

**WIND TURBINE
FLAMINGO AERO-4.4**

Manual and service instruction



NOTICE!

Pay your attention and scrutinize the service instruction, and keep it for next use. Nonobservance of the installation and maintenance rules may cause the lifetime reduction or equipment failure.

Made in Ukraine

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Congratulations!

You've become a successful owner of reliable and high-technology wind turbine **FLAMINGO AERO-4.4**.

In spite of wind turbine's installation and usage simplicity, please read this manual through carefully before installation and maintenance.

Please keep this instruction book!

Before buying, installation and operation pay your attention to the following recommendations of our engineers, managers and mounters:

- **choice of wind turbine rated capacity at the purchase;**
- **correct, professional selection of the accompanying equipment – the tower, the inverter, storage batteries, automatics, consumables, etc.**
- **right choice of a place for installation;**
- **conditions of the correct operation of all equipment established in system;**
- **observance of necessary safety precautions during wind turbine and the accompanying equipment operation.**

If you will have any questions or remarks on the subject of our wind-driven generator operation, please contact us and we will give you all the necessary information.

DESIGNATION

Wind-driven generator **FLAMINGO AERO-4.4** is intended for energy production through the kinetic wind energy transformation.

Produced energy could be used for service load supply or accumulated in battery pack for latter utilizing.

DELIVERY SET:

The standard **FLAMINGO AERO-4.4** delivery set (fig. 1) includes:

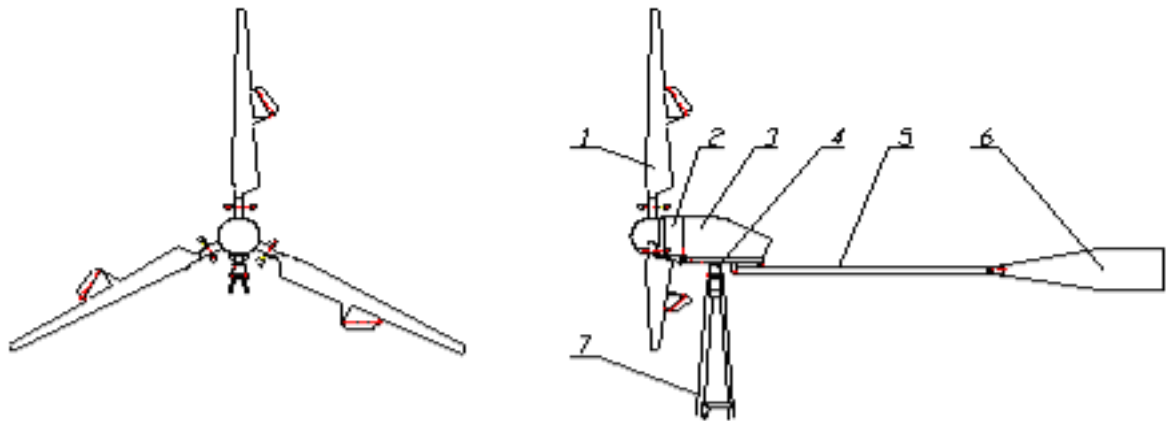


Fig. 1

1. Blades	3 pieces
2. Generator with hub on the central frame with rectifier	1 piece
3. Covers	3 pieces
4. Rotary support	1 piece
5. Tail boom	1 piece
6. Tail unit	1 piece
7. Charging batteries controller	1 piece

Optional could be added:

1. Truss tower;
2. Battery pack;
3. DC/AC transducer (inverter, uninterruptable power supply);

The optional components are not included in standard pack and purchased separately.

TECHNICAL SPECIFICATION

Key specifications (features)

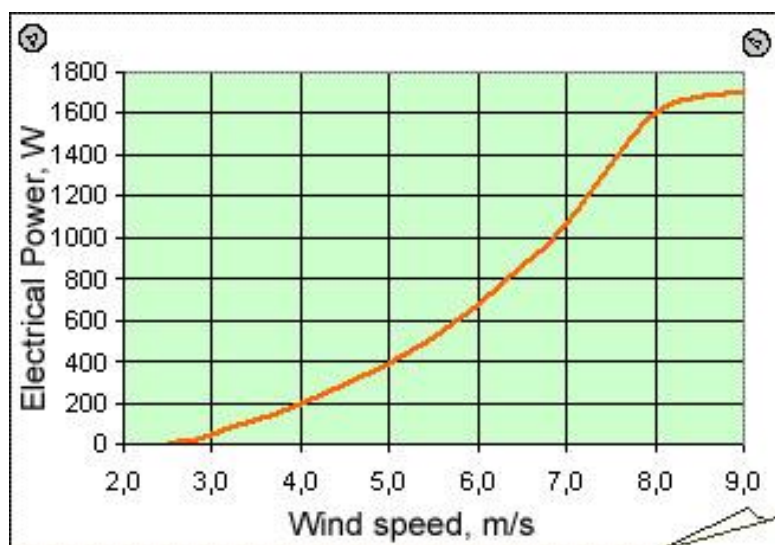
Rated capacity	W	1600
Diameter	m	4.4
Nominal rotation rate	rot/min	210
Number of blades	pieces	3
Blades' material	fiberglass plastic	
Location relative to the tower	windward	
Wind orientation method	by the use of tail unit	
Rotation rate regulation	aeromechanical	
Generator type – three-phase launched by permanent magnets.		
Rated voltage of generator	V	48
Recommended tower's height	m	17-23

Wind speeds operating range, m/s

Start (cut-in wind speed)	2.5
Rated wind speed (generator's power is 1600W)	8
Cut-out wind speed	50

Power (energy) production per month (at full use) with respect to average wind speed

Average wind speed, m/s	Production, kWh
3	140
4	280
5	445
6	600



SAFETY ENGINEERING DIRECTIONS

Wind turbine FLAMINGO AERO-4.4 was manufactured in consideration of all the safety requirements. Not depending on that fact, when you are planning location, installation and exploitation of wind-driven generator, you have to attend about safety guaranteeing. It is not necessary to forget about dangers, which are connected with mechanical and electrical devices and blades.

