



FFA

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37

FLIGHT- AND MAINTENANCE MANUAL

(Art. 15 of the VV to the LFG)

Approved by the Swiss Federal Air Office

Type : DIAMANT 16.5
Serial No. : 012
Registration No.: N 1193

The sailplane must be operated in accordance with this Flight- and Maintenance Manual. This Manual is requested to be carried on board.

	FFA		Swiss Federal Air Office
Prepared by :	<i>Weichelt</i>	Approved by :	<i>Waber</i>
Date :	<i>July 24, 1968</i>	Date :	<i>August 30 1968</i>



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FLIGHT- AND MAINTENANCE MANUAL
Approved by the Federal Air Office
Type DIAMANT 16.5

Report No.: FV - 818
Summary of Contents
Date: July 1, 1968

SUMMARY OF CONTENTS

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MAINTENANCE MANUAL

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Record of revisions
Date: July 1, 1968

Revisions of the Flight- and Maintenance Manual

Rev. No.:	Concerning		Date of Revision	Official approval		Pages exchanged		
	Section	Page		Date	Signature	Date	Signature	
All revisions up to July 1, 1968 have been incorporated in this edition.								
1	2	2	12- 4-1968	} 12-4-68	<i>L+A</i> <i>[Signature]</i>	} 5.12.68	<i>[Signature]</i>	
2	2	3	12- 4-1968					
3	4	3	12- 4-1968					
4	6	1	22- 1-1969	} 2-4-69	<i>[Signature]</i>	} 18.2.69	FFA/Gu	
5	6	2	22- 1-1969					
6	6	3	22- 1-1969					
7	9	6	22- 1-1969	} 14-4-69	<i>[Signature]</i>			
8	1	3	10- 4-1969					
9	3	14	10- 4-1969					

The changes on the revised pages are marked with | at the right.



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Type DIAMANT 16.5

Report No.: FV - 818
Section 1, page 1
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1. DESCRIPTION

A. GENERAL

The DIAMANT is a single seat high-performance sailplane built of all-fiber-glass monocoque structure to the latest stand of engineering know-how. The use of mainly synthetic material for construction produces excellent surface quality, showing two outstanding features:

- absolute trueness of contours and profile,
- high indifference to all weather conditions.

B. CONSTRUCTION

The fiberglass shell is a sandwich construction throughout, consisting of glass-reinforced plastic outer and inner skins with a foam core. The wing spars as well as the higher stressed parts are made out of solid glass-reinforced plastic with the glass fibres orientated in the direction of the forces. The required ultimate strengths, at temperatures simulating a hot summer day, have been proven by tests.



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Section 1, page 2
Date: July 1, 1968DESCRIPTION (continued)C. SPECIAL FEATURES OF THE DIAMANT

- The low wing loading and mild stall characteristics allow favorable climb rates, even in weak thermals.
- The high useful load limit permits the installation of extra equipment and instruments as well as water ballast in the wings to increase the wing loading under favorable thermal conditions.
- The efficient dive brakes facilitate steep landing approaches as well as increasing the safety of landings on unimproved fields. These brakes will also prevent exceeding the maximum permissible air speed.
- The wing-camber flaps permit optimization of the airfoil to various flight conditions, thereby minimizing the aerodynamic drag.
- The retractable landing gear reduces the parasitic drag.
- The long fuselage with the all-movable horizontal tail, arranged in T-tail configuration, enhance the dynamic stability.
- The quick-release control connections for the elevator, ailerons, wing-camber flaps and the dive brakes make the rigging of the DIAMANT quick, easy and safe.



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DESCRIPTION (continued)D. COCKPIT

The semi-reclining position of the pilot is comfortable during long flights. The back-rest is adjustable to the size of the pilot. All controls have been conveniently located for this semi-reclining position.

The large transparent canopy, integral with the fuselage contours, permits good vision. The cockpit ventilation system prevents the canopy from fogging-over.

The easily removable instrument assembly is ample size for the highest normal requirements.

