

## **The detailed shell/double filigree walls transport instruction.**

### **BASIC INFORMATION**

Shell/double filigree walls are manufactured according to individual technical documentation provided by the customer or the documentation prepared by the manufacturer. These elements play the role of lost formwork for the wall made on site. The dimensions and weight of each element are stated in the individual technical documentation. For the purpose of the right selection of lifting equipment, it is recommended to assume the weight margin of the elements 10 to 15% higher than that indicated in the documentation.

### **TRANSPORT**

Prior to loading, the individual elements have its own transport strength. Transport takes place on standard or specialised trailers. The elements are placed in racks on even and cleaned platforms in a vertical position. In such orientation, the wall elements are always parallel to the direction of travel.

### **PLACE OF UNLOADING THE ELEMENTS**

The trailer should be placed on a stable and level ground, within the range of optimal operation of lifting devices. Unloading should be proceeded without the necessity of avoiding obstacles. All bystanders and other materials must be removed from the unloading zone in order to minimise the risk of an accident or significant material damage.

### **PRELIMINARY PROCEEDINGS PRIOR TO UNLOADING**

Prior to unloading, check that the delivery complies with the delivery note and the agreed assembly plan. The delivered elements should be assessed for the purpose of transport damage. All damage and deviations should be recorded in the transport document and send back to the manufacturer along with the photo on the delivery day. In the event of any damage that may affect the unloading safety, the manufacturer should be consulted.

Particular attention should be paid to any cracks and dents in the area of transport hooks, in window and door lintels, in door sill reinforcements etc.

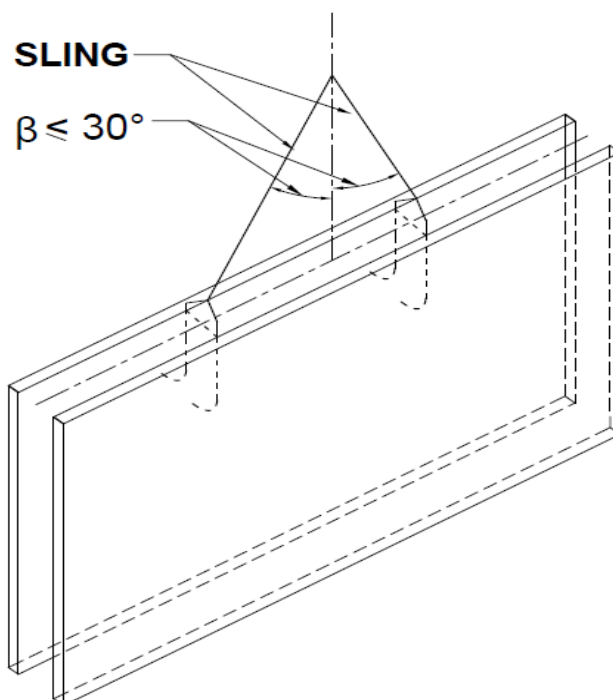
The condition of the reinforcements in the form of steel bars or profiles must be inspected for possible damage. Their cutting or disassembly may only take place after the element has been built in.

Prior to lifting the first element from a given delivery, make sure that the lifting devices and slings are suitable, efficient and properly load-bearing. Good visibility for the crane and radio communication between the crane operator and the hook operator should be ensured.

## UNLOADING

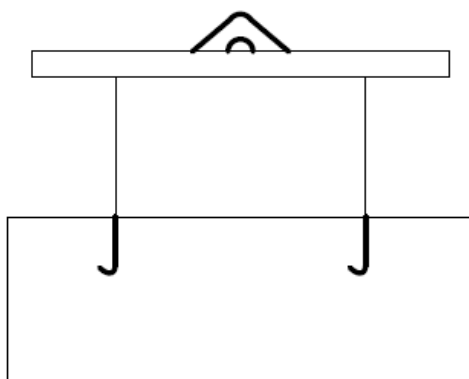
After removing the transport locks, hoisting the elements should be carried out smoothly, without unnecessary jerks and sudden movements, controlling the even tension of all slings.

The element should be attached to the transport handle, indicated in the design documentation.

