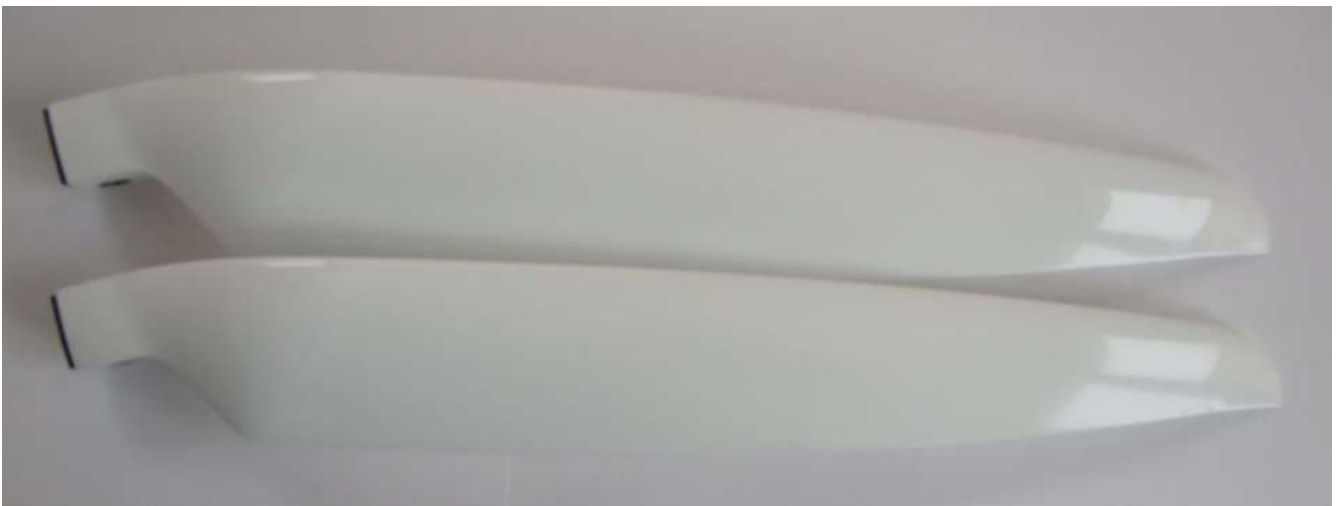




# FES PROPELLER MANUAL

Version 1.11

Type: **FES-HPH-P1-102**



LZ design d.o.o., • Brod 3D, 1370 Logatec, Slovenia • tel +386 59 948 898  
[info@lzdesign.si](mailto:info@lzdesign.si) • [www.front-electric-sustainer.com](http://www.front-electric-sustainer.com)

---

**Table of Content**

1. Important notices .....	3
1.1 Limited Warranty .....	3
2. General.....	5
3. Model designation .....	5
4. Construction .....	6
4.1 Certification standards .....	6
4.2 Construction Material .....	6
4.3 Surface finish .....	6
5. Installation.....	6
6. Removal .....	8
7. Inspection.....	8
8. Acceptable minor damages .....	9
9. Maintenance and repair .....	10
10. Shipping and storage .....	10
11. Revision history .....	10

## **1. Important notices**

Owners of FES system should read this manual thoroughly. It contains important information about operation, maintenance and service of FES propeller blades, having a vital importance to the flight safety.

Information in this document is subject to change without notice. LZ design reserves the right to change or improve their products and to make changes in the content of this material without obligation to notify any person or organization of such changes or improvements.

### **1.1 Limited Warranty**

This product is warranted to be free from defects in materials or workmanship for two years from the date of purchase. Within this period, LZ design will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts and labor, the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident, or unauthorized alterations or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL LZ DESIGN BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. Some states do not allow the exclusion of incidental or consequential damages, so the above limitations may not apply to you. LZ design retains the exclusive right to repair or replace the unit or software, or to offer a full refund of the purchase price, at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

To obtain warranty service, contact your local LZ design dealer or contact LZ design directly.

February 2013

© 2013 LZ design. All rights reserved

**Warning:**

Users of FES powered sailplanes should recognize that various types of risks are involved, and they should take all precautions to minimize them, since they cannot be entirely eliminated.

