



SkyView HDX

Autopilot Servo Installation & Maintenance Manual

Cessna Series 182

Models: 182E–182T, T182, R/TR182

Includes Instructions for Continued Airworthiness (ICA)

STC SA02594SE

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Revision History

REV	DYNON SUBMITTAL DATE	DESCRIPTION OF CHANGES
A	02/24/2022 ECO 373555	Initial Submission Accepted by Seattle ACO on 3/11/2022
B	7/8/2022 ECO 380329	Revised bridle cable tension value in Sections 7.2, 7.3, 11.8, and 11.9. Accepted by Anchorage ACO on 7/13/2022
C	2/20/2023 ECO 384045	<ul style="list-style-type: none"> Removed FAA Acceptance column from Revision History table per feedback from AACO. (Change not tracked.) Replace 'mechanic' with 'technician' or 'appropriately rated person or facility' throughout document. (Change not tracked.) Removed parentheses from drill bit sizes throughout document. (Change not tracked.) Made procedural step to secure controls/yoke into an important note throughout document. (Change not tracked.) Split Table 2: Pitch Servo Installation Materials into two tables (Retractable Landing Gear Airplanes and Fixed Landing Gear Airplanes). Split Section 7.3: Pitch Servo Installation into two sections (Retractable Landing Gear Airplanes and Fixed Landing Gear Airplanes). Clarified Dynon's harness standard in Section 8.1: Custom Wire Harness Preparation. Added links to new figures in Section 11.9: Pitch Servo Removal and Replacement. (Change not tracked.) Updated figures 5, 11, 12, 13, 14, and 15 in Section 12.1: Roll Servo Figure to show more detail. Updated figures 27, 29, 30, and 31 in Section 12.2: Pitch Servo Figure to show more detail. Split Section 12.2: Pitch Servo Figures into two sections (Retractable Landing Gear Airplanes and Fixed Landing Gear Airplanes). Accepted by Anchorage ACO on 3/9/2023
D	04/28/2023 ECO 385865	<ul style="list-style-type: none"> Added parts for the new roll servo cable guard and bridle cable to Table 1: Roll Servo Materials. Item numbers in Table 2 and Table 3 updated due to new parts introduced in Table 1. (No bars for this change). Revised verbiage in Section 5: Control Cable Verification to include rigging and tension. Added steps to Section 7.2: Roll Servo Installation for the new roll servo cable guard and bridle cable. Reversed order of Section 7.3.1: Fixed Landing Gear Airplanes and Section 7.3.2: Retractable Landing Gear airplanes to align with numbering changes in Table 2 and Table 3. (No bars for this change). Added steps to Section 11.8: Roll Servo Removal and Replacement for the new roll servo cable guard and bridle cable. Updated figures in Section 12.1: Roll Servo Figures to show new roll servo cable guard and bridle cable. Updated figures in Section 12.1: Roll Servo Figures for new item numbers. (No bars for this change). Reversed order of Section 12.2.1: Fixed Landing Gear Airplanes and Section 12.2.2: Retractable Landing Gear airplanes to align with numbering changes in Table 2 and Table 3. (No bars for this change). Accepted by Anchorage ACO on 3/9/2023
E	06/21/2023 ECO 387045	<ul style="list-style-type: none"> Added a note in Sections 7.3.1 and 7.3.2 about possible shear clip trimming needed for certain aircraft. Added Figure 50 in Section 12.2.3 to provide guidance on shear clip trimming. Updated as Minor Change on 7/11/2023
F	07/19/2023 ECO 387651	<ul style="list-style-type: none"> Moved one step in Section 7.3.1 for clarity (change not tracked). Revised important note in Section 7.3.1 to correct position of elevator cable. Updated Fig. 22 to emphasize position of elevator cable. Accepted by Anchorage ACO on 7/24/2023

Technical changes since previous revision are tracked with change bars in margins.

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1 Introduction

This document provides installation and configuration information for SkyView autopilot servos and bracketry in Cessna 182 series of airplanes. It also provides Instructions for Continued Airworthiness (ICA) for use by authorized personnel to service and maintain the servos according to Federal Aviation Regulation (FAR) 14 CFR § 23.1529 and 14 CFR 23 Appendix G.

This document does not provide ICA for the SkyView HDX system. That information is provided in the *SkyView HDX General Maintenance Manual* document at dynoncertified.com/docs.

1.1 Document Control

This document is released, archived, and controlled according to the Dynon's document control system. To revise this document, a letter is submitted to the FAA with the revision. The FAA then accepts and approves any revision to Section 2: [Airworthiness Limitations](#). After FAA acceptance/approval, Dynon posts the revised document for customer use at dynoncertified.com/docs, and STC owners and installers are notified of the new revision via an official Dynon Marketing email release.

1.2 Using this Manual

To save paper, Dynon does not provide a printed version of this manual. However, Dynon grants permission to third parties to print this manual, as necessary. The most recent PDF version is available for download at dynoncertified.com/docs. This manual is updated periodically. It is important to use the most recent version when servicing SkyView components.

Dynon suggests keeping a PDF version of the manual on a smartphone, tablet, or laptop computer while servicing SkyView components. Using the manual electronically allows quick navigation of the document, figures to be viewed in color, and keyword searches.

1.3 Intended Audience

This document is intended for FAA-certified Airframe and Powerplant Technicians. It assumes technicians have the typical aircraft knowledge and training required to perform the procedures in this manual.

1.4 Manual Iconography

This manual uses the following iconography:



Alerts reader to critical guidance that if not followed could result in an unsafe condition.



Alerts reader to FAA regulatory information.



Alerts reader to important installation and/or maintenance information.



Alerts reader to helpful tips or suggestions.

1.5 Reference Documents

The following documents are referenced in or supplement this manual:

- 103261-000 - SkyView HDX System Installation Manual, *current revision*
- 103221-000 - SkyView HDX General Maintenance Manual, *current revision*
- 103488-000 - SkyView HDX Wiring Diagram - Single Engine, *current revision*
- 103272-000 - SkyView HDX Airplane Flight Manual Supplement, *current revision*
- 103777-000 - SkyView HDX System Equipment Installation Record, *current revision*
- 103000-000 - Dynon Servo Shear Screw Replacement Kit Instructions, *current revision*
- AC 23.1311-1C - Installation of Electronic Display in Part 23 Airplanes
- AC 43.13-1B - Acceptable Methods, Techniques, and Practices - Aircraft Inspection
- AC 43.13-2B - Acceptable Methods, Techniques, and Practices - Aircraft Alterations

1.6 Mechanical Drawings

All mechanical drawings included in this manual are for *reference purposes only*. They should not be scaled or copied and used as templates or patterns.

1.7 Product Delivery and Warranty

Upon delivery, visually inspect all components, brackets, fasteners, cable harnesses, and accessories for damage that may have occurred during shipping. If damage has occurred, contact Dynon Technical Support.

1.8 Product Registration

Register SkyView components at dynoncertified.com/register. Product registration verifies ownership, expedites warranty claims, and allows Dynon to send notification when product Service Bulletins and Technical Advisories are published. This site also allows owners and installers to register to receive news and product announcements from Dynon. Dynon will not share contact information with third-parties or send announcements without explicit consent.

1.9 Installation Record

The technician performing the installation should record where each component has been installed in the airplane. This documentation should be entered into airplane's permanent record. Dynon provides a document template to record this information. Download the *SkyView HDX Equipment Installation Record* document at dynoncertified.com/docs.

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2 Airworthiness Limitations

For any Airworthiness Limitations associated with the installation of SkyView autopilot servos, see the *SkyView HDX General Maintenance Manual* document at dynoncertified.com/docs. It is the principal ICA document for the SkyView HDX system.

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3 Basic Control and Operation

Pilots interact with all autopilot functions through a SkyView HDX display unit. No special operating procedures are required for using the SkyView Autopilot. Control descriptions and detailed operating procedures are found in the *SkyView HDX Airplane Flight Manual Supplement* document at dynoncertified.com/docs.

Operating limitations for the SkyView Autopilot are listed in the *SkyView HDX Airplane Flight Manual Supplement* document at dynoncertified.com/docs.

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4 Installation Compliance

If the airplane receiving the installation has been modified, it may be difficult to use the information in this manual to completely substantiate the installation in compliance with STC SA02594SE. Therefore, it is the installer's responsibility to make the final determination of applicability for each individual airplane.

Prior to completing the installation, and before returning the airplane to service, the installer must complete and submit a completed Form FAA 337 - Major Repair & Alteration (Airframe, Powerplant, Propeller, or Appliance) to the appropriate FAA Aircraft Registration Branch. The form must include the following:

- Description of the autopilot servo installation.
- Description of how the autopilot servos interface with existing equipment and systems.
- Appropriately approved or acceptable data that demonstrates compliance.

Refer to AC 43.9-1G - Instructions for Completion of FAA Form 337 for additional information.

4.1 Pre-installation Information

Read and understand the following before proceeding with installation activities.

Always install avionics equipment in accordance with the instructions in this manual and the guidance and approved engineering methods outlined the following FAA documents:



- AC 23.1311-1C - Installation of Electronic Display in Part 23 Airplanes
- AC 43.13-1B - Acceptable Methods, Techniques, and Practices - Aircraft Inspection
- AC 43.13-2B - Acceptable Methods, Techniques, and Practices - Aircraft Alterations



The technician who will authorize the airplane's return to service should agree with the installation plan (i.e., methods, component locations, wiring harness routing, etc.) before installation activities begin. This will help avoid potential rework should any part of the installation be found non-compliant.

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5 Control Cable Verification

The SkyView Autopilot for the Cessna 182 series of airplanes is designed to attach to the airplane's original control cables. It is important for installers to verify the condition, rigging, tension, and diameter of the control cables before starting installation activities. The diameter of control cables should be measured in the vicinities where the autopilot servos will be installed.



DO NOT connect an autopilot system to improperly rigged and tensioned control cables. This includes control cables that are frayed or do not meet manufacturers' specifications.

To measure the aileron control cable, installers need to access the area in the left wing between WS100 and WS118 (see [Figure 1](#) for exact location) in accordance with the manufacturer's service manual. To measure the elevator control cables, installers need to access the area in the fuselage between FS172 and FS185 (see [Figure 18](#) for exact location) in accordance with the manufacturer's service manual.

Control Cable Specification:

Dynon's bridle cable clamps are designed to meet the requirements below for wire rope as specified by MIL-DTL-83420.

CONTROL CABLE	NOMINAL DIAMETER	MINIMUM DIAMETER	MAXIMUM DIAMETER
Aileron, Elevator	1/8"	0.125"	0.139"



If the airplane's original control cables are outside this specification, contact Dynon Technical Support for a resolution.

Out-of-specification control cables can cause cable clamps to slip under load.

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6 Materials

6.1 Roll Servo Materials

The materials identified in [Table 1](#) are provided to install the roll servo. ITEM numbers are also used to call-out parts in the figures in [Section 12.1](#).

Table 1: Roll Servo Materials

ITEM	DYNON P/N	DESCRIPTION	QTY
1	503933-000	SERVO ASSEMBLY: SV42C-SERVO, CAPSTAN 0.68" R	1
1-1		SV42C SERVO	1
1-2		CAPSTAN 0.68" R	1
1-3		AN310-5 CASTLE NUT 5/16"	1
1-4		WAVE WASHER 5/16"	1
1-5		NYLON WASHER 5/16"	1
1-6		PHILIPS PAN HEAD SCREW #6-32 X 1/4" L, NYLOK	4
1-7		MS35333-37 INTERNAL TOOTH WASHER #6	4
1-8		CABLE GUARD	1
2	504666-000	CAPSTAN ACCESSORY KIT, 1/8" CONTROL CABLE	1
2-1		AN3-6A HEX BOLT #10-32	6
2-2		AN960-10 FLAT WASHER #10	6
2-3		AN365-10 LOCK NUT #10-32	6
2-4		BRIDLE CABLE CLAMP 1/8"	4
2-5	504659-000*	BRIDLE CABLE, INBOARD	1
2-6	504660-000*	BRIDLE CABLE, OUTBOARD	1
2-7	104563-000*	TURNBUCKLE BARREL	1
2-8		TURNBUCKLE SAFETY WIRE	2
2-9		ST2-2 STOP SWAGE, 1/16" CABLE	2
3	503965-000	UPPER ROLL SERVO BRACKET	1

ITEM	DYNON P/N	DESCRIPTION	QTY
4	503966-000	LOWER ROLL SERVO BRACKET	1
5	504232-000	ROLL SERVO TEMPLATE	1
6	504649-000	ROLL SERVO CABLE GUARD BRACKET	1
7	504648-000	ROLL SERVO CABLE GUARD	1
8	104168-000	ROLL SERVO HARDWARE KIT	1
8-1		MS24665-210 COTTER PIN	1
8-2		AN3H-4A HEX BOLT #10-32, DRILLED HEAD	4
8-3		AN3-3A HEX BOLT #10-32	2
8-4		AN3-4A HEX BOLT #10-32	2
8-5		AN960-10 FLAT WASHER #10	8
8-6		MS35333-39 INTERNAL TOOTH WASHER #10	3
8-7		AN525-832R7 PHILLIPS WASHER HEAD SCREW #8-32, 7/16" L	6
8-8		MS21051-08 NUTPLATE	6
8-9		MS20426AD-3-3.5 FLUSH MOUNT RIVET	12

NOTE: An item without a Dynon part number is packaged in a kit.

** Packaged in a kit, but item also sold separately.*

6.2 Pitch Servo Materials

Pitch servo installation differs between Cessna 182 airplanes with retractable landing gear and fixed landing gear. The materials identified in [Table 2](#) (fixed) and [Table 3](#) (retractable) are provided to install the pitch servo. ITEM numbers are also used to call-out parts in the figures in [Section 12.2](#).

Table 2: Fixed Landing Gear — Pitch Servo Materials

ITEM	DYNON P/N	DESCRIPTION	QTY
9	504160-000	SERVO ASSEMBLY: SV42C SERVO, CAPSTAN 0.80" R	1
9-1		SV42C SERVO	1
9-2		CAPSTAN 0.80" R	1
9-3		AN310-5 CASTLE NUT 5/16"	1
9-4		WAVE WASHER 5/16"	1
9-5		NYLON WASHER 5/16"	1
9-6		PHILLIPS PAN HEAD SCREW #6-32 X 1/4" L, NYLOK	4
9-7		MS35333-37 INTERNAL TOOTH WASHER #6	4
9-8		CABLE GUARD	1
10	503674-000	CAPSTAN ACCESSORY KIT, 1/8" CONTROL CABLE	2
10-1		AN3-6A HEX BOLT #10-32	6
10-2		AN960-10 FLAT WASHER #10	6
10-3		AN365-10 LOCK NUT #10-32	6
10-4		BRIDLE CABLE CLAMP 1/8"	4
10-5		BRIDLE CABLE	1
10-6		ST2-2 STOP SWAGE, 1/16" CABLE	2
11	503970-000	PITCH SERVO BASE BRACKET	1
12	503972-002	PITCH SERVO RISER BRACKET, FIXED GEAR	1
13	503971-000	PITCH SERVO SHEAR CLIP	4
14	504623-000	PITCH SERVO ALIGNMENT FIXTURE	1
15	104624-000	PITCH SERVO HARDWARE KIT	1

ITEM	DYNON P/N	DESCRIPTION	QTY
15-1		MS24665-210 COTTER PIN	1
15-2		AN3H-4A HEX BOLT #10-32, DRILLED HEAD	4
15-3		AN3-4A HEX BOLT #10-32	6
15-4		AN960-10 FLAT WASHER #10	10
15-5		AN365-1032A LOCK NUT #10-32	2
15-6		AN525-832R8 PHILLIPS WASHER HEAD SCREW #8-32, 1/2" L	12
15-7		AN525-832R7 PHILLIPS WASHER HEAD SCREW #8-32, 7/16" L	4
15-8		AN960-8 FLAT WASHER #8	16
15-9		AN365-832A LOCK NUT #8-32	16
15-10		MS21047-03 NUTPLATE	6
15-11		MS20470AD-3-4 UNIVERSAL HEAD RIVET	8
15-12		MS20426AD-3-4 FLUSH MOUNT RIVET	12

NOTE: An item without a Dynon part number is packaged in a kit.

Table 3: Retractable Landing Gear Airplanes — Pitch Servo Materials

ITEM	DYNON P/N	DESCRIPTION	QTY
16	504160-000	SERVO ASSEMBLY: SV42C SERVO, CAPSTAN 0.80" R	1
16-1		SV42C SERVO	1
16-2		CAPSTAN 0.80" R	1
16-3		AN310-5 CASTLE NUT 5/16"	1
16-4		WAVE WASHER 5/16"	1
16-5		NYLON WASHER 5/16"	1
16-6		PHILLIPS PAN HEAD SCREW #6-32 X 1/4" L, NYLOK	4
16-7		MS35333-37 INTERNAL TOOTH WASHER #6	4
16-8		CABLE GUARD	1
17	503674-000	CAPSTAN ACCESSORY KIT, 1/8" CONTROL CABLE	2
17-1		AN3-6A HEX BOLT #10-32	6
17-2		AN960-10 FLAT WASHER #10	6
17-3		AN365-10 LOCK NUT #10-32	6
17-4		BRIDLE CABLE CLAMP 1/8"	4
17-5		BRIDLE CABLE	1
17-6		ST2-2 STOP SWAGE, 1/16" CABLE	2
18	503970-000	PITCH SERVO BASE BRACKET	1
19	503972-000	PITCH SERVO RISER BRACKET	1
20	503971-000	PITCH SERVO SHEAR CLIP	4
21	503986-000	PITCH SERVO PHENOLIC CABLE GUARD BRACKET	1
22	504212-000	PITCH SERVO PHENOLIC CABLE GUARD	1
23	104167-000	PITCH SERVO HARDWARE KIT	1
23-1		MS24665-210 COTTER PIN	1
23-2		AN3H-4A HEX BOLT #10-32, DRILLED HEAD	4

ITEM	DYNON P/N	DESCRIPTION	QTY
23-3		AN3-4A HEX BOLT #10-32	6
23-4		AN960-10 FLAT WASHER #10	10
23-5		AN525-832R8 PHILLIPS WASHER HEAD SCREW #8-32, 1/2" L	12
23-6		AN525-832R7 PHILLIPS WASHER HEAD SCREW #8-32, 7/16" L	4
23-7		MS35206-246 PHILLIPS PAN HEAD SCREW #8-32, 5/8" L	2
23-8		AN960-8 FLAT WASHER #8	18
23-9		AN365-832A LOCK NUT #8-32	18
23-10		MS21047-03 NUTPLATE	6
23-11		MS20470AD-3-4 UNIVERSAL HEAD RIVET	8
23-12		MS20426AD-3-4 FLUSH MOUNT RIVET	12

NOTE: An item without a Dynon part number is packaged in a kit.

7 Initial Servo and Bracketry Installation

This section provides instructions for installing the roll and pitch servos and associated bracketry, attaching bridle cable assemblies to the aileron and elevator control cables, and the checking the physical installations. The instructions apply to the Cessna 182 series of airplanes listed on the cover of this document. These instructions assume that the areas affected by these installations are unmodified from the factory-delivered configuration.



Printing the figures at the end of this document and keeping them on-hand during installation activities is recommended.

7.1 Additional Tools

The following non-typical tools are needed to complete the installation:

- Angle Drill,
- #10 Nutplate Drill Jig,
- Swage compression tool appropriate for ST2-2 stop swages,
- Cutters for 1/16" diameter wire rope.

7.2 Roll Servo Installation

The roll servo and bracketry are installed in the left wing between WS100 and WS118 (see [Figure 1](#) for exact location). To install the roll servo, installers need to access this area in accordance with the manufacturer's service manual. See [Figure 17](#) for an example of a complete installation.



Remove any previously installed autopilot equipment that may interfere with the new servo installation.



Make sure all flight control cables are rigged and tensioned in accordance with manufacturer's instructions.



Always disconnect aircraft battery before starting installation activities.



Always deburr drilled holes.



Unless otherwise specified, torque all fasteners per specifications in AC 43.13-1B, Table 7-1. Include specified friction drag value when torquing screws.

To install the roll servo:

1. Remove capstan from roll servo (see Section 11.5 for instructions).



DO NOT remove shear screw from servo disc!

2. Temporarily attach lower roll servo bracket to plate template (see Figure 3).
3. Insert and position lower bracket assembly into wing, as shown in Figure 4.
4. Insert upper roll servo bracket into wing and temporarily attach to lower bracket assembly, as shown in Figure 4.
5. Take note of bracket assembly position in relation to WS100.50.



If bracket assembly does not fit in location shown in Figure 4 without contacting rivets on rear spar, contact Dynon Technical Support.



When properly located, bracket assembly will almost contact the bend radius at the top of the rear spar.

6. Remove bracket assembly from wing. (Leave plate template attached to lower bracket.)
7. From outside aircraft, position upper bracket, as shown in Figure 5 and noted in Step 5.



Make sure upper bracket is positioned between rivets with adequate edge margins for 0.17" diameter holes.

8. Use inboard pilot hole in upper bracket to mark a hole location (see Figure 5), drill (#40) hole through wing, and then temporarily fasten upper bracket to wing.
9. Use outboard pilot hole in upper bracket to match drill up to #40 hole through wing.
10. Remove upper bracket from wing.
11. Insert upper bracket into wing and temporarily fasten using holes made in Step 8 and Step 9.
12. Use pilot holes in upper bracket to match drill up to #18 holes through bracket and wing. Temporarily fasten upper bracket to wing after each hole is drilled.
13. Insert and temporarily fasten lower bracket assembly to upper bracket, as shown in Figure 6.



Make sure lower bracket is positioned between rivets with adequate edge margins for 0.17" diameter holes.

14. Use inboard pilot hole in lower bracket to match drill up to #40 hole through wing, and then temporarily fasten lower bracket to wing.
15. Use outboard pilot hole in lower bracket to match drill up to #40 hole through wing.

16. Use pilot holes in lower bracket to match drill up to #18 holes through bracket and wing. Temporarily fasten lower bracket to wing after each hole is drilled
17. Remove bracket assembly from wing and disassemble.
18. Countersink rivet holes in upper and lower brackets, and then attach nutplates to brackets (see [Figure 7](#)).
19. Permanently fasten upper bracket to wing (see [Figure 8](#)).
20. Permanently fasten lower bracket to roll servo (see [Figure 9](#)).
21. Safety wire three roll servo bolts (see [Figure 14](#) for example).
22. Assemble bridle cables, as shown in [Figure 10](#) and [Figure 11](#).
23. Slide a swage stop onto one end of bridle cable, and then position it per specifications in [Figure 10](#) and [Figure 11](#).
24. Crimp swage stop to bridle cable, and then trim bridle cable end flush with outside edge of swage stop.
25. Repeat Steps 23 and 24 on the other end of bridle cable.
26. Insert bridle cable's engagement swage into capstan's engagement hole.
27. Start from swage engagement hole and wrap bridle cable 1 time in each direction around capstan, as shown in [Figure 11](#).



Securing bridle cable to capstan grooves with tape prevents cable from unraveling when handling.

28. Attach capstan to roll servo, as shown in [Figure 11](#).



Position servo capstan so orientation mark on capstan faces away from servo, capstan is in 12 'o' clock position, and servo is fully seated on servo disc. The capstan has a hole that fits over shear screw head.

29. Insert roll servo assembly into wing, as shown in [Figure 12](#).
30. Permanently fasten roll servo assembly to upper bracket and wing (see [Figure 13](#)).

To attach the roll servo to the aileron cable:



Secure ailerons and/or yoke in center of travel.

1. Make sure aileron control cable in area where bridle cable clamps will attach is clean and free of dirt and grease.
2. Use bridle cable clamps to loosely connect inboard and outboard bridle cable ends to aileron control cable, as shown in [Figure 15](#). Make sure clamps contact swage stops at each end of bridle cable.

3. Position bridle cable clamps so that:
 - Swage engagement hole is in the 12 'o' clock position.
 - Clamps are located as shown in [Figure 15](#).
 - Clamps are positioned to avoid contacting any structure.

4. Make sure bridle cable does not contact cable guard.



The bridle cable will prematurely wear if bridle cable and cable guard make contact when control is in a neutral position.

5. If cable guard interferes with bridle cable, adjust cable guard position (see Section [11.6](#) for instructions), and then repeat Step 4.
6. Tighten all bridle cable clamp nuts to 35-40 in-lb.
7. Use a feeler gauge to measure gaps between bridle cable clamp halves (top and bottom). Make sure gaps meet the following criteria:
 - Gap measurements on both sides of clamp are not less than 0.003" and not more than 0.050".



If clamp gap measurements do not meet criteria above, measure diameter of control cable, and then contact Dynon Technical Support for a resolution.

Out-of-specification cable clamps can slip under load.

8. Using turnbuckle, tension and bridle cable to 15-20 lbs. Make sure swage engagement hole is located upward and on same side as cables exit.



The tension on bridle cable should never exceed manufacturer's specified tension for control cable.

9. Safety wire bridle cable turnbuckle halves and barrel.
10. Attach cable guard bracket to roll servo (see [Figure 16](#)).
11. Capture aileron control cable and bridle cable with cable guard, as shown in [Figure 16](#), and then attach cable guard to cable guard bracket (see [Figure 16](#)).
12. Adjust cable guard and/or cable guard bracket as needed so cables do not contact cable guard.
13. Permanently attach capstan to roll servo (see Section [11.5](#) for instructions).

To check the roll servo installation:

1. Release ailerons and/or yoke.
2. Move aileron control through full range of motion per manufacturer's maintenance instructions, and verify the following:
 - Control is smooth throughout (i.e., no grinding, rubbing, or roughness).
 - Bridle cable clamps do not contact any structures during entire travel.
 - Capstan never rotates more than 150 degrees in either direction from neutral.
3. Cycle the control surface several times, return it to neutral, and verify the following:
 - Swage engagement hole is in the 12 'o' clock position.
 - Position of bridle cable clamps closely matches [Figure 15](#).
 - Bridle cable tension has not changed.

7.3 Pitch Servo Installation

Pitch servo installation differs between Cessna 182 airplanes with retractable landing gear and fixed landing gear. Both installations are covered in this section. The pitch servo and bracketry are installed in the fuselage between FS172 and FS185 (see [Figure 18](#) for exact location) in both installations. To install the pitch servo, installers need to access this area in accordance with the manufacturer's service manual. See [Figure 49](#) (retractable) and [Figure 33](#) (fixed) for examples of complete installations.



Remove any previously installed autopilot equipment that may interfere with the new servo installation.



Make sure all flight control cables are rigged and tensioned in accordance with manufacturer's instructions.



Always disconnect aircraft battery before starting installation activities.



Always deburr drilled holes.



Unless otherwise specified, torque all fasteners per specifications in AC 43.13-1B, Table 7-1. Include specified friction drag value when torquing screws.

7.3.1 Fixed Landing Gear Airplanes

To install the pitch servo:



Secure elevator and/or yoke in most pitch-down position.

1. If required for access, remove aircraft battery in accordance with manufacturer's service instructions.
2. Temporarily attach alignment fixture to riser bracket (see [Figure 20](#)).
3. Position pitch servo base bracket, as shown in [Figure 21](#).
4. Place riser bracket assembly on base bracket, and then adjust both brackets as needed to position riser bracket, as shown in [Figure 22](#).



Aligning riser bracket with elevator control cable, as shown in [Figure 22](#), is critical for an airworthy installation.

5. Use holes in brackets and bracket edges to mark locations for positioning base bracket on fuselage skin and riser bracket on base bracket.
6. Remove riser bracket assembly from airplane. Leave base bracket in position.
7. Remove alignment fixture from riser bracket. Retain hardware for later use.
8. Use pilot holes in base bracket to match drill up to #18 holes through base bracket and fuselage skin (see [Figure 23](#)).
9. Position shear clips, as shown in [Figure 24](#).



Depending upon aircraft model and year, it may be necessary to trim a small amount of material from shear clips, so they fit flush against the frames. See [Figure 50](#) for shear clip trimming guidance.

10. Use pilot holes in shear clips to match drill up to #40 holes through base bracket (see [Figure 24](#)).
11. Use pilot holes in shear clips to match drill up to #18 holes through shear clips and FS172 and FS185 frames (see [Figure 24](#)).
12. Remove base bracket and shear clips from airplane.
13. On a workbench, use pilot holes in riser brackets to match drill up to #10 holes through riser bracket and base bracket (see [Figure 25](#)).
14. Use nutplate drill jig to drill up to #40 rivet holes through base bracket.
15. Countersink rivet holes in riser bracket, and then attach nutplates to bracket (see [Figure 26](#)).
16. Rivet shear clips to base bracket (see [Figure 27](#)).

17. Remove capstan and cable guard from pitch servo (see Section 11.5 for instructions).



DO NOT remove shear screw from servo disc!

18. Attach pitch servo to riser bracket (see Figure 28).



Position servo capstan so orientation mark on capstan faces away from servo, capstan is in 12 'o' clock position, and servo is fully seated on servo disc. The capstan has a hole that fits over shear screw head.

19. Safety wire pitch servo bolts (see Figure 29 for example).

20. Permanently fasten base bracket to fuselage skin (see Figure 30).

21. Permanently fasten riser bracket assembly to base bracket (see Figure 31).

To attach the pitch servo to the lower elevator cable:



Secure elevator and/or yoke in center of travel.

1. Insert bridle cable's engagement swage into capstan's engagement hole.
2. Start from swage engagement hole and wrap bridle cable 1.5 times in each direction around capstan.



Securing bridle cable to capstan groove with tape prevents cable from unraveling when handling.

3. Make sure elevator control cable in area where bridle cable clamps will attach is clean and free of dirt and grease.
4. Use bridle cable clamps to loosely connect forward and aft bridle cable ends to elevator control cable, as shown in Figure 32.
5. Position bridle cable clamps so that:
 - Swage engagement hole is in the 12 'o' clock position.
 - Clamps are located as shown in Figure 32.
 - Clamps are positioned to avoid contacting any structures.
6. Mark locations for swage stops on bridle cable at outside edges of bridle cable clamps.
7. Slide a swage stop onto one end of bridle cable, and then position it per specifications in Figure 32.
8. Crimp swage stop to bridle cable, and then trim bridle cable end flush with outside edge of swage stop.
9. Repeat Steps 7 and 8 on the other end of bridle cable.
10. Make sure bridle cable does not contact cable guard.



The bridle cable will prematurely wear if bridle cable and cable guard make contact when control is in a neutral position.

11. If cable guard interferes with bridle cable, adjust cable guard position (see Section 11.6 for instructions), and then repeat Step 10.
12. Tension and temporarily secure bridle cable to 15-20 lbs. Make sure swage engagement hole is on opposite side of capstan from lower elevator cable.



