AIRPLANE FLIGHT MANUAL

FOR THE POWERED SAILPLANE

HK 36 TTC

Engine	**: Rotax 914 F3 or 914 F4**
Model	**: HK 36 TTC**
Serial No.	**: _____**
TC Data Sheet No.	**: SF 3/82**
Doc. No.	**: 3.01.20-E**
Date of Issue	**: 03 Mar 1997**

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Signature : Winkler

Authority : AUSTRO CONTROL GmbH
Abteilung Flugtechnik
Zentrale
A-1030 Wien, Schnirchgasse 11

Stamp : AUSTRO CONTROL GmbH 640

Original date of approval : 15. April 1997

This Powered Sailplane must be operated in compliance with the information and limitations contained herein.

Prior to operating the Powered Sailplane, the Pilot must take notice of all the information contained in this Airplane Flight Manual.

This powered sailplane manual is FAA approved for U.S. registered aircraft in accordance with the provisions of 14 CFR Section 21.29, and is required by FAA Type Certificate Data Sheet No. G07CE.

DIAMOND AIRCRAFT INDUSTRIES GMBH
N.A. OTTO-STR. 5
A-2700 WIENER NEUSTADT
AUSTRIA

PREFACE

Congratulations on your choice of the HK 36 TTC Powered Sailplane. Skilful operation of an airplane will ensure your safety and provide you with hours of enjoyment. Therefore, you should take the time to get familiar with your new HK 36 TTC.

We ask you to read this manual thoroughly and to pay attention to the recommendations given in it, so that you can expect many hours of incident-free flight operation from your Powered Sailplane.

0.1 RECORD OF REVISIONS

Any revision of the present manual, except current weighing data, must be recorded in the following table and, in the case of approved sections, endorsed by the responsible airworthiness authority.

The new or amended text on the revised page will be indicated by a black vertical line in the left hand margin, and the Revision No. and the date will be shown on the bottom of the page.

If you have purchased a second hand HK 36 TTC, please let us know your address so that we can supply you with the publications you need for the safe operation of the Powered Sailplane.

Rev. No.	Sec	Pages	Date of Revision	Approval	Date of Approval	Date Inserted	Signature
1	0	0-0, 0-3 through 0-6	25 Aug 1997	[approved by Ing. Andreas Winkler for ACG]	04 Sep 1997		
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	5	5-3, 5-6					
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2	0	0-3, 0-4	28 Oct 1998	[approved by Ing. Andreas Winkler for ACG]	29 Oct 1998		
	2	2-10					
3	0	0-3 through 0-6	28 Jul 2000	AUSTRO CONTROL GESMBH 640 27. Nov. 2000			
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0.3 TABLE OF CONTENTS

SECTION

SECTION 1
GENERAL

Page No.

1.1 INTRODUCTION

The Powered Sailplane Flight Manual has been prepared to provide pilots and instructors with information for the safe and efficient operation of the Powered Sailplane.

This manual includes the material required to be conveyed to the Pilot by JAR-22. It also contains supplementary data supplied by the Powered Sailplane Manufacturer.

This Flight Manual conforms to the actual version of the customer's airplane. However, any optional equipment (COM, NAV, etc.) is not considered. For their operation, the operating manual of the respective manufacturer must be followed.

This manual must always be kept on board the airplane.

1.2 CERTIFICATION BASIS

The HK 36 TTC Powered Sailplane has been type certified by Austro Control GmbH (ACG) in accordance with Change 5 of JAR-22 from 28 Oct 1995 for sailplanes and powered sailplanes as a derivative of the HK 36 TC. The HK 36 TC is a variant of the HK 36 R, which was type certified in accordance with Change 4 from 07 May 1987. The Type Certificate Data Sheet No. SF 3/82 has been extended.

Category of Airworthiness: Utility.

1.3 WARNINGS, CAUTIONS AND NOTES

The following definitions apply to warnings, cautions and notes used in the Flight Manual.

WARNING

Means that the non-observation of the corresponding procedure leads to an immediate or important degradation of flight safety.

CAUTION

Means that the non-observation of the corresponding procedure leads to a minor or to a more or less long term degradation of flight safety.

NOTE

Draws the attention on any special item not directly related to safety but which is important or unusual.

1.4 EXPLANATIONS

1.4.1 ABBREVIATIONS

ACG	Austro Control GmbH
AGL	Above Ground Level
CG	Center of Gravity
CFRP	Carbon Fiber Reinforced Plastic
GFRP	Glass Fiber Reinforced Plastic
ISA	International Standard Atmosphere
EGT	Exhaust Gas Temperature
OAT	Outside Air Temperature
IAS	Indicated Airspeed (read from airspeed indicator without any correction of errors).
TAS	True Airspeed (IAS corrected for errors due to instrument, system, altitude and temperature)

1.4.2 PHYSICAL UNITS

	SI units	US units	conversions
length	[mm] millimeters [m] meters	[in.] inches [ft.] feet	[mm] / 25.4 = [in.] [m] / 0.3048 = [ft.]
velocity	[km/h] kilometers per hour [m/s] meters per second	[kts.] knots [mph] miles per hour [fpm] feet per minute	[km/h] / 1.852 = [kts.] [km/h] / 1.609 = [mph] [m/s] * 196.85 = [fpm]
rotary speed	[min^{-1}] revolutions per minute	[RPM] revolutions per minute	[min^{-1}] = [RPM]
mass	[kg] kilograms	[lbs.] pounds	[kg] * 2.2046 = [lbs.]
force, weight	[N] Newtons	[lbs.] pounds	[N] * 0.2248 = [lbs.]
pressure	[hPa] Hectopascal [mbar] millibar [bar] bar	[inHg] inches mercury column [psi] pounds per square inch	[hPa] = [mbar] [hPa] / 33.86 = [inHg] [bar] * 14.504 = [psi]
current intensity	[A] Amperes		-
capacity	[Ah] Ampere hours		-
voltage	[V] Volts		-

1.4.3 SPECIAL TERMS

Pressure altitude — Altitude indicated by the altimeter when the subscale is adjusted to 1013.25 mbar or 1013.25 hPa (29.92 inHg)

Service ceiling — Maximum altitude that can be reached with a climb rate of at least 0.5 m/s (approximately 100 ft./min.)

Take-off roll — Distance between the start of the take-off run and the lift-off point

Take-off distance — Distance between the start of the take-off run and the point above which the airplane is able to clear a 15 m (approximately 50 ft.) obstacle

Non-lifting parts — Fuselage, rudder, horizontal tail surfaces and useful load

Useful load — Crew, baggage and fuel

1.5 DESCRIPTIVE DATA

The HK 36 TTC is a two-seated powered sailplane of fiber-composite construction, designed in compliance with JAR-22; Category of Airworthiness: Utility.

It is a low wing airplane with T-tail, side-by-side seating configuration, tricycle landing gear and Schempp-Hirth type air brakes in the upper surface of the wings.

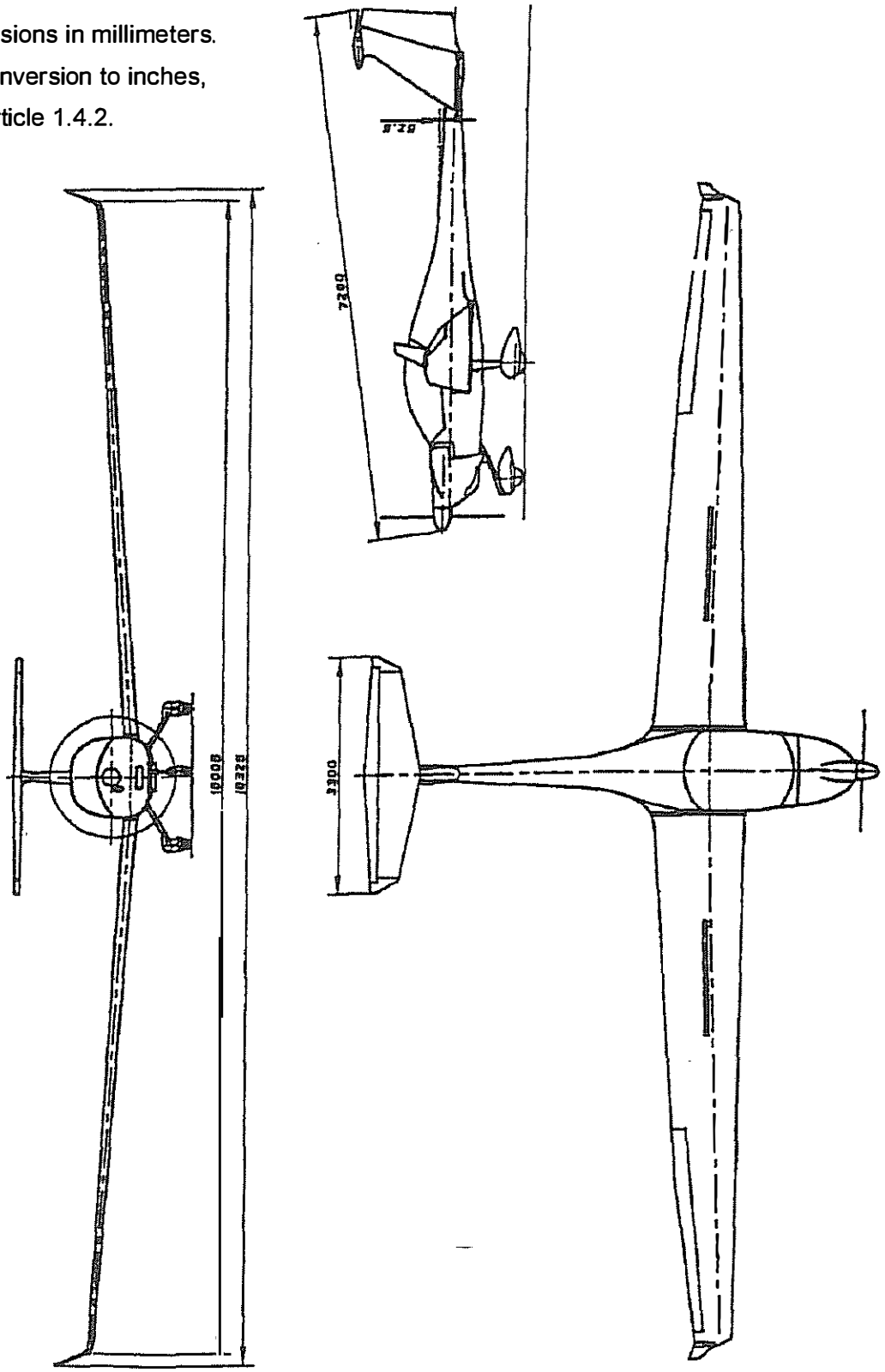
In order to enable a fast disassembly and space-saving storage, the airplane can be fitted with a wing folding mechanism.

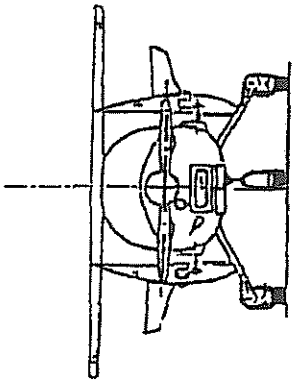
The power plant is a Rotax R 914 F engine with an mt-propeller MTV-21-A-C-F/CF175-05 hydro-mechanically variable pitch propeller.

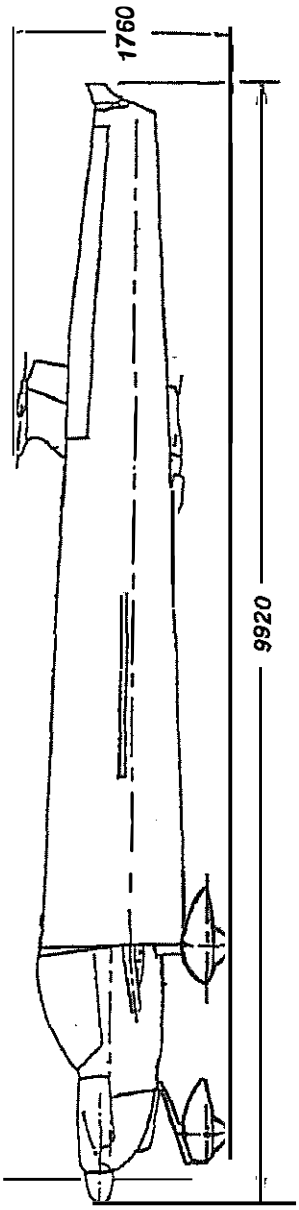
Span	with winglets	: 16.33	m	53.58	ft.
	without winglets	: 16.01	m	52.53	ft.
Length		: 7.28	m	23.88	ft.
Height		: 1.78	m	70.08	in.
MAC		: 1.004	m	39.53	in.
Wing area		: 15.30	m^2	165.7	sq.ft.
Max. wing loading		: 50.30	kg/m^2	10.30	lbs./sq.ft.
Aspect ratio		: 17.11			
Airfoil		: Wortmann FX 63-137			

1.6 THREE-VIEW DRAWINGS

Dimensions in millimeters.
For conversion to inches,
see Article 1.4.2.



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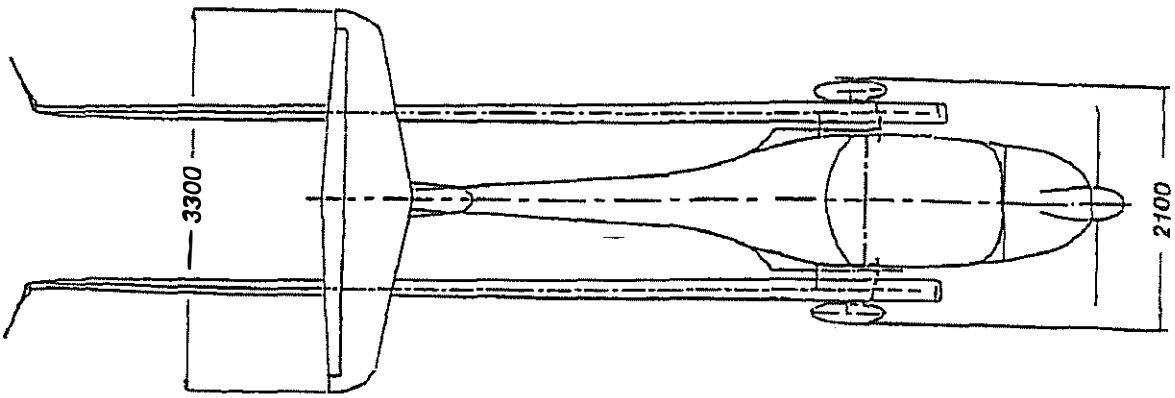
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SECTION 2

LIMITATIONS

Page No.

2.1 INTRODUCTION

Section 2 includes operating limitations, instrument markings, and basic placards necessary for safe operation of the Powered Sailplane, its engine, standard systems and standard equipment.

The limitations included in this section and in Section 9 have been approved by Austro Control GmbH (ACG).

WARNING

All operation values must be kept within the limits stated herein during flight.

2.2 AIRSPEED

NOTE

The airspeeds shown below must be understood as IAS.

Airspeed limitations

Airspeed limitations and their operational significance are shown below:

Airspeed		IAS			Remarks
		km/h	kts.	mph	
v_{NE}	Never exceed speed	261	141	162	Do not exceed this speed in any operation and do not use more than 1/3 of control deflection. (Do not use more than 1/3 of the travel between position of the controls for unaccelerated flight and deflection to stop.)
v_{RA}	Rough air speed	210	113	130	Do not exceed this speed except in smooth air, and then only with caution. Examples of rough air are lee-wave rotors, thunderclouds, etc.
v_A	Maneuvering speed	176	95	109	Do not make full or abrupt control movements above this speed, as the Powered Sailplane could become overstressed by full control movement under certain conditions.
v_{ABF}	Maximum admissible speed with air brakes fixed in half extended position	150	81	93	Above this speed, the air brakes could become extended inadvertently over the half extended position by aerodynamic forces.

