AILERON AND ROLL TRIM SYSTEM

1. DESCRIPTION

This section describes that portion of the flight control system which controls the position and movement of the ailerons. Included are; aileron system rigging, control grip assembly, control yoke assembly, V-grooved guide wheel, pulleys and cables, roll trim cartridge, and 4-way trim/autopilot disconnect switch, and roll relays.

Aileron control motion is transferred by the control yoke through a linkage to a pulley mounted on the console structure. From the pulley, control motion is passed to a single cable system and is routed through the forward pulley gang at the bottom of the center console, under the cabin floor to the rudder-aileron interconnect (Serials 1005 thru 1885), and along the fuselage longerons to kick-out pulleys which direct the cables to the wing area between the aft spar and flap cove. The cables pass through fairleads at each flap hinge location where they attach to the aileron actuation pulley. As the aileron actuation pulley rotates, the control surface is deflected via a right-angle drive arm. A cross-over cable returns to the other wing, interconnecting the left and right ailerons. Cable retainers on each set of pulleys prevent fouling. Adjustable control stops on each aileron actuation pulley limit control surface travel.

The roll trim system acts as autopilot servo through the use of a captured compression spring cartridge integrated into the control system and activated by an electric motor. The spring cartridge, bolted directly to the LH aileron actuation pulley, and the electric trim motor, provide a centering force regardless of the direction of control surface deflection. When activated, the trim motor moves the spring cartridge causing the aileron actuation pulley to move the aileron to a new trimmed position. A 4-way switch, mounted on both yoke grips, controls the roll trim system.
2. MAINTENANCE PRACTICES

**WARNING:** A system rigging Inspection/Check must be performed after loosening any flight control cable to assure proper control surface operation. Refer to the appropriate control system’s rigging procedures for the Inspection/Check maintenance practices.

### A. Aileron System Cables *(See Figure 27-101)*

1. **Removal - Aileron System Cables**
   
   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>String</td>
<td>-</td>
<td>Any Source</td>
<td>Cable routing.</td>
</tr>
</tbody>
</table>

   b. Remove kick plate. *(Refer to 25-10)*
   
   c. Remove MFD. *(Refer to 31-60)*
   
   d. Remove passenger seats. *(Refer to 25-10)*
   
   e. Remove carpet and access panels CF1L, CF1R, CF3C, CF4C, CF4R, and CF4L. *(Refer to 06-00)*

   **Note:** *Serials 2016 & subs w/ Perspective Avionics:* Note location of roll servo bridle cable clamps on aileron cable to facilitate reinstallation.

   f. *Serials 2016 & subs w/ Perspective Avionics:* Remove bolts, nuts, and clamps securing roll servo bridle cable to aileron cable. *(See Figure 22-135)*
   
   g. Remove LH and RH ailerons. *(Refer to 57-50).*
   
   h. At access holes CF3C and CF4C, remove turnbuckles from LH, RH, and forward aileron cables.
   
   i. *Serials 1005 thru 1885:* Disconnect rudder/aileron interconnect bungee from RH aileron cable. *(Refer to 27-20)*
   
   j. Remove cotter pins, washers and cable retaining clevis pins from kick-out and cross-over pulley brackets.
   
   k. Remove safety wire securing aileron cable to LH aileron actuation pulley and remove bolt and washer securing cable guard to pulley bracket. Repeat procedure on RH side.
   
   l. Remove cotter pins and washers securing pulley guard pins to forward pulley gang bracket and remove pins.
   
   m. Remove safety wire securing aileron cable to console actuation pulley.
   
   n. Loosen bolts and washers securing pulley keepers to center console.

   **Note:** Attach string to end of cable prior to removing from airplane to facilitate cable routing during installation.

   o. Attach string to end of forward aileron cable below access hole CF3C and pull cable through. Remove cable from airplane.
   
   p. Attach string to end of LH aileron cable below access hole CF4C and pull cable through. Remove cable from airplane. Repeat procedure for RH aileron cable.

2. **Installation - Aileron System Cables**

   a. At access hole CF3C, route forward aileron cable to forward pulley gang, up to console actuation pulley and back to access hole CF3C.
(b) At access hole CF4C, route LH aileron cable to kick-out pulley, aileron actuation pulley, cross-over pulley and back to center of fuselage floor. Repeat procedure for RH aileron cable.
(c) Secure forward aileron cable to console actuation pulley with safety wire.
(d) Tighten bolts and washers securing pulley keepers to center console.
(e) At forward pulley gang bracket, verify cable routing, insert pulley guard pins, and install washers and cotter pins.
(f) For LH aileron cable, verify cable routing through flap-hinge fairleads, kick-out, and cross-over pulleys, install cable retaining clevis pins, washers, and cotter pins. Repeat procedure for RH aileron cable.
(g) At LH aileron actuation pulley, verify cable routing, position cable guard to pulley bracket, and install washer and bolt. Safety wire aileron cable to pulley. Repeat procedure at RH aileron actuation pulley.

**WARNING:** Position turnbuckle so that at aileron neutral position, turnbuckle is centered between LH and RH longerons and at full left and full right aileron deflection swaged cable end does not contact either longeron.

