Joint Stock Company "SPORTINĖ AVIACIJA ir Ko"
Pociūnų km., Ašmintos sen., LT-59327, Prienų raj., Lithuania
tel.:+370 319 60567 • fax:+370 319 60568 • e-mail: info@lak.lt • www.lak.lt

TVIRTINU
UAB "Sportinė aviacija ir Ko"
Direktorius
_____ Vytautas Mačiulis

## FLIGHT MANUAL

# LAK-17A FES

Powered Sailplane
**with Front Electric Sustainer system**

**TYPE: LAK-17** **MODEL: LAK-17A FES**

**SERIAL NO.** _____

**REGISTRATION** _____

**DATE OF ISSUE** _____

It is a preliminary manual. The sailplane is not certified and has not shown compliance with airworthiness requirements.

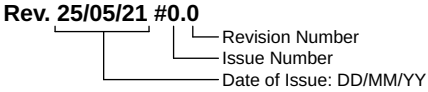
This sailplane is to be operated in compliance with the information and limitations contained herein.

**THIS MANUAL SHOULD ALWAYS BE KEPT ON BOARD OF THE SAILPLANE**

## 0.1 Record of revisions

Any revision of the present manual, except actual 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 in the revised page will be indicated by a black vertical line in the left hand margin, and the revision number will be shown on the bottom left hand of the page. Revision number contains the following information:




| Revision | Affected Chapter | Affected Pages | Approval | Date of Approval | Date of Insertion | Signature |
|---|---|---|---|---|---|---|
| | | | | | | |

(continued)

| Revision | Affected Chapter | Affected Pages | Approval | Date of Approval | Date of Insertion | Signature |
|---|---|---|---|---|---|---|
| | | | | | | |

## 0.2 List of Effective Pages

| Section | Page | Date of Issue | Section | Page | Date of Issue |
|---|---|---|---|---|---|
| 0 | (i) | 25 05 2021 | 4 | 4-1 | 25 05 2021 |
| | (ii) | 25 05 2021 | | Appr. 4-2 | 25 05 2021 |
| | (iii) | 25 05 2021 | | Appr. 4-3 | 25 05 2021 |
| | (iv) | 25 05 2021 | | Appr. 4-4 | 25 05 2021 |
| | (v) | 25 05 2021 | | Appr. 4-5 | 25 05 2021 |
| | (vi) | 25 05 2021 | | Appr. 4-6 | 25 05 2021 |
| | | | | Appr. 4-7 | 25 05 2021 |
| 1 | 1-1 | 25 05 2021 | | Appr. 4-8 | 25 05 2021 |
| | 1-2 | 25 05 2021 | | Appr. 4-9 | 25 05 2021 |
| | 1-3 | 25 05 2021 | | Appr. 4-10 | 25 05 2021 |
| | 1-4 | 25 05 2021 | | Appr. 4-11 | 25 05 2021 |
| | 1-5 | 25 05 2021 | | Appr. 4-12 | 25 05 2021 |
| | 1-6 | 25 05 2021 | | Appr. 4-13 | 25 05 2021 |
| | | | | Appr. 4-14 | 25 05 2021 |
| 2 | 2-1 | 25 05 2021 | | Appr. 4-15 | 25 05 2021 |
| | Appr. 2-2 | 25 05 2021 | | Appr. 4-16 | 25 05 2021 |
| | Appr. 2-3 | 25 05 2021 | | | |
| | Appr. 2-4 | 25 05 2021 | | | |
| | Appr. 2-5 | 25 05 2021 | 5 | 5-1 | 25 05 2021 |
| | Appr. 2-6 | 25 05 2021 | | Appr. 5-2 | 25 05 2021 |
| | Appr. 2-7 | 25 05 2021 | | Appr. 5-3 | 25 05 2021 |
| | Appr. 2-8 | 25 05 2021 | | Appr. 5-4 | 25 05 2021 |
| | Appr. 2-9 | 25 05 2021 | | Appr. 5-5 | 25 05 2021 |
| | Appr. 2-10 | 25 05 2021 | | Appr. 5-6 | 25 05 2021 |
| | Appr. 2-11 | 25 05 2021 | | | |
| | Appr. 2-12 | 25 05 2021 | | | |
| | | | 6 | 6-1 | 25 05 2021 |
| 3 | 3-1 | 25 05 2021 | | 6-2 | 25 05 2021 |
| | Appr. 3-2 | 25 05 2021 | | 6-3 | 25 05 2021 |
| | Appr. 3-3 | 25 05 2021 | | 6-4 | 25 05 2021 |
| | Appr. 3-4 | 25 05 2021 | | 6-5 | 25 05 2021 |
| | Appr. 3-5 | 25 05 2021 | | 6-6 | 25 05 2021 |
| | Appr. 3-6 | 25 05 2021 | | 6-7 | 25 05 2021 |
| | Appr. 3-7 | 25 05 2021 | | 6-8 | 25 05 2021 |
| | Appr. 3-8 | 25 05 2021 | | | |

(continued)

| Section | Page | Date of Issue | Section | Page | Date of Issue |
|---|---|---|---|---|---|
| 7 | 7-1 | 25 05 2021 | | | |
| | 7-2 | 25 05 2021 | | | |
| | 7-3 | 25 05 2021 | | | |
| | 7-4 | 25 05 2021 | | | |
| | 7-5 | 25 05 2021 | | | |
| | 7-6 | 25 05 2021 | | | |
| | 7-7 | 25 05 2021 | | | |
| | 7-8 | 25 05 2021 | | | |
| | 7-9 | 25 05 2021 | | | |
| | 7-10 | 25 05 2021 | | | |
| | 7-11 | 25 05 2021 | | | |
| | 7-12 | 25 05 2021 | | | |
| | 7-13 | 25 05 2021 | | | |
| | 7-14 | 25 05 2021 | | | |
| 8 | 8-1 | 25 05 2021 | | | |
| | 8-2 | 25 05 2021 | | | |
| | 8-3 | 25 05 2021 | | | |
| | 8-4 | 25 05 2021 | | | |
| 9 | 9-1 | 25 05 2021 | | | |

## 0.3 Table of Contents

**General** (an non-approved section) ..... §1

**Limitations** (an approved section) ..... §2

**Emergency procedures** (an approved section) ..... §3

**Normal procedures** (an approved section) ..... §4

**Performance** (a partly approved section) ..... §5

**Weight and balance / equipment list**
(a non-approved section) ..... §6

**Sailplane and systems description**
(a non-approved section) ..... §7

**Sailplane handling, care and maintenance**
(a non-approved section) ..... §8

**Supplements** (a non-approved section) ..... §9

INTENTIONALLY LEFT BLANK

## Section 1

# GENERAL

1.1 Introduction . . . . . 1-2
1.2 Certification basis . . . . . 1-2
1.3 Warnings, cautions and notes . . . . . 1-2
1.4 Descriptive data . . . . . 1-2
1.5 Three-view drawing . . . . . 1-5
1.6 Abbreviations . . . . . 1-6
1.7 Unit conversions . . . . . 1-6

## 1.1 Introduction

The sailplane flight manual has been prepared to provide pilots and instructors with information for the safe and efficient operation of the LAK-17A FES sailplane with Front Electric Sustainer system.

This manual includes the material required to be furnished to the pilot by CS-22. It also contains supplemental data supplied by the sailplane manufacturer.

## 1.2 Certification basis

The compliance of the airworthiness code of this type of sailplane has been checked by the Lithuanian CAA, dated 16 April 2003. The type has been approved by EASA in accordance with Joint Airworthiness Requirements for Sailplanes and Powered Sailplanes (JAR 22), Amendment 6, effective August 01, 2001, and in accordance with Special Conditions issues for FES.

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 the 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 the flight safety.

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

## 1.4 Descriptive data

The LAK-17A FES is a modification of the single seat high performance sailplane of FAI 15 m / 18 m class LAK-17A designed according to JAR-22, category "U" specifications. It is a mid-wing glider with flaps, T-tail,

retractable main landing gear and 180 liter water ballast tanks. Sailplane is equiped with Front Electric Sustainer system.

Main parts of the FES system are:

- Brushless electric motor,
- Controller for motor,
- Foldable propeller,
- FES BATTERY PACK GEN2 with internal BMS (Battery Management System),
- Charger (one 1200 W or two 600 W),
- FCU (FES Control Unit) instrument,
- LXUI box with Shunt (for current and voltage measurements),
- FCC box (FES connecting circuit),
- Power switch,
- DC/DC converter (converts high voltage to 12 V).

The sailplane is made of hybrid composite materials (Kevlar, carbon and fiberglass). The wing spar is made of modern carbon rods GRAPHLITE SM315 and has a double T section. The airbrakes are located on the upper wing surface only. The wing airfoil is *LAP 92-130/15* at the root transiting into the *LAP 92-150/15* at the tip.

The cockpit is of monocoque construction. The manually controlled seatback and an adjustable head rest together with optimally arranged controls offer notable comfort for the long flights. The one-piece Plexiglas canopy hinges forward.

On the left side there is a sliding window for additional ventilation. The instrument panel folds up together with a canopy.

The retractable landing gear with shock absorbers has a 5.00-5 6PR ply tire. The mechanical main wheel brake is actuated via the handle on the stick (or via the airbrake control handle / with the BERINGER wheel and brake system). The rudder pedals are adjustable in flight. All controls, including the water ballast system, hook up automatically or semiautomatically. Towing hooks are mounted: near the main landing gear (C.G. / winch / autotow hook) and/or in front of the pilot cockpit at the bulkhead (aero tow hook).

Both towing hooks are operated by the same handle. The wings incorporate forktype spar tips, joined with two pins.

The T-tail (fixed stabilizer with elevator) of the LAK-17A FES provides stable and responsive pitch characteristics. The elevator hooks up automatically during assembly. The glider is fitted with a fin ballast tank of 8 ltr (2.11 US gal) capacity in order to adjust the optimum C.G. position. The antenna is mounted in the vertical fin.

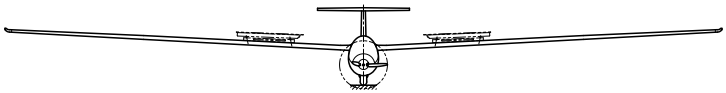
FES parameters are controlled by the FCU (FES Control Unit) instrument, produced by LX NAV d.o.o. company. The motor is operated with the Power and brake button located on the FCU instrument. Electronic safety devices are provided to avoid misoperation.

## Technical data of the LAK-17A FES

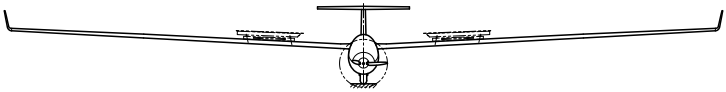
| Wing span | 15 m (49.2 ft) | 18 m (59.06 ft) |
|---|---|---|
| Fuselage length | 6.53 m (21.42 ft) | |
| Height | 1.29 m (4.23 ft) | |
| Max gross weight | 500 kg (1102 lbs) | |
| Mean aerodynamic chord | 0.626 m (24.6 in) | 0.598 m (23.5 in) |
| Wing area | 9.06 $m^2$ (97.52 $ft^2$ ) | 9.8 $m^2$ (105.49 $ft^2$ ) |
| Wing loading: | | |
| minimum | 36.4 kg/$m^2$ (7.45 lbs/$ft^2$ ) | 34.2 kg/$m^2$ (7.0 lbs/$ft^2$ ) |
| maximum | 55 kg/$m^2$ (11.3 lbs/$ft^2$ ) | 51 kg/$m^2$ (10.45 lbs/$ft^2$ ) |

## 1.5 Three-view drawing

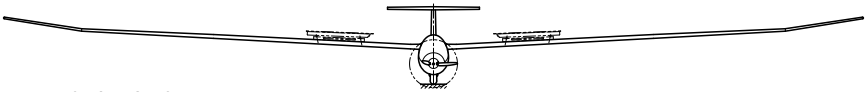
15 m



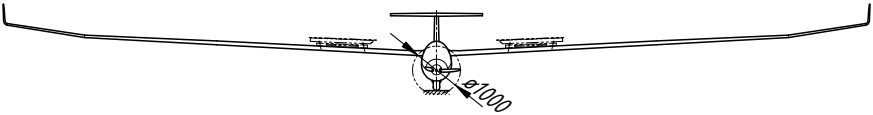
15 m (winglet)

