

ELEVATOR - ADJUSTMENT/TEST

1. General

- A. This section has procedures for the following airplanes.
- (1) Airplanes with the 400B, 400B IFCS Autopilot Types AF-550A, IF-550A installed.
 - (2) Airplanes with the KAP-150 Autopilot, KFC-150, KFC-225 Flight Control System installed.
- B. The following procedures give instructions for the elevator rigging and friction band for these airplanes.

2. Elevator Rigging (Airplanes with 400B and 400B IFCS Autopilot Types AF-550A and IF-550A Installed)

- A. Adjust the elevator rigging (Refer to Figure 501 and 502).
- (1) Set the control wheels in the neutral position of elevator.
 - (2) Attach a neutral rigging tool to the control column. If necessary, make a neutral rigging tool for the control column.
 - (3) Use an inclinometer on the left elevator's trailing edge and adjust inclinometer to show zero degrees. The left elevator must be in the streamlined position.

CAUTION: Do not attempt to align the horn (balance weight portion) on the elevator to the stabilizer.

- (4) Remove the aft baggage partition to get access to the elevator actuator, chain, and cable assemblies.

CAUTION: Make sure a support stand is under the tail to prevent the tail cone from dropping while working inside the tail cone.

- (5) If installed, remove the liquid barrier. Refer to Chapter 53, Plates/Skins - Maintenance Practices.

- (6) Make sure the elevator actuator cable assemblies are correctly rigged.

- (a) Make sure the elevator actuator and the elevator actuator mount are correctly attached together with four bolts and washers.
- (b) Make sure the actuator mount is correctly attached to the mounting bracket with four bolts.
- (c) Make sure the mounting bracket assembly is correctly attached to the bulkhead station 308.00.
- (d) Make sure the lower cable assembly is correctly attached to the aft portion of the bell crank assembly, attach bracket with one bolt, washers, nut, and cotter pin.
- (e) Make sure the chain is correctly centered and aligned on the actuator sprocket. The chain guard posts must be correctly installed and attached with safety wire.
- (f) Make sure the chain is correctly attached to the cable assembly and turnbuckle terminal with the chain connecting links.
- (g) Make sure the turnbuckle is attached with safety wire. Refer to Chapter 20, Safetying - Maintenance Practices.

NOTE: If the chain is to be replaced, you must first remove the safety wire attached to the two chain guard posts. Then remove the chain guard posts.

CAUTION: Do not lose the lock washers when you loosen the chain guard posts for removal.

- (h) Make sure the upper cable fork is correctly attached to the upper forward part of the bell crank attach bracket with a bolt, washer, nut, and cotter pin.
 - (i) Make sure the chain and terminal are correctly attached together with a chain connect link.
- (7) Do a check of the elevator actuator cable tension.
 - (a) Make sure the pitch actuator is rigged.
 - (b) Attach a cable tensiometer to the elevator actuator cable. The tensiometer must indicate 10 - 15 pounds (44.45 - 66.72 N).
 - (c) If the cable tension is less than 10 pounds (44.45 N) or more than 15 pounds (66.72 N), adjust the cable to bring it to the desired tension.
 - 1 Remove the safety wire from the turnbuckle.
 - 2 If cable tension is too high, loosen the turnbuckle. If cable tension is too low, tighten the turnbuckle.
 - 3 Attach safety wire to the turnbuckle. Refer to Chapter 20, Safetying - Maintenance Practices.
 - 4 Remove the cable tensiometer from the actuator cable.
 - (8) Check the inclinometer on the left elevator trailing edge to make sure it shows 0 degrees. Remove the inclinometer if

value is 0 degrees. If the value is not 0 degrees, repeat the elevator rigging procedure.

- (9) Remove the rigging tool attached to the control wheels.
 - (10) The 400B autopilot has a GYRO switch located on the rear of the control head to eliminate the gyro roll and pitch signals generated by a non-erected gyro.
 - (a) Set the GYRO switch to the OUT position.
 - (11) The 400B IFCS does not have a gyro out switch. It will be necessary to hook up an outside vacuum source or operate the engine to erect the gyro.
 - (a) If an outside vacuum source is used, it must be calibrated in inches of mercury. The desired suction range required to erect the gyro is 4.6 to 5.4 inches of mercury.
 - (b) If the engine is operated to erect the gyro, the engine must be run at 65 degrees No. This will provide the desired amount of vacuum and maintain correct bus voltage.
 - (12) Turn to ON, the airplane battery switch, 1 & 2 avionics power switches, and the autopilot (A) switch. Allow the pitch wheel to run to electrical neutral.
 - (13) Pull the control wheel back until the control forces are neutralized.
 - (14) Hold the control wheel to prevent full travel and rotate the PITCH command wheel in the NOSE-DOWN direction. The control wheel must move forward.
 - (15) Turn the autopilot (A) switch to OFF and then back to ON. Allow the PITCH command wheel to neutralize.
 - (16) Pull the control wheel back until there is a slight tendency for the control wheel to travel forward. Rotate the PITCH command wheel in the NOSE-UP direction. The control wheel must be prevented to move forward by the actuator force. Push control wheel forward 2 to 3 inches to confirm that actuator force is being applied.
 - (17) Check that the autopilot can be overpowered using control wheels at any time. This practice must be kept to a minimum because wear of the slip-clutch will result from extended periods of manual overpower. Extended periods of manual overpower of the actuator will cause a thermostatic switch to remove power from the actuator. After approximately 10 minutes, the switch will automatically reset to close the autopilot interlock circuit. Power can then be reapplied to the actuator by engaging the AP/ON-OFF switch.
- NOTE:** Because of ground loads applied to the elevators, elevator travel from stop to stop cannot be obtained in most instances while you conduct the ground tests. The service technician must not assume the elevator actuator is not completely operational. Flight tests in accordance with the appropriate 400B Service/Parts manual must be completed after rigging procedures are completed to fully determine if the system is completely operational. Make sure the Gyro switch is set in the IN position before flight tests are initiated.
- (18) Turn the autopilot (AP) switch, avionics power switches, and the airplane battery switch to OFF.
 - (19) If previously installed, install the liquid barrier. Refer to Chapter 53, Plates/Skins - Maintenance Practices.
 - (20) Install the aft baggage partition.

3. Elevator Friction Band (Airplanes with 400B and 400B IFCS Autopilot, Types AF-550A and IF-550A Installed)

- A. Do a check of the elevator friction band.

NOTE: The elevator friction band without an autopilot installed must be 15 pounds (66.72 N) or less. The maximum allowable friction band is 20 pounds (88.96 N) with an autopilot installed. You must check the friction band every time the autopilot rigging is checked. The friction band must be measured and calculated. Correct action to reduce the elevator system friction band must be completed.

