



Erecting a Fuhrländer FL30 wind turbine

This document is used by service technicians to have a proper document to describe the re-erecting of Fuhrländer FL30 wind turbine.

Work steps described are also used to give an advise how to act and react on site to avoid any emergency situations as well as physical incidents to people on site.

The document is also used as a document to analyze whether the service technicians are skilled and trained to carry out all labor on site, and is a regulation, how to use all necessary tools, power tools, electrical tools as well as self-protecting issues!

This description can also be used as an instruction document to advice service technicians how to erect a turbine and reduce danger for any incident coming up during labor carried out.

1. Turbine data:

- Rated power output: 30KW
- Hub heights: 18mtr.
- Rotor diameter: 11mtr.
- Weights:
 - Tower: 5 to.
 - Nacelle 1,2 to.
 - Rotor: 0,8to.

2. Site preparation

1.1 Access

1.1.1. Labor on site:

- Access to the foundation is required at all time, including crane and trucks with trailer
- Keep the site clear from all wooden logs and material remaining on site from Foundation installation
- Site itself should be drained during digging work
- Earthing: Connecting the earthing as restricted by the local power company
- Storage of components: All components must be stored close to the site as the crane need to have access to all single parts
- Wooden logs are needed for storing the tower sections after it had been build up, hub, blades and nacelle
- A circular space of a diameter of 15mtr. diameter is needed to complete the rotor on the ground
- Crane rack place must be build up with a min. space of 10x10mtr. square to have enough space for the outriggers

1.2 Site installation

1.2.1. Installation of a Generator for temporary power supply

- Place generator on a horizontal place



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- Earthing: An earthing of the generator is needed
- Cable protection: Cable to the turbine erecting place must be kept protected

1.2.2. Tools and Equipment needed

- Wooden logs
- Generator
- Drilling machine
- Welding equipment
- Screws, M12 with washer for earthing connection
- Thread cutter

1.2.3. Potential danger, health protection

- Clamp injuries due to log- handling
- Electrical injuries due to handling mistakes with the generator
- Electrical injuries due to missing earthing
- Fire hazard due to fuel handling

Safety equipment for service technicians, used as standard, like helmets, workwear with special shoe protection, eye protection and gloves are needed.

3. Erecting the tower:

2.1 General:

- Crane with the correct capacity needed.
The crane capacity depends on local dimensions on site for the settle place for crane and position of the foundation
- The access area of the crane must be signed as “restricted”!
- Crane operator is responsible for the safety of crane operations!

Personnel safety equipment has to be weared at all time during staying on site!

