FES PROPELLER MANUAL

Version 1.2

Type: **FES-DIS-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 6
6. Installation of propeller blades 6
7. Operating instructions 9
8. Acceptable minor damages 9
9. Maintenance and repair 10
10. Shipping and storage 10
11. Revision history 10

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.

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.

February 2013

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 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:	23 kW;
Maximum rotational speed:	4500 RPM;
Propeller blade mass excluding attachment bolts:	approximately 260 g each blade;
Diameter of the propeller:	d=1000 (+20,-0) mm;
Service time between periodic controls:	50 hours or 12 months
Service time between special controls:	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 DIS 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 (A or B) YYYY

where:

- XXX(A or B) - serial number of the propeller;

  left blade is marked as A
  right 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).

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

4. Construction

4.1 Certification standards

Propeller type FES-DIS-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 acrylic white paint (PPG D700) is used to protect the composite body against moisture and erosion. Each blade pair is sanded and polished so that mass difference is only about 0,1g (0,3g is maximum weigh difference tolerance). 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 can be painted in other colors as a safety mark. Otherwise only allowed color is white as this is structural part.

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. Note that 2 screws are 2mm shorter!

2. Before start of propeller blades removal 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.
Flatten and remove split pin, which secure M8 crown nut on each end of propeller blade attachment bolt. Carefully unscrew crown nuts, and remove M8 spacers

3. Push attachment bolt out of the hub. If is not possible to push them out with hands, you can use small plastic or wooden hammer and carefully push them out completely. Propeller blades are then free to take out.

6. Installation of propeller blades

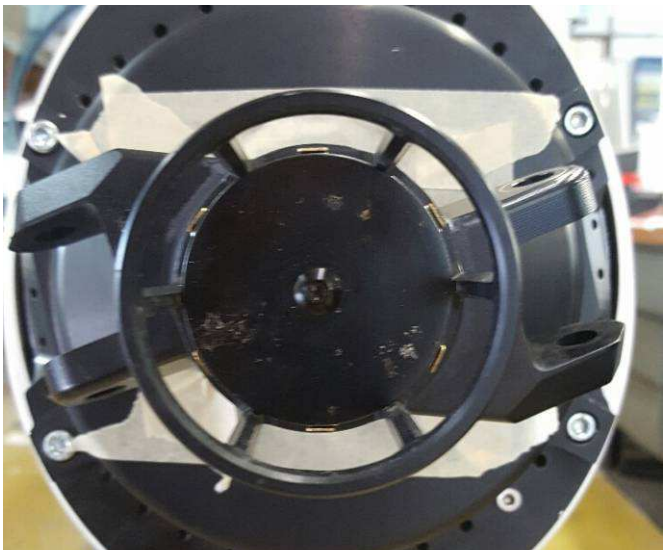
1. Before installation of new propeller blades, check that marking on the label, which is located on lower inner surface, confirms the correct type. For Discus 2c FES, propeller type is FES-DIS-P1-102. Left blade is marked as A and right blade is marked as B.

2. Left (marked as A) and right (marked as B) 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.

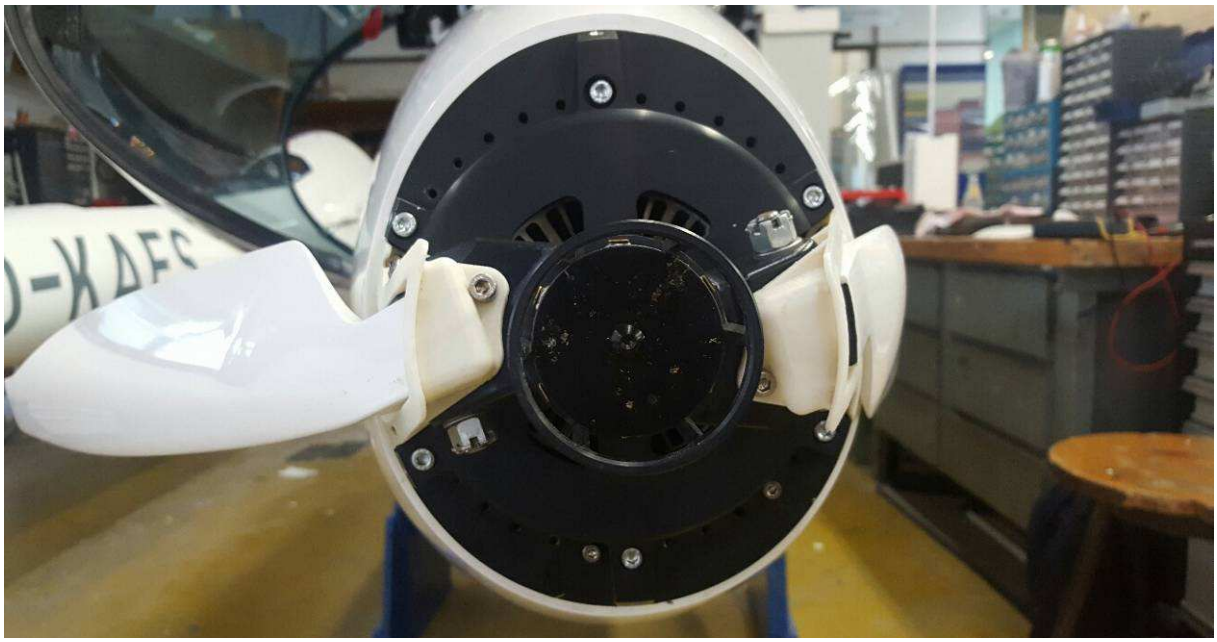
3. Before inserting the bolts, lubricate the shaft of the bolt with thin layer of grease. We recommend using white silicon grease (use only clean grease, from closed tube). Then insert such lubricated bolts to each propeller blades bushing, from each side, so that thin film of the grease will be also 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 four Inox M4x8mm countersink head screws, and two M4x6mm screws. **Two screws which are 2mm shorter are located at 60deg and at 300deg angle (upper left and right).** 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 creates 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 nicer!

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

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 cartoon 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

March 2015	Initial release of manual, v1.0
November 2016	Updated version of manual, v1.1
February 2017	Additional info about service life time and maintenance, v1.2