- (1) All friction band measurements must be made with the load scale so the force exerted to move the elevator is applied in a direction parallel to the control column. The movement of the control wheel must be slow and steady. The friction band requirements apply to all of the elevator travel range. The production inspection must be made at or in 1.00 inch of either side of the position occupied by the control wheel when the elevator is set in the neutral position.
 - (a) Put the elevators in a down position (the control wheel one inch forward of the position occupied when elevator is in neutral position).
 - 1 Move the control wheel aft by exerting force described in Step 3.A.(1).
 - 2 Do a load scale check as the control wheel passes the elevator neutral position. Identify the load scale check as F1.

- (b) Put the elevators in an up position (the control wheel assembly one inch aft of the position occupied when elevator is in neutral position).
 - 1 Move the control wheel assembly forward by exerting force described in Step 3.A.(1).
 - 2 Do a load scale check as the control wheel passes the elevator neutral position. Identify the load as F2.
- (2) The elevator friction band must be calculated from the measurements taken from the previous steps.
 - (a) The friction band is the sum of forces F1 and F2 where a force must be applied in a forward direction toward the panel to return the elevators to a down position. The friction band = $F1 + F2$.
 - (b) The friction band is the difference between two forces where a restraining force must be applied in a aft direction away from the panel to prevent the elevator from abruptly returning to a down position. The friction band = $F1 - F2$.
- (3) When the friction band exceeds the limits, the following instructions must be completed in the order shown to reduce friction to the system.
 - (a) Decrease the tension to the elevator cable to 10 pounds (44.48 N) with the elevator set in the neutral position.
 - (b) Do a check for binding and correct alignment of the pulleys. Correct alignment if necessary.
 - (c) Make sure the hinges are clean and lubricated.

4. Slip Clutch Adjustment, Values and Capstan (Airplanes with KAP-150 Autopilot and KFC-150, KFC-225 Flight Control System Installed)

- A. Servo Slip Clutch Torque Settings (Refer to Figure 503).

NOTE: The servo slip clutch torque settings are adjustable and must be set before servo installation.

- (1) Set the servo slip clutch torque to the appropriate value.

NOTE: The fixtures and tools required to complete the adjustments are supplied with the KTS 150 test set and the KTS 158 test set.

5. KM 275 and KM 277 Slip Clutch Torque Adjustment (Airplanes with KAP-150 Autopilot and KFC-150, KFC-225 Flight Control System Installed)

- A. Adjust the Slip Clutch Torque (Refer to Figure 503).

- (1) Refer to Slip Clutch Adjustment, Values and Capstan to determine the servo mount part number and setting required for each axis of the airplane.
- (2) Remove the capstan guard from the KM 275 and KM 277 Capstan plate.
- (3) Attach the KM 275 or KM 277 servo mount and servo motor to the KTS 158 test stand (047-4238-01).
 - (a) When you adjust a KM 275, place the adapter tool over the KM 275 capstan and insert the positioning pin (from the straight-up position) to attach the adapter tool.
 - (b) When you adjust a KM 277, use the three sprocket pins (071-6065-00) to attach the adapter tool to the capstan.

NOTE: An alternative adjustment method for the KM 277 is to use the King gear adapter assembly (071-6018-06).

- (4) Insert a torque wrench (Snap-On TEP-6FUA or equivalent).
- (5) Connect the servo motor to the appropriate KTS 158 Test Set connector and apply power to the servo motor.
- (6) Do a test of the torque value.

NOTE: The desired torque value is the average of the maximum and minimum indications from the clockwise and counter clockwise rotations. The test must be repeated three times in each direction and then the average of the six values is used to determine the true torque value.

 - (a) Use the appropriate switch on the KTS 158 Test Set and turn the servo motor in the clockwise direction. Write down the torque value shown on the wrench.
 - (b) Use the appropriate switch on the KTS 158 Test Set and turn the servo motor in the counter clockwise direction. Write down the torque value shown on the wrench.
 - (c) If the level measured falls below the desired value, rotate the clutch adjust nut clockwise.
 - (d) If the level measured falls above the desired value, rotate the clutch adjust nut counterclockwise.
- (7) After an adjustment, repeat the torque test.

- (8) After wiring has been completed and the servos installed, make sure the rotation direction of the servo capstans is correct.

6. Elevator Rigging (Airplanes with KAP-150 Autopilot and KFC-150, KFC-225 Flight Control System Installed)

A. Adjust the elevator rigging (Refer to Figure 504).

- (1) Set the control wheels in the neutral position of elevator.
- (2) Attach to the control column a neutral rigging tool. If necessary, make a neutral rigging tool for the control column.
- (3) Install an inclinometer on the left elevator's trailing edge and adjust the inclinometer to read zero degrees while the left elevator is set in the neutral position.

CAUTION: Do not align the horn (balance weight portion) on the elevator to the stabilizer.

- (4) Set in position a support stand under the tail skid to prevent the tailcone from dropping while working inside the tailcone.
- (5) Remove the aft baggage partition to get access to the elevator, servo mount and bridle cable assembly.
- (6) If installed, remove the liquid barrier. Refer to Chapter 53, Plates/Skins - Maintenance Practices.
- (7) Adjust the elevator servo slip clutch values and capstan. Refer to Slip Clutch Adjustment, Values and Capstan and Slip Clutch Torque Adjustment.
- (8) The KS 270A Pitch Servo, KM 275 Servo Mount and the flap sense circuit breakers are installed for the KAP-150 Autopilot System and KFC-150, KFC-225 Flight Control System. The KS 270A and KM 275 Servo Mount are located just aft of FS 308.0 in the center of the airplane.
- (9) Make sure the pitch servo bracket is correctly attached to the servo gusset.
- (10) Make sure the pitch KM 275 servo mount is correctly attached to the pitch servo bracket and servo gusset.
- (11) Do an inspection to make sure the bridle cable is correctly attached to the top and bottom attach brackets.
- (12) Place the elevator in the full nose down position.
 - (a) Do a check to make sure the KM 275 capstan ball location is rotated approximately 30 degrees aft from the straight up position.
 - (b) Make sure the pitch bridle cable is wrapped on the KM 275 Capstan.
 - (c) Make sure the turnbuckle end of the pitch bridle cable is routed from the top of the KM 275 Capstan to the top pitch link of the bell crank.
 - (d) Make sure the opposite end of the pitch bridle cable is routed from the bottom of the KM 275 Capstan to the bottom pitch link of the bell crank.
 - (e) Make sure the attach ends of the pitch bridle cable are correctly attached to the bell crank pitch links.
 - (f) Install the Tensiometer on the pitch bridle cable and adjust the tension on the turnbuckle of the pitch bridle cable to 20 +5 or -5 pounds (88.96 +22.24 or -22.24 N).
 - (g) Remove the Tensiometer and make sure the turnbuckle clips are installed.
- (13) Check the pitch bridle cable for fraying and corrosion.
- (14) If previously installed, install the liquid barrier. Refer to Chapter 53, Plates/Skins - Maintenance Practices.
- (15) Install the aft baggage partition.