The tension on bridle cable should never exceed manufacturer's specified tension for control cable.

13. When satisfied with tension and capstan position, tighten all bridle cable clamp nuts to 35-40 in-lb.
14. Use a feeler gauge to measure gaps between bridle cable clamp halves (top and bottom). Make sure gaps meet the following criteria:
 - Gap measurements on both sides of clamp are not less than 0.003" and not more than 0.050".



If clamp gap measurements do not meet criteria above, measure diameter of control cable, and then contact Dynon Technical Support for a resolution.

Out-of-specification cable clamps can slip under load.

15. Permanently attach capstan and cable guard to pitch servo (see Section 11.5 for instructions).

To check the pitch servo installation:

1. Release elevator and/or yoke.
2. Move elevator control through full range of motion per manufacturer's maintenance instructions, and verify the following:
 - Control is smooth throughout (i.e., no grinding, rubbing, or roughness).
 - Bridle cable clamps do not contact any structures during entire travel.
 - Capstan never rotates more than 150 degrees in either direction from neutral.
3. Cycle the control surface several times, return it to neutral, and verify the following:
 - Swage engagement hole is in the 12 'o' clock position.
 - Position of bridle cable clamps closely matches [Figure 32](#).
 - Bridle cable tension has not changed.

7.3.2 Retractable Landing Gear Airplanes

To install the pitch servo:



Secure elevator and/or yoke in center of travel.

1. If required for access, remove aircraft battery in accordance with manufacturer's service instructions.
2. Temporarily attach pitch servo to pitch servo riser bracket (see [Figure 35](#)).
3. Position pitch servo base bracket, as shown in [Figure 36](#).
4. Place riser bracket assembly on base bracket, and then adjust both brackets as needed to position servo capstan as shown in [Figure 37](#).



Aligning pitch servo capstan with elevator control cable, as shown in [Figure 37](#), is critical for an airworthy installation.

5. Use holes in brackets and bracket edges to mark locations for positioning base bracket on fuselage skin and riser bracket on base bracket.
6. Remove riser bracket assembly from airplane. Leave base bracket in position.
7. Use pilot holes in base bracket to match drill up to #18 holes through base bracket and fuselage skin (see [Figure 38](#)).
8. Position shear clips, as shown in [Figure 39](#).



Depending upon aircraft model and year, it may be necessary to trim a small amount of material from shear clips, so they fit flush against the frames. See [Figure 50](#) for shear clip trimming guidance.

9. Use pilot holes in shear clips to match drill up to #40 holes through base bracket (see [Figure 39](#)).
10. Use pilot holes in shear clips to match drill up to #18 holes through shear clips and FS172 and FS185 frames (see [Figure 39](#)).
11. Remove base bracket and shear clips from airplane.
12. On a workbench, use pilot holes in riser brackets to match drill up to #10 holes through riser bracket and base bracket (see [Figure 40](#)).
13. Use nutplate drill jig to drill up to #40 rivet holes through base bracket.
14. Countersink rivet holes in riser bracket, and then attach nutplates to bracket (see [Figure 41](#)).
15. Rivet shear clips to base bracket (see [Figure 42](#)).

16. Remove capstan and cable guard from pitch servo (see Section 11.5 for instructions).



DO NOT remove shear screw from servo disc!

17. Attach pitch servo to riser bracket (see Figure 43).



Position servo capstan so orientation mark on capstan faces away from servo, capstan is in 6 'o' clock position, and servo is fully seated on servo disc. The capstan has a hole that fits over shear screw head.

18. Attach cable guard bracket to riser bracket (Figure 44).

19. Position phenolic cable guard so elevator control cable is centered in upper (larger) hole in cable guard, and then clamp cable guard to cable guard bracket.

20. Use pilot holes in cable guard bracket to match drill up to #18 holes through cable guard bracket and phenolic cable guard (see Figure 44).

21. Safety wire pitch servo bolts (see Figure 45 for example).

22. Permanently fasten base bracket to fuselage skin (see Figure 46).

23. Permanently fasten riser bracket assembly to base bracket (see Figure 47).

To attach the pitch servo to the upper elevator cable:



Secure elevator and/or yoke in center of travel.

1. Insert bridle cable's engagement swage into capstan's engagement hole.
2. Start from swage engagement hole and wrap bridle cable 1.5 times in each direction around capstan.



Securing bridle cable to capstan groove with tape prevents cable from unraveling when handling.

3. Make sure elevator control cable in area where bridle cable clamps will attach is clean and free of dirt and grease.
4. Use bridle cable clamps to loosely connect forward and aft bridle cable ends to elevator control cable, as shown in Figure 48.
5. Position bridle cable clamps so that:
 - Swage engagement hole is in the 6 'o' clock position.
 - Clamps are located as shown in Figure 48.
 - Clamps are positioned to avoid contacting any structures.
6. Mark locations for swage stops on bridle cable at outside edges of bridle cable clamps.
7. Slide a swage stop onto one end of bridle cable, and then position it per specifications in Figure 48.

8. Crimp swage stop to bridle cable, and then trim bridle cable end flush with outside edge of swage stop.
9. Repeat Steps 7 and 8 on the other end of bridle cable.
10. Make sure bridle cable does not contact cable guard.



The bridle cable will prematurely wear if bridle cable and cable guard make contact when control is in a neutral position.

11. If cable guard interferes with bridle cable, adjust cable guard position (see Section 11.6 for instructions), and then repeat Step 10.
12. Tension and temporarily secure bridle cable to 15-20 lbs. Make sure swage engagement hole is on opposite side of capstan from upper elevator cable.



The tension on bridle cable should never exceed manufacturer's specified tension for control cable.

13. When satisfied with tension and capstan position, tighten all bridle cable clamp nuts to 35-40 in-lb.
14. Use a feeler gauge to measure gaps between bridle cable clamp halves (top and bottom). Make sure gaps meet the following criteria:
 - Gap measurements on both sides of clamp are not less than 0.003" and not more than 0.050".



If clamp gap measurements do not meet criteria above, measure diameter of control cable, and then contact Dynon Technical Support for a resolution.

Out-of-specification cable clamps can slip under load.

15. Permanently attach capstan and cable guard to pitch servo (see Section 11.5 for instructions).

To check the pitch servo installation:

1. Release elevator and/or yoke.
2. Move elevator control through full range of motion per manufacturer's maintenance instructions, and verify the following:
 - Control is smooth throughout (i.e., no grinding, rubbing, or roughness).
 - Bridle cable clamps do not contact any structures during entire travel.
 - Capstan never rotates more than 150 degrees in either direction from neutral.
3. Cycle the control surface several times, return it to neutral, and verify the following:
 - Swage engagement hole is in the 6 'o' clock position.
 - Position of bridle cable clamps closely matches [Figure 48](#).
 - Bridle cable tension has not changed.

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8 Servo Electrical Connection

Refer to the following documents at dynoncertified.com/docs for complete electrical connection guidance:

- *SkyView HDX Wiring Diagram - Single Engine*
- *SkyView HDX System Installation Manual*

Dynon provides the SV-NET-SERVO Network Autopilot Servo Cable Kit to aid in wiring the servos. Contact Dynon Sales for more information.



Servo electrical harnesses must be routed through the airframe structure as outlined in AC 43.13-1B, Chapter 11, Section 3.



Power for all servos must be controlled by a switch labeled AP Power that is installed prominently on the instrument panel. This provides the pilot the ability to quickly turn off power to the servos should it be needed. See the *SkyView HDX System Installation Manual* for more information.



An Autopilot Disconnect (AP DISC) button must be installed prominently on the instrument panel or yoke/wheel. This provides the pilot the ability to quickly disengage the pitch and roll servos. See the *SkyView HDX System Installation Manual* for more information.



Servo power and Autopilot Disconnect circuits are required to be separate from the signal and power circuits provided over the SkyView Network. The servos should receive power from a common power source with circuit protection sized for the loads associated with all servos.



Terminate servo electrical harnesses with a D9 connector with female pins; terminate pigtailed on servo electrical harnesses with mating D9 connector with male pins.



Servo electrical harnesses must not chafe against airframe structure. After all electrical connection activities are complete, visually inspect all harness routing.



Servo electrical harnesses cannot interfere with the airplane's flight controls. After all electrical connection activities are complete, confirm this by moving all controls through full range of motion per manufacturer's maintenance instructions.

After electrically connecting the autopilot servos, perform the Servo Calibration Procedure (see Section [11.2](#) for instructions).

8.1 Custom Wire Harness Preparation

If your SkyView Autopilot installation requires customized wire harnesses, refer to [Table 4](#) for wire/pin connection guidance. Dynon harness standard is to connect servo wires to a D9 male connector with threaded jack nuts. (See the *SkyView HDX Wiring Diagram - Single Engine* and *SkyView HDX System Installation Manual* documents at dynoncertified.com/docs for additional electrical installation information.)

Table 4: Autopilot Servo Harness, Pin/Wire Connections

D9 Harness Pin #	D9 Harness Wire Function	D9 Harness Wire Color	Connection / Notes
1	SkyView Network Data 1A	Green	SkyView Network D9 Connector, Pin 1
2	Ground	Black	Common Airframe Ground
3	Autopilot Disconnect	Yellow	A/P DISC Button
4	SkyView Network Data 2B	White w/ Blue	SkyView Network D9 Connector, Pin 4
5	None	No Wire	No Connection
6	SkyView Network Data 1B	Blue	SkyView Network D9 Connector, Pin 6
7	Power	Red	Electrical Bus Use 10A Circuit Breaker / Fuse
8	SkyView Network Data 2A	White w/ Green	SkyView Network D9 Connector, Pin 8
9	None	No Wire	No Connection

9 Electric Trim Control

Existing pitch trim motors certified for the airplane can be controlled through the SkyView Autopilot. Such trim motors must operate on 10–30 Volts with a maximum current draw of 5 Amps. This includes trim motors with or without a clutch.

Instructions for connecting to a trim motor, configuring SkyView HDX for trim control, and functionally testing the feature are found in the *SkyView HDX System Installation Manual* document at dynoncertified.com/docs.

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10 Servo Troubleshooting

This section provides troubleshooting information for the autopilot servos. See the *SkyView HDX General Maintenance Manual* document at dynoncertified.com/docs for information about troubleshooting the SkyView Autopilot interface.

10.1 Servos Offline Messages

Condition:

One or more of the following messages appear on SkyView HDX display unit:

- PITCH SERVO OFFLINE
- ROLL SERVO OFFLINE

If all three messages annunciate:

1. Verify Master Power is *ON*.
2. Verify Autopilot circuit breaker and switch are *ON*.
3. Verify all harness connectors for all servos are properly mated.
4. Verify electrical power to all servos.
5. Verify adequate ground quality for all servos.

If condition persists, or if only one message annunciates:

1. Enter SETUP menu (simultaneously hold Buttons #7 and #8).
2. Go to SYSTEM SETUP -> SKYVIEW NETWORK SETUP-> NETWORK STATUS
3. Locate SV32/SV42 servos in list of network devices. If necessary, use knobs to scroll through entire list. If a servo entry is not listed under network devices, press BACK, and perform a SkyView Network configuration (refer to the *SkyView HDX System Installation Manual* document).
4. If any servos are highlighted in RED:
 - a) Verify Autopilot system circuit breaker and switch are *ON*.
 - b) Inspect and fix wiring to affected servo, or common wiring if multiple servos are offline.
5. If any servos are highlighted in YELLOW, a software upgrade did not complete properly (refer to the *SkyView HDX System Installation Manual* document at dynoncertified.com/docs).
6. If all above fails, contact Dynon Technical Support.

10.2 Servo Slip Messages

Condition:

One or more of the following messages appear and persist on SkyView HDX display unit:

1. PITCH SERVO SLIP
2. ROLL SERVO SLIP

The momentary appearance of SERVO SLIP messages is expected due to certain weather conditions during autopilot operation. If a SERVO SLIP message persists, contact Dynon Technical Support for assistance.

10.3 Abnormal Operation

Condition:

One or more autopilot axes fail to move as expected or operate in an unexpected manner.

To test for bridle cable clamp slippage:

1. On ground, engage the autopilot into Level Mode.
2. Have an assistant observe the bridle cable clamps during Step #2.
3. From exterior of the airplane, grasp, and gently attempt to move the affected control surface (i.e., elevator, aileron).
4. If cable clamp slips, remove and install the clamp per guidance in Section [11.8](#) or [11.9](#).

To test for broken shear screw:

1. On ground, engage the autopilot into Level Mode.
2. From exterior of the airplane, grasp, and gently attempt to move the affected control surface (i.e., elevator, aileron).
3. If autopilot does not resist attempt to move control surface, contact Dynon Technical Support to request a Shear Screw Replacement Kit (P/N 102991-000).

11 Servo Maintenance

This section provides maintenance information for the autopilot servos. See the *SkyView HDX General Maintenance Manual* document at dynoncertified.com/docs for information about troubleshooting the autopilot's system interface.



No special tools or facility are required to service autopilot servos.

11.1 Service

Every 12 months (1 calendar year), the autopilot servo components and wiring harnesses should be inspected to ensure continued integrity of the installation (see below).

- Inspect for security of servo attachment, which includes visual inspection of brackets and other supporting structures that attach to the airplane.
- Inspect for signs of corrosion.
- Inspect condition of wiring, shield terminations, routing, and attachment/clamping, along with any airplane penetration points.

In the event of system failures, contact Dynon Technical Support. Always have an appropriately rated person or facility remove a failed component.

11.2 Calibration Procedure

The SkyView Autopilot servo settings are available for download as a configuration file that is loaded into the SkyView HDX display unit. This file configures the autopilot servo performance settings to meet the applicable certification regulations. Servo calibration cannot be performed without the following:

- An ADAHRS module (SV-ADAHRS-200) installed and configured in the SkyView Network.
- All servos installed and configured in the SkyView Network.
- V-speeds correctly entered in the SkyView HDX. (See the *SkyView HDX System Installation Manual* document at dynoncertified.com/docs for instructions.)

To make a new servo appear on SkyView HDX, configure the SkyView Network (SYSTEM SETUP > NETWORK SETUP > CONFIGURE). (See the *SkyView HDX System Installation Manual* document at dynoncertified.com/docs for instructions.)

To calibrate the servos, enter the Servo Calibration Wizard (SETUP MENU > HARDWARE CALIBRATION > AP SERVO CALIBRATION > CALIBRATION) and follow the onscreen instructions to calibrate the servo(s).

SkyView HDX checks the status of the AP Disengage Button. If SkyView HDX detects that the button is pressed (the input is grounded) upon entering AP SERVO CALIBRATION, the AP

Disengage Button is assumed to be stuck (or incorrectly installed), resulting in the following message being displayed, and the Autopilot servo calibration is aborted:

"The servo disconnect switch appears to be pressed and may be installed incorrectly. The servo disconnect switch should be a type Momentary, Push Button Normal Open (PBNO). Press cancel below to return to the servo calibration menu."

If the servo calibration procedure is not successful, inspect the button and servo wiring. (See the *SkyView HDX System Installation Manual* document at dynoncertified.com/docs for instructions.) If button type and wiring is correct, call Dynon Technical Support.

If the servo calibration procedure is successful, SkyView HDX will automatically instruct you to run the servo test procedure. (See Section 11.3 for instructions.)

11.3 Test Procedure

The servo test procedure requires a successful servo calibration. The servo test procedure verifies that each servo is configured properly by moving the control surfaces while the installer verifies the correct movement. You may run this procedure on its own at any time after a successful servo calibration. SkyView HDX will not display AP status on the Top Bar until after this test procedure is successfully completed.

To run this procedure on its own (after a successful servo calibration procedure), enter the Servo Test Wizard (SETUP MENU > HARDWARE CALIBRATION > AP SERVO CALIBRATION > TEST) and follow the onscreen instructions to test the servo(s).

11.4 Servo Operation Check

Complete the following procedures to confirm the autopilot servos are operating correctly.

To check the pitch and roll axes:

1. Make sure master power and autopilot servo power are *ON*.
2. Center, and lightly hold in place, flight control yoke.
3. Align HDG/TRK bug with current heading.
4. Select ALT and HDG.
5. Engage autopilot.
6. Set vertical speed to +1000.
7. Set altitude to 1000 feet above current.
Yoke should move in Nose Up direction.
8. Press and hold ALT button to return altitude bug to current.
Yoke should move back to neutral position.
9. Change HDG/TRK bug to right of current heading.
Yoke should move in direction of a right roll.

-
10. Change HDG/TRK bug to left of current heading.

Yoke should move in direction of a left roll.

To check Autopilot Disconnect:

1. Make sure master power and autopilot servo power are *ON*.
2. Engage autopilot.
3. Complete the following:
 - Press AP button in Autopilot Control menu, and make sure autopilot disconnects.
"AUTOPILOT DISCONNECT" aural indication should be heard.
 - Turn AP Servo Power switch *OFF*, and make sure autopilot disconnects.
"AUTOPILOT DISCONNECT" aural indication should be heard.
 - If installed, press AP button on Autopilot Control Panel, and make sure autopilot disconnects.
"AUTOPILOT DISCONNECT" aural indication should be heard.
 - If installed, press panel-mounted Autopilot Disconnect button, and make sure autopilot disconnects.
"AUTOPILOT DISCONNECT" aural indication should be heard.
 - If installed, press yoke-mounted Autopilot Disconnect button, and make sure autopilot disconnects.
"AUTOPILOT DISCONNECT" aural indication should be heard.

11.5 Servo Capstan Removal and Attachment

Dynon's autopilot servos are shipped with capstans installed. Servo installation procedures often require the temporary removal and re-attachment of capstans.



Unless otherwise specified, torque all fasteners per specifications in AC 43.13-1B, Table 7-1. Include specified friction drag value when torquing screws.

Reference [Figure 51](#) when performing the following procedure.

To remove and re-attach the capstan:

1. Remove cotter pin that secures castle nut to servo shaft.
2. Mark position of castle nut in relation to servo shaft, and then remove castle nut from servo shaft.
3. Remove wave washer from servo shaft.
4. Removed nylon washer from servo shaft.
5. Remove capstan from servo shaft.



The shear screw does not need to be removed from the servo disc. The capstan has a hole that fits over the shear screw head.



If the shear screw is loosened, it must be completely removed and replaced (see Section [11.7](#) for instructions).

6. Place capstan onto output shaft, aligning hole in capstan with shear screw head located in servo disc.
7. Replace nylon washer on servo shaft.
8. Replace wave washer on servo shaft.
9. Finger-tighten castle nut onto servo shaft, and then use a wrench to tighten until slot in castle nut lines up with hole for cotter pin in servo shaft.



DO NOT overtighten the castle nut!

Tightening the castle nut beyond 4 in-lbs may prevent the capstan from rotating freely in the event of shear screw failure.

10. Install new cotter pin to secure castle nut to servo shaft.

11.6 Cable Guard Adjustment

Dynon's Autopilot servos are shipped with cable guards installed. The cable guard may need to be repositioned to avoid interference with the flight control cables or the bridle cables during servo installation procedures. The following procedure details the task of adjusting a cable guard.



Unless otherwise specified, torque all fasteners per specifications in AC 43.13-1B, Table 7-1. Include specified friction drag value when torquing screws.

Reference [Figure 51](#) when performing the following procedure.

To adjust the cable guard:

1. Remove capstan from servo shaft (see Section [11.5](#) for instructions).
2. Remove screws and washers that secure capstan guard to servo.
3. Rotate capstan guard to correct position.
4. Secure capstan guard to servo with screws and washers.
5. Re-attach capstan to servo shaft (see Section [11.5](#) for instructions).

11.7 Shear Screw Replacement

Dynon servos come equipped with a capstan. The capstan connects to the servo via a frangible shear screw. The shear screw can be broken by the pilot to restore system movement should a servo become jammed. It is possible for turbulence loads acting on the airplane to cause a shear screw to fail, even though the servo never jammed.



In the event of a shear screw failure, contact Dynon Technical Support to request a Shear Screw Replacement Kit (P/N 102991-000).



Shear screw replacement instructions are provided in the *Dynon Servo Shear Screw Replacement Instructions* document included in the Shear Screw Replacement Kit (P/N 102991-000).

11.8 Roll Servo Removal and Replacement

This section provides instructions for removing and replacing a roll servo and connecting it back to the control system.

The roll servo and bracketry are installed in the left wing between WS100 and WS118 (see [Figure 1](#) for exact location). To service the roll servo, installers need to access this area in accordance with the manufacturer's service manual. See [Figure 17](#) for an example of a complete installation.



Make sure all flight control cables are rigged and tensioned in accordance with manufacturer's instructions.



Always disconnect aircraft battery before starting removal and installation activities.



Unless otherwise specified, torque all fasteners per specifications in AC 43.13-1B, Table 7-1. Include specified friction drag value when torquing screws.

To remove the roll servo:

1. Disconnect D9 cable harness connector from servo.
2. Mark locations of bridle cable clamps on aileron control cable.



Securing bridle cable to capstan grooves with tape prevents cable from unraveling when handling.

3. Remove cable guard and cable guard bracket from roll servo (see [Figure 16](#)).
4. Loosen bridle cable clamps (see [Figure 15](#)).
5. Remove capstan (with bridle cable) from roll servo (see [Section 11.5](#) for instructions).



DO NOT remove shear screw from servo disc!

6. Remove safety wiring from roll servo bolts.
7. Remove bolts and washers that secure roll servo to upper and lower roll servo brackets (see [Figure 9](#) and [Figure 13](#)). Retain hardware for servo installation.
8. Remove roll servo and capstan (with bridle cable) from aircraft.
9. Remove safety wiring from bridle cable turnbuckle halves and barrel.

To replace the roll servo:



Secure ailerons and/or yoke in center of travel.

1. Secure roll servo to upper and lower roll servo brackets (see [Figure 13](#)).
2. Safety wire roll servo bolts (see [Figure 14](#) for example).
3. Attach capstan (with bridle cable) to roll servo, as shown in [Figure 11](#).



Position servo capstan so orientation mark on capstan faces away from servo, capstan is in 12 'o' clock position, and servo is fully seated on servo disc. The capstan has a hole that fits over shear screw head.

4. Make sure aileron control cable in area where bridle cable clamps will attach is clean and free of dirt and grease.
5. Use bridle cable clamps to loosely connect bridle cable ends to aileron control cable at marks made during removal process. Make sure clamps contact swage stops at each end of bridle cable, as shown in [Figure 15](#).
6. Make sure bridle cable does not contact cable guard.



The bridle cable will prematurely wear if bridle cable and cable guard make contact when control is in a neutral position.

7. If cable guard interferes with bridle cable, adjust cable guard position (see [Section 11.6](#) for instructions), and then repeat Step 6.
8. Tighten all bridle cable clamp nuts to 35-40 in-lb.
9. Use a feeler gauge to measure gaps between bridle cable clamp halves (top and bottom). Make sure gaps meet the following criteria:
 - Gap measurements on both sides of clamp are not less than 0.003" and not more than 0.050".



If clamp gap measurements do not meet criteria above, measure diameter of control cable, and then contact Dynon Technical Support for a resolution.

Out-of-specification cable clamps can slip under load.

10. Using turnbuckle, tension and bridle cable to 15-20 lbs. Make sure swage engagement hole is located upward and on same side as cables exit.



The tension on bridle cable should never exceed manufacturer's specified tension for control cable.

11. Safety wire bridle cable turnbuckle halves and barrel.
12. Attach cable guard bracket to roll servo (see [Figure 16](#)).
13. Capture control cable and bridle cable with cable guard, as shown in [Figure 16](#), and then attach cable guard to cable guard bracket (see [Figure 16](#)).

14. Adjust cable guard and/or cable guard bracket as needed so cables do not contact cable guard.
15. Permanently attach capstan to roll servo (see Section 11.5 for instructions).
16. Connect D9 cable harness connector to servo.

To check the roll servo installation:

1. Release ailerons and/or yoke.
2. Move aileron control through full range of motion per manufacturer's maintenance instructions, and verify the following:
 - Control is smooth throughout (i.e., no grinding, rubbing, or roughness).
 - Bridle cable clamps do not contact any structures during entire travel.
 - Capstan never rotates more than 150 degrees in either direction from neutral.
3. Cycle the control surface several times, return it to neutral, and verify the following:
 - Swage engagement hole is in the 12 'o' clock position.
 - Bridle cable clamps are located as shown in Figure 15.
 - Bridle cable tension has not changed.



After all Autopilot servos have been serviced, perform servo calibration procedure (see Section 11.2 for instructions).

11.9 Pitch Servo Removal and Replacement

This section provides instructions for removing and installing a pitch servo and connecting it back to the control system.

The pitch servo and bracketry are installed in the fuselage between FS172 and FS185 (see [Figure 18](#) for exact location). To service the pitch servo, installers need to access this area in accordance with the manufacturer's service manual. See [Figure 49](#) (retractable landing gear airplanes) and [Figure 33](#) (fixed landing gear airplanes) for examples of complete installations.



Make sure all flight control cables are rigged and tensioned in accordance with manufacturer's instructions.



Always disconnect aircraft battery before starting removal and installation activities.



Unless otherwise specified, torque all fasteners per specifications in AC 43.13-1B, Table 7-1. Include specified friction drag value when torquing screws.

To remove the pitch servo:

1. Disconnect D9 cable harness connector from servo.
2. Mark locations of cable clamps on elevator control cable.



Securing bridle cable to capstan grooves with tape prevents cable from unraveling when handling.

3. Loosen bridle cable clamps.
4. Remove capstan (with bridle cable) from pitch servo (see [Section 11.5](#) for instructions).



DO NOT remove shear screw from servo disc!

5. Remove safety wiring from pitch servo bolts.
6. Remove bolts and washers that secure pitch servo to riser bracket (see [Figure 28](#) or [Figure 43](#)). Retain hardware for servo installation.
7. Remove pitch servo and capstan (with bridle cable) from aircraft.

To replace the pitch servo:



Secure elevator and/or yoke in center of travel.

1. Secure pitch servo to riser bracket (see [Figure 28](#) or [Figure 43](#)).
2. Safety wire pitch servo bolts (see [Figure 29](#) or [Figure 45](#) for example).
3. Attach capstan (with bridle cable) to pitch servo (see [Figure 28](#) or [Figure 43](#)).



Position servo capstan so orientation mark on capstan faces away from servo, capstan is in 6 'o' clock position (retractable landing gear airplanes) or 12 'o' clock position (fixed landing gear airplanes), and servo is fully seated on servo disc. The capstan has a hole that fits over shear screw head.

4. Make sure elevator control cable in the area where bridle cable clamps will attach is clean and free of dirt and grease.
5. Use bridle cable clamps to loosely connect bridle cable ends to elevator control cable at marks made during removal process. Make sure clamps contact swage stops at each end of bridle cable, as shown in [Figure 32](#) or [Figure 48](#).
6. Make sure bridle cable does not contact cable guard.



The bridle cable will prematurely wear if bridle cable and cable guard make contact when control is in a neutral position.

7. If cable guard interferes with bridle cable, adjust cable guard position (see [Section 11.6](#) for instructions), and then repeat Step 6.
8. Tension and temporarily secure bridle cable to 15-20 lbs. Make sure swage engagement hole is located upward and on same side as cables exit.



The tension on bridle cable should never exceed manufacturer's specified tension for control cable.

9. When satisfied with tension and capstan position, tighten all bridle cable clamp nuts to 35-40 in-lb.
10. Use a feeler gauge to measure gaps between bridle cable clamp halves (top and bottom). Make sure gaps meet the following criteria:
 - Gap measurements on both sides of clamp are not less than 0.003" and not more than 0.050".



If clamp gap measurements do not meet criteria above, measure diameter of control cable, and then contact Dynon Technical Support for a resolution.

Out-of-specification cable clamps can slip under load.

11. Permanently attach capstan to roll servo (see [Section 11.5](#) for instructions).
12. Connect D9 cable harness connector to servo.

To check the pitch servo installation:

1. Release elevator and/or yoke.
2. Move elevator control through full range of motion, and verify the following:
 - Control is smooth throughout (i.e., no grinding, rubbing, or roughness).
 - Bridle cable clamps do not contact any structures during entire travel.
 - Capstan never rotates more than 150 degrees in either direction from neutral.
3. Cycle the control several times, return it to neutral, and verify the following:
 - Swage engagement hole is in the 6 'o' clock position (retractable landing gear airplanes) or 12 'o' clock position (fixed landing gear airplanes).
 - Bridle cable clamps are located as shown in [Figure 32](#) or [Figure 48](#).
 - Bridle cable tension has not changed.



After all Autopilot servos have been serviced, perform servo calibration procedure (see Section [11.2](#) for instructions).

