AZbox Noir

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**Specialised Group No. 17: Networks and Purification**

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*In case of doubt or dispute, the French version only is valid.*
On 19 October 2017, Specialised Group no.17 examined the request relating to the AZbox Noir system submitted by the NIDAPLAST organisation. This Group issued the following Technical Appraisal concerning these components. This document, to which the Technical File drawn up by the applicant is appended, transcribes the Appraisal formulated by Specialised Group No.17 on the product and the provisions for installation proposed for its use in the target area of use and under the conditions of European France and its overseas départements, régions and authorities (départements, régions et collectivités d’Outre-mer - DROM-COM).

1. Brief definition

1.1 Brief description

The AZbox Noir system for storage and infiltration of rainwater is made from polypropylene modules with a stack structure, and of various elements assembled on site.

The AZbox Noir module comprises two half-modules, each made up of a plate pre-mounted on four corner supports.

The space between the corner supports allows operating equipment to pass through and a water diffusion drain to be installed in the structure.

The modules may be placed side-by-side or stacked in order to form a reservoir for the purpose of receiving rainwater.

Various accessories made of polypropylene are used to make hydraulic connections, for tank ventilation, for blanking off the front faces and the plates on the upper layer of the tank.

The principal characteristics of the AZbox Noir modules are as follows:

- Colours: plates: black, corner supports: black, connectors and covers: yellow,
- Length: 1200 mm,
- Width: 600 mm,
- Height: 660 mm (after insertion).

1.2 Identification

In accordance with the reference system for QB marking each module element bears the following statements:

- NIDAPLAST,
- The commercial designation AZbox Noir,
- The batch identification,
- The material (PP),
- The date of manufacture (year, month),
- The logo followed by the reference shown on the certificate.

2. APPRAISAL

2.1 Area of use

The AZbox Noir modules are designed to make underground storage structures, under the conditions defined in section 1 and 7 of the Technical File, so as to enable:

- Rainwater to be retained when the structure is covered with a watertight geo-membrane,
- Or infiltration into the supporting ground when the structure is not designed to be watertight.

It should be remembered that:

- AZbox Noir modules must never be located in zones liable to flooding,
- There must be an outlet: overflow and connection to a rainwater evacuation system.

2.2 Assessment of the system

2.2.1 Health and environmental data

The AZBox Noir products have no Environmental Statement (ES), and therefore no particular environmental performance may be claimed for them. The Environmental Statement documents do not fall within the scope of an appraisal of the system’s fitness for use.

2.2.2 Durability – Maintenance

2.2.2.1 Material

Given the nature of the material of construction, the durability of the components is not a particular problem.
2.222 Conditions for access
The conditions for access as defined in the Technical File are satisfactory. Access must be gained using inspection chambers or hatches located upstream and downstream of the structure, or using infiltration wells in the roof of the tank, which allow all stages of the module to be accessed.

2.223 Long-term reliability of the functions
The Ultra Light Cellular Structure cannot be cleaned out fully. Only the diffusion channels or drains can be cleaned more or less completely.

The installation of an upstream treatment device minimizes the frequency of maintenance operations and ensures long-term functional reliability of the storage structure.
Consideration must be given to the characteristics of the rainwater (present of macro-waste, dead leaves etc.) in order to define the access conditions, the percolation channels and the nature of the prior treatment.

The functions that are expected of the structure will be conditional upon compliance with the maintenance requirements.

The inspection hatches or chambers and channels must be inspected, and if necessary, cleared out after heavy rain or accidents, and at a frequency which is appropriate for the site conditions. Maintenance operations are to be appropriate depending on the result of these inspections.

In the case of infiltration structures, compliance with the project design study approach as defined in section 3 of the ULCS guide (nature of the effluents, soil characteristics etc.) and of maintenance conditions are essential to ensure that the infiltration capacity is maintained over time.

On condition that the design rules and maintenance arrangements are complied with, the storage volume of the structure can be considered to be maintained over time.

2.23 Manufacturing and inspection
The manufacture of the various component parts of the AZbox Noir modules is performed using injection moulding.

The book of specifications relating to the material has been submitted to CSTB.

The manufacture of components making up the AZbox Noir modules is subject to internal inspections incorporated in a quality system based on standard NF EN ISO 9001 (2008).

