Puraflo®

Peat Fiber Biofilter

Buoyancy Calculations

Only modules bearing
the NSF® logo and designated
P150N*XX are certified to NSF/ANSI Standard 40

ANUA

336.547.9338 ■ anuainternational.com

Puraflo® Buoyancy Calculations

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1.0 Letter of Bouyancy Calculations

S.O.S.
SNOWDEN ONSITE SERVICES, INC.
"Superior Onsite Service"

July 23, 2009

Mr. Colin Bishop, R.S.
Head of Government Relations & Business Development
Bord na Móna Environmental Products U.S. Inc.
PO Box 77457
Greensboro NC 27417

RE: Puraflo Buoyancy Calculations

Dear Mr. Bishop:

The following is a discussion of the results of buoyancy calculations performed on the Puraflo modules. These calculations are based on dimensional and weight information provided by Bord na Mona, and assumptions that were made on how to apply that information. Should any of the information be incorrect, the use of this information be incorrect, or the assumptions made on how to apply this information are incorrect, then the results of these calculations are likely to not be valid.

Two weights were provided: one referred to as saturated fiber, and the other referred to as unsaturated fiber. It is assumed herein that saturated fiber occurs when the Puraflo modules are being dosed with wastewater as they are in regular use. It is also assumed that unsaturated fiber occurs when the Puraflo modules are left unused, therefore not dosed with wastewater, for long periods of time. Lastly, it is assumed that the drain holes at the bottom of the modules are sealed. If, however, this assumption is incorrect, then again, the results of these calculations are likely to not be valid.

The results of the calculations indicate that in an unsaturated fiber condition the modules have a factor of safety against buoyancy of no less than 1.07 if buried up to fifteen (15) inches deep. In a saturated fiber condition the calculations indicate that the modules have a factor of safety against buoyancy of no less than 1.05 if buried up to nineteen (19) inches deep. Since the modules are built with steps in the outside dimensions, calculations are only performed at depths that correspond to these steps as it is the most convenient for inspectors to verify.

We hope that this information is clear. Please let us know if you have any questions.

Yours truly,

Jeff A. Snowden, P.E.

Attachments

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Austin, TX 78730-1103
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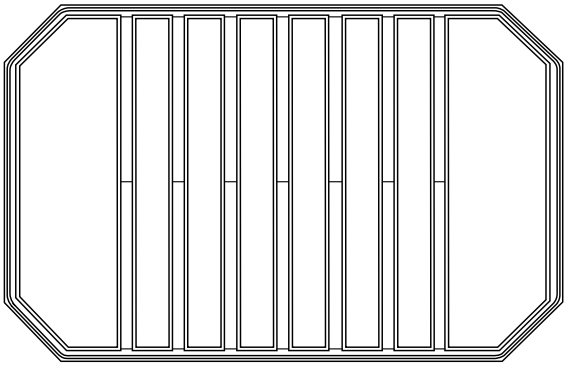
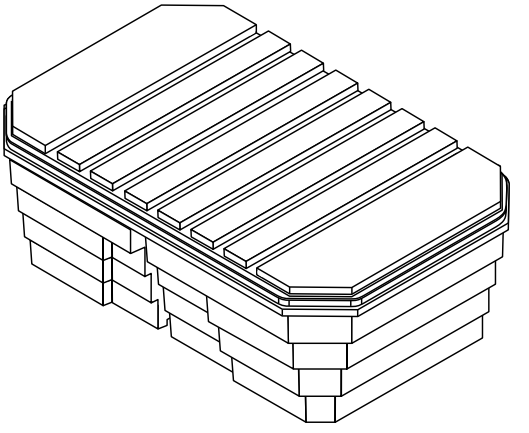
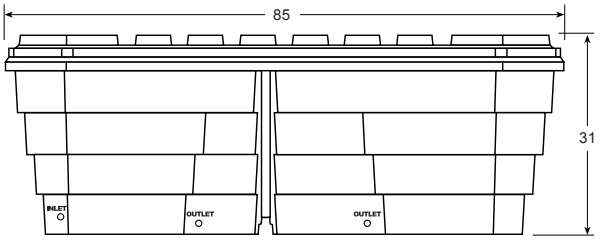
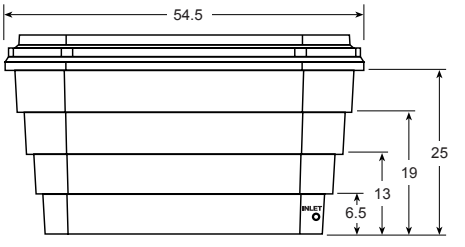
Phone (512) 338-1804
FAX (512) 338-4475