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12 Figures

12.1 Roll Servo Figures

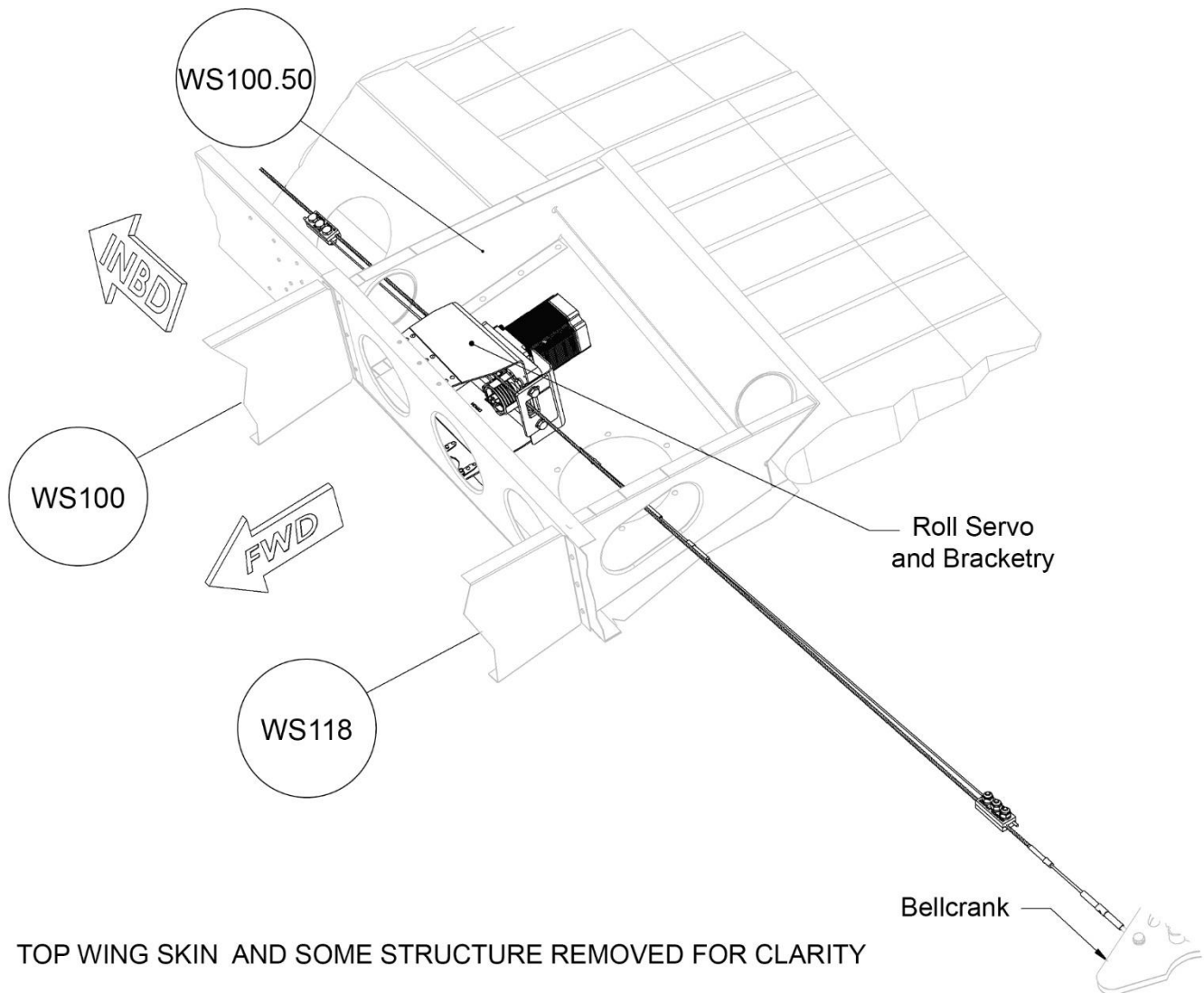


Figure 1: Roll Servo Location

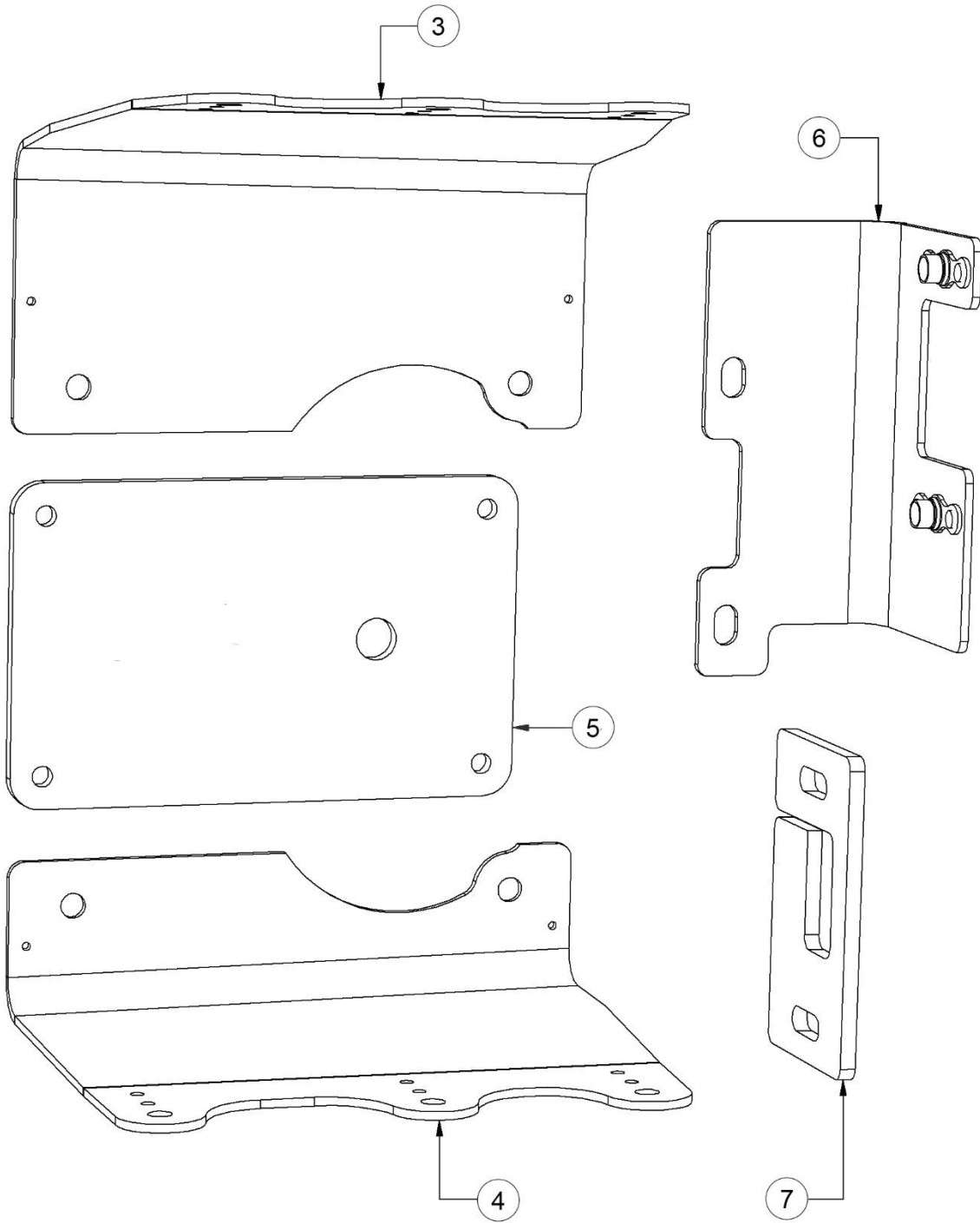


Figure 2: Roll Servo Bracketry

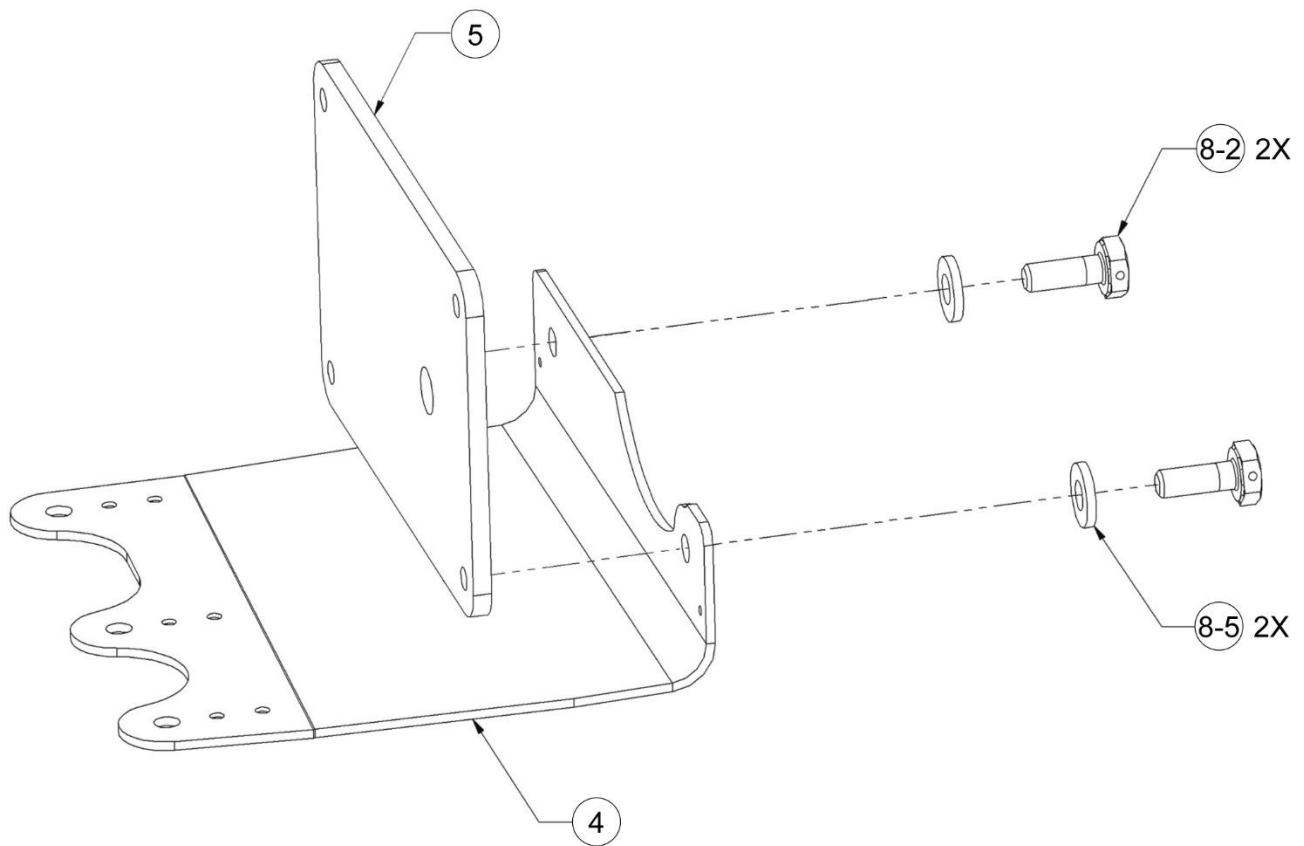


Figure 3: Attaching Lower Roll Servo Bracket to Servo Template

AIRCRAFT STRUCTURE CUT-AWAY FOR CLARITY

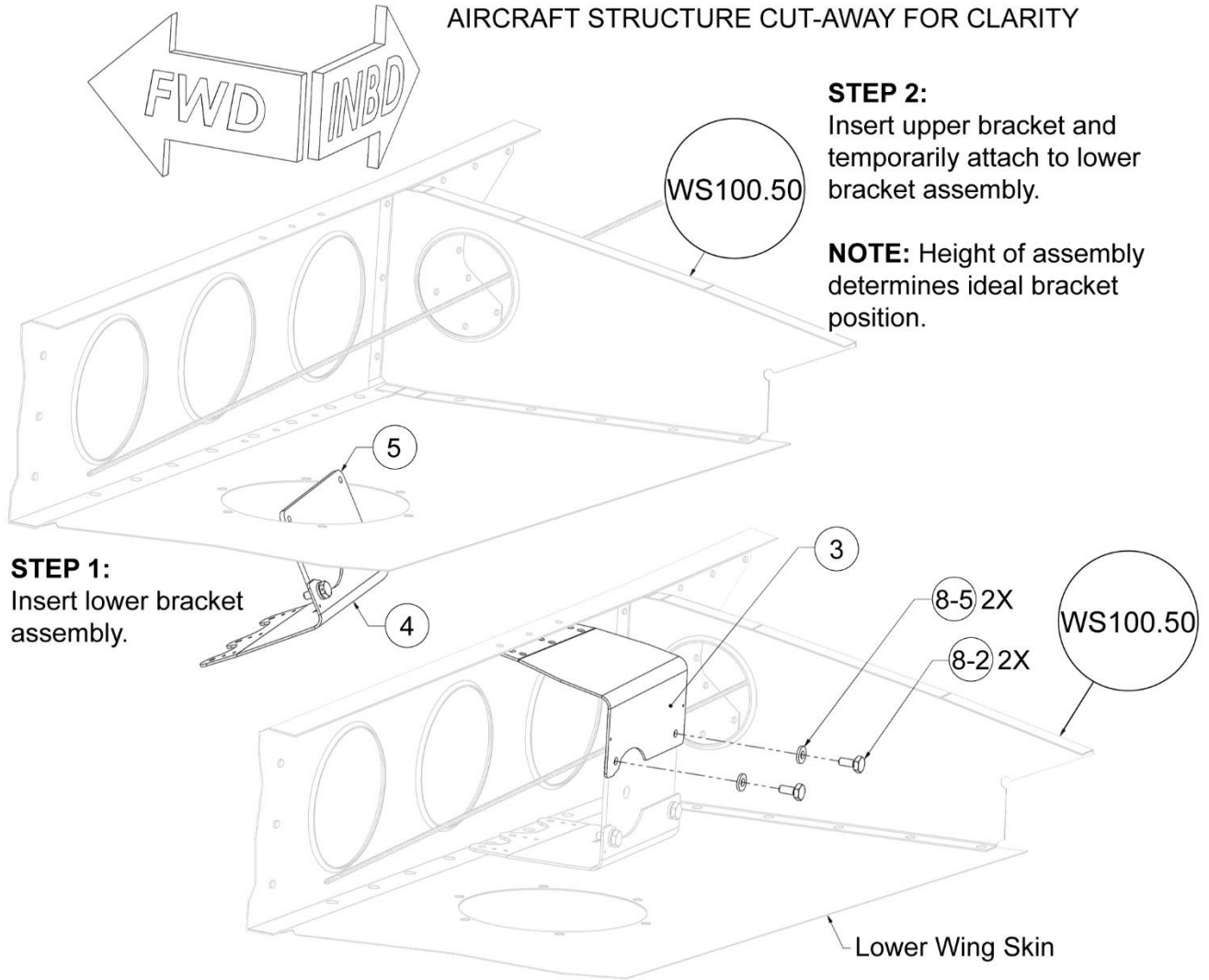


Figure 4: Positioning Roll Servo Bracketry

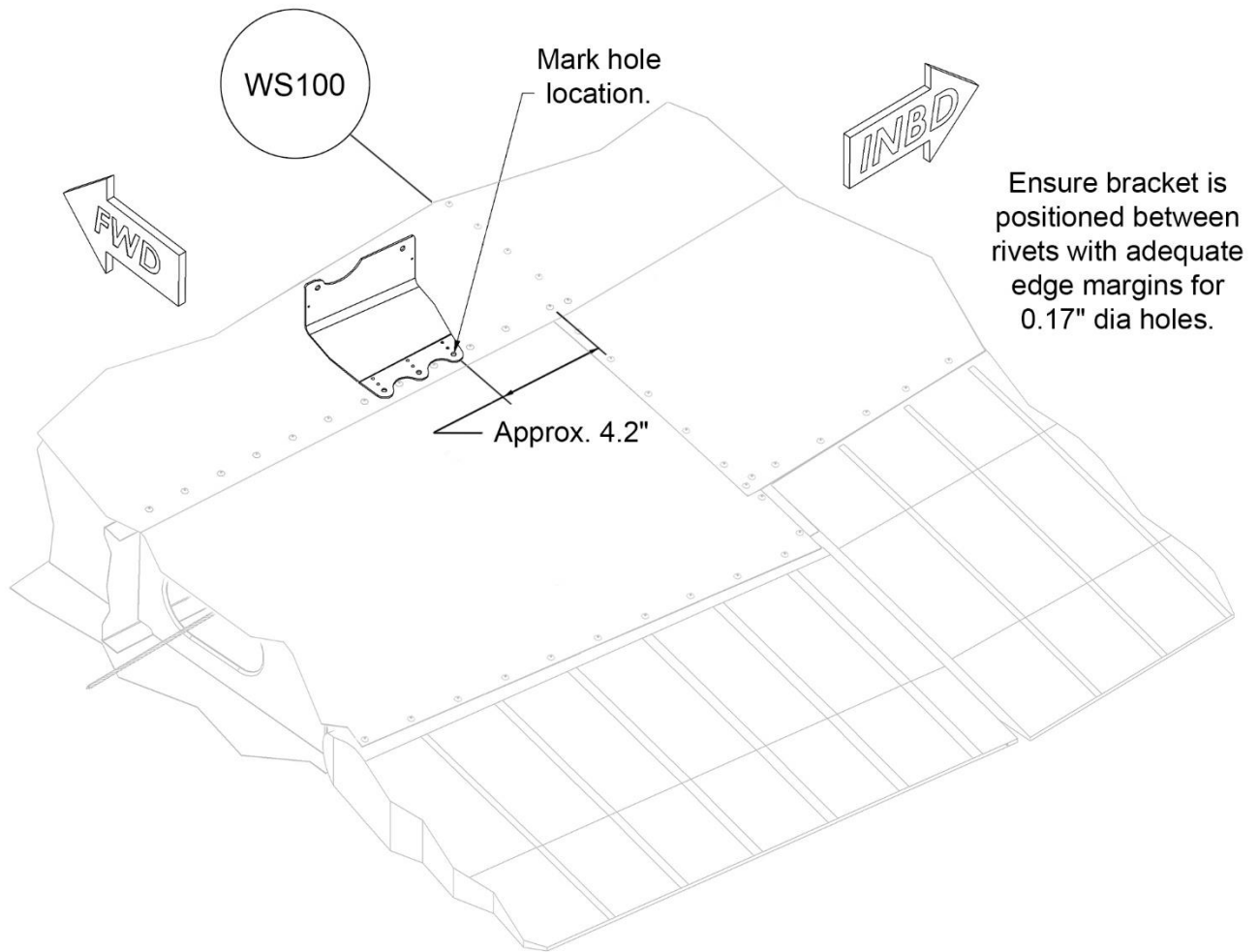
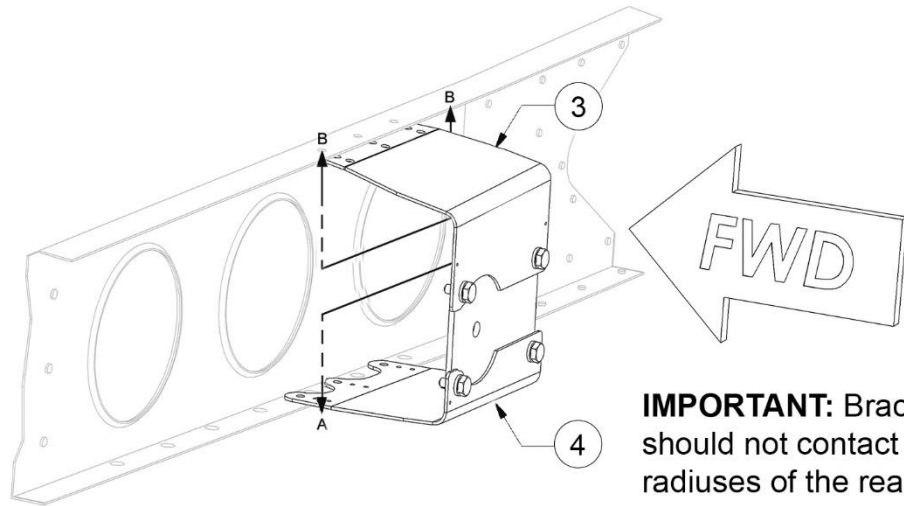


Figure 5: Positioning Upper Roll Servo Bracket and Marking Hole



IMPORTANT: Brackets should not contact bend radiuses of the rear spar.

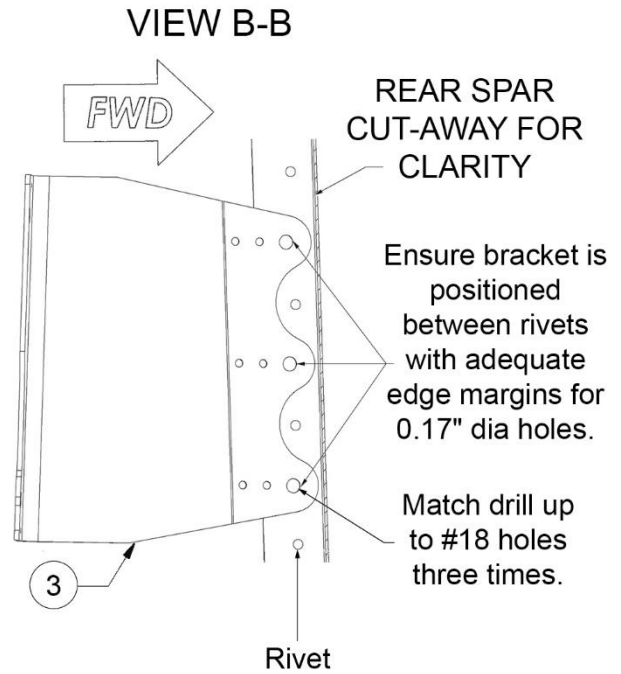
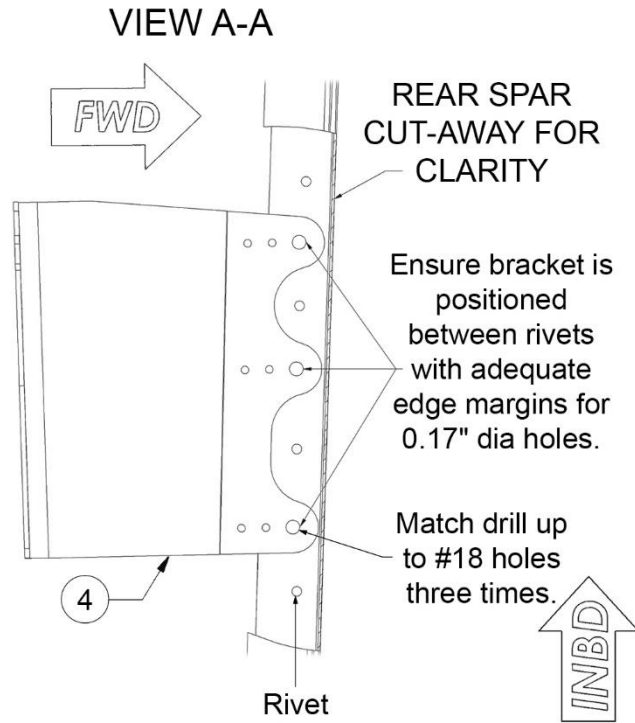


