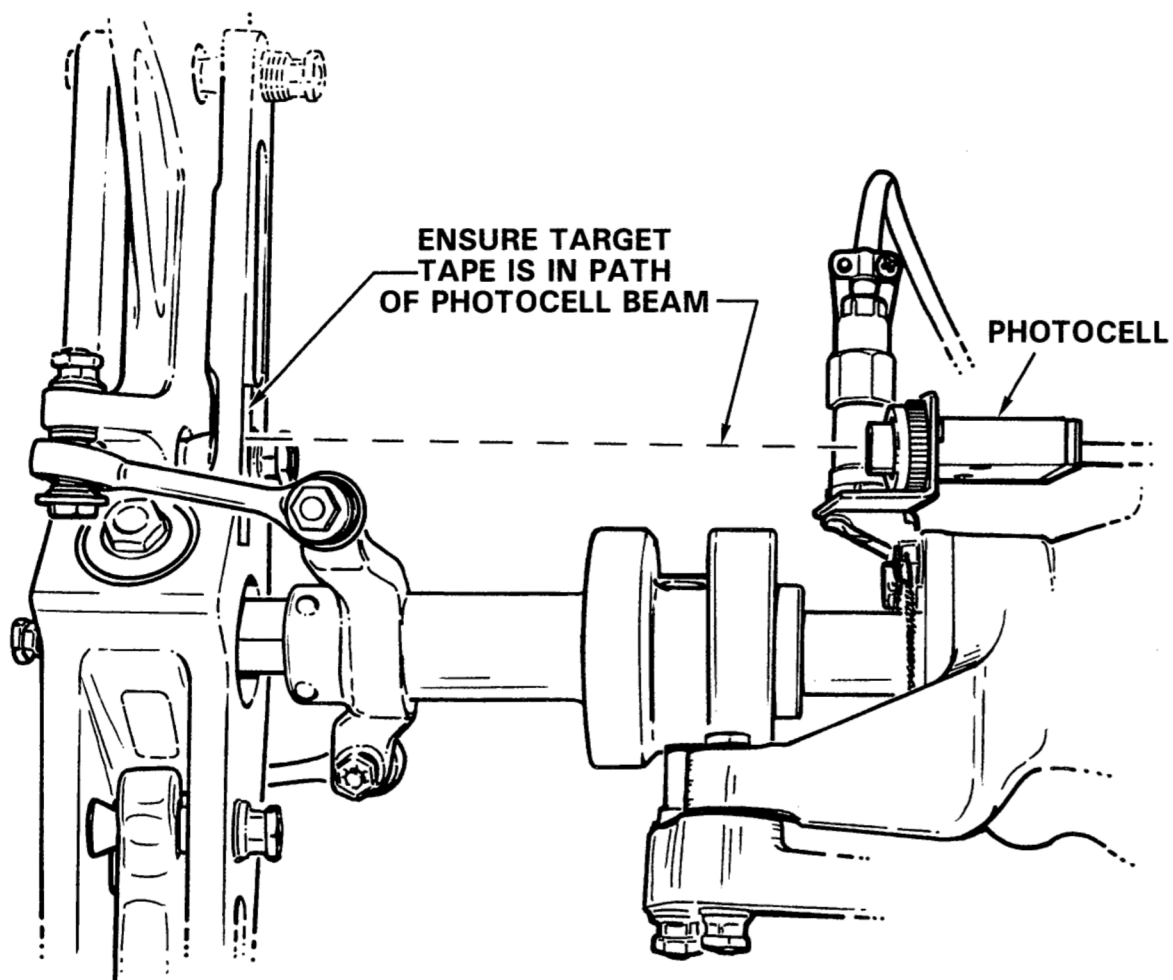


FIGURE 10-9C
TAIL ROTOR BALANCING EQUIPMENT INSTALLATION



(VIEW LOOKING FORWARD)

FIGURE 10-9D

TAIL ROTOR PHOTOCELL INSTALLATION

10.230 Main Rotor Track and Balance Procedure**NOTE**

Prior to installing balancing equipment, verify blades are clean and smooth, rod ends and spherical bearings play are within limits, correct swashplate tilting friction, and correct teeter and coning hinge frictions.

In-flight track and balance is accomplished using the following testing and adjustment sequence:

1. Check main rotor track in a hover. When using Vibrex 177- or 8350-series equipment, place Function knob in track position, RPM (flash rate) on Strobex to 326. Adjust track by shortening high blade pitch link per Section 10.232 to bring track within 0.25 inch.
2. Check main rotor balance in a hover. For Vibrex 177- or 8350-series equipment, place Function knob in "A" position, RPM on Phazor to 408. Adjust balance as indicated by main rotor balance chart (maximum 0.2 IPS).
3. Fly the helicopter at 50, 60, 70, 80, 90, 100, 110, 120, and 130 knots. Check track at each airspeed and record.

WARNING

Do not exceed Vne of helicopter when checking track.

4. Make slight tab adjustment to correct for a climbing blade by bending trim tab down per Section 10.233.

WARNING

Blades with two trim tabs are obsolete and must be removed from service.

