

Chapter 27

Flight Controls

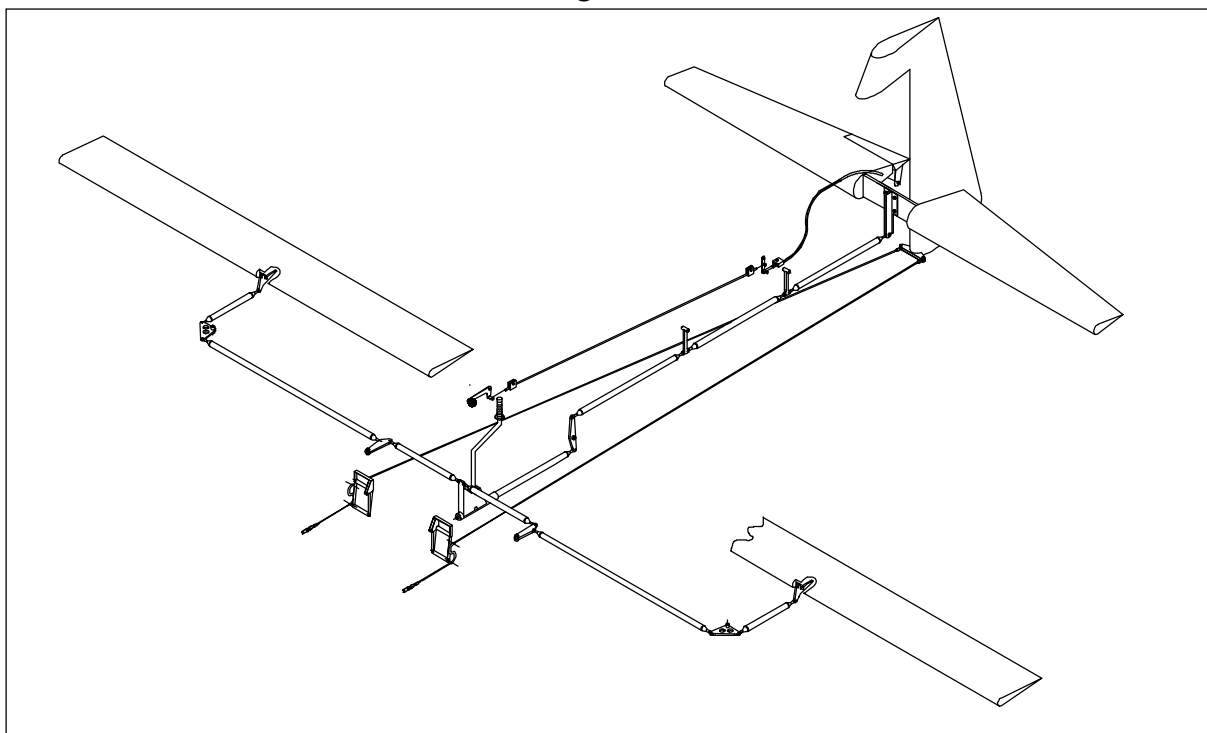
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27-00-00

GENERAL

(Refer to Figure 1) The EXTRA 300S is standard equipped with a conventional control stick and adjustable rudder pedals. The control surfaces are operated by a direct mechanical linkage. The control surface deflections are shown in Figure 2. From Serial N° 29 there is a rubber plugged hole in the bottom fuselage cover for rear torque tube bearing lubrication.



*Controls
Figure 1*

27-00-01

Free Play in the Control System

** measured at the trailing edge
and max. chord*

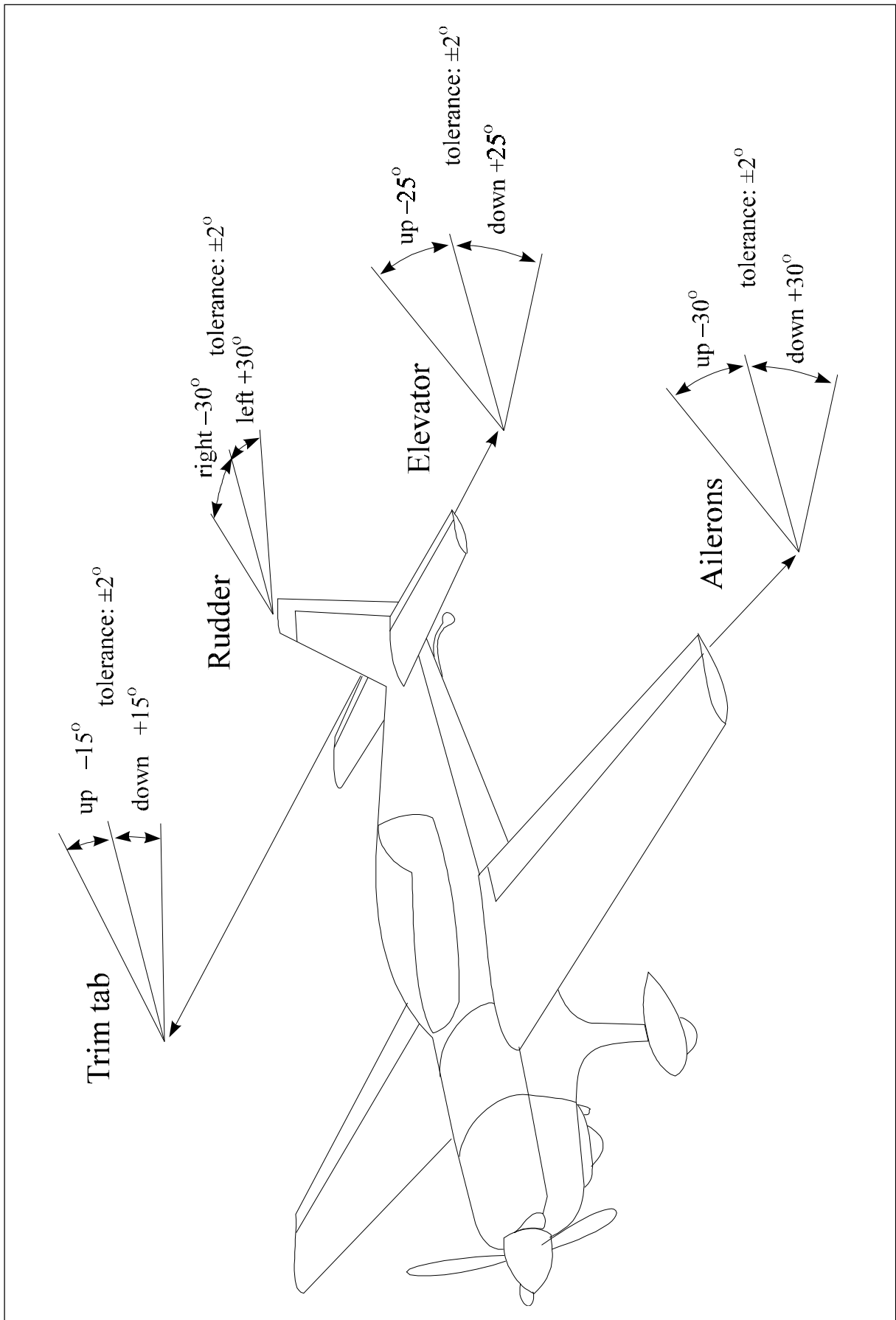
With controls (stick and rudder pedals) locked, the free play measured at the control surfaces must not exceed the values listed:

Aileron: ± 1 mm*

Elevator: ± 1 mm*

Trim tab: ± 2 mm*

The rudder has a direct cable connection with retracting springs and is therefore always under tension.