The following informations are stated on a placard in the cockpit:

- This airplane must be operated in compliance with the approved Airplane Flight Manual.
- The design maneuvering speed, the max. speed for landing gear operation and the max. speed with landing gear extended.
- The approved acrobatic maneuvers.



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DESCRIPTION (continued)

E. APPROVAL

Basis USA FAR 21.29
FAA BASIC GLIDER CRITERIA HANDBOOK of 1962

Category High Performance Sailplane

F. DIMENSIONS

Wing span 54.2 ft.
Length overall 24.7 ft.
Height overall 4.35 ft.
Wing area 143.0 sq.ft.
Aspect ratio 20.5

G. COORDINATE REFERENCES FOR DETERMINATION OF CENTER OF GRAVITY

Datum Wing leading edge at root rib.

Leveling means The fuselage reference line "BL", which is parallel to a line defined by the following points:

Point "A" on the upper fuselage surface centerline at the aft end of the canopy, and

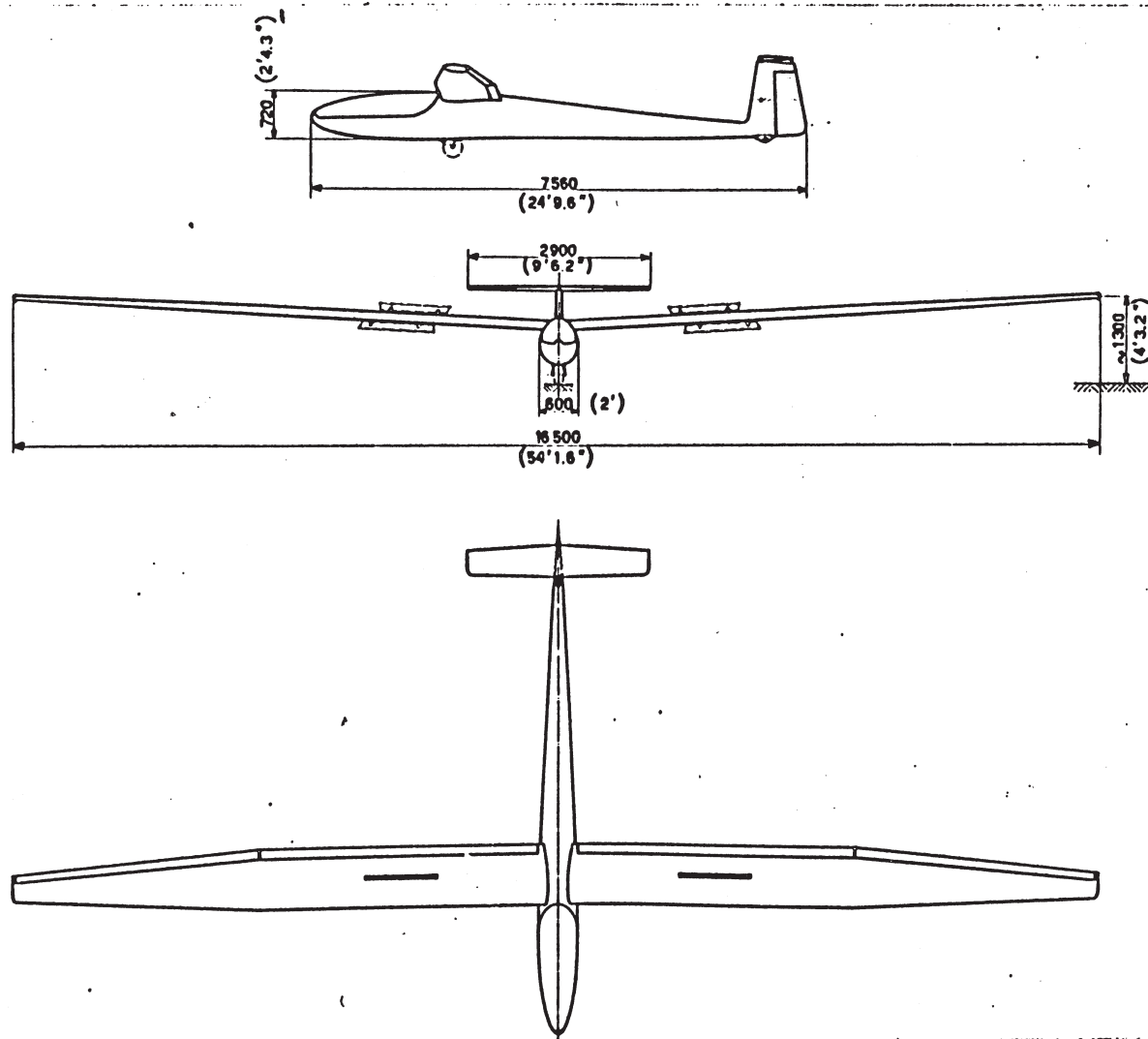
Point "B" 1 3/8 inches above the upper fuselage surface centerline 40 inches aft of point "A".



