CHAPTER 8

WEIGHT AND BALANCE

Section *Title* *Page*

8-10 Leveling 8.1
8-11 Leveling for Weight and Balance 8.1
8-12 Leveling for Rigging 8.3
8-20 Weighing 8.5
8-21 Preparing Helicopter for Weighing 8.5
8-22 Weighing Procedure and Calculations 8.7
8-30 Fixed Ballast 8.11
8-31 Nose Ballast 8.11
8-32 Empennage Ballast 8.12

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CHAPTER 8

WEIGHT AND BALANCE

8-10 Leveling

NOTE

Perform leveling and weighing in a zero-wind environment.

NOTE

Verify spirit level is calibrated by placing level on a designated surface and noting bubble position. Rotate spirit level 180°; verify bubble is in the same position.

8-11 Leveling for Weight and Balance

NOTE

Main rotor blade position does not affect weight and balance calculations.

1. Jack helicopter per Section 7-10.
2. Refer to Figure 8-1. Place a spirit level laterally on F463-1 aft tunnel cover. Verify cover is flat; if cover is not flat, remove cover and place spirit level across keel panel flanges.
3. Adjust jacks at (landing gear) aft strut assembly jack lugs/tabs until helicopter is level laterally.
4. Position spirit level longitudinally on aft tunnel cover, or atop left or right keel panel if cover is removed. Adjust jack under ground handling ball until helicopter is level longitudinally.

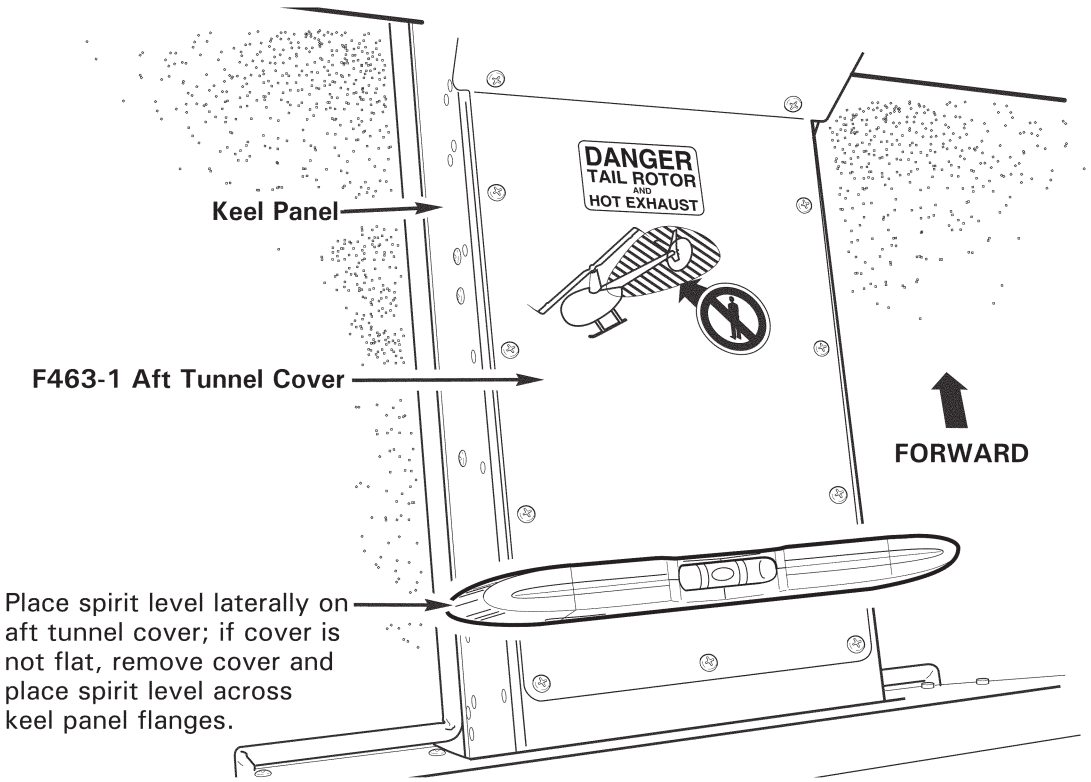


FIGURE 8-1 LEVELING FOR WEIGHT AND BALANCE
(Lateral shown; view looking down between aft seat footwells)

