

MODIFICATION INSTRUCTIONS



Middle Fork Mods. LLC

TAIL TIE-DOWN REPLACEMENT

APPROVED MODEL LIST STC

Document No: 16-020-AE3301
Revision 5

LOG OF REVISIONS

Revision	Date	Description of Change	Prepared	Approved
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1	8/07/17	Incorporated DER Comments	Adams	West
2	9/13/17	Incorporated Structures DER Comments	Adams	West
3	11/7/17	Sec. 3.3 , added note regarding inspection of painted surfaces	Adams	West
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5	1/22/20	<ul style="list-style-type: none"> • Sec. 1.3 Table 1-3 Changed to optional modification materials • Sec. 1-3 added table 1-3 Cessna Model applicability • Sec. 3.4 Added optional item: Tail Tie Down Reinforcement Assembly • Sec. 3.5 Added optional item: Sealant • Sec. 4 1.5 Add table 4-1.2 Replacement Tie-Down Center of Gravity reinforcement Assesembly with/without reinforcement Assesembly 	Nelson	Nelson

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1. INTRODUCTION

Middle Fork Mods. LLC prepared these modification instructions in support of the installation of a tail tie-down replacement on aircraft listed in Table 1-



Figure 1-1, Replacement Tail Tie-down Installation

This tail tie-down installation removes the factory tail tie-down ring and replaces it with a tie-down structure that eliminates the single point attachment. The replacement tail tie-down utilizes multiple attachment points at the two most rearward fuselage bulkheads.

1.1 References

- 1.1.1 Middle Fork Mods. Document 16-020-MT2901, Instructions for Continued Airworthiness
- 1.1.2 FAA Advisory Circular, 43.13-1B, Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair
- 1.1.3 Cessna Maintenance Manual 182SMM14, Model 182/T182, 1997 And On
- 1.1.4 Cessna Maintenance Manual 206HMM13, Model 206/T206, 1998 And On
- 1.1.5 Cessna Parts Catalog 206HPC22, Model 206, 1998 And On
- 1.1.6 Cessna Parts Catalog, Cessna 210B, C, D, E, F, T210, 1962-1967
- 1.1.7 Cessna Parts Catalog P697-12, Model P210, 1978 Thru 1986
- 1.1.8 Cessna Service Manual D138-13, Cessna 100 Series, 1962 and prior
- 1.1.9 Cessna Service Manual D637-1-13, Cessna 100 Series, 1963 Thru 1968
- 1.1.10 Cessna Service Manual D2006-4-13, Model 182, 1969 Thru 1976
- 1.1.11 Cessna Service Manual D2068-3-13, Model 182 & T182, 1977 Thru 1986
- 1.1.12 Cessna Service Manual D2069-3-13, Model R182 & TR182, 1978 Thru 1986
- 1.1.13 Cessna Service Manual D310-13, Cessna 200 Series, 1965 and prior
- 1.1.14 Cessna Service Manual D606-16, Cessna 200 Series, 1966 Thru 1968
- 1.1.15 Cessna Service Manual D2007-3-13, Model 206 & T206, 1969 Thru 1976

- 1.1.16 Cessna Service Manual D2070-3-13, Model 206 & T206, 1977 Thru 1986
- 1.1.17 Cessna Service Manual D2008C1-13S, Model 207, 1969 Thru 1975
- 1.1.18 Cessna Service Manual D2060-1-13, Model 207, 1969-1984
- 1.1.19 Cessna Service Manual D693-13, Model 210, 1969
- 1.1.20 Cessna Service Manual D2004-5-13, Centurion Series, 1970 Thru 1976
- 1.1.21 Cessna Service Manual D2057-3-13, Model 210 & T210, 1977 Thru 1984
- 1.1.22 Cessna Service Manual D2058-2-13, Model P210, 1978 Thru 1983
- 1.1.23 Cessna Service Manual D2074-2-13, Model P210, 1985 Thru 1986
- 1.1.24 Cessna Service Manual D2073-2-13, Model 210 & T210, 1985 Thru 1986

1.2 Definitions

AC	Advisory Circular
AML	Approved Model List
AN	Army-Navy
A/R	As Required
CFR	Code of Federal Regulations
CG	Center of Gravity
FAA	Federal Aviation Administration
ICA	Instructions for Continued Airworthiness
STC	Supplemental Type Certificate
TCDS	Type Certificate Data Sheet

1.3 Tools Required

- Basic hand tools

1.4 Materials Required

Table 1-1, Required Modification Materials

Item	Quantity	Part No.	Description	Supplier
1	1	16-020-534510	Tail Tie-Down Assembly	Middle Fork Mods LLC.
2	12-13	AN525-832R12	Screw	--
3	A/R	AN960-8	Washer	--
4	12-13	AN365-832A	Nut	--
5	1	AN5-7A	Bolt	--
6	1	AN365-524A	Nut	--
7	A/R	AN960-516	Washer	--
8	1	MS27183-11	Steel Washer	--
9	A/R	MS20426AD	Countersunk Rivet	--