7. Elevator Friction Band (Airplanes with KAP-150 Autopilot and KFC-150, KFC-225 Flight Control System Installed)

A. Do a check of the elevator friction band.

NOTE: Without an autopilot installed the elevator friction band is 15 pounds (66.72 N) or less. With an autopilot installed, the elevator friction band is 20 pounds (88.96 N) or less. Measurement of the elevator friction band is necessary when you examine the autopilot rigging. An adjustment to decrease the aileron system friction band is necessary if it is higher than the band range specified.

- (1) All friction band measurements must be made with the load scale. The load scale must be set in a position so that the force exerted to move the elevator is applied in a direction parallel to the control column. The movement of the control wheel assembly must be slow and steady. The friction band requirements apply over the complete elevator travel range. The inspection must be made at or within one inch from either side of the position occupied by the control wheel assembly when the elevator is in neutral position.
 - (a) Start with the elevators in a down position (control wheel assembly is one inch forward of the position occupied

when elevator is in neutral position). Move the control wheel assembly aft by exerting force as instructed in Step 7.A. (1).

- 1 Write down the load scale value as the wheel assembly passes the elevator neutral position. Identify the value as F1.
- (b) Start with the elevators in an up position (control wheel assembly is one inch aft of the position occupied when elevator is in neutral position). Move the control wheel assembly forward by exerting force as instructed in Step 7.A. (1).
 - 1 Write down the load scale value as the wheel assembly passes the elevator neutral position. Identify the value as F2.
- (2) The elevator friction band must be calculated from the values given.
 - (a) In a system where a force must be exerted in a direction toward the panel (forward) to return the elevators to a down position, the friction band is the sum of forces F1 and F2. The friction band = $F1 + F2$.
 - (b) In a system where a restraining force must be exerted in a direction away from the panel (aft) to prevent the elevator from abruptly returning to a down position, the friction band is the difference of the two forces. The friction band = $F1 - F2$.
- (3) When the friction band exceeds the limits, the following steps must be completed in the order shown to reduce system friction:
 - (a) Reduce the tension on the pitch bridle cable to 15 pounds (66.72 N) with the elevator in the neutral position.
 - (b) Do a check for binding and alignment of pulleys. Correct as necessary.
 - (c) Make sure the hinges are clean and lubricated.

Figure 501 : Sheet 1 : Elevator Rigging

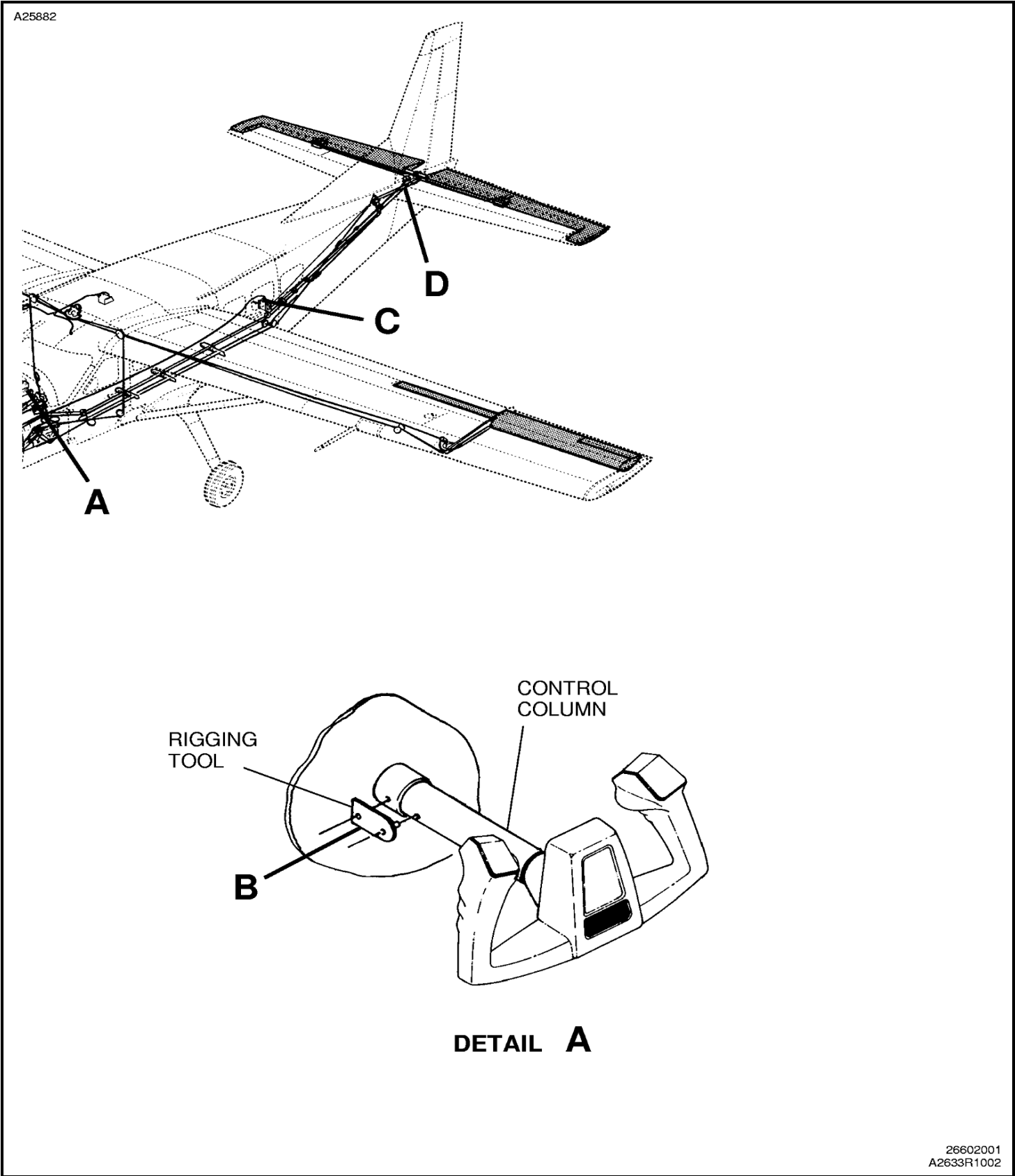
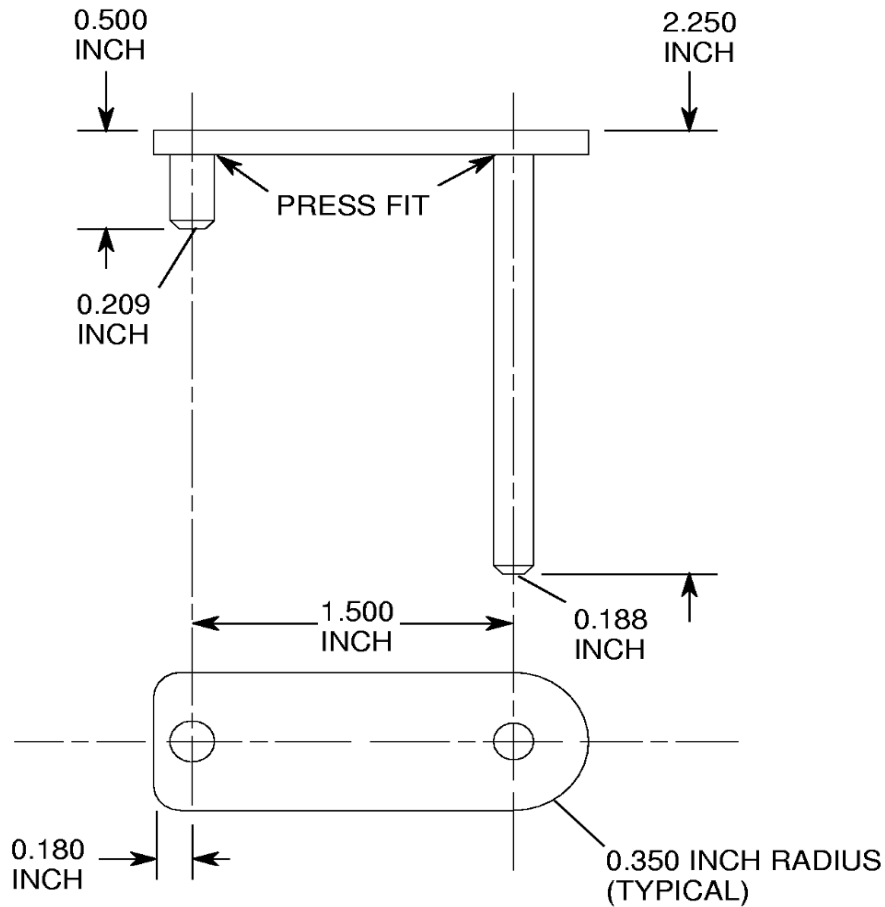