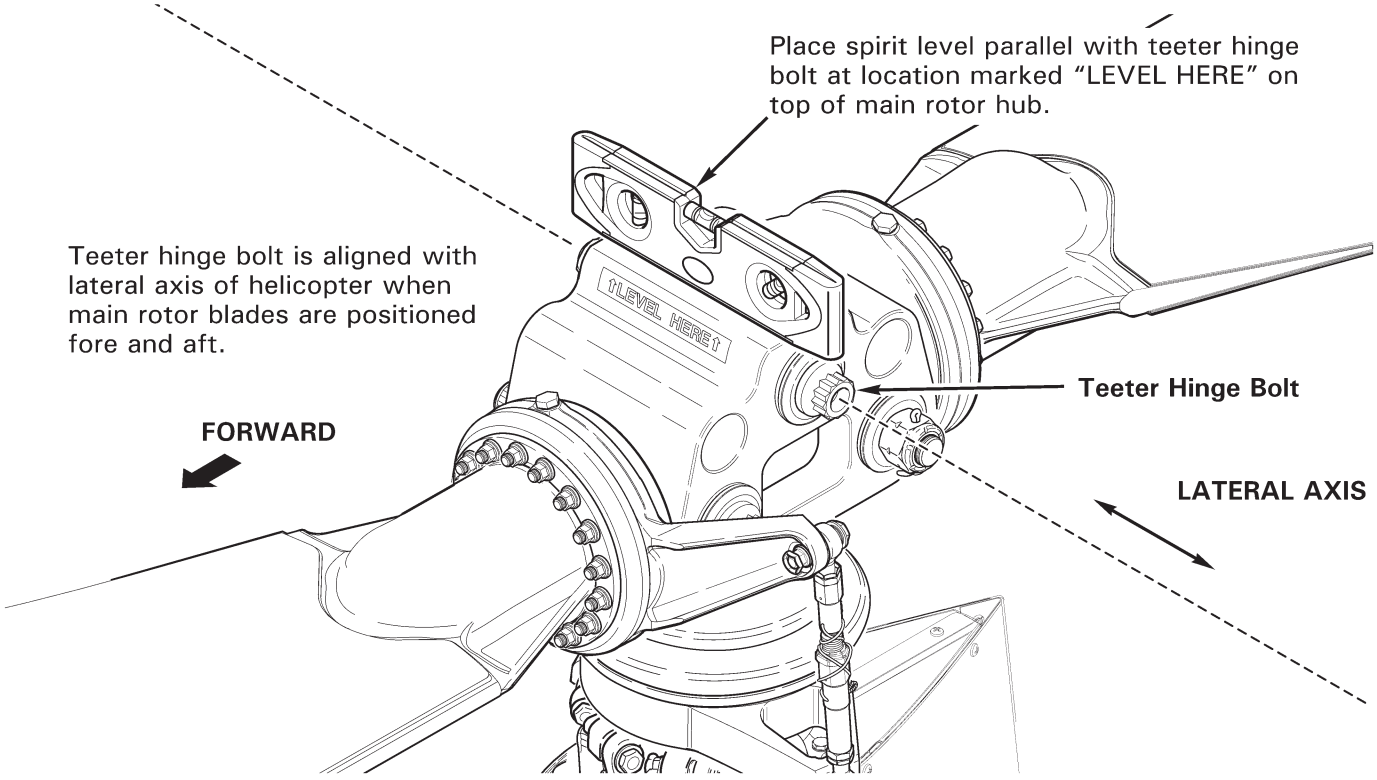


FIGURE 8-2 LEVELING FOR RIGGING
(Lateral shown)

8-12 Leveling for Rigging

1. Refer to Figure 8-2. Place cyclic stick in vertical position and apply cyclic friction. Position main rotor blades approximately fore and aft and apply rotor brake. (Teeter hinge bolt is aligned with lateral axis of helicopter.)

