

Chapter 27

Flight Controls

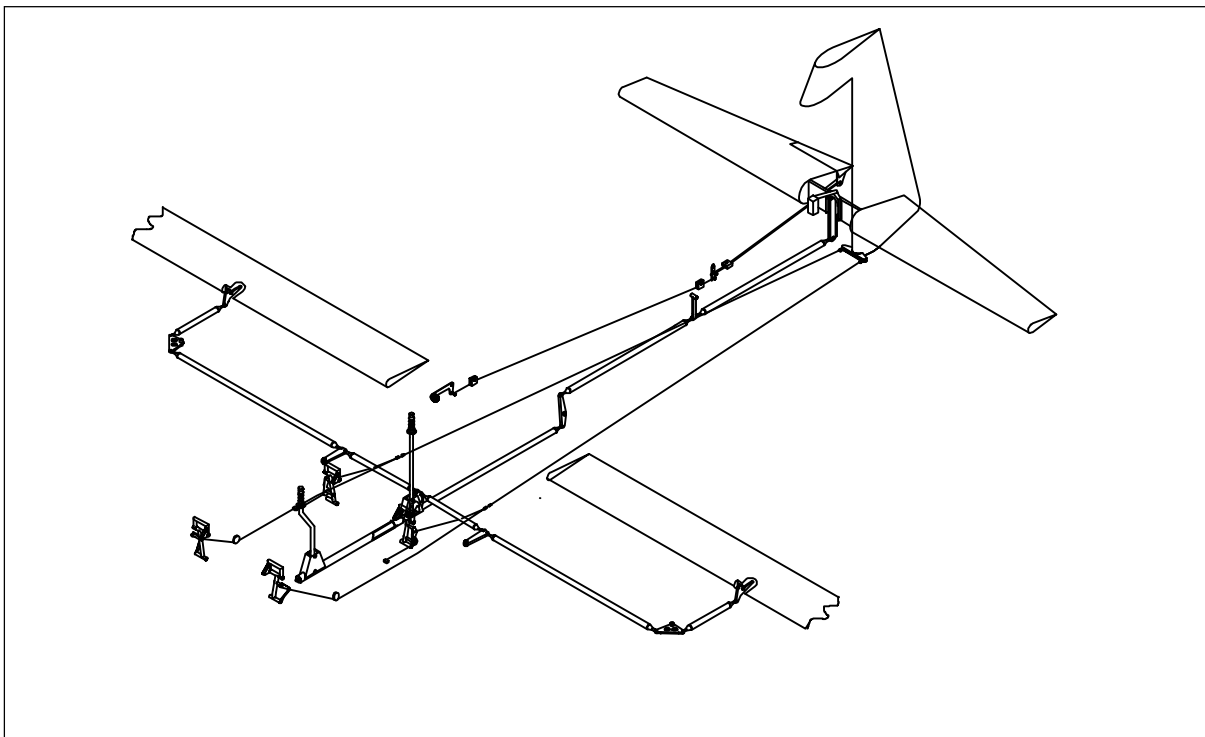
TABLE OF CONTENTS

Chapter	Title	
27-00-00	GENERAL	3
27-00-01	Free Play in the Control System	3
27-00-02	Control Rod Lengths	5
27-01-00	MAINTENANCE PRACTICES	6
27-01-01	Control Rod Removal/Installation	7
27-01-02	Bellcrank Removal/Installation	7
27-01-03	Front Control Stick Removal/Installation	8
27-01-04	Rear Control Stick Removal/Installation	9
27-01-05	Torque Tube Removal/Installation	10
27-01-06	Control Rod Length Adjustment	10
27-10-00	AILERONS	12
27-11-00	MAINTENANCE PRACTICES	14
27-11-01	Aileron Removal/Installation	14
27-11-02	Aileron Rigging	14
27-11-03	Spade Rigging	16
27-20-00	RUDDER	17
27-21-00	MAINTENANCE PRACTICES	19
27-21-01	Rudder Removal/Installation	19
27-21-02	Bottom Hinge Bracket Removal/Installation	19
27-21-03	Bottom Hinge Bellcranks Removal/Installation	19
27-21-04	Control Cable Removal	20
27-21-05	Control Cable Installation	20
27-21-06	Fairlead Removal/Installation	22
27-21-07	Rudder Rigging	22
27-30-00	ELEVATOR AND TAB	24
27-31-00	MAINTENANCE PRACTICES	26
27-31-01	Elevator Removal/Installation	26
27-31-02	Trim Tab Removal/Installation	26
27-31-03	Elevator Rigging	26
27-31-04	Trim Tab Rigging	28

27-00-00

GENERAL

(Refer to Figure 1) The EXTRA 200 is standard equipped with full dual primary flight controls including conventional control sticks and adjustable rudder pedals. The control surfaces are operated by a direct mechanical linkage. The control surface deflections are shown in Figure 2.