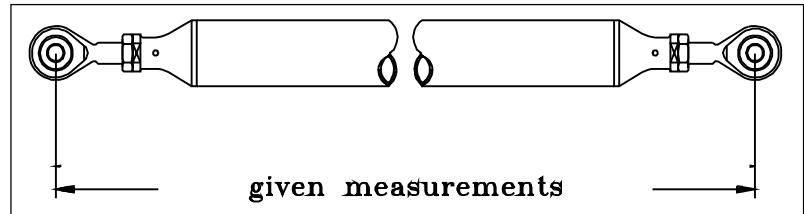


Control Surface Deflections
Figure 2

27-00-02

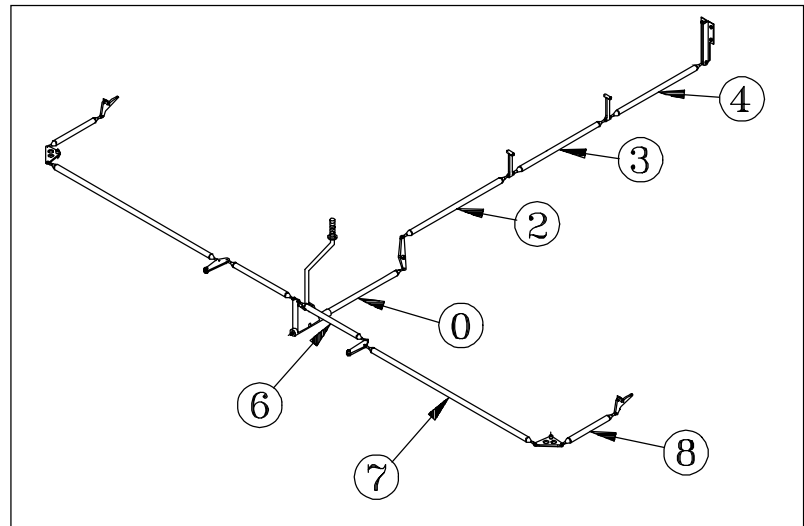
Control Rod Lengths

The measurements given in this chapter refer to the distances between the centers of the rod end bearings (see Figure 3).



*Control Rod Measurement
 Figure 3*

Refer to the following Figure 4 for identification of the control rods.



*Control Rod Identification
 Figure 4*

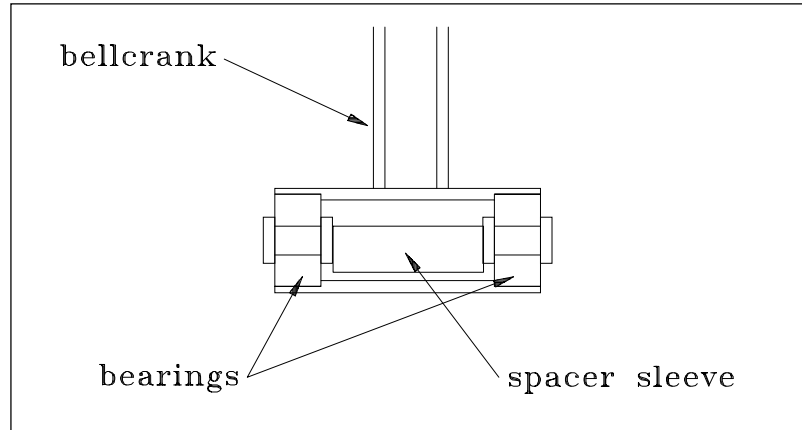
Control rod	Measurements
0	811 mm
2	729 mm
3	588 mm
4	891 mm
6	520 mm
7	1863 mm
8	420 mm

27-01-00

MAINTENANCE PRACTICES

NOTE

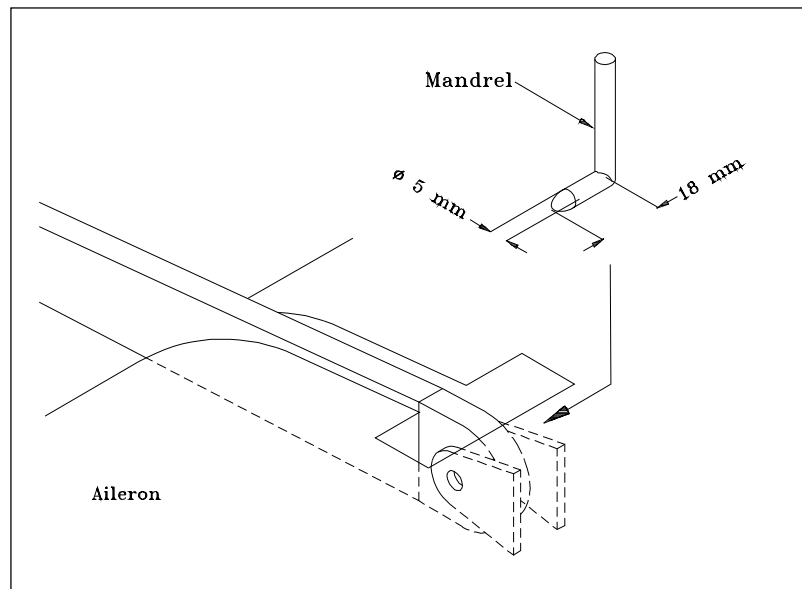
When installing a bellcrank or control stick the spacer sleeve inside the bearing could be displaced as shown in Figure 5. Use a mandrel to adjust the spacer sleeve.



*Spacer Sleeve Displaced
Figure 5*

NOTE

When installing a control surface use mandrels as shown in the following Figure 6 to preset the control surface. Then press out each mandrel by pushing a bolt into the bearing.



*Control Surface Mounting Aid
Figure 6*

27-01-01

Control Rod Removal/Installation

Refer to Figure 7. All control rods are attached to the control levers in the same way with AN bolts, washers and self-locking nuts. The control rods inside the wing are interconnected by ground bonding leads fastened to the rod ends by additional nuts. So the rod ends have to be disassembled, when the ground bonding leads shall be disconnected. In this case also refer to Chapter 27-01-05.

For the EXTRA 300S up to serial No. 21 castle nuts and cotter pins are used instead of the selflocking nuts (except the control stick to control rod connection for which is also used a selflocking nut).

1 Remove the respective access panels.

NOTE

In case of removal of the control rod connected to the control stick also observe the instructions given in the Chapters 27-01-03.