The propeller blades are one of the most critical parts of powered sailplane, having vital importance to the flight safety. They are subject to constant torque loads from the motor, airflow, and high centrifugal and bending loads. A mechanical failure could cause a forced landing or create vibrations sufficiently severe to damage the glider. Unusual vibration should be investigated and fixed immediately, as it could be a warning that something is not OK.

Please pay your attention, especially to the section dealing with inspections and checks. It is essential that the propeller blades are properly maintained according to the service procedures and intervals described in this manual.

## 2. General

The foldable, fixed pitch composite propeller blades marked as FES-HPH-P1-102 are high quality product.

### Technical data and limitations of the propeller:

Number of propeller blades:	2
Maximum power on a propeller shaft:	23 kW;
Maximum rotational speed:	4500 RPM;
Propeller blade mass excluding attaching bolts:	approximately 260 g each blade;
Diameter of the propeller:	d=1000 (+20,-0) mm;
Service time between main overhauls:	50 hours;
Total service time:	200 hours;
Type of propeller:	tractor;
Sense of rotation:	clockwise looking at direction of flight.
Operating conditions:	the propeller can be operated in any normal environment conditions except hail, sand storm or similar

## 3. Model designation

Propeller model designation is the following:

FES HPH P1 102

(1) (2) (3) (4)

where:

- (1) designed for application;
- (2) designed for specific sailplane type;
- (3) model version;
- (4) Propeller diameter in cm;

Propeller serial-number is identified as follows:

XXX      YYYY

where:

- XXX - serial number of the propeller; one blade is marked A second as B
- YYYY - year of manufacture.

Propeller identification placard is located on the propeller sticker (glued on inner center part of the propeller).

**Warning:** *Do not use your propeller as a handle to move the airplane! The propeller is one of the most important parts of your powered sailplane!*

**NOTE:** Propeller type FES-HPH-P1-102 is identical like FES-DIS-P1-102. It is marked differently due to different manufacturer of the sailplane.

## 4. Construction

### 4.1 Certification standards

Propeller type FES-HPH-P1-102 described here is designed and tested according to CS 22 Subpart J.

This manual is intended to comply with CS- 22.1903, providing the essential information for installing, servicing and maintaining the propeller.

### 4.2 Construction Material

Propeller is made of GFC and CFC. It is produced in accurate metal molds, which were manufactured using modern CNC technology. This made it possible, to have very accurate propeller geometry. At attachment point of propeller blade is integrated hardened steel bushing with very accurate tolerance, so that play is minimal.

### 4.3 Surface finish

Quality acrylic white paint is used to protect the composite body against moisture and erosion. Each blade pair is sanded and polished so that mass difference is only 0,1g. Paint is resistant against fuel, oil and other chemical products. This type of paint has also an excellent flexibility. Only tips can be painted red as a safety mark.

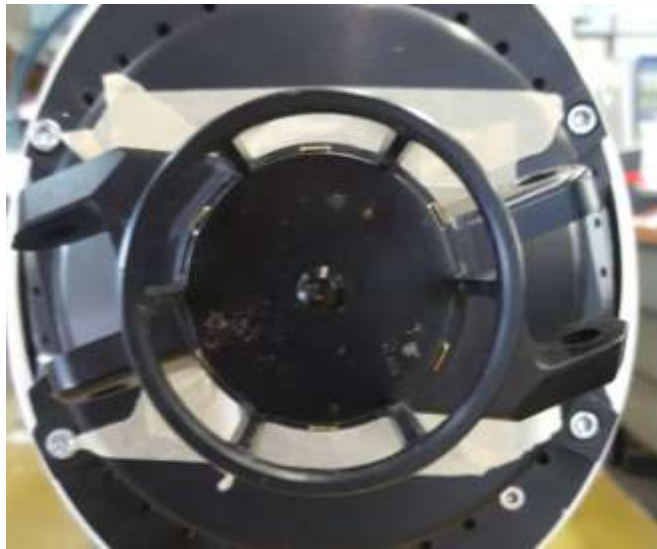
## 5. Installation

1. Before installation of new propeller blades, check that markings on the label, which is located on lower inner surface, confirms the correct type. For HPH304ES, propeller type is FES-HPH-P1-102.
2. Left and right propeller blade have slightly different shape of top center surface due to asymmetric shape of the spinner. When each of them is installed on proper side, and aligned with the fuselage, top surface of the first 3cm need to have contour aligned with spinner shape.