The internal and external inspections as described in the Technical File ensure that acceptably consistent quality is achieved.

This appraisal is formulated taking into consideration the manufacturing checks and inspection methods described in the Technical File drawn up by the Applicant (DTED).

2.24 Installation
The products must be installed in accordance with the indications shown in chapter 7 of the Technical File.

The installation conditions must be rigorously monitored.

Particular attention must be paid to the flatness of the support bed, to the choice of backfill materials and compacting conditions, in particular in the case of an infiltration structure.

The light weight of the modules facilitates their installation.

2.3 Technical Specifications

2.31 Product characteristics
The characteristics of the AZbox Noir modules must be in compliance with those indicated in the Technical File.

2.32 Design - Dimensioning
The elements that must be collated in the context of the prior study are defined in the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management (2011)" and in "Fascicule 70 Titre II".

These in particular include the following elements:
- associated with the physical environment: terrain topography, height of water table, permeability and geo-technical characteristics of the soil.
- associated with urbanisation: re-use of space, presence of buildings, water quality and use, traffic.
- assessment of water variables: catchment area, active surface, volumes and flows based on Technical Memento (Technical Instruction 77/284).

2.33 Manufacturing and inspection
Inspection as described in the Technical File must be implemented by the manufacturer.

2.34 Installation
Compliance with the installation conditions stated in chapter 7 of the Technical File is an essential condition for ensuring correct operation and long working life of tanks formed from AZbox Noir modules.

The same is true for additional requirements specified by the Project manager which are a consequence of the specific conditions of the site of the retention and rainwater infiltration tank.

Conclusions

Overall assessment
The use of the AZbox Noir modules in the accepted area of use is favourably assessed.

Validity
Until 30 November 2020.

For Specialised Group No. 17
The Chairman

3. Additional comments from the Specialised Group

Specialised Group no.17 draws the designer’s attention to:
- the importance of protecting these structures to prevent the introduction of materials which might settle out,
- the constraints associated with cleaning-out operations. In particular, the pressurised water cleaning systems selected must be verified to ensure that they are compatible with the product characteristics.

Rapporteur of Specialised Group no. 17
A. Description

1. Principle

The AZbox Noir retention and infiltration system was designed for the construction of underground storage structures (tanks, valleys or infiltration pits) to ensure optimised management of rainwater run-off and is intended for applications in the field of public works and civil engineering, as well as for individual rainwater treatment.

These products fall into the category of structures that are built as defined in the guide "Ultra Light Cellular Structures (ULCS) for rainwater management" published in December 2011 by IFSTTAR.

They have a stackable structure and the various elements can be handled manually.

AZbox Noir modules can be adapted to meet different site constraints in terms of mechanical strength and water flow depending on the type of operation of the tank.

Structures made from AZbox Noir modules and the various accessories allow the following functions to be carried out:

Service functions:
The service functions performed by structures made from AZbox Noir modules are storage and/or infiltration.

Effluents are retained when the structure is covered with a water-tight geo-membrane.

When the structure is not designed to be water-tight, infiltration into the supporting soil can occur.

Technical functions:
The technical functions carried out by structures made from AZbox Noir modules are as follows:

Collection and release (See figure 7):
Both these functions are carried out using accessory components, comprising inspection hatches, interface components and diffusion channels formed in the space between the corner supports.

The installation of drains between the corner supports allows rainwater to be distributed inside the structure and channels suspended solids, thus facilitating the maintenance of the structure.

In the case of a water-tight structure, the evacuation flow-rate is a function of the fill level of the tank and of the internal diameter of the connection to the evacuation network, or is regulated by means of a suitable device.

Structural:
The structural character of the blocks allows soil to be used at the surface.

Access:
AZbox Noir modules are designed to allow maintenance and to be cleared out with pressurised water at all levels, on condition that access pits at each level are installed.

Access is gained by means of inspection hatches or chambers at the periphery, or by access wells in the upper parts of the tank. (See figure 7).

Furthermore, if diffusion drains are installed, these can be inspected and cleared out using pressurised water between the upstream and downstream inspection hatches to which the drains are collected.

Ventilation:
The structure must allow air pressure to equilibrate during filling and emptying phases.