CAUTION: DO NOT INSTALL THE WIND TURBINE IF ANYONE IS IN THE AREA OF BLADES ROTATION! OCCURRENCE OF ANY OBJECTS (CABLES, CONSTRUCTION ELEMENTS, TREES, AND ETC.) IS PROHIBITED!

Mechanical harmful sources:

Rotating blades is the most serious mechanical harmful source. The ends of the blades develop high speed and can inflict serious traumas! Do not install the wind turbine in the places where contact of human (or objects) with moving rotor blades is possible.

IMPORTANT!

Any kind of works which are related to lifting on tower should be done under shut down wind turbine.

Electrical harmful sources:

Wind turbine is equipped by electrical devices, which were manufactured with a glance to all protective qualities from electric harmful sources, concerning extreme currents. REMEMBER, that some risks still exist when you work with electricity.

Heat liberation in electro technical installation systems is the result of extreme currents flowing through small wire section or through the bad contacts.

Batteries can emit currents of dangerous magnitudes. In the case of short circuit, in the wires going from battery, fire may occur.

Changing the connection scheme, additional elements installation (starters, fuses, etc.) are prohibited! You must come to agreement with assembly organization which did the installation.

CAUTION: COMMUTATION (CONNECTION/DISCONNECTION) OF MAIN LEADS UNDER THE ROTATING WIND TURBINE MAY CAUSE THE ARCING WHICH DRAWS THE SKIN BURNS AND ORGANS OF VISION INJURY.

The wind turbine generator is engineered and manufactured according to normative documents of safety measures standard system.

During wind turbine preparation period and in the process of exploitation it is necessary to keep the following construction-and-use **laws**:

NOTICE!

Firstly, you must close study of safety engineering directions and only after that you are allowed to start the installation!

1. **All the installation works, concerning tower and wind turbine, should be done by qualified (ready, trained) personnel with admission on altitude activity and with safety equipment;**
2. It is desirable to do installation works in windless weather, if installation in windless weather is impossible, all the works should be done under the wind speed ≤ 4 m/s and temperature $-5\text{ }^{\circ}\text{C} \leq t \leq 30\text{ }^{\circ}\text{C}$;
3. It is PROHIBITED: to stand under the wind generator during lifting/lowering, and to be in the surface of rotor blades rotation during operation;
4. Standing near wind turbine generator during thunderstorm, lightning, etc. is not allowed;
5. Works, concerning with power -of/-on, lifting on tower, are allowed only with stopped wind turbine;

6. In occurrence of vibrations or oscillations, cracks on wind turbine units, unfastening, screw locking device disturbances, the system should be stopped immediately for emergency maintenance.

Operation of such wind turbine is strictly prohibited till the fault repair.

EXHORTATION!

Don't do the installation works without assistance!

DESIGN AND OPERATION PRINCIPLE

The basic principle of wind turbine generator consists in kinetic wind energy transformation into mechanical one, with further transformation into electric power by generator. Incoming flow acts on the rotor blades, creating torque which is passed on electric generator rotor. Generated electricity is rectified and passed on batteries charge controller or other load.

Design of FLAMINGO-AERO-4.4 wind turbine is shown on the figure 2. All units are installed on the steel fabricated (welded) frame.

Generator is represented by butt double-gap three-phase multipolar electric machine on permanent magnets. Structurally generator consists of two cast alumenic boards (67), where stators are fixed. Stators consist of magnetic conductors (32) with windings (31). Rotor consists of cast alumenic body (35) twisted from magnetic conductor tape (33) and permanent magnets (34). Rotor is fixed directly on main shaft (73), which supports on radial (68, 72) and trust (70) ball-bearings located in boards borings. There are studs (30) located all around the boards, connect them between each other. Studs are also used for unloading of thrust ball-bearings from magnetic attractive forces between stator and rotor. Windings of each stator are “star” connected. Generator's cavity is covered by steel tape case. Generator is fastened to the rotary support frame by means of four studs (66) and screw nuts (65).