1.5 Optional Materials

Table 1-2, Optional Modification Materials

Item	Quantity	Part No.	Description	Supplier	Notes
1	1	16-020-534545	Plate, Tie-Down Reinforce Assy Optional	Middle Fork Mods LLC.	
2	A/R	748	RTV Sealant	Dow Corning	Or Equivalent
3	A/R	P/S 890 Class B	Pro-Seal	PPG	

1.6 Aircraft Component Compatibility

Table 1-3, Cessna Aircraft Model Applicability

Make	Series			
	182 Series	206 Series	207 Series	210 Series
Cessna	182	206	207	210
	182A	P206	207A	210A
	182B	P206A	T207	210B
	182C	P206B	T207A	210C
	182D	P206C		210D
	182E	P206D		210E
	182F	P206E		210F
	182G	U206		T210F
	182H	U206A		210G
	182J	206H		T210G
	182K	U206B		210H
	182L	U206C		T210H
	182M	U206D		210J
	182N	U206E		T210J
182P	U206F		210K	



Make	Series			
	182 Series	206 Series	207 Series	210 Series
	182Q	U206G		T210K
	182R	TP206A		210L
	182S	TP206B		T210L
	182T	TP206C		210M
	R182	T206H		T210M
	T182	TP206D		210N
	T182T	TP206E		T210N
	TR182	TU206A		210R
		TU206B		210-5 (205)
		TU206C		210-5A (205A)
		TU206D		P210N
		TU206E		P210R
		TU206F		T210R
		TU206G		

2. STANDARD PRACTICES

The following suggestions should be applied wherever they are applicable when working on the aircraft.

- To ensure proper reinstallation and/or assembly, tag and mark all parts, clips, clamps, brackets, etc. as to their location prior to removal and/or disassembly.
- During removal of various parts, inspect them for indications of scoring, burning or other undesirable wear conditions. To facilitate reinstallation, observe the location of each part during removal. Tag any unserviceable part and/or units for investigation and possible repair before reinstallation.
- Ensure that all parts are thoroughly cleaned before assembling.
- Never reuse lockwire, lockwashers, tablocks, tabwashers or cotter pins. All lockwire and cotter pins must fit snugly in holes drilled in studs and bolts for locking purposes. Cotter pins should be installed so the head fits into the castellation of the nut, and unless otherwise specified, bend one end of the pin back over the stud or bolt and the other end down flat against the nut. Use only corrosion resistant steel lockwire and/or cotter pins. Bushing plugs shall be lockwired to the assembly base or case. Do not lockwire the plug to the bushing.
- All workmanship is to be performed to the standards set forth in FAA Advisory Circular 43.13-1B (reference 1.1.2)

3. MODIFICATION

NOTE: “Forward” and “aft” are used throughout these modification instructions in reference to the two most rearward bulkheads of the applicable aircraft. These bulkhead locations are defined by Table 3-1 and depicted in Figure 3-1 and Appendix A.

Table 3-1, Cessna Bulkhead Identification

Make	Series	Forward Bulkhead Station (in.)	Aft Bulkhead Station (in.)
Cessna	182	209.00	230.18
	206	209.00	230.18
	207	239.00	260.18
	210	209.00	230.18

3.1 Tail Tie-Down Ring Removal

The aircraft’s tail tie-down ring, shown in Figure 3-1, is a threaded eye-bolt that bolts to the underside of the aircraft tail through a hole in the bottom of the aft fuselage bulkhead. The tie-down ring is often interchangeably referred to as a “mooring ring,” “eyelet,” or “eye-bolt” in various publications.

The tie-down ring must be completely removed from the aircraft following the instructions below:

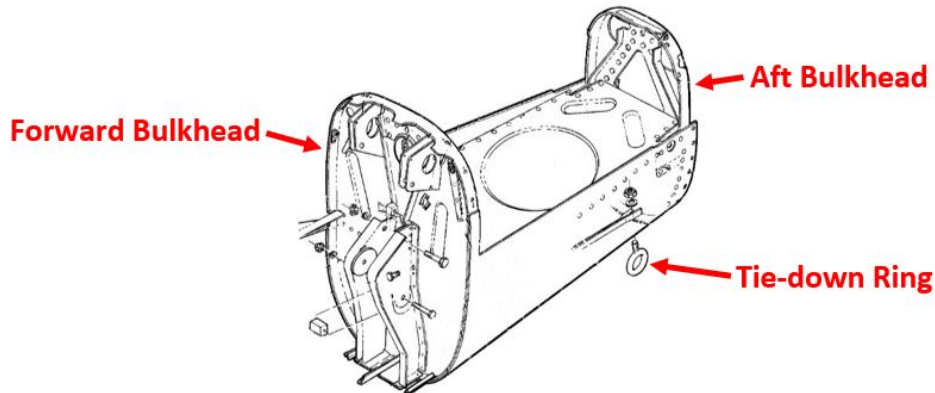


Figure 3-1, Aft Tail Section Cutaway

- 3.1.1 Remove the aircraft’s tail cone (Figure 3-2, item 1) in accordance with the applicable aircraft maintenance manual to gain access to the aft fuselage bulkhead.

