

Commonwealth of Pennsylvania
Department of Environmental Protection (DEP)
Bureau of Point and Non-Point Source Management
Harrisburg, PA

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Technology: Eljen Geotextile Sand Filter (Eljen GSF[®])

Classification Type: Alternate technology (Listing #A2010-0007-0004)

Classification Date: February 24, 2010, August 1, 2011, December 22, 2011,
May 21, 2013

In accordance with Title 25, Chapter 73, Section 73.72, DEP classifies the Eljen Geotextile Sand Filter (Eljen GSF[®]) for use as an alternate onlot sewage treatment system in the Commonwealth of Pennsylvania. This classification permits the use of the Eljen GSF as an advanced treatment system used for the specific purposes of reducing CBOD₅ and TSS in the sewage effluent. This system has demonstrated that it can produce an effluent which shall not exceed 10 mg/l CBOD₅ and 10 mg/L TSS as monthly averages.

I. Technology Description

The Eljen GSF is a modular treatment component integrated with a soil absorption system comprised of an anti-siltation fabrics, perforated pipes, Bio-Matt fabrics, cuspated plastic cores, and a layer of sand situated above the native soil. The Eljen GSF design provides increased surface area for biological treatment that exceeds the module's footprint. Anti-siltation geotextile fabric covers the top and sides of the Eljen GSF module to protect the specified sand and soil from fines that can clog the sand while maintaining effluent storage within the module. Open air channels within the B43 module support aerobic bacteria growth on the Bio-Matt geotextile fabric interface.

II. Design Requirements

- A. Location: The Eljen GSF must be installed for the treatment of domestic strength wastewater only.
- B. Treatment Tank:
 - (1) Tank installations must consist of either a two-compartment rectangular tank, two rectangular tanks in series, or otherwise conform to meet the requirements of Section 73.31. Vertically aligned circular (round) tanks are not permitted.
 - (2) Measures to control flotation of the tank must be implemented when the tank is installed in areas below any indication of a water table.

- (3) An effluent filter bearing the seal of NSF indicating testing and approval by that agency under Standard No. 46 must be installed on the outlet of the final tank or compartment.

C. Dosing:

- (1) Distribution of effluent from the septic tank or pump chamber to the absorption area may be by either gravity or pressure distribution.
- (2) If a pump is required to lift effluent to the filter, a timed dose is required.
- (3) Pressurized systems or lift pump/gravity systems shall have both a dosing volume less than 4 gallons/dose/module and less than 30 gallons per day/module.

D. Construction: The Eljen GSF must be installed with the following criteria:

- (1) Per the manufacturer's installation instructions as described in the Pennsylvania Design and Installation Manual. The manual can be obtained from the manufacturer's website.
- (2) The Eljen GSF may be installed on slopes less than 15%.
- (3) Only B43 modules (48" L, 36" W, and 7" H) may be used. If the number of modules required is fractional, round up the nearest whole number. Modules may not be cut or otherwise resized.
- (4) In calculating the number of modules necessary, the effective bottom absorption area will be either 16 ft² per module for percolation rates between 3 min/in to 60 min/in or 24 ft² per module for percolation rates between 61 min/in to 180 min/in. Additional modules may be necessary to meet the dosing requirements prescribed by II.C.3
- (5) When the HLLR Table is used to calculate the dimensions of the absorption area, the following conditions apply:
 - a) The minimum number of modules is determined by Eq. (1). Additional modules may be necessary to meet the dosing requirements prescribed by II.C.3

$$\text{Min. Number of B43 Modules} = \frac{\text{Length of Infiltration Field from HLLR Table}}{4 \text{ ft}} \quad \text{Eq. (1)}$$

- b) The minimum amount of sand required on each side of the modules is 6" (six) inches. Additional sand will be required to meet the width required by the HLLR Table (i.e. Minimum Width Specified by HLLR Table rounded up to the nearest whole number \leq Sand on Upslope Side of Modules + 3 feet Width of B43 Module + Sand on Downslope Side of the Modules). The width calculated from the HLLR Table should be rounded up to the nearest whole foot (i.e. If width required by HLLR is 4.2 feet, round the width to 5 feet.)
- c) The minimum amount of sand required at the beginning and end of each module row is six inches (6") of sand.