The WARNINGS on the following page must be complied with.

WARNING

In order to ensure the flutter safety of the airplane, the never exceed speed is reduced at pressure altitudes above 2000 meters or 6500 ft. (see Article 4.5.7).

WARNING

At speeds beyond the rough air speed, the airplane may become overstressed by heavy gusts (lee-wave rotors, thunderclouds, whirlwinds and turbulence at close range to mountain ridges).

WARNING

The maneuvering speed stated on the previous page applies to the maximum T/O mass (max. T/O weight) of 770 kg (1698 lbs.) At lower flight masses, the following limits must be applied:

T/O mass	T/O weight	Maneuvering speed v_A		
kg	lbs.	km/h	kts.	mph
700	1543	168	91	104
650	1433	162	87	101
600	1323	155	84	96

WARNING

These speeds are not marked on the airspeed indicator. Simultaneous full deflection of elevator and rudder can overstress the airplane, even at speeds below v_A.

Diverse airspeeds

Airspeed		IAS			Remarks
		km/h	kts.	mph	
v_y	Best rate of climb speed	110	59	68	This airspeed is marked on the airspeed indicator with a blue line. At this airspeed, the airplane climbs with the maximum possible rate of climb.
v_x	Best angle of climb speed	97	52	60	This airspeed is not marked on the airspeed indicator. At this airspeed, the airplane climbs with the maximum possible angle of climb.
	Recommended lowest airspeed for approach	105	57	65	See NOTE below.

NOTE

Conditions such as strong headwind, danger of wind shear, turbulence, or wet wings require a higher approach speed.

Stalling speeds

see Article 5.2.2

2.3 AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their color-code representation are shown below:

Marking	Value or Range (IAS)			Meaning
	km/h	kts.	mph	
green arc	86 - 210	46 - 113	53 - 130	Normal Operating Range. Lower limit is 1.1 v_{S1} at max. flight mass (weight) and most forward CG. Upper limit is v_{RA}.
yellow arc	210 - 261	113 - 141	130 - 162	Caution Range, v_{RA} to v_{NE}. Maneuvers must be conducted with caution and only in smooth air.
red line	261	141	162	Maximum speed for all operations v_{NE}.
blue line	110	59	68	Best rate-of-climb speed v_y.
yellow triangle	105	57	65	Approach speed at max. flight mass (weight).

2.4 POWER PLANT, FUEL AND OIL

Engine manufacturer : Bombardier Rotax
Engine model : Rotax 914 F3 or 914 F4

NOTE

The engine drives the propeller through a speed-reducing gear with a gear ratio of 2.4286:1. The built-in tachometer indicates the propeller speed. Consequently, all speeds given in this manual are propeller speeds (in contrast to the Operator's Manual for the Engine).

Max. T/O power (5 minutes) : 84.5 kW (115 DIN hp.)
Max. T/O RPM : 2385 38.4 inHg (TCU Part No. 966 470)
39.9 inHg (TCU Part No. 966 741)

Max. continuous power : 73.5 kW (100 DIN hp.)
Max. continuous RPM : 2260 34.0 inHg (TCU Part No. 966 470)
35.4 inHg (TCU Part No. 966 741)

Idle RPM : 600
Power check RPM : 2300 ± 50 38.4 inHg (TCU Part No. 966 470)
39.9 inHg (TCU Part No. 966 741)

CAUTION

At high ambient temperatures or at high altitudes, the maximum admissible manifold pressure cannot be reached, as the turbo control unit prevents excessive airbox temperatures by decreasing the manifold pressure.

Outside air temperature (OAT) at high altitude		Deviation from International Standard Atmosphere (ISA)		Max. manifold pressure obtainable up to altitude	
[° C]	[° F]	[° C]	[° F]	[m]	[ft.]
-1	30	ISA	ISA	2440	8000
17	63	ISA + 10°	ISA + 18°	1220	4000
35	95	ISA + 20°	ISA + 36°	0	0

NOTE

During normal operation, take-off power should only be selected until a safe altitude is reached. The engine wear is higher compared to maximum continuous power.

Maximum cylinder head temperature : 135 °C (275 °F)

Minimum oil temperature : 50 °C (122 °F)

Maximum oil temperature : 130 °C (266 °F)

Favorable oil temperature : approximately 90 to 110 °C (194 to 230 °F)

Oil pressure:

	engine S/N's through 4,420.085	engine S/N's 4,420.086 and subsequent
minimum	1.5 bar (22 psi)	0.8 bar (12 psi), only below 1450 RPM
maximum	7 bar (102 psi), admissible only for a short term after engine cold-start	
normal range	1.5 to 5 bar (22 to 73 psi)	2 to 5 bar (29 to 73 psi)

Max. oil consumption : 0.1 liters per hour (approximately 0.1 US quarts per hour)

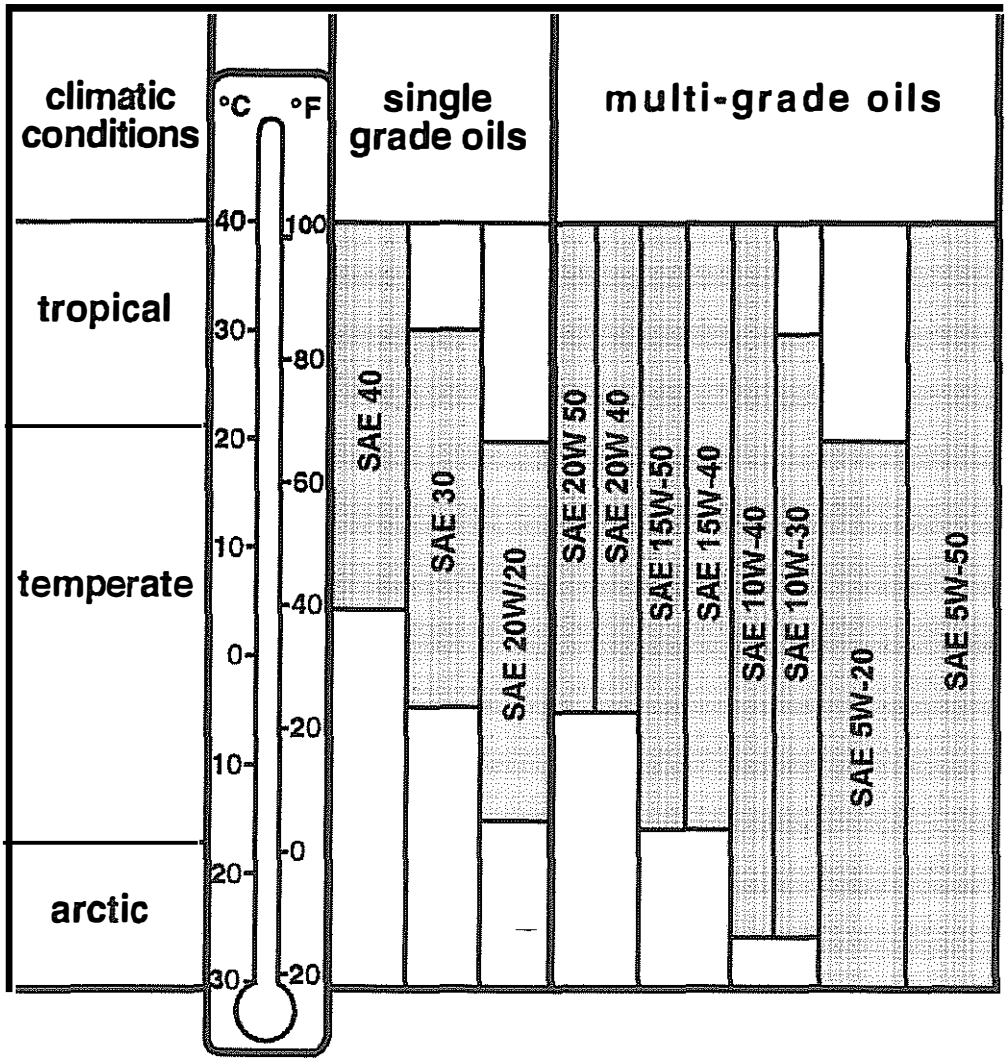
Oil quantity minimum : 2.0 liters (2.1 US quarts)

maximum : 3.0 liters (3.2 US quarts)

Oil grade : Automotive lubricants with additives for transmission gears with SAE ratings complying with seasonal temperatures (see chart). The lubricant quality rating according to the API system must be "SF" or "SG" + "GL4" or "GL5". Do not use fully synthetic lubricants, in particular when using AVGAS or other leaded fuels. Multi-grade oils are recommended.

CAUTION

Because of the incompatibility with automotive lubricants, Aviation grade oil should not be used under any circumstances!



Admissible OAT range

For starting engine : -25 to +50 °C (-13 to +122 °F)
For OATs below -25 °C (-13 °F), the engine must be pre-warmed.

Propeller manufacturer : mt-propeller, Straubing, Germany

Propeller model : Hydraulically variable pitch propeller
MTV-21-A-C-F/CF175-05

Low pitch : 16.5° ± 0.2°
Starting pitch : 19° ± 1°
Feathered pitch : 83° ± 1°
Counterweights at low pitch : 32.5° ± 1°
High pitch : 28° ± 1°

Propeller governor : Woodward A210790 or
McCauley DCFU290D17B/T2

Pressure accumulator : P-447

2.5 POWER PLANT INSTRUMENT MARKINGS

Power plant instrument markings and their color code representation are shown below:

Indicator	Red Line Minimum Limit	Green Arc Normal Operating Range	Yellow Arc Caution Range	Red Line Maximum Limit
RPM indicator	-	600 - 2260 RPM	2260 - 2385 RPM	2385 RPM
Oil temp. indicator	50 °C	50 - 130 °C	-	130 °C
Cylinder head temperature indicator	-	-	-	135 °C
Oil pressure indicator, engine S/N's through 4,420.085	1.5 bar	1.5 - 5 bar	5 - 7 bar	7 bar
Oil pressure indicator, engine S/N's 4,420.086 and subsequent	0.8 bar	2 - 5 bar	0.8 - 2 bar, 5 - 7 bar	7 bar
Manifold pressure indicator TCU Part No. 966470	-	-	34.0 - 38.4 inHg	38.4 inHg
Manifold pressure indicator TCU Part No. 966741	-	-	35.4 - 39.9 inHg	39.9 inHg
Fuel quantity indicator	-	-	-	-

The following table shows the representation of the warning and caution lights:

Light	red	amber
Manifold pressure	*continuous:* manifold pressure exceeds 1500 hPa (44.3 inHg) *flashing:* T/O power selected for more than 5 minutes	-
Turbo	-	*flashing:* sensor defective
Fuel pressure	fuel pressure less than 0.15 bar above airbox pressure	-
Generator	voltage exceeds 16.2 V or generator failure	-
Temperature	-	EGT exceeds 950 °C (1740 °F) or airbox temp. exceeds 72 °C (162 °F)

2.6 MASS (WEIGHT)

Maximum take-off mass (max. T/O weight)	: 770 kg	(1698 lbs.)
Maximum landing mass	: 770 kg	(1698 lbs.)
Maximum mass of all non-lifting parts	: 610 kg	(1345 lbs.)
Maximum mass in baggage compartment	: 12 kg	(26 lbs.)
Maximum useful load (including fuel)	: see Paragraph 6.6	
Maximum useful load on right seat	: 110 kg	(243 lbs.)
Maximum useful load on left seat	: 110 kg	(243 lbs.)

WARNING

Exceeding the mass limits can lead to overstressing of the airplane and to a degradation of flying characteristics and flight performance.

2.7 CENTER OF GRAVITY

The datum plane for the center of gravity (CG) specifications lies on the leading edge of the wing at the root rib. It is vertical when the fuselage tube lies horizontally. Procedures for a horizontal alignment and empty mass CG specifications can be found in the Maintenance Manual, Section 4.

The permissible flight CG range is:

Maximum forward CG	: 318 mm (12.52 in.) aft of datum plane
Maximum rearward CG	: 430 mm (16.93 in.) aft of datum plane

WARNING

A flight CG which lies outside the permissible range reduces the controllability and stability of the airplane.

The procedure for determining the CG position is included in Section 6.

2.8 APPROVED MANEUVERS

This Powered Sailplane is certified in the Utility category.

CAUTION

Aerobatics and spinning are not permitted.

2.9 MANEUVERING LOAD FACTORS

Table of maximum permissible load factors:

	v_A	v_{NE}
positive	5.30	4.00
negative	-2.65	-1.50

WARNING

Exceeding the maximum permissible load factors may overstress the airplane.

2.10 FLIGHT CREW

Solo flights must be conducted from the left seat.

2.11 KINDS OF OPERATION

The HK 36 TTC is certified for DAY-VFR operation. Night VFR operation, if permitted by the competent authority, requires additional equipment in accordance with national regulations.

IFR, flights in clouds, flights into known icing conditions and aerobatics are not permitted.

2.12 FUEL

Fuel capacity

Standard tank	: 55 liters	14.5 US gal.
Long range tank	: 79 liters	20.9 US gal.

Usable fuel

Standard tank	: 54 liters	14.3 US gal.
Long range tank	: 77 liters	20.3 US gal.

Approved fuel grades

- Automotive Super, min. octane rating: 95 ROZ, unleaded
- EN 228 Super
- EN 228 Super Plus
- Aviation Grade (AVGAS) 100 LL

NOTE

Due to its high lead concentration, AVGAS causes increased wear of the valve seats and produces more residue in the combustion chambers. It should therefore only be used at high ambient temperatures (to prevent vapor bubbles) or when other fuel grades are not available.

2.13 AEROTOW, WINCH AND AUTOTOW LAUNCHING

The Powered Sailplane is designed for self-take-off only.

2.14 OTHER LIMITATIONS

Electrical consumers

The landing light and the position lights (optional equipment) may only be used during 10 % of the engine operating time. Otherwise, adequate battery charging cannot be guaranteed.

WARNING

The charging of the battery is of great importance to the prevention of the risk of engine failure, since the engine has no mechanical fuel pump.

Limitations for soaring when using a battery with a capacity of 18 Ah:

The capacity of the lead-accumulator is highly dependent on the temperature. Therefore, the duration of continuous soaring at low temperatures is restricted to:

4 hours at 0° C (32° F),

2 hours at -10° C (14° F).

Good maintenance and charging of the battery are prerequisites. Average current requirement: 0.3 A.

There are no such limitations when a 30 Ah battery is installed.

2.15 LIMITATION PLACARDS

The following placard is attached to the left side of the instrument panel:

Maneuvering speed at maximum gross weight	v_A = 176 km/h
Minimum seat payload, full tank, no baggage	
Minimum seat payload, full tank, 12 kg baggage	
Maximum permissible useful load	

The following optional placard is attached to the instrument panel:

Landing Light and Position Lights
may only be used for
10 % of engine operating time

The following placard is attached to the canopy frame, left side (US registered Serial Nos. only):

This airplane must be operated as a utility category airplane in compliance with the operating limitations as stated in the form of placards, markings, and manuals.

MAXIMA:	MANEUVERING SPEED (IAS)	176 km/h (95 kts. / 109 mph)
	GROSS WEIGHT	770 kg (1698 lbs.)
	FLIGHT LOAD FACTOR	+5.3/-2.65

No acrobatic maneuvers, including spin, approved. Altitude loss in a stall recovery: 20 m (65 ft.). Flight into known icing conditions prohibited. This airplane is certified for the following flight operations as of date of original airworthiness certificate: DAY-VFR.