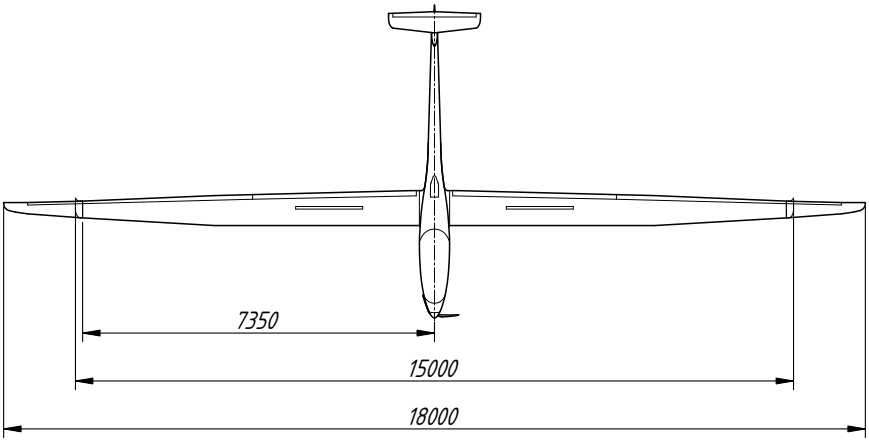


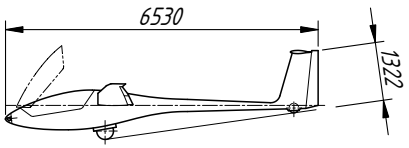
18 m



18 m (winglet)



## 1.6 Abbreviations

| | | |
|---|---|---|
| CAS | – | calibrated airspeed means indicated airspeed of a sailplane, corrected for position (due to position of pressure ports on sailplane) and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level |
| C.G. | – | center of gravity |
| daN | – | decanewton |
| h | – | hour |
| IAS | – | indicated airspeed means the speed of a sailplane as shown on its pitot-static aircraft indicator and is uncorrected for the system error |
| m | – | meter |
| kg | – | kilogram |
| km | – | kilometer |
| s | – | second |
| ltr | – | liter |

## 1.7 Unit conversions

| | |
|---|---|
| 1 bar | 14.5 pounds per square inch (psi) |
| 1 decanewton (daN) | 2.25 pounds force |
| 1 kilogram (kg) | 2.2 pounds (lbs) |
| 1 meter (m) | 39.4 inches (in.) = 3.28 feet (ft.) |
| 1 millimeter (mm) | 0.0394 inches (in.) |
| 1 liter | 0.2642 U.S. gal |
| 1 square meter ($m^2$) | 10.764 sq. ft |
| 1 kg/$m^2$ | 0.204 lbs/sq. ft |
| 1 m/s | 1.944 knots (kts) |
| 1 km/h | 0.5396 kts |
| 1 kW | 1.34 HP |

## Section 2

# LIMITATIONS

2.1 Introduction . . . . . 2-2
2.2 Airspeed . . . . . 2-2
2.3 Airspeed indicator markings . . . . . 2-3
2.4 Power-plant information and operation limitations . . . . . 2-4
2.4.1 Power-plant . . . . . 2-4
2.4.2 Batteries . . . . . 2-5
2.5 Mass (weight) . . . . . 2-6
2.6 Center of gravity . . . . . 2-6
2.7 Approved manoeuvres . . . . . 2-6
2.8 Manoeuvring load factors . . . . . 2-7
2.9 Flight crew . . . . . 2-7
2.10 Kinds of operation . . . . . 2-7
2.11 Minimum equipment . . . . . 2-8
2.12 Aero tow, winch and auto tow launching, self-launching . . . . 2-9
2.13 Other limitations . . . . . 2-9
2.14 Limitation placards . . . . . 2-10

## 2.1 Introduction

Section 2 includes operation limitations, instrument markings and placards, necessary for safe operation of the LAK-17A FES sailplane, it's motor, standard systems and standard equipment.

The limitations have been approved. Compliance with these limitations is mandatory.

**Warning:** LAK-17A FES is a self-sustaining powered sailplane and is prohibited from taking off solely by the means of it's own power.

## 2.2 Airspeed

Airspeed limitations and their operational significance are shown below:

| | Speed | IAS, km/h / (kts) 15 m & 18 m | Remarks |
|---|---|---|---|
| $V_{NE}$ | Never exceed speed | | Do not exceed this speed in any operation and do not use more than 1/3 of control deflection at: |
| | | 275 / (148) | 0 - 4 000 m (0 - 13 100 ft) |
| | | 260 / (140) | up to 5 000 m (16 400 ft) |
| | | 245 / (132) | up to 6 000 m (19 680 ft) |
| | | 220 / (119) | up to 8 000 m (26 250 ft) |
| | | 195 / (105) | up to 10 000 m (32 800 ft) |
| $V_{PE}$ | Maximum operation with motor running | 160 / (86) | Do not exceed this speed with the motor running (at any power setting) |
| $V_{RA}$ | Rough air speed | 190 / (102) | Do not exceed this speed except in smooth air and then only with caution. Rought air is in lee wave rotor, thunderclouds, etc. |

| | Speed | IAS, km/h / (kts) 15 m & 18 m | Remarks |
|---|---|---|---|
| $V_A$ | Manoeuvring speed | 190 / (102) | Do not make full or abrupt control movement above this speed, because under certain conditions the sailplane may be over stressed by full control movement |
| $V_{FE}$ | Maximum flap extended speed. Flap setting: | | Do not exceed these speeds with the given flap setting |
| | –1 up to 0 | 275 / (148) | |
| | +1 up to L | 160 / (86) | |
| $V_W$ | Maximum winch and auto-tow launch speed | 140 / (76) | Do not exceed this speed during winch or auto-tow launching |
| $V_T$ | Maximum aero towing speed | 160 / (86) | Do not exceed this speed during aero towing |
| $V_{LO}$ | Maximum landing gear operations speed | 205 / (110) | Do not extend or retract the landing gear above this speed |
| $V_{PO\ min}$ | Minimum speed to start motor | 90 / (49) | Do not start the motor below this speed |
| $V_{PO\ max}$ | Maximum speed to start motor | 160 / (86) | Do not start the motor above this speed |

**Warning:** At higher altitudes the true airspeed is higher than the indicated airspeed, and $V_{NE}$ is reduced with altitude.

## 2.3 Airspeed indicator markings

Airspeed indicator markings and their color code significance are shown below:

| Marking | IAS value or range km/h / (kts) | Significance |
|---|---|---|
| White Arc | 102...160 / (55...86) | Positive Flaps Operating Range: Lower limit is 1.1 $V_{SO}$ in landing configuration at maximum weight. Upper limit is maximum speed permissible with flaps extended positive. |
| Green Arc | 108...190 / (58...102) | Normal Operating Range: Lower limit is 1.1 $V_{S1}$ at maximum weight and most forward C.G. with flaps neutral. Upper limit is rough air speed. |
| Yellow Arc | 190...275 / (102...148) | Manoeuvres must be conducted with caution and only in smooth air. |
| Red Line | 275 / (148) | Maximum speed for all operations. |
| Blue Line | 95 / (51) | Speed for best climb $V_y$, flaps in position "+2". |
| Yellow Triangle | 95 / (51) | Approach speed at maximum weight without water ballast. |

## 2.4 Power-plant information and operation limitations

LAK-17A FES is equipped with Front Electric Sustainer system. The use of the power-plant has some limitations which needs to be observed:

- start motor in flight only at the speed range $V_{PO}$ = 90...160 km/h (49...86 kts);
- do not fly glider with motor running at the speed higher than $V_{PE}$ = 160 km/h (86 kts).

### 2.4.1 Power-plant

#### Motor

Motor manufacturer..... "Sportinė aviacija ir Ko"
Motor model..... FES-LAK-M100

Out runner BLDC brushless synchronous permanent magnet motor with electronically controlled commutation system 3 phase, air cooled.

- Up to 23 kW for shorter time.
- Diameter 180 mm, length 100 mm.
- Weight of motor – 7.3 kg.
- Efficiency more than 95%.

Maximum power ..... 23 kW (30 hp), at 4500 RPM
Continuous power ..... 16 kW at 116 V
Max motor RPM ..... 4500 RPM
Recommended RPM for
max. altitude gain ..... 4000-4300 RPM
Recommended RPM for
level flight ..... 3000-3200 RPM

## Propeller

Diameter ..... 1.0 m (3.28 ft)
Manufacturer ..... "Sportinė aviacija ir Ko"
Model ..... FES-LAK-P10-100

### 2.4.2 Batteries

LAK-17A FES has two battery packs wired in serial. Each battery pack has 14 cells, so altogether 28 cells.

Nominal capacity of each cell is 40 Ah, at middle voltage 3.7 V (minimum 3.2 V, maximum 4.2 V).

Min total allowed voltage of batteries ..... 90 V
Max total voltage of batteries ..... 118 V
Battery charger ..... KOP1001 BMS version,
or two KOP602 BMS version

More detailed data about battery packs are described in separate FES Battery pack GEN2 with integrated BMS (Battery Management System) manual.

## 2.5 Mass (weight)

Maximum take-off mass of the LAK-17A FES is:

| | |
|---|---|
| for 15 m: | 500 kg (1102 lbs); |
| for 18 m: | 500 kg (1102 lbs). |

Maximum landing mass:

| | |
|---|---|
| for 15 m: | 500 kg (1102 lbs); |
| for 18 m: | 500 kg (1102 lbs). |

**Note:** When landing on a rough and hard surface always dump all water ballast before landing.

| | |
|---|---|
| Maximum mass of all non lifting parts: | 263 kg (580 lbs) |
| Maximum mass in baggage area: | 7 kg (15.4 lbs) |

**Caution:** Heavy pieces of baggage must be secured to the baggage compartment floor

## 2.6 Center of gravity

Position of C.G. in flight:

| | |
|---|---|
| front limit: | 182 mm aft of wing root rib leading edge; |
| rear limit: | 305 mm aft of wing root rib leading edge. |

**Warning:** The sailplane may be safely operated only when loaded in the range defined in the Section 6 of this manual.

## 2.7 Approved manoeuvres

This sailplane is certified for normal gliding in the "Utility" category according to CS-22. Aerobatic manoeuvres are not permitted.

## 2.8 Manoeuvring load factors

Limit load factors are:

| | |
|---|---|
| for $V_A$ = 190 km/h (102 kts): | +5.3 / −2.65; |
| for $V_{NE}$ = 275 km/h (148 kts): | +4.0 / −1.5; |
| for $V_{NE}$ = 275 km/h (148 kts), air brakes extended: | +3.5 / 0; |
| for $V_F$ = 160 km/h (86 kts), flaps +1, +2, L: | +4.0 / 0. |

## 2.9 Flight crew

LAK-17A FES is a single seat motor-glider. Load in a pilot seat must be as follows:

| | |
|---|---|
| max load in the seat: | 110 kg (242 lbs); |
| min load in the seat: | see placard in cockpit and weighing report. |

With these loads, the C.G. range given in §2.6 will be in the limits if the empty glider weight and C.G. is in the limits (see empty center of gravity chart in §6).

**Caution:** With low pilot weight lead ballast must be added to the front part of the cockpit.

## 2.10 Kinds of operation

Flights must be conducted under Day / VFR conditions.

Where permitted by national regulations, cloud flying may be conduced but only with 15 m wings (including 15 m winglets) and without water ballast. Consider different national legal requirements (for e.g. additional equipment) for cloud flying (see also §2.11).

Aerobatic maneuvers are not permitted.

**Warning:** Flying with removed motor is not allowed.

**Warning:** Flying under power in strong rain is not allowed. Make sure that a cover of the battery compartment is sealed with a plastic tape.

**Warning:** Flying with removed FES batteries are allowed only using the dummy boxes instead. See §3.4.11 of the Maintenance Manual for the use of these boxes.

## 2.11 Minimum equipment

As minimum equipment only the instruments and equipment specified herein and in the equipment list (see §2 of the Maintenance Manual) are admissible:

- airspeed indicator, scale 50...300 km/h (27...162 kts), with range markings (see §2.3);
- altimeter with altitude corrector and fine range pointer;
- magnetic direction indicator (compensated in an aircraft);
- four point symmetrical seat harness;
- power supply;
- FCU instrument, which incorporates:
  - V meter,
  - A meter,
  - power meter,
  - motor temperature indicator,
  - Bat1, Bat2 temperature indicator,
  - RPM indicator,
  - alarm messages together with alarm sound;
- outside air temperature (OAT) gauge (if water ballast is carried);
- emergency locator transmitter (ELT) (if required by national regulations);
- required placards, check lists and flight manual;
- battery box fire warning system.