1.1 The module

A module is made up of 2 half-modules assembled together manually on site. Each half-module is made up of 4 corner supports fixed on an open plate.

Two modules are joined together using a fastening system and are assembled on site.

1.2 Module sub-components

1.2.1 Corner supports (See figure 1)
The corner supports are designed to be easily and permanently assembled together. The assembly of corner support/plates is facilitated by fool-proofing devices which ensure that the completed assembly conforms to requirements. Assembly marks are engraved on the components.

The corner supports have holes in their upper surface to allow filling and emptying to take place. They are black in colour.

1.2.2 Open plates (See figure 2)
The open plates form the base of the structure and are the interface components between each stage of the module. They are supplied pre-fitted with 4 corner supports, thus forming a half-module.

They allow ventilation and inspection wells to be formed by connecting a corrugated tube DN/ID 300 CR8 (type R2 in terms of NF P 16-351, without holes) using an adaptor sleeve which can be obtained from Nidaplast. Cutting on site is facilitated by a template.

1.2.3 Closed plates (See figure 3)
Closed plates are installed at the periphery of the structure. They may be cut in two.

In particular they are used for drain outlets inside the structure, cylindrical road drain DN/ID 300 (type R2 in terms of standard NF P 16-351) or DN/OD 355 (type R1) maximum. Cutting on site is facilitated by a template.

1.2.4 Covers (See figure 5)
Covers are used to close off the open plates of modules in the upper layer of the tank.

1.2.5 Connectors (See figure 4)
Connectors are used to join two modules in a horizontal plane.

1.2.6 Diffusion drain
The diffusion drain allows rainwater to be introduced and to diffuse inside the structure. This drain may be installed between the corner supports of the AZbox Noir modules. The space that is available between the corner supports means that a road drain can be used whose characteristics are as follows:

• complies with standard NF P16-351,
• maximum internal diameter: 355 mm,
• rigidity class CR8,
• minimum capture surface area 50 cm²/m.

The NIDAPLAST organisation can supply the NIDADRAIN DN/ID 300 drain (type R2 in terms of standard NF P 16-351) with a capture surface area greater than 240 cm²/m.
The upper 2/3 of the drain are open, to allow hydraulic continuity at low flows between the upstream and downstream of rainwater storage structures. The drain is connected to the network through an inspection hatch if necessary.

1.27 Upper stages

The upper stages are made by successively adding 4 corner supports onto the open plate of the top layer, then fitting a half-module (open plate pre-fitted with 4 corner supports).

<table>
<thead>
<tr>
<th>Plates and accessories are shown below:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (mm)</td>
</tr>
<tr>
<td>1 module</td>
</tr>
<tr>
<td>2 modules</td>
</tr>
<tr>
<td>3 modules</td>
</tr>
<tr>
<td>660</td>
</tr>
<tr>
<td>1270</td>
</tr>
<tr>
<td>1880</td>
</tr>
</tbody>
</table>

2. Method of manufacture and materials

2.1 Manufacturing method

The parts are manufactured using injection moulding.

2.2 Materials

The material used for all the injection moulded parts is a controlled blend of virgin and/or recycled polypropylene and additives, the purchase specification and compositions for which have been submitted to CSTB.

2.21 Corner supports

The characteristics of the materials used for manufacturing the corner supports are shown below:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specifications</th>
<th>Test parameters</th>
<th>Test methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>≥900 kg/m²</td>
<td>T=23±2°C</td>
<td>NF EN ISO 1183</td>
</tr>
<tr>
<td>Melt flow index</td>
<td>From 3 to 28 g/10 min.</td>
<td>T=230°C / 2.16 kg</td>
<td>NF EN ISO 1133</td>
</tr>
<tr>
<td>Tensile strength at flow limit</td>
<td>≥ 20 MPa</td>
<td>Speed 50 mm/min T=23 ± 2°C</td>
<td>NF EN ISO 527</td>
</tr>
<tr>
<td>Tensile or flexing modulus</td>
<td>≥ 1400 MPa</td>
<td>Speed 2 mm/min T=23 ± 2°C</td>
<td></td>
</tr>
<tr>
<td>Thermal stability (OIT*)</td>
<td>≥ 8 min.</td>
<td></td>
<td>NF EN 728</td>
</tr>
</tbody>
</table>