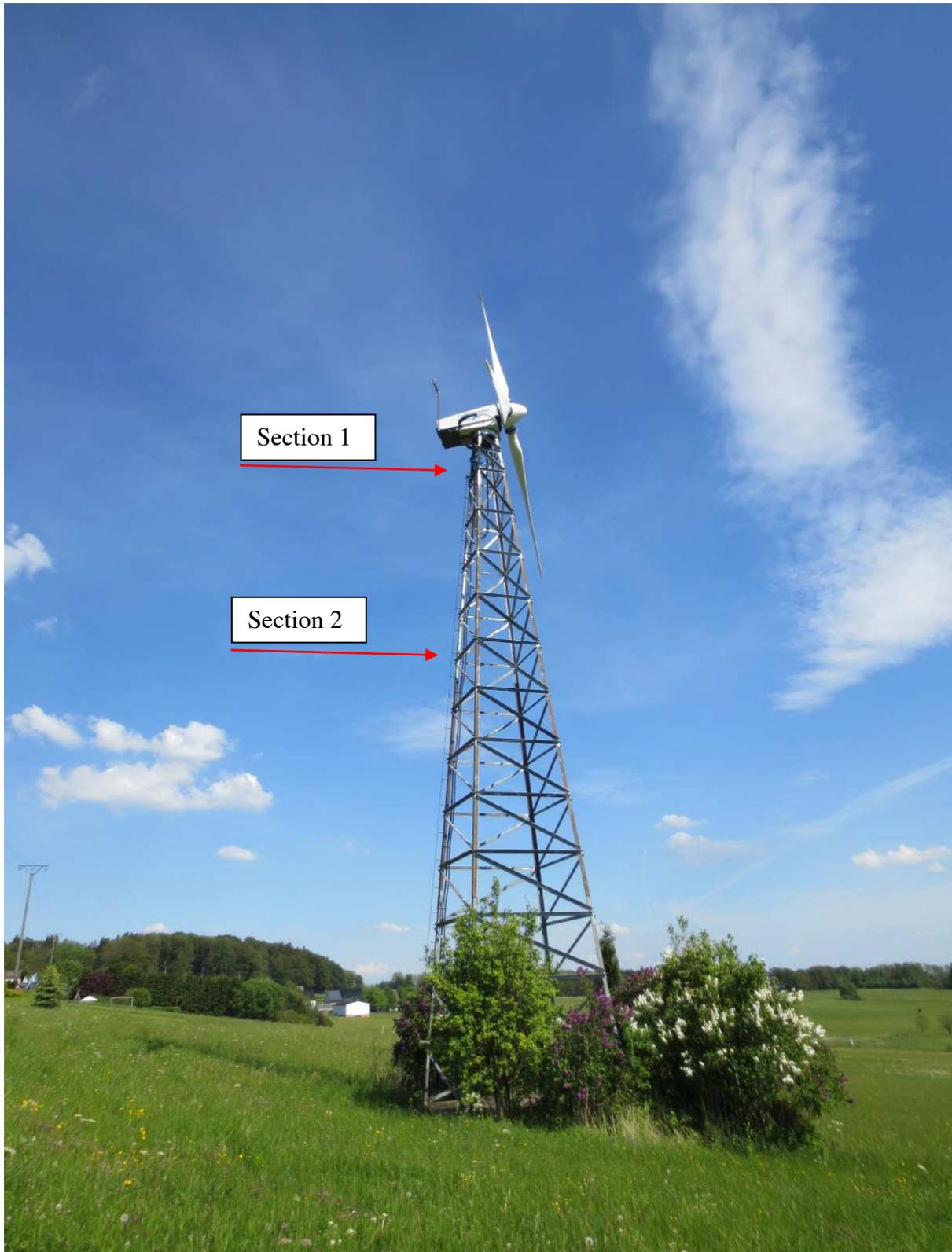
2.2 Tower assembly:

2.2.1. Lattice tower, parts:

- First two upper sections are still assembled. Tower assembly starts with these two sections.



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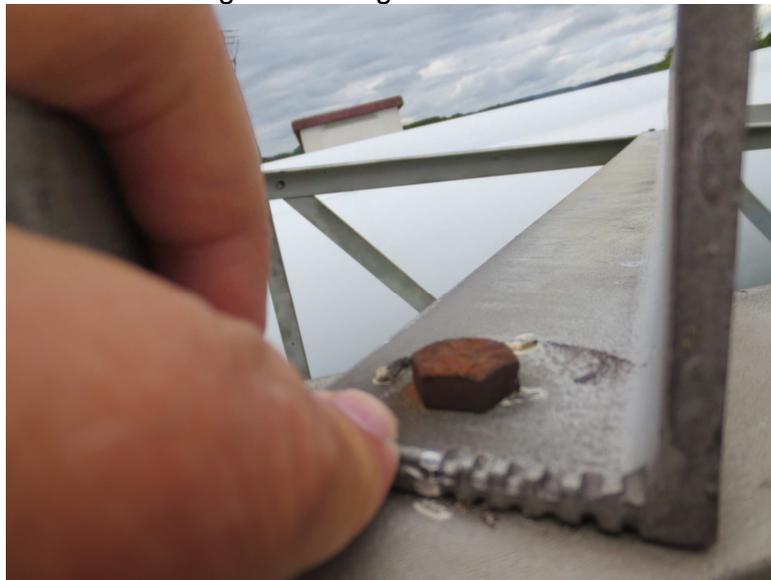
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2.2.2. Lattice tower, parts:

- First two upper sections are still assembled. Tower assembly starts with these two sections.
- Place the tower angle steel feet, left and right, on the ground
- Assemble the angle steel crossway, start under the second section with crossbar
 - Start with angle steel crossway with four scores



- Assemble the angle steel diagonal
 - Start with angle steel diagonals with four scores



- Continue with the crossway and diagonal angle steel bars until you reach the end.
- Continue with the upper section of the lattice tower
- Lift up the upper section of the tower with the crane and mount the crossway, and diagonal angle steel bars, left and right.
- Connect the crane hook to the top flange of the tower



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- Attention: Observe the weight of the tower: ~5 to. Use adequate connection devices.

2.2.3. Tools:

- Torque tool, manual
- Ratched/spanner with nuts, 19, 24, 36mm
- Hammer
- Drift pin
- Screw, M12, M16, M24

2.2.4. Potential danger/ personal health requirements

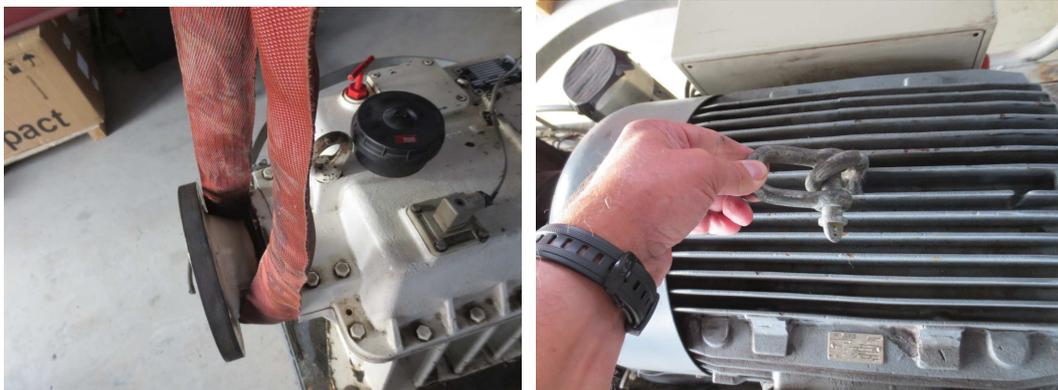
- Clamp injuries due to angle steel bar handling
- Feet injuries
- Head injuries while crane hook is shaking
- Eye injuries caused by damages of the hot coated zinc layer

Safety equipment for service technicians, used as standard, like helmets, workwear with special shoe protection, eye protection and gloves are needed.

2.3 Nacelle assembly

2.3.1. Hook the nacelle with two Nylon ropes:

- Use the center ear of the gearbox
- Use the connection flange of the generator
- Double the ropes to connect
- Use a chain hoist to adjust the nacelle, yaw bearing, horizontal, if needed. Chain hoist has to be connected to the rear. Max. load: 1,5 to.



- Att.: Take care once you put the ropes in the crane hook. Damage of gearbox components, eg sensors, might get damaged.
- Lift up the nacelle

2.3.2. Lift the nacelle on top of the tower

- Secure the nacelle with ropes, manual from the ground, front and rear
- Lower down the nacelle



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- Take the power-, and signal cables off from the nacelle frame and lower them down.



- ATT.: Take care once you lower down the nacelle on the tower top. Make sure, that the cables don't get pressed/damaged
- Place the nacelle on tower top
- Leave the crane hooked on the nacelle with a preload of 0,4to.
- Put in all bolts M12 x 50
- Use a manual torque tool, fasten all bolts with 90Nm

2.3.3. Enter the nacelle:

Att.: Before leaving the tower top make sure, that the person is secured with minimum one lanyard at all time!