The following placard is attached to the canopy frame, left side (US and Canadian registered Serial Nos. only):

Altitude [m]	Altitude [ft.]	v_{NE} (IAS) [km/h]	v_{NE} (IAS) [kts.]	v_{NE} (IAS) [mph]
2000	6500	261	141	162
3000	9800	246	133	153
4000	13100	233	126	145
5000	16400	221	119	137
6000	19600	210	113	130

SECTION 3

EMERGENCY PROCEDURES

3.1 INTRODUCTION

Section 3 provides checklists and recommended procedures for use in the case of an emergency.

Since it is impossible to foresee all kinds of emergencies and consider them in the Flight Manual, it is absolutely necessary for the Pilot to know the airplane and to have knowledge and experience in solving problems that may occur. It will only be possible to handle emergency situations safely if the emergency procedures have been practiced.

Emergency procedures relating to optional equipment are given in the corresponding supplements to the Manual.

Any problems which occur must be recorded, along with their remedy, in compliance with the applicable national regulations.

3.2 CANOPY JETTISON

1. Red canopy locks (LH and RH) . . . . swing 180° rearward
2. Canopy . . . . . push up and rearward with both hands

3.3 BAILING OUT

1. Canopy . . . . . jettison
2. Seat harness . . . . . release
3. Evacuate airplane

NOTE

When using a manual parachute, wait two seconds after exiting the airplane before pulling the rip-cord.

3.4 STALL RECOVERY

3.4.1 BEHAVIOR WITH POWER OFF

Under all loading conditions, air brakes extended or retracted, in straight and level or in banked flight, the HK 36 TTC enters a horizontal stall, during which the ailerons remain effective, even with maximum elevator deflection.

A partial loss of positive control in the stick and pedals, buffeting, and a pitch angle of 20° to 30° occur during this condition.

NOTE

During the horizontal stall, the IAS rises to approximately 85 km/h (46 kts. / 53 mph).

3.4.2 BEHAVIOR WITH POWER ON

See behavior with power off. At 50 % to 100 % power, straight and level flight, and maximum rearward center of gravity, the airplane may perform a stall dive over the left or right wing after entering the horizontal stall if the control stick is pulled even further.

NOTE

During a horizontal stall, the airspeed indicator readings fluctuate and are too high.

3.4.3 RECOVERY

The horizontal stall can be terminated immediately by relaxing the force on the elevator control.

NOTE

If the airplane performs a stall dive, immediately relax the force on the elevator control and pull out the airplane smoothly. If the stick is pulled further, the airplane may start to spin.

* Altitude loss resulting from stationary horizontal stall described above: approximately 10 - 20 m (33 - 65 ft.).
* Altitude loss resulting from stall dive over a wing: approximately 40 m (130 ft.).

3.5 SPIN RECOVERY

1. Rudder . . . . . apply fully opposite to spin direction
2. Control stick . . . . . forward, ailerons neutral

After spin movement has stopped:

3. Rudder . . . . . neutral
4. Pull airplane out smoothly

3.6 SPIRAL DIVE RECOVERY

There is no tendency to a spiral dive. The standard recovery procedure is:

1. Rudder . . . . . apply fully opposite to spiral dive rotation
2. Aileron . . . . . apply fully opposite to spiral dive rotation
3. Pull airplane out smoothly

3.7 ENGINE FAILURE

3.7.1 ENGINE FAILURE DURING TAKE-OFF

1. Fuel valve . . . . . check if OPEN
2. Fuel booster pump . . . . . check if ON
3. Propeller speed control . . . . . TAKE-OFF
4. Ignition switch . . . . . BOTH
5. Choke . . . . . OFF

WARNING

If the symptoms cannot be eliminated immediately and the engine refuses to deliver enough power, a straight-in landing must be performed if below 80 m (260 ft.) AGL.

Before touchdown:

- Fuel valve . . . . . CLOSED
- Ignition . . . . . OFF
- Master switch . . . . . OFF

3.7.2 ENGINE FAILURE DURING CRUISE

1. Fuel valve . . . . . check if OPEN
2. Fuel booster pump . . . . . ON
3. Choke . . . . . check if OFF
4. Carburetor heat . . . . . ON at power settings below 75 %

NOTE

When the carburetor heat is activated at a high power setting, the maximum admissible airbox temperature can be exceeded, resulting in increased engine wear.

5. Ignition . . . . . check if switch is in "BOTH" position
6. Fuel quantity . . . . . check

NOTE

If the symptoms cannot be eliminated and the engine refuses to deliver enough power, proceed as follows:

1. Throttle control . . . . . IDLE
2. Ignition . . . . . OFF
3. Propeller . . . . . feather
4. Fuel valve . . . . . CLOSED
5. Master switch . . . . . OFF
6. Airspeed . . . . . best glide speed (105 km/h (57 kts. / 65 mph))
7. Look for a suitable landing field
8. Cowl flap . . . . . CLOSE

3.7.3 ENGINE RESTART WITH A DISCHARGED BATTERY (during flight)

1. Electrical consumers . . . . . OFF
2. Fuel valve . . . . . OPEN
3. Master switch . . . . . ON
4. Mode select switch . . . . . POWER FLIGHT
5. Choke . . . . . as required
6. Throttle control . . . . . IDLE
7. Ignition switch . . . . . BOTH
8. Airspeed . . . . . increase to between 180 and 200 km/h (97 - 108 kts. / 112 - 124 mph)
9. Propeller speed control . . . . . very slowly move from FEATHER to TAKE-OFF
10. Oil pressure . . . . . should be available within 10 seconds
11. Choke . . . . . re-adjust if required
12. Propeller check:
    - Throttle control . . . . . adjust to 2000 RPM
    - Propeller speed control . . . . . CRUISE (pull back to cam before FEATHER position), wait until speed drops to approximately 1900 RPM; reset to TAKE-OFF position

    Repeat procedure at least three times.

CAUTION

Without repeating this procedure, it is not ensured that the pitch change mechanism will operate faultlessly.

13. RPM and throttle . . . . . as required to continue flight

CAUTION

After prolonged soaring periods, adequate altitude reserve must be ensured for engine warm-up.

14. All electrical consumers
    essential for flight operation . . . . . ON

WARNING

When the battery charge state is already very poor, it is not possible to recharge it. However, the electric main fuel pump is supplied with power by the generator via the on board electrical network.

15. Ammeter . . . . . check if battery is being charged
    (indicator clearly in positive range)

WARNING

If the battery is not being charged, land on next airfield and correct the fault. Without a serviceable battery, a generator failure will lead to engine failure.

16. Continue flight normally
17. Determine reason for battery discharge

CAUTION

The engine is started due to windmilling. Because of the high airspeed required for this process, an altitude loss of up to 300 m (1000 ft.) must be expected. The maximum admissible airspeeds must not be exceeded.

3.7.4 PROPELLER STUCK IN FEATHERED POSITION

NOTE

The propeller requires hydraulic pressure for pitch reduction. The hydraulic pressure is supplied through a pressure accumulator. When this accumulator is empty, the pressure must be built up by the oil pump of the engine. The engine is started with the propeller in feathered pitch and the throttle control in IDLE position.

1. Electrical consumers . . . . . OFF
2. Fuel valve . . . . . OPEN
3. Master switch . . . . . ON
4. Mode select switch . . . . . POWER FLIGHT
5. Fuel booster pump . . . . . ON
   Check whether the red warning light extinguishes after build-up of fuel pressure.
6. Choke . . . . . as required
7. Throttle control . . . . . IDLE
8. Ignition switch . . . . . BOTH
9. Propeller speed control . . . . . TAKE-OFF
10. Ignition switch . . . . . turn clockwise to start engine until the propeller adopts the working position

CAUTION

It is possible to start the engine with the propeller in the feathered position, although this significantly increases engine wear.

11. Oil pressure . . . . . should be available within 10 seconds
12. Choke . . . . . re-adjust as required
13. RPM and throttle . . . . . as required to continue flight
14. Fuel booster pump . . . . . OFF
15. Electrical consumers . . . . . ON
16. Continue flight normally
17. After landing, determine the reason for the loss of oil pressure and correct the fault.

3.7.5 SUDDEN DROP IN MANIFOLD PRESSURE AND RPM

In case of loud noise or bang: it is very likely that the turbocharger is damaged.

1. Proceed to next airfield, keep watching oil pressure
2. Throttle control . . . . . keep manifold pressure in admissible range
3. Propeller speed control . . . . . keep RPM in admissible range

NOTE

If the symptoms cannot be eliminated and the engine refuses to deliver enough power, proceed as follows:

1. Throttle control . . . . . IDLE
2. Ignition . . . . . OFF
3. Propeller . . . . . feather
4. Fuel valve . . . . . CLOSED
5. Master switch . . . . . OFF
6. Airspeed . . . . . best glide speed (105 km/h (57 kts. / 65 mph))
7. Look for a suitable landing field
8. Cowl flap . . . . . CLOSE

3.7.6 FLUCTUATING MANIFOLD PRESSURE AND RPM

1. TCU . . . . . OFF
2. Propeller speed control . . . . . make slight RPM changes in order to bleed system
3. TCU . . . . . ON

If manifold pressure and RPM do not stabilize:

1. TCU . . . . . OFF
2. Throttle control . . . . . keep manifold pressure in admissible range
3. Propeller speed control . . . . . keep RPM in admissible range
4. Land on nearest airfield and determine reason for malfunction

3.7.7 RED MANIFOLD PRESSURE WARNING LIGHT CONTINUOSLY ILLUMINATED

The manifold pressure limit has been exceeded.

1. Throttle control . . . . . keep manifold pressure in admissible range
2. Propeller speed control . . . . . keep RPM in admissible range
3. Land on nearest airfield and determine reason for malfunction

3.7.8 RED MANIFOLD PRESSURE WARNING LIGHT FLASHING

The time limit for engine take-off power has been exceeded.

1. Throttle control . . . . . keep manifold pressure in admissible range
2. Propeller speed control . . . . . keep RPM in admissible range
3. Continue flight normally

3.7.9 AMBER TURBO CAUTION LIGHT FLASHING

Defect in the area of the sensors, sensor wiring, or Turbo Control Unit or leakage of the airbox.

1. Throttle control . . . . . keep manifold pressure in admissible range
2. Propeller speed control . . . . . keep RPM in admissible range

CAUTION

If it is impossible to control RPM and manifold pressure manually:

Turbo Control Unit . . . . . OFF

3. Land on nearest airfield and determine reason for malfunction

3.7.10 RED FUEL PRESSURE WARNING LIGHT CONTINUOUSLY ILLUMINATED

Fuel pressure has dropped below the minimum.

1. Fuel booster pump . . . . . ON
2. Fuel valve . . . . . check if OPEN
3. Fuel quantity indicator . . . . . check fuel quantity
4. Ammeter . . . . . check if in positive range, otherwise switch OFF all equipment that is not needed

If light extinguishes

Land on nearest airfield and determine reason for malfunction.

WARNING

The main fuel pump is supplied with power by the generator. A generator failure will lead to the failure of the main fuel pump, causing the warning light to come on. Therefore, the illumination of the fuel pressure warning light can be an indication of generator failure. In this case, the on board network, including the fuel booster pump, is supplied with power only from the battery. All electrical consumers which are not essential to flight operation must be switched OFF. The load on the battery must be monitored by means of the ammeter which should not be too far in the negative range. The current requirement with all switchable consumers switched OFF is approximately 6 A. With a charged, well maintained battery, the fuel booster pump will be supplied with power for another 30 minutes.

If light does not extinguish

The required fuel flow cannot be maintained, or the fuel pressure switch is defective. However, an engine failure is possible at any time. See NOTES in Article 3.7.2 ENGINE FAILURE DURING CRUISE.

3.7.11 RED GENERATOR WARNING LIGHT CONTINUOUSLY ILLUMINATED

The generator is not delivering power to the on board network.

1. Fuel booster pump . . . . . ON
2. All electrical consumers not essential for flight operation . . . . . OFF
3. Land on nearest airfield and determine reason for malfunction

WARNING

The engine has no mechanical fuel pump. In case of generator failure, the fuel booster pump is supplied with power from the battery. The remaining flight duration with the engine running depends on the charge state of the battery. With a charged, well maintained battery, the remaining flight duration is approximately 30 minutes with the electrical consumers switched OFF.

3.7.12 AMBER TEMPERATURE CAUTION LIGHT CONTINUOUSLY ILLUMINATED

The admissible exhaust gas temperature (EGT) or the admissible airbox temperature has been exceeded. Excessive EGT will cause damage to the exhaust system. Excessive airbox temperatures lead to increased engine wear.

1. Carburetor heat . . . . . OFF
2. Throttle control . . . . . reduce power as soon as the situation allows so that caution light extinguishes

NOTE

When the carburetor heat is on, the airbox temperature will increase. At a power setting above 75 %, the use of carburetor heat is unnecessary and not recommended, as the maximum admissible airbox temperature can be exceeded.

3.7.13 INSUFFICIENT OIL PRESSURE

1. Throttle control . . . . . reduce manifold pressure as far as the situation allows
2. Land on nearest airfield and determine reason for insufficient oil pressure

WARNING

Engine failure can occur at any time.

3.7.14 EXCESSIVE OIL OR CYLINDER HEAD TEMPERATURE

1. Cowl flap . . . . . check if OPEN
2. Throttle control . . . . . reduce manifold pressure as far as the situation allows
3. Propeller speed control . . . . . reduce RPM as far as the situation allows
4. Land on nearest airfield and determine reason for high temperature

WARNING

Engine failure can occur at any time.

3.7.15 EXCESSIVE RPM

1. Propeller speed control . . . . . reduce RPM as far as the situation allows
2. Throttle control . . . . . reduce manifold pressure as far as the situation allows
3. Land on nearest airfield and determine reason for high temperature

WARNING

Engine failure can occur at any time.

3.7.16 CARBURETOR ICING

NOTE

Carburetor icing can be recognized by a drop in the engine RPM and/or loss of manifold pressure and/or irregular running of the engine without a change in the throttle control position, the choke position, the propeller setting, the airspeed, or the altitude.

CAUTION

Since the turbocharger increases the effect of intake air heating, the activation of the carburetor heat is not recommended at power settings above 75 %.

1. Carburetor heat . . . . . ON at power settings below 75 %

NOTE

The engine output will slightly drop, due to the intake air heating, and fuel consumption will slightly increase.

2. Carburetor heat . . . . . OFF as required

3.8 FIRE

3.8.1 FIRE ON GROUND

1. Fuel valve . . . . . CLOSED
2. Throttle control . . . . . FULL
3. Master switch . . . . . OFF
4. Cabin air . . . . . CLOSE
5. Cabin heat . . . . . OFF

3.8.2 FIRE DURING TAKE-OFF

1. Master switch . . . . . OFF
2. Cabin air . . . . . CLOSE
3. Cabin heat . . . . . OFF

After reaching a safe altitude:

4. Fuel valve . . . . . CLOSE
5. Engine . . . . . shut down
6. Perform landing with engine off (see Section 4)

3.8.3 FIRE DURING FLIGHT

1. Fuel valve . . . . . CLOSE
2. Throttle control . . . . . FULL
3. Master switch . . . . . OFF
4. Cabin air . . . . . CLOSE
5. Cabin heat . . . . . OFF
6. Engine . . . . . shut down
7. Perform landing with engine off (see Section 4)

3.9 OTHER EMERGENCIES

3.9.1 MALFUNCTION OR FAILURE OF PROPELLER SPEED CONTROL

1. Throttle control . . . . . keep RPM in admissible range
2. Airspeed . . . . . reduce

3.9.2 ICING

1. Leave icing area
2. Constantly move the controls to prevent them from becoming locked by ice
3. If the canopy is iced over:
   weather window . . . . . open
   cabin heat . . . . . ON

3.9.3 EMERGENCY LANDING

1. Engine . . . . . shut down
2. Perform landing with power off (see Section 4)

WARNING

Ensure that landing area is clear of obstacles. Touch-down with lowest possible airspeed and apply brakes carefully.

