

IFAS Process



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Cleartec® Biotextil

Application

Cleartec® cage system is constructed to carry and support the biological growth media. Installed in the reactor of an activated sludge plant Cleartec® leads to an increase of performance of the plant. The necessary quantity and the dimensioning of the cage size as well as its positioning will be given by the planner. This guideline explains the constructive demands for an adequate cage design.

Material

Only materials with sufficient resistance against wastewater may be used. Stainless steel is the preferred metallic material; in Germany Type 1.4571 or similar is favoured. Furthermore, wastewater resistant polymers or glass fibre reinforced plastics can be applied.

Dimensioning load

The decisive load on the cage construction occurs in an empty tank with a fully developed biofilm on the textile. The same design load applies also while lifting cages out of the filled basin. The design load for wet Cleartec® Biotextil with biofilm is about 12.5 kg per meter length (with a standard width of one meter). An additional partial safety factor of 1.5 may be considered. The calculated weight has to be absorbed by the supporting poles of the cage construction. If the textile is only fixed at the top and the bottom, the full textile length needs to be taken into account for the load design. If the textiles are equipped with one or more central supporting loops, the load is divided and absorbed by the centre poles accordingly. The supporting poles are to withstand a minimum load of 10 kg (~100 N) in order to only bear the tensioning of Cleartec® Biotextil at installation. This case applies mainly to the lower supporting poles. The calculation of the design load and cage constructions is as follow:

$$q_p \left(\frac{N}{m} \right) = \frac{L_{\text{TEX}} (m)}{(n_{\text{loop}} - 1)} \cdot 12,5 \left(\frac{kg}{m} \right) \cdot 1,5 \cdot 9,81 \left(\frac{m}{s^2} \right)$$

With:

Character	Unit	Meaning
q_p	N/m	Linear load, which effects the supporting poles at the supporting loops
L_{TEX}	m	Total length of the textile elements
n_{loop}	-	Number of supporting loops (2 to 4)

Example of calculation:

Cleartec® Biotextil, Length = 3.8 m with 3 loops

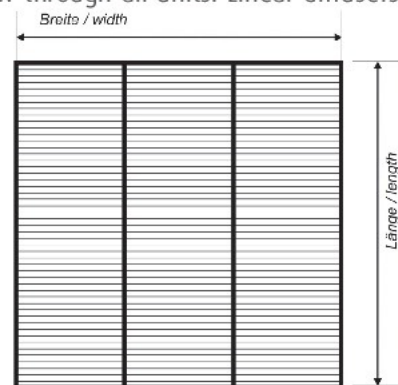
$$q_p = \frac{3,8 \text{ m}}{(3-1)} \cdot 12,5 \left(\frac{kg}{m} \right) \cdot 1,5 \cdot 9,81 \left(\frac{m}{s^2} \right) \approx 350 \left(\frac{N}{m} \right)$$

The upper and central supporting poles have to bear a linear load of around 350 N/m. The lower supporting pole bears an initial load of 100 N/m. Jäger recommends using GRP supporting poles with 25 mm diameter. Those poles withstand a linear load up to 400 N/m which covers most designs.

Dimensioning the footprint

A quadratic footprints of 2 m x 2 m or 3 m x 3 m are common. Depending on aeration tank size other footprints are possible. The following issues should be considered while determine the footprint:

- Weight for the crane: Craning weight needs to be in a typical range for a crane load.
- Geometry of the tank: The footprint of the cages should be chosen in a way that the area of the tank is well covered. Planner's specifications have to be regarded for each case.
- If the cages shall be installed above an existing aeration grid, the positioning of the diffusers and the cages has to ensure sufficient flow through all units. Linear diffusers shall be positioned perpendicular to the textiles. Cleartec Biotextil is arranged successively; the quantity determines the final cage length. The total width of the cage results from the multiple of one textile width.