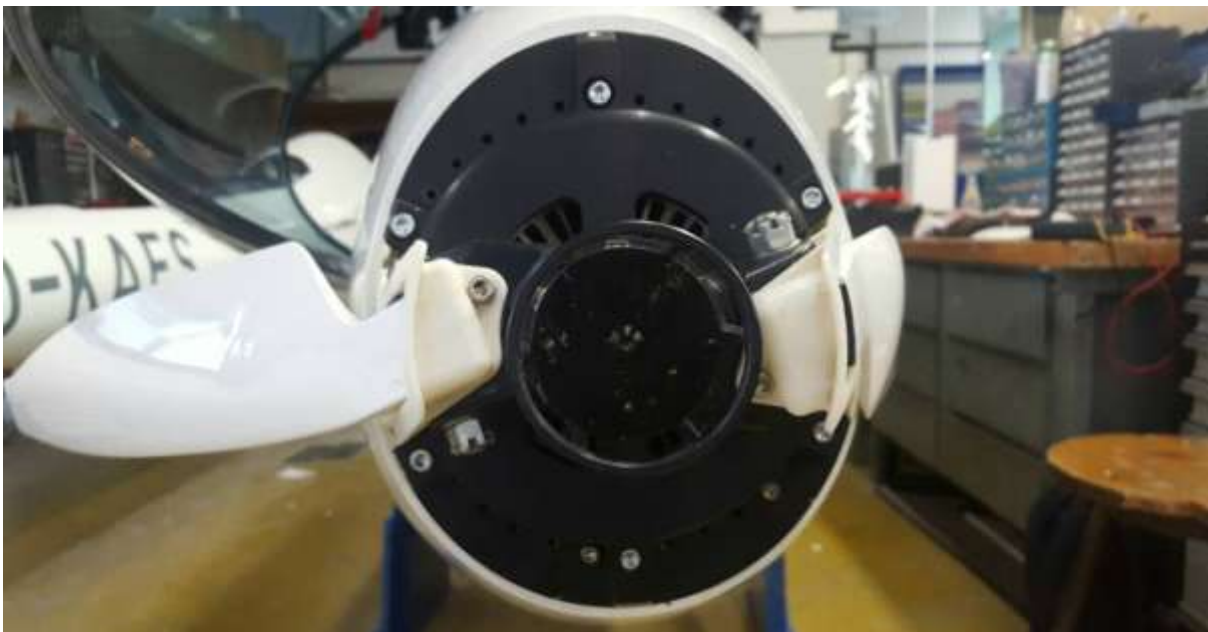


3. Before inserting the bolts, lubricate the stable with thin layer of grease. We recommend using white silicon grease (use only clean grease, from closed tube). Then insert such lubricated bolts to each propeller blades bushing, from each side, so that thin film of the grease will be also transferred to inner surface of bushing. Clean away any exceed amount of grease. If there is too much grease, it will be later spilled to inner surface of the spinner by centrifugal force, so we recommend using only a minimum amount of grease. Take out the bolts, and put them on clean surface, to be ready for assembly.

4. Align propeller blade so that its fixing hole is nicely aligned with hole of propeller holder. From back side of the holder, insert lightly lubricated, special bolts. **This means that head of the bolt must be on trailing edge side of propeller as on picture below!** One of the two special bolts is **marked** on the head with a small dot. Be sure to install it to proper side of propeller holder which is marked with small dot.



5. Before placing washers, crown nuts, and split pins, it is strongly recommended to close motor openings with a tape, as show on photo above in order to reduce possibility that any of the small parts could enter into the motor, if it falls through the fingers by coincidence. If this would happen, it is usually necessary to remove and open motor, which is quite demanding job, so it is better to tape openings.



6. Place M8 Inox washer to the threaded side of a bolt, and then a crown nut M8. Tighten the crown nut with key number 13, so that there is some tension in holder forks, which created enough friction so that bolt can not rotate freely. If there is too much tension in the forks, propeller blades would not be able to open and close freely. If this is the case, un-tight crown not so that blades can move free, and it is also possible to insert split pin into the hole in the pin trough crown nut. Carefully insert new safety pin of 1,4mm diameter x 22mm length, and bend its two ends, around crown nut.



