Table of Contents

SUBJECT

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSF SYSTEM DESCRIPTION</td>
<td>5</td>
</tr>
<tr>
<td>1.0 DESIGN AND INSTALLATION</td>
<td>6</td>
</tr>
<tr>
<td>2.0 TRENCH INSTALLATION SIZING AND GUIDELINES</td>
<td>10</td>
</tr>
<tr>
<td>3.0 BED INSTALLATION SIZING AND GUIDELINES</td>
<td>13</td>
</tr>
<tr>
<td>4.0 MOUND INSTALLATION SIZING AND GUIDELINES</td>
<td>16</td>
</tr>
<tr>
<td>5.0 DOSING DISTRIBUTION GUIDANCE</td>
<td>20</td>
</tr>
<tr>
<td>6.0 PRESSURE DISTRIBUTION GUIDANCE</td>
<td>20</td>
</tr>
<tr>
<td>7.0 SYSTEM VENTILATION</td>
<td>21</td>
</tr>
<tr>
<td>8.0 TREATMENT APPLICATIONS</td>
<td>24</td>
</tr>
</tbody>
</table>

GSF DRAWINGS AND TABLES

| FIGURE 1: GSF SYSTEM OPERATION               | 5    |
| FIGURE 2: TYPICAL A42 GSF CROSS SECTION     | 6    |
| FIGURE 3: SEPARATION DISTANCE TO THE LIMITING LAYER | 7    |
| FIGURE 4: PLAN VIEW – 800 GPD – A42 TRENCH SYSTEM – LEVEL SITE | 10   |
| FIGURE 5: SECTION VIEW – 800 GPD – A42 TRENCH SYSTEM – LEVEL SITE | 11   |
| FIGURE 6: SECTION VIEW – 800 GPD – A42 TRENCH SYSTEM – SLOPING SITE | 11   |
| FIGURE 7: PLAN VIEW – 600 GPD – A42 BED SYSTEM – SLOPING SITE | 14   |
| FIGURE 8: SECTION VIEW – 600 GPD – A42 BED SYSTEM – LEVEL SITE | 14   |
| FIGURE 9: SECTION VIEW – 600 GPD – A42 BED SYSTEM – SLOPING SITE | 14   |
| FIGURE 10: CROSS SECTION – PRESSURE MOUND SYSTEM | 16   |
| FIGURE 11: PLAN VIEW – PRESSURE MOUND SYSTEM | 16   |
| FIGURE 12: PLAN VIEW – 600 GPD – DISTRIBUTION CELL MOUND SYSTEM | 18   |
| FIGURE 13: SECTION VIEW – 600 GPD – MOUND SYSTEM | 18   |
| FIGURE 14: SECTION VIEW – 600 GPD – MOUND SYSTEM | 18   |
| FIGURE 15: PRESSURE PIPE PLACEMENT           | 20   |
| FIGURE 16: PRESSURE CLEANOUT                 | 21   |
| FIGURE 17: CONTOURED TRENCH PRESSURE DISTRIBUTION | 21   |
| FIGURE 18: VENT FOR GRAVITY AND DEMAND DOSED BED SYSTEMS | 22   |
| FIGURE 19: AIR BY-PASS LINE PLAN VIEW FOR VENTING OF PUMPED SYSTEMS | 22   |
| FIGURE 20: VENT LAYOUT FOR GRAVITY AND LOW PRESSURE SYSTEMS | 23   |
| FIGURE 21: GSF WITH 4” VENT EXTENDED TO CONVENIENT LOCATION | 23   |
| FIGURE 22: TYPICAL A42 GSF TREATMENT CROSS SECTION | 24   |