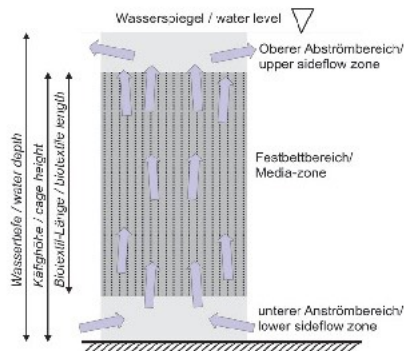


The height of the cage

The water level in the tank influences the necessary textile length which in turn determines the height of the cage. This length is fixed by the planner for each case. Normally the length of the textile is around 80 % of the water depth. Three functional zones can be differed when viewing an installed Cleartec® cage:

1. The lower sideflow zone:

The diffusers are located at the lower sideflow zone. The distance from the diffuser membrane to the lower supporting loops shall be at least 10 % of the water depth. The use of a header pipe results in a diffuser distance up to 400 mm above the tank floor, depending on the type of diffusers. This is a loss of water column which has negative effect on the oxygen transfer. Therefore it is recommended to use flat type diffusers which has the least distance from the bottom.



2. The media zone:

The media zone is the area between lower and upper supporting bar. Within the media zone there is an upstream vertical flow which is caused by the diffusers.

3. The upper sideflow zone:

The upper sideflow zone lies between upper supporting bar and the water level of the tank. In order to enable a spiral flow the distance between the support bar and the water depth shall be 400-500 mm.

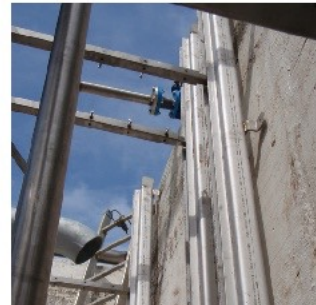
Fixing of the supporting poles

There are different methods to fix the supporting poles. For all constructive solutions it is important to secure the supporting poles against sideways shifting/falling out. It appears that the mounting of the textiles at the construction site is most effective.

Possibilities for repositioning

Repositioning the cages depends on the overall plant conditions. If the cages shall be lifted in and out of the tank during operation, the following methods are recommended:

Guide rails at the tank wall that generally help moving the cages (example Gorizia).



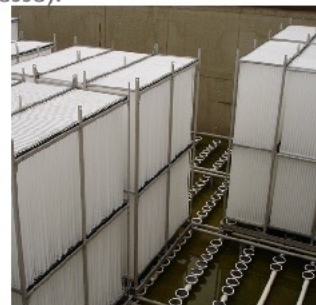
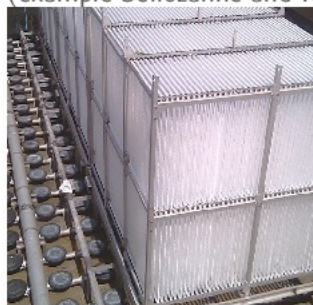
Cross bars at the side walls that support the repositioning of cages in small tanks (example Lahnstein)



If cages aren't close to the side walls they can be repositioned with upright guide rods. The upper edge of the guide rod has to be above the water level or at least visible after lowering the water level (example Komárno).

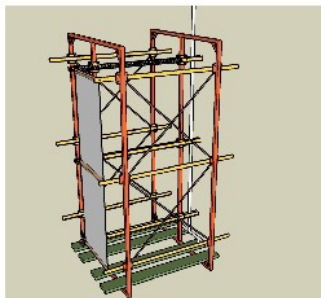


It is easier to lift the cages from an empty tank. Therefore, hold points or retaining rails on the tank floor are required (example Bellozanne and Terrassa).



Integrated diffusers

Alternative to a fix aeration grid it is possible to integrate the diffusers to the supporting frame. Integrated diffusers enable easy maintenance of the same during operation. Different type of diffusers required different ways of connection that needs to be considered in the design. In order to exploit the maximum volume, flat diffusers are recommended. The following figures show some examples:



Summary / specifications for the construction on engineer

The following specifications for the construction of the cages are given by the planner:

1. Heights

- a. H_{TOT} = Total height of cage
- b. L_{TEX} = Length of textile (\triangleq Distance between upper and lower supporting pole)
- c. N = Number of supporting bars
- d. H_U = Lower free space from tank floor to lower supporting pole

2. Footprint

- a. L = Length of the cage
- b. B = Width of the cage (multiple of system width)
- c. N = Equipment of cage (gives distances between textiles; when equipped with 17 pcs/960 mm, the Cleartec® click-bar can be applied)

3. Further information

- a. Material
- b. Cage without diffusers → information about existing aeration grid
- c. Cage with diffusers → information about type, arrangement, fixing
- d. Fixing / repositioning → information about preferred system (guide rails, guide rods or guide cross bars)