*Controls
Figure 1*

27-00-01

Free Play in the Control System

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

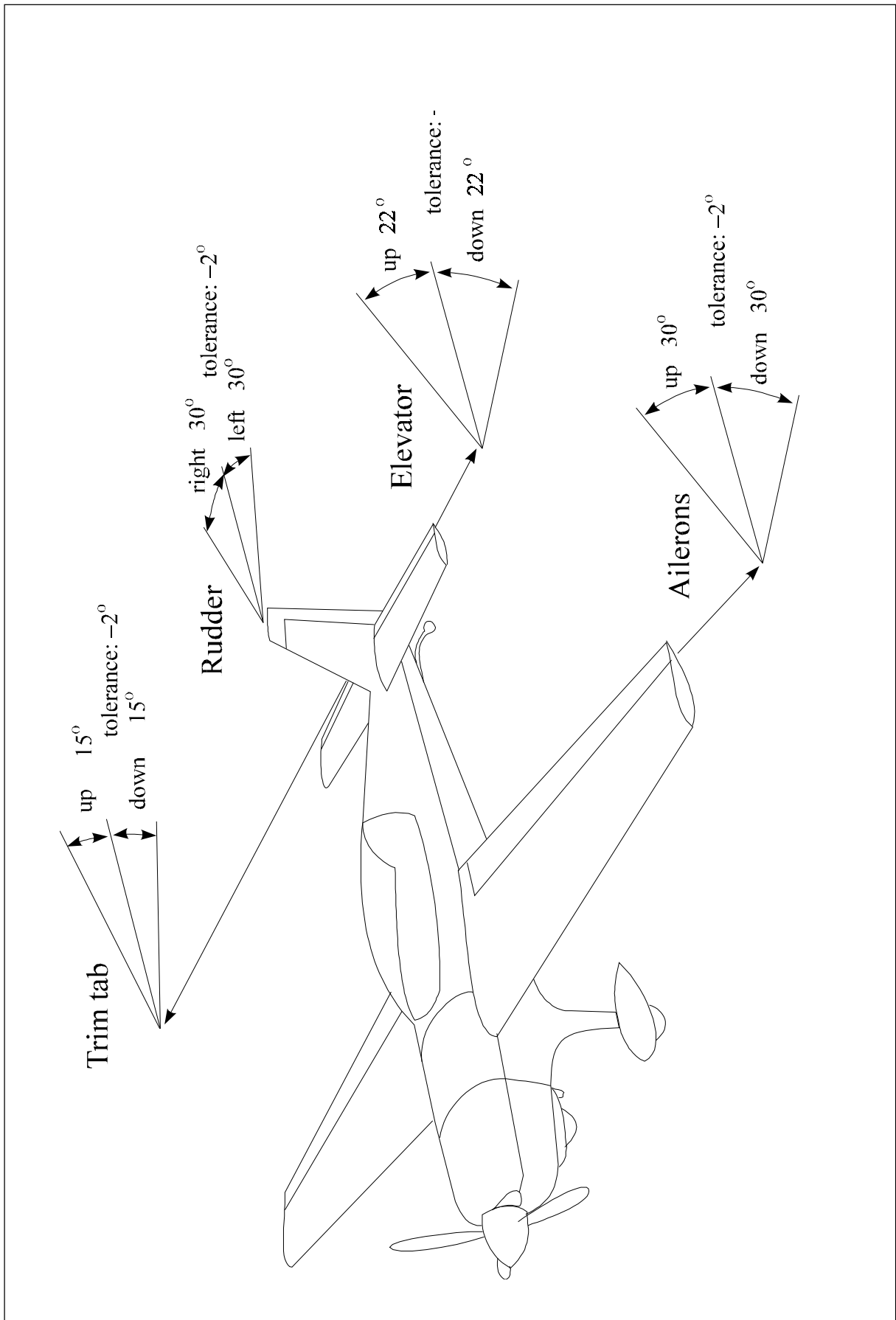
Aileron: $\pm 1 \text{ mm}^*$

Elevator: $\pm 1 \text{ mm}^*$

Trim tab: $\pm 2 \text{ mm}^*$

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

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

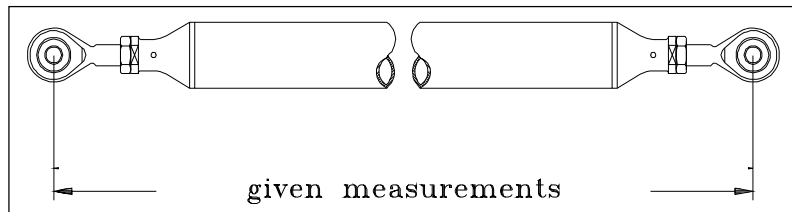


Control Surface Deflections
Figure 2

27-00-02

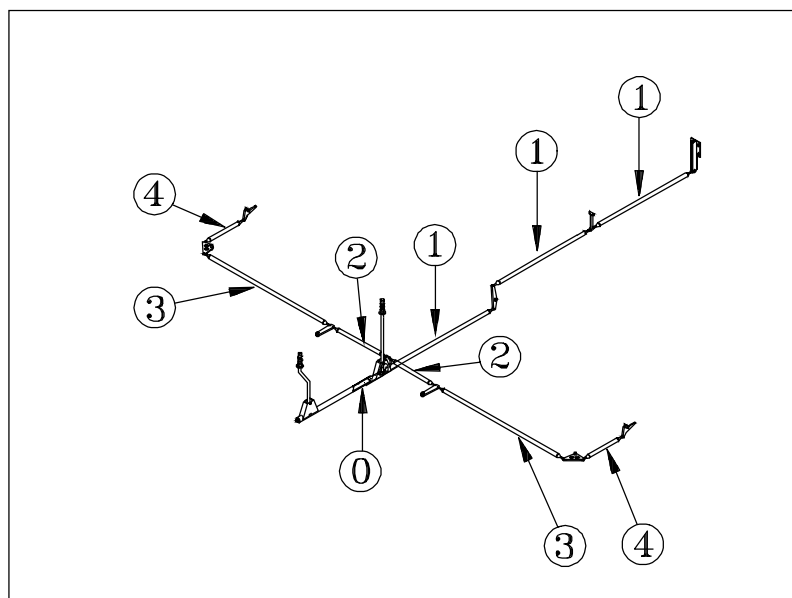
Control Rod Lengths

The measurements given in this chapter refer to the distances between the centers of the rod end bearings resp. of the clevis head (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

