GARDNET®

HYDROTECH®
Tech Data

1. Product Name
GardNet™ Soil Confinement Assembly

2. Product Description
Basic Use
The GardNet soil confinement assembly provides a means of confining or restraining Hydrotech's LiteTop® growing media on Garden Roof® Assemblies that have slopes greater than 3:12 (14 degrees, 25%).

Advantages
- Prevents sliding of growing media on high slope Garden Roof applications
- Provides anchorage for established vegetation
- Allows for the free drainage of excess water

Limitations
- GardNet is not be used for slopes in excess of 9:12 (37°, 75%), except for extensive assemblies where the system is topped with precultivated sedum carpet.
- *Attachment brackets and the means of securing them to the structure are not specified, provided, or quoted by American Hydrotech*. It is the sole responsibility of the architect or engineer of record to design and specify the correct attachment to satisfy the load requirements provided by Hydrotech.
- *ALL LOADING, ANCHORING, AND GARDNET ASSEMBLY PHYSICAL PROPERTIES MUST BE REVIEWED AND VERIFIED BY A QUALIFIED STRUCTURAL ENGINEER FOR EACH PROJECT. A STATEMENT OF SUCH REVIEW SIGNED/STAMPED BY THE ENGINEER MUST BE ON FILE WITH AMERICAN HYDROTECH, INC. PRIOR TO SHIPMENT OF ANY GARDNET MATERIAL.*

Composition and Materials
GardNet is composed of polyethylene sheet strips connected by a series of offset, full-depth, ultrasonically welded seams. When stretched apart, the sheet strips form the walls of a flexible, 3-dimensional series of diamond-shaped cells.

The polyethylene strips are textured with diamond shaped indentations designed to improve friction within the cells and are perforated with a series of 0.391 inch diameter (10 mm) holes designed to increase drainage and allow root growth between individual cells.

GardNet sections are available in 3, 4, 6, 8, and 12 inch (75, 100, 150, 200, and 300 mm) heights/depths. GardNet sections are 8 cells wide and available in lengths of 18, 21, 25, 29 and 34 cells long. See Table 1 for coverage area of the GardNet sections.

Accessories
The required number and spacing of the Tendons and Oval Sleeves and the required number and spacing of the Washer/Stop assemblies down the length of the Tendons is dictated by the severity and length of the slope and anticipated loading. These requirements will be provided to the installing contractor prior to starting the installation. All required hardware, except for the structural attachment bracket, is provided by American Hydrotech.

- GardNet Tendons - 3/16 inch (4.76 mm) or 1/4 inch (6.35 mm) diameter braided steel cable. Tendons are secured to the structure at pre-determined structural anchorage points with metal Oval Sleeves that are crimped to the Tendon to fix it at the anchorage point. Once secured, the Tendons are threaded through pre-drilled holes in the GardNet cell walls.

- GardNet Tendon Oval Sleeves - pure copper, oval-shaped sleeves; 1 inch long to fit the 3/16 inch Tendon and 1 3/16 inches long to fit the 1/4 inch Tendon. Tendon Oval Sleeves are used to permanently fix a Tendon to the structure by running one end of the Tendon through one opening of the oval sleeve, looping the Tendon through a structural attachment bracket, and continuing the looped Tendon through

PHYSICAL PROPERTIES (Table 1)

Attribute	Value	Test Method
Color	Black	
Cell Wall Thickness	0.05 in. (1.27 mm) (-5,+10%)	ASTM D5199
Sheet Strip Height	3, 4, 6, 8, 12 in. (75, 100, 150, 203, 305 mm)	
Expanded Individual Cell Dimension - nominal	13 in. wide x 10.5 in. long (320 mm x 287 mm)	
Section Coverage - nominal each section is 8 cells wide (approx 8.7 ft. - expanded)	18 cell section - 136 sq.ft. (12.6 sq.m.) 21 cell section - 159 sq.ft. (14.8 sq.m.) 25 cell section - 189 sq.ft. (17.6 sq.m.) 29 cell section - 219 sq.ft. (20.3 sq.m.) 34 cell section - 257 sq.ft. (23.9 sq.m.)	
Polyethylene Density	58.4 - 60.2 lb./cu.ft. (0.935 - 0.965 g/cm3)	ASTM D1505
Polyethylene Environmental Stress Crack Resistance (ESCR)	3,000 hours	ASTM D1693
Seam Peel Strength	240 lb.-force (1060 N) - 3 in. strip 320 (1420) - 4 in. strip 480 (2130) - 6 in. strip 640 (2840) - 8 in. strip 960 (4260) - 12 in. strip	
Seam Hang Strength	160 lb. (72.5 kg)	ASTM E41
Carbon Black Content	1.5 - 2.0 %	

the second opening of the sleeve. The Oval Sleeve is then crimped to the Tendon. This attachment loop is installed at the end of each Tendon at the top of slope and/or as directed by Hydrotech.