TABLES

| TABLE 1: SPECIFIED SAND SIEVE REQUIREMENTS | 4    |
| TABLE 2: ILLUSTRATION M – SOIL SUITABILITY FOR ON-SITE SEWAGE DESIGN | 9    |
| TABLE 3: GSF A42 TRENCH SIZING CHART       | 9    |
### Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A42 Module</strong></td>
<td>48&quot; x 24&quot; x 7&quot; (L x W x H)</td>
</tr>
<tr>
<td><strong>Bio-Matt™ fabric</strong></td>
<td>Proprietary filter fabric within the Geotextile Sand Filter Modules upon which the primary biomat layer forms.</td>
</tr>
<tr>
<td><strong>Cover Fabric</strong></td>
<td>The geotextile cover fabric (provided by manufacturer) that is placed over the GSF modules.</td>
</tr>
<tr>
<td><strong>Cuspated Core</strong></td>
<td>The rigid plastic core of the GSF module. It separates the geotextile fabric and creates downward infiltration channels and upward aeration channels to provide primary filtration and biological treatment of the septic effluent. The curvilinear shape of the cuspsations offers increased treatment surface area and greater effluent storage.</td>
</tr>
<tr>
<td><strong>Design Flow</strong></td>
<td>The estimated peak flow that is used to size a GSF system is derived from the Illinois 2003 Private Sewage Disposal Licensing Act and Code, January 2011, Section 905, Quantity of Sewage Flows. 200 gpd per bedroom for single family homes.</td>
</tr>
<tr>
<td><strong>Distribution Box</strong></td>
<td>A plastic or concrete box that receives effluent from a septic tank and splits the flow to pipes placed above the GSF modules. For equal distribution, the outlet pipe orifices are typically set at the same elevation to equalize the flow to each line.</td>
</tr>
<tr>
<td><strong>Flow Dial/Equalizer</strong></td>
<td>Special insert placed in the end of distribution pipes within the distribution box to compensate for possible unlevel installation and promote favorable flow to the distribution pipes.</td>
</tr>
<tr>
<td><strong>GSF</strong></td>
<td>The Eljen Geotextile Sand Filter Modules and the 6-inch sand layer at the base and 6 inches along the sides of the modules.</td>
</tr>
<tr>
<td><strong>GSF Module</strong></td>
<td>The individual module of a GSF system. The module is comprised of a cuspated plastic core and corrugated geotextile fabric.</td>
</tr>
<tr>
<td><strong>LTAR</strong></td>
<td>Long Term Acceptance Rate (LTAR) is the average equilibrium absorption rate for effluent in a system, usually expressed in gallons per day per square foot. It should not be confused with the soil loading rate that is used by regulatory officials in their regulations.</td>
</tr>
<tr>
<td><strong>SHWT</strong></td>
<td>Seasonal High-Water Table (SHWT), whether perched or regional, determined by direct observation of the water table or indicated by soil mottling where common mottles comprise at least 2% to 20% of the soil, in a progressive downward direction in the soil.</td>
</tr>
</tbody>
</table>
Specified Sand  
To ensure proper system operation, the system must be installed using ASTM C33 sand with less than 10% passing a #100 sieve and less than 5% passing a #200 sieve. Listed below is a chart outlining the sieve requirements for the Specified Sand. Ask your material supplier for a sieve analysis to verify that your material meets the required specifications.

**TABLE 1: SPECIFIED SAND SIEVE REQUIREMENTS**

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Sieve Square Opening Size</th>
<th>Specification Percent Passing (Wet Sieve)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>9.52 mm</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>4.76 mm</td>
<td>95 - 100</td>
</tr>
<tr>
<td>No. 8</td>
<td>2.38 mm</td>
<td>80 - 100</td>
</tr>
<tr>
<td>No. 16</td>
<td>1.19 mm</td>
<td>50 - 85</td>
</tr>
<tr>
<td>No. 30</td>
<td>590 µm</td>
<td>25 - 60</td>
</tr>
<tr>
<td>No. 50</td>
<td>297 µm</td>
<td>5 - 30</td>
</tr>
<tr>
<td>No. 100</td>
<td>149 µm</td>
<td>0 - 10</td>
</tr>
<tr>
<td>No. 200</td>
<td>75 µm</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>
GSF System Description

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 module’s 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
1.0 Design and Installation

1.1 REQUIREMENTS: GSF systems must meet the local rules and regulations except as outlined in this manual. The Illinois 2003 Private Sewage Disposal Licensing Act and Code, January 2011, and the local regulations will be referred to as the guidelines in this manual.

Please contact Eljen’s Technical Resource Department at 1-800-444-1359 for design information on commercial systems.

1.2 DESIGN FLOW: The Eljen GSF is sized using 200 gpd per bedroom.

1.3 SIZING GSF SYSTEM FOR TRENCHES, BEDS & SAND MOUNDS:

The absorption capacity of the soil shall be determined by a soil investigation and Illustration M of the Private Sewage Disposal Code. Procedures for the soil investigation are outlined in Section 90.55 a) of the regulations. Illustration M is attached below for your convenience.