For cloud flying the following additional equipment is required:

- variometer;

- turn and bank indicator, non-icing;
- transceiver ready for operation;
- parachute, automatic or manual opening type;
- non-icing airspeed system.

The minimum equipment must correspond with national regulations.

## 2.12 Aero tow, winch and auto tow launching, self-launching

The maximum launch speeds for both 15 m and 18 m wing are:

aerotow – 160 km/h (86 kts);
winch / auto-tow launch – 140 km/h (76 kts).

For all of the above launching methods a weak link of 650 daN (1461 lbs) must be used in the launch cable or towrope.

For aerotow, the towrope must be at least 20 m (66 ft) long.

**Warning:** For winch or auto-tow launch, only the C.G. hook can be used.

**Warning:** Aerotow launches are only allowed at the aerotow hook.

## 2.13 Other limitations

### Crosswinds

The maximum demonstrated crosswind component according to the airworthiness requirements for takeoff and landing is 15 km/h (8 kts).

### Water ballast

Filling of the wing water ballast tanks must result in the symmetrical loading condition only. After filling, balance the wings by dumping enough water from the heavy wing to achieve lateral balance. Flight with leaking water ballast is not permitted as this may result in asymmetrical loading. For maximum permissible water ballast see §6.9.

**Warning:** Flight with water ballast must be conducted at an OAT greater than 2 °C (36 °F). Otherwise jettison both wing and fin water ballast in order to prevent structural damages due to freezing of water.

**Warning:** Maximum take-off weight must not be exceeded.

## 2.14 Limitation placards

The following limitation placards are installed in a glider:

Air speed data and loading placard in a cockpit

| LAK-17A FES – AIR SPEED DATA & LOADING PLACARD | | | | | | |
|---|---|---|---|---|---|---|
| **Speed IAS** | | km/h | kts | **Masses and loads** | kg | lbs |
| Never exceed | $V_{NE}$ | 275 | 148 | Max mass with water ballast | 500 | 1102 |
| Rough air | $V_{RA}$ | 190 | 102 | Maximum cockpit load | 110 | 242 |
| Manoeuvring | $V_A$ | 190 | 102 | Minimum cockpit load | | |
| Aerotow | $V_T$ | 160 | 86 | | | |
| Winch-launch | $V_W$ | 140 | 76 | Recommended weak link | 650 daN | 1461 lbs |
| Landing gear operation | $V_{LO}$ | 205 | 110 | | | |
| Max operation with motor running | $V_{PE}$ | 160 | 86 | **Land always in the gliding configuration** | | |
| Max speed to start motor | $V_{PO\ max}$ | 160 | 86 | **Aerobatic manoeuvres are not permitted** | | |
| Min speed to start motor | $V_{PO\ min}$ | 90 | 49 | | | |

FES MCU indication (LED) meanings

| | |
|---|---|
| LED 1 – red | Alarms from FCU, see specifications of errors |
| LED 2 – green | Controller and motor are ready for operation |
| LED 3 – red | Something is wrong with motor or controller |

| m - **Altitude** - ft | | km/h - **$V_{NE}$, IAS** - kts | |
|---|---|---|---|
| 4000 | 13100 | 275 | 148 |
| 5000 | 16400 | 260 | 140 |
| 6000 | 19680 | 245 | 132 |
| 8000 | 26250 | 220 | 119 |
| 10000 | 32800 | 195 | 105 |

High altitude flights $V_{NE}$ limitations on a rightside canopy rail, for the pilot in flight visible place.

| Nose ballast<br>Max permitted 6.0 kg (13.2 lbs) | |
|---|---|
| **Reduction of the min cockpit load by:** | **Lead weight required:** |
| 5 kg (11 lbs) | 2 kg (4.4 lbs) |
| 10 kg (22 lbs) | 4 kg (8.8 lbs) |
| 15 kg (33 lbs) | 6 kg (13.2 lbs) |

Nose ballast limitations placard – located at a bulkhead at the nose of the glider (optional).

| Max baggage weight<br>7 kg (15.4 lbs) |
|---|

In a baggage area

| Pressure in a main wheel tire<br>from 2.3 to 2.5 bar |
|---|

On a main gear door

| Pressure in a tail wheel tire<br>from 1.8 to 2.0 bar |
|---|

Next to the tail wheel

INTENTIONALLY LEFT BLANK

## Section 3

# EMERGENCY PROCEDURES


3.1 Introduction . . . . . 3-2
3.2 Canopy jettison . . . . . 3-2
3.3 Bailing out . . . . . 3-2
3.4 Stall recovery . . . . . 3-3
3.5 Spin recovery . . . . . 3-3
3.6 Spiral dive recovery . . . . . 3-3
3.7 Motor failure . . . . . 3-3
3.7.1 Power loss during flight . . . . . 3-3
3.8 Fire . . . . . 3-4
3.8.1 Fire on the ground . . . . . 3-4
3.8.2 Fire during flight . . . . . 3-5
3.9 Loss of electrical power in flight . . . . . 3-6
3.10 Landing with the motor (propeller) runnig . . . . . 3-6
3.11 Recovery from unintentional cloud flying . . . . . 3-6
3.12 Flight with asymmetrical water ballast . . . . . 3-6
3.13 Emergency wheel up landing . . . . . 3-7
3.14 Ground loop . . . . . 3-7
3.15 Ditching landing on water . . . . . 3-7

## 3.1 Introduction

Section 3 provides a checklist and explanations for coping with emergencies that may occur. Emergency situations can be minimized by proper pre-flight inspections and maintenance.

## 3.2 Canopy jettison

The following steps accomplish canopy jettison:

1. Pull the red canopy jettison handle aft to the limit of its travel.

2. Release the handle.

The canopy jettison handle is located on the instrument panel and has an icon describing its function. A compression spring in the canopy hinge pushes the canopy upward and lets the airflow to lift the front of the canopy upward while the rear of the frame pivots about a small lip on the fuselage. This system is designed to lift the canopy up and away from the flying glider to allow the pilot a quick bailout from the cockpit.

If necessary, push the canopy upwards with both hands on the Plexiglas.

**Warning:** The red handle of the spring-type mechanism on the canopy hinge must be in the unlocked (working) position.

## 3.3 Bailing out

First jettison the canopy then unlock the safety harness and bail out. The low walls of the cockpit allow for a quick push-out exit.

It is recommended that bail out procedures be practiced on the ground at the beginning of each flying season.

**Warning:** If you have to bail out with the motor running, stop the motor, if there is time enough to do so, as follows:
by rotation of the Rotary encoder button counter clockwise stop the propeller.

**Warning:** If there is no time to stop the propeller, try to avoid the propeller by leaving the sailplane beneath the wing.

## 3.4 Stall recovery

Stall recovery is accomplished by easing the stick forward and picking up a dropping wing with sufficient opposite rudder.

## 3.5 Spin recovery

Apply full opposite rudder against the direction of rotation and keep the stick neutral until the rotation stops. At aft C.G. positions the glider may move temporarily to a nose up position making it necessary to apply full stick forward. As the rotation stops centralize the controls and carefully pull out of the dive. The ailerons should be kept neutral during spin recovery.

Recovery from unintentional spins should be done immediately.

**Caution:** Altitude loss due an incipient spin from straight flight with prompt recovery is 30 m (98 ft), increasing to 60 m (196 ft) from circling flight and 60 m (196 ft) to 120 m (394 ft) with airbrakes extended. Maximum speed during recovery is 190 km/h (103 kts).

## 3.6 Spiral dive recovery

To recover from a spiral dive, apply rudder and aileron in the direction opposite to the spiral dive rotation and carefully pull out of the dive.

## 3.7 Motor failure

In the event that the motor does not start, continue flying as pure glider.

In the event of motor failure during running motor, try to stop the propeller from wind milling phase with electronic brake.

In case that you are not able to stop propeller you will need to land with the propeller in wind milling phase. In such situation try to land on both landing gear wheels simultaneously, to avoid damage on the propeller.

L/D with propeller in wind milling phase is only little degraded.

### 3.7.1 Power loss during flight

If power is lost during flight, push the control stick forward gently, to sustain desired airspeed. Than you can do next actions:

1. Check first if you maybe unintentionally switched OFF power switch.

   If this actually happened, just switch Power switch ON again and adjust throttle knob.

2. If Power switch was not unintentionally switched OFF, proceed with following actions:

   - switch OFF "Power switch" and then also FCU;
   - turn ON FCU and check it for any strange behaviour;
   - if everything is OK switch on Power switch and try to start motor again.

   If motor starts and there is any strange behaviour under power:

   - stop the propeller from the wind milling phase with the electronic brake;
   - after propeller is stopped, switch OFF Power switch and keep FCU "ON".

   In case that you are not able to stop propeller, you will need to land with the propeller in wind milling phase. In such situation try to land carefully on both landing gear wheels simultaneously, to avoid possible damage of the propeller.

**Warning:** Try to avoid landing into high grass or similar.

**Note:** L/D of sailplane with propeller in wind milling phase is only a little degraded, so you might have enough time to choose a suitable landing place if you have enough altitude.

Read *FES FCU Instrument manual* for detailed behaviour and necessary actions after appearance of certain messages or LED lights.

## 3.8 Fire

### 3.8.1 Fire on the ground

- switch OFF the "Power switch";
- switch OFF all instruments;

- get out of the cockpit;
- extinguish fire.

### 3.8.2 Fire during flight

If motor fire occurs during start of motor or in flight:

- stop the motor immediately;
- switch OFF the "Power switch";
- open front ventilation (if not already opened);
- open canopy side window;
- land as soon as possible (or bail out if appropriate);
- extinguish fire after landing.

If battery fire occurs in flight:

- stop the motor immediately;
- switch OFF the "Power switch";
- open front ventilation (if not already opened);
- open canopy side window;
- land as soon as possible (or bail out if appropriate);
- after landing, extinguish fire with a lot of water.

**Note:** Sailplane is equipped with one of two types of battery compartment fire warning systems:

- temperature indicator with a buzzer (when $T \geq 90\,^{\circ}C$) on top of the instrument panel (option 1);
- flashing red LED (when $T \geq 88\,^{\circ}C$) in the instrument panel (option 2).

## 3.9 Loss of electrical power in flight

With the motor stopped:

- continue flying as a sailplane.

With the motor running:

- try to stop the propeller from wind milling phase with electronic brake. If successful, propeller will fold to fuselage contour automatically.

If electronic braking system failed too and propeller cannot be stopped – land with propeller in wind milling phase, but try to carefully land on both wheels simultaneously, to avoid damage on the propeller.

## 3.10 Landing with the motor (propeller) runnig

You can land also with propeller in wind milling phase, but try to carefully land on both landing gear wheels simultaneously, to avoid damage on propeller.

L/D with propeller in wind milling phase is only little degraded.

## 3.11 Recovery from unintentional cloud flying

At speeds below 190 km/h (102 kts), extend the dive brakes fully. At higher speeds, up to $V_{NE}$, pull out the dive brakes very carefully and expect high aerodynamic forces and g-loads. Enter the descent and fly normally until leaving the cloud. When clear of the cloud, retract the dive brakes and reduce speed. Spins are not to be used to lose altitude.

## 3.12 Flight with asymmetrical water ballast

If you suspect that the water ballast is not dumping symmetrically you should close the dump valves immediately to avoid greater asymmetry. Asymmetry can be verified by the necessary aileron deflection in straight flight at low airspeeds.

When flying with asymmetric water ballast you must increase your airspeed, especially in turns, so that you can avoid stall at all costs. Should the aircraft enter a spin under these conditions, aggressive stick forward spin recovery will be necessary. Fly the landing pattern and touch down with approximately 10 km/h (5.4 kts) faster than normal and after touch down

attempt to control the bank angle to avoid the heavy wing from touching the ground too early.

## 3.13 Emergency wheel up landing

An emergency wheel up landing is not recommended since the absorption capability of the fuselage is much smaller than that of the landing gear. If the landing gear cannot be extended the landing touchdown should be at slow speed.

## 3.14 Ground loop

If there is a risk of overshooting the landing area after touchdown an intentional ground loop may be initiated by forcing a wing tip to the ground and at the same time you should PUSH the stick forward to lighten the load on the tail wheel and apply the opposite rudder.

## 3.15 Ditching landing on water

Our experience shows that in ditching the cockpit area likely will be forced downward under water. Therefore an emergency landing on water is recommended only with the landing gear extended and then only as a last resort.

