GSF®

Geotextile Sand Filter

Eljen Iowa Sand Filter
Design & Installation Manual

eljen
CORPORATION

Innovative Onsite Products & Solutions Since 1970

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Glossary of Terms

A42 Module 48” x 24” x 7” (L x W x H)

Cover Fabric The geotextile cover fabric (provided by manufacturer) that is placed over the GSF modules.

Design Flow The estimated peak flow that is used to size a GSF system is 150 gallons per day per Bedroom.

GSF The Eljen Geotextile Sand Filter Modules and the sand layer at the base and along the sides of the modules.

GSF Module The individual module of a GSF system. The module is comprised of a cuspated plastic core and geotextile fabric.

Specified Sand To ensure proper system operation, the system MUST be installed using ASTM C33 Sand.

ASTM C33 sand will have less than 10% passing the #100 Sieve and less than 5% passing the # 200 sieve. Ask your material supplier for a sieve analysis to verify that your material meets the required specifications.

TABLE 1: SPECIFIED SAND SIEVE REQUIREMENTS

ASTM C33 SAND SPECIFICATION		
Sieve Size	Sieve Square Opening Size	Specification Percent Passing (Wet Sieve)
3/8 inch	9.52 mm	100
No. 4	4.76 mm	95 - 100
No. 8	2.38 mm	80 - 100
No. 16	1.19 mm	50 - 85
No. 30	590 µm	25 - 60
No. 50	297 µm	5 - 30
No. 100	149 µm	0 - 10
No. 200	75 µm	0 - 5

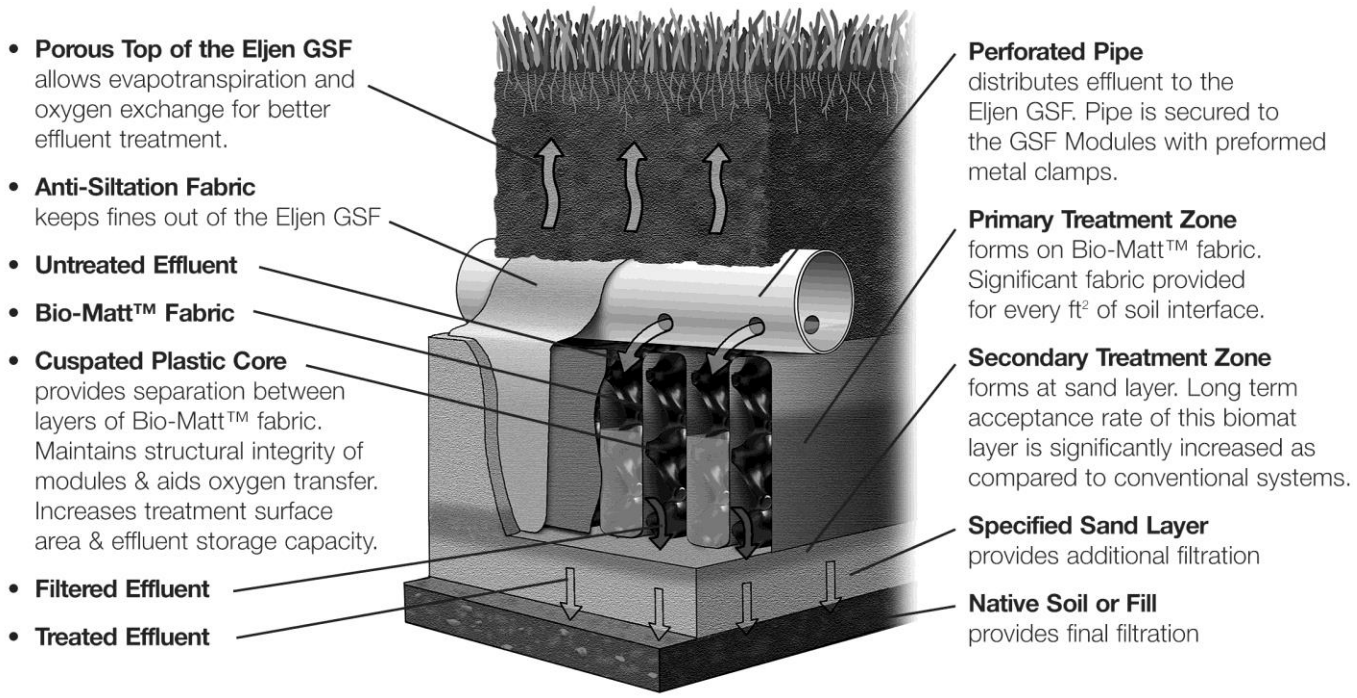
Primary Treatment Zone

- Perforated pipe is centered above the GSF module to distribute septic effluent over and into corrugations created by the cuspated core of the geotextile module.
- Septic effluent is filtered through the Bio-Matt fabric. The module's unique design provides increased surface area for biological treatment that greatly exceeds the module's footprint.
- Open air channels within the module support aerobic bacterial growth on the modules geotextile fabric interface, surpassing the surface area required for traditional absorption systems.
- An anti-siltation geotextile fabric covers the top and sides of the GSF module and protects the Specified Sand and soil from clogging, while maintaining effluent storage within the module.