5. Repeat Steps 3 & 4 as required until track will remain on at all airspeeds within 3/8 inch.
6. Readjust main rotor balance in a hover (maximum 0.2 IPS).
7. Check autorotational RPM per Section 10.250. Adjust as required.
8. Evaluate collective trim and adjust as required (non-hydraulic aircraft only).
9. Check main rotor balance in a hover. Adjust as required.

10.230 Main Rotor Track and Balance Procedure (cont'd)10.231 Main Rotor Balance Adjustments

Spanwise balance adjustments are made by adding or subtracting weight as indicated by the balance chart. Weight is changed by removing the blade tip cover and changing C298 tip weights. Fine adjustments may be made with AN960-10 or -10L washers and also by trimming washers.

Coarse adjustment of chordwise balance is accomplished by shifting rotor hub (see Section 9.124) as indicated on balance chart. Fine adjustment of chordwise balance is accomplished by adding or subtracting A255-1 or -2 chord weights or AN970-4 washers as indicated by balance chart. A maximum of four A255-2 weights (four A255-2 weights equal twelve A255-1 weights) may be installed.

Three A255-1 Weights = One A255-2 Weight

Eight AN970-4 Washers = A255-1 Weight

10.232 Main Rotor Pitch Link Adjustment

Two length adjustments can be made on the main rotor pitch link. Coarse adjustment is made by loosening upper rod end jam nut, disconnecting rod end from blade pitch horn and turning rod end up or down (one-half turn of rod end changes track approximately 0.25 inch).

Fine adjustment is made by leaving rod end connected to pitch horn and loosening rod end jam nut, loosening barrel jam nut, and then screwing barrel up or down. One barrel revolution is equivalent to one-half turn of rod end. Partial turns of barrel can be made by counting number of hex flats rotated (see Figure 10-11).

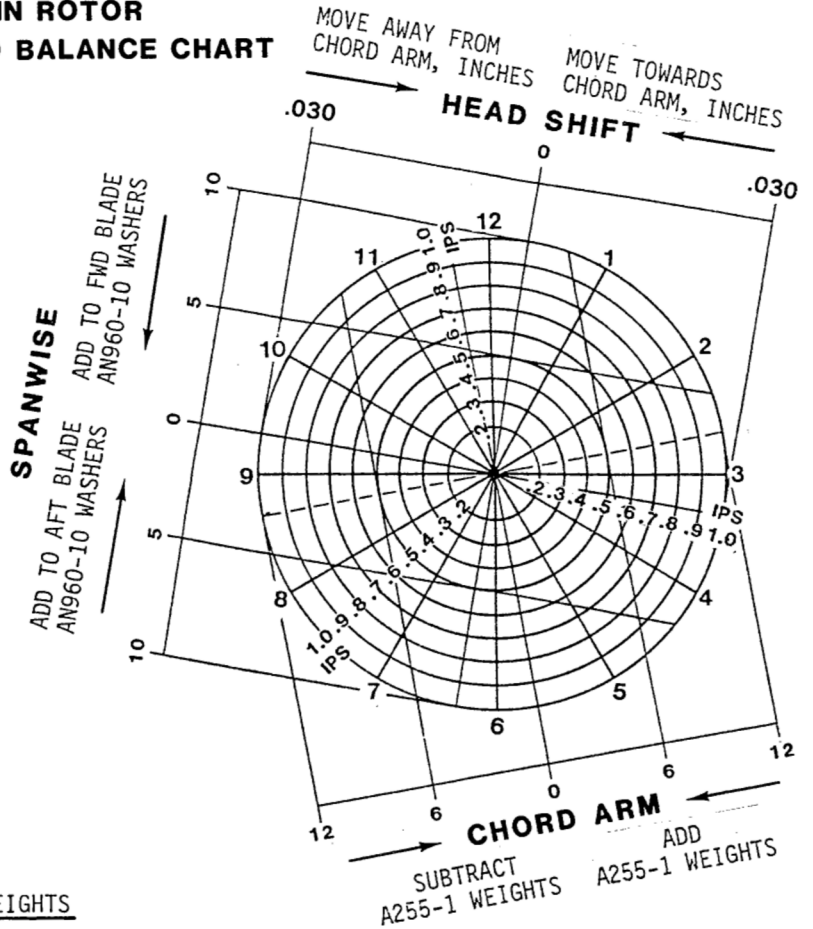
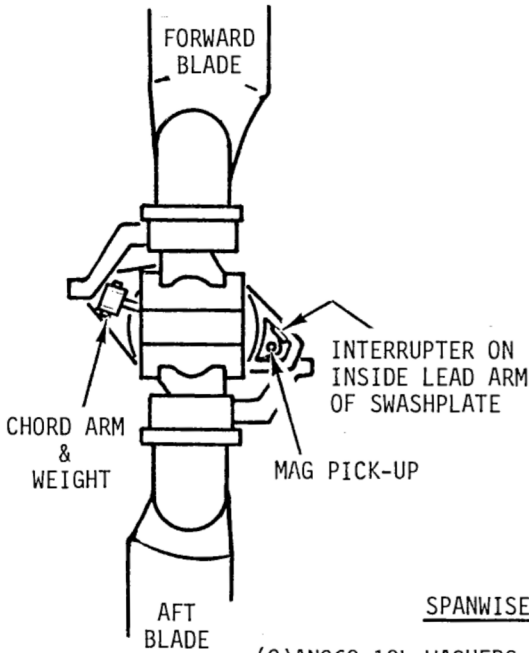
CAUTION

After adjusting pitch link, verify 0.020 inch diameter safety wire cannot pass through witness holes.

