1. GENERAL

The elevator is a horizontal movable control surface on the tail of the airplane. The elevator is mounted to the horizontal stabilizer. The elevator is used to rotate the airplane about its lateral axis and includes an elevator trim tab used for pitch trim adjustment. The elevator is made from aluminum. The elevator tips are made from composite materials.

The elevator assembly is a conventional sheet metal control surface made of riveted aluminum skins, ribs and spar. A lead balance weight is fastened to the inboard and outboard horn ribs at BL 72. The elevator is attached to the horizontal stabilizer at five hinge locations, BL 0, BL ±36, and BL ±72. The elevator is attached to a torque tube at BL ±3.33 and BL ±20. This torque tube is attached to a bellcrank.

*Serials 22-0002 thru 22-0497:* The elevator bellcrank is actuated by a pushrod that is attached to a pulley in the empennage area of the fuselage. *(Refer to 27-30)*

*Serials 22-0498 & subs, 22T-0001 & subs:* The elevator bellcrank is actuated by a pushrod that is attached to a bellcrank in the empennage area of the fuselage. *(Refer to 27-30)*

The pilot controls the actuation of this system.
2. MAINTENANCE PRACTICES

A. Elevator Assembly (See Figure 55-201)

**CAUTION:** Serials w/ FIKI: Elevator removal and installation requires that the deicing fluid feed line be cut and the connection relocated. The condition exists that after repeated replacement cycles, the service loop may become too short and restrict elevator movement. After replacement of elevator assembly, special care must be taken to verify correct elevator operation and deflection.

(1) Removal - Elevator Assembly
   (a) **Serials w/ FIKI:** Remove elevator tip.
      1. Remove screws securing elevator tip to elevator assembly.
      2. Remove cable tie securing porous panel feed line to elevator tip.
      3. Place container below coupling to catch fluid drip.
      4. Disconnect nut, olive, and O-ring securing feed line to porous panel.
      5. Remove elevator tip from airplane.
      6. Cut feed tube as close to olive as possible.
      7. Cap feed line and porous panel fitting to prevent system contaminates.
      8. Remove cable tie securing porous panel feed line to elevator feed line bracket.

   (b) Remove access panels LE1 and RE1 to gain access to the bellcrank/elevator mounting bolts. (Refer to 06-00)

   (c) Remove cotter pin, nut, washers, and bolt securing trim cartridge to aft elevator bellcrank.

   (d) Remove the mounting bolts, washers, shims, and self-locking nuts securing the RH and LH elevator sections to bellcrank.

   (e) Remove cotter pin and washers from each elevator hinge pin.

   (f) **Serials w/o FIKI:** Slide elevator sections off of horizontal stabilizer hinge pins and remove elevator sections from airplane.

   (g) **Serials w/ FIKI:** Slide elevator sections off of horizontal stabilizer hinge pins, pull porous panel feed lines through holes in elevator, and remove elevator sections from airplane.

   (h) Remove remaining washers installed to horizontal stabilizer hinge pins.

(2) Disassembly - Elevator Assembly

   **Serials w/o FIKI:** Elevator assembly may be further disassembled through removal of the elevator tip and trim tab.

   **Serials w/ FIKI:** Elevator assembly may be further disassembled through removal of the trim tab.

   (a) **Serials w/o FIKI:** To disassemble elevator tip, remove screws securing elevator tip to elevator. Remove elevator tip from elevator.

   (b) To disassemble elevator trim tab, perform the following steps:

   **WARNING:** The airplane may not be flown when the elevator trim tab is removed. Installation of elevator trim tab requires a maintenance check flight.

   1. Acquire necessary parts, tools, equipment, and supplies.

<table>
<thead>
<tr>
<th>Description</th>
<th>P/N or Spec.</th>
<th>Supplier</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill bit 0.0980 inch (2.489 mm)</td>
<td>#40</td>
<td>Any Source</td>
<td>Drilling</td>
</tr>
</tbody>
</table>

   2. Drill out rivets securing trim tab to LH aft inboard elevator.
(3) Assembly - Elevator Assembly

(a) To assemble elevator trim tab, perform the following steps:

1. Acquire necessary parts, tools, equipment, and supplies.
2. Using an Alodine pen, apply corrosion protection to edge of each rivet hole.
3. Install rivets securing trim tab to LH aft inboard elevator. (Refer to 20-70)
4. Apply thin coat of paint to each rivet head.
5. Perform Adjustment/Test - Elevator Balancing. (Refer to 55-20)

Note: If installed elevator tip is new or different from previously installed elevator tip, perform Elevator Tip Replacement. (Refer to 55-20)

(b) Serials w/o FIKI: To assemble elevator tip, Position elevator tip to elevator, ensuring tip flange is inserted between upper and lower layers of elevator surface, and secure with screws.