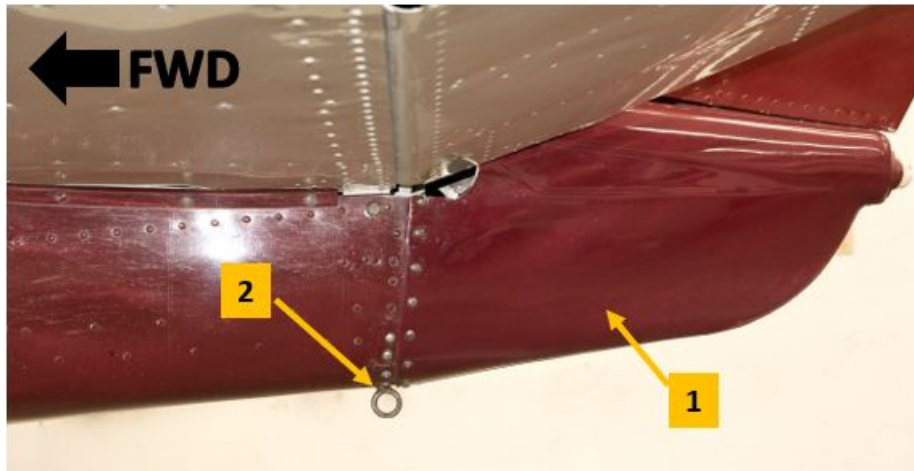


Figure 3-2, Aircraft Tail Section

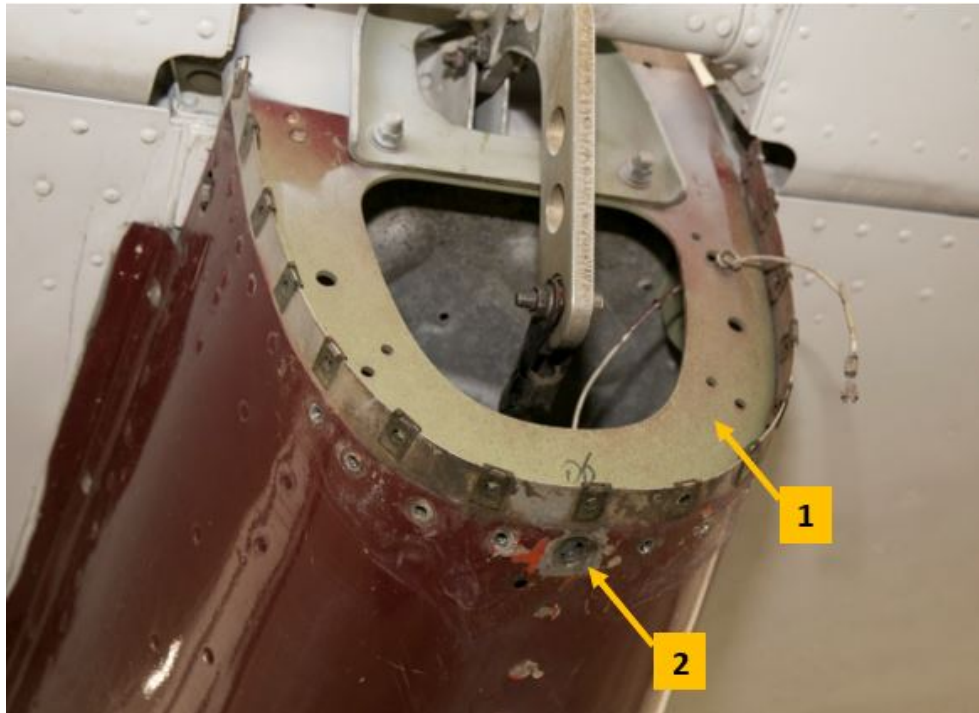


Figure 3-3 Tail Cone and Tie-Down Removed

- 3.1.2 Remove the aircraft's tail tie-down ring (Figure 3-2, item 2) and all accompanying hardware from the aft fuselage bulkhead (Figure 3-3, item 1).
- NOTE:** Do not destroy or discard the removed tie-down ring. The removed tie-down ring and hardware weight must be measured and used in the weight and balance calculations of Section 4.1.
- 3.1.3 Inspect the tie-down ring attachment hole (Figure 3-3, item 2) and surrounding aft bulkhead structure for any damage and perform any necessary repairs before continuing this installation.

3.2 Tail Tie-Down Installation Preparation

In preparation for installation of the replacement tail tie-down a variety of universal head rivets will need to be removed from the tail section between the forward and aft bulkheads. The removed rivets will be replaced with either countersunk rivets to allow for clearance, or machine screws and nuts used to attach the replacement tie-down to the aircraft. The number of rivets to be removed varies based on the model aircraft being modified.