SHIP S/N _____
 Page _____ of Page _____

**MAIN ROTOR
 TRACK AND BALANCE CHART**

MOUNT ACCELEROMETER ON LEFT
 SIDE OF CONSOLE POINTED LEFT



SPANWISE WEIGHTS

- (2)AN960-10L WASHERS = (1)AN960-10 WASHER
- (5)AN960-10 WASHERS = (1)C298-2 WEIGHT
- (11)AN960-10 WASHERS = (1)C298-3 WEIGHT
- (4)C298-3 WEIGHTS = (1)C298-4 WEIGHT

CHORD ARM WEIGHTS

- (8)AN970-4 WASHERS = (1)A255-1 WEIGHT
- (3)A255-1 WEIGHTS = (1)A255-2 WEIGHT

BALANCE		TRACK (KNOTS)										
CLOCK	IPS	HOVER	CLIMB	50	60	70	80	90	100	110	120	130

CHANGE MADE:

--	--	--	--	--	--	--	--	--	--	--	--	--

CHANGE MADE:

--	--	--	--	--	--	--	--	--	--	--	--	--

CHANGE MADE:

--	--	--	--	--	--	--	--	--	--	--	--	--

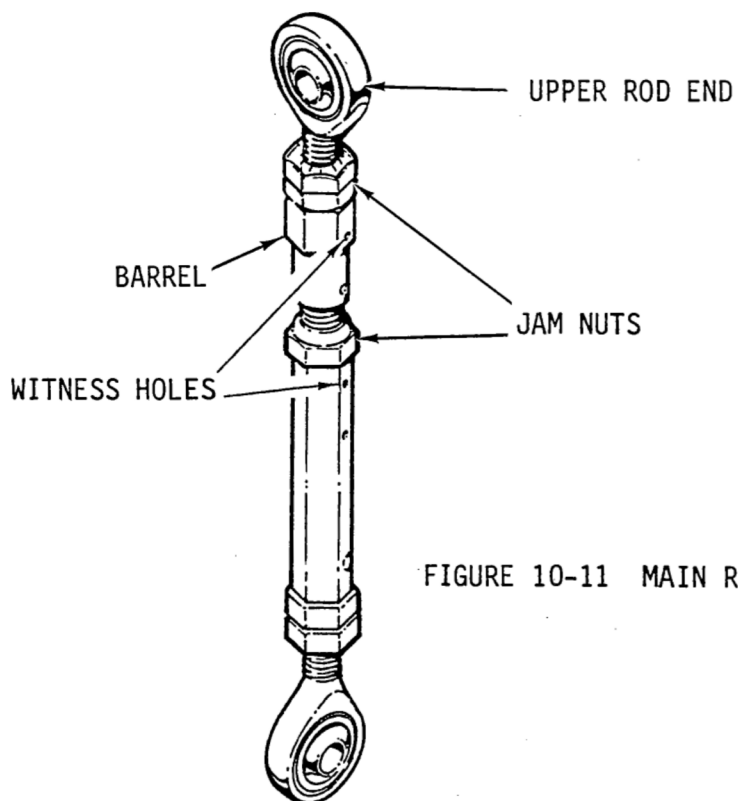


FIGURE 10-11 MAIN ROTOR PITCH LINK

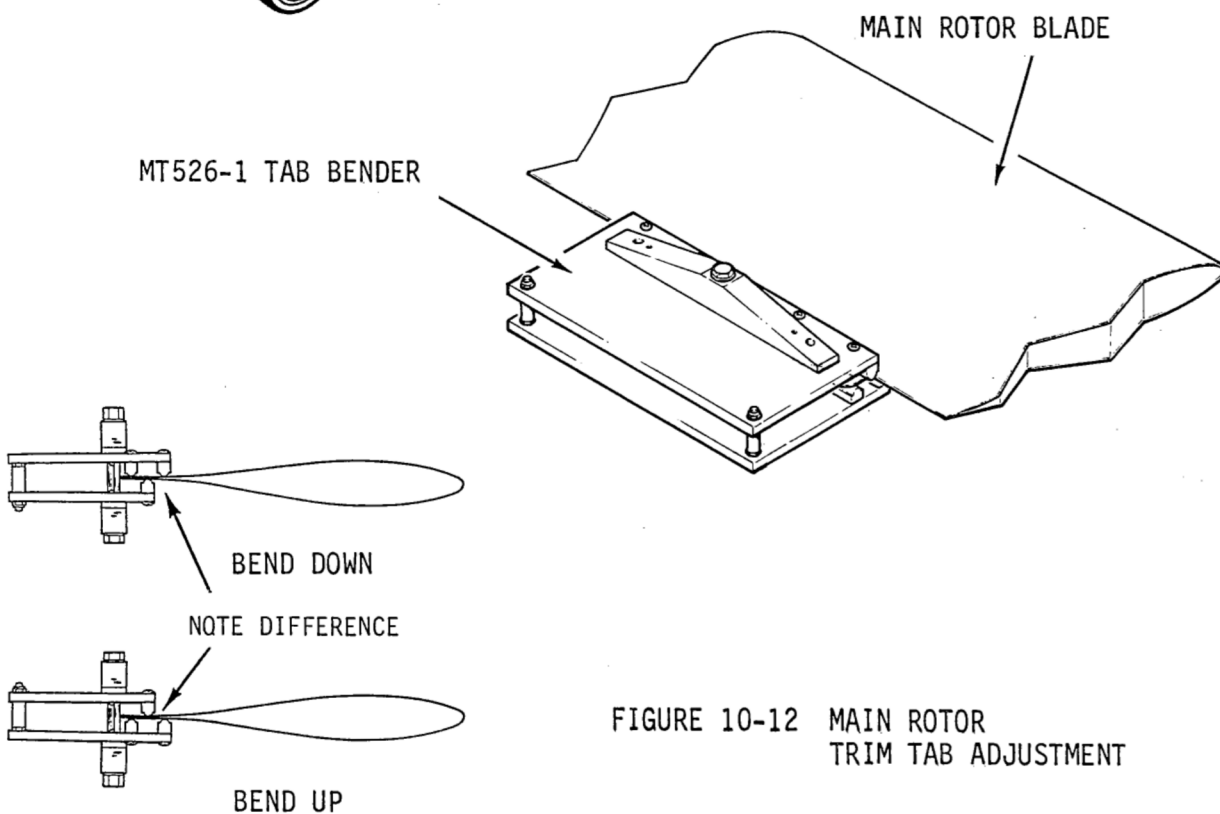


FIGURE 10-12 MAIN ROTOR TRIM TAB ADJUSTMENT

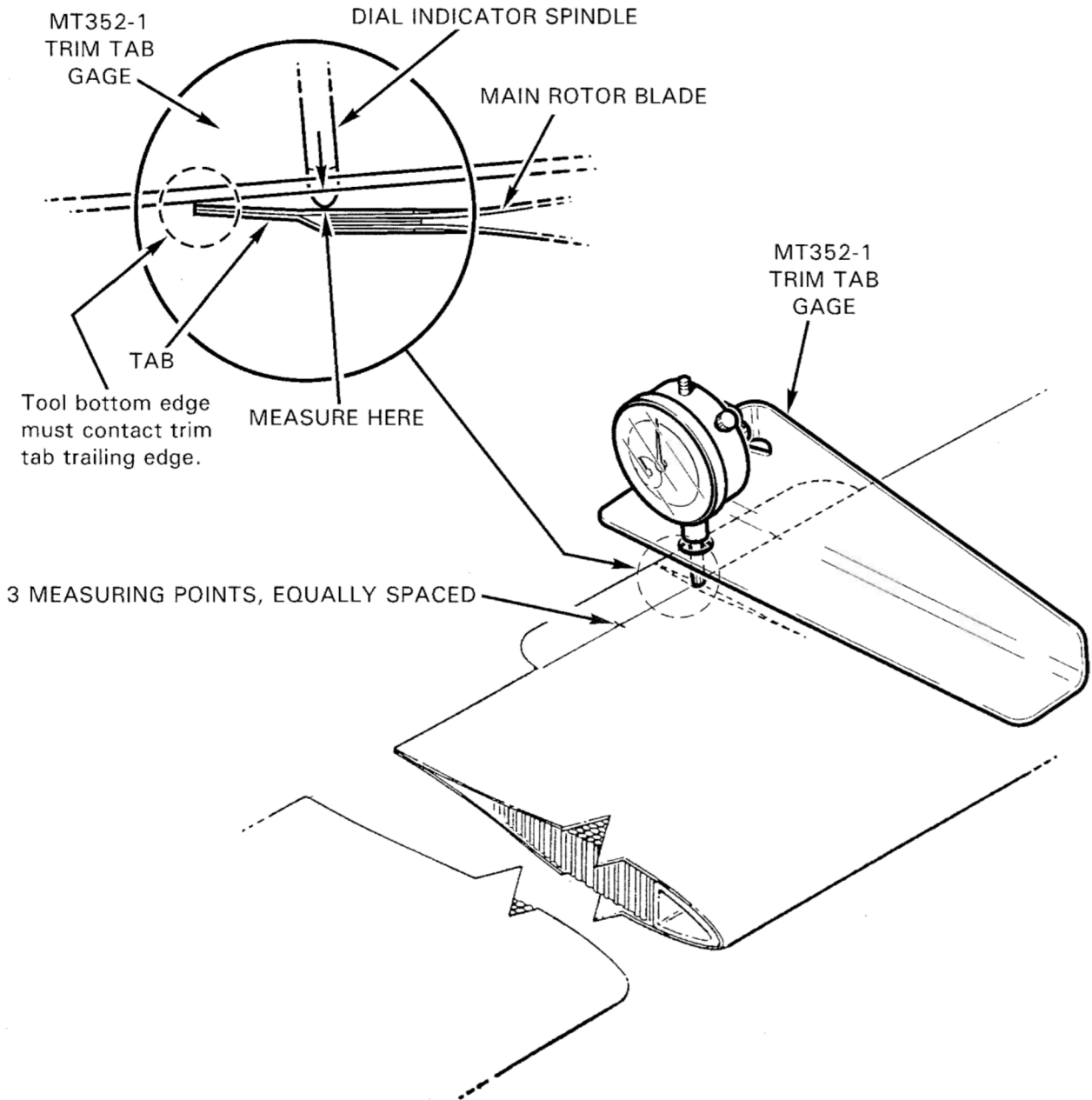


FIGURE 10-13 MAIN ROTOR TRIM TAB MEASUREMENT

10.233 Main Rotor Blade Trim Tab Adjustment

Main rotor blade trim tab adjustments are made using the MT526-1 tab bender and the MT352-1 trim tab gage. Refer to Figure 10-13. Using a felt marker, draw a line across top of trim tab aligned with blade trailing edge. Mark line with three equally spaced measuring points. Place trim tab gage chordwise across upper surface of blade and trim tab trailing edge with dial indicator stylus resting on a marked measuring point. Set dial indicator scale to zero. Similarly measure both remaining measuring points and verify they are within 0.005 inch of first.

CAUTION

MT352-1 gage must contact trim tab trailing edge. Space between edge of gage and trailing edge of trim tab indicates trim tab bent beyond limit.