Figure 501 : Sheet 2 : Elevator Rigging

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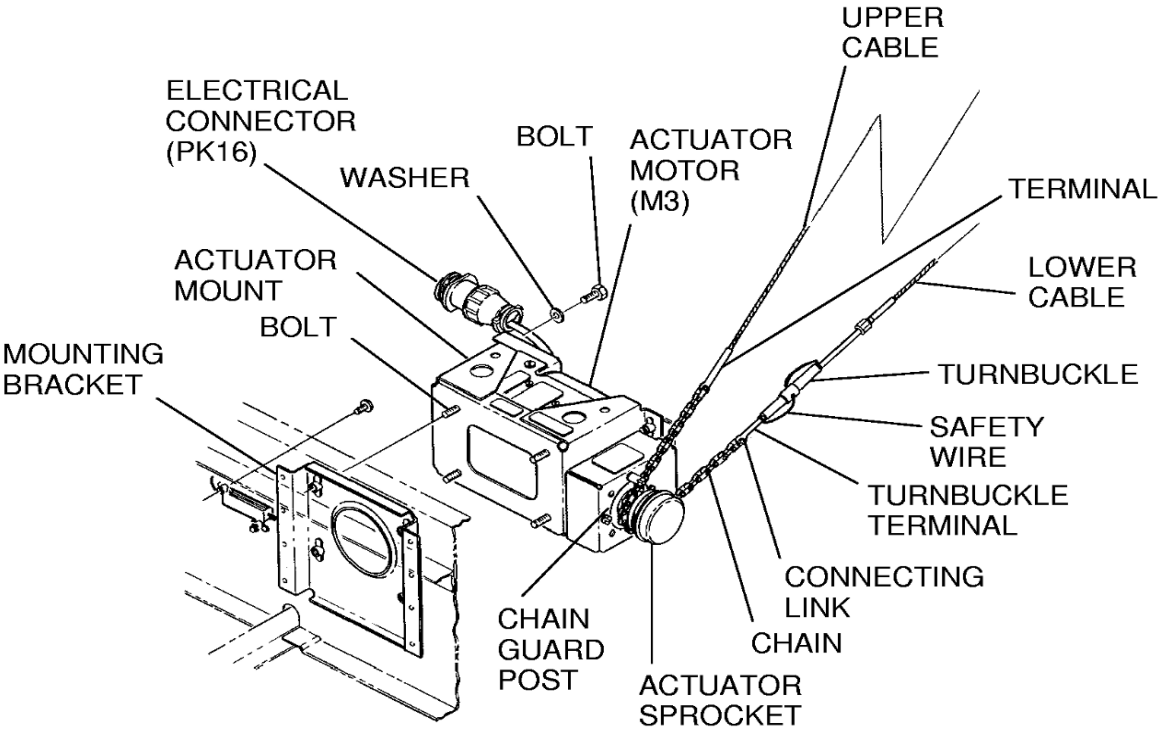
DETAIL B

NOTE: FABRICATE NEUTRAL RIGGING TOOL FROM 0.125 INCH STEEL PLATE AND 0.188 INCH AND 0.209 INCH DIAMETER DRILL RODS ACCORDING TO DIMENSIONS SHOWN. IF DESIRED, RIGGING TOOL MAY BE PURCHASED FROM CESSNA SUPPLY DIVISION. ORDER PART NUMBER SE1511.