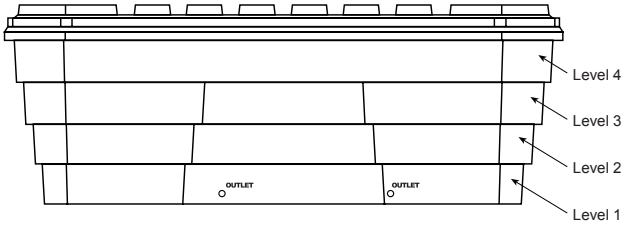
2.0 Buoyancy Calculations Model

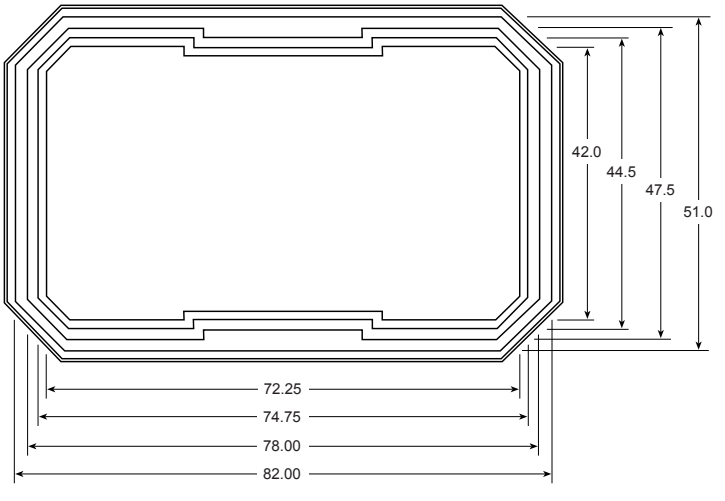












Note: Drawings are not to scale.
Dimensions shown in inches.

3.0 Buoyancy Calculations for Unsaturated Module

NOTE:
These calculations are based on information known to and provided by the manufacturer. The results, therefore, are only as accurate as the information provided.

Buoyancy:
The upward force on an object produced by the surrounding liquid or gas in which it is fully or partially immersed, due to the pressure difference of the fluid between the top and bottom of the object.

Weight of the Puraflo Module (dry): 1800 lbs
Due to the wedge shape of the module, the effect of the soil on the side walls was ignored.
h = burial depth of module (from grade to bottom of module)

inches	ft^2	ft^3
@ h = 6.5	area = 20.0	volume = 10.83
@ h = 13.0	area = 22.0	volume = 22.75
@ h = 15.0	area = 24.5	volume = 26.83
@ h = 19.0	area = 24.5	volume = 35.00
@ h = 25.0	area = 28.2	volume = 49.10

Volume of water displaced in gallons, * by 7.48, - to pounds * by 8.345

inches	gallons	lbs	Safety Factor	lbs
@ h = 6.5	81	676	1	$F_{up}\uparrow$ = 676
@ h = 13.0	170	1420	1	$F_{up}\uparrow$ = 1420
@ h = 15.0	201	1675	1	$F_{up}\uparrow$ = 1675
@ h = 19.0	262	2185	1	$F_{up}\uparrow$ = 2185
@ h = 25.0	367	3065	1	$F_{up}\uparrow$ = 3065

Weight of the filled module (dry) $F_{mod\ down}\downarrow$: 1800lbs
h = distance from ground surface to bottom of module
Fully saturated soil (Calculated as 100% water)

inches	F.S. = $F_{mod\ down}\downarrow$ / $F_{up}\uparrow$
@ h = 6.5	2.66 against buoyancy
@ h = 13.0	1.27 against buoyancy
@ h = 15.0	1.07 against buoyancy
@ h = 19.0	0.82 against buoyancy
@ h = 25.0	0.59 against buoyancy

Professional Engineer sealed calculation sheet can be provided upon request

4.0 Buoyancy Calculations for Saturated Module

NOTE:
These calculations are based on information known to and provided by the manufacturer. The results, therefore, are only as accurate as the information provided.

Buoyancy:
The upward force on an object produced by the surrounding liquid or gas in which it is fully or partially immersed, due to the pressure difference of the fluid between the top and bottom of the object.

Weight of the Puraflo Module (saturated): 2300 lbs
Due to the wedge shape of the module, the effect of the soil on the side walls was ignored.
h = burial depth of module (from grade to bottom of module)

inches	ft^2	ft^3
@ h = 6.5	area = 20.0	volume = 10.83
@ h = 13.0	area = 22.0	volume = 22.75
@ h = 15.0	area = 24.5	volume = 26.83
@ h = 19.0	area = 24.5	volume = 35.00
@ h = 25.0	area = 28.2	volume = 49.10

Volume of water displaced in gallons, * by 7.48, - to pounds * by 8.345

inches	gallons	lbs	Safety Factor	lbs
@ h = 6.5	81	676	1	$F_{up}\uparrow$ = 676
@ h = 13.0	170	1420	1	$F_{up}\uparrow$ = 1420
@ h = 15.0	201	1675	1	$F_{up}\uparrow$ = 1675
@ h = 19.0	262	2185	1	$F_{up}\uparrow$ = 2185
@ h = 25.0	367	3065	1	$F_{up}\uparrow$ = 3065

Weight of the filled module (dry) $F_{mod\ down}\downarrow$: 2300lbs
h = distance from ground surface to bottom of module
Fully saturated soil (Calculated as 100% water)

inches	F.S. = $F_{mod\ down}\downarrow$ / $F_{up}\uparrow$
@ h = 6.5	3.40 against buoyancy
@ h = 13.0	1.62 against buoyancy
@ h = 15.0	1.37 against buoyancy
@ h = 19.0	1.05 against buoyancy
@ h = 25.0	0.75 against buoyancy

Professional Engineer sealed calculation sheet can be provided upon request

Notes and Calculations:

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