To bend trim tab, loosen bolt on MT526-1 tab bender and slide tab bender over trim tab trailing edge as far toward leading edge as possible. Ensure single-rib side of tool contacts blade bottom surface to bend tab down and vice-versa. Tighten bolt to bend tab. Clamping action of tool is sufficient to bend tab; do not use tool like a lever. Refer to Figure 10-12. Make very slight bends downward on trim tab. Do not bend trim tab upward unless absolutely necessary; bending trim tab upward can increase cyclic stick shake. A trim tab bend of approximately 0.015 inch will move tip of main rotor blade approximately 0.2 inch. Remeasure trim tab with MT352-1 gage. Adjust bend in trim tab as required to keep three measuring points within 0.005 inch.

CAUTION

Do not use main rotor blade trim tab bending tools manufactured by other helicopter manufacturers. Use of these tools will damage main rotor blade.

10.234 Main Rotor Track and Balance Troubleshooting

<u>Symptom</u>	<u>Probable Cause</u>	<u>Correction</u>
1. Excessive Cyclic or Stick Shake	Rough or binding A205-5 fork assembly (upper swashplate).	Replace or refer to Section 8.6.
	Brinelled spindle bearing (rough movement).	Send blade(s) to RHC or Service Center for spindle bearing replacement.
	Rough blade surface (chipped paint).	Repair blades per Section 9.130.
	Rough or binding pitch links.	Replace pitch link rod ends
	MR blade boot misaligned.	Realign or replace boot per Sections 9.113 & 9.114.
	MR teeter or coning hinge binding.	Replace bearings per Section 9.126.
	MR blade trim tabs bent upward.	Bend trim tabs evenly down per Section 10.233.
2. Excessive Ship Vibration	Blade mismatch.	Send blade(s) to RHC for replacement.
	MR out of track and balance.	Track and balance per Section 10.230.
	MR teeter or coning hinge friction.	Adjust hinge friction per Section 9.124.
	MR teeter or coning hinge binding.	Replace bearings per Section 9.126.
	Brinelled spindle bearing (rough movement).	Send blade(s) to RHC or Service Center for spindle bearing replacement.