(h) Install turnbuckles on LH, RH, and forward aileron cables.
(i) **Serials 1005 thru 1885:** Install rudder/aileron interconnect to RH aileron cable. *(Refer to 27-20)*
(j) Install ailerons. *(Refer to 57-50)*
(k) Perform Adjustment/Test - Aileron System Rigging. *(Refer to 27-10)*
Figure 27-101
Aileron System Cables

LEGEND
1. Aileron Actuation Pulley - Console
2. Aileron Actuation Pulley - Wing
3. Bracket
4. Cable Guard
5. Washer
6. Bolt
7. RH Aileron Cable
8. Cross-over Pulley
9. Clevis Pin
10. Cotter Pin
11. Cross-over Turnbuckle
12. LH Aileron Cable
13. Kick-out Pulley
14. Pin
15. Forward Aileron Cable
16. Forward Pulley Gang
17. RH Direct Turnbuckle
18. LH Direct Turnbuckle

DETAIL A

Serials 1005 thru 1877, 1879 thru 1885.
(3) Adjustment/Test - Aileron System Rigging (See Figure 27-102)

**CAUTION:** Allow temperature to stabilize for a period of four hours before setting cable tensions.

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

<table>
<thead>
<tr>
<th>Description</th>
<th>P/N or Spec.</th>
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<th>Purpose</th>
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<td>3/16&quot; Lockout Pin</td>
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<td>WS 144 Rigging Template</td>
<td>13057-109</td>
<td>Cirrus Design Duluth, MN 55811</td>
<td>Aileron rigging.</td>
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<td>218-727-2737</td>
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<td>Inclinometer</td>
<td>PRO360</td>
<td>Macklanburg Duncan Oklahoma City, OK 73125 800-654-0007</td>
<td>Deflection angle determination.</td>
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<tr>
<td>Tensiometer</td>
<td>BT-33-75D</td>
<td>Kent Moore Warren, MI 48092 800-345-2233</td>
<td>Cable tension determination.</td>
</tr>
</tbody>
</table>

(b) Remove kick plate. (Refer to 25-10)
(c) Remove MFD. (Refer to 31-60)
(d) Remove passenger seats. (Refer to 25-10)
(e) Remove carpet and access panels CF3C and CF4C. (Refer to 06-00)

**Note:** *Serials 2016 & subs w/ Perspective Avionics:* Note location of roll servo bridle cable clamps on aileron cable to facilitate reinstallation.

(f) *Serials 2016 & subs w/ Perspective Avionics:* Remove bolts, nuts, and clamps securing roll servo bridle cable to aileron cable. (See Figure 22-135)

(g) Remove cotter pin, nut, washers, and bolt securing trim cartridge push/pull rod to aileron actuation pulley.

(h) Insert lockout pins at aileron actuation pulleys in LH and RH wing.

(i) Insert lockout pin at aileron actuation pulley in center console.

(j) Set LH yoke grip to 45° by adjusting LH aileron push/pull rod at aileron actuation bracket so trim indicator is aligned with 0° on roll trim decal. Repeat procedure on RH side. (See Figure 27-102)

(k) Tighten turnbuckles to adjust aileron control cable tension according to ambient temperature. (See Figure 06-001)

**Note:** Control cable tension should be within approved range and equal between each set of locked-out pulleys.

1. At access hole CF4R, measure tension of RH aileron cable between crossover pulley and crossover turnbuckle.
2. At access hole CF4L, measure tension of LH aileron cable between crossover pulley and crossover turnbuckle.
3. At access hole CF4R, measure tension of RH aileron cable between RH kick-out pulley and RH wing aileron actuation pulley.
4 At access hole CF4L, measure tension of LH aileron cable between LH kick-out pulley and LH wing aileron actuation pulley.

(l) Ensure aileron cables at kick-out and cross-over pulleys do not rub against pulley flange.

(m) Remove lockout pins from LH and RH aileron actuation pulleys.

(n) Set ailerons to neutral position using WS 144 rigging template.

Note: To keep the opposite aileron in approximate neutral position, as the cross-over turnbuckle is tightened, the same-side direct-cable turnbuckle must be loosened (or vice-versa).

1 Align aileron trailing edges to wing chord line. To lower trailing edge, tighten cross-over cable turnbuckle and loosen direct-cable turnbuckle for appropriate aileron side.

2 After both ailerons are adjusted to neutral, recheck position of aileron rigged first to verify position did not shift during cable adjustment.

(o) Fasten inclinometer to LH aileron and set at 0°

(p) Remove lockout pin in center console aileron actuation pulley.

(q) Verify aileron neutral position remains at 0 ±0.5° with control yoke in neutral position.

(r) Verify neutral position between LH and RH ailerons is not greater than 0.5°.

WARNING: Turning control yoke counterclockwise should put left aileron trailing edge in raised position. If this is not true, system is improperly rigged. The system MUST BE RIGGED CORRECTLY. Check for crossed or wrapped cables.

(s) Verify turning control yoke counterclockwise places LH aileron in raised position.

Note: Verify aileron up and down travel with inclinometer. If travel requirements are not met, remove aileron and adjust stop screws as necessary.

(t) Adjust stop screws at LH aileron actuation pulley to allow 12.5 ±1° up and down aileron travel. In addition, adjust stops screws at LH aileron actuation pulley so that for full left roll input; (See Figure 27-102)

1 the LH lower aileron stop contacts first with 12.5 ±1° aileron up travel,

2 the RH upper aileron stop shows a 0.035 ±0.020 inch (0.89 ±0.51 mm) gap between stop and pulley bearing,

3 the secondary stop mounted on the co-pilot control yoke assembly shows a 0.070 ±0.020 inch (1.8 ±0.51 mm) gap between stop and center console.

(u) Fasten inclinometer to RH aileron and set at 0°.

(v) Adjust stop screws at RH aileron actuation pulley to allow 12.5 ±1° up and down aileron travel. In addition, adjust stops screws at RH aileron actuation pulley so that for full right roll input; (See Figure 27-102)

1 the RH lower aileron stop contacts first with 12.5 ±1° aileron up travel,

2 the LH upper aileron stop shows a 0.035 ±0.020 inch (0.89 ±0.51 mm) gap between stop and pulley bearing,

3 the secondary stop mounted on pilot control yoke assembly shows a 0.070 ±0.020 inch (1.8 ±0.51 mm) gap between stop and center console.

(w) Install bolt, washers, nut, and cotter pin securing trim cartridge push/pull rod to aileron actuation pulley.