Figure 6: Positioning Upper and Lower Roll Servo Brackets and Drilling Holes

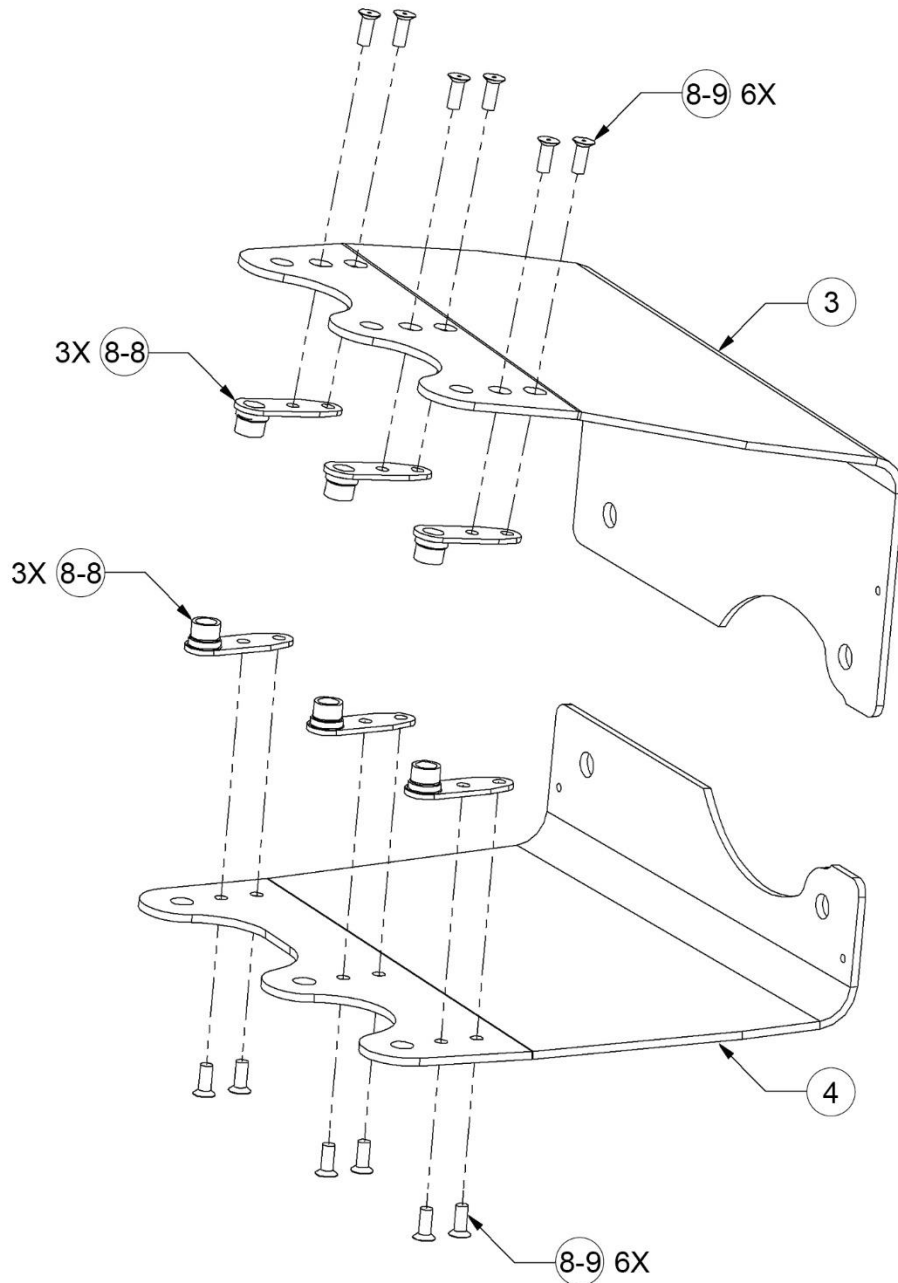


Figure 7: Attaching Nutplates to Upper and Lower Roll Servo Brackets

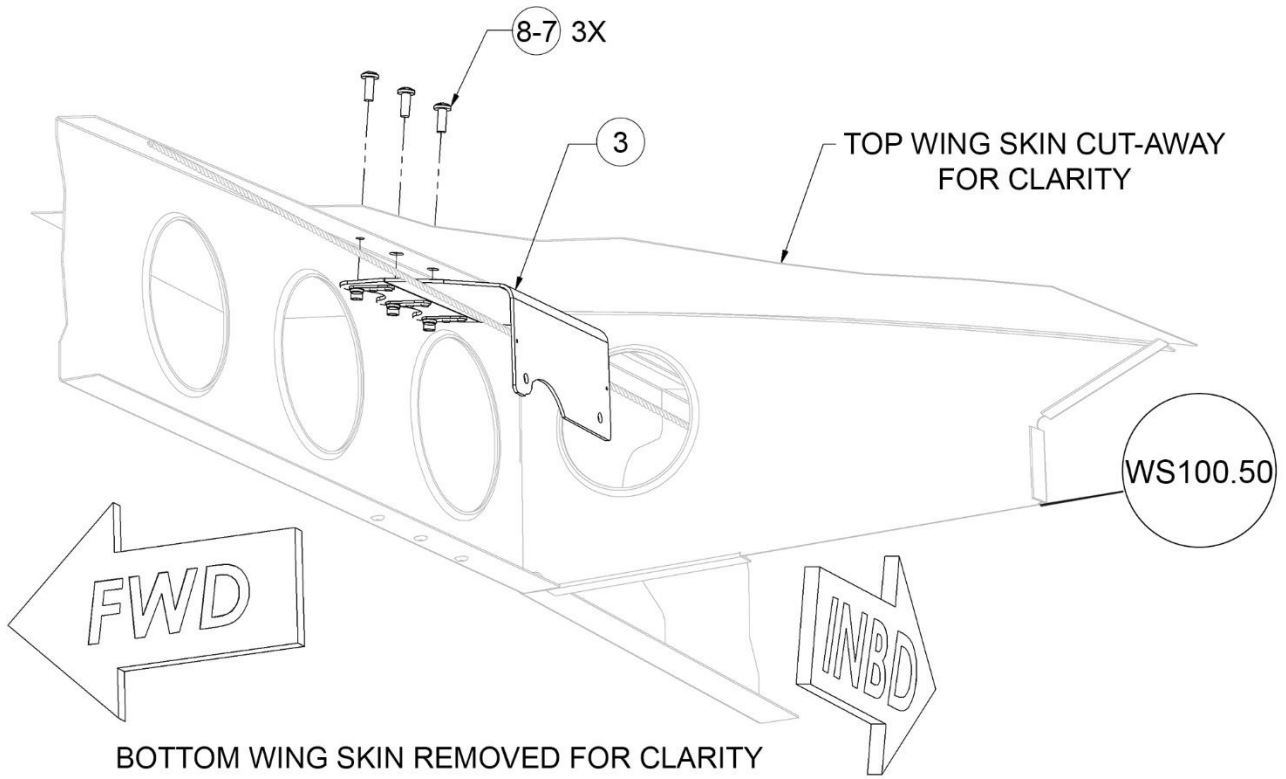


Figure 8: Permanently Fastening Upper Roll Servo Bracket

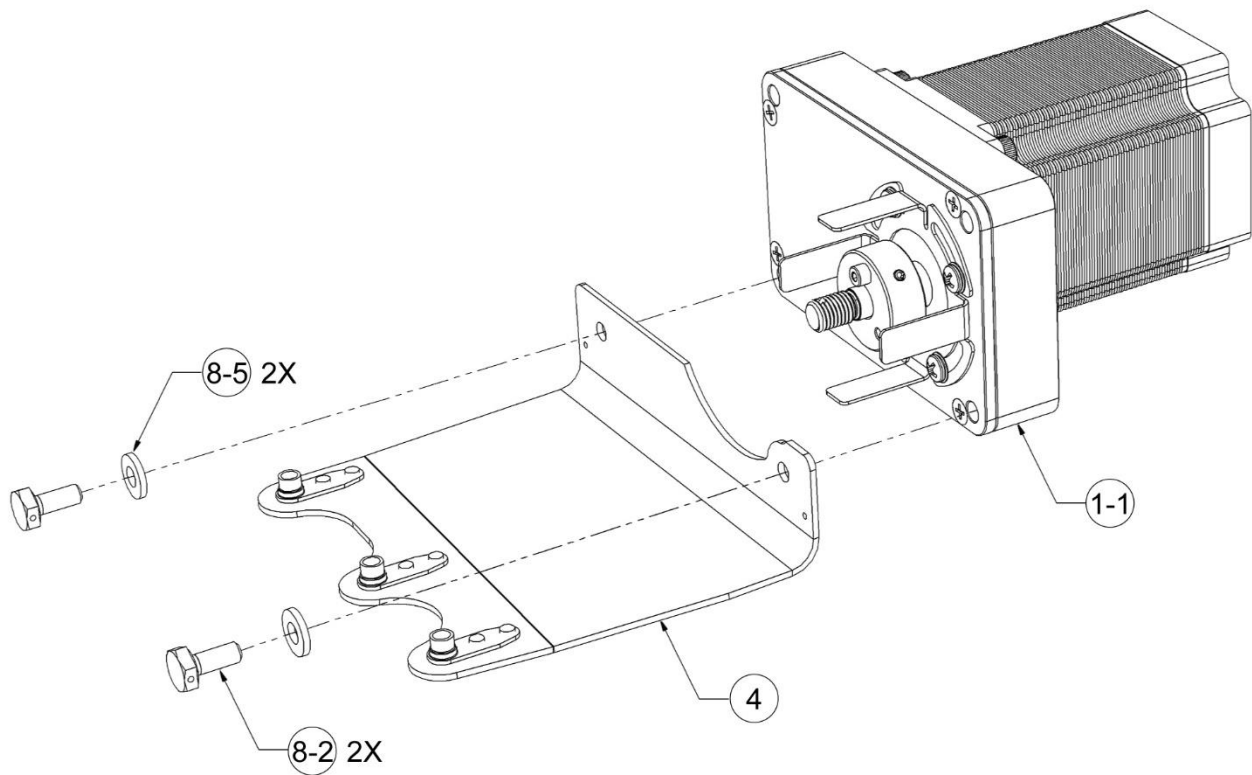


Figure 9: Attaching Lower Roll Servo Bracket to Roll Servo

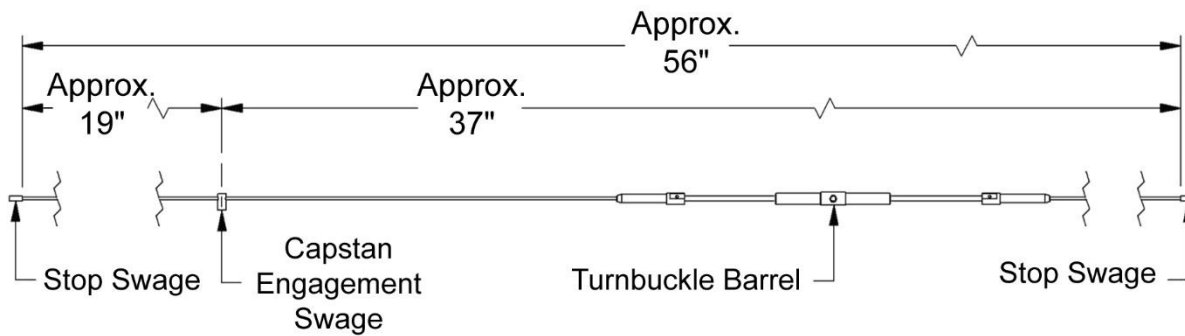


Figure 10: Roll Servo Bridle Cable Length

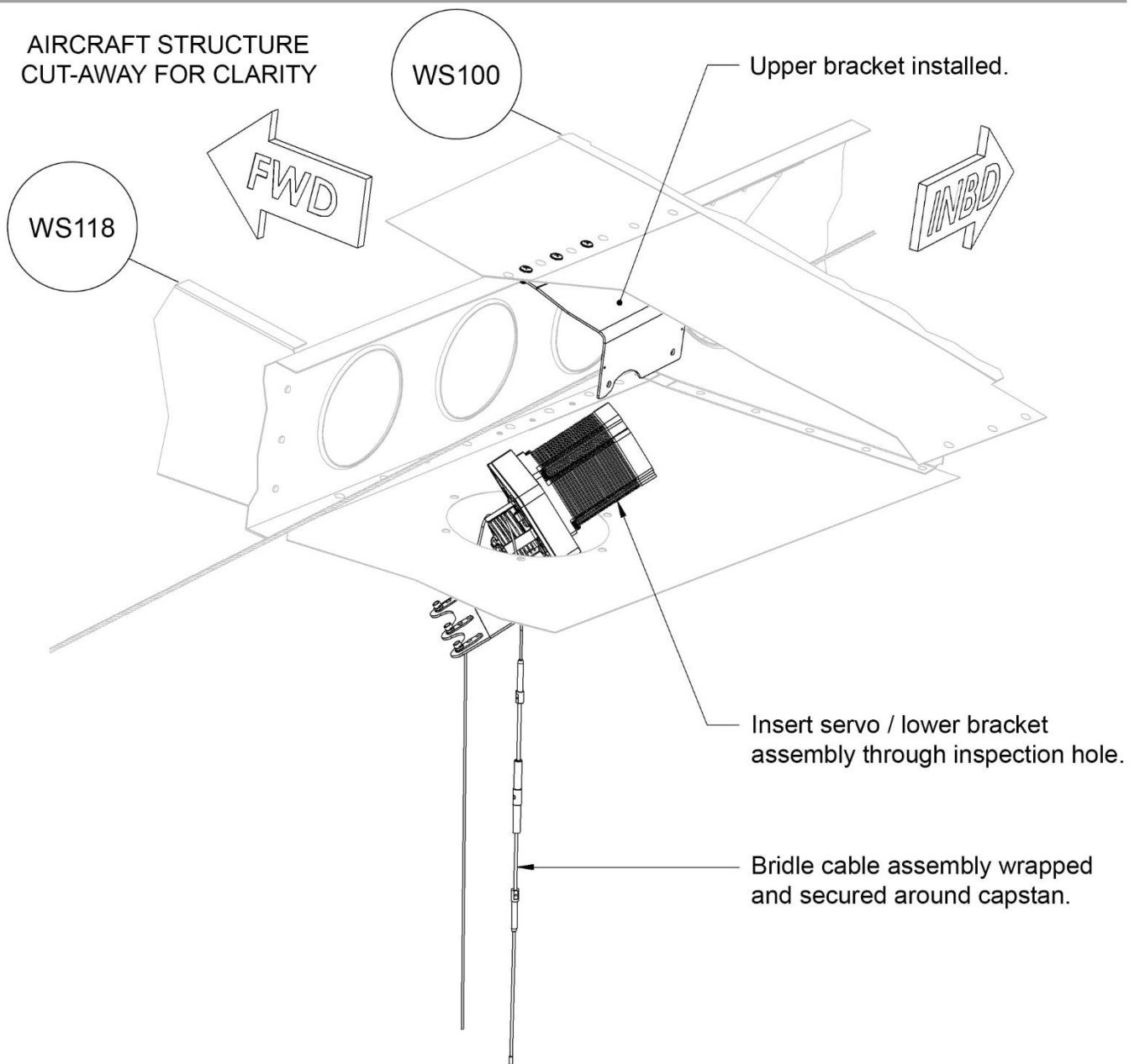
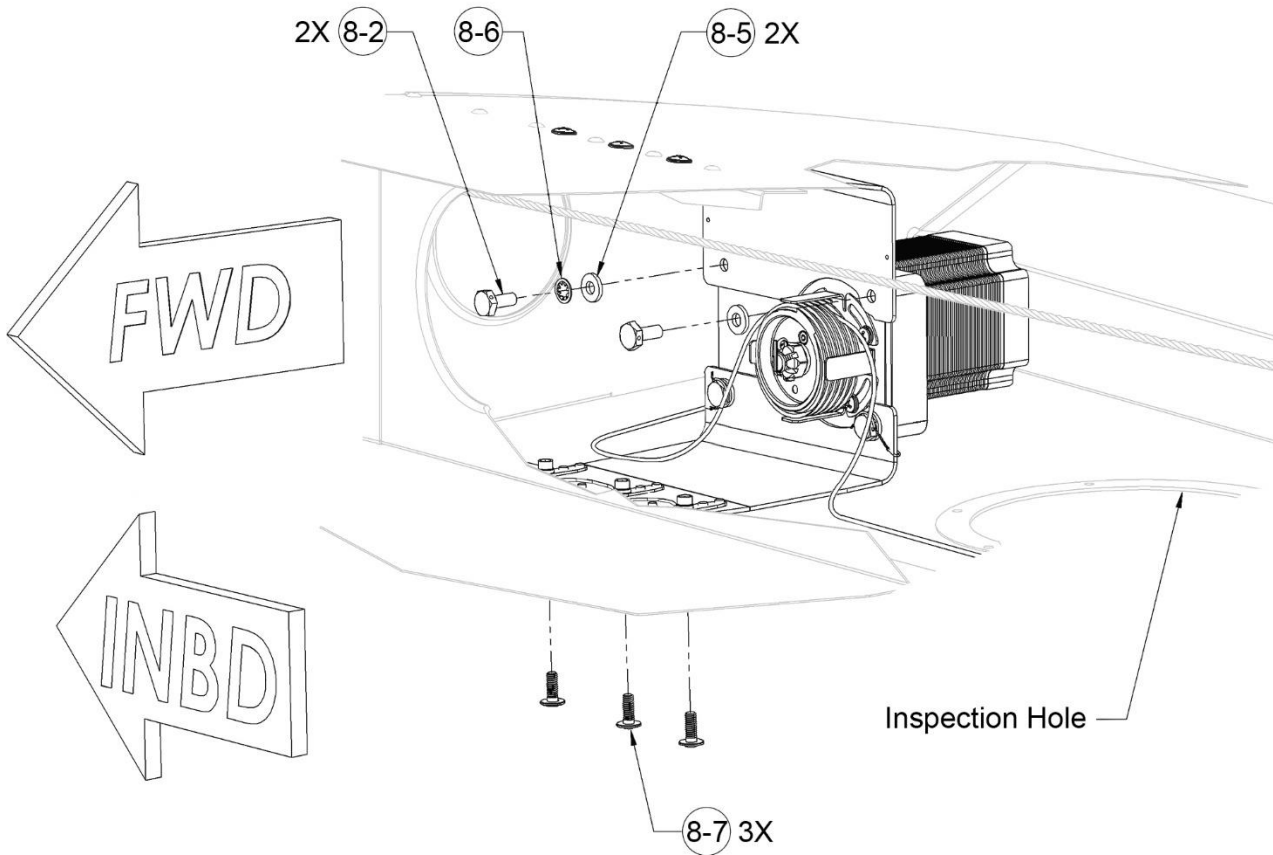


Figure 12: Inserting Roll Servo / Lower Bracket Assembly



AIRCRAFT STRUCTURE CUT-AWAY FOR CLARITY

Figure 13: Attaching Roll Servo Assembly

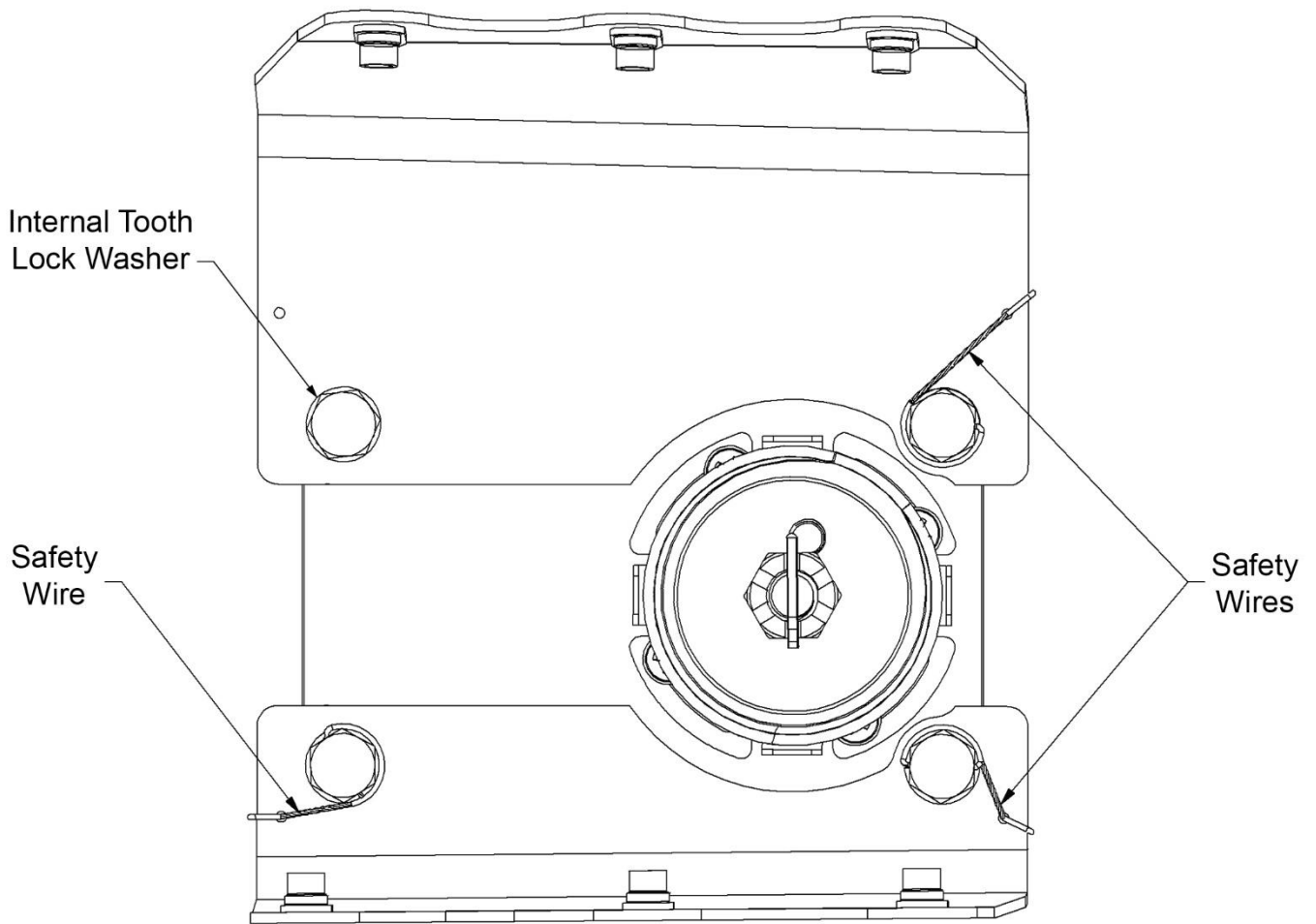


Figure 14: Example of Safety Wiring Roll Servo Bolts

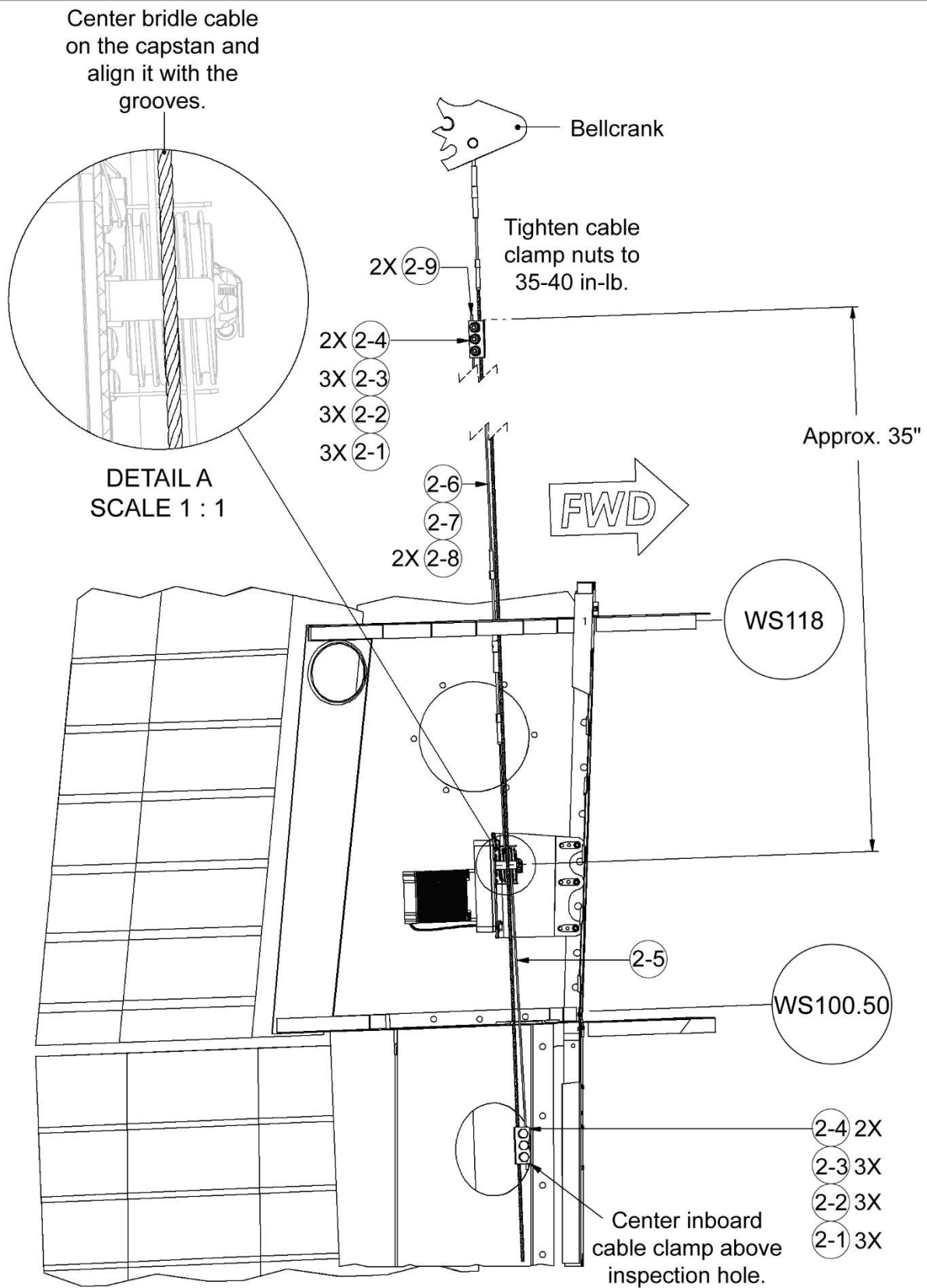


Figure 15: Attaching Bridle Cable to Aileron Control Cable

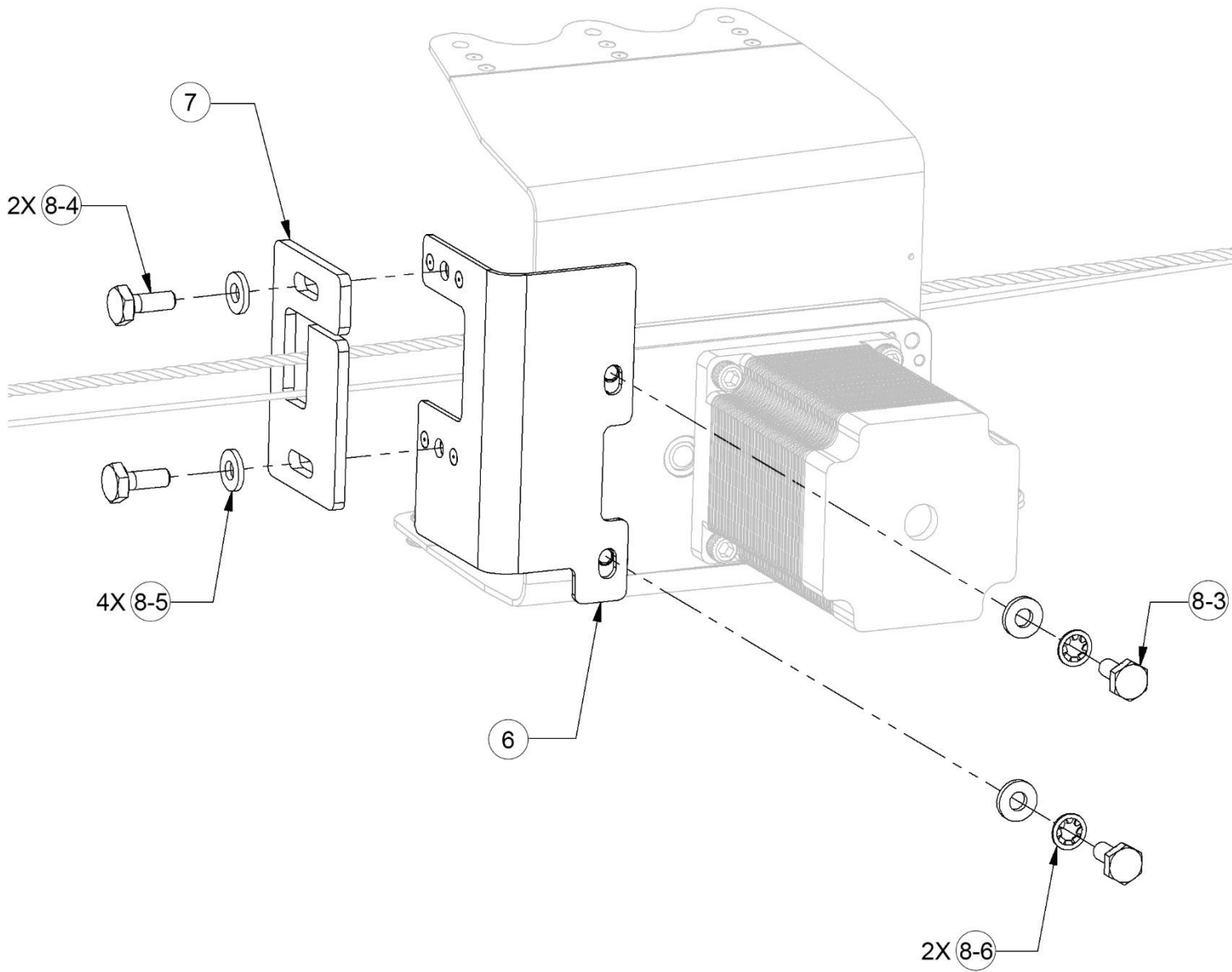
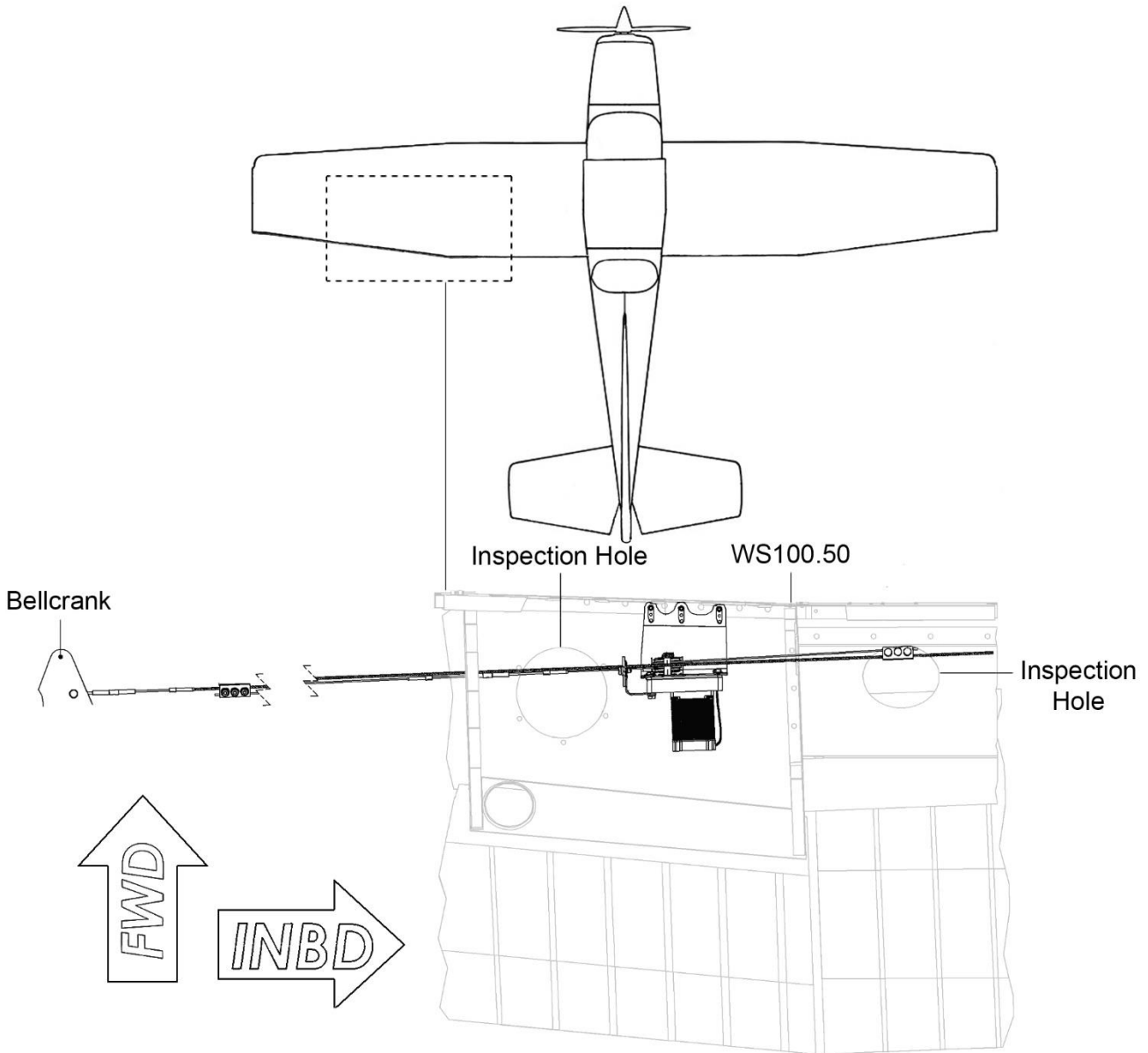


Figure 16: Attaching Cable Guard Bracket and Cable Guard to Roll Servo

TOP VIEW OF AIRCRAFT



TOP WING SKIN AND SOME STRUCTURE REMOVED FOR CLARITY

Figure 17: Roll Servo – Complete Installation

12.2 Pitch Servo Figures

AIRCRAFT STRUCTURE CUT-AWAY FOR CLARITY

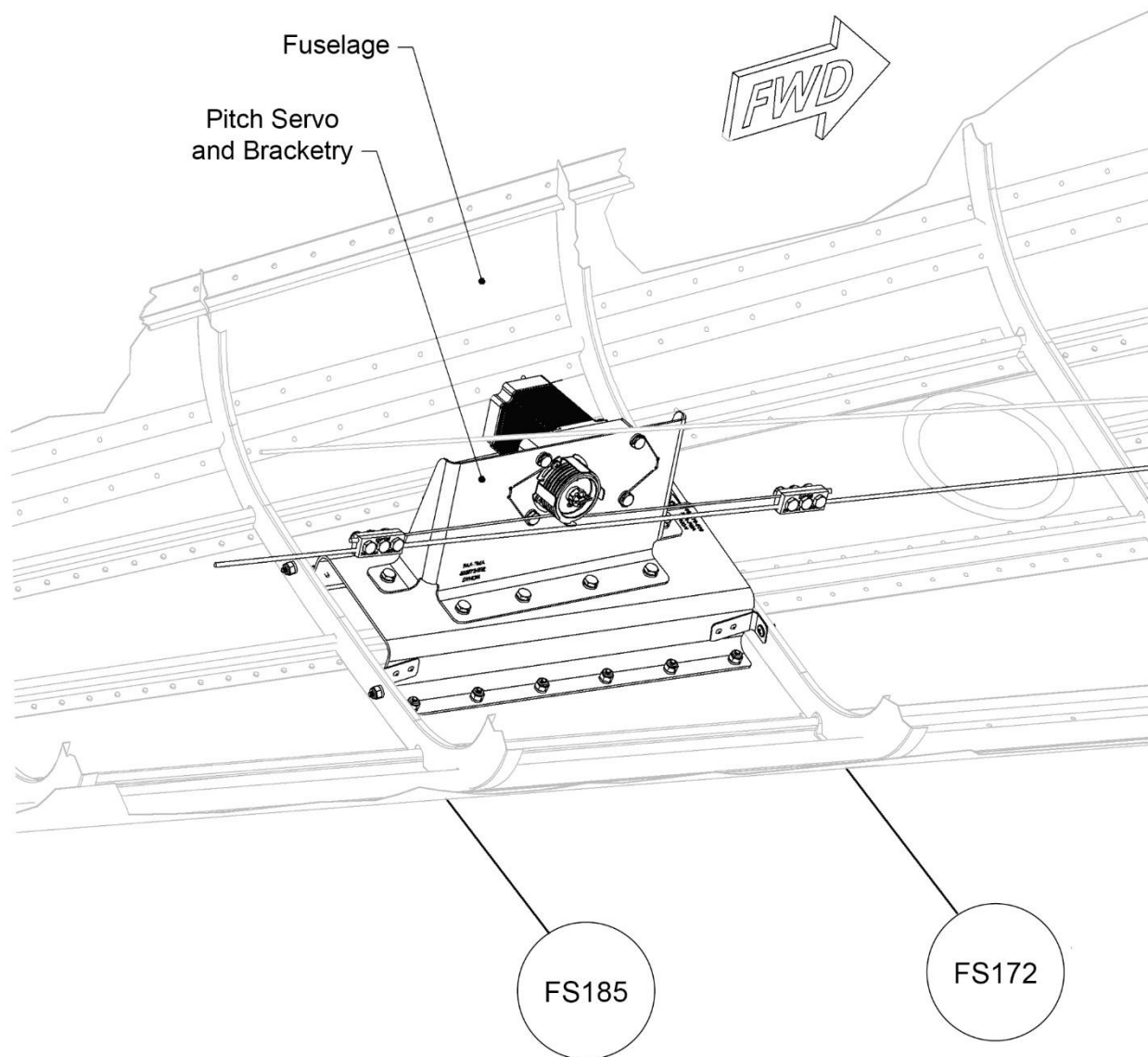


Figure 18: Pitch Servo Location (Fixed Landing Gear Airplane Shown)