• GardNet Poly-Washers - 3 inch x 3 inch, 0.05 inch thick, polyethylene squares with centered, pre-drilled holes. Poly-Washers are used to prevent the GardNet Washer/Tendon Stop assembly from pulling through the back side of the GardNet cells walls under load. Poly-Washers are the first of three pieces included in a Washer/Tendon Stop assembly (Poly-Washer+Washer+Tendon Stop) to be threaded onto the Tendons.

• GardNet Washers - 2 inch O.D. x 0.286 inch I.D. x 0.125 inch thick, 304 stainless steel washers. GardNet Washers are the second of three pieces included in a Washer/Stop assembly (Poly-Washer+Washer+Tendon Stop) threaded onto the Tendons. GardNet Washers are threaded onto the Tendons after the GardNet Poly-Washers and before the GardNet Tendon Stops.

• GardNet Tendon Stops - pure copper, round sleeves; 1 inch long to fit the 3/16 inch Tendon and 1 3/16 inches long to fit the 1/4 inch Tendon. Tendon Stops are used to fix the Washer/Stop assemblies onto the Tendons and distribute the gravitational load along the length of the Tendons. Permanently fixed (by crimping), the Stops transfer the load exerted by the GardNet assembly to the Tendon with each Stop restraining the potion of the load directly down slope from its location along the Tendon. GardNet Stops are the third and last of three pieces included in a Washer/Stop assembly (Poly-Washer+Washer+Tendon Stop) threaded onto the Tendons. GardNet Tendon Stops are threaded onto the Tendons after the GardNet Poly-Washers and GardNet Washers.

• GardNet Wing Spacers - 9 1/2 inches long, U-shaped, plastic channels. Edge Wing Spacers are installed by snapping them onto the outermost Tendons along a roof areas perimeter. They are installed within the open outer edge cells along the sloped perimeters of the roof to maintain uniform spacing of the "wings" or "half cells". The Wing Spacers snap-fit tightly on the Tendons, keeping the wings in place, and preventing the growing media from sliding down slope.

• GardNet Zip-ties - heavy-duty, 120 pound rated, UV-protected and chemically resistant, nylon zip-ties. GardNet Zip-ties are used to secure sections of GardNet together that lie side-by-side on a slope. They are also used to secure uniquely shaped sections of GardNet that have been trimmed to fit custom shapes. When installed and completely tightened the excess Zip-Tie material should be trimmed off and properly disposed of. This is important so that this material is not visible once the GardNet is filled with the LiteTop growing media.

• GardNet Installation Tools – specialized crimping tools designed to properly crimp Oval Sleeves and Stops onto the Tendons. The crimping tools required to properly install/fix the Tendon Oval Sleeves and Tendon Stops are very specific to each project. ***ONLY those tools available from Hydrotech can be used to install the GardNet.*** The selection of the proper tools for a particular project will depend on the complexity of the job. All tools required for installation are available for purchase or rent through Spartan Leasing, Inc.

Coverage / Packaging

When collapsed the GardNet strip sections measure 11.8 feet (3.6 m) wide x 2.25 – 4.25 inches (57.2 – 108 mm) thick. Refer to Table 1 for the expanded dimensions and nominal coverage areas by GardNet section. All GardNet is stacked and shipped on pallets and shrink wrapped. GardNet Tendons are available in spools of 500 linear feet minimum and 1000 linear feet maximum. The 1/4 inch Tendon weighs approximately 11 pounds/100 feet and the 3/16 inch Tendon weighs approximately 6.5 pounds/100 feet. Please add 10-20 lbs. for the spool.