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Figure 501 : Sheet 3 : Elevator Rigging

A25885

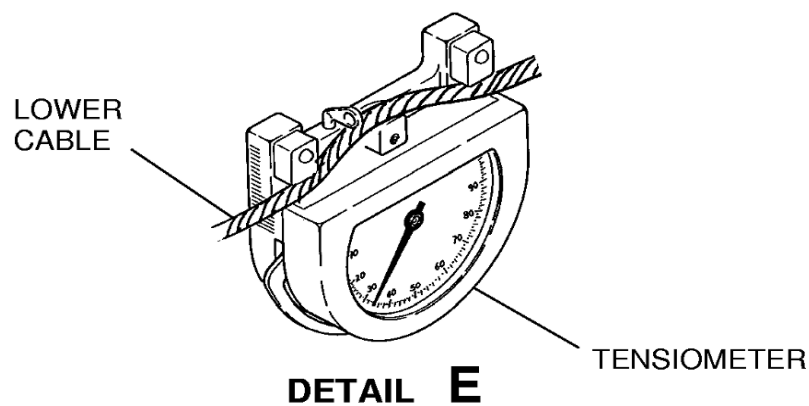
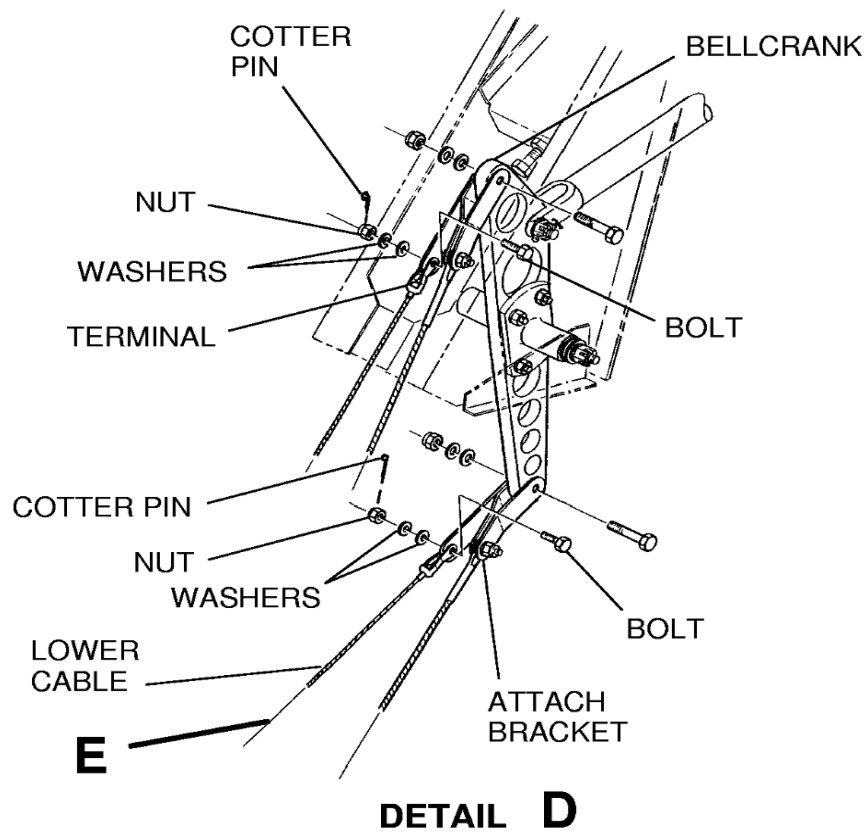


DETAIL C

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Figure 501 : Sheet 4 : Elevator Rigging

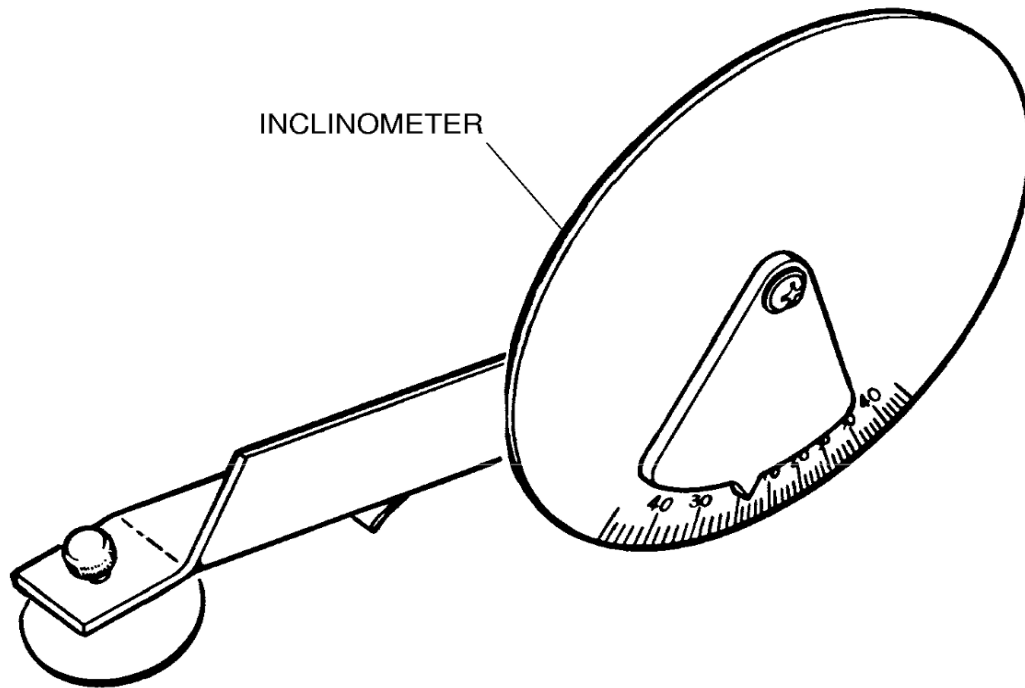
A25886



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Figure 502 : Sheet 1 : Inclinator

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NOTE: INCLINOMETER MAY BE PURCHASED FROM CESSNA SUPPLY DIVISION.
ORDER PART NUMBER SE716.

2663R1004

Figure 503 : Sheet 1 : Clutch Torque Adjustment

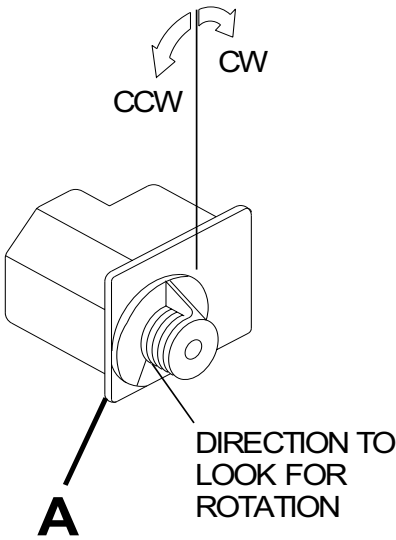
A100624

PITCH SERVO KS 270 SERIES			
CESSNA AIRCRAFT MODEL NUMBER	SERIAL NUMBER	ACFT NOSE UP CAPSTAN DIRECTION	SLIP CLUTCH TORQUE (IN. LB.)
208	ALL	CW	43 +/- 4
208B	ALL	CW	43 +/- 4

ROLL SERVO KS 271 SERIES			
CESSNA AIRCRAFT MODEL NUMBER	SERIAL NUMBER	ACFT NOSE UP CAPSTAN DIRECTION	SLIP CLUTCH TORQUE (IN. LB.)
208	ALL	CW	33 +/- 3
208B	ALL	CW	38 +/- 4