Secondary Treatment Zone

- Effluent drips into the Specified Sand layer and supports unsaturated flow into the native soil. This Specified Sand/soil interface maintains soil structure, thereby maximizing the available absorption interface in the native soil. The Specified Sand supports nitrification of the effluent, which reduces oxygen demand in the soil, thus minimizing soil clogging from anaerobic bacteria.
- The Specified Sand layer also protects the soil from compaction and helps maintain cracks and crevices in the soil. This preserves the soil's natural infiltration capacity, which is especially important in finer textured soils, where these large channels are critical for long-term performance.
- Native soil provides final filtration and allows for groundwater recharge.

FIGURE 1: GSF SYSTEM OPERATION



Testing and Performance

GSF Modules were subjected to independent third-party testing in accordance with NSF/ANSI Standard 40 Protocol. Three different methods of distribution were tested:

- Pressure Distribution
- Lift Pump/Gravity Demand Dosed Distribution
- Gravity Distribution

The data and detailed reports for each system tested were reviewed by NSF in accordance with NSF/ANSI Standard 40 Protocol and the Pennsylvania Department of Environmental Protection Technical Verification Program. This independent review validates the performance data listed below for Demand Dosed, Pressure Dosed, and Gravity systems.

Testing Arrangement & Common Factors:

Common Factors for all tested systems listed in Table 2:

- A42 modules: (L x W x H) 48" x 24" x 7" plus Specified Sand.
- Six modules per bedroom at 150 gal/day, 18 modules total for three bedrooms per house equals 450 gal/day.
- Standard distribution pipe with orifices at the 4 & 8 o'clock position,
- 12 inches of Specified Sand base extending 6 inches at either edge of the modules.

Lift Pump/Gravity Demand Dosed System:

- 1000-gal septic tank – 500-gallon pump chamber to distribution box.
- Dial-a-flow fittings set level to deliver effluent into each of the three rows of laterals via a 4-inch perforated distribution pipe with orifices at the 4 & 8 o'clock position.
- A non-perforated pipe connects the distal end to the end of other rows.

Time Pressure Dosed System:

- 1000-gal septic tank – 500-gal pump chamber – 1.25" low-pressure pipe (LPP) or other diameter as required.
- LPP placed inside a 4-inch perforated distribution pipe with orifices at 12 o' clock, at least one drain hole per line at 6 o'clock.
- The 4-inch perforated pipe orifices are placed at the 4 & 8 o'clock positions with the end of pipe capped

Gravity System Trench Design:

- 1000-gal septic tank–gravity to distribution box.
- Dial-a-flow fittings set level to deliver influent into three individual trenches.
- Perforated distribution pipe with orifices at the 4 & 8 o'clock positions with the end of pipe capped.

TABLE 2: TESTING RESULTS

GSF Modules Treatment Performance
NSF Standard 40 Protocol
Wastewater Influent Median Characteristics:
CBOD 180 mg/L & TSS 180 mg/L

Demand Dosed

	CBOD (mg/L)	TSS (mg/L)
Mean	2	2.7
Median	1	2.5
Min Value	1	2.5
Max Value	7.2	7

GSF Modules Treatment Performance
NSF Standard 40 Protocol
Wastewater Influent Median Characteristics:
CBOD 180 mg/L & TSS 190 mg/L

Timed Pressure Dosed

	CBOD (mg/L)	TSS (mg/L)
Mean	2.6	2.7
Median	2.2	2.5
Min Value	1	2.5
Max Value	14	9

GSF Modules Treatment Performance
NSF Standard 40 Protocol
Wastewater Influent Median Characteristics:
CBOD 180 mg/L & TSS 180 mg/L

Gravity

	CBOD (mg/L)	TSS (mg/L)
Mean	8	7.4
Median	7.6	5
Min Value	1	2.5
Max Value	18	55

TSS 2.5mg/L = sample was below detection limits
CBOD 1.0mg/L = sample was below detection

1.0 Conditions for Use

1.0.1 ALTERATION OF MODULES: GSF modules shall not be altered by cutting or any other type of physical modification.

1.0.2 WATER SOFTENER BACKWASH: Water softener backwash shall be discharged to a separate soil absorption field meeting all required state codes and local regulations.