3.9.4 EMERGENCY LANDING ON WATER

Emergency landings on water should be performed only in extreme emergency situations, since it must be assumed, from trials with sailplanes, that the airplane will submerge immediately after touching the water and then surface again.

1. Parachute harness . . . . . open
2. Seat harness . . . . . tighten
3. Airspeed . . . . . normal approach speed
4. Touchdown . . . . . with minimum speed and air brakes retracted

NOTE

Conditions such as strong headwind, danger of wind shear, turbulence, or wet wings require a higher approach speed.

WARNING

On touchdown, protect your face with one arm!

5. Seat harness . . . . . release
6. Red canopy locks (LH and RH) . . . . swing 180° rearward
7. Canopy . . . . . push up and away
8. Evacuate airplane as quickly as possible

SECTION 4

NORMAL PROCEDURES

Page No.

4.1 INTRODUCTION

Section 4 contains checklists and a description of the normal operating procedures which is based on the results of flight tests. Normal procedures associated with optional systems can be found in Section 9. The refilling of operating fluids must be recorded in compliance with national regulations.

4.2 RIGGING AND DE-RIGGING

4.2.1 GENERAL

Each wing is connected to the fuselage by three bolts. The two main bolts are located at the center of the spar tunnel. They are accessible between the backrests and can be inserted from the front side. A spring loaded hook is placed over the bolt handles to secure the bolts.

The A- and B-bolts are fixed to the fuselage at the wing root. The A-bolt is placed in front of the spar tunnel and the B-bolt lies near the trailing edge. Self locking units are screwed onto the B-bolts, which are accessible through handholes on the upper surface of the wing. Locking rings are integrated in the B-bolt locking units, which therefore do not require any further safetying.

The horizontal stabilizer is attached to the vertical stabilizer by means of three bolts. The two bolts at the rear are fixed to the mount in the vertical stabilizer. The threaded bolt located at the front is fitted with a hexagonal socket. When screwed in, it is automatically secured by means of a locking ring integrated into the horizontal stabilizer.

4.2.2 WING INSTALLATION (WING FOLDING MECHANISM NOT PROVIDED)

1. Clean all bolts and bushes and the B-bolt locking unit and apply a light coat of grease.

2. Lift one wing (two persons at the root rib, one at the wing tip) and insert spar stump into spar tunnel. Ensure the smooth insertion of the A- and B-bolts. Connect position and strobe lights (optional) when the gap between fuselage and wing is just wide enough to reach the wires.

3. Insert main bolt while moving the wing tip in small circles. The aileron and air brake control systems are automatically connected. Do not release the wing before the main bolt has been completely inserted.
   The wide track of the landing gear allows the attached wing to support itself; no outside support is required.

4. Screw the B-bolt locking unit onto the B-bolt and tighten it by hand.

5. Install the other wing in a similar manner.

6. Tighten both B-bolt locking units with a wrench (size 17 mm), applying moderate hand torque (approximately 6 Nm (4.5 ft.lbs.)).

7. Secure main bolts with spring loaded hook.

8. Apply water resistant adhesive tape to the gap between fuselage and wing.

4.2.3 WING INSTALLATION (WING FOLDING MECHANISM PROVIDED)

1. Clean all bolts, bushes and the B-bolt locking unit and apply a light coat of grease, remove lid over B-bolt handhole.

2. Unhook one wing from its hanging mount and pull it rearward to the stop. A second person should stand between the wing and fuselage and relieve the load on the telescopic tube by lifting the wing at the spar stump.

3. Walk forward until the wing is 90° from line of flight; rotate the wing until the root ribs are parallel; keep wing in its correct position.

4. Introduce spar stump into spar tunnel while ensuring the smooth insertion of A- and B-bolts. Connect position and strobe lights (optional) when the gap between the fuselage and wing is just wide enough to reach the wires.

5. Insert main bolt. The aileron and air brake control systems are automatically connected. Do not release the wing before the main bolt has been completely inserted.
   The wide track of the landing gear allows the attached wing to support itself; no outside support is required.

6. Screw the B-bolt locking unit onto the B-bolt and tighten it by hand.

7. Install the other wing in a similar manner.

8. Tighten both B-bolt locking units with a wrench (size 17 mm), applying moderate hand torque (approximately 6 Nm (4.5 ft.lbs.)).

9. Secure main bolts with the spring loaded hook.

10. Apply water resistant adhesive tape to the gap between fuselage and wing.

4.2.4 WING REMOVAL

To remove the wings, reverse the procedure.

NOTE

When installing or removing the wings, prevent the airplane from falling onto its nosewheel or tail skid due to the CG movement.

4.2.5 WINGLET INSTALLATION

1. Clean the bolts and bushes if necessary.

CAUTION

Do not lubricate the bolt threads!

2. Install winglet with washers and self locking nuts.

3. Tighten self locking nuts with moderate hand torque (approximately 6 Nm (4.5 ft.lbs.)).

4. Apply water resistant adhesive tape to the gap.

4.2.6 WINGLET REMOVAL

To remove the winglet, reverse the procedure.

4.2.7 HORIZONTAL STABILIZER INSTALLATION

1. Clean all bushes and bolts and apply a light coat of grease.

2. Move the trim knob to full NOSE DOWN position.

3. Remove the Pitot tube.

4. Position the horizontal stabilizer over the stabilizer mount; the elevator control rod must be connected by a second person.

WARNING

The elevator control system is not connected automatically!

5. Slip the horizontal stabilizer onto both rearward bolts.

6. Screw in the fastening bolt to the stop with an 8 mm hexagon key, applying moderate hand torque (approximately 6 Nm (4.5 ft.lbs.)).

7. Check the horizontal stabilizer for insecure attachment and inspect load transmission of elevator control system.

8. Install the Pitot tube.

9. Apply water resistant adhesive tape to the gap between the horizontal stabilizer and the vertical stabilizer.

4.2.8 HORIZONTAL STABILIZER REMOVAL

To remove the horizontal stabilizer, reverse the procedure.

4.3 DAILY INSPECTION

WARNING

Master switch OFF, ignition OFF!

1. Fuel tank drain check: drain off about 1/8 liter (approximately 1/8 US quart) of fuel using a transparent drain cup (see Paragraph 7.10). Inspect for dirt or water.

NOTE

In order to prevent the water deposited in the tank from dispersing, the airplane should not be agitated prior to the drain check.

2. Ensure completeness of the onboard documents and ensure that the remaining operating time before the next scheduled inspection (100, 200 or 600 hrs.) allows for the intended flight.

3. Inspect left fuselage skin for damage or cracks.

4. Inspection of vertical stabilizer:
   - Check skin for damage or cracks.
   - Check rudder for improper or insecure mounting.
   - Check for excessive play.
   - Check rudder control system for improper connection and interference.
   - Remove Pitot tube cover.
   - Check Pitot tube for improper mounting and blockage of bores.

5. Inspection of horizontal stabilizer:
   - Check horizontal stabilizer and tips for improper mounting and insecure attachment and inspect skin for damage and cracks.

- Check elevator for improper mounting, play, damage and cracks.
- Check elevator control system for improper connection, lack of load transmission and interference.

6. Inspect right fuselage skin for damage and cracks.

7. Inspection of right wing:
   - Check wing, aileron and winglet for improper or insecure mounting, excessive play, damage, and cracks.
   - Check aileron control system for improper connection, lack of load transmission and interference.
   - Check air brakes for incomplete retraction; ensure flushness with the wing surface.
   - Check air brake control system for improper connection, lack of load transmission and interference.
   - Check air brake box for foreign bodies.

8. Inspection of right main landing gear:
   - Check landing gear strut for damage and cracks.
   - Check wheel fairing for damage and looseness.
   - Visually check tires and brakes.
   - Ensure correct inflation (2.3 bar (33 psi)).

9. Inspection of propeller:
   - Check propeller blades for damage, cracks and excessive play.
   - Check spinner for damage and insecure mounting.

10. Inspection of nose landing gear:
    - Check nosewheel strut for damage and cracks.
    - Check wheel fairing for damage and looseness.
    - Visually check tire.
    - Ensure correct inflation (1.8 bar (26 psi)).

11. Oil and coolant check:
    - Check oil level.

NOTE

The oil consumption is minor, but becomes somewhat greater with a full oil tank. Therefore, only refill engine oil when the oil level reaches or falls below the minimum marking.

- Ensure coolant level in equalizing reservoir is more than 1/3.

NOTE

The coolant equalizing reservoir should not be more than 2/3 full.

- Check engine compartment for obvious defects.
- Check coolers for obstruction.
- Check air intake opening for foreign bodies.

12. Inspection of left main landing gear:
    - Check landing gear strut for damage and cracks.
    - Check wheel fairing for damage and looseness.
    - Visually check tires and brakes.
    - Ensure correct inflation (2.3 bar (33 psi)).

13. Inspection of left wing:
    - Check wing, aileron and winglet for improper or insecure mounting, excessive play, damage, and cracks.
    - Check aileron control system for improper connection, lack of load transmission, and interference.
    - Check air brakes for incomplete retraction; ensure flushness with the wing surface.
    - Check air brake control system for improper connection, lack of load transmission and interference.
    - Check air brake box for foreign bodies.

14. Check in the cabin:
    - Check if loading is admissible (refer to Section 6).

NOTE

Ensure compliance with loading restrictions by changing and/or rearranging the useful load.

- Master switch . . . . . ON
- Mode select switch . . . . . POWER FLIGHT
- All circuit breakers . . . . . pushed in
- Fuel quantity . . . . . check using fuel quantity indicator and log book entries; refuel if necessary

NOTE

Usable fuel quantity and approved fuel grades: see Paragraph 2.12, FUEL.

- Master switch . . . . . OFF
- Cabin . . . . . check for foreign bodies and loose objects
- Canopy . . . . . check for dirt and damage
- Cowl flap . . . . . check for improper operation
- Main bolts . . . . . verify that bolts are properly secured

15. Check of propeller FEATHER position:
    - Rudder pedals . . . . . adjust
    - Canopy . . . . . closed & locked
    - Fuel valve . . . . . OPEN
    - Parking brake . . . . . set
    - Electrical consumers . . . . . OFF
    - Master switch . . . . . ON
    - Mode select switch . . . . . POWER FLIGHT

- Propeller speed control . . . . . TAKE-OFF
- Cowl flap . . . . . OPEN
- Fuel booster pump . . . . . ON; verify red warning light extinguishes after build up of fuel pressure
- Throttle control . . . . . IDLE
- Choke . . . . . ON if engine is cold

WARNING

People must stay clear of the propeller danger zone!

- Ignition switch . . . . . turn clockwise to start engine
- Throttle control . . . . . adjust to approximately 1000 RPM
- Oil pressure . . . . . must reach operating range within 10 seconds

CAUTION

If oil pressure is too low, turn off engine immediately!

NOTE

When the Powered Sailplane has been parked for long periods, or the hydraulic pressure accumulator is emptied for any other reason, a loss of oil pressure may occur after oil pressure build up in the area of the oil pressure sensor. The reason for this is the filling process of the accumulator. The oil pressure indicator may drop to zero for a maximum of 15 seconds.

- Choke . . . . . push forward as required
- Fuel booster pump . . . . . OFF
- At increased idle speed (approximately 1000 RPM), turn off ignition and simultaneously pull propeller speed control all the way back to the FEATHER position.

NOTE

Unless the propeller speed control is actuated simultaneously with the ignition switch, the propeller will remain in the take-off position. Propeller feathering is only possible at 800 RPM or above (see Article 7.9.5, PROPELLER SPEED CONTROL).

- Propeller speed control . . . . . TAKE-OFF

NOTE

If the propeller does not move to the take-off position, apply the emergency procedure described in Paragraph 3.7, ENGINE FAILURE.

- Master switch . . . . . OFF
- Mode select switch . . . . . SOARING

4.4 PREFLIGHT INSPECTION

The following checklist with the most important items is located where it is well visible for both Pilots:

START CHECK

1. Mass & Balance checked
2. Main bolts secured
3. Fuel valve OPEN
4. Fuel quantity checked
5. Canopy locked
6. Seat harness on and secure
7. Propeller check
8. Magneto check
9. Carburetor heat OFF
10. Controls free
11. Trim checked
12. Parking brake released
13. Air brakes locked
14. TCU ON
15. Fuel booster pump ON

4.5 NORMAL PROCEDURES AND RECOMMENDED SPEEDS

4.5.1 LAUNCH/ENGINE STARTING, RUN UP & TAXIING PROCEDURES

1. Rudder pedals . . . . . adjust
2. Seat harnesses . . . . . fasten
3. Canopy . . . . . closed & locked
4. Fuel valve . . . . . OPEN
5. Controls . . . . . free
6. Air brakes . . . . . verify proper operation
7. Air brakes . . . . . lock
8. Parking brake . . . . . set
9. Electrical consumers . . . . . OFF
10. Master switch . . . . . ON
11. Mode select switch . . . . . POWER FLIGHT

12.	Warning and caution lights	All warning and caution lights light up; some extinguish automatically after approximately 2 seconds.
13.	Propeller speed control	TAKE-OFF
14.	Fuel quantity indicator	check
15.	Cowl flap	OPEN
16.	Fuel booster pump	ON; verify red warning light extinguishes after build up of fuel pressure
17.	Throttle control	IDLE
18.	Choke	ON if engine is cold

WARNING

People must stay clear of the propeller danger zone!

19.	Ignition switch	turn clockwise to start engine
20.	Throttle control	adjust to approximately 1000 RPM
21.	Oil pressure	must reach operating range within 10 seconds

CAUTION

If the oil pressure is too low, turn off engine immediately!

NOTE

When the Powered Sailplane has been parked for long periods, or the hydraulic pressure accumulator is emptied for any other reason, a loss of oil pressure may occur after oil pressure build up in the area of the oil pressure sensor. The reason for this is the filling process of the accumulator. The oil pressure indicator may drop to zero for a maximum of 15 seconds.

22. Choke . . . . . push forward as required

WARNING

If the engine is warm, the activated choke will considerably reduce the engine output!

23. Fuel booster pump . . . . . OFF
24. Fuel pressure warning light . . . . . verify main fuel pump maintains fuel pressure
25. Electrical consumers . . . . . ON or OFF as required
26. Altimeter . . . . . set
27. Oil temperature . . . . . check

CAUTION

Before loading the engine, allow the oil temperature to rise to 50° C (122° F) with the cowl flap open at 1000 to 1500 RPM (also possible during taxiing).

28. Choke . . . . . OFF

29. Ignition circuits check:
    - Throttle control . . . . . adjust to 1600 RPM
    - Ignition circuits . . . . . check; drop should be 50 to 150 RPM; difference between circuits 1 and 2 should not exceed 50 RPM.

CAUTION

If RPM drop is too high at low outside temperatures, repeat check with the carburetor heat ON.

30. Carburetor heat . . . . . check at 1600 RPM;
drop should be approximately 20 RPM

31. Propeller check:
- Throttle control . . . . . adjust to 2000 RPM
- Propeller speed control . . . . . CRUISE (carefully pull back to cam before FEATHER position)
wait until speed drops to approximately 1900 RPM
reset to TAKE-OFF position

Repeat procedure at least three times.

CAUTION

Without repeating the procedure, it is not ensured that the pitch change mechanism will operate faultlessly.

32. Power plant instruments . . . . . verify all indicators are in admissible range

4.5.2 TAKE-OFF AND CLIMB

1. Cowl flap . . . . . OPEN
2. Fuel booster pump . . . . . ON
3. Propeller speed control . . . . . TAKE-OFF
4. Throttle . . . . . FULL (2350 ± 35 RPM, manifold pressure in yellow range)

CAUTION

The manifold pressure for take-off power is set with the throttle control in the foremost 1/2 cm (1/5 in.) of the setting range. The TCU sets the take-off manifold pressure. In this range, it is not possible to control the manifold pressure with the throttle control. With high outside air temperatures at high field elevations, the highest permitted manifold pressure will not be reached.