Make sure that all the electricity is turned off before landing.

INTENTIONALLY LEFT BLANK

## Section 4

# NORMAL PROCEDURES


4.1 Introduction . . . . . 4-2
4.2 Rigging and de-rigging, filling the water tanks, charging, battery pack installation . . . . . 4-2
4.2.1 Rigging and de-rigging . . . . . 4-2
4.2.2 Filling the water tanks . . . . . 4-3
4.2.3 FES battery packs charging . . . . . 4-4
4.2.4 FES battery packs or the dummy boxes installation . . 4-4
4.3 Daily inspections . . . . . 4-5
4.4 Preflight inspection . . . . . 4-7
4.5 Normal procedures and recommended speeds . . . . . 4-9
4.5.1 Aero-tow launch . . . . . 4-9
4.5.2 Winch-launch or auto-tow . . . . . 4-9
4.5.3 Free flight . . . . . 4-10
4.5.4 Low speed flight and stalling behavior . . . . . 4-10
4.5.5 Cruise with running motor . . . . . 4-11
4.5.6 Approach and landing . . . . . 4-13
4.5.7 Flight with water ballast . . . . . 4-15
4.5.8 High altitude flights . . . . . 4-15
4.5.9 Flight in rain . . . . . 4-16

## 4.1 Introduction

This section provides checklists and explanations of procedures for conducting normal operating procedures. Normal procedures associated with optional equipment can be found in section 9.

## 4.2 Rigging and de-rigging, filling the water tanks, charging, battery pack installation

### 4.2.1 Rigging and de-rigging

**Warning:** Make sure that connecting cable between battery packs is not installed (if the batteries are fixed inside the fuselage)

The following procedures are recommended for rigging and de-rigging the LAK-17A FES sailplane:

1. Clean and lubricate all pins, bushings and control connections. Inspect the pins and bushings for burrs and gouges.

2. Support the fuselage and keep it upright, open the canopy and lower the landing gear. Place the control stick in the center of its travel. Position the dive brake handle near it most forward position, flaps handle in "−1" position. Put the water ballast control in the forward, closed position.

3. Be sure the dive brake system in the wings is not locked. Remove any supports or locks over the ailerons.

4. Insert the left wing spar fork into the fuselage. As the wing root approaches the fuselage look to be sure the automatic hook ups for the aileron, flaps and dive brake properly engage. Look to see if the water ballast control is engaging correctly. After the wing is pushed into position support the wing tip.

**Note:** It's not allowed to rig or de-rig wings with winglets or 18 m wingtips with or without winglets installed.

5. Insert the right wing spar into the fuselage. As the wing root approaches the fuselage look to be sure the automatic hook ups for the aileron, flap and dive brake properly engage. Look to see if the water ballast control is engaging correctly. Line up the main pin bushings. Insert both spar pins fully. Lock the main wing pin handles.

**Warning:** Lock the main wing pin handles with fixing studs.

6. Install winglets or wing tips, lock and secure. To connect left and right wingtip: screw bolt M5 into the wingtip/winglet fixator and pull it out until it reaches the stop. While holding fixator in lifted position, push the winglet completely into the wing. Release fixator, push it down flush with the wing surface, and remove the bolt. Pull on the wingtip or winglet to make sure it is locked.

7. Slide the stabilizer onto the drive pins and look to make sure the automatic hookups for the elevator properly engage. Push the stabilizer all the way onto the drive pins. Screw the locking bolt in and make sure, that the bolt is fixed. After removing the assembly tool, place a piece of glider tape over the locking bolt.

**Warning:** For de-rigging, before unscrewing mounting bolt, unfix it by pulling out the locking pin.

8. Apply sealing tape to the wing/fuselage gaps.

9. Perform a positive control check for all controls.

10. Install total energy tube and temporary equipment (barographs etc.).

11. Perform Daily Inspection.

12. De-rigging follows the reverse order of rigging. Confirm that water ballast has been dumped before de-rigging. Also see Section 3 of the *Maintenance Manual*.

**Note:** Remove horizontal stabilizer before removing the wings.

### 4.2.2 Filling the water tanks

If water ballast is necessary, fill each wing tank according to the loading chart (see §6) and confirm symmetrical loading by balancing at the wing tip. The wing ballast is filled through the dumping valves at the bottom side of the wing using special filling equipment. A light coating of waterproof grease applied to the dump valve seat will help insure the valve is leak free.

Fin water ballast is filled through the filling opening at the top of the fin. This can be done with or without stabilizer installed. Fill fin tank according to the loading chart (see §6).

**Warning:** Allow tanks to vent while filling. Do not fill with pressure exceeding 1 psi / 0.06 bar as the structure could be damaged. Check for proper dump valves operation prior to flight. Do not exceed the maximum gross weights.

### 4.2.3 FES battery packs charging

If motor was used for longer time during previous flight, battery packs should be recharged in order to have enough energy available if needed.

Detailed instructions about charging of battery packs are described in separate *FES Battery pack GEN2 with integrated BMS manual*.

### 4.2.4 FES battery packs or the dummy boxes installation

### FES battery packs installation

**Warning:** Make sure that both battery packs are fully charged before installation into the sailplane. Both battery packs *must have* approximately the same voltage level of each cell (close to 4.16 V per cell). There should be less than 0.4 V difference, between total voltage levels of each battery pack!

1. Inspect battery housing for any mechanical damage;

**Warning:** Even small visually detectable damages imply that the affected battery is not airworthy.

2. Open cover;
3. Check that Power switch is OFF;
4. Check that FCU instrument and all other instruments (Flight computer, Flarm, Radio, Transponder, PDA...) are switched OFF;
5. Put one pack into the fuselage so that contacts are facing forward;
6. Slide it back to rear position;
7. Put another pack into the fuselage so that contacts are facing rearward;
8. Place fixation plates;
9. Tighten battery pack fixation knobs;
10. Insert and secure temperature sensor connectors, to each battery pack;

11. Connect red " + " wire to " + " terminal of front battery and black " – " wire to " – " terminal of rear battery;
12. Close cover.

## The dummy boxes installation

1. Open cover;
2. Insert first box into the fuselage and slide it back to rear position;
3. Insert second box into the fuselage and slide it to the first one;
4. Place pair of fixation plates (the same as used for the FES batteries fixation) in the middle of the rear dummy box, above carrier strap and tighten fixation knob;
5. Place pair of fixation plates (the same as used for the FES batteries fixation) in the middle of the front dummy box, above carrier strap and tighten fixation knob;
6. Check that FES batteries power cables and temperature sensor cable are firmly fixed to the side of battery compartment;
7. Close cover.

For more information about the dummy boxes, refer to the 2.5.3_02 illustration of the *Maintenance manual*.

## 4.3 Daily inspections

Keep in mind the importance of the inspection after rigging the glider and respectively each day prior to the first take off. As a minimum, check the following items. If any problems are found they must be corrected before flying.

1. Airworthiness documents, placards and markings.
2. Check forepart of the fuselage.
3. Check the cockpit:
    - cockpit area for lose objects or damaged components;
    - the cockpit canopy glass;

- operation of cockpit canopy lock, canopy jettison system;
- unlock canopy jettison system if locked;
- wings connection pins locked;
- operation of towing hook(s);
- operation of water ballast system;
- operation of control systems: ailerons, flaps, elevator, rudder and airbrakes (confirm that air brakes lock when closed);
- operation of pilot cockpit ventilation, seat back adjustment;
- operation of a trimmer;
- batteries and oxygen bottle for condition, properly secured;
- operation of flight instruments (especially pneumatic);
- radio communication;
- safety belts.

4. Check for good condition and pressure of main and tail wheel tires and operation of the main wheel brake.
5. Check the left wing:
   - upper and lower wing surfaces;
   - leading edge;
   - upper and lower surfaces of ailerons and flaps;
   - deflections of ailerons and flaps and their clearances;
   - airbrakes for proper function and locking;
   - ailerons and flaps attachment to the wing;
   - clearance between the wing and the fuselage;
   - winglets or wing tips installed, locked and secured.
6. Check function of control systems (of an ailerons, flaps, airbrakes), their connections to corresponding control systems in the fuselage.
7. Check the fuselage exterior surface.
8. Check a stabilizer, an elevator and a rudder:
   - surfaces;
   - deflections and clearances of controls;

- fixing of joint of the stabilizer attachment to the fin;
- clearance of the stabilizer with respect to the fin.

9. Check the right wing (same as for the left wing according to item 5).
10. Check the FES system visually, especially condition of the propeller blades.

**Caution:** After a hard landing or if high loads have been experienced, a complete inspection according to §5.5 of the *Maintenance Manual* must be performed. Contact the manufacturer for assistance if required.

## 4.4 Preflight inspection

1. Main spar pins installed and locked.
2. Controls checked for operation and freedom of movement.
3. Lead or water ballast for underweight pilot installed or filled.
4. Tail dolly removed.
5. Unlock canopy jettison system if locked.
6. Batteries and oxygen bottle installed, properly secured.
7. Pilot safety harness connected and properly adjusted/tightened.
8. Seat back and rudder pedals adjusted. Seat back properly fixed!
9. All control knobs within reach.
10. Water ballast checked, dump valve closed and vents open.
11. Airbrakes closed and locked.
12. Trim set to takeoff position.
13. Flaps set to takeoff position.
14. Check wheel brake.
15. Altimeter set correctly.
16. Check direction of wind component.

17. Close and lock canopy.
18. Max mass not exceeded.
19. Switch FCU instrument ON (if motor batteries are installed).

**If powered flight is planned or expected:**

Perform FES ground test run as described below.

1. Remove propeller covers and a tail dolly;
2. Open battery compartment cover;
3. Check that Power switch is OFF;
4. Insert connecting cable between the battery packs;
5. Switch ON BMS switch on each battery pack;
6. Seal battery compartment cover with glider tape;
7. Seat into the glider, and close canopy;
8. Check that no one is around propeller zone, in front of glider or in line of propeller;
9. Switch on FCU;
10. Switch on Power switch, and rotate gently a throttle knob clockwise;
11. Wait about 8 seconds, for FCU to show all battery bottles;
12. Start the motor but use only low power to check proper operation;

**Caution:** In case that you would like to test system at maximum power, somebody needs to hold a fuselage tube down, and hold a glider

13. Check if propeller braking and automatic positioning are working fine;
14. Switch OFF Power switch;
15. Keep FCU instrument ON;
16. Check whether FES battery compartment fire warning system is working fine;
17. Check for good condition of the main-wheel landing gear tire and minimum tire pressure.

## 4.5 Normal procedures and recommended speeds

### 4.5.1 Aero-tow launch

Flaps should be set at take off position "+1" when C.G. is at rearmost position and "+2" at middle and foremost position of C.G. Trim should be set forward of neutral.

When aerotowing in a crosswind it is recommended to park the sailplane approximately two meters on the left or right side from sailplanes axis to the side of the wind.

**Warning:** Aero-tow launches are only allowed at the aero-tow hook.

**Warning:** When water tanks are partially filled, keep wings horizontal before take-off to avoid uneven water distribution.

**Warning:** It is not allowed to start and run FES motor during aero tow.

Weak link in tow cable: max 650 daN (1461 lbs). Use wheel brake during tightening of tow cable to avoid rolling over tow cable.

Minimum aerotow speed:

| | |
|---|---|
| without water ballast: | 100 km/h (54 kts); |
| with water ballast: | 120 km/h (65 kts). |

### 4.5.2 Winch-launch or auto-tow

Trim should be set forward of neutral. Set flaps to "+1" at rearmost position of C.G. and "+2" at middle and foremost position of C.G.

**Warning:** For winch or auto-tow launch, only the C.G. hook can be used.

**Warning:** It is prohibited to use the aero-tow hook for winch or auto-tow launches.

**Warning:** When water tanks are partially filled, keep wings horizontal before take-off to avoid uneven water distribution.

**Warning:** It is not allowed to start and run FES motor during winch or auto tow.

**Warning:** Seat back must be properly fixed.

Weak link in tow cable: max 650 daN (1461 lbs). Use wheel brake during tightening of tow cable to avoid rolling over tow cable. Pronounced forward stick pressure is required during transition arc.

Minimum winch-launch speed:

| | |
|---|---|
| without water ballast: | 100 km/h (54 kts); |
| with water ballast: | 120 km/h (65 kts). |

### 4.5.3 Free flight

Circling flight (thermalling) with flaps position "+2", stick forces to zero. Best gliding ratio is between 95 and 105 km/h (51 and 57 kts).