PITCH TRIM SERVO KS 272 SERIES			
CESSNA AIRCRAFT MODEL NUMBER	SERIAL NUMBER	ACFT NOSE UP CAPSTAN DIRECTION	SLIP CLUTCH TORQUE (IN. LB.)
208	ALL	CW	45 +/- 5
208B	ALL	CW	45 +/- 5

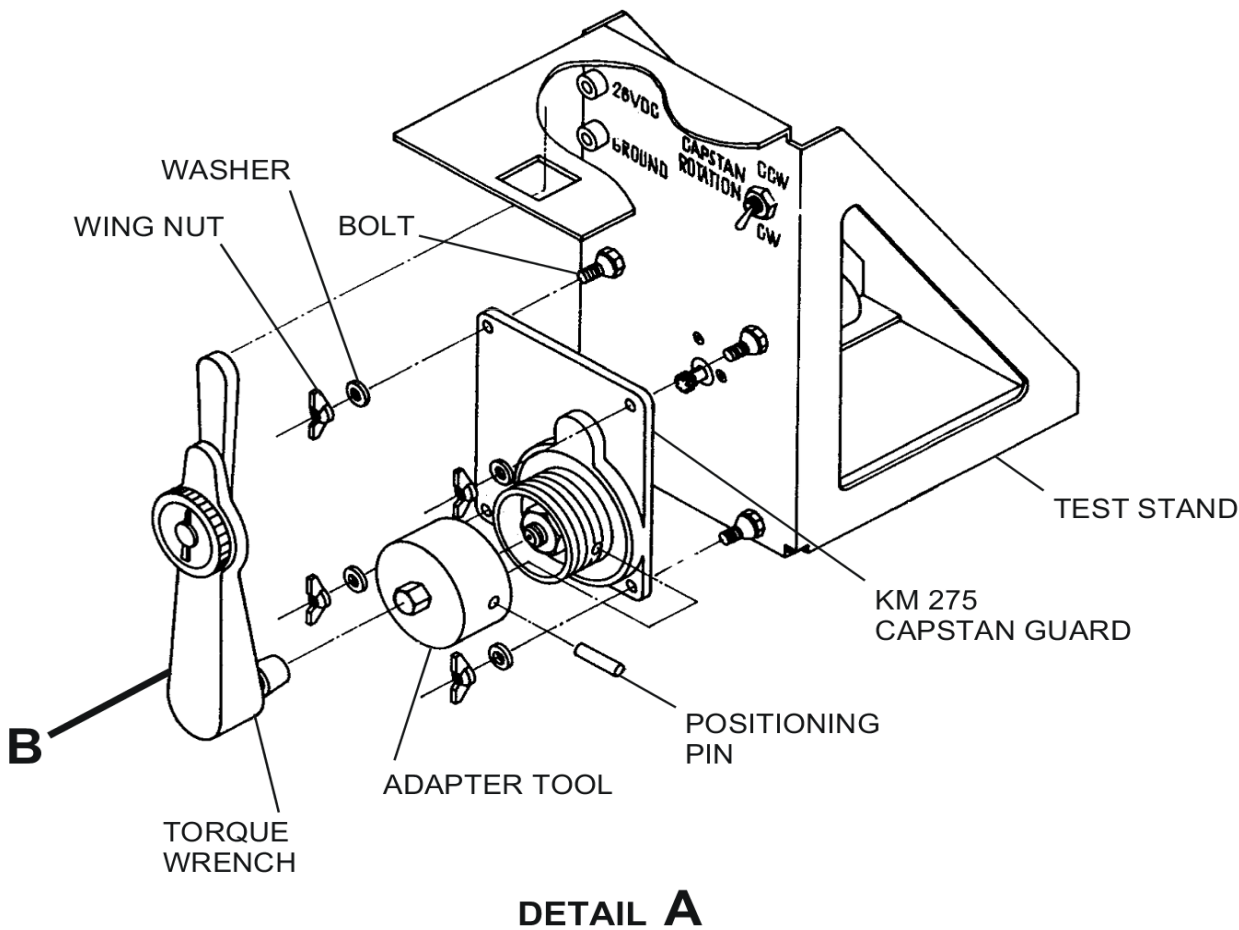
YAW SERVO KS 271 SERIES			
CESSNA AIRCRAFT MODEL NUMBER	SERIAL NUMBER	ACFT NOSE UP CAPSTAN DIRECTION	SLIP CLUTCH TORQUE (IN. LB.)
208	ALL	CW	50 +/- 5
208B	ALL	CW	50 +/- 5