5. Start take-off run with elevator neutral, maintaining direction with rudder.

6. Lift nosewheel at approximately 80 km/h (43 kts. / 50 mph); airplane will lift off by itself at approximately 90 km/h (49 kts. / 56 mph).

7. Perform climb with at least 97 km/h (52 kts. / 60 mph); monitor oil pressure, oil temperature and cylinder head temperature, which must all stay within the green range.

8. At a height of 100 m (330 ft.) AGL:
   - Fuel booster pump . . . . . OFF

   If the fuel system is intact, the red warning light must not illuminate, since the main fuel pump maintains the fuel pressure.

9. After reaching a safe altitude:
   - Propeller speed control . . . . . set RPM below yellow range
   - Throttle control . . . . . set manifold pressure below yellow range

For best angle of climb, adjust airspeed to 97 km/h (52 kts. / 60 mph). For best rate of climb, adjust to 110 km/h (59 kts. / 68 mph). Figures apply to maximum T/O mass (max. gross weight).

CAUTION

The manifold pressure for maximum continuous power is set in the range from 1/2 to 1 1/2 cm (1/5 to 3/5 in.) behind the foremost throttle control position. In this range, the TCU sets the manifold pressure between 32 and 35.4 inHg and it is not possible to control the manifold pressure with the throttle control.

4.5.3 FLIGHT (INCLUDING IN-FLIGHT ENGINE STOP/START PROCEDURES)

NOTE

Economic power settings can be found in Article 5.3.7.

WARNING

When setting the power in turbulent air, make sure not to exceed V_{RA}.

In-flight engine stop

1. Throttle control . . . . . IDLE

CAUTION

In order to avoid overheating the bearings in the turbocharger, the engine must be cooled down at a low power setting for approximately one minute before being turned off.

2. Electrical consumers . . . . . OFF

WARNING

Engine start can become impossible:

- After prolonged soaring with several electrical consumers switched on (mis-operation of mode select switch)
- In extreme cold (see Paragraph 2.14, OTHER LIMITATIONS)
- If the battery is in a poorly maintained condition or barely charged

3. Airspeed . . . . . maintain approximately 100 km/h (54 kts. / 62 mph).

NOTE

At airseeeds below 100 km/h (54 kts. / 62 mph), the windmilling propeller RPM becomes very low or the propeller stops. However, the propeller will only feather at a sufficient RPM (above 800).

4. Ignition . . . . . OFF
5. Propeller speed control . . . . . FEATHER (pull all the way back over the cam)

NOTE

The propeller rotates after ignition shut-off due to windmilling. Feathering will occur with the propeller rotating.

6. Mode select switch . . . . . SOARING
7. Cowl flap . . . . . CLOSE

In-flight engine start

1. Electrical consumers . . . . . OFF
2. Master switch . . . . . ON
3. Mode select switch . . . . . POWER FLIGHT
4. Propeller speed control . . . . . TAKE-OFF
5. Cowl flap . . . . . OPEN
6. Choke . . . . . ON if engine is cold
7. Fuel booster pump . . . . . ON
8. Throttle control . . . . . IDLE
9. Ignition switch . . . . . turn clockwise to start engine
10. Oil pressure . . . . . check

NOTE

The hydraulic pressure accumulator is not full after the propeller pitch change. After pressure build-up, there might be a loss of oil pressure in the area of the oil pressure sensor. The reason for this is the filling process of the pressure accumulator. The oil pressure indicator may drop to zero for a maximum of 15 seconds.

11. Choke . . . . . OFF if necessary
12. Fuel booster pump . . . . . OFF
13. Fuel pressure warning light . . . . . verify main fuel pump maintains fuel pressure
14. Electrical consumers . . . . . ON as required
15. Oil temperature . . . . . check

16. Propeller check:
    - Throttle control . . . . . adjust to 2000 RPM
    - Propeller speed control . . . . . CRUISE (carefully pull back to cam before FEATHER position)
      wait until speed drops to approximately 1900 RPM
      reset to TAKE-OFF position

    Repeat procedure at least three times.

CAUTION

Without repeating the procedure, it is not ensured that the pitch change mechanism will operate faultlessly. The propeller system becomes bled by this procedure. If this check is not carried out, the propeller pitch could fluctuate.

Sideslips

The speed range in which sideslips can be performed depends on the strength of the Pilot, since significant rudder control forces are required at higher airspeeds. Usually, the upper limit is approximately 150 km/h (81 kts. / 93 mph).

A control force reversal can occur when the rudder is fully deflected and the ailerons are deflected opposite to the rudder. To recover, either release the aileron control or apply approximately 30 N (7 lbs.) to the rudder pedal to overcome the control force reversal.

4.5.4 APPROACH

1. Throttle control . . . . . reduce power as required

WARNING

When setting the power in turbulent air, make sure not to exceed v_{RA}.

2. Carburetor heat . . . . . ON if required
3. Trim . . . . . adjust as required
4. Air brakes . . . . . apply as required

4.5.5 LANDING

Power-on landing

1. Propeller speed control . . . . . TAKE-OFF
2. Fuel booster pump . . . . . ON
3. Throttle control . . . . . reduce power
4. Carburetor heat . . . . . ON
5. Cowl flap . . . . . OPEN
6. Trim . . . . . adjust as required
7. Air brakes . . . . . apply as required

NOTE

The air brake lever locks when the air brakes are extended half way. With slightly increased force, this position can be overtraveled in either direction. With the air brakes locked in the half extended position, it is possible to control the glide path with the throttle control. The maximum airspeed for air brakes fixed in the half extended position (v_{ABF}) must not be exceeded.

8. Sideslip . . . . . possible, but not necessary
9. Approach speed . . . . . 105 km/h (57 kts. / 65 mph) during final approach

NOTE

Conditions such as strong headwind, danger of wind shear, turbulence, or wet wings require a higher approach speed.

10. Touchdown . . . . . on main landing gear
11. Wheel brakes . . . . . apply as required, using toe brakes

CAUTION

The wheels have a differential braking system. Apply toe brakes symmetrically to avoid skidding.

12. Fuel booster pump . . . . . OFF

Balked landing with the engine running

1. Air brakes . . . . . retract
2. Carburetor heat . . . . . OFF
3. Throttle control . . . . . FULL

WARNING

When approaching with the air brakes fixed in the half extended position, one hand on the control stick and the other on the throttle control, FIRST select full throttle, then retract the air brakes.

NOTE

Climbing is possible with the air brakes fixed in the half extended position.

4. Perform climb with at least 97 km/h (52 kts. / 60 mph). Monitor oil pressure, oil temperature, and cylinder head temperature which must all stay within the green range.

5. At a height of approximately 100 m (330 ft.) AGL:
   - Fuel booster pump . . . . . OFF

   If the fuel system is intact, the red warning light must not illuminate, since the main fuel pump maintains the fuel pressure.

Power-off landing

NOTE

If the propeller is feathered, sufficient height must be allowed on approach to ensure that the landing field is reached, since starting the engine takes too much time during final approach!

1. Trim . . . . . adjust as required
2. Air brakes . . . . . apply as required

NOTE

The air brake lever locks when the air brakes are extended half way. With slightly increased force, this position can be overtraveled in either direction.

3. Approach speed . . . . . 105 km/h (57 kts. / 65 mph) during final approach

NOTE

Conditions such as strong headwind, danger of wind shear, turbulence, or wet wings require a higher approach speed.

4. Touchdown . . . . . on main landing gear
5. Wheel brakes . . . . . apply as required, using toe brakes

CAUTION

The wheels have a differential braking system. Apply toe brakes symmetrically to avoid skidding.

4.5.6 (omitted)

4.5.7 HIGH ALTITUDE FLIGHT

The never exceed speed is reduced at pressure altitudes above 2000 meters (6500 ft.), as shown in the following table.

Pressure altitude		Never exceed speed (v_{NE})		
meters	feet	km/h	kts.	mph
0 to 2000	0 to 6500	261	141	162
2000 to 3000	6500 to 9800	246	133	153
3000 to 4000	9800 to 13100	233	126	145
4000 to 5000	13100 to 16400	221	119	137
5000 to 6000	16400 to 19600	210	113	130

WARNING

Due to the lack of oxygen at high altitudes, perception and reaction become greatly reduced and even unconsciousness may occur. The use of oxygen apparatus is strongly advised for flights above 3500 m (11500 ft.). National legislation for flights at high altitudes should be referred to.

WARNING

During the flight tests, the Powered Sailplane was only tested up to altitudes of 5000 m (16000 ft.).

4.5.8 FLIGHT IN RAIN

NOTE

Flight performance deteriorates in rain. The impact on the flying characteristics is minor. Flight in very heavy rain should be avoided because of the reduced visibility.

4.5.9 AEROBATICS

NOTE

Aerobatics and spinning are not permitted.

4.5.10 ENGINE SHUT-DOWN

1. Propeller speed control . . . . . TAKE-OFF
2. Throttle . . . . . IDLE

CAUTION

In order to avoid overheating the turbocharger bearings, the engine must be cooled down at a low power setting for approximately one minute before being turned off. This should be observed especially after engine test running. Sufficient cooling usually occurs through landing approach and subsequent taxiing.

3. Parking brake . . . . . set (see Paragraph 7.5)
4. Fuel booster pump . . . . . OFF
5. Electrical consumers . . . . . OFF
6. Ignition . . . . . OFF
7. Master switch . . . . . OFF

8. Mode select switch . . . . . SOARING
9. Air brakes . . . . . lock

4.5.11 PARKING

When parking for a short time, the airplane should be oriented in headwind direction with the parking brake set and the air brakes fixed in the half extended position. In case of longer unattended parking or in unpredictable wind conditions, the airplane should be moored or stored in a hangar. It is also advisable to cover the Pitot tube.

CAUTION

Avoid outdoor parking for prolonged periods of time.

NOTE

The Powered Sailplane should not be parked with the propeller in the feathered pitch position. With an empty oil pressure accumulator, the propeller cannot assume the take-off position. Starting the engine with the propeller in feathered pitch is possible, but significantly increases engine wear.

SECTION 5
PERFORMANCE

Page No.

5.1 INTRODUCTION

Section 5 provides approved data for airspeed calibration, stall speeds and take-off performance, along with additional information which does not require approval.

The data in the charts has been computed from actual flight tests with the Powered Sailplane and engine in good condition, with wheel fairings, winglets and spinner installed and using average piloting techniques.

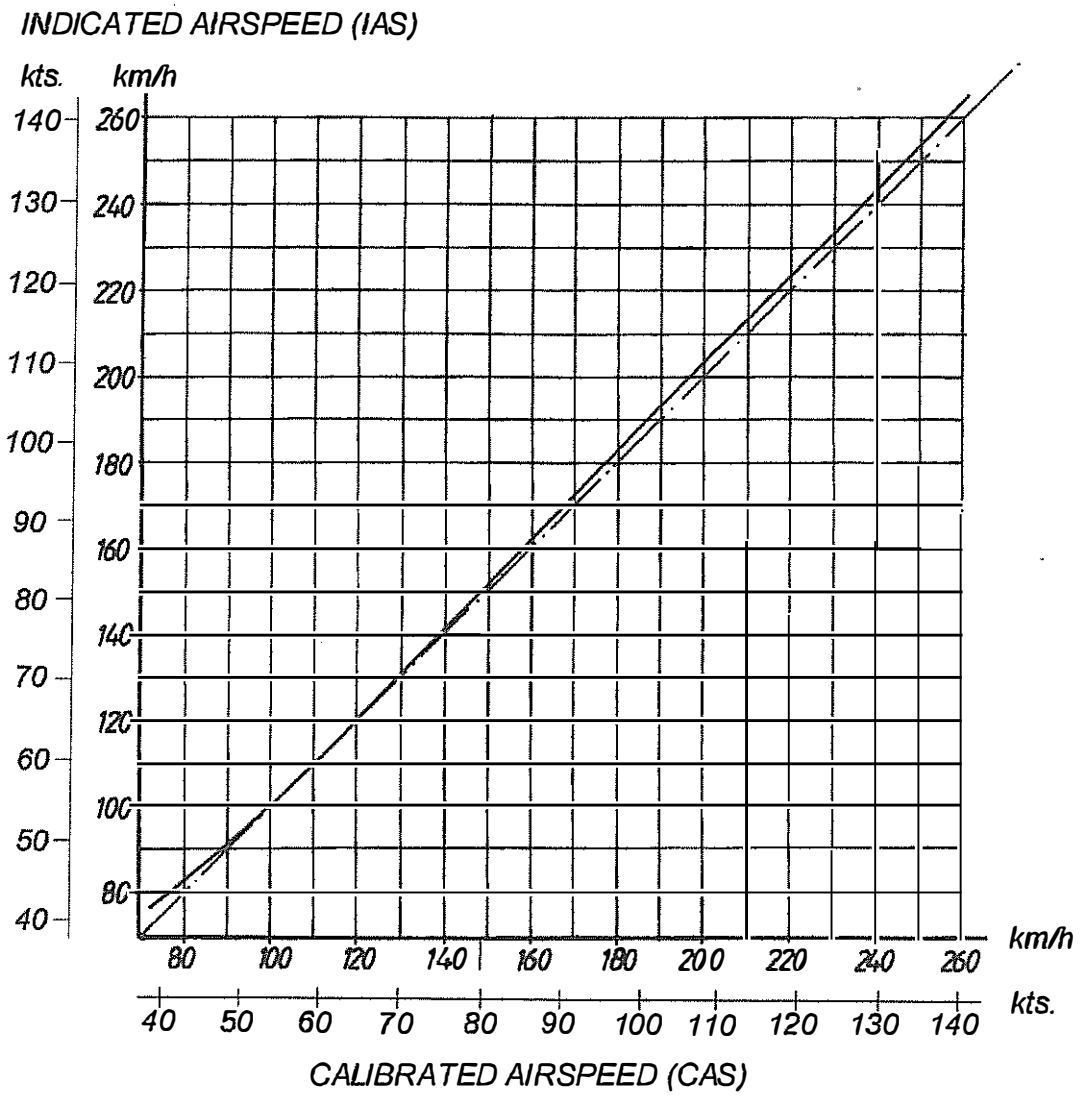
The specified airspeeds must be understood as IAS. The performance data has been evaluated using the normal procedures described in Section 4.

NOTE

A poor maintenance condition of the airplane and unfavorable external circumstances (high temperature, rain) can considerably deteriorate the specified performance values.

5.2 ACG-APPROVED DATA

5.2.1 AIRSPEED INDICATOR SYSTEM CALIBRATION



5.2.2 STALL SPEEDS

Stall speeds at different bank angles in **km/h**:

Air brakes		Bank angle			
		0°	30°	45°	60°
retracted	v_{SO}	78 km/h	84 km/h	93 km/h	110 km/h
extended	v_{S1}	81 km/h	87 km/h	96 km/h	115 km/h

Stall speeds at different bank angles in **kts.**:

Air brakes		Bank angle			
		0°	30°	45°	60°
retracted	v_{SO}	42 kts.	45 kts.	50 kts.	60 kts.
extended	v_{S1}	44 kts.	47 kts.	52 kts.	62 kts.

Stall speeds at different bank angles in **mph**:

Air brakes		Bank angle			
		0°	30°	45°	60°
retracted	v_{SO}	48 mph	52 mph	58 mph	69 mph
extended	v_{S1}	50 mph	54 mph	60 mph	71 mph

NOTE

Conditions such as turbulence, wet wings, or high load factors increase the stall speeds.