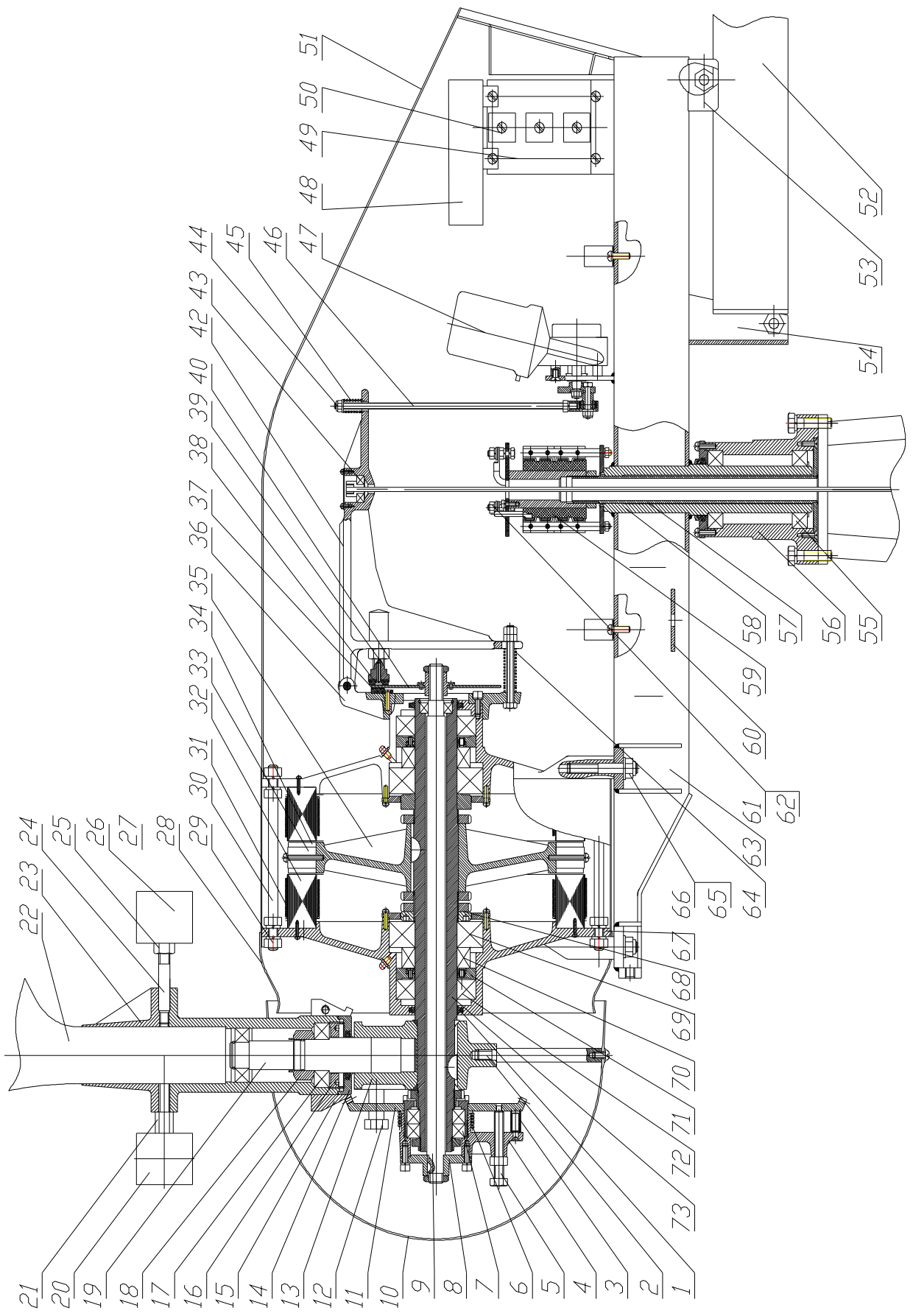


Fig. 2

Elements to designs (Fig. 2):

1 – sealing ring	36 – body
2 – bracket	37,38 – friction linings
3 – latching device	39 – bracket
4 – cushion springs	40 – brake disc
4 – body	42 – lever
5 – controllable stop blocks	43 – cable
6 – wind vane spring	44 – brake cable
7 – bearings	45 – spring
8 – reducer (coupling arrangement)	46 – rod travel
9 – auxiliary shaft	47 – electric drive
10 – front case	48 – on-board controller
11 – synchronizer	49 – radiators
12 – latching device	50 – assembly rectifier
13 – hub of wind turbine	51 – back case
14 – cover	52 – tail unit
15 – cone gear sectors	53, 54, 60 – brackets
16,18 – screw (nuts)	55 – bearing
17 – bearings	56 – body
19 – blade axle	57 – cored welded bracket
20 – centre weight	58 – axle
21,24 – brackets	59 – current collection node
22 – blade	61 – nut
23 – aluminium shell	62 – puck
25 – fixative nut	63 – steel fabricated (welded) frame
26 – compensation weight	64 – return spring
28 – case	65,68 – screws (nuts)
29 – nut	66 – studs
30 – studs	67 – aluminic boards
31 – windings	69 – bearing
32 – magnetic conductor	70 – trust ball-bearing.
33 – magnetic conductor tape	71 – puck
34 – permanent magnets	72 – radial ball-bearings
35 – cast aluminic body	73 – main shaft

Wind turbine of FLAMINGO AERO-4.4 is three-blades high-speed with aeromechanical rotation frequency stabilization system and with wind vane system.

Hub of wind turbine (13) is fixed on main shaft by using of screw nut and cone hoops. Torsion torque is transferred son main shaft through the bushing key. The blade (22) is pasted in aluminium shell (23). There are some loads (20, 26) on the brackets (21, 24) in the shell, used for adjustment of blade's inertial characteristics. Blade's axle is installed in the shell on ball-bearings (17) and fixed

by screw nuts (16, 18). Bearings' cavity is closed by the cover (14). Thereby, the blade can easily turn around its longitudinal axis.

There is special system for turn angles synchronization, which consists of cone gear sectors (15) and synchronizer (11), installed through the sliding fit on the body (4), which may turn on the ball-bearings of main shaft (7). For action play elimination the spring application (4) and controllable stop blocks (5) are used. There are cylindrical ridges on the stop blocks, which are in the coupling engagement with the synchronizer aperture for prevention of its turn around the body (4). For improvement of starting characteristics the wind vane spring (6) is included.

The process of wind turbine shut-down is realized through the blades conversion into wind vane position. There is a special system for this purpose, which consists of reducer (8), auxiliary shaft (9), brake disk (40), body (36), and lever (42) and two friction linings (37, 38). After pressing the lever down, occurs clamping and slowing down of the disk and synchronizer. During wind turbine rotation, segment gears (15) roll around synchronizer and turn the blades into wind vane position. Pressing the lever down may occur manually by cable (43) or electric drive (47). After this, the lever goes back to initial position by spring (64) and looses the disk (40) with synchronizer, which turns back by the wind vane spring to the position ready for start of wind turbine.

In operating mode wind turbine is controlled by means of pitch change.

