LT1500
LIFTRA INSTALLATION CRANE

Storyboard

CONTENT

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- Crane pad layout
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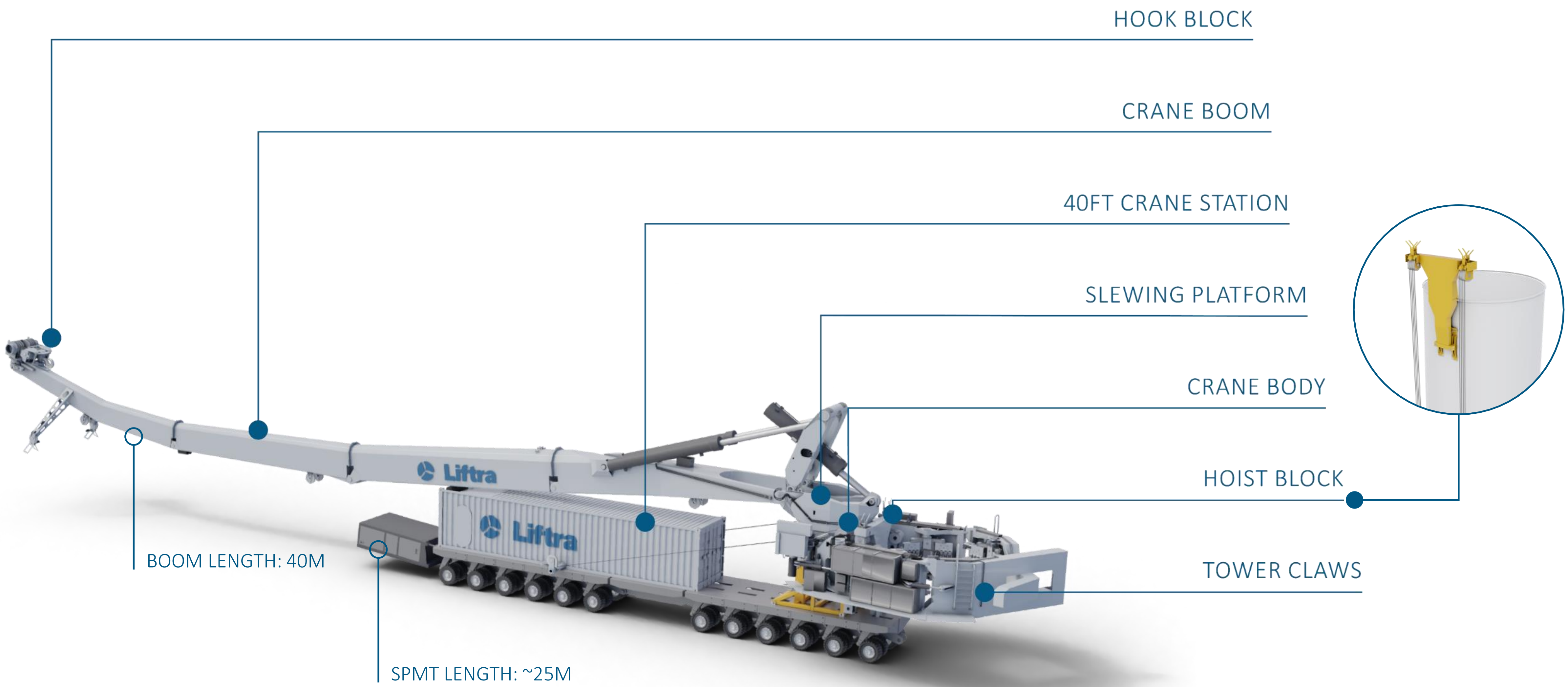
- Claw test

SYSTEM OVERVIEW



SPECIFICATIONS

PERFORMANCE

WLL	120 t
Max. tower height	250 m
Crane system weight	120 t

MARKET

Design for use in region	EU, US, AUS & Asia
Conditions	Onshore
Third-party validation	DNV

ENVIRONMENT

Operating temp.	-20/50 °C
Out-of-service temp.	-30/60 °C
Peak wind	18 m/s (14 for blades)
Peak wind, out of service	40 m/s

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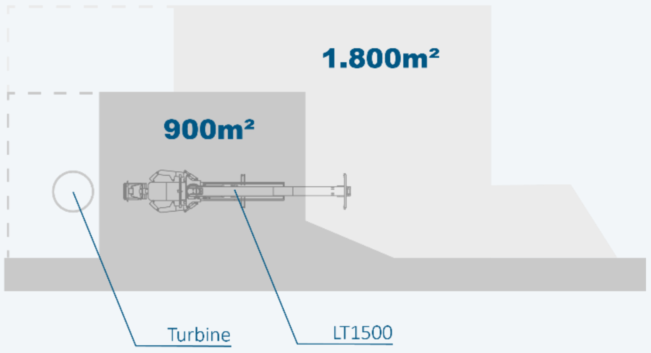
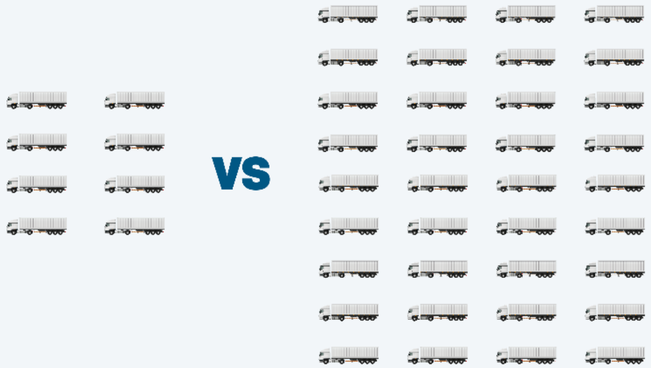
ADVANTAGES OF THE LT1500



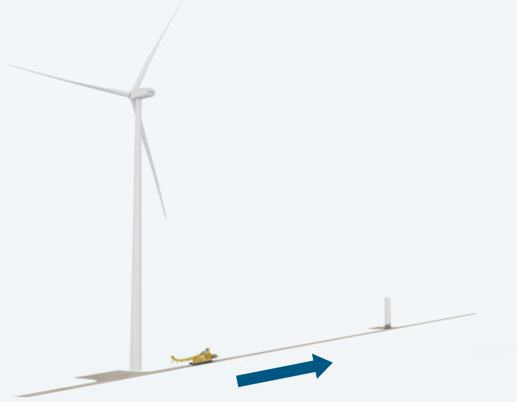
REDUCED CIVIL WORK

- 50% reduction in crane pad area compared to Conventional cranes.
- No need for long boom → no assembly area and assisting crane pads.
- No minimum lifting radius → small crane pads
- Small crane size -> Road size only defined by turbine component transport



MINIMAL MOBILIZATION

- Mobilized by only 5-8 trucks contrary to the 30-40 trucks for conventional cranes.



FAST RELOCATION

- No need for disassembly
- Can be relocated between turbines in just one day
- No extra cranes or trucks are needed.