For high speed flight up to 275 km/h (148 kts) position flaps between "0" and "–1" according to speed.

Due to flap control forces, flaps position "+2" may not be set above 160 km/h (86 kts).

**Warning:** During flight always keep the FCU turned ON.

Recommended flaps positions:

| Flap position | Speed, km/h / (kts) | |
|---|---|---|
| | without water ballast | with maximum take-off weight |
| L | landing | landing |
| +2 | $\leq$ 90 / (49) | $\leq$ 110 / (60) |
| +1 | 90...120 / (49...65) | 110...150 / (60...81) |
| 0 | 110...180 / (60...97) | 140...220 / (76...119) |
| −1 | 150...275 / (81...148) | 190...275 / (103...148) |

### 4.5.4 Low speed flight and stalling behavior

The LAK-17A FES behaves normally in slow and stalled flight.

With a forward C.G. position, there is a clear and distinct stall warning. The stall characteristics are very gentle and large aileron deflections can be applied without dropping the wing.

At rearward C.G. positions airflow separation over the fuselage results in buffeting and gives warning to an impending stall.

Full and sudden aileron or rudder deflections will result in a spiral dive, spin entry or slide slip depending on the C.G. position.

**Caution:** Altitude loss due to an incipient spin from straight flight with prompt recovery is approximately 30 m (100 ft), increasing for circling flight.

### 4.5.5 Cruise with running motor

The motor of the LAK-17A FES can be used for long continuous cruise at low power settings, or climbing at higher power settings.

Before motor operation **open ventilation** fully (ventilation lever must be pushed fully forward).

### Motor starting procedure during flight

1. FCU instrument must be ON.
2. Turn on Power Switch.
3. Check if there is green LED ON (left lower LED), check Voltage level (If there is no green LED or red LED is blinking motor will not run). Read *FES FCU instrument manual* for detailed FCU description.
4. Start motor with Throttle knob rotating in clockwise direction gently.

Use about 4 kW of power for horizontal flight, and more for climbing. At 22 kW of power, climb rate is around 2.5 m/s. Available maximum power is reducing slowly due to voltage drop, during discharging of battery packs. Maximum power can be used only until any of temperature values reach yellow warning (motor and controller at 70 °C, battery packs at 45 °C).

**Note:** You can reduce power in thermals, and use more power in sinking air.

Do not use high current at lower voltages; this mean below 95 V. Always try to fly as much as possible on lower power settings where efficiency of complete system is the highest.

The maximum range of the powered flight without water ballast is around 100 km depending on lift-sink conditions (62 miles). Put flaps on "+2" or "+1" and fly at speed 90 km/h.

Maximum altitude gain without water ballast is about 1200 m (4000 ft) depending on liftsink conditions. Best climb rate is achieved with flaps on "+2" position and climbing speed 85 km/h.

During flight always keep the FCU turned ON. Switch OFF Power switch if motor is not running.

## Propeller stop with electronic braking

To stop propeller with electronic braking, you need to rotate Throttle knob in counter-clockwise direction for 1 step, from zero throttle, so that throttle line on display starts blinking red.

**Note:** For successful stop the motor should reach minimum 700 RPM, otherwise braking will not be working, due to *insufficient induced voltage* (regeneration function of controller is used for propeller braking).

In the air there is nearly always enough RPM. But if you want to test electronic braking on the ground, make sure you set at least 1000 RPM, and rotate throttle knob quickly in counter clockwise direction.

## Propeller positioning

1. FES installations *without* automatic positioning:

   If propeller stops in such position that pilot can see one of the blades through the canopy, just start motor again to about 3000 RPM and then stop it again. Repeat this procedure until blades are randomly positioned in suitable position.

2. FES installations *with* automatic positioning:

   If your system is equipped with automatic positioning of blades, the electronics will rotate them in horizontal position.

   After electronic braking stops the motor, wait for 2-3 seconds, until RPM data shows zero RPM. After that, automatic positioning will start. You can always stop automatic positioning by pressing throttle knob.

   In settings it is possible to adjust:

   - time between steps from 50 ms to 1 s;
   - power used for positioning at 115 V and at 90 V;
   - number of steps after hall sensor for position is detected.

**Note:** Positioning does not work if Canopy message is active, or if throttle is set to zero power instead of braking.

### 4.5.6 Approach and landing

Recommended flaps position is "L" (landing).

In light winds and without water ballast the approach to landing should be flown at about 95 km/h (51 kts). Stronger winds require increased airspeeds. The very effective dive brakes make a short landing possible; however, do not approach too slowly with fully extended dive brakes as the aircraft may drop during the flare out. The glider should touch down on the main and tail wheel. The main wheel brake can then be applied for a shortened ground roll. When flying with inside-slip with airbrakes extended, vibrations of the sailplane occurs. The control stick should be in aft position. Due to side-slip, control force decrease or reversal is possible.

Land always with propeller blades in horizontal position, or propeller blades might be damaged during the landing, or during opening of canopy.

**Warning:** Land always in the gliding configuration.

**After landing.** If motor was used during flight, take out both batteries and recharge those according to detailed charging instructions in *FES Battery pack manual*, latest revision.

**Caution:** Always remove connecting cable between the packs after landing.

**Warning:** Make sure that Power switch is OFF before removing connecting cable.

**Taking Battery packs or the dummy boxes out of sailplane.** Taking battery packs out of sailplane:

1. Check that Power switch is OFF;
2. Check that FCU instrument and all other instruments (Flight computer, Flarm, Radio, Transponder, PDA...) are switched OFF;
3. Open cover;
4. Take out connecting cable between the packs;

5. Take out RED " + " and BLACK " – " power connectors;
6. Fix supply cables to the side of battery compartment box;
7. Remove both temperature sensor connectors, from each battery pack;
8. Fix temperature sensor cable to the side of battery compartment box;
9. Un-tighten battery pack fixation knobs;
10. Take the fixation plate out;
11. Firmly grip the front battery by a carrier strap;
12. Lift it out of the fuselage and put it on safe place;
13. Firmly grip the rear battery by a carrier strap and slide it forward along the bottom of the battery compartment;
14. Lift the battery pack out of the fuselage and put it on safe place;
15. Close cover.

Taking the dummy boxes out of sailplane:

1. Open cover;
2. Untighten battery packs/dummy boxes fixation knobs;
3. Take the fixation plates out;
4. Firmly grip the front box by a carrier strap;
5. Lift it out of the fuselage and put it on safe place;
6. Firmly grip the rear box by a carrier strap and slide it forward along the bottom of the battery compartment Lift the dummy box out of the fuselage and put it on safe place;
7. Close cover.

### 4.5.7 Flight with water ballast

Flight in excess of the maximum gross weight 500 kg (1102 lbs) is prohibited. The maximum amount of water allowed depends on the empty weight of the sailplane combined with the total cockpit load (see §6.9).

**Warning:** Flight with water ballast must be conducted at an OAT greater than 2 °C (36 °F). If there is a risk of freezing temperatures, all water ballast, including fin water ballast must be dumped before freezing temperatures are reached. The flight conditions must comply with the following table:

| | | | | | | |
|---|---|---|---|---|---|---|
| Ground temperature | °C | 10 | 15 | 20 | 30 | 40 |
| | °F | 50 | 59 | 68 | 86 | 104 |
| Max. flight altitude | m | 1200 | 2000 | 2700 | 4300 | 5800 |
| | ft | 4000 | 6500 | 9000 | 14000 | 19000 |

**Filling and dumping the water ballast.** After filling the ballast tanks, either full or with partial loads, the wings should be leveled and checked for symmetrical loading. Flight with leaking ballast valves is prohibited. Open ballast valves fully to dump water ballast.

A time to drain water ballast tanks:

- wing tanks $\sim$ 4 min 30 s;
- tail tank $\sim$ 1 min 30 s.

**Warning:** Filling of the ballast tank with pressurized water is prohibited. Always allow space for the displaced air to escape.

If you want to achieve maximum climb rate performance or range under power, then drop water ballast.

### 4.5.8 High altitude flights

Indicated airspeed readings are progressively under-stated of true airspeed with higher altitudes. The limitations apply to high altitude flights as indicated at the placard given in §2.14 of this manual.

Special care should be taken to ensure that there is no moisture on any section of the control junctions that could lead to freezing at high altitudes.

### 4.5.9 Flight in rain

With light rain the stall speed and sink rate increase slightly, therefore landing approach speeds in rain must be increased. Rainwater on wings should be removed before takeoff. Do not fly into icing conditions with a wet sailplane.

**With the motor running:** always avoid flying through heavy rain and thunderstorms. It is recommended to close ventilation, to prevent entering water into the spinner. Before flight, seal the battery compartment with a glider tape, to prevent water entering.

**Warning:** Avoid flying close to lightning activity.

It is allowed to fly through light rain, with running motor if necessary. However use only lower RPM settings, suitable for horizontal flight, to avoid damaging propeller blades. Stop motor if rain becomes stronger.

## Section 5

# PERFORMANCE

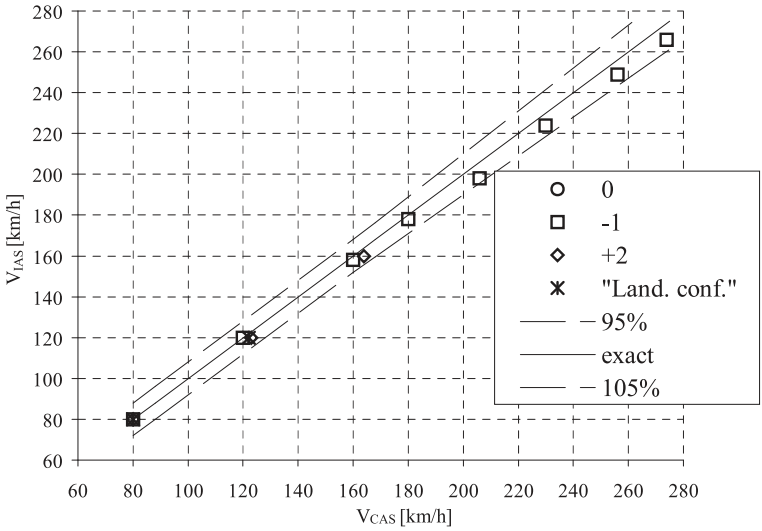
5.1 Introduction . . . . . 5-2
5.2 Data approved by EASA . . . . . 5-2
5.2.1 Airspeed indicator system calibration . . . . . 5-2
5.2.2 Stall speeds . . . . . 5-3
5.3 Additional information . . . . . 5-3
5.3.1 Demonstrated crosswind components . . . . . 5-3
5.3.2 Glide performance . . . . . 5-3
5.3.3 Flight polar . . . . . 5-4
5.3.4 Powered flight performance . . . . . 5-4

## 5.1 Introduction

This Chapter provides EASA approved data for airspeed calibration, stall speeds and take-off performance and non-approved further information. The data in the charts have been computed from actual flight tests with the sailplane in good condition and using average piloting techniques.

## 5.2 Data approved by EASA

### 5.2.1 Airspeed indicator system calibration




**Caution:** The airspeed indicator is to be connected to the pitot source from the fuselage vertical stabilizer and static source from the aft fuselage part.

Color coding of the plastic tubing is as follows:

- red – pitot;
- yellow – tail static;
- TE tube – green (not available when FES is installed into used sailplanes).

### 5.2.2 Stall speeds

| Flap position | Stall speed in level flight, km/h (kts) | |
|---|---|---|
| | without water ballast | with maximum take off weight |
| L | 85 (46) | 93 (50) |
| +2 | 86 (46.5) | 94 (51) |
| +1 | 87 (47) | 96 (52) |
| 0 | 88 (47.5) | 97 (52) |
| −1 | 89 (48) | 99 (53) |

The loss of altitude for wings level stall recovery is approximately 30 m (100 ft) if recovery is immediate.

The loss of altitude for turning flights stall recovery is up to 50 m (164 ft) if recovery is immediate.

## 5.3 Additional information

### 5.3.1 Demonstrated crosswind components

The demonstrated crosswind velocity is 4.16 m/s (15 km/h) (8 kts) according to the airworthiness requirements.