2661T1015

Figure 503 : Sheet 2 : Clutch Torque Adjustment

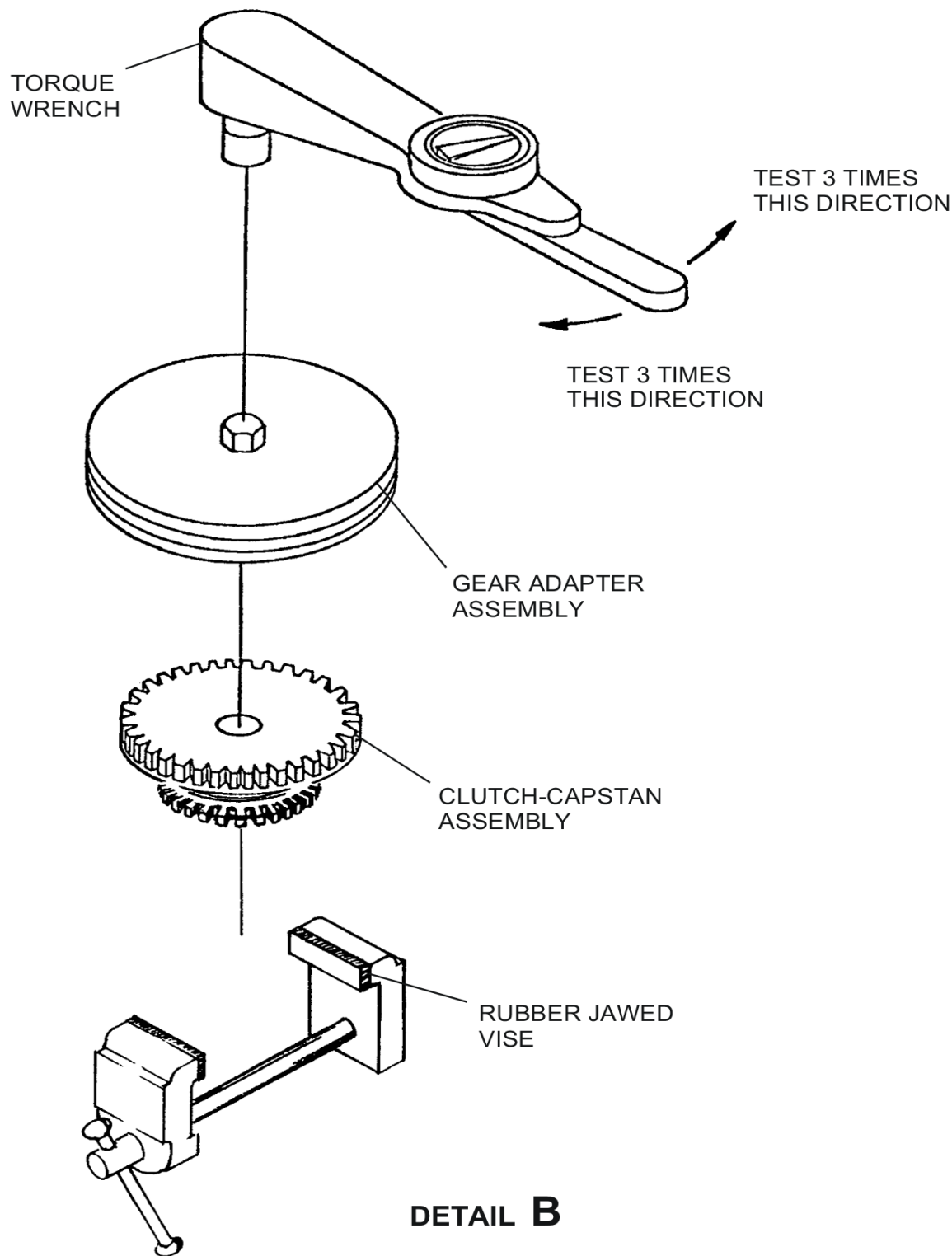
A24224



A2661R1013

Figure 503 : Sheet 3 : Clutch Torque Adjustment

A24227



B2661R1014

Figure 504 : Sheet 1 : Elevator Rigging

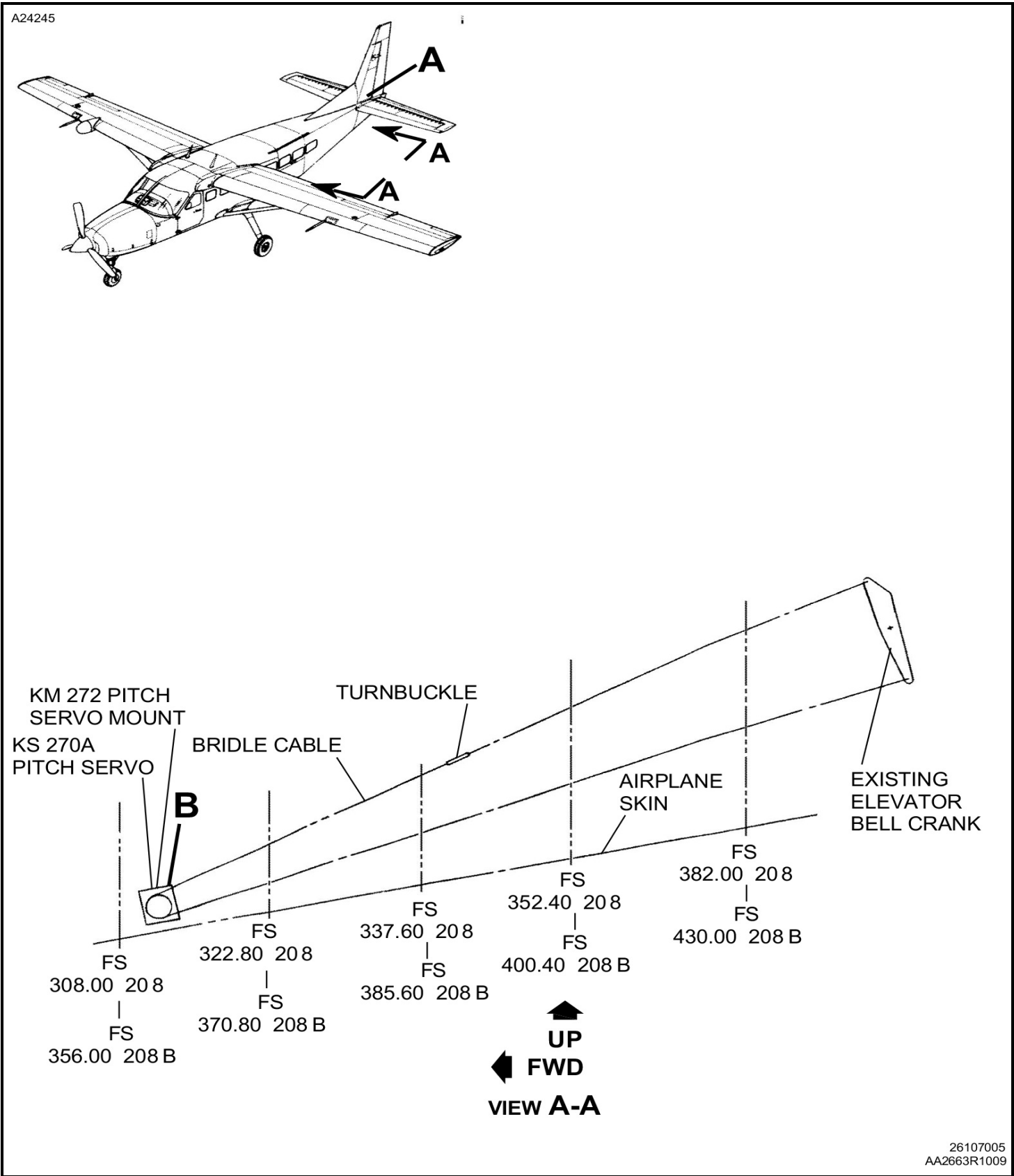
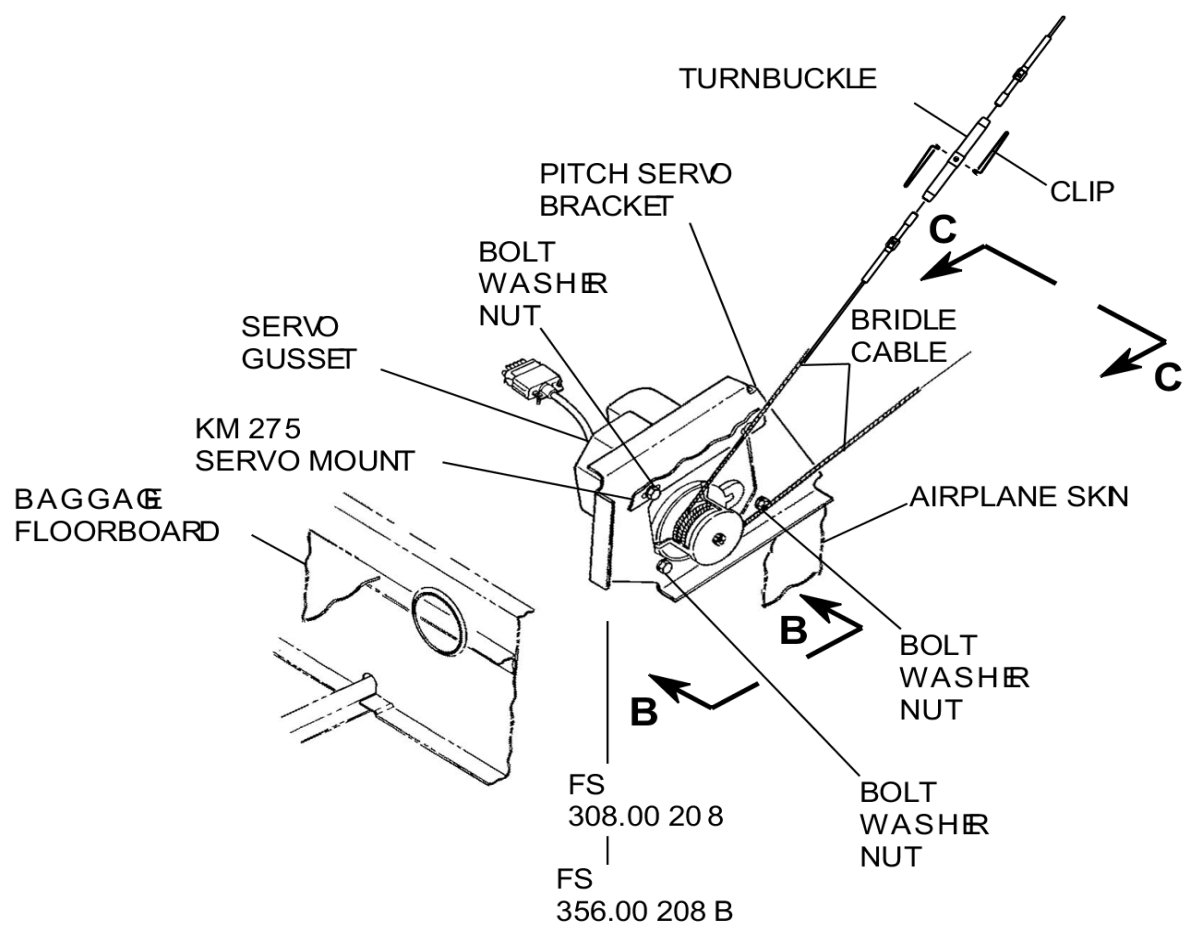