* *clevis head at the rear control stick*

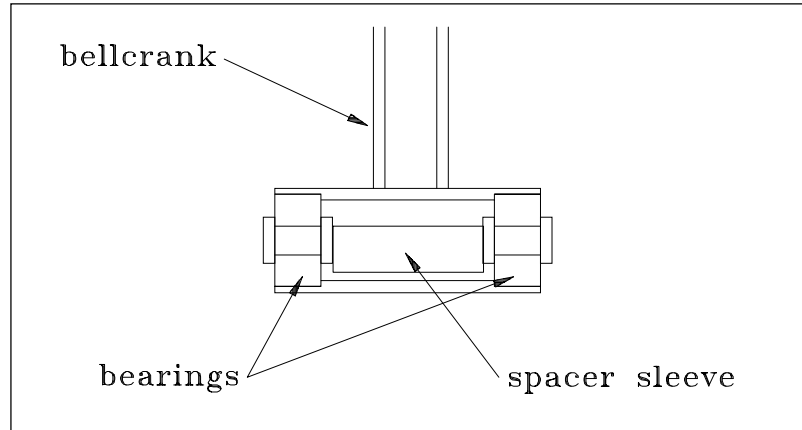
Control rod	Measurements
0*	801 mm
1	932 mm
2	520 mm
3	1884 mm
4	420 mm

27-01-00

MAINTENANCE PRACTICES

NOTE

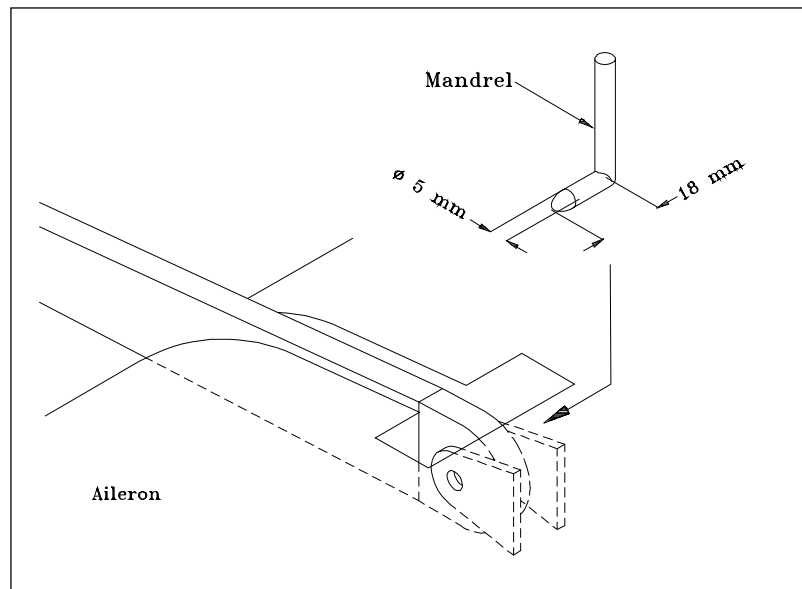
When installing a bellcrank or control stick the spacer sleeve inside the bearing could be displaced as shown in Figure 5. Use a mandrel to adjust the spacer sleeve.



*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 27-01-06.

1 Remove the respective access panels.

NOTE

In case of removal of the control rod connecting the control sticks also observe the instructions given in the Chapters 27-01-03 and -04.

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

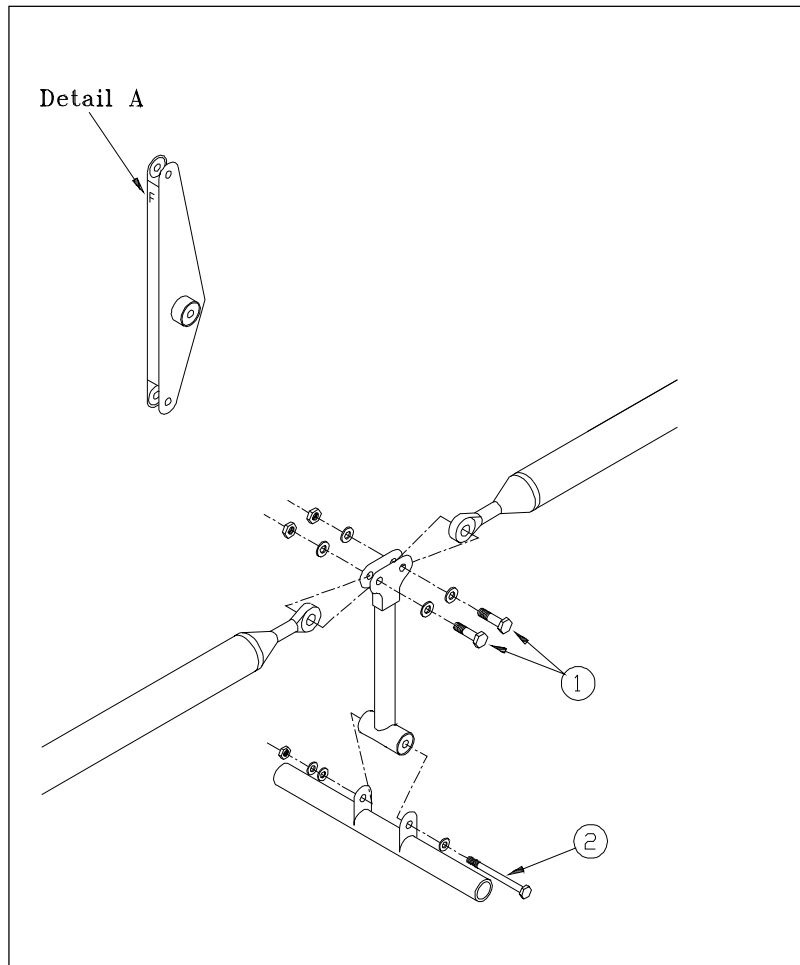
1 Remove the respective access panels.