7. Fix the spinner with six Inox bolts with countersink head M4x8mm. Just tight them gently with small torque (do not use high torque, as thread in the aluminum plate could be damaged). Please do not use any glue to secure fixing bolts, as during rotation centrifugal force to the bolts creates high enough friction, which prevent them, from unscrewing. We prepare to cover heads of the bolts with thin white round stickers, which additionally secure the bolts from unscrewing, and it also looks nicer!

## 6. Removal

Follow the steps like in previous chapter, from 1 to 7, just in reverse order.

## 7. Inspection

1. Before first flight in a day, perform short **daily inspection** of each propeller blade:
  - a) Clean the propeller with any car wash solution or equivalent.
  - b) Check leading and trailing edge at the root, for any visible cracks, or other damages from small stones etc.
  - c) Check that each blade is moving forward and backward freely with only small friction.

If there is no sign of cracks/deformations on the surface, you can assume the blades are fit to fly. Small damages of paint due to small stones are unavoidable after long usage.

If there are visible cracks or damages, contact the manufacturer for advice before usage.

**Before each flight** perform preflight check including points b) and c) of daily inspection.



2. At the 25 hours inspection (periodically to be done up to the annual inspection):
  - clean the propeller with any car wash solution or equivalent.
  - make the normal preflight inspection.
  - inspect leading edge of the blades for minor paint damages from small stones. Such minor damages can be easily repaired with small droplets of white acrylic paint. When droplets of paint are dry, any excessive paint need to be carefully sanded so that is in line with other surface. Only qualified persons are allowed to perform such minor repair.

### 3. Annual inspection

- inspect propeller as per instructions given under point 2. If any crack is found in the root section of propeller blades, they should be removed from service and send to the manufacturer for inspection.

4. Service time between overhauls is 50 engine time running hours. At overhaul propeller blades need to be inspected as per annual inspection. If there is more damages on the paint than acceptable (see next section) propeller blades need to be repainted by qualified person, with high quality white acrylic paint. Special care must be taken about equal weight of the blades after repainting. Max acceptable difference is 0.3 grams.

## 8. Acceptable minor damages

1. No structural cracks or de-laminations of composite structure are allowed for the propeller.
2. Thin cracks up to 10 mm of length in paint are allowed, but not in the root section. Only in the outer part of the blade (15cm or more distance from attachment point) such cracks in paint are acceptable. No sudden blade failure can occur due to such cracks. If such cracks do occur, it is anyway advisable to consult with qualified service or manufacturer regarding airworthiness. If is not clear please send a good photo and information about operating time to FES producer.
3. Some erosion which occurs due to the peripheral speed of the blade and is normal. However, always take care that the erosion never becomes so deep that FRP-coat is damaged and there is a possibility that moisture may enter into the blade body. In this case the blade must be repaired/overhauled immediately.
4. Stone damages. If stone damages are visible, mark them and check them periodically. Maximum size of stone damages permitted for operation is 2x4 mm large and 0,7 mm deep. Maximum number of damages allowed is one damage per 4 cm<sup>2</sup>. If bigger or more damages exist on a blade, send propeller to manufacturer or qualified service for inspection and overhaul.
5. Cracks or deformations in a center part of the propeller are not allowed. If such occurs, send propeller back to manufacturer for the overhaul or replacement.

## 9. Maintenance and repair

**Note:** *Fine cracks in center section of the propeller blade usually originate from the inside of the blade, and extending through the paint and so are visible from outside. These cracks might be radial or tangential. They should be considered as serious issue.*

1. Clean propeller if necessary with water.
2. Usually small stone nicks are unimportant as long as there is not obvious structural damage. Scratches and nicks should be filled and protected during routine maintenance with a coating of acrylic paint. Acceptable minor damages are described in section 8 of this document.
3. Broken central section of the blades are not repairable and have to be replaced. Small damages on the trailing edge or tips of the blades can be repaired by manufacturer or qualified service.

## 10. Shipping and storage

1. If storage is required, it is recommended to use the original packing. If original packaging is not available, store it in a horizontal position on a soft padding. The propeller should not be stored close to heat source or in rooms with extreme changes in temperature or humidity.
2. Careful packing is the best protection against damage during shipment. Especially the blade tips and trailing edge should be sufficiently protected.

## 11. Revision history

March 2015	Initial release of manual, Version 1.0
November 2016	Updated version of manual, Version 1.1
November 2016	Information added, Version 1.11