1.4 SPECIFIED SAND SPECIFICATION FOR TRENCH SYSTEMS: The first 6 inches of sand immediately under and the 6 inches of sand around the perimeter of the GSF system must be an ASTM C33 WASHED CONCRETE SAND WITH LESS THAN 10% PASSING A #100 SIEVE AND LESS THAN 5% PASSING A #200 SIEVE. Please place a prominent note to this effect on each design drawing. See Table 1 for more information on the ASTM C33 sand and sieve specifications.
1.5 SEPARATION DISTANCE TO LIMITING LAYER: Measure from the bottom of the GSF unit to the limiting layer. The figure below depicts proper placement of the GSF with the limiting layer. A minimum one-foot separation is required. Measure from the bottom of the sand to the restrictive layer.

![Separation Distance to the Limiting Layer](image)

1.6 CONNECTIONS AND FITTINGS: Connections of lines to tanks and distribution boxes must be made using watertight mechanical seals. Use of any grouting material is not permitted.

1.7 PLACING GSF MODULES: The “White Stripe” on the GSF modules indicates the top of the module and is not intended to indicate the location of the distribution pipe. With the white stripe facing up, all rows of GSF modules are set level, end to end on the Specified Sand layer. No mechanical connection is required between modules.

1.8 DISTRIBUTION PIPE: SDR-35 or equivalent is required. Place perforated pipe on top of GSF modules with holes at 4 and 8 o’clock. Secure pipe to GSF modules with provided wire clamps, one clamp per Eljen module. All piping must meet state and local regulations.

1.9 DISTRIBUTION BOX: Set the gravity system D-box outlet invert a minimum of ¼ inch drop in elevation per linear foot to the top first module in the trench. Set a 2-inch minimum drop for dosed systems from the D-box to the modules. Ensure that the distribution box and pipes feeding the system are placed on settled soil. Flow Dials may be used in either Gravity or Dosed installations.

1.10 COVER FABRIC: Geotextile cover fabric is provided by Eljen Corporation for all GSF systems. It is placed over the top and sides of the module rows to prevent long term siltation and failure. **Cover fabric substitution is not allowed.** Fabric should drape vertically over the pipe and must not block holes in the distribution pipe or be stretched from the top of the pipe to the outside edge of the modules. “Tenting” will cause undue stress on fabric and pipe.

1.11 BACKFILL & FINISH GRADING: Complete backfill with 12-18 inches of clean porous fill measured from the top of modules. Backfill exceeding 18 inches requires venting at the far end of the trench or bed. Use well graded native soil fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of the pipe assembly. Divert surface runoff from the Effluent Disposal Area, (EDA). Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.
1.0 Design and Installation

1.12 ADDITIONAL FACTORS EFFECTING 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.

1.13 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, follow the guidance from the guidelines, Section 905.20, paragraph o: When garbage grinders are used in residential property, solids shall be retained by one of the following methods:

- A solids retention tank constructed in accordance with Section 905.40 (of the guidelines) shall be placed between the wastewater source and the septic tank to intercept solids from the garbage grinder. This tank shall receive waste from the garbage grinders or the kitchen wastes only. No other fixtures shall discharge into this tank. The solids retention tank shall be at least 50% in liquid volume of the septic tank sized for the waste from the rest of the property; however, the minimum size tank to be used shall be 500 gallons.

- A septic tank receiving all flows from the property sized in accordance with Appendix A, Illustration F of the guidelines.

1.14 WATER SOFTENER BACKWASH: At no time should water softener backwash be disposed of in the septic system. Water softener backwash should be discharged to a separate soil absorption field.

1.15 SEPTIC TANKS: Many designers are now specifying dual compartment tanks for all their systems. Eljen supports this practice as it helps to promote long system life by reducing TSS and BOD to the effluent disposal area. Gas baffles are also recommended.

1.16 SEPTIC TANK FILTERS: Wastewater filters are required as a means of preventing solids from leaving the tank and entering your system. Filter manufactures require that filters be cleaned from time to time. Ask your installer or designer for specific cleaning requirements based on the type or make of the filter installed. Eljen requires the septic tank to be pumped every three years or as needed which would be a good time to check and conduct filter maintenance.

1.17 SYSTEM VENTING: It is strongly recommended to vent all systems that are over 18” below finished grade and systems beneath any surface condition that would not allow for surface air exchange with the system such as patios. See Section 8.0 for a more detailed explanation of venting GSF products.