Follow the instructions below to remove and replace the correct rivets:

NOTE: Be sure not to oversize or damage rivet holes during the rivet removal process. Inspect and deburr all rivet holes as necessary prior to reinstalling rivets or adding fasteners.

3.2.1 Remove the inspection panel (Figure 3-4, item 1) located just forward of the forward bulkhead.

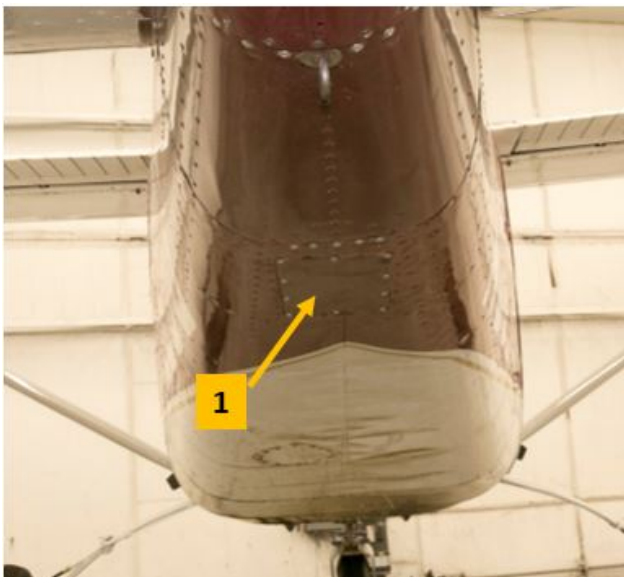


Figure 3-4, Inspection Panel

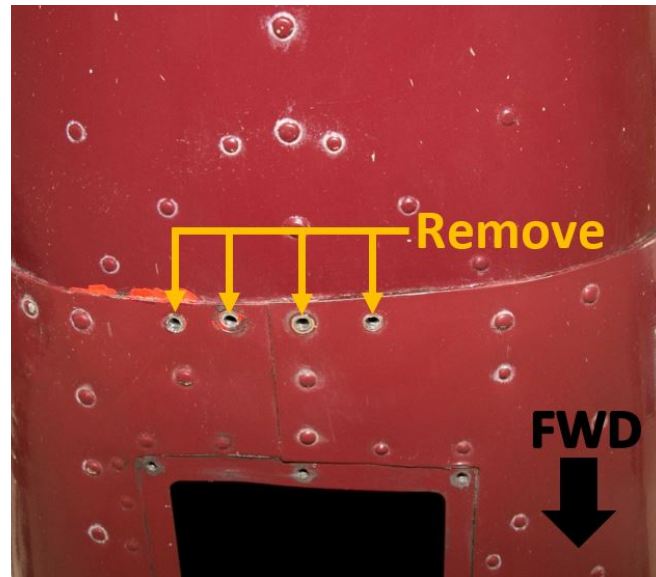


Figure 3-5, Fwd Bulkhead Rivets Removed

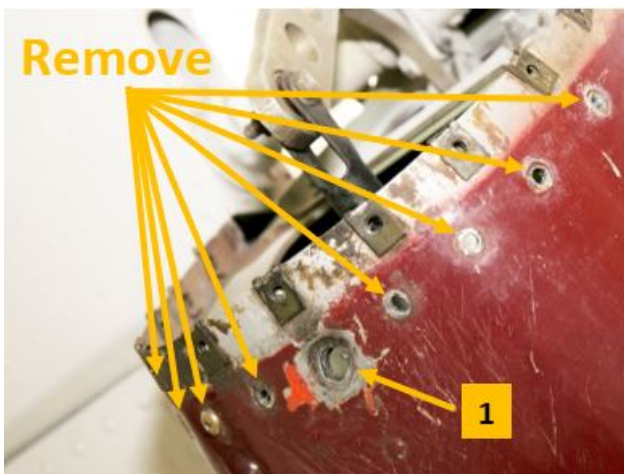


Figure 3-6, Aft Bulkhead Rivets Removed



Figure 3-7, Universal Head Rivets - Remove

- 3.2.2 Carefully remove the four or five most bottom center rivets from the forward bulkhead station shown in Figure 3-5.
- NOTE:** The number of rivets to be removed from the forward bulkhead is either four or five depending on the aircraft model. Remove rivets as required for proper flush fitment of the replacement tie-down.
- 3.2.3 Carefully remove the eight most bottom center rivets from the aft bulkhead station shown in Figure 3-6.
- NOTE:** The tail tie-down hole (Figure 3-6, item 1) marks the bottom center of the rivets to be removed with four rivets on either side of the hole.
- 3.2.4 Carefully remove all universal head rivets along the bottom centerline of the aircraft between the forward and aft bulkhead stations that will be located underneath and interfere with the flush fitment of the replacement tie-down, reference Figure 3-7.
- NOTE:** The number of rivets to be removed from the underside of the aircraft may vary by aircraft model. To determine the exact rivets to be removed, test fit the replacement tie-down to the aircraft fuselage. All rivets that interfere with the flush fitment of the tie-down will need to be removed and replaced with countersunk rivets of equal size.
- 3.2.5 Prepare all rivet holes by dimpling all skins prior to installing countersunk rivets.
- NOTE:** Countersinking rivet holes by countersink drilling is NOT acceptable for this installation. Aircraft skins must be dimpled.
- 3.2.6 Replace the universal head rivets (MS20470AD) removed in step 3.2.4 with equivalently sized countersunk rivets (MS20426AD). All riveting workmanship is to be performed in accordance with AC 43.13-1B Chapter 4, Section 4, Paragraph 4-57.