3. Excessive Cyclic Stick Forces	MR teeter hinge bearings worn.	Replace bearings per Section 9.126.
	Brinelled spindle bearing (rough movement).	Send blade(s) to RHC or Service Center for spindle bearing replacement.
4. Intermittent Blade Track Picture	MR teeter or coning hinge friction	Adjust hinge friction per Section 9.124.
	MR coning hinge binding.	Replace bearings per Section 9.126.
	MR teeter hinge not "broken-in."	Track and balance per Section 10.230. Adjust track to minimize error.
	Brinelled spindle bearing (rough movement).	Send blade(s) to RHC or Service Center for spindle bearing replacement.
5. Radical Changes to Cyclic Trim	MR teeter hinge bearings worn.	Replace bearings per Section 9.126.
	Brinelled spindle bearing (rough movement).	Send blade(s) to RHC for spindle bearing replacement.
6. Lateral Intermittent Ship Vibration	Engine misfiring due to malfunction in spark plugs, ignition leads, magneto, or engine not "broken-in."	Refer to Textron-Lycoming Maintenance Instructions.
7. 4 per second Fore/Aft Oscillation	Aircraft CG out of limits.	Operate aircraft within CG envelope.
	Deteriorated / contaminated main gearbox rubber mount(s).	Replace main gearbox mounts.

10.240 Tail Rotor Balance Procedure

Refer to specific manufacturer's installation instructions when using balancing equipment other than Chadwick-Helmuth Vibrex system.

Install Chadwick-Helmuth equipment per Section 10.222. Set Function Knob on Balancer to appropriate channel. Set balancer RPM Range knob to X10 and set RPM to 231. With helicopter running with governor ON, view tail rotor assembly with Strobex. Tune Balancer while viewing target tape and adjusting RPM dial on Balancer. Record clock angle and IPS on tail rotor balance chart. Adjust as required until balance is less than 0.2 IPS.