1.18 NUMBER OF GSF MODULES REQUIRED: Residential systems use a minimum of six (6) A42 modules per bedroom.
TABLE 2: ILLUSTRATION M – SOIL SUITABILITY FOR ON-SITE SEWAGE DESIGN

<table>
<thead>
<tr>
<th>Design Group</th>
<th>Soil Group (Most limiting Layer)</th>
<th>Permeability Range</th>
<th>Residential Reg. Absorption (ft²/bedroom)</th>
<th>Institutional/Commercial Allowable Application Rate (GPD/ft²)</th>
<th>Units per Bed in Bed Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1A</td>
<td>Very Rapid</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>II</td>
<td>2A; 2B 2K</td>
<td>Rapid</td>
<td>100</td>
<td>2.00</td>
<td>6</td>
</tr>
<tr>
<td>III</td>
<td>3B; 3K</td>
<td>High Moderately Rapid</td>
<td>110</td>
<td>1.82</td>
<td>6</td>
</tr>
<tr>
<td>IV</td>
<td>3A; 3C; 3L; 4B; 4K</td>
<td>Low Moderately Rapid</td>
<td>120</td>
<td>1.68</td>
<td>7</td>
</tr>
<tr>
<td>V</td>
<td>4A; 4C; 4D; 4L; 4M; 5B; 5D</td>
<td>Very High Moderate</td>
<td>133</td>
<td>1.50</td>
<td>8</td>
</tr>
<tr>
<td>VI</td>
<td>5C; 5E; 5K; 6F</td>
<td>High Moderate</td>
<td>145</td>
<td>1.38</td>
<td>9</td>
</tr>
<tr>
<td>VII</td>
<td>5A; 5H; 6D</td>
<td>Moderate</td>
<td>163</td>
<td>1.24</td>
<td>10</td>
</tr>
<tr>
<td>VIII</td>
<td>4N; 5I; 5L; 6A; 6E; 6G; 6K</td>
<td>Low Moderate</td>
<td>193</td>
<td>0.52</td>
<td>10</td>
</tr>
<tr>
<td>IX(2)</td>
<td>5J; 5M; 6C; 6H; 6L; 7A; 7D; 7F</td>
<td>High Moderately Slow</td>
<td>223</td>
<td>1.04</td>
<td>11</td>
</tr>
<tr>
<td>X(2)</td>
<td>6I; 7E; 7G; 8A</td>
<td>Low Moderately Slow</td>
<td>250</td>
<td>0.80</td>
<td>11</td>
</tr>
<tr>
<td>XI(2)</td>
<td>5N; 6J; 6M; 7I; 7K</td>
<td>Slow</td>
<td>370</td>
<td>0.54</td>
<td>12</td>
</tr>
<tr>
<td>XII(2)</td>
<td>7J; 7L; 8I</td>
<td>Very Slow</td>
<td>500</td>
<td>0.40</td>
<td>13</td>
</tr>
<tr>
<td>XII(2)</td>
<td>6N; 7M; 7N; 8J; 8N</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>XIII</td>
<td>9</td>
<td>SUBSURFACE DISPOSAL NOT RECOMMENDED</td>
<td>223</td>
<td>1.04</td>
<td>11</td>
</tr>
</tbody>
</table>

The chart above reflects a 50% reduction for residential and a 2:1 increase for institutional/commercial applications and gives the required field size for a system in relation to the design group. It also shows the required units per bedroom for bed designs in relation to the design group. To calculate the number of modules required in a trench, use the required absorption area from this table divided by the square foot per module from Table 3. Section 2.0 gives more information on trench sizing and Section 3.0 gives more information on bed sizing. Soils in Design groups IX through XII should be designed with additional care.

TABLE 3: GSF A42 TRENCH SIZING CHART

<table>
<thead>
<tr>
<th>Eljen Module</th>
<th>Sizing (sq ft / Module)</th>
<th>Sizing (sq ft / lf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A42</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>

For bed systems, use a minimum of 6 A42 Modules per bedroom. You can maximize out at 13 A42 Modules per bedroom.