2. Jack helicopter per Section 7-10.

3. Place a spirit level parallel with teeter hinge bolt at location marked "LEVEL HERE" on top of main rotor hub.

4. Adjust jack at (landing gear) aft strut assembly jack lugs/tabs until helicopter is level laterally.

5. Release rotor brake and rotate main rotor until teeter hinge bolt is aligned with longitudinal axis of the helicopter. Apply rotor brake. Verify cyclic stick is in vertical position with friction applied.

6. Adjust jack under ground handling ball until helicopter is level longitudinally. Remove spirit level.

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8-20 Weighing

Reweigh helicopter when helicopter empty weight and empty weight center of gravity have been modified and if the accuracy of additional calculations is suspect.

Maintain a continuous record of the helicopter's weight and balance using the Weight and Balance Record in R66 Pilot's Operating Handbook (POH) Section 6.

NOTE

Verify scales are calibrated. Operate scales according to scale manufacturer's instructions.

NOTE

Never weigh the helicopter in the wind. Weigh helicopter on a flat, hard surface in a zero-wind environment for accurate scale readings.

8-21 Preparing Helicopter for Weighing

1. Defuel helicopter per Section 12-42.
2. Service engine oil, hydraulic fluid, and main & tail rotor gearboxes per Chapter 12.
3. Clean aircraft per Section 20-10. Ensure helicopter is completely dry prior to weighing.
4. Remove foreign objects from baggage compartments and stowage areas.
5. Verify cowlings, removable panels, cabin doors, removable controls, and R66 Pilot's Operating Handbook (POH) are installed.
6. Verify Equipment List/Weight and Balance Data sheet (RF 134) and modifications recorded in the Weight and Balance Record correspond with installed equipment and recorded equipment locations.

