

Example of technical specifications for a Vertiss® Plus green wall

The vertical growing method Vertiss can be considered as an exterior wall cladding with living plants. It is an easy system to cover walls with planted EPP modules and a metal structure to be mounted on a loadbearing support like concrete for example. Yet its function is not to assure the stability or the water tightness of the building, which is part of the structural works of the building. The green wall should be made out of Vertiss modules with suitable plants, a growing medium specifically developed for vertical growing and a professionally dimensioned automatic irrigation system.

The green wall is to be built by mounting modules made of high density expanded polypropylene (HD-EPP). The modules can be cut to size (if possible) to achieve a maximum layout design.

The successful bidding company for this work will need to include in its offer: the supply and the installation of the growing method, the dimension studies if necessary (metal frame, free-standing metal structure if included in the project (metalwork), the irrigation system and the horticultural lighting system if needed), finishing elements (water recovery, lateral frame, ...) and the necessary maintenance for at least one year. Extending the maintenance contract beyond the first year is highly recommended, please revert to the corresponding section.

Type: Vertiss® Plus from Novintiss® or equivalent.

PLANTING MODULE (LANDSCAPE WORK):

Size of the modules: 760*590*190 mm.

Mass at PAWC*: 46.66 kg, i.e. 93.3 kg/m² (module + saturated substrate + plants).

The planting modules should be composed of preformed plant containers with an angle of inclination of -35° along its horizontal axis X that respects the plants' natural phototropism, facilitating planting and possible replacements. Each module will need to have 16 plant containers to ensure a plant density of 32 plants/m² and its geometry should limit compaction of the growing medium. The back side of the module should be watertight to limit water loss of the growing medium in the ventilated air gap. The opening of the plant containers should be 115 x 70 mm to enable potted plants or plants with a diameter of 8/9 cm to be planted without having to break up the root ball. The modules should have an exchange surface of max 15% compared to the total surface and be made of HD-EPP to ensure that the root system is well insulated against extreme winter and summer temperatures. They should be 100 % modular to allow for any maintenance behind the green wall. The modules should have a drainage hole to evacuate possible excessive irrigation water.

UV resistance: 0.7 mm surface material deteriorated after 3 years of direct UV exposure. (Testing based on French standard NF T51-165.)

Frost resistance: 50 % and 1.5 MPa strain at -30 °C based on ISO 844 and DIN 53 421.

Resistance to nitrates: shows very good resistance after prolonged nitric acid immersion diluted at 10 % (H+NO3-: strong oxidant).

*PAWC stands for Plant Available Water Capacity.

METALLIC STRUCTURE (METALWORK):

Design calculations should be used to determine the size of the metal frame's various structural components and of the anchoring devices for the loadbearing or free-standing structure (such as Hilti, Split or equivalent). The anchoring system should be appropriate for the type of structure (concrete, breeze block, etc.). The steel frame for supporting the planting modules (secondary structure) should be composed of individual elements joined together by bolts when they are mounted on site. The frame will be composed of U shape vertical rails mounted on the structure or bolted to a free-standing structure (primary structure). Tray/support components housing the modules will be mounted horizontally between and in the vertical rails. The modules will be held pressed against the rails with side clips bolted into the rails. The types of metal used for the frame should be decided based on the atmosphere in which the green wall will be installed (unpolluted rural atmosphere E11, normal urban atmosphere E12, seaside E16, mixed atmosphere E17, etc.). There should be a ventilated air gap of at least 20 mm between the back of the module and the loadbearing structure.

The total load (permanent load and operational load) of the green wall will be borne by the building's primary structure or by a free-standing structure (on the basis of design calculations). Finishing elements should be fixed to the sides and upper sections in colours chosen by the contractor.

SPECIAL OPTIONS (CLADDING/WATER TIGHTNESS WORK):

A drip guttering or tray should be installed in the lower section of the green wall to catch and drain any excess water. An anti-rodent grid should be installed at the lower, ventilated part of the green wall as well as a cover in the upper ventilated part.

PLANTING (LANDSCAPE WORK):

The plants will be planted by hand in the rigid preformed containers with a maximum density of 32 plants/m², above which there will be competition between the plants. The plants should be in 9 cm pots maximum so as not to break up the root balls when they are placed in the containers. The choice of green wall should be based on the environment's limiting factors (light, temperature, plant requirements, etc.) in agreement with the contractor.

During planting process, the growing medium should be added as the plants are placed and cover totally the root ball to ensure that the roots benefit from irrigation.

SPECIFIC GROWING MEDIUM FOR GREEN WALLS (LANDSCAPE WORK):

The growing medium should be specifically designed for use in a vertical position to limit constraints such as compaction, water retention, weight, drainage, etc.