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).



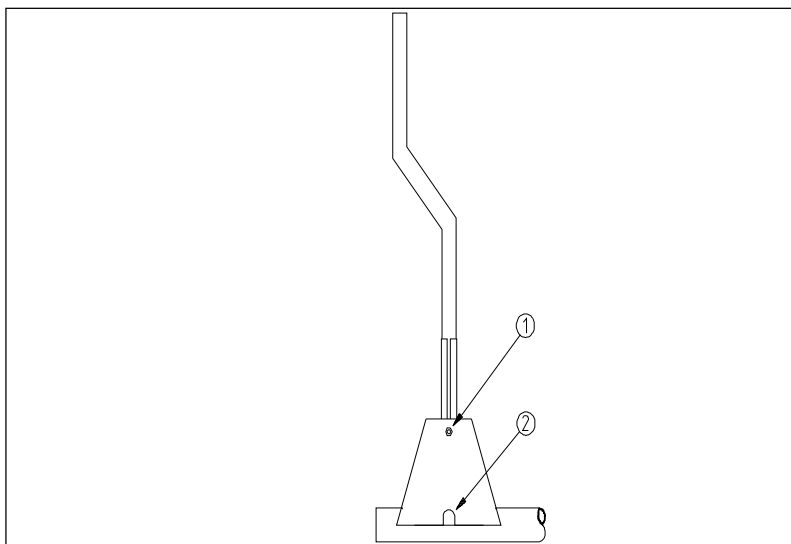
*Control Levers and Rods Removal/Installation
Figure 7*

27-01-03

Front Control Stick Removal/Installation

Refer to Figure 8.

- 1 Remove front seat per Chapter 25-15-01.
- 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 within the mounting hole area (2).



Front 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

Rear Control Stick Removal/Installation

- 1 Remove rear seat per Chapter 25-15-02.
- 2 Disconnect the electrical wiring.
- 3 Remove the control stick attachment bolt.
- 4 Use the control stick to move the control rod attachment bolt within the mounting hole area (2, Figure 8) and disconnect the stick from the control rods per Chapter 27-01-01.
- 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.

27-01-05

Torque Tube Removal/Installation

- 1 Remove the respective access panels.
- 2 Remove the control sticks and rods from the torque tube per Chapters 27-01-01 and 27-01-03/04.
- 3 Remove the bolt of the rear torque tube bearing.
- 4 Push torque tube some centimeters to the rear to remove pin from the front bearing and remove the torque tube.
- 5 Reverse procedure to install the torque tube. Consider to secure the castle nut of the rear torque tube bearing. Lubricate the bearings with Aeroshell grease 22C or equivalent (MIL-G-81322D).

27-01-06

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

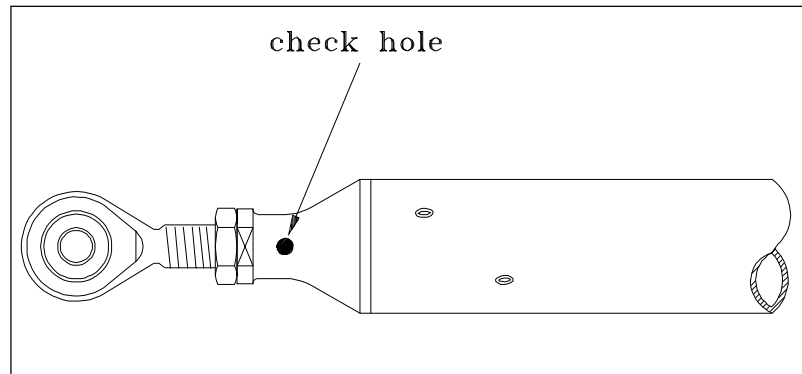
It might be necessary to adjust both rod ends to get the correct length. In this case the free thread of both rod ends should have the same length.

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.