For trench systems, divide your total Eljen Drain Field Size by 12 ft² for A42 Modules to determine the minimum number of modules needed. Use a center to center spacing of 9 ft between trench distribution lines.
2.0 Trench Installation Sizing and Guidelines

Trench Example:

House size 4 Bedrooms
Size of System (determined from Table 2) Group V 133 Square Feet/Bedroom

Conventional Field Size = Size of System x Bedrooms =
133 ft²/Bedroom x 4 Bedrooms 532 ft²

Modules Required = Conventional Field Size ÷ Eljen Sizing
A42: 532 ft² ÷ 12 ft²/Module = 44.3, round to 45 Modules

For this example, assume the number of trenches equals two:

Trench Width: Module width (2 ft) + Sand Sidewalls (6" + 6") = 3 ft
Trench per Row: 45 modules ÷ 2 trenches = 22.3 round up 23 A42 modules per

Modules (23) x 4 lf/module + 1 ft (6" sand at each end of trench) = 93 ft
Trench area (width x length x trenches) – 3 ft x 93 ft x 2 trenches = 558 ft²

A42 Trench Dimensions:
Length = 93 ft/trench
Width = 3 ft
Trenches = 2
Modules = 45 A42
Total Area = 558 ft²

FIGURE 4: PLAN VIEW – 800 GPD – A42 TRENCH SYSTEM – LEVEL SITE
2.0 Trench Installation Sizing and Guidelines

FIGURE 5: SECTION VIEW – 800 GPD – A42 TRENCH SYSTEM – LEVEL SITE

SEED AND LOAM
GEOTEXTILE FABRIC
NATIVE SOIL
SPECIFIED SAND

FIGURE 6: SECTION VIEW – 800 GPD – A42 TRENCH SYSTEM – SLOPING SITE

SEED AND LOAM
GEOTEXTILE FABRIC
NATIVE SOIL
SPECIFIED SAND
2.0 Trench 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 required using the trench sizing example.

3. Prepare the site. Do not install a system in saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas.

4. Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.

5. Excavate the trench; scarify the receiving layer to maximize the interface between the native soil and specified sand.

6. Minimize walking in the trench prior to placement of the specified sand to avoid soil compaction.

7. Place specified sand in a 6” lift, stabilize by foot, a hand-held tamping tool or a portable vibrating compactor. The stabilized height below the GSF module must be level at 6”.

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

9. 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 position.

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

11. (Pressure Distribution Systems Only) 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 15. 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 the trench.

12. **Cover fabric substitution is not allowed.** The installer should lay the Eljen provided geotextile cover fabric lengthwise down the trench, 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.

13. 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 trench.

14. Complete backfill with a minimum of 12 inches of clean porous fill measured from the top of the modules. Backfill exceeding 18 inches requires venting at the far end of the trench. Use well graded native soil fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly.

15. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.
3.0 Bed Installation Sizing and Guidelines

Bed Example:

House size: 3 bedrooms
Size of System (determined from Table 2): 145 Square Feet/Bedroom

Conventional Field Size = Size of System x Bedrooms x 1.5 for Bed Upsizing:
145 ft²/Bedroom x 3 Bedrooms x 1.5 = 652.5 round up = 653 ft²

Refer to Table 2 to determine the number of units needed for this installation.
A42 Units per Bedroom: 9 A42 Units
Total Units: 27 A42 Units

For this example, assume the number of rows in the bed equals two:
A42: Modules per Row: 27 modules ÷ 2 rows = 13.5 round up = 14 A42 modules per row
Bed Length: Modules (14) x 4 ft/module + 1 ft (6" sand at each end of bed) = 57 ft
Minimum Bed Width: Disposal Field ÷ Bed Length = 653 ft² ÷ 57 ft = 11.45 rounded up from 11.45
Bed area (width x length) – 12 ft x 57 ft = 684 ft²
Lateral to Lateral Spacing: 12 ft ÷ 2 rows = 6 ft
Edge to Lateral Spacing: 6 ft ÷ 2 = 3 ft

A42 Bed Dimensions:
Length = 57 ft
Width = 12 ft
Rows = 2
Modules = 28 A42
Total Area = 684 ft²
Lateral to Lateral Spacing = 6 ft
Edge to Lateral Spacing = 3 ft
3.0 Bed Installation Sizing and Guidelines

FIGURE 7: PLAN VIEW – 600 GPD – A42 BED SYSTEM – SLOPING SITE

FIGURE 8: SECTION VIEW – 600 GPD – A42 BED SYSTEM – LEVEL SITE

FIGURE 9: SECTION VIEW – 600 GPD – A42 BED SYSTEM – SLOPING SITE
3.0 Bed 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 required using the bed sizing example.

3. Prepare the site. Do not install a system in saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas.

4. Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.

5. Excavate the bed absorption area; scarify the receiving layer to maximize the interface between the native soil and specified sand.

6. Minimize walking in the absorption area prior to placement of the specified sand to avoid soil compaction.

7. Place specified sand in a 6" lift, stabilize by foot, a hand-held tamping tool or a portable vibrating compactor. The stabilized height below the GSF module must be level at 6".