3.3 Tail Tie-Down Installation

Installation of the replacement tail tie-down is achieved by properly fitting the tie-down to the airframe, match drilling the weldment to the preexisting airframe rivet holes, and attaching the tie-down to the airframe using an assortment of AN hardware. The finished installation can be seen in Figure 3-8, below.

NOTE: Prior to installation, inspect the aircraft skin and tail tie-down to ensure that the mating surfaces are painted. If either surface has exposed metal, repair by conversion coating per MIL-C-5541 or alodine 1132, prime with zinc chromate, epoxy primer or equivalent, and apply topcoat (optional) before continuing the installation.

NOTE: If the “◀ TIE DOWN HERE” placard is damaged or covered by additional topcoat, repair the placard in accordance with Section 8 of the ICA (reference 1.1.1) before returning the aircraft to service.

NOTE: Prior to installation, weigh the replacement tail tie-down and record the weight in the appropriate tables of Section 4.1.

NOTE: Maintain 2D minimum edge distance for all fasteners.



Figure 3-8, Installed Replacement Tail Tie-Down

3.3.1 Test fit and adjust the replacement tie-down to fit flush to the airframe as shown in Figure 3-8.

NOTE: The replacement tail tie-down is manufactured to match the curvature of the tail section at the forward and aft bulkhead attachment points. However, due to imperfections and repairs that many aircraft contain, slight manual reforming of the mounting flanges may be necessary for a precise fitment. If the tail tie-down appears to be significantly out of shape for your aircraft, stop the installation and contact the supplier for additional installation instructions.

- 3.3.2 Install an AN5-7A bolt with MS27183-11 steel washer through the new tail tie-down bolt hole and the bolt hole located in the aft bulkhead (Figure 3-9, items 1 and 2). Secure the tie-down bolt using AN960-516 washers as needed and an AN365-524A nut on the inside of the aft bulkhead. Final bolt torque will be accomplished in a later step.

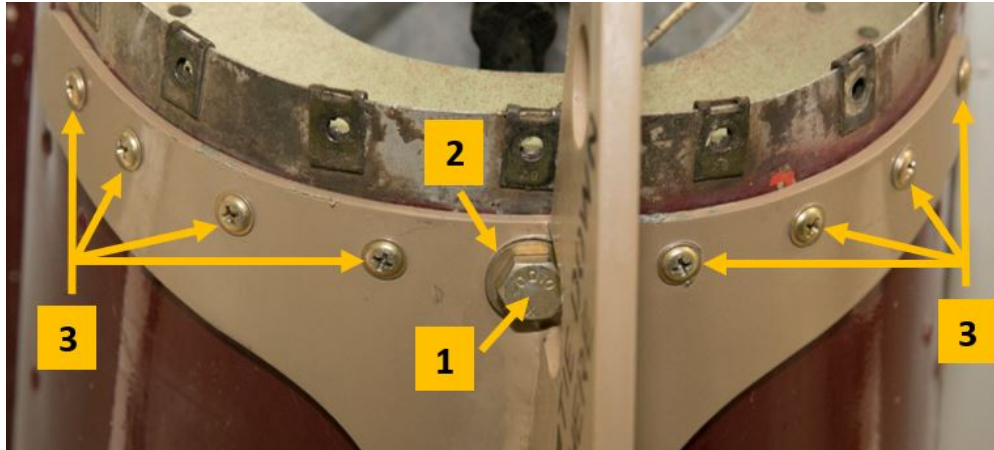


Figure 3-9, Aft Bulkhead Attachment

- 3.3.3 Align the tie-down along the centerline of the aircraft by ensuring the center of the forward bulkhead mounting flange is centered with the centerline of rivets that were replaced along the underside of the aircraft's tail, reference Figure 3-10, below.