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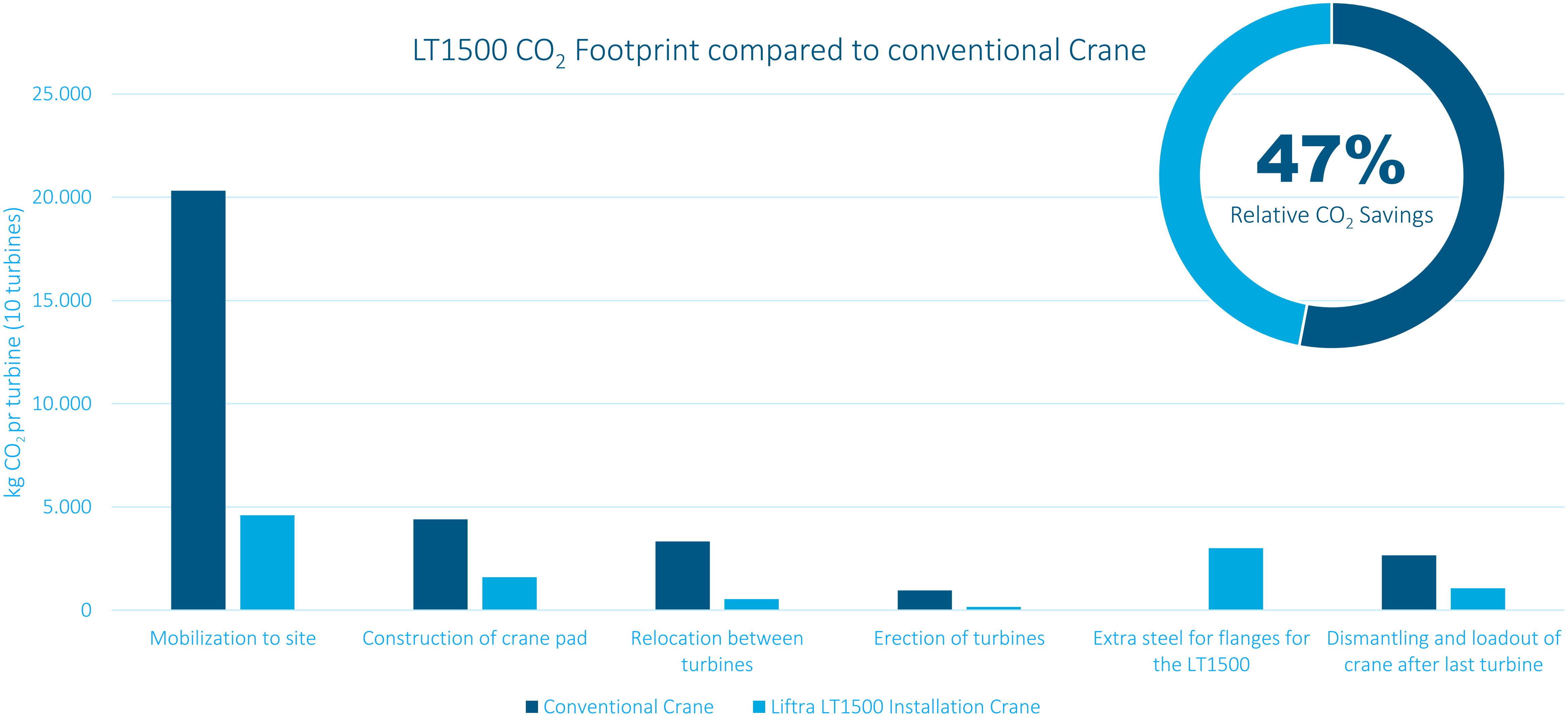
CO_2 COMPARISON



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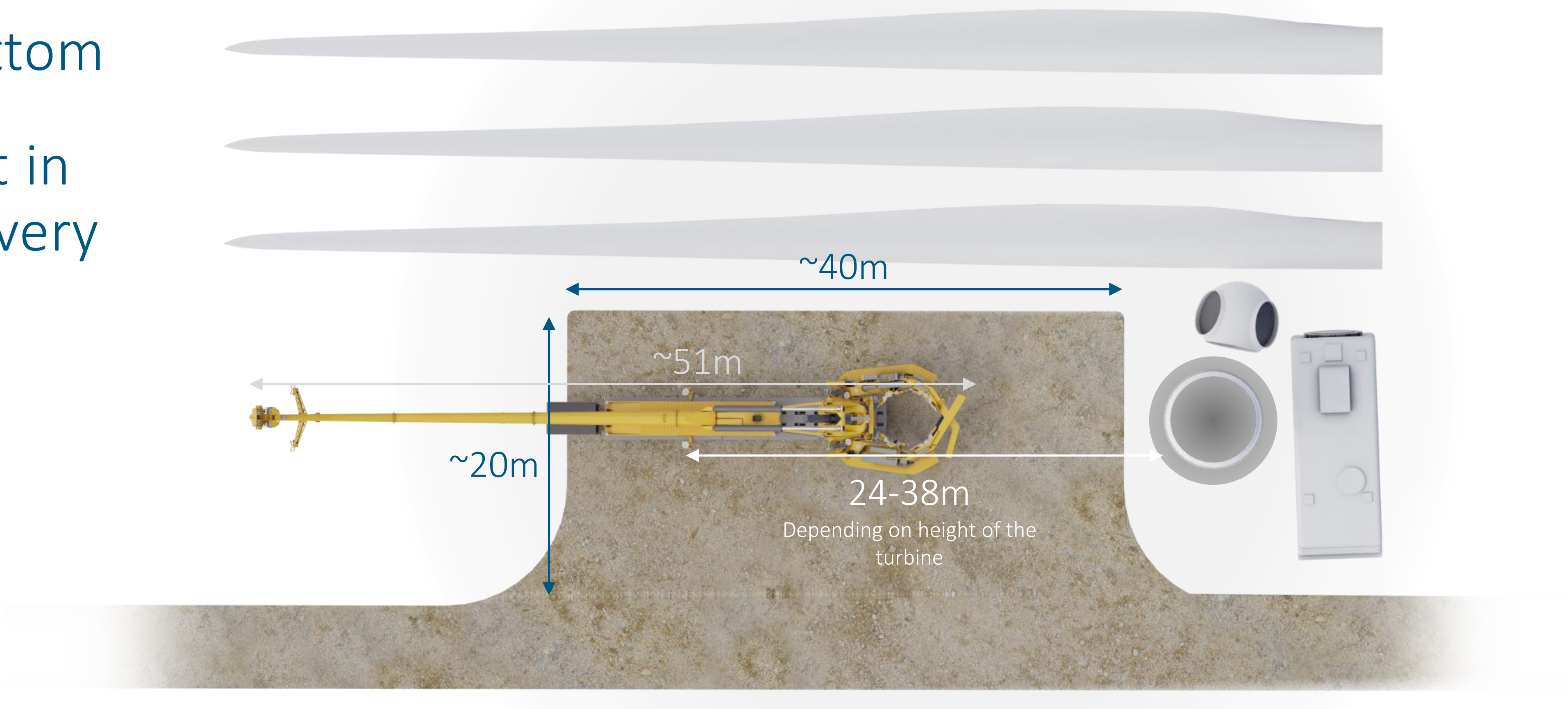
CRANE PAD LAYOUT

- Based upon preinstalled bottom
- Based upon just in time tower delivery



CONVENTIONAL CRANE PAD COMPARISON

Required crane pad area:	
Liftra LT1500: 900m²	**Conventional solutions:** >1800m²

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PREPARATION – FIRST TURBINE ON SITE

- Prepare all Crane components down-tower.
  - Prepare the SPMT
  - Position the Crane Station on the SPMT
  - Assemble the crane on the SPMT
  - Attach the wire to the Crane
  - After positioning the SPMT, Crane is ready to climb the tower

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ATTACH CRANE TO TOWER

- Lift the Hoist Block to the top flange of the preinstalled tower sections with the assist crane.
- Install the Hoist Block onto the flange.