* Checks on finished products

2.22 Plates and accessories

The characteristics of the material recipes used for manufacturing the plates and accessories are shown below:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specifications</th>
<th>Test parameters</th>
<th>Test methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>≥890 kg/m²</td>
<td>T=23±2°C</td>
<td>NF EN ISO 1183</td>
</tr>
<tr>
<td>Melt flow index</td>
<td>From 5 to 20 g/10 min.</td>
<td>T=230°C / 2.16 kg</td>
<td>NF EN ISO 1133</td>
</tr>
<tr>
<td>Tensile strength at flow limit</td>
<td>≥ 18 MPa</td>
<td>Speed 50 mm/min T=23 ± 2°C</td>
<td>NF EN ISO 527</td>
</tr>
<tr>
<td>Tensile or flexing modulus</td>
<td>≥ 800 MPa</td>
<td>Speed 2 mm/min T=23 ± 2°C</td>
<td></td>
</tr>
<tr>
<td>Thermal stability (OIT*)</td>
<td>≥ 8 min.</td>
<td></td>
<td>NF EN 728</td>
</tr>
</tbody>
</table>

* Checks on finished products

3. Product description

3.1 Appearance, finish

The corner supports are black in colour. The plates are grey coloured. The covers and connectors are yellow in colour. AZbox Noir products are free of any visual defects which could adversely affect their function.

3.2 Dimensions

The dimensions of the constituent components of an AZbox Noir module are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Corner Supports</th>
<th>Open plate</th>
<th>Closed plates</th>
<th>Cover</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (mm)</td>
<td>422</td>
<td>1200</td>
<td>1192</td>
<td>417</td>
<td>72</td>
</tr>
<tr>
<td>Tolerances (mm)</td>
<td>+/-3</td>
<td>+2/-10</td>
<td>+2/-10</td>
<td>+/-3</td>
<td>+/-0.5</td>
</tr>
<tr>
<td>Width (mm)</td>
<td>228</td>
<td>600</td>
<td>558</td>
<td>224</td>
<td>35.5</td>
</tr>
<tr>
<td>Tolerances (mm)</td>
<td>+/-3</td>
<td>+2/-10</td>
<td>+2/-10</td>
<td>+/-3</td>
<td>+/-0.6</td>
</tr>
<tr>
<td>Height (mm)</td>
<td>343</td>
<td>49.5</td>
<td>49.5</td>
<td>29.5</td>
<td>38.3</td>
</tr>
<tr>
<td>Tolerances (mm)</td>
<td>+/-3</td>
<td>+/-0.5</td>
<td>+/-0.5</td>
<td>+/-0.5</td>
<td>+/-0.5</td>
</tr>
</tbody>
</table>

These functional dimensions together allow the structure to be assembled correctly and are subjected to specific dimensional checks. The minimum wall thickness at the corner supports is 3.8 mm.

3.3 Mass

The masses of the constituent components of an AZbox Noir module are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Corner Supports</th>
<th>Open plate</th>
<th>Closed plate</th>
<th>Cover</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass (g)</td>
<td>1850</td>
<td>6500</td>
<td>5350</td>
<td>360</td>
<td>16.5</td>
</tr>
<tr>
<td>Tolerances</td>
<td>+/-6%</td>
<td>+/-8%</td>
<td>+/-8%</td>
<td>+/-8%</td>
<td>+/-6%</td>
</tr>
</tbody>
</table>

3.4 Usable volume

For the first layer of a structure, the gross volume of a module is 475 litres and the usable storage volume is 451 litres. For all the upper layers the gross volume is 439 litres and the usable storage volume is 422 litres. The storage volumes are obtained from the dimensions, weights and density of the material.