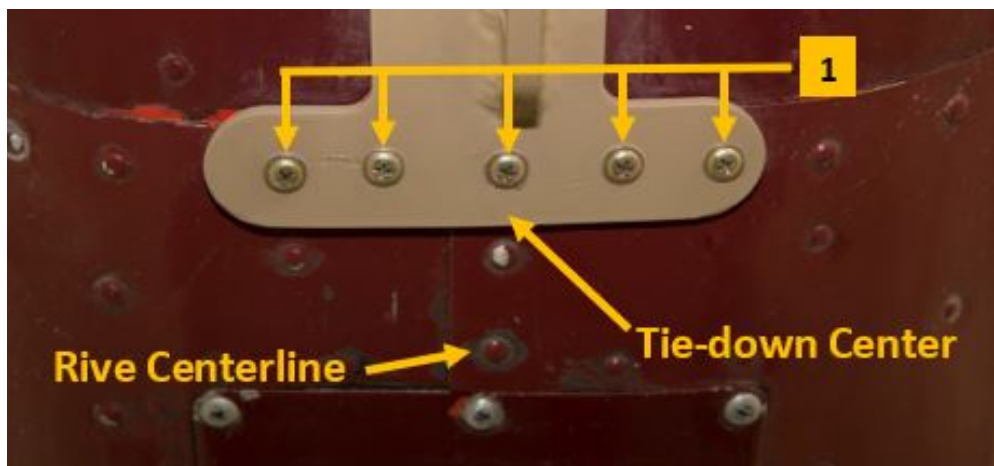


Figure 3-10, Fwd Bulkhead Attachment

- 3.3.4 Match drill the tie-down forward mounting flange and the forward bulkhead station using the existing rivet locations and a #20 drill bit.

NOTE: The new attachment hardware is slightly larger than the removed rivets and will require match drilling to resize the existing rivet holes. Ensure all drilled holes are deburred and free of debris before installing new fasteners.

HOLE TOLERANCE: 0.164 +0.000/-0.002

- 3.3.5 Attach the tie-down forward mounting flange to the airframe using four/five AN525-832R12 machine screws through the tie-down with an AN960-8 washer and AN365-832A nut on the backside of the forward bulkhead (Figure 3-10, item 1).

3.3.6 Match drill the tie-down aft mounting flange to the aft bulkhead station using the existing rivet locations and a #20 drill bit, reference note and hole tolerance in step 3.3.4.

3.3.7 Attach the tie-down aft mounting flange to the airframe using eight AN525-832R12 machine screws through the tie-down with an AN960-8 washer and AN365-832A nut on the backside of the aft bulkhead (Figure 3-9, item 3).

NOTE: Additional AN960-8 washers may be required on the backside for the aft bulkhead to account for variable bulkhead thicknesses. Use washers as needed for your installation.

NOTE: For best fitment it is recommended that the AN525-832R12 machine screws be installed and tightened starting at the bottom of the tie-down (closest to the AN5-7A bolt) and working upwards along the aft mounting flange.

3.3.8 Torque all tie-down attachment hardware in accordance with Table 3-2.

Table 3-2, Hardware Torque Specification

Hardware	Hardware Size	Torque (inch-pounds)
AN525-832R12	8-32	12-15
AN365-524A	5/16-24	60-85

3.3.9 Reinstall the aircraft tail cone and inspection panel in accordance with the applicable aircraft maintenance manual.

3.4 Optional Item: Tie-Down Reinforcement Assembly

Installation of the Reinforcement Assembly (Table 1-2, item 1) is not required for function of the tail tie-down. If desired, the optional reinforcement assembly may be installed as follows:

- 3.4.1 Mate and align the reinforcement plate onto the tie-down plate outer periphery and tie-down hole profile within 0.030" as shown in Figure 3-11.