(c) Elevator Tip Replacement

1. Acquire necessary parts, tools, equipment, and supplies.
2. Position elevator tip to elevator ensuring tip flange is inserted between upper and lower layers of elevator surface.
3. Using straight edge, align elevator tip with inboard edge of elevator.
4. Verify reveal line between elevator tip and elevator is consistent along length of seam, and trailing edge of elevator tip is flush with trailing edge of elevator.
5. Use marker to mark match drill locations in elevator tip.
6. Remove elevator tip from elevator.
7. Using 0.196 inch (0.498 cm) drill bit, drill at marked locations on elevator tip.
8. Install elevator tip. (Refer to 55-20)
9. Perform Adjustment/Test - Elevator Balancing. (Refer to 55-20)

(4) Installation - Elevator Assembly

WARNING: The airplane may not be flown when the elevator trim tab is removed.

CAUTION: Ensure a flat washer remains on the outboard side of each horizontal stabilizer hinge pin before installing the elevator sections. Installing the elevator sections onto the hinge pins without a flat washer in place can cause the elevator assembly to bind.
(a) Install washers onto horizontal stabilizer hinge pins.
(b) *Serials w/o FIKI:* Position and slide LH and RH elevator sections onto hinge pins.
(c) *Serials w/ FIKI:* Route porous panel feed lines through holes in elevator then position and slide LH and RH elevator sections onto hinge pins.
(d) Install washer over each hinge pin. Secure LH and RH mid elevator sections to each hinge pin with new cotter pins.
(e) Install bolts, washers, shims, and self-locking nuts securing LH and RH inboard elevator sections to elevator bellcrank. Torque to 160 - 190 in-lb (17.6 - 20.9 Nm).
(f) Install cotter pin and washer on outboard hinge pin. Secure outboard elevator hinge to hinge pin with washer and nut. Dry torque to 25 - 30 in-lb (2.8 - 3.3 Nm) adding torque value to overcome nut friction. *(Refer to 20-60)*

**Note:** Do not rotate hinge pin once nut is torqued.

(g) Align trim cartridge to mounting hole on aft elevator bellcrank and install bolt, washers, nut, and new cotter pin.
(h) *Serials w/ FIKI:* Install elevator tip. *(Refer to 55-20)*

**Note:** If installed elevator tip is new or different from previously installed elevator tip, perform Elevator Tip Replacement. *(Refer to 55-20)*

1. Remove caps from feed line and porous panel fitting.
2. Secure new olive to feed line.
3. Connect nut, olive, and new O-ring securing feed line to porous panel.

**CAUTION:** Ensure elevator tip feed line is long enough to allow full elevator movement without any abnormal resistance.

**Note:** If necessary, locate feed line service loop in horizontal, ahead of the spar. Additional porous panel feed line length may be added by removing cable tie and adjusting service loop as required to maintain full elevator travel.

4. Operate elevator controls and inspect for full elevator movement without any abnormal resistance.
5. Install cable tie securing feed line to elevator feed line bracket.
6. Install cable tie securing feed line to elevator tip.
7. Position elevator tip to elevator, ensuring tip flange is inserted between upper and lower layers of elevator surface, and secure with screws.

(i) Install access panels LE1 and RE1. *(Refer to 06-00)*
(j) Perform Inspection/Check - Elevator Gap and Overlap. *(Refer to 55-20)*
(k) Perform Inspection/Check - Elevator Assembly. *(Refer to 55-20)*
(l) If elevator trim tab was replaced, perform Adjustment/Test - Elevator Trim Tab. *(Refer to 55-20)*
(5) Inspection/Check - Elevator Assembly
   (a) Serials w/ FIKI: Acquire necessary tools, equipment, and supplies.