2 Remove the M6 attachment bolts (1).

3 Remove the control rod.

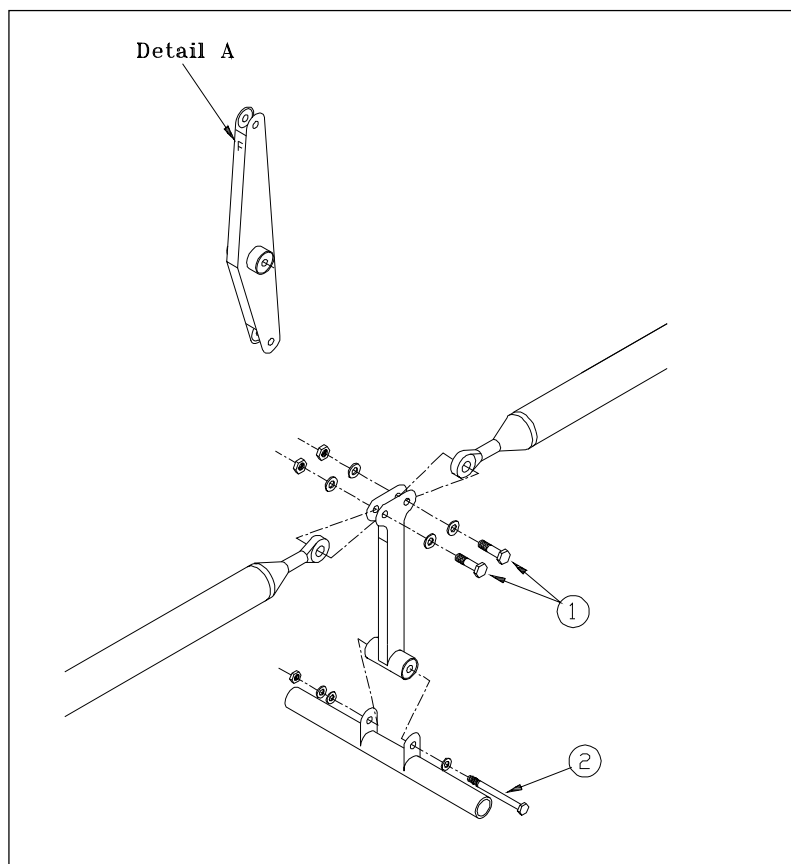
4 Reverse procedure to install the control rod. Replace the selflocking nuts.

27-01-02

Bellcrank Removal/Installation

Refer to Figure 7

- 1 Remove the respective access panels.
- 2 Remove the adjacent control rods per Chapter 27-01-01.
- 3 Remove the M5 attachment bolt (2).
- 4 Remove the bellcrank.
- 5 Reverse procedure to install the bellcrank using sufficient washers (min. 2) at the nut side of the bolt to cover the shank (except the rocker type bellcrank: use only one washer on each side). Replace the selflocking nuts. Observe the first Note of Chapter 27-01-00. To ensure installation of the elevator rocker type bellcrank in correct direction this bellcrank is marked by an "F" which indicates the front side (refer to Detail A of Figure 7).



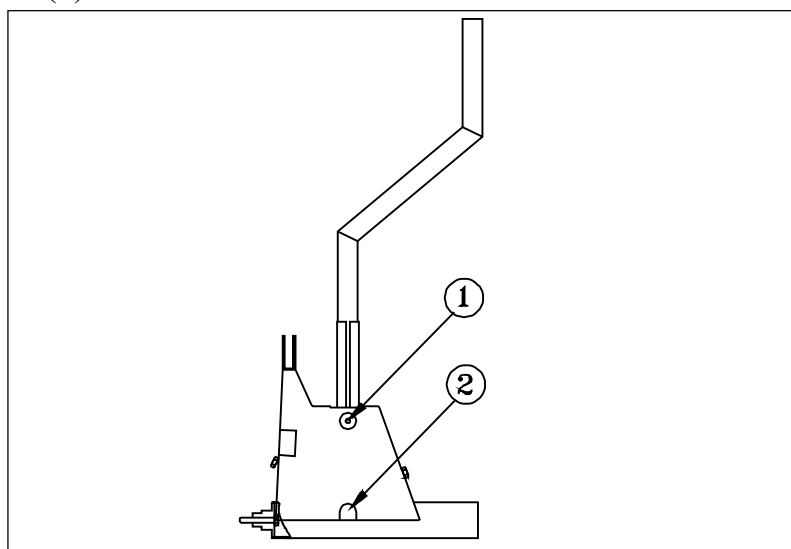
*Control Levers and Rods Removal/Installation
Figure 7*

27-01-03

Control Stick Removal/Installation

Refer to Figure 8.

- 1 Remove the leather protection cuff.
- 2 Disconnect the electrical wiring.
- 3 Remove the control stick attachment bolt (1).
- 4 Disconnect the control stick from the control rod per Chapter 27-01-01. Use the control stick to move the control rod attachment bolt to the mounting hole area (2).



*Control Stick Removal/Installation
Figure 8*

- 5 Remove the control stick.
- 6 Reverse procedure to install the control stick. Replace the selflocking nuts. Observe the first Note of Chapter 27-01-00.
- 7 Check for potential chafing of the wiring after installation.

27-01-04

Torque Tube Removal/Installation

- 1 Remove the respective access panels.
- 2 Remove the control stick and the respective rod per Chapters 27-01-01 and 27-01-03.
- 3 Loosen the bolts of the front and rear bearing blocks.
- 4 Disassemble the bearing blocks and remove the torque tube.
- 5 Reverse procedure to install the torque tube. Ensure that the lubrication hole of the rear bearing block is on the bottom. Lubricate the rear bearing with Aeroshell grease 22C or equivalent (MIL-G-81322D).

27-01-05

Control Rod Length Adjustment

The standard measurements are given in Chapter 27-00-02

- 1 Remove the respective access panels.
- 2 Disconnect one rod end from the respective bellcrank.
- 3 Loosen the check nut.

NOTE

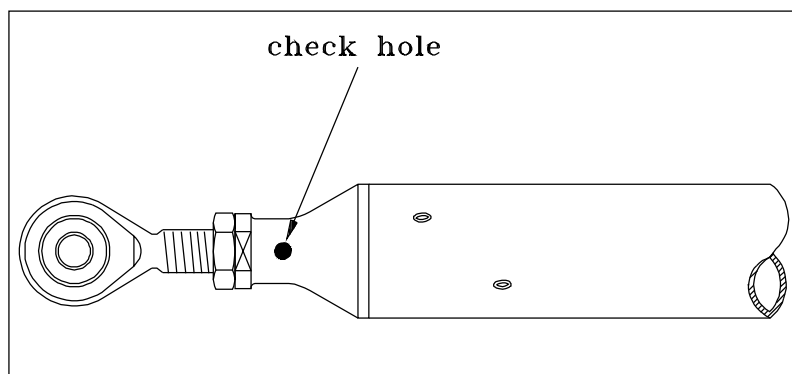
It might be necessary to adjust both rod ends to get the correct length. In this case the free thread of both rod ends should have the same length.

IMPORTANT

Observe that the rod ends joined to the rocker type bellcrank should be adjusted long enough not to obstruct the travel.

IMPORTANT

Ensure that the threaded rod is visible in the check hole (Figure 9) in any case.