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

9. 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 position.

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

11. (Pressure Distribution Systems Only) 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 15. 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.

12. **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.

13. 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.

14. Complete backfill with a minimum of 12 inches of clean porous fill measured from the top of the modules. Backfill exceeding 18 inches requires venting at the far end of the bed. Use well graded native soil fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly.

15. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.
4.0 Mound Installation Sizing and Guidelines

4.1 PRESSURE MOUND REFERENCE: The following sizing and guidelines provide the dimensions of the distribution cell for your mound. Consult Title 77: Public Health, Chapter 1: Department of Public Health, Subchapter: Wastewater and Sewage, Part 906: Private Sewage Mound Code for more information on the construction of a mound system.

4.2 MOUND EXAMPLE:

- House size – 3 bedrooms
- Slope of site – 4%
- Soil Group/Design Group – Group V
- Design Flow = 200 gpd x 3 bedrooms = 600 gpd

4.3 IMPROVE THE HYDRAULIC LINEAR LOADING RATE: The linear loading rate is defined as the amount of effluent (gallons) applied per day per linear foot of the system (gpd/lf). Scientific studies show that longer and thinner systems are often the best design for maximizing the life of a system. The design linear loading rate is a function of effluent movement rate away from the system and the direction of movement away from the system. If the movement is primarily vertical, then the linear loading rate is not as critical as if the flow is primarily horizontal. Other factors such as gas transfer from beneath the absorption area suggests that the absorption area width be relatively small (Tyler et al, 1986). Design long and thin systems to improve the hydraulic linear loading rate.

![FIGURE 10: CROSS SECTION – PRESSURE MOUND SYSTEM](image)

![FIGURE 11: PLAN VIEW – PRESSURE MOUND SYSTEM](image)

- A – Distribution cell width (accounts for sand) – **Minimum 3 ft for A42**
- B – Distribution cell length
- C – Up slope fill depth under distribution cell – **Minimum 1 ft**
- D – Down slope fill depth under distribution cell – **Minimum 1 ft**
- E – Distribution cell depth – **Constant 7 in**
- F – Depth of final cover – **Minimum 1 ft**
- I – Distance from edge of distribution cell to down slope edge of fill
- J – Distance from edge of distribution cell to up slope edge of fill
- K – Distance from end of distribution cell to edge of fill
- L – Overall mound fill length
- W – Overall mound fill width
4.0 Mound Installation Sizing and Guidelines

4.4 CALCULATE VARIABLES: The following equations are used to design a basic mound. This is just one example on how to construct a mound and other sound engineering practices may be used.

Distribution cell Area (Absorption Area) = Design Flow $\div$ 2.0 gal/ft$^2$/day (2.0 gal/ft$^2$/day is the absorption rate for the fill material after passing through the Eljen GSF System. 600 gpd $\div$ 2.0 gal/ft$^2$/day = 300 ft$^2$

A – Distribution cell width

The distribution cell width is determined by the module that is going to be used.

Use 3 ft wide for A42 units.

For this example, we are going to use A42 units. 3 ft

B – Distribution cell length = Distribution Cell Area $\div$ 12 ft$^2$/module (A42) $\div$ Number of Rows

Distribution cell length = 300 ft$^2$ $\div$ 12 ft$^2$/module $\div$ 1 Row = 25 Modules

Number of Modules $\times$ 4 ft / module $\div$ 1 foot =

25 Modules $\times$ 4 ft/module $\div$ 1 foot = 101 ft

C – Up slope fill depth under distribution cell = Minimum 1 ft

(Note: For this example, assume the depth of fill at the up-slope edge of the distribution cell is 1.5 ft.)

D – Down slope fill depth under distribution cell = Minimum 1 ft

C + (Slope of site x Distribution cell width)

1.5 ft + (0.04 x 3 ft) = 1.62 ft

E – Distribution cell depth – Constant 7 in., convert to feet – 0.583 ft

F – Depth of final cover = We are using 1 ft in this example.