Spanwise balance adjustments for C029-1 square-tip blades are made by adding, subtracting, or exchanging weights under the removable tip cover. Use C134-1 or -2 tip weights or AN960-8 or -8L washers. -8L washers may be trimmed as a very fine adjustment.

Spanwise balance adjustments for C029-2 and C029-3 round-tip blades are made by exchanging different diameter washers under nut securing blade's outboard retaining bolt. The bolt has sufficient length to allow necessary spanwise weight changes; verify 2-4 threads protruding past nut after torquing per Section 1.320.

Chordwise balance is adjusted by adding, subtracting, or exchanging A141-14, A214-3, NAS1149F0463P/F0432P, or NAS1149D0463J/D0432J washers under nut securing blade's pitch link attaching bolt. Change pitch link attaching bolt length as required for proper thread engagement (see Section 1.310, refer to IPC for allowable lengths).

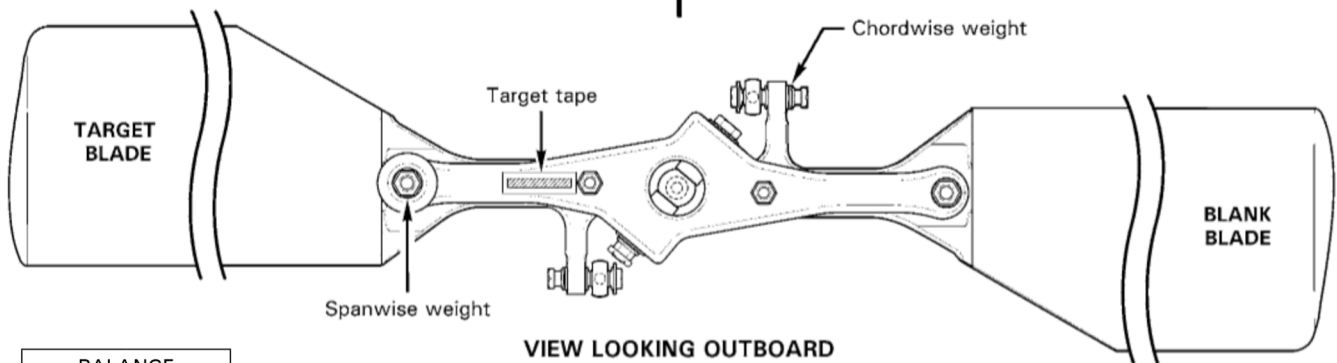
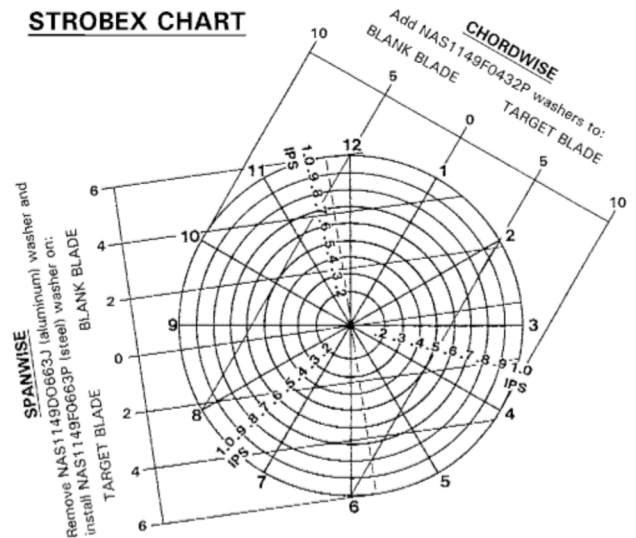
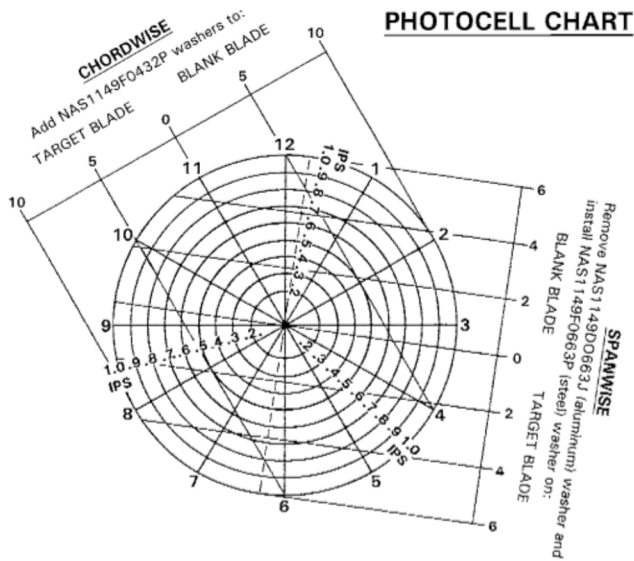
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C008-9 TAIL ROTOR ASSEMBLY