*Control Rod Check Hole
Figure 9*

- 4 Turn the rod end in the desired direction to change the length.
- 5 Ensure that the rod end is in proper alignment with the respective control lever and tighten the check nut.
- 6 Reinstall the control rod per Chapter 27-01-01.
- 7 Ensure that the control rods don't jam when the control sticks are moved between the extreme positions.

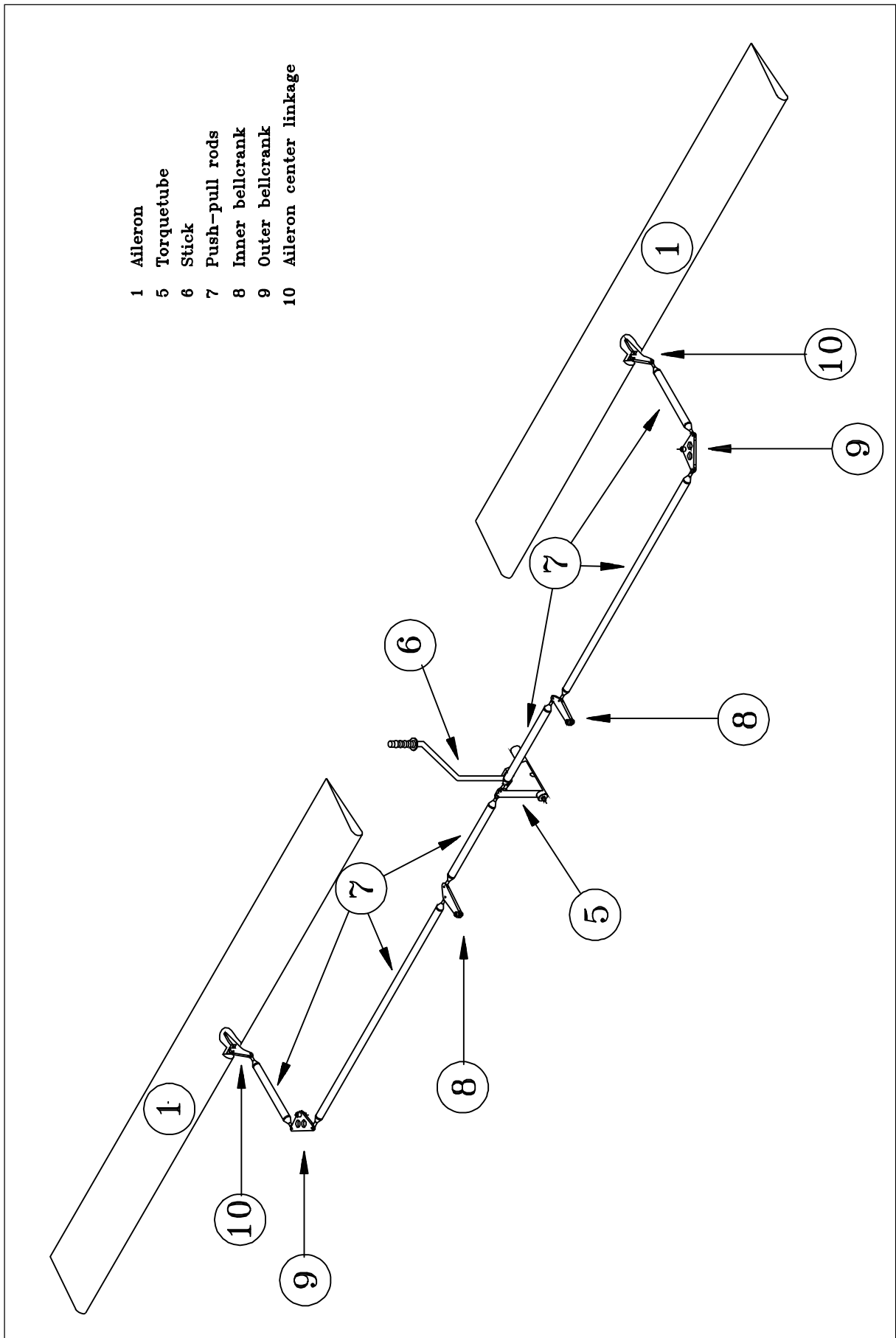
27-10-00

AILERONS

(Refer to Figure 10) The aileron (1) is direct mechanical linked to the control stick (6) by the aileron center linkage (10) with spade arm, push-pull rods (7), bellcranks (8-9) and the torque tube (5). The bell cranks have two sealed ball bearings. Each aileron is mounted at three points in spherical bearings pressed into aluminium hinge arms. For lightning protection reason each hinge arm is grounded to the corresponding attachment bracket at the aileron by bonding leads. The rod end bearings of the push-pull rods located in the wing are also interconnected by bonding leads. The travel stops are located at the torque tube.

To reduce pilot's hand forces the hinge line of the ailerons is positioned at 25% of the aileron chord at the root and 21,5% at the tip. Furthermore, the ailerons are equipped with spades. To prevent flutter the ailerons are mass balanced in the overhanging leading edge.

Two access panels are located at the bottom surface of each side of the wing.



*Aileron Control
Figure 10*

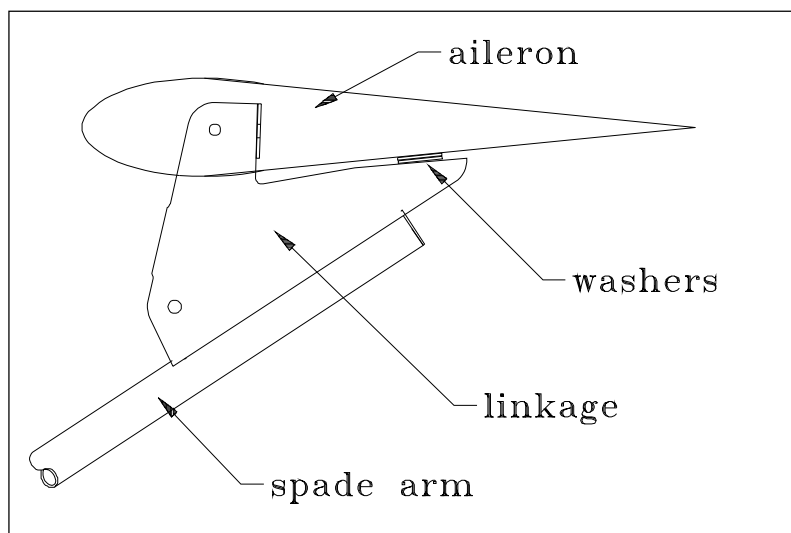
27-11-00

MAINTENANCE PRACTICES

27-11-01

Aileron Removal/Installation

- 1 Disconnect the actuator rod from the aileron center linkage.
- 2 Disassemble the spade if necessary observing the quantity and location of washers.
- 3 Loosen the hinge bolts and the ground bonding leads and remove the bolts.
- 4 Install in reverse sequence of removal. Ensure that the spade is installed with the same quantity and location of washers. Observe aileron to linkage connection (refer to Figure 11) and spade to mounting plate connection (refer to Figure 13). From Serial No. 9 the washers of the aileron to linkage connection have been omitted. Also observe the second Note of Chapter 27-01-00.