(x) Perform Inspection/Check - Roll Trim Cartridge. (Refer to 27-10)

(y) Serials 2016 & subs w/ Perspective Avionics: Perform Adjustment/Test - GSM 85A/86 Roll Servo Mount Bridle Cable Tension. (Refer to 22-13)
(z) Install access panels and carpet. (Refer to 06-00)
(aa) Install passenger seats. (Refer to 25-10)
(ab) Install MFD. (Refer to 31-60)
(ac) Install kick plate. (Refer to 25-10)

(4) Inspection/Check - Aileron System Rigging
(a) Acquire necessary tools, equipment, and supplies.

(b) Perform Inspection/Check - Aileron Gap and Overlap. (Refer to 57-50)
(c) Remove passenger seats. (Refer to 25-10)
(d) Remove carpet and access panels CF3C and CF4C. (Refer to 06-00)
(e) Verify aileron control cable tension. (Refer to 27-10)
(f) Verify aileron cable at kick-out pulleys do not rub against pulley flange. (Refer to 27-10)
(g) Verify 0.1 inch (2.54 mm) minimum clearance between aileron control cables and composite structure where aileron control cables pass through step closeout, aft longeron, and fuselage skin.
(h) Verify aileron neutral position remains at 0 ±0.5° with control yoke in neutral position.
(i) Verify neutral position between LH and RH ailerons is not greater than 0.5°.
(j) Verify 12.5 ±1° aileron up and down travel. (Refer to 27-10)
(k) Verify that under full left roll input, the LH lower aileron stop contacts first with 12.5 ±1° aileron up travel.
(l) Verify that under full right roll input, the RH lower aileron stop contacts first with 12.5 ±1° aileron up travel.
(m) Verify upper aileron stops show a 0.035 ±0.020 inch (0.89 ±0.51 mm) gap between stops and pulley bearings at aileron actuation pulleys under full left or right roll input. (Refer to 27-10)
(n) Verify secondary stop mounted on control yoke assembly shows a 0.070 ±0.020 inch (1.8 ±0.51 mm) gap between stop and center console under full left or right roll input. (Refer to 27-10)
(o) Verify 6 ±1° aileron trim deflection. (Refer to 27-10)
(p) Serials 1005 thru 1885: Perform Inspection/Check - Rudder-Aileron Interconnect. (Refer to 27-20)
(q) Serials 2016 & subs w/ Perspective Avionics: Verify roll servo mount bridle cable tension inboard of bridle cable clamps is 25.0 ±2.0/-0.0 lb (11.3 ±0.9/-0.0 kg). (Refer to 22-13)
(r) Verify minimum rod end thread engagement of 0.313 inch (0.80 cm).
(s) Verify proper installation of safety wires and cotter pins on all fasteners and engagement of all jam nuts throughout entire aileron control system.
(t) Install access panels and carpet. (Refer to 06-00)
(u) Install passenger seats. (Refer to 25-10)

<table>
<thead>
<tr>
<th>Description</th>
<th>P/N or Spec.</th>
<th>Supplier</th>
<th>Purpose</th>
</tr>
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<td>Scale</td>
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<td>Inclinometer</td>
<td>PRO360</td>
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<td>Deflection angle.</td>
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<td>Kent Moore</td>
<td>Cable tension.</td>
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<td>Warren, MI 48092</td>
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<tr>
<td></td>
<td></td>
<td>800-345-2233</td>
<td></td>
</tr>
</tbody>
</table>
NOTE

⚠️ Set yoke grip to 45° by adjusting aileron push/pull rod at aileron actuation bracket so trim indicator is aligned with 0° on roll trim decal.

⚠️ Alignment hole in center console pulley must align with corresponding hole in console.

⚠️ Verify aileron neutral position remains at 0° ±0.5° with control yoke in neutral position and cable tension at 30 - 40 lb (13.6 - 18.1 kg). Verify neutral position between left and right ailerons is not greater than 0.5°.

LEFT AND RIGHT AILERON

DETIAL C

WING STATION 144

NOTE

1. Control Yoke Assembly
2. Aileron Push/Pull Rod
3. Roll Trim Decal
4. Center Console Pulley

DETAIL B

LOCK-OUT HOLE (REF)

CHORD

0.0±5°

FWD

LEFT AND RIGHT AILERON

DETIAL B

WING STATION 144

NOTE

1. Control Yoke Assembly
2. Aileron Push/Pull Rod
3. Roll Trim Decal
4. Center Console Pulley

DETAIL A

Figure 27-102
Aileron System Rigging (Sheet 1 of 2)
NOTE

⚠️ Verify aileron stops show a 0.035 inch +/- 0.020 inch gap between stops and pulley bearings at aileron actuation pulleys under full left or right roll input.

⚠️ Verify secondary stop mounted on control yoke assembly shows a 0.070 inch +/- 0.020 inch gap between stop and center console under full left or right roll input.

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Figure 27-102
Aileron System Rigging (Sheet 2 of 2)
B. Control Grip Assembly *(See Figure 27-103)*

(1) Removal - Control Grip Assembly

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

(b) Set BAT 1, BAT 2, and AVIONICS switches to OFF position.

(c) Pull AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.

(d) Remove kick plate. *(Refer to 25-10)*

(e) Remove seat. *(Refer to 25-10)*

(f) Remove set screws securing control yoke grip to yoke tube.

(g) Carefully pull wires through yoke tube and remove grip assembly from airplane.

(2) Installation - Control Grip Assembly

(a) Route control yoke wires through yoke tube.

**Note:** Ensure retaining barbs are sufficiently bent away from electrical pins to prevent pins from dislodging from connector body.

(b) Install pins into electrical connector and connect electrical connector.

(c) Install yoke tube cover.

(d) Install screws securing control grip to yoke tube.

(e) *Serials 1005 thru 1885:* Perform Servicing - Push-to-Talk (PTT) Switch. *(Refer to 27-10)*

(f) Reset AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.