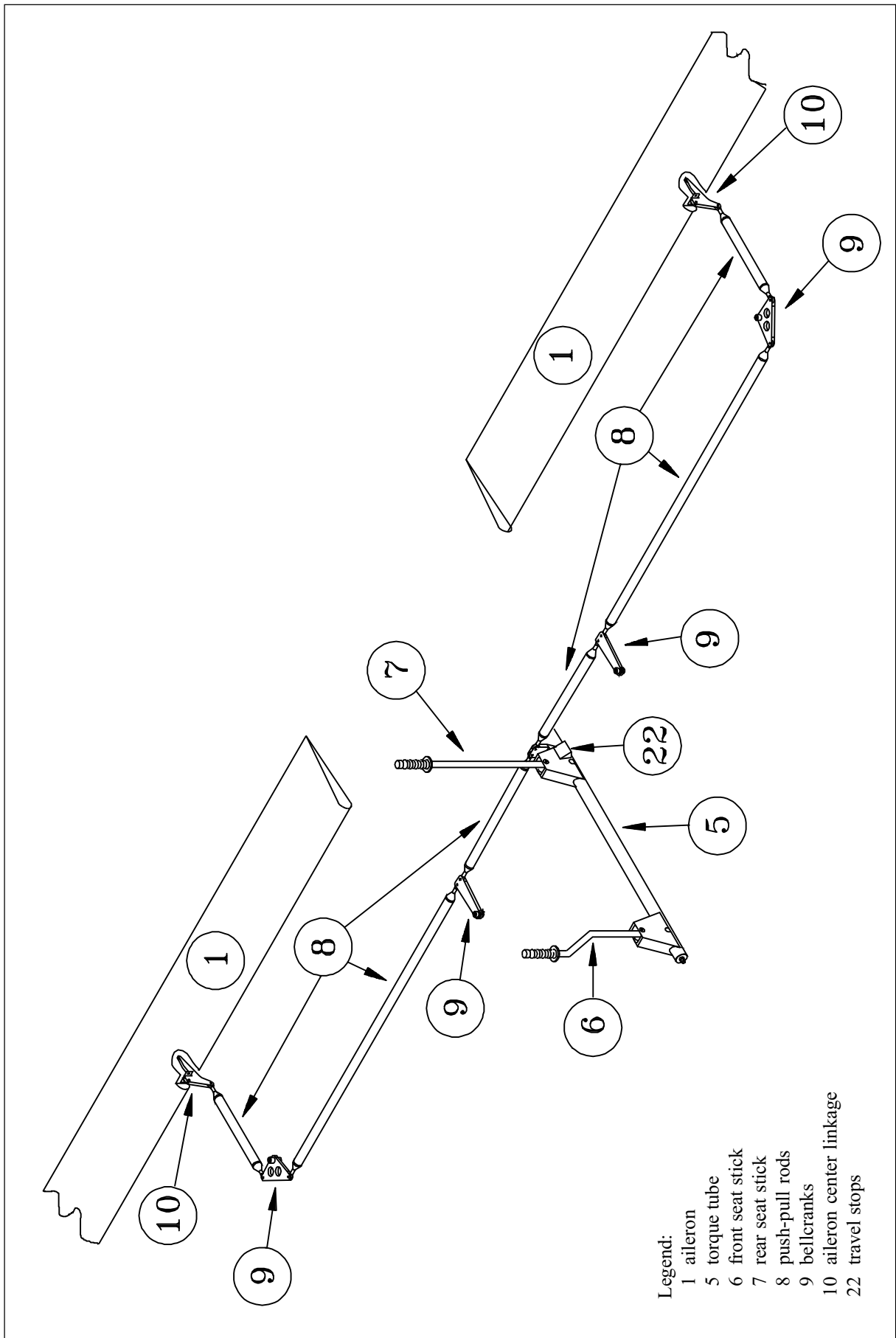
27-10-00

AILERONS

(Refer to Figure 10) The aileron (1) is direct mechanical linked to the control sticks (6, 7) by the aileron center linkage (10) with spade arm, push-pull rods (8), bellcranks (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 (22) are located at the torque tube next to the rear control stick (7).

To reduce pilot's hand forces the hinge line of the ailerons is positioned at 20 - 25% of the aileron chord. 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

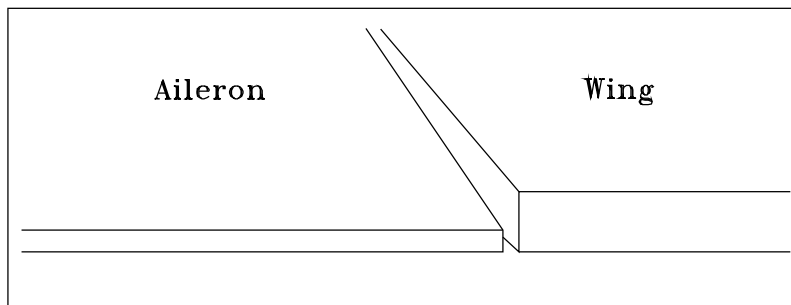
- 1 Disconnect the actuator rod from the aileron center linkage.
- 2 Disassemble the spade if necessary observing the quantity and location of washers.
- 3 Loosen the hinge bolts and the ground bonding leads and remove the bolts.
- 4 Install in reverse sequence of removal. Ensure that the spade is installed with the same quantity and location of washers (refer to Figure 12). Observe the second Note of Chapter 27-01-00.

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 27-01-06.

- 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 the correct length (Refer to Chapter 27-00-02).
- 3 Adjust length if necessary per Chapter 27-01-06.
- 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 11).



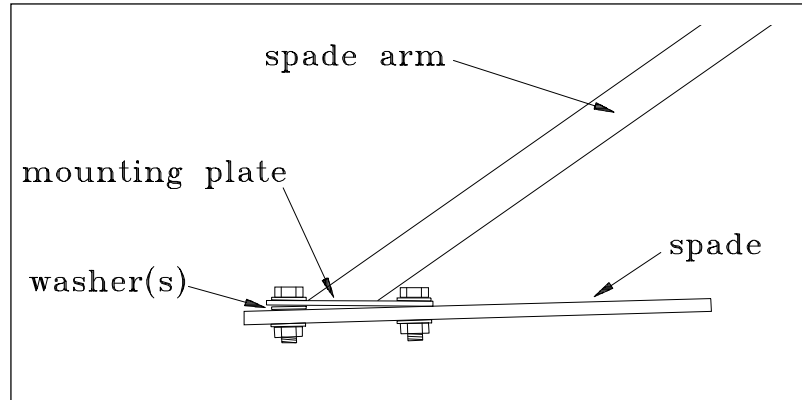
*Trailing Edge Alignment
Figure 11*

- 5 If necessary adjust the length of the control rods connecting the aileron center linkage to the outer wing bellcrank per Chapter 27-01-06.
- 6 Check if the left aileron travel is within the given tolerances. Use a conventional protractor.
- 7 Adjust the travel stops if necessary.
- 8 Follow step 6 for the right aileron.
- 9 If the travel of the right aileron exceeds the given tolerances, contact the manufacturer.
- 10 Check if the movement of the control sticks is free over the whole travel range and check if the rear 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 12). For example: When the aircraft rolls to the left, insert washer(s) at the front attachment bolt of the right spade.