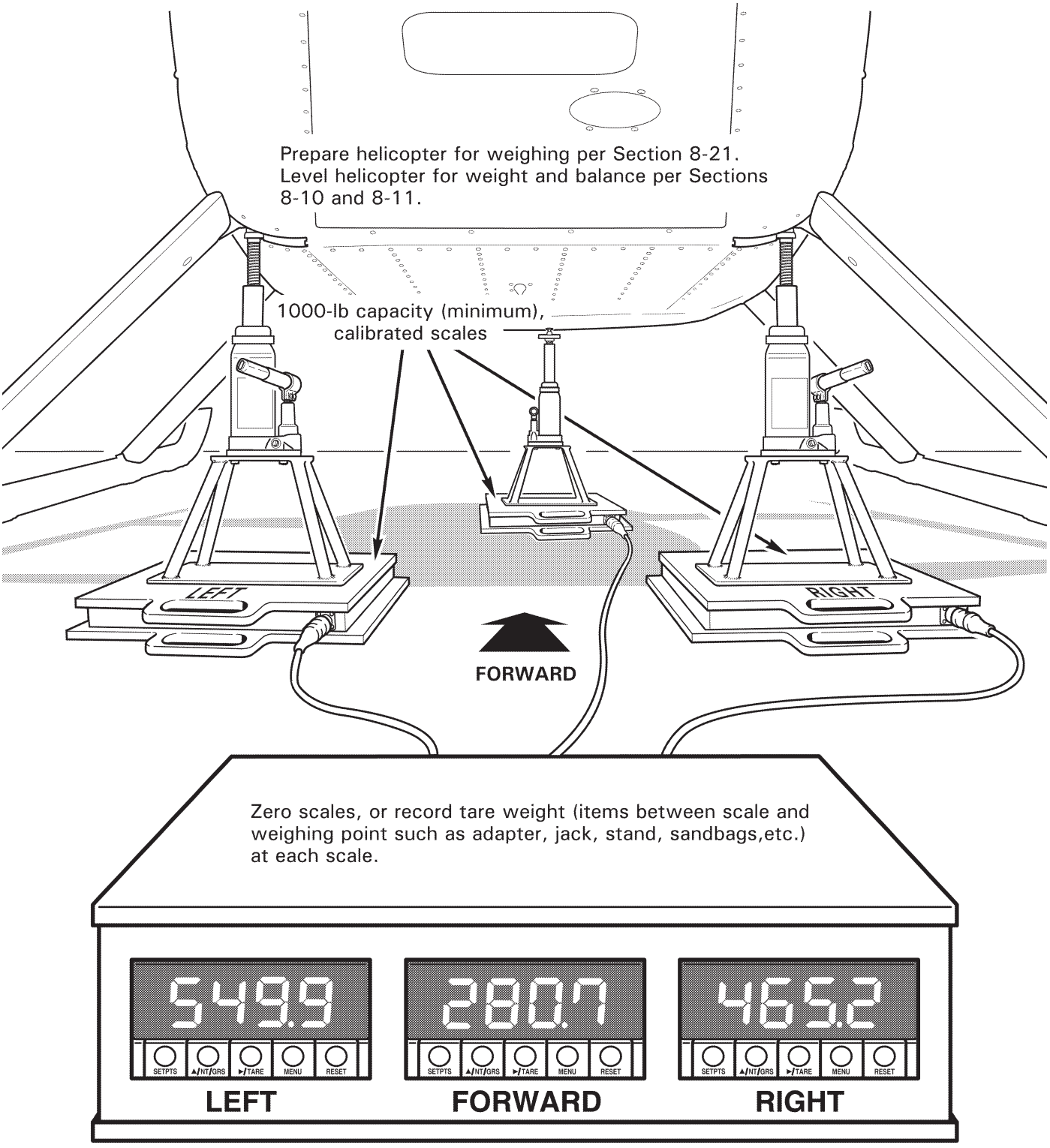


FIGURE 8-3 WEIGHING
(Scale indications for demonstration only)

8-22 Weighing Procedure and Calculations

NOTE

- Arm is the distance in inches from datum.
- Datum is located 100 inches forward of main rotor centerline.
- CG (arm) is determined by dividing total moment by total weight.

1. Refer to § 8-20. Prepare helicopter for weighing per § 8-21.
2. Refer to Figure 8-3. Place a jack and one 1000-lb capacity (minimum) scale under each (landing gear) aft strut assembly jack lug/tab and under the ground handling ball.
3. Zero scales, or record tare weight (items between scale and weighing point such as adapter, jack, stand, sandbags, etc.) at each scale.
4. Level helicopter for weight and balance per §§ 8-10 and 8-11. Remove spirit level. If removed, carefully replace F463-1 aft tunnel cover, unsecured, on top of keel panels.
5. Calculate net weights:

Weighing Point	Scale Indication		Tare Weight		Net Weight	
Forward:	_____	–	_____	=	_____	lb
Left:	_____	–	_____	=	_____	lb
Right:	_____	–	_____	=	_____	lb

8-22 Weighing Procedure and Calculations (continued)

6. Calculate weight and CG per the following table. Adjust ballast per steps 6b thru 6e, as required, until calculated CG is between 101.50 and 102.50 per step 6a. For Police or ENG versions, also refer to § 90-90 or § 92-285, respectively.

NOTE
Calculated CG forward of 101.5 inches with maximum empennage ballast installed is permissible.