3.5 Mechanical characteristics

3.5.1 Short-term characteristics

3.5.11 Unconfined compressive strength of a base module

The unconfined compressive strength is determined using elementary modules comprising 2 corner supports and 2 open plates. The unconfined compressive strengths measured in accordance with standard XP P16-374 in the X, Y and Z direction are as follows:

<table>
<thead>
<tr>
<th>Direction in which force is applied</th>
<th>Specifications</th>
<th>Test parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum breaking load</td>
<td>140 kPa</td>
<td>Temperature 23 ± 1°C</td>
</tr>
<tr>
<td>Deformation at maximum load</td>
<td>&lt; 4%</td>
<td>Age of blocks &gt; 7 days</td>
</tr>
</tbody>
</table>

Remark: The unconstrained compressive strength reflects the consistency of manufacture of the products, and serves to verify the suitability for use on site. It is not sufficient, however, for establishing mechanical design dimensions of the finished structure. For factory-based inspection a quarter of modules are checked.

3.5.12 Compressive strength of stacked modules

Type tests have been carried out for two stacked module levels. The vertical compressive strength is equal to or greater than 300 kPa.

3.5.13 Compressive strength of modules with slope defect

Type testing show that a sub-grade slope of 1 % has no impact.

3.5.2 Long-term characteristics

3.5.21 Allowable long-term vertical load

The long-term behaviour of AZbox Noir modules has been determined on the basis of tests based on deformation and failure criteria measurements. The tests are based on a series of long-term unconstrained compressions, carried out over a minimum period of 7500 hours.
These tests gave a regression line from which the maximum admissible vertical pressure which would lead to failure of the modules after 50 years’ service could be determined.

The maximum extrapolated vertical pressure is 90 kPa.

3.522 Allowable long-term horizontal load

The long-term behaviour of AZbox Noir modules has been determined on the basis of tests based on deformation and failure criteria measurements. The tests are based on a series of long-term unconstrained compressions, carried out over a minimum period of 3000 hours.

These tests gave a regression line from which the maximum admissible horizontal pressure which would lead to failure of the modules after 50 years’ service could be determined.

The maximum extrapolated horizontal pressure is 36 kPa.

4. Marking

The marking of AZbox Noir module complies with requirements associated with the Technical Appraisal and with QB marking references.

5. Packaging, handling, storage

5.1 Packaging

The various AZbox Noir components are delivered stacked on a single-use pallet. The connectors and covers are delivered in cartons.

5.2 Handling

Usual precautions must be observed, such as the use of a fork-lift truck, in order to avoid damaging components. Sudden handling movements and components falling to the ground when they are being unloaded should be avoided.

 unpacking operations should be carried just before the products are used as the work on site progresses.

5.3 Storage

Each pallet must be stored on a flat surface which is free of any objects which might damage the products.

The maximum storage period outside is one year.

6. Design studies and design dimensions

The information provided must allow the conditions for installation of the structure to be characterised.

It should be emphasised that the information shown in said technical design studies are elements to assist with the design. They allow the project manager to establish the design dimensions and to carry out the validations that they are responsible for.

6.1 Prior study

The project manager submits the results of the prior study, in particular the geological and hydrological environment in which the structure is installed and in particular:

• the geo-technical conditions (feasibility and potential geo-technical hazards, soil stability, shallow hard rock horizons, density, earth pressure coefficient), hydro-geological conditions (subjacent water table etc.),

• hydraulic conditions (profile, design dimensions of upstream/downstream systems, feed and drainage devices etc.).

6.2 Volumes

6.2.1 Excavation volumes

The excavation volume is determined in accordance with the requirements of the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management" (December 2011) (Section 5.2.).

6.2.2 Usable volume of the structure

The hydraulic design calculations for the storage device are to be performed by the project manager or main contractor, as relevant.

The usable volume is determined by the project manager in accordance with the requirements of the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management".

The usable volume of the structure must take into account:

• The usable volume and the number of modules installed,

• The effluent water flow,

• Any slope of the sub-grade in the case of a water-tight structure. The sub-grade slope of the tank is generally 0.5% and must be less than 1%.

• The size of the pipework used for ventilation of the structure.

In the case of a retention structure, the net volume of the structure is reduced by the volume between the bottom of the structure and the water outlet. The height between the bottom of the tank and the water outlet is 50 mm.

In the case of an infiltration structure, the net volume is the same as the maximum theoretical volume.

6.3 Mechanical behaviour

The design dimensions are established in accordance with the Guide "Ultra Light Cellular Structures (ULCS) for rainwater management" (December 2011).

