



FES PROPELLER MANUAL

Version 1.2

Type: **FES-DIA-P1-102**



LZ design d.o.o., • Brod 3D, 1370 Logatec, Slovenia • tel +386 59 948 898
info@lzdesign.si • www.front-electric-sustainer.com

Table of Content

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

1. Important notices

Owners and pilots who use 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.



Caution: *Yellow triangle is shown for parts of the manual which should be read carefully and are important for proper operation.*



Warning: *Notes with a red triangle describe procedures that are critical and may result in reduced safety or may lead to a critical situation.*



Note: *A bulb icon is shown when a useful hint is provided to the reader.*

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, but 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 parts, 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.

**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 eliminated entirely.

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 vibrations should be investigated and fixed immediately, as it could be a warning that something is wrong.

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

2. Technical data

FES propeller is assembly of foldable, fixed pitch composite propeller blades which are mounted on special hub with attachment bolts at certain angle.

Number of propeller blades	2
Maximum power on a propeller shaft	30 kW
Maximum rotational speed	5300 RPM
Propeller blade mass (excluding attaching bolts)	approximately 260 g each blade
Diameter of the propeller	1000 mm
Service time between periodic controls	50 engine running hours or 12 months
Service time between special controls	200 engine running hours
Type of propeller	tractor
Sense of rotation	clockwise looking at direction of flight.
Operating conditions	any normal environment condition

3. Model designation

Propeller model designation is the following:

FES DIA P1 102

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

where:

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

Propeller serial-number is identified as follows:

XXX (A and B) - YYYY

where:

- XXX (A and B) - serial number of the propeller

One blade is marked as A

One blade is marked as B

- YYYY - year of manufacture.

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

4. Construction

4.1 Certification standards

Propeller type FES-DIA-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 blades are made of CRFP (carbon fiber reinforced plastic). They are produced in accurate metal molds, which were manufactured using modern CNC technology. This made it possible, to have very accurate profile geometry. At attachment point of propeller blade is integrated hardened steel bushing with very accurate tolerance, so that play is minimal.

Propeller hub is CNC milled part, from Aluminum alloy 7075, black anodized.

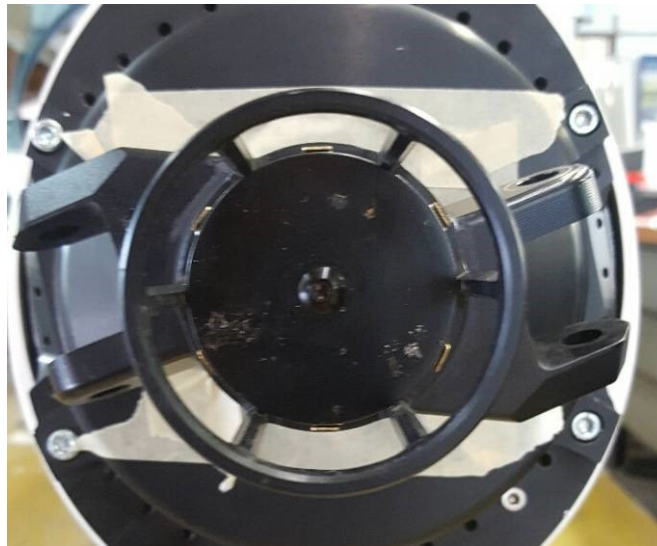
4.3 Surface finish

High quality white acrylic paint (PPG Deltron D700) is used to protect the composite body against moisture and erosion. Paint is resistant against fuel, oil and other chemical products. This type of paint has also an excellent flexibility. Only tips of the propeller blades are allowed to be painted in other colour as a safety mark. Otherwise only allowed colour is white as this is structural part.

Pairs of propeller blades are produced in a way that maximum weight difference is 0,3g, and maximum tip weight difference is 1,0g.

5. Removal of propeller blades

1. Carefully remove white round stickers which are glued over 6 screws, which hold the spinner. Unscrew all 6 M4 countersink screws, with 2,5mm sized hex key, to remove the spinner.
2. Check for small holes with 2,5mm diameter drilled shallow as markings for proper orientation of spinner (inner side of spinner surface), propeller blades (close to root section) and propeller holder (one side of attachment forks). Parts are properly assembled when all three dots are on the same side.
3. Before propeller blades removal it is strongly recommended to close motor openings with a tape, as show on photo below in order to prevent that any of the small parts could enter 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 much easier to tape openings.