The control forces are created by stabilizers (8) (fig. 3). Stabilizer is fixed behind blade tip using brackets (1, 9), bushes (3) and torsion bar (2) – the axis of its rotation. Torsion bar has the preliminary tightening (gripping) +30 degrees and fixed from one side on the flattened surface by screw (4) to stabilizer, from another side it is fixed on the bracket (9) with the help of ledge (10). Screw (5) is the stop block and it provides the required initial angle for setup of stabilizer relative to blade. The initial stabilizer's angle provides the wind turbine start and it's spinning to the operating mode rotations. In further increasing of wind turbine rotation rate, centrifugal force, which acts on control loads (7), gets over the

torsion twisting force and decreases angle for setup of stabilizer relative to blade. This leads the blade turn to the side of bigger pitch, incidence angles reduction and properly decreasing of aerodynamic force and rotation rate stabilization.

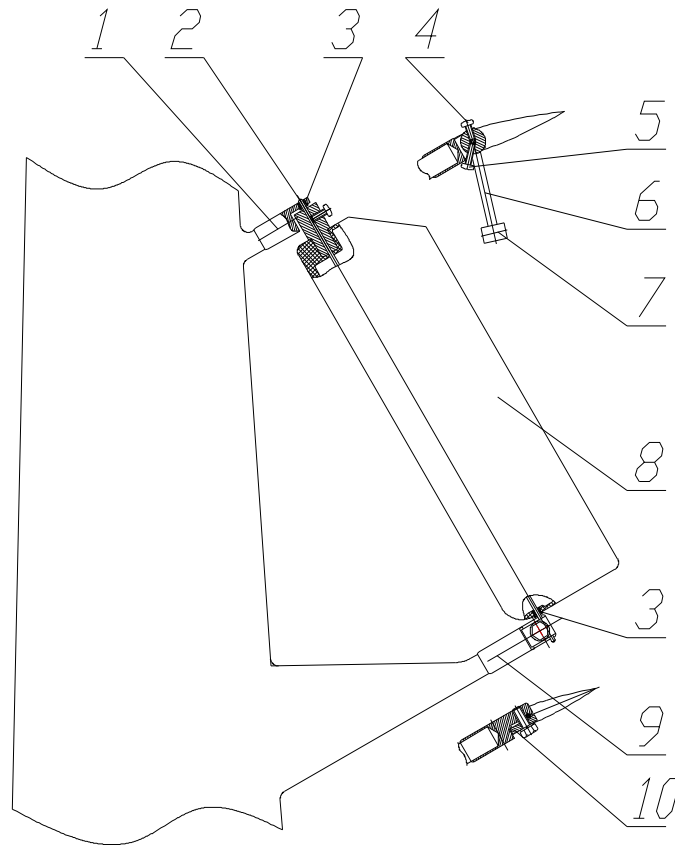


Fig. 3.

The basic units:

- 1,6,9 – brackets*
- 2 – torsion bar*
- 3 – bushes*
- 4 – screw*

- 5 – screw (stop block)*
- 7 – control loads*
- 8 – stabilizers*
- 10 – ledge*

Rotary support is serving for fixing of wind turbine on the tower, wind vane (downwind) orientation, and electricity transmission from rotating wind generator to the fixed tower.

The rotary support frame is made from steel square tube. The generator fastening brackets, wind vane electric drive, rectifiers and supporting shroud (casing) diaphragm, which has the tunnel for cooling the radiator of rectifier, are welded to the frame tube. The axle (58) and brackets (60) for lift device fastening are welded in the middle of frame. The free end of axle on the ball-bearings (55) is installed in the body (56). Cored welded bracket (57) of current collection node (59) is fastened in body hollow chamfer. The node consists of four rings, which are in contact with copper-graphite brush each. The brushes are connected with rotary support frame, while rings stay immovable relative to the tower of wind-driven generator. The lower two rings are served for electric power collection, upper two – for data communication between on-board electronics and terrestrial unit. The terminal block for plugging of power and signal cables is located on the upper part of current collection node. Brake cable (44), signal and power cables are passed through the aperture in terminal block and cored bracket.

Rectifier (50) is serving for rectification of generated current. It is manufactured according to Larionov's scheme and consists of two radiators (49), where assembly rectifiers (50) are installed. There is on-board controller (48) on the top of the radiator.

Tail unit is served for wind turbine rotation according to wind direction around vertical axle. It consists of tail boom (52) fixed by 2 screws on the central frame, and plastic "feather".

Cases (shrouds) hide the wind turbine connection joints from direct precipitation, dust and sunbeams. The front case (10) hides the turbine hub. It is rested on brackets (1). The middle case is fastened by self-screws to the generators shroud. The back case (31) hides the central frame, brake lever, rectifier and current collector. It is fastened by clamps to the frame of rotary support.

INSTALLATION OF WIND TURBINE

The installation process should be carried out **ONLY** by **SKILLED (TRAINED) personnel. USE THE SAFETY EQUIPMENT** during installation process.

The installation process is **PROHIBITED**:

- when the wind speed is more than 4 m/sec;
- there are precipitation;
- (thunder) storm appears;
- when the temperature of ambient air is less then -5°C or more than $+30^{\circ}\text{C}$.

Exclude the presence of people under the wind generator and in the zone of possible tools drop during installation process. **USE the protective hat, safety shoes, safety strap, etc.**

In transportation condition **FLAMINGO AERO-4.4** has the following separate units:

- tail unit is separated from tail boom;
- tail boom is separated from central frame;
- blades and axles are taken out from hub.

Wind generator is packed into shipping container. There are head and controller in the box , blades, tail boom and tail unit are in the box.

If the wind turbine was disassembled on tail unite components, it should be aggregated according to structure description.

The installation proceeds in the following way:

1. To install on the tower the lifting device for the head (elevator) in accordance with instructions. Fix the device in such a way that during lifting the head would be sited naturally relative to the wind.
2. Fasten the terminal block on the top and connect to it necessary cables, fasten these cables on the post of the tower. Pick up and temporarily fasten the manual feather cable. It is permissible to connect the cable with the end of wind generator's cable with the help of clasp (latch hook).