Spade Rigging
Figure 12

27-20-00

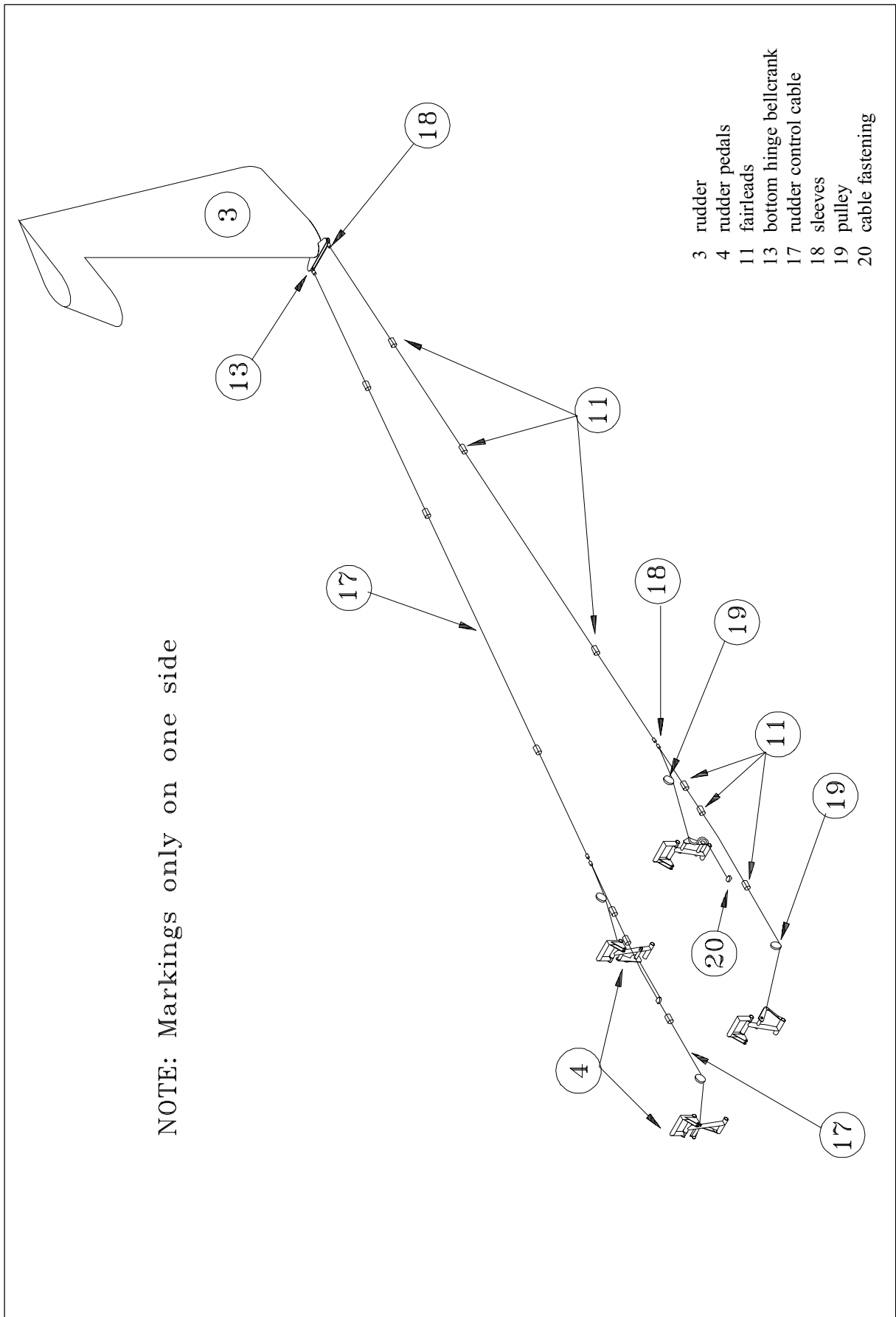
RUDDER

(Refer to Figure 13) The rudder pedals (4) are connected via a cable system (17) to the bottom hinge bellcrank (13). The cables are guided by fairleads (11). Springs keep the cables under tension when they are not operated. Adjustment of the rear pedals is made via multihole rod. 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. A 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 13*

27-21-00

MAINTENANCE PRACTICES

I M P O R T A N T

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 cable to fuselage attachment bolts.
- 3 Remove the cable to rudder bellcrank attachment bolts.
- 4 Cut the control cables behind the front shrinking sleeves and behind the cable to cable connection.
- 5 Remove the control cable parts by pulling out to the back.

27-21-05

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 Secure the rudder (3, Figure 13) in 0°-position.
- 3 Mount the pre-assembled shackle of the longer control cable to the LH cable fastening (20).
- 4 Slip 800 mm teflon protective hose on the control cable.
- 5 Thread the cable through the "S"-shaped tube at the pedal and the pulley (19).
- 6 Adjust rear rudder pedals (4) in rearmost position.
- 7 Let the front end of the protective hose extend to 10 mm in front of the pedal "S"-tube and cut the rear end 10 mm in front of the pulley.
- 8 Slip 2 NICOPRESS (National Telephone Supply Co., Cleveland Ohio) 18-3-M sleeves (18) and a 771095 shrinking sleeve on the control cable.
- 9 Thread the free end of the control cable through the rear fairleads (11) and the hole in the fabric to the tail.