<table>
<thead>
<tr>
<th>Description</th>
<th>P/N or Spec.</th>
<th>Supplier</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inclinometer</td>
<td>PRO360</td>
<td>Macklanburg Duncan</td>
<td>Deflection angle determination.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oklahoma City, OK 73125</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>800-654-0007</td>
<td></td>
</tr>
</tbody>
</table>

   (b) Verify proper hinge bolt torque.
   (c) Remove access panels LE1 and RE1. (Refer to 06-00)
   (d) Verify proper hinge bolt installation and torque on inboard hinge.
   (e) Ensure elevator skin is smooth and free of any defects or irregularities.
   (f) Inspect rivets and elevator skin for tightness.
   (g) Verify proper installation of safety wire and for use of new cotter pins on all fasteners.
   (h) Install access panels LE1 and RE1. (Refer to 06-00)
   (i) Operate elevator controls and inspect for any abnormal resistance.
   (j) Serials w/ FIKI: Using inclinometer, verify 15 ±1° down and 25 +0/-1.0° up elevator travel.

(6) Adjustment/Test - Elevator Trim Tab

**WARNING:** Maintenance check flight must be performed by a qualified pilot.

**CAUTION:** Ballast must be secured during flight.

(a) Add and secure ballast to obtain an aft CG of 147.4 to 148.1 inches (30 to 31.5% MAC).
(b) After airplane is in flight and clear of all traffic, turbulence, and wake, set throttle to cruise power.
(c) Input full down elevator trim, wait for airspeed to stabilize, and verify knots indicated airspeed (KIAS) of at least 180, and no greater than Vne.

**Note:** Support trim tab at the bend when adjusting to ensure trim tab does not bend at the rivets and pull away from elevator.

Do not bend trailing edge of elevator trim tab more than 25° from straight.

(d) If airplane speed is less than 180 KIAS, bend elevator trim tab up in small increments (approximately 1-2°) and repeat maintenance check flight.
(e) If airplane speed approaches Vne, bend elevator trim tab down in small increments (approximately 1-2°) and repeat maintenance check flight.
Figure 55-201
Elevator Assembly

LEGEND
1. Nut
2. Washer
3. Mass Balance
4. Lead Washer
5. Bolt
6. Screw
7. Elevator Tip
8. Bell Crank
9. Shim
10. Axle
11. Cotter Pin
12. Castellated Nut
13. Trim Tab
14. Rivet

SR22_MM55_1964
(7) Inspection/Check - Elevator Gap and Overlap (See Figure 55-202)
   (a) Acquire necessary tools, equipment, and supplies.

   CAUTION:  Allowable gap between elevator tip and horizontal stabilizer is 0.10 inch (2.54 mm) or greater.

   (b) At elevator tip, verify gap between elevator tip and horizontal stabilizer is 0.10 inch (2.54 mm) or greater.
   If gap between elevator tip and horizontal stabilizer is less than 0.10 inch (2.54 mm), subtract gap measurement from 0.10 inch (2.54 mm) to determine minimum shim thickness to reduce and perform Inspection/Check - Elevator Shimming. (Refer to 55-20)

   Note:  The following gap and overlap inspections need only be performed after the installation of a replacement (new or different) elevator. If elevator leading edge gap and overlap inspections do not fall within the specified clearances, contact Cirrus Design Customer Service Department for disposition.

   (c) Replacement Elevator Installation Only:  Verify gap between elevator leading edge and trailing edge of horizontal stabilizer has a minimum of 0.060 inch (1.524 mm) and a maximum of 0.200 inch (5.080 mm) clearance when elevator is fully deflected up and down.

   (d) Replacement Elevator Installation Only:  Verify overlap between elevator and horizontal stabilizer has a minimum of 0.00 inch (0.00 mm) and a maximum of 0.125 inch (3.175 mm) clearance. Elevator may be deflected downward 0 - 5° to achieve upper overlap, and may be deflected upward 0 - 5° to achieve lower overlap.

(8) Inspection/Check - Elevator Shimming
   (a) Acquire necessary tools, equipment, and supplies.