1.0.3 SEPTIC TANK OUTLET FILTERS: Eljen requires the use of outlet filters on all tanks including single compartment tanks, up-sized tanks or when the dwelling has a garbage disposal installed.

1.0.4 GARBAGE DISPOSALS: Eljen discourages the use of garbage disposals with septic systems. If a GSF system is to be designed and installed with garbage disposals the following measures must be taken to prevent solids from leaving the tank and entering the GSF system:

- Increase the septic tank capacity by a minimum of 30% *or*
- Installation of a second septic tank installed in series if a multi-compartment tank isn't used

1.0.5 ADDITIONAL FACTORS AFFECTING RESIDENTIAL SYSTEM SIZE: Homes with expected higher than normal water usage may consider increasing the septic tank volume as well as incorporating a multiple compartment septic tank. Consideration for disposal area may be up-sized for expected higher than normal water use.

For example:

- Luxury homes, homes with a Jacuzzi style tubs, and other high use fixtures.
- Homes with known higher than normal occupancy.

1.0.6 SYSTEM PROHIBITED AREAS: All vehicular traffic is prohibited over the GSF system. GSF systems shall not be installed under paved or concreted areas. If the system is to be installed in livestock areas, the system must be fenced off around the perimeter to prevent compaction of the cover material and damage to the system.

1.0.7 ELJEN INSTALLER CERTIFICATION: All installers are required to be trained and certified by an authorized Eljen representative. Contact your local distributor for training information.

1.1 System Installation Sizing and Guidelines

1.1.1 REQUIREMENTS: GSF systems must meet the local rules and regulations except as outlined in this manual. The Chapter 69 of the Iowa Regulations, Private Sewage Disposal Systems and the local regulations will be referred to as the *guidelines*.

The sizing charts apply to residential systems only and are found in section 1.1.4. Please contact Eljen's Technical Resource Department at 1-800-444-1359 for design information on commercial systems.

1.1.2 NUMBER OF GSF MODULES REQUIRED: The minimum design requirements per 150 gpd are 6 A42 modules or 5 B43 modules. However, use the sizing in Table 2 to determine the minimum modules needed for your system.

1.1.3 SIZING GSF SYSTEMS:

TABLE 3: SYSTEM SIZING

	Residential	Units Required
Gravity Flow	144 sf/bedroom	12 A42s per bedroom
Siphon-dosed	120 sf/bedroom	10 A42s per bedroom
Pressure-dosed	96 sf/bedroom	8 A42s per bedroom

1.1.4 EXPERIMENTAL SYSTEMS: Shall meet the regulation requirements under 69.21 to include plans and specifications submitted by an engineer.

1.1.5 VARIANCES SYSTEMS: The administrative authority has the authority to size the system in accordance with this manual using a variance under 69.22 in the guidelines. The state authority may be consulted in this decision.

2.0 Eljen Iowa Sand Filter Design and Installation

SAND FILTER DESIGN CRITERIA: The Eljen Sand Filter system shall/must be permitted following 567 IAC Ch. 69.21 (private sewage disposal systems) by your local administrative authority typically your local County Sanitarian or Local Board of Health.

	Residential	Units Required
Gravity Flow	144 sf/bedroom	12 A42s per bedroom
Siphon-dosed	120 sf/bedroom	10 A42s per bedroom
Pressure-dosed	96 sf/bedroom	8 A42s per bedroom

Sand Filter Example:

House size: 3 Bedrooms
Design Flow: 450 gpd
System Distribution: Pressure

Calculate Minimum Absorption Area

	Residential	Units Required
Pressure-dosed	96 sf/bedroom	8 A42s per bedroom

Absorption Area: Number of Bedrooms x Absorption Area / Bedroom

3 Bedrooms x 96 ft^2 / bedroom = 288.0 ft^2

Calculate Number of Modules Required

	Residential	Units Required
Pressure-dosed	96 sf/bedroom	8 A42s per bedroom

Number of units required = Bedrooms x Units per Bedroom

A42 units required

3 x 8 units / bedroom = 24 Modules

Calculate Minimum Sand Filter Length

For this configuration, we will use 1 row per bedroom
24 Units ÷ 3 Rows = 8 Mods/Row
Round up 8 Mods/Row