- (6) The aggregate used must be a medium to coarse, washed, silica sand meeting the uniform size and grading requirements in ASTM C33 (sand) specifications. The aggregate must have less than 10% passing a #100 sieve and less than 5% passing a #200 sieve. Alternatively, PA DOT Type A (Cement Concrete Sand) sand may be used.
- (7) A minimum of 12" of specified sand must be placed underneath the B43 modules.
- (8) For percolation rates ranging between 3 min/in to 60 min/in, a minimum of six inches (6") of sand must be placed at the perimeter of the modules. For percolation rates ranging from 61 min/in to 180 min/in, a minimum of eighteen inches (18") of sand will be required along both sides of the B43 modules while a minimum of six inches (6") of sand will be required at the beginning and end of each Module row.
- (9) A minimum of twelve inches (12") of specified sand must be used between rows of modules in beds with percolations rates between 3 min/in to 60 min/in. For percolation rates between 61 min/in to 180 min/in, thirty-six inches (36") of specified sand between rows of modules in beds must be used.
- (10) For gravity systems, the PVC pipe distributing effluent to the B43 modules shall meet the following specifications:
 - a) The diameter of the SDR-35 or equivalent pipe shall be 4 inches.
 - b) The perforations shall be located at both the 4 o'clock and 8 o'clock positions.
- (11) For pressurized systems, the PVC pipe distributing effluent to the B43 modules shall meet the following specifications:
 - a) The diameter of the SDR-35 or equivalent pipe shall be 4 inches.
 - b) The perforations shall be located at both the 4 o'clock and 8 o'clock positions.
 - c) The pipe may have perforations that conform to either II.D.11.c.i or II.D.c.ii configuration:
 - i. Pipe purchased from a manufacturer shall have a 3-hole perforation with the $\frac{5}{8}$ " diameter holes located at the 4 o'clock, 6 o'clock, and 8 o'clock positions.
 - ii. Pipe purchased from a manufacturer shall have a 2-hole perforation with the $\frac{5}{8}$ " diameter holes located at the 4 o'clock and 8 o'clock positions. Additional perforations at the 6 o'clock position are acceptable provided that there are three 6 o'clock perforations in the pipe for each B43 module. The perforations shall be placed such that the first hole be placed 8" from the end of the B43 module. Subsequent perforations shall be placed 16" center to center. (i.e. One 6 o'clock perforation 8" from the end of each module and one 6 o'clock perforation in the center of the B43 module.). The diameter of the perforations at the 6 o'clock shall be either $\frac{5}{8}$ " diameter or $\frac{3}{4}$ " diameter.
- (12) For pressurized systems, the orifices for the inner pipe must:
 - a) Conform to Section 73.44 with the exception that the orifices must be placed at the 12 o'clock position.
 - b) Include a minimum of one $\frac{1}{4}$ " diameter drain hole at the 6 o'clock position for each lateral.
- (13) Due to the assembly of the laterals, Section 73.52(b)(11) is not required.

(14) The area surrounding the tanks and the absorption areas shall be constructed to divert surface water.

E. Use of the Component/System and Siting Requirements:

- (1) Eljen GSF may be used for either new construction or as a repair.
- (2) For final treatment and disposal for an onlot system described in Chapter 73 other than IRSIS, up to a 40 percent reduction in the size of the absorption area is allowed where the percolation rate is in the range of 3 to 60 minutes per inch (min/in), inclusive. However, where the percolation rate is in the range of 61 to 180 min/in, inclusive, no reduction in absorption area sizing is permitted.
- (3) For final treatment and disposal for a shallow at-grade, an at-grade, or an elevated absorption area, the following specifications must be met:
 - a) The system must use a pressure-dosed distribution system.
 - b) The percolation test must be sized in accordance with the requirement of Section 73.16(c)(Table A), using the column under "Subsurface Sand Filters and Elevated Sand Mounds." No sizing reduction is permitted for use of an aerobic tank.
 - c) Placing absorption areas hydraulically upgradient or downgradient from each other (known as "stacking") is prohibited.
 - d) For an at-grade or an elevated absorption areas only. A minimum 4:1 length to width ratio shall be used for slopes ranging from 8% to 12%. Slopes ranging from 12% to 15% shall utilize a 6:1 length to width ratio or greater.
 - e) A 2:1 aggregate slope shall be maintained on all sides of the aggregate.
 - f) Berms shall meet the requirements of Section 73.55(b)(7), 73.55(d)(3), and 73.55(d)(4). The cover over the aggregate shall be 8 to 12 inches of soil suitable for the growth of vegetation and shall be seeded to assure the stability of the berm.
 - g) The surface shall be chisel plowed across the slope, including the area under the berm, as described in Section 73.55(b)(2).
 - h) Lateral end cleanouts are required.
 - i) On sites exhibiting limiting zones **greater than or equal to 20 inches** from the mineral soil surface, the following conditions apply:
 - i. The soil profile must show that there is a minimum of 20 inches of suitable soil between the bottom of the proposed absorption area and the limiting zone.
 - ii. Where the percolation rate is in the range of 3 to 60 minutes per inch, inclusive, up to a 40 percent reduction in the size of the absorption area is allowed. However, where the percolation rate is in the range of 61 to 180 min/in, inclusive, no reduction in absorption area sizing is permitted.
 - j) On sites exhibiting limiting zones **less than 20 inches** from the mineral soil surface, the site must meet the following conditions:
 - i. The minimum vertical isolation distances for this final treatment option is greater than or equal to 10 inches to the seasonal high water table or greater than or equal to 16 inches to rock formation.