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ATTACH CRANE TO TOWER

- Start hoisting the Crane by winching in the hoist block.
- Boom is lifted by assist crane

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ATTACH CRANE TO TOWER

- Start hoisting the Crane by winching in the hoist block.
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ATTACH CRANE TO TOWER

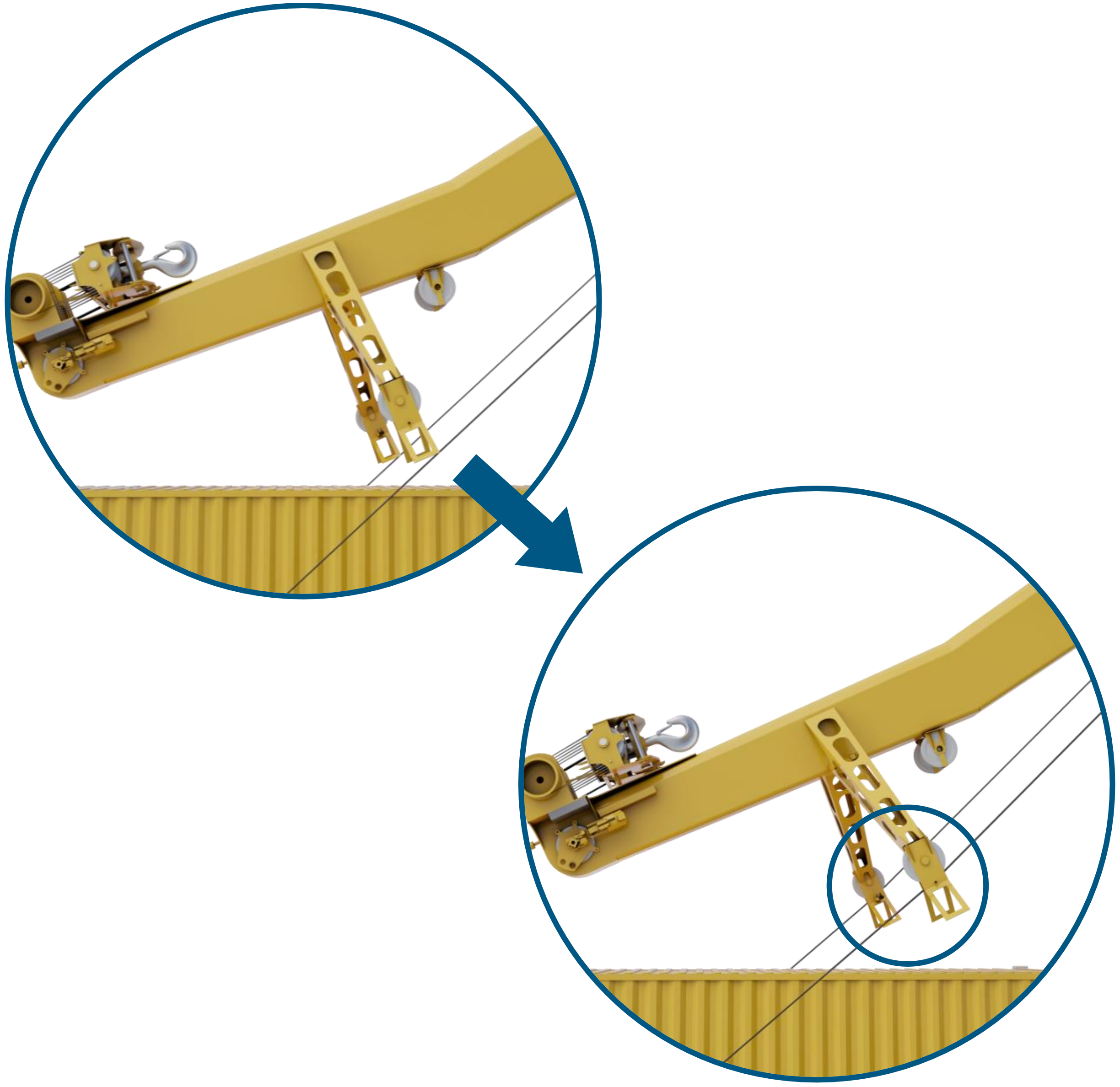
- Claws are opened

ATTACH CRANE TO TOWER

- Crane is hoisted by winching in the hoist block.
- Boom is lifted by assist crane

ATTACH CRANE TO TOWER

- Boom Koala locks onto the outer wire
- Crane is kept in position by the boom Koalas at the outer wire and by the wire crawlers on the side of the crane body



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ATTACH CRANE TO TOWER

- Crane is lifted to the top flange of the preinstalled tower sections by winching in.
- Lock the crane to the tower by clamping onto the flange with the claws.

INSTALLATION

- Boom up the Crane to lifting position.

INSTALLATION

- Upend Tower section with assist crane.

INSTALLATION

- Lift the tower section to correct position.
- Tower section is lowered down and connected to the pre-installed tower sections.
- Max parameters for Tower installation:
  - Maximum lifting height : 42.000[mm]
  - Maximum diameter for Top flange: Ø6.500[mm]
  - Maximum Weight: 120.000[kg] including lifting equipment

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INSTALLATION

- Upend and install the next tower sections in the same manner.

CLIMBING TO NEXT POSITION

- Release the Hoist Block from the tower flange.

CLIMBING TO NEXT POSITION

- Lift the Hoist Block to the Outside flange of the top section.
- Install the Hoist Block onto the flange.

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CLIMBING TO NEXT POSITION

- Winch in until the hook block is in parking position at the crane jib.
- Bring the Boom in climbing position by using the raise cylinders on the slewing platform, combined with the cylinders on the boom.