### 5.3.2 Glide performance

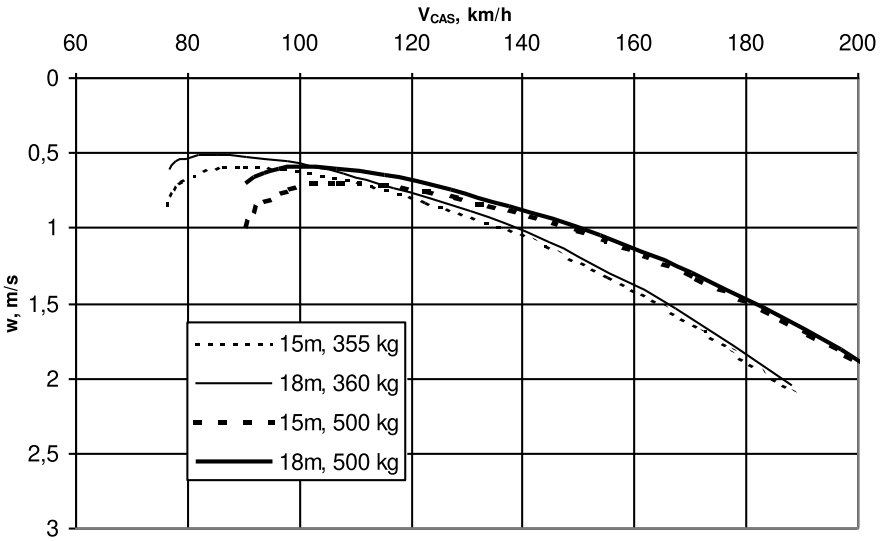
Data evaluated by comparison flights.

For optimum performance the aircraft should be flown with a C.G. position between medium and the rear of the allowable range. However, the aircraft will be more pitch sensitive at aft C.G. positions.

The wing fuselage joint and the tail plane locking pin should be taped over and the aircraft thoroughly cleaned to obtain maximum performance.

The polar apply to a clean aircraft, motor stopped. With dirty wings or flight in rain the performance drops accordingly.

### 5.3.3 Flight polar




### 5.3.4 Powered flight performance

**Rate of climb.** Maximum rate of climb is available only for a few minutes with fully charged Battery packs. As voltage is reduced, the maximum rate of climb is reduced as well.

Measured average rate of climb at MSL, standard atmosphere, flaps position "+2", flying at a speed 95...100 km/h (51...54 kts) is:

- 2 m/s (315 ft/min) for maximum weight without water ballast;
- 1.5 m/s (235 ft/min) for maximum weight with water ballast.

**Cruising flight.** The cruising speed is 95 km/h (51 kts) at around 3200 RPM and 40...50 Amps of current. Max range is about 100 km, dependable on lift-sink conditions.

Use a "+1" position of flaps.

**Maximum operational altitude.** To achieve maximum altitude gain you should use about 15 kW of power (not full power, as total efficiency is better at lower power settings. Maximum altitude that can be reached at a standard atmosphere conditions is:

- 1200 m (3900 ft) for the maximum weight without water ballast;
- 800 m (2600 ft) for the maximum weight with water ballast.

INTENTIONALLY LEFT BLANK

## Section 6

# WEIGHT AND BALANCE / EQUIPMENT LIST

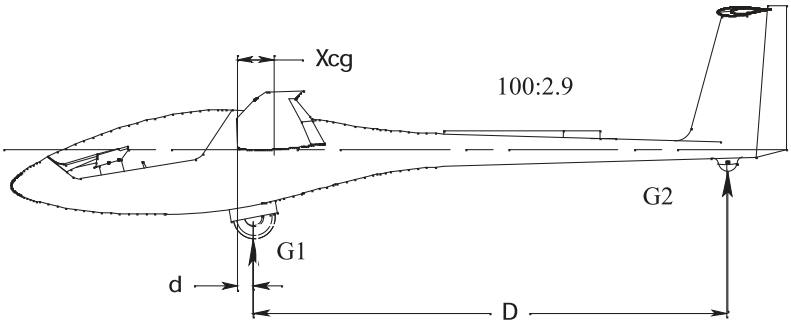

6.1 Introduction . . . . . 6-2
6.2 Weighing procedures . . . . . 6-2
6.3 Weighing record . . . . . 6-2
6.4 Empty weight and C.G. . . . . 6-3
6.5 Calculation of C.G. position . . . . . 6-5
6.6 Weight of all non-lifting parts . . . . . 6-7
6.7 Maximum weight . . . . . 6-7
6.8 Useful loads . . . . . 6-7
6.9 Water ballast loading table . . . . . 6-7
6.10 Determining possible loading of the glider . . . . . 6-8

## 6.1 Introduction

This section contains the payload range within which the sailplane can be safely operated. Procedures for weighing the sailplane and the calculation method for establishing the permitted payload range are also provided. A comprehensive list of all equipment available for this sailplane is contained in the Maintenance Manual.

## 6.2 Weighing procedures

The Weight and Balance Report for the LAK-17A FES must be calculated in accordance with the currently valid weighing data. The weighing must be established according following picture:




## 6.3 Weighing record

The result of each C.G. weighing is to be entered in the Weight and Balance Report in §6.4. The current minimum cockpit load must also be entered on the cockpit placard. When adding or changing instruments or equipment the new weighing report may be produced by a C.G. calculation using the following formula:

$$X_{cg} = \frac{G2 \cdot D}{G1 + G2} + d, \text{mm}$$

## 6.4 Empty weight and C.G.

Approved in flight C.G. positions are:

| No. | Parameter | Approved limit, mm |
|---|---|---|
| 1 | Foremost position of C.G. | 182 |
| 2 | Rearmost position of C.G. | 305 |

## Weight and balance record

| Date | Empty weight of the sailplane, kg | C.G. location, mm | Approved | |
|---|---|---|---|---|
| | | | Date | Signature |
| | | | | |

| Date | Empty weight of the sailplane, kg | C.G. location, mm | Approved | |
|---|---|---|---|---|
| | | | Date | Signature |
| | | | | |

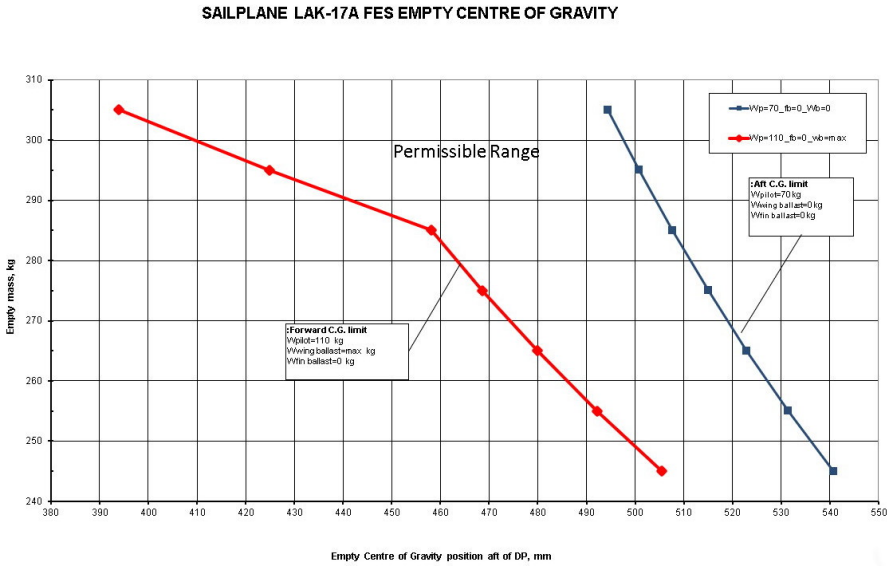
Empty weight center of gravity of the LAK-17A FES is defined for the 15 m / 18 m wing configuration, water ballast tanks empty, glider ready to fly, excluding weight of pilot and parachute.

**Warning:** Due to flutter reasons it is not allowed to add additional masses to the fin battery or the fin battery compartment.

Removable ballast used to supplement the weight of an occupant and

parachute (when lower as minimum cockpit load) in order to keep C.G. position within limits is fastened in fuselage nose. The 2.0 kg (4.4 lbs) of removable ballast equals a pilot weight of 5 kg (11 lbs).

The permissible range of empty glider center of gravity is given below:




## 6.5 Calculation of C.G. position

Center of gravity position after loading glider (additional instruments, equipment, water ballast, pilot) is defined as:

$$X_{CG} = \frac{\sum\limits_{n} (G_n \cdot X_n)}{\sum\limits_{n} G_n}, \text{ mm}$$

where:

$G_n$ = the glider component mass, kg;
$X_n$ = distance between glider component mass C.G. and wing root leading edge, mm; distance "–", if mass C.G. is ahead of the wing root leading edge, distance "+" if mass C.G. is behind of the wing root leading edge;
$n$ = number of glider components;
$\sum_n G_n$ = sum of all glider components masses;
$\sum_n (G_n \cdot X_n)$ = sum of moments of all glider components masses.

The C.G. calculation table

| No | Component | Weight $G_n$ (kg) | Distance $X_n$ (mm) | Moment $G_n \cdot X_n$ (kg · mm) |
|---|---|---|---|---|
| 1 | Empty glider* | | | |
| 2 | Pilot | | | |
| 3 | Battery in fin | 3.5 | 4192 | |
| 4 | Battery in baggage compartment | 2.6 | 157 | |
| 5 | Water ballast in wings | | 168 | |
| 6 | Water ballast in fin | | 4003 | |
| 7 | Instrument N1 in instrument panel | | −1010 | |
| 8 | Instrument N2 in instrument panel | | | |
| ... | | | | |
| n–1 | Removable ballast in fuselage nose | | −1785 | |
| n | Baggage weight | | 150 | |
| | | $\sum_n G_n =$ ..... | | $\sum_n (G_n \cdot X_n) =$ ..... |

* – these data for columns Weight $G_n$ and Distance $X_n$ should be taken from current "Weight and balance record" table (§6.4) as $G_n$ = "Empty weight of the sailplane" and $X_n$ = "C.G. location".

- Pilot: actual pilot weight with parachute:
  - distance $X = -520$ mm, when pilot seat is in the rearmost position;
  - distance $X = -670$ mm, when pilot seat is in the foremost position.

- Water ballast in a wings: actually filled water ballast weight;
- Water ballast in a fin: weight of actually filled water ballast in to the fin tank;
- Baggage weight: weight of baggage in a baggage compartment weight.

**Note:** The glider empty weight and empty weight center of gravity are defined by weighing data.

## 6.6 Weight of all non-lifting parts

Weight of non-lifting parts of the sailplane includes weight of pilot, fuselage, stabilizer with elevator, rudder, instruments and equipment.

Maximum weight of non-lifting parts of the LAK-17A FES is 263 kg (580 lbs).

## 6.7 Maximum weight

The maximum approved take-off and landing weight is 500 kg (1102 lbs).

## 6.8 Useful loads

The maximum useful load of the LAK-17A FES is equal to the maximum approved take-off and landing weight minus the empty weight of the aircraft plus the weight of any added water ballast.

## 6.9 Water ballast loading table

The max permissible water ballast weight (kg) is given in the following table.

Wing span: 15 m and 18 m; Sailplane maximum take-off mass: 500 kg

| Mass of pilot with parachute, kg | Sailplane empty weight, kg + fin ballast weight, kg | | | | | | |
|---|---|---|---|---|---|---|---|
| | 270 | 275 | 280 | 285 | 290 | 295 | 300 |
| 70 | 160 | 155 | 150 | 145 | 140 | 135 | 130 |
| 75 | 155 | 150 | 145 | 140 | 135 | 130 | 125 |
| 80 | 150 | 145 | 140 | 135 | 130 | 125 | 120 |
| 85 | 145 | 140 | 135 | 130 | 125 | 120 | 115 |
| 90 | 140 | 135 | 130 | 125 | 120 | 115 | 110 |
| 95 | 135 | 130 | 125 | 120 | 115 | 110 | 105 |
| 100 | 130 | 125 | 120 | 115 | 110 | 105 | 100 |
| 105 | 125 | 120 | 115 | 110 | 105 | 100 | 95 |
| 110 | 120 | 115 | 110 | 105 | 100 | 95 | 90 |

Maximum capacity of wing tanks: 180 liter (47.55 US gal).
Maximum capacity of fin tank: 8 liter (2.11 US gal).

## 6.10 Determining possible loading of the glider

The allowed fin water ballast depending on a pilot weight must be calculated (LAK-17A_FES_CG_calculator.xls).

Fin water ballast is only usable to compensate the pilots moment.

**Warning:** It is not allowed to use the fin water ballast to bring back a heavy pilot into the allowed C.G. range. In that case jettisoning the fin water ballast will cause a C.G. position out of the allowed range.