Calculate Minimum Row Length

8 Units x 4 ft/unit +1 = 33 ft per Row

Bed Width

Bed Width = Rows x 3 ft

3 Rows x 3 ft = 9 ft

Final Dimension Layout

(Note: System layout and number of rows will vary based on site constraints)

A42 Sand Filter

Bed Length	33 ft
Bed Width	9 ft
Minimum Number of Units	24 Units
Units per Row	8 units per row
Lateral to Lateral Spacing	3 ft
Lateral to Edge Spacing	1.5 ft
System Area	297 ft^2

FIGURE 2: SAND FILTER PLAN VIEW

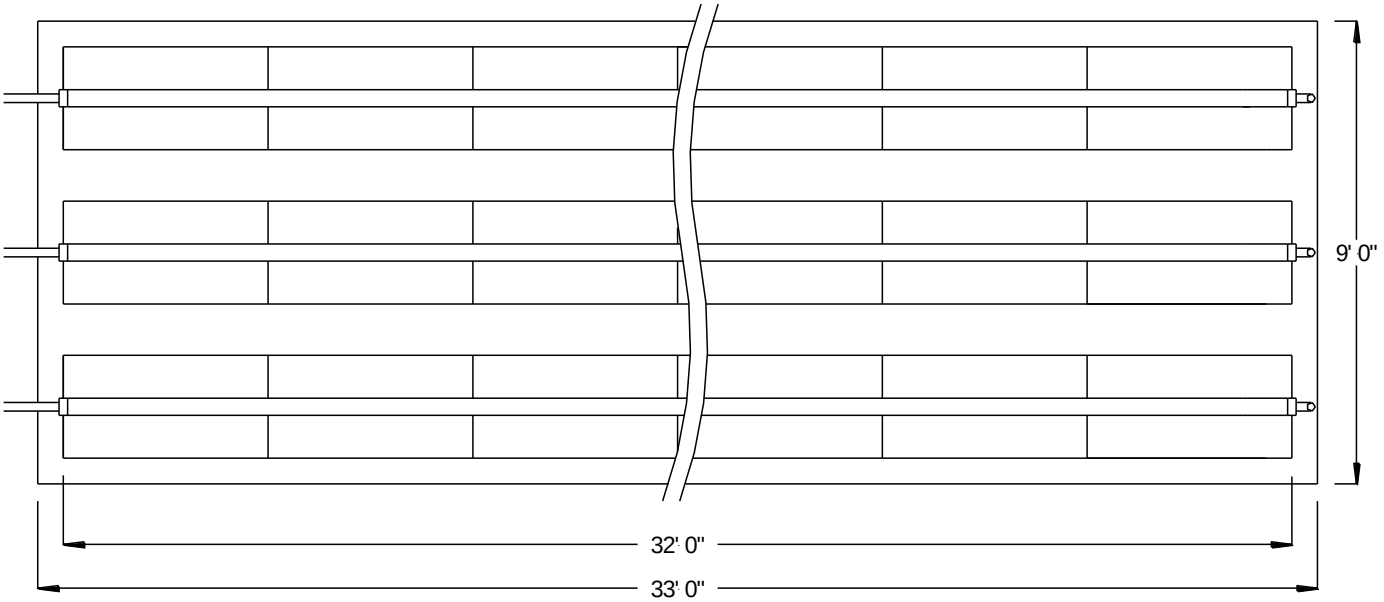
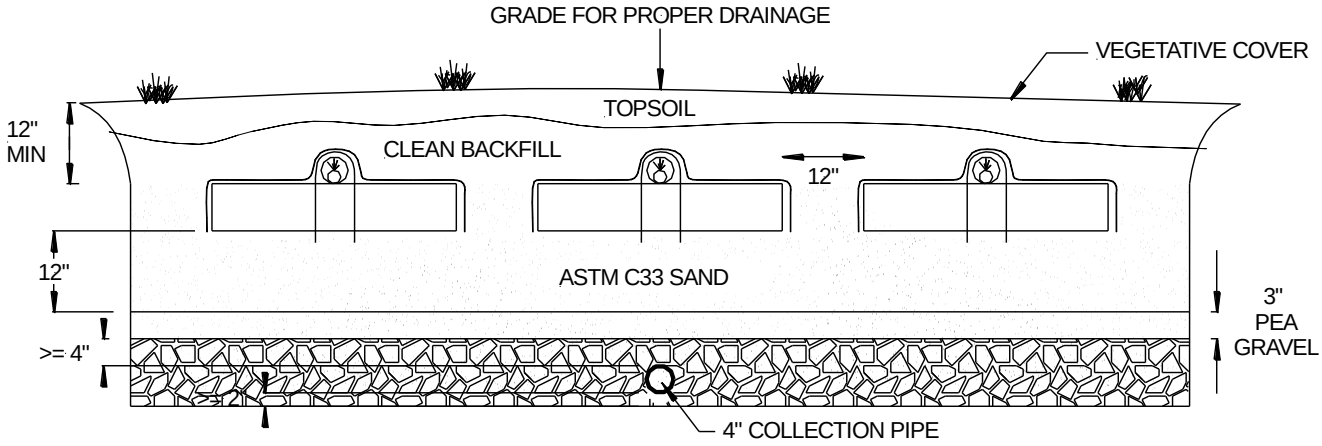