(g) Install kick plate. *(Refer to 25-10)*

(h) Install seat. *(Refer to 25-10)*
C. 4-Way Trim / 4-Way Trim and Autopilot Disconnect Switch (See Figure 27-103)

(1) Removal - 4-Way Trim / 4-Way Trim and Autopilot Disconnect Switch
(a) Set BATTERY and AVIONICS switches to OFF position.
(b) Pull AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.
(c) Remove screws securing switch plate assembly to top of control grip.
(d) De-solder electrical leads from switch terminals.
(e) Remove jam nut and washer securing switch to switch plate. Remove switch from airplane.

(2) Installation - 4-Way Trim / 4-Way Trim and Autopilot Disconnect Switch
(a) Solder electrical leads to switch terminals.
(b) Install jam nut and washer securing switch to switch plate.
(c) Install screws securing switch plate assembly to top of control grip.
(d) Reset AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.
D. Autopilot Disconnect Switch - *Serials 1706 & subs* *(See Figure 27-103)*

1. Removal - Autopilot Disconnect Switch
   a. Set BATTERY and AVIONICS switches to OFF position.
   b. Pull AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.
   c. Remove screws securing switch plate assembly to top of control grip.
   d. De-solder electrical leads from switch terminals.
   e. Remove nut securing switch to switch plate and remove switch from airplane.

2. Installation - Autopilot Disconnect Switch
   a. Solder electrical leads to switch terminals.
   b. Install nut securing switch to switch plate.
   c. Install screws securing switch plate assembly to top of control grip.
   d. Reset AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.
E. A/P Altitude Hold Switch - *Serials 1005 thru 1705 (See Figure 27-103)*

(1) Removal - A/P Altitude Hold Switch
   (a) Set BATTERY and AVIONICS switches to OFF position.
   (b) Pull AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.
   (c) Remove screws securing switch plate assembly to top of control grip.
   (d) De-solder electrical leads from switch terminals.
   (e) Remove nut and bezel securing switch to switch plate and remove switch from airplane.

(2) Installation - A/P Altitude Hold Switch
   (a) Solder electrical leads to switch terminals.
   (b) Install nut and bezel securing switch to switch plate.
   (c) Install screws securing switch plate assembly to top of control grip.
   (d) Reset AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.
F. Push-to-Talk (PTT) Switch (See Figure 27-103)

(1) Servicing - Push-to-Talk (PTT) Switch
   (a) Acquire necessary tools, equipment, and supplies.
   (b) Cover control grip leather with shop towel.
   (c) Depress switch and apply electrical contact cleaner to space between switch and housing.
   (d) Release switch and apply electrical contact cleaner to space between switch and housing.
   (e) Engage switch several times to ensure distribution of electrical contact cleaner.
   (f) Remove shop towel from control grip leather.

(2) Removal - Push-to-Talk (PTT) Switch
   (a) Set BATTERY and AVIONICS switches to OFF position.
   (b) Pull AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.
   (c) Remove screws securing switch plate assembly to top of control grip.
   (d) Cut electrical leads from switch as close to switch base as possible.
   (e) Serials 1005 thru 1705: Remove bezel and unscrew switch from control grip.
   (f) Serials 1706 & subs: Unscrew switch from control grip.

(3) Installation - Push-to-Talk (PTT) Switch
   (a) Solder new electrical leads to switch.
   (b) Serials 1005 thru 1705: Route electrical leads through mounting hole, screw switch into control grip, and install bezel.
   (c) Serials 1706 & subs: Route electrical leads through mounting hole, and screw switch into control grip.
   (d) Splice switch leads to harness leads.
   (e) Install screws securing switch plate assembly to top of control grip.
   (f) Reset AUTOPILOT, PITCH TRIM, and ROLL TRIM circuit breakers.

---

**Description** | **P/N or Spec.** | **Supplier** | **Purpose**
---|---|---|---
Electrical Contact Cleaner | - | Any Source | Clean switch.

**CAUTION:** Electrical contact cleaner may cause leather discoloration. Use care when applying electrical contact cleaner to avoid damaging control grip leather.
Control Grip Assembly Installation

EFFECTIVITY:
All

SR20_MM27_1166D
G. Control Yoke Assembly (See Figure 27-104), (See Figure 27-105)

(1) Removal - Control Yoke Assembly
   (a) Remove control grip assembly. (Refer to 27-10)
   (b) Remove seat. (Refer to 25-10)
   (c) Remove kick plate. (Refer to 25-10)
   (d) Remove bolster panel trim. (Refer to 25-10)
   (e) Remove cotter pin, nut, washers, and bolt securing aileron push/pull rod to control yoke aileron actuation bracket.
   (f) Remove cotter pin, nut, washers, and bolt securing elevator push/pull rod to control yoke elevator stop.

   Note: For the following step, note washer stackup to aid in reinstallation.

   (g) Remove cotter pins, nuts, washers, and bolts securing control yoke assembly rod ends to console assembly.
   (h) Remove control yoke assembly from airplane.

(2) Installation - Control Yoke Assembly
   (a) Position control yoke assembly on center console and install bolts, washers, nuts, and cotter pins securing control yoke assembly rod ends to console assembly.
   (b) Install bolt, washers, nut, and cotter pin securing elevator push/pull rod to control yoke elevator stop.
   (c) Position aileron push/pull rod to control yoke aileron actuation bracket and install bolt, washers, nut, and cotter pin.
   (d) Perform Inspection/Check - Control Yoke Assembly. (Refer to 27-10)
   (e) Install bolster panel trim. (Refer to 25-10)
   (f) Install kick plate. (Refer to 25-10)
   (g) Install seat. (Refer to 25-10)
   (h) Install control grip assembly. (Refer to 27-10)

(3) Inspection/Check - Control Yoke Assembly
   (a) Acquire necessary tools, equipment, and supplies.