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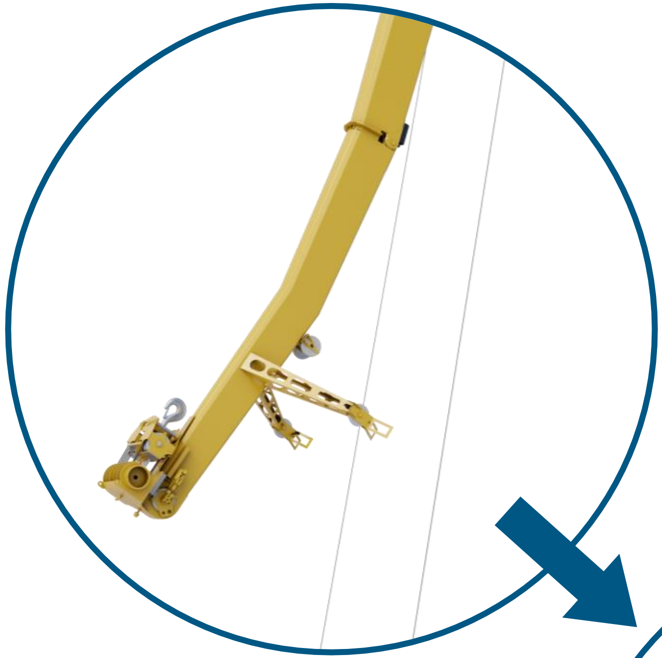
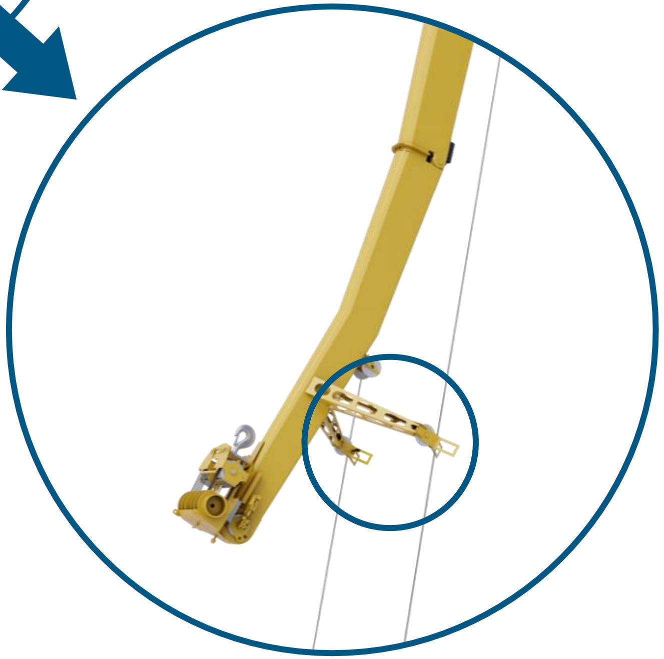
CLIMBING TO NEXT POSITION

- Make contact between the boom koalas and the outer crane wire.
- Lock the boom koalas to the wires.



THE BOOM KOALA DESIGN IS BASED ON THE LSHC SYSTEMS.



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CLIMBING TO NEXT POSITION

- Release the crane from the tower flange.

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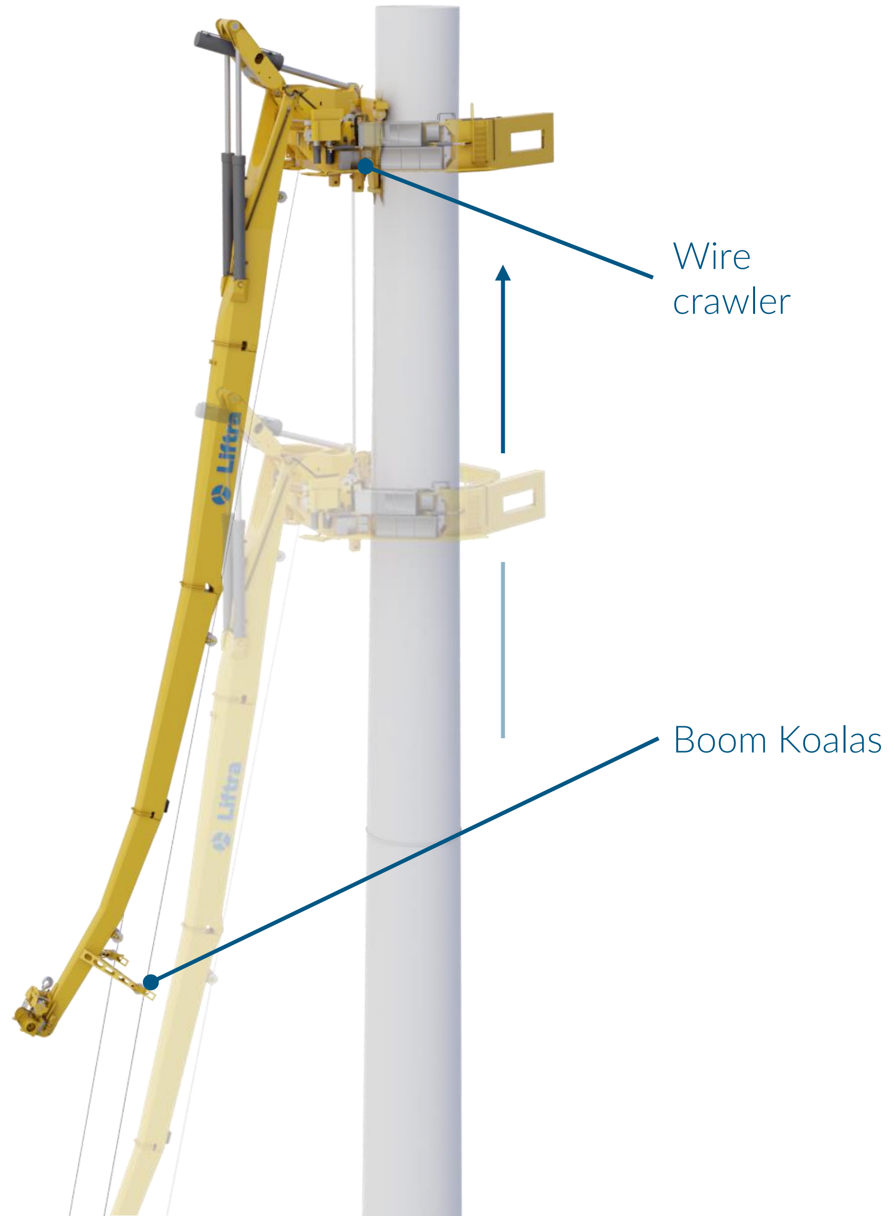
CLIMBING TO NEXT POSITION

- Lift the crane using the Hoist Block by winching in.
- The crane is supported on the outer wires by the boom koalas and at the wire crawlers at the crane body.
- Adjust the crane angle and position using the boom cylinders and the winches.



CLIMBING TO NEXT POSITION

- Lock the crane to the tower by clamping onto the flange with the claws.

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CLIMBING TO NEXT POSITION

- Disconnect the boom koalas from the outer wires.
- Boom the crane arm up, release the hook.
- The crane is ready to install up tower components.

NACELLE INSTALLATION

- Nacelle, drivetrain and hub are installed one by one from the top flange position.
- Blades will be installed from same position

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BLADE INSTALLATION (HORIZONTAL) ONSHORE (COG 24M)

Yaw nacelle to correct position.

Mount first blade.

Mount first blade.

Rotor is turned 120 deg CCW or CW with turning tool while hook is lowered for next blade.

Second blade is installed.

Rotor is turned once more.

Third blade is installed.

Installation is complete.