3. To install the box with the head in lifting point.
4. To remove the upper cover, braces and side slabs of the box. To take off the controller from the box. Remove front and back cases.
5. To bring the lifting hook under the frame from the side of the post and fix it by the authorized bolts with the appropriate brackets of the frame. (Check the lift cable during the process.)
6. To create the prior cable tension, without airborne (lifting) the head of wind generator.
7. Insert the tail unit between the plates of the tail boom and fix it by screws and nuts. (Tightening torque is 5 – 7 N·m).
8. To put in the tail boom with feather to the appropriate places on the frame and fix it by screws and nuts. (Tightening torque is 30 – 40 N·m). Put the whetstone under appropriate side of the box if it is necessary, for better access to the places of fixing the tail boom and indexing (aperture registration).
9. To raise the head of generator using the lifting device on the accessible (handy) height. In the same way check the tail boom not to damage.
10. Pass the feathering, power and signal cables through the aperture in the terminal block and the bracket of current collector node.
11. Examine the brake disk node of wind vane (feather) system. The clearance between disk and friction lining should be in the limits 0.5 – 1.2 mm. Pressing manually on the brake lever, check the ease of its motion. After stop pressing, the lever should go back to the initial position by the spring. For regulation the clearance, loose the check (counter) nut and turn the disc over on the auxiliary roller until you'll get the necessary spacing. Stream to the smallest clearance. Hold the disk hub and tighten check (counter) nut with the tightening torque is 75 – 90 N·m. The clearance between disk and friction lining is regulated by screwing/unscrewing of the bracket (39). (Fig.2). Tightening torque is 30 – 40 N·m.

12. Examine the electric wiring. To observe a polarity and energize the power cable with constant voltage 48 V. The source should give a current not less than 10 A. Check the forced wind vane (feathering) system's electric drive. During switching on the cover of on-board electronic block the output shaft driving gear output shaft should turn over on 180°. During rod travel (46) down, at the end of motion the spring (45) snug occurs. This force breaks the return spring (64) force and leads to pressing the disk edge by the friction linings. The pressing force is checked during main shaft turn over by the front case bracket. There should be a force 30 – 40 N at the end of the bracket. Do 3-4 switches to check the electric drive. Transfer the mechanism into “out of feather”.
13. Twist off the self-screws of middle case and move it back, step by step put the blades into appropriate hub cradle and fix them by clamps. (Tightening torque is **50 – 60 N·m**).

NOTICE!!!

13.1. Labeled cog on the blade sector should be located in the gash between labeled cogs of synchronized gearwheel.

13.2. The groove (non cylindrical) on the blade axel (6) should be oriented so, that latching device (3) will enter into it.(Fig.4)

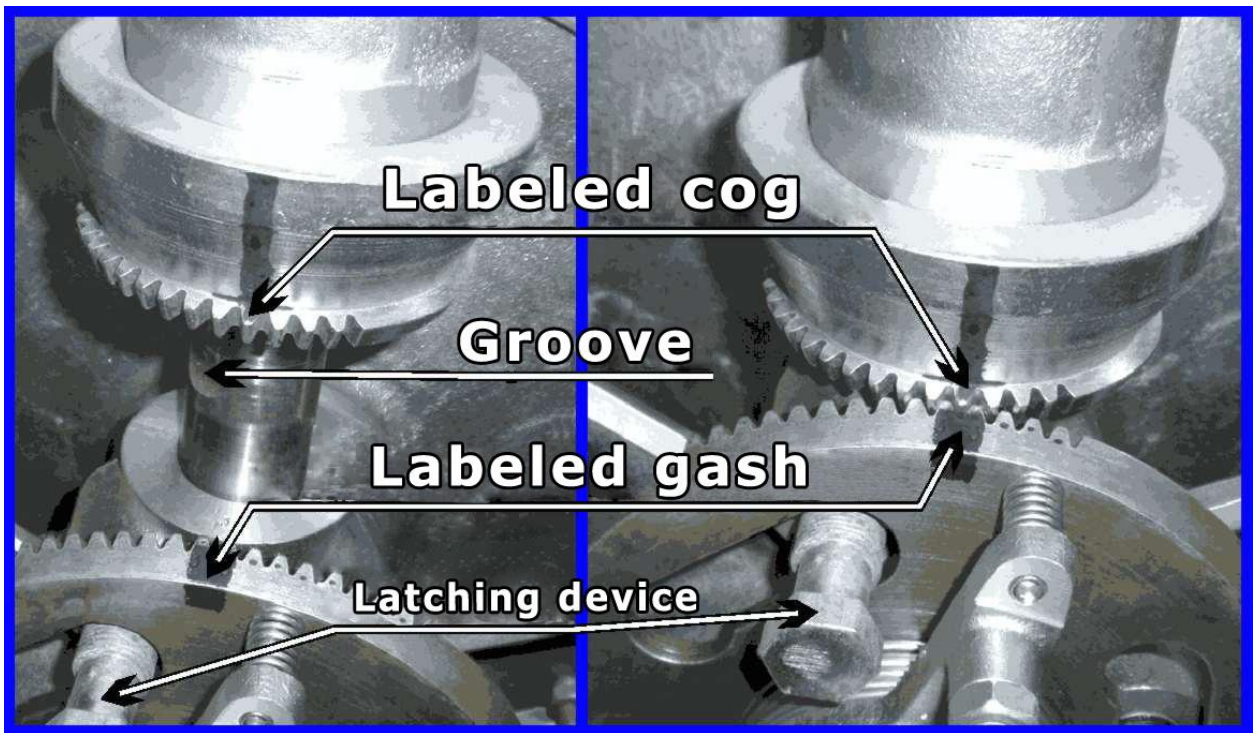


Fig.4.