   (b) Remove seat. (Refer to 25-10)
   (c) Remove kick plate. (Refer to 25-10)
   (d) Verify zero vertical play exists between yoke tube and V-grooved guide wheels.
   (e) Verify V-grooved guide wheel bolts are torqued to 50 - 55 in-lb (5.6 - 6.2 Nm).
   (f) Verify positive clearance and proper operation of control yoke assembly through full range of motion.
   (g) Verify yoke movement is free of resistance.
   (h) Remove control grip assembly. (Refer to 27-10)
   (i) Apply corrosion inhibitor.
      1. Cover surrounding components, furnishings, and structures to prevent inadvertent application of corrosion inhibitor to these areas.
      2. Cover or plug opposite end of control yoke tube during application of corrosion inhibitor.
3. Apply a thin coat of corrosion inhibitor to inside of control yoke tubes per the manufacturer’s instructions.

(j) Verify yoke tubes and V-grooved guide wheels are free of grit build-up.

(k) Verify engagement of jam nuts on control yoke assembly rod ends.

(l) Verify proper installation of safety wires and cotter pins on all fasteners.

(m) Install control grip assembly. (Refer to 27-10)

(n) Install kick plate. (Refer to 25-10)

(o) Install seat. (Refer to 25-10)
H. Aileron Push/Pull Rods *(See Figure 27-104), (See Figure 27-105)*

(1) Removal - Aileron Push/Pull Rods
   (a) Remove kick plate. *(Refer to 25-10)*
   (b) Remove MFD. *(Refer to 31-60)*
   (c) Remove cotter pin, nut, washers, and bolt securing aileron push/pull rod to aileron actuation pulley.
   (d) Remove cotter pin, nut, washers, and bolt securing aileron push/pull rod to control yoke aileron actuation bracket and remove push/pull rod from airplane.

(2) Installation - Aileron Push/Pull Rods
   (a) Position aileron push/pull rod to control yoke aileron actuation bracket and install bolt, washers, nut, and cotter pin.
   (b) Install bolt, washers, nut, and cotter pin securing aileron push/pull rod to aileron actuation pulley.
   (c) Install MFD. *(Refer to 31-60)*
   (d) Install kick plate. *(Refer to 25-10)*
I. V-Grooved Guide Wheel *(See Figure 27-104), (See Figure 27-105)*

(1) Removal - V-Grooved Guide Wheel
   (a) Remove control yoke assembly. *(Refer to 27-10)*
   (b) Remove bolt, washers, bearing tie plate, spacers, and nut securing V-grooved guide wheel to control yoke assembly.

(2) Installation - V-Grooved Guide Wheel
   (a) Position washers, spacers, V-grooved guide wheel, bearing tie plate, and yoke tube to bearing mount and loosely secure with bolts and nuts.
   (b) Perform Adjustment/Test - V-Grooved Guide Wheel. *(Refer to 27-10)*
   (c) Install control yoke assembly. *(Refer to 27-10)*

(3) Adjustment/Test - V-Grooved Guide Wheel
   (a) On bottom, aft side of bearing mount, loosen jam nut and adjust hex screw so zero vertical play exists between yoke tube and V-grooved guide wheel.
   (b) On bottom, forward side of bearing mount, loosen jam nut and adjust hex screw so zero vertical play exists between yoke tube and V-grooved guide wheel.
   (c) When no vertical play exists between yoke tube and V-grooved guide wheels, torque bearing nuts to 50 - 55 in-lb (5.5 - 6.1 Nm). After torquing bearing nuts to proper spec, check for vertical play between yoke tube and V-grooved guide wheels. If play exists, loosen bearing nuts and repeat Adjustment/Test - V-Grooved Guide Wheel.
To reduce rotating friction of yoke assembly, any combination of washers .016" & .032" thickness may be added between control yoke assembly & console assembly. Min. total .016", max. total .064".

**NOTE**

**LEGEND**

1. Castellated Nut
2. Washer
3. Bolt
4. End Fitting
5. Torque Tube Coupler
6. Control Grip Assembly
7. Set Screw
8. Yoke Tube Cover
9. Yoke Tube
10. Control Yoke Assembly
11. Push/Pull Rod - Aileron
12. Jam Nut
13. Rod End
14. Cotter Pin
15. Bearing
16. Bearing Plate
17. Elevator Torque Tube
18. Thrust Collar
19. Nut
20. Spacer
21. Aileron Actuation Bracket

**DETAIL A**

Serials 1005 thru 1300, 1302 thru 1306.

**Figure 27-104**

Control Yoke Assembly - Serials 1005 thru 1306 (Sheet 1 of 2)
Adjust hex screw so zero vertical play exists between yoke tube and V-grooved guide wheel.

Figure 27-104
Control Yoke Assembly - Serials 1005 thru 1306 (Sheet 2 of 2)
To reduce rotating friction of yoke assembly, any combination of washers .016" & .032" thickness may be added between control yoke assembly & console assembly. Min. total .016", max. total .064".

**NOTE**

**CONSOLE ASSEMBLY (REF)**

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**CONSOLE ASSEMBLY (REF)**

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**CONSOLE ASSEMBLY (REF)**

**CONSOLE ASSEMBLY (REF)**

**LEGEND**

1. Castellated Nut
2. Washer
3. Bolt
4. End Fitting
5. Torque Tube Coupler
6. Control Grip Assembly
7. Set Screw
8. Control Grip Assembly
9. Yoke Tube Cover
10. Yoke Tube
11. Control Yoke Assembly
12. Push/Pull Rod - Aileron
13. Jam Nut
14. Rod End
15. Cotter Pin
16. Push/Pull Rod - Elevator
17. Bearing
18. Bearing Plate
19. Elevator Torque Tube
20. Thrust Collar
21. Nut
22. Spacer
23. Aileron Actuation Bracket
24. Pin, Hi-Lok

**Figure 27-105**
Control Yoke Assembly - Serials 1307 & subs (Sheet 1 of 2)
Figure 27-105
Control Yoke Assembly - Serials 1307 & subs (Sheet 2 of 2)

NOTE
Bend washer tabs up securing nut in place with nut corner between tabs.
J. Aileron Actuation Pulley - Console (See Figure 27-106) (See Figure 27-107)

(1) Removal - Aileron Actuation Pulley - Console
    (a) Remove carpet and access panel CF3C from passenger compartment floor. (Refer to 06-00)
    (b) Identify and loosen aileron cable tension via turnbuckle.
    (c) Remove MFD. (Refer to 31-60)
    (d) Remove cotter pin, nut, washers, and bolt securing aileron push/pull rods to aileron actuation pulley.
    (e) Cut safety wire securing cable to aileron actuation pulley.
    (f) Remove cotter pin, nut, washers, spacer, and bolt securing aileron actuation pulley to console assembly and remove from airplane.