12.2.1 Fixed Landing Gear Airplanes

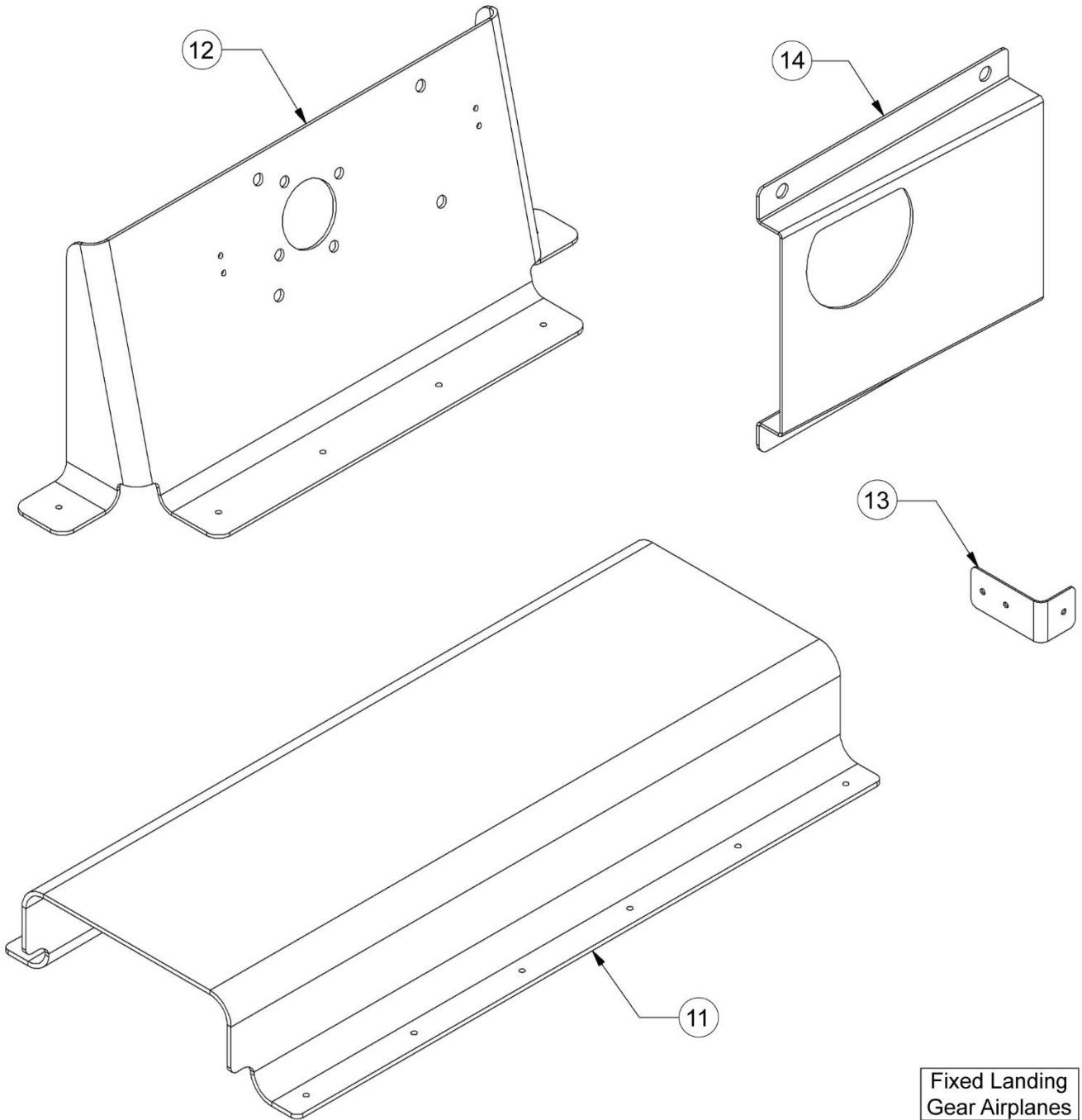


Figure 19: Pitch Servo Bracketry

Fixed Landing
Gear Airplanes

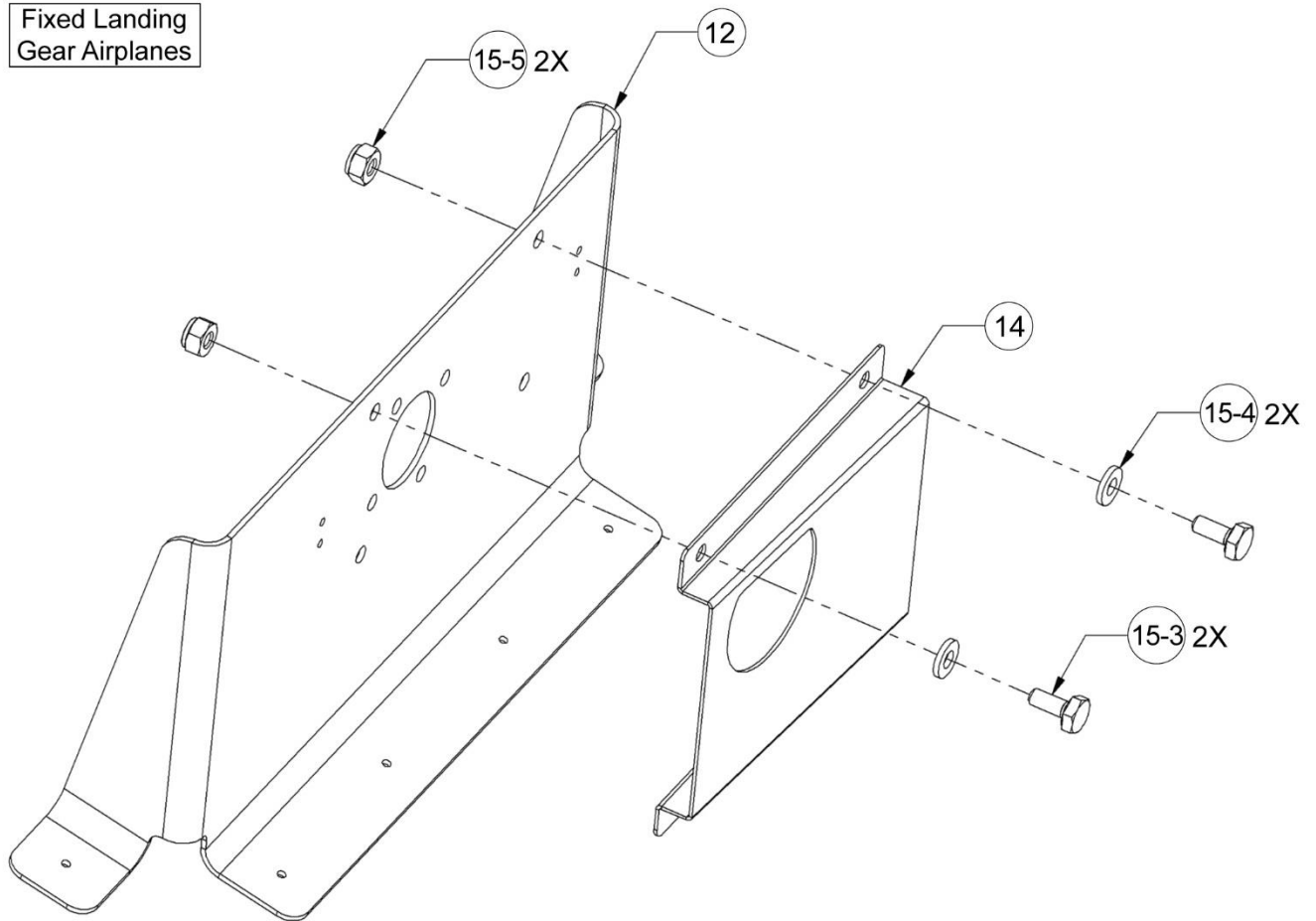


Figure 20: Temporarily Attaching Alignment Fixture to Riser Bracket

AIRCRAFT STRUCTURE
CUT-AWAY FOR CLARITY

Fixed Landing
Gear Airplanes

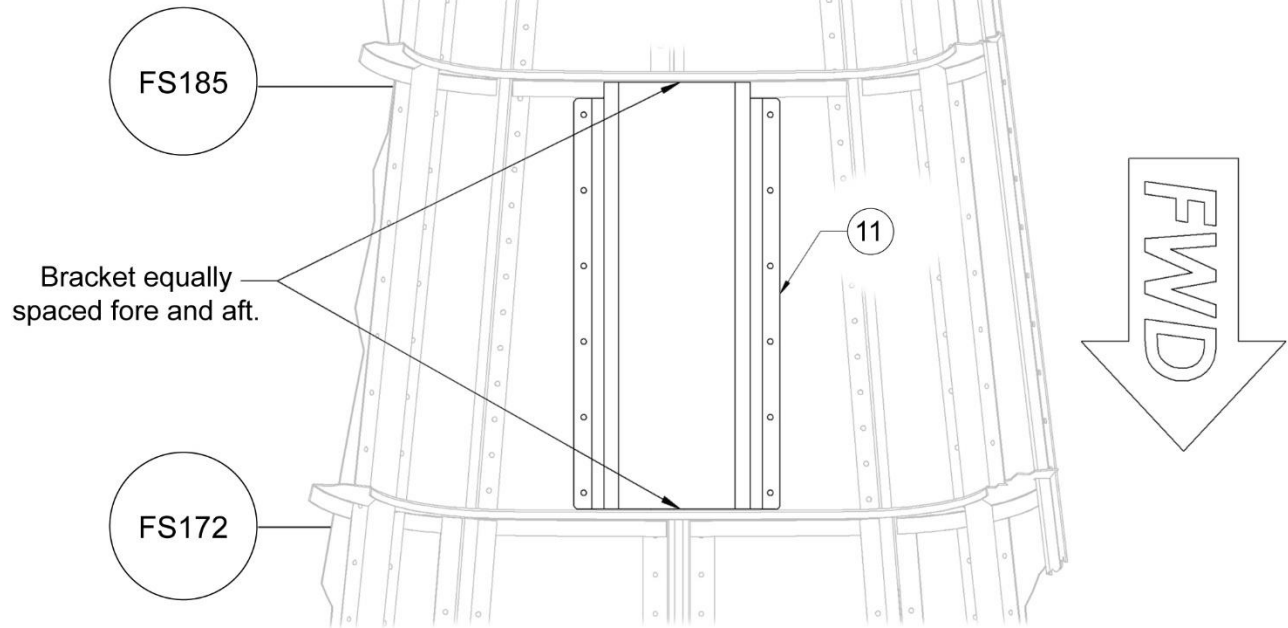
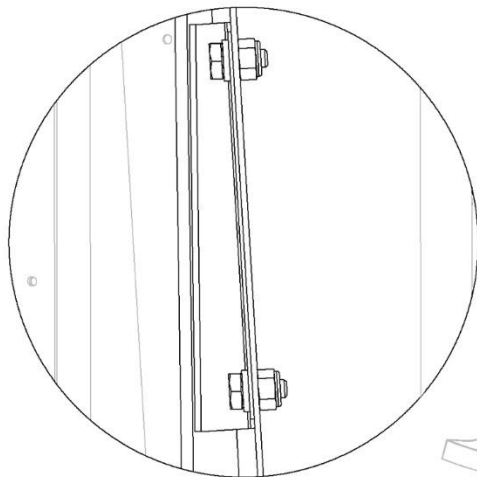


Figure 21: Positioning Pitch Servo Base Bracket

While elevator cable is in its most pitch-down position, rotate riser bracket as needed to align face of fixture along length of lower elevator control cable as shown in detail below.

The lower elevator control cable should be located 1/4" to 3/8" below the capstan cutout in the alignment fixture.

After riser bracket is positioned, mark locations of both brackets.