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scale = 133,7 x



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Section 2, page 1
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2. FLIGHT - LIMITS

A. GENERAL

Fitted with the required minimum amount of necessary equipment, this sailplane may be used for flights as follows:

- Flights under Visual Meteorologic Conditions during daylight hours,
- Flights in clouds during daylight hours,
- Aerobatics (limitations see section 3, page 12).

Flying at night is prohibited.

NOTE:

The temperature of the fiberglass shell must not exceed +54° C (+130° F) while flying.

The full ultimate load is calculated for a temperature of +54° C (+130° F); an additional safety margin therefore exists during normal flying at lower temperatures.



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Date: Dec. 4, 1968FLIGHT - LIMITS (continued)B. FLYING SPEEDS AND MARKS ON THE AIRSPEED INDICATOR DIAL

(True indicated airspeed)

	knots	mph	km/h	
Never exceed speed	130	150	240	(red mark)
Caution speed range (no abrupt control movements, avoid heavy turbulent zones)	90-130	103-150	165-240	(yellow arc)
Normal operating speed range	40-90	47-103	65-165	(green arc)
Minimum speed with camber flaps neutral	40	47	65	(red mark)
Maximum permissible speed with camber flaps full positive	80	93	150	
for lowering landing gear	80	93	150	(white mark)
for aero towing	80	93	150	
for winch launching	80	93	150	
Operating range with camber flaps full positive	35-80	40-93	55-150	(white arc)



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FLIGHT - LIMITS (continued)

C. MAX. WEIGHTS AND LOAD FACTORS

	WITHOUT WATERBALLAST	WITH WATERBALLAST
Max. permissible gross weight :	860 lbs.	900 lbs.
Max. permissible weight without wings:	485 lbs.	485 lbs.
Max. recovery load factors positive:	+5,58 g	+5,33 g
negative:	-2,79 g	-2,67 g
Max. gust load factors positive:	+5,74 g	+5,57 g
negative:	-3,74 g	-3,57 g

D. CENTER OF GRAVITY RANGE DURING FLIGHT

Max. forward C.G. position :	9,5 in. behind datum	(31 % MAC.)	0,24m
Max. rearward C.G. position:	16,0 in. behind datum	(51 % MAC.)	0,405
Coordinate references :	See section 1, page 4		
Loading chart :	See section 4, page 3		

E. PRESET SAFETY BREAKING POINT OF TOWING CABLE

For winch take-off :	1870 lbs. \pm 10 %	(German safety link no. 3, red)
For aero towing :	1250 lbs. \pm 10 %	(German safety link no. 2, blue)



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Section 3, page 1
Date: July 1, 19683. OPERATIONA. ACTUATING OF CONTROLSPrimary flight controls

The primary flight controls - the all-moveable tail plane, the ailerons and the rudder - are operated in the conventional manner by the centrally mounted stick and the rudder pedals.