Remove split pin, which secures M8 crown nut on each end of propeller blade attachment bolt. Carefully unscrew crown nuts, and remove M8 spacers

4. Push both propeller blades attachment bolts out of the hub. If is not possible to push them out with fingers, you can use small plastic or wooden hammer and carefully push them out completely, with help of metal bolt or similar round object with about 8mm diameter. Without attachment bolts, propeller blades are free to take out.

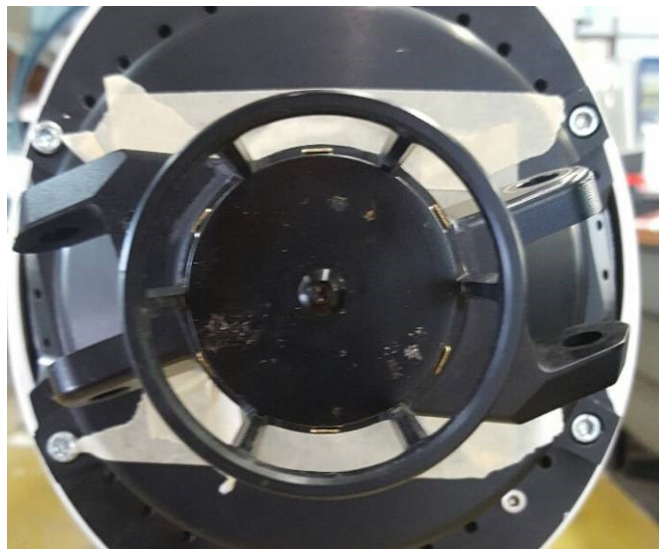
6. Installation of propeller blades

1. Check that marking on the labels, which are located on the lower inner surface of propeller blades, confirms the correct type of propeller blades. For Diana 2 FES, proper propeller type is FES-DIA-P1-102. One blade is marked as A and the other one is marked as B.
2. Find small holes with about 2,5mm diameter, drilled shallow as markings, for proper orientation of spinner (inner side of spinner surface), propeller blades (close to root section) and propeller holder (one side of attachment forks). **Parts are properly assembled when all three dots are on the same side.**

3. Before inserting the bolts, lubricate the shaft of the bolts with thin layer of grease. We recommend using PTFE 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.

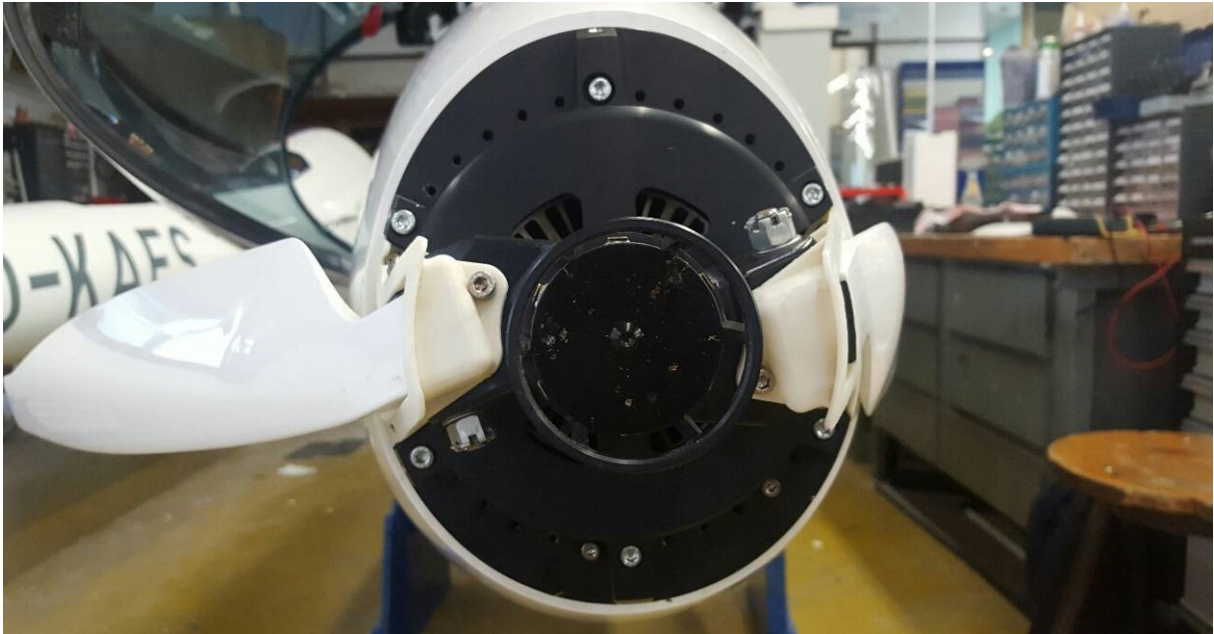


4. Before placing washers, crown nuts, and split pins, it is strongly recommended to close motor openings with a tape, as show on photo below to prevent possibility that any of the small parts could enter the motor, if it falls through the fingers by coincidence. If this would happen, it is usually necessary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