DETAIL VIEW

AIRCRAFT STRUCTURE
CUT-AWAY FOR CLARITY

Fixed Landing
Gear Airplanes

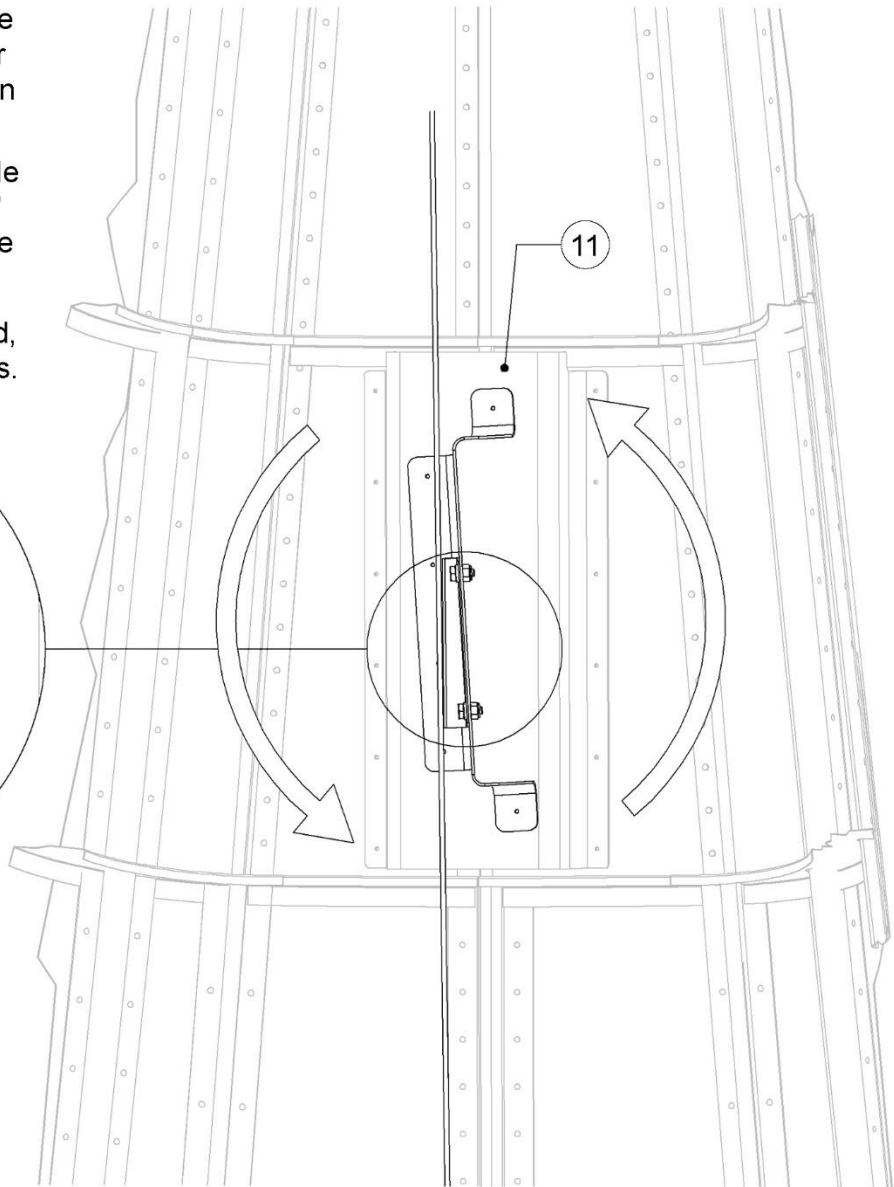


Figure 22: Positioning Pitch Servo Riser Bracket Assembly

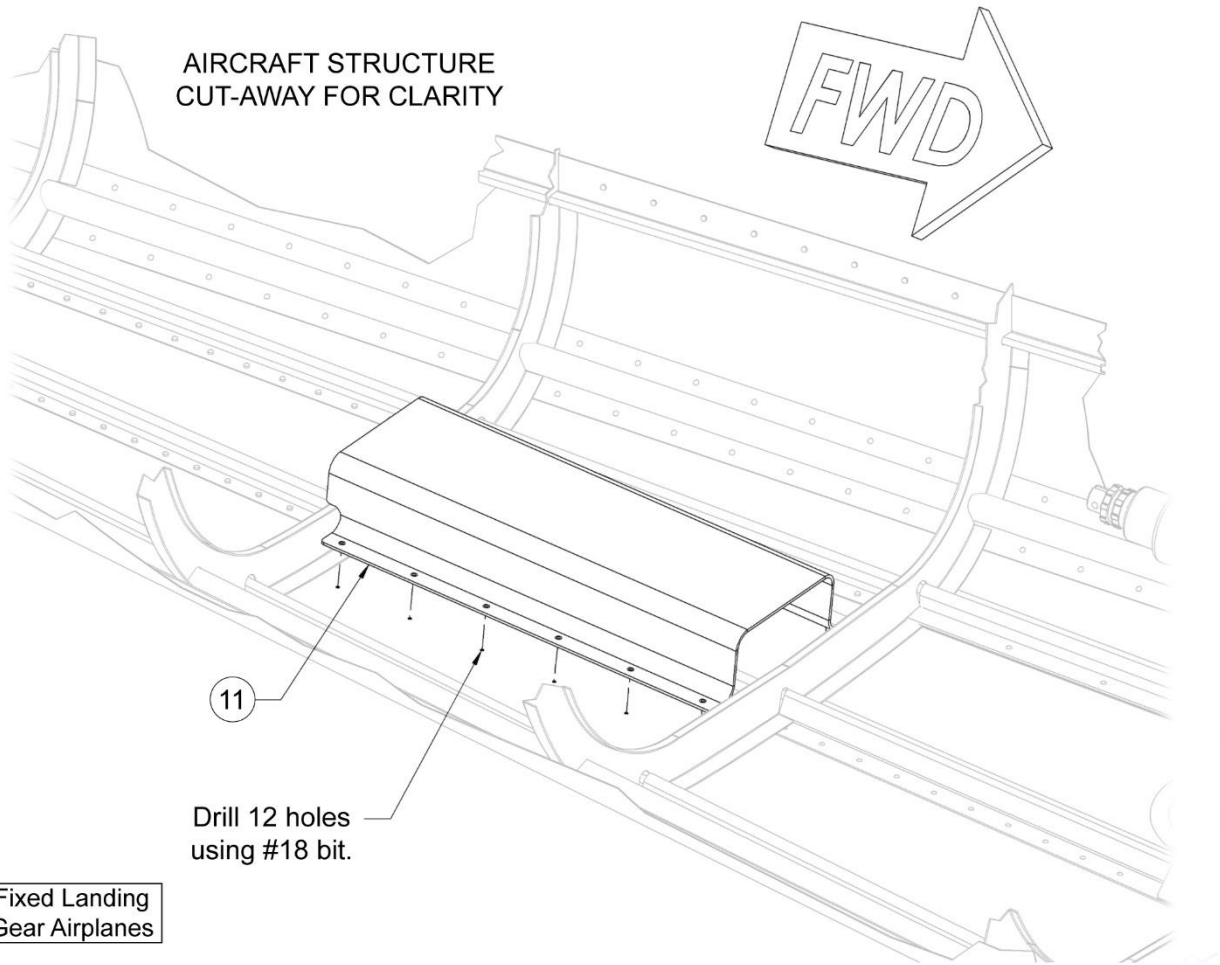


Figure 23: Drilling Holes for Pitch Servo Base Bracket

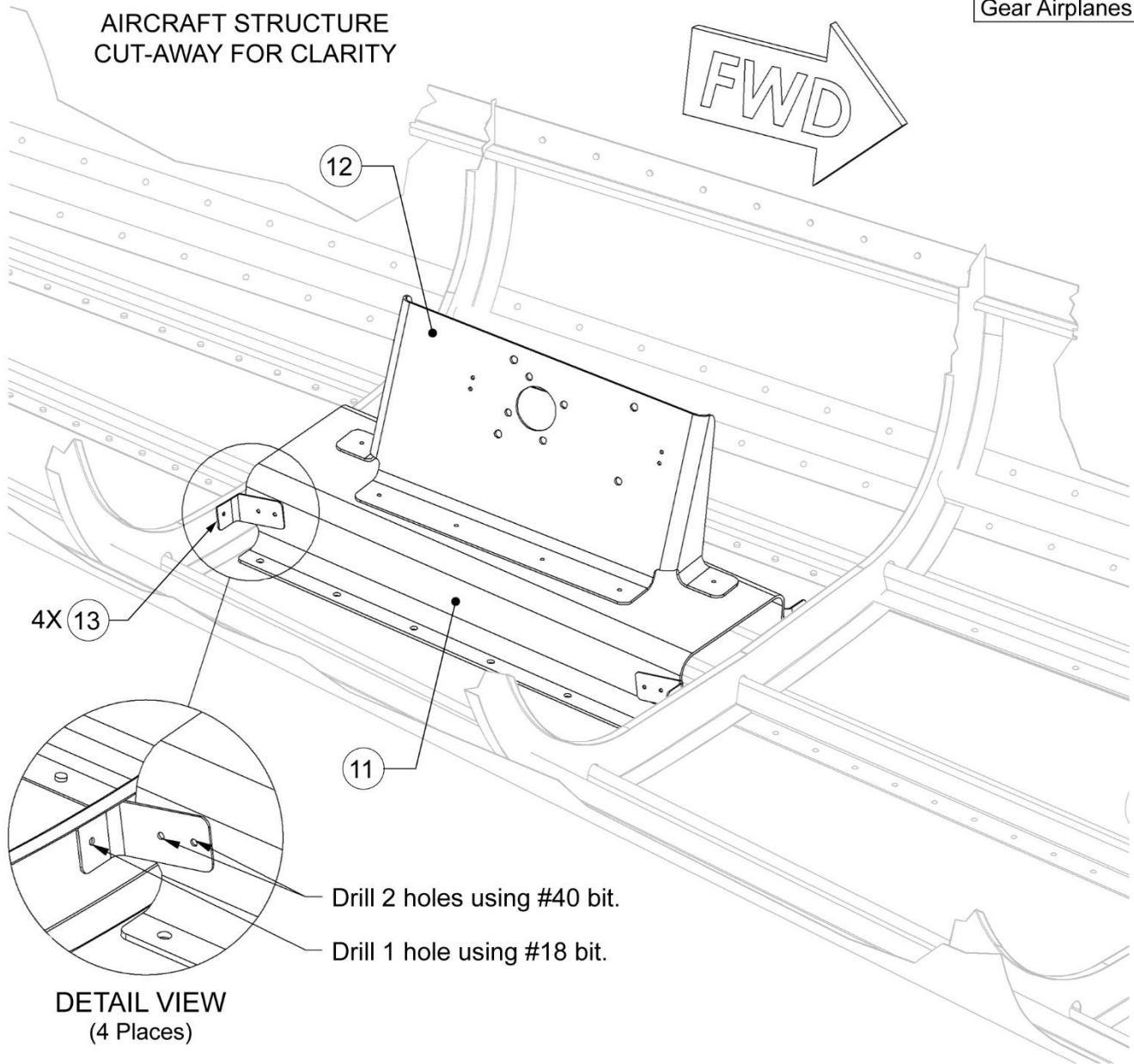


Figure 24: Drilling Holes for Pitch Servo Shear Clips

Fixed Landing
Gear Airplanes

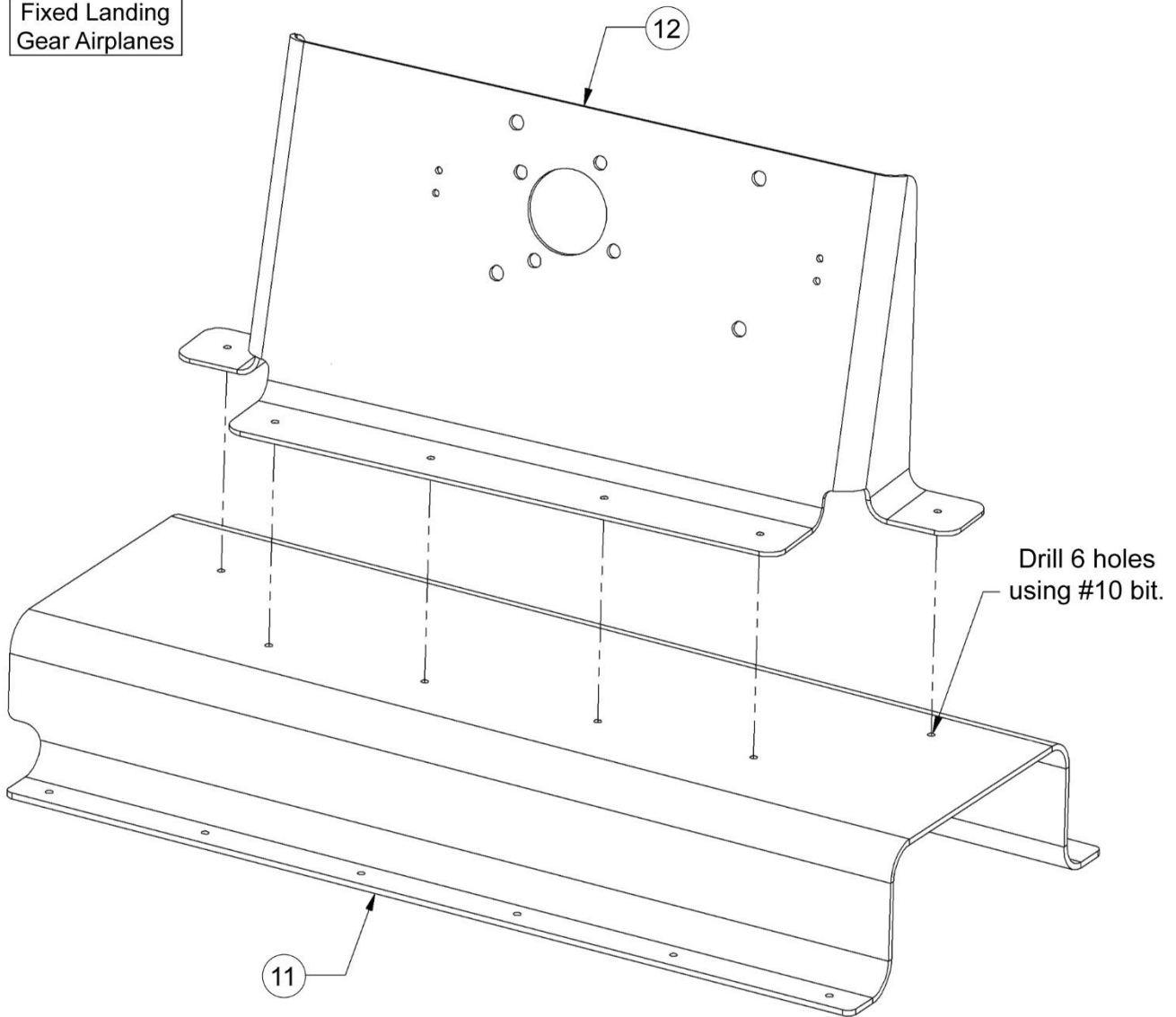


Figure 25: Drilling Holes for Pitch Servo Riser Bracket

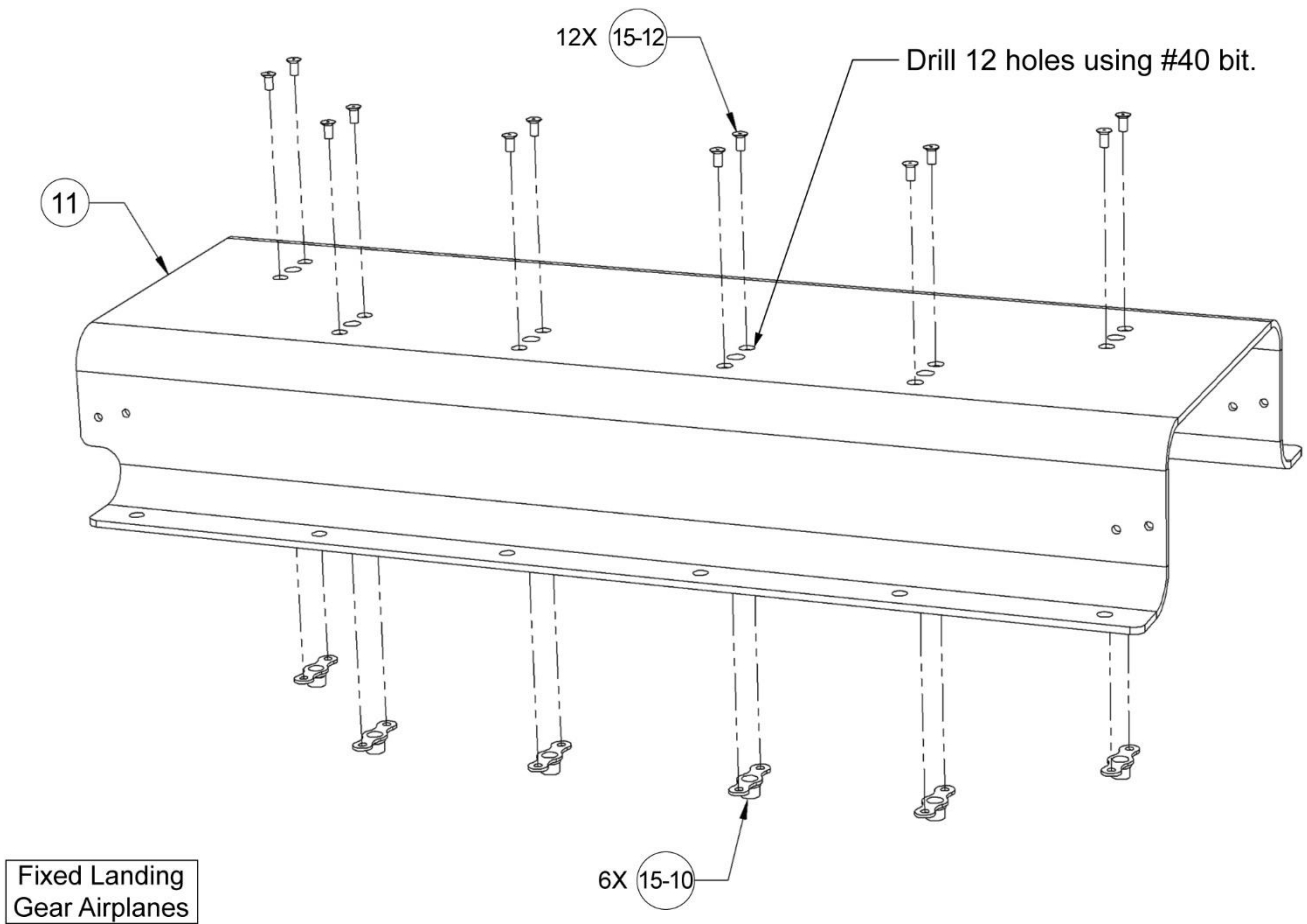


Figure 26: Attaching Nutplates to Pitch Servo Base Bracket

Fixed Landing
Gear Airplanes

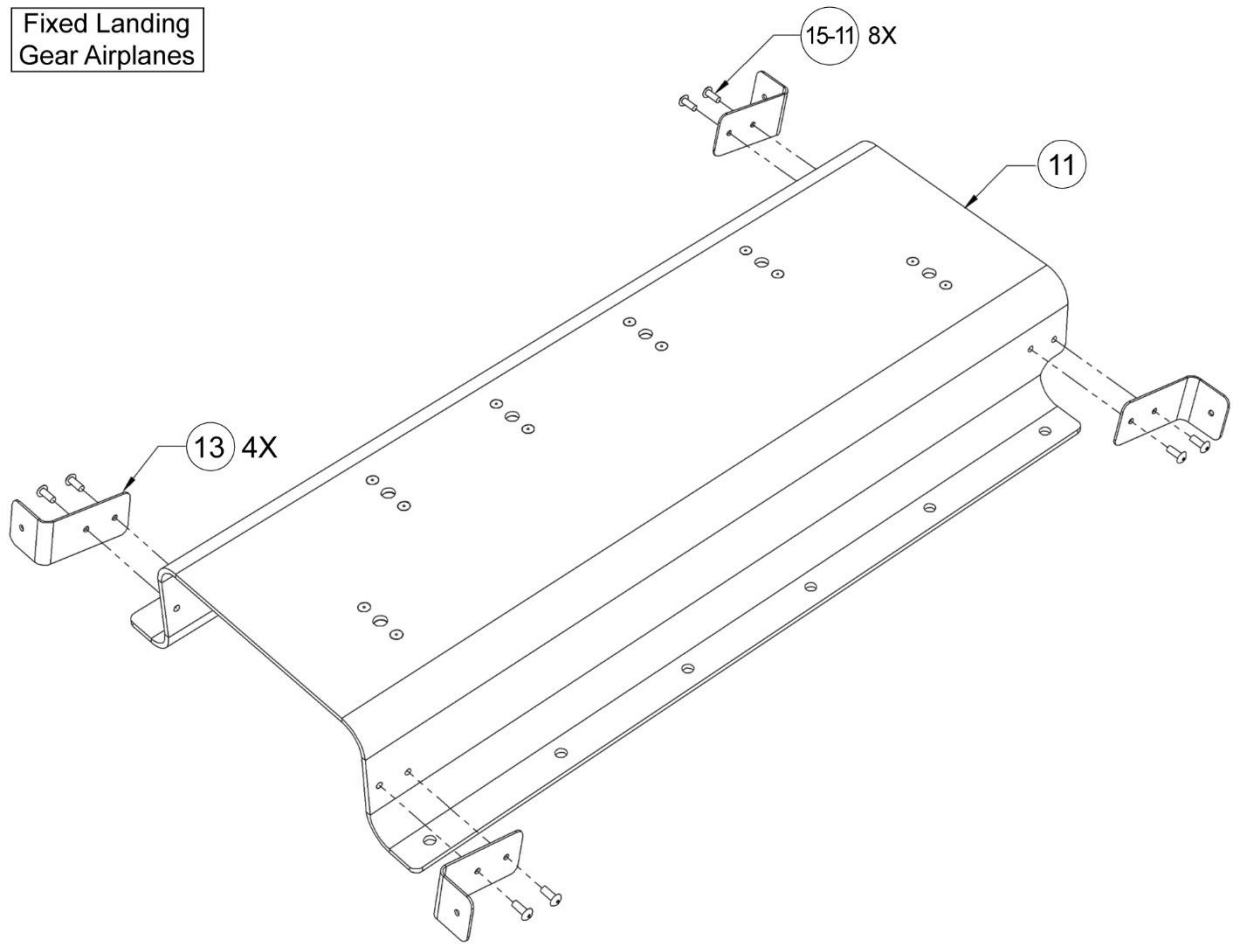


Figure 27: Riveting Pitch Servo Shear Clips to Base Bracket

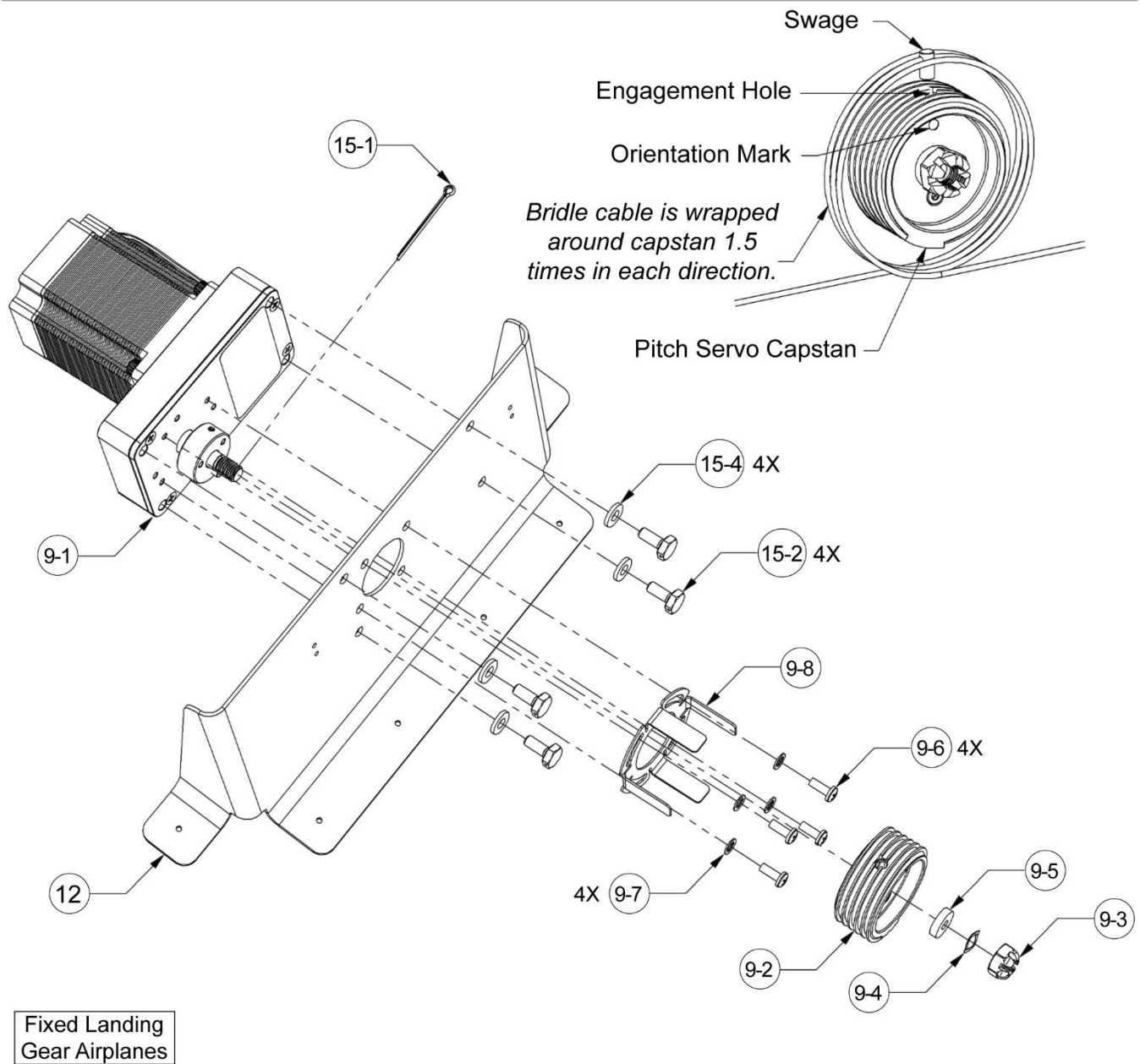


Figure 28: Attaching Pitch Servo to Riser Bracket

Fixed Landing
Gear Airplanes

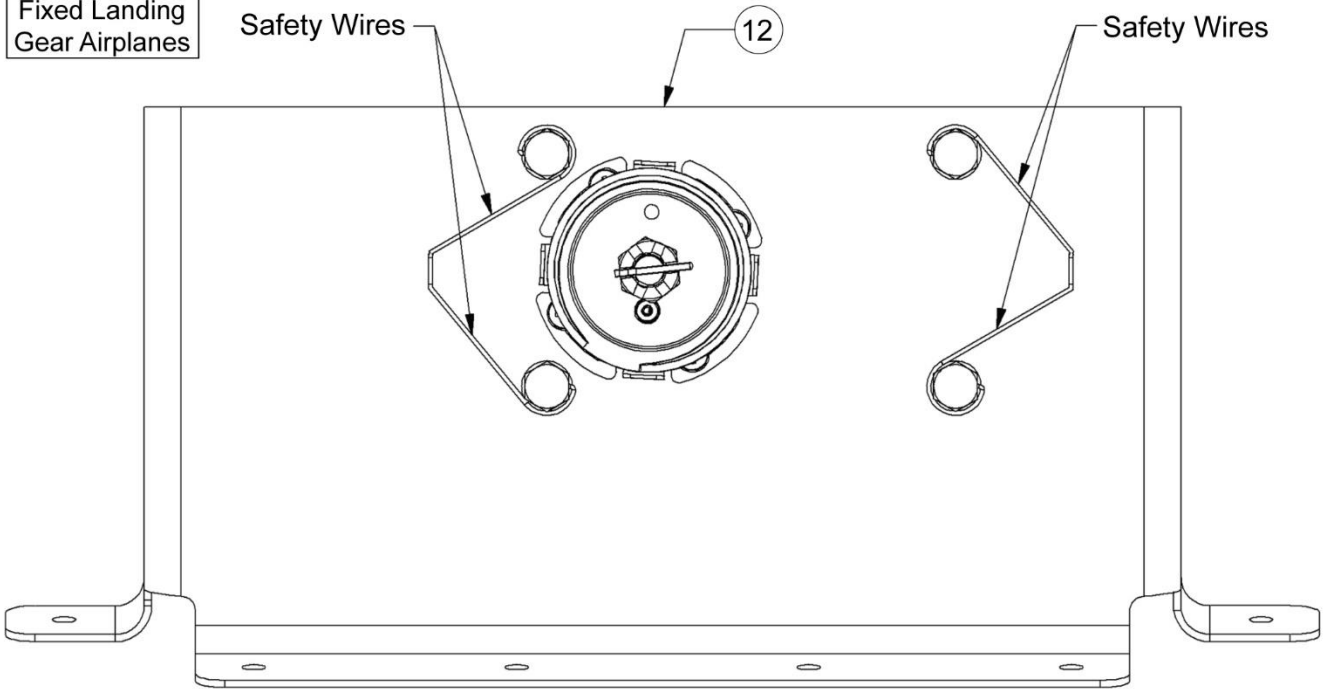


Figure 29: Example of Safety Wiring Pitch Servo Bolts

Fixed Landing
Gear Airplanes

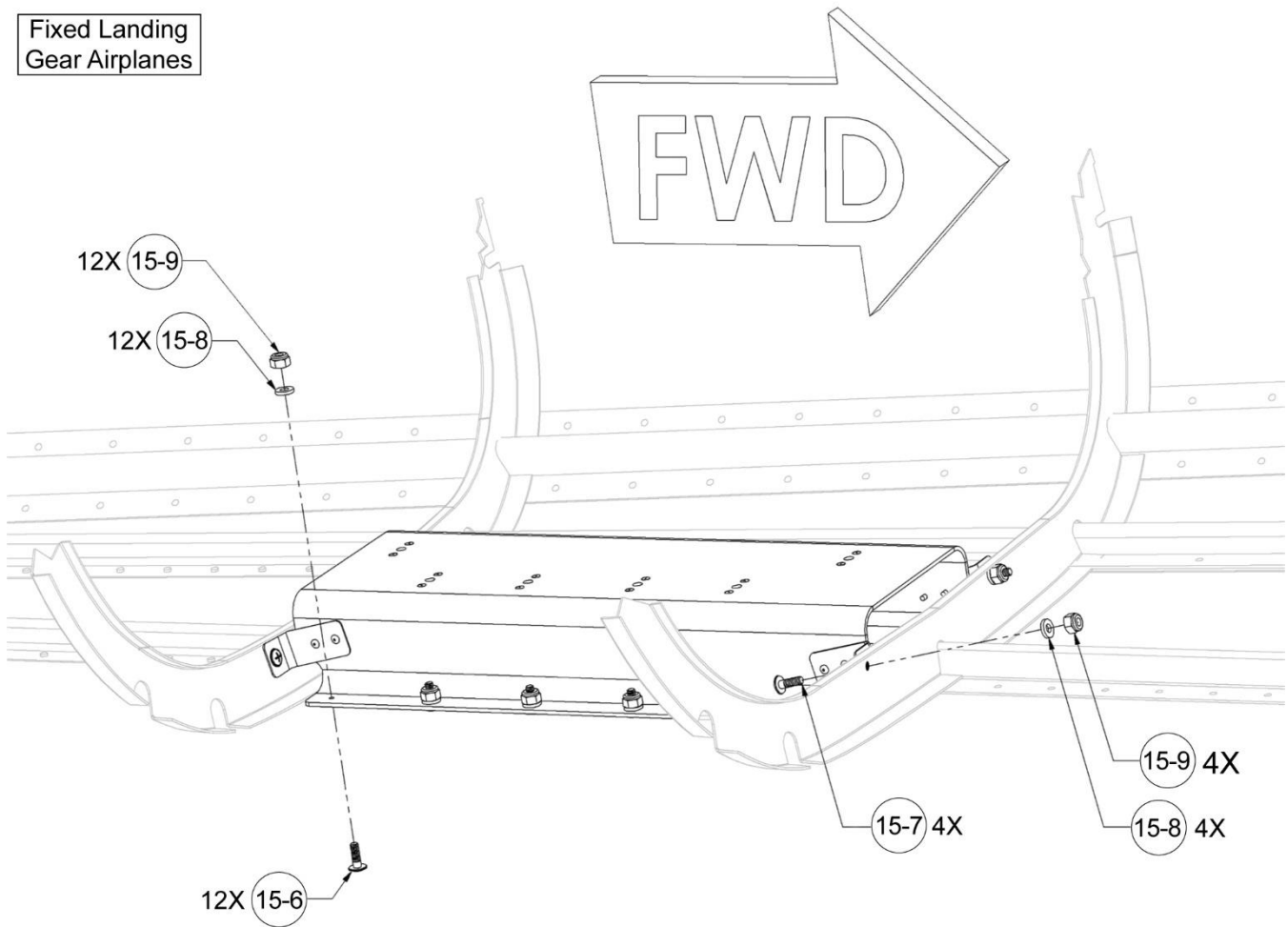


Figure 30: Attaching Pitch Servo Base Bracket to Fuselage

Fixed Landing
Gear Airplanes

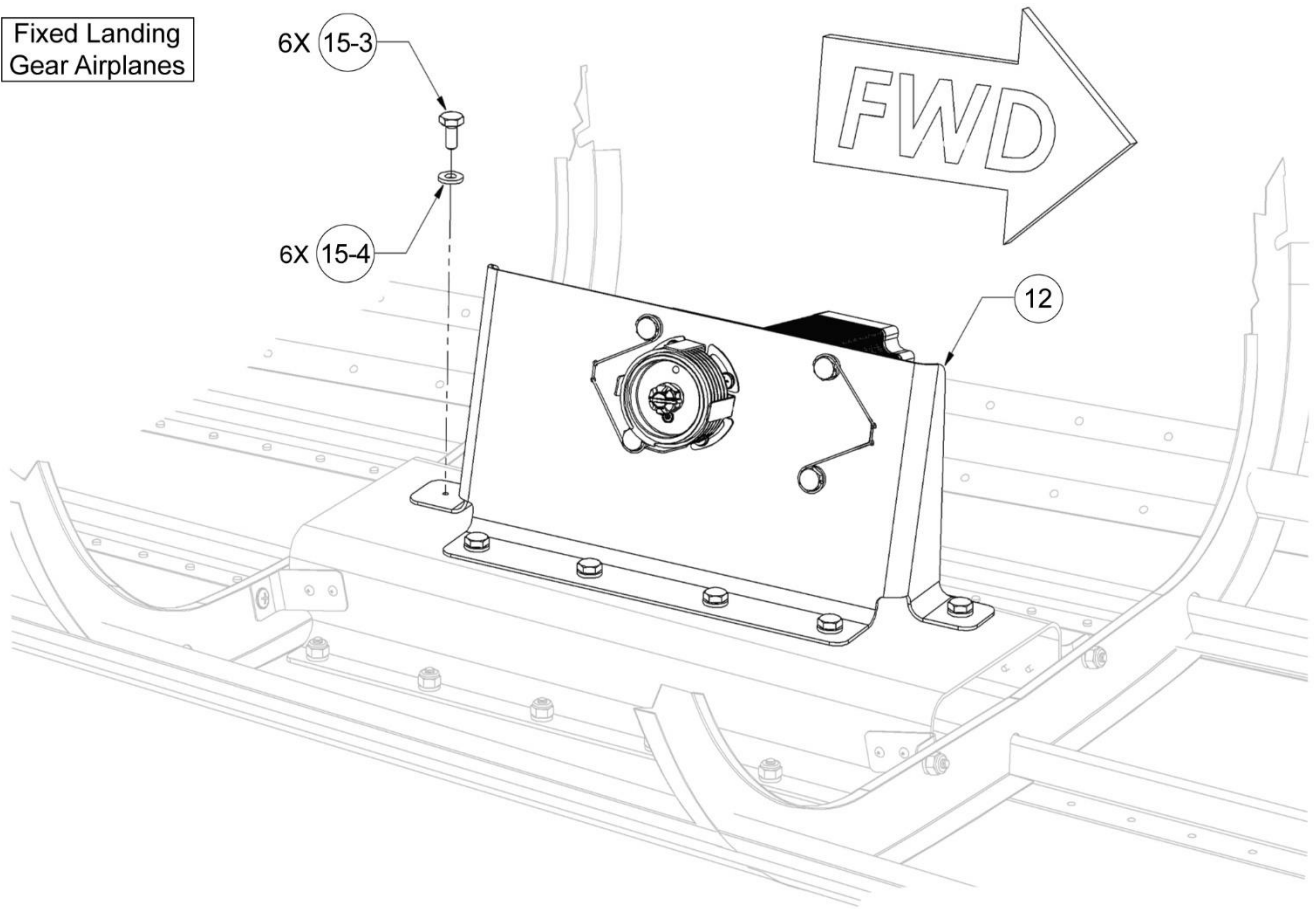


Figure 31: Attaching Pitch Servo Riser Bracket Assembly to Base Bracket

Fixed Landing
Gear Airplanes

AIRCRAFT STRUCTURE REMOVED FOR CLARITY

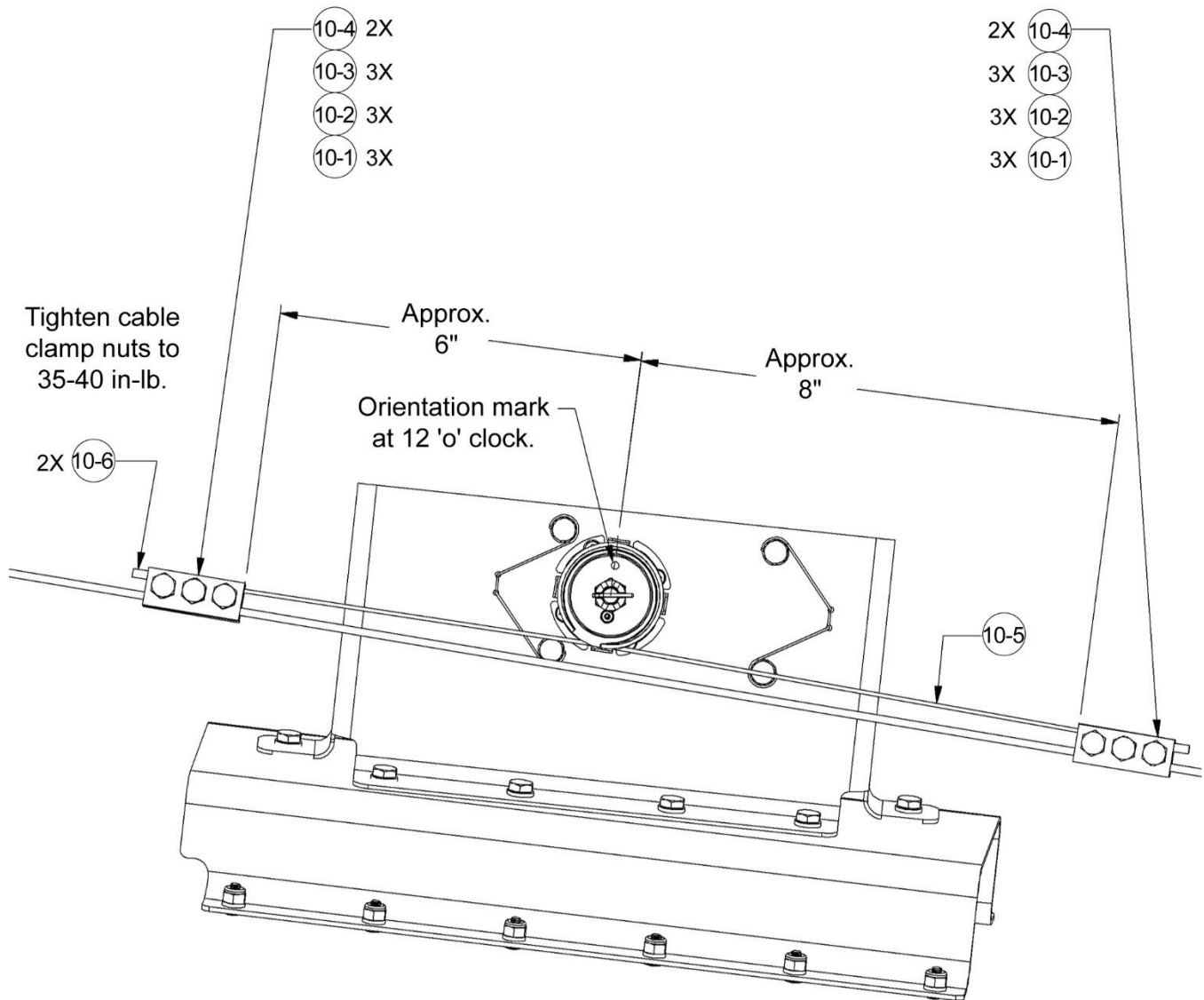


Figure 32: Attaching Bridle Cable to Elevator Control Cable

Fixed Landing
Gear Airplanes

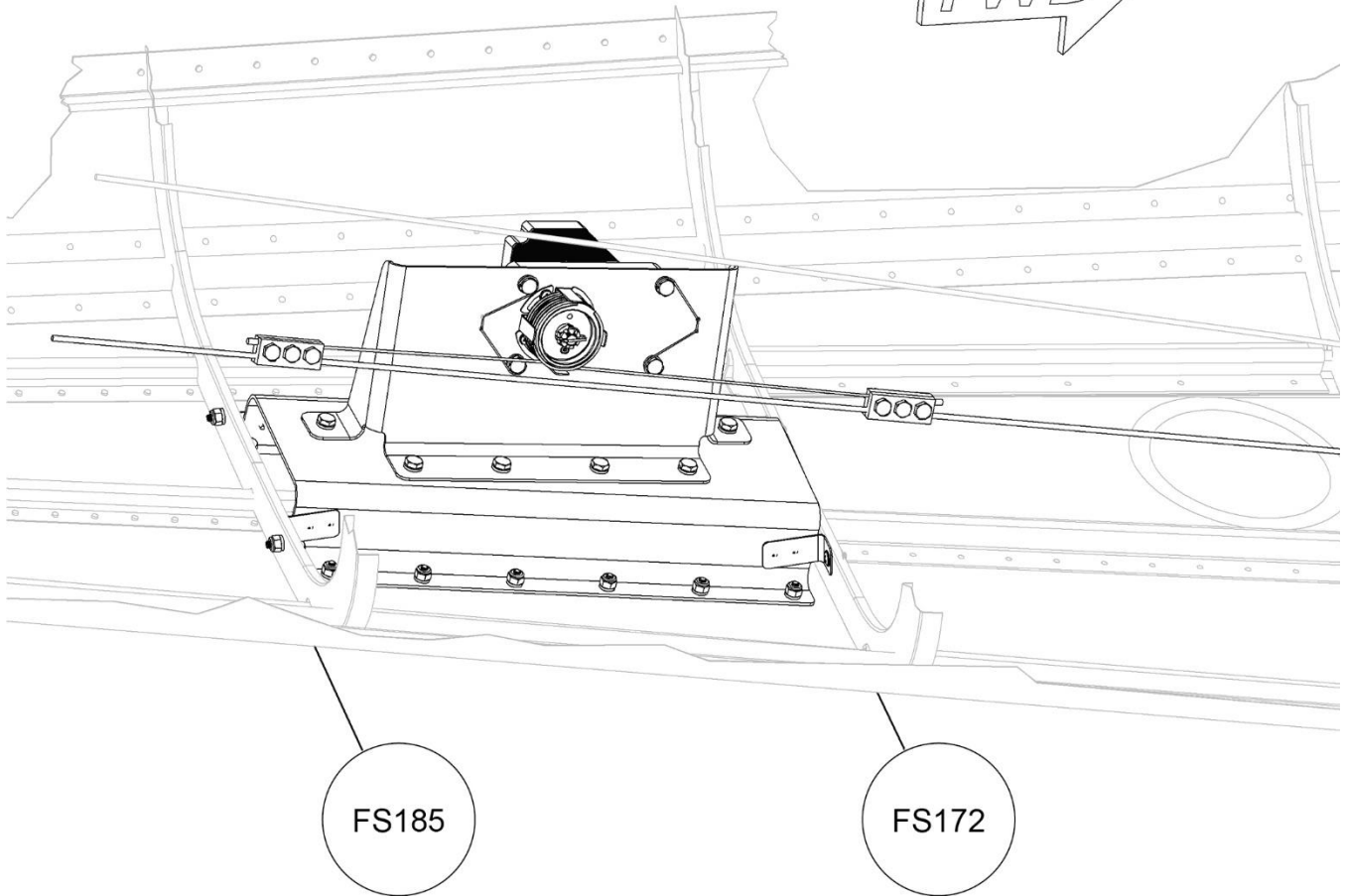
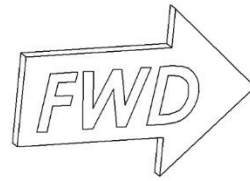


Figure 33: Pitch Servo – Complete Installation

12.2.2 Retractable Landing Gear Airplanes

Retract Landing
Gear Airplanes

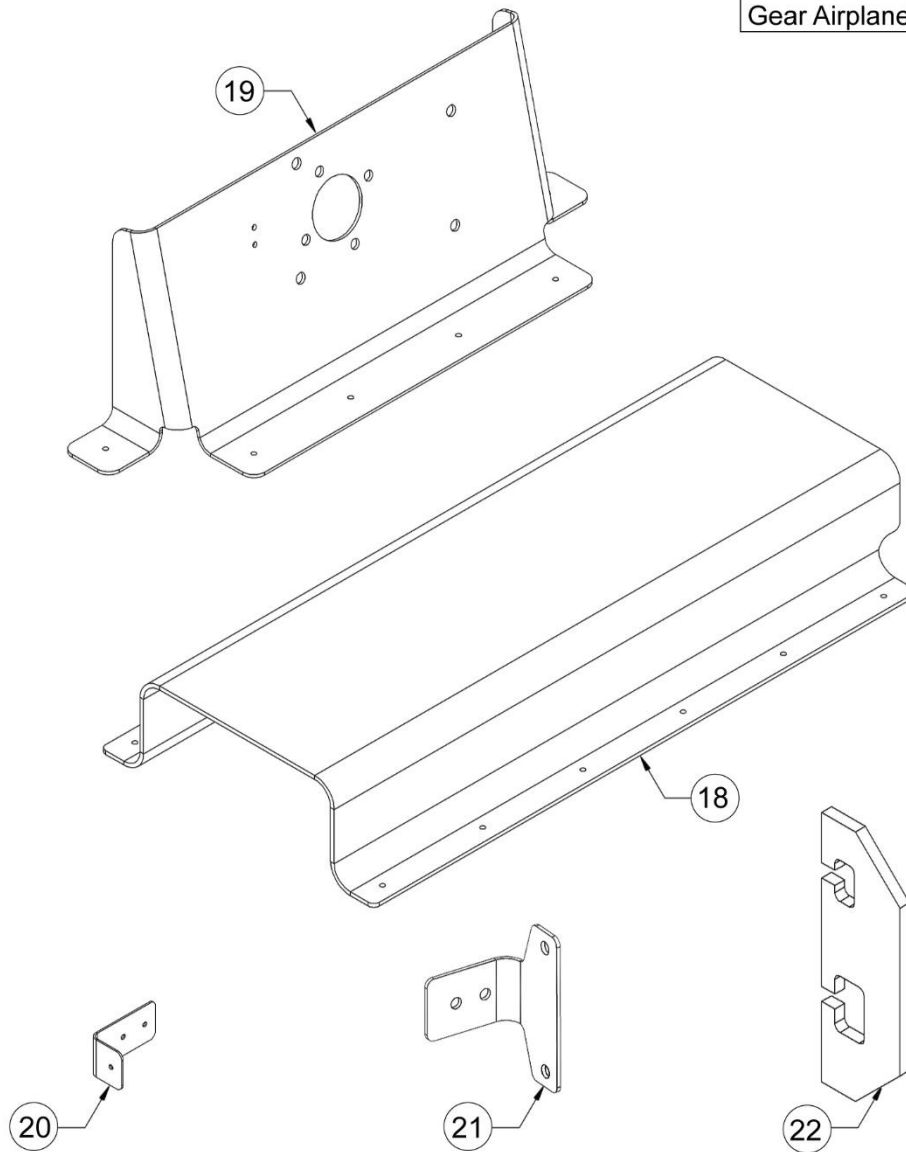


Figure 34: Pitch Servo Bracketry

Retract Landing
Gear Airplanes

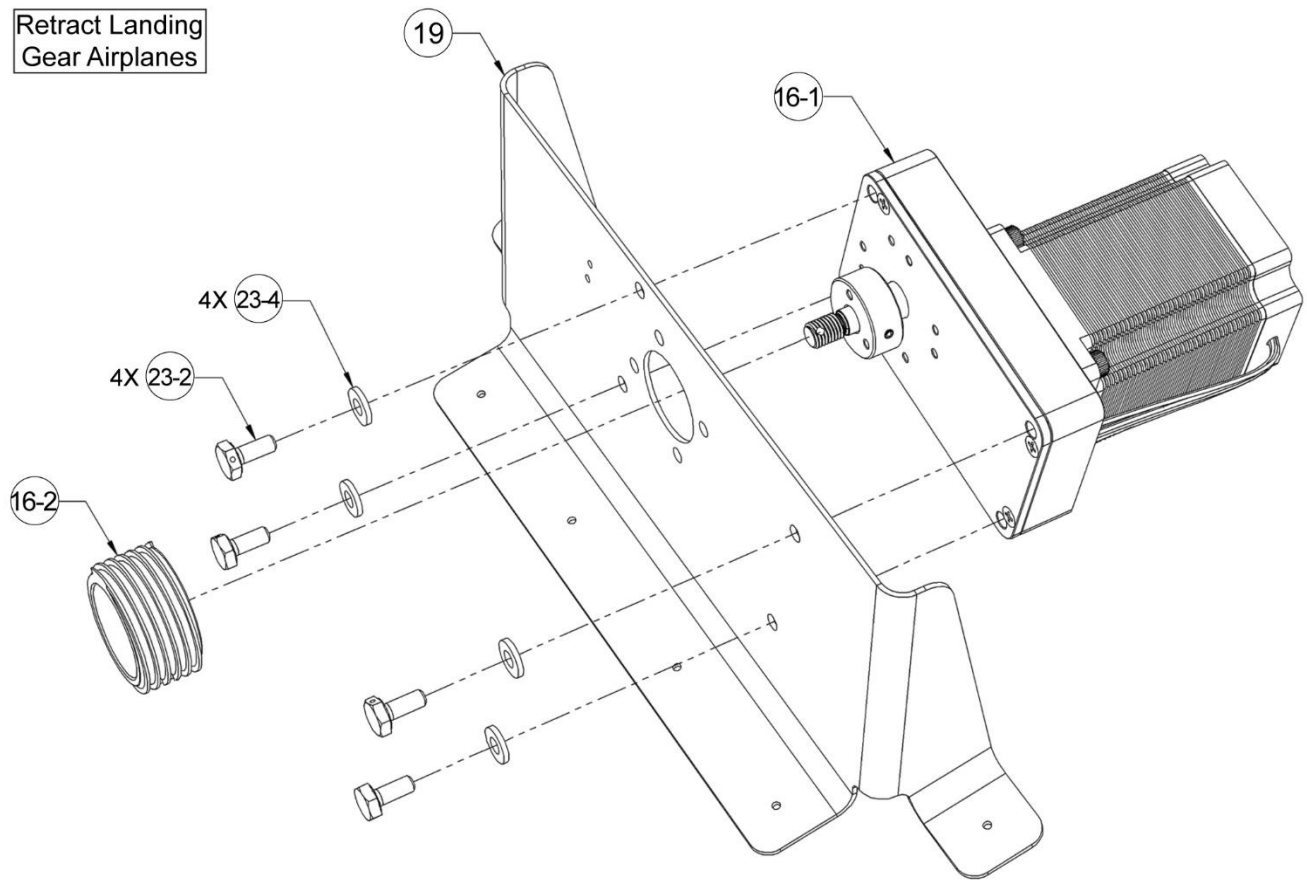


Figure 35: Temporarily Attaching Pitch Servo to Riser Bracket

AIRCRAFT STRUCTURE
CUT-AWAY FOR CLARITY

Retract Landing
Gear Airplanes

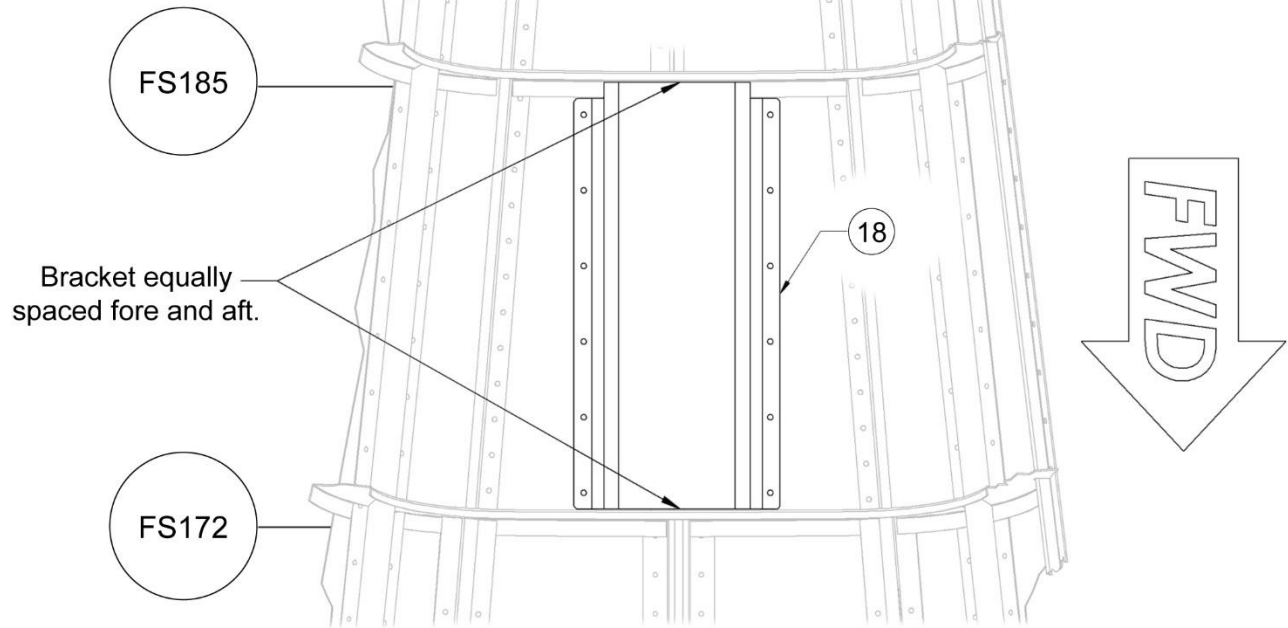
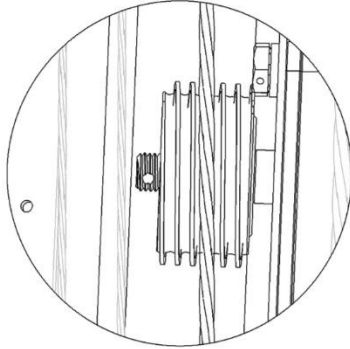