The stick may be adjusted in two positions while on ground: short or long. The bolt must be secured with a self-locking nut.

The rudder pedals may be adjusted while on ground. If required, leather straps may be mounted to prevent the feet from slipping off the pedals at negative accelerations.

NOTE: At high speeds the controls must be actuated very carefully, as they become very sensitive.

Trimming control

The airplane has only a longitudinal trimming system. The trim lever is connected with the elevator push rod by springs. Trimming is done by adjusting the trim lever on the right-hand cabin wall behind the gear lever. The trim lever should be locked by tightening the thumb screw provided. The springs give adequate control forces on the stick when the trim lever is locked.

NOTE: The sailplane may be flown with the trim lever loose, but this results in very small elevator control forces.



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OPERATION

Wing camber flaps

The wing camber flaps are actuated by the inner lever mounted on the left-hand cabin wall. By means of a detent and index disk the flap position may be selected and locked in steps of $2,5^{\circ}$. The camber flaps are unlocked by pushing down the small lever on top of the camber flap lever.

Limits of camber flap deflections.

Up to 80 knots (93 mph) IAS : Full positive deflection permitted
Above 110 knots (125 mph) IAS : Full negative deflection recommended

(IAS = indicated air speed, positive deflection = flaps down)

Optimum flap deflections

See appendix : FLIGHT PERFORMANCES

NOTE: The ailerons are partially deflected in coordination with the wing camber flaps. At full positive wing camber flap deflection the aileron effectiveness is slightly reduced.

Do not use full positive camber flap deflection at strong turbulence.

NOTE: Do not let the left hand rest on the camber flap lever at high speeds; the camber flaps may be unintentionally unlocked during sudden gusts.



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OPERATION (continued)

Dive brakes

The dive brakes are actuated by the outer lever mounted on the left-hand cabin wall.

Lever in forward position : Dive brakes retracted and locked

Lever in aft position : Dive brakes extended and unlocked

The dive brakes may be used over the entire speed range. Retraction of the dive brakes should be done at speeds less than 80 knots (93 mph), otherwise the forces on the lever may be excessive.

NOTE: While the dive brakes are being opened, they are strongly pulled outward by aerodynamic forces.

Landing gear

The landing gear is actuated by the lever placed on the right-hand cabin wall.

Lever in forward position : Landing gear in and locked

Lever in aft position : Landing gear out and locked

To unlock the landing gear, pull the lever slightly inward (toward the cabin center) out of the detent.

Retraction and lowering of the landing gear is permissible up to 80 knots (93 mph) indicated airspeed.

Flying with the landing gear extended is permissible over the entire speed range.



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OPERATION (continued)

Wheel brake

The wheel brake lever is attached to the dive brake lever. Both brakes may be operated simultaneously or separately.

Towing clutch

The sailplane is equipped with a TOST automatic safety towing clutch. It is mounted on the landing gear and will retract with it after the towing cable is released. The clutch may be used for aero-towing or for winch-launching. The release lever is located at the left side of the instrument panel.

Canopy hood

The sailplane is equipped with a sliding canopy hood, which is supported at the front by a telescoping tube. The canopy hood is locked by the handle at its rear end.

Closing of the canopy hood

- Turn the handle at the rear end to the middle position.
- Pull the canopy hood backwards by the handle.
- Turn the handle to the right for locking the canopy hood.



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Date: July 1, 1968OPERATION (continued)Make sure that

- both of the canopy hood forward hold-down catches are in a vertical position
- the telescoping support is hooked exactly in the middle of the canopy nose
- the guide bars fit precisely inside the cabin wall.

Opening of the canopy hood

- Turn the handle from the sideward position to the middle for unlocking the canopy hood.
- Push the canopy hood slowly and horizontally forward.
- Rest the canopy hood on the rising support.

NOTE: Do not push the canopy hood downward; the telescoping tube may be bent.

Jettisoning of the canopy hood

- Loosen seat belts and harness and bend forward.
- Pull the red handle on the right-hand cabin wall in front of the gear lever.
- This will release the forward canopy hood attachment.