The appropriate quantities of GardNet accessories (Tendon Oval Sleeves, Poly-Washers, Washers, Stops, Edge Wing Spacers, Zip-ties) will be shipped with the GardNet to perform the installation as specified. All listed accessories and hardware are included in the square footage pricing estimates. The amount of hardware required is dictated by the severity and length of the slope and anticipated loading. These requirements will be given to the installing contractor prior to starting the installation. Please note that any other hardware, including the structural attachment bracket, is the responsibility of the installing contractor.

3. Technical Data

Refer to Table 1 for typical physical properties of the GardNet.

4. Installation

Refer to the Garden Roof Assembly GardNet Installation Guidelines and contact Hydrotech for more detailed information on installation methods. A Hydrotech Technical Representative will be onsite at the start of all GardNet installations.

Design

All project information ***MUST*** be reviewed with American Hydrotech, Inc. prior to any consideration for the use of GardNet. This review must occur as early in the design process as possible to ensure that the appropriate anchorage points and structure are provided. *The slope of the roof deck, the length of the slope, the width of the sloped areas, and depth of growing media required must be submitted to American Hydrotech*. The above should include any drawings, details, or sketches depicting the sloped portion of the roof. Once the above information has been provided, recommendations for the appropriate GardNet sections, number and spacing of anchorage points and Tendons, Tendon lengths, and spacing of Washer/Stops assemblies along each Tendon will be provided along with the anticipated loads of the GardNet assembly and growing media.

These anticipated loads are to be used by the architect or engineer of record to design and specify the attachment bracket at the top of the slope. ***The attachment brackets and the means of securing them to the structure are not specified, provided, or quoted by American Hydrotech***. It is the sole responsibility of the architect or engineer of record to specify the correct attachment to satisfy the load requirements provided by Hydrotech. The General Contractor, or installing Contractor if this portion is within their contract, must purchase the correct material and install it according to the designer's specifications.

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Along with this letter, a detail of the attachment should be submitted. This detail will be reviewed by American Hydrotech to ensure that it meets all membrane flashing requirements. **SEE HYDROTECH'S MM6125 ROOFING AND GARDEN ROOF ASSEMBLY GUIDELINE DETAILS FOR TYPICAL DETAILING CONDITIONS**.

Preparation
Application of the Monolithic Membrane 6125®EV-FR (MM6125EV-FR) roofing membrane and appropriate flashings should be completed with Hydroflex®RB II root barrier protection. If STYROFOAM® brand insulation is to be installed above the membrane, placement should start at the bottom of the slope working upslope, stacking/butting adjacent boards tightly together. Hydrodrain®302 drainage mat for non-insulated projects or Hydrodrain 300 drainage mat for insulated projects shall be placed over the root barrier or insulation layer respectively. Sections of Systemfilter filter fabric should be pre-cut and ***MUST*** be installed at all perimeters, penetrations, and any other areas required to hold the growing media in place.

Pre-Stringing Tendon Washer/Stop Assemblies
GardNet sections should be "prepped" ***BEFORE*** they are opened or stretched out to their installed dimensions. Prepping involves pre-stringing the Washer/Stop assemblies onto the Tendons as the Tendons are strung through the pre-drilled holes through the GardNet sections. ***The number and spacing of Washer/Stop assemblies along the Tendons is dictated by the severity and length of the slope and anticipated loading. These requirements are given to the installing contractor prior to starting the installation.***

Tendon/Oval Sleeve Anchorage
GardNet sections should be positioned, in the collapsed state, with the top and bottom ends of the Tendon coiled and temporarily secured. Secure all the pre-cut Tendons to the anchorage brackets by looping the ends of the Tendons through one opening of a Tendon Oval Sleeve, the anchorage bracket eye bolt, and then the other opening in the Tendon Oval Sleeve. Tendon Oval Sleeves are then crimped according to specifications and permanently fixed in place. (Fig. 1)

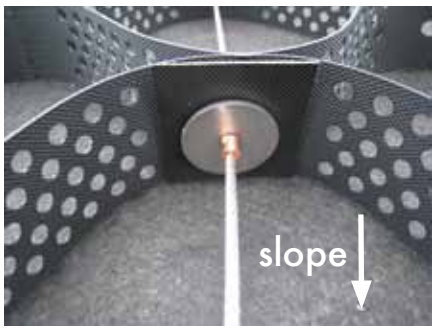
(Fig. 1)

Stretching Out the GardNet Sections
Once all of the Tendons are completely secured to the attachment bracket/eye bolts, the GardNet section should be carefully expanded and stretched out down the slope of the roof over the previously installed Hydrodrain. Care must be exercised to prevent the "prepped" Washer/Stop assemblies from coming loose along the Tendon and to prevent the Tendon from slipping all the way through the last cell wall. The GardNet section needs to be expanded to its full length at this point.