Depending on the product, and in the absence of any specific requirements pertaining to construction, the tank may be installed beneath pavements, roadways, verges or green spaces, within the following limits:

• the minimum depth of overlay in green spaces is at least 0.30 m,

• beneath pavements or verges with H ≥ 0.50 m,

• beneath moving loads, the design dimensions will depend on the envisaged traffic:

  • beneath light traffic roadways (PTEC < 3.5 t) with H ≥ 0.60 m,

  • beneath heavy traffic roadways (BC convoy type) with H ≥ 0.80 m.

A safety coefficient of 2.5 is to be applied to the long term maximum allowable vertical pressure extrapolated to 50 years. This safety coefficient, used for establishing the design dimensions of the structures, corresponds to a γA of 1.35 and a γM of 1.85. The same is to be done for the admissible maximum horizontal pressure.

AZbox Noir retention structures can be installed if there is a water table present. In this case design dimensions should be established by taking this variable into account in validating the mechanical strength of the structure and its behaviour in terms of the Archimedes buoyancy effect.

6.4 Diffusion drain

In the case of a diffusion drain being installed, the number of drains necessary for the structure to operate correctly must be established by prior calculation of the design dimensions, so as to ensure that the diameter and the drain capture surface area envisaged allow the tank to fill and empty satisfactorily during use.

7. Installation

Installation operations must be carried out in accordance with the minimum requirements of the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management" (December 2011).

The installation of the AZbox Noir product is the subject of general installation requirements.

7.1 Groundwork operations

Groundwork and excavation must be undertaken in accordance with the requirements of "Fascicule 70, titres I and II".

The general excavation dimensions must be at least 50 cm wider on each side than the unit dimension of the tank, and must take the characteristics of the natural ground into account. The length must also take the number and diameter of hatches into consideration.

The dimensions of the excavation must allow safe access in accordance with the regulations and allow the following operations to be carried out:

• connection of the pipework to the tank,

• installation of accessories and hatches,

• placement of the geo-textiles and/or geo-membranes,

• installation of any drains,

• backfill and compacting with a suitable material.

In the case of an infiltration device, a minimum distance of 5 metres from the nearest building must be observed.

In all events the drawings and installation locations defined by the project manager must be complied with.

7.2 Support bed

The blocks are to be installed on a pre-compactied flat surface which has fully settled, with a slope of 0 to 0.5%.

Particular care must be taken with the flatness of the support bed in order to ensure that the structure is stable and to allow easy installation.

• In the specific case of infiltration, the support bed must be made with a drainage material which forms the sub-grade.

• In the case of a sealed tank, since settling of the sub-grade occurs below the geo-membrane sealed device, every precaution must be taken to prevent it being damaged.

The use of crushed material with a 5/15 particle size distribution or compacted sand is preferred.
7.3 Geo-membrane and/or geo-textile / water-tightness device

Installation characteristics and conditions for the geo-textile and for the water-tightness device are selected and implemented in accordance with the minimum requirements of the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management" (December 2011).

The characteristics must be appropriate for the tank configuration. In particular, in the case of heterogeneous supporting soils the use of a high-modulus geo-textile is recommended in order to ensure that the modules are held tightly together, thus ensuring monolithic operation of the ULCS structure.

7.31 Infiltration tank

In the infiltration case, a geo-textile which has sufficient filtration opening is preferred.

The characteristic values of the various functions and the mechanical and hydraulic properties are to be appropriate for the site requirements.

7.32 Retention tank

A retention tank comprises an outlet where the discharge flow can be regulated. It may or may not be water-tight, depending on the project manager’s requirements in terms of local constraints. These are in particular associated with protection of the water table.

7.33 Water-tight tank

In the case of water-tight tanks, they are made water-tight in accordance with best practices and in the case where water-tight membranes are used, in accordance with the general recommendations for ensuring water-tightness using geo-membranes of "Fascicule 10" of the "Comité Français des Geotextiles et Geomembranes" "Recommandations générales pour la réalisation d'étanchéité par géomembranes".

7.4 Installation of modules

7.41 Preparation

Check that the modules are seated correctly by carefully adjusting the diffusion layer or support bed as indicated in section 7.2.

7.42 Creation of the first layer

Special care must be taken with the first layer of modules, as the quality of installation of the following layers will depend on this.