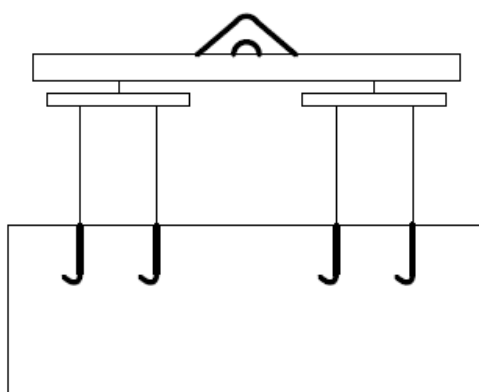


In the case of narrow elements, equipped with two transport hooks, the angle  $\beta$  between the sling and the vertical should be in the range of  $0^\circ - 30^\circ$ .

If it is not possible to obtain the above-mentioned parameters, use the traverse in accordance with the diagram below:

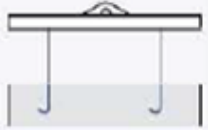
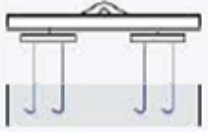
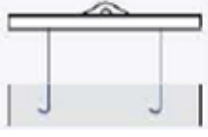
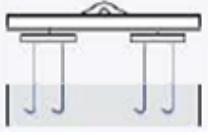

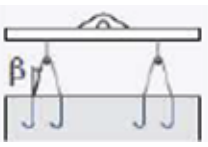
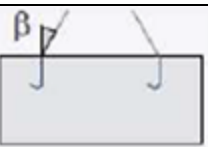
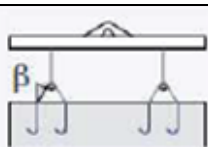


In the case of wide elements, equipped with four transport hooks, a traverse should be used to hoist the element as shown as in the diagram below.



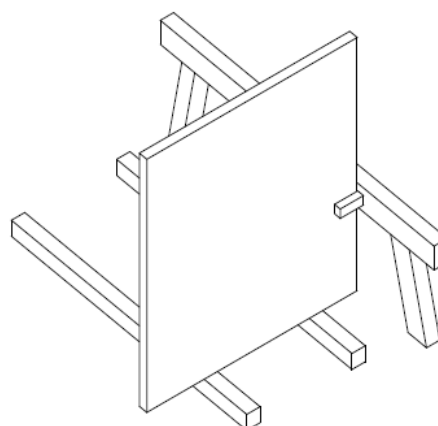
Any changes, modifications of the above-mentioned lifting methods should be consulted with the manufacturer.

The influence of changes in the lifting method of the load capacity of anchors is presented in the table below.

| Load case<br>(mould adhesion not considered)                                             | 2 load bearing anchors<br>(symmetric to centre of gravity)                          |                                         | 4 load bearing anchors<br>(symmetric to centre of gravity with compensation rig) |                                                                                      |                                         |                                         |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------|
|                                                                                          |   | max. element weight                     |                                                                                  |   | max. element weight                     |                                         |
|                                                                                          |                                                                                     | $f_{cc}$ 15<br>N/mm <sup>2</sup><br>[t] | $f_{cc}$ 19<br>N/mm <sup>2</sup><br>[t]                                          |                                                                                      | $f_{cc}$ 15<br>N/mm <sup>2</sup><br>[t] | $f_{cc}$ 19<br>N/mm <sup>2</sup><br>[t] |
| <b>Axial tension</b><br>( $\beta = 0^\circ$ , cross beam required)<br>with tilt-up table |   | 4.15                                    | 4.15                                                                             |   | 8.30                                    | 8.30                                    |
| <b>Diagonal tension</b><br>( $\beta = 15^\circ$ )                                        |  | 4.01                                    | 4.01                                                                             |  | 8.02                                    | 8.02                                    |
| <b>Diagonal tension</b><br>( $\beta = 30^\circ$ )                                        |  | 3.60                                    | 3.60                                                                             |  | 7.20                                    | 7.20                                    |

### SHORT-TERM STORAGE

If possible, avoid temporary storage of elements on the construction site by carrying out assembly directly from the means of transport. If it is necessary to store elements on the construction site, an even and stable storage yard should be prepared. Wall elements can only be stored vertically on levelled and stabilised