<table>
<thead>
<tr>
<th>Description</th>
<th>P/N or Spec.</th>
<th>Supplier</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shim: 0.125 inch (3.175 mm)</td>
<td>11508-001</td>
<td>Cirrus Design Duluth, MN 55811 218-727-2737</td>
<td>Adjust shim thickness at bellcrank.</td>
</tr>
<tr>
<td>Shim: 0.141 inch (3.581 mm)</td>
<td>11508-002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shim: 0.016 inch (0.406 mm)</td>
<td>11508-003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shim: 0.032 inch (0.813 mm)</td>
<td>11508-004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shim: 0.063 inch (1.600 mm)</td>
<td>11508-005</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   (b) Remove elevator assembly. (Refer to 55-20)
   (c) At bellcrank, subtract value obtained in Inspection/Check - Elevator Gap and Overlap from thickness of shim(s).

   CAUTION:  Maximum thickness of shim(s) is 0.063 inch (1.600 mm).

   (d) Reduce thickness of shim(s) as required.
   (e) Install elevator assembly. (Refer to 55-20)
Verify gap between elevator tip and horizontal stabilizer is 0.10 inch (2.54 mm) or greater.

Replacement Elevator Installation only:
- Verify leading edge gap has a minimum of 0.060 inch (1.524 mm) and a maximum of 0.200 inch (5.080 mm) clearance.
- Measure tangent to the leading edge curvature.

Replacement Elevator Installation only:
- Verify overlap gap has a minimum of 0.00 inch (0.00 mm) and a maximum of 0.125 inch (3.175 mm) clearance.
- Measure overlap tangent to the leading edge curvature. Use a 6 inch straight edge.

Figure 55-202
Elevator Gap and Overlap
(9) Adjustment/Test - Elevator Balancing (See Figure 55-203)

**CAUTION:** *Serials w/o FIKI*: When balancing the elevator, the elevator assembly must be complete including paint, composite elevator tip, and all attaching hardware.

*Serials w/ FIKI*: When balancing the elevator, the elevator assembly must be complete including paint, composite elevator tip, all attaching hardware, and porous panel feed line with hardware. Feed line must be retained to simulate installation routing through horizontal spar. Porous panel and feed line must be blown dry prior to balancing.

**CAUTION:** The bench used to support the knife edge supports must be level. Maximum mass balance weight is 1.67 pounds (0.76 kg).

(a) Acquire necessary tools, equipment, and supplies.

<table>
<thead>
<tr>
<th>Description</th>
<th>P/N or Spec.</th>
<th>Supplier</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grease Pencil</td>
<td>-</td>
<td>Any Source</td>
<td>Mark chord line.</td>
</tr>
<tr>
<td>Knife Edge Supports</td>
<td>-</td>
<td>Any Source</td>
<td>Support elevator.</td>
</tr>
<tr>
<td>Balance Arm Assembly</td>
<td>-</td>
<td>Any Source</td>
<td>Verify position of elevator chord line.</td>
</tr>
<tr>
<td>String</td>
<td>-</td>
<td>Any Source</td>
<td>Attach cup to elevator.</td>
</tr>
<tr>
<td>Tape</td>
<td>-</td>
<td>Any Source</td>
<td>Attach cup to elevator.</td>
</tr>
<tr>
<td>Paper Cup</td>
<td>-</td>
<td>Any Source</td>
<td>Determine required weight for balance.</td>
</tr>
<tr>
<td>Scale</td>
<td>-</td>
<td>Any Source</td>
<td>Determine required weight for balance.</td>
</tr>
<tr>
<td>Lead Washers</td>
<td>12682-001</td>
<td>Cirrus Design Duluth, MN 55811 218-727-2737</td>
<td>Add weight to elevator.</td>
</tr>
</tbody>
</table>

(b) Verify workbench is level in all directions.
(c) Ensure knife edge supports and balance arm assembly are parallel to workbench top.
(d) Remove elevator. *(Refer to 55-20)*

**Note:** The chord line is defined as the line extending from the trailing edge through the hinge line. It is perpendicular to the spar.

(e) Mark the chord line on the inboard rib shearweb.
(f) *Serials w/ FIKI*: Blow dry porous panel and feed line.
(g) *Serials w/ FIKI*: Maintain installed orientation of feed line to simulate installation routing through horizontal spar.
(h) Place elevator assembly on knife edge supports.
(i) Determine if a static imbalance exists.