NOTE: It is not necessary to unlock the handle at the rear end of the canopy hood before jettisoning.



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OPERATION (continued)

Water ballast system

As an optional extra a water ballast system may be installed in the DIAMANT, to increase the wing loading.

Installation of the water ballast tanks

The flexible water ballast tanks are mounted in the strengthened part of the wing leading edge. The tanks should be nearly completely collapsed when they are installed. After assembling the wings and the fuselage (see section 6, page 1) the hoses from the tanks are connected to the dump valve mounted in the fuselage in front of the wing spar stubs. A flexible hose leads from the dump valve to the gutter tube located at the left of the landing gear. This valve is operated by a small lever on the left-hand cabin wall.

Lever in forward position : Dump valve open
Lever in aft position : Dump valve closed

Filling the water ballast tanks

The water ballast tanks may be filled through the flexible hose provided for dumping the water in flight. This hose must be pulled out of the gutter tube and raised above the fuselage. The water dump valve must be opened, and as much air sucked out of the tanks as possible, as there is no other vent in the system for the air to escape. The use of a hose extension and a funnel will facilitate filling the water tanks. When filled, these two tanks together contain 50 to 60 liters of water (13 to 16 U.S. gallons). Note that the dump valve is



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spring-loaded in the closed position. Note also that the water may flow from one tank to the other, regardless whether the dump valve is open or closed.

Emptying the water ballast tanks

The water ballast tanks may be emptied by opening the dump valve, either in flight or on the ground. Approximately 4 minutes are required to completely empty these tanks. Unequal amounts of water in the two tanks has been found to cause no trouble, as these tanks are close to the center of the sailplane.

Icing of the water ballast system

When flying at high altitudes or under freezing conditions with water ballast, anti-freeze should be used in the water ballast system.

Cabin ventilation

Regulation of the cabin ventilation airflow is controlled by a lid in the nose of the fuselage, which may be adjusted by the small lever on the left-hand cabin wall. The air flows out again by the opening behind the tail wheel. To increase the ventilation, the sliding window may be opened.



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OPERATION (continued)

B. FLIGHT

Before each take-off

1. Check the canopy hood locking devices.
2. Check that the dive brakes are retracted.
3. Hook the towing cable into the clutch.

Winch launching

1. Recommended wing camber flap position is $7,5^{\circ}$ to 10° positive.
(The sailplane should take off quickly.)
2. Adjust the trim lever between the forward and the neutral position according to the C.G. position.
3. Hold the launching speed between 45 and 65 knots (50 and 75 mph).
At 54 knots (62 mph) IAS the DIAMANT reaches the highest cable release altitude.
4. No abnormal behaviour has been observed during winch-launch.
5. Correct lateral displacements with rudder only.

NOTE: To prevent the pilot from slipping backwards during steep climb, make sure that the shoulder harness is securely fastened before the winch-launch.



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OPERATION (continued)

Aero-towing

1. Recommended wing camber flap and trim lever settings

C.G. position	forward	center	aft
Camber flap setting	7.5° positive	5° positive	0° neutral
Trim lever setting	neutral	1/3 nose down	full nose down

2. Lock the trim lever, otherwise the sailplane is too sensitive to the elevator control, due to inadequate stick forces.
3. Line up the sailplane carefully, as the DIAMANT will not automatically follow the tow plane, due to the C.G. towing cable attachment position.
4. Normal take-off is at about 43 knots (50 mph) indicated airspeed.
5. The recommended towing speed is 55 - 65 knots (60 - 70 mph).
- NOTE: Keep the towing speed above 48 knots (56 mph) during gusty air conditions. At lower speeds the ailerons are not adequately effective.
6. During aero-towing the DIAMANT must be flown as in free flight, as the C.G. towing cable attachment position does not provide any increase of stability.
7. During towing, make position and towing speed corrections smoothly, so as to minimize sagging of the towing cable. Excessive towing cable sagging may cause the towing clutch to release automatically.
8. NOTE: Do not retract the landing gear during aero-towing.
The towing clutch is mounted on the landing gear, and difficulties may be experienced in releasing the towing cable when the landing gear is extracted.