- Stand in the tower steel angle, crossway
- Lean back in the rear binder
- Keep secured at all time
- Lower down the crane, remove the ropes
- Clean the flange of the gearbox to secure the position of the hub

2.3.4. Potential danger, health protection

- Clamp injuries due to log- handling
- Electrical injuries due to handling mistakes with the generator
- Electrical injuries due to missing earthing
- Fire hazard due to fuel handling

Safety equipment for service technicians, used as standard, like helmets, workwear, lanyards, slider, special shoe protection, eye protection and gloves are needed.

2.4 Rotor assembly:

2.4.1. Hub:

- Place the hub in an open area which is convenient to place all three blades in the necessary position

Att.: The hub has to be placed horizontal: Use a water level to secure the position



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- Use wooden logs to have a solid and accessible position
- Place the hub upfront with the “spinner side”

2.4.2. Blades

- Lift the blades and settle it on long wooden logs
- Turn the blades, upwind side in the upper direction, horizontal
 - Lift up the blade with the crane on the balance marking. Balance is correct once
Att.: The Tip- end of blade must be kept horizontal
- Scratch the position on the hub flange, if needed
- Place the blade in the position to connect it in the 0° position
- Before bolting secure the correct blade angle whilst using the water lever
- But all bolts, M16 x 100, 8.8, in and torque them to 250Nm.

2.5 Rotor erection

2.5.1. Finish of rotor assembly:

- Once the rotor is completed place the spinner on the upfront side
- Secure the spinner with the small screws
- Place two nylon ropes on the two blades showing in the upper direction once lifted up

2.5.2. Lift the rotor

- Lift the rotor, hold the blade with two guys in horizontal position once the rotor is lifted by the crane
- Bring the rotor in the front position of the turbine

2.5.3. Connect the rotor

- Place the hub in front of the gearbox flange
- Put in all bolts: M20x80. These bolts have a fine thread, M20x1,0!

2.5.4. Finish the turbine erection:

- Torque the rotorbolts with 350Nm.
- Lower down the crane and remove the ropes
- Secure the rotor while installing the arrestor whilst using the arrestor brachekt in the clutch.





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4. Safety requirements:
 - 4.1 All people working on site must be trained and skilled in erecting wind turbines.
 - 4.2 Safety equipment must be worn at all time once anybody is on the site or in the work area
 - 4.3 Use the special installed safety point to be secured with lanyard or slider at all time
 - 4.4 It might be necessary to install additional labeling to secure labor on site. Those requirements have to be observed
5. Tools:
 - 5.1 Based on the described tools in the sentences above some other tools or other standard equipment to erect turbines are needed on site.
Those tools are:
 - Manual torque tool, 200-500Nm, 500-1000 Nm
 - Transport Bin
 - Standard set of spanner and ratchet brace
 - Connection device to lift tower sections
 - 1 pcs. Nylon rope, working length: 4 mtr., 3to.
 - Wooden logs, several
 - Radio to communicate with crane and the people in the nacelle
 - Nylon ropes for manual use to secure the rotor from the ground, 10 – 12mm, length 30mtr. minimum
 - Shackle, several sizes, 6to., 12to.
 - Chain hoist, 1,5to.
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 - 5.2 Personell safety equipment
 - Safety belt
 - Lanyard, double or duplex
 - Helmets
 - Eye protection
 - Gloves
 - Workwear with special shoe protection
 - Ear protection while using the electrical bolt driver
6. Potential danger:
 - 6.1 Safety and health protection:
 - Visual inspection of the safety belt and lanyards
 - Respect the advises from the supervisor
 - Never stay under lifted weight
 - Respect all signings
 - Install-, or renew requirier signing
 - The use of the safety equipment is advised once on site



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