5.2.3 TAKE-OFF PERFORMANCE

Conditions:
- Outside air temperature: 15° C (59° F)
- Atmospheric pressure: 1013 hPa (1013 mbar (29.92 inHg))
- Calm
- Full throttle
- Maximum flight mass (max. gross weight)
- Propeller setting: TAKE-OFF
- Rotation at approximately 80 km/h (43 kts. / 50 mph)
- Lift-off speed approximately 90 km/h (49 kts. / 56 mph)
- Speed during climb approximately 97 km/h (52 kts. / 60 mph)
- Level runway, asphalt surface

Take-off roll	: 182 m (597 ft.)
Take-off distance to clear a 15 m (50 ft.) obstacle	: 274 m (899 ft.)

NOTE

For take-off distances under circumstances different from those described above, refer to the charts in Article 5.3.3.

WARNING

The take-off distances given here contain no safety margins. Poor maintenance condition of the airplane, deviation from the procedures prescribed in this manual and unfavorable external conditions (rain, crosswind, wind shear, rough ground and, in particular, long grass) can considerably extend the take-off distance.

5.3 ADDITIONAL INFORMATION

5.3.1 DEMONSTRATED CROSSWIND PERFORMANCE

Take-off : 15 km/h (8.1 kts. / 9.3 mph)
Landing : 15 km/h (8.1 kts. / 9.3 mph)

5.3.2 GLIDE PERFORMANCE AND FLIGHT POLAR

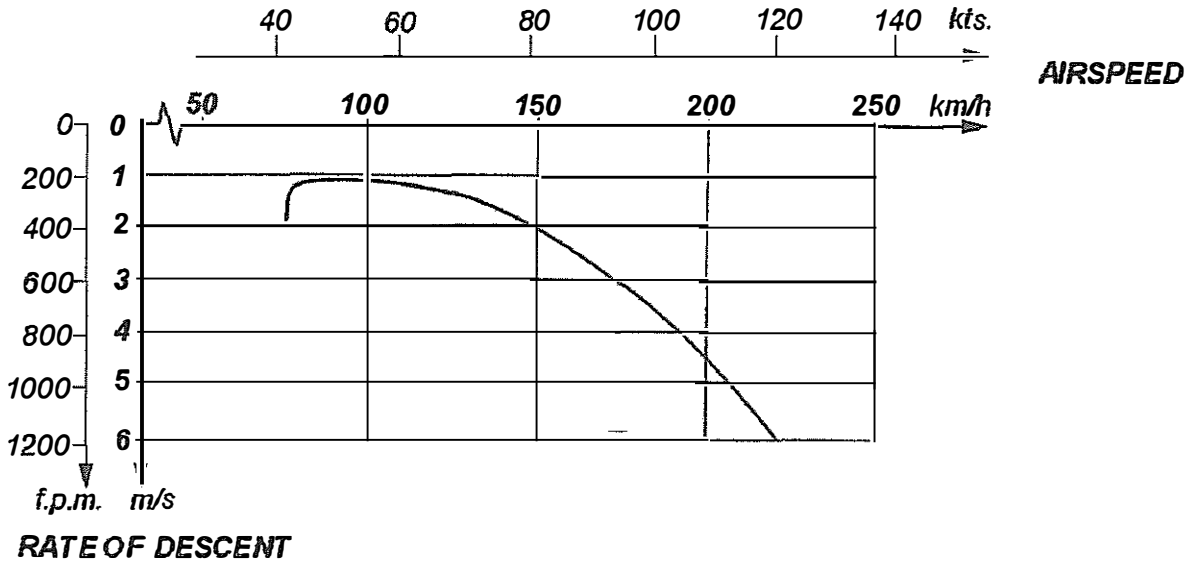
Glide performance

Conditions:
- Maximum flight mass (max. gross weight)
- Winglets, wheel fairings, and spinner installed
- Propeller feathered

Minimum rate of descent : 1.19 m/s (234 ft./min) at 97 km/h (52 kts. / 60 mph)
Maximum lift drag ratio : 27 at 105 km/h (57 kts. / 65 mph)

Flight polar

Conditions:
- Maximum flight mass (max. gross weight)
- Winglets, wheel fairings, and spinner installed
- Propeller feathered



5.3.3 TAKE-OFF CHARTS

Conditions:
- Full throttle
- Maximum flight mass (max. gross weight)
- Propeller setting: TAKE-OFF
- Lift-off speed approximately 90 km/h (49 kts. / 56 mph)
- Speed during climb approximately 97 km/h (52 kts. / 60 mph)
- Level runway, asphalt surface
- TCU on

s_1 = Take-off roll;

s_2 = Take-off distance to clear a 15 m (50 ft.) obstacle

Head-wind comp. [kts.]	OAT [° C]	Pressure altitude above MSL [m] / QFE [hPa]							
		0/1013		400/966		800/921		1200/877	
		s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]	s_1 [m]	s_2 [m]
0	0	158	244	172	260	186	277	202	297
	15	182	274	197	292	214	314	231	336
	30	208	307	225	328	251	363	282	400
5	0	129	206	141	220	153	235	167	253
	15	149	232	162	248	177	267	192	287
	30	171	261	186	280	209	309	236	344
10	0	103	171	112	183	123	197	135	212
	15	119	193	130	208	143	224	157	241
	30	137	218	150	236	170	261	193	291

Head-wind comp. [kts.]	OAT [° F]	Pressure altitude above MSL [ft.] / QFE [inHg]							
		0/29.9		1310/28.5		2620/27.2		3940/25.9	
		s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]	s_1 [ft.]	s_2 [ft.]
0	32	518	801	564	853	610	909	663	974
	59	597	899	646	958	702	1030	758	1102
	86	682	1007	738	1076	823	1191	925	1312
5	32	423	676	463	722	502	771	548	830
	59	489	761	531	814	581	876	630	942
	86	561	856	610	919	686	1014	774	1129
10	32	338	561	367	600	404	646	443	696
	59	390	633	427	682	469	735	515	791
	86	449	715	492	774	558	856	633	955

WARNING

A grass surface will extend the take-off distances by at least 20 %, depending its characteristics (softness, grass length). The take-off distances given here contain no safety margins. Poor maintenance condition of the airplane, deviation from the procedures prescribed in this manual and unfavorable external conditions (rain, crosswind, wind shear, uneven terrain and, in particular, long grass) can considerably extend the take-off distance.

5.3.4 NOISE DATA

The evaluation of noise emission was carried out according to the Noise Regulations of ICAO Annex 16.

Annex 16, Chapter 10:

with standard exhaust system	: 65.9 dB(A)
with silent exhaust system (SB 57)	: 59.9 dB(A)

Annex 16, Chapter 6 for basic training and towing flight (for Austria only, cf. Federal Law Gazette dated 29 Oct 1993, 738th Decree):

with standard exhaust system	: 66.4 dB(A)
with silent exhaust system (SB 57)	: 62.3 dB(A)

5.3.5 CLIMB PERFORMANCE

Conditions:	- Sea level - Full power - Maximum flight mass (max. gross weight)
Airspeed:	v_y = 110 km/h (59 kts. / 68 mph)
Propeller speed:	2260 RPM
Manifold pressure:	34 inHg / 35.4 inHg
Max. rate of climb:	5.4 m/s (1063 ft./min)

5.3.6 SERVICE CEILING

Service ceiling is above 5000 m (16400 ft.).

NOTE

For flights at high altitude, attention should be paid to Article 4.5.7, HIGH ALTITUDE FLIGHT.

5.3.7 FUEL CONSUMPTION, CRUISING SPEED, MAXIMUM FLIGHT DURATION

NOTE

The specifications for maximum flight duration and range apply to a full tank and do not include any reserve. The speed and consumption specifications apply to flight in still air with ISA conditions and a well-maintained, correctly adjusted airplane. For the determination of the range, attention must be paid to the influence of wind, as well as safety reserves.

Power	Manif. press.	Engine speed	Fuel consumption		True cruising speed, v_{TAS}, at altitudes of 1000 m, 2000 m, 3000 m (3300 ft, 6600 ft, 9800 ft)			Maximum duration with 55 l / 79 l tank	
[% MCP]	[inHg]	[RPM]	[l/h]	[US gal./h]	[km/h] [kts. / mph]			[h:min]	
115	38.4 or 39.9	2385	33	8.7	-	-	-	-	-
100	34.0 or 35.4	2265	27	7.1	217 117/135	222 120/138	227 123/141	2:00	2:51
90	32	2200	24	6.3	210 113/131	215 116/134	219 118/136	2:15	3:13
75	30	2100	20	5.3	197 106/122	201 109/125	205 111/127	2:42	3:51
60	28	2000	17	4.5	184 99/114	187 101/116	190 103/118	3:11	4:32
45	26	1900	14	3.7	168 91/104	170 92/106	173 93/108	3:51	5:30

NOTE

As a simplified rule for reducing power below the maximum continuous power, the manifold pressure (throttle control) should be reduced by approximately 2 inHg per 100 RPM propeller speed reduction (propeller speed control).

SECTION 6
MASS (WEIGHT) AND BALANCE / EQUIPMENT LIST

Page No.

6.1 INTRODUCTION

Section 6 describes the range of loading in which the HK 36 TTC can be operated safely.

Descriptions of the weighing procedure, the determination of the admissible empty mass CG range and a list of the equipment that must be present in the airplane during the weighing process are included in the Airplane Maintenance Manual, Section 4.

WARNING

Exceeding the maximum mass (maximum gross weight) can lead to overstressing of the airplane. Falling short of the minimum useful load on the seats leads to a deterioration of controllability and stability.

6.2 WEIGHING PROCEDURES

The weighing procedures are described in the Airplane Maintenance Manual, Paragraph 4.2. The purpose of weighing the airplane is to evaluate the empty mass (empty weight) and the corresponding CG lever arm (i.e. CG position). It may be carried out by authorized personnel only.

6.3 WEIGHING REPORT

The Weighing Report shows the current empty mass (empty weight) and the corresponding CG position. The Weighing Report is preserved in the Airplane Maintenance Log.

NOTE

After equipment changes, repair work, repainting, etc. the airplane must be reweighed in compliance with the Airplane Maintenance Manual by an authorized person, and the new empty mass (empty weight) CG position must be determined. The results must be entered in the Mass and Balance Form, and the new limits must be drawn on a new Mass and Balance Diagram.

6.4 BASIC EMPTY MASS (WEIGHT) AND CORRESPONDING MOMENT

The empty mass (empty weight) CG limitations are defined in the Airplane Maintenance Manual, Section 4.

These limitations guarantee that solo-pilots with a mass (weight) of at least 70 kg (154 lbs.) will not overstep the maximum rearward CG when flying with a full tank and no baggage.

The CG will not exceed the maximum forward position if no more than 220 kg (485 lbs.) useful load on the seats and 10 kg (22 lbs.) of fuel for a half hour flight are carried onboard.

6.5 MASS (WEIGHT) OF ALL NON-LIFTING PARTS

The maximum mass (weight) of all non-lifting parts is 610 kg (1345 lbs.). A list of all non-lifting parts is included in the Airplane Maintenance Manual, Paragraph 4.6.

NOTE

Due to the design of the HK 36 TTC, the mass (weight) of all non-lifting parts will not be exceeded unless the maximum flight mass (max. gross weight) of 770 kg (1698 lbs.) is overstepped.

6.6 MASS (WEIGHT) AND BALANCE FORM

The Mass and Balance Form on Page 6-6 shows the following values:

- Current empty mass
- Current empty mass CG position
- Current maximum useful load including parachute, seat cushions, fuel, and baggage
- Minimum useful load on the seats for solo flights with full tank and no baggage
- Minimum useful load on the seats for solo flights with full tank and maximum baggage mass (12 kg (26 lbs.))

Furthermore, the Mass and Balance Form is a record of all weighings carried out.

The Mass and Balance Form must be updated by an authorized person in compliance with the currently effective Weighing Report. The corresponding instructions can be found in the Airplane Maintenance Manual, Paragraph 4.7.

In addition to the Mass and Balance Form, a new Mass and Balance Diagram is filled out upon each weighing. The corresponding instructions are given in the Airplane Maintenance Manual, Paragraph 4.8.

NOTE

Weighing is carried out with the equipment shown in the Equipment Inventory installed. Airplane operation without winglets, spinner or wheel fairings is only permissible in exceptional cases (e.g. ferry flights or test flights after maintenance). The influence on the empty mass (weight) and the corresponding CG position is negligible.

MASS AND BALANCE FORM

Serial No.: _____ Call sign: _____

Date of weighing	Empty mass (weight)	Empty mass CG pos.	Max. useful load	Minimum useful load on seats with full tank		A.M.E.
				with no baggage	with max. baggage	

6.7 USEFUL LOADS

6.7.1 MAXIMUM USEFUL LOAD

The useful load includes the masses (weights) of the occupants, baggage, and fuel. The maximum permissible useful load is shown in the Mass and Balance Form, in the Mass and Balance Diagram and on the placard on the instrument panel.

NOTE

The total crew mass comprises of the mass of the passengers and parachutes.

6.7.2 USEFUL LOAD ON THE SEATS

Minimum useful load on the seats

The Mass and Balance Form and the placard in the cockpit (left hand section of instrument panel) show the following data:

- Minimum useful load on the seats for solo flights with a full tank and no baggage;
- Minimum useful load on the seats for solo flights with a full tank and maximum baggage mass (12 kg (26 lbs.)).

The minimum useful load on the seats is never less than 55 kg (121 lbs.).

NOTE

Pilots with a mass (a weight) between 55 kg (121 lbs.) and the minimum useful load on the seats shown on the placard in the cockpit must install a trim weight in the case of solo flights.

Trim weights

If the minimum useful load on the seats exceeds 55 kg (121 lbs.), a trim weight fixture must be installed on the center console, 400 mm (15.75 in.) behind the firewall. A deficit in the useful load on the seats should be compensated for using the following table.

Deficit in useful load on the seats		Trim mass (weight)	
[kg]	[lbs.]	[kg]	[lbs.]
5	11	1.7	3.75
10	22	3.4	7.50
15	33	5.1	11.24

Maximum useful load on the seats

The useful load on one seat must not exceed 110 kg (243 lbs.).

Lever arm of useful load on the seats

A lever arm of 143 mm (5.63 in.) aft of datum plane is assumed for all CG computations.

6.7.3 USEFUL LOAD IN BAGGAGE COMPARTMENT

The maximum useful load in the baggage compartment is 12 kg (26 lbs.). For the preparation of the Mass and Balance Diagram, the lever arm of the baggage was assumed to be equal to the lever arm of the fuel tank (i.e. 727 mm (28.62 in.) for the standard tank or 824 mm (32.44 in.) for the long range tank).

NOTE

When loading baggage, make sure not to exceed the maximum permissible useful load.

6.7.4 FUEL LOAD

Fuel capacity

The fuel capacity is given in Paragraph 2.12.

NOTE

When refuelling, make sure not to exceed the maximum permissible useful load.

Lever arm of the fuel tank

The following lever arms are assumed for all CG computations:

Standard tank : 727 mm (28.62 in.) aft of datum plane

Long range tank : 824 mm (32.44 in.) aft of datum plane

6.8 MASS / C.G. ENVELOPES

The Mass and Balance Diagram is a supplement to the Mass and Balance Form. It informs the Pilot whether a loading is permissible, taking maximum permissible useful load and minimum useful load on the seats into account. It shows the permissible mass (weight) of fuel and baggage for a given useful load on the seats.

The diagram applies to one specific airplane. It is based on the data provided by the Mass and Balance Form and must be redrawn by an authorized person upon each empty mass and CG determination, using the broken auxiliary lines.

The corresponding instructions are laid down in the Airplane Maintenance Manual.

Use of the diagram

The permitted combinations of useful load on the seats and total mass (weight) of fuel and baggage are bounded by the hatching.

Beside the diagram there is a scale for the conversion of the fuel quantity in liters or US gallons to the fuel mass (weight) in kilograms or pounds. The following examples show how the Mass and Balance Diagram should be used.