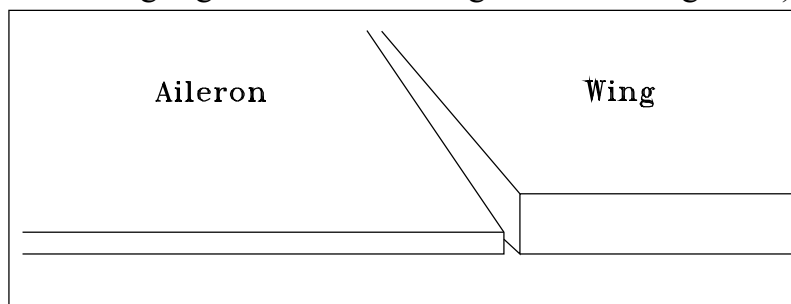


*Aileron to Linkage Connection
Figure 11*

27-11-02**Aileron Rigging**

Before beginning any adjustments inspect control rods, levers and hinges for signs of wear or damage, check if the control rod lengths correspond with the measurements given in Chapter 27-00-02. If necessary replace parts and correct lengths per Chapter 27-01-05.

- 1 Secure the control stick in the neutral position.
- 2 Check if the control rods connecting the torque tube and the inner wing bellcranks have correct length (Refer to Chapter 27-00-02).
- 3 Adjust length if necessary per Chapter 27-01-05.
- 4 Check if the ailerons are in 0°-position (The trailing edge bottom of the aileron is in alignment with the trailing edge bottom of the wing as shown in Figure 12).



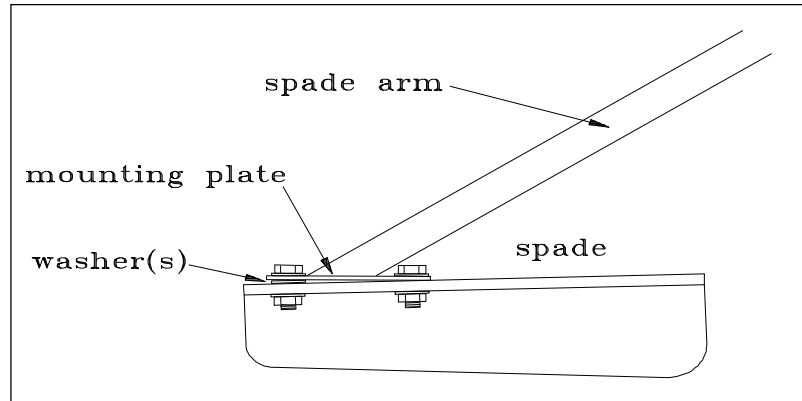
*Trailing Edge Alignment
Figure 12*

- 5 If necessary adjust the length of the control rods connecting the aileron center linkage to the outer wing bellcrank per Chapter 27-01-05.
- 6 Check if the left aileron travel is within the given tolerances (up/down 30°, ±2°). Use a conventional protractor.
- 7 Adjust the travel stops if necessary.
- 8 Follow step 6 for the right aileron. If the travel of the right aileron exceeds the given tolerances, contact the manufacturer.
- 9 Check if the movement of the control sticks is free over the whole travel range and check if the control stick travel is symmetrically to each side. If it is not contact the manufacturer.

27-11-03

Spade Rigging

For roll trim the spade rigging angle of incidence has to be changed. Insert washer(s) between the spade and the mounting plate (refer to Figure 13). For example: When the aircraft rolls to the left, insert washer(s) at the front attachment bolt of the right spade. (From Serial N° 29 even spades are used).



Spade Rigging
Figure 13

27-20-00

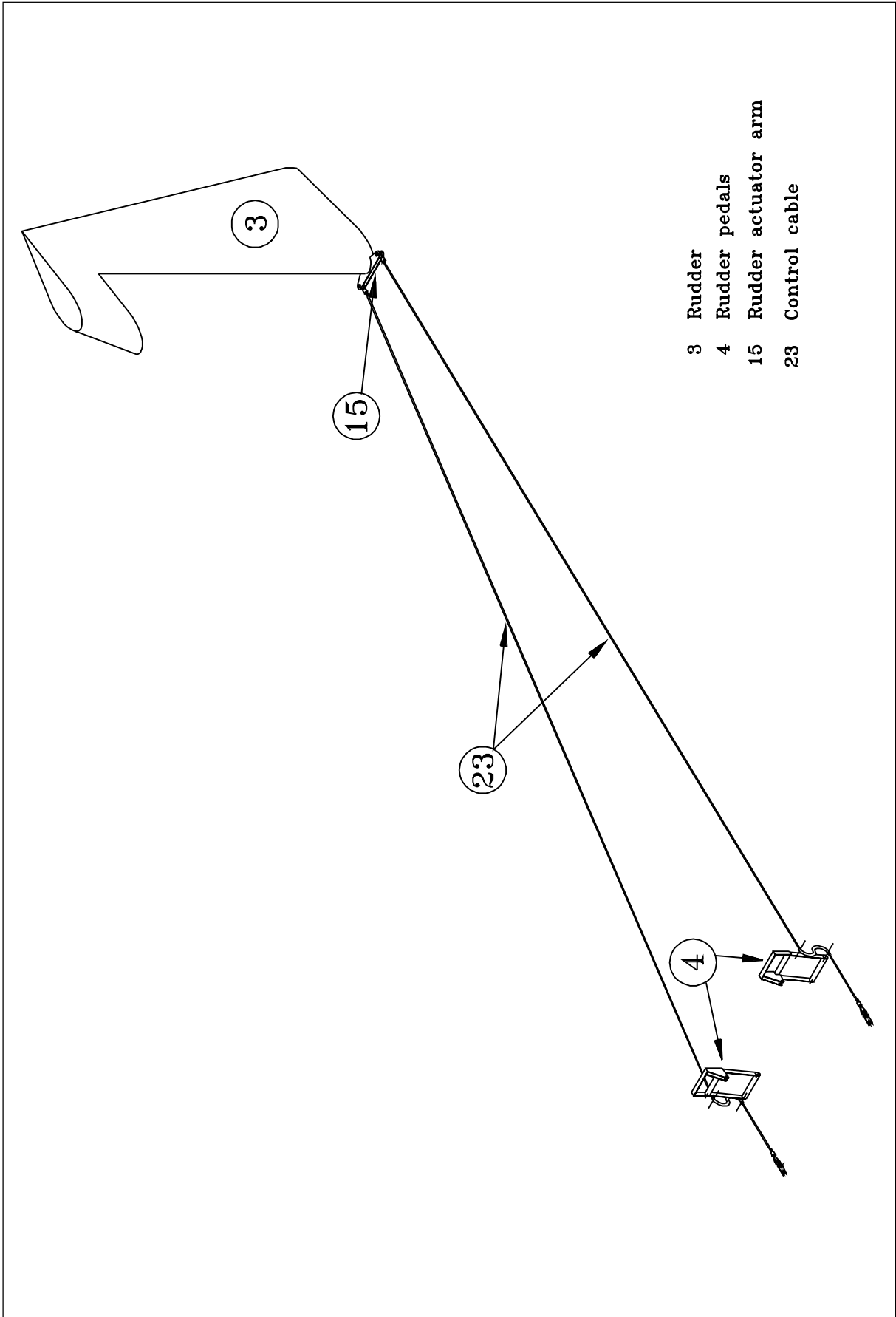
RUDDER

(Refer to Figure 14) The rudder pedals (4) are connected via a cable system (23) to the bottom hinge bellcrank (15). The cables are guided by fairleads. Pedal retracting springs keep the cables under tension when they are not operated. Adjustment is made by an electrical actuator. The rudder (3) is mounted at three points in spherical bearings pressed into a aluminium hinge resp. into aluminium hinge arms. For lightning protection reason each hinge (arm) is grounded to the corresponding attachment bracket at the rudder by bonding leads. A travel stop plate is located at the bottom hinge bracket. A second safety stop is located at the rudder pedal bearing having the only purpose of protecting the lower brake system fitting in case of rudder cable failure.