CHORDWISE WEIGHTS		
(1) NAS1149F0463P Washer	=	(2) NAS1149F0432P Washers
(1) A214-3 Washer	=	(3.5) NAS1149F0432P Washers
(1) A141-14 Washer	=	(5) NAS1149F0432P Washers

SPANWISE WEIGHTS		
(1) C141-23 Washer	=	(3.5) NAS1149F0663P Washers
(1) C141-24 Washer	=	(7) NAS1149F0663P Washers
(2) NAS1149F0632P		(1) NAS1149F0663P Washer



BALANCE	
CLOCK	IPS
CLOCK	IPS
CLOCK	IPS
CLOCK	IPS

ADJUSTMENT: _____

ADJUSTMENT: _____

ADJUSTMENT: _____

ADJUSTMENT: _____

FIGURE 10-14 C008-9 TAIL ROTOR ASSEMBLY DYNAMIC BALANCE CHART

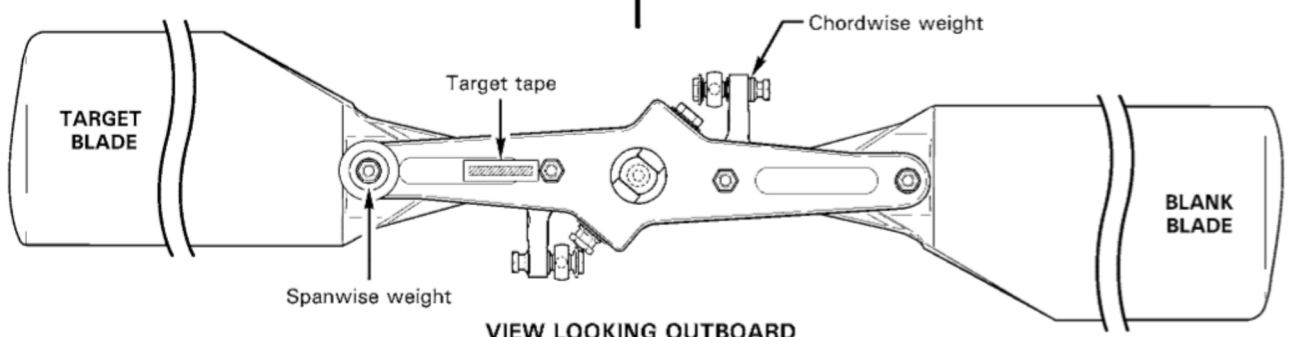
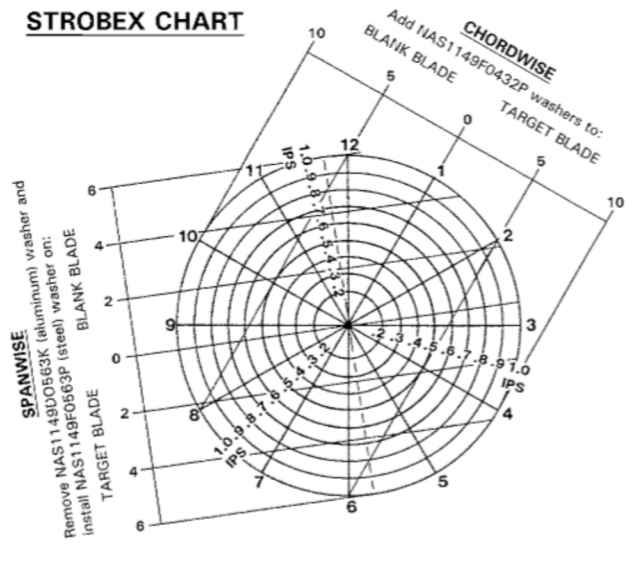
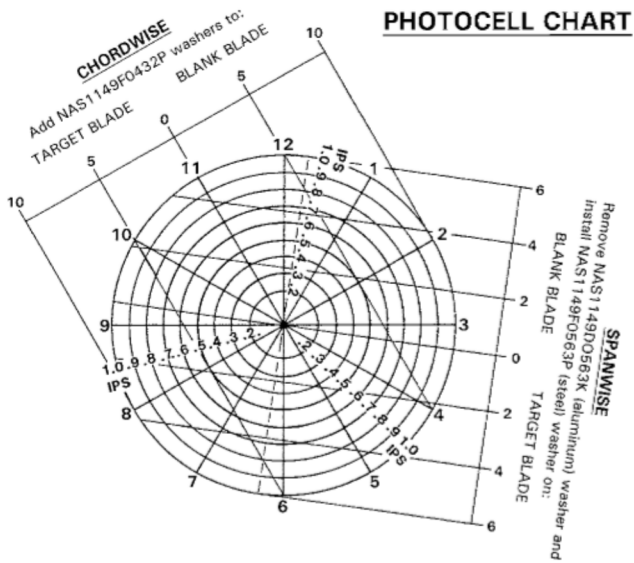
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C008-4 TAIL ROTOR ASSEMBLY

CHORDWISE WEIGHTS			
(1) NAS1149F0463P Washer	=	(2)	NAS1149F0432P Washers
(1) A214-3 Washer	=	(3.5)	NAS1149F0432P Washers
(1) A141-14 Washer	=	(5)	NAS1149F0432P Washers