Example A:
* Pilot: 70 kg (154 lbs.), Copilot: 82 kg (181 lbs.), total: 152 kg (335 lbs.)
* Long range tank: full (60 kg (132 lbs.)), no baggage

The corresponding point in the diagram does not touch any boundary, so the loading is permissible.

Example B:
* Pilot: 65 kg (143 lbs.), solo flight
* Long range tank: full (60 kg (132 lbs.)), baggage: 12 kg (26 lbs.), total: 72 kg (159 lbs.)

The loading oversteps the maximum rearward CG position. The Pilot must remove 15 kg (33 lbs.) (20 liters (5.3 US gal.)) of fuel.

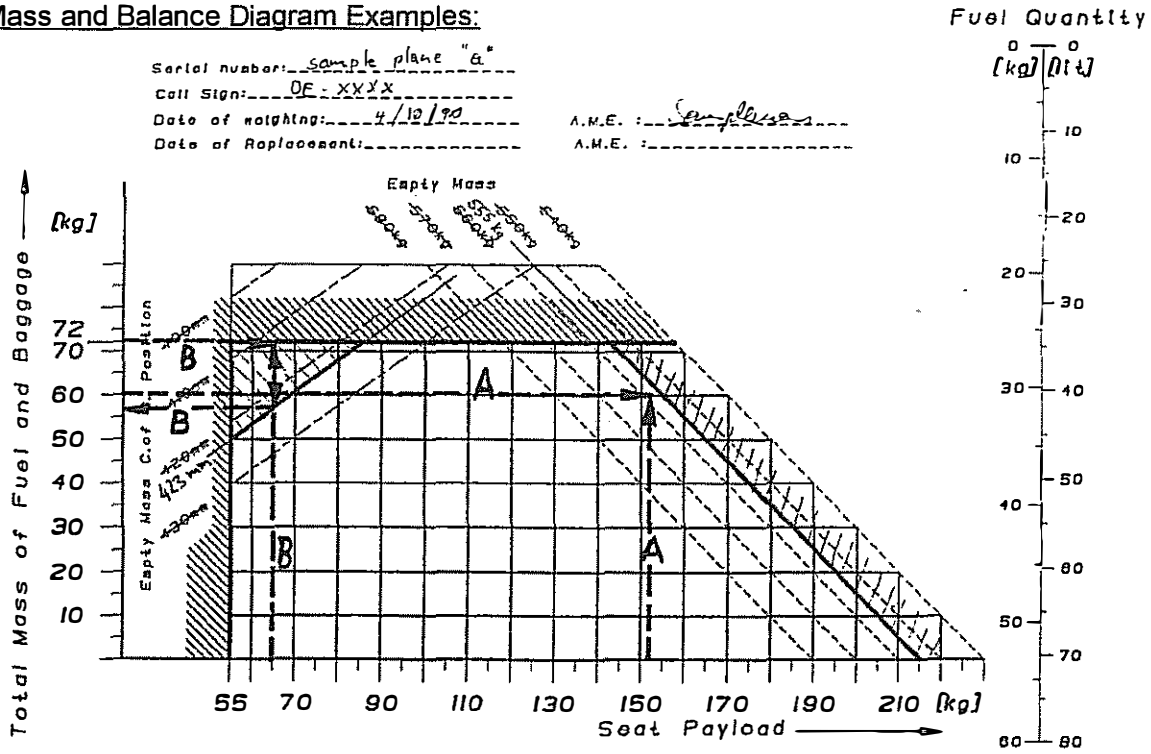
Example C:
* Pilot: 92 kg (203 lbs.), Copilot: 105 kg (231 lbs.), total: 197 kg (434 lbs.)
* Standard tank

In case they do not take any baggage aboard, they may take off with 27 kg (60 lbs.) (36 l (9.5 US gal.)) of fuel in Sample Airplane B.

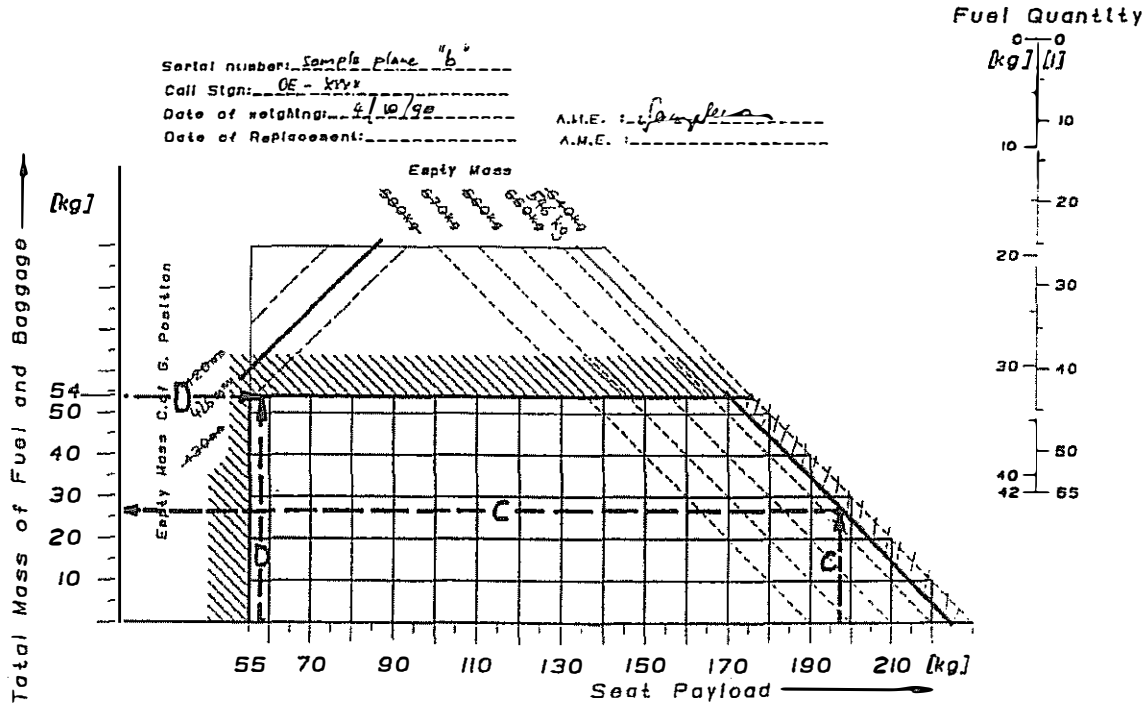
Example D:
* Pilot: 57 kg (126 lbs.), solo flight
* Standard tank: full (42 kg (93 lbs.)), baggage: 12 kg (26 lbs.) total: 54 kg (119 lbs.)

Since the maximum rearward CG position is not effective in with an empty mass CG position of 426 mm (16.77 in.), the Pilot may use the maximum mass (weight) of fuel plus baggage, which amounts to 54 kg (119 lbs.).

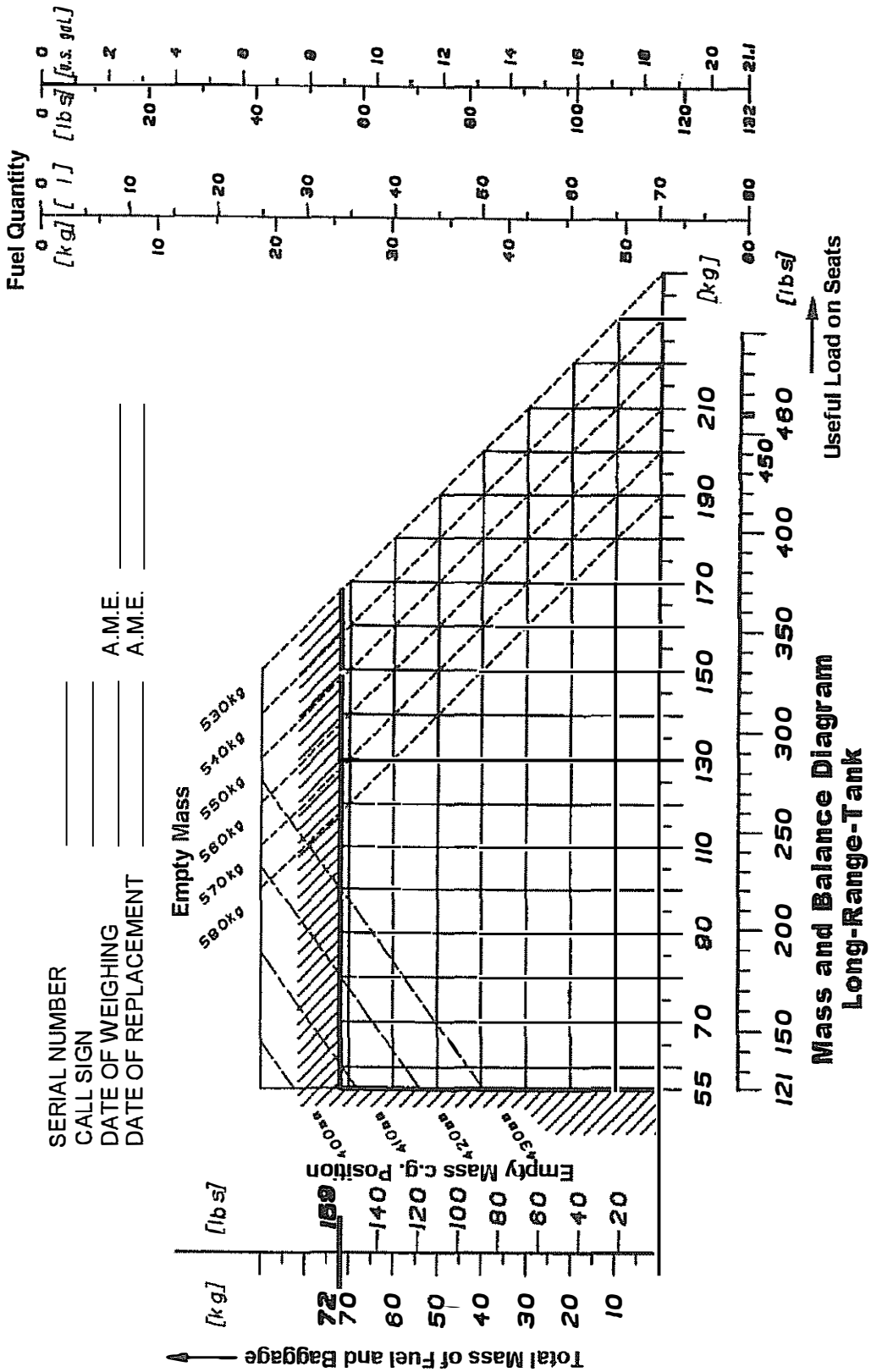
Mass and Balance Diagram Examples:



Mass and Balance Diagram
Long Range Tank (79 liters)



Mass and Balance Diagram
Standard Tank (55 liters)


Mass and Balance Diagram
Long-Range-Tank
Useful Load on Seats
[kg]
[lbs]
Empty Mass
530kg
540kg
550kg
560kg
570kg
580kg
A.M.E.
A.M.E.
SERIAL NUMBER
CALL SIGN
DATE OF WEIGHING
DATE OF REPLACEMENT
Empty Mass c.g. Position
Total Mass of Fuel and Baggage
Fuel Quantity
[l]
[US gal]

6.9 EQUIPMENT LIST

Minimum equipment (VFR)

1 Altimeter
1 Airspeed indicator
1 Magnetic compass
1 RPM indicator
1 Running time meter
1 Manifold pressure indicator
1 Oil pressure indicator
1 Oil temperature indicator
1 Cylinder head temperature indicator
1 Fuel quantity indicator
1 Ammeter
1 Deviation table
1 Manifold pressure warning light
1 Turbo caution light
1 Fuel pressure warning light
1 Generator warning light
1 Temperature caution light

Additional equipment

A list of the currently installed equipment is provided in the Equipment Inventory which is preserved in the Aircraft Maintenance Log.

SECTION 7

POWERED SAILPLANE & SYSTEMS DESCRIPTION

Page No.

7.1 INTRODUCTION

Section 7 provides a description of the Powered Sailplane and its systems, together with notes for the user. Refer to Section 9, Supplements, for details of optional systems and equipment.

7.2 AIRFRAME

7.2.1 WINGS

The GFRP/CFRP wings are manufactured in semi-monocoque sandwich construction. The ailerons are made of CFRP and are attached to the wing by means of five hinges, also made of CFRP. Schempp-Hirth type air brakes are provided on the upper surface of the wings.

Each wing is connected to the fuselage by three bolts.

The winglets are manufactured from CFRP and are attached to the wing tips with two threaded bolts each.

7.2.2 FUSELAGE

The GFRP fuselage is manufactured in semi-monocoque construction. A special fire-resistant fabric sheet is sandwiched between a stainless steel barrier and the firewall. The main bulkhead is made of CFRP/GFRP.

The instrument panel is made of GFRP. The maximum permissible mass (weight) of the instrument panel, including the instruments installed, is 17 kg (37.5 lbs.).

7.2.3 TAIL PLANE

The rudder, elevator and horizontal stabilizer are manufactured in semi-monocoque sandwich construction. The folded-top COM antenna and the Pitot tube mount are located in the vertical stabilizer. The horizontal tail surfaces are attached with two bolts and a fastening screw.

7.3 FLIGHT CONTROLS

7.3.1 PRIMARY CONTROLS

The ailerons and elevator are driven by push-rods and the rudder is driven by control cables. Elevator control forces can be compensated for by means of a spring trim system.

The aileron and air brake control systems are automatically connected when the wing is installed. However, the strobe and position lights (optional equipment) must be connected. The elevator control system is not connected automatically, and must be connected by hand.

7.3.2 ELEVATOR TRIM SYSTEM

The trim lever with a green knob is located on the center console behind the throttle quadrant. To trim the airplane, unlock the knob by pulling it upwards, then move it to the desired position. The knob is spring-loaded and locks when it is released.

Knob forward = NOSE DOWN

7.3.3 RUDDER PEDAL ADJUSTMENT

CAUTION

The rudder pedals must be adjusted on the ground.

The pedals are unlocked by pulling the black T-grip in front of the control stick.

Move forward: Push pedals forward with your heels while pulling the grip. Release the grip and allow the pedals to lock perceptibly.

Move rearward: Pull pedals rearward with the grip. Release the grip, using your feet to push the pedals forward until they lock.

7.4 AIR BRAKE SYSTEM

There is a blue air brake lever on either side panel. By pulling the lever rearward, the air brakes are unlocked and extended. They may be extended at all speeds up to v_{NE}.

The air brake lever locks when the air brakes are extended half way. This position can be overtraveled in either direction with slightly increased force. To lock the air brakes, the lever must be pushed to the forward stop, overcoming the resistance which occurrs after the air brake is retracted. The air brakes have oil dampers.

WARNING

When exceeding the maximum admissible speed with the air brakes fixed in the half extended position, v_{ABF}, the air brakes can become extended by aerodynamic forces.
The extension of the air brakes produces a nose down moment which is more intense at higher airspeeds.
At v_{NE}, the air brakes must be extended slowly in order to avoid excessive deceleration.

7.5 LANDING GEAR SYSTEM

7.5.1 GENERAL

The landing gear consists of a resilient main undercarriage, with disk brakes, mounted on spring steel struts, and a resilient castering nose wheel. An elastomer damper provides suspension for the nosewheel.

7.5.2 WHEEL BRAKE

The main wheels are equipped with hydraulically actuated disk brakes which are individually operated through toe pedals.

7.5.3 PARKING BRAKE

The draw-button is located on the center console behind the trim lever. The parking brake is released when the button is in the inserted position.

To set the parking brake, draw the button to the stop and actuate the brake pedals a few times. To release the parking brake, step on the toe brakes again, in order to relieve the shut-off valve, and push the button in.