IMPORTANT

This second stop must not be reached under normal operation conditions. Missalignment or excessive elongation of the rudder cables will result in misuse of this second stop and a subsequent overload of the rudder bearing. An subsequent inflight failure of the footrest could occur.

To prevent flutter the rudder is mass balanced. The mass balance weight of the rudder is installed in the rudder horn.



*Rudder Control
Figure 14*

27-21-00

MAINTENANCE PRACTICES

IMPORTANT

Perform checks 10-11 of "Flight Controls" presented in Chapter 05-20-04 after each maintenance work affecting the rudder control cables.

27-21-01

Rudder Removal/Installation

- 1 Disconnect the rudder control cables from the bottom hinge bellcrank.
- 2 Loosen the hinge bolts and the ground bonding leads and remove the bolts.
- 3 Install in reverse sequence of removal. Observe the second Note of Chapter 27-01-00.

27-21-02

Bottom Hinge Bracket Removal/Installation

- 1 Remove the rudder per Chapter 27-21-01.
- 2 Loosen the attachment bolts.
- 3 Remove the bottom hinge bracket with the travel stop plate.
- 4 Install in reverse sequence of removal.

27-21-03

Bottom Hinge Bellcranks Removal/Installation

- 1 Remove the rudder per Chapter 27-21-01.
- 2 Loosen the attachment bolts.
- 3 Remove the bottom hinge bellcranks.
- 4 Install in reverse sequence of removal.

27-21-04

Control Cable Removal

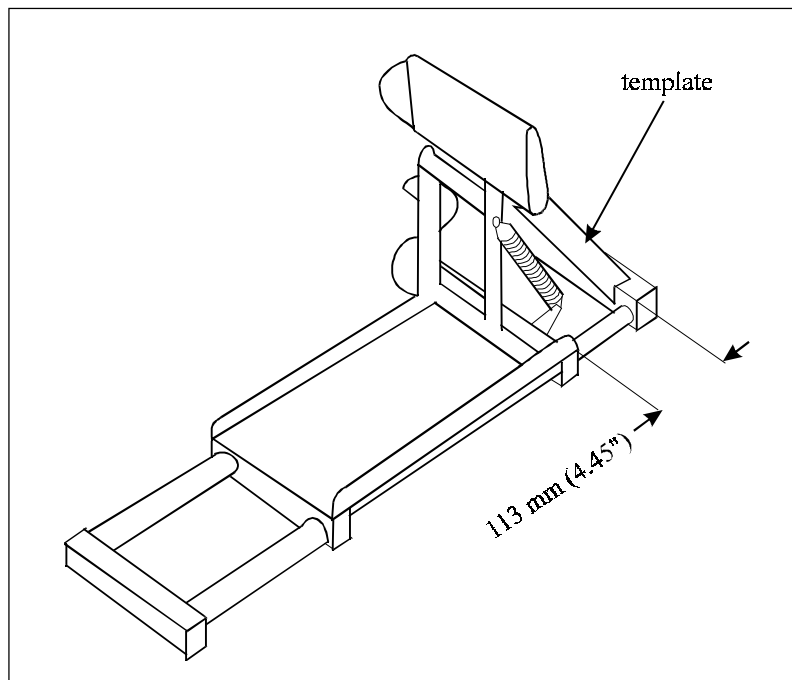
- 1 Remove the respective access panels.
- 2 Remove the front cable attachment bolts.
- 3 Remove the cable to rudder bellcrank attachment bolts.
- 4 Cut the control cable behind the front shrinking sleeve.
- 5 Remove the control cable by pulling it out to the back.

27-21-04

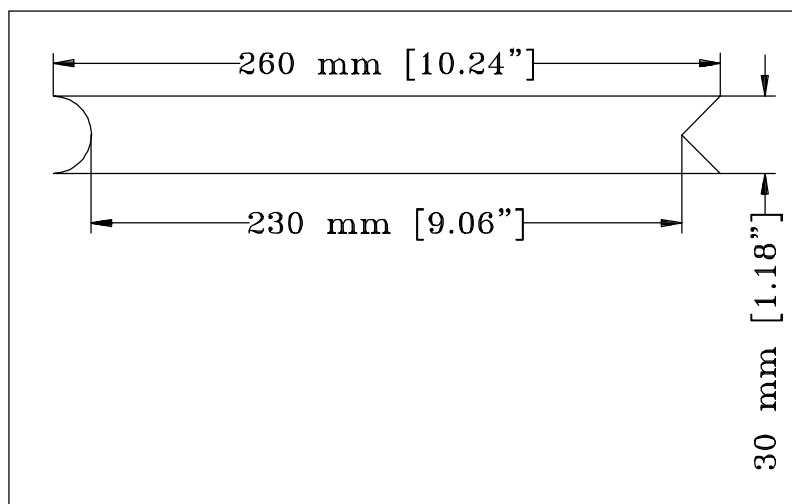
Control Cable Installation

Use only control cables manufactured by EXTRA FLUGZEUGBAU GmbH. Those cables are prepared for simply installation.

- 1 Remove the respective access panels per Chapter 51.
- 2 Move the pedal adjustment in a position as shown in Figure 15.
- 3 Fix pedals in 90° position using templates as shown in Figure 16.
- 4 Secure the rudder in 0°-position.
- 5 Slip 110 mm teflon protective hose on the control cable up to the pre-assembled control cable end.
- 6 Mount the shackle of the pre-assembled control cable end to the front cable attachment point.
- 7 Thread the other end through S-shaped tube at the pedal, the fairleads and the hole in the fabric to the tail.
- 8 Slip 600 mm teflon protective hose on the control cable end. The protective hose should extend to the first fairlead inside the fuselage.
- 9 Pre-install the LN9355-06-20 bolt, the sleeve, the 3 DIN 125 M6 outer washers (1 washer above, 2 washers below), the 4 DIN 125 M8 inside washers (2 washer above, 2 washers below), the LN9348-06 stop nut, and the thimble to the bottom hinge bellcrank.



Pedal Adjustment Position
Figure 15



Pedal Fix Template
Figure 16

- 10 Slip the 771095 shrinking sleeve and the NICOPRESS (National Telephone Supply Co., Cleveland Ohio) 18-3-M sleeve on the cable end.
- 11 Move the cable around the thimble and tighten.