(2) Installation - Aileron Actuation Pulley - Console
    (a) Position aileron actuation pulley over console assembly ensuring lockout holes line up, and install bolt, washer, nut.
    (b) Install bolt, washers, nut, and cotter pin securing aileron push/pull rods to aileron actuation pulley.
    (c) Perform Adjustment/Test - Aileron System Rigging. (Refer to 27-10)
    (d) Install access panel CF3C and carpet. (Refer to 06-00)
    (e) Install MFD. (Refer to 31-60)
K. Forward Pulley Gang (See Figure 27-106), (See Figure 27-107)

(1) Removal - Forward Pulley Gang
The forward pulley gang is used to route the aileron, rudder, and elevator system control cables.
(a) Remove carpet and access panel CF3C from passenger compartment floor. (Refer to 06-00)
(b) Identify and loosen aileron cable tension via turnbuckle.
(c) Remove carpet and access panel CF5 from baggage compartment floor. (Refer to 06-00)
(d) Identify and loosen rudder and elevator cable tension via turnbuckle.
(e) Remove pilot and co-pilot seats. (Refer to 25-10)
(f) Remove carpet and access panel CF2L and CF2R from cockpit floor. (Refer to 06-00)
(g) Remove cotter pin, nut, washers, spacers, and bolt securing pulleys to console assembly and remove pulleys from airplane.

(2) Installation - Forward Pulley Gang
(a) Position and install bolt, spacers, washers, nut, and cotter pin securing pulleys to console assembly.
(b) Rig aileron system and perform Adjustment/Test - Aileron System Rigging. (Refer to 27-10)
(c) Rig rudder system and perform Adjustment/Test - Rudder System Rigging. (Refer to 27-20), (Refer to 27-20)
(d) Rig elevator system and perform Adjustment/Test - Elevator System Rigging. (Refer to 27-30), (Refer to 27-30)
(e) Install access panels CF3C, CF5, CF2L, and CF2R. (Refer to 06-00)
(f) Install carpet. (Refer to 25-10)
L. Kick-Out Pulley (See Figure 27-108)

(1) Removal - Kick-Out Pulley
   (a) Remove passenger compartment seats. (Refer to 25-10)
   (b) Remove carpet and access panel CF4C from passenger compartment floor. (Refer to 06-00)
   (c) Identify and loosen aileron cable tension via turnbuckle.
   (d) Remove cotter pins, washers, and cable retaining clevis pins from pulley assembly and remove cable from pulley.
   (e) Remove cotter pin, nut, washers, and bolt securing kick-out pulley to pulley brackets and remove from airplane.

(2) Installation - Kick-Out Pulley
   (a) Install pulley, bolt, washers, nut, and cotter pin securing kick-out pulley to brackets.
   (b) Position cable on pulley and install cable retainer clevis pins, washers, and cotter pins.
   (c) Perform Adjustment/Test - Aileron System Rigging. (Refer to 27-10)
   (d) Install access panel CF4C. (Refer to 06-00)
   (e) Install carpet. (Refer to 25-10)
M. Cross-Over Pulley (See Figure 27-108)

(1) Removal - Cross-Over Pulley
   (a) Remove passenger compartment seats. (Refer to 25-10)
   (b) Remove carpet and access panels CF4L and CF4R from aft floor. (Refer to 06-00)
   (c) Identify and loosen aileron cable tension via turnbuckle.
   (d) Remove cotter pin, washer, and cable retainer clevis pin from pulley assembly and remove cable from pulley.
   (e) Remove cotter pin, nut, washers, and bolt securing cross-over pulley to pulley brackets and remove from airplane.

(2) Installation - Cross-Over Pulley
   (a) Install pulley, washers, bolt, and cotter pin securing cross-over pulley to bracket assembly.
   (b) Position cable on pulley and install cable retainer clevis pin, washer, and cotter pin.
   (c) Perform Adjustment/Test - Aileron System Rigging. (Refer to 27-10)
   (d) Install access panels CF4L and CF4R. (Refer to 06-00)
   (e) Install carpet. (Refer to 25-10)
   (f) Install passenger compartment seats. (Refer to 25-10)
LEGEND
1. Castellated Nut
2. Washer
3. Bolt
4. Rod End
5. Cotter Pin
6. Bearing
7. Spacer
8. Aileron Actuation Pulley - Console
9. Pulley Guard
10. Pin
11. Pulley
12. Pulley Assembly

Figure 27-106
Forward Pulley Gang - Serials 1005 thru 1306
Figure 27-107
Forward Pulley Gang - Serials 1307 & subs

Legend:
1. Castellated Nut
2. Washer
3. Bolt
4. Rod End
5. Cotter Pin
6. Bearing
7. Spacer
8. Aileron Actuation Pulley - Console
9. Pulley Guard
10. Pin
11. Pulley
12. Pulley Assembly
13. Nut
14. Clevis Pin

Effectivity:
Serials 1307 & subs

15 Jun 2010
Figure 27-108
Aileron Kick-Out and Cross-Over Pulleys

LEGEND
1. Castellated Nut
2. Washer
3. Bolt
4. Cotter Pin
5. Pulley
6. Nut
7. Clevis Pin
8. Pulley Bracket
9. Shim
10. Backing Plate
N. Roll Trim System *(See Figure 27-109)*

(1) Removal - Aileron Actuation Pulley - Wing
   (a) Remove passenger compartment seats. *(Refer to 25-10)*
   (b) Remove carpet and access panels CF3C and CF4C from passenger compartment. *(Refer to 06-00)*
   (c) Identify and loosen aileron cable tension via turnbuckles.
   (d) Remove ailerons. *(Refer to 57-50)*
   (e) Serials 1005 thru 1885: Remove wing access panel LW7. *(Refer to 06-00)*
   (f) Serials 1886 & subs: Remove wing access panel LW11. *(Refer to 06-00)*
   (g) Cut safety wire securing cable to aileron actuation pulley.
   (h) Remove cotter pin, nut, washers, and bolt securing trim cartridge push/pull rod to aileron actuation pulley. (LH side only.)
   (i) Cut safety wire, remove bolt and washer securing aileron actuation pulley to pulley bracket, and remove pulley from airplane.