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OPERATION (continued)

Free flight

1. Retract the landing gear after release of the towing cable.
2. The aerodynamic noise is very faint when the landing gear is retracted.
3. The speeds must therefore be checked by the airspeed indicator.
3. The forces on the elevator control are very small when the elevator is trimmed. Therefore actuate the elevator very carefully at high speed.
4. Choose the wing camber flap settings according to the prevailing flight conditions.
Opt. wing camber flap settings: See appendix "FLIGHT PERFORMANCES"
5. In order to determine side slip conditions, it is recommended that a yarn tuft be taped to the outside top of the canopy.

Cloud flying

1. Switch on and check the blind-flying instruments.
2. Keep the flight speed within the green sector on the airspeed indicator dial. One should make it a rule to open the dive brakes when flying at speeds indicated in the lower part of the yellow sector.
3. NOTE: The DIAMANT accelerates very quickly to high speeds.
4. Watch for icing conditions.

Flight at high altitudes

Use breathing oxygen at altitudes above 10 000 ft. above sea level.



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OPERATION (continued)

LANDING

Landing

1. Lower the landing gear.
2. Select the wing camber flap setting and approach speed according to the prevailing weather conditions:
Slightly gusty : Camber flap setting : 10 to 15° positive
Approach speed : 43 to 49 knots (50 to 56 mph)
Strongly gusty : Camber flap setting : 5 to 7.5° positive
Approach speed : 49 to 54 knots (56 to 62 mph)
3. Very steep approaches are possible with the dive brakes extended. During abnormal steep approaches to the landing field, the airspeed increases to about 65 knots (75 mph). The flare-out is relatively short.
4. Do not pull the control stick all the way back for normal landings. The normal landing attitude of the DIAMANT is nearly level. For short landings the control stick may be pulled all the way aft, but then the sailplane touches down tail wheel first.
5. Apply the wheel brake after touch-down. The brake application can be infinitely varied.
6. If the wheel brake is applied excessively the sailplane may pitch forward and scrape the nose. This will shorten the landing run but should be used only in the event of an emergency, to avoid wear and tear on the fuselage.
7. NOTE: For off-field landings on soft ground, the landing may be performed with the landing gear retracted.



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OPERATION (continued)

Aerobatics

1. The following aerobatic figures are approved:
Loop, wing-over (renversement), tight spirals, precision spins.
2. All other aerobatic maneuvers are prohibited.
3. NOTE: The sailplane accelerates very quickly to very high speeds.
4. Recommended airspeeds and wing-camber flap settings:

Wing-camber flap setting for all maneuvers is neutral.

Loop	:	92 to 97 knots	(105 to 112 mph)	entry speed
Wing-over	:	92 to 110 knots	(105 to 125 mph)	entry speed
		65 to 93 knots	(75 to 105 mph)	at employing rudder,
				depending on climb angle
Tight spirals:		60 to 65 knots	(68 to 75 mph)	for 3 turns in 30 sec.



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OPERATION (continued)

Aerobatics

5. Spinning

See also chapter "DANGER CONDITIONS - Spinning characteristics"

- The sailplane does not enter a spin easily at neutral or forward C.G. positions.
- A spin is most easily initiated from a steep climb attitude.
- When the sailplane is nearly stalled, pull the control stick to the rear and deflect the rudder, then deflect the ailerons in the direction of rotation.
- For neutral and forward C.G. positions the DIAMANT will normally terminate the spin without corrective action after about 1 1/2 rotations. Neutralizing the controls will terminate a spin almost immediately.
- For aft C.G. positions the spinning rotation will continue until all controls are neutralized.
- The loss of altitude during spin recovery is 300 to 450 ft.

NOTE: During spinning the rudder control forces are very high.