IMPORTANT

Clamping has to be performed in accordance with the Service Bulletin 300-1-93 and the Instruction No. 32 of the National Telephone Supply Co., Cleveland Ohio.

- 12 Clamp the sleeve. Consider to let a distance of 1 mm between the thimble and the sleeve.

- 13 Cut the free end of the cable (20 mm behind the sleeve).
- 14 Move the teflon protective hose up to the sleeve and fix with an appropriate adhesive.
- 15 Slip the shrinking sleeve on the sleeve and the end of the teflon hose and heat up with a heat gun.
- 16 Follow the steps 5 to 15 for the LH control cable.
- 17 Remove rudder and rudder pedals securing devices.
- 18 Check free travel of rudder.

27-21-05

Fairlead Removal/Installation

- 1 Remove the fairlead retaining clip.
- 2 Pull the fairlead halves out of the sleeve.
- 3 Reverse procedure to install the fairlead.

27-21-06

Rudder Rigging

Inspect the control cables, the fairleads and the bottom hinge assembly (with the travel stop plate) for signs of wear or damage before beginning any adjustments. Replace parts if necessary.

- 1 Secure the rudder pedals following step 2 and 3 of Chapter 27-21-04.
- 2 Check if the rudder is in 0°-position. (Rudder horn leading edge in alignment with the leading edge of the vertical stabilizer.)
- 3 Replace the control cables and adjust the length per Chapter 27-21-04 if necessary.
- 4 Check if the rudder travel is within the given tolerances (left/right 30°, ±2°).
- 5 If the rudder travel is out of limits, contact the manufacturer for advice.

27-30-00

ELEVATOR AND TAB

Refer to Figure 17. The control movements are transferred from the control stick (6) to the elevator (2) by push-pull rods (7) and bellcranks (11, 12). The bell cranks have two sealed ball bearings. The elevator is mounted at five points in spherical bearings pressed into aluminium hinge arms. For lightning protection reason each hinge arm is grounded to the corresponding attachment bracket at the elevator by bonding leads. The travel stops are located at the torque tube.

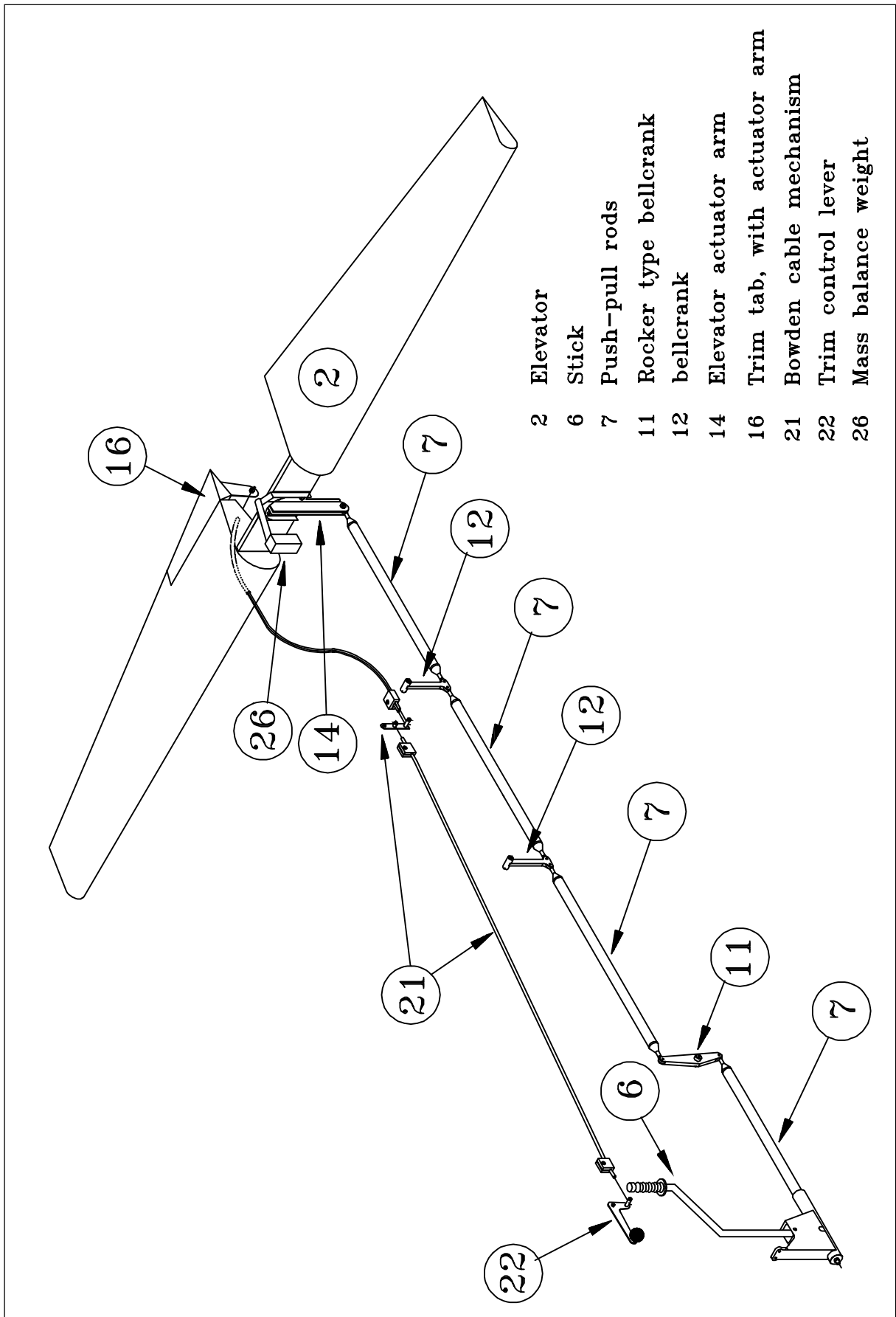
The mass balance weight (26) is mounted on the center bracket of the elevator extending into the fuselage.

An access panel is located at the right side of the rear fuselage.

Trim Tab

The elevator trim control lever (22) is located at the right side in the cockpit. Pitch trim is done by means of the trim tab (16) on the right elevator trailing edge operated by a bowden cable mechanism (21). The trim tab is mounted by two piano hinges.

The trim tab is not mass balanced.



*Elevator and Trim Tab Control
 Figure 17*

27-31-00

MAINTENANCE PRACTICES

27-31-01

Elevator Removal/Installation

Before the removal of the elevator, the vertical stabilizer has to be disassembled.

- 1 Remove the respective access panels.
- 2 Remove the rudder per Chapter 27-21-01
- 3 Remove the vertical stabilizer per Chapter 55-21-01.
- 4 Loosen the bowden cables from the trim tab. If a replacement is necessary order new cable.
- 5 Disconnect the elevator actuator arm from the push-pull rod.
- 6 Loosen the hinge bolts and the ground bonding leads and remove the bolts.
- 7 Install in reverse sequence of removal. Observe the second Note of Chapter 27-01-00.