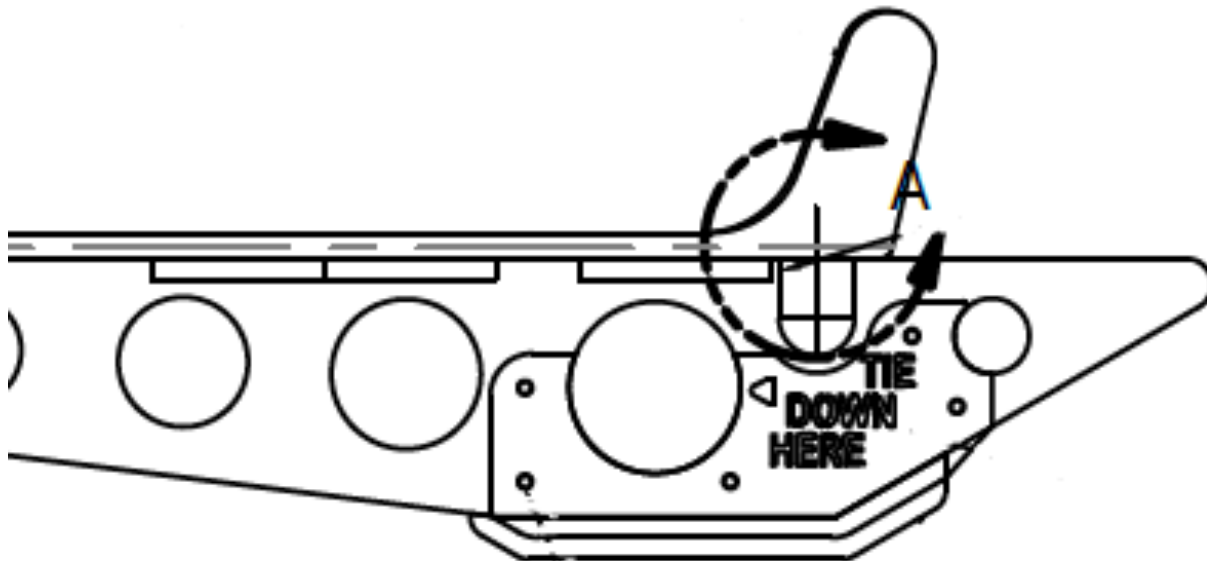


Figure 3-11, Reinforcement Assembly Location

- 3.4.2 Match-drill (5) holes to 0.190 +0.010/-0.000 diameter.
- 3.4.3 Attach the reinforcement plate using (5) AN525-832 R12 screws, (5) AN365-832A nuts, and (5) or more AN960-8 washers under nuts as needed. Torque according to Table 3-2.

NOTE: If the “◀ TIE DOWN HERE” placard (Figure 3-11) is damaged or covered by additional topcoat, repair the placard in accordance with Section 8 of the ICA (reference 1.1.1) before returning the aircraft to service. “◀ TIE DOWN HERE” must be visible over the installed reinforcement assembly.

3.5 Optional Item: Sealant

- 3.5.1 After the tail tie-down is installed, it is allowable to seal the tie-down to the aircraft tail using materials listed in Table 1-2, items 2 and 3 to help prevent dirt and debris from becoming trapped in between the tie-down and the aircraft tail. If desired, run a bead of sealant around the entire perimeter of the tie-down.

NOTE: Ensure that the tie-down is completely sealed. No gaps in the sealant between the aircraft and tie-down are acceptable.

4. POST INSTALLATION

4.1 Weight and Balance

Determine the new empty weight of the aircraft and corresponding center of gravity.

- 4.1.1 Weigh the replacement tail tie-down before installation. Record the weight in Table 4-2.
- 4.1.2 Weigh the factory tie-down that was removed from the airframe after cleaning and removing all debris. Record the measured weights in Table 4-2.
- 4.1.3 Obtain the baseline aircraft’s weight and balance records and verify the information is up to date and accurate. Record the required information in Table 4-2 and Table 4-3.
- 4.1.4 Perform the calculations in Table 4-2, Table 4-3, and Table 4-4 to determine the modified aircraft CG location.
- 4.1.5 Update aircraft weight and balance records accordingly.

*Table 4-1, Replacement Tie-Down Center of Gravity **without** Reinforcement Assesembly*

Make	Series	Installed Center of Gravity (in.)
Cessna	182	222.7
	206	222.7
	207	252.7
	210	222.7

*Table 4-1.2, Replacement Tie-Down Center of Gravity **with** Reinforcement Assembly*

Make	Series	Installed Center of Gravity (in.)
Cessna	182	224.6
	206	224.6
	207	254.6
	210	224.6

4.1.6 Aircraft Weight Calculation

Table 4-2, Modified Aircraft Empty Weight Calculation

Baseline Aircraft Empty Weight (lb)	-	Removed Tie-Down Weight	+	Installed Tail Tie-Down Weight	=	Modified Aircraft Empty Weight (lb)

4.1.7 Moment Calculations

Table 4-3, Modified Aircraft Moment Calculation

Article	Net Weight (lb)	X	Arm/CG (in)	=	Moment (in-lb)
Baseline Aircraft Empty					
					-
Article	Net Weight (lb)	X	Arm/CG (in)⁽¹⁾	=	Moment (in-lb)
Removed Tie-Down					
					+
Article	Net Weight (lb)	X	Arm/CG (in)⁽²⁾	=	Moment (in-lb)
Replacement Tie-Down					
					=
Total Moment (in-lb)					

⁽¹⁾ Refer to Table 3-1 for the aft bulkhead CG location for the applicable aircraft.

⁽²⁾ Refer to Table 4-1 for the replacement tie-down CG location for the applicable aircraft.