If the length of the slope is longer than the GardNet sections provided, subsequent sections of GardNet must be added. The subsequent, down-slope section of GardNet should be positioned, fully collapsed, up against the last cells of the upper GardNet section, and the Tendons should be threaded through the corresponding cells of the lower section. The number and spacing of the Washer/Stop assemblies to be placed within the cells of the lower GardNet section will be the same as previously placed in the upper GardNet section.

All non-tendoned cells between upper and lower GardNet sections can be secured with a GardNet Zip-Tie to maintain the shape of the GardNet field.

Crimping the Stops
All Washer/Stop assemblies must be fixed in place by crimping the Stop to the Tendon. Each cell should be measured, making sure the length from the upper most cell wall is a nominal 10.5 – 11 inches and the width from weld to weld is 12.5 – 13



(Fig. 2)

inches. Crimp each Stop to the Tendon as instructed to permanently fix the Washer/Stop assembly in place. (Fig. 2) Repeat this process for all cells down slope. The final width of a properly expanded GardNet section should be 8.67 feet from the edge of one outside wing to the other.

Installing Wing Spacers
Once all of the GardNet sections for a particular area have been expanded, measured, and all Stop/Washer assemblies crimped in place, outer-edge Tendons should be threaded through the upper most sheet strip wing and down through each wing down the length of the slope. Once the Tendon has passed through all of the sheet strip wings, GardNet Edge Wing Spacers should be snapped onto the Tendon, separating and maintaining the spacing of each wing. (Fig. 3)

(Fig. 3)

Installing GardNet Zip-Ties
Once all GardNet sections are in place and all Stops have been crimped, adjoining sections shall be fastened together with GardNet Zip-Ties through the holes in the strip cell walls. (Fig. 4)

(Fig. 4)

(Fig. 5)

Growing Media Placement
Infilling of GardNet sections with the specified LiteTop growing media and/or ballast begins when all anchoring work is complete. Placement of the growing media *MUST* begin at the top/crest of the slope and continue down slope. The infill material should not be dropped into the GardNet from higher than 3 feet (1 meter) above the top of the GardNet section. Proper placement of the growing media requires that the GardNet be overfilled by 1 – 2 inches (25 – 50 mm) followed by a light tamping, rolling or jetting with water. If this compacting leaves the growing media flush with the top edges of the cell walls, an additional 1/2 – 1 inch of growing media should be added and tamped until the finished grade is at least 1/2 inch above the top edge of the GardNet cell walls. The media should be tightly compacted into the cells with no evidence of under-filled areas. All areas should have at least 1/2 – 1 inch of growing media above the cells walls. (Fig. 5)

Place vegetation as specified.

Installation of GardMat erosion control blankets is typically required with any GardNet or steep slope installation. Depending on the vegetation sowing requirements, GardMat may be placed after sowing (i.e., seeding, sedum cuttings) or prior to sowing (i.e., plugs). GardMat is typically rolled out over the infilled GardNet and staked into place in accordance with project specifications and installation guidelines. Installation of GardMat is not necessary when InstaGreen™ vegetation mats are to be used.

Precautions
Use caution when working on steep slopes, particularly when surface is wet from rain, dew or frost.

Many components underlying GardNet may be loose laid. Take all necessary steps to temporarily ballast until growing media or other infill materials are placed.

5. Availability and Cost
GardNet and accessories are available through American Hydrotech, Inc. Cost quotations are only available after submission of the project parameters - slope of the roof deck, the length of the slope, the width of the sloped areas, and depth of growing media required – to American Hydrotech, Inc.

6. Guarantees
Contact American Hydrotech, Inc. for specific warranty information.

7. Maintenance
While periodic maintenance is required for the vegetation and occasional inspections of flashings, roof drains, etc is recommended, the GardNet assembly specifically requires no maintenance.

8. Technical Services
Technical service is provided by Hydrotech's Technical Services and Garden Roof Departments. *Every GardNet application must be reviewed by American Hydrotech, Inc. prior to any material order or installation*.

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