Item	Weight (lb)		Longitudinal CG (arm, inches)		Moment (in.-lb)
Forward Net:	_____	x	32.67	=	_____
Left Net:	_____	x	127.35	=	_____
Right Net:	_____	x	127.35	=	_____
Pilot (right forward seat; add):	160.00	x	49.00	=	7840.00
Unusable fuel (add):	6.70	x	110.40	=	739.68
Calculated weight and CG:	_____		_____		_____

a. If Calculated CG is between 101.50 and 102.50, (additional) ballast is not required. Proceed to step 7.

b. If Calculated CG is less than 101.50 and nose ballast is not installed, install empennage ballast per § 8-32. Reweigh helicopter and calculate new weight and CG per the previous steps.

c. If Calculated CG is less than 101.50 and nose ballast is installed, determine (minimum) nose ballast to remove:

$$\frac{(102.50 - \text{Calculated CG}) \times \text{Calculated weight}}{97.35} = _____ \text{ lb}$$

Round down to nearest 0.25 lb. Remove nose ballast per § 8-31. Reweigh helicopter and calculate new weight and CG per the previous steps.

d. If Calculated CG is greater than 102.50 and empennage ballast is installed, remove empennage ballast per § 8-32. Reweigh helicopter and calculate new weight and CG per the previous steps.

e. If Calculated CG is greater than 102.50 and empennage ballast is not installed, determine (minimum) additional nose ballast required:

$$\frac{(\text{Calculated CG} - 102.50) \times \text{Calculated weight}}{97.35} = _____ \text{ lb}$$

Round up to nearest 0.25 lb. Install nose ballast per § 8-31. Reweigh helicopter and calculate new weight and CG per the previous steps.

8-22 Weighing Procedure and Calculations (continued)

7. Lower helicopter per § 7-10. Secure aft tunnel cover.

8. Calculate basic empty weight and longitudinal CG:

Item	Weight (lb)		Longitudinal CG (arm, inches)		Moment (in.-lb)
Forward Net:	_____	x	32.67	=	_____
Left Net:	_____	x	127.35	=	_____
Right Net:	_____	x	127.35	=	_____
Unusable fuel (add):	6.70	x	110.40	=	739.68
Basic empty weight and longitudinal CG:	_____		_____		_____

9. Calculate basic empty weight and lateral CG:

Item	Weight (lb)		Lateral CG (arm, inches)		Moment (in.-lb)
Forward Net:	_____	x	4.13	=	_____
Left Net:	_____	x	– 16.73	=	_____
Right Net:	_____	x	16.73	=	_____
Unusable fuel (add):	6.70	x	– 20.70	=	– 138.69
Basic empty weight and lateral CG:	_____		_____		_____