(Note: For the slope of the mound, we are using a recommended 3:1 slope)

I – Distance from edge of distribution cell to down slope edge of fill:

Down slope correction factor = 906. Appendix A. Exhibit C = 1.14

$3 \times (D + E + F) \times$ Down slope correction factor

$3 \times (1.62 + 0.583 + 1) \times 1.14 = 10.95$ ft

J – Distance from edge of distribution cell to up slope edge of fill

Up slope correction factor = 906. Appendix A. Exhibit C = 0.89

$3 \times (C + E + F) \times$ Up slope correction factor

$3 \times (1.5 + 0.583 + 1) \times 0.89 = 8.23$ ft

K – Distance from end of distribution cell to edge of fill

$3 \times [((C + D)/2) + E + F]$ $\times [((1.5 + 1.62)/2 + 0.583 + 1] = 9.42$ ft

L – Overall mound fill length

B + 2(K)

100 + 2(9.42) = 119.86 ft

W – Overall mound fill width

A + I + J

3 + 10.95 + 8.23 = 22.18 ft
4.0 Pressure Mound Installation Sizing and Guidelines

FIGURE 12: PLAN VIEW – 600 GPD – DISTRIBUTION CELL MOUND SYSTEM

4" DISTRIBUTION PIPE

1/4" HOLE AT 12 O'CLOCK

SPECIFIED SAND

VENT PORT

4.5 MOUND CONSTRUCTION–
Overall Width (with slopes) – 28.6 ft
Overall Length (with slopes) – 125.14 ft

FIGURE 13: SECTION VIEW – 600 GPD – MOUND SYSTEM

8.23' 3' 10.95'

1.5' 1.62'

7''

FIGURE 14: SECTION VIEW – 600 GPD – MOUND SYSTEM

SEPTIC TANK

PUMP CHAMBER
4.1 Mound 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 mound dimensions using the design example.

3. Prepare the site. Do not install a system on saturated ground or wet soils that are smeared during excavation. Keep machinery off infiltrative areas.

4. Plan all drainage requirements above (up-slope) of the system. Set soil grades to ensure that storm water drainage and ground water is diverted away from the absorption area once the system is complete.

5. Scarify the receiving layer to maximize the interface between the native soil and Specified Sand. Minimize walking in the bed prior to placement of the Specified Sand to avoid soil compaction.

6. Place Specified Sand in two 6-inch lifts, stabilize each lift at a time. The stabilized height below the GSF module must be level at 12 inches. A hand tamping tool or vibrating compactor is both acceptable.

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

8. 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 position.

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

10. (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 15. 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.

11. **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.

12. 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.

13. Complete backfill with a minimum of 12 inches of clean porous fill measured from the top of the module. Backfill exceeding 18 inches requires venting at the far end of the bed. Use well graded native soil fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used with caution, avoiding crushing or shifting of pipe assembly.

14. Divert surface runoff from the system. Finish grade to prevent surface ponding. Topsoil and seed system area to protect from erosion.
5.0 Dosing Distribution Guidance

5.1 PUMP DISTRIBUTION BOX: Specify an oversized distribution box for pumped systems. Provide velocity reduction in the D-box with a tee or baffle. Set D-box invert 2 inches higher than invert of perforated pipe over GSF modules. If the absorption area is installed deeper than 18 inches, the system must be vented. See section 7.0 of this manual for detailed information on venting of systems.

5.2 DOSING DESIGN CRITERIA: Dosing volume must be set to deliver a maximum of 3 gallons per A42 Module per dosing cycle with low head high volume pumps preferred. Higher flow rates and short dose cycle push the effluent down the line and thus disperse the effluent over a larger area. A valve on the force main is recommended to set the flow rate so that the orifices on the outlet pipes are submerged and the d-box does not overflow. Adjustment of the flow rate is likely needed if a row of modules are rested thus changing the number or outlets. Fewer outlets in the d-box force more effluent down each line and improve linear loading. Head loss and drain back volume must be considered in choosing the pump size and force main diameter.

6.0 Pressure Distribution Guidance

Standard procedures for design of pressure distribution networks apply to the GSF filter. Orifices shall be a minimum of 4-foot on center spacing so the orifices fall in the center of each module. A minimum orifice size of ¼ inch shall be maintained. A ¼ inch diameter drain hole is required at the 6 o’clock position of each pressure lateral for drainage purposes. The lateral pipe network (size per design and code) is placed within a standard 4-inch perforated pipe. The perforation in the 4-inch outer pipe are set at the 4 and 8 o’clock position, the drilled orifices on the pressure pipe are set to spray at the 12 o’clock position directly to the top of the 4-inch perforated pipe as shown below.