FIGURE 3: SAND FILTER CROSS SECTION



1.1 Sand Filter Installation Sizing and Guidelines

1. Ensure all components leading to the GSF system are installed properly. Septic tank effluent filters are required with the GSF system.

2. Determine the number of GSF Modules and layout required using the sand filter sizing example.

3. Carefully lay out all boundaries defining the location and elevation for all system components.
    a. Boundaries should be extended in all directions of the bed measurements to make room in the excavation for the Liner Installation.
    b. Eljen recommends a minimum of 5 ft for ease of movement in the excavation.

4. Prepare the site according to state and local regulations.

5. Plan all drainage requirements above (up-slope) the system and set soil grades to ensure storm water drainage and surface water is diverted away from the absorption area once the system is complete.

6. Excavate the bed area.

7. Place the Liner in the excavation down the center line.

8. Place gravel and pea gravel base under and over drainage pipe in the liner to a level height.

9. Place and stabilize a 12-inch level layer of ASTM C-33 sand along the pea gravel bottom, 6-inch at a time.

10. ASTM C-33 Sand must meet the requirements listed in the component section of this manual. Ask your material supplier for a sieve analysis report to verify that the sand you are going to install meets this specification. A hand tamper or a vibratory plate compactor is sufficient for stabilization of the ASTM C-33 Sand layer.

11. Place GSF modules with **PAINTED STRIPE FACING UP**, end to end on top of the specified sand along their 4-foot length.

12. A standard 4-inch perforated pipe, SDR 35 or equivalent, is centered along the modules 4-foot length. Orifices are set at the 4 & 8 o'clock positions.

13. All 4-inch pipes are secured with manufacturers supplied wire clamps, one per module.

14. (Pressure Distribution Systems) Insert a pressure pipe (size per design and code) into the standard 4-inch perforated pipe. The pressure pipe orifices are set at the 12 o'clock position as shown in Figure 13. Each pressure lateral will have a drain hole at the 6 o'clock position. Each pressure lateral shall have a clean out at the end of each module row.

15. Ensure the rows are level.

16. ***Cover fabric substitution is not allowed.*** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the row, with the fabric fitted to the perforated pipe on top of the GSF modules. Fabric should be neither too loose, nor too tight. The correct tension of the cover fabric is set by:
    a. Spreading the cover fabric over the top of the module and down both sides of the module with the cover fabric tented over the top of the perforated distribution pipe.
    b. Place shovelfuls of Specified Sand directly over the pipe area allowing the cover fabric to form a mostly vertical orientation along the sides of the pipe. Repeat this step moving down the pipe.

2. Place 6 inches of Specified Sand along both sides of the modules edge. A minimum of 6 inches of Specified Sand is placed at the beginning and end of each module row. A minimum of 12 inches of Specified Sand is placed in between module rows.

17. Complete backfill with topsoil, a minimum of 12 inches of cover over the GSF modules. Backfill exceeding 18 inches requires venting at the distal end of the system. Fill must be clean, porous, and devoid of rocks. Do not use wheeled equipment over the system during backfill operation. A light track machine may be used with extreme caution, avoiding crushing, or shifting of pipe assembly. Divert surface runoff. Finish grade to prevent surface ponding. Use backfill material that is soil suitable for the growth of vegetation and be seeded to control erosion.

COMPANY HISTORY

Established in 1970, Eljen Corporation created the world's first prefabricated drainage system for foundation drainage and erosion control applications. In the mid-1980s, we introduced our Geotextile Sand Filter products for the passive advanced treatment of onsite wastewater in both residential and commercial applications. Today, Eljen is a global leader in providing innovative products and solutions for protecting our environment and public health.

COMPANY PHILOSOPHY

Eljen Corporation is committed to advancing the onsite industry through continuous development of innovative new products, delivering high quality products and services to our customers at the best price, and building lasting partnerships with our employees, suppliers, and customers.

eljen CORPORATION

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