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BLADE INSTALLATION (VERTICAL)

OFF/ONSHORE WITH THE BLADE SKYLARK

Yaw hub to correct position.

First blade is mounted vertically.

Rotor is turned 120 deg either CW or CCW.

Rotor is turned 120 deg either CW or CCW.

Second blade is installed, and rotor is turned again.

Last blade is installed.

RELOCATION OF THE CRANE

- Boom crane down to claiming position
- Connect boom koalas on the outer wires
- Release crane from tower

RELOCATION OF THE CRANE

- Crane is lowered down

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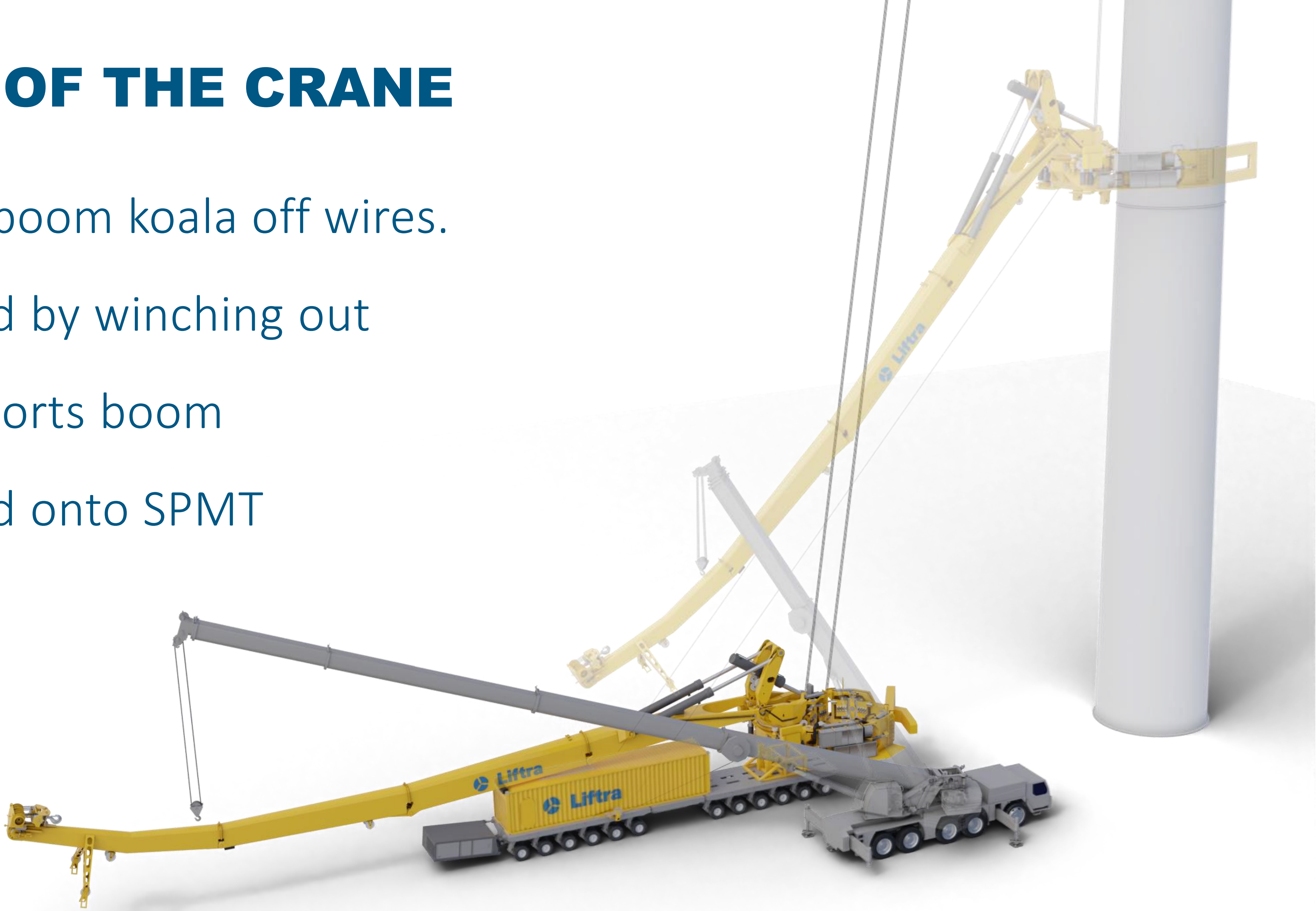
RELOCATION OF THE CRANE

- Assist crane lifts boom koala off wires.
- LT1500 is lowered by winching out
- Assist crane supports boom
- LT1500 is lowered onto SPMT



RELOCATION OF THE CRANE

- Hoist block is lowered down by internal crane and parked on Crane

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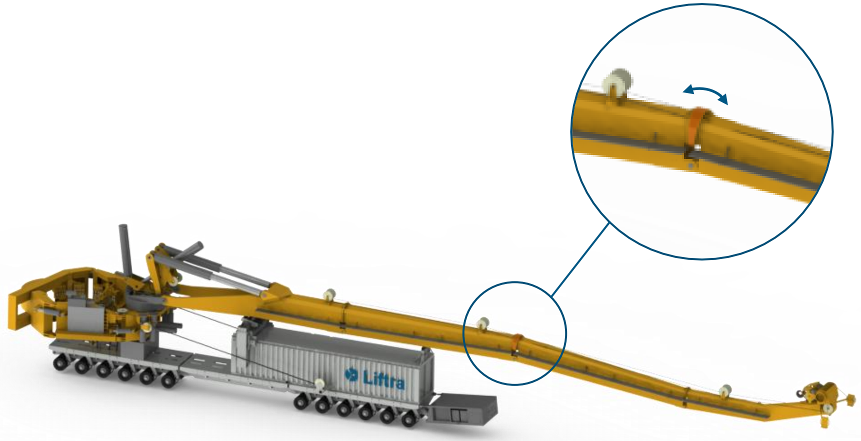
RELOCATION OF THE CRANE

- Crane is ready to relocate
  - No need for disassembly

RELOCATION OF THE CRANE

DIFFERENT POSSIBILITIES FOR RELOCATION:

Full system on SPMT



Full system on SPMT w. height adjusted boom

Boom on external trailer

On 40ft flats for offshore transport

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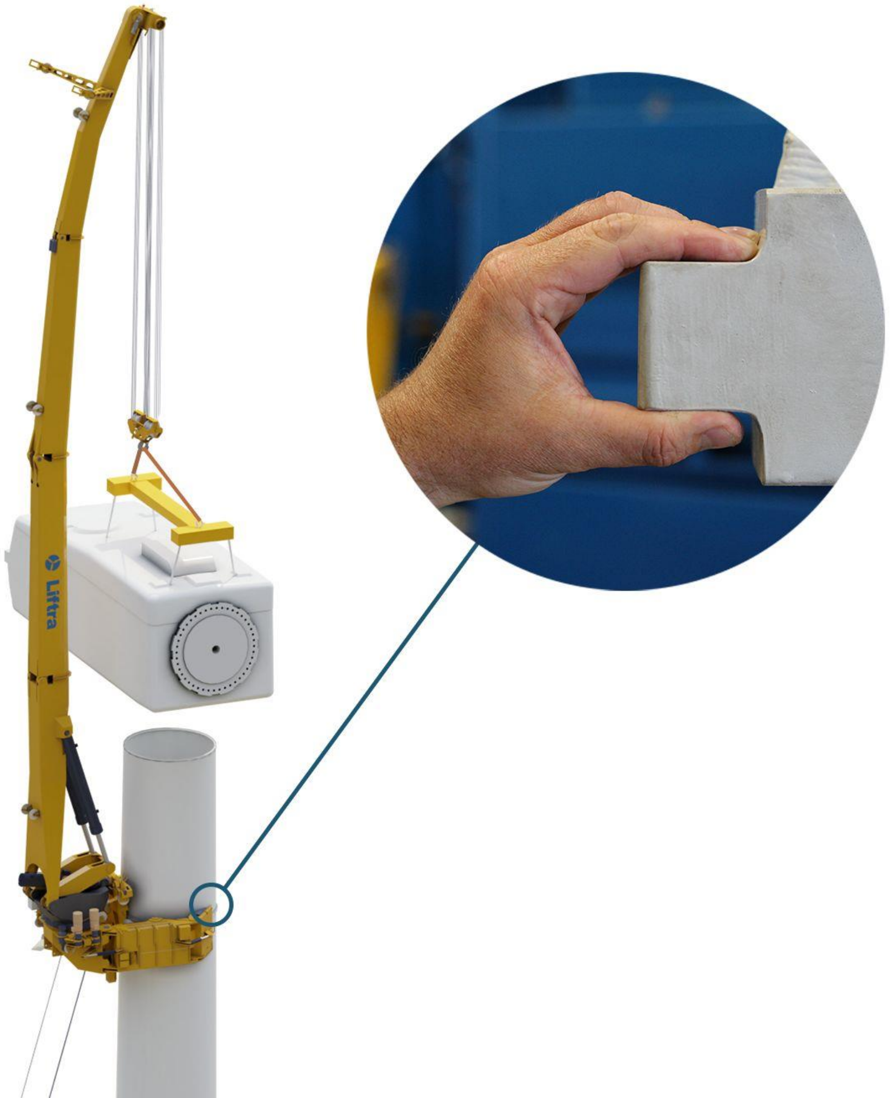
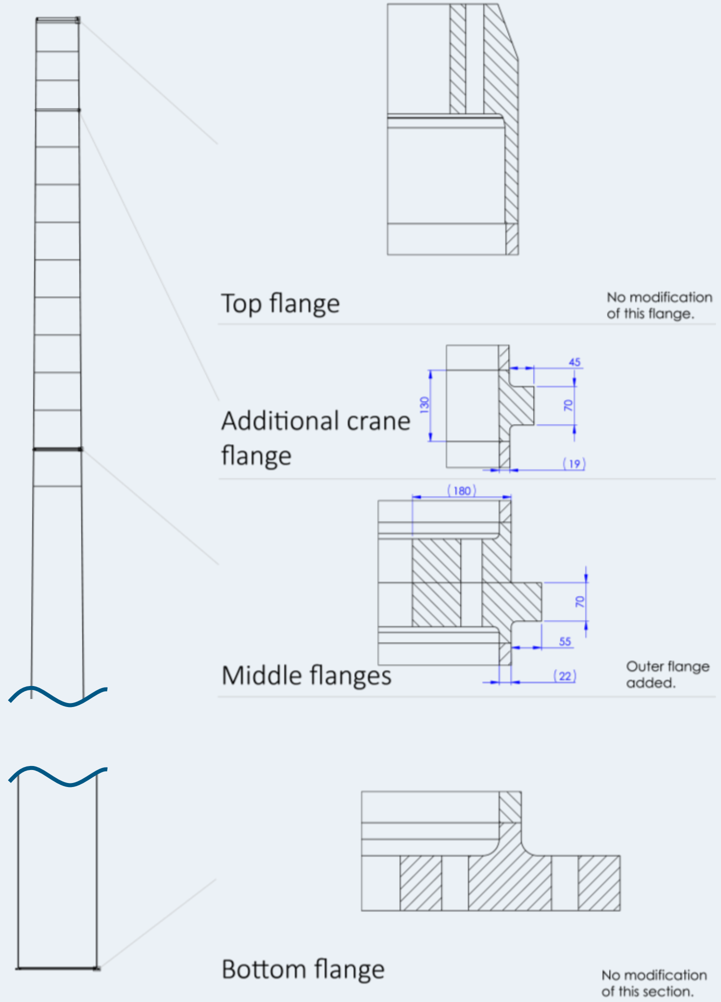
TOWER MODIFICATIONS

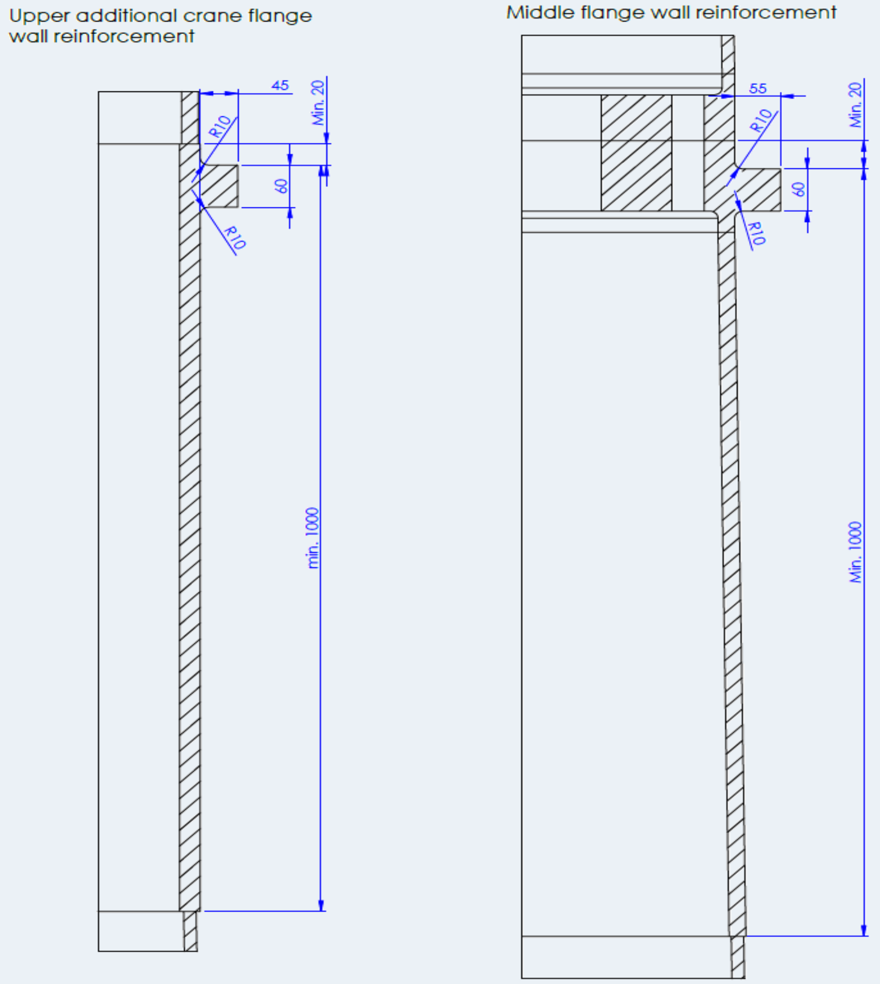
- Required modifications
  - Modified flanges
  - Additional top flange
  - Reinforced wall thickness 1 m from flange