Figure 36: Positioning Pitch Servo Base Bracket

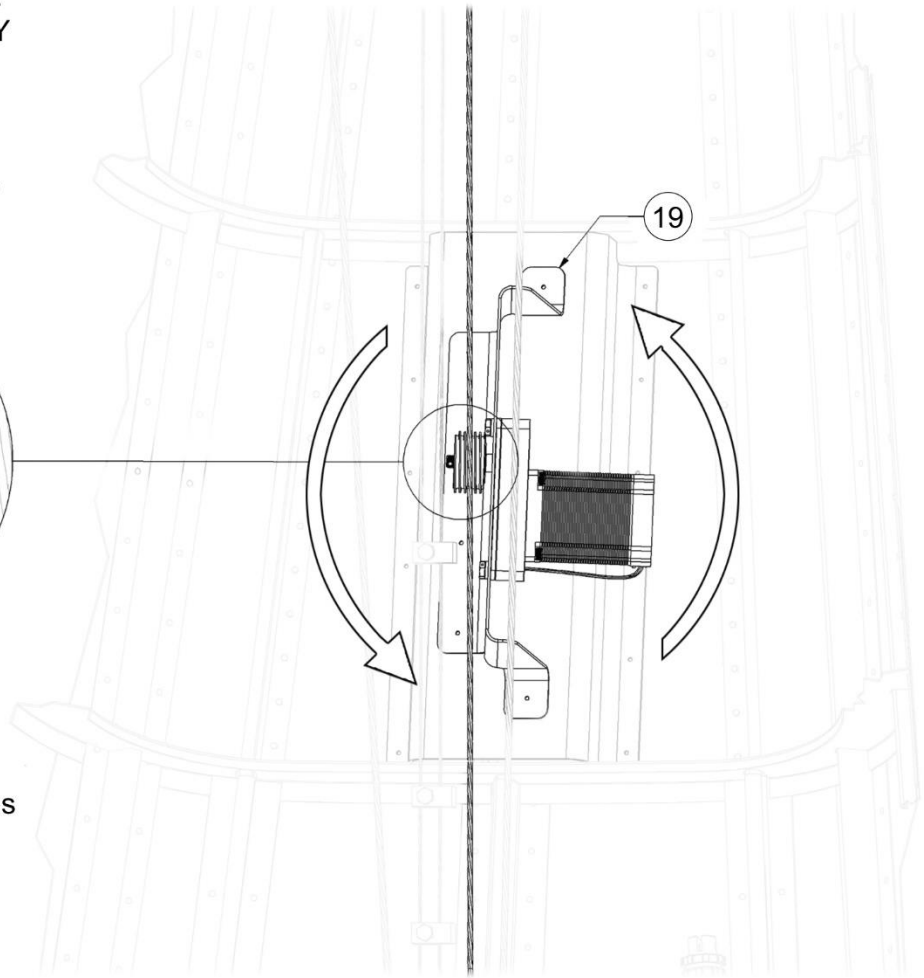
AIRCRAFT STRUCTURE
CUT-AWAY FOR CLARITY

Rotate riser bracket as needed to align center of capstan and grooves as shown here:



DETAIL VIEW

After riser bracket is positioned, mark locations of both brackets.



Retract Landing
Gear Airplanes

Figure 37: Positioning Pitch Servo Riser Bracket Assembly

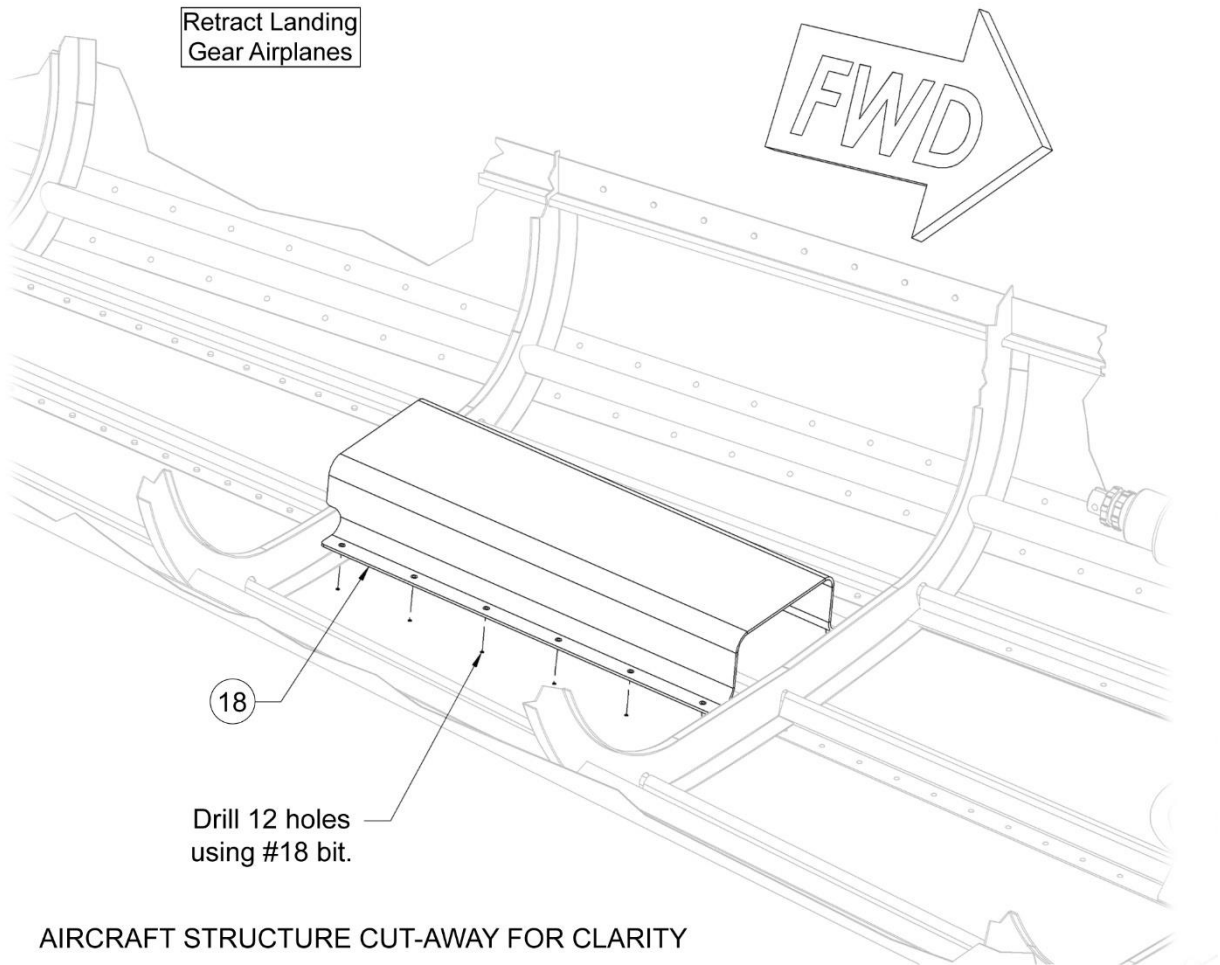


Figure 38: Drilling Holes for Pitch Servo Base Bracket

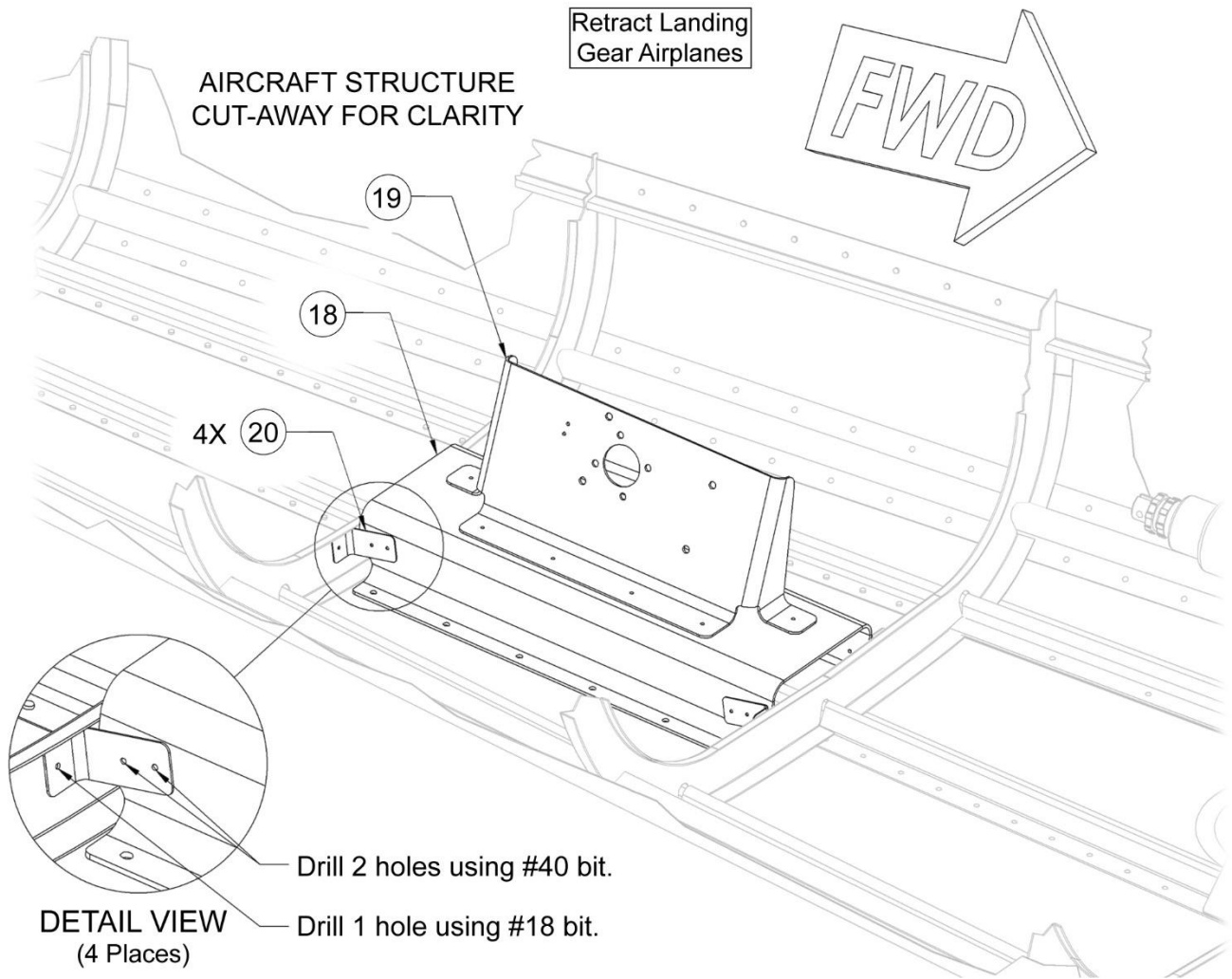


Figure 39: Drilling Holes for Pitch Servo Shear Clips

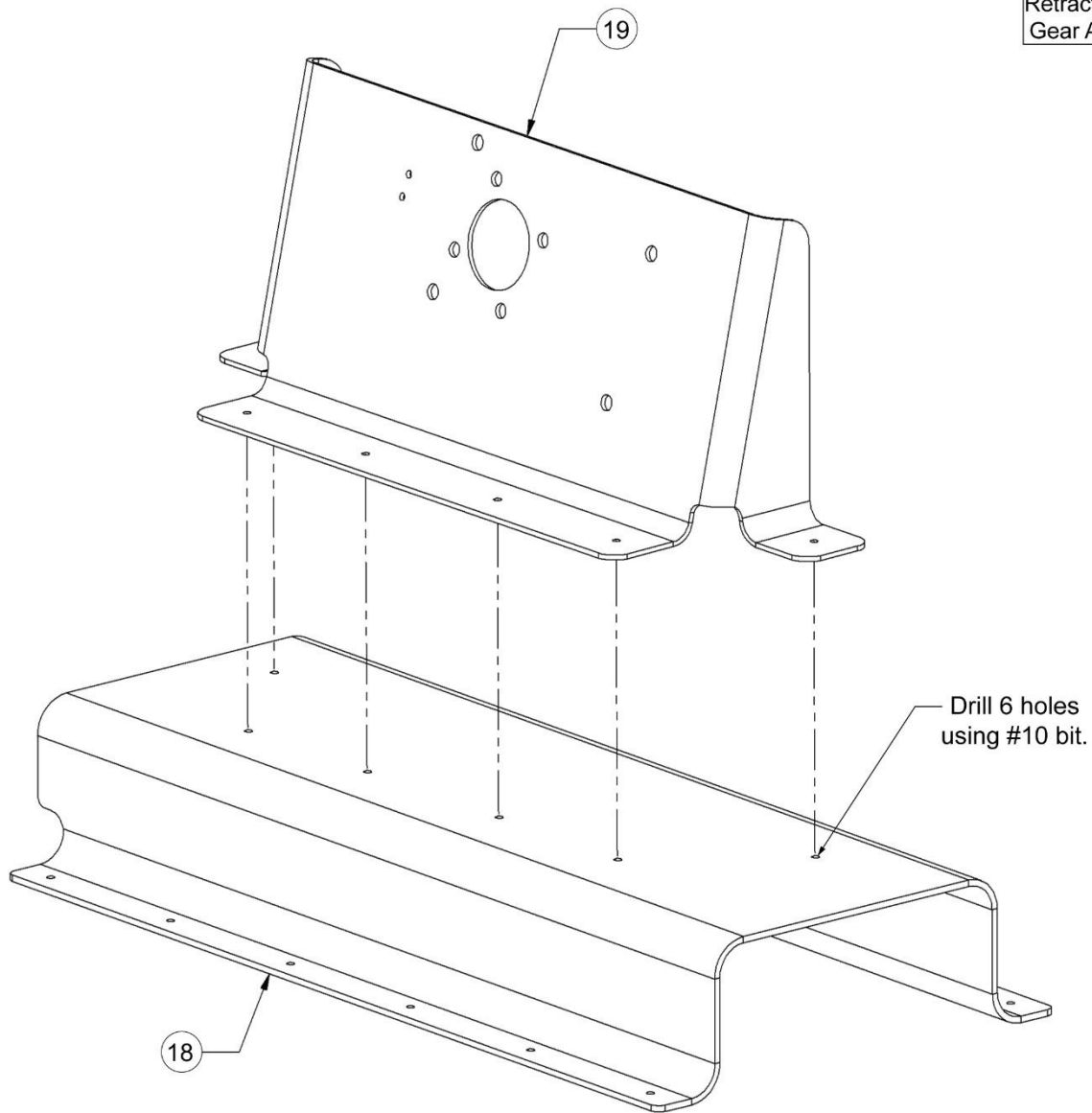


Figure 40: Drilling Holes for Pitch Servo Riser Bracket

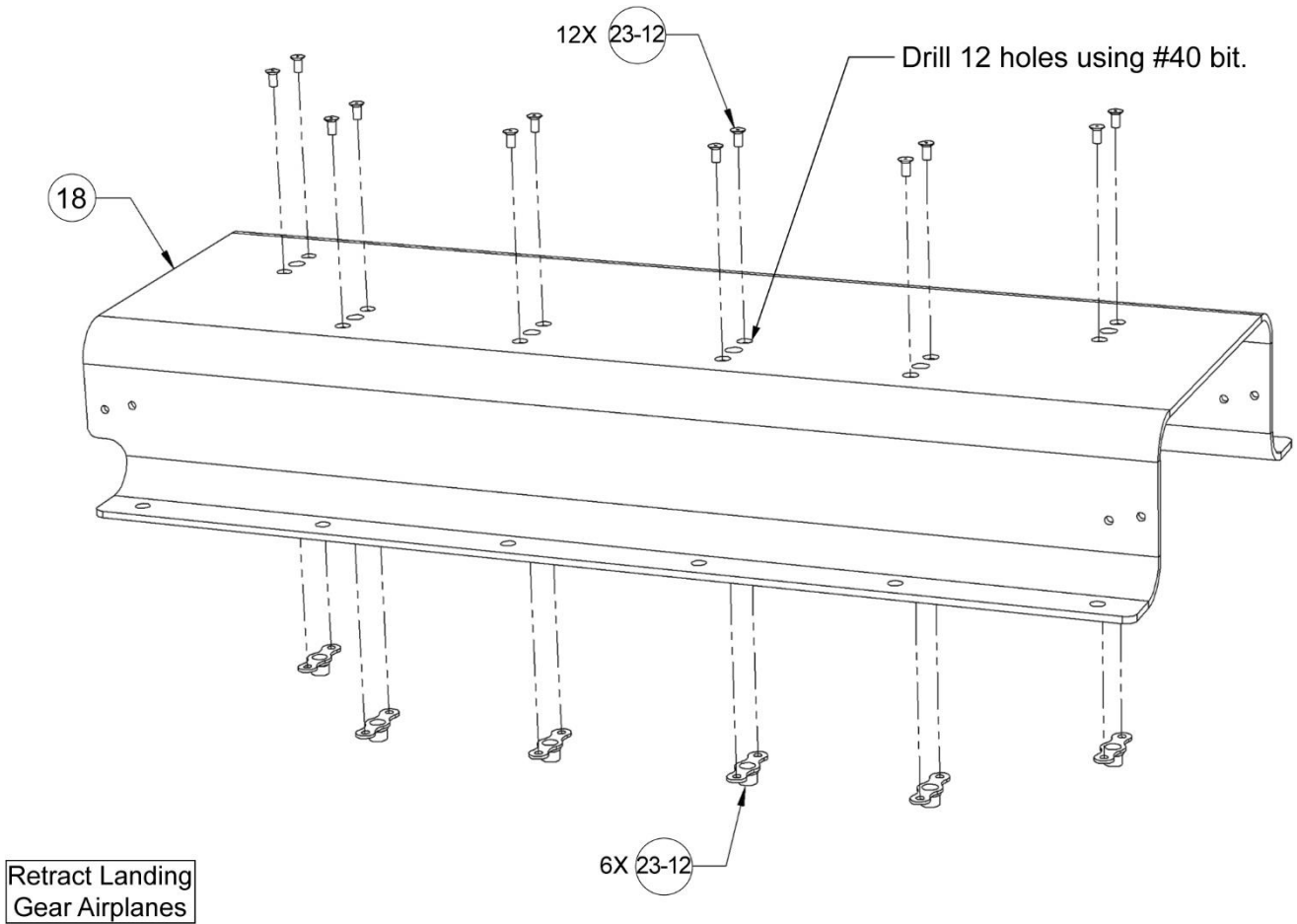


Figure 41: Attaching Nutplates to Pitch Servo Base Bracket

Retract Landing
Gear Airplanes

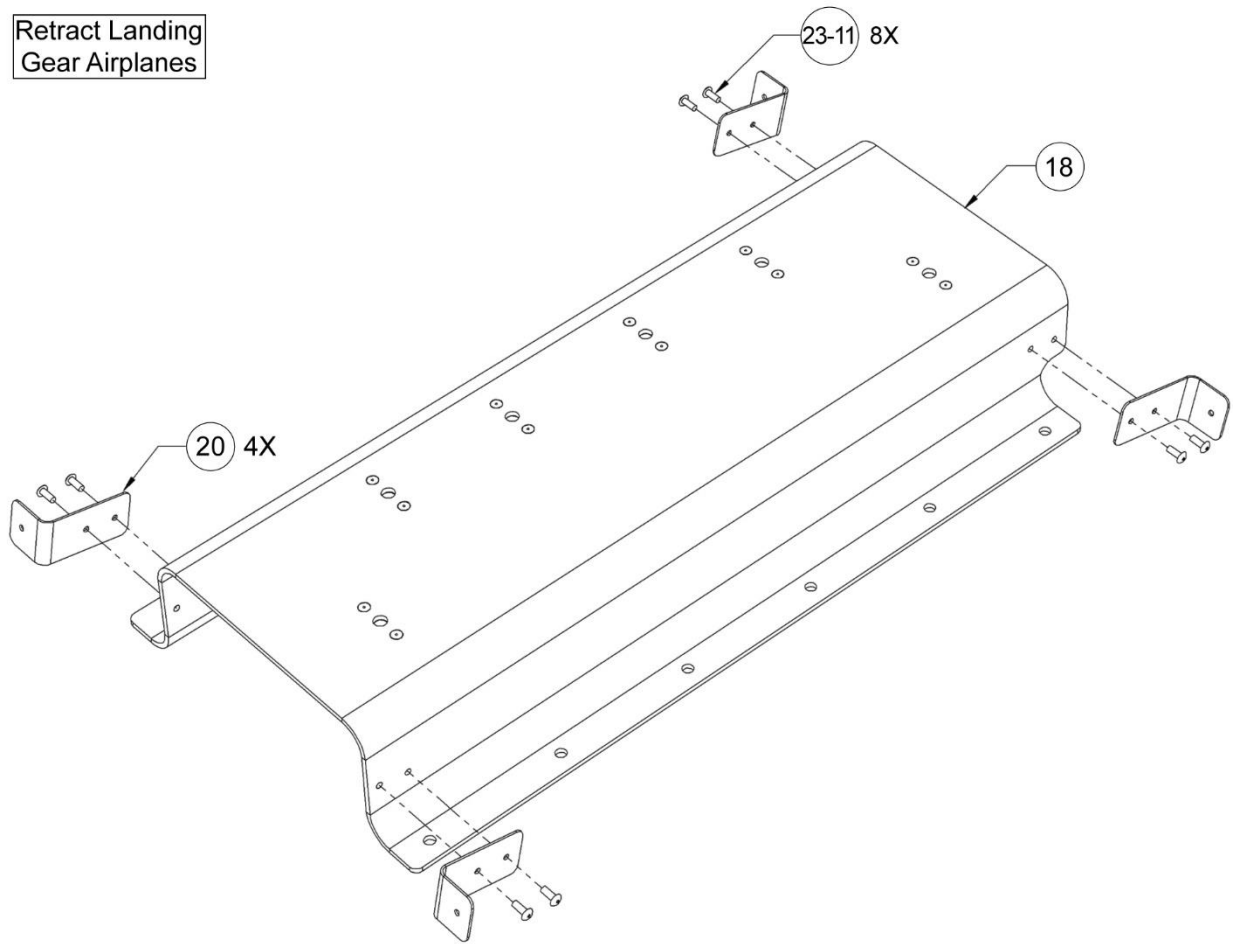


Figure 42: Riveting Pitch Servo Shear Clips to Base Bracket

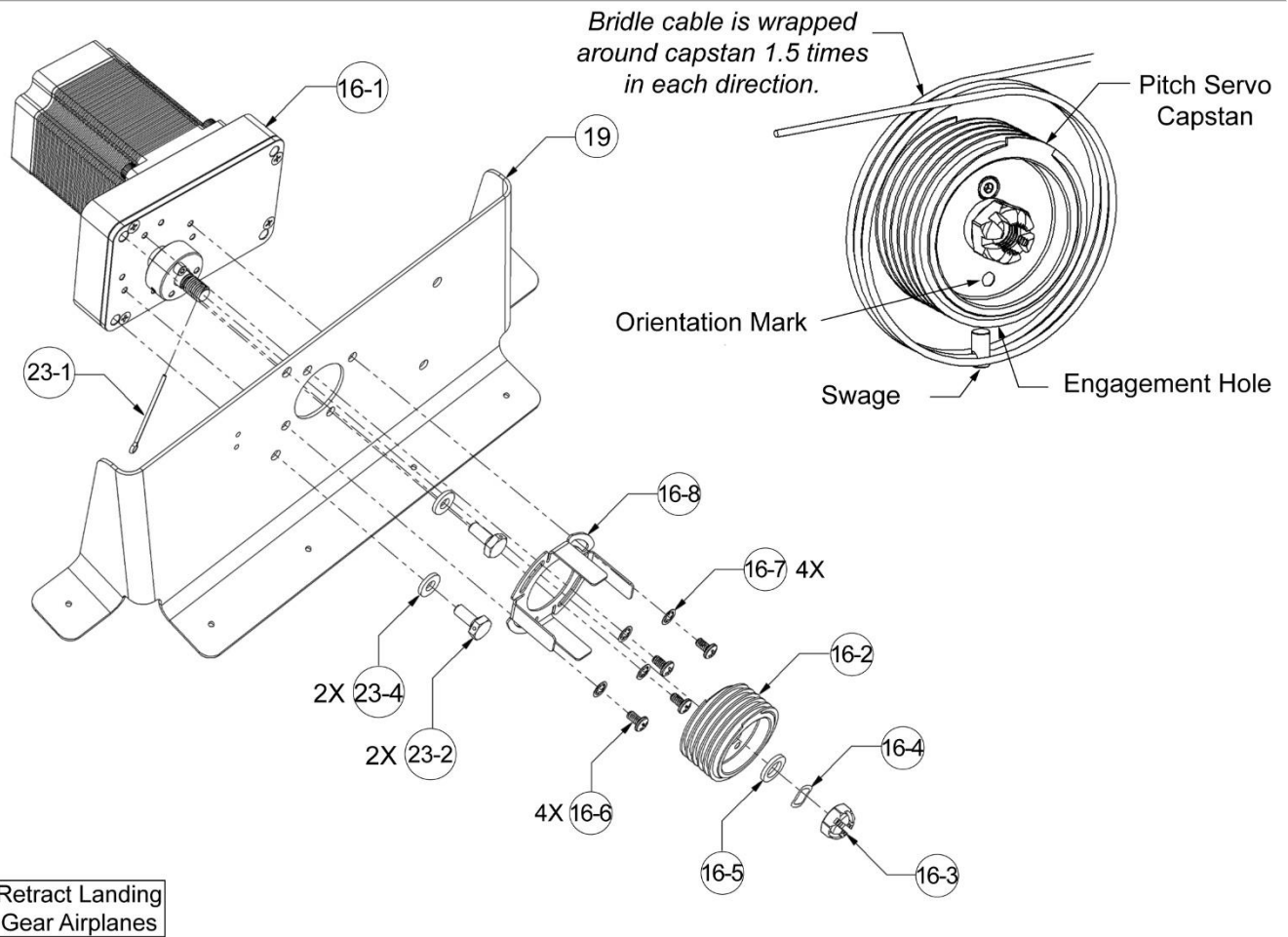


Figure 43: Attaching Pitch Servo to Riser Bracket

Retract Landing
Gear Airplanes

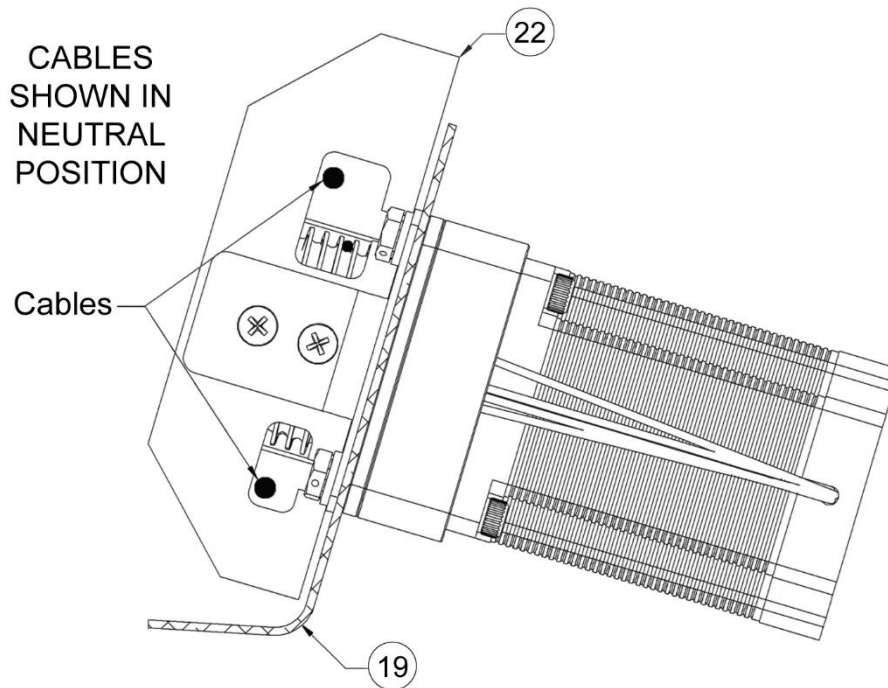
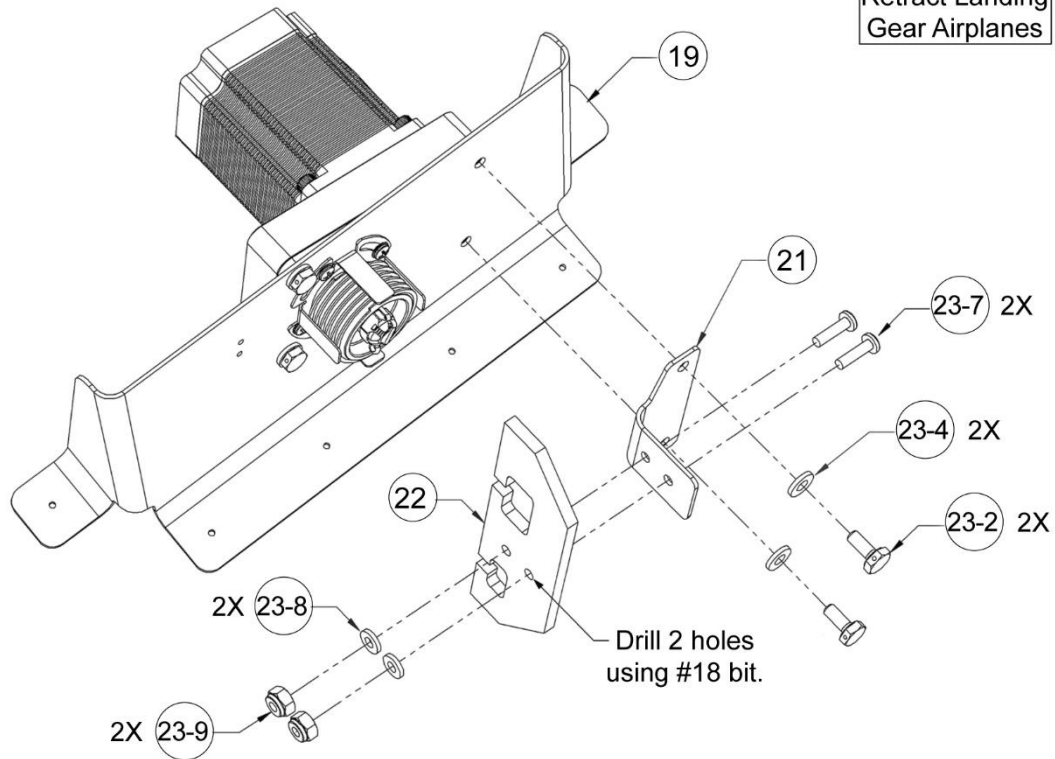