It should have the following properties:

- Dry density: 0.633
- Density at PAWC: 1.11
- Amount of water held at pF1: 490 ml/l
- Amount of water held at pF2: 314 ml/l
- Permeability: 0.08 cm/s
- Air content at pF1: 451 ml/l
- PH value: 5.5 to 6.2
- Amount of organic matter (% of mass: 4 %)
- Water-holding capacity: 40 % to 50 % (% of the volume)

It should have a volume of 62 l/m² to ensure sufficient volume for the root system. Its composition will be organic-mineral (30 % and 70 %) and strictly composed of pozzolan, crushed clay balls, peat and water-retention agents (cross-linked polymers). Fertilising the substrate must be carried out either by 'fertigation', using an automated watering system (strongly recommended) or using a slow release fertiliser (such as Osmocote or equivalent).

The substrate should be placed as required in the modules as the plants are planted. The substrate should be fully in contact with the clods to ensure that the roots are provided with water.

WATERING SYSTEM OR FERTIGATION (LANDSCAPE & PLUMBING WORK):

Irrigation with or without fertilisation has to be done with an automatic dripper system in accordance to the professional automatic irrigation rules set forth by the corresponding national union or equivalent.

The irrigation should be dimensioned in accordance to the set-up of the green wall (height, sun orientation, and type of plants ...) and also the dynamic flow and pressure of the construction site and the installation of the watering system should be carried out accordingly by the company in charge of this part to ensure a good functioning of the watering system. The water available at site should be analysed to determine its chemical properties.

The watering system will be divided in two networks.

Primary network made out of all parts before the electro valves:

- Water meter
- Manual valve
- Backflow preventer
- Flow sensor
- Adjustable pressure controller made out of brass with manometer
- 100 and 130 μ filter
- By-pass dosing pump
- Tank for liquid fertiliser
- Check valve
- Pressure surge prevention valve
- Overpressure station if necessary
- 24V master electro valve
- Manual shut-off air valve
- 24 V Electro valves network
- 24 V programmer
- Miscellaneous: connectors, PE or PVC hoses, centralised controlling, water softener, raising pump, water reserve

A technical room or cupboard should be provided.

Secondary network made out of all parts behind the electro valves to ensure a micro irrigation with self-regulating drippers.

Every network should contain:

- 130 μ filter
- Adjustable pressure controller made out of brass with manometer
- Flow controller in case of remote control
- 2l/h dripper self-regulating and anti-syphon on 16 mm 4 bar micro irrigation PE hose, short distance of 131 mm and long distance 204 mm
- Air valve
- Drain valve
- Miscellaneous: connectors, 25 mm 10 bars PE hoses or rods (if necessary even bigger) for the vertical irrigation line ...

Every module will be watered by minimum 4 self-regulating and anti-syphon drippers 2L/h type Techflow from Netafim or equivalent on 16 mm 4 bars PE hose with a short distance of 131 mm and a long distance of 204 mm.

Pipes should be made out of 10 bar 25 mm PE rods (or bigger if necessary) and the dripper lines out of 16 mm 4 bar micro irrigation PE hoses. The 16 mm hoses should be connected together for an optimised distribution.

An air valve should be installed on the upper part and at each end of the network. A drain valve, easily accessed should be installed in the lower part of the green wall for every network.

The quantity of irrigation networks should be determined according to the available flow and the height and width of the green wall but also sun orientation and type of plants used.

There should be maintenance of the drip lines and a minimum space between the modules to make access to them easy.

Frequency and duration of irrigation to be calculated under consideration of the water loss due to the soil and the plants themselves, there should always be a water reserve. It is recommended to program short but regular watering periods.

For a need of 3 mm irrigation per day for example, there will be 2 irrigations of 5 min, ie 10 minutes per day. This has to be adapted according to the season and the vegetative stage.

Irrigation has always to be adapted/dimensioned to the green wall as a whole.

There should be a water recovery device (gutter or equivalent ...) below the first row of modules in case of excessive watering made out of aluminium or stainless steel. A water discharge device should be installed below the water recovery device.

Dimensioning and installation of the watering system should be done by a professional.

MAINTENANCE (LANDSCAPE WORK):

The necessary maintenance should be included for at least one year and should include:

- The control of the irrigation system : pressure and debit check, cleaning of the filter, purging of electro valves, check of electrical connections, adjustments in programming the frequency and duration of irrigation, checking of the programmer, fertilisation There should be around 15 controls per year
- The control of the plants: pruning before and after winter period, possible replacement of plants in spring or autumn, phytosanitary treatment if necessary. There should be 3 controls per year.
- The control of the metal frame/structure together with the anchoring devices at least once a year.

It is highly recommended to offer a maintenance contract also after the first year to ensure a long lasting living wall.