5. 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!** Note that 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!**

6. Place M8 Inox spring washer to the threaded side of a bolt, and then a crown nut M8. Tighten the crown nut with key number 13 (while holding bolt head in position with another key number 13), so that tension in spring washer create enough friction that bolt can not rotate freely. If there is too much tension, propeller blades might not be able to open and close freely. If this is the case, un-tight crown nut until blades can move freely, and it is also possible to insert split pin into the pin hole through the crown nut. Carefully insert new safety pin of 1,4mm diameter x 22mm length, and bend its two ends nicely around crown nut.



6. Fix the spinner with six Inox M4 x 8mm countersink head screws. Tightening of all 6 screws should be 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 them, as during rotation centrifugal force to the screws create high enough friction, which prevent unscrewing. We prefer to cover heads of the screws with white round stickers (diameter about 14mm), which additionally secure the screws from unscrewing, and it also looks nice!



7. Operating instructions

To ensure reliability and safety of the propeller, preflight check of the propeller should be done before each flight by the pilot/owner:

- remove protection fluorescent fabric cover
- make sure that propeller surfaces are clean before each flight. Propeller full of bugs is less efficient and in worst case they can even increase level of vibrations. For cleaning, use wet cloth as used for other parts of the glider.
- check visually the leading and trailing edge at the root. If there are visible any cracks or other major damages, please contact manufacturer for advice before next flight. If is not clear, please check next chapter about acceptable minor damages.
- check that each blade is opening and closing freely with only small friction. If there is too much friction, it is necessary to clean and lubricate the attachment bolts and bushing. To perform this is necessary to remove the propeller blades.

8. Acceptable minor damages

1. 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 propeller blade (15 cm or more from attachment point) such cracks in paint are acceptable. If such cracks do occur, it is anyway advisable to consult with qualified service or manufacturer regarding airworthiness. Please send a good photo and information about operating time.
2. Only small damages of the paint on the leading edge are acceptable, as they are unavoidable after long time of usage.
3. Structural cracks, deformations or de-laminations of composite structure are not acceptable for the propeller blades. If they occur, please send propeller blades to manufacturer for the inspection.

9. Maintenance and repair

1. Periodic control of propeller is required after every 50 hours of motor run or after 12 months, whatever comes first, by air-worthiness controller:

- check visually the leading and trailing edge at the root. If there are visible any cracks or other major damages, please contact manufacturer for advice before next flight. If is not clear, please check chapter about acceptable minor damages.
- check that each blade is opening and closing freely with only small friction. If there is too much friction, it is necessary to clean and lubricate the attachment bolts and bushing. To perform this is necessary to remove the propeller blades.
- check condition of rubber part, glued to the root section of each propeller blade. If rubber parts have signs of wear or they are damaged, they should be removed and replaced. New rubber part should be glued to each propeller blade with Loctite Super Attak quick glue or similar.
- inspect the leading edge of the blades for minor paint damages from small stones; If such damages are found, they should be 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. Do not repaint complete propeller blades, as repainting might affect balance of the propeller. Maximum acceptable weigh difference between the propeller blades is 0.3g.

2. Special control of the propeller is required at 200h of motor run. It can be performed by manufacturer or by workshops which are approved by manufacturer.

10. Shipping and storage



Note: *During the transport in the trailer, we recommend **using a soft cotton canopy cover**, which covers the nose of the sailplane and prevents the opening of propeller blades.*

*If you are not using a canopy cover, use **FES covers for propeller blades** to prevent the propeller blades from opening when pulling the fuselage out of the trailer.*

If shipping or storage is required, careful packing is the best protection against damage. Especially the tips and trailing edge should be sufficiently protected. The easiest way is to use a few layers of bubble wrap for each propeller blade, and then place them into thick carton or wooden box.

The propeller blades should not be stored close to heat source or in rooms with extreme changes in temperature or humidity.

11. Revision history

January 2019	Initial release of manual, v1.0
September 2020	Minor update, v1.1
December 2020	Minor corrections, v1.11
January 2023	Minor text corrections, v1.2