A first course of open plates, each pre-fitted with 4 corner supports, is placed directly on a compacted and levelled sub-grade. Diffusion drains are arranged between the corner supports of the first stage, linking the upstream and downstream hatches of the tank, where appropriate.

A second course of plates pre-fitted with 4 corner supports is then fitted directly onto the first lower half-modules to complete the first layer.

7.5 Fabrication of upper modules

The upper stages are made by fixing four corner supports onto the open plate of the lower layer, then fitting one more half-module (open plate pre-fitted with 4 corner supports) onto the corner supports. All the open plates are linked to each other by connectors.

The last open plate forming the top of the ULCS is closed off using covers designed for this purpose.

7.6 Ventilation / inspection wells

To prevent the structure becoming pressurised an air evacuation device must be made.

Ventilation of the structure is achieved using ventilation wells in the roof of the tank (See section 8).

In the case of ventilation in the roof of the tank, the ventilation and inspection wells are obtained by cutting out the upper part of the module, at the indication marks, using a jigsaw.

Position the DN/ID 300 type adaptor sleeve, a DN/ID 300 CR8 type core and distribution slab (in the case of moving loads), the crown device and the appropriate cover. Inspection hatches or chambers

7.7 Inspection hatches or chambers

These are installed in accordance with the requirements of "Fascicule 70".

7.8 Backfill

Backfill operations must be carried out in accordance with the minimum requirements of the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management" (December 2011).

All materials of the roadworks guide classification "Guide des Terrassements Routiers" [SETRA, LCPC, 1992] may be used for backfill except materials of diameter greater than 60 mm and clay materials.

The recommendations of "Fascicule 70" and of standard NF P98-331 must be observed.

7.81 Side-fill

In the backfill and compacting stage, care must be exercised to prevent asymmetrical stresses on the structure. This is achieved by backfilling and then compacting in successive layers alternately on either side of the structure.

The re-use of excavation materials is to be encouraged, once large components have been screened out.

Take care not to damage the geo-textile and/or the geo-membrane water-tightness devices.

Depending on the type of backfill used:
- If compacting is necessary, carry this out using low-power tools in successive 30 cm layers.
- Other types of material, such as gravel (20/40 rounds for example), are put in place without compacting.

7.82 Covering

Driving over AZbox Noir modules is prohibited before backfilling and compacting.

The use of a vibrating compactor of width less than 1.3 m of class PV4, or of a vibrating plate of class PQ4 (see NF P 98-736 Tables 7 and 9) is recommended for this operation.

Backfill over the tank progressively using a compacted layer of 30 cm minimum.

8. Access to the structure

Access can be gained to the structure by means of:
- inspection hatches or chambers at the periphery of the structure,
- inspection wells made in the roof of the structure (See Figure 8 and section 7.6) which allow access to each stage of the modules for maintenance of the structure.

9. Upkeep and maintenance

General conditions for maintenance and operation of the structures are carried out in accordance with the Technical Guide "Ultra Light Cellular Structures (ULCS) for rainwater management" (December 2011).

The space available between the AZbox Noir corner supports allows access equivalent to a road drain of diameter 355 mm.

If necessary, clearing out with pressurised water is carried out using a cleaning head with a pressure of less than 120 bar and whose flow is between 120 and 300 l/min.

Most cleaning head types may be used, except for chain heads (which could damage the modules or the drain) and rotary heads (which could cause settled material to be returned into suspension).

The use of a specific treatment upstream can reduce the frequency of maintenance operations.

10. Method of commercialisation

AZbox Noir modules and their accessories are marketed through a network of distributors.

11. Internal inspections

AZbox Noir modules are manufactured in manufacturing facilities which use a Quality Assurance Plan.

11.1 Raw material checks

A certificate of conformity of type 3.1 in terms of standard NF EN 10204 is provided by the supplier(s) for each batch of material.

Approval of a new material is subject to a specific process relating to the compliance of values with the table of materials (see section 2.2), compliance of all characteristics of the finished product, and of the short- and long-term mechanical performance of the finished product.

11.2 Checks on the manufacturing process

Production parameters and inspections are subject of specific procedures.

11.3 Checks on finished products

The following checks are carried out.