1 The elevator is balanced if elevator chord line mark is parallel to balance arm.
A static overbalance exists if elevator is leading edge heavy.
A static underbalance exists if elevator is trailing edge heavy.

(j) Determine the amount of static imbalance.

Note: Ensure paper cup hangs centered and vertical with no contact with elevator.

1. Attach paper cup to one end of string.
2. For static underbalance condition attach string to leading edge of elevator. For static overbalance condition attach string to trailing edge of elevator.
3. Add attaching hardware to paper cup.
4. Add lead washers to cup until elevator chord line mark is parallel to balance arm.

(k) Calculate the elevator static balance.

In overbalance conditions, the static balance (M) is defined as

\[ M = D \times W. \]

In underbalance conditions, the static balance (M) is defined as

\[ M = D \times W \times -1 \]

where

D = distance perpendicular from hinge line to center of gravity (C.G.) of added mass,
W = weight required to balance the elevator.

Note: The value of M is positive for overbalance conditions and negative for underbalance conditions.

Serials w/o FIKI: Static balance must be within +3.0 in-lb overbalance and 0.0 in-lb underbalance. Assuming a deviation of ±0.5 in-lb exists due to measurement error, calculated static balance must therefore fall within 0.5 - 2.5 in-lb overbalance and 0.0 in-lb underbalance.

Serials w/ FIKI: Static balance must be within 0.5 to 2.0 in-lb overbalance. An underbalance condition is not applicable. Assuming a deviation of ±0.5 in-lb exists due to measurement error, calculated static balance must therefore fall within 1.0 - 1.5 in-lb overbalance.

1. Measure distance perpendicular from hinge line to C.G. of added mass in cup.
2. Weigh string, cup, and contents with a calibrated scale.
3. Using obtained measurements, solve formula to determine elevator static balance.
4. Verify static balance is within defined overbalance and underbalance limits.

Example:

Assume an non-FIKI-equipped elevator is underbalanced. If balance is achieved by adding 0.07 pounds, 13.13 inches forward of the hinge line, the elevator static balance is:

\[ W = 0.07 \text{ pound} \]
\[ D = 13.13 \text{ inches} \]
\[ M = (0.07 \times 13.13) \times -1 = -0.92 \pm 0.5 \text{ in-lb} \]

In the example, -0.92 in-lb exceeds the tolerance for a static underbalance condition. To obtain elevator balance, 0.92 in-lb must be added forward of the hinge line. The balance must be rechecked to ensure static balance tolerance is not exceeded.
CAUTION: Do not exceed a maximum of four washers per bolt or nut. Always place steel washer next to nut.

(l) Add or remove weight as necessary to balance the elevator.
   1 An underbalanced condition is corrected by adding lead washers under the bolts securing the mass balances.
   2 An overbalance condition is corrected by removing small amounts of material from the lead mass balance in equal quantities. Typically this is done by drilling or other means.

(m) Tighten mass balance bolts to 20 - 25 in-lb (2.3 - 2.8 Nm).
(n) Install elevator. (Refer to 55-20)
In overbalance conditions, the static balance (M) = D x W.
In underbalance conditions, the static balance (M) = D x W x -1.

D = Distance perpendicular from hinge line
to center of gravity of added mass.

W = Weight required to balance the elevator.

**NOTE**

⚠️ Add mounting hardware and lead washers to cup until chord line is parallel to balance arm.

⚠️ Add lead washers to mass balance attachment hardware to correct underbalance condition.
Remove mass balance material to correct overbalance condition.

⚠️ *Serials w/ FIKI* Maintain installed orientation of porous panel feed line to simulate installation routing through horizontal spar.

**LEGEND**

1. Elevator
2. Knife Edge Support
3. Balance Arm
4. Tape
5. String
6. Cup

Figure 55-203
Elevator Balancing
B. Elevator Bellcrank

(1) Removal - Elevator Bellcrank
   (a) Remove elevator. (Refer to 55-20)
   (b) Remove cotter pin, nut, washers, and bolt securing elevator bellcrank to horizontal stabilizer hinges.

(2) Installation - Elevator Bellcrank
   (a) Position elevator bellcrank between horizontal stabilizer hinges and secure with bolt, washers, nut, and new cotter pin.
   (b) Install elevator. (Refer to 55-20)
Intentionally Left Blank