14. Set the middle case back to the initial site.
15. To feather the wind-driven generator using electric drive. Deenergize the power cables.
16. To make greasing of gearing synchronization according to regulations of technical operation. Install the front case and to fix it with the bolts for brackets. Pay attention, that aligning cavities on brackets have entered into apertures on the front case. (Tightening torque is **3 – 5 N·m**)
17. To put on a back case and to fix its clips. Lateral walls of a case should lean against a cylindrical surface of carving plugs of clips, and the forward edge should come under a generator case.
18. To fasten a cord-delay over the weights' brackets of one blade with effort of rupture not less than 2000 N and length not less than 3 heights of a tower.
19. Extending a free cord of the lift device, to lift the wind generator on height 4-6 cm exceeding flange of a tower. At lifting by a cord-delay to create a backlash (clearance) between wind generator elements and a tower, without wind generator damage. To get the free ends of power, signal and wind vane

- (feather) cables in an aperture on a tower flange. To displace the carriage of the lift device before combination of a tower flanges and the body of wind generator rotary device. To lower wind generator till backlash (clearance) will be 5-10 mm between flanges. To combine apertures on a flange of the rotary device with apertures on a tower flange. To insert into apertures of the rotary device bolts and to screw them on 3-4 turns. Obligatory there is an application of spring lock washers. To lower wind generator before contact of flanges. To screw the bolts with the tightening torque 30 – 40 N·m.
20. To connect the bottom end of a wind vane (feather) cable with earlier lifted cable.
 21. To attach terminals of the power and signal cables, going from a current collector, to terminal block in the top part of a tower, observing polarity of connection. Descent from terminal block should be strongly fixed on a tower to exclude hit of wires in wind turbine.
 22. To tie up a lift hook to the halyard of auxiliary device, to disconnect the end of a cord of the basic lift from the carriage, to extend it from pulley block and to lower downwards. To disconnect a hook of the lift device from a frame of the rotary support and to lower it on auxiliary halyard.
 23. To dismantle the lift device.

During installation, the regular technical service works proceed excluding points 2, 7 and 9 for the new items.

PERIODICITY AND ENGINEERING SERVICE LOAD

Regular technical service is carried out two times per year, every 6 months (spring and autumn are recommended). Extra maintenance is carried out in the case of wind turbine operation disturbances. The service procedure of extra maintenance is the same as during regular. The next regular technical service could be done in 5 - 7 months after previous one.

Regular technical service

1. Check the absence of cyclical oscillations and vibrations of the system during operation.

NOTICE!!!

The cyclical oscillations indicate the wind turbine aerodynamic or mass balancing disturbance. Such wind turbine exploitation is strictly prohibited!!! The system needs to be demounted and sent to manufacturing plant for repair.

The short-time oscillations are allowed in transient states, when the rotation rate is less than operation one with amplitude **2 – 3 cm** at the end of the tail unit. Cyclic oscillations may be caused by blades fouling, and in some cases they could be eliminated after flaps and blades cleaning with wipe and special detergent solution.

Vibrations could be caused by:

- rectifier bridge diodes' breakdown;
- short circuit in one of generator's phase;
- bearings destruction.

2. Stop the wind turbine and do the wind turbine cleaning. Blades and cases should be cleaned with detergent solution.

3. Do the external examination of wind turbine simultaneously with cleaning. Pay attention to absence of splits, worn spots, places oiling materials outflow, sparking in electrical connections (contacts)'.

4. Check the bolted connections. They should have the following limits:

- blades fixing devices – **50 - 60 N*m**;
- connection nuts of generator and frame rotation device axle – **30 - 40 N*m**;
- connection nuts of rotation device flange, tail boom, tower braces – **20-23 N*m** (it is allowed the spot check of braces nuts tightening at the rate of 7-12 pieces through all the tower's height);
- check-nuts of forced wind vane system brake plate – **60-80 N*m**;

- nuts that connect tail unit with tail boom, screws of flaps torsion connection –

5-7 N*m.

NOTICE!

The wind turbine exploitation with clenched connection holes is prohibited

5. Check the synchronizer coupling engagement. The clearance gap between stop bolt butt and synchronizer surface should be in the limits **0.05 – 0.2 mm**. The blades should be turned free at any range of angles installation and come out the wind vane position with the help of spring.

The reasons of difficulties during turns:

- small clearance or tension between stop bolt and synchronizer surface;
- foul coupling engagement by foreign objects;
- spring biting and deformation;
- destruction of synchronizer or blade bearings;
- absence of the clearance gap between synchronizer and brake plate;
- strong coupling engagement tear of sectors and synchronizer.

When strong tear or bearings destruction occurs, the repair at manufacturing plant is required.

For the clearance gap regulation it is necessary to loosen check-nut, and turning the screw, set the desired clearance. Set it less, if it is possible. Torque the check-nut to 25-35 N*m and control clearance again. After checking the quality of blades turns do the abundant oiling of the coupling engagement by lubricant. Put some lubricant on the internal parts of synchronizer under cogs for the refilling under the influence of centrifugal force.

6. Check the forced wind vane (feathering) system's electric drive. During switching on the cover of on-board electronic block the output shaft driving gear output shaft should turn over on 180°. During rod travel (46) down, at the end of

motion the spring (45) snug occurs. This force breaks the return spring (64) force and leads to pressing the disk edge by the friction linings. The pressing force is checked during main shaft turn over by the front case bracket. There should be a force 30 – 40 N at the end of the bracket. Do 3-4 switches to check the electric drive. Check the wind vane cable. Rust and slight tears are not allowed.