4.1.8 CG Calculation

Table 4-4, Modified Aircraft CG Calculation

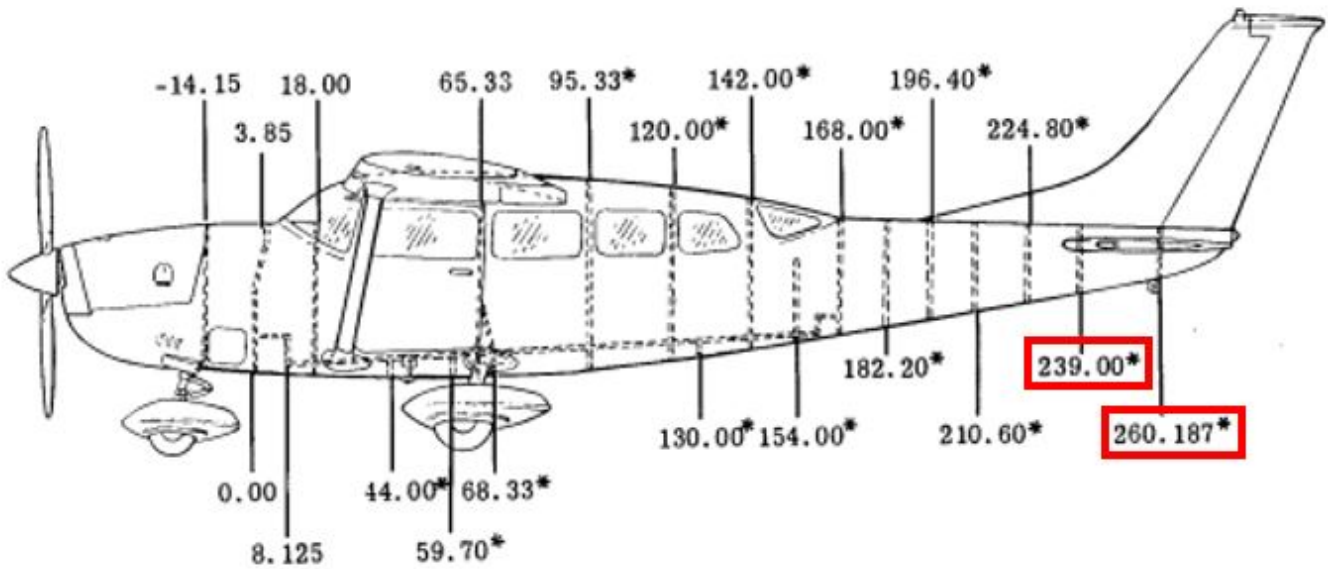
Total Moment (in-lb)	/	Modified Aircraft Empty Weight (lb)	=	CG Location (in)

4.2 Return to Service

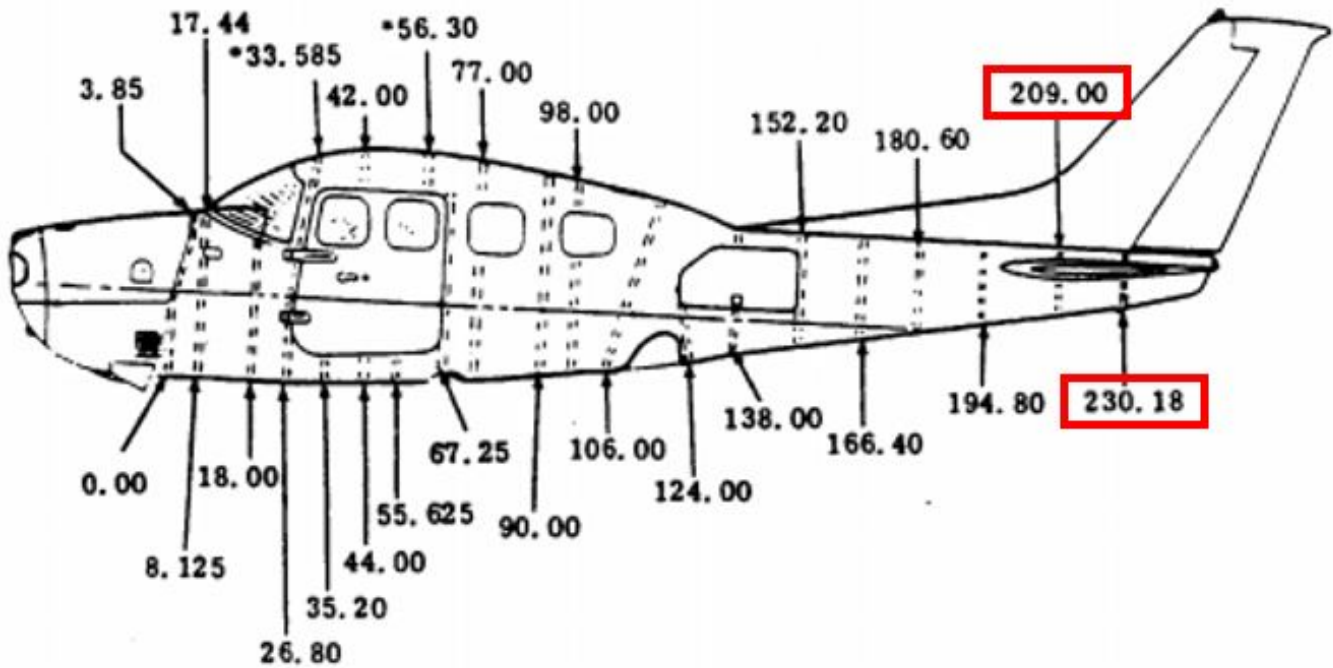
4.2.1 Complete FAA form 337 stating that the tail tie-down replacement has been installed in accordance with this STC.

4.2.2 Update all aircraft logbooks accordingly.

A.3 Cessna 207 Series



A.4 Cessna 210 Series





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