(2) Disassembly - Aileron Actuation Pulley - Wing
   (a) Serials 1005 thru 1195: Remove bolts securing bearing block and spacers to aileron actuation pulley.
   (b) Serials 1196 & subs: Remove bolts securing bearing block to aileron actuation pulley.

(3) Reassembly - Aileron Actuation Pulley - Wing
   (a) Serials 1005 thru 1195: Install bolts securing bearing block and spacers to aileron actuation pulley.
   (b) Serials 1196 & subs: Install bolts securing bearing block to aileron actuation pulley.

(4) Installation - Aileron Actuation Pulley - Wing
   (a) Acquire necessary tools, equipment, and supplies.
   (b) Position aileron actuation pulley to pulley bracket and install bolt and washer. Torque bolt 10 - 15 in-lb (1.1 - 1.6 Nm) and safety wire.
   (c) Install bolt, washers, nut, and cotter pin securing trim cartridge push/pull rod to aileron actuation pulley. (LH side only.)
   (d) Serials 1005 thru 1885: Install wing access panel LW7. *(Refer to 06-00)*
   (e) Serials 1886 & subs: Install wing access panel LW11. *(Refer to 06-00)*
   (f) Install ailerons. *(Refer to 57-50)*
   (g) Rig and perform Adjustment/Test - Aileron System Rigging. *(Refer to 27-10)*
   (h) Install carpet and access panels CF3C and CF4C. *(Refer to 06-00)*
   (i) Install passenger compartment seats. *(Refer to 25-10)*

(5) Removal - Roll Trim Cartridge

**WARNING:** A maintenance check flight must be performed after the installation of a replacement (new or different) trim cartridge.

   (a) Remove LH aileron. *(Refer to 57-50)*
   (b) Serials 1005 thru 1885: Remove wing access panel LW7. *(Refer to 06-00)*
   (c) Serials 1886 & subs: Remove wing access panel LW11. *(Refer to 06-00)*
   (d) Slightly loosen trim motor assembly to facilitate trim cartridge removal. *(Refer to 27-10)*
(e) Remove cotter pin, nut, washers, spacer, and bolt securing trim cartridge to trim motor offset arm.

(f) Remove cotter pin, nut, washers, and bolt securing trim cartridge push/pull rod to aileron actuation pulley and remove roll trim cartridge from airplane.

6) Installation - Roll Trim Cartridge
(a) Align trim cartridge push/pull rod with mounting hole on aileron actuation pulley and install bolt, washers, nut, and cotter pin.
(b) Align trim cartridge with trim motor offset arm and install bolt, washers, nut, and cotter pin.
(c) Tighten trim motor assembly. (Refer to 27-10)
(d) Perform Adjustment/Test - Roll Trim Cartridge. (Refer to 27-10)
(e) Serials 1005 thru 1885: Install wing access panel LW7. (Refer to 06-00)
(f) Serials 1886 & subs: Install wing access panel LW11. (Refer to 06-00)
(g) Install LH aileron. (Refer to 57-50)
(h) If replacement (new or different) trim cartridge installed, perform maintenance check flight. If airplane cannot be trimmed properly during maintenance check flight, perform Adjustment/Test - Aileron Trim Tab. (Refer to 57-50)

7) Adjustment/Test - Roll Trim Cartridge
(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>3/16” Lockout Pin</td>
<td>-</td>
<td>Any Source</td>
<td>Lockout ailerons.</td>
</tr>
<tr>
<td>Inclinometer</td>
<td>PRO360</td>
<td>Macklanburg Duncan Oklahoma City, OK 73125 800-654-0007</td>
<td>Deflection angle determination.</td>
</tr>
</tbody>
</table>

(b) Remove MFD. (Refer to 31-60)
(c) Insert lockout pin at aileron actuation pulley in center console.
(d) Remove LH aileron. (Refer to 57-50)

CAUTION: To prevent damage to trim motor, set adjustment screws on limit switch stops all the way in to limit travel of motor to minimal rotation.

(e) Fasten inclinometer to RH aileron and set at 0°.
(f) Remove lockout pin.
(g) Adjust trim cartridge length to allow 6 ±1° aileron trim deflection:
   1. If required, adjust initial length of trim cartridge to 9.4 inches (24.1 cm).
   2. To increase RH aileron trailing edge up movement (LH aileron trailing edge down), lengthen trim cartridge by loosening jam nut and turning rod counterclockwise.
   3. Shorten cartridge for opposite results.
   4. If additional travel is required, adjust trim motor adjustment screws.
(h) Verify trim cartridge minimum rod end thread engagement of 0.313 inch (0.792 cm). Tighten jam nuts.
(i) Perform Inspection/Check - Roll Trim Cartridge. (Refer to 27-10)
(j) Install LH aileron. (Refer to 57-50)
(k) Install MFD. (Refer to 31-60)

8) Inspection/Check - Roll Trim Cartridge
(a) Acquire necessary tools, equipment, and supplies.