Figure 504 : Sheet 2 : Elevator Rigging

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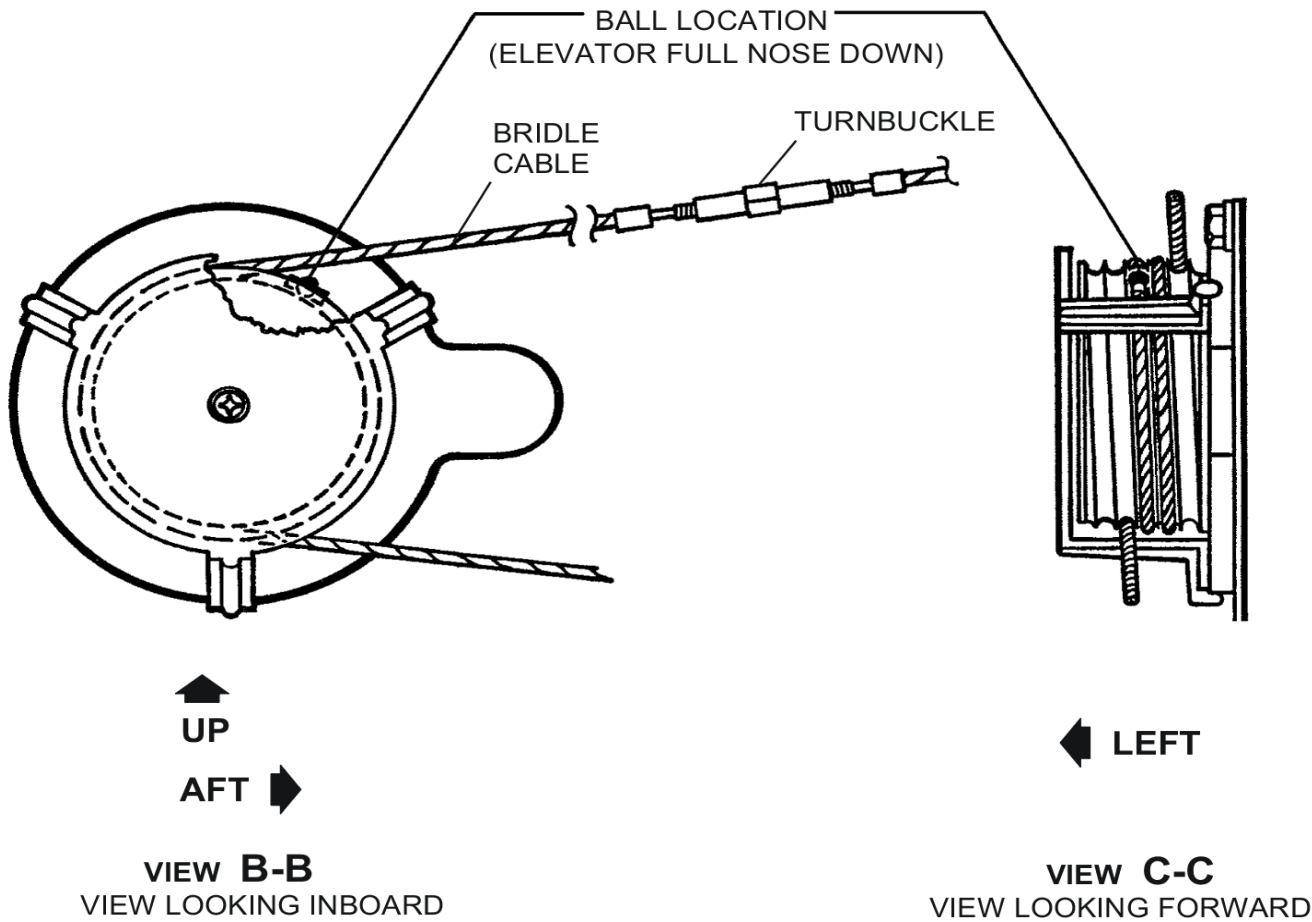


DETAIL B

A2663R3001

Figure 504 : Sheet 3 : Elevator Rigging

A24244



BB2663R1008
CC2663R1008

Figure 504 : Sheet 4 : Elevator Rigging