Figure 44: Attaching Pitch Servo Cable Guide and Bracket to Riser Bracket

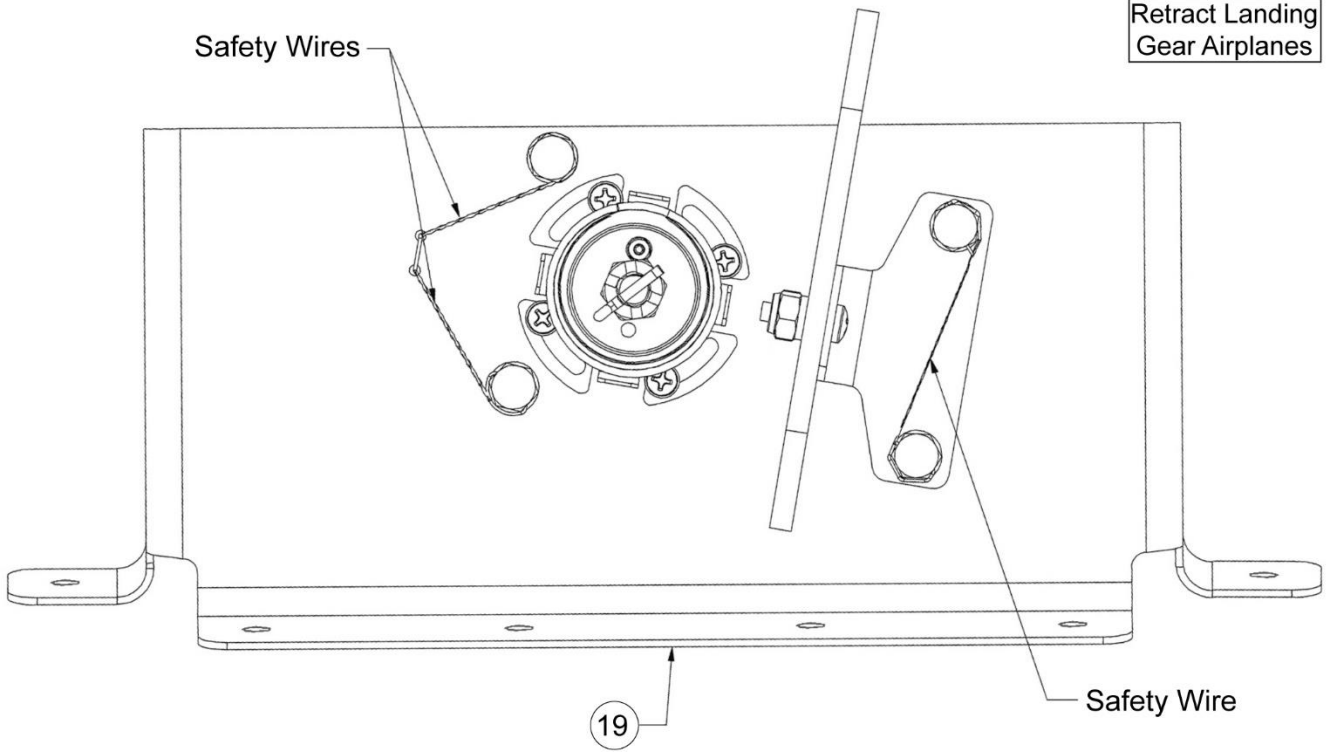


Figure 45: Example of Safety Wiring Pitch Servo Bolts

Retract Landing
Gear Airplanes

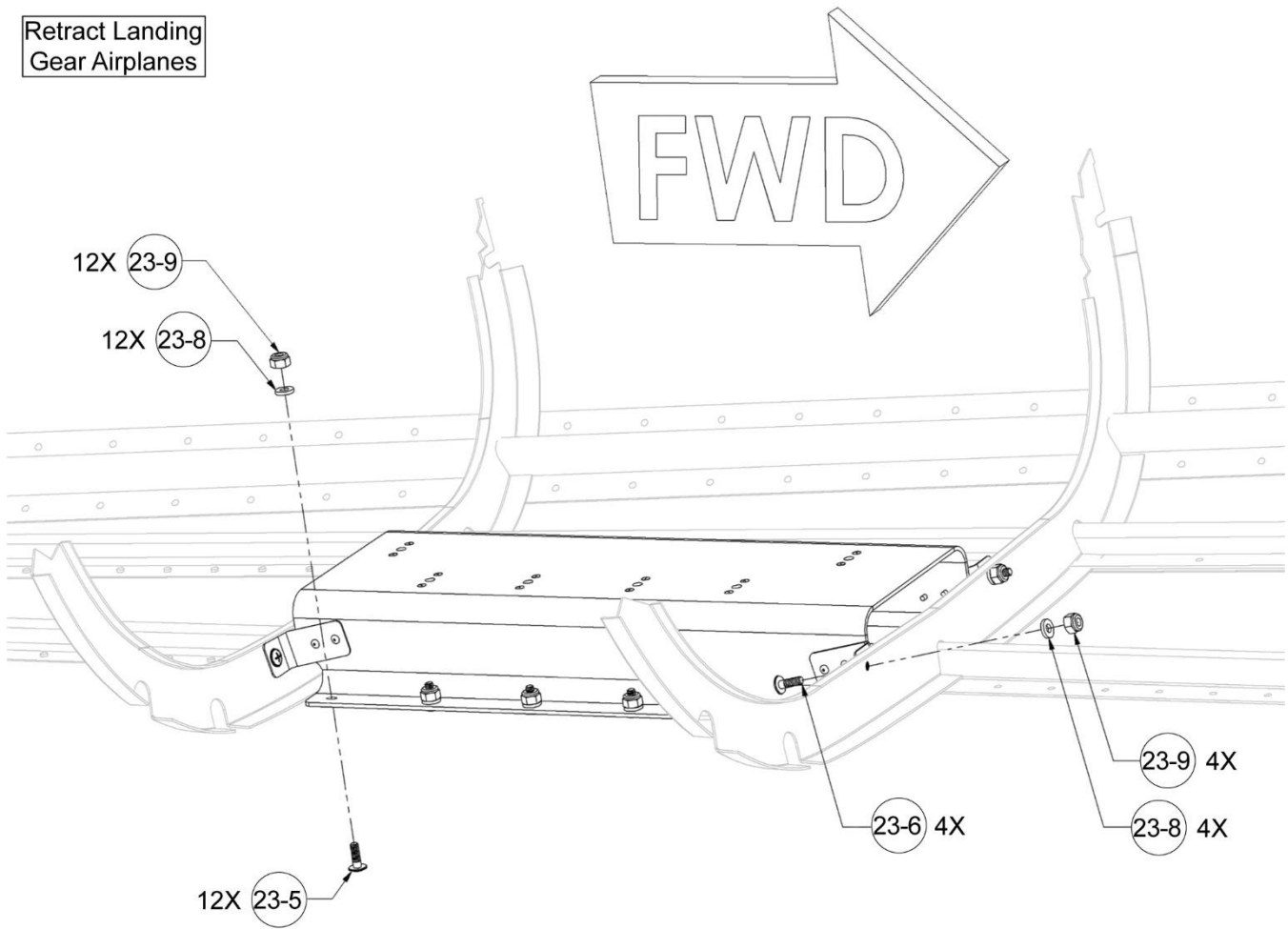


Figure 46: Attaching Pitch Servo Base Bracket to Fuselage

Retract Landing
Gear Airplanes

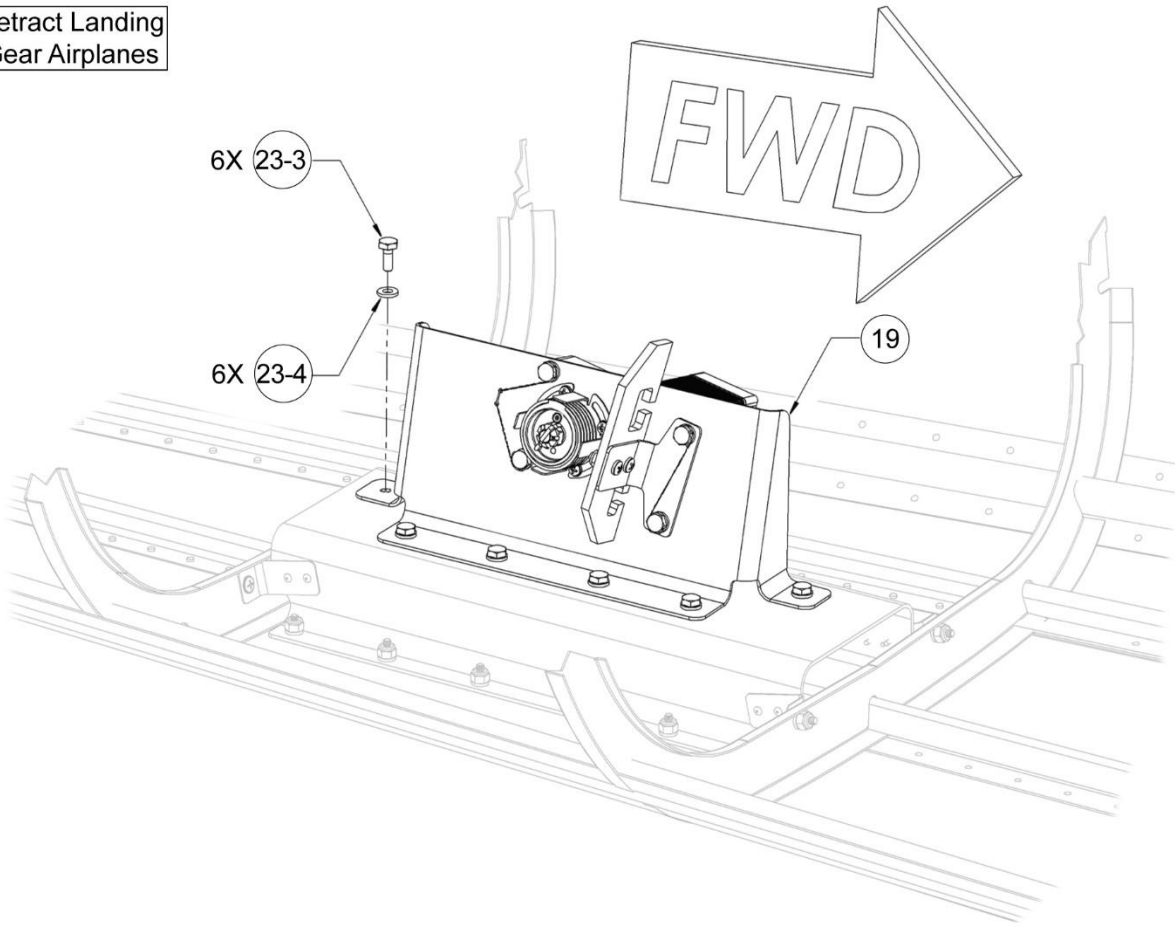


Figure 47: Attaching Pitch Servo Riser Bracket Assembly to Base Bracket

Retract Landing
Gear Airplanes

AIRCRAFT STRUCTURE REMOVED FOR CLARITY

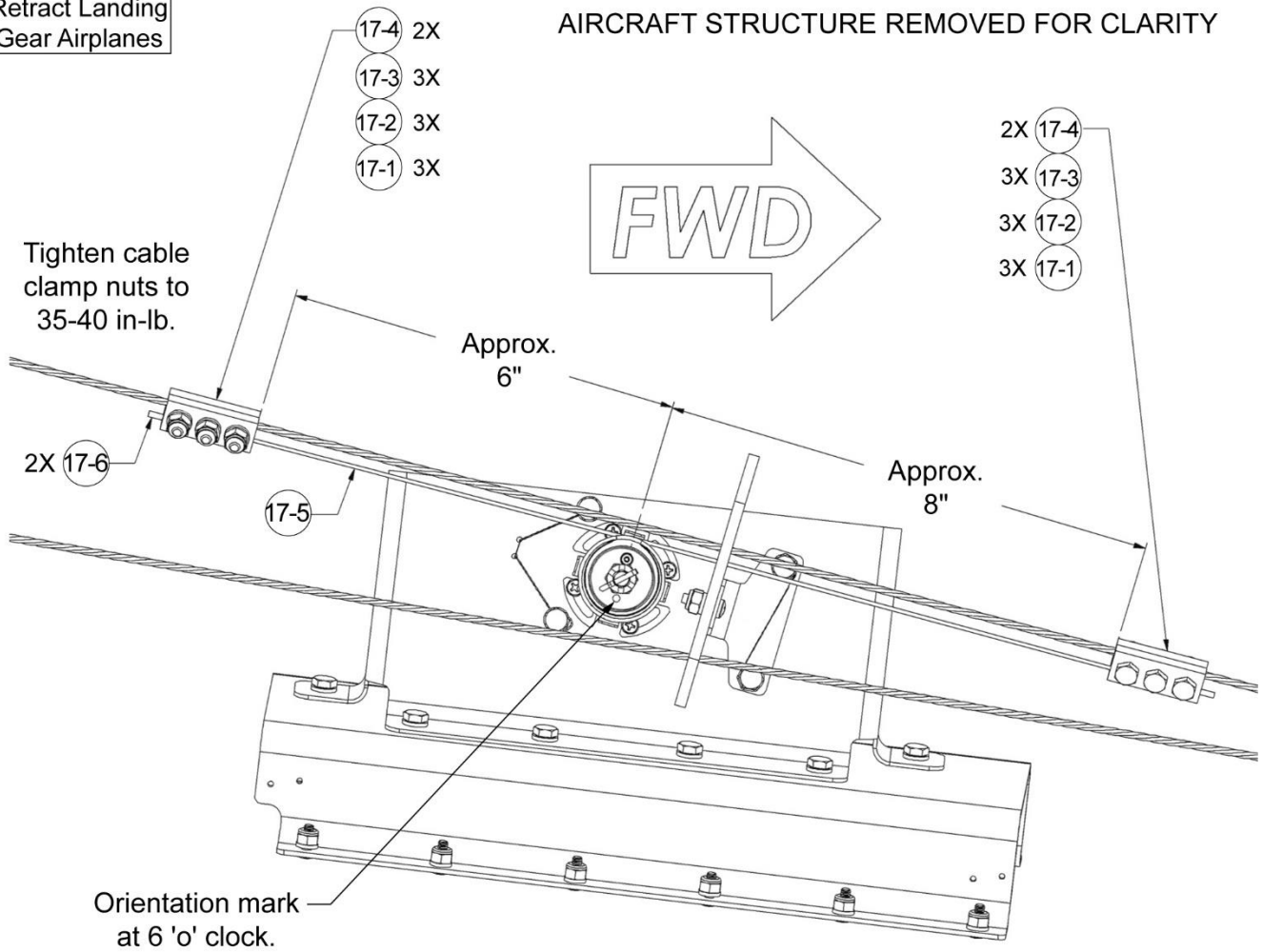


Figure 48: Attaching Bridle Cable to Elevator Control Cable

Retract Landing
Gear Airplanes

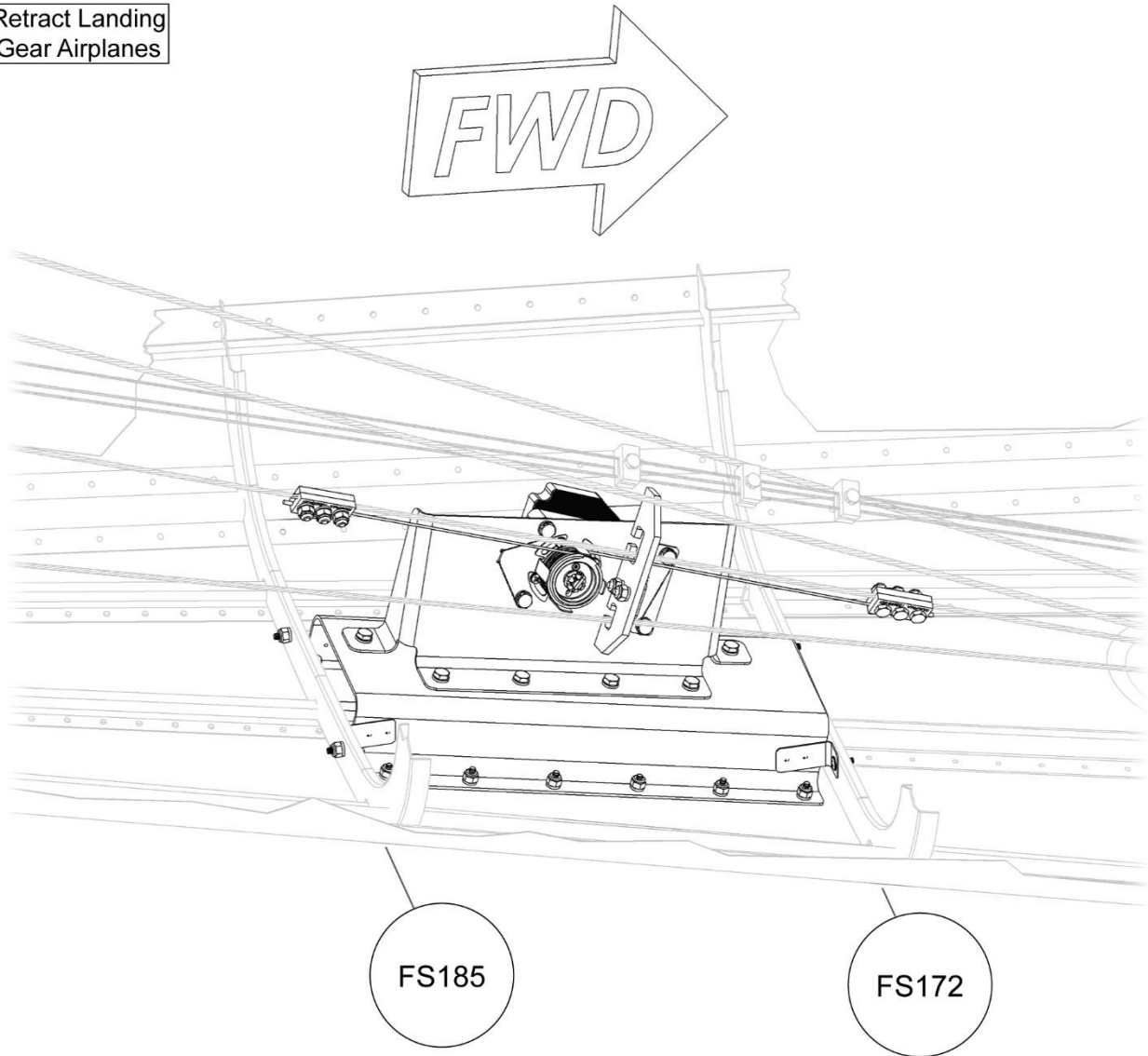


Figure 49: Pitch Servo – Complete Installation

12.2.3 Shear Clip Trimming Guidance

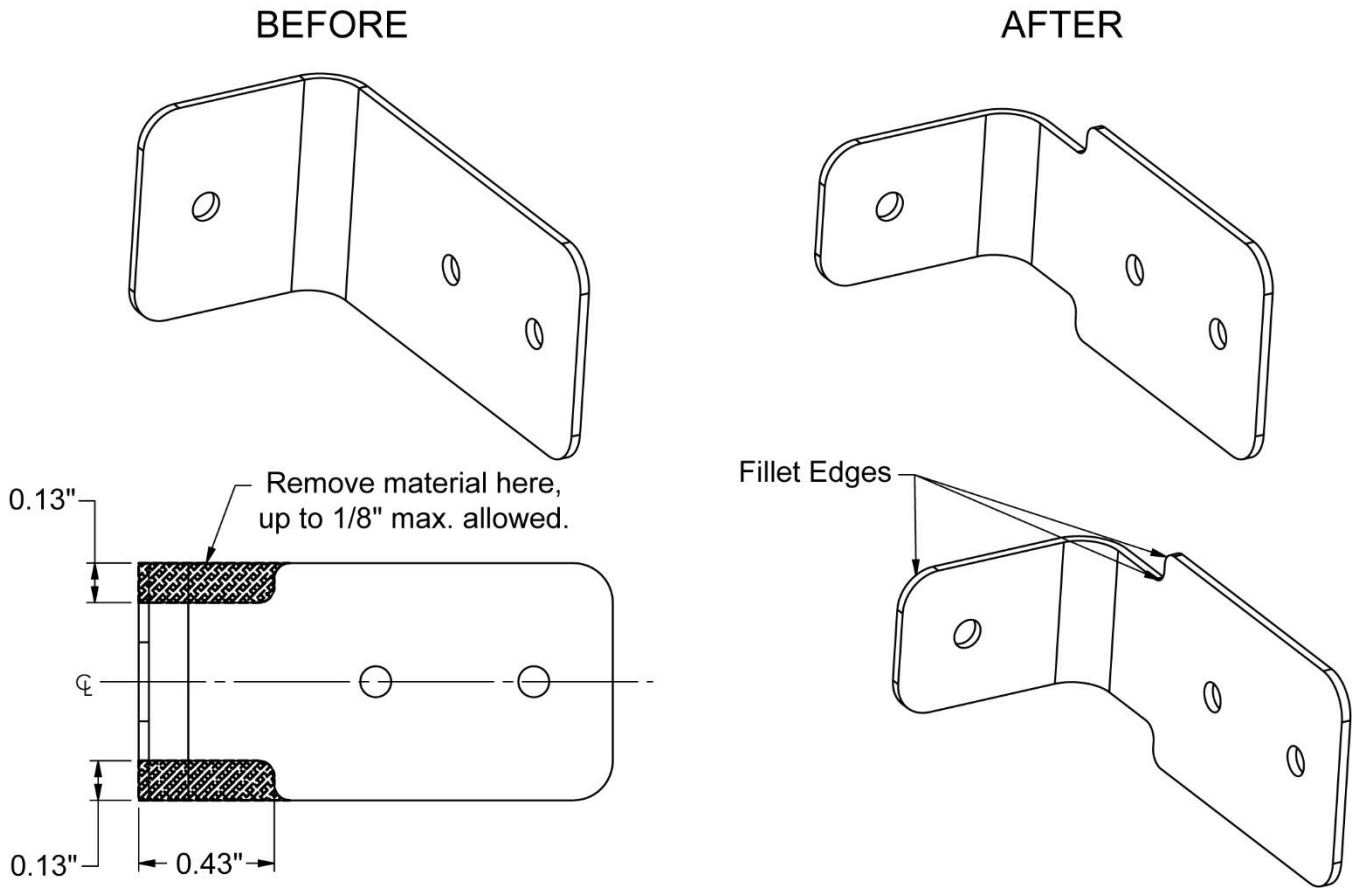


Figure 50: Trimming Shear Clips

12.3 Servo Capstan Removal/Installation

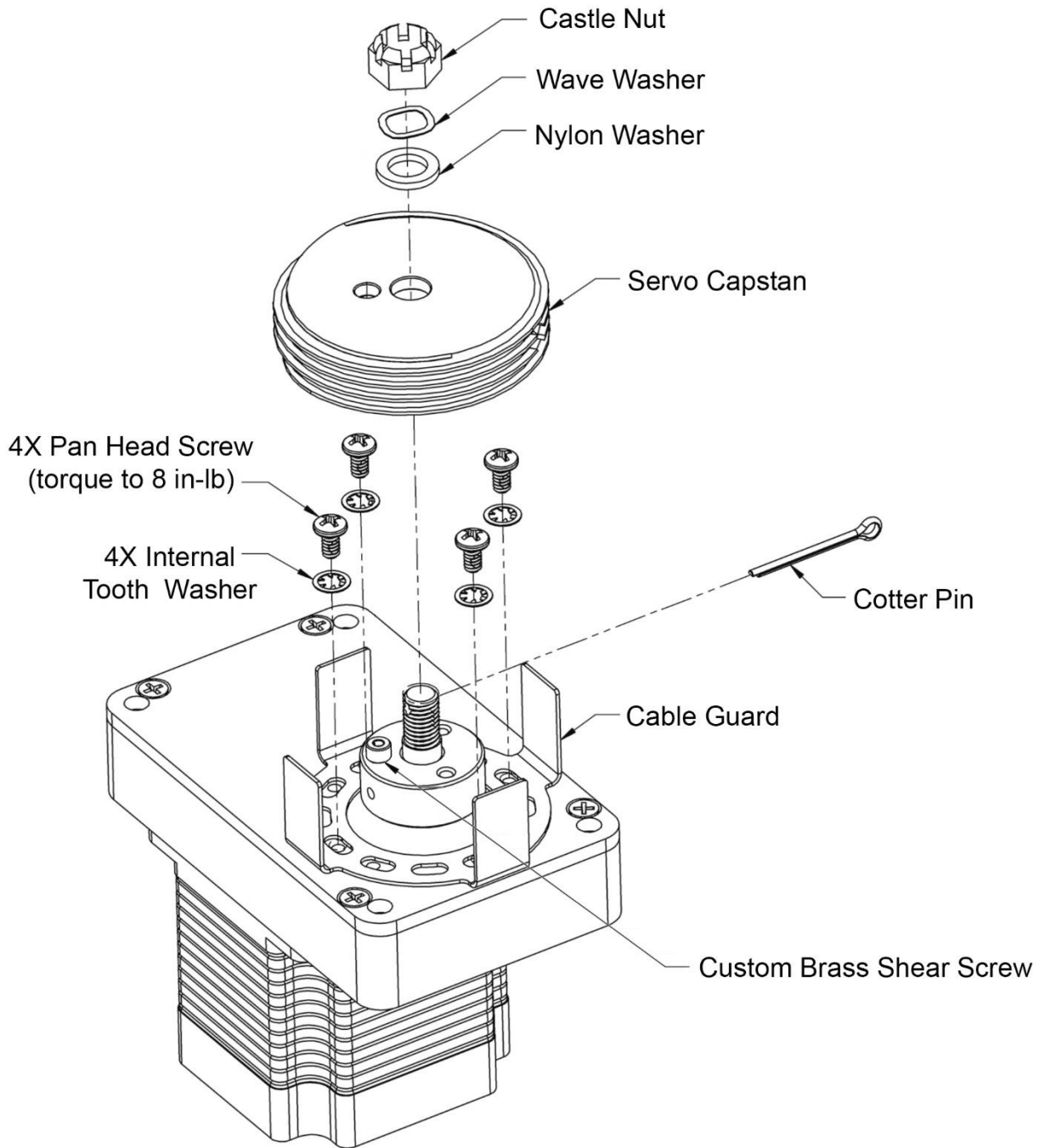


Figure 51: Exploded View of a Typical Servo Capstan Assembly