CAUTION

Pushing the button in without stepping on the toe brakes leads to overstressing of the operating circuit. Excessive wear may result.

7.6 SEATS AND SAFETY HARNESSES

The seat shells are removable in order to permit maintenance and inspection of the control system parts beneath. Jackets on the control sticks and on the air brake levers prevent foreign bodies from falling into the area of the control gear.

The seats are furnished with removable cushions. Parachutes with manual release can be used instead of the cushions. There is no fixture for the release cord of parachutes with automatic release. Therefore, these parachutes cannot be used.

Each seat is provided with a four-part harness. To fasten the harness, the end pieces must be inserted into the lock. To open the harness, turn the twist handle on the lock.

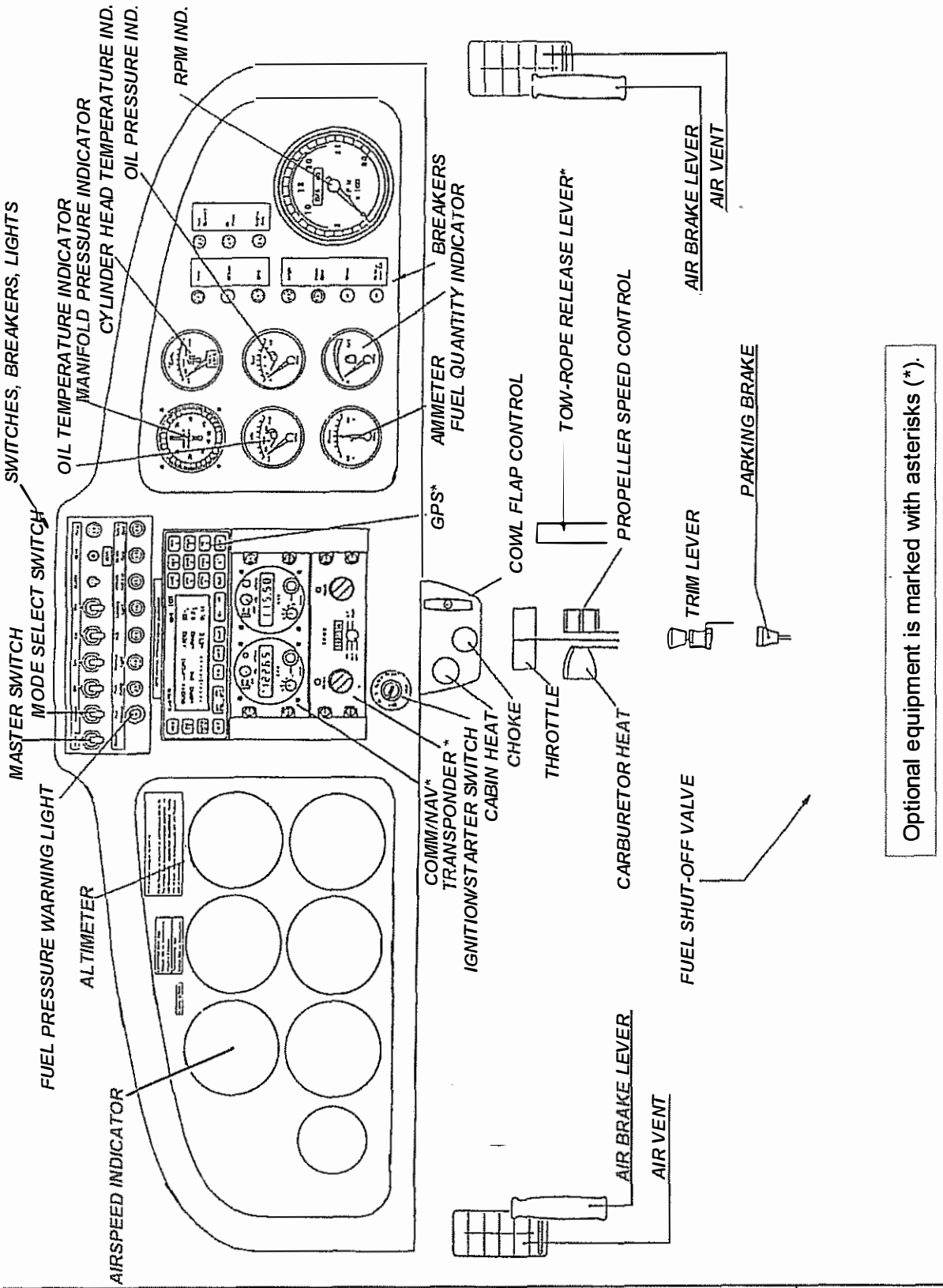
7.7 BAGGAGE COMPARTMENT

The baggage compartment is located behind the backrest above the fuel tank. Baggage pieces should be distributed evenly over the compartment. For safety reasons, the baggage pieces must be tied down.

CAUTION

Before loading the baggage compartment, pay attention to the maximum useful load, or, in case of solo flights, the minimum useful load on the seats. Refer to the Mass and Balance Form and/or the Mass and Balance Diagram.

7.8 COCKPIT


SWITCHES, BREAKERS, LIGHTS
OIL TEMPERATURE INDICATOR
MANIFOLD PRESSURE INDICATOR
CYLINDER HEAD TEMPERATURE IND.
OIL PRESSURE IND.
RPM IND.
BREAKERS
FUEL QUANTITY INDICATOR
AMMETER
GPS*
COWL FLAP CONTROL
TOW-ROPE RELEASE LEVER*
PROPELLER SPEED CONTROL
AIR BRAKE LEVER
AIR VENT
PARKING BRAKE
TRIM LEVER
MASTER SWITCH
MODE SELECT SWITCH
FUEL PRESSURE WARNING LIGHT
ALTIMETER
AIRSPEED INDICATOR
COMM/NAV/*
TRANSPONDER*
IGNITION/STARTER SWITCH
CABIN HEAT
CHOKE
THROTTLE
CARBURETOR HEAT
FUEL SHUT-OFF VALVE
AIR BRAKE LEVER
AIR VENT
Optional equipment is marked with asterisks (*).

7.8.1 MODE SELECT SWITCH

When the mode select switch is in the SOARING position, only the COM equipment and the electric vertical speed indicator (optional) are supplied with battery power. All other electrical consumers are switched off.

7.8.2 TCU SWITCH

This switch is only operated in emergency procedures (see Section 3). It is used to switch the TCU off. With the TCU switched off, the manifold pressure must be set manually by the Pilot. The switch is shielded by a red cover in order to prevent accidental operation.

7.8.3 INSTRUMENTS

The flight instruments are installed in the left hand section of the instrument panel. The power-plant instruments are installed in the right hand section.

7.8.4 CABIN HEAT AND CABIN AIR

The draw-button for the cabin heat is located in the center console under the instrument panel. Pull the button to turn the cabin heat on.

The cabin can be aerated through the swivelling nozzles on the side panels. The two sliding/knockout windows in the canopy can be opened for additional aerating.

7.8.5 CANOPY

Canopy lock

To close the canopy, pull shut with the black grips located on the front of the canopy frame. The canopy is locked by pushing forward the two red levers attached to the frame on either side. To open the canopy, reverse the sequence.

CAUTION

Before starting the engine, close and lock the canopy!

Canopy jettison

By forcefully swinging the red levers 180° rearward, the canopy is disconnected from the brackets. Then the Pilot must place both hands above his/her head against the canopy and push it away in upward direction.

7.9 POWER-PLANT

7.9.1 ENGINE

Information about the engine can be found in the Operator's Manual for the engine.
The engine operating instruments are located on right hand side of the instrument panel.
The ignition is operated by a key switch. The ignition is switched on by turning the key clockwise. The starter is operated by turning the key all the way to the stop.

7.9.2 TCU

The manifold pressure is controlled by an electronic control unit. This controls a flap (waste gate) parallel to the turbocharger. Independent of the altitude, the same manifold pressure is always set for a given throttle control setting, and the manifold pressure is kept within the limits.
At high outside air temperatures, the highest permitted manifold pressure will not be reached, since the turbocharger prevents excessive airbox temperatures by reducing the manifold pressure. By switching off the TCU (see Emergency Procedures), the waste gate is no longer controlled. Further details can be found in the Operator's Manual for the engine.
There are two different TCU versions available.
TCU Part No. 966 470 and TCU Part No. 966 741. The difference between those two versions is the used software version.
This results also in different MP limitations (refere to Chpt. 2) at the same nominal power output.

7.9.3 POWER PLANT CONTROLS

Carburetor heat, throttle control, and propeller speed control are combined in a unit (throttle quadrant) on the center console.

Carburetor heat: Small rectangular lever

Lever fully rearward = CARBURETOR HEAT ON
The carburetor heat is normally OFF (lever fully forward)

Throttle control: Large round lever

Lever fully forward = FULL THROTTLE

Propeller speed control: Black star shaped lever

Lever fully forward	= TAKE-OFF
Lever rearward to cam	= CRUISE
Lever fully rearward	= FEATHER

The choke button (self-resetting) is installed in the center console under the instrument panel.

Choke button pulled	= CHOKE ACTIVATED

7.9.4 COWL FLAP

For the operation of the manual cowl flap, there is a T-grip on the center console next to the cabin heat button. To arrest the T-grip, turn it 90° clockwise.

T-grip pulled	= COWL FLAP CLOSED

The cowl flap is closed during soaring in order to reduce drag. At outside temperatures below 0° C (32° F), partial closing of the cowl flap avoids continuous operation with an oil temperature below 80° C (176° F).

NOTE

Continuous operation with oil temperatures below 80° C (176° F) may lead to increased accumulation of condensation, which can be recognized by white foam in the oil tank.

CAUTION

Leave the cowl flap at least half open while the engine is running in order to avoid overheating. Pay special attention to the engine temperatures.

7.9.5 PROPELLER SPEED CONTROL

NOTE

The propeller speed control works differently from the usual systems in so far as hydraulic pressure is needed to *reduce* the blade pitch.

Small pitch is achieved by applying hydraulic pressure supplied by the governor. A spring moves the propeller to the feathered pitch position.

Propeller adjustments are made through the propeller speed control installed into the center console on the right of the throttle control. Pulling the control back to the cam (the point where the resistance increases) causes an RPM reduction. The governor keeps the selected RPM constant, independent of airspeed and throttle control position. If the engine power selected with the throttle control is not sufficient to maintain the selected RPM, the propeller blades will move to the lowest possible pitch (maximum RPM at this power setting).

If the propeller speed control is moved fully rearward over the cam (FEATHER position) and the propeller speed is higher than 800 RPM, the blades will move into the feathered pitch position. At too low RPMs, claws controlled by centrifugal force extend and keep the blades in low pitch position. Thus, it is impossible to feather the propeller at engine standstill or at very low engine speeds. During flight at a speed of 100 km/h (54 kts. / 62 mph) or more, the propeller carries on rotating due to windmilling, even with the ignition switched OFF. The propeller stops rotating only when it is feathered.

The propeller governor is flanged to the engine. It is driven directly by the engine. The propeller control circuit is part of the engine oil circuit.

In case of defects in the oil system, the propeller is supplied with hydraulic pressure from the pressure accumulator. Without the engine running, the propeller pitch change mechanism will remain operative for at least two minutes.

CAUTION

The propeller speed control must not be moved over the cam to the FEATHER position as long as the engine is running. Refer to the Normal Procedure described in Article 4.5.3

7.10 FUEL SYSTEM

7.10.1 GENERAL

The aluminum tank is located behind the backrest, beneath the baggage compartment. The standard version holds 54 liters (14.3 US gal.) and the long range version holds 77 liters (20.3 US gal.) of usable fuel. At its lowest point, the tank is connected to the fuel tank drain on the underside of the fuselage.

The fuel passes through a finger filter in the tank and through a fine filter before it reaches the electric fuel pumps. The main fuel pump works automatically as soon as the engine is running. The fuel booster pump is switched ON or OFF manually.

7.10.2 FUEL SHUT-OFF VALVE

The fuel shut-off valve is located on the left side of the center console near the Pilot's feet.

Tap in flight direction = valve OPEN

7.10.3 TANK DRAIN

To drain the tank sump, activate the spring loaded drain by pushing the brass tube in with a drain cup. The brass tube protrudes approximately 30 mm (1.2 in.) from the fuselage contour and is located on the left hand side of the fuselage underside, approximately at the same station as the fuel filler.

7.10.4 FUEL QUANTITY INDICATOR

The fuel quantity indicator is adjusted for flight attitude. On the ground, the indication may be slightly too low.

7.11 ELECTRICAL SYSTEM

The master switch is a toggle type. The mode select switch is situated to the right of the master switch.

CAUTION

Starting the engine is only possible if the mode select switch is in the POWER FLIGHT position.
In the SOARING position, all electrical consumers, except for the COM equipment and the electric vertical speed indicator (optional), are currentless.

The electric main fuel pump is supplied with current directly from the generator. The actuation of the master switch has no influence on this current supply. Failure of the generator leads to failure of the main fuel pump.

The NAV and COM equipment is located in the center section of the instrument panel. The transmit button for the radio is integrated into the control stick. The radio loudspeaker is installed in the baggage compartment. A backrest-mounted connection set for two headsets is optional.

7.12 PITOT AND STATIC SYSTEM

Static pressure, total head and the pressure for the compensation of the vertical speed indicator are measured by means of a Pitot tube which is mounted to the vertical stabilizer. The tube is removable. A safe connection of the lines is established automatically when the Pitot tube is inserted to the stop in the mount.

The lowest point in the Pitot and static lines is bridged by means of bypass lines. Water that might have entered the system can accumulate there. Removal of water must be done during scheduled inspections (refer to the Airplane Maintenance Manual).

7.13 MISCELLANEOUS EQUIPMENT

For the operation of additional avionics, refer to the manuals of the respective manufacturers.

7.14 PLACARDS / INSCRIPTIONS

The limitation placards are presented in Paragraph 2.15. A list of all placards and inscriptions is included in the Airplane Maintenance Manual.

SECTION 8

POWERED SAILPLANE HANDLING, CARE AND MAINTENANCE

Page No.

8.1 INTRODUCTION

Section 8 contains the Manufacturer's recommended procedures for proper ground handling and servicing of the Powered Sailplane. The Airplane Maintenance Manual identifies certain inspection and maintenance requirements which must be followed if the Powered Sailplane is to retain a new plane performance and reliability. It is wise to adhere to the Lubrication Schedule and perform preventative maintenance based on climatic and flying conditions encountered.

8.2 POWERED SAILPLANE INSPECTION PERIODS

Inspections are scheduled every 100, 200 and 600 hours. The respective inspection checklists are prescribed in the Airplane Maintenance Manual, Paragraph 3.1.

8.3 POWERED SAILPLANE ALTERATIONS OR REPAIRS

Alterations or repairs of the Powered Sailplane may only be carried out as prescribed in the Airplane Maintenance Manual and only by authorized personnel. In exceptional cases (e.g. ferry flights or test flights after maintenance), airplane operation without winglets, spinner, or wheel fairings is admissible.

8.4 GROUND HANDLING / ROAD TRANSPORT

For ground handling, a draw tongue which is hooked to the nose wheel should be used. Road transport using a trailer is described in the Airplane Maintenance Manual, Paragraph 1.2.

8.5 CLEANING AND CARE

It is advisable to remove insects with a wet sponge at the end of every flying day.

CAUTION

Extreme dirt accumulation degrades flight performance.

Refer to the Airplane Maintenance Manual, Paragraph 1.4, for further care measures.

SECTION 9
SUPPLEMENTS

At this time, the following Supplements are available:

Supplement No. 1

Tow-Plane Operation

Supplement No. 3

Electrical Power Socket for Additional Equipment

Supplement No. 5

Operation with a Winterization Kit

Supplement No. 9

Operation with Tow-Rope Retraction Device

Supplement No. 11

Additional Performance Data