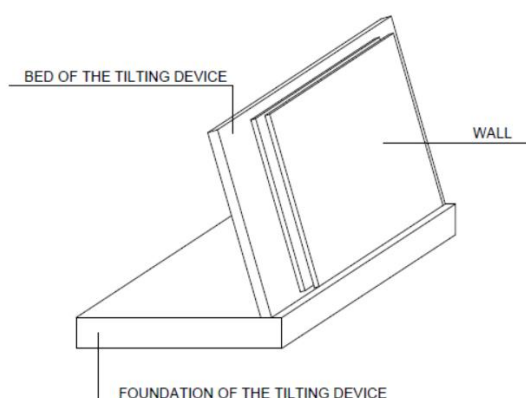
transport stands with their subsequent fastening. The elements should be arranged in accordance with the sequence of their embedding into the building. For the storage of panels at the construction site, you can also use rack stands ensuring the vertical plane of the element, made in a stable manner, in accordance with the drawing above:

### ITEMS ROTATION

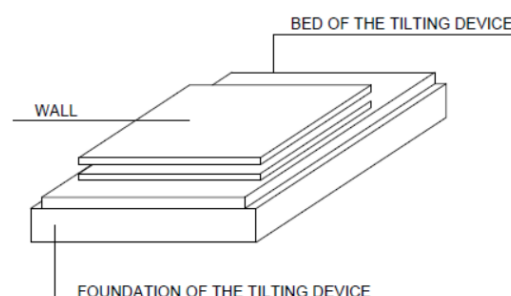
In the case of high walls, usually above 3.10 m, the elements are transported to the construction site in a side position, inconsistent with the installation direction. According to the design documentation, high walls are equipped with an additional set of transport handles. Elements with a height of more than 3.10 m must be turned on site.

The element is best rotated using an automatic turntable, as shown in the figure below:

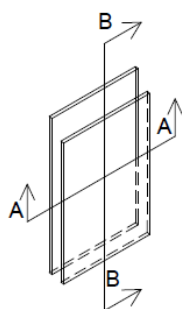
**Side position**



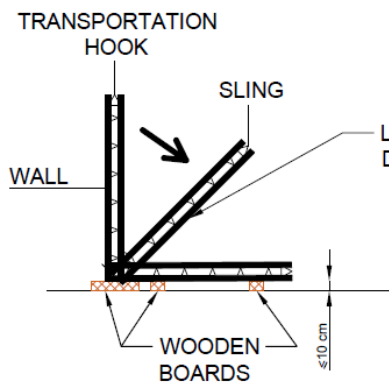
**Horizontal position**



In the absence of a turntable, the wall element should be lifted up and laid down flat with the longer wall down on wooden slats in such a way that the sleepers lie along all trusses. Then place the protective board under the bottom edge of the wall and rotate the element. The element should be rotated smoothly, all the time pulling up by the crane without lowering. The above steps are shown in the figure below:

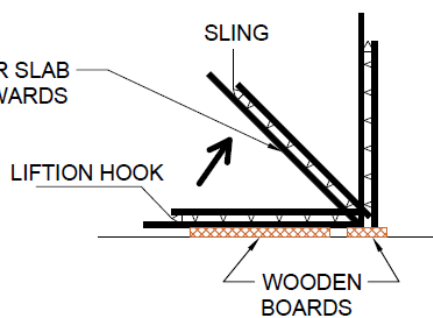


## UNLOADING FROM A TRANSPORT POSITION



SECTION A-A

## LIFTING TO THE BUILT-IN POSITION



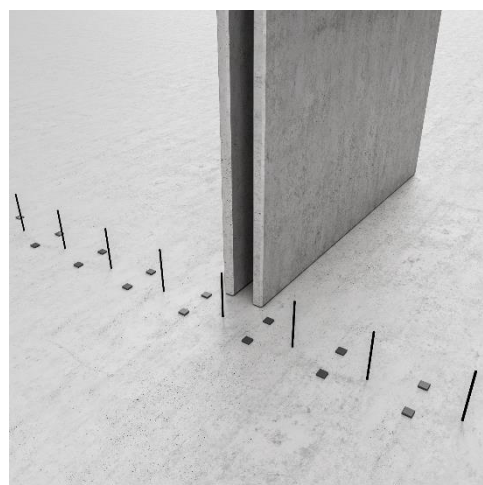
SECTION B-B

## The detailed shell/double filigree walls assembly instruction

### PREPARATORY WORK

The subsoil on which the walls will be placed should be even and clean - the required accuracy is +/- 1 cm. Starting bars should be at least 7 cm from the outer edges of the walls. Before assembly, mark the external contours of the walls on the dedicated surface along with characteristic points such as: doors, culverts and openings, and mark the highest point on the substrate.