T-FLANGE DESIGN



APPROPRIATE WALL REINFORCEMENT LENGTH: 1M



WALL THICKNESS: ~30 MM

~20 MM

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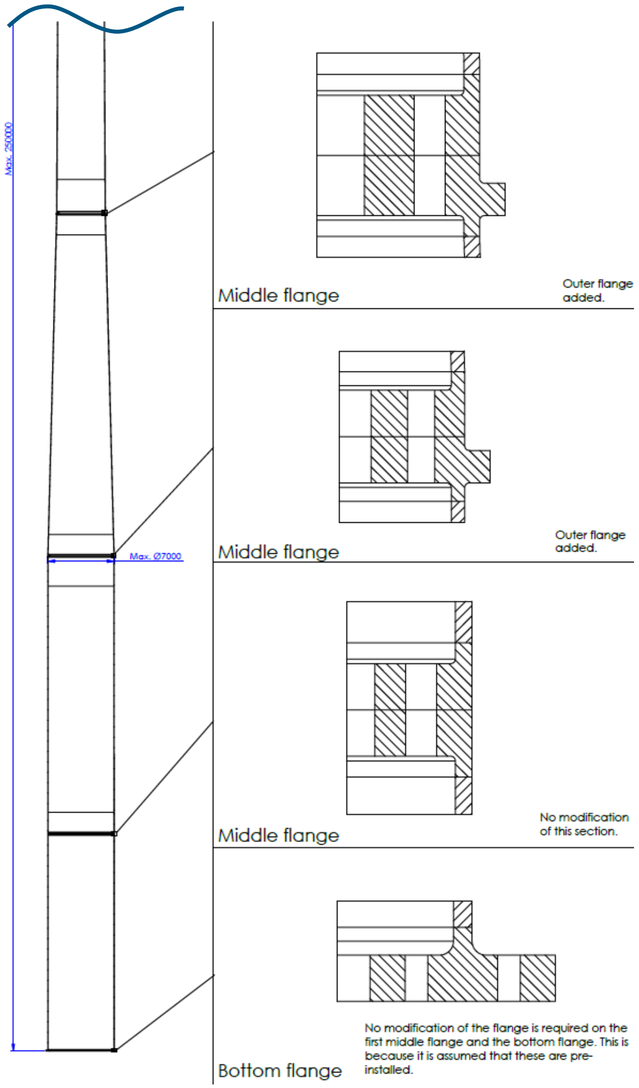
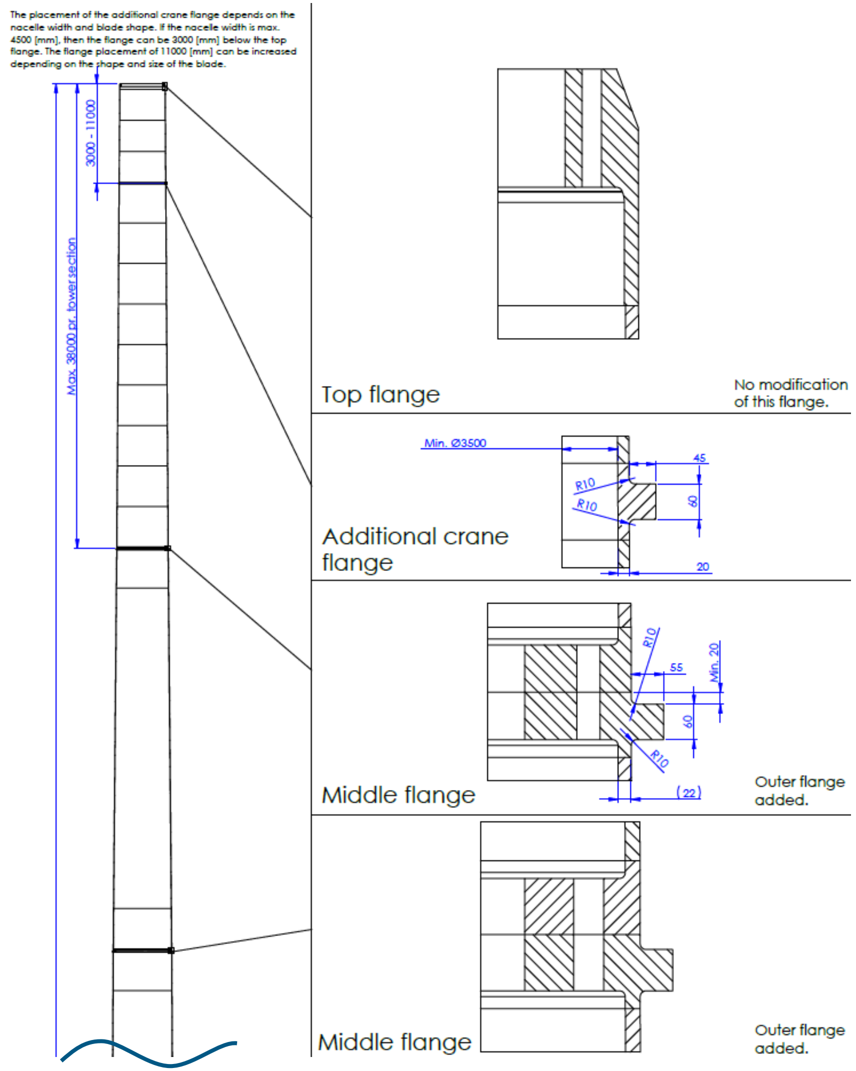
TOWER CRANE INTERFACE

T-FLANGE DESIGN

- Design is a suggestion from Liftra.
- Modular claw concept -> Multiple interface designs possible.
- Suggestions from the tower designers on design and production would be beneficial to optimize the solution.
- Final design and strength verification is to be performed by the turbine tower designer with supplied loads from Liftra.
- It is also possible for Liftra to assist with the detailed strength analysis, which the tower designer will then have to review and approve.