- 10 Slip 600 mm teflon protective hose on the control cable end. The protective hose should extend to the first fairlead inside the fuselage.
- 11 Adjust rear pedals in middle position.
- 12 Fix rear pedals in vertical position (90° relative to the footrest).
- 13 Pre-install the LN9355-06-20 bolt, the DIN 125 M6 washers (2 washers outside, 3 washers inside), the spring clip, the LN 9348 M6 stop nut and the thimble to the bottom hinge bellcrank (also see item 9 on Fig. 3 of Chapter 32).
- 14 Slip the 771095 shrinking sleeve and a NICOPRESS 18-3-M sleeve on the cable end.
- 15 Move the cable around the thimble and stretch the control cable with a force that is equivalent to the tractive effort of the rear pedal retracting spring.

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.

- 16 Consider to let a distance of 1 mm between the thimble and the sleeve and clamp the sleeve.
- 17 Cut the free end of the cable 20 mm in front of the sleeve.
- 18 Slip the shrinking sleeve on the cable end and heat up with a heat gun.
- 19 Remove the pedal securing device.
- 20 Mount the pre-assembled shackle of the shorter control cable to the front pedal.
- 21 Thread the free end of the control cable through the pulley, the front fairleads and the pre-installed NICOPRESS 18-3-M sleeves.
- 22 Fix the front pedal in vertical position (parallel to the firewall).
- 23 Stretch the shorter control cable with a force that is equivalent to the tractive effort of the front pedal retracting spring.

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.

IMPORTANT

To prevent twisting the cables clamp the sleeves in the same plane.

- 24 Consider that the clamping area shall be 30 cm aft the rear pulley and clamp the sleeves.
- 25 Cut the free end of the cable (20 mm behind the sleeve).
- 26 Slip the shrinking sleeve on the rear sleeve and heat up with a heat gun (The front sleeve can be left free for visual control of the cable-to-cable connection).
- 27 Remove the front pedal securing device.
- 28 Follow the steps 3 to 27 for the RH control cable.
- 29 Remove rudder securing devices.
- 30 Check free travel of rudder.

27-21-06

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.

27-21-07

Rudder Rigging

NOTE

Inspect the control cables, the pulleys, 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 in neutral position.
- 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 27-21-05 if necessary.
- 4 Check if the rudder travel is within the given tolerances.
- 5 If the rudder travel is out of limits, contact the manufacturer for advice.

27-30-00

ELEVATOR AND TAB

Refer to Figure 14. The two control sticks (6, 7) are connected by a push-pull rod (8) inside the torque tube (5). The control movements are transferred from the rear control stick (7) to the elevator (2) by push-pull rods (8) and bellcranks (9, 9a). The bellcranks 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 (22) are located at the torque tube.

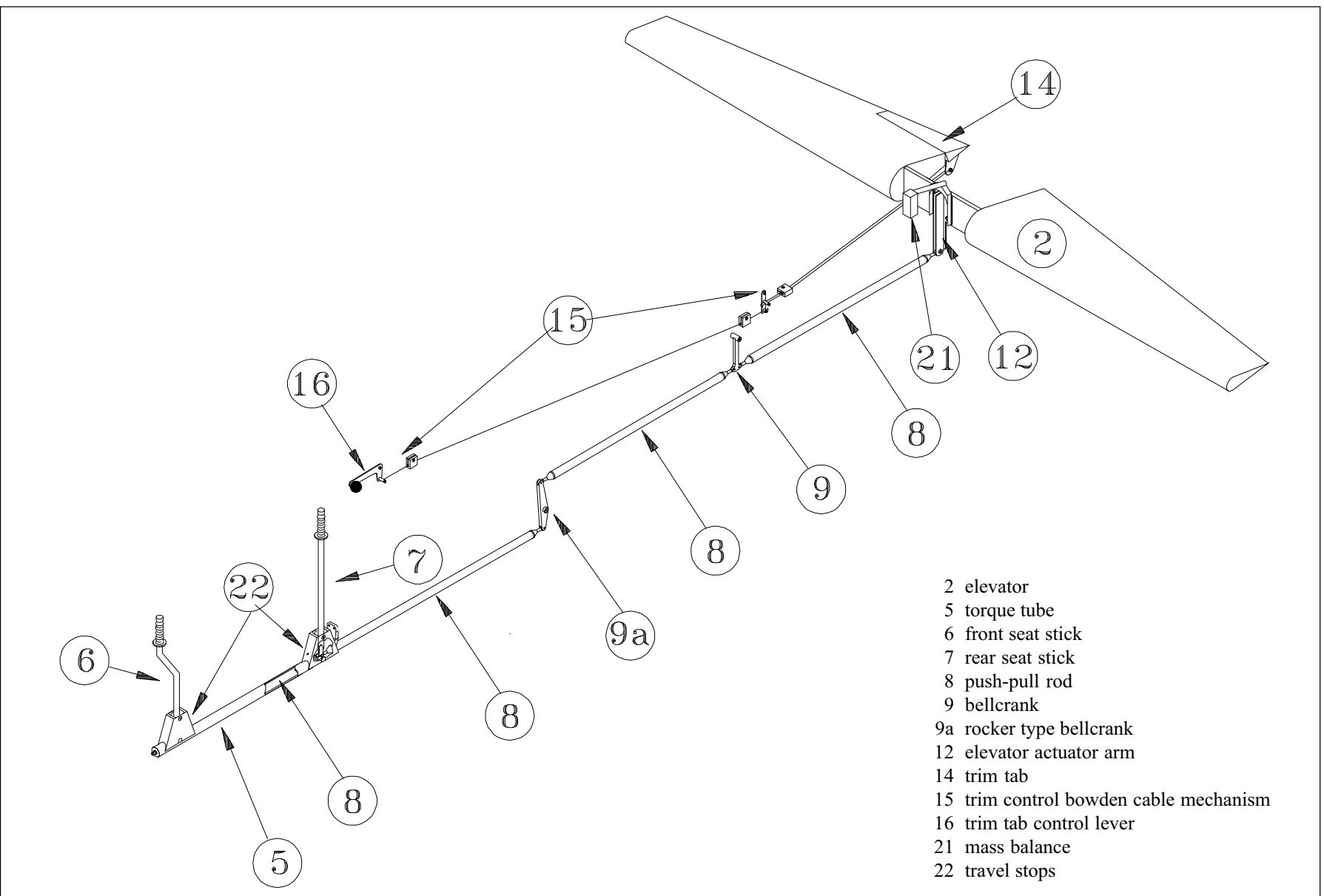
The mass balance weight (21) is mounted on the center bracket of the elevator extending into the fuselage.