- ii. A soil scientist who is a professional member of the Pennsylvania Association of Professional Soil Scientists (PAPSS) or who is a “Qualified Soil Scientist” as defined in Chapter 73 of the regulations must perform a soil morphological test.
- iii. On these sites, the treatment and disposal distribution configuration is based on the horizontal linear loading rate derived from the soil morphological analysis and the Hydraulic Linear Loading Rate (HLLR) described by Table 1.
- iv. Preparation of a soils report which includes the following at a minimum:
 - a. Inclusion of project name, project location, date of investigation, soils series, and slope.
 - b. A minimum of four soil profile test pits shall be evaluated to verify the morphology of the proposed absorption site. These soil profiles shall include two soil profile evaluations on contour, bracketing the proposed absorption area, and two soil profile evaluations on contour, 50 feet downgradient from the absorption area.
 - c. Determination of the depth to the seasonal high water table limiting zone and/or the depth to the rock limiting zone.
 - d. Determination of the soil drainage classification and the appropriate loading rate and horizontal linear load from the HLLR table.
 - e. The on-contour spacing of the soil profile evaluations shall not exceed 100 feet in length.
 - f. In cases where the calculated aggregate area length exceeds 100 feet, additional test pit evaluations are required to verify the soil morphology of both the absorption area and the downgradient area.
 - g. Overall site suitability will be limited by the most restrictive depth to the seasonal high water table, depth to rock formation and soil morphology from all of the soil test pits evaluated.
 - h. The soil must have a consistency of “very firm” or less to be suitable.
 - i. Distribution of the effluent in the absorption area will be determined by the soil profile evaluations and the vertical depth between the bottom of the aggregate and the top of the seasonal high water table or rock formation.
 - j. The loading rate (required to calculate aggregate area square footage) and hydraulic loading rate (required to calculate aggregate area length) shall be determined with the HLLR table by using the most restrictive results from the soil profile evaluations conducted. The shape and grade of structure, as well as textural classification of the mineral soil from the profile horizon above the seasonal high water table or restrictive horizon, is used to determine these rates.

- k. Signature of the qualified soil scientist (a professional member of the Pennsylvania Association of Professional Soil Scientists (PAPSS) or is a qualified soil scientist as defined in Section 73.1) certifying the contents of the soils report which includes the items in Section II.E(3)j)iv.
- (4) Where absorption area sizing reductions are proposed, they are not cumulative. No additional sizing reduction is allowed for use of an aerobic tank.
- (5) If absorption area sizing reductions are proposed, where the system is used to serve a new dwelling, the soil profile evaluations and percolation testing must document that sufficient area is available for installation of a full-sized absorption area (prior to the calculation of the 40% reduction).
- (6) The absorption area must be designed to take full advantage of the slope to move effluent out from under the absorption area and downgradient with the laterals placed parallel to the contour.