The example how to determine possible loading of the glider:

Sailplane empty weight: 273 kg;
Empty weight center of gravity: 478 mm;
Pilot with parachute weight: 80 kg;
Wing span: 18 m.

According to the graph "Sailplane LAK-17A FES empty center of gravity" the empty weight C.G. is in permissible range.

According to the "Water ballast loading table" – the max permissible wing water ballast weight is $\approx$ 145 kg.

## Section 7

# SAILPLANE AND SYSTEMS DESCRIPTION


7.1 Introduction . . . . . 7-2
7.2 Airframe construction . . . . . 7-2
7.3 Flight controls and trim . . . . . 7-5
7.4 Airbrakes and wheel brake . . . . . 7-5
7.5 Flaps . . . . . 7-6
7.6 Landing gear . . . . . 7-6
7.7 Tow release . . . . . 7-6
7.8 Canopy operation . . . . . 7-6
7.9 Water ballast system . . . . . 7-7
7.10 Cockpit ventilation . . . . . 7-7
7.11 Seat back adjustment . . . . . 7-8
7.12 Baggage compartment . . . . . 7-8
7.13 Safety harness . . . . . 7-8
7.14 Pitot and static pressure system . . . . . 7-8
7.15 Miscellaneous equipment . . . . . 7-8
7.15.1 Oxygen system . . . . . 7-8
7.15.2 Emergency locator transmitter . . . . . 7-9
7.16 Radio transceiver . . . . . 7-9
7.17 Power plant . . . . . 7-9
7.18 Battery packs . . . . . 7-9
7.19 Electrical system . . . . . 7-9
7.20 Motor controls . . . . . 7-10
7.21 Fire warning system . . . . . 7-11

## 7.1 Introduction

This Chapter provides a description of the sailplane, its systems and provided standard equipment with instructions for use.

## 7.2 Airframe construction

The LAK-17A FES is a single seat high performance sailplane with Front Electric Sustainer system designed to meet FAI 15 m and 18 m Class requirements. The wings are constructed with glass and carbon fiber reinforced plastic over a plastic foam core with carbon rod spar caps. The ailerons are from carbon fiber reinforced plastic. The fuselage is made using glass fiber reinforced plastic with Kevlar and carbon for local stiffness. The stabilizer, elevator and rudder are glass fiber reinforced plastic over plastic foam core.

Cockpit layout description is given below:

1. Seat back adjustment handle;
2. Trim control knob;
3. Flaps control handle;
4. Airbrakes control handle;
5. Tow release knob;
6. Canopy latching handle;
7. Cockpit ventilation knob;
8. Canopy jettison handle;
9. Instrument panel;
10. Rudder pedals;
11. Landing gear control handle;
12. Water ballast control handle;
13. Rudder pedals control handle;
14. Tail water ballast control handle (optional);
15. Side pocket;

16. Control stick;

17. Safety harness;

18. Power Switch;

19. FES battery compartment temperature indicator (fire warning system Option 1);

20. Fire warning system test button (fire warning system Option 2);

21. Wheel brake control lever.

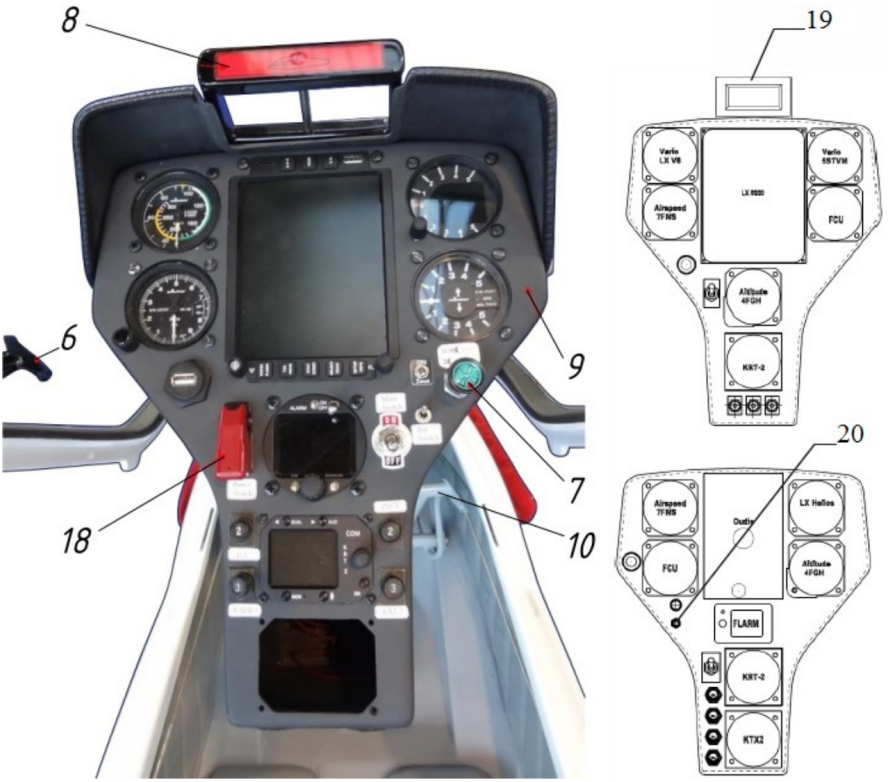



**Figure 7.2-1**

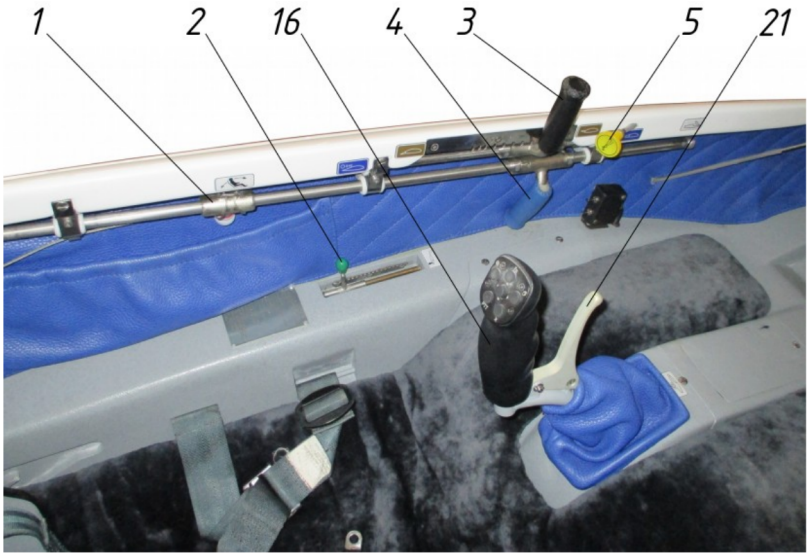



Figure 7.2-2

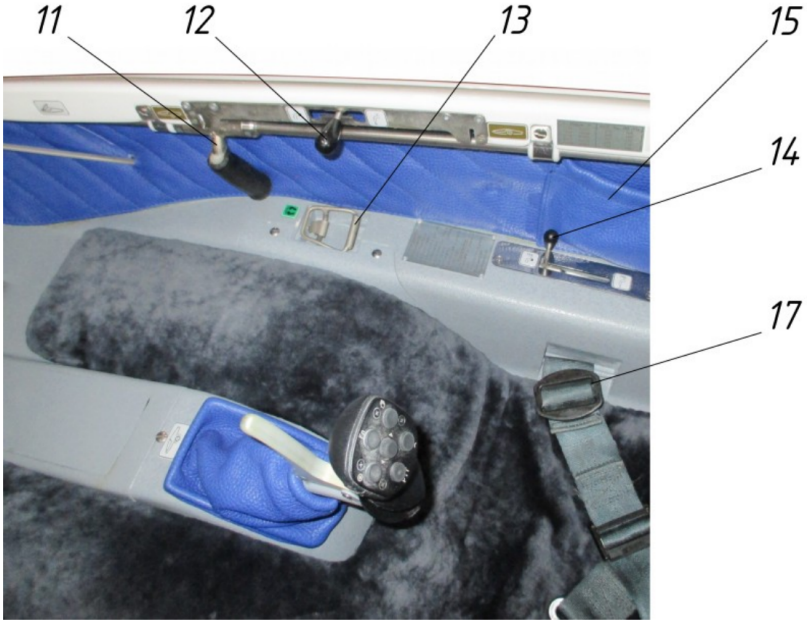
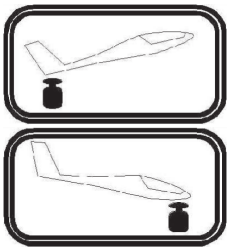



Figure 7.2-3

## 7.3 Flight controls and trim

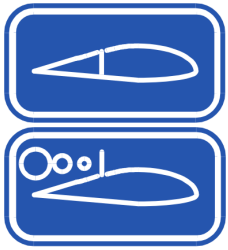
The ailerons and elevator are operated from the central control column (control stick).



The trim adjustment control knob is located *in the left armrest* and controls the elevator trim select position. See Maintenance Manual §2. To set the trim, simply move the adjustment knob to the desired trim position.

The rudder pedals control the rudder by a cable system and are adjusted using the gray knob located in the right armrest. Pull the knob to loosen the rudder pedal lock, make the adjustment, and release the knob to lock the rudder pedals in the desired position.

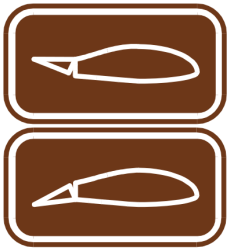
## 7.4 Airbrakes and wheel brake



The airbrakes are operated by the blue control handle located on the left cockpit wall. Pull the handle back to extend the airbrakes and push forward to retract and lock.

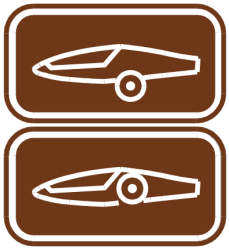
The wheel brake is actuated via the handle on the control stick (optionally) or by the airbrakes control handle. See Maintenance Manual §2.

## 7.5 Flaps



The flaps are operated by the gray control handle located on the left cockpit wall. For more information see Maintenance Manual §2.

## 7.6 Landing gear



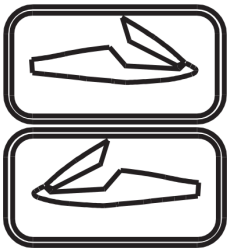
The landing gear is extended and retracted with the gray control handle located in the right hand armrest. Landing gear locked positions are located at either end of the control handle travel. Forward to extend, back to retract. The system is assisted by a nitrogen gas strut. See Maintenance Manual §2.

## 7.7 Tow release

The tow release is the yellow control knob located at the left side wall of the cockpit. Pull this control knob to open the tow release and release the knob to allow the tow coupling to snap closed and lock.

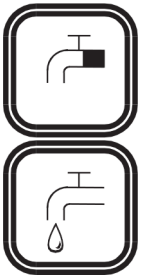
## 7.8 Canopy operation

To jettison the canopy pull the red canopy release handle firmly back and release it. A spring will push the front of the canopy up. This allows the airflow to lift it up and carry it away.

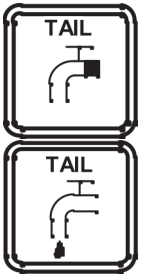


The canopy latching handles are black and are located on either side of the canopy frame. Pull the handles back to lock and push forward to un-lock.
Never use the window opening to lift or lower the canopy. Cracks in the canopy will result.
When sitting in the cockpit use the small tabs on the frame to raise and lower the canopy.

## 7.9 Water ballast system

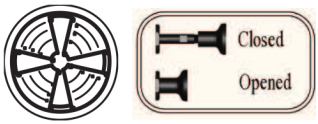


In a standard configuration the tank valves for the wing and tail open simultaneously with one knob.
The water ballast valves control knob is located on the right side of the cockpit wall. To open the dump valves move the knob to the back and to close the dump valves move the knob forward.




If the sailplane has an independent (optional) control system for the fin tank valve, the water ballast valve control knob of the fin tank is located on the right side of the cockpit wall. To open the dump valve move the knob to the back and to close the dump valve move the knob forward.

## 7.10 Cockpit ventilation




The canopy de-mist vent control is located on the instrument panel. Push to open, pull to close.

## 7.11 Seat back adjustment

Seat back adjustment is accomplished by using the squeeze ring located on the left cockpit side.

## 7.12 Baggage compartment

Hard objects cannot be carried in the baggage compartment without a suitably designed lashing or anchorage. The baggage compartment load must not exceed 7 kg (15.4 lbs).

## 7.13 Safety harness

A safety harness with four fixed attachment points is provided.