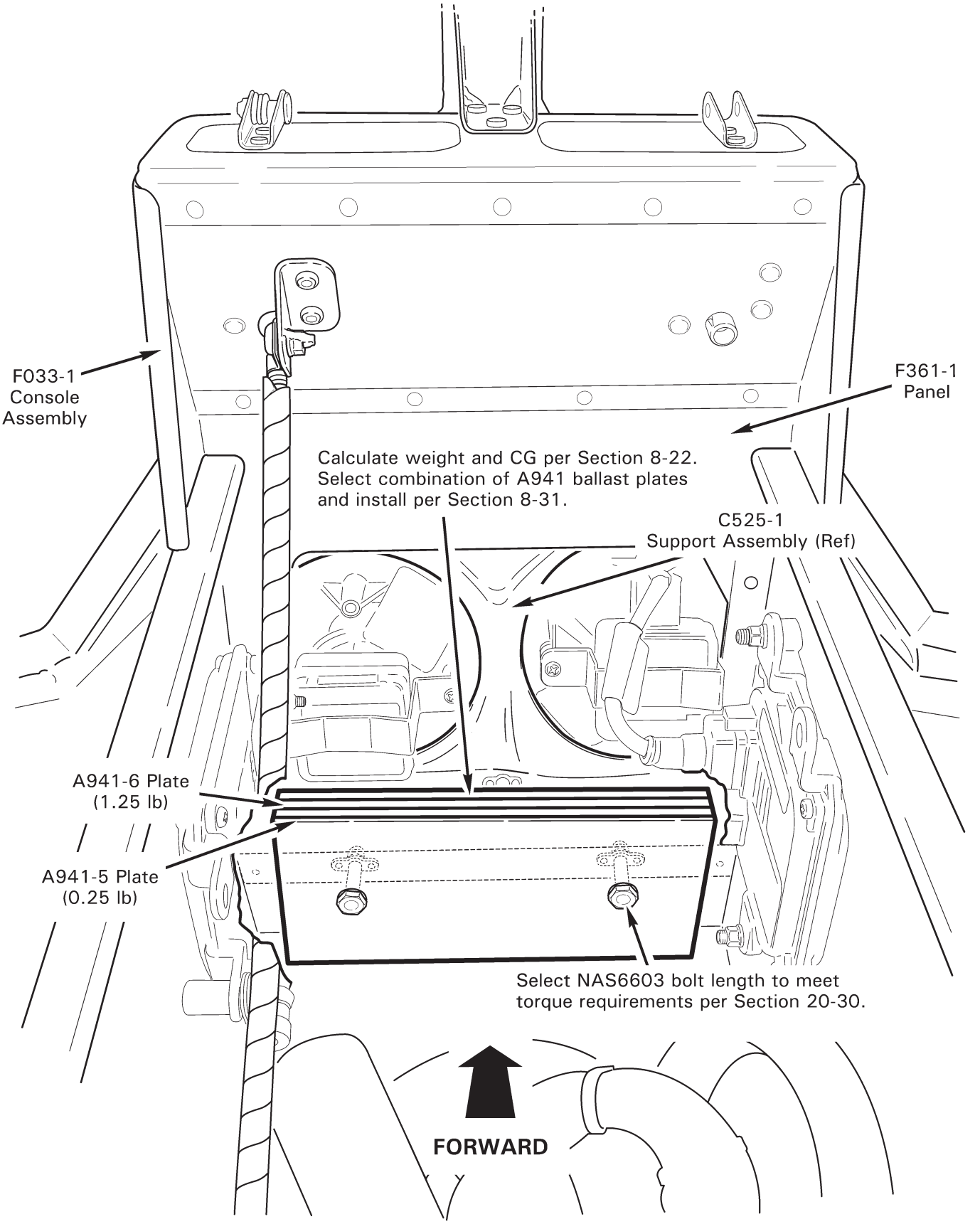


FIGURE 8-4 NOSE BALLAST
(View inside lower console assembly with upper console hinged aft)

8-30 Fixed Ballast

8-31 Nose Ballast

NOTE

Maximum allowable nose ballast is 15.00 lb.

CAUTION

Changing fixed ballast amount affects helicopter empty weight & center of gravity (CG). If helicopter empty weight & CG historical data is suspect, weigh helicopter per § 8-22.

1. Open or remove console assembly per § 95-10.
2. Refer to Figure 8-4. Remove hardware securing A941-5 or -6 ballast plate(s), if installed, to F361-1 panel.
3. Remove or install ballast plates per calculations performed in § 8-22. Select NAS6603 bolt length to meet torque requirements per § 20-30 Part E. Install hardware, standard torque bolts per § 20-32, and torque stripe per Figure 5-1.
4. Install or close console assembly per § 95-10. Verify security.
5. Reweigh and/or calculate basic empty weight and CG per § 8-22.
6. Revise Weight and Balance Record in R66 Pilot's Operating Handbook (POH) Section 6 to reflect ballast removal or installation using the following data:

Item	Weight	Longitudinal Arm	Longitudinal Moment	Lateral Arm	Lateral Moment
Nose ballast	0–20.00 lb	5.15 in.	Variable	0.00 in.	0.00 in.-lb

8-32 Empennage Ballast

NOTE

Approved materials are listed in § 20-70.

CAUTION

Changing fixed ballast amount affects helicopter empty weight & center of gravity (CG). If helicopter empty weight & CG historical data is suspect, weigh helicopter per § 8-22.

A. Removal

CAUTION

Maximum allowable empennage ballast is 9.0 lb (except Police and E.N.G. Versions). One upper and one lower weight are required. Available combinations provide total weight of 3.0, 6.0, & 9.0 lb.