III. Minimum Maintenance Standards

- A. The manufacturer's representative must meet with the property owner within one (1) month of system start-up and/or occupancy of the dwelling and with the local agency's SEO upon request, to explain the operation and maintenance of the system and provide written instructions to the property owner that includes:
 - (1) GSF Septic System Owner's Manual;
 - (2) Instructions on the operation and maintenance of the system;
 - (3) The locations of all parts of the system;
 - (4) A commitment that the manufacturer's service provider will investigate and troubleshoot system problems;
 - (5) Contact information for the manufacturer, the manufacturers' representatives, and manufacturer's service provider;
- B. Warranty: The manufacturer of the Eljen GSF must provide a minimum 2-year warranty on all defects due to materials or workmanship.
- C. Inspection and Maintenance:
 - (1) Inspection of the area around soil absorption area every 6 months by the homeowner to ensure that there is no ponding of effluent or downgradient seepage.
 - (2) The Eljen GSF system should be maintained per the manufacturer's Septic System Owner's Manual.
 - (3) The service provider shall inspect at least the following items at an interval frequency recommended by the manufacturer's requirements:
 - a) Inspect septic tanks, dosing tanks, and lift pump tanks for structural integrity of the tank, inlet and outlet baffles, solids retainer, pumps, siphons, and electrical connections;
 - b) Ensure that the pumping system is operational;
 - c) Ensure that the absorption area cleanouts and/or vents are in proper working condition;
 - d) Ensure that the septic effluent filter is in proper working condition.

- (4) The service provider shall inspect and pump excess solids in accordance with the manufacturer's requirements.

IV. Permitting Requirements

- A. An SEO who has successfully completed an appropriate Department sponsored training course that included this specific technology or has received review delegation in writing from the Department may independently review the design and issue the permit for systems including components designed under this listing. All other system proposals under this listing must be submitted to the Department for review and comment.
- B. Copies of the plans and specifications and the designer's report are to be attached to the applicant's, sewage enforcements officer's, and the Department's copy of the application for sewage permit.

V. Planning Requirements

Not Applicable

Table 1
Hydraulic Linear Loading Rate Table

Soil Characteristics			Infiltration Loading Rate, gal/ft ² /d	Hydraulic Liner Loading Rate, gal/ft/d					
				Slope					
Texture	Structure			0-4%		5-9%		>10%	
	Shape	Grade		Infiltration Distance, Inch		Infiltration Distance, Inch		Infiltration Distance, Inch	
				10-12	12-20	10-12	12-20	10-12	12-20
COS, S, LCOS, LS	--	0SG	1.6	4.0	5.0	5.0	6.0	6.0	7.0
FS, VFS, LFS, LVFS	--	0SG	1.0	3.5	4.5	4.0	5.0	5.0	6.0
CSL, SL	--	0M	0.6	3.0	3.5	3.6	4.1	5.0	6.0
	PL	1	0.5	3.0	3.5	3.6	4.1	4.0	5.0
		2, 3							
	PR/BK /GR	1	0.7	3.5	4.5	4.0	5.0	5.0	6.0
2, 3		1.0	3.5	4.5	4.0	5.0	5.0	6.0	
FSL, VFSL	--	0M	0.5	2.0	2.3	2.4	2.7	2.7	3.2
	PL	1, 2, 3							
		1	0.6	3.0	3.5	3.3	3.8	3.6	4.1
	PR/BK /GR	2, 3	0.8	3.3	3.8	3.6	4.1	3.9	4.4
L		--	0M	0.5	2.0	2.3	2.4	2.7	2.7
	PL	1, 2, 3							
		1	0.6	3.0	3.5	3.3	3.8	3.6	4.1
	PR/BK /GR	2, 3	0.8	3.3	3.8	3.6	4.1	3.9	4.4
SIL		--	0M	0.2	2.0	2.5	2.2	2.7	2.4
	PL	1, 2, 3							
		1	0.6	2.4	2.7	2.7	3.0	3.0	3.5
	PR/BK /GR	2, 3	0.8	2.7	3.0	3.0	3.5	3.3	3.8
SCL, CL, SICL		--	0M						
	PL	1, 2, 3							
		1	0.3	2.0	2.5	2.2	2.7	2.4	2.9
	PR/BK /GR	2, 3	0.6	2.4	2.9	2.7	3.0	3.0	3.5
SC, C, SIC		--	0M						
	PL	1, 2, 3							
		1							
	PR/BK /GR	2, 3	0.3	2.0	2.5	2.2	2.7	2.4	2.9

Adapted from Tyler, 2000.

Width of Infiltration Field = Hydraulic Linear Loading Rate divided by Infiltration Hydraulic Loading Rate

Length of Infiltration Field = Wastewater Volume divided by Hydraulic Linear Loading Rate