27-31-02

Trim Tab Removal/Installation

- 1 Loosen bowden cables. If a replacement is necessary order new cable.
- 2 Disconnect the safety cotter pins and remove the hinge pins.
- 3 Install in reverse sequence of removal.

27-31-03

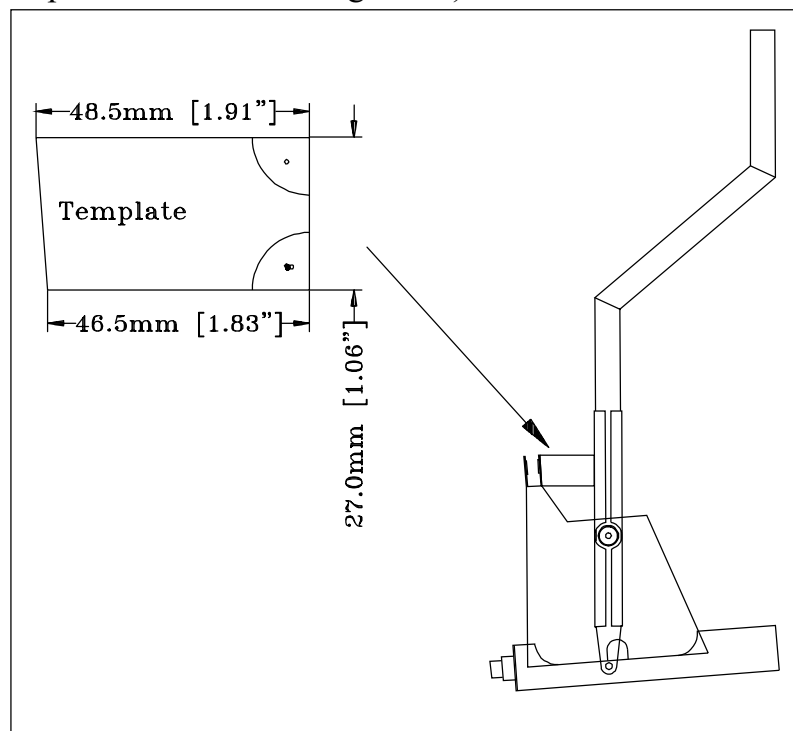
Elevator Rigging

IMPORTANT

- 1 Remove the respective access panels.

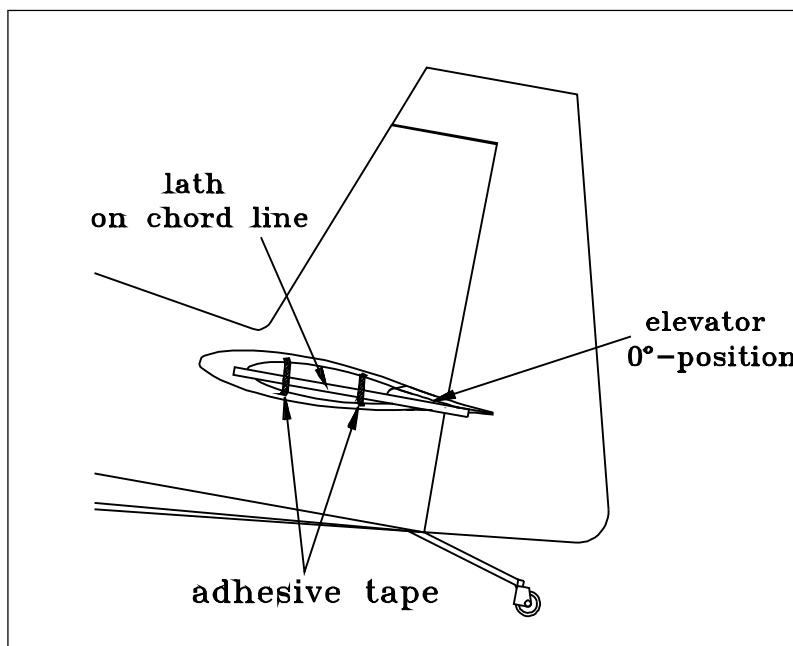
Before beginning any adjustments, inspect control rods, levers and hinges for signs of wear or damage and check if control rod lengths correspond with the measurements given in Chapter 27-00-02. Replace parts and correct lengths if necessary per Chapter 27-01-05.

- 2 Remove the control stick leather protection cuff.
- 3 Secure the control stick in the neutral position. (Control stick perpendicular to the upper longerons. Use a template like shown in Figure 18).



*Neutral Position of the Control Stick
Figure 18*

- 4 Check if the elevator is in 0°-position. (Trailing edge on chord line. Fasten a lath to the tip rib of the horizontal tail per Figure 19 using adhesive tape.)



Lath on Chord Line
Figure 19

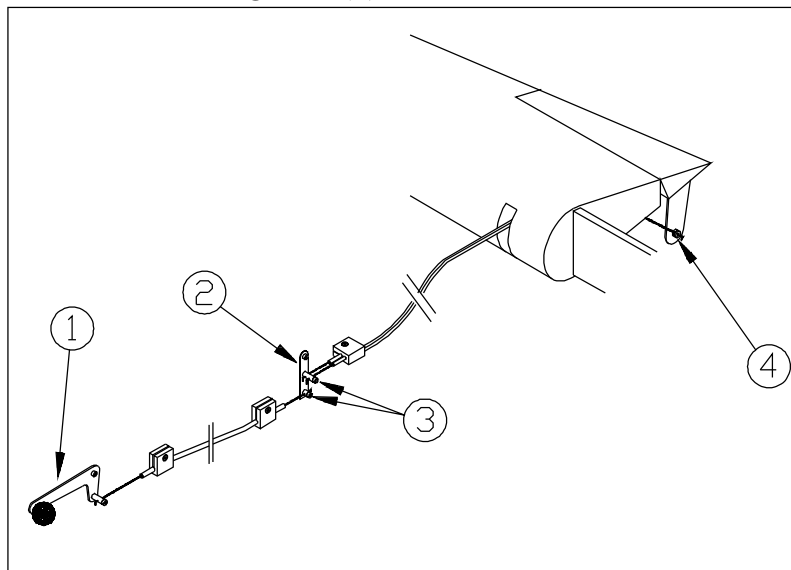
- 5 If necessary adjust the length of the middle tail control rod per Chapter 27-01-05.
- 6 Check if the elevator travel is within the given tolerances (up/down 25° , $\pm 2^\circ$). Use a conventional protractor.
- 7 Adjust the travel stops if necessary.
- 8 Check if the control stick travel is symmetrically.
- 9 If it is not, contact the manufacturer.

27-31-04

Trim Tab Rigging

Refer to Figure 20.

- 1 Secure the control stick in normal position.
- 2 Secure the trim control lever (1) in horizontal position.
- 3 Adjust the fuselage bellcrank (2) in middle position. Use new selflocking nuts (3).



Trim Tab Rigging
Figure 20

- 4 Bring the trim tab in 0°-position. Use new selflocking nuts (4).
- 5 Bring the trim lever in extreme positions and check if trim tab travel is $\pm 15^\circ$ (tolerance $\pm 2^\circ$). If it is not, check free travel of the trim levers, fuselage bellcrank and bowden cables.