7. Add 3-4 cm through the oilcan on the front shield cubed of lubricant to generator thrust bearing.

Check the easiness of generator rotation, absence of extraneous noises and jams, absence of cyclic “cogs” torque.

The difficulties during rotation may be caused by:

- tear or destruction of bearings
- short circuit in generator coil or transmission line.

Cyclic or “cogs” torque may be caused by:

- short circuit in one of generator phases;
- failure of rectifier bridge diodes.

8. Check the reliability (safety) of electrical connections. If it is necessary, do the tightening of bolted and clamp connections.

9. Take off insulators of current collector brushes. Clean the hoops and brushes with the help of wipe and special solution (petrol). In the case of severe contamination, use the sand paper with the further cleaning by wipe and special solution (petrol). Assemble the unit; check the easiness of brushes shift in guide and reliability of pressing to the hoops.

NOTICE!

**Points 8 and 9 must be executed under disconnected battery!!!
During installation of brushes and insulators on appropriate place
follow the correctness of installation procedure and polarity!**

10. Lubricate the flap slider bearings (1 drop of any transmission oil to each bearing). Check the easiness of flaps rotation.

11. Check the rest wind turbine equipment, according to enclosed instruction.
12. Check the functionality of a complex, charging current, its correspondence with airstream value.
13. Complete the form of exploitation and technical service.
14. Send the report to the manufacturing plant.

MAINTENANCE RECOMMENDATIONS

1. Wind turbine operation in icing condition may cause its failure. **During icing weather or close to it, STOP the wind turbine for better conditions (in such weather conditions the wind turbine operation is prohibited).**
2. Do the technical service in accordance with part “periodicity and engineering service load”.

The Owner of wind power plant and installed auxiliary equipment can insure this property from the risks of damage or destruction by fire, natural disasters, accidents, and illegal acts of third parties, as well as its responsibility before the third parties during its operation against the risks of harm to their property, life and health with our partner:

Public Insurance Company “Leader Re”

04050, Kyiv, Ukraine, Glybochytska St.

WIND TURBINE FLAMINGO AERO-4.4

Service instruction



NOTICE!

Pay your attention and scrutinize the service instruction, and keep it for next use. Nonobservance of the installation and maintenance rules may cause the lifetime reduction or equipment failure.

THE MAIN RULES OF FILLING AND LOGBOOK CONDUCTING:

- THE DATA CARD IS FILLED WITH THE AUTHORIZED ASSEMBLY ORGANIZATION – LEGAL OR THE PHYSICAL PERSON HAVING LICENSES FOR INSTALLATION, WARRANTY (POSTWARRANTY) SERVICE;
- SAMPLES OF LICENSES ARE RESULTED IN APPENDICES 1 AND 2;
- THE CUSTOMER (CLIENT) SUBSCRIBES (PUT THE SIGNATURE) ABOUT ACCEPTANCE OF WORKS.

Logbook should be completed for each object. During wind turbine transportation to another object, the other logbook has to be opened. The note about transportation is put into the column “Additional Information” to the both logbooks. The completed insert is sent to the manufacturing plant

Object information	
Wind generator works number	
Sale date	
Installation date	
Installation place address	
The name of installation organization	
Contact information of installation organization	
Height of tower	
Battery's (accumulator) capacity	
Inverter's power	
System type (off-line, reserve)	
Additional components (inverters, stabilizers, diesel-generator set)	
Additional information	
Client signature	Works are accepted, acquainted with service conditions _____ Initials _____ Date
The work is done by (initials)	

The scheme of wind generator switching on
(should be filled up by the representative of authorized assembly organization)

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The work is done by (initials)

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Dispatch list	The notes about work execution (should be filled up by the representative of authorized assembly organization)				
Date					
1					
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7					
8					
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14					
Additional comments and works					
Client signature					
The work is done by (initials)					

Dispatch list	The notes about work execution <small>(should be filled up by the representative of authorized assembly organization)</small>				
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Additional comments and works					
Client signature					
The work is done by (initials)					

Dispatch list	The notes about work execution <small>(should be filled up by the representative of authorized assembly organization)</small>				
Date					
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Additional comments and works					
Client signature					
The work is done by (initials)					

GENERAL PROVISIONS

The warranty is a technical support of wind turbine working capacity by manufacturing plant throughout the warranty period. The warranty is a free replacement of parts and knots which have the defects arisen because of manufacturing plant under condition of regular wind turbine operation.

Warranty package doesn't extend on the malfunctions (failures) caused by infringement of operating rules, maintenance and wind turbine service, influence of extraneous subjects or factors, or corrective actions which change the wind turbine design unapproved by manufacturing plant.

Maintenance service, installation and putting into operation, - procedure paid, according to the prices of the Authorized Service Center (ASC).

Installation, putting into operation, repair and service should be carried out only by the experts trained and certified in the enterprise «Svit Vitru».

In order to avoid misunderstanding, we ask you convincingly to study attentively the maintenance instruction on the given product.

WARRANTY PERIOD

The Manufacturing plant gives a warranty period of 3 years on the «FLAMINGO AERO» wind turbine under condition of the contract conclusion on maintenance service with the assembly organization, regular performance of maintenance service regulations; or 12 months without the contract conclusion.

The user of the equipment should every 6 months of operation provide the admission of ASC representatives for carrying out wind turbine maintenance service*. If the wind turbine has not been passed maintenance service in time, the warranty period makes 12 months from the date of putting wind turbine into operation.

The warranty period starts from the date of wind turbine sale to the Buyer which is brought in the passport and logbook, and is assured by a stamp of the seller who has released the wind turbine to the Buyer. Without this data, as well as

in case of passport and logbook absence, the claims on the warranty are not accepted and are not considered.

Warranty package for the failed parts replaced in a wind turbine warranty period expires at the moment of wind turbine warranty package termination.