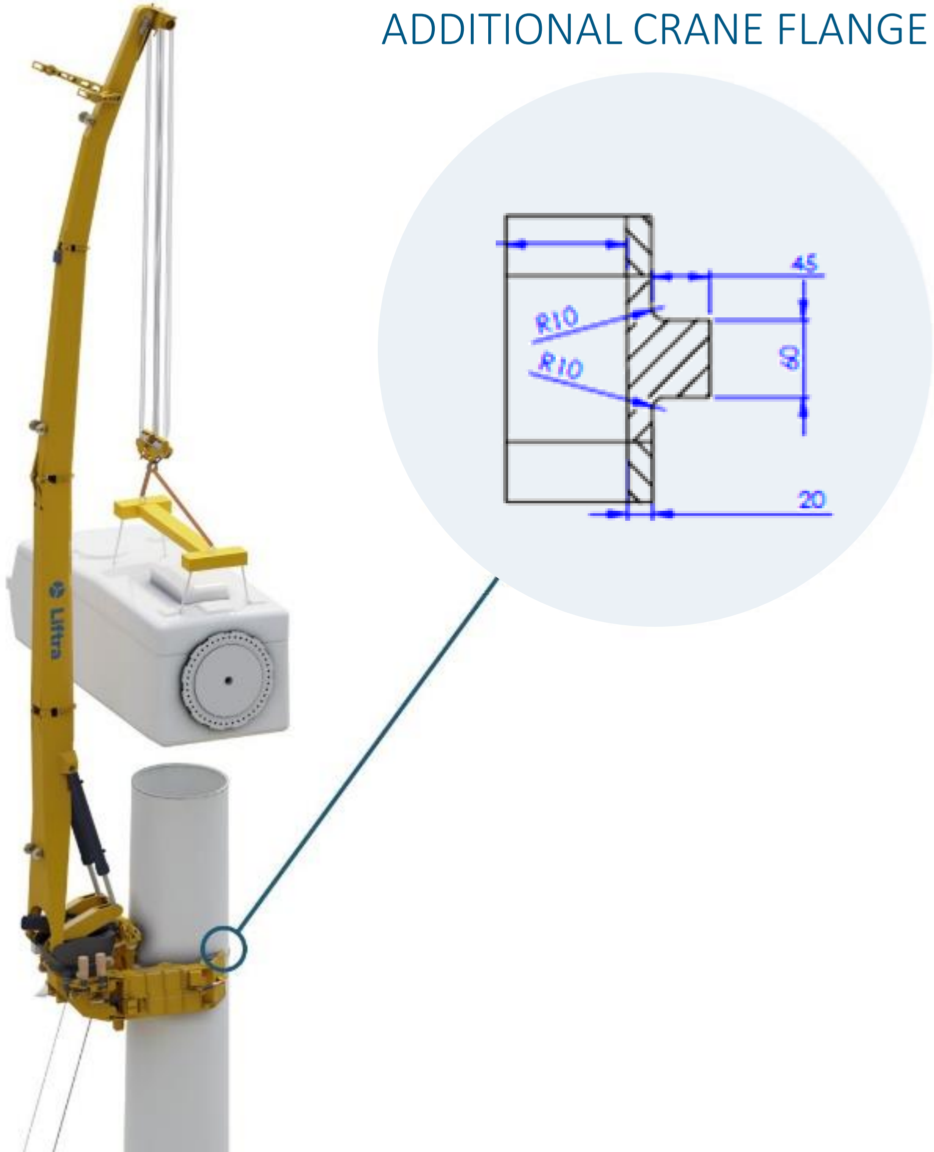


TOWER CRANE INTERFACE

- The crane will be positioned on the additional crane flange during installation of the nacelle, drivetrain, hub and blades. The flange could be produced by rolling and machining of a 65 mm plate. The flange is then welded into the section as per normal procedure.

- The crane will be positioned on the outer flange on the middle flanges during tower section installation.

ADDITIONAL CRANE FLANGE



TOWER CRANE INTERFACE

- In some cases, it might be required to reinforce the tower wall in addition to adding an outer flange. This will usually only be the case for the upper additional crane flange, as the governing load case is blade installation.

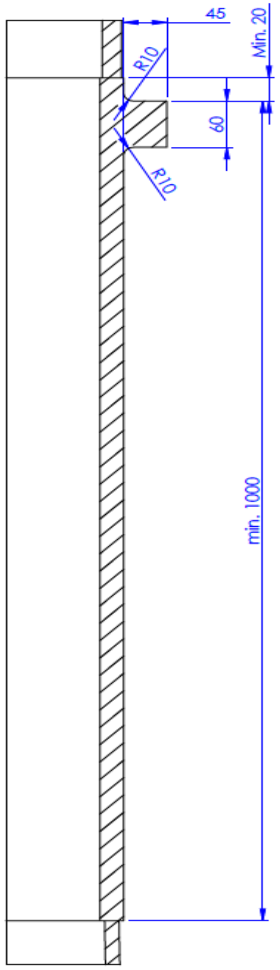
- The reinforcement is an added wall thickness below the outer flange, as illustrated in the figure below. The thickness of the reinforced wall depends on the load case and material used. A wall thickness of 20 [mm] will usually be sufficient for the following case:

  - The governing load case is the one described above with the defined maximum values.
  - The tower shell/wall material is minimum S355J0 EN 10025-2.
  - The tower flange material is minimum S355NL EN10025-3.

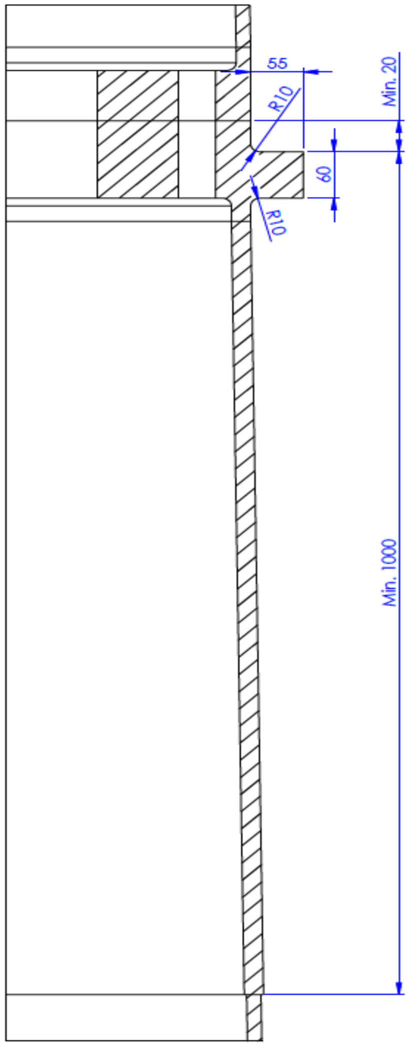
Load case parameters:

- WLL: 45.000 [kg], which is a 30.000 [kg] blade and 15.000 [kg] yoke with rigging.
- Blade COG position from the root: 27 [m]
- Resulting crane reach: 23 [m]
- Other loads considered:
  - Wind loads on the blade and crane arm with gust winds of 18 [m/s].
  - Crane arm and crane body own weight, which both act unfavorably in the load case.
  - Wire loads from the wires going to the winch on the ground.
  - Top mass onto the tower section, which is nacelle, drivetrain and hub weight.
    - This top mass is applied directly to the tower geometry.

Upper additional crane flange wall reinforcement



Middle flange wall reinforcement



FEATURES OF THE LT1500

- 50.000+ engineering hours spent
- Clamping technology tested in real size and full load case.
- No electrical wires – battery charged by transfer of mechanical energy
- No contact with tower – only flanges

CRANE DESIGN

- SPMT is not part of the crane
- Color and logos are Buyer's choice

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