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

Trim Tab

The elevator trim control lever (16) is located at the right side in the rear cockpit. Pitch trim is done by means of the trim tab (14) on the right elevator trailing edge operated by a bowden cable mechanism (15). The trim tab is mounted by a piano hinge.

The trim tab is not mass balanced.



*Elevator and Trim Tab Control
Figure 14*

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 pin and remove the hinge pin.
- 3 Install in reverse sequence of removal and use a new cotter pin.

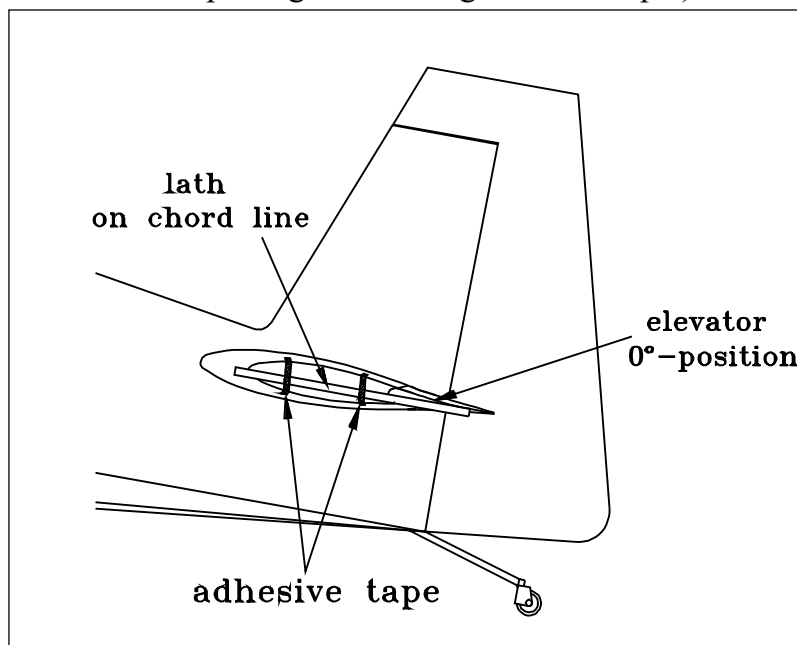
27-31-03

Elevator Rigging

IMPORTANT

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 27-01-06.

- 1 Remove the canopy and the main fuselage cover per Chapter 51 and the seats per Chapter 25.
- 2 Secure the rear control stick in the neutral position. (Control stick parallel to the vertical steel tube carrying the trim tab control lever resp. perpendicular to the upper longerons).
- 3 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 15 using adhesive tape.)



*Lath on Chord Line
Figure 15*

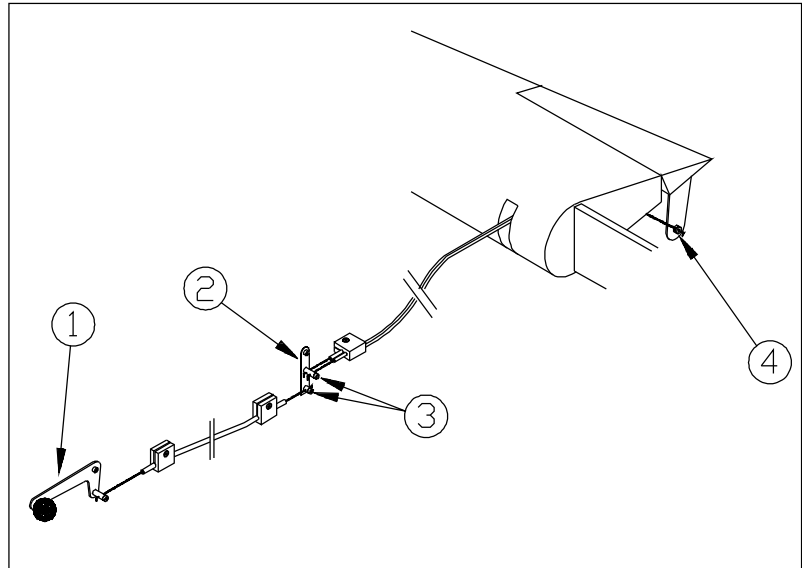
- 4 If necessary adjust the length of the rearmost tail control rod per Chapter 27-01-06.
- 5 Check if the elevator travel is within the given tolerances. Use a conventional protractor.
- 6 Adjust the travel stops if necessary.
- 7 Check full travel of control sticks in each direction.
- 8 Check if the rear control stick travel is symmetrically.
- 9 If it is not, contact the manufacturer.

27-31-04

Trim Tab Rigging

Refer to Figure 16.

- 1 Secure the rear 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 16

- 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 within given tolerances. If it is not, check free travel of the trim levers, fuselage bellcrank and bowden cables.