Also, we offer you after wind turbine warranty period termination – the ASC post warranty support. The ASC post warranty support gives possibility for clients to reduce the size of expenses connected with «FLAMINGO AERO» wind turbine repair by timely, qualitative maintenance service, and also diagnostics and preventive maintenance of malfunctions. The Manufacturing plant extends also post warranty support to spare parts which have been installed or replaced by official ASC during the warranty period.

Owing to post warranty service in ASC, our clients remain happy, understanding that the manufacturing plant cares of long and qualitative product operation even in post warranty period.

For reception of post warranty supports it is necessary to conclude the contract on post warranty maintenance with ASC.

CONDITIONS OF WARRANTY PACKAGE PERFORMANCE

At revealing of infringements during wind turbine operation or suspicion on wind turbine disoperation it is necessary to address immediately with ASC or manufacturing plant for consultation and elimination of malfunctions (emergency maintenance).

The right to warranty repair of wind turbine can be given only on passport and logbook presentation with the marks confirming timely passage of obligatory maintenance service at ASC.

Warranty package includes repair or replacement (at impossibility of repair) faulty parts, knots, having manufacturing defects, and also free performance of the disassembling/installation works connected with it, except for cases when repair

and works have been caused by abuse (irregular running), influence of extraneous subjects or factors and unauthorized (self-willed) changes in wind turbine design.

Any indirect damage (for example, expenses on work of benzine-diesel generators, straight lines or indirect losses, etc.), connected with wind turbine malfunction aren't compensated.

REFUSAL CONDITIONS IN WARRANTY PACKAGE PERFORMANCE

Refusal in warranty package performance can come in following cases:

- If wind turbine irregularly passed (or didn't pass at all) obligatory maintenance service at ASC;

- If wind turbine was served or under repair not at ASC:

- If changes have been made in wind turbine design and tower, not authorized by ASC or manufacturing plant, including, change of structure connected to wind turbine electric and other equipment, which were not provided by the complete delivery set and had no ASC permissions for application.

- Non-observance or infringement of wind turbine service instructions (rules), maintenance and operation activity.

Terms of warranty don't provide indemnification of expenses on the lost benefit, delivery, installation, consultations.

* - service paid, payment is carried out under the price-list of the authorized service center (ASC).

Exclusive representative: “GRESA-GROUP” Ltd.

03058 Kiev, Ukraine, Nezhinskaya St. 29b, p. b. 118

Exclusive representative in Latino America: “Xóchitl srl” Tel.: +38 067 464 5270

01033 Kiev, Ukraine, Zhilianska 26

Manufacturing plant: Private Enterprise “Svit Vitru”

61108 Kharkov, Ukraine, Kurchatova Ave.

Authorized service center (ASC): Private Enterprise “Admiral Service”

04060 Kiev, Ukraine, Petropavlovskaya St.

REMARK: SAMPLES OF CERTIFICATES TO LEGAL OR THE PHYSICAL PERSON FOR INSTALLATION AND WARRANTY SERVICE ARE RESULTED IN APPENDICES 1 AND 2.

RIGHT TO ISSUE SUCH KIND OF CERTIFICATES HAS “GRESA-GROUP” LTD.

ACCEPTANCE CERTIFICATE

Producer: Private Enterprise “Svit Vitru”
61108 Kharkov, Ukraine, Kurchatova Ave.

The wind turbine FLAMINGO AERO-4.4 corresponds to engineer documentation and available for exploitation.

Works number _____ Manufacturing date _____

Inspector’s signature and initials _____

Exclusive representative: “GRESA-GROUP” Ltd.
03058 Kiev, Ukraine, Nezhinskaya St.

The wind turbine FLAMINGO AERO-4.4 is accepted on balance as the complete set.

Works number _____ Manufacturing date _____

Inspector’s signature and initials _____

MARKS ABOUT PERFORMANCE OF THE ASSEMBLY (DISMANTLING) WORKS

Filled up by the executor of installation works

Wind turbine FLAMINGO AERO-4.4 is mounted and placed for operation:

(Name and address of the enterprise executed installation works)

Date of installation works (putting into operation): « _____ » _____ 201__ year.

The license number for installation of the legal or physical persons who were carrying out installation works (putting into operation): _____

Responsible person: _____
(Signature and initials)

Filled up by Customer (Client)

Acquainted with conditions of warranty and safety precautions during wind turbine operation:

(Signature and initials)

Available licenses for installation and warranty service of the legal (physical) persons who carried out the installation procedure (convinced): _____
(Signature and initials)

The wind turbine FLAMINGO AERO-4.4 is mounted and placed in operation; I have no claims to the executed works: _____
(Signature and initials)

Date « _____ » _____ 201__ year.

Filled up by the executor of assembly (dismantling) works:

SPECIAL MARKS (dismantling, features, etc. – filled necessarily):

Responsible person: _____
(Signature and initials)

Date « _____ » _____ 201__ year.

Is valid at filling

WARRANTY SERVICE COUPON

Filled by seller (vendor)

Wind turbine FLAMINGO AERO-4.4

Works number: _____

Trading organization:

(The name and address)

Sale date: « _____ » _____ 201__ year.

Checked up by seller:

(Signature and initials)

Filled by the executor of warranty (post warranty) service

Wind turbine FLAMINGO AERO-4.4 is accepted on warranty (post warranty) service:

(Name and address of the enterprise responsible for warranty service)

Service acceptance date « _____ » _____ 201__ year.

Service contract number: _____

The license number for installation and warranty service of the legal or physical persons who is responsible for service procedure:

The responsible person: _____

(Signature and initials)

Filled by Customer (Client)

Acquainted with conditions of warranty and safety precautions during wind turbine operation:

(Signature and initials)

Available licenses for installation and warranty service of the legal (physical) persons who carried out the warranty service procedure (convinced):

(Signature and initials)