Samples of each part are taken: corner supports, open plates, closed plates, connectors, covers.
<table>
<thead>
<tr>
<th>Nature of the checks</th>
<th>Frequency</th>
<th>Sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>On each start-up + 1 per shift</td>
<td>1 piece of each part</td>
</tr>
<tr>
<td>Weight</td>
<td>On each start-up + 1 per shift</td>
<td>1 piece of each part</td>
</tr>
<tr>
<td>Appearance</td>
<td>Continuously</td>
<td>1 piece of each part</td>
</tr>
<tr>
<td>Assembly</td>
<td>On each start-up + 1 per shift</td>
<td>1 corner support/open plate assembly</td>
</tr>
<tr>
<td>Vertical compressive strength</td>
<td>1 test for each material batch and at least 1 test per week</td>
<td>2 test pieces</td>
</tr>
<tr>
<td>Thermal stability</td>
<td>2/year</td>
<td>1 corner support sample</td>
</tr>
</tbody>
</table>

12. Certification

12.1 Quality system


12.2 Certification

12.21 Product

AZbox Noir modules are QB mark certified. This shows that the consistency and results of internal checks for each manufacturing site are satisfactory.

Products which hold a valid certificate can be identified by the presence of the QB logo on the products.

The certified characteristics are as follows:

- dimensional characteristics (see 3.2),
- determination of the unconstrained compressive strength of a module (see 3.51).

As part of the certification process, CSTB audits production sites in accordance with the QB reference system for:

- Validation of the quality system,
- Sampling of a block and performance of the mark laboratory tests (dimensional, mechanical strength).

The results of this monitoring are examined by the certificate assessment committee.

B. Experimental results

Sites have been used as reference sites and as a result reference sheets which show the techniques for tank operation have been submitted to CSTB.

The following tests relating to AZbox Noir modules are the subject of report CAPE AT 16-249:

- dimensional characteristics,
- material characteristics,
- unconstrained compressive strength tests in directions X, Y, Z.
- unconstrained compressive strength tests on two layers in the Z direction.

The effect of a slope defect of 1% on the module is the subject of report no. CAPE 17-8592.

Lateral compressive strength was the subject of additional tests in MFPA: PB 5.2/16-294-3.

The long-term behaviour of the product in the vertical direction was the subject of internal laboratory reports NIDAPLAST FLUAGE AZBOX NOIR FEVRIER 2017 – CSTB V2 - FR as well as additional tests carried out by the MFPA laboratory PB 5.2/15-248-3.

C. References

C1. Health and Environmental Data (1)

The AZbox Noir products are not subject to an Environmental Statement (ES). Therefore, no particular environmental performance may be claimed.

The purpose of ES data is for calculation of environmental impacts of structures in which the products (or processes) in question are likely to be incorporated.

C2. Other references

A list of references has been submitted to CSTB.

(1) Not examined by the Specialised Group within this Technical Appraisal.
Tables and Figures of the Technical File

Figure 1 – AZbox Noir corner support

Figure 2 – AZbox Noir open plate

Figure 3 – AZbox Noir closed plate
Figure 4 – AZbox Noir Connector

Figure 5 – AZbox Noir Cover

Figure 6 – AZbox Noir Assembly
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input channel</td>
</tr>
<tr>
<td>2</td>
<td>Concrete cover</td>
</tr>
<tr>
<td>3</td>
<td>Downstream inspection hatch (DN 1000)</td>
</tr>
<tr>
<td>4</td>
<td>Diffusion drain DN 300</td>
</tr>
<tr>
<td>5</td>
<td>Geo-textile / Geo-membrane</td>
</tr>
<tr>
<td>6</td>
<td>AZbox Noir modules</td>
</tr>
<tr>
<td>7</td>
<td>Ventilation (Grille, extension tube)</td>
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<tr>
<td>8</td>
<td>Downstream inspection hatch (DN 1000)</td>
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<tr>
<td>9</td>
<td>Flow limiter</td>
</tr>
<tr>
<td>10</td>
<td>Overflow</td>
</tr>
<tr>
<td>11</td>
<td>Outlet channel</td>
</tr>
</tbody>
</table>

**Figure 7 – Representative cross-section of AZbox Noir collection and retention tank**
Figure 8 – Schematic diagram for the creation of access well in the top of the tank.