FIGURE 15: PRESSURE PIPE PLACEMENT

![Pressure Pipe Placement Diagram]
6.0 Pressure Distribution Guidance

FIGURE 16: PRESSURE CLEAN OUT

FINISHED GRADE
LATERAL ENDS AT LAST ORIFICE WHERE VARIABLE LENGTH CLEANOUT BEGINS
4" PERFORATED PIPE
4" END CAP
DISTRIBUTION LATERAL
LATERAL CLEANOUT
6 - 8" DIAMETER LAWN SPRINKLER
THREADED CLEANOUT PLUG
LONG SWEEP 90 OR TWO 45 DEGREE BENDS SAME DIAMETER AS LATERAL

FIGURE 17: CONTOURED TRENCH PRESSURE DISTRIBUTION

PRIOR TO PLACING FABRIC COVER, HAND SHOVEL SPECIFIED SAND IN THESE AREAS
STANDARD FITTING(S)
DRAIN OPENING AT 6 O'CLOCK
CAP END OF 4" PIPE
PRESSURE PIPE (SIZE PER DESIGN/CODE)
PRESSURE PIPE EXTENDS THRU END CAP, AND IS EXTENDED FOR CLEAN OUT

GSF Pressure Distribution trench placed in contour or winding trenches to maintain horizontal separation distances may also be used in Dosed or Gravity system by removing the pressure pipe and using the 4-inch diameter perforated distribution pipe.

7.0 System Ventilation

7.1 SYSTEM VENTILATION: Air vents are required on all absorption systems located under impervious surfaces or systems with more than 18 inches of cover material as measured from the top of the GSF module to finished grade. This will ensure proper aeration of the modules and sand filter. Under normal operating conditions, only a fraction of the filter is in use. The unused channels remain open for intermittent peak flows and the transfer of air. The extension of the distribution pipe to the vent provides adequate delivery of air into the GSF system, as shown in Figure 20.

Home plumbing operates under negative pressure due to hot water heating the pipes and reducing the density of air in the house vent. As hot air rises and exits the home, it must be replaced by air from the GSF. To maintain this airflow and fully aerate the GSF system, it is important that air vents are located only on the distal end of the GSF pipe network.
7.0 System Ventilation

FIGURE 18: VENT FOR GRAVITY AND DEMAND DOSED BED SYSTEMS

7.2 VENTILATION FOR PRESSURE AND DEMAND DOSED SYSTEMS: If a pressure or demand dosed system is specified with greater than 18 inches of cover, an additional 2-inch minimum air line must be extended from the GSF D-box back to a knockout or riser on the septic tank or pump chamber. This maintains the continuity of airflow from the field into the house plumbing.

FIGURE 19: AIR BY-PASS LINE PLAN VIEW FOR VENTING OF PUMPED SYSTEMS
7.0 System Ventilation

7.3 VENT PIPE FOR LOW PRESSURE DISTRIBUTION SYSTEMS: If the system is a low-pressure distribution system with greater than 18 inches of cover, ensure that the LPP clean outs are located in the vent for easy access.

FIGURE 20: VENT LAYOUT FOR GRAVITY AND LOW-PRESSURE SYSTEMS

7.4 VENTILATION PLACEMENT: In a GSF system, the vent is usually a 4-inch diameter pipe extended to a convenient location behind shrubs, as shown in Figure 21. Corrugated pipe may be used. If using corrugated pipe, ensure that the pipe does not have any bends that will allow condensation to pond in the pipe. This may close off the vent line. The pipe must have an invert higher than the system so that it does not drain effluent.

FIGURE 21: GSF WITH 4” VENT EXTENDED TO CONVENIENT LOCATION
8.0 Treatment Applications

8.1 TREATMENT APPLICATIONS: Some applications may require specific treatment levels. The Eljen GSF system can meet industry standards by adding an additional 6 inches of specified sand under the GSF modules. For these types of applications, the total Specified Sand height below the A42 modules will be 12 inches. Please contact the Eljen Technical department for more information on treatment at 800-444-1359. Additional information on treatment applications is available on our website at: http://eljen.com/Pages/GSF/GSFoverview.html. This application is for use in trench, beds and mound installations.

FIGURE 22: TYPICAL A42 GSF TREATMENT CROSS SECTION

- 6 inches of Specified Sand is at the edges of the GSF module.
- 6 inches of Specified Sand is at the beginning and end of each GSF Trench.
- 6 inches of Specified Sand is directly below the GSF module.
- 6 inches of Additional Specified Sand for Higher level Treatment.
- Minimum 12 inches of native soil fill above the module.
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.