## 7.14 Pitot and static pressure system

The fuselage-mounted tubes provide the pitot and static pressure.

**Warning:** An air leak will adversely affect airspeed indication and other instruments. Make sure the probe is fully seated in the receptacle for proper operation.

See the Maintenance Manual §2.

## 7.15 Miscellaneous equipment

### 7.15.1 Oxygen system

The oxygen system (Aerox Oxygen, type C, D or M) must be operated in accordance with the instructions provided by the manufacturer (Aerox Oxygen, type C, D or M) of the system.

**Caution:** Installation of the oxygen system (Aerox Oxygen, type C, D or M) must be accomplished by the aircraft manufacturer or by a certified aircraft mechanic, according to national rules and regulations. An authority aircraft inspector must approve the installation.

### 7.15.2 Emergency locator transmitter

The system must be operated in accordance with the instructions provided by the manufacturer of the Emergency Locator Transmitter system. See the Maintenance Manual, §2, for recommended installation places.

**Caution:** Installation of the Emergency Locator Transmitter must be accomplished by the aircraft manufacturer or by a certified aircraft mechanic, according to National rules and regulations. An authority aircraft inspector must approve the installation.

## 7.16 Radio transceiver

Any of approved radio station types should be used (Becker, Filser or similar).

## 7.17 Power plant

Detailed description of FES power plant can be found in separate *FES maintenance manual*.

## 7.18 Battery packs

Detailed description of FES Battery packs can be found in separate *FES Battery packs manual* (latest version).

## 7.19 Electrical system

Detailed description of FES electrical system can be found in *FES maintenance manual*.

## 7.20 Motor controls

The LAK-17A FES motor is controlled by the FCU (FES control unit) instrument (fig. 7.20-1).

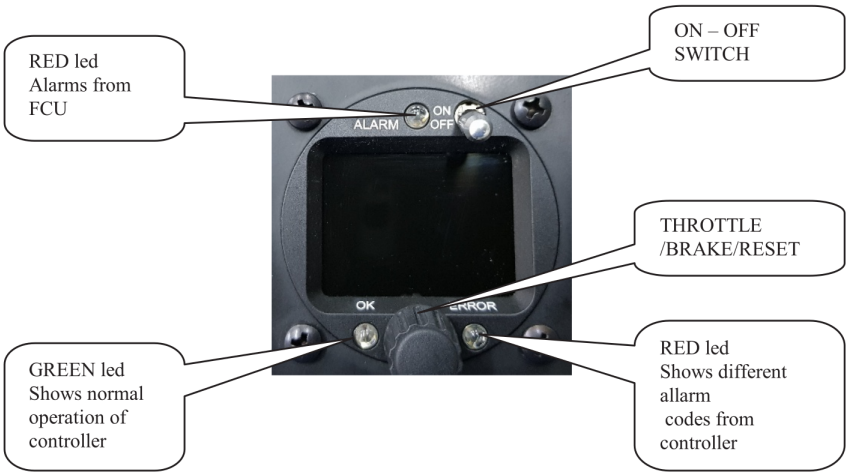



**Figure 7.20-1:** FES control unit instrument

The FCU instrument is designed to control and improve safety of motor use. FCU instrument must be continuously switched ON during flight.

**Caution:** Keep FCU instrument power supply always switched on during flight

### Basic instrument controls and indications

The FCU instrument has ON/OFF switch and throttle/brake knob.

There are three LEDs showing the most important states of the system during all the operation time. Colour LCD display gives more detailed information about power, available energy and other values. On the back side of instrument are connectors.

| Description | Description of function |
|---|---|
| Switch | ON/OFF for FCU instrument |
| Throttle, brake, reset | Power button from minimum to maximum RPM<br>Push button to reset and second screen |
| LED 1 – red colour | alarms from FCU, see detailed specification of errors |
| LED 2 – green colour | if green LED is ON then controller is ready for operation |
| LED 3 – red colour | if red LED is blinking then something is wrong on controller – see error codes |
| LCD Color display | V meter, A meter, Power meter, Temperature of motor, controller, Bat1, Bat2, RPM, Alarm messages |
| Alarm buzzer | Voltage level in batteries reached minimum, release throttle or stop operation<br>Temperature of motor is too high, release throttle or stop operation |
| Power switch | ON/OFF for controller (not on FCU but on cockpit right side) |

More detailed functionality of FCU is described in separate FES FCU INSTRUMENT manual (latest version).

## 7.21 Fire warning system

Sailplane is equipped with one of two options of battery compartment fire warning systems.

### Option 1

Digital temperature indicator with audible and visual alarm on top of the instrument panel and a thermocouple inside the batteries compartment. Alarm will activate when the temperature is greater than 90 °C. Temperature indicator specifications:

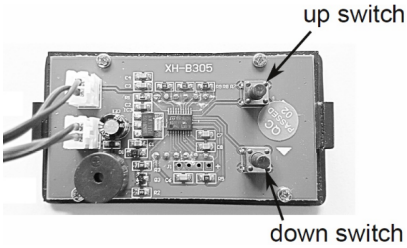
- Power requirement: DC 12 V;

- Measuring range: $-60 \ldots +125\,^{\circ}\mathrm{C}$;
- Power consumption: 18 mA;
- Temperature probe: 10K/B3950, waterproof stainless steel probe;

**Temperature indicator setting.**

- Long press "up" switch to set high temp value. Hold up and down switch at the same time to correction temperature. Set $+90\,^{\circ}\mathrm{C}$ temperature.
- Long press "down" switch to set low temperature value. Hold up and down switch at the same time to correction temperature. Set $-20\,^{\circ}\mathrm{C}$ temperature.

  The setting value are retained when power cut off. Temperature indicator will alarm when measuring temperature reach to the setting value.




**Testing the fire warning system.**

1. Make sure that the main battery (located in the fin) is connected.
2. Switch the "Main switch" to "ON" position.
3. The warning system works properly if the temperature indicator shows the batteries compartment's inside temperature. The value should be close to the outside weather temperature if the FES system wasn't turned on before.

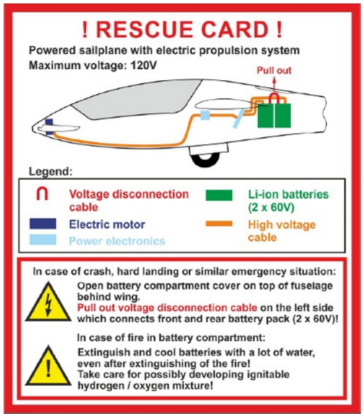
## Option 2

Audible and visual alarm system which consists of flashing LED indicator, a buzzer, and a linear heat detector. The system will activate when the temperature inside the batteries compartment is greater than $88\,^{\circ}\mathrm{C}$.

This fire warning system is switched on all the time when the main battery is connected.

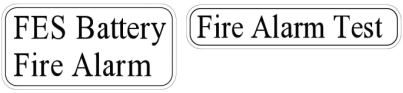
**Testing the fire warning system.** Make sure that the main battery (located in the fin) is connected. Push the test button mounted in the instrument panel. The warning system works properly if the speaker makes a warning sound and the red LED is flashing. Release the button and the system should stop making warnings.

## Corresponding placards




Cockpit inner skin on the right, front area of baggage compartment, as detachable card.


On top of FES battery compartment temperature indicator (fire warning system Option 1).




Near *fire warning system LED* and *fire warning system test button* (fire warning system Option 2).

INTENTIONALLY LEFT BLANK

## Section 8

# SAILPLANE HANDLING, CARE AND MAINTENANCE

8.1 Introduction . . . . . 8-2
8.2 Inspection periods and maintenance . . . . . 8-2
8.3 Alterations and repairs . . . . . 8-2
8.4 Tie down . . . . . 8-2
8.5 Sailplane trailer . . . . . 8-3
8.6 Ground handling . . . . . 8-4
8.7 Cleaning . . . . . 8-4

## 8.1 Introduction

This chapter contains the manufacturer's recommended procedures for proper handling and servicing of the sailplane. It also identifies certain inspection and maintenance activities, which are needed to retain performance and dependability.

## 8.2 Inspection periods and maintenance

The Instructions for Continued Airworthiness as provided in the LAK-17A FES Maintenance Manual must be followed. Before each rigging, all connecting pins and bushings should be cleaned and greased. Also, at least once a year the control surface displacements and adjustments must be inspected to insure conformity with factory data. See the LAK-17A FES Maintenance Manual for additional information.

The Instructions for Continued Airworthiness as provided in the *FES Maintenance manual* must be followed.

## 8.3 Alterations and repairs

It is essential that the responsible airworthiness authority be contacted prior to any major alterations on this sailplane to ensure that the airworthiness is not impaired. Major alterations without approval from the manufacturer are prohibited. Furthermore, the manufacturer will not be held liable for unapproved alterations or for damages resulting from changes in the characteristics of the aircraft due to these alterations. External loads from camera installations are to be regarded as major alterations. Repair instructions are located in the Maintenance Manual §8. No repair should be performed to this aircraft without referring to Maintenance Manual. When in doubt as to the suitability of a repair contact the manufacturer.

**Caution:** No additional color marking on the white upper surface is allowed.

## 8.4 Tie down

The recommended tie down points are the tow release, wing tips and fuselage tail just ahead of the vertical fin. The cockpit always must be closed and covered when tied down.

Do not leave sailplane outside on the rain, unless it is covered with high quality all weather covers. Protect motor and battery compartment from water entering. Take Battery packs out of the glider and store them on dry place.

**Note:** The external surfaces of the LAK-17A FES are finished in a durable epoxy paint, however long exposure to sun and humidity will lead to premature aging of any surface finish.

**Note:** Close fully ventilation. Prevent motor and batteries from water.

## 8.5 Sailplane trailer

A sailplane of this quality and value should be transported and stored in a high quality enclosed trailer constructed of metal or fiber glass reinforced plastics. Proper ventilation and UV blocking characteristics should be provided. The wings should be supported as close as possible to the inner most root rib and again at a point one third from the wing tip. The horizontal stabilizer may be stored vertically or horizontally. The fuselage should be supported in a fuselage dolly positioned just forward of the main landing wheel opening. Due to the angle of the fuselage in the trailer a forward stop must be provided for the fuselage dolly. Otherwise it will roll forward and leave the fuselage with no support. Forward and aft motion of the fuselage should be restricted with a felt lined nose cone support and a tail wheel well with a fuselage strap located just forward of the vertical fin.

**Caution:** For fuselages forward and jumping motion of the fuselage restriction could be arranged with a nose cone support in shape of spinner with a big enough recess for propeller blades in horizontal position, covered with a soft thick material.

It is recomended to use soft cotton canopy cover which goes also around spinner nose of sailplane, which than also prevent opening of propeller blades.

If canopy cover is not used than propeller blades should have fitted a cover with elastic, which also prevent opening propeller blades.

The fuselage should be supported in a fuselage dolly positioned just forward of the main landing wheel opening. Forward stop must be provided for the fuselage dolly, otherwise it will roll forward and leave the fuselage with no support.

## 8.6 Ground handling

Ground towing should be accomplished using the tow release and standard double aero tow ring. Ground towing should also be accomplished with a tail dolly tow bar and wing tip wheel.

On the ground propeller blades should be protected with a special blade protection covers, which prevents propeller blades from opening. Do not forget to remove propeller covers before flight.

**Caution:** Make sure that propeller is in horizontal position when lifting rear part of fuselage to attach tail dolly.

**Warning:** Newer use a propeller or spinner for pushing, pulling or tail lifting.

## 8.7 Cleaning

The exterior painted surfaces should be cleaned with clear water using a sponge or soft cotton towel and chamois. These surfaces should also be protected with a silicone free hard wax reapplied at least once a year by hand or with a rotating cloth disc. Tape adhesives are best removed using pure petroleum spirits or wax containing a light polishing agent. Do not clean the exterior surfaces with alcohol, acetone or lacquer thinner.

Clean the Plexiglas canopy only as necessary using a soft cotton towel and clear water mixed with a small amount of mild detergent. Protect the canopy with anti-static cleaning agents which are made specifically for Plexiglas.

All non-painted metal surfaces must be regularly wiped clean and protected with a light coating of grease.

Avoid cleaning with huge amount of water around area of FES motor, and batteries compartment. Spinner and propeller blades should be cleaned with a wet sponge or soft cotton towel. Tape adhesives are best removed using pure petroleum spirits or nitro thinner.

Section 9

# SUPPLEMENTS

THERE ARE NO SUPPLEMENTS