1. Remove D079-1 tail rotor guard per § 53-50.
2. Leaving NAS6606-78 bolts installed in C004-2, C004-3, or F004-2 empennage assembly, remove stamped nuts, nuts, washers, and lower D301-2, -4, or -8 ballast weight from empennage assembly.
3. Remove one bolt then rotate upper ballast weight to expose empty bolt hole. Install NAS6606-47 bolt and associated hardware in exposed hole, finger tight (install [1] or [2] NAS1149F0663P washers as required under nut to meet torque requirements per § 20-30 Part E).
4. Remove second bolt & upper ballast weight from empennage assembly. Install NAS6606-47 bolt and associated hardware (install [1] or [2] NAS1149F0663P washers as required under nut to meet torque requirements per § 20-30 Part E). Standard torque bolts securing empennage to C148-5 bulkhead per § 20-32. Install stamped nuts and standard torque per § 20-32, do not torque stripe at this time.
5. As required, solvent-clean upper & lower surfaces of empennage assembly around and between attach bolts. Apply light coat zinc-chromate or epoxy primer to noted surfaces and hardware. Apply topcoat as desired.
6. Apply torque stripe to hardware per Figure 5-1.
7. Install tail rotor guard per § 53-50.
8. As required, weigh helicopter or calculate basic empty weight & CG per § 8-22.
9. Revise Weight and Balance Record in R66 Pilot's Operating Handbook (POH) Section 6 to reflect ballast removal using Table 8-1.

8-32 Empennage Ballast (continued)

B. Installation

CAUTION

Maximum allowable empennage ballast is 9.0 lb (except Police and E.N.G. Versions). One upper and one lower weight are required. Available combinations provide total weight of 3.0, 6.0, & 9.0 lb.

1. Remove C004-2, C004-3, or F004-2 empennage assembly per § 53-70.
2. Solvent-clean around and between 0.375 inch diameter holes on upper & lower surfaces of F044-1 vertical stabilizers mount assembly or C044-1 or -2 horizontal stabilizer, as applicable.
3. Temporarily position correct combination of two D301-2, -4, or -8 weights on mount assembly (or horizontal stabilizer) using two NAS6606-78 bolts & associated hardware, finger tight.
4. Trace outline of weights onto mount assembly (or horizontal stabilizer) upper & lower surfaces using felt-tip marker or tape. Remove weights.
5. Remove paint within traced outlines on mount assembly (or horizontal stabilizer) using approved stripper (ref. § 20-71), or by block sanding (to maintain flatness) using 320-grit or finer aluminum-oxide abrasive sandpaper.
6. Remove tracing tape, if installed. Solvent-clean bare metal on mount assembly (or horizontal stabilizer) & weight clamping surfaces. Conversion coat upper & lower bare metal surfaces of mount assembly (or horizontal stabilizer) per § 20-51.
7. Apply approved chromated-epoxy primer (ref. § 20-75) per § 20-60 to bare metal clamping surfaces of weights and mount assembly (or horizontal stabilizer). While primer is still wet, install empennage assembly per § 53-70.
8. As required, apply primer and topcoat to exposed hardware.
9. As required, apply A257-18 to O-ring and install two AN814-10D plugs on upper weight only (except D301-2 weights). Special torque plugs per § 20-33 and torques stripe per Figure 5-1.
10. Weigh helicopter or calculate basic empty weight and CG per § 8-22.
11. Revise Weight and Balance Record in R66 Pilot's Operating Handbook (POH) Section 6 to reflect ballast installation using Table 8-1.

Item	Weight	Longitudinal Arm	Longitudinal Moment	Lateral Arm	Lateral Moment
Empennage Ballast	3.0 lb	325.4 in.	976.2 in.-lb	4.45 in.	13.35 in.-lb
	6.0 lb	325.4 in.	1952.4 in.-lb	4.45 in.	26.70 in.-lb
	9.0 lb	325.4 in.	2928.6 in.-lb	4.45 in.	40.05 in.-lb

TABLE 8-1 EMPENNAGE BALLAST WEIGHT AND BALANCE

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