<table>
<thead>
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<td>Deflection angle determination.</td>
</tr>
</tbody>
</table>

(b) Verify correct aileron system rigging. *(Refer to 27-10)*
(c) Fasten inclinometer to left aileron and set at 0°
(d) Verify roll trim cartridge is adjusted to hold ailerons in neutral position ±1°.
(e) Run trim motor to full right and full left bank trim positions and verify 6 ±1° aileron trim deflection. If roll trim is out of adjustment, perform Adjustment/Test - Roll Trim Cartridge. *(Refer to 27-10)*
(f) *Serials 1005 thru 1885:* Verify that at full aileron trim travel (±6°), the aileron-rudder interconnect bungee does not get tensioned.
(g) Remove inclinometer.
(h) Verify positive clearance between trim cartridge and actuation pulley under full range of trim motor positions.
(i) Verify minimum rod end thread engagement of 0.313 inch (0.79 cm).
(j) Verify proper installation of safety wires and cotter pins on all fasteners.

(9) Removal - Roll Trim Motor Assembly
(a) Set BATTERY and AVIONICS switches to OFF position.
(b) Pull ROLL TRIM circuit breaker.
(c) Remove LH aileron. *(Refer to 57-50)*
(d) *Serials 1005 thru 1885:* Remove wing access panel LW7. *(Refer to 06-00)*
(e) *Serials 1886 & subs:* Remove wing access panel LW11. *(Refer to 06-00)*
(f) Slightly loosen trim motor assembly to facilitate trim cartridge removal. *(Refer to 27-10)*
(g) Remove cotter pin, nut, washers, spacer, and bolt securing trim cartridge assembly to trim motor offset arm.
(h) Remove bolts and washers securing ground lead and trim motor assembly to spar.
(i) Disconnect electrical connector and remove trim motor assembly from wing

(10) Installation - Roll Trim Motor Assembly
(a) Connect electrical connector and insert trim motor assembly into spar.
(b) Align mounting bracket with bolt holes and install bolts and washers securing ground lead and trim motor assembly to spar. Leave assembly slightly loose to facilitate trim cartridge installation.
(c) Install bolt, washers, spacer, nut, and cotter pin securing trim cartridge assembly to trim motor actuation arm. Bend cotter pin prongs around nut rather than over
(d) Tighten bolts securing trim motor assembly to spar.
(e) Perform Adjustment/Test - Roll Trim Cartridge. *(Refer to 27-10)*
(f) *Serials 1005 thru 1885:* Install wing access panel LW7. *(Refer to 06-00)*
(g) *Serials 1886 & subs:* Install wing access panel LW11. *(Refer to 06-00)*
(h) Install LH aileron. *(Refer to 57-50)*
(i) Reset ROLL TRIM circuit breaker.

O. Aileron Trim Tab

Roll trim adjustment is ground adjustable only and is achieved by changing the deflection angle of the aileron trim tab. For maintenance practices pertinent to the aileron trim tab, see Flight Surfaces. *(Refer to 57-50)*
Figure 27-109
Roll Trim System Installation

LEGEND
1. Castellated Nut
2. Washer
3. Bolt
4. Rod End
5. Cotter Pin
6. Spacer
7. Pulley
8. Nut
9. Jam Nut
10. Threaded Rod
11. Screw
12. Cable Retainer
13. Bearing Block
14. Roll Trim Cartridge
15. Offset Arm
16. Limit Arm
17. Set Screw
18. Limit Switch
19. Roll Trim Motor
20. Spacer, Bearing Block

DETAIL A
P. Relays (See Figure 27-1010) (See Figure 27-1011)

CAUTION: Failure of either roll relay is cause for replacement of both relays. Replace both relays upon failure of one.

(1) Removal - Roll Relay
   (a) Pull ROLL TRIM circuit breaker.
   (b) Serials 1005 thru 1422: Remove rear passenger seats. (Refer to 25-10)
   (c) Serials 1005 thru 1422: Remove access panel CF4C. (Refer to 06-00)
   (d) Serials 1423 & subs: Remove access panel CF3R. (Refer to 06-00)
   (e) Remove relay from socket.

(2) Installation - Roll Relay
   (a) Position relay to socket and push firmly to install.
   (b) Serials 1005 thru 1422: Install access panel CF4C. (Refer to 06-00)
   (c) Serials 1423 & subs: Install access panel CF3R. (Refer to 06-00)
   (d) Serials 1005 thru 1422: Install rear passenger seats. (Refer to 25-10)
   (e) Reset ROLL TRIM circuit breaker.
CAUTION

Failure of either relay is cause for replacing both relays.

LEGEND
1. Roll Autopilot Relay
2. Screw
3. Washer
4. Spacer
5. Nut
6. Bolt
7. Roll Relay-Left
8. Roll Relay-Right
9. Relay Socket
10. Mounting Plate

Figure 27-1010
Roll Relay Assembly - Serials 1005 thru 1422 (Sheet 1 of 3)

EFFECTIVITY:
Serials 1005 thru 1422
Figure 27-1010
Roll Relay Assembly - Serials 1423 & subs w/o Perspective Avionics (Sheet 2 of 3)

EFFECTIVITY:
Serials 1423 & subs w/o Perspective Avionics

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LEGEND
1. Roll Autopilot Relay
2. Screw
3. Washer
4. Spacer
5. Nut
6. Bolt
7. Roll Relay-Left
8. Roll Relay-Right
9. Relay Socket
11. Mounting Plate, Aft
12. Mounting Plate, Forward

RH LONGERON (REF)

RH LONGERON (REF)

Failure of either relay is cause for replacing both relays.

CAUTION
Failure of either relay is cause for replacing both relays.
EFFECTIVITY:
Serials w/ Perspective Avionics

Figure 27-1011
Roll Relay Installation - Serials w/ Perspective Avionics

LEGEND
1. Mounting Plate, Forward
2. Screw
3. Washer
4. Spacer
5. Nut
6. Bolt
7. Roll Relay-Left
8. Roll Relay-Right
9. Relay Socket

CAUTION
⚠️ Failure of either relay is cause for replacing both relays.

31 May 2011