SPANWISE WEIGHTS			
(1) C141-20 Washer	=	(5)	NAS1149F0563P Washers
(1) AN970-5 Washer	=	(13)	NAS1149F0563P Washers



BALANCE	
CLOCK	IPS
CLOCK	IPS
CLOCK	IPS
CLOCK	IPS

ADJUSTMENT: _____

ADJUSTMENT: _____

ADJUSTMENT: _____

ADJUSTMENT: _____

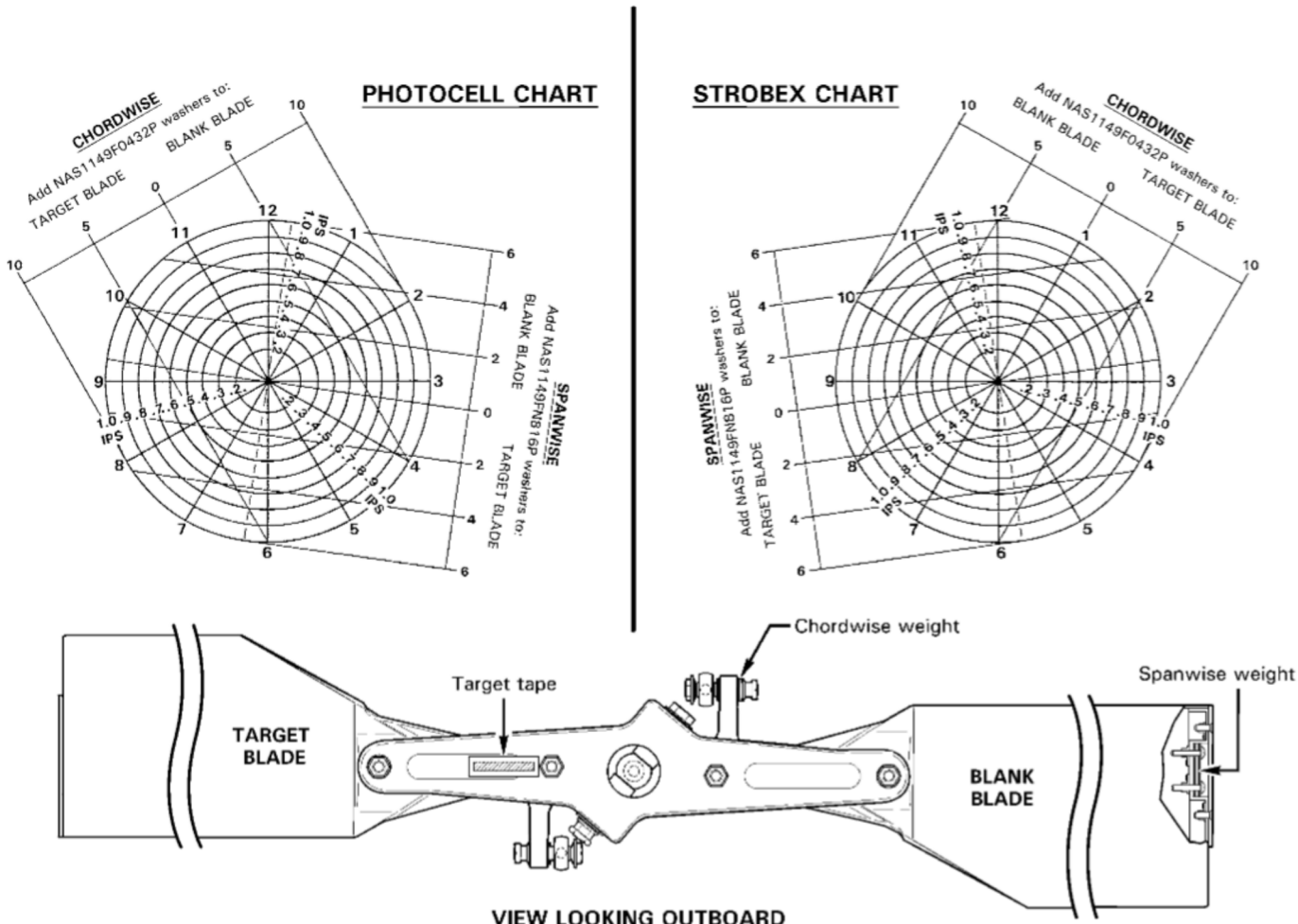
FIGURE 10-15 C008-4 TAIL ROTOR ASSEMBLY DYNAMIC BALANCE CHART

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C008-2 TAIL ROTOR ASSEMBLY

CHORDWISE WEIGHTS			SPANWISE WEIGHTS		
(1) NAS1149F0463P Washer	=	(2) NAS1149F0432P Washers	(1) NAS1149FN832P	=	(2) NAS1149FN816P Washers
(1) A141-14 Washer	=	(5) NAS1149F0432P Washers	(1) C134-1 Weight	=	(14) NAS1149FN816P Washers



BALANCE	
CLOCK	IPS

ADJUSTMENT: _____

ADJUSTMENT: _____

ADJUSTMENT: _____

ADJUSTMENT: _____

FIGURE 10-16 C008-2 TAIL ROTOR ASSEMBLY DYNAMIC BALANCE CHART

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