Starting from the highest point of the floor, level the wall supporting plane by preparing a combination of plastic spacers of different thicknesses. There should be at least 4 support points per wall (two for each wall layer). It is recommended to use additional pads for walls with holes. The thickness of the pads should be selected in such a way as to maintain the exact surface of the upper and lower elements. The



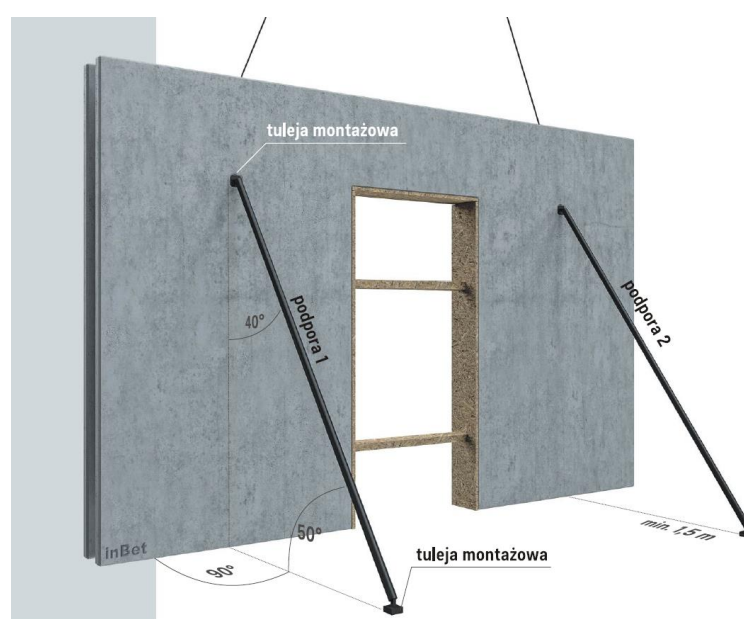
distance between the ground and the lower edge of the prefabricated element should be at least 3.0 cm to allow the concrete poured at the construction site to flow under the bottom of the prefabricated element in order to ensure full cooperation of the prefabricated element with the core concrete. Fix the lower edge formwork to the base, e.g. with guide planks, to prevent concrete leakage.

It should be ensured that there will be no collisions of the prefabricated element with the existing elements of the structure (e.g. reinforcing bars, starters) or construction equipment (health and safety protection, machines, etc.). Assembly should be proceeded in a smooth and uninterrupted manner. Additionally, it should be ensured that after installing a

given element, all further activities will take place without the need to disassemble the given element again (in particular with regard to placing additional reinforcements on the construction site). It is recommended at this stage to check the location and patency of electrical conduits placed in the prefabricated element.

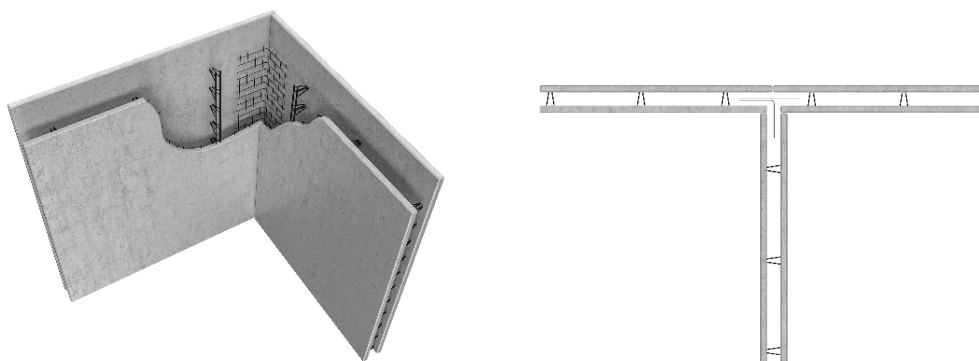
### ADJUSTMENT OF SHELL/DOUBLE FILIGREE WALLS

The wall should be transported to the place of its installation, following the rules described in the detailed shell/double filigree walls assembly instruction. Lower slowly onto the previously prepared pads, and then fix the assembly supports permanently. Level the element on the supports.



Then install the wall joints reinforcement provided in the project, the wall-to-ceiling reinforcement and the lintel reinforcement etc. Secure, using boards, gaps between the walls and between the walls and the substrate, so that no concrete leakage occurs during concreting.





### CONCRETING PROCESS

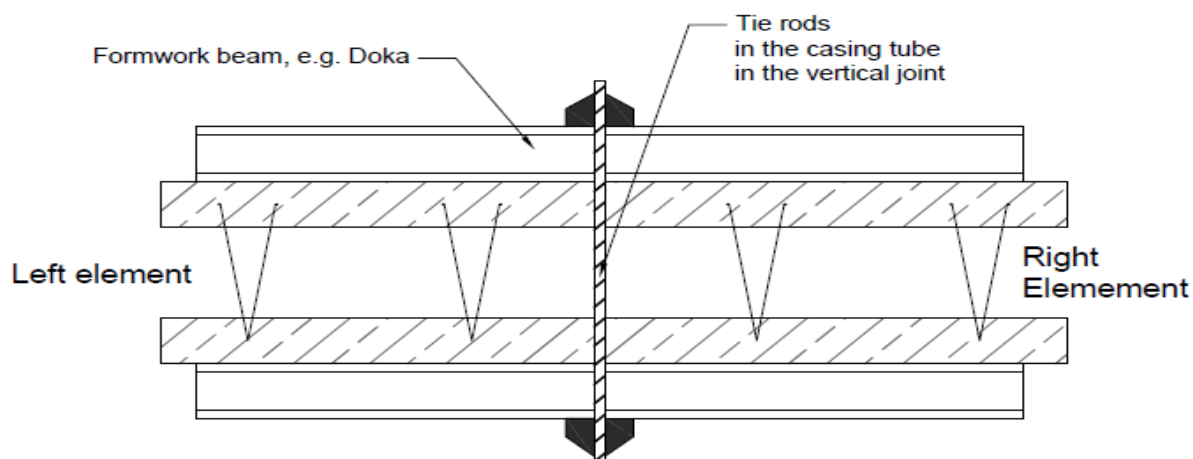
Prior to commencing the concreting proceedings, pre-moisten the inside of the walls and obtain a poker vibrator with dimensions adapted to the height of the walls and the gap between the layers (recommended diameter 35-40 mm).

Concrete slowly and evenly, not allowing the formation of a cone. It is not allowed to pour the mixture into one place and hold the vibrator in order to dissolve the mixture. Concrete in horizontal layers in all walls simultaneously. Vertical joints should not be allowed to form, only in the places of designed working joints. Fill the bottom joint with the same concrete as the inside of the walls.

The maximum concreting speed should be assumed in accordance with the design documentation. In the absence of such data, the concreting speed should not exceed 0.5 m/h. Too high pace of concreting may result in exceeding the permissible values of pressure on the formwork. The consistency of the concrete and the adopted method of thickening the mixture should guarantee tight filling of all joints and spaces between two layers of prefabricated elements. The maximum grain size of the aggregate is 16 mm. The design recommendations regarding the consistency of concrete should be followed.

In case of lack of detailed information, a maximum consistency of F3 should be used. Attention should be paid to the admixtures and additives used in the mixture that may extend the setting time of the concrete and thus increase the pressure of the mixture at a given concreting speed.

For walls with a height of more than 3.10 m, it is recommended to use additional protections on the edges of the elements in the form of formwork ties, according to the diagram below:



After completion of concreting the stage and initial bonding of the concrete, the mounting pads under the walls should be removed.

The dismantling procedure of the